Gender-differentiated preferences regarding rohu carp (*Labeo rohita*) in Bangladesh:
A case study

WorldFish

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CGIAR RESEARCH PROGRAM ON Policies, Institutions, and Markets Led by IFPRI

CGIAR RESEARCH PROGRAM ON Fish Led by WorldFish

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1. Background

1.1. The case

The focus of this case study is the rohu carp genetic improvement program based in Bangladesh. The work forms part of the Sustainable Aquaculture Program of WorldFish and the CGIAR Research Program on Fish Agri-Food Systems (FISH, Flagship 1, Cluster 1 Genetics). The genetic improvement program aims to produce faster growing fish for fish farmers in Bangladesh, but with broad relevance to the whole rohu market chain in the country. The program also underpins improved efficiency, profitability and reduced environmental impact of the industry while contributing to meeting market demand.

The case covers the period 2014–2021.

1.2. Summary of the importance of the case study

Fish is a primary source of affordable animal protein for the rural and urban poor, and rohu is the most popular farmed fish in Bangladesh (Belton et al. 2018, Mehar et al. 2022). Rohu is one of the top 10 aquaculture species produced worldwide, with consumption highest in South Asia (FAO 2020). Bangladesh is among the top five aquaculture producing countries in the world (Khan et al. 2021), and rohu comprises a major component of its carp aquaculture production (DOF 2019).

1.3. Context and study population

Aquaculture production generates 56% of total fish production in Bangladesh, and 79% of it comes from earthen-pond farms (DOF 2019). Smallholder fish producers in this low-income country context often farm in homestead ponds and rely on fish both for consumption and for income. Women and men in the households both engage in fish farming, though gender dynamics and norms tend to frame men as farmers and women as homemakers. In this sector, the quality of fingerlings, as well as feed, labor and capital, is a critical input and determinant of risk and productivity (Khan et al. 2021).

The case draws on a trait preference study done in the divisions of Mymensingh and Khulna in 2018. That study focused specifically on gathering gender disaggregated information on rural smallholder farmers, with a total of 288 respondents from 144 dual adult households. The following were the key characteristics of the study group:

- Fish farming was the primary source of income for the households, followed by agriculture.
- Households reported having, on average, four ponds, with an average size of 0.49 ha.
- Most households were involved in grow-out farming using polyculture systems. Rohu were stocked at less than 40% of all fish, with an average cultivation period of 9.8 months.
- Most men respondents were 30–45 years old and reported fish farming as their primary occupation.
- The majority of women respondents were divided between two age groups: 20–30 and 30–45 years old. Many reported "homemaker" as their primary occupation, which is common in this context, even when women engage in homestead production.
- The largest share of both women (39%) and men (37%) had a Grade 6–10 education.

2. Narrative of the process of change

2.1. Time 1: "Before"

2.1.1. Definition of Time 1

Time 1 is defined as 2014 to 2017. It began before the start of this research on gender-differentiated preferences when no information on these preferences for rohu was available to the breeding program.

2.1.2. Stage in the breeding program

Fish breeding does not go through the same stages as plant breeding, and certainly not as many. As such, this case does not present stages in the same way as in plant breeding cases. For a comparison of animal and plant breeding, see the excellent summary in Hickey et al. (2017).

The WorldFish breeding program for rohu carp began only in 2014, with a view to a release in 2022 after three generations of selection for improved growth. As of 2017, the program was still in the product development, pre-release stage.

2.1.3. Breeding team composition

The opportunistic origin of the program (section 2.1.4) was small at its foundation, and there were limited resources available to the WorldFish team. The operational team from 2013 consisted of a senior manager in aquaculture and genetics (Dr. J. Benzie) and a quantitative geneticist (Dr. W. Mekkawy) together with a technical fish handling team of 12 in Bangladesh and a senior advisor in the United States Agency for International Development (USAID) program (Dr. M.G. Hussain, a former director at the Bangladesh Fisheries Research Institute). From 2013 onward, the country logistics management and liaison with National Agricultural Research System from Bangladesh's Department of Fisheries (DOF) was undertaken by two senior aquaculture scientists (Dr. M.I. Karim and Dr. B. Barman), with chiefs of party for the USAID major development program enabling the activity. Previous senior DOF staff, who are now operating as consultants to Bangladesh industry and government, provided additional advice and used previous reports of industry and development needs underpinning industry development and also identified client needs.

2.1.4. Processes for prioritizing traits and decision-making in the breeding program

In terms of the origins of the rohu carp breeding program, it is important to note that it was developed opportunistically because of unprecedented scientific access to new biological material. To replenish its aquaculture hatcheries, the USAID Aquaculture for Income and Nutrition (AIN) program had collected several thousand rohu from the few remaining wild sources in Bangladesh. The aim of the AIN collection was to replace inbred fish that produced lower quality fry, which demonstrated lower growth and poorer performance on farm. Despite being a difficult, time-consuming and expensive process, this provided a unique opportunity to segragate a portion of these fish to develop a genetic improvement program in 2014. A decision had to be made quickly, however, before all the fish were mixed, evidence of their origin was lost and the fish were distributed to hatcheries throughout Bangladesh. Although the window of opportunity was short (several weeks), there was enough time to separate and keep subsets of the fish to establish base breeding populations that would support a genetic improvement program.

The genetic goals needed to meet the aims of the initial USAID development program: provision of high quality fry that had a high survival rate and grew well. These characteristics were based on a generic need of producers that several programs had identified as inhibiting industry development. The specific trait selected was "harvest weight." It was the most directly relevant trait to producers that is easy to measure and a fundamental requirement on which to base a fish improvement program. Selection for harvest weight would lead to faster growing fish, and survival would be monitored to ensure that it remained strong, although not a specific selection target.

2.1.5. Gathering and using information about preferences

When setting up the genetic improvement program, information on user preferences was based on socieconomic analysis used by previous surveys and reports that included data on markets and general clients, both producers and consumers. No information was available on gender-differentiated preferences, so these were not taken into account in the decision-making process, though the team would have been receptive to it had it been available. In terms of feedback from clients as a source of information, the breeding program for rohu has not yet obtained feedback from producers since the program is still at the product development stage and no improved varieties of rohu have yet been released. Rohu has a 2-year generation cycle, and as mentioned in section 2.1.2 three generations of improvement were planned before any release of improved material.

2.1.6. Definition of the customer

Choosing the basic trait of larger and faster growing fish was based on the generic needs of the industry, so the breeding program targeted "fish farmers" broadly as its clients. This umbrella terms ranges from smallholder subsistence producers growing fish for home consumption up to large-scale commercial producers growing fish for sale. Regardless of the size of the fish farmer, all of them would be supplied with young fish from three types of customers: fish nurseries, small hatcheries or fry suppliers—all of whom get their fish from the main hatcheries. No other factor, including gender, was used to differentiate them. The team had an informal profile of these customers based on the socioeconomic information from field visits to fish farmers and markets from previous fish projects in Bangladesh. There was general agreement on the target group and no deliberate bias toward subsistence fish producers. The program took an "industry" perspective based on the experience of the lead geneticist, and local experts, in the private sector.

2.1.7. Breeding objectives, prioritized traits and strategy

Since the breeding program, which began in 2016, was new, the initial objectives were basic: (1) increase the size as measured by "harvest weight," while (2) maintaining the survival rate of rohu carp in Bangladesh. Aligned with these objectives, the priority trait selected for improvement was harvest weight. The strategy was to use fully pedigreed family-based selective breeding with molecular assessment of the wild caught fish to avoid close relatives from mating.

2.2. New knowledge about gender-differentiated trait preferences

2.2.1. What enabled the team to obtain this novel gender-differentiated trait preference information

The case study presented here was catalyzed by and conducted in collaboration with the Gender and Breeding Postdoctoral Fellow (PDF) initiative funded by the CGIAR GENDER Network to promote more gender-responsive breeding programs. This CGIAR investment had two components: (1) direct funding for a post-doctoral fellow in FISH (50% funded by CGIAR, 50% by FISH), and (2) capacity development for the post-doctoral fellow and the team through the PDF initiative, hosted by WorldFish. Additionally, WorldFish's FISH breeding program made investments via the time of geneticists and gender expert in co-designing the study, supervision, and reviewing and interpreting the research results. It also provided direct salary support for the post-doctoral fellow in project extensions.

Four members of the study team collaborated on the design of the case and thus catalyzed the generation of this knowledge: the research fellow (Dr. Mamta Mehar), the coordinator of the PDF initiative and gender research leader (Dr. Cynthia McDougall), and two geneticists (Dr. John Benzie and Dr. Wagdy Makkawy). The breeding program welcomed the PDF initiative because the team was aware of a general knowledge gap on client preferences beyond the simple preference for large fish and high survival rate obtained from industry assessments. The PDF also engaged input from FISH scientists working on farm management and value chain-related aspects, including design inputs from the PDF initiative. The project also benefitted from free access to the PDF to use the 1000minds tool for this study. This was the first application used on fish and was well established to determine trait preferences in livestock and crops (https://www.1000minds.com/sectors/business/breeding-articles). A representative of the PDF initiative provided direct information to the post-doctoral fellow to support the use of the 1000 minds tool.

2.2.2. Overview of the PDF initiative on gender-differentiated trait preferences

The design of the PDF study on rohu was built on learnings from a previous global review (Mehar et al. 2020). Information was extremely limited in the research literature on trait preferences for fish by users, and there was a complete lack of information on gender-differentiated fish trait preferences globally. Some information indicated that clients from different market segments may have different trait preferences (Box 1). These segments included gender and other socioeconomic characteristics, such as income, or the role in the value chain. This information suggested that a greater understanding of client needs could better identify traits relevant to target clients. This is particularly relevant for low-income country contexts or for low-income producers and in relation to public breeding programs. Obtaining a better understanding would improve targeting of improvement programs and potentially improve adoption of better aquaculture system outcomes—for which there are already exemplars in agriculture. Along these lines, the rohu study was designed to explore user-specific trait preferences.

Study aims: To determine the preferences of rohu traits among smallholder farmers. Within this assessment, the study considered whether and how trait preferences differed by the gender of the farmers.

Design: The rohu study was an empirical one on trait preferences conducted in Bangladesh and India. It has two components:

1. A rapid scoping with farmers and market actors in both countries to inform design
2. Followed by a field study using a multistage sampling method and a concurrent mixed methods approach in a three-part dual headed survey: (1) closed questions to collect information related to production system and farm management, (2) open-ended questions to identify traits of interest, and (3) a stated choice experiment using the 1000minds software to identify trade-offs among pre-selected traits identified during the scoping study. Enumerators were asked to probe respondents with open-ended questions so as not to influence responses. These responses did not necessarily distinguish desires from specific practical choices or separate aspirations, practical choices and absolute needs.

Box 1. Summary of key findings of the literature review (Mehar et al. 2020)

- Despite conducting a global review and searching for users across the entire fish value chain and wide search engines, only 28 studies of preferences were identified: consumers (15), traders (6), farmers (4), fry or fingerling suppliers (2), and a hatchery and nursery operator (1).
- Only four aimed at understanding preferences of specifically well-defined traits related to genetic improvement. None of these four explored rohu. The remaining 24 studies investigated preferences in a more general sense.
- Some identified traits such as body texture and nutritional value that are not included in breeding programs reported to date.
- Only one study of general preferences was found for rohu: Dey et al. (2005). This study compiled preferences for five countries/regions (Bangladesh, India, China, Thailand, Northern Vietnam and Southern Vietnam) and for two users (consumers and producers). The reported traits for rohu were color (bright and reddish, brown), thickness, size and percentage of higher dress-out (the weight of the fish without head, viscera and skin divided by total weight).
- Some studies, mainly of consumers, indicated that clients from different market segments (gender and other socioeconomic characteristics, such as age, household size, wealth-status or income, family size and region) have different preferences. For example, women and older people are more likely to pay more for breeding programs that have healthy environments for the fish.

The sequence of these methods was important and jointly decided by the social science and genetic experts before going to the field study. Open-ended questions were designed to reveal farmers needs. However, we also required information concerning trade-offs between traits, so we used trait information available using pre-selected traits derived from the literature and scoping study. Because of the limited time and resources available for the study, these approaches had to be done at the same time.

Geographic scope: While the PDF initiative research covered Bangladesh and India, the focus of this case study is Bangladesh alone. See Mehar et al. (2022) for detailed results for both countries.

Value chain actors: The limited funding and time did not allow for a complete survey of all users throughout the value chain. After discussion among the joint social science and genetic improvement team, it was decided to focus on smallholder producers, both as farmers and consumers.

2.2.3. Findings: Novel information on gender-differentiated trait preferences

The following are key findings of the empirical rohu trait preference study (Mehar et al. 2022):

1. Producers were readily able to identify a range of preferences relating to rohu traits and characteristics. They did not value traits equally, which meant that some traits were more desirable than others. In addition, both women and men, as producers, were able to provide this trait information. As such, both genders can inform priorities and trade-offs among traits despite widely held views in Bangladesh that men are fish farmers and women are only "homemakers."
2. The preferences indicated in the initial survey ranged broadly (Table 1). They included elements that might not be able to be addressed, or most suitably addressed, by breeding programs, and they only became more specific when asked what they would wish improved. As an example, changes in farm or value chain processes would best address traits such as freshness. More focused responses were achieved when specific trade-offs could be used. Traits identified as important to women and men producers for improvement focused on improved productivity and reduced risk to production (Table 1).
3. In terms of gender, the sets of identified priority traits and their rankings between women and men were neither identical (completely overlapping) nor completely distinct. Rather, there was considerable overlap, along with some small statistically significant differences in emphasis and importance in regards to the frequency of mentions in survey questions. There were also small differences in rankings, with significant differences between genders for only two of the lower ranked traits in the 1000 minds approach.
4. Where preferences differed between women and men, the direction of difference appeared to reflect men placing more value on market-related characteristics, such as good prices, and women placing more value on the quality or adequacy of the fish, like flesh content and odor, as safe and sufficient food supply. This aligns with gendered division of labor as well as mobility constraints on women in the study context. Men are engaged in markets while women are more socially confined to the homestead and ascribed the primary responsibility for cooking and caregiving.
5. Significance of findings for the genetic improvement program was variable. As indicated in Table 1, the preferences may be relevant for breeding programs or more appropriately addressed though changes to farm management or value chain practices. Some may require further research to clarify the precise need and relevant response.

The following are the traits that could potentially be addressed through the genetic improvement program's key findings:

1. Both women and men ranked weight as the most important preference in the stated choice experiment. Similarly, larger size is in the top three for women and men in terms of being "liked" and in the top five for both in "improvement." Growth was the shared top priority "for improvement" for both women and men. These confirm the relevance of the original first objective of the rohu genetic improvement program, actioned in 2016: increased harvest weight.

	Findings: Key trait preference by respondents			Interpretation: Preferences likely addressed by breeding or other management	
	Women	**Men**	**Both genders, same ranking**	**New traits for potential consideration by breeding program**	**Changes in farm or value chain management**
1. Survey: Production perspective [= frequency of mention]					
"Liked" traits	4. Flesh content 5. Natural odor	4. Good price 5. Boniness	1. Good taste 2. Good appearance 3. Larger size	**Women:** Flesh content **Men:** Less Boniness	**Women:** Natural odor **Men:** Good price **Both:** Good taste Good appearance
"Disliked" traits	1. Poor appearance 2. Slow growth 3. Disease resistance 4. Too many bones 5. Small size	1. Small size 2. Too many bones 3. Poor appearance 4. Slow growth 5. Disease resistance	------	**Both:** Slow growth Too many bones Disease resistance	**Women:** Poor appearance
Traits "for improvement"	2. Increasing size 3. Reducing culture period 4. Increasing disease resistance	2. Reducing the culture period 3. Improving fry quality 4. Increasing disease resistance 5. Increasing size	1. Growth	**Both:** Reducing the culture period	**Men:** Improving fry quality
2. Survey: Consumer perspective					
Which traits are most important when selecting fish from ponds or market?	**Pond**: 1. Larger size 2. Appearance 3. Freshness **Market**: 1. Appearance 2. Freshness 3. Larger size	------	------	------	**Women:** Appearance Freshness
3. Stated choice experiment (1000 minds) [= ranking of 8 predetermined traits]					**From top 5**
1000 minds	2. Skin color 3. Gill color 4. Price 5. Length 6. Eye color 7. Taste* 8. Slender body shape*	2. Gill color 3. Price 4. Skin color 5. Length 6. Eye color 7. Taste 8. Slender body shape	1. Weight	------	**Both:** Skin color Gill color Price

Notes: The production and consumption preferences are based on open-ended questions and are ordered by number in relation to the most frequently identified traits, as identified during analysis; the stated choice experiment numbers represent actual ranking generated through the pair-wise comparison involved in 1000 minds. A more detailed analysis is available in Mehar et al. (2022).

Source: Mehar et al. 2022.

Table 1. Rohu traits identified by producers.

2. New traits were identified in addition to that included in the existing program: faster growth. Some traits, such as large size and reduced culture period, could be improved by selecting a faster-growing strain. Others, such as disease resistance, were important to both women and men. Women identified body shape as important to them, but this needs greater clarification to better define the specific trait and its importance.
3. Women and men did not necessarily have the same number of likes or dislikes, and the gender identifying the greater number might potentially identify additional traits (Mehar et al. 2022). However, the differences in number dropped as the questions focused on the need for improvement. There, differences in men's and women's preferences were not in terms of identifying different traits but giving different emphasis in the open-ended survey and ranking in 1000minds to traits. This broadly reflects preferences associated with current gender division of labor.

2.3. Time 2: "After the introduction of above novel information"

2.3.1. Definition of Time 2

Time 2 here refers to 2021 after the data was analyzed. The information obtained through the PDF initiative was the first on gender-differentiated preferences available to the breeding program published in Mehar et al. (2022).

2.3.2. Progress in Time 2

By mid-2021, the core program had measured the improvement of more than 30% in the core breeding program, and young fish were provided to hatcheries for growth in preparation for release in 2022.

2.3.3. Composition of the breeding team

The above study illustrated novel interdisciplinary collaboration. Specifically, during the PDF initative from 2017 to 2019 and continuing work to write-up results, the geneticists worked with the post-doctoral fellow to design and analyze the research on preferences. The design and process of writing up the findings from the study has led to closer ongoing collaboration between the geneticists and social scientists (post-doctoral fellow and GENDER research leader).

To date, however, the composition of the genetic improvement team has not formally changed in Time 2. No funding was made available through the CGIAR Excellence in Breeding Platform toward assisting livestock or fish to improve and extend the platform's processes or institute a more formal stage gate process. It is possible that the composition of the breeding team (the team involved in prioritization) will be reassessed during the upcoming restructuring of WorldFish and One CGIAR.

2.3.4. Processes for the prioritization of traits and decision-making in the breeding program

There is no change in the rohu trait prioritization processes at the moment, as the priority traits identified, specifically relating to growth, were already the focus of improvement. There are no plans to introduce further traits at this stage given the lack of clarity of the importance and economic value of the traits. Identified traits could possibly be addressed by genetic improvement after they are more clearly established through further surveys and feedback is obtained on the suitability of the fish improved for growth after their release to farmers.

Note: Reorganization and improvement on technical approaches was attempted through the CGIAR Excellence in Breeding program in 2018–2019 for this and other fish programs. While resources were initially offered, they were ultimately not provided from that source, and fish breeding is now separate from the other genetics investments in the next phase of the One CGIAR plan. Investment to achieve expansion of the fish breeding team and mechanisms for dissemination and innovation are now being sought through alternative pathways, but limited resources mean the operational team remains small.

2.3.5. Gathering and use of information about preferences to inform prioritization, including gendered information

From the analyses underaken, follow-up studies will be needed to clarify more exactly the definition and importance of the desired traits, such as body shape and flesh content. Differences in understanding and the perspective of farmers, interviewers and discipline experts affected their ability to inquire of and identify specific traits, and this led us to recognize the need to use a sequential approach. Future studies will certainly require a multidisciplinary approach and multiple interview pathways. The genetic improvement and social science teams were clear and supportive of such future joint preference studies covering other value chain actors at a larger scale.

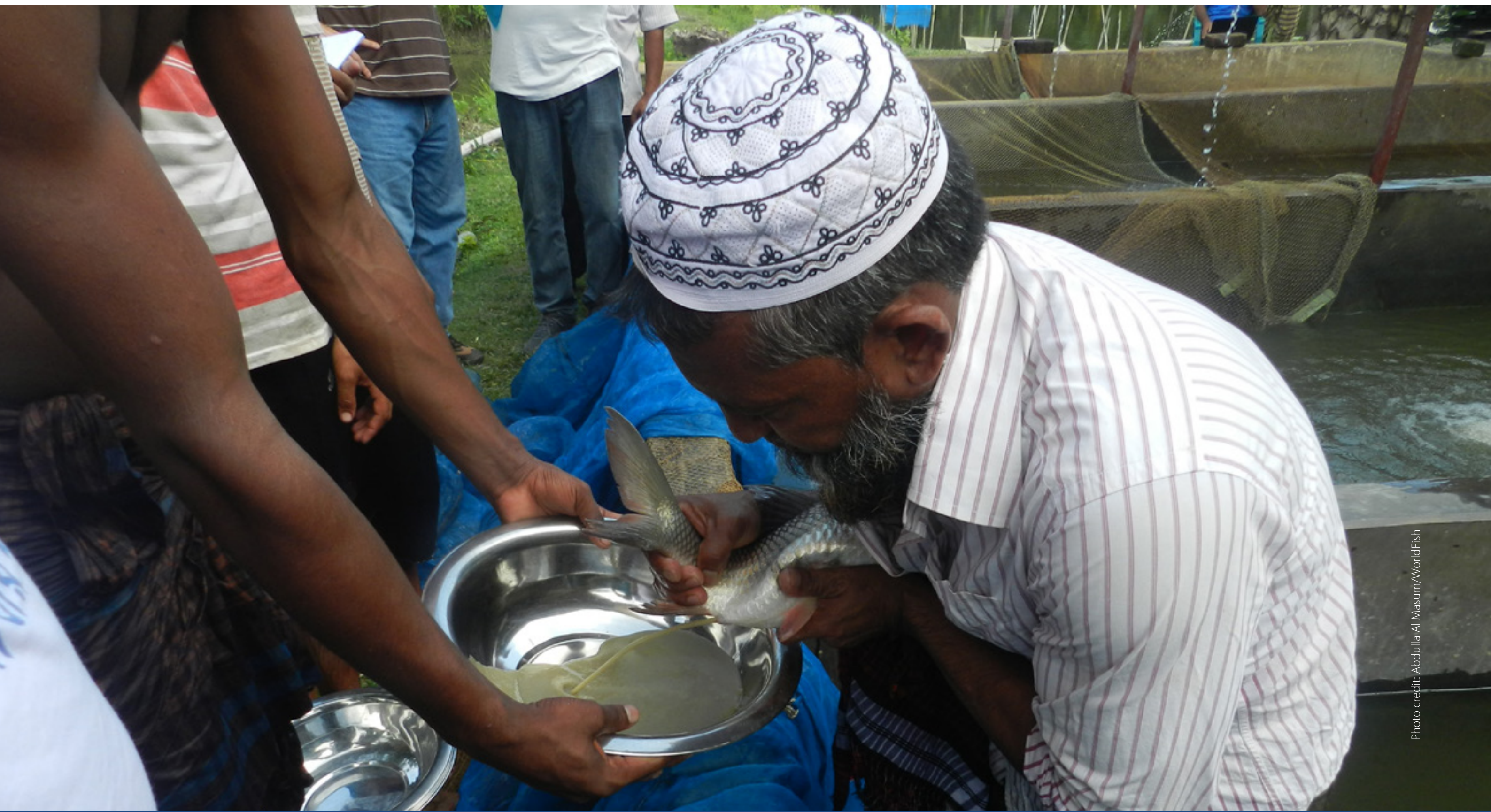
2.3.6. Definition of the "customer" for breeding products

The original trait choice of larger and faster growing fish was based on the generic needs for the industry, and it targeted "fish farmers" broadly as the clients of the breeding program. This case study has contributed to widening the breeding program by more explictly recognizing and counting both women and men as producers. It also gathered information from farmers as consumers as well as producers to open up the idea of expanding future "customer segments" from farmers to also considering processors and other value chain and market actors.

2.3.7. Breeding objectives, priority traits and strategies

As noted in section 2.1.7, the original breeding objective was larger fish, while making sure that survival was not adversely affected even though survival was not actively selected. The research confirmed that harvest weight should remain the key objective in the breeding program, as it was the third-most important identified trait after taste and appearance in open-ended questions. Greater weight (in kg) was ranked first in the choice experiment study by both men and women. Interestingly, characteristics relating to "survival" as an objective emerged less prominently from the study, though both women and men identified disease resistence as the fourth-most important trait to improve.

Other identified traits in the study, such as shape, boniness and flesh content, need to be further explored, refined and validated. This must be done before reporting for genetic improvement consideration, as must feedback on the on-farm performance of faster growing fish from farmers following the release of the improved fish to them in 2022.



Spawning rohu carp at a private hatchery in Jessore, Bangladesh.

3. Learning and insights for good practice

3.1. Learning related to and receptivity regarding information

Both social scientists and genetics experts were receptive to the learnings emerging from the joint work. Boxes 2 and 3 indicate the learnings related to genetics and social scientists, respectively. The following are common learnings by both disciplines:

1. Research on trait studies is scarce for fish, and even lower for specific fish. In a systematic literature review, only one study was found that explored rohu trait preferences and this was not specifically with regard to input to genetic improvement programs (Mehar et al. 2020).

2. The results from the rohu study suggest that while the top preference was the same for both women and men, there were interesting differences in emphasis and ranking. As such, understanding the difference between men’s and women’s preferences is important to capture trait preferences for genetic improvement.

3. Both sets of experts had difficultly determining the needs of users who used a different, more general, framework to articulate their needs than that used by the technical experts to identify the precise biological change in the organism that would lead to the desired outcome, whether biological, economic or otherwise. As such, the study demonstrated that consecutive mixed methods would be more effective than concurrent methods, because they allow information from one stage to inform the next, such as the surveys informing the stated choice experiments.

4. In terms of methodologies used, both experts found that the trade-off approach used in ranking traits is necessary to determine “priority” and “practiced” preferences. Additionally, although methods for such research are available, they are not commonly used in the context of trait preference studies. For example, 1000minds is well established or exemplary in agriculture and livestock, but it has only recently been used for the first time for rohu species trade-offs.

5. Open-ended surveys were important to reveal preferences but have a critical methodological shortcoming. Specifically, the methods identified aspects such as aspirations, preferences, needs, available choices and expectations, all of which needed further refinement. Similarly, producers identified issues best dealt with by changes in farm management and the value chain team, as well as those that could be useful traits in a genetic improvement program.

Box 2. Geneticist learnings

- There are many issues, such as price and freshness, that are important to users. However, these cannot be modified by genetics, and this distinction needs to be carefully explained to others, including social scientists and stakeholders.
- Careful and transparent translations are needed to convert users' stated preferences, like bigger size, to specific traits for selection, such as whole fish weight or fillet size. To meet the desired outcomes requires understanding the reasons a user has for preferring a given trait such as larger size, i.e. better market prices, bigger whole fish, more meat, smaller relative bone quantity, and the actual size in length or weight.
- Many results from open-ended questions were not applicable because the preferences did not distinguish between genetically heritable “traits” and general “characteristics.”
- Both women and men farmers in Bangladesh ranked growth as the most important factor to improve, but there were still interesting differences between genders. For example, differences emerged in preferences for small or large rohu that need to be further clarified.

Box 3. Social scientist learnings

- There are biological constraints to genetic improvement programs:
  - Only traits that are heritable can be used in a breeding program. Therefore, user preference studies need to identify heritable traits that are technically feasible to introduce into a genetics program and justify the practical needs of the user given their resource constraints. Revealing their aspirations, likes or desires is not sufficient.
  - Breeding programs can only deal with a small number of traits, as more traits reduce selection efficiency and optimization and increase response time (years).
  - Genetic programs take time and money, so traits identified from the user perspective need economic assessment. As such, they may not be integrated into the breeding program immediately and can take years for improvement to be achieved.
  - Breeding stages of fish are not the same as those in crop breeding.
- Identifying traits is a "necessary" but not "sufficient" condition. Traits used by breeders have a precise definition and criteria, and attach weight or economic value:
  - Trait definition varies across users and time in the production cycle. For example, survival rate for a multiplication center is the percentage of fish survived from fry to fingerling. For a farmer, however, it is the percentage of fish surviving from fingerling to harvest size. Similarly, terminology varies for the weight of fish: body weight, harvest weight, fat weight, stocking weight, body weight at slaughter, body weight in 290 days, daily weight growth and fillet weight. These terms depend primarily on when the fish are weighed and the type of users. For example, stocking and harvest weight are important for farmers, while fillet weight is important for processors and consumers.
  - The economic value of a trait measured in monetary terms is necessary to assess trade-offs between traits and to check that the return is worth the investment in breeding.

6. The process is useful but it takes time and money to design and conduct such multidisciplinary studies when it comes to collecting, compiling, analyzing and inferring data, or reporting back to the program.

3.2. What good practice does the case study suggest for genetic improvement programs that are aiming to become gender-responsive?

Good practice insights emerged in the following three key areas:

1. Multidisciplinary teams—and interdisciplinary culture and capacities

The case suggests that investigative teams having the required multiple disciplines is a necessary, albeit insufficient, foundation for good practice. To succeed, effective practice requires that teams also develop an interdisciplinary culture and capacities. (See, for example, Brown et al. 2015.) Geneticists may benefit from acknowledging the wider lens of the trait and social science information. While not all can be acted upon, they can give the program a deeper understanding of clients, their expressed preferences, the reasons underlying preferences, and whose preferences are being captured and met, as well as whose are not. And all of these can contribute to effective customer segmentation and targeting. Gender and social scientists in this endeavor may benefit from being attuned to the biological constraints of genetic improvement programs, which can only operate on characteristics that are inherited and can be measured efficiently. They may also benefit from paying attention to the dual requirement that a trait must not only be technically but also economically feasible, as the additional cost of incorporating this trait will be met by either the customer, who is willing to pay, or by a subsidy from the program. Mechanisms to enable cross-disciplinary understanding include cross-learning strategies, such as reading common key literature across disciplines and regular low-pressure exchanges to clarify and learn from each other. They also include purposeful discussion and joint strategizing. These include explicit co-planning of the data needed (what and how precise), the methods and tools, and the analysis, in terms of how the breeding data and the gender data will inform each other and when and how they will be integrated in the analysis.

2. Strategy: Defining goals for whom, where and why

Critical to success for the assembled team is developing the strategy needed to address the scope and scale of the study, including clarity on the degree of understanding and technical competence in the team. The extent of existing knowledge on the social or biological system to be investigated would determine whether one study or a series of studies is needed. A short and focused study could be undertaken based on previous knowledge, allowing trade-offs to be defined and tested immediately. A series of consequential studies, meanwhile, would be needed to enable successively more detailed questions to be answered in a less well-known system. In circumstances with many types of users and varied geographies and cultures, there are likely to be conflicting requirements, so strong decision support systems would be needed to help prioritize outcomes. It will be critical for the equitable prioritization and navigation of trade-offs to be done transparently.

3. Designing studies with appropriate methods to obtain valid useable data

Good practice also involves the team jointly identifying what the "good data" would look like for their agreed research questions, who will use what data, how and for what, and what degree of granularity will be needed. The study showed that the best fit tools likely involve consecutive mixed methods, specifically qualitative following quantitative. This allows not only for triangulation, but also for accessing the needed explanatory information regarding complex or contradictory quantitative findings and the gendered dynamics that drive preferences. To unpack the complexities, the team should use iterative and flexible approaches. External validity can be supported by linking micro-studies on trait preferences to large datasets, which may not include trait information but information regarding farm, gender and so forth.

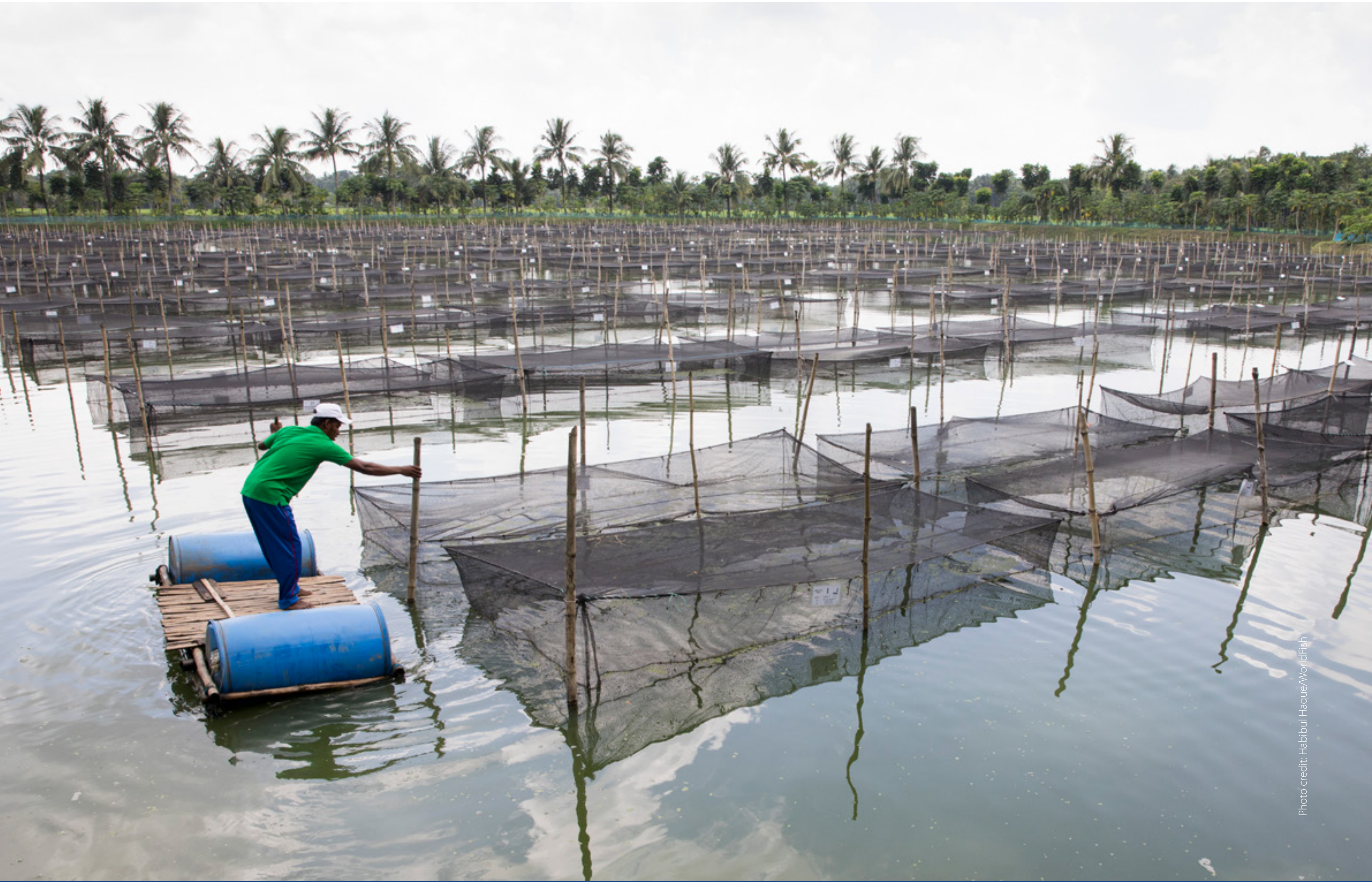
Preparing for packaging to transport, Faltita Bazer, Fakirhat, Bagerhat, Bangladesh.

4. Conclusion

The study underscored that innovation in breeding programs must operate within the parameters of traits needing to be technically feasible. They must also be economically feasible, such that the additional cost of incorporating this trait will be met either by the customer, who is willing to pay, or by a subsidy from the program. Moreover, as genetic improvement programs are logistically challenging and expensive, they are often national or regional in scope, seeking to serve major sectors with potentially many users having conflicting requirements. Finally, both geneticists and social scientists may find it challenging to get aligned responses to accurately determine the preferences and needs of diverse users.

There were four key insights from the case study:

1. the need for more complete and inclusive assessment of the needs and preferences of diverse users based on their gender, socioeconomic status their value chain roles
2. the need for transparency in the trade-off assessment and prioritization systems
3. the necessity of continuing to build interdisciplinary skills and understanding as a part of gender-responsive good practice
4. the need to understand that breeding programs must operate within the parameters of traits that are biologically, technically and economically feasible.



A nursery worker feeding fish at a research pond in Talbaria, Jessore Sadar, Bangladesh.

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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.

WorldFish is part of One CGIAR, the world's largest agricultural innovation network.

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