



Editorial: Multidisciplinary Approaches to Mitigating Fisheries Bycatch

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Editorial on the Research Topic

Multidisciplinary Approaches to Mitigating Fisheries Bycatch

INTRODUCTION

This Research Topic of Frontiers, *Multidisciplinary Approaches to Mitigating Fisheries Bycatch*, was inspired by a workshop which gathered an international and multidisciplinary group of researchers from a wide range of institutions including government, academia, and industry. Featured speakers described relevant tools from environmental economics as well as the more traditional scientific and technical approaches to bycatch. Some participants shared their experiences with novel approaches that benefitted from engagement of industry (fishing, seafood and retailers) as well as other stakeholders such as NGOs and intergovernmental organizations (FAO, RFMOs, other intergovernmental organizations - IGOs).

Bycatch continues to be a key threat to many species, particularly protected species. In the case of marine mammals and sea birds, bycatch is the primary threat and, in some cases, can lead to extinction. Classic command-and-control, top-down fishery management has resulted in few success stories for addressing bycatch. The case studies and overall policy frameworks in the papers contained in this special edition seek to demonstrate that by expanding the toolbox and working throughout the process with the entire range of stakeholders and disciplines, there are practical solutions to addressing bycatch while allowing a viable fishing industry. Where appropriate, lessons can be learned from other environmental policy, including energy, forestry, water conservation and pollution.

The fundamentals of the multidisciplinary approach featured in the workshop are presented in a biodiversity mitigation hierarchy in a key overview paper in this Research Topic, notably Squires et al. This provides a framework for the other articles in this Special Research Topic, establishing four basic approaches to bycatch mitigation:

1. Private solutions
2. Direct or 'command-and-control' regulation
3. Incentive or market-based approaches and
4. Hybrid of direct and incentive-based regulation.

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The articles feature some of the workshop case studies and provide additional, field-tested reports on the strengths and weaknesses of various innovations in multidisciplinary bycatch monitoring and mitigation.

The papers included in this Research Topic cover a broad range of:

Species: elasmobranchs, cetaceans, sea turtles, finfish and others, taking in some cases a multi-taxa approach.

Gear types: trap, trawl, gillnets, longlines, purse seine.

Fisheries and community structures: from small scale to industrial, and in some cases a multi-sized fleet.

Regions: South and North America Pacific and Atlantic, Indian Ocean, Western Pacific.

Tools: Bycatch quotas and credits, risk pools, gear modifications, gear deployment modifications, time/area closures, 'move on' measures, use of real-time information sharing. These can be voluntary or mandatory, regulatory or agreed within a fleet.

CASE STUDIES: LESSONS LEARNED

Among the most significant and novel insights offered by the case studies from the workshop and this special edition is a synthesis of "lessons learned". Specifically, successes and failures, and the situation-specific characteristics of each case study offer important insights into potential bycatch mitigation solutions, as summarized below. References to some of the articles in this Research Topic are noted in italics to provide specific examples. It should be noted however that several characteristics listed below appear in the case studies contained in most of these references.

Large-Scale, Industrial Fleet

- Individual Bycatch Quotas, transferable or non-transferable (Ballance et al.)
- Credit systems (cap-and-trade on bycatch, or penalty/reward either bycatch or effort) (Squires et al.)
- Performance standards for market access
- High-tech fishing for avoidance
- Incentives with penalties and rewards
- Rationalization to provide tools to address bycatch
- Risk pools and insurance (Holland and Martin)
- Hard cap on level of bycatch for whole fishery or vessel-level bycatch quotas (transferable or non-transferable)
- Addressing waste from regulatory discards (Watson et al.).

Small-Scale Coastal Artisanal Fishery

- Critical importance of a multidisciplinary approach, including social science
- Economic/social incentives focused on net income and livelihoods
- Community-based measures, working with local fleet to understand the context and ensure buy-in (Arlidge et al.)
- Investments in technology change and/or gear substitutions (Berninsone et al.)
- Offsets from industrial fleet or other activities with impacts on the same species (Gupta et al.)

- Rationalization *via* cooperatives to provide tools/incentives to address bycatch and create long-term value/stewardship
- Engaging the entire distribution chain to promote implementation of bycatch reduction measures/best practices
- Certification/access to markets for "eco-friendly" fishers
- Alternative livelihoods.

Lack of National Policy Measures

- Import restrictions (such as the US MMPA rule), if target catch is exported to the U.S. market
- Collective action/sectors; make use of existing cooperatives between local fishers and processors.

Characteristics of Bycatch Species

- Localized Ranges: Education, Adopt a species, regional collaboration
- Global/Transboundary Ranges: Collaborate (RFMO, FAO, IWC, CBD, CMS, CITES, other regional or global collaboration)
- Time/area closures; dynamic or static (Smith et al., 2021)
- K-Selected: Risk pool with low quota, Limit/quotas, Ecosystem impacts on removals, Protected areas
- R-Selected: Constant rate of bycatch limit.

Community Structure

- Homogeneous: use social pressure/incentives, identify measures through bottom-up approach, political ecology (Bisack and Magnusson)
- Heterogeneous: develop common goals, use cooperation, social science and opportunities, political ecology.

Situation: Target Bycatch Species Are Highly Migratory (Shared, High Seas)

- Work with RFMO, FAO, etc. to develop guidelines, best practices, shared conservation and management measures to monitor and mitigate bycatch.
- Use measures that restrict market access to "good actors"
- Buyer/Processor-imposed requirements/incentives (private vs. government incentives)
- Ecolabels/certification (particularly where markets are globally integrated, e.g., tuna)
- Multilateral implementation of technical measures for gear and gear deployment; recognize that unilateral actions may be counter-productive.

Lack of Alternative Livelihoods

- Seek aid (national government, foundations, FAO) (Pakiding et al.)
- Relocation and retraining programmes with incentives (e.g., engage fishers in enforcement, observer or research jobs)
- Government subsidize/other support and Payments for Ecosystem Services

- Basic income support
- Buyouts of vessels, gear (Sanjuro-Rivera et al.).

Poor Compliance, Corruption

- Create incentives for self-enforcement within groups
- Rights-based measures
- Co-management
- Incentives, financial or others
- In-kind retraining/gear swaps vs buyouts
- Surveys or focus groups to understand economic/normative factors that influence non-compliance
- Affordable monitoring equipment, e.g., VMS (pings with GPS coordinates) to enforce spatial/temporal closures and camera surveillance.

Situation: Open-Access, Over-Capitalized Fishery

- Subsidies for bycatch-friendly gear development/deployment
- Community fishing cooperatives with performance standards, community coordination
- Rights-based management with transferability to reduce capacity; recognize role of RBM in effectively addressing bycatch.

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Bycatch has not always been given attention in national and regional fisheries management bodies due to their focus on target species. As noted above, this is regrettable given that in many cases, bycatch injury and mortality is substantial and even leading to extinction for some species. This has been known since the early 2000s and has led to the concept of ecosystem-based fisheries management (Pikitch et al., 2004). Unfortunately, we are still far from ecosystem-based fisheries. Integrated cross-cutting approaches, adapted to each fishery, species and ecosystem context, have shown results, which it is important to disseminate. The research results presented in this Research Topic provide a wide and expanding array of potential solutions for monitoring and mitigating bycatch, even in the most challenging of circumstances. These options should reassure policy makers and stakeholders that it is possible to ensure a viable fishing industry whilst addressing the ecosystem impacts of fishing.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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