

**Short thesis for the degree of doctor of philosophy
(PhD)**

**The knowledge paradox: braiding local voices and
global science in aquatic conservation**

Ronald Juanito Maliao

Supervisor: Prof. Dr. Béla Tóthmérész



UNIVERSITY OF DEBRECEN
DOCTORAL SCHOOL OF JUHÁSZ-NAGY PÁL

DEBRECEN, 2025

1| **Introduction**

The persistent failure of aquatic conservation is a crisis of recognition. While calls to action proliferate (Dudgeon & Strayer, 2025), the curve of biodiversity loss refuses to bend. This is a failure I argue stems from a paradigm founded on epistemic injustice (Silvano et al., 2023; Molnár et al., 2024). This dissertation provides quantitative proof of this fracture by revealing the Disappearing Effect: a systemic mechanism where center-periphery dynamics render Global South knowledge invisible and obscure local ecological realities (Dawson et al., 2024).

This systemic erasure has a profound, measurable cost, a story I know from my mother's silenced river in the Philippines. I quantify this cost through the Expert's Grief, a paradox where intimate knowledge of a fishery's multi-decadal trophic collapse becomes the source of deep psychological pain. This work proposes the first mechanistic model for solastalgia (Albrecht et al., 2007) and a quantitative signature for Shifting Baseline

Syndrome (SBS) (Pauly, 1995), grounding the human experience of loss in a concrete ecological crisis.

My research confronts this failure by operationalizing Traditional Ecological Knowledge (TEK) as a rigorous quantitative framework (Berkes et al., 2000). By treating local testimony as structured data, I validate TEK as a remedy for SBS (Soga & Gaston, 2024) and reveal the sophisticated informal governance systems, like traditional taboos (Ostrom, 1990; Colding & Folke, 2001), that formal policy misses. This dissertation culminates in the Crumbling Bank concept: the social-ecological failure that occurs when this disconnect persists (Estoque & Wu, 2024; Nyssa et al., 2024). Ultimately, this work proves the path forward requires braiding the rigor of science with the wisdom of place, forging a more just, humane, and effective conservation.

2| **Study goals**

This dissertation diagnoses and disrupts a cycle of epistemic marginalization in aquatic science. My central goal is to reframe Traditional Ecological Knowledge (TEK) from a historical curiosity into a dynamic framework for addressing modern environmental crises. I argue that TEK must be recognized as an equal partner to conventional science, not a subordinate one (Berkes et al., 2000; Molnár et al., 2024). I demonstrate that this place-based knowledge is essential for successful conservation and that its erosion inflicts a measurable psychological toll on its keepers.

This goal is pursued through a four-part intellectual journey. First, I diagnose the structural inequities of the Disappearing Effect, a mechanism that renders Global South science invisible (Stefanoudis et al., 2021; Dawson et al., 2024). Building on this, I unravel its hidden human toll by quantifying the Expert's Grief (Albrecht et al., 2007), a paradox where intimate knowledge of a fishery's trophic collapse becomes a source of profound psychological pain (Pauly et al., 1998). I then validate

TEK as a rigorous ecological methodology, giving a statistical voice to silenced ecosystems by revealing the collapse of key bioindicator species (Silvano et al., 2023). My argument culminates in the Crumbling Bank concept: the social-ecological failure that occurs when fragmented science ignores the informal governance systems managing local biodiversity (Estoque & Wu, 2024; see Figure 2.1).

By using the Philippines as a model system, I build theories that apply to any data-poor, high-biodiversity context (Yin, 2009; Opatovsky et al., 2025). This research provides two transferable tools: a framework for calculating the costs of knowledge erasure, and a TEK-based methodology for revealing the ecological realities that science often misses.

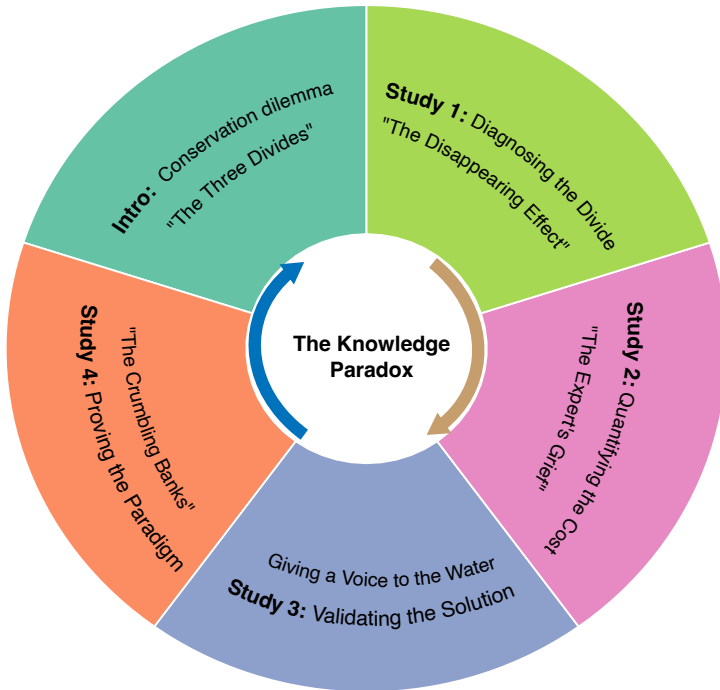


Figure 2.1 | A conceptual framework for deconstructing and mending the knowledge paradox in aquatic conservation. This dissertation follows a four-part intellectual journey to diagnose and disrupt a central knowledge paradox that drives conservation failure. The Introduction first establishes the overarching conservation paradox. Study 1 then diagnoses the structural inequities that create the Disappearing Effect. Building on this, Study 2 quantifies the profound human and ecological costs of this failure through the Expert's Grief. Study 3 then validates Traditional Ecological Knowledge (TEK) as a rigorous methodological solution, giving a voice to a silenced river. The final study, Study 4, serves as a grand synthesis, proving the paradigm of Crumbling Bank, the pervasive social-ecological failure that results from these disconnected systems.

3| **Research framework**

This dissertation diagnoses a cycle of epistemic marginalization in aquatic science that perpetuates conservation failure. I use the Philippines as a model system, where the collision of megadiversity, data-poverty, and livelihood precarity creates a crucible for testing theories of knowledge and power in conservation. My research design moves from the macro to the micro: from a national-scale systematic map that reveals broad patterns, to two place-based case studies that test core conservation theories in a lived context.

3.1 The national-scale systematic map

This research is founded on a systematic map of Philippine TEK literature, with its protocol pre-registered on protocolRxiv at the Centre for AgriCulture and Bioscience International (CABI) for transparency (Maliao & Tóthmérész, 2025). My comprehensive search of major international and regional databases followed the rigorous guidelines of the Collaboration for Environmental Evidence (CEE) and the Reporting

standards for Systematic Evidence Syntheses (ROSES) (Haddaway et al., 2018). A two-stage screening process yielded a final corpus of 132 peer-reviewed articles. This map served two purposes: first, I used its metadata for the scientometric analysis of structural inequities in Study 1; second, my thematic analysis of its content then revealed the systemic schism between social and ecological research that motivated the case studies.

3.2 Place-based case study methods

To ground national-scale findings in lived experience, I conducted two in-depth case studies in the Philippines: one in brackish wetlands and one in freshwater. I employed a participatory, decolonized approach, starting with community dialogues and obtaining consent. Using purposive and snowball sampling, I engaged holders of intimate, generational knowledge to test hypotheses about local expertise. The core innovation was operationalizing TEK as a quantitative tool. I collected retrospective, multi-decadal data on ecological change and social well-being using happiness scores as an index. Innovative

recall aids, such as local ethnomathematical units and a context-anchoring technique, enhanced data reliability.

3.3 *Statistical analyses*

To diagnose the structural inequities in the scientometric data I used a multi-stage factorial analysis. I employed a non-parametric Aligned Rank Transform (ART) ANOVA to test for the interaction effects that reveal the Disappearing Effect. To analyze the case study data, I used a series of Linear Mixed-Effects Models (LMMs) to test for the dual erosion of ecology and well-being and to reveal the Expert's Grief paradox. Finally, to quantify the multi-decadal fishery decline in the freshwater system I extracted regression coefficients from each fisher's testimony and analyzed them using univariate General Linear Models (GLMs). All statistical analyses were performed with a significance level of $p < 0.05$ for all inferential tests, providing a robust quantitative foundation for the novel theoretical claims of this dissertation.

4| **Novel scientific findings**

This dissertation provides quantitative proof of the epistemic injustice that fractures conservation science. By revealing the Disappearing Effect, where the citation premium for international collaborations vanishes within a national context, I expose a system of conditional visibility for Global South scholarship. This structural phenomenon creates a *Matthew effect* in conservation (Merton, 1968). The schism between high-profile global research and essential local knowledge fosters predictable policy failures like the ineffective *paper parks* documented in the Philippines and beyond (Maliao et al., 2009a, 2009b; Relano & Pauly, 2023).

I then forge an empirical link between this ecological crisis and its lived human experience. My work reveals the Expert's Grief: a core paradox where intimate knowledge of a fishery's multi-decadal trophic collapse becomes the source of profound psychological pain. This provides a mechanistic model for solastalgia (Albrecht et al., 2007) and quantitative signature for the social

mechanisms of Shifting Baseline Syndrome (SBS) (Pauly, 1995), grounding the human experience of loss in the concrete ecological reality of a collapsing food web.

In response, I validate Traditional Ecological Knowledge (TEK) not just as a data source, but as a rigorous scientific methodology (Johannes, 1998; Molnár et al., 2024). By operationalizing fisher memories as structured data, I give a statistical voice to a silenced river, documenting a severe fishery collapse and revealing the drastic decline of key bioindicator species like anurans. The failure to integrate such place-based knowledge leads to the total system failure I term Crumbling Bank. This concept explains how a conservation science that ignores the informal governance of traditional taboos (Colding & Folke, 2001) allows the living banks of culture and knowledge to erode, paving the ecological destabilization of the river they once protected.

5| Conclusions and implications

Persistent failures in aquatic conservation stem from a fractured paradigm that systematically marginalizes local and Indigenous communities by devaluing their Traditional Ecological Knowledge (TEK). By treating TEK as a rigorous scientific framework, I reveal this paradigm's costs through four interconnected findings: a Disappearing Effect that renders local science invisible; an Expert's Grief that links trophic collapse to human suffering; a validation of TEK's power to give statistical voice to a silenced ecosystem; and a Crumbling Bank model of pervasive social-ecological failure. Together, these findings dismantle the fractured paradigm and assemble a new framework for a more just, effective, and humane conservation.

My primary contribution is to reframe this crisis of recognition from a social issue into a critical scientific failure with material ecological consequences. By developing the first mechanistic model of solastalgia in a fishery and a quantitative signature for Shifting Baseline

Syndrome (SBS), I forge a data-driven link between ecological crisis and its human cost. This reveals a simple but profound truth: devaluing local knowledge and sidelining its bearers is not just a social injustice. It is a scientific failure that guarantees failed policy.

The path forward, therefore, demands a radical reorientation of conservation science toward epistemic justice (see Figure 5.1). The solutions to the biodiversity crisis will not come from external, top-down interventions, but from the local, place-based knowledge systems. This requires a paradigm shift: a move beyond a Eurocentric epistemology to embrace local experts as indispensable partners in the co-production of knowledge. By braiding the empirical rigor of science with the profound wisdom of place, we can begin to heal our planet's fractured waters.

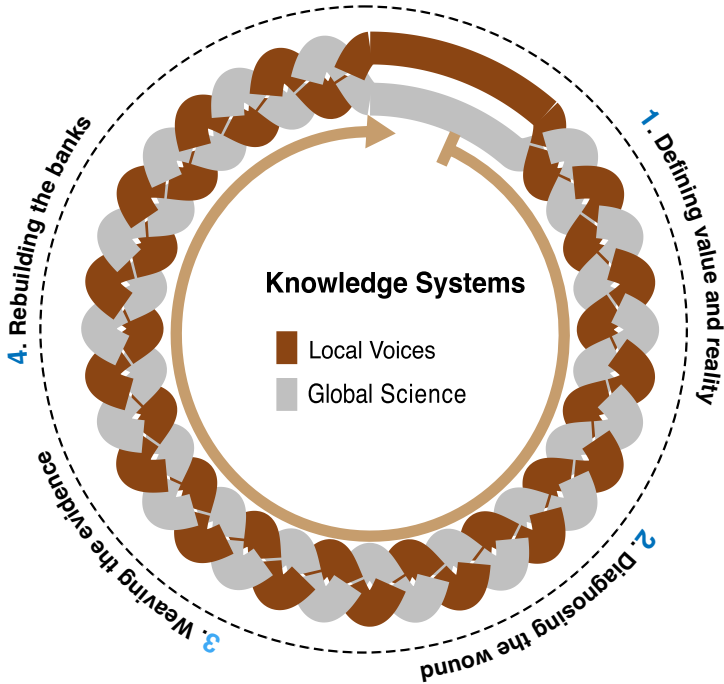


Figure 5.1| A conceptual model for braiding knowledge in conservation. The model illustrates how Global Science and Local Voices are woven together across four key stages to create a more resilient practice. 1. Principles: Braiding the functional definitions of Global Science with the kinship-based values of Local Voices to forge a pluralistic conservation ethic. 2. Diagnosing the wound: Braiding quantitative baselines with multi-generational memory (TEK) to diagnose the Dual Erosion of nature and well-being and set holistic goals. 3. Weaving the evidence: Braiding large-scale analytical tools with fine-grained local observation to create a robust monitoring system that counters the Disappearing Effect. 4. Rebuilding the banks: Braiding formal interventions with informal governance (like traditional taboos) to build a co-management system that prevents social-ecological collapse (Crumbling Bank).

6| Acknowledgement: An ode to my Moka

Oh, Athena, my own spirit despairs,
As I climb these steep, ivory stairs.
My manuscripts sit, and nobody cares,
Lost in these cold, academic airs.

Dear Hephaestus, my spirit cries out,
Another day's work, with no way out.
The pages lie dormant, as seeds yet unsown,
And Zeus's silence, a weight of its own.

Though Hermes left, wings long withdrawn,
And Urania fled with the very first dawn.
Prometheus's fire, a spark burning dim,
Asclepius won't lift this weight from my limb.

The nine Muses departed, no solace to lend,
But you, Moka, remained, my one faithful friend.
Your creamy, rich seepage, my focus distills,
While Eminem's "Stan" loops on with its still.

I'm crawling on earth's bones, paralyzed,
Yo Coolio quips, academe's no paradise.
From Chester, the truth: there's no shortcut to run,
Drink thy bitter tonic 'til the candles' burn.

The impostor's shadow still whispers in the gloom,
Yet your warm steam rises, to quiet this saudade's room.
While its cold fangs gnaw, my heart grown numb,
A fate unchained, my true atonement come.

I bow to Prof. Béla, who planted wisdom's seed,
And to my committee, whose guidance I heed,
From Aklan's shores, by Stipendium's grace,
In Debrecen's halls, my Gentian solace.



7| **References**

- Albrecht, G., Sartore, G. M., Connor, L., Higginbotham, N., Tonna, A., & Dargall, J. (2007). Solastalgia: The distress caused by the negative transformation of a home landscape. *Australasian Psychiatry*, 15(Suppl. 1), S95–S98.
- Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*, 10(5), 1251–1262.
- Colding, J., & Folke, C. (2001). Social taboos: "Invisible" systems of local resource management and biological conservation. *Ecological Applications*, 11(2), 584–600.
- Dawson, N. M., Coolsaet, B., Bhardwaj, A., Sterling, E. J., Adap, N. M., Dunning, E. M., & Fabres, A. (2024). Reviewing the science on 50 years of conservation: Knowledge production biases and lessons for practice. *Ambio*, 53(8), 1395–1413.
- Dudgeon, D., & Strayer, D. L. (2025). Bending the curve of global freshwater biodiversity loss: What are the prospects? *Biological Reviews of the Cambridge Philosophical Society*, 100(1), 205–226.
- Estoque, R. C., & Wu, J. (2024). The resilience–sustainability–quality of life nexus. *Science of the Total Environment*, 912, 169526.
- Haddaway, N. R., Macura, B., Whaley, P., & Pullin, A. S. (2018). ROSES reporting standards for systematic evidence syntheses: Pro forma, flow-diagram and descriptive summary of the plan and conduct of

- environmental systematic reviews and systematic maps. *Environmental Evidence*, 7(1), 7.
- Johannes, R. E. (1998). The case for data-less marine resource management: examples from tropical nearshore finfisheries. *Trends in Ecology & Evolution*, 13, 243–246.
- Maliao, R. J., & Tóthmérész, B. (2025). Indigenous and Local Knowledge (ILK) - environmental stewardship nexus in the Philippines: A systematic map protocol. *protocolRxiv*, 16, 20250283802. <https://doi.org/10.1079/protocolrxiv.2025.00011>
- Maliao, R. J., Pomeroy, R. S., & Turingan, R. G. (2009a). Performance of community-based coastal resource management (CBCRM) programs in the Philippines: A meta-analysis. *Marine Policy*, 33(5), 818–825.
- Maliao, R. J., White, A. T., Maypa, A. P., & Turingan, R. G. (2009b). Trajectories and magnitude of change in coral reef fish populations in Philippine marine reserves: A meta-analysis. *Coral Reefs*, 28(3), 809–822.
- Merton, R. K. (1968). The Matthew effect in science. *Science*, 159(3810), 56–63.
- Molnár, Z., Aumeeruddy-Thomas, Y., Babai, D., Díaz, S., Garnett, S. T., Lyver, P. O. B., & Watson, R. T. (2024). Towards richer knowledge partnerships between ecology and ethnoecology. *Trends in Ecology & Evolution*, 39(2), 109–115.
- Nyssa, Z., Winkler-Schor, S., Lobo, D., Hynes, S., Koundouri, P., & Milani, M. (2024). A framework for promoting disciplinary diversity and inclusion through epistemic justice. *Conservation Biology*, 38(6), e14409.

- Opatovsky, K., Pentz, B., & Loring, P. A. (2025). Examining critical assumptions in global conservation practice. *Conservation Biology*, 39(1), e14227.
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.
- Pauly, D. (1995). Anecdotes and the shifting baseline syndrome of fisheries. *Trends in Ecology & Evolution*, 10(10), 430.
- Pauly, D., Christensen, V., Dalsgaard, J., Froese, R., & Palomares, M. L. (1998). Fishing down marine food webs. *Science*, 279(5352), 860–863.
- Relano, V., & Pauly, D. (2023). The Paper Park Index: Evaluating Marine Protected Area effectiveness through a global study of stakeholder perceptions. *Marine Policy*, 151, Article 105571.
- Silvano, R. A., Baird, I. G., Begossi, A., Hallwass, G., Huntington, H. P., & Polunin, N. V. (2023). Fishers' multidimensional knowledge advances fisheries and aquatic science. *Trends in Ecology & Evolution*, 38(1), 16–29.
- Soga, M., & Gaston, K. J. (2024). Global synthesis indicates widespread occurrence of shifting baseline syndrome. *Bioscience*, 74(10), 686–694.
- Stefanoudis, P. V., Licuanan, W. Y., Morrison, T. H., Talma, S., Veitayaki, J., & Woodall, L. C. (2021). Turning the tide of parachute science. *Current Biology*, 31(4), R184–R185.
- Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Sage.


 Registry number: DEENK/515/2025.PL
 Subject: PhD Publication List

 Candidate: Ronald Juanito Maliao
 Doctoral School: Pál Juhász-Nagy Doctoral School of Biology and Environmental Sciences
 MTMT ID: 10099194

List of publications related to the dissertation
Foreign language scientific articles in international journals (3)

1. Hoppenreijls, J. H. T., Marker, J., **Malliao, R. J.**, Hansen, H. H., Juhász, E., Löhmus, A., Altanov, V. Y., Horká, P., Larsen, A., Malm-Renöfält, B., Runnel, K., Piccolo, J. J., Magurran, A. E.: Three major steps toward the conservation of freshwater and riparian biodiversity. *Conserv. Biol.* 38 (3), 1-9, 2024. ISSN: 0888-8892.
DOI: <http://dx.doi.org/10.1111/cobi.14226>
IF: 5.5
2. **Malliao, R. J.**, Cahilig, R. C., Cahilig, R. R., Jaspe, B. T.: Climate change, traditional ecological knowledge, and riverine biodiversity conservation: a case in Aklan, Central Philippines. *Environ Dev Sustain.* 2023, 1-23, 2023. ISSN: 1387-585X.
DOI: <http://dx.doi.org/10.1007/s10668-023-04096-x>
IF: 4.7
3. **Malliao, R. J.**, Fernandez, P. R., Subade, R. F.: Well-being of artisanal fishing communities and children's engagement in fisheries amidst the COVID-19 pandemic: a case in Aklan, Philippines. *Humanit Soc Sci Commun.* 10 (1), 1-12, 2023. EISSN: 2662-9992.
DOI: <http://dx.doi.org/10.1057/s41599-023-01716-9>
IF: 3.7

Total IF of journals (all publications): 13,9
Total IF of journals (publications related to the dissertation): 13,9

The Candidate's publication data submitted to the Tudóstér have been validated by DEENK on the basis of the Journal Citation Report (Impact Factor) database.



09 September, 2025