How to Put Ecosystem-Based Fisheries Management Into Practice

Clear objectives can improve ocean health, ensure resilient fish populations and support biodiversity

Overview

Over decades of international negotiation, the nations of the world have committed to the sustainable management of fisheries and protection of marine ecosystems. Multiple treaties and conventions require fishery managers to account for the impact of fishing activity on the health of the entire ecosystem, not just targeted fish stocks.

To effectively translate these obligations into practice, managers have begun to implement an approach known as ecosystem-based fisheries management (EBFM), which accounts for interactions among species, fishing activities, habitats and wider environmental concerns such as climate change. A critical step in the process of adopting EBFM is the development of "ecological objectives" – targets that are more comprehensive and dynamic than the objectives used in traditional, single-species management.

This brief provides guidance for fishery managers and environmental authorities on how to design effective ecological objectives and offers case studies from jurisdictions that have successfully incorporated these objectives into management practice.[1]

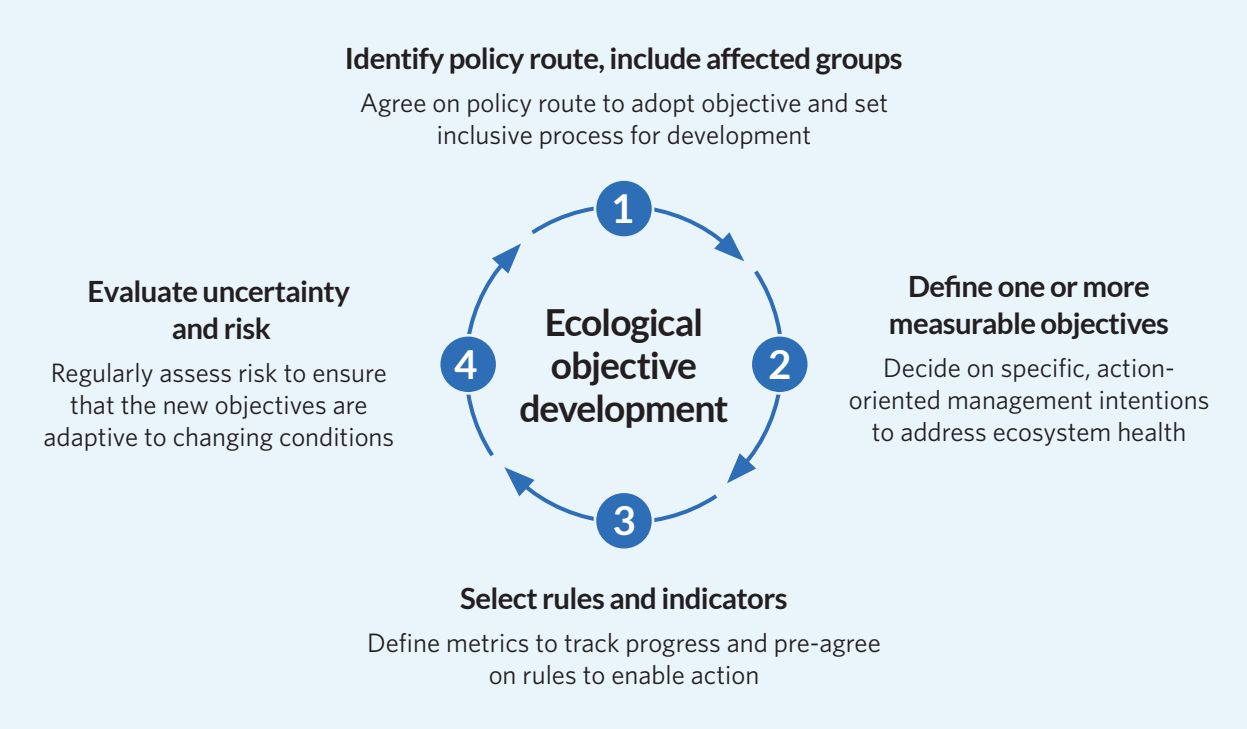
Set achievable, robust ecological objectives

Fisheries managers and environmental authorities should follow four key steps when setting these objectives. (See Figure 1.)

Figure 1

Fisheries Managers, Environmental Authorities Should Jointly Set Ecological Objectives

Sample development pathway



Step 1: Identify policy route, include affected groups

When setting ecological objectives, decision makers should first identify the policy route through which they will be developed and who should be involved. In particular, occasions when national fisheries laws, international agreements or management plans are being amended or revised provide opportunities to develop ecological objectives as part of those revisions. Additionally, managers may set objectives when developing new, targeted policies such as EBFM road maps or ecosystem-based fisheries plans.

Whichever policy route is selected, the process for developing objectives should be agreed among government bodies with overlapping responsibilities – including the various decision makers tasked with protecting ocean biodiversity and ensuring the sustainability of fisheries – and external actors, such as industry and non-governmental organizations. These various entities should align their policy priorities by establishing open dialogue, pooling their collective expertise and engaging their networks of scientific advisers and interested groups. Non-governmental actors should play an integral role in the process, proposing issues to be addressed by the objectives and providing feedback, insights, experience and data.

How Three Fisheries Management Bodies Initiated Ecological Objective Development

Agreeing on an international road map

In 2017, the parties to the Northwest Atlantic Fisheries Organization agreed to put the broad commitments in their revised convention into practice using an ecosystem approach road map, which included specific objectives such as minimizing impacts on threatened species.[2]

Revising a domestic fisheries policy

In 2020, the United Kingdom overhauled its fisheries rules by passing its Fisheries Act, which defined objectives relating to marine ecosystem health, bycatch reduction and climate change adaptation.[3]

Developing regional plans

Since 2007, the United States has introduced fishery ecosystem plans to transform national ecological objectives into regionally appropriate goals.[4]

Step 2: Define one or more measurable objectives

With a process initiated, the next step is for fisheries managers, environmental authorities and external actors to define the new objectives, with a focus on the management intention in relation to the marine ecosystem, including commitments linked to international conservation policies, treaties and other agreements. These may include minimizing ecological harm on certain species, for instance surface-feeding seabirds; maintaining the ecological condition of an ocean area with critical habitats; or promoting recovery of particular fish populations or of ecological relationships, such as food web integrity.

Like conventional fisheries management objectives, ecological objectives should precisely define the target or targets of the management intentions. As part of this step, decision makers should commission scientific advice on the feasibility and implications of proposed objectives to ensure that they are clearly defined and can be effectively implemented.

Step 3: Select rules and indicators

Overarching environmental goals often do not provide the level of specificity needed to drive measurable action, especially when they flow from globally agreed treaties or commitments.[5]

To yield meaningful results, goals such as the Kunming-Montreal Global Biodiversity Framework's mission to "halt and reverse" biodiversity loss require not only translation into clear, measurable objectives, but also actionable management rules and indicators to help measure progress and ensure meaningful implementation.

The process of selecting indicators should be a collaboration between the managers and the scientists who advise them, with regular input from other stakeholder groups, and should be guided mainly by scientific advice, even though the choice among indicators can involve political trade-offs.[6]

Managers should consider indicators that track one or more elements noted in (or of relevance to) the objective, such as the status or composition of predator diets or change in average sea surface temperature and corresponding shifts in species distribution. Such indicators can enable managers to make sure they are on track to maintain or improve elements of an ecosystem, as required by their objectives.

Further, managers should diversify their indicators and metrics to proactively tackle ongoing marine environmental decline and build progress towards EBFM, rather than relying on outdated standards. Table 1 offers examples of indicators that nations and international bodies have employed. An environmental indicator is relevant to fisheries management when fishing activity can be linked to the status of that indicator. For example, managers may need indicators for the status of each predator that eats the target species to ensure that fishing does not deprive those predator species of enough prey to thrive.

Table 1

Associated Rules and Indicators Can Help Integrate Ecological Objectives Into Fisheries Management

Examples of objectives and implementation approaches at the domestic and international levels

Management body and target species	Ecological objective	Associated indicator(s)	Associated rule(s)
Domestic			
United States' Atlantic States Marine Fisheries Commission – Atlantic menhaden	"Maintain the Atlantic menhaden stock at levels which sustain viable fisheries and support predators which depend on the forage base."	• Fishing rate on Atlantic menhaden, forage species. • Fishing rate on striped bass, predator species. • Biomass (i.e. population size) of Atlantic menhaden. • Biomass of striped bass.	• Set the Atlantic menhaden fishing rate at (or below) the level needed to sustain its population size and to provide enough menhaden to feed and support the target population size for striped bass.
Australian Fisheries Management Authority – Eastern tuna and billfish	"Ensure that the exploitation of fisheries resources … are conducted in a manner consistent with the principles of ecologically sustainable development, in particular the need to have regard to the impact of fishing activities on non-target species."	• Bycatch rate of seabirds (birds per hook) in oceanic longline operations.	• Achieve and maintain this rate at less than 0.05 birds per 1,000 hooks in five-degree latitudinal bands during summer and winter fishing seasons.
International			
Convention for the Conservation of Antarctic Marine Living Resources – krill	"Any harvesting … shall be conducted in accordance … with the following principles of conservation … maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources."	• Fishing rate on krill. • Biomass of krill. • Level of spatial overlap between krill and its predator.	• Set the krill fishing rate at (or below) the level needed to sustain its target population size and to leave 75% of its biomass in the ocean for predators. • Reduce fishing rates and associated catch limits in areas of high krill-predator overlap.

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Management body and target species	Ecological objective	Associated indicator(s)	Associated rule(s)
International			
Northwest Atlantic Fisheries Organization – any harvested species	"Ensure the long-term conservation and sustainable use of the fishery resources in the Convention area and, in so doing, to safeguard the marine ecosystems in which these resources are found."	• Fishing rates on individual species in an ecological group (e.g. bottom-dwelling fish). • Fishing rate on all species in the ecological group. • Biomass of all species in the ecological group. • Level of ecosystem productivity of the ecological group (i.e. how much of the group an ecosystem can produce in a given area or time).	• Notify parties when aggregate fishing rates of all species in an ecological group exceed the levels of ecosystem productivity and become unsustainable.
Agreement on the International Dolphin Conservation Program – Eastern Pacific tuna	"To progressively reduce incidental dolphin mortalities in the tuna purse-seine fishery in the Agreement area to levels approaching zero, through the setting of annual limits."	• Dolphin mortality incidents.	• Limit total incidental dolphin mortality in the Agreement area's purse-seine tuna fishery to no more than 5,000 annually, through the adoption and implementation of relevant measures.

Sources: Australian Government, Department of the Environment and Energy, Australian Antarctic Division, *Threat Abatement Plan for the Incidental Catch (or Bycatch) of Seabirds During Oceanic Longline Fishing Operations (2018)*, 2018. Australian Fisheries Management Authority, *Fishery Management Strategy: Eastern Tuna and Billfish Fishery (ETBF) 2019-2023*, 2021. Atlantic States Marine Fisheries Commission, *Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden*, 2017. Commission for the Conservation of Antarctic Marine Living Resources, *Convention on the Conservation of Antarctic Marine Living Resources, Article II*. Northwest Atlantic Fisheries Organization, *Convention on Cooperation in the Northwest Atlantic Fisheries*, 2017. Agreement on the Inter-American Tropical Tuna Commission, *Agreement on the International Dolphin Conservation Program (Amended)*, 2017

Having identified the necessary indicators, decision makers should use management rules to define the actions they will take to meet their ecological objectives. Management rules are defined using reference points – values used to evaluate the health of the fish stock or ecosystem element targeted by a management objective, such as a population size associated with stock collapse. The rules then detail the actions to be taken when undesirable states are reached or traversed, for instance, reducing fishing activity to enable stock recovery.

Such rules are commonly used to set conditions for target species actions, but managers should move towards adoption of ecosystem-based reference points to achieve broader ecological objectives. For example, managers can structure their harvest strategies – pre-agreed, formulaic systems for setting fishing limits, typically used as a single-species management tool – to set objectives, rules and indicators at the ecosystem level. Harvest strategies provide a ready-made vehicle through which to implement ecosystem-related targets within existing management practice.

Ecological Objectives in Harvest Strategies

The use of harvest strategies for target species in domestic and international fisheries is growing, and management objectives – both for a fishery's target species and for ecosystem elements (i.e. bycatch species, critical habitats or food webs) – are an essential element of harvest strategies. Setting management objectives within a harvest strategy in effect defines ecological objectives at the level of a specific fishery, helping to implement EBFM.

Other critical elements of harvest strategies are harvest control rules – pre-agreed guidelines for how much fishing can take place, based on indicators of the target stock's status – and reference points. Both can be structured to account for ecosystem considerations and, in doing so, put ecological objectives into practice. For example, managers could define a reference point for a target species that designates the proportion of biomass that must remain in the water to meet predator needs. They could then create a harvest control rule to ensure that no more than that amount is taken in the fishery (under certain conditions).[7]

Step 4: Evaluate uncertainty and risk

As with traditional management objectives, the future state of the ecosystem and the impact of ecological objectives will always involve some uncertainty. Managers can address this by building consideration of risk and uncertainty into the process when setting ecological objectives.

Of all the parts of the objective-setting effort, risk management requires collaboration among government bodies with shared ocean biodiversity obligations. For instance, an environmental authority might evaluate the status of and risk to specific parts of marine ecosystems and cooperate with a fisheries manager to ensure that management of fisheries accounts for the results of those assessments.[8] Risk evaluation processes may also require fisheries managers and environmental authorities to account for other activities that affect ocean health, such as offshore energy generation, and to involve regulators of these activities in efforts to assess and address risk. One example of shared responsibility for ecological objectives through risk assessment comes from Australia. That nation's environment ministry annually analyses risks to various components of marine ecosystems and then the fisheries ministry adapts its harvest strategy rules to any significant changes in the status of a species or habitat that is affected by a fishery.[9]

Furthermore, the process of ecological objective setting may involve agreeing on potential environmental conditions under which an objective and its associated rules would require amendment or cease to apply. When future risks related to ecological changes are hard to predict – for example, the impact of climate change on target species populations – or when data is limited, circumstances may have to be assessed based on the probability of change. Inherent uncertainty requires managers to agree on how success is measured and how much risk they are willing to assume when considering an objective.[10]

By regularly evaluating, quantifying and agreeing on responses to potential risks, managers can ensure that those objectives remain relevant to changing environmental conditions.

Conclusion

In the face of declining global biodiversity and changing ocean conditions, many governments have committed to reducing the impact of human activities on marine life. EBFM is a key tool that decision makers can use to meet their commitments to safeguarding ocean health, while also maintaining viable fisheries. Setting ecological objectives is the first step in ensuring that EBFM is effective.

Endnotes

1 Daniela Diz, "The Ecosystem Approach as a Frame for SDG 14 Implementation," *Ocean Yearbook Online* 33, no. 1 (2019): 187-206, https://doi.org/10.1163/9789004395633_008.

2 Mariano Koen-Alonso et al., "The Northwest Atlantic Fisheries Organization Roadmap for the Development and Implementation of an Ecosystem Approach to Fisheries: Structure, State of Development, and Challenges," *Marine Policy* 100 (2019): 342-52, https://www.sciencedirect.com/science/article/pii/S0308597X18305694.

3 United Kingdom Parliament, Fisheries Act 2020 (2020), https://www.legislation.gov.uk/ukpga/2020/22/contents.

4 Kristin N. Marshall et al., "Ecosystem-Based Fisheries Management for Social-Ecological Systems: Renewing the Focus in the United States With Next Generation Fishery Ecosystem Plans," *Conservation Letters* 11, no. 1 (2018): e12367, https://doi.org/10.1111/conl.12367.

5 Keith J. Sainsbury, André E. Punt, and Anthony D. M. Smith, "Design of Operational Management Strategies for Achieving Fishery Ecosystem Objectives," *ICES Journal of Marine Science* 57, no. 3 (2000): 731-41, https://doi.org/10.1006/jmsc.2000.0737.

6 R. L. P. Lanters and E. L. Enserink, "Integration of Ecological and Fisheries Objectives Through Indicator Development," *International Council for the Exploration of the Sea CM 1998/T* 11 (1998), https://www.ices.dk/sites/pub/CM%20Doccuments/1998/T/T1198.pdf. Ewald Rametsteiner et al., "Sustainability Indicator Development—Science or Political Negotiation?" *Ecological Indicators* 11, no. 1 (2011): 61-70, https://doi.org/10.1016/j.ecolind.2009.06.009.

7 Magnuson-Stevens Fishery Conservation and Management Act Provisions; Fisheries of the Northeastern United States; Amendment 8, 50 CFR Part 648, National Oceanic and Atmospheric Administration, 2021, https://www.federalregister.gov/documents/2021/01/11/2020-29127/magnuson-stevens-fishery-conservation-and-management-act-provisions-fisheries-of-the-northeastern.

8 Stephen J. Newman et al., "A Risk Assessment and Prioritisation Approach to the Selection of Indicator Species for the Assessment of Multi-Species, Multi-Gear, Multi-Sector Fishery Resources," *Marine Policy* 88 (2018): 11-22, https://doi.org/10.1016/j.marpol.2017.10.028.

9 A. D. M. Smith et al., "Scientific Tools to Support the Practical Implementation of Ecosystem-Based Fisheries Management," *ICES Journal of Marine Science* 64, no. 4 (2007): 633-39, https://doi.org/10.1093/icesjms/fsm041.

10 Daniel E. Duplisea et al., "Fish Harvesting Advice Under Climate Change: A Risk-Equivalent Empirical Approach," *PLOS ONE* 16, no. 2 (2021): e0239503, https://doi.org/10.1371/journal.pone.0239503.

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