

Government Support for Small Scale Aquaculture

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Abstract

Aquaculture policy must reconcile rising food demand with ecological limits and equitable livelihoods. This narrative review examines whether governments should prioritise small-scale producers when allocating public support. It draws on international production statistics, comparative environmental research, a Bangladesh producer study, evidence on rice–fish integration and Indian policy documents. The evidence supports targeted assistance where finance, information or shared infrastructure constrain viable small-scale production. It does not support treating farm size as a reliable proxy for sustainability. Commercial production can improve food access, while small farms can also contribute to pollution and disease risks. A policy framework is proposed that combines accessible extension services, shared facilities and carefully tested risk protection with environmental conditions applying across scales. Public programmes should be evaluated through additional gains in income, food access, and environmental performance, rather than output or expenditure alone.

Keywords: aquaculture; small-scale producers; food security; environmental externalities; sustainable intensification; public policy

1. Introduction

Aquaculture has become central to the aquatic food supply. FAO's 2026 assessment reports that aquatic animal aquaculture reached 103 million tonnes in 2024, compared with 92 million tonnes from capture fisheries. Aquaculture consequently represented approximately 53 per cent of global aquatic animal production [1]. These figures exclude algae and describe production, not consumption, or the contribution of small farms alone.

As aquaculture expands, governments must decide which activities warrant to scarce public funding. Small producers may need services that individual households cannot afford. Larger enterprises may offer reliable volumes, specialised expertise, and access to processing networks. The relevant policy question is how assistance changes outcomes for producers, consumers, and shared ecosystems.

This paper argues for conditional priority for small producers where identifiable barriers prevent socially valuable improvements. It also recognises that commercial scale, production intensity, and environmental performance are distinct characteristics. Effective policy should address unequal access to resources while requiring all producers to operate within ecological limits.

2. Review approach and definitions

This is a focused narrative review and policy analysis, not a systematic review or an original empirical investigation. Sources were selected for their relevance to production trends, environmental performance, food access, producer diversity, and public intervention. Priority was given to FAO publications, peer-reviewed research, and official Indian programme documentation. No comprehensive

database search, formal risk-of-bias assessment or meta-analysis was undertaken; the selection is therefore not exhaustive.

The review compares evidence across five policy dimensions: production and affordability; producer livelihoods; environmental pressure; access to finance and services; and the additional benefits expected from public spending. Descriptive statistics establish context; comparative studies inform interpretation, and government documents establish programme intentions. The recommendations are analytical proposals, rather than measured effects of interventions evaluated in this paper.

Small-scale aquaculture is used here to describe household or locally managed enterprises with comparatively limited capital and operational capacity. No universal area threshold is imposed. Industrial aquaculture describes larger, capital-intensive commercial enterprises. Neither category specifies stocking density, species, technology, or market destination.

These characteristics must be examined separately when explaining performance.

3. Production growth and food access

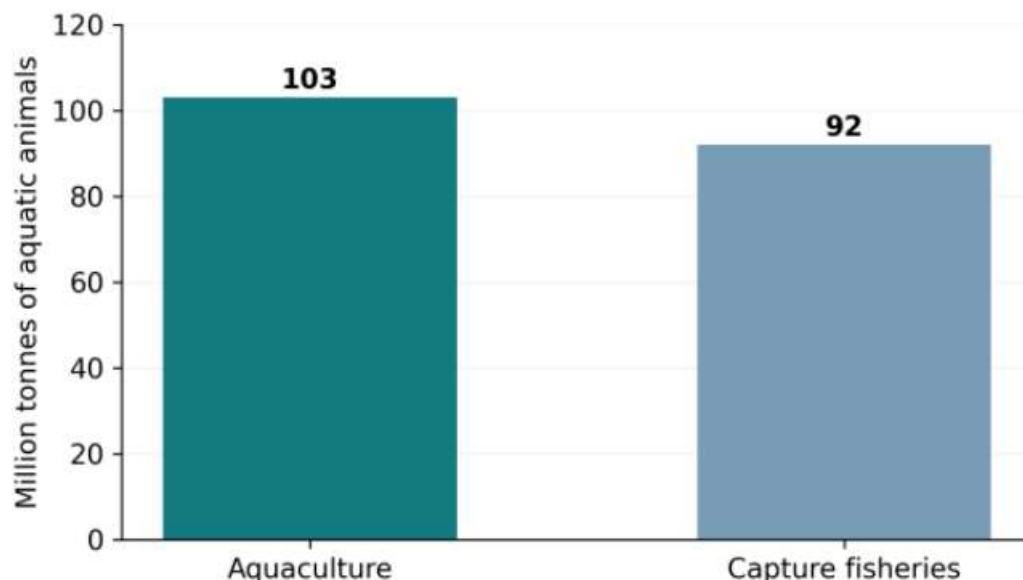


Figure 1. Aquatic animal production in 2024. Author-prepared chart using rounded FAO figures [1]. Algae excluded; the values describe all production scales.

Figure 1 shows the scale of aquaculture contribution, but it cannot identify which producers should receive subsidies. A national production increase can arise through expansion, higher yields, or reduced losses. These routes can create different environmental pressures and distribute benefits differently. Policy evaluation should therefore ask what changed, who benefited and whether the gains required public assistance.

Food security includes affordability and access, not simply aggregate output. Belton, Bush, and Little challenge the assumption that commercially farmed fish in the Global South serves wealthy or export markets. Their analysis emphasizes domestic consumption and the role of commercial supply chains in making farmed fish accessible [2]. This provides an important counterargument to a blanket preference for low-input, semi-subsistence production.

The implication is to assess producers and consumers together. A household may benefit by eating its own fish or by using sales income to purchase food. Consumers may benefit when efficient distribution lowers prices. Support for small producers is most defensible when these pathways can be demonstrated, rather than inferred from local ownership alone.

4. Economic justifications for targeted support

The economic case for larger farms rests partly on spreading fixed costs over more output. A hatchery, laboratory or storage facility may be expensive to establish but cheaper per unit when widely used. This is a plausible efficiency mechanism, not evidence that every large operation has lower costs. A comparison must also account for species, input prices, location, and production practices.

Public intervention is justified more clearly by an identified market failure than by producer size alone. A viable small enterprise may lack acceptable collateral, affordable technical advice, or access to shared facilities. A publicly supported testing service can address a common constraint without requiring every farmer to buy equipment. In contrast, an unconditional equipment grant may fund purchases that would have occurred anyway or equipment that recipients cannot maintain.

Pollution creates a separate justification for intervention. If downstream users bear damage that is absent from a farm account, its private costs understate social costs. Regulation and monitoring should address that externality directly. Assistance intended to improve competitiveness should not compensate producers for ignoring environmental duties.

Employment should be evaluated through earnings and working conditions as well as job counts. More labour per tonne may support livelihoods but can also reflect low productivity or unpaid family work. Similarly, export receipts do not by themselves measure local welfare. An appraisal should examine operating costs, debt exposure, and the distribution of income, alongside the opportunity cost of the public funds committed.

5. Environmental performances across systems

Comparative evidence does not support a simple ranking by farm size. Gephart and colleagues assess greenhouse gas emissions, nutrient emissions, land use, and freshwater use across aquatic food groups. Farmed bivalves and seaweeds show low pressures across these indicators, while differences among fed species involve trade-offs [3]. Their analysis concerns species groups and production characteristics; it does not establish that all small farms outperform all industrial farms.

Naylor and colleagues' retrospective review documents improvements in feed efficiency alongside continuing concerns involving feed sourcing, pathogens, and environmental management [4]. Efficiency gains can reduce pressure per unit of output, but aggregate production and local conditions still matter. A lower impact per kilogram does not guarantee that total discharge remains acceptable in a particular water body.

Nutrient pressure should be assessed at both farms and receiving water levels. Several small farms can collectively overload shared drainage. Conversely, assessing only total discharge can overlook differences in the amount of food produced. Regulators need information on the intensity of resource use, cumulative pressure, and the capacity of the receiving environment.

Alternative feeds and recent technologies should also be evaluated across their supply chains. Replacing one ingredient may transfer pressure to land, energy, or another resource. Support should depend on evidence of overall improvement and practical suitability, including costs that producers face after a

grant ends. These are appraisal criteria proposed here, rather than claims that a particular technology will always reduce impacts.

6. Integration and resource management

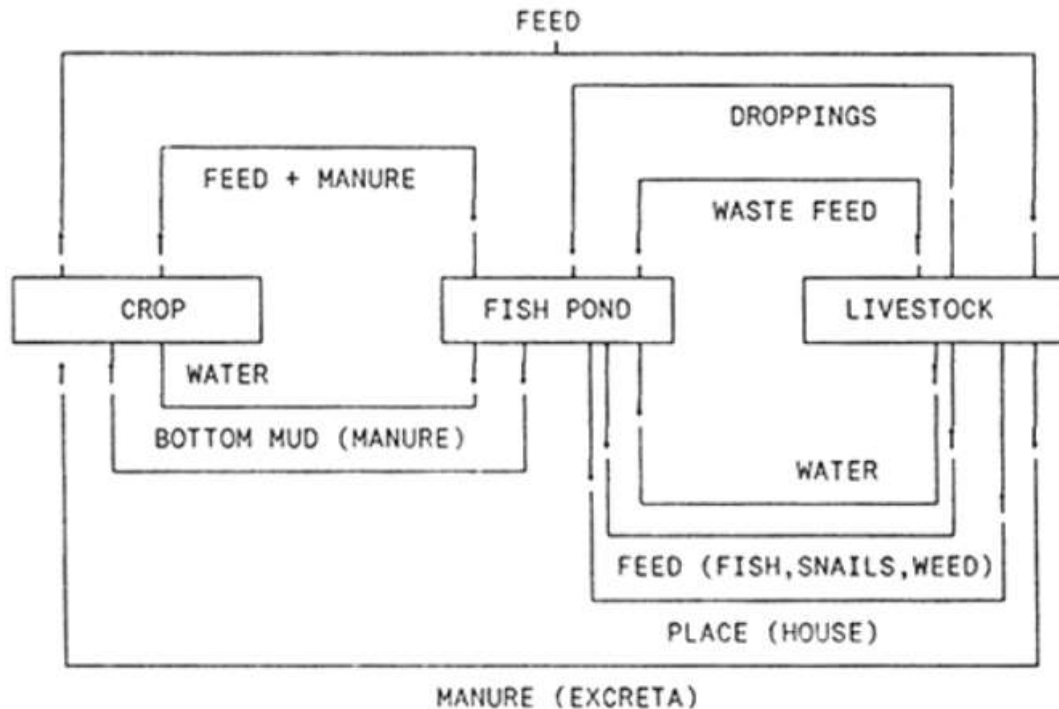


Figure 2. Resource flows in integrated fish–crop–livestock farming. Source: FAO manual, chapter 3, Figure 3.1 [5]. The diagram is historical technical guidance, not an assessment of farm performance.

Integrated production can link activities through resource flows. The FAO manual illustrates exchanges among fishponds, crops, and livestock, including the use of pond sediment and water in crop production [5]. It explains a management approach but does not establish a universal yield benefit. Suitability depends on nutrient loading, water use, hygiene, and the activities already occupying the farm.

Stronger evidence for a particular integration mechanism comes from Xie and colleagues' surveys and experiments in south China. They found that rice–fish coculture could maintain rice yields with lower pesticide and fertiliser inputs, supported by pest reduction and complementary nitrogen use [6]. This is a site-specific comparison with rice monoculture, rather than proof that small aquaculture farms have lower environmental costs.

Rice–fish farming, crop–fish–livestock integration, and integrated multi-trophic aquaculture are distinct systems. The latter combines organisms with different feeding roles, such as fed fish and extractive species. Potential resource recovery should not be assumed to capture every waste stream or remove environmental standards. Selection should follow local testing and farmer consultation.

7. Evidence from Bangladesh

Dompreh and colleagues surveyed 4,540 carp producers across 54 regions in Bangladesh and identified four clusters with different production characteristics and sustainability performance [7]. Figure 3

summarises their typology. The study offers a stronger basis for distinguishing producer needs than if all small farms operate in the same way.

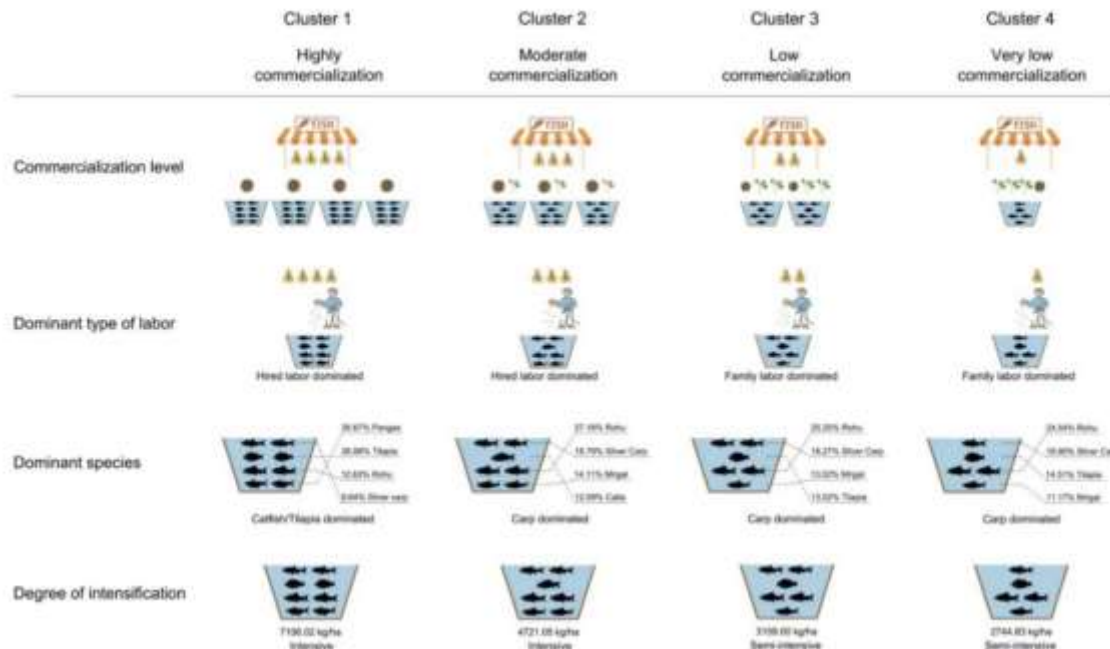


Figure 3. Characteristics of four producer clusters in Bangladesh. Reproduced from Dompheh et al. [7], Figure 1; resized only. © The Author(s), CC BY 4.0, <https://creativecommons.org/licenses/by/4.0/>. Published online in 2025, journal issue dated 2026.

More commercialised clusters rely on hired labour, while less commercialised clusters rely more on family labour [7]. This evidence challenges a binary opposition between local smallholders and commercial producers: substantial variation exists within the small-scale category itself. A common eligibility label can conceal differences in resources, objectives, and capacity to adopt technology. The appropriate inference is that assistance should be differentiated. A household prioritising its own food supply may need advice and affordable inputs, whereas a market-oriented producer may face a transport or storage constraint. These are policy interpretations of the study, not interventions it experimentally tested. Its observational design cannot establish the effects of allocating equal subsidies to each cluster, and the findings should not automatically be generalised to marine aquaculture or other countries.

8. Implications for Indian policy

India's Pradhan Mantri Matsya Sampada Yojana provides a documented example of public investment design. At its 2020 approval, the programme envisaged INR 20,050 crore, comprising INR 9,407 crore centrally, INR 4,880 crore from states, and INR 5,763 crore from beneficiaries. Its original implementation period was 2020–21 to 2024–25 [8]. These are initial planned investments, not verified expenditure or evidence that targets were achieved.

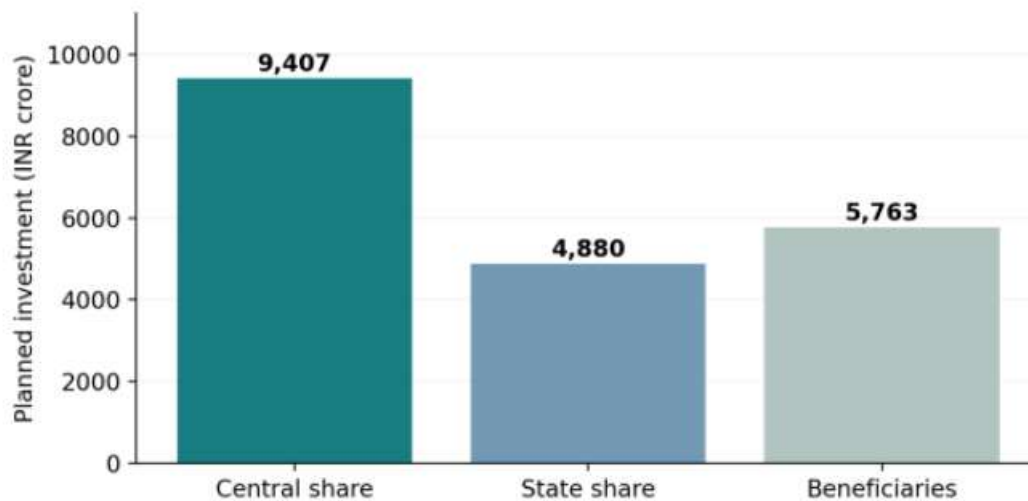


Figure 4. Original PMMSY planned investment shares at 2020 approval, INR crore. Source: Government of India [8]. Programme-wide totals are not uniform contribution rates for individual beneficiaries.

The programme's stated objectives include infrastructure, productivity, management, and welfare [8]. Its breadth illustrates why appraisal should go beyond total spending. An infrastructure facility can be completed without becoming accessible to small producers. Location, charges, booking arrangements, and transport connections influence who can use it. Operational funding and maintenance duties deserve attention before construction is approved.

For pond-based aquaculture in West Bengal, a useful starting point would be a local assessment of tenancy, water access, disease risks, and market connections. This is a proposal for programme design, not a claim about a completed regional assessment. Consultation should include tenant farmers and people involved in processing and marketing, since support tied exclusively to land ownership may miss other participants.

Local food preferences can inform species' selection and marketing, but cultural familiarity does not establish financial viability or environmental suitability. Programmes should assess demand alongside household resources and ecological conditions. Programme objectives should be tested against local evidence on livelihoods, consumer demand, and environmental conditions.

9. A conditional support framework

The following framework is an analytical proposal. It is consistent with the FAO Guidelines for Sustainable Aquaculture's broad emphasis on food security, equitable livelihoods, and environmental sustainability [9], but its specific instruments require local appraisal and evaluation.

Shared services should be prioritized where a common constraint has been documented. Water testing, disease advice, or coordinated transport may serve several producers more effectively than separate equipment purchases. Farmer organisations could manage these facilities, provided fees, access rules and maintenance duties are transparent. Public funding should be conditional on a credible operating plan.

Finance should be matched to the investment's expected returns and the producer's ability to absorb losses. Credit is unsuitable where debt repayments depend on optimistic yields or unstable selling prices.

Grants may be justified for public benefits or initial access barriers, but their purpose and duration should be explicit. Extension support should accompany changes in stocking or feeding so that assistance does not create risks farmers are poorly equipped to manage.

Insurance deserves a complementary role. Coverage can soften covered losses but cannot prevent disease or repair unsuitable husbandry. Before subsidizing a product, a pilot should test premium affordability, exclusions, claims handling and payouts to match farmers' losses. Preventive services remain necessary, and coverage conditions should be understandable and feasible. This paper does not establish which insurance design is most effective.

Environmental conditions should apply across scales. More intensive or ecologically sensitive sites may need closer monitoring, while public testing can make compliance accessible to small producers. Expansion support should be withheld where shared waters are already overloaded until management improves. Larger enterprises may warrant support when they provide demonstrable benefits beyond investments they would otherwise finance commercially.

A programme should also specify when support ends or changes. Repeated assistance without performance review can preserve dependence or reward well-connected applicants. Continued funding should require evidence that the underlying service remains useful, and that benefits are reaching its intended users. Where an instrument fails, revising or discontinuing it can release resources for a more effective alternative.

10. Evaluation and limitations

Evaluation should begin with a baseline. Relevant outcomes include net household income after operating costs, the value of family labour, fish consumption or affordability, disease losses, and receiving water quality. Participation should be recorded by tenancy and other locally relevant characteristics. Administrative outputs, such as facilities built or farmers trained, should be reported separately from changes in welfare or environmental performance.

Where feasible, phased implementation can support comparisons with similar producers not yet receiving help. Differences in experience, assets, and market access must be considered because they can influence both participation and outcomes. Higher earnings among recipients alone do not prove that the programme caused the improvement. Evaluation should also examine whether benefits persist after initial funding ends.

The evidence assembled here has several limits. Global statistics aggregate unlike systems and cannot reveal the effects of farm size. Environmental comparisons depend on species, boundaries, and measurement of choices. The Bangladesh study distinguishes producer groups but does not estimate subsidy effects, while the rice–fish evidence comes from a specific agricultural setting. Indian programmed documents describe intentions rather than independent impact evaluations.

A focused narrative review can identify mechanisms and policy trade-offs but cannot establish the optimal budget allocation between small and industrial producers. This paper therefore makes a conditional recommendation. Research comparing well-defined interventions in comparable settings, including their distributional and ecological consequences, would strengthen future decisions.

11. Conclusion

Governments should give small-scale aquaculture producers priority where targeted assistance overcomes identifiable barriers and creates public benefits. Shared services, appropriate finance and

technical support offer defensible starting points when they respond to demonstrated needs. Insurance can complement these measures but should not substitute for prevention or environmental management. Farm size alone cannot determine eligibility or sustainability. Responsible commercial production can improve food access, while poorly managed small farms can impose costs on shared ecosystems. A credible policy should combine attention to unequal resources with standards applying across scales, then evaluate the additional gains in livelihoods, food access, and environmental performance produced by public spending.

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