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TEK and the Future of Sustainable Fisheries in Mexico and Latin America

Across Mexico and Latin America, small-scale fishing communities are confronting declining fish stocks, climate variability, and increasing industrial pressure. In this context, traditional ecological knowledge (TEK), offers not a nostalgic relic of the past, but a practical pathway toward sustainable fisheries. Traditional ecological knowledge is the cumulative body of knowledge, practices, and beliefs developed by Indigenous and local communities. Integrating TEK into fisheries management strengthens ecological resilience, improves governance, and supports cultural continuity. Evidence from recent research in Mexico and across Latin America demonstrates that TEK is not only scientifically valuable, but essential to the future of sustainable fisheries.

In coastal Mexico, fishers possess a detailed understanding of species behavior, seasonal cycles, tides, lunar phases, and habitat conditions. A recent study on knowledge transmission in Mexican fishing communities found that ecological understanding is passed across generations through observation, apprenticeship, and participation in daily fishing activities (Melo et al., 2024). This knowledge includes recognizing spawning periods, identifying nursery habitats, and adjusting fishing effort in response to environmental variability. Such adaptive practices often function as informal conservation mechanisms. For example, fishers may involuntarily avoid harvesting during spawning seasons or shift target species when abundance declines. These practices reflect long-term ecological observation rather than short-term economic calculation.

Research from southern Mexico further illustrates how TEK can improve formal fisheries management. In the Huave Lagoon System, local fishers collaborated with researchers to develop ecosystem models grounded in traditional knowledge (Brueckner-Irwin et al., 2019). These fishers contributed through providing detailed spatial maps of fishing zones, migration routes, and habitat changes over time. When incorporated into transdisciplinary ecosystem modeling, this knowledge improved understanding of lagoon dynamics and resource pressures. Importantly, the process fostered trust between scientists and fishers, creating a shared framework for decision-making. The study demonstrates that TEK enhances not only ecological data but also governance capacity by empowering stakeholders to participate in management meaningfully.

Beyond Mexico, a review of TEK across Latin America highlights how local communities contribute to conservation of biodiversity through resource-specific knowledge systems (Castro Siqueira et al., 2021). In riverine, estuarine, and coastal systems, fishers identify subtle environmental cues: watercolor, salinity shifts, and wind patterns. The cues help identify fish movements or ecosystem stress. These observational insights often precede measurable scientific indicators. In regions where formal monitoring is limited by funding infrastructure, TEK serves as an early warning system. By recognizing ecological change in real time, fishing communities can adjust practices before overexploitation occurs. Case studies from Argentina's Paraná River region further show how traditional fishing techniques align with ecological sustainability (Martino & Toledo, 2021). Fishers there employ gear types and seasonal restrictions tailored to species-specific life histories. Rather than maximizing catch efficiency, many traditional methods prioritize selectivity, reducing bycatch and habitat damage. Such practices contrast sharply with industrial fishing operations that often rely on non-selective gear and high extraction rates. The Argentine example underscores a broader pattern across Latin America; artisanal fisheries rooted in TEK tend to operate within ecological limits shaped by generational experience.

The benefits of TEK extend beyond ecological accuracy. Social and cultural dimensions are equally significant. Traditional knowledge systems reinforce community identity, intergenerational bonds, and stewardship ethics. When fishers see themselves as caretakers of ecosystems rather than extractors of resources, compliance with conservation measures increases. The Food and Agriculture Organization of the United Nations' (FAO) work on fishers' knowledge and ecosystem-based management emphasizes that integrating local ecological knowledge improves legitimacy and enforcement of fisheries regulations (Fischer et al., 2015). Policies developed without local participation often face resistance or noncompliance. In contrast, co-management frameworks that incorporate TEK promote shared responsibility and adaptive governance.

Climate change adds urgency to this discussion. Latin American fisheries are experiencing shifting species distributions, altered storm patterns, and warming waters. Fishers frequently report changes before they appear in scientific datasets. Studies of fishing captains in Campeche, Mexico, show that experienced fishers track environmental variability and adjust navigation routes and target species accordingly (Ehuan-Noh et al., 2020). This responsiveness demonstrates the adaptive capacity embedded within TEK systems. As climate uncertainty increases, management strategies must become more flexible. TEK provides localized, real-time observations that complement satellite data and stock assessments.

Critics sometimes argue that traditional knowledge lacks scientific rigor or is anecdotal. However, TEK is built on systematic, long-term observation, often spanning decades or centuries. Its methodologies differ from experimental science but are no less empirical. When validated through participatory research, TEK frequently aligns with biological surveys and ecological modeling. The strength of TEK lies in its fine-scale resolution and contextual depth. It captures nuances of places that large-scale assessments may overlook.

Moreover, integrating TEK addresses historical inequities in environmental governance. Many Indigenous and coastal communities in Latin America have been marginalized from decision-making processes despite their dependence on fisheries for food security and livelihoods. Recognizing TEK affirms the intellectual contributions of these communities and promotes more inclusive management. Sustainable fisheries are not solely ecological challenges; they are social and political ones.

The future of fisheries in Mexico and Latin America will depend on collaborative governance frameworks that value multiple knowledge systems. Policymakers should institutionalize mechanisms for TEK inclusion, such as participatory mapping, community monitoring programs, and co-management councils. Universities and research institutions should expand transdisciplinary approaches that treat fishers as research partners rather than data sources. Funding agencies should prioritize projects that integrate social and ecological knowledge.

Traditional ecological knowledge is not a substitute for science, it is a partner. Together, they offer a more comprehensive understanding of marine and freshwater ecosystems. In a time of ecological uncertainty and declining fisheries productivity, ignoring TEK would be both scientifically shortsighted and socially unjust. By elevating the knowledge embedded within fishing communities, Mexico and Latin America can chart a path toward fisheries management that is resilient, equitable, and sustainable.

References

Brueckner-Irwin, I., Armitage, D., & Courtenay, S. (2019). Applying a social-ecological well-being approach to enhance opportunities for marine protected area governance. *Ecology and Society*, 24(3). <https://doi.org/10.5751/es-10995-240307>

Castro Siqueira, G., Martins Guimarães, H., Toledo Pastre, B., & Horák, M. (2021). Traditional Ecological Knowledge in Latin America: A Critical Literature review. *Universidad Verdad*.

Ehuan-Noh, R. G., Mariaca, R., Sáenz-Arroyo, A., & Espinoza, A. (2020). Tactics and knowledge: The captains of fishing in the face of environmental variability of the sea. *Sociedad Ambiente*.

Fischer, J., Jorgensen, J., Josupeit, H., Kalikoski, D., & Lucas, C. M. (Eds.). (2015). Fishers' Knowledge and the Ecosystem Approach to Fisheries: Applications, experiences and lessons in Latin America. *Food and Agriculture Organization of the United Nations*, 4–5.

Martino, J. P., & Toledo, B. A. (2021). Conocimiento ecológico tradicional, técnicas de pesca y manejo de la ictiofauna de pescadores de San Javier (Santa Fe, Argentina). *Revista Facultad De Ciencias Exactas, Físicas Y Naturales*.

Melo, F. F., Torre, J., Cuevas-Gómez, G. A., Amador-Castro, I. G., Velázquez-Castillo, M. A., & Espinoza-Tenorio, A. (2024). Inheriting wisdom: transfer of traditional, scientific, and ecological knowledge in fishing communities in Mexico. *Frontiers in Sustainability*, 5.
<https://doi.org/10.3389/frsus.2024.1386259>