Photo credit: Agness Chileya/WorldFish

Building climate resilience in small-scale aquatic food systems

Locally led initiatives in Bangladesh, Timor-Leste, and Zambia show why small-scale fisheries and aquatic food producers need a seat at national climate change policy tables.

Small-scale fishers and aquaculture producers, who make outsized contributions to global aquatic food systems, are suffering severe impacts from climate change.

Their already inadequate incomes and food and nutrition security are threatened by warming oceans and inland waters, by salt-water incursion and flooding from violent storms and rising seas, and by droughts that reduce rivers, ponds, and lakes.

Currently underrepresented in climate change policy, small-scale fisheries and aquaculture urgently need to be more strongly reflected in national climate strategies and targets, as well in budgets and programs for climate change adaptation.

Cases from three countries — Bangladesh, Timor-Leste, and Zambia — where small-scale fishers and aquatic food farmers are at the frontline of addressing climate change threats to their food security and livelihoods, illustrate ways in which local participation can contribute.

Climate change: Major threat to aquatic food systems and small-scale actors

Climate change effects are limiting marine and freshwater production, aquaculture feed supplies, and post-production activities worldwide, and the effects are expected to worsen, with grave consequences for the most vulnerable. A 2021

Fish and other aquatic foods

Critical for nutrition, livelihoods, and economies

- As of 2022, global production of fisheries and aquaculture exceeded 223 million tons— providing nearly 21 kilograms of aquatic animal food per capita or about 15 percent of the animal protein supply— and demand is rising, expected to double by 2050.
- Besides protein, these foods provide essential micronutrients such as calcium, iron, vitamin A, vitamin B12, and omega-3 fatty acids.
- Some 3.3 billion people rely on aquatic foods for at least 20 percent of their animal protein intake.
- Small-scale fisheries and aquaculture generate livelihoods for around 600 million people, most in developing countries.
- The trade of aquatic food products involves over 230 countries and territories and generates US $195 billion yearly, or 11% of all agricultural trade.

modeling study (Tigchelaar et al. 2021) showed that, with high greenhouse gas (GHG) emissions and no mitigation, by 2050 more than 90 countries will face substantial threats to the productivity of fisheries and freshwater aquaculture. Especially affected will be small island developing states, as well as countries in Africa, South Asia, and Southeast Asia, whose inhabitants depend heavily on aquatic foods for nutrition, income, and livelihoods.

Though bearing the costs of climate change, fisheries and aquaculture can also contribute to adaptation and mitigation in global food systems. Recently released guidelines (Stanford Center for Ocean Solutions et al. 2024) show that sustainable management of aquatic food systems can significantly reduce the GHG emissions of food production, for example, by more effectively managing capture fisheries and shifting fisheries and aquaculture to lower-emission species and practices.

Yet, despite the high potential for contributions from fisheries and aquaculture to climate change mitigation and adaptation, aquatic food production systems are currently underrepresented in Nationally Determined Contributions (NDCs). A review of 2020 NDCs showed that 84 countries do not mention aquatic foods at all, while 37 only mention them in passing (Stanford Center for Ocean Solutions et al. 2024).

This underrepresentation of fisheries and aquaculture in national climate strategies precludes their inclusion in climate financing. The costs of adaptation for the aquatic food sector in all developing countries has been estimated at US $4.8 billion per year by 2030 and likely to rise significantly towards 2050 (FAO 2024), whereas public international adaptation finance flows to the aquatic food sector have averaged only US $200 million per year during 2017–21 (Chiriac, D. H. Vishnumolakala, and P. Rosane, 2023).

Small-scale actors are big players in fishing and aquatic food production and thus could carry a large adaptation and mitigation footprint. Small-scale fisheries alone account for at least 40 percent of the global catch from capture fisheries and employ an estimated 60 million people — about 90 percent of the total in fisheries, with most of them in developing countries (FAO, Duke University & WorldFish, 2023).

Ensuring effective representation in environmental decision-making for small-scale actors, women, indigenous communities, and other marginalized groups who practice fishing and aquaculture is crucial to enhance aquatic food systems' climate resilience and to support food and nutrition security, and economic growth.

Locally led approaches: Essential for climate adaptation

The settings and climate-related challenges of aquatic food production around the world are highly diverse, as illustrated in examples from three countries. Situated on the Bay of Bengal with an enormous delta and lush waterways, low-lying **Bangladesh** suffers frequent saltwater intrusion from rising seas, storms, and tidal surges, while increasingly heavy rain is causing devastating floods. Surrounded by oceans on three sides, **Timor-Leste** is prone to floods, tropical storms and cyclones that can

Rice-fish farming providing higher profits and climate resilience in Bangladesh.

Photo credit: Balaram Mahalder/WorldFish

cause significant damage, not to mention regular droughts and extreme temperatures, all affecting freshwater fisheries and aquaculture. The nation's extreme poverty limits its ability to address these conditions. In landlocked **Zambia**, dry spells and floods lead to abandoned ponds, damaged infrastructure, and wild fish failing to spawn. The rapid and unexpected onset of cyclones and strong winds make fishing on inland lakes more dangerous and costly, as fishers and boats are more often lost.

Locally led approaches build climate resilience by adapting fisheries and aquaculture production to new climate realities through nature-based solutions and by building agencies of small-scale fishers and fish farmers to make climate-informed decisions and diversify their livelihoods based on community strengths.


A seaweed farmer in Liquica, Timor-Leste.
Photo credit: Habibul Haque/WorldFish

Examples of successful adaptation

- **In Bangladesh**, small-scale producers are alternating farming of traditional species such as freshwater prawn and finfish during the wet season with salt-tolerant species, such as brine shrimp or Artemia, seaweed, bivalves, crab, seabass, salt-water shrimp, and mullet, during the dry season. Operational decisions are supported by real-time climate information services. Islam et al. (2024) concluded that for every 10 percent of climate-related loss offset by effective climate information systems, aquatic food production would increase by a volume worth some US $14 million annually.
- **In Timor-Leste**, fishery and aquaculture dependent communities are being trained in aquaculture – effective pond construction, healthy living conditions for fish, hubs for feed and fingerling distribution; climate-smart seaweed production, including business training for processing and marketing; equitable access to an early warning system for marine fisheries; and in water conservation innovations (IkanAdapt project).
- I**n northern Zambia**, small-scale producers are integrating fish farming into their agricultural practices, which is diversifying their diets and livelihoods while also improving water efficiency and acting as a buffer in times of climate shock. Through the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA-Zambia) initiative, more than 45,000 smallholder fish farmers have received training on integrated aquaculture and agriculture. Further, the Zambia Meteorological Department started including fisheries in climate advisories in bulletins and on TV, while the Citizens Economic Empowerment Commission and other private insurers are offering loans and climate insurance for aquaculture farmers. Climate-smart processing technologies, such as solar tent driers for fish and modernized smoking kilns, are making fish processing lucrative for women through the Technologies for African Agricultural Transformation (TAAT) program. As part of PROFISHBLUE, WorldFish works with institutions and small- and intermediate-scale fish producers and processors in Zambia and other Southern African Development Community countries to sustainably manage fisheries, improve market connectivity, and build adaptive capacities through digital Climate Information Services and genetic gains in indigenous tilapia.

Locally led adaptation strengthens the capacities of vulnerable communities to adapt to climate change by combining scientific insights with local, bottom-up knowledge and locally defined priorities.

Recommendations for action

Locally led approaches for climate adaptation in fisheries and aquaculture can strengthen the resilience of small-scale actors, along with diversifying foods, nutrition and incomes. But to be effective, these approaches need appropriate resourcing and other support by way of enabling policies at the local, national, and international levels. To scale up climate action for aquatic foods, decision-makers must act on the following:

1. Integrate aquatic foods into national climate strategies, such as NDC targets. Policymakers can draw upon recently produced guidelines that identify policy options across fisheries and aquaculture production, supply chains, consumption and diets, and blue carbon ecosystems (see Integrating blue foods into national climate strategies).
2. Support locally led, evidence-based climate solutions for fishers and farmers with action at the national and regional levels, for example, in policies on agriculture, environment, and water management.
3. Increase investments in climate adaptation for aquatic food systems through funding mechanisms like the Global Environment Facility and Green Climate Fund.

Conclusion

The adaptation efforts described here exemplify successful local innovations for climate adaptation in fisheries and aquaculture. These and similar local efforts need far stronger funding, institutional support, capacity strengthening, and integration in multi-sectoral and multi-level policies. Integrating small-scale fisheries and aquaculture into national climate strategies will help countries set goals for and track progress in this vital sector, align local activities with national objectives, and signal to climate funders that this is an untapped area with large and diverse gains well worth supporting.

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References

Chiriac D, H Vishnumolakala, Rosane P. 2023. *Landscape of climate finance for agrifood systems*. Climate Policy Initiative. https://www.climatepolicyinitiative.org/wp-content/uploads/2023/07/landscape-of-climate-finance-for-agrifood-systems.pdf

Food and Agriculture Organization. 2024. *The state of world fisheries and aquaculture 2024 – Blue transformation in action.* Rome. https://doi.org/10.4060/cd0683en

Food and Agriculture Organization, Duke University & WorldFish. 2023. *Illuminating hidden harvests – The contributions of small-scale fisheries to sustainable development*. Rome. https://doi.org/10.4060/cc4576en

Islam S, et al. 2024. Economic valuation of climate induced losses to aquaculture for evaluating climate information services in Bangladesh. *Climate Risk Management*. https://doi.org/10.1016/j.crm.2023.100582

Stanford Center for Ocean Solutions, WorldFish, the Food and Agriculture Organization of the United Nations, Beijer Institute of Ecological Economics, CARE, and Environmental Defense Fund. 2024. *Integrating blue foods into national climate strategies: Enhancing nationally determined contributions and strengthening climate action*. Stanford Center for Ocean Solutions. https://doi.org/10.25740/cq607gn4098

Tigchelaar M, et al. 2021. Compound climate risks threaten aquatic food system benefits. *Nature Food*. https://doi.org/10.1038/s43016-021-00368-9

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About WorldFish

WorldFish is a leading international research organization working to transform aquatic food systems to reduce hunger, malnutrition and poverty. It collaborates with international, regional and national partners to co-develop and deliver scientific innovations, evidence for policy, and knowledge to enable equitable and inclusive impact for millions who depend on fish for their livelihoods. As a member of CGIAR, WorldFish contributes to building a food- and nutrition-secure future and restoring natural resources. Headquartered in Penang, Malaysia, with country offices across Africa, Asia and the Pacific, WorldFish strives to create resilient and inclusive food systems for shared prosperity. Learn more at www.worldfishcenter.org

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