
wildestanimal/Getty Images

Ecosystem-Based Fisheries Management Needed to Help Marine Life Thrive in Northeast Atlantic Ocean

Decision makers should build on successes to meet both sustainability and environmental commitments

Overview

Historically, fisheries management has largely focused on maximizing catch of a target species. Attempts by fisheries managers around the world to reduce overfishing in recent decades have yielded mixed progress. Positive results have come largely in well-monitored, large-scale fisheries where science-based management has been applied. In such cases, success has been defined in terms of groups of individual fish stocks in specific ocean regions—for example, Northeast Pacific groundfish or North Atlantic swordfish—gradually recovering from overexploitation.[1] However, even in such success stories, managers have often failed to account for the impact of fishing on ecosystems, such as the depletion of non-target species caught as bycatch or the imbalance created when too many of an important predator or prey species are removed.

Recent science shows that commercial fishing has had the largest footprint of any human activity on the marine environment over the past 50 years,[2] specifically by causing declines in target and non-target species and degrading their habitats.

Reversing some of this damage and minimizing the disruption that commercial fishing can cause to complex, interconnected ocean ecosystems will require a major shift in how fisheries are governed.

The solution is an approach called ecosystem-based fisheries management (EBFM). EBFM accounts for the effects of fishing on a range of species—not just the one targeted—and their habitats, as well as the impacts of environmental changes (for example, shifts in microscopic plankton prey levels) on fish populations and fisheries. EBFM requires managers to consider interactions among species (for example, how fishing of one species may deplete the food available for another) and to dynamically adapt fishing opportunities in response to predicted or observed changes in the environment, such as shifts in a species' biomass or range due to rising ocean temperature.

Under EBFM, fisheries management decisions must be driven by evidence-based, ecological objectives such as safeguarding the integrity of food webs, ensuring wider ecosystem functioning and maintaining resilience to environmental stressors such as climate change, rather than only aiming to catch as much of one stock as possible.

To date, many decision makers around the world have made political—and, in some cases, legally binding—commitments to adopt EBFM. The United Nations Food and Agriculture Organization and U.N. Convention on Biological Diversity have strongly encouraged governments and international fisheries management bodies to adopt ecosystem-based management approaches.[3] In the Northeast Atlantic Ocean, the European Union, the United Kingdom and Norway, among others, have included commitments relating to EBFM prominently in their domestic fisheries policies.[4]

It is time to take these words and put them into action in this region, where coastal states, regional management organizations and scientific bodies that support decision-making have the ideal conditions for implementing EBFM.

Implementing EBFM in the Northeast Atlantic

Marine fisheries in the Northeast Atlantic (NEA) are governed by the European Union and six countries (Faroe Islands, Greenland, Iceland, Norway, Russia and the United Kingdom) within their own waters, as well as one regional fisheries management organization—the North-East Atlantic Fisheries Commission, which governs the region's international waters. (See Figure 1.) A further patchwork of bilateral/trilateral fisheries agreements covers shared fish stocks across two or more of these countries' domestic waters.

Several of the world's largest marine fisheries are in the NEA. Three species in particular—Atlantic herring, blue whiting and Atlantic mackerel—accounted for 4.1 million metric tons, or 6 per cent of global finfish catch, in 2020.[5] These species form some of the largest vertebrate populations in the world. Atlantic herring populations in the Norwegian Sea peaked at an estimated 97 billion individuals in 1994 (and stood at 23 billion in 2021).[6] Species such as mackerel and herring are widely consumed in European markets, while catches of species such as blue whiting are predominantly processed into fishmeal and fish oil for use in farming and aquaculture feeds.

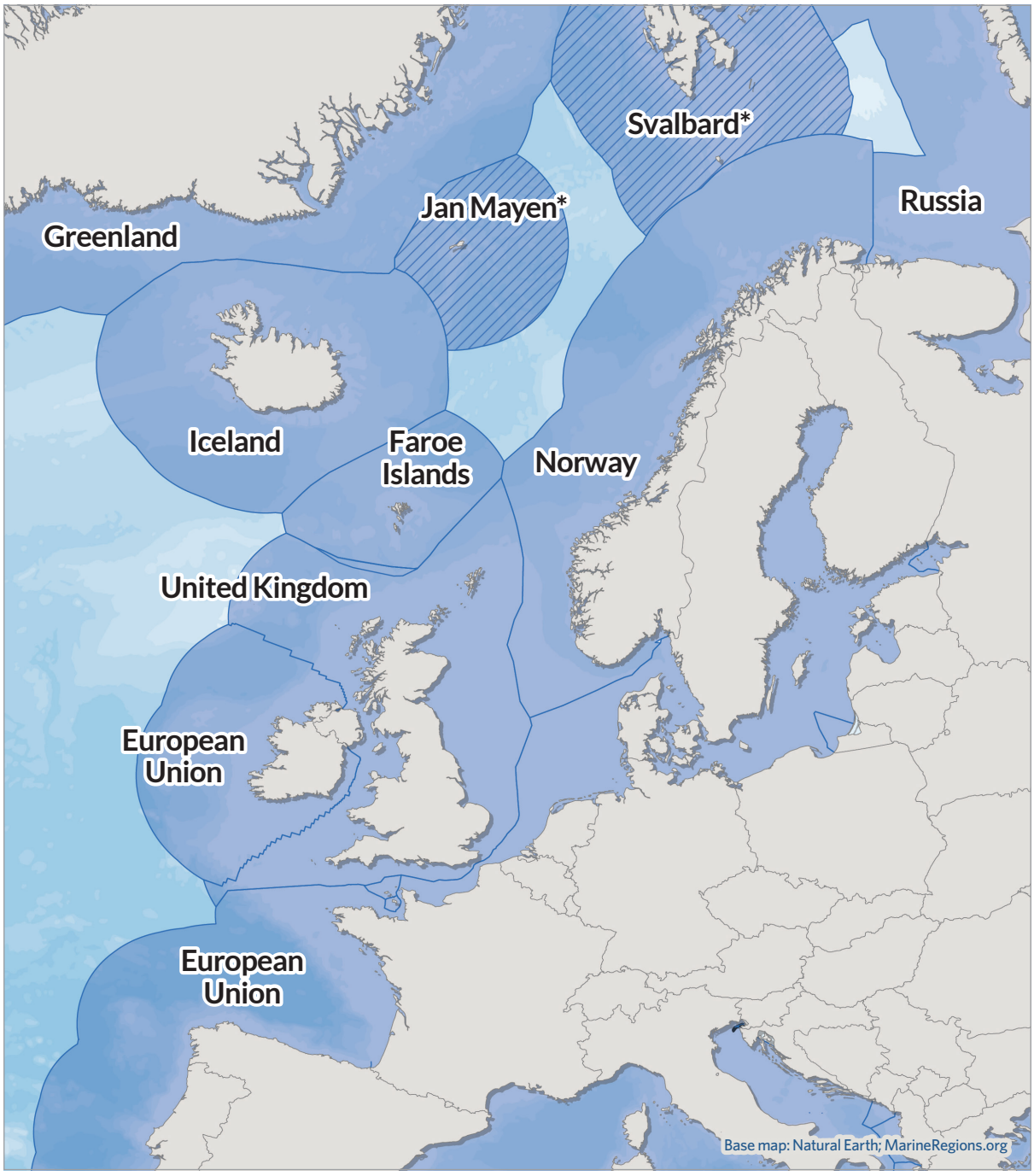
There are clear and timely opportunities for the implementation of ecosystem-based fisheries management in the NEA, including:

- **Existing political commitments towards EBFM.** Several Northeast Atlantic nations, as well as the European Union, have committed to adopting an ecosystem approach to fisheries management in their overarching fisheries policies.
- **Well-established networks of relevant scientific institutions and advisory bodies.** NEA states host some of the oldest and most established marine/fishery science research institutions in the world. Many of these institutes collaborate through the International Council for the Exploration of the Sea (ICES), an intergovernmental organization that connects nearly 6,000 scientists throughout more than 700 marine science institutions in 20 countries.[7]

Figure 1

Busy Waters Highlight Need for Collaborative Ecosystem-Based Fisheries Management

7 fisheries managers and an international management body should work together to improve Northeast Atlantic rules



Exclusive economic zones

International waters governed by the North-East Atlantic Fisheries Commission

* Established as fishery protection zones under Norwegian law

- **Well-developed systems for requesting, receiving and following scientific advice.** Fisheries managers in the NEA receive regular scientific advice from ICES. In its most common form, this advice provides decision makers with an advised total catch limit for a given target species based on an assessment of its status, including current and historical population health.
- **Growing momentum around requesting and providing advice at ecosystem level.** Scientific advice on fisheries in the NEA is beginning to incorporate considerations of target species' ecosystem role and their ecological interactions with other species and habitats. For example, some recent scientific stock assessments, which decision makers consider when setting catch limits, have included estimates from ecosystem models of how much of a targeted stock is eaten by predators. In a recent agreement with the UK, ICES stipulated that it would provide "advice on fishing, opportunities, including information on the state of marine ecosystems and human impacts."[8] A recent ICES self-evaluation revealed that nearly 50 per cent of stock assessments considered "ecosystem trends and variability."[9]

However, despite many political commitments to EBFM, most management frameworks and decision-making processes still lack the specificity needed to request and receive ecosystem-based scientific advice that is operational. As a result, managers then lack the impetus and tools (for example, means of assessing trade-offs between exploited species and ecosystem health) to apply management at this level.

The complex and overlapping nature of Northeast Atlantic fisheries doesn't help, with many different players needed at the table to ensure strong, cohesive management. Although other organizations, such as fishing industry bodies and civil society groups, can contribute to the management process, domestic and international fisheries managers still make many important decisions with limited stakeholder involvement or public scrutiny.

Climate change and the related movement of fish populations create further challenges for managing species that have previously been under another country's or management organization's jurisdiction.

However, by fully implementing EBFM, managers across the region can safeguard productive fisheries and the ecosystems they rely on.

Steps towards EBFM

With the firm political commitments already mentioned, fisheries managers are now obligated to take concrete actions to transition single species management to strategies that consider the overall health of ocean ecosystems. To accomplish that, managers should prioritize the following actions:

- **Commission and apply ecosystem-level scientific advice.** Making management decisions that take the ecosystem into account requires incorporating evidence beyond fisheries' traditional catch data. Fisheries managers should commission scientists to produce ecosystem models—simulations of marine ecosystems and/or food webs used to predict the status of specific species or environmental conditions—and apply the results to the setting of catch limits.
- **Set fishing limits within ecosystem constraints.** As ecosystem-level advice becomes progressively more available, decisions on catch limits should be based on the full range of ecological consequences of those decisions, rather than solely on the population health of a single exploited species. Catch limits that are informed by ecosystem trends and variability are fundamental to implementing EBFM, and their adoption would be a promising first operational step in this shift.
- **Develop long-term, ecosystem-based fisheries management strategies.** Long-term management strategies (LTMS) are also known as harvest strategies or management procedures.[10] These are pre-agreed frameworks for making sustainable, science-based fisheries management decisions, such as setting catch limits. LTMS aim to shift the perspective from short-term reactive decision-making to longer-term objectives for a fishery and, therefore, provide an ideal mechanism for managers to implement EBFM. When developing LTMS, managers can incorporate ecological management

objectives (for example, leaving enough of a prey species in the ocean to support healthy predator populations), giving those managers a more informed idea of what EBFM looks like in practice and a better understanding of the trade-offs, such as lower amounts of allotted catch, associated with keeping an entire ecosystem healthy.

- **Protect areas of fishery and ecosystem importance.** Area-based protection is a recognized, best practice tool that contributes to the implementation of EBFM.[11] This involves protecting the habitats of targeted species, particularly zones where these species are at vulnerable life stages, such as nursery and spawning areas. Area-based protection also safeguards other species, for example, those caught as bycatch.

Examples of EBFM progress in the NEA

The Northeast Atlantic is an ideal region to begin meaningful implementation of EBFM at scale and throughout multiple, interconnected, international fisheries.

Box 1 and Table 1 show examples in the Northeast Atlantic of fisheries managers and science advisory bodies beginning to introduce tentative steps towards EBFM.

Box 1:

North Sea Sandeel: A "Test Bed" for EBFM Implementation

Sandeels are small fish in the sand lance (*Ammodytidae*) family that spend most of their lives partly buried in sand or gravel-dominated areas of the seafloor. They are part of a group of short-lived fish species at the base of marine food webs known as forage fish, a group that also includes other NEA species such as sprat and Norway pout. Scientists and many decision makers recognize forage fish as the "test bed" for EBFM implementation, in part due to their role as food for a variety of predators, from seabirds to marine mammals.[12]

In the NEA, sandeel is fished largely by EU and Norwegian fleets and is reduced into fishmeal for use in farming and aquaculture. Most sandeel stocks in the region are managed through a scientific advice rule (which governs how catch limits are calculated for particular species or stocks) and reference points (benchmarks that scientists and managers use to compare the current status of a stock or fishery to a desirable or undesirable state) for short-lived species developed by ICES.[13] The rule and reference points account for unpredictable changes in sandeel population size by setting catch limits that aim to keep enough fish in the sea every year after fishing to ensure future spawning success. Catch limits under this advice are developed annually, without long-term and/or ecosystem-level objectives in place. ICES has suggested management plans need to be developed for these stocks.[14]

Although the scientific advice that informs sandeel catch limits does, to an extent, incorporate estimates of how much sandeel is eaten by predators, these estimates do not capture the full ecological dynamics of, for example, seabird predation on this species. Scientists have recommended the development of a more comprehensive approach—one that accounts for not only how much sandeel seabirds consume (i.e., their physiological requirements) but also the total abundance of sandeel needed in the water in order to find the fraction of the stock that seabirds actually eat (i.e., their ecological requirements).[15]

Clearly, NEA fisheries managers have work to do to ensure sandeel is subject to comprehensive EBFM, but they have made promising preliminary steps. As sandeel (and other forage fish) management continues to evolve, this progress could serve as a template for the shift towards EBFM in other marine species in the NEA.

Table 1

Priority Ecosystem-Based Fisheries Management (EBFM) Actions from Northeast Atlantic Fisheries, With Progress and Next Steps

EBFM priority action	Example(s) of progress in the Northeast Atlantic	Example(s) of next steps needed
1. Commissioning and applying ecosystem-level scientific advice	Three ecosystem models were developed by a group of International Council for the Exploration of the Sea and fishing industry scientists for the Irish Sea, simulating interactions among marine species groups as well as their responses to environmental drivers. This process provides the basis for (as yet unimplemented) ecosystem-informed advice to set fishing opportunities for some Irish Sea commercial species such as cod, whiting, herring and Norway lobster.	Managers should request similar models in other ecologically complex Northeast Atlantic (NEA) sea basins, such as the North Sea or Norwegian Sea, and engage stakeholders on opportunities to apply those models in fisheries management.
2. Setting fishing limits within ecosystem constraints	Scientific advice on fishing limits generally incorporates basic estimates of "natural mortality"—how much of a target species dies of natural causes such as disease and predation. Catch limits for some NEA species—including herring, sprat and sandeel in the North Sea—go further and include more refined mortality estimates by using ecosystem models.	Managers should build in a wider range of ecosystem considerations into fishing limits, including climate variability and more refined natural mortality estimates, and apply this approach to more species groups.
3. Developing long-term, ecosystem-based fisheries management strategies and/or ecological management objectives	Long-term managment strategies (LTMS) were established by some NEA nations for blue whiting in 2016 and Atlanto-Scandian herring in 2018, but these are built on single species reference points and do not contain explicit ecological management objectives.	Managers should introduce ecological management objectives within existing LTMS and ensure ecosystem considerations in any future LTMS development, for example, combining target species management with other indicators, such as seabird reproductive success, to trigger timely adjustment of fishing activities.
4. Protecting areas of key fishery and ecosystem importance	Fishing of sandeel off the east coast of Scotland in the 1990s was linked to declines in several sensitive seabirds' colonies. The EU implemented the "North-east UK sandeel closed area" in 2000, resulting in healthier sandeel populations and improved breeding success of the kittiwake seabird.	Managers should routinely collate and consider existing spatial management data and propose spatial measures as standard complementary tools to ecosystem-based catch limits.

Sources: "Agreed Record of Conclusions of Fisheries Consultations Between the European Union, the Faroe Islands, Iceland and Norway on the Management of Blue Whiting in the North-East Atlantic in 2017" (2016); "Agreed Record of Conclusions of Fisheries Consultations Between Iceland, the European Union, the Faroe Islands, Norway and the Russian Federation on the Management of the Norwegian Spring-Spawning (Atlanto-Scandian) Herring Stock in the North-East Atlantic in 2019" (2018); J.W. Bentley et al., "Retrospective Analysis of the Influence of Environmental Drivers on Commercial Stocks and Fishing Opportunities in the Irish Sea" (2020); F. Daunt et al., "The Impact of the Sandeel Fishery Closure on Seabird Food Consumption, Distribution, and Productivity in the Northwestern North Sea" (2008); European Commission, "Commission Staff Working Document: Evaluation of Closed Area Schemes (SGMOS-07-03) Subgroup on Management of Stocks, of the Scientific, Technical and Economic Committee for Fisheries (STECF), STECF Opinion Expressed During the Plenary Meeting of 5-9 November 2007 in ISPRA" (2007); International Council for the Exploration of the Sea, "Working Group on Multispecies Assessment Methods " (2021); International Council for the Exploration of the Sea, "Cod (*Gadus morhua*) in Division 7.A (Irish Sea)" (2022)

Atlantic Puffin (*Fratercula arctica*) with sandeels

Conclusion

Widespread adoption and implementation of EBFM involves complexities and challenges and will necessitate that countries and international bodies significantly change the status quo. But transitioning to EBFM is critical to advancing fisheries management in the twenty-first century and will help to deliver both sustainable fisheries and biodiversity protection, which have until now been managed in separate silos.

The Northeast Atlantic region presents a prime opportunity for governments there to implement EBFM and fulfill their commitments. Building on the promising early steps in this region, there is now an increasing need for coherent, thorough implementation of EBFM in more NEA sea basins, covering a wider range of targeted species and focusing on more complex ecosystem interactions.

Pew recommends that NEA fisheries managers take the steps described above to apply this important approach on the water.

Endnotes

1 Food and Agriculture Organization of the United Nations, "The State of World Fisheries and Aquaculture: Towards Blue Transformation" (2022), https://www.fao.org/state-of-fisheries-aquaculture.

2 P. Balvanera et al., "Status and Trends – Drivers of Change," in The Global Assessment Report on Biodiversity and Ecosystem Services, (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services 2019), https://zenodo.org/record/5517423#.Yx_eW3YpA2w.

3 U.N. Convention on Biological Diversity, "Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity at Its Ninth Meeting" (2008), https://www.cbd.int/decision/cop/?id=11650; United Nations Food and Agriculture Organization Committee on Fisheries, "Declaration for Sustainable Fisheries and Aquaculture" (2021), https://www.fao.org/documents/card/en/c/cb3767en/.

4 European Union, Regulation (EU) No 1380/2013 [Common Fisheries Policy] (2013), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R1380; Norwegian Directorate of Fisheries, The Marine Resources Act (2008), https://www.fiskeridir.no/English/Fisheries/Regulations/The-marine-resources-act; The United Kingdom, Fisheries Act (2020), https://www.legislation.gov.uk/ukpga/2020/22/contents.

5 Food and Agriculture Organization of the United Nations, "The State of World Fisheries and Aquaculture: Towards Blue Transformation."

6 International Council for the Exploration of the Sea, "Working Group on Widely Distributed Stocks (WGWIDE)" (ICES Scientific Reports, 2021), 874, http://doi.org/10.17895/ices.pub.8298.

7 International Council for the Exploration of the Sea, "Who We Are," https://www.ices.dk/about-ICES/who-we-are/Pages/Who-we-are.aspx.

8 The United Kingdom and International Council for the Exploration of the Sea, "Memorandum of Understanding Between the United Kingdom of Great Britain and Northern Ireland and the International Council for the Exploration of the Sea" (2021), https://www.ices.dk/about-ICES/Documents/Cooperation%20agreements/UK/UK_MOU.pdf.

9 M. Dickey-Collas et al., "ACOM Sanctioned Analysis of ICES Productivity Questionnaire (Ad Hoc) " (International Council for the Exploration of the Sea, 2022), 12, https://ices-library.figshare.com/ndownloader/files/34204328.

10 The Pew Charitable Trusts, "Harvest Strategies: 21st Century Fisheries Management" (2019), https://www.pewtrusts.org/-/media/assets/2019/11/harveststrategiesconsolidated_brief_v2.pdf.

11 Food and Agriculture Organization of the United Nations, "The Ecosystem Approach to Fisheries in FAO Technical Guidelines for Responsible Fisheries 4, Supplement 2" (2003), https://www.fao.org/3/Y4470E/y4470e00.htm.

12 J. Rice and D. Duplisea, "Management of Fisheries on Forage Species: The Test-Bed for Ecosystem Approaches to Fisheries," *ICES Journal of Marine Science* 71, no. 1 (2014): 143-52, https://doi.org/10.1093/icesjms/fst151.

13 International Council for the Exploration of the Sea, "Herring Assessment Working Group for the Area South of 62°" (2021), 917, https://doi.org/10.17895/ices.pub.8214.

14 Ibid.

15 R.W. Furness, "How Many Fish Should We Leave in the Sea for Seabirds and Marine Mammals?" in *Top Predators in Marine Ecosystems*, ed. I.L. Boyd, S. Wanless, and C.J. Camphuysen (Cambridge: Cambridge University Press, 2006); RSPB, "Revive Our Seas: The Case for Stronger Regulation of Sandeel Fisheries in UK Waters," (2021), https://www.rspb.org.uk/globalassets/downloads/documents/campaigning-for-nature/rspb2021_the-case-for-stronger-regulation-of-sandeel-fisheries-in-uk-waters.pdf.

For further information, please visit:

pewtrusts.org/internationalfisheries

Contact: Leah Weiser, communications manager **Email:** lweiser@pewtrusts.org
Project website: pewtrusts.org/internationalfisheries