

Co-Creation Workshop on Inclusive Business Models for Cage Aquaculture in Small Reservoirs – Bolgatanga, Ghana

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Background and objectives

Ghana faces a significant decline in marine fish stocks, threatening national food security and livelihoods. Small-scale aquaculture is emerging as a viable alternative, particularly in northern Ghana, where small reservoirs offer untapped potential in terms of their multifunctional use to culture fish. Yet, systemic barriers persist, including limited technical capacity, high input costs, financing gaps, and weak market linkages. These challenges are particularly acute in northern Ghana, where water scarcity and limited access to fingerlings and feed, further hinder aquaculture development.

To address these issues, the International Water Management Institute (IWMI), in collaboration with CSIR–Water Research Institute (CSIR-WRI) and the Fisheries Commission of Ghana, under the CGIAR Sustainable Animal and Aquatic Foods (SAAF) Science Program, piloted cage aquaculture in small reservoirs at four sites in the North-East Region of Ghana. By November 2025, almost all participating groups had completed their second production cycle, demonstrating strong potential to scale up cage aquaculture in small reservoirs across northern Ghana to create employment and improve food security for communities. Building on these results and on the inclusive business model research, data collection, and stakeholder engagement conducted to date, IWMI convened a co-creation workshop in Bolgatanga, Upper East Region, under the SAAF Science Program to bring together aquaculture farmers, potential private investors, and key sector regulators.

Objective of the Co-creation Workshop

The workshop aimed to collaboratively assess the outcomes of IWMI's pilots and business model research and co-create viable investment opportunities to sustainably scale aquaculture in small reservoirs in the Upper East Region. Additionally, it aimed to strengthen linkages between practitioners and institutional actors to enhance knowledge exchange, capacity building, and policy alignment in the aquaculture sector with the objective of scaling aquaculture in the region.

Workshop Structure

The workshop combined plenary presentations by IWMI researchers and invited farmers with interactive group work and plenary discussions aimed at co-designing preferred investment models. It opened with welcome remarks by the Upper East Regional Director of the Fisheries Commission, Mrs. Sarah Bachon-ene Nwinibuobu Bamie, followed by an introduction to the workshop objectives by Ms. Sarah Appiah, who also served as the moderator. The program featured presentations by Dr. Giulia Zane on IWMI's aquaculture pilots and Mr. Joseph Salmawobil on investment opportunities in cage aquaculture in small reservoirs, followed by experience sharing by two farmers, an interactive question-and-answer session, and group work with plenary feedback. The agenda is reported in the Annex.

The workshop was attended by 44 stakeholders, including private aquaculture farmers, fish farmer groups, hatchery operators, potential private investors, financial institutions, and sector regulators, to reflect on key lessons from the IWMI-led cage aquaculture pilots in small reservoirs and to co-create viable investment opportunities. Participants were made up of 32 males and 12 females. Participants list is summarized in the Table 2 in the Annex.

Key discussions and outcomes

Dr. Giulia Zane delivered the opening presentation, providing an overview of the CGIAR SAAF program and key lessons learned from [IWMI's pilot cage aquaculture interventions](#) in the North-East Region of Ghana, including the results of the discrete choice experiment (DCE) on community preferences. The presentation highlighted the strong potential of small reservoirs for aquaculture development, noting underutilized potential of [over 2,000 small reservoirs in northern Ghana](#). It emphasized that pilot interventions have demonstrated that cage aquaculture in small reservoirs is technically feasible and can become profitable with improved production efficiency, with some farmer groups already able to cover 50–60% of investment costs after the first cycle. Key constraints such as limited access to finance, technical knowledge gaps, and operational challenges (e.g., water quality and input management) were identified as critical barriers to scaling.

Subsequently, Mr. Joseph Salmawobil presented the investment opportunities in cage aquaculture in small reservoirs, followed by a question-and-answer session with participants. The presentation positioned small reservoir aquaculture as a viable and scalable business opportunity, requiring relatively low infrastructure and capable of generating gross revenues up to USD 8,400 (corresponding to approximately GHS 98,000)¹ per 2-cage system per cycle with an investment of about USD 8,300 (GHS 97,000). It highlighted key investment gap, noting that while communities have access to water resources and labour, they are limited in capital and technical expertise, creating strong potential for private sector engagement. The role of IWMI and partners in facilitating investments through technical support, community engagement, and institutional linkages was also emphasized as a way of reducing investor risk.

Invited private farmers, Mr. Bamark Amatus (C4U Ghana Limited / ADB Navrongo) and Mr. Samuel Abunkunyi (Tono Catch), then shared their perspectives on the operational risks, incentives, and required returns associated with investing in aquaculture in small reservoirs. The two farmers emphasized that while aquaculture can be rewarding, its success depends on access to reliable information, technical expertise, and continuous engagement with sector regulators such as the Fisheries Commission for early detection of technical challenges. They highlighted high feed costs, theft, and water quality as key challenges and stressed the importance of careful planning and cost analysis.

In group sessions, participants discussed alternative investment modalities and co-designed their preferred business models, including:

- **Community-Private Partnership:** Investors provide capital while communities contribute to reservoir access and labor, creating shared ownership that can reduce theft risks and strengthen local commitment. Here the investor may go into 50-50 profit arrangement with community. However, participants noted potential challenges related to profit sharing and trust.
- **Full Ownership with Hired Labor:** Investors retain full ownership and decision-making authority while employing community members and, where necessary, skilled external workers. While community involvement may help reduce theft, participants cautioned that theft could persist if some community members feel entitled to the enterprise, and noted the risks of water-use conflicts, high capital requirements, and the need for strong supervision.
- **Contract Farming:** Investors finance production and purchase the harvest, providing farmers with access to capital and assured markets. However, trust issues and the risk of side-selling were identified as key challenges.
- **Passive Investor Model:** Investors provide financing and share profits with farmers through a farm manager. While this model reduces farmers' capital constraints, participants viewed it as carrying the highest risk due to management, accountability, and trust challenges, which could result in investors losing their capital.

Following the group feedback, participants expressed a clear preference for the full ownership model as their first choice, followed by the community–private partnership model. They emphasized that the terms and responsibilities under either arrangement should be clearly defined and agreed upon to minimize operational risks.

Successes and challenges

The workshop was marked by high levels of engagement and productive interaction among diverse participants, including farmers, investors, researchers, private sector actors, and policymakers. Group discussions were dynamic, and participants actively shared their experiences, challenges, and ideas, leading to rich insights that will inform the next phase of the project. The structure of the workshop, which combined presentations, plenary Q&As, and breakout group work, proved effective in encouraging inclusive participation and idea generation. Notably, the workshop created a valuable platform for cross-sector dialogue and strengthened networks among key actors in the aquaculture space.

¹ USD 1 = GHS 11.65, exchange rate on 28th July, 2026. GHS refers to Ghana Cedis, the official currency of Ghana.

While no challenges were encountered with the workshop or with the SAAF Program, several structural challenges surfaced through the discussions. These included persistent barriers to aquaculture investment in northern Ghana, such as limited access to credit, poor availability of quality inputs, inadequate extension services, and issues around water user conflicts and infrastructure maintenance. These challenges, while external to the workshop itself, reflect ongoing constraints that the co-designed business models will need to address in order to succeed.

Participant's Feedback on Workshop

Participants also completed a structured questionnaire at the end of the workshop to capture their feedback on the overall experience, investment interest, perceptions, and perceived risks associated with cage aquaculture in small reservoirs. The responses provide a comprehensive assessment of how participants evaluated the workshop, their investment readiness, and the key opportunities and constraints shaping future engagement in the sector.

Overall assessment

Participants rated the workshop very positively, with an average score of 4.72/5 for overall usefulness **and** 4.25/5 for clarity of investment opportunities. This indicates that the workshop was highly relevant to participants and largely successful in communicating key investment concepts.

What participants valued most

Participants strongly valued the interactive nature of the workshop, particularly group discussions, which enabled peer learning and exchange of ideas. The initial presentations, group presentations and facilitation were also well received for clearly explaining aquaculture systems and investment models.

Participants appreciated the exposure to investment opportunities and partnerships, as well as the capacity-building aspect, noting improved understanding of aquaculture and its potential for food security, jobs, and income. Cross-learning among farmers, researchers, and other stakeholders further enhanced the workshop's value.

Areas for improvement

Participants highlighted the need for more practical content, including field visits to some cage aquaculture farms, hands-on training, and real-life examples. Majority of them also noted that time was insufficient, suggesting a longer (2–3 day) workshop to allow deeper discussions.

Some asked for stronger focus on risks, challenges, and mitigation strategies, as well as **more** technical depth and data support to the presentations given. Participants also recommended involving more value chain actors and improving logistics such as accommodation support for participants from very far places.

Investment Interest

Among respondents, 79% (27 out of 37) expressed interest in investing, indicating strong potential. The few who were not interested cited limited access to suitable reservoirs, security concerns, and preference for pond systems, rather than low attractiveness of the sector.

Among those interested, readiness to invest was high, with 13 willing to invest within 1 month, 7 within 6 months, and 6 within 1 year. However, investment capacity remains a key constraint. Most participants fall below the USD 5,100 (GHS 60,000) range (14 participants), which is insufficient to finance a full two-cage system (≈USD 8,400). Only 6 participants indicated capacity above USD 8,600, while others fall within the USD 5,100 – 8,600 range, suggesting a need for flexible financing or partnership models.

Preferred Investment Models

Participants showed a strong preference for full ownership models, particularly those allowing investors to hire labor independently. This was followed by full ownership with labor sourced from the community. Some participants suggested hybrid approaches, combining community involvement with external technical expertise to balance local participation and efficiency. These responses are visualized in figure 1 below.

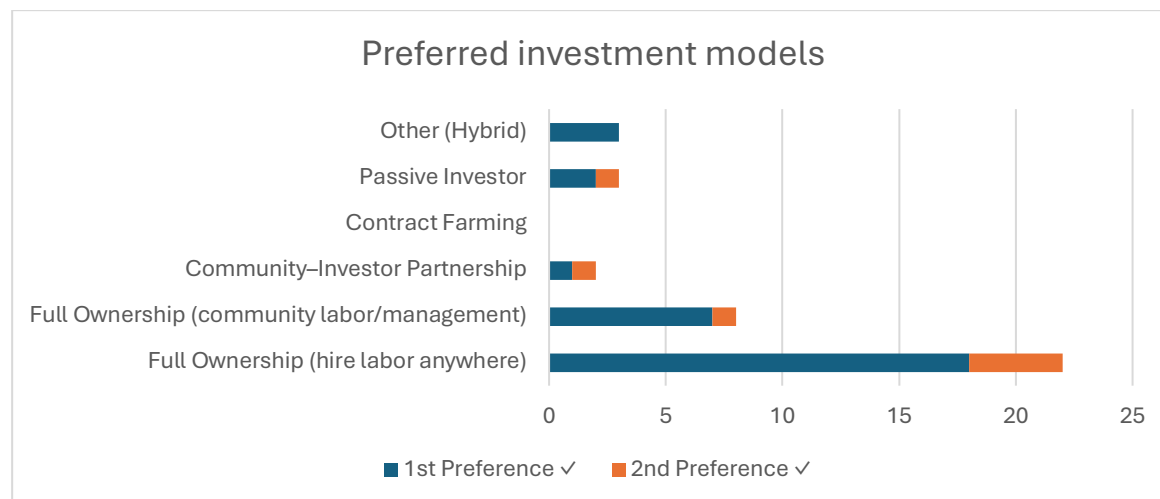


Figure 1 Participants preferred investment models

Source: Post-Workshop Questionnaire

Perceptions and Risk Assessment

Participants expressed generally positive perceptions of cage aquaculture in small reservoirs. The activity is widely viewed as profitable (4.11), and respondents reported relatively high confidence in their ability to invest successfully (4.03). There is moderate agreement on the feasibility of working with communities (3.69), although perceptions of how manageable risks remain slightly lower (3.17), reflecting some caution.

Perceived risks are moderate across categories. Market price fluctuations (3.41) are considered the most significant concern, followed by **fish mortality, theft, and community conflicts (3.05 each)**. **Regulatory risks (2.92)** are perceived as less critical. Overall, while participants are optimistic about the sector, they recognize the importance of addressing operational and market risks to support successful investment.

Next steps

The outcomes of the co-creation workshop and farmer investment interest assessment will inform the pilot implementation of selected inclusive investment models in at least one or two reservoirs in the Upper East Region, with the aim of demonstrating their feasibility for scaling up across similar small reservoir systems in northern Ghana. In the coming weeks, the IWMI team will follow up with the potential investors identified during the workshop to gauge their interest and identify potential communities and reservoirs for the pilot. CSIR-Water Research Institute, who are partners on will then conduct a suitability assessment, select the communities for the pilot, and obtain the necessary permits, before engaging the selected communities—together with IWMI and the selected investors—to introduce the co-designed models and secure local buy-in. Local management groups will subsequently be formed, with the support of CSIR-WRI, the Fisheries Commission, and local extension officers, and governance rules for the pilot models will be drafted. Pilot agreements (MOUs/lease terms) between investors, communities, and local authorities will then be finalized, and pilot implementation will commence with the signing of the agreements and the initial stocking of cages. In parallel, quantitative data on community preferences, perceptions, and welfare impacts will be collected through structured surveys, and the entire co-design process and its insights will be documented and disseminated through output products (e.g., IWMI/CSIR blog, outcome brief) shared with wider stakeholders.

Annex

Table 1: Workshop Agenda

Time	Session Title & Objectives	Responsible
08:30 – 09:00	Arrival & registration	Joseph Salmawobil
09:00 – 09:10	Words of Welcome from the Fisheries Commission	FC Regional Director
09:10- 09:15	Purpose of the workshop	Ms. Sarah Appiah
09:15 – 09:30	Lessons from pilot cage aquaculture in the North East Region	Giulia Zane
09:30 – 10:00	Investment opportunities in Aquaculture in small reservoirs	Joseph Salmawobil
10:00 – 10:30	Investor Perspectives: Insights into operational risks, incentives, and required returns.	Investors
10:30 – 10:45	<i>Health Break</i>	All
10:45 – 11:45	Interactive Group Work: Participants split into groups to discuss alternative investment modalities and co-design their preferred business model	All
11:45 -12:30	Plenary presentation and General discussion	All
12:30 – 1pm	Closing remarks	Giulia Zane
1 pm - 2 pm	Lunch & Networking	All

Table 2: Workshop Participants

Organization	Expertise	Women	Men
IWMI - CGIAR	Economics	2	1
Fisheries Commission	Fisheries and Aquaculture	2	5
CSIR Water Research Institute		0	3
NGOs and Community Groups	Community Development	0	2
Hatcheries	Hatchery	0	1
Fish Farmer Groups	Aquaculture	3	3
Private fish Farmers	Aquaculture	3	14
Fish Processors, Aggregators and Cold Stores	Fish marketing	2	3
TOTAL		12	32

Presentations



Lesson from the IWMI-CSIR-FC aquaculture pilot in the North East Region

Giulia Zane
9th June, 2026



Why Aquaculture in Small Dams?

- Over **2,000 small reservoirs** exist in the 5 regions of northern Ghana (Akpoti et al, 2024)
- The reservoirs have **multiple uses**: irrigation, livestock watering, construction, etc.
- Fishing is also common in many small reservoirs, but aquaculture is very rare
- Introduction of aquaculture can provide livelihood opportunities for youths and women in the community and increase fish availability



SMALL RESERVOIRS PORTAL

Explore over 2,000 small reservoirs in Ghana's northern regions

Reset view

IWMI International Water Management Institute

Ownership & use

Current use of the reservoir

AI

Accessibility

Is the reservoir easily accessible by road?

AI

Is the reservoir less than 30 minutes motor travel time away from a town?

AI

Suitability for aquaculture

What is the reservoir suitability level?

AI

Risk of drying

Risk of drying

AI

Water quality

How do you describe the turbidity of the reservoir during the dry season?

AI

What kind of water quality issues have you observed in the past?

AI

Water availability

Do you have year-round water available in the reservoir?

AI

What is the approximate depth of the reservoir during the end of the dry season?

AI

From which months do you observe a significant reduction in the water surface area?

AI

Name of Reservoir	Region	District	Risk of Drying (0-10)	Suitability Level
PISA DAM	Upper East	Bulsa South	Extremely low (0%)	Suitable
PISA DAM	Upper East	Bulsa South	Extremely low (0%)	Suitable
PISA DAM	Upper East	Bulsa South	Extremely low (0%)	Suitable

Reset all filters

Pilot design

- IWMI, the Fisheries Commission of Ghana and the CSIR Water Research Institute pilot group-based aquaculture in small dams
- 4 reservoirs were selected in the North-East region of Ghana after a suitability assessment: Nalerigu, Langbinsi, Tombu, and Nansoni
- Youth groups of 10-15 people were trained and received cages, canoes, life jackets, coaching, and inputs for 1 aquaculture cycle (tilapia fingerlings and feed)
- The first cycle started in September 2023. The second cycle was completed recently.



Achievements

- The pilot project has demonstrated the feasibility of fish farming in small community reservoirs in northern Ghana
- In 2 reservoirs, the revenues from the first harvest were sufficient to cover 50-60% of the reinvestment for the second cycle
- One of the groups received the Best Farmer Award for the North-East region
- Our calculations suggest that, with increased efficiency, it can be a profitable business



Challenges & lessons (1)

- Water quality (turbidity) in some reservoirs might be an issue, especially during the rainy season
 - Timing of stocking
 - Size of fingerlings
 - Fish species
 - Reservoir suitability



Challenges & lessons (2)

- Starting a new aquaculture venture requires substantial capital and know-how. Typically, both are not available to the communities.
 - Access to finance
 - Collaboration with private sector
 - Inclusive business models



Co-developing inclusive business models

- Workshop in Tamale in 2025
- Household survey – to understand community preferences over business modalities
- Cost-benefit analysis and profitability study
- Scoping visits



What Makes Communities Accept Your Investment

"Will this create jobs for us?"

- → Projects offering **salaried employment** gain the strongest support

"Will our community benefit directly?"

- → Investments linked to **local markets** are more likely to be accepted

What Consumers Are Willing to Buy

Type of Fish

- There is a higher preference for Catfish over Tilapia

Form of Fish

- Consumer have higher preference for smoked one and smaller pieces

What's next

- Aquaculture in small reservoirs is a promising business opportunity for investors
- The communities can benefit through employment generation and access to fish
- How do we make this happen?



Unlocking Small Reservoirs for Scalable Aquaculture

Joseph Salmawobil (IWMI)



THE OPPORTUNITY

450+ Reservoirs. Waiting to Produce.



2,000+

small reservoirs in Northern Ghana
~450 suitable for year-round cage aquaculture

IWMI pilots confirm technical feasibility of cage aquaculture in these waters.

Communities hold the land rights. You bring the capital and expertise.

Minimal infrastructure needed — existing water bodies, no land clearing.



3

THE GAP

Real Opportunity — Missing Capital

Communities have reservoirs and the human capacity, but are limited in capital, coordination and technical expertise.



The Cost requirement/Cycle for 2 cages

CAPEX ≈ GHS 36,500

- Cages, nets, canoe, safety gear, monitoring tools, harvesting equipment

OPEX ≈ GHS 60,700

- Feeds, fingerlings, transport, harvesting expenses, energy, labour and logistics

Total ≈ GHS 97,200

- With proper management, capital investment can be recovered in first cycle



THE PROBLEM

Fish Farming Is Getting Harder

- ↑ Demand for fish is rising — but costs are also rising
- 💰 Setting up and maintaining ponds/tanks is labour intensive
- 💧 Constant water changes and pumping drain time and money
- 🏠 Limited space makes it difficult to grow output

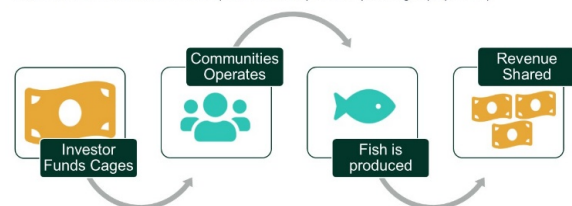
There has to be a better way.



THE SOLUTION

Community-Based Cage Culture

A scalable model that connects investor capital to community labour — producing tilapia profitably.



4

THE NUMBERS

Revenue Per 2 Cages per Cycle

6-month production cycle • Tilapia fingerlings to harvest

8,000 Fingerlings in 2 cages	70% Survival rate	1,960 kg Average harvest per cage	GHS 50 Farm-gate price per kg
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Gross Revenue for 2 Cages per Cycle

per 6-month cycle

GHS 98,000



OUR OFFER

What You Get — And What We Need

We Provide

- Mediation & negotiation with communities
- Technical training for community teams
- Cage setup, monitoring & management support
- Access to institutions, input suppliers & markets

We seek partnerships and investment to:

- Expand cage culture to communities in Northern Ghana
- Provide start-up cages and inputs
- Accelerate scaling across multiple reservoirs



8

Post-Workshop Questionnaire: Investment Interest in Cage Aquaculture

Thank you for attending the workshop. This short questionnaire will help us understand your feedback and interest in investment. All responses are **anonymous** and will be used only for research and program improvement purposes.

Section A: Participant Profile

1. Gender: ☐ Male ☐ Female
2. Age group: ☐ 18-24years ☐ 24-35yrs ☐ 35-45 yrs ☐ 45-60 years ☐ More than 60 years
3. Type of Organization / Farm / Company: ☐ Individual Farmer ☐ Farmer Group / Cooperative ☐ Private Company ☐ NGO ☐ Government Institution ☐ Other: _____
4. Your Role: ☐ Farmer ☐ Investor ☐ Trader ☐ Government Official ☐ NGO Staff ☐ Other: _____
5. Years of experience in agriculture, aquaculture or related business: ☐ None ☐ 1–5 years ☐ 6–10 years ☐ More than 10 years

Section B: Workshop Feedback

6. How useful was the workshop overall?
☐ 1 Very Low ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very High
7. How clear are the investment opportunities in cage aquaculture after this workshop?
☐ 1 Not clear ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very clear
8. What did you like most about the workshop?

9. What could be improved in future workshops?

Section C: Investment Interest

10. Are you interested in investing in **cage aquaculture** in small reservoirs?

☐ Yes

☐ No - **Please indicate reason** _____

(If No please go to Section D – question 12)

11. If **Yes**, how soon are you willing to invest?

☐ Within 1 month ☐ Within 6 months ☐ Within 1 year ☐ Within 2 years ☐ Later

12. How much are you willing to invest? Please select one option. [for reference, full cost of a 2-cage business is approx. GHS 90,000]

- ☐ **Less than 40,000**
- ☐ **40,000 – 60,000**

- ☐ 60,000 – 80,000
- ☐ 80,000 – 100,000
- ☐ More than 100,000

Section D: Business Model Preferences [for everyone]

13. Which business model do you prefer **most as an investor**?

Please tick (✓) one option for your 1st and one option for your 2nd preference.

Business Model	1st Preference (✓)	2nd Preference (✓)
Full ownership (hire labor from anywhere – pay for access to dam)	☐	☐
Full ownership (hire labor/management from community)	☐	☐
Community–Investor Partnership	☐	☐
Contract Farming (provide input + technical support and buy output)	☐	☐
Passive investor	☐	☐
Other (Specify): _____	☐	☐

Section E: Perceptions (1 = Strongly Disagree, 5 = Strongly Agree)

Statement	1	2	3	4	5
15. Cage aquaculture in small reservoirs is profitable	☐	☐	☐	☐	☐
16. Working with local communities is feasible and beneficial	☐	☐	☐	☐	☐
17. The risks (water, mortality, theft, market, etc.) are manageable	☐	☐	☐	☐	☐
18. I feel confident I can successfully invest in this sector	☐	☐	☐	☐	☐

Section F: Perceived Risks (1 = Low Concern, 5 = High Concern)

Risk Factor	1	2	3	4	5
19. Water availability & quality	☐	☐	☐	☐	☐
20. Fish mortality / disease	☐	☐	☐	☐	☐
21. Theft / Security	☐	☐	☐	☐	☐
22. Market price fluctuations	☐	☐	☐	☐	☐
23. Community conflicts	☐	☐	☐	☐	☐
24. Regulatory / Policy risks	☐	☐	☐	☐	☐

Section G: Next Steps

25. Would you like to be contacted regarding participation in a pilot project? ☐ Yes ☐ No

If you wish to be contacted for further steps, please leave us the following information.

Section F: Participant Information (Optional)

26. Name: _____
27. Name or organization/company: _____
28. Phone Number: _____
29. Email Address (Personal or Company): _____
30. Preferred next step (Choose all that applies): ☐ Site visit ☐ One-on-one investment discussion ☐ Technical training / support ☐ Detailed business plan / financials ☐ More information via email/WhatsApp

Thank you very much for completing this questionnaire! Your feedback is highly valuable and will help shape future programs.



Contact:

Giulia Zane, IWMI, g.zane@cgiar.org

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SUSTAINABLE ANIMAL
AND AQUATIC FOODS

