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WorldFish

Training Report on Integrated Ricefield Pond Systems in the Mekong and 3S Landscapes

Building Climate-Resilient and Nature-Positive Farming Systems

July 2026



Credit: Vichet Sean/WorldFish

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Authors
Vichet Sean, Kosal Mam, Vathanak Sun and Raksa Sok

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Contact
WorldFish Communications and Marketing Department, Jalan Batu Maung, Batu Maung, 11960 Bayan Lepas, Penang, Malaysia. Email: worldfishcenter@cgiar.org

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Chua Seong Lee, Thavamaler Ramanathan and Sabrina Chong, WorldFish.

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Abbreviation

AoW1	Area of Work 1
BSF	Black Soldier Fly
CAO	Commune Agriculture Officer
DAO	District Agriculture Office
GDF	General Directorate of Fisheries
IPM	Integrated Pest Management
IRFPS	Integrated Ricefield Pond System
MFL	Multifunctional Landscapes Programme
PDAFF	Provincial Department of Agriculture, Forestry and Fisheries

Executive Summary

Between 20 and 28 July 2026, six farmer training events were conducted on Integrated Ricefield Pond System (IRFPS) in Prey Veng and Ratanakiri Provinces under the CGIAR–Multifunctional Landscapes Programme (MFL), Area of Work 1 (AoW1). A total of 149 farmers participated, including 63 women, demonstrating strong gender inclusivity. Following the training, 69 farmers signed adoption agreements to implement IRFPS, while nine farmers committed to piloting Black Soldier Fly (BSF) larvae production as a suitable low-cost fish feed innovation.

The training combined technical instruction with participatory approaches, including group discussions, dream mapping, and field-based learning, enabling farmers to adapt recommendations to local conditions. Collaboration among WorldFish, General Directorate of Fisheries (GDF), the Provincial Departments of Agriculture, Forestry and Fisheries (PDAFF), District Administrations (DAOs) and local extension officers strengthened local ownership and enhanced the relevance and feasibility of the innovations.

The programme improved farmer knowledge of ecological pond management, integrated rice–fish–vegetable production, and biodiversity friendly farming practices. Strong interest in BSF larvae production highlighted farmers' willingness to adopt climatesmart technologies that improve productivity while reducing input costs and organic waste. Key challenges identified included dryseason water shortages, variability in pond conditions, and limited financial capacity for farm investments, underscoring the need for continued technical support and adaptive implement strategies.

To accelerate adoption and scaling, the report recommends strengthening demonstration activities, facilitating farmer-to-farmer learning exchange, maintaining regular monitoring of pilot sites, and deepening collaboration with provincial partners. By generating evidence on productivity income, nutrition and environmental benefits, the programme can support wider uptake of IRFPS across the Mekong and 3S Landscapes. Overall, the training established a solid foundation for promoting resilient and sustainable farming systems that contribute to food security, livelihood improvement, biodiversity conservation, and climate adaptation.

1. Introduction

The CGIAR–MFL Programme promotes naturebased solutions that enhance agricultural productivity, biodiversity conservation, nutrition, and climate resilience. Recognizing the multifunctional nature of landscapes, the programme emphasizes integrated approaches that balance food production with ecological stewardship. Within this framework, AoW1 focuses on scalable agroecological innovations that improve soil fertility, water management, biodiversity, nutrition, and livelihoods.

Cambodia provides a compelling context for AoW1 interventions. Ricefield fisheries are central to rural life, supplying essential protein and micronutrients while supporting cultural traditions and community identity.

However, ricefield fisheries face growing pressures. Habitat degradation, change hydrology from irrigation and dams, and agricultural intensification have contributed to declining fish populations. Farmers report reduced catches, fewer species, and greater vulnerability to pests and diseases.

The loss of fish, crustaceans, mollusks, and aquatic plants undermines ecosystem functions, reduces productivity and resilience, and weakens the nutritional value of ricefield systems for rural households.

Figure 1. Rice–Fish Harmony: Ecological Pond Systems in Cambodia.



Figure 2. Challenges in Rice Field Pond Management in Cambodia.



Climate change compounds these challenges. Unpredictable rainfall patterns, prolonged droughts, and more frequent floods have destabilized traditional farming calendars. Farmers face growing uncertainty in crop planning, water management, and protecting crops and fish stocks. Flood can damage ponds and rice crops in lowland areas, while water scarcity constrains production in the upland regions. These stresses highlight the need for climate-resilient farming strategies.

The IRFPS was developed by WorldFish as a response to these interlinked challenges. Rather than requiring costly new structures, IRFPS improves existing ponds through ecological management. It integrates rice, fish, vegetables, water management, and biodiversity conservation into a single system. By harnessing natural processes, IRFPS reduces reliance on chemical inputs, improves soil fertility, enhances water use efficiency, and diversifies production to strengthen food security and livelihood.

The rationale for IRFPS is clear: it offers a holistic solution that addresses declining fisheries, biodiversity loss, and climate risks while improving livelihoods. By embedding ecological principles into pond management, IRFPS transforms ricefields into multifunctional landscapes that support both people and nature. This innovation aligns with Cambodia's national priorities for climate adaptation and food security, making it a timely and relevant intervention.

2. Objectives

The July 2026 farmer training programme was designed to support the broader goals of the CGIAR–MFL Programme by strengthening farmers' capacity to manage ricefield ponds ecologically and sustainably. Through a focus on pond improvement and water management, the training promotes practical approaches that optimize existing resources rather than rely on costly infrastructure investments.

Another key objective was to promote integrated rice–fish–vegetable farming systems. This approach not only diversifies production, improves household nutrition, and strengthens resilience while encouraging biodiversity conservation through habitat protection, broodfish conservation, and ecologically sustainable practices.

Innovation was also central to the programme. The introduction of Black Soldier Fly (BSF) larvae production provided farmers with a sustainable alternative fish feed, reducing input costs while recycling organic waste. This innovation offers both economic and environmental benefits.



Credit: Vichet Sean/WorldFish

3. Training Design and Methodology

The training programme was designed to strengthen farmers' capacity through a participatory approach that combines presentations, group discussions, dream mapping, and field demonstrations. These methods enable farmers to identify local challenges, develop practical solutions, and link farm improvements to broader livelihood goals.

Presentations provided technical knowledge on ecological pond management, integrated farming, and biodiversity conservation, while group discussions and dream mapping encouraged participants to reflect on opportunities, constraints, and future aspirations for their farms.

Field demonstrations helped farmers visualize key practices, including pond improvement, water management, and BSF larvae production. These practical examples increased confidence in adopting innovations and reinforced farmertofarmer learning.

Collaboration was a key feature of training. WorldFish worked closely with the GDF, PDAFF, DAOs, and local extension officers to ensure the training was aligned with local priorities and supported by relevant institutions.

The programme also promotes gendersensitive participation by encouraging women to contribute to discussions and take leadership roles. This strengthens inclusivity, decisionmaking and community resilience.

Overall, the training combined technical learning, participatory engagement, institutional collaboration, and gender inclusion to create a stronger foundation for adopting and scaling IRFPS and BSF innovations across the Mekong and 3S Landscapes.


Credit: Vichet Sean/WorldFish

4. Implementation Training Events

Between 20 and 28 July 2026, WorldFish, in collaboration with the GDF, PDAFF, DAOs, and local authorities delivered six farmer training events across six communes in four districts of Prey Veng and Ratanakiri provinces.

Table 1. Summary participant in training on IRFPS.

Date	Commune	District	Province	People	Women
20 Jul 2026	Cheach	Kamchay Mear	Prey Veng	32	25
21 Jul 2026	Smaong Khang Cheung	Kamchay Mear	Prey Veng	20	4
22 Jul 2026	Preal	Kanhchriech	Prey Veng	24	7
23 Jul 2026	Kouk Kong Kaeut	Kanhchriech	Prey Veng	22	9
24 Jul 2026	Prey Tueng	Sithor Kandal	Prey Veng	33	12
28 Jul 2026	Srae Ankrang	Kon Mom	Ratanakiri	18	6
Total	**6**	**4**	**2**	**149**	**63**

The programme reached 149 farmers, including 63 women, through participatory training under the CGIAR-MFL Programme (AoW1). Training covered ecological pond improvement, water management, fish habitat enhancement, integrated rice-fish-vegetable production, and use of BSF larvae as a sustainable fish feed source. Farmers also discussed project implementation, collaboration arrangements, and establishment of demonstration sites.



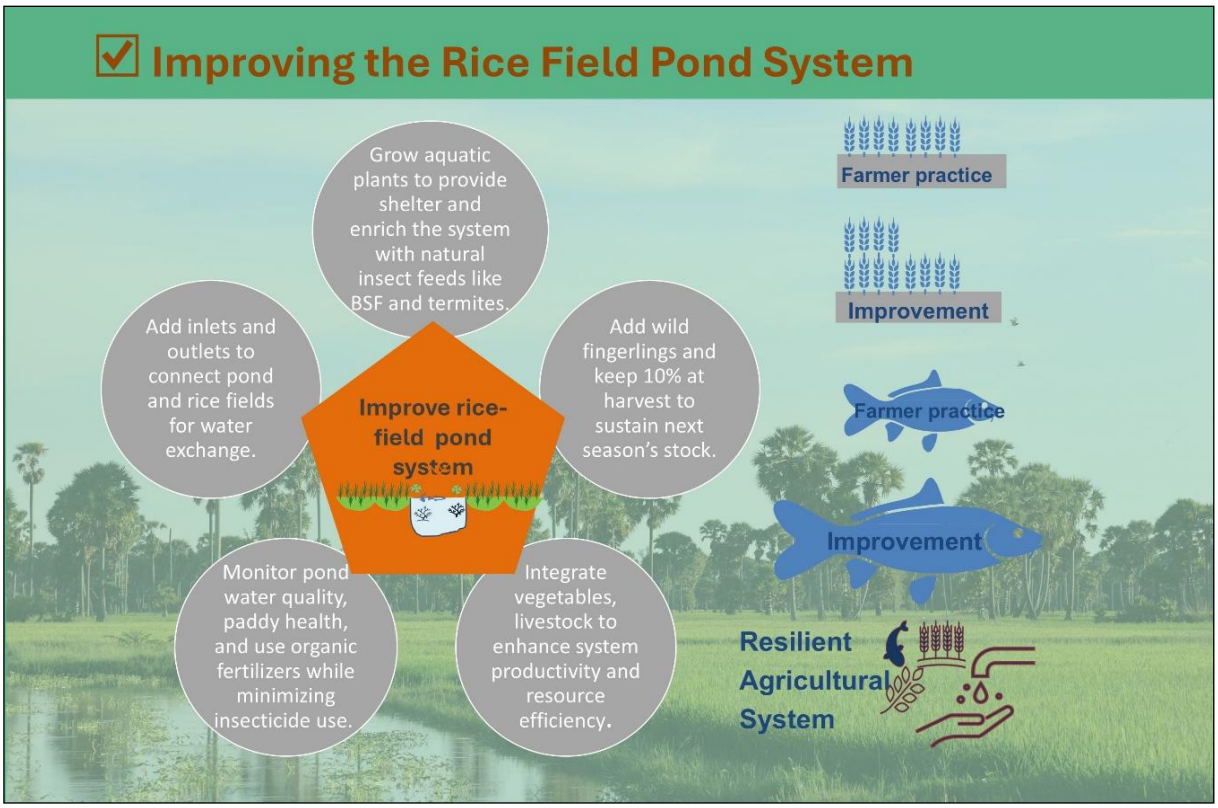
Credit: Vichet Sean/WorldFish

5. Technical Training on the IRFPS

The training programme equipped farmers with practical knowledge and skills to establish and manage the IRFPS as a climate-resilient, nature-based farming approach. It emphasized the integration of rice, fish, vegetables, water, biodiversity, and farm resources to improve productivity and sustainability.

The technical modules addressed several key challenges facing Cambodian farming systems, including declining ricefield fisheries, climate variability, droughts and floods, rising feed costs, soil degradation, and limited income opportunities. The training promoted practical, low-cost innovations that enhance productivity, ecosystem health, and climate resilience.

Figure 3. Intervention in Improving Rice Field Pond Systems.



5.1. Pond Design and Improvement

One of the first technical modules focused on improving existing ricefield ponds rather than constructing costly new infrastructure. Farmers learned that a well-designed pond serves as water storage facilities, fish refuges, biodiversity habitats, and year-round production areas.

Training covered practical pond improvements, including increasing depth, strengthening embankments, improving side slopes, and installing inlet and outlet structures. These measures improve water circulation and quality, support fish movement, and reduce the risk of flooding or embankment failure.

Farmers also learned the importance of maintaining vegetative cover along pond embankments to reduce erosion, filter sediments, and provide habitat for beneficial organisms. These improvements enhance pond functionality, extend pond lifespan, and reduce maintenance costs over time.

5.2. Water Storage and Management

Water management was a core component of the training, because reliable water availability underpins rice, fish, and vegetable production. Farmers discussed the impacts of drought, erratic rainfall, and localized flooding, which are becoming more frequent under changing climatic conditions.

Participants were introduced to practical water storage and retention techniques, including appropriate pond depth and design. Demonstrations showed how ponds can capture and store rainfall during the wet season for use during dry periods, helping reduce production risks.

Training also emphasized efficient water allocation throughout the production season. Farmers learned how to manage water levels for rice, fish, and vegetables while maintaining water quality through monitoring key parameters such as clarity, temperature, and dissolved oxygen.

The training highlighted that effective water management not only improves productivity but also strengthens resilience to droughts, floods, and other climate-related shocks.

5.3. Fish Habitat Enhancement

Declining fish populations and reduced natural fish recruitment have become major concerns in Cambodian ricefield ecosystems. Contributing factors include habitat degradation, reduced connectivity between rice fields and water bodies, changed flooding patterns, agro-chemical use, overharvesting, loss of aquatic vegetation, and climate variability. These changes reduce breeding habitats, natural food sources, and ecosystem resilience.

To address these challenges, the training promoted practical approaches to enhancing fish habitat within existing ricefield ponds. Farmers were encouraged to improve pond ecology rather than rely solely on fish stocking, creating conditions that support fish's survival, growth, and natural reproduction.

Farmers learned to establish underwater shelters using locally available materials such as bamboo, tree branches, and brush piles. They were also encouraged to maintain 20–40% aquatic vegetation cover to provide shade, support aquatic food organisms, improve habitat quality, and create feeding and refuge areas for fish. Another important topic was broodfish conservation. Farmers were encouraged to retain healthy mature fish rather than harvest all fish at the end of the production cycle. This practice helps sustain fish population while supporting household production and aquatic biodiversity.

Training also highlighted the importance of maintaining connectivity between ponds and surrounding rice fields, whenever possible, to facilitate seasonal fish movement, enhance natural recruitment, and support healthier aquatic ecosystems.

5.4. Biodiversity Conservation

A central theme throughout the training was the role of ricefield ponds as important biodiversity refuges within agricultural landscapes. Farmers learned that ponds support a wide range of aquatic organisms, including fish, frogs, aquatic insects, snails, crustaceans, microorganisms, and aquatic plants, all of which contribute to ecosystem health.

The training encouraged farmers to minimize unnecessary pesticide and herbicide applications which can negatively affect aquatic life and contaminate water resources. Instead, farmers were introduced to Integrated Pest Management (IPM) approaches that emphasize biological control, habitat management, and pest monitoring before chemical interventions are considered.

The ecological benefits of maintaining native vegetation around ponds were also highlighted. Buffer vegetation filters runoff, improves water quality, reduces erosion, and provides habitat for pollinators and natural enemies of crop pests.

By conserving biodiversity, farmers can enhance ecosystem services such as natural pest control, nutrient cycling, water purification, and pollination, while simultaneously strengthening the long-term sustainability of their farming systems.

5.5. Nutrient Recycling and Circular Farming

The training introduced nutrient recycling as a key principle of the Integrated Ricefield Pond System. Farmers learned how crop residues, livestock manure, household organic waste, and aquatic vegetation can be converted into valuable farm inputs rather than treated as waste.

Practical demonstrations covered compost production using locally available materials. Farmers observed how compost improves soil structure, increases organic matter, enhances water retention, and provides a steady supply of nutrients for crop growth.

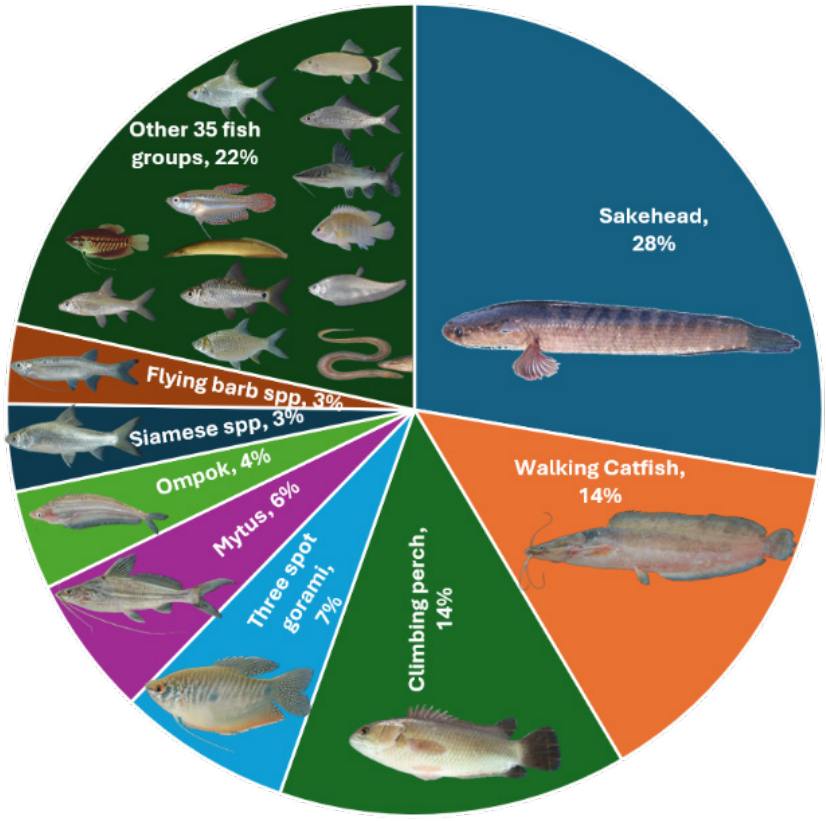
Livestock manure was also highlighted as another resource that, when properly managed, can supply nutrients to rice fields, vegetable gardens, and pond ecosystems. Improved nutrient cycling reduces fertilizer costs, minimizes environmental pollution, and supports healthier soil and aquatic ecosystems.

The concept of circular farming was emphasized, where outputs from one farm component become valuable inputs for another, creating a more efficient, resilient, and sustainable production system.

5.6. Natural Feed Production Using BSF Larvae

Most fish in rice field pond systems are predators, preferring live prey such as insects, larvae, or smaller fish rather than vegetables or commercial feed. To support their diet naturally, farmers can introduce a rich protein source and help sustain fish growth without relying on costly manufactured feeds. This approach strengthens the ecological balance of the system while improving productivity.

Figure 4. Species Composition in Rice Field Pond Systems.



One of the most innovative components of the training was the introduction of BSF larvae production as an affordable and environmentally friendly fish feed source. Farmers recognized that feed is often the largest expense in aquaculture, limiting profitability for small-scale producers.

Training demonstrated how BSF larvae can be produced using simple household materials and locally available organic waste, including vegetable residues, fruit waste, and agricultural by-products. Participants learned the complete production cycle, including establishing breeding containers, managing larvae development, harvesting mature larvae, and storing them for fish feeding.

The advantages of BSF production were discussed in detail. BSF larvae provide high-protein and high-fat feed suitable for many fish species, while reducing organic waste accumulation around households. Farmers also appreciated that BSF production requires relatively little space, low investment, and minimal technical inputs.

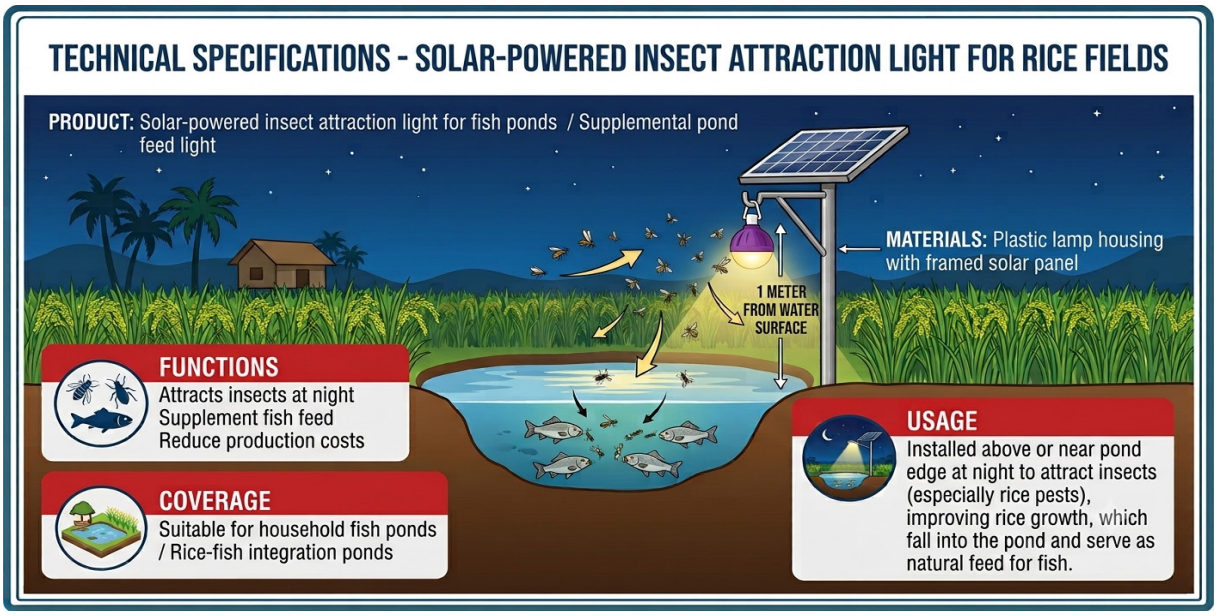
During discussions, many participants expressed strong interest in adopting BSF production to lower production costs, improving fish growth, reducing dependence on purchased feeds, and contribute to more environmentally sustainable farming practices.

5.7. Solar Insect-Attracting Lights

Another innovative technology introduced during the training was the use of solar-powered insect-attracting lights. These simple devices use renewable energy to attract insects at night, allowing insects to fall directly into ponds where they become natural live feed for fish.

Farmers learned how the technology works, suitable installation locations, routine maintenance, and methods to maximize insect attraction. Compared with conventional fish feeding, solar insect-attracting lights provide a low-cost and environmentally friendly source of supplemental nutrition while reducing dependence on commercial feed.

Figure 5. Solar-Powered Insect Attraction Light for Rice Field Pond Systems.



The technology also supports ecological processes by utilizing naturally occurring insect populations without requiring chemical attractants or grid electricity. Participants viewed this innovation as particularly suitable for remote rural communities where electricity access may be limited, and input costs are high.

5.8. Practical Vegetable Production

An additional practical session focused on vegetable production as a key component of IRFPS. Farmers learned how to integrate vegetables with rice and fish production can improve household nutrition, diversify income, and strengthen climate resilience, while making productive use of pond embankments and surrounding land.

Through hands-on demonstrations, participants learned site selection, land preparation, raised-bed construction, seedling production, transplanting, irrigation management, and the use of compost and organic fertilizers produced from on-farm sources. The training also introduced IPM, emphasizing preventive and environmentally friendly approaches that reduce reliance on chemical pesticides.

Participants actively engaged in discussions and practical exercises, combining local knowledge with technical guidance. The session concluded by highlighting how vegetable cultivation can improve food security, generate regular income, reduce erosion, enhance water management, and increase the overall sustainability and resilience of integrated farming systems.

Figure 6. Vegetable Seedling Preparation for Integration into Rice Field Pond Systems.



6. Key Results and Outcomes

The July 2026 training programme delivered several important results that demonstrate both the effectiveness of the IRFPS approach and farmers' readiness to adopt ecological innovations.

First, the training improved farmer knowledge of ecological pond management, integrated rice–fish–vegetable farming, biodiversity conservation, and nutrient recycling. Through practical demonstrations and discussions, farmers gained confidence in applying key techniques such as pond reinforcement, water storage, and broodfish conservation.

Second, the programme strengthened farmer ownership and commitment. The signing of 69 adoption agreements reflected strong interest in IRFPS, with demonstration sites expected to support farmertofarmer learning, and with uptake of good practices.

Third, the training enhanced collaboration with government agencies and local authorities. The involvement of the GDF, PDAFF, DAOs, CAOs helped align training outcomes with government priorities and provided a strong foundation for future scaling.

Finally, BSF larvae production emerged as a promising innovation. Nine farmers committed to piloting BSF units, recognizing their potential to reduce feed costs, recycle organic waste, and improve sustainability and resource efficiency of farming systems.

Table 2. Summary of farmers agreed to adopt the technologies.

No	Commune	District	Province	Demo Farmers	Black Soldier Fly Lavar
1	Cheach	Kamchay Mear	Prey Veng	19	5
2	Smaong Khang Cheung	Kamchay Mear	Prey Veng	10	1
3	Preal	Kanhchriech	Prey Veng	10	0
4	Kouk Kong Kaeut	Kanhchriech	Prey Veng	9	0
5	Prey Tueng	Sithor Kandal	Prey Veng	9	2
6	Srei Ankrang	Kon Mom	Ratanakiri	12	1
Total	**6**	**4**	**2**	**69**	**9**

Together, these outcomes demonstrate that the training programme has established a strong platform for refining and scaling the IRFPS approach. Improved knowledge, stronger farmer ownership, enhanced collaboration, and the early adoption of BSF larvae production highlight the potential of ricefield ponds as multifunctional systems that support food security, nutrition, biodiversity conservation, and climate resilience.

7. Lessons Learned

The July 2026 training programme generated several important lessons to inform future IRFPS implementation and scaling.

One of the clearest insights was the effectiveness of participatory methods. By combining presentations, group discussions, dream mapping, and field demonstrations, the programme encouraged active engagement, knowledge sharing, and stronger farmer ownership compared to lecture-based approaches.

The importance of demonstration farms also emerged as a key lesson. Farmers expressed strong interest in practical examples of IRFPS in action, highlighting the importance of demonstration sites for showcasing results and promoting farmertofarmer learning.

Another lesson was the high interest in BSF larvae production. Farmers recognized the potential to reduce feed costs, recycle organic waste, and improve farm sustainability, indicating strong demand for low-cost, environmentally friendly innovations.
Finally, the training highlighted the value of women's participation. Women actively contributed insights on nutrition, vegetable production, and farm management, with strong participation in adoption agreements demonstrating their growing role in household and community decisionmaking.

Together, these lessons confirm that participatory methods, demonstration farms, innovative feed solutions, and gender inclusivity are key drivers of successful IRFPS adoption and scaling.



Credit: Vichet Sean/WorldFish

8. Challenges

While the July 2026 training programme achieved notable successes, several challenges were identified that must be addressed to support effective and sustainable scaling of the IRFPS.

The most pressing challenge was dry season water shortages. Farmers in both floodplain and upland ecosystems reported difficulties maintaining pond water levels, affecting fish production and irrigation. This highlighted the need for improved water storage and management systems.

Another challenge was the variation in pond conditions across sites. Differences in soil type, water retention capacity, and pond design meant that technical recommendations must be adapted to local contexts, requiring flexible and site-specific support.

The training further revealed the need for continued extension support. While farmers valued the initial training, they emphasized the importance of on-going technical guidance to support implementation, problem solving, and consistent adoption of good practices.

A broader structural challenge is the increasing intensification of rice cultivation. Monocropping, higher chemical input use, and declining biodiversity can undermine the ecological foundation of IRFPS. Farmers noted that pressure to maximize rice production can conflict with efforts to diversify production and conserve aquatic resources.

Together, these challenges illustrate that successful IRFPS scaling will depend on improved water management, locally adapted technical support, sustained extension services, and approaches that balance agricultural productivity with ecological sustainability.



Credit: Vichet Sean/WorldFish

9. Recommendations

Building on the successes and lessons learned from the July 2026 training programme, several recommendations are proposed to strengthen adoption and scaling of the IRFPS.

First, demonstration farmers should be closely monitored. As local champions, their experiences can provide valuable evidence on productivity, nutrition, biodiversity, and the overall effectiveness of the IRFPS approach.

Second, the programme should prioritize systematic documentation of outcomes. Collecting data on yields, income diversification, and ecological benefits will help build a strong evidence base for policy engagement, and future scaling.

Third, farmer exchange visits and field days should be organized to promote peer learning. Seeing IRFPS in practice can increase farmer confidence, encourage wider adoption, and support knowledge sharing across different agroecological contexts.

Fourth, collaboration with government agencies and local authorities must be further strengthened to ensure IRPFS is aligned with and integrated into government priority and development programme.

Fifth, user-friendly communication materials, including visual guides, manuals, and short videos, should be developed to reinforce learning and support adoption. These materials should be gendersensitive and accessible to farmers with varying literacy levels.

Finally, efforts should focus on institutionalizing IRFPS within extension services, agricultural policies, and climate adaptation strategies. Embedding the approach within the national programme will support long term scaling and contribute to Cambodia's food security, nutrition, and biodiversity goals.



Credit: Vichet Sean/WorldFish

10. Conclusion

The July 2026 farmer training programme established a strong foundation for scaling the IRFPS across Cambodia's diverse agroecological landscapes. By engaging 149 participants, including 63 women, and securing 69 adoption agreements, the programme demonstrated both farmer interest and institutional support.

The early uptake of BSF larvae production by nine farmers further highlighted the potential of climatesmart innovations to reduce feed costs, recycle organic waste, and strengthen sustainability. These adopters provide valuable evidence that farmers are willing to embrace new technologies when they deliver both economic and environmental benefits.

The programme also strengthened collaboration with government agencies, extension officers, and local authorities, helping align IRFPS with local and national development priorities. A participatory and gendersensitive facilitation approach reinforced inclusivity, with women playing active role in training activities and adoption decisions.

Together, these outcomes contribute to food security, improved nutrition, biodiversity conservation, and climate resilience. By integrating rice, fish, vegetables, and ecological pond management, IRFPS offers a holistic solution to the challenges facing Cambodia's ricefield ecosystems.

The July 2026 programme has laid a solid foundation for future scaling. With demonstration farmers, solar light and BSF, and strong institutional partnership, IRFPS has significant potential to reach more households, enhance resilience, and transform ricefield ponds into multifunctional landscapes that support both people and nature.

Annexes

Annex 1. Ricefield Pond Features and Production

Commune	Avg. of year dug	Avg. of own ricefield connected pond (ha)	Avg. of pond size (m^2)	Avg. of Depth in wet (m)	Avg. of Est total fish Kg
Cheach	2018	0.47	199	2.92	28
Kouk Kong Kaeut	2022	0.13	547	2.94	52
Preal	2021	0.07	152	2.50	40
Prey Tueng	2019	0.28	194	3.28	45
Smaong Khang Cheung	2013	0.53	281	2.83	32
Srae Angkrong	2017	1.29	220	3.46	19
Grand Total		**0.49**	**250**	**3.00**	**36**

Annex 2. Selected Photos of training






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Integrated Ricefield Pond System
Product Features
SOLAR PANEL
SOLAR PANEL
SOLAR PANE







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