Keepers of the Shore: Indigenous Ecological Knowledge, Integral Ecology, and the Survival of Coastal Fishing Micro-Enterprises

Introduction and Problem Statement

Along the 48-kilometer coastal stretch surrounding Kochi in Kerala, India, traditional fishing communities have sustained themselves and their marine ecosystems for centuries through indigenous knowledge systems governing resource harvesting, seasonal restrictions, and communal stewardship of coastal commons (Gopal et al., 2018; Celestine & Xavier, 2023). These predominantly lower-caste Latin Catholic and Dheevara fisher families operate artisanal micro-enterprises representing one of the world's most enduring knowledge-intensive, low-external-input food systems (Altieri, 2018; Wezel et al., 2020). Yet this system faces existential threat. Rapid urbanization, port expansion, industrial pollution, coastal erosion, dwindling fish stocks from mechanized trawling, and climate-driven disruptions to monsoon patterns have collectively eroded both the ecological base and socioeconomic viability of these communities (Shyam et al., 2014). As Boff (1997) argued, and as *Laudato Si'* later affirmed, the cry of the earth and the cry of the poor are two faces of the same structural injustice (Deneulin, 2021b).

Our research asks, how do indigenous ecological knowledge systems among coastal fishing microenterprises function as practices of integral ecology, and how can these be mobilized into scalable, policy-based interventions? It directly answers *Laudato Si'*s insistence that social and environmental crises constitute one complex crisis requiring an integrated response (LS par. 139).

Theoretical Foundations: Integral Ecology Meets Agroecological Fisheries

Our research bridges three theoretical streams. First, it draws on integral ecology as articulated in *Laudato Si'* (2015) and developed by Imanaka, Prussia, and Alexis (2017), which

reconceptualizes sustainability as requiring the simultaneous reordering of environmental, economic, social, cultural, and daily-life ecologies. Deane-Drummond (2023) argues that without theological grounding, integral ecology risks collapsing into generic interdisciplinarity, losing its distinctive moral urgency. The coastal fishing communities of Kochi represent a living laboratory for this interconnectedness. The decline of marine biodiversity is inseparable from the erosion of livelihoods, cultural identity, and intergenerational knowledge transmission. Deneulin (2021a) has shown, that integral ecology can be operationalized as a framework for evaluating whether development processes expand or constrict the freedoms of the most vulnerable, building on the case for engaging religious ethical frameworks within development studies (Deneulin & Rakodi, 2011).

Second, it extends the emerging agroecological fisheries framework applying agroecology's principles of food sovereignty, indigenous governance, and socio-cultural embeddedness to small-scale fisheries (Levkoe et al., 2017; Altieri & Toledo, 2011). We examine how Kochi's fishermen enact these principles through seasonal self-regulation, communal gear restrictions, rotational fishing grounds, and integration of traditional ecological knowledge (TEK) (Berkes, 2012). These mechanisms instantiate what Ostrom (1990) identified as design principles for sustainable commons institutions and echo the bright spots Cinner et al. (2016) documented where local governance produces positive ecological outcomes against prevailing degradation.

Third, the TEK literature further demonstrates that indigenous fishermen hold empirically valid knowledge about species behavior and ecosystem dynamics that complements formal management systems (Reid et al., 2020; Silvano & Valbo-Jorgensen, 2008). Jentoft (2019)

argues that fisheries governance failing to foreground the lived experience of small-scale fishermen is both ethically impoverished and practically ineffective.

Research Design: A Sequential Mixed-Methods Approach

Study 1: Qualitative Grounded Theory (n = 52). We conducted semi-structured interviews with 52 artisanal fishermen and microenterprise operators across seven coastal villages along the Kochi coast, selected through purposive and snowball sampling to capture variation in age, gear type, and proximity to development pressures. Interviews conducted in Malayalam focused on indigenous harvesting practices, perceived threats, communal governance mechanisms, and adaptive strategies. Our analysis followed Gioia et al.'s (2013) methodology, progressing from first-order informant categories to second-order themes to aggregate theoretical dimensions. Figure 1 presents our conceptual model from Study 1.

Study 2: Quantitative Hypothesis Testing (n=315). Building on hypotheses from Study 1, Study 2 surveyed 315 fishing micro-enterprises across the greater Kochi coastal region. The instrument captures a multi-item Indigenous Ecological Practice scale developed from Study 1, Livelihood Resilience indicators (adapted from Islam et al., 2014), Ecosystem Health Perceptions, Development Pressure Intensity, and Policy Intervention Receptivity. We test whether higher IEP engagement predicts greater livelihood resilience and more positive ecosystem health perceptions, moderated by development pressure such that indigenous practices become most critical where threats are most acute.

Impact on the Ground: From Research to Policy Intervention

This project is designed as a direct catalyst for policy intervention, responding to Deneulin's (2021a) call for empirical work that operationalizes integral ecology with measurable impact on human development outcomes. Our findings are designed to inform a co-

designed Coastal Fisheries Stewardship Protocol developed with the Kerala State Fisheries Department and local panchayat bodies through three mechanisms - community-managed no-take zones based on fishermen's traditional knowledge of breeding grounds, grounded in Ostrom's (1990) design principles; a TEK-Science Bridge Program connecting fishermen's knowledge holders with marine scientists at ICAR-CMFRI following the two-eyed seeing framework (Reid et al., 2020) and the Laudato Si' Research Institute's commitment to foregrounding marginalized voices (Deane-Drummond & Artinian-Kaiser, 2018); and a Micro-Enterprise Resilience Fund providing seed capital for climate-adaptive livelihood diversification that reinforces rather than displaces traditional practices.

The project mirrors the spirit of Fr. Henri de Laulanie, S.J., whose System of Rice Intensification demonstrated that indigenous observation and low-external-input innovation can transform resource productivity without dependency on industrial systems (Uphoff, 2015; Parr, 2025). Just as it empowered Malagasy rice farmers through knowledge-intensive practice changes, this project demonstrates that Kochi's fishermen possess the ecological intelligence to sustain both livelihoods and marine commons, provided policy frameworks protect and scale these indigenous systems. As Zink et al. (2025) argue, conventional sustainability frameworks fail to capture the integrated moral, ecological, and social dimensions that integral ecology demands. Figure 2 illustrates our research-to-policy pathway.

Expected Contributions

Our research provides the first empirical, mixed-methods investigation of how indigenous fishing communities enact integral ecology in practice, bridging *Laudato Si"*s moral vision with ground-level evidence from the Global South and contributing to the interdisciplinary dialogue on operationalizing integral ecology (O'Hara et al., 2020). It extends agroecological

theory from terrestrial agriculture to marine fisheries, proposing and testing a model of agroecological fisheries resilience grounded in indigenous knowledge. Most critically, it translates research into actionable policy with measurable and clear impact on the ground.

Extended Abstract Word Count: 1000 words

Figure 1. Conceptual Model: Agroecological Fisheries Resilience Through Integral Ecology

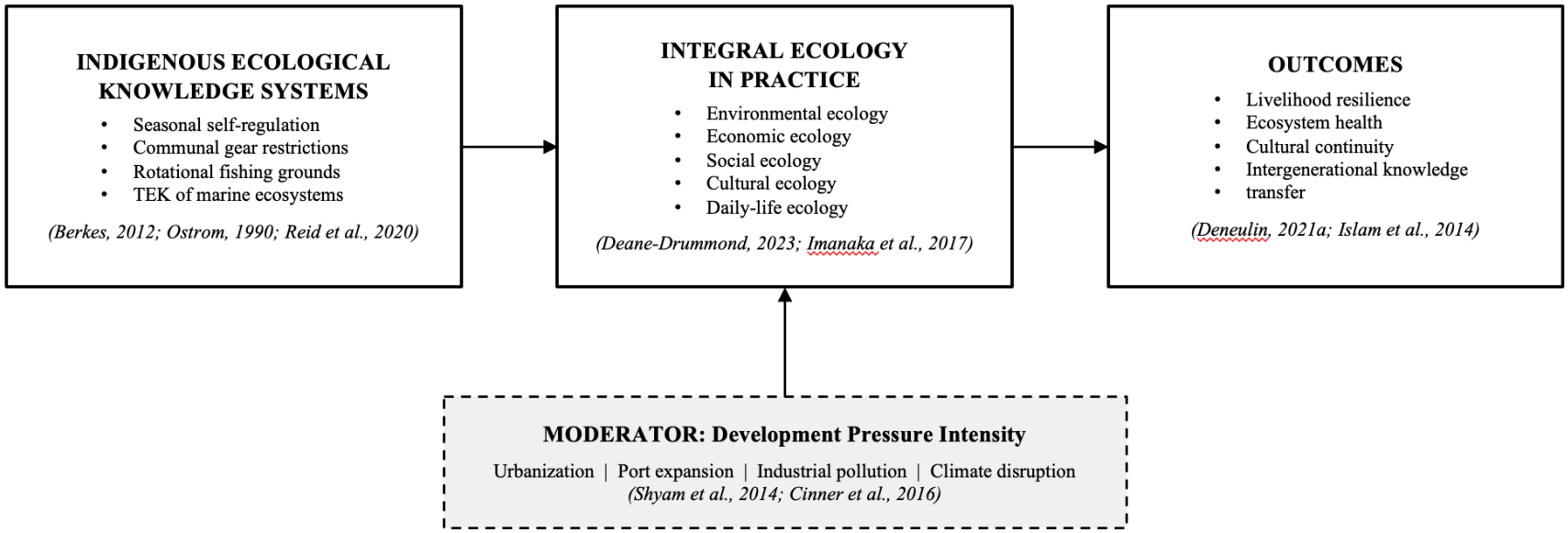
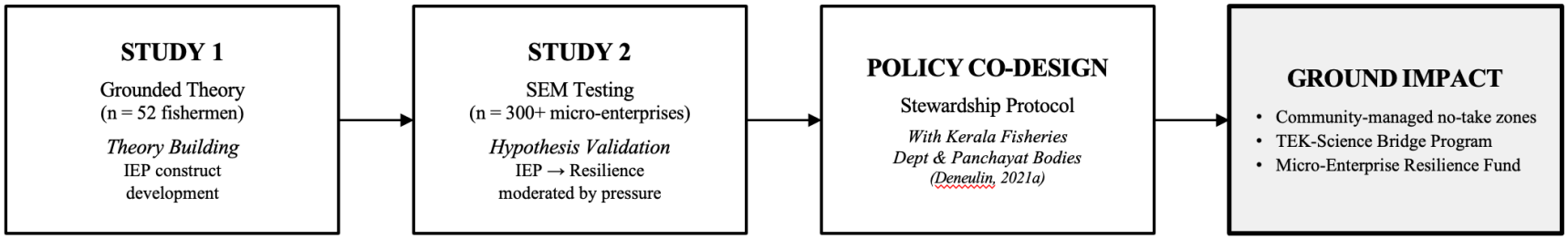


Figure 2. Research-to-Policy Pathway: Coastal Fisheries Stewardship Protocol (Practice-based agroecology with clear impact on the ground)



Endnotes

1. The term "agroecological fisheries" extends agroecology's principles to marine and coastal food systems. Like SRI's transformation of rice cultivation through knowledge-intensive management rather than external inputs, this framework privileges fisher knowledge over technocratic management regimes. The theoretical move parallels Thies and Zink's (2024) argument that Jesuit sustainability education must transcend instrumentalist frameworks.
2. The study area encompasses fishing villages within a 48 km radius of Kochi, within Ernakulam district. Kochi's coastline is one of India's most ecologically and commercially contested marine zones, with the juxtaposition of artisanal fishing, international shipping, petroleum refining, and tourism creating competing claims on the same coastal commons. These competing claims exemplify what Deneulin (2021b) describes as the tensions between dominant economic structures and the principles of integral ecology.
3. Preliminary engagement with Kerala State Fisheries Department officials and CMFRI scientists has confirmed institutional receptivity to the proposed Stewardship Protocol, pending the dissemination of empirical findings from this research.

References

Altieri, M. A. (2018). *Agroecology: The science of sustainable agriculture* (2nd ed.). CRC Press.

Altieri, M. A., & Toledo, V. M. (2011). The agroecological revolution in Latin America: Rescuing nature, ensuring food sovereignty and empowering peasants. *Journal of Peasant Studies*, 38(3), 587-612.

Berkes, F. (2012). *Sacred ecology* (3rd ed.). Routledge.

Boff, L. (1997). *Cry of the earth, cry of the poor*. Orbis Books.

Celestine, P. F., & Xavier, S. (2023). Livelihood problems and challenges of the small-scale fishermen of Kerala. *Journal of Survey in Fisheries Sciences*, 10(3), 213-224.

Cinner, J. E., Huchery, C., MacNeil, M. A., Graham, N. A. J., McClanahan, T. R., Maina, J., ... & Mouillot, D. (2016). Bright spots among the world's coral reefs. *Nature*, 535, 416-419.

Deane-Drummond, C. (2023). Pope Francis's integral ecology paradigm: An exploration of its theological foundations and ethical implications. *Irish Theological Quarterly*, 88(2), 99-111.

Deane-Drummond, C., & Artinian-Kaiser, R. (Eds.). (2018). *Theology and ecology across the disciplines: On care for our common home*. Bloomsbury.

Deneulin, S. (2021a). *Human development and the Catholic social tradition: Towards an integral ecology*. Routledge.

Deneulin, S. (2021b). Religion and development: Integral ecology and the Catholic Church Amazon Synod. *Third World Quarterly*, 42(10), 2282-2299.

Deneulin, S., & Rakodi, C. (2011). Revisiting religion: Development studies thirty years on. *World Development*, 39(1), 45-54.

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research. *Organizational Research Methods*, 16(1), 15-31.

Gopal, N., Neelima, M. V., Harsha, K., Sajesh, V. K., Arathy, A., Bindu, J., Sreejith, S., Velloth, S., Pillai, N. G. K., & Jayakumar, A. (2018). *Traditional knowledge in marine fisheries of Kerala*. ICAR-Central Institute of Fisheries Technology.

Imanaka, J. L., Prussia, G., & Alexis, S. (2017). Laudato Si' and integral ecology: A reconceptualization of sustainability. *Journal of Management for Global Sustainability*, 5(1), 39-61.

Islam, M. M., Sallu, S., Hubacek, K., & Paavola, J. (2014). Vulnerability of fishery-based livelihoods to the impacts of climate variability and change. *Regional Environmental Change*, 14, 281-294.

Jentoft, S. (2019). *Life above water: Essays on human experiences of small-scale fisheries*. TBTI Global.

Levkoe, C. Z., Lowitt, K., & Nelson, C. (2017). "Fish as food": Exploring a food sovereignty approach to small-scale fisheries. *Marine Policy*, 85, 65-70.

O'Hara, D., Eaton, M., & Ross, M. T. (Eds.). (2020). *Integral ecology for a more sustainable world: Dialogues with Laudato Si'*. Lexington Books.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.

Parr, A. (2025). Ecological crisis and the Jesuit way of proceeding in the mission of Henri de Laulanie. *Journal of Jesuit Studies*, 12, 521-547.

Pope Francis. (2015). *Laudato Si': On care for our common home*. Vatican Press.

Reid, A. J., Eckert, L. E., Lane, J.-F., Young, N., Hinch, S. G., Darimont, C. T., Cooke, S. J., Ban, N. C., & Marshall, A. (2020). "Two-eyed seeing": An Indigenous framework to transform fisheries research and management. *Fish and Fisheries*, 22, 243-261.

Shyam, S. S., Kripa, V., Zacharia, P. U., Mohan, A., & Ambrose, T. V. (2014). Vulnerability assessment of coastal fisher households in Kerala: A climate change perspective. *Indian Journal of Fisheries*, 61(4), 99-104.

Silvano, R. A. M., & Valbo-Jorgensen, J. (2008). Beyond fishermen's tales: Contributions of fishers' local ecological knowledge to fish ecology and fisheries management. *Environment, Development and Sustainability*, 10, 657-675.

Wezel, A., Herren, B. G., Kerr, R. B., Barrios, E., Goncalves, A. L. R., & Sinclair, F. (2020). Agroecological principles and elements and their implications for transitioning to sustainable food systems. *Agronomy for Sustainable Development*, 40(4), 1-13.

Zink, T., Fitzpatrick, M., Nordin, J., & Thies, J. S. (2025). Why the triple bottom line fails: Advancing the Jesuit vision for sustainability education in business. *Journal of Management for Global Sustainability*, 13(2).