Ethnofishecology

Bridging Traditional Fishing Methods and Knowledge to Current Practices

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1 Preface

1.1 About This Book

This book was born from a desire to capture something that often slips between disciplinary cracks: the full arc of human knowledge about fish, from the place-based observations of fishing communities to the quantitative frameworks of contemporary fisheries science. It treats oral tradition, fishing practice, and community-based ecological observation as evidence that can complement formal surveys, stock assessments, and policy analysis when handled carefully and with explicit uncertainty.

The impetus was simple: fisheries management often privileges the period covered by formal monitoring, even when communities hold much longer records of seasonality, habitat use, gear selectivity, and local change. From handline fishers in the Pacific to gill-net communities in the North Atlantic, people have long tracked fish behaviour, abundance, and ecological change through repeated practice. Understanding how those observations connect to, complement, and sometimes challenge modern methods is the central project of ethnofishecology.

That premise closely parallels Robert E. Johannes's *Words of the Lagoon: Fishing and Marine Lore in the Palau District of Micronesia* (Johannes 1981), which treated fishers' marine lore, terminology, and repeated place-based observation as serious ecological evidence rather than anecdotal background.

1.2 Scope and Structure

This book explores the evolving relationship between humans and fisheries ecosystems, synthesizing insights from anthropology, ichthyology, human ecology, economics, and environmental science. It introduces the emerging field of ethnofishecology, maps its historical development, and highlights future directions.

The chapters include:

- **Concept note** — frames the problem, objective, and initial research agenda for ethnofishecology as a field-building project.
- **Chapter 1. Foundations** — defines the scope of ethnofishecology, describes traditional fishing practices and folk knowledge, and positions the field alongside ethnoichthyology, ethnobiology, maritime anthropology, human ecology, and fisheries science.

- **Chapter 2. Emergence (1960s–1980s)** — reconstructs the adjacent literatures that treated fishing communities as analytically central to fisheries systems, from maritime anthropology to early fishers' knowledge research.
- **Chapter 3. Integration with human ecology and ethnoecology (1990s–2000s)** — examines socio-ecological models, local ecological knowledge, co-management, and stewardship incentives in small-scale fisheries.
- **Chapter 4. Pre-industrial fisheries and historical methods** — documents distinctive fishing technologies such as kite fishing, eel traps, dipnets, weirs, spears, and harpoons as records of ecological knowledge embedded in craft.
- **Chapter 5. Modern ecosystem-based and human-integrated management (2010s–present)** — describes frameworks such as NOAA's Human-Integrated Ecosystem-Based Fishery Management, bycatch utilization, catch shares, and the shift toward socio-ecological trade-off analysis.
- **Chapter 6. Non-commercial fishing** — examines subsistence, sustenance, sport, and recreational fisheries as major cultural, economic, and management domains with their own ethics, conflicts, and ecological effects.
- **Chapter 7. Research ethics and data sovereignty** — sets out CARE and FAIR principles, consent, attribution, benefit-sharing, and the institutional practices needed to work with community knowledge responsibly.
- **Chapter 8. Methods for integrating cultural and quantitative evidence** — shows how ethnographic and local-knowledge data can enter stock assessments and management strategy evaluation through priors, selectivity inputs, structured elicitation, and explicit uncertainty.
- **Chapter 9. Future directions** — looks ahead to climate change, equity, participatory modelling, new data tools, and the next decade of ethnofishecological practice.

The current manuscript is intentionally synthetic. It is meant to provide a usable starting point for researchers and practitioners who want a clearer conceptual bridge between fisheries science, ethnobiology, and the study of fishing communities as ecological actors.

1.3 Note on Development

Much of the original compilation of this manuscript was aided by artificial intelligence. The core ideas, framing, and direction of the project originated with the author, while AI tools were used primarily to help expand prose, organize material, surface connections across literatures, and accelerate drafting. The resulting text should therefore be understood as author-directed and AI-assisted rather than as an independently generated work.

2 Concept Note

> **What this note is**
>
> A one-page framing of the problem, objective, and research agenda for ethnofishecology. Longer treatments follow in the chapters listed below.

2.1 Problem

Fisheries science relies heavily on quantitative stock assessment and fishery-independent monitoring, but it under-represents the culturally embedded knowledge and practices that shape fishing effort, selectivity, and ecological outcomes. That omission matters most where long time series are sparse, governance is contested, or behavioural change drives ecological change faster than standard data systems can explain.

2.2 Objective

Establish ethnofishecology as a field that treats cultural knowledge and fishing practice as interpretable ecological evidence, improving explanation, diagnosis, and management without collapsing the distinction between lived experience and formal inference.

2.3 Approach

- Systematize cultural practice data (gear, timing, spatial patterns, rules, narratives).
- Link those data to ecological mechanisms (selectivity, recruitment exposure, habitat use).
- Integrate with assessments through structured inference and explicit uncertainty (Chapter 8).
- Govern that integration with CARE and FAIR principles (Chapter 7).

2.4 Expected Outcomes

- More accurate representation of fishing dynamics where behaviour and local practice are poorly captured by survey data.
- Better diagnostics for explaining divergence between observed stock dynamics and model assumptions.
- Management strategies that are more socially legible and ecologically robust.

2.5 Research Agenda

1. How do culturally specific gear practices map to selectivity patterns?
2. What validation pathways are appropriate for oral or practice-based knowledge?
3. How should uncertainty from cultural data be propagated into assessments?
4. How do governance systems adapt when ecological change breaks historical practice?
5. Which community-defined performance metrics should sit alongside biological reference points in MSE?

2.6 Position in the Book

This concept note frames the chapters that follow. The foundations and emergence chapters (1–2) establish the field's intellectual basis. The integration chapter (3) links it to human ecology and ethnoecology. The pre-industrial and modern management chapters (4–5) supply historical and contemporary evidence. The non-commercial chapter (6) covers subsistence, sustenance, and recreational fisheries. The ethics chapter (7) sets the governance expectations. The methods chapter (8) operationalizes the research agenda above. The futures chapter (9) looks ahead.

2.7 Limitations

This concept note introduces no new empirical data and should be read as a proposal for synthesis and method development rather than a claim that ethnofishecology is already a fully institutionalized field.

3 Foundations of Ethnofishecology

3.1 Introduction

Ethnofishecology examines the relationships between human cultures and fisheries and asks how those relationships shape ecological outcomes. It draws on anthropology, fisheries science, and marine ecology to explain how people know, use, classify, and govern fish across time and place. Recent reviews in ethnobiology and ethnoichthyology make clear that fish knowledge is not only symbolic or folkloric; it is also embedded in labour, gear design, taxonomy, and repeated observation of local environments (Begossi and Caires 2015; Svanberg and Locker 2020). Robert E. Johannes's *Words of the Lagoon* is an important precursor to this framing because its central theme is that fishers' marine lore can encode detailed ecological knowledge about behaviour, habitat, and seasonality that deserves analytical attention rather than dismissal (Johannes 1981).

> **Working definition**
>
> Ethnofishecology is the study of how human cultures shape fishing practices and how those practices, in turn, shape ecological outcomes. It integrates cultural knowledge, historical practice, and fisheries science to explain selectivity, effort distribution, and ecological impact across time and space.

3.2 Scope

The scope of ethnofishecology covers four things at once. First, it treats traditional knowledge, practices, and technologies as structured evidence about fish and fishing environments, not as anecdote. Second, it examines the ecological and cultural consequences of fishing practices across time and space. Third, it studies the interplay among Indigenous, artisanal, and industrial fishing methods as overlapping rather than sequential systems. Fourth, it insists on clear boundaries with related fields — ethnobiology (broader human–biota relationships), fisheries anthropology (social systems), and fisheries science (population dynamics) — while drawing material from each.

3.3 Position Among Adjacent Fields

Ethnofishecology does not appear in an empty intellectual landscape. Several adjacent fields already study fishers, fish, and their interaction. The value of a new label depends on whether it does something those fields do not.

Table 3.1 summarizes what each adjacent field contributes and where ethnofishecology tries to add. The common thread across the adjacent fields is that each chooses one axis — classification, social organization, population dynamics, human–environment coupling — and goes deep on it. Ethnofishecology is designed as a *coupling* frame: it asks how cultural knowledge, fishing practice, governance, and ecological dynamics interact inside a single fishery system, and it commits to making that interaction legible to quantitative assessment and management.

Table 3.1: Adjacent fields and what ethnofishecology adds.

Adjacent field	Main question it answers	What it does especially well	What ethnofishecology adds
Ethnoichthyology	How do cultures classify, name, and relate to fish?	Folk taxonomy, species knowledge, symbolism, cultural use (Svanberg and Locker 2020)	Links classification to selectivity, effort, and stock-level outcomes
Ethnobiology	How do human groups relate to the wider biota?	Broad comparative framework, methods for knowledge documentation (Begossi and Caires 2015)	Focuses specifically on fisheries systems and the behavioural–ecological inference they require
Maritime / fisheries anthropology	How are fishing societies organized?	Household strategy, labour, tenure, governance	Ties social organization to population-level ecological signals that fisheries science actually uses
Human ecology of fisheries	How do people adapt to changing aquatic environments?	Socio-ecological feedbacks, adaptation, food security (Begossi et al. 2015)	Treats cultural data as interpretable inputs to formal assessment, not only as context

Adjacent field	Main question it answers	What it does especially well	What ethnofishecology adds
Fisheries science	How do fish populations respond to exploitation?	Stock assessment, selectivity, population dynamics, MSE	Provides a bridge so that cultural evidence can enter assessments with explicit uncertainty
Local / traditional ecological knowledge research	What do fishers know that science has not recorded?	Interview, participatory mapping, validation studies (Neis et al. 1999; Haggan et al. 2007)	Places that knowledge inside a fisheries-science workflow with priors, likelihoods, and scenarios

Seen this way, ethnofishecology is not a replacement. It is a coupling frame that holds the adjacent fields accountable to each other when the object of inquiry is a fishery.

3.4 Origin and Inspiration

Ethnomusicology provides a useful analogy because it formalized the cultural context of music as a legitimate object of study rather than background material. Ethnofishecology is proposed in a similar spirit: it treats the cultural, historical, and ecological dimensions of fishing as central components of fisheries research rather than peripheral context. The analogy is heuristic rather than genealogical, but it clarifies the ambition of the field.

3.5 Methods and Evidence

The evidentiary base for ethnofishecology is plural. It includes ethnographic observation, oral history, vernacular taxonomies, gear descriptions, spatial knowledge, historical records, and contemporary ecological datasets. The key methodological move is not to treat all sources as interchangeable, but to ask what each source can reliably say about fish behaviour, habitat, abundance, seasonality, and fishing effort. Reviews of fisheries ethnobiology show that cultural materials reveal ecological information when interpreted with attention to context, transmission, and scale (Begossi and Caires 2015; Svanberg and Locker 2020). Chapter 8 describes how these sources enter quantitative assessment; Chapter 7 describes the ethics that must govern their collection and use.

3.6 Traditional Knowledge and Early Practices

Fishing communities have long developed folk taxonomies and behavioural knowledge that guide when, where, and how fish are taken. Those classifications often encode habitat, morphology, seasonality, and use value, making them relevant to ecological interpretation as well as cultural analysis. Handlines, nets, traps, weirs, and spears were adapted to specific environments and resource constraints, so gear is not just a technical object but a record of how communities learned the behaviour and accessibility of fish populations over time. Fishing practices also shaped settlement patterns, livelihoods, exchange, language, and material culture. Historical reviews of freshwater fisheries in Europe show how artisanal fisheries supported food systems while shaping local institutions and landscapes (Svanberg and Locker 2020). Across regions, artisanal and Indigenous fisheries show that fish are at once food, livelihood, ecological indicator, and cultural symbol. That combined role is exactly why a narrowly biological account is incomplete.

3.7 Significance

Understanding the foundations of ethnofishecology clarifies why fishing knowledge matters to present-day science and management. The field does not claim that all traditional practice is inherently sustainable or automatically generalizable. It argues that historically grounded knowledge of fish, gear, and place improves how fisheries researchers formulate hypotheses, interpret anomalies, and communicate management choices.

4 Emergence of Ethnofishecology (1960s–1980s)

4.1 Introduction

This chapter is research background rather than a claim that ethnofishecology existed as a bounded field in the 1960s–1980s. The defensible point is that scholars in maritime anthropology, ethnobiology, and fisheries sociology produced adjacent lines of work that treated fishing communities as analytically central to fisheries systems. This book uses ethnofishecology to recognize, gather, and bind those contributions into a more legible conversation about knowledge, practice, and ecological change.

> A note on the timeline
>
> The decades in the chapter title mark when the adjacent literatures matured, not when a single "ethnofishecology" discipline began. Chapter 3 (Figure 5.1) shows how those strands converge into the coupling frame this book adopts.

4.2 Methods and Evidence

The relevant background is best reconstructed through comparative historical synthesis. Evidence includes ethnographic studies of fishing communities, archival material on artisanal fisheries, and early work on fishers' ecological knowledge. Read this way, the period is not the origin story of a single discipline. It is a convergence of literatures that began to ask related questions about how people know fish, organize fishing, and negotiate the relationship between lived practice and formal management.

4.3 Key Themes

- **Formal recognition of ethnoichthyology.** Work under the banner of ethnoichthyology provided a vocabulary for studying human knowledge of fish and fish-related practices across cultures. It linked species classification, use, symbolism, and practical fishing knowledge, and it established fish as a legitimate focus within ethnobiology rather than a niche topic within natural history (Svanberg and Locker 2020).

- **A precursor text on marine knowledge.** Robert E. Johannes's *Words of the Lagoon* offered a strong early demonstration of the ideas that animate this book. By documenting how Palauan fishers organized marine lore through named places, species knowledge, behaviour, and fishing practice, it showed that local knowledge could function as cumulative ecological evidence rather than informal anecdote (Johannes 1981).
- **Maritime anthropology and human ecology.** Anthropologists studying coastal and riverine communities increasingly described fisheries as coupled social and ecological systems. This shift redirected attention toward household strategy, labour allocation, seasonal movement, and the institutional settings in which fishing decisions were made.
- **Local knowledge versus scientific management.** The period also exposed a recurring tension between local observation and centralized management. Newfoundland research later showed that interviews with fishers could recover information about cod behaviour, spawning areas, changing catchability, and rising fishing efficiency that standard assessment inputs had missed or underweighted (Neis et al. 1999).
- **Artisanal fisheries and cultural heritage.** Historical work on European freshwater fisheries reinforced the point that artisanal fisheries were not marginal survivals. They were durable systems of livelihood, knowledge transmission, and local governance, even when later industrial and regulatory changes rendered them less visible in mainstream fisheries science (Svanberg and Locker 2020).

4.4 Conclusion

Taken together, this background justifies ethnofishecology as a synthetic frame for the present work. The aim is not to rename or overwrite maritime anthropology, ethnobiology, or fisheries sociology. It is to make their overlap visible in the context of fisheries science and management. Drawing those strands together prepares the ground for later discussion of co-management, adaptive governance, and mixed-methods ecological inference.

5 Integration with Human Ecology and Ethnoecology (1990s–2000s)

5.1 Introduction

During the 1990s and 2000s, ethnofishecology began integrating more explicitly with human ecology and ethnoecology, recognizing that fisheries are dynamic socio-ecological systems. Researchers increasingly asked how local practice, ecological feedback, and governance co-produced outcomes. The result was a move from description alone toward frameworks that could explain adaptation, learning, and institutional change.

> **i** What integration means here
>
> Integration does not mean that local ecological knowledge was reduced to a proxy for survey data. It means that scientific and local knowledge were paired, triangulated, and treated as complementary sources of evidence with their own uncertainties.

5.2 A short timeline of the field's intellectual strands

5.3 Methods and Evidence

The integration phase was defined by mixed methods. Ethnographic observation, interviews, participatory mapping, and oral-history approaches were paired with catch records, habitat information, and other ecological data. This made local ecological knowledge legible to interdisciplinary research without reducing it to a simple proxy for survey data. Reviews from the period emphasize validation, triangulation, and co-production rather than a binary choice between scientific and local knowledge (Begossi et al. 2015; Berkström et al. 2019).

5.4 Key Themes

- **Human ecological models and cultural adaptation.** Human ecological models described how communities adapt to changes in stocks, markets, and governance. In

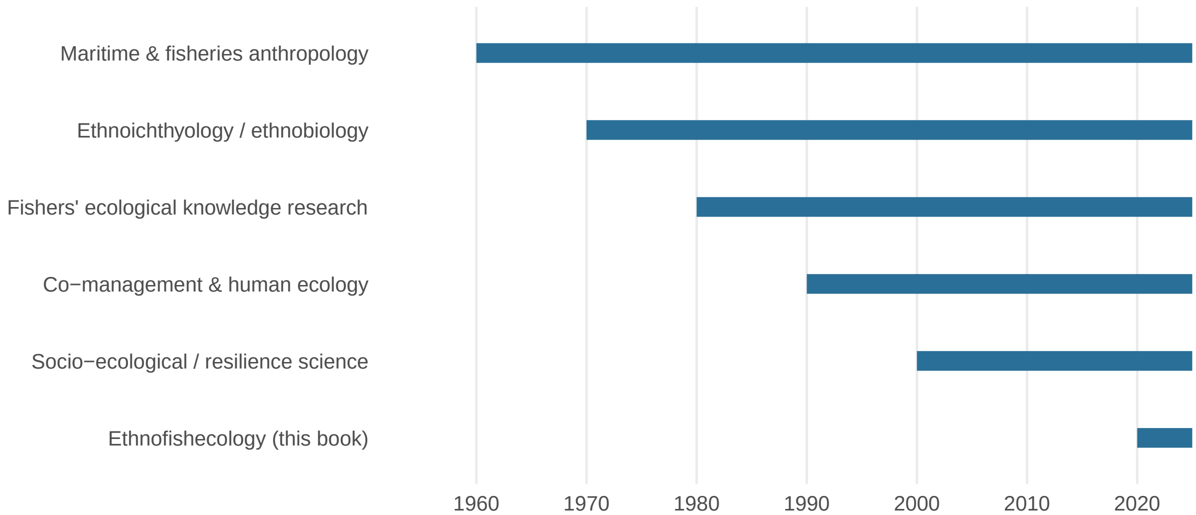

Figure 5.1: Convergence of adjacent literatures into ethnofishecology as a coupling frame. Bars indicate the decades when each strand matured; overlaps show where the strands began to inform each other.

the fisheries literature, the Cultural Adaptation Template organized feedback among ecological information, collaborative process, and food security rather than treating fishery behaviour as a static response to prices or biomass alone (Begossi et al. 2015).

- **Local ecological knowledge and co-management.** Researchers documented how fishers and Indigenous communities hold detailed knowledge about habitat connectivity, seasonal migration, and fishing grounds. That knowledge proved particularly useful in data-poor settings and in participatory management processes where legitimacy depended on more than biological accuracy (Armengol et al. 2018; Berkström et al. 2019). The edited volume *Fishers' Knowledge in Fisheries Science and Management* consolidated much of this case-study evidence and set expectations for what fishers' knowledge could contribute to formal assessment (Haggan et al. 2007).
- **Incentives and stewardship.** The period broadened the discussion to stewardship incentives, including payments for environmental services and other mechanisms that reward conservation behaviour. These ideas were not framed as universal solutions but as ways to align ecological goals, fisher incentives, and local institutional capacity in small-scale fisheries (Begossi et al. 2015).
- **Historical and global perspectives.** Comparative work across regions showed that artisanal knowledge systems remained analytically important even under rapid modernization. The point was not nostalgia. Contemporary management still depends on understanding historically sedimented fishing practices and institutions.

5.5 Conclusion

The integration phase expanded ethnofishecology beyond description to incorporate models, participatory processes, and incentive design. By linking human ecology with fisheries research, scholars developed tools for asking how communities respond to ecological change and how collaborative management systems can use local knowledge without romanticizing it.

6 Pre-industrial Fisheries and Historical Fishing Methods

6.1 Introduction

Before industrial engines, synthetic gear, and standardized management categories, fisheries were already technologically rich. Pre-industrial fishing methods were not "simple" in any useful sense. They were tuned to current, tide, season, fish behaviour, and locally available materials. In many places, the fishing device itself was a condensed ecological model: it worked only if its maker understood where fish moved, how they oriented to flow, what materials resisted teeth or abrasion, and when a site could be fished safely.

This chapter creates space for that record. The point is not antiquarian curiosity. It is to show that historical fishing technologies can be read as evidence of accumulated knowledge, selective harvesting, and environmental design. Seen this way, pre-industrial fisheries belong to the research background for ethnofishecology because they preserve relationships among craft, ecology, and social organization that later industrial gear often obscured.

> **Gear as ecological model**
>
> A working pre-industrial fishing device encodes assumptions about flow, substrate, season, and fish behaviour. Read the device and you recover the ecological model; read the ecological model and you recover the device.

6.2 Methods and Evidence

Evidence for pre-industrial fisheries comes from several partial archives: museum collections, oral histories, community organizations, ethnographic writing, and the surviving use of older methods in living fisheries. None of these sources is complete on its own. Museum objects preserve materials and form but often lose context; oral traditions preserve process and meaning but may not be widely documented; archaeological remains can show structures such as weirs or sinkers without capturing the full practice around them.

The chapter therefore treats fishing technologies as socio-ecological systems rather than isolated artifacts. The emphasis is on what these methods reveal about selectivity, habitat knowledge, labour, and continuity.

For the Pacific Islands in particular, Robert D. Gillett's work provides one of the strongest bridges between historical and contemporary fisheries analysis. His FAO syntheses treat coastal fishing as a central part of Pacific Island food systems, culture, and employment, and document the major types of coastal fishing and their relationship to offshore tuna development (Gillett 2010, 2011). His short history of industrial fishing in the Pacific Islands is especially useful because it shows how older inshore and reef-based methods were not simply replaced by industrial systems but persisted alongside and were transformed by later commercial and tuna-centered fisheries development (Gillett 2007). His earlier case studies of traditional tuna fishing in Tokelau and at Satawal document tuna-specific techniques, gear, and ecological knowledge at island scale (Gillett 1985, 1987).

6.3 Why Historical Methods Matter

Historical fishing methods matter for three reasons. They show that fisheries knowledge was often encoded in material design, not only in spoken tradition. They document forms of selectivity and effort control that do not map cleanly onto modern categories of "gear type." They preserve regional distinctiveness that disappears when fisheries history is summarized only as a transition from subsistence to commercialization.

6.4 Distinctive Technologies

- **Leaf kites, aerial lines, and spider-web lures.** Pacific kite-fishing traditions show how little material was needed to build a functional fishing system. Museum collections from the Solomon Islands preserve fishing kites made from leaf material and spider web, indicating a method in which lift, line placement, and lure design were all integral to catching surface-feeding fish such as needlefish (British Museum n.d.a). Related Kiribati records show that fishing kites were also part of Gilbert Islands material culture, not an isolated curiosity (DigitalNZ and Auckland War Memorial Museum Tāmaki Paenga Hira n.d.). Read broadly, these traditions include extremely light leaf-based kite forms, including single-leaf kite practices using large leaves such as breadfruit elsewhere in Oceania, alongside more built-up fishing kites. Capture could therefore depend on aerodynamic control and delicate lure materials rather than metal or bone hooks.
- **Kiribati eel traps and reef-trap engineering.** I-Kiribati eel trapping shows how trap design can encode species knowledge, household organization, and ritual practice at the same time. Recent documentation records that eel traps were built by experienced fishers from ngea wood, sized in relation to the target eel, and fitted with an internal

throat that guided the eel into an interior chamber while making exit difficult (Singh et al. 2025). British Museum records describe the full-sized *rabono ni u* as a moray-eel trap made from hard coastal wood and coconut fibre (British Museum n.d.b). The same Kiribati research describes permanent fish traps built from coral or stone, with openings oriented by observing the drift of a coconut shell and timed to the movement of the tide (Singh et al. 2025). These are not generic basket traps; they are hydraulic devices based on close reading of lagoon flow and animal movement.

- **Haenyeo breath-hold diving and collective stewardship.** Jeju's haenyeo show that fishing technology can reside in trained bodies, social institutions, and marine knowledge as much as in external gear. The UNESCO inscription of the Culture of Jeju Haenyeo describes women divers, including many elders, harvesting abalone, sea urchins, and other shellfish by breath-hold diving without oxygen tanks, while knowledge is transmitted through families, schools, cooperatives, associations, and the Haenyeo Museum (UNESCO 2016). For ethnofishecology, the case matters because it joins fine-grained knowledge of sea conditions and marine life with gendered labour, ritual practice, apprenticeship, and community involvement in managing harvest. Fishing methods are not only tools and traps; they are also embodied skills and institutions that organize access, safety, and sustainability.
- **Dipnets, platforms, and river hydraulics.** Columbia River salmon fisheries illustrate another kind of engineering intelligence. Oregon Historical Society material on Celilo Falls records that dipnets were the most common traditional nets there prior to dam construction and distinguishes between movable dipnets swept through current and set dipnets positioned where fish fell back or rested in eddies (Oregon Historical Society n.d.). Columbia River Inter-Tribal Fish Commission documentation adds that platform fishing depended on wooden scaffolds built at favorable sites and passed within families, with nets, hoops, bindings, poles, and pitch all selected for particular hydraulic conditions (Columbia River Inter-Tribal Fish Commission n.d.). In smaller rivers, dipnetting remained viable precisely because it gave fishers fine control in swift, rocky currents. The gear cannot be separated from the river architecture around it.
- **Spears, weirs, and selective capture.** Historical salmon fisheries across the Northwest Coast and Columbia Basin also relied on spears and weirs — technologies that directed fish movement rather than simply intercepting a random catch (Smithsonian Ocean n.d.). Their importance for ethnofishecology lies in selectivity and site knowledge: such methods require intimate familiarity with runs, migration timing, channel geometry, and fish behaviour under changing water conditions.
- **Harpoons as living knowledge systems.** Harpoons are often misread as merely archaic weapons. Indigenous sturgeon fisheries show a different picture. The Beaty Biodiversity Museum's collaboration with the Musqueam First Nation presents the sturgeon harpoon not just as an artifact but as a living knowledge web linking language, territory, technology, and responsibility (UBC Beaty Biodiversity Museum n.d.). In that framing, the harpoon is a tool of precision and relationship. Its use depends on judgement about fish position, depth, and movement, and on the ethical responsibilities attached to harvest. That is a different epistemic model from industrial extraction, and it deserves

analytical attention on its own terms.

6.5 Interpretation

Across these examples, several patterns recur. First, pre-industrial fisheries were often highly selective, even when they did not resemble modern regulatory notions of selectivity. Second, the skill required to use the gear was inseparable from place: a dipnet without the right current, a kite without the right wind, or a trap without the right tidal opening is not really the same technology. Third, many of these methods joined material efficiency with ecological sophistication. Spider web, leaf fibre, saplings, stone, coral, wood, and sinew were not signs of technological absence; they were local solutions fitted to local fisheries.

These methods also reveal how fishing technologies were embedded in social organization. Household ownership of traps, family control of platform sites, intergenerational teaching, women's diving associations, and rituals around harvest all point to fisheries as institutional systems as much as technical ones.

6.6 Conclusion

Pre-industrial fisheries deserve a full chapter because they supply texture that broad histories often flatten. They show that fishing methods were historically diverse, materially inventive, and ecologically informed long before industrialization. For ethnofishecology, they matter not as relics but as evidence: they document how knowledge of wind, current, behaviour, habitat, and social rules became durable in gear, craft, and fishing place.

7 Modern Ecosystem-based and Human-integrated Fisheries Management (2010s–present)

7.1 Introduction

From the 2010s onward, ethnofishecology has increasingly intersected with ecosystem-based fisheries management (EBFM) and explicitly human-integrated approaches. Agencies such as NOAA now frame humans as part of the ecosystem and call for interdisciplinary science that can evaluate conservation, economic profitability, food production, jobs, and human well-being together rather than sequentially (NOAA Fisheries 2021). This period emphasizes trade-offs, scenario analysis, and the integration of social, economic, and ecological data into decision-making.

> **Why this chapter covers four cases**
>
> HI-EBFM, Alaska pollock and trawling impacts, regional bycatch utilization, and catch-share allocation are treated together because they illustrate the same underlying point: modern management is an exercise in coupled social–ecological design, not a sequence of isolated technical choices.

7.2 Methods and Evidence

The modern management literature is methodologically diverse. It combines policy analysis, governance mapping, social and economic indicators, stock assessment outputs, and participatory scenario evaluation. Institutional strategies such as NOAA's HI-EBFM plan matter here because they formalize the expectation that economics, human dimensions, and ecology should be coupled in routine fisheries science rather than treated as post hoc add-ons (NOAA Fisheries 2021).

7.3 Key Themes

- **Human-integrated ecosystem-based fishery management (HI-EBFM).** NOAA's research strategy argues that marine resource management must study humans and the environment as a coupled system. The strategy foregrounds trade-offs among conservation, seafood production, profitability, and community well-being, and calls for deeper integration of economics and human dimensions into climate, ecosystem, and stock-assessment work (NOAA Fisheries 2021).
- **Socio-ecological resilience and adaptive management.** Contemporary management focuses on resilience: the capacity of systems and communities to absorb shocks, reorganize, and adapt. Ethnofishecology contributes by showing how communities perceive change, which indicators they treat as meaningful, and what institutional responses are likely to be workable.
- **Interdisciplinary data integration.** Modern approaches combine biological data with social surveys, economic metrics, community profiles, and cultural indicators. The analytic goal is not fuller description; it is better prediction of how policies affect fish populations, fleet behaviour, distributional outcomes, and the persistence of fishing communities.
- **Trade-off analysis and scenario planning.** Management strategy evaluation and related scenario tools have become central because they make competing objectives explicit. NOAA-linked work on Atlantic herring shows how stakeholder participation improves the realism and eventual uptake of MSE exercises while complicating the design of the process (Feeney et al. 2019).

7.4 From High-impact Industrial Fishing to More Selective Fisheries

Modern fisheries management has also had to confront the legacy of highly destructive industrial fishing methods. Some of the sharpest concerns have centered on tropical shrimp trawls with very high discard ratios, mixed demersal trawls with substantial non-target mortality, and bottom-contact gears that damage benthic habitats when poorly managed. Reviews of trawling impacts continue to identify bycatch, habitat effects, and fuel use as major sources of concern, especially where fishing pressure is intense and mitigation is weak (Hilborn et al. 2023).

The modern period is not only a story of damage. It is also a story of technical and institutional efforts to make fisheries more selective and, in some cases, less carbon intensive. Across regions, those efforts include excluder devices, sorting grids, changes in mesh and codend design, move-on rules, time–area closures, bycatch caps, catch shares, electronic monitoring, and cooperative fleet communication. Selectivity is now produced through a combination of gear engineering, data systems, and governance rather than through gear design alone.

Alaska pollock is a useful example of this shift. NOAA describes the fishery as a semi-pelagic midwater trawl fishery with minimal habitat impact relative to bottom-contact gears and reports incidental catch of other species at less than 1 percent of the total catch (NOAA Fisheries 2025a). That does not make the fishery impact-free: salmon bycatch remains a major management and community concern, and NOAA continues to study the oceanographic and operational conditions associated with salmon encounters in the eastern Bering Sea pollock fishery (NOAA Fisheries 2025b). It does illustrate the broader point that large industrial fisheries are not environmentally equivalent. Some have moved toward much tighter monitoring, stronger bycatch avoidance, and lower habitat impact than the high-discard industrial fisheries that shaped earlier critiques.

Fuel use is part of that transition. The ICES review by Hilborn and colleagues notes that carbon emissions from capture fisheries are dominated by fuel use and vary strongly by gear type, with bottom trawls generally more fuel intensive than many pelagic gears. That makes fisheries such as Alaska pollock important not only because they are selective at scale but because they offer an example of a very large fishery that sits closer to the lower-carbon end of the wild-capture spectrum than heavily fuel-intensive bottom-contact fisheries (Hilborn et al. 2023; NOAA Fisheries 2025a).

7.5 Bycatch Utilization and Regional Discard Patterns

Bycatch is not handled the same way everywhere, and the contrast is not only technical; it is also cultural and economic. A useful broad pattern, though not an absolute rule, is that fisheries in much of Asia have historically retained and utilized a larger share of low-value catch, while fisheries in Europe and North America have more often generated regulated or market-driven discards at sea. FAO reviews of the Asia-Pacific region note that expanding markets for low-value fish, fishmeal, aquaculture feed, and processed products have made discards negligible in many fisheries in China and Southeast Asia, even when catches include species that would be treated elsewhere as bycatch or "trash fish" (Food and Agriculture Organization 2005).

Western discard regimes have often been driven by quota rules, minimum-size rules, protected-species rules, and market grading. The European Commission's discard policy makes this explicit: fish are discarded because fishers lack quota, fish are undersized, species are prohibited, or the market value is too low. The landing obligation was introduced because discarding had become recognized as a substantial waste of resources and a distortion of both ecological and economic accounting (European Commission 2025).

For ethnofishecology, this regional difference matters because "bycatch" is not only a biological category. It is also a social classification shaped by markets, cuisine, labour, regulation, and processing capacity. The same fish may be landed, dried, minced, reduced to meal, or discarded depending on where it is caught and how value is assigned. Bycatch utilization is an especially clear case where human systems shape ecological outcomes and the meaning of waste itself.

7.6 Catch Shares, Allocation, and Uneven Community Outcomes

Current management systems also rely heavily on allocation rules, and catch shares are one of the clearest examples. NOAA defines catch shares as management systems that allocate a portion of the allowable catch to individuals, cooperatives, communities, or other entities. In principle, these systems end the race to fish, improve accountability, and give harvesters more flexibility in timing and business decisions (NOAA Fisheries 2025c). FAO's rights-based management literature makes the same general argument at a global scale: secure and durable harvesting rights align incentives, reduce overcapacity, and improve matching between fishing opportunity and fleet behaviour (Squires et al. 2013).

The allocation question has never been purely technical. The National Research Council's *Sharing the Fish* framed quota-based management as a set of trade-offs among biological performance, economic efficiency, and social distribution rather than a neutral optimization exercise (National Research Council 1999). Who receives the initial allocation, whether quota can be transferred or consolidated, and whether communities or crew have any protected access all shape who benefits from the system and who absorbs its costs.

Over time that point has only become clearer. Olson's review of fisheries privatization shows that quota systems generate different outcomes across vessel owners, crew, households, and communities, often producing recognizable winners and losers rather than a uniform improvement in well-being (Olson 2011). Carothers' work in Kodiak makes the Alaska dimension concrete: fisheries privatization was widely discussed there as a major social rupture, and respondents often described its community effects in terms of fairness, opportunity, and the erosion or preservation of local social values (Carothers 2015). NOAA-led research similarly finds that quota-share transfer and consolidation can redistribute access rights across places, affecting employment, tax base, support businesses, and long-term community vulnerability (Szymkowiak et al. 2019).

Catch shares also change behaviour within fleets. A large NOAA-led study found that catch shares generally reduced diversification for vessels that remained in the catch-share fishery and for vessels that exited but continued fishing elsewhere (Holland et al. 2017). That pattern implies a shift toward greater specialization. Specialization can improve efficiency and stabilize operations for some firms, but it also makes vessels and communities more exposed when the productivity, distribution, or quota availability of a single stock declines. Stock-specific declines therefore do not just reduce catch; they hit specialized portfolios harder than diversified ones.

For ethnofishecology, catch shares are important not simply as a policy instrument but as a social sorting mechanism. They reorganize time, access, risk, and attachment to place. Whether a catch-share program produces resilience or displacement depends not only on stock status and enforcement, but on allocation design, transfer rules, local capital structure, and the degree to which communities retain access as fisheries become more specialized.

❗ Counter-evidence to keep in view

The diversification finding in Holland et al. (2017) is not universal. In some fisheries, catch shares have been associated with expanded portfolio fishing where vessels use share flexibility to enter additional fisheries. The direction depends heavily on allocation design and local fleet structure, which is exactly the point this chapter is making.

7.7 Conclusion

Modern ecosystem-based and human-integrated management approaches represent a shift toward more explicit socio-ecological governance. Ethnofishecology matters in this setting because it keeps culture, behaviour, community knowledge, and technological practice visible when models and policy processes are built. The modern period is not only about better indicators and bigger models. It is also about how fisheries reduce waste, reshape gear selectivity, lower fuel-intensive impacts where possible, allocate access through tools such as catch shares, and redefine what counts as usable catch. Its contribution is strongest when it sharpens those trade-offs rather than adding social context around the edges.

8 The Evolution and Importance of Non-commercial Fishing

8.1 Introduction

Non-commercial fishing — subsistence, sustenance, sport, and recreational — deserves its own chapter because these systems are large, persistent, and consequential. In many industrialized societies, non-commercial fishing is a dominant or sole user of inland fish stocks and an increasingly important user of coastal stocks. It is also a domain where fishing is valued not only for food but for leisure, identity, skill, competition, tourism, conservation funding, and connection to nature (Arlinghaus 2006; Arlinghaus et al. 2019).

For ethnofishecology, non-commercial fisheries make the cultural dimensions of fishing especially visible. Decisions about what constitutes a good catch, whether fish should be harvested or released, how access should be allocated, and what kinds of experiences matter are all socially shaped. Non-commercial fisheries therefore reveal that fisheries management is not simply about biomass extraction but also about the governance of values, practices, and expectations.

> **i** Why "non-commercial" and not "recreational"
>
> "Recreational fishing" covers only part of this chapter. Subsistence, sustenance, and customary fisheries share gear, grounds, and seasons with sport fishing, but they differ in purpose and in the meanings attached to harvest. "Non-commercial" is the broader term and is used throughout.

8.2 Methods and Evidence

The literature on non-commercial fisheries draws from ecology, economics, psychology, sociology, and management science. It includes angler surveys, creel surveys, harvest and effort monitoring, economic impact assessments, and studies of behaviour, ethics, and policy. That mix is necessary because recreational fishing is a coupled social–ecological system: fish populations, regulations, travel behaviour, technology, and cultural meaning all interact.

In U.S. marine systems, NOAA's Marine Recreational Information Program and associated economic reporting provide the clearest official infrastructure for measuring participation, catch, and spending (NOAA Fisheries 2024). Globally, review literature by Arlinghaus, Cooke, Cowx, and collaborators has defined recreational fisheries as a serious field of management and conservation rather than a minor leisure issue (Arlinghaus et al. 2019; Lynch et al. 2024).

8.3 Historical Evolution

Modern sport fishing developed out of subsistence traditions. It expanded dramatically with industrialization, urbanization, mass-produced tackle, motorized mobility, and growing leisure time. Over time, recreational fishing became less tied to simple food acquisition and more tied to specialized techniques, tournament culture, charter operations, destination travel, and species-specific identities.

One of the clearest signs of that evolution is the rise of catch-and-release. Arlinghaus and colleagues describe catch-and-release not just as a technical practice but as a historically layered ethical and managerial shift in which fish can be pursued for challenge, experience, and stewardship without necessarily being retained (Arlinghaus et al. 2007). That shift has been reinforced by harvest regulations, conservation campaigns, and trophy-oriented angling cultures, even though harvest for food remains a major motive for many recreational fishers.

The result is a fishery sector that is simultaneously traditional and modern. Shore angling, family salmon trips, pier fisheries, and local club culture persist, but they now coexist with highly networked tournaments, guided charter fleets, social-media reporting, advanced electronics, and increasingly mobile anglers who can concentrate pressure quickly when information spreads.

8.4 Why Recreational Fishing Matters

Recreational fishing matters because of scale. Arlinghaus and colleagues argue that roughly one in ten people in developed nations fishes for pleasure and that there are at least 220 million recreational fishers worldwide, more than five times the number of commercial capture fishers (Arlinghaus et al. 2019). In many local fisheries, recreational removals rival or exceed commercial catches even when the global biomass harvested remains lower than commercial extraction.

It also matters economically. NOAA's annual *Fisheries Economics of the United States* report documents billions of dollars in sales impacts, value-added impacts, and hundreds of thousands of jobs supported by U.S. saltwater recreational fishing, with major contributions from charter operations, bait and tackle, boats, and travel spending (NOAA Fisheries 2024). These figures explain why recreational fisheries are politically consequential even when they are not the dominant source of seafood.

Recreational fishing also matters culturally. NOAA's recreational fishing policy framework treats it as both a conservation contributor and an important economic driver, while acknowledging that it introduces stewardship challenges and allocation conflicts (NOAA Fisheries 2025d). In practice, recreational fisheries often connect children and new participants to aquatic environments, create durable local traditions, and generate constituencies for habitat protection, stocking, and access maintenance.

Ethnofishecology should not let the category of recreational fishing stand in for the whole non-commercial sector. Non-commercial fishing also includes subsistence, sustenance, and traditional fisheries in which fishing is oriented toward household food, sharing networks, cultural continuity, and customary obligations rather than leisure alone. These forms overlap with sport and recreational fishing in gear, location, and season, but they differ in social purpose and in the meanings attached to harvest, access, and responsibility.

Using the broader term non-commercial fishing therefore matters analytically and politically. It makes room for sport and recreational fisheries while recognizing fishers whose practices are not well described by the language of recreation, especially in Indigenous, island, and rural communities. It also highlights a recurring problem in management: agencies often have better data and more developed policy frameworks for recreational fishing than for subsistence and sustenance uses, even when those uses are central to food security and cultural life.

8.5 Management, Conflict, and Allocation

Recreational fisheries are difficult to manage because the objectives differ from those of commercial fisheries. Managers are not only trying to sustain fish stocks; they are also trying to sustain opportunity, satisfaction, fairness, and access across heterogeneous groups of fishers. Arlinghaus and colleagues argue that maximum-sustainable-yield logic cannot simply be transferred into recreational contexts because anglers value diverse outcomes such as harvest, trophy size, solitude, challenge, and time on the water (Arlinghaus et al. 2019).

This creates recurring conflicts. In mixed fisheries, commercial and recreational sectors compete over allocation. Within the recreational sector, shore anglers, charter clients, private boaters, tournament fishers, and subsistence-oriented recreationists may all have different priorities. Seasonal closures, bag limits, size limits, and access restrictions often benefit some users more than others. NOAA's recreational fishing framework reflects this complexity by emphasizing both partnership and data collection, including the Saltwater Recreational Fisheries Policy and the continuing role of MRIP in catch and effort estimation (NOAA Fisheries 2025d).

Recreational fisheries also create genuine conservation problems. Arlinghaus argued that recreational fisheries had been underestimated as a conservation issue despite the cumulative mortality generated by millions of participants (Arlinghaus 2006). Later syntheses extended this point, showing that even when fish are released, recreational fisheries alter fish behaviour, create selection pressures, contribute to local depletion, and generate conflict over crowded sites and scarce opportunities (Arlinghaus et al. 2007, 2019).

8.6 Ethnofishecological Relevance

Sport and recreational fishing belong in ethnofishecology because they make visible the contemporary cultural life of fishing. They show how fish become tied to status, memory, region, gear preference, moral debate, and ideas of fair access. Recreational fisheries are also one of the clearest places where modern technologies and older fishing identities mix: a person may use advanced sonar and social media while still participating in a deeply local fishing culture tied to a pier, river, reef, or seasonal run.

They also complicate any simple distinction between "traditional" and "modern" fisheries. Recreational practices preserve local knowledge and family continuity, but they can also intensify pressure, exclude certain users, and transform fish into leisure objects rather than food. That ambiguity is exactly why they matter analytically.

8.7 Conclusion

Non-commercial fishing is central to any contemporary account of fisheries culture. Recreational fishing has become a major economic sector, a large-scale user of fish stocks, and a powerful arena for debates over ethics, allocation, and conservation. Subsistence and sustenance fishing anchor food security, cultural continuity, and local governance in ways that are often invisible to commercial statistics. For ethnofishecology, the non-commercial sector offers a direct way to study how modern fisheries are shaped by values and practices that extend well beyond commercial production.

9 Research Ethics and Data Sovereignty

9.1 Introduction

A book that argues for integrating cultural evidence into fisheries science must also set out the ethics that make such integration legitimate. Without them, "integration" easily slides into extraction: communities contribute knowledge, researchers publish and move on, and the benefits flow away from the people whose observations made the work possible. This chapter sets the ethical and governance expectations that the methods in Chapter 8 are meant to follow.

> **!** A single test
>
> If a community cannot see the results of the research, correct its interpretations, and benefit from its use, the research is not ethnofishecology in the sense this book defends.

9.2 Core Principles

Two sets of principles — CARE and FAIR — together frame the practice this book endorses.

The **CARE Principles for Indigenous Data Governance** (Carroll et al. 2020) foreground **C**ollective benefit, **A**uthority to control, **R**esponsibility, and **E**thics. CARE is the counterweight to a technical-first view of open data: it insists that data about or derived from Indigenous communities carries obligations that do not disappear once a dataset is anonymized.

The **FAIR Principles** (Wilkinson et al. 2016) foreground **F**indable, **A**ccessible, **I**nteroperable, and **R**eusable data. FAIR is important for scientific practice but is insufficient on its own; a dataset can be FAIR and still violate CARE. Ethnofishecology needs both.

The combination is not contradictory. FAIR describes how data should behave once it is shared; CARE determines whether, how, and on whose terms it should be shared in the first place.

9.3 Consent, Attribution, and Benefit-Sharing

Three practical expectations follow from CARE and FAIR together.

Consent is ongoing, not one-shot. A community's agreement to participate at the outset does not authorize every downstream use. Consent should be renewed when new analyses, new publications, or new data products are proposed. This is especially important in fisheries work because data often moves from one stock assessment cycle to the next without fresh review.

Attribution is specific, not generic. "Local knowledge" as a bulk credit is insufficient. Where a prior, parameter, or scenario in an assessment reflects a specific community's contribution, that attribution belongs in the methods section and, where appropriate, in authorship.

Benefit-sharing is tangible. Benefits take many forms — training, co-authorship, funding, data access, analytical products, employment, or material compensation — and the appropriate mix is negotiated, not assumed. A strong default is that the community receives, at minimum, the deliverables produced from its contribution in a usable format before external publication.

9.4 Institutional Considerations

Most fisheries agencies, universities, and NGOs have institutional review structures, and those structures matter. IRB or ethics committee review should be sought early, and the review should address community-level risk as well as individual-level risk. For federal U.S. work, tribal consultation requirements under relevant trust responsibilities and government-to-government protocols apply regardless of whether the project is classified as "research." For international work, national regulations, regional agreements, and community-level protocols typically all need to be respected, and the strictest applies.

Beyond regulation, three institutional practices help in practice. First, a written data-sharing agreement between the research team and the community specifies ownership, use, return, and modification rights. Second, a co-authored data management plan describes how data will be stored, who holds the keys, and under what conditions access can change. Third, a named point of contact on both sides carries the agreement forward across staff turnover, which is often where these arrangements collapse.

9.5 Avoiding Knowledge Extraction

Five patterns recur in extractive research, and each has a counter-practice that is cheap to adopt.

Pattern 1: interview and leave. A team arrives, records interviews, and departs. **Counter-practice:** build return visits, interim reports, and co-presentation into the project plan from the start, not as goodwill at the end.

Pattern 2: paraphrase into invisibility. Community contributions are summarized and paraphrased until the source is no longer recoverable. **Counter-practice:** quote where consent permits; cite where it does not; maintain a provenance record for every community-sourced input.

Pattern 3: parameter without person. A prior or parameter is reported without any trace of whose observation informed it. **Counter-practice:** maintain an elicitation record (see Chapter 8) that makes the source auditable even when individual identity is withheld.

Pattern 4: consent creep. Consent given for one study is treated as consent for all downstream uses. **Counter-practice:** treat each new use — reanalysis, teaching, follow-up publication — as a fresh request unless a written agreement anticipates it.

Pattern 5: disappearing benefits. Benefits promised in the proposal do not materialize because they were never operationalized. **Counter-practice:** put benefits on the project timeline and budget, with named deliverables and dates.

9.6 A Minimum Standard for Ethnofishecological Projects

The following minimum standard is proposed for ethnofishecological work in this book. Projects that cannot meet it should not claim to be ethnofishecology in the sense defended here.

- Written consent covering the specific use of the data, renewable as the scope changes.
- Named community partners with defined roles and decision rights.
- A data-sharing agreement specifying custody, access, and modification.
- Attribution at the level of the input (prior, parameter, scenario), not only at the project level.
- Scheduled return of deliverables — reports, datasets, analytical products — to the community in usable form.
- Budget lines for benefit-sharing, translation, and return visits.
- A documented path for community review of results before external publication, with enough time for substantive comment.
- Compliance with CARE principles for any Indigenous-sourced material.
- An archival plan that respects the community's preferences about whether, where, and how the data is retained.

9.7 Working Across Jurisdictions

Fisheries work often crosses jurisdictions, and ethics must follow. A project that collects data in one country and analyzes it in another, or that combines tribal, state, and federal data, inherits obligations from each. The practical rule is that the strictest applicable standard governs, and that when doubt exists, the community's stated preference is the tiebreaker. This is not always convenient. It is, however, what distinguishes ethnofishecology as a disciplined practice from opportunistic data reuse.

9.8 Conclusion

Ethics is not a wrapper around ethnofishecology; it is part of the method. The steps in this chapter — CARE plus FAIR, ongoing consent, specific attribution, tangible benefit-sharing, institutional agreements, and a minimum standard — are what allow the quantitative integration in Chapter 8 to be legitimate rather than extractive. A fisheries science that claims to take local and traditional knowledge seriously has to take its ethics seriously too, all the way to the model output and back.

10 Methods for Integrating Cultural and Quantitative Evidence

10.1 Introduction

Earlier chapters argue that cultural knowledge, historical practice, and community observation should count as interpretable ecological evidence. This chapter shows how to make that argument operational. It lays out concrete integration points between ethnographic evidence and the quantitative tools that drive modern fisheries science — stock assessment, management strategy evaluation (MSE), and the supporting inference machinery in ADMB, TMB, and RTMB (Fournier et al. 2012; Kristensen et al. 2016). The objective is not to replace ethnographic rigor with quantitative rigor; it is to give ethnofishecology a repeatable workflow so that local and traditional knowledge can inform decisions without being flattened into false precision.

> **!** Scope of this chapter
>
> This chapter assumes the ethical foundation laid out in Chapter 7. Any quantitative integration is legitimate only when the underlying consent, attribution, and benefit-sharing arrangements are in place. The mechanics described here are necessary but not sufficient.

10.2 Where Cultural Evidence Can Enter an Assessment

Stock assessments and MSEs are assembled from many modular pieces. Each of those pieces is a place where cultural evidence can contribute, provided the contribution is stated explicitly and carries its own uncertainty. Table 10.1 summarizes the main integration points.

Table 10.1: Entry points for cultural evidence in a fisheries assessment or MSE.

Assessment component	Typical input	What cultural evidence can add	Recommended treatment
Stock structure	Genetics, tagging, oceanography	Named grounds, seasonality, run timing, spawning sites	Hypothesis framing, boundary priors
Selectivity	Gear experiments, length comps	Gear history, targeting behaviour, mesh practice	Shape priors on selectivity curves
Catchability and effort	CPUE series, effort data	Fleet learning, spatial targeting, crew choices	Time-varying q priors, effort covariates
Recruitment	Survey indices, environmental covariates	Observed year-class strength, unusual conditions	Qualitative anomaly priors
Natural mortality	Life history, tagging	Predation reports, disease observation	Plausibility bounds on M
Life history	Growth, maturity studies	Spawning-site knowledge, maturation timing	Priors on maturity-at-age
Discards and bycatch	Observer data	Retention customs, market drivers, discard practice	Informing discard mortality assumptions
Management objectives	Agency mandate	Community-defined values and trade-offs	Additional MSE performance metrics
Reference points	Biological benchmarks	Culturally meaningful benchmarks	Complementary performance criteria

10.3 Elicitation Workflow

Cultural evidence rarely arrives as a probability distribution, so the first methodological task is structured elicitation. The workflow below is adapted from expert-elicitation practice (O'Hagan et al. 2006) but reframed for fishers, Indigenous knowledge holders, and community members rather than only credentialed experts.

1. **Scope.** Define the quantity of interest in language the knowledge holder uses (e.g., "when the first big run arrives," not "peak spawning migration").

2. **Co-design the elicitation.** Work with community partners to decide who is asked, how, and in what setting. Group, pair, and individual formats reveal different knowledge.
3. **Anchor the scale.** Ground the question in observable phenomena — years, tides, seasons, named places, catch composition — rather than abstract units.
4. **Elicit central tendency and range.** Ask for the typical value, the best year remembered, the worst year, and the transition points. Record uncertainty qualitatively.
5. **Translate to distributional form.** Convert the response into a distribution (often triangular, beta, or log-normal) using a simple rule that is documented and reproducible.
6. **Validate.** Show the translation back to the knowledge holder and ask whether it fits their understanding. Revise as needed.
7. **Archive.** Store the elicitation record, translation rule, and version so that later analyses can cite and audit it.

This workflow takes qualitative material seriously without pretending it is a survey measurement.

10.4 Building Priors from Local Knowledge

Many entry points in Table 10.1 are best implemented as informative priors. Two patterns are common.

Shape priors on selectivity. Community knowledge of mesh sizes, hook sizes, and targeting behaviour is often richer than a short gear study. When a fishery has moved from one dominant gear to another, a selectivity-at-age curve with a cultural prior on its position parameter can prevent the estimator from drifting into implausible shapes during sparse years.

Plausibility bounds on mortality. Knowledge of predator abundance, disease observations, or mass-mortality events can set plausibility bounds on natural mortality in years where no direct estimate exists. The bounds are not a point estimate; they are a prior with enough mass outside the implausible range to pull the posterior away from unrealistic values.

The simplest implementation is Bayesian. ADMB supports penalized likelihood with user-coded priors; TMB and RTMB support explicit priors through the negative log-density; and R packages such as `tmbstan` make posterior sampling straightforward once a TMB template is written. The practical discipline is to record each prior with its source, its elicitation date, and its form so that sensitivity analyses can vary it transparently.

10.5 A Small Worked Example

The example below is illustrative rather than a production assessment. It fits a simple age-structured model with a logistic selectivity curve and uses a community-informed prior on the age at 50% selectivity (a50). The prior is justified by interviews that reported consistent use of a mesh size known to escape sub-adults of a given length.

```
library(RTMB)

# --- Synthetic inputs ---
ages   <- 1:12
years  <- seq_len(30)
obs_C  <- structure(rep(100, length(ages) * length(years)),
                    dim = c(length(ages), length(years)))

# Community-informed prior on a50 (age at 50% selectivity)
# Interview-based central value of 4 with modest spread; see elicitation record v1.
a50_prior_mean <- 4.0
a50_prior_sd   <- 0.7

# --- RTMB model ---
make_nll <- function(pars) {
  getAll(pars)
  sel <- 1 / (1 + exp(-(ages - a50) / max(sel_slope, 1e-6)))
  mu_C <- outer(sel, exp(logN), "*")

  nll  <- -sum(dnorm(log(obs_C + 1), log(mu_C + 1), obs_sd, log = TRUE))

  # Community-informed prior on a50
  nll <- nll - dnorm(a50, a50_prior_mean, a50_prior_sd, log = TRUE)

  nll
}

pars <- list(
  a50       = 4.0,
  sel_slope = 1.0,
  logN      = rep(log(1e6), length(years)),
  obs_sd    = 0.3
)

obj <- MakeADFun(make_nll, pars, silent = TRUE)
opt <- nlminb(obj$par, obj$fn, obj$gr)
sdr <- sdreport(obj)
```

Two things matter here, and neither is the code itself. First, the prior is labelled and sourced so that a reviewer can trace its provenance. Second, the same template can run with and without the prior, making it easy to report how much cultural evidence is actually moving the estimate. That pair of habits — provenance plus sensitivity — is what turns an informal claim into a defensible assessment input.

10.6 Uncertainty Propagation and Sensitivity

Once cultural evidence enters the model as priors, likelihoods, or scenario inputs, its influence should be tracked through the usual uncertainty machinery. Three practices are essential.

Prior sensitivity. Run the assessment with the community-informed prior, with a diffuse alternative, and with a deliberately contradictory prior. Report how the posterior and key reference points shift. If the cultural input makes no difference, say so; if it dominates, say that as well.

Elicitation uncertainty. Treat the prior's parameters (mean, scale, shape) as themselves uncertain. A hierarchical prior or a small grid over elicitation summaries is often enough.

Narrative audit. For each informative prior or cultural input, produce a short written statement — one paragraph at most — that names the source, the elicitation date, the translation rule, and the alternative that was tested. This audit trail is what allows a reviewer to distinguish evidence-based priors from author judgement (Kruschke 2018).

10.7 Incorporating Cultural Objectives into MSE

MSE is the natural home for cultural evidence that does not fit inside a single likelihood (Punt et al. 2016). Three extensions are particularly useful.

Cultural performance metrics. Alongside standard metrics (yield, biomass, probability of overfishing), MSE can report metrics the community has defined: consistency of seasonal access, protection of named sites, retention of a given mix of species, or stability of employment in a specific port.

Community-defined scenarios. Operating models can include scenarios that reflect community-identified risks, such as a shift in run timing, a loss of access to a nearshore ground, or a change in processing capacity that forces discarding of formerly retained species.

Participatory interpretation. Results are presented back to the community in a format that makes trade-offs visible. The same MSE that reports biological performance can report cultural performance side by side, making the trade-off legible instead of implicit.

The point is not to inflate the number of objectives until nothing passes. It is to make the objectives the community already holds part of the formal decision space rather than informal pressure on managers.

10.8 Limitations and Failure Modes

Two failure modes deserve explicit attention.

The first is spurious precision. Translating a nuanced oral account into a narrow prior can give the appearance of strong evidence where there is actually careful qualitative observation. The remedy is a widely supported prior scale, explicit sensitivity runs, and a written narrative that makes the caveat visible.

The second is one-way extraction. A community contributes knowledge, the model runs, and the community never sees the result. The remedy is built into the ethics chapter: results return to the community, with time for revision, before the assessment is finalized.

10.9 Conclusion

Ethnofishecology becomes decision-relevant when its evidence enters the same tools the rest of the field already uses — assessments, MSEs, and the inference machinery that supports them. The workflow in this chapter (elicitation, priors, sensitivity, MSE objectives, participatory interpretation) is not a new statistical theory. It is a commitment to discipline: name the source, propagate the uncertainty, report the alternative, and close the loop. That is what turns cultural evidence from background context into a usable assessment input.

11 Future Directions in Ethnofishecology

11.1 Introduction

As global fisheries face accelerating climate change, shifting species distributions, social inequities, and rapid technological change, ethnofishecology needs to evolve beyond synthesis into durable research practice. The next stage of the field will be defined less by naming the problem and more by building repeatable methods for integrating cultural evidence into ecological assessment and governance.

11.2 Methods and Evidence

Future-oriented work in ethnofishecology depends on horizon scanning, participatory modelling, mixed-methods synthesis across regions, and better protocols for validation. The central challenge is methodological: communities, scientists, and managers need ways to compare knowledge systems, represent uncertainty, and use qualitative insight without flattening it into false precision (Schmidt et al. 2023). Chapter 8 sets out the methodological scaffolding; this chapter asks where that scaffolding will be pushed hardest over the next decade.

11.3 Key Themes

- **Climate change and shifting stocks.** Climate-driven shifts in distribution, productivity, and seasonality will continue to destabilize fishing practice and management assumptions. NOAA's HI-EBFM strategy treats climate adaptation, changing stock geography, and community resilience as linked research problems rather than separate domains (NOAA Fisheries 2021). Ethnofishecology contributes by documenting how communities perceive and interpret these shifts, often earlier and with different framings than survey-based monitoring.
- **Social justice and equity.** Future research needs to examine who benefits, who bears risk, and whose knowledge is legible in management systems. That includes Indigenous peoples, small-scale fishers, women, youth, and communities whose fishing is subsistence-oriented or culturally important but weakly represented in commercial statistics. Equity is not a peripheral concern; it determines which data enter models and which decisions are accepted as legitimate (Mansfield et al. 2024).

- **Participatory modelling and co-design.** Participatory modelling is likely to become one of the field's most useful tools because it lets knowledge holders shape scenarios, parameters, and interpretations. The payoff is not only better participation; it is more credible model structure and clearer discussion of assumptions (Punt et al. 2016).
- **Data integration and technological innovation.** Remote sensing, digital trace data, machine learning, and genomics will expand the range of usable fisheries data. Ethnofishecology should engage these tools selectively, using them to connect ecological, social, and cultural signals rather than assuming that more data automatically resolves interpretive conflict.
- **Urban and recreational fisheries.** Urban shore fishing, charter fisheries, and recreational harvest are increasingly important arenas for identity, food access, and local ecological knowledge. These fisheries are visible to communities but thinly represented in conventional management narratives, which makes them promising areas for future ethnofishecological work (Lynch et al. 2024).

11.4 Research Agenda for the Next Decade

- Build and validate elicitation protocols that translate fishers' ecological knowledge into priors usable in stock assessment and MSE (see Chapter 8).
- Develop community-level indicators of resilience that can sit alongside biological reference points in HI-EBFM scenarios.
- Expand the evidence base on subsistence and sustenance fisheries in regions where commercial statistics dominate policy attention.
- Establish shared standards for documenting, storing, and citing community knowledge that respect CARE and FAIR principles (see Chapter 7).
- Test whether participatory scenarios improve policy uptake relative to expert-only MSE, using pre-registered comparisons across case studies.

> What success looks like in ten years
>
> A decade from now, an ethnofishecological contribution should be recognizable by three markers: a documented elicitation record, a reported sensitivity analysis showing how much the cultural input moved the result, and a community-endorsed summary of the decision relevance. If all three are present, the field has matured.

11.5 Conclusion

The future of ethnofishecology lies in its ability to produce methods that are both interdisciplinary and disciplined. If the field can make cultural evidence comparable, transparent, and decision-relevant without stripping away context, it can contribute meaningfully to climate adaptation, equity-focused governance, and more realistic fisheries models.

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