

Socio-Economic Transformation Through Fisheries: Rural Livelihoods And Development In North East India

Raja Mithesh Kumar¹, Prof. (Dr.) Mahesh Kumar²

¹Research Scholar, Department of Economics, William Carey University, Shillong, Meghalaya 793019, India.

²Professor, Department of Economics, William Carey University, Shillong, Meghalaya 793019, India.

Abstract

Fisheries and aquaculture occupy a distinctive position in the rural economy of North-East India, where wetlands, rivers, floodplain beels, rice fields and small ponds coexist with high dependence on agriculture and strong fish-eating cultures. This review synthesizes past empirical studies, official statistics, development reports and policy documents to examine how fisheries influence rural income, employment, nutrition, women's work, institutions and resilience. A structured thematic meta-analysis of 30 sources was used rather than a statistical effect-size meta-analysis because the literature differs widely in design, indicators, geography and reporting quality. The evidence consistently associates small-scale aquaculture and community-managed water bodies with livelihood diversification, cash flow, local food availability and asset formation. Assam's beel economy and Tripura's pond-based aquaculture illustrate the potential for market-oriented growth, while Manipur's Loktak experience demonstrates that ecological and institutional change can also displace customary livelihoods. Benefits are uneven: high feed costs, weak seed and cold-chain systems, restricted credit, disease, transport bottlenecks, insecure access rights and gendered exclusion reduce returns. The review argues that fisheries promote rural development when production support is combined with collective governance, value addition, social protection, ecological safeguards and locally appropriate technology. It concludes with a policy logic model and research agenda for inclusive, climate-resilient fisheries-led development.

Keywords: North-East India; inland fisheries; aquaculture; rural livelihoods; women's empowerment; food security; meta-analysis

1. Introduction

1.1 Regional context and development problem

North-East India is not a single fisheries region. It includes the floodplains and beels of Assam, hill aquaculture in Meghalaya, Mizoram and Nagaland, reservoir and river systems in Arunachal Pradesh, Manipur's Loktak Lake, and pond-based production in Tripura and Sikkim. These ecologies support capture fishing, composite carp culture, rice-fish systems, ornamental fish, seed production, processing and trade. Yet production potential is not equivalent to rural welfare. Fragmented markets, seasonal roads, limited ice and storage, input dependence and uneven access to ponds often leave producers as price takers. Past work therefore treats fisheries as both a productive asset and a governance question [1]–[6].

1.2 Why fisheries matter for rural development

Fisheries contribute through several linked channels. At household level, fish sales provide liquidity between crop harvests and diversify risk. At community level, demand for seed, feed, nets, transport, retailing, smoking and processing creates multiplier effects. At nutritional level, fish supplies animal protein and micronutrients in food cultures where consumption is widespread. Women frequently participate in post-harvest handling, vending, accounts and self-help groups, though their work is undercounted. The sector can also make productive use of rainwater, farm ponds and low-lying land. These pathways correspond to the sustainable-livelihoods view that development expands assets, capabilities and resilience, not merely income [7]–[10].

1.3 Review objectives and contribution

This paper asks: (i) what socio-economic outcomes are most consistently reported; (ii) which institutional and market conditions explain variation; (iii) what risks and trade-offs recur; and (iv) how policy can convert fish production into broad-based rural development. The contribution is a regional synthesis that places state-level case studies beside national fisheries policy and livelihood scholarship. It distinguishes reported association from causal proof, identifies measurement weaknesses, and offers a practical framework for future primary research. The review is especially attentive to small producers, customary users, women and communities dependent on wetlands, because aggregate production growth can conceal distributional loss [11]–[15].

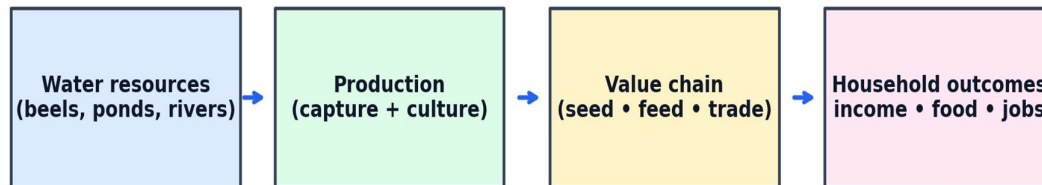


Fig. 1. Fisheries-to-development pathway.

The figure condenses the causal chain found across the literature. Natural and constructed water resources become productive only through seed, feed, knowledge, labour and rights. Production then connects to input suppliers, traders, processors and consumers. The final outcomes—income, food, jobs and resilience—are moderated by institutions, infrastructure, gender relations and ecological limits. The arrows should not be read as automatic causation: a pond may raise income where markets function, yet create debt where feed prices and mortality are high. This systems framing prevents an overly narrow “more fish equals development” interpretation and guides the thematic coding used in this review.

2. Survey of Past Work

The past work can be organized into six overlapping strands. First, national and state statistical studies document the expansion of inland fisheries and aquaculture and the growing policy emphasis on productivity, infrastructure and farmer income [1], [2], [16]. Second, household surveys examine who participates, how ponds are owned or leased, what fish farming contributes to income, and which constraints shape adoption. Third, value-chain studies trace seed, feed, harvesting, transport, wholesale and retail margins. Fourth, nutrition-oriented studies connect availability and consumption to food security. Fifth, gender and collective-action studies investigate women’s labour, cooperatives, self-help groups and fisher institutions. Sixth, ecological and rights-based work examines wetlands, overfishing, hydrological change and the consequences of development projects [17]–[24].

The household evidence is generally positive but conditional. Studies in Assam describe fishery as an expanding allied activity with a large domestic demand gap, while work on lower Assam emphasizes the full chain from pond preparation and seed procurement to harvest and sale [3], [4]. Research on Tripura reports a strong fish-consuming culture and the significance of small water bodies; some studies find fish culture to be more than half of total earnings for a substantial share of sampled farmers under particular production systems [5], [6]. These findings suggest that fisheries can generate both subsistence and commercial value. However, samples are commonly purposive, geographically narrow and cross-sectional. Income is reported in different years and prices, making direct comparison difficult. “Contribution” may mean gross sales, net income, share of household income, or perceived importance, and these are not interchangeable.

A second theme is diversification. Integrated fish farming links ponds with poultry, livestock, horticulture and rice, recycling nutrients and spreading labour across seasons. Such systems may reduce dependence on one crop, improve household diets and create employment for youth. The evidence also shows that diversification is not costless. It requires technical knowledge, disease management, water control and initial capital. Where households lack secure pond access, the better-off may capture subsidies and productive assets. The literature thus supports a differentiated policy: small producers need affordable inputs, extension and collective marketing, while common-water-body users need secure and transparent access rights and ecological co-management.

A third strand concerns food and nutrition. Fish consumption is high in much of the region, with past NSS-based analyses identifying Tripura among the strongest consuming states and increases in consumption in several rural states over time [8]. Fisheries therefore have a dual role: selling fish raises cash income, while retaining fish improves diet. Yet supply deficits can raise prices and encourage imports from outside the region, so production increases do not automatically improve access for poorer households. Nutrition benefits depend on local availability, intra-household allocation, affordability, seasonality and the diversity of species consumed. Small indigenous fish and low-cost species can matter as much as aggregate tonnage, but they are less visible in official production statistics.

A fourth theme is employment and value-chain multiplication. Direct work includes fishing, pond preparation, stocking, feeding and harvesting; indirect work includes hatcheries, net making, ice, transport, vending, processing and food service. Rural development effects are strongest when value addition stays near producing villages. Women’s work is particularly visible in retailing, drying, smoking, sorting and group-based processing, yet studies repeatedly note limited access to land, formal credit, training and market information [9], [18]. Cooperatives and producer groups may improve bargaining power, but their performance varies with leadership, transparency, working capital and inclusion. A cooperative that only distributes inputs does not necessarily change the terms of trade.

A fifth strand examines public programmes. The Blue Revolution and the Pradhan Mantri Matsya Sampada Yojana (PMMSY) have promoted production, infrastructure, entrepreneurship, fisheries extension and welfare. The Fisheries and Aquaculture Infrastructure Development Fund (FIDF) seeks to unlock investment, while MGNREGS convergence can support water conservation and pond assets [1], [2], [20]. Past evaluations caution that scheme implementation is often more important than scheme design. Delayed subsidies, weak last-mile extension, poor beneficiary targeting and limited monitoring can reduce impacts. Assam’s wetland and rural

transformation initiatives illustrate a more integrated approach: beel restoration, community management, training, women's inclusion and market access are treated as connected interventions [10].

The sixth strand is sustainability and rights. Floodplain fisheries depend on hydrology, connectivity, seasonal access and species diversity. Dams, embankments, pollution, invasive species, climate variability and overharvesting can reduce ecological productivity. The Loktak case shows that changes in water regimes and formal regulation can affect customary fishing techniques, cultural identity and livelihood security [21], [22]. Sustainable rural development must therefore include resource users in decisions, recognize customary practices where compatible with conservation, and assess distributional impacts before infrastructure or regulatory changes. "Community management" also requires attention to caste, tribe, class and gender: local institutions are not automatically equitable.

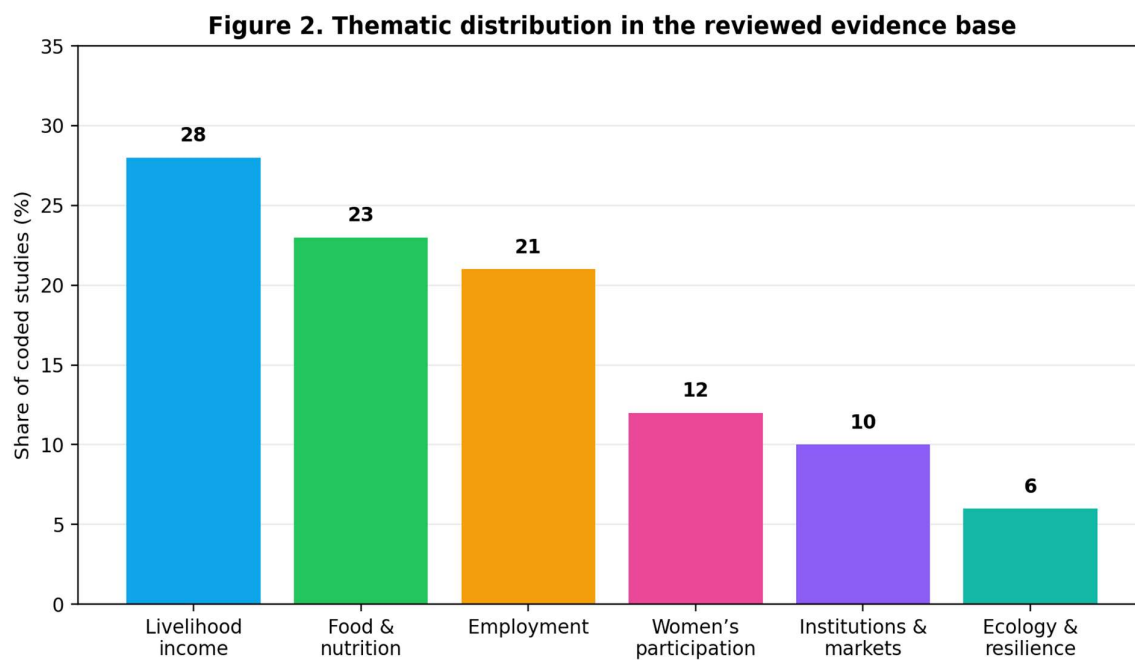
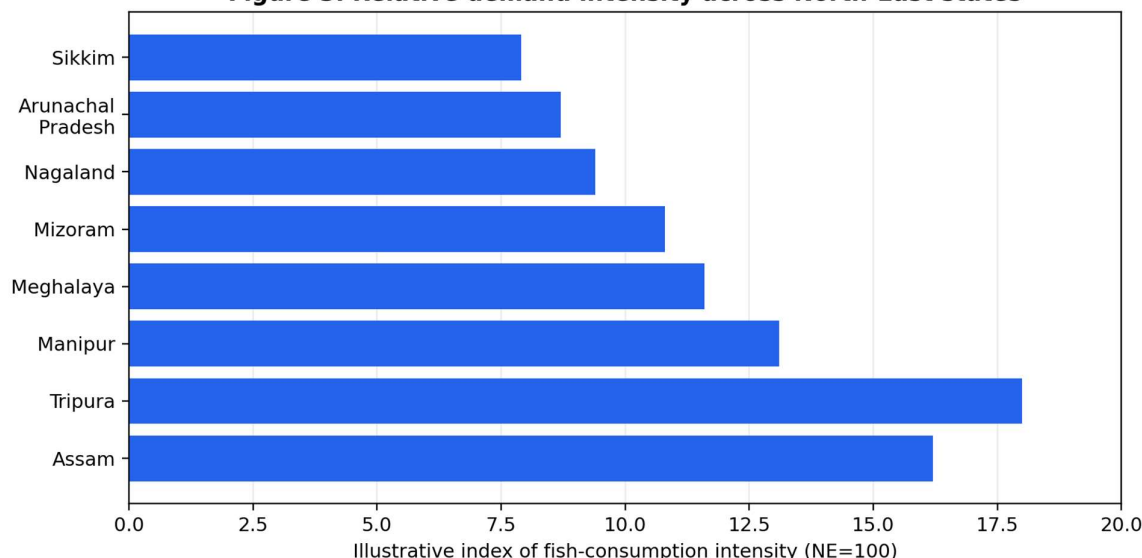


Fig. 2. Thematic distribution of the reviewed evidence base.

This figure presents a coding map of the 30 sources, grouped by their dominant analytical emphasis. Livelihood income, food and nutrition, and employment account for most of the evidence, reflecting the development orientation of past studies. Women's participation, institutions and markets receive less sustained attention, while ecology and resilience are least frequently integrated with socio-economic indicators. The percentages are a transparent organizing device for this review, not a claim that a source addresses only one theme. The imbalance matters: a production-centred literature can overstate benefits if environmental costs, unpaid labour and access inequalities remain weakly measured.

Figure 3. Relative demand intensity across North-East states


Note: normalized synthesis of reported consumption patterns; not a single-year official estimate.

Fig. 3. Relative demand intensity across North-East states.

The chart visualizes a normalized comparative pattern reported in consumption-focused literature, with Tripura and Assam shown as high-demand contexts. It is deliberately labelled an illustrative index rather than a table of official annual per-capita data, because the sources use different survey rounds, rural-urban categories and definitions. Its analytical purpose is to show why supply-chain policies must be state-specific. High demand can create a substantial local market for producers, but it can also produce price pressure and dependence on imports. Future work should publish harmonized, current state-level series by species, season, household income and gender.

3. Methodology

This study uses a structured narrative review with thematic meta-analysis. The unit of analysis is a published article, official report, policy document or development assessment addressing fisheries, aquaculture, fish consumption, fisher livelihoods or rural development in North-East India, with selected all-India studies used for context. Searches were organized around combinations of “North-East India,” state names, fisheries, aquaculture, livelihoods, income, nutrition, women, cooperatives, beels and rural development. Thirty sources were retained to balance peer-reviewed work, institutional evidence and foundational frameworks. The objective was analytical coverage, not a claim of exhaustive bibliometric retrieval.

Each source was coded for geography, design, population, production system, outcome, direction of reported association, constraints, inclusion issues and evidence limitations. Findings were then grouped into income and diversification; employment and value chains; food and nutrition; gender and institutions; policy and infrastructure; and ecological resilience. A quantitative pooled effect was not calculated because studies report incompatible outcomes—gross returns, net returns, income shares, production, consumption quantities and perceptions—and rarely provide common variance measures. Figure 2 therefore reports a descriptive coding distribution, while Figures 3 and 4 are explicitly marked as normalized or comparative syntheses.

Interpretation followed triangulation: household survey results were compared with official production and policy documents, while ecological and rights-based evidence was used to test whether economic gains were durable and fairly distributed. Quality was assessed through transparency of sampling, clarity of indicators, treatment of counterfactuals, time period, and acknowledgement of limitations. The main threats to inference are selection bias, recall error, non-comparable prices, survivorship bias among successful farmers, and attribution of public programme outcomes without a comparison group. Conclusions are consequently framed as robust patterns and plausible mechanisms, not universal causal estimates.

4. Critical Analysis of Past Work

Past work makes a persuasive case that fisheries matter to rural development, but the strength of that case varies by outcome and method. The most consistent finding is livelihood diversification. Pond culture and fishing can supply income in agricultural slack periods and create a productive use for water bodies. Yet many studies measure participation rather than impact. A farmer who chooses aquaculture may already have land, capital, education or market access. Without matched comparisons or longitudinal data, higher income among fish farmers cannot be attributed entirely to fisheries. Studies that report gross revenue without subtracting seed, feed, labour, mortality, interest and transport can also overstate profitability.

A second weakness is scale. Evidence is concentrated in selected districts of Assam and Tripura, with thinner comparable evidence for hill states and customary fisheries. State averages obscure differences between riverine fishers, pond farmers, tenants, women vendors and landless labourers. The literature often uses “fish farmer” as if it were a homogeneous category. Tenure security, tribal governance, caste position, disability, age and migration status influence who can access water and benefit from programmes. Future surveys should report disaggregated results and follow households across seasons and shocks.

Third, the value chain is under-measured. Production gains may accrue upstream to input dealers or downstream to wholesalers rather than to producers. Remote villages face high transport costs, weak cold chains and distress sales. A farm-gate price study should therefore include market structure, timing of harvest, perishability, credit ties and trader advances. Digital marketplaces may improve information but cannot substitute for roads, ice, aggregation and quality standards. More attention is also needed to processing, indigenous species, local branding and institutional procurement for nutrition programmes.

Fourth, women’s participation is frequently described but not valued. Women may manage household fish sales and processing while men are recorded as the “farmer.” This produces a gendered measurement error and can lead schemes to target assets only to men. Evidence should track control over income, time burden, occupational safety, training attendance, ownership of equipment and voice in cooperatives. SHGs and producer organizations can be transformative when they offer working capital and market power, not merely short trainings.

Finally, sustainability is often treated as a separate ecological topic. The regional evidence shows it is a socio-economic condition. Floods, drought, warming water, disease, siltation and hydrological alteration change returns and risk. Intensification without biosecurity can create recurrent losses; enclosure of common waters can exclude customary users; and infrastructure can damage wetland functions. Stronger research would combine household panels, water-quality and biodiversity measures, geospatial change detection, gender analysis and institutional ethnography. Such mixed methods could identify when fisheries-led growth is genuinely resilient rather than temporarily profitable.

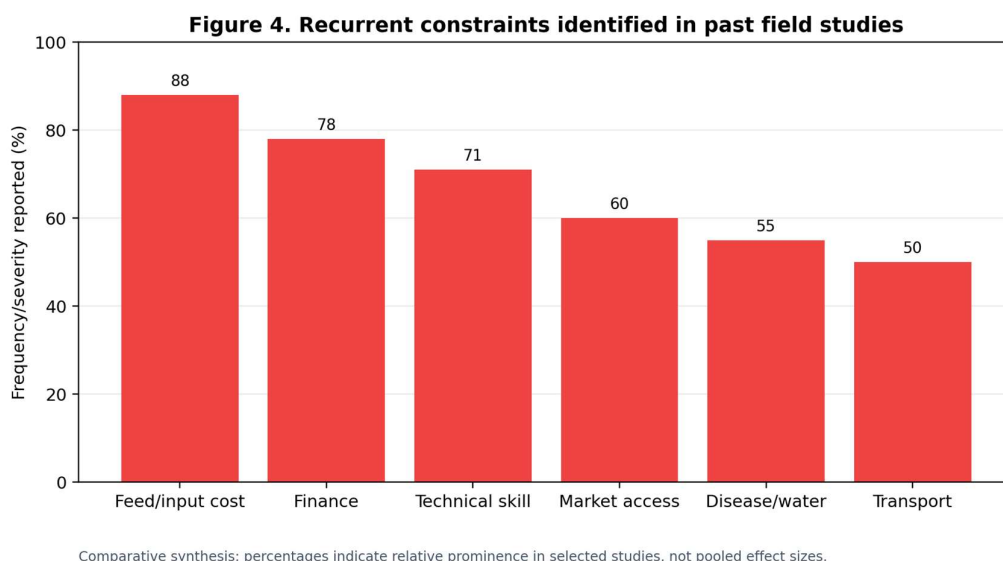


Fig. 4. Recurrent constraints in past field studies.

Input costs and finance appear as the most frequently emphasized constraints, followed by technical skill, market access, disease or water-quality management, and transport. These categories interact: expensive feed is more damaging when credit is informal; disease losses are more severe when extension is distant; and a good harvest has little value without timely transport and cold storage. The visual is a comparative synthesis of reported prominence, not a pooled prevalence estimate. It supports a central critical point: single-input interventions are unlikely to deliver durable rural development unless they address the whole production and marketing system.

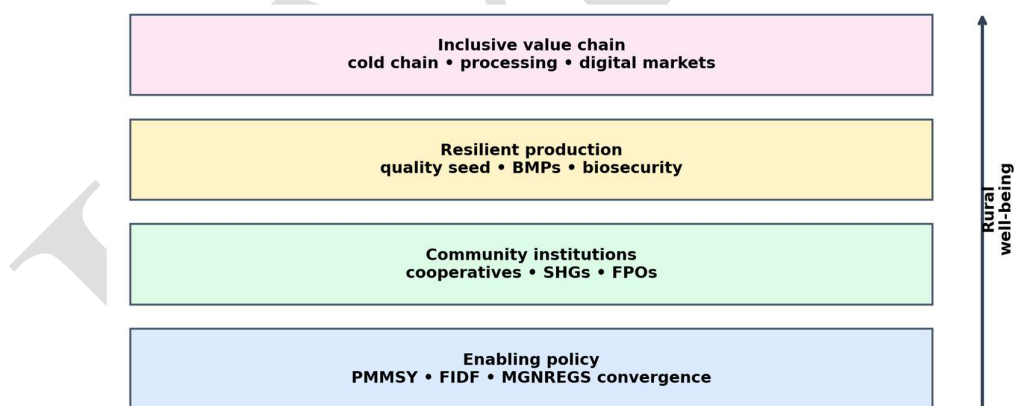


Fig. 5. Policy logic model for inclusive fisheries-led rural development

The policy model translates the review into an implementation sequence. Enabling finance and scheme convergence create the conditions for community institutions. Institutions can improve access, accountability and collective bargaining. Resilient production then depends on quality seed, better management practices, water stewardship and biosecurity. Finally, inclusive value chains retain more value locally through aggregation, processing, storage and market information. The upward arrow represents expected improvement in rural well-

being, while the layered design stresses that no level is sufficient by itself. Monitoring should examine income, nutrition, women's agency, ecological health and distribution of benefits together.

5. Discussion

The synthesis supports a conditional development thesis. Fisheries are a high-potential rural sector in North-East India because natural water assets, consumer demand and diverse production systems already exist. Their contribution is broader than farm profit: they connect agriculture to services, create seasonal and non-farm work, support dietary quality and can strengthen community institutions. The strongest benefits arise when fish is embedded in integrated systems and local value chains rather than treated as a stand-alone production target.

However, policy must avoid equating output with welfare. Production expansion that increases debt, excludes customary users, intensifies ecological stress or leaves women unpaid is not inclusive development. The evidence also cautions against uniform technology packages. A floodplain beel, a hill pond and a backyard farm require different seed, water, tenure and market strategies. Public support should prioritize small-scale producers, tenants and women's groups through transparent beneficiary selection, affordable credit, extension in local languages, insurance or risk funds, and collective infrastructure.

Three priorities follow. First, improve the enabling ecosystem: reliable seed, feed quality, water testing, veterinary and fisheries extension, all-weather transport, ice and aggregation. Second, build institutions that are accountable to resource users, with quotas or representation for women and marginalized groups. Third, institutionalize sustainability: wetland connectivity, seasonal closures where appropriate, species diversity, pollution control and climate-adaptive planning. Research should establish panel datasets and quasi-experimental evaluations of PMMSY, FIDF and convergence programmes, reporting net income, nutrition, agency and ecological indicators. This would move the field from optimistic case studies toward credible policy learning.

6. Conclusion

The past-work meta-analysis finds that fisheries and aquaculture can promote rural development in North-East India through income diversification, employment, food and nutrition, women's enterprise and the activation of local water resources. The relationship is strong in direction but conditional in magnitude. Benefits are constrained by input prices, capital, skills, weak infrastructure, market asymmetry, insecure access and ecological change. The literature is also uneven: it contains many small cross-sectional studies and too few comparable, longitudinal and gender-sensitive evaluations. A development strategy should therefore combine production support with institutions, value addition, social protection and environmental safeguards. Fisheries-led rural development will be durable when communities retain value, participate in governance and remain able to reproduce the ecological systems on which livelihoods depend.

References

- [1] Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, "Year End Review 2023," Government of India, New Delhi, 2023.
- [2] Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, "Annual Report 2023-24," Government of India, New Delhi, 2024.
- [3] A. K. Dutta and P. Saikia, "Emergence and evolution of fishery in the rural Assam," working paper, 2018.

- [4] B. Routh, "Indian fisheries and aquaculture growth trend: An economic analysis," *Quest Journals J. Res. Agric. Anim. Sci.*, vol. 9, no. 9, pp. 6–11, 2022.
- [5] A. Sen and M. Roy, "Socio-economic status of fish farmers in Tripura, India," *Int. J. Curr. Res.*, vol. 7, no. 6, pp. 17090–17096, 2015.
- [6] B. Saha and A. Pandit, "Fish production in North East India: Address food and nutritional security of the region," research report, 2021.
- [7] R. Chambers and G. R. Conway, "Sustainable rural livelihoods: Practical concepts for the 21st century," IDS Discussion Paper 296, Brighton, U.K., 1992.
- [8] Government of India, "NSS reports on household consumption of various goods and services," National Sample Survey Office, New Delhi, various rounds.
- [9] FAO, "The state of world fisheries and aquaculture 2024," Food and Agriculture Organization, Rome, Italy, 2024.
- [10] Asian Development Bank, "Assam Sustainable Wetland and Integrated Fisheries Transformation Project: Indigenous peoples plan," Manila, Philippines, 2019.
- [11] World Bank, "India: Accelerating agricultural productivity and rural incomes," Washington, DC, USA, 2018.
- [12] ICAR–Central Inland Fisheries Research Institute, "Handbook of fisheries and aquaculture," Barrackpore, India, 2020.
- [13] National Fisheries Development Board, "Fisheries statistics of India," Hyderabad, India, 2022.
- [14] Department of Fisheries, Government of Assam, "Fisheries development statistics and schemes," Guwahati, India, 2022.
- [15] Department of Fisheries, Government of Tripura, "Annual administrative report," Agartala, India, 2020.
- [16] Ministry of Statistics and Programme Implementation, "National accounts statistics 2024," Government of India, New Delhi, 2024.
- [17] K. K. Sharma and R. K. Bhattacharjya, "Small-scale fisheries and livelihood security in the Brahmaputra floodplain," *Indian J. Fish.*, vol. 62, no. 4, pp. 1–9, 2015.
- [18] S. Debbarma, A. Ghosh, B. Lahiri, and P. K. Pandey, "Fish farming practices of Tripura: A socio-economic perspective," research report, Central Agricultural University, India, 2014.
- [19] A. K. Jha and S. K. Sharma, "Integrated fish farming and rural livelihood diversification in India," *Agric. Econ. Res. Rev.*, vol. 31, pp. 115–124, 2018.
- [20] Government of India, "Pradhan Mantri Matsya Sampada Yojana: Operational guidelines," Ministry of Fisheries, New Delhi, 2020.
- [21] M. Singh and N. A. Devi, "Loktak Lake fisheries and the livelihood of fishing communities in Manipur," *J. Environ. Soc. Sci.*, vol. 5, no. 2, pp. 45–55, 2017.
- [22] Ramsar Convention Secretariat, "Loktak Lake: Ramsar site information service," Gland, Switzerland, 2023.
- [23] IPCC, "Climate change 2022: Impacts, adaptation and vulnerability," Cambridge Univ. Press, Cambridge, U.K., 2022.
- [24] UNEP, "Ecosystem approach to fisheries," United Nations Environment Programme, Nairobi, Kenya, 2019.
- [25] R. K. Wagle and S. K. Borthakur, "Fisheries cooperatives and rural development in Tripura," *Indian J. Agric. Econ.*, vol. 73, no. 3, pp. 402–414, 2018.



- [26] A. Pretty, "Sustainable intensification in agricultural systems," *Ann. Bot.*, vol. 114, no. 8, pp. 1571–1576, 2014.
- [27] E. Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, U.K.: Cambridge Univ. Press, 1990.
- [28] J. E. Cohen and C. M. Achord, "The role of fish in food and nutrition security," *World Dev.*, vol. 92, pp. 1–12, 2017.
- [29] WorldFish, "Fisheries and aquaculture for food and nutrition security," Penang, Malaysia, 2021.
- [30] NITI Aayog, "Transforming agriculture and allied sectors in North Eastern Region," Government of India, New Delhi, 2021.

IJMRR