

ICES and Ecosystem Based Management.

The ecosystems approach to management of marine activities has been described by many organisations and in legislation ([FAO](#), [CBD](#), [Arctic Council](#), [NOAA](#), CFP, MSFD). ICES sees Ecosystem Based Management (EBM) as the primary approach for the management of the human activities affecting the ecosystems and Ecosystem Based Fisheries Management (EBFM) as a constituent part of the management addressing the fishing sector. Certain key words illustrate the central tenet of the ecosystem approach: management of human activities, consideration of collective pressures, achievement of good environmental status, sustainable use, optimize benefits among diverse societal goals, trade-offs and stewardship for future generations.

ICES role is to provide the evidence for ecosystem based decision making for the management of fisheries and other sectors in the ICES area. The evidence is required to explore the consequences of likely trade-offs (central to EBM) in the management of, and between sectors, and their impacts and services from the biodiversity of species and habitats. This is to support sustainable development aimed at both human and ecosystem well-being and stewardship of marine ecosystems. EBFM should result in fisheries management that maintains resilient and productive ecosystems. ICES can provide the knowledge base to achieve this end, as encapsulated in the ICES mission of providing the “information, knowledge, and advice on the sustainable management of human activities affecting, and affected by, marine ecosystems.”

EBM is a process towards this goal, and ICES is incrementally using its network, data centre, and advisory role to provide the scientific basis for operational management. As the process is incremental, it allows ICES to respond appropriately to the changing demands of a developing policy landscape.

Evidence Base and Tools

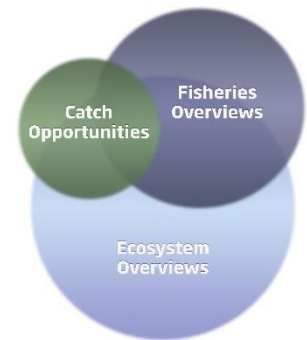
Since 1992, the ICES Working Group on Ecosystem Effect of Fishing Activities (WGECO) has considered the framework and application of EBFM. Its outputs have been, and continue to be, transformative with the working group continuing to provide leadership on the development of the concepts, such as those underlying the European Marine Strategy Framework Directive (MSFD). The understanding then propagates throughout the ICES network facilitating the development of the knowledge required to provide relevant and timely operational advice.

Through the ICES data centre and with strategic partners, ICES is also providing operational information products to underpin the exploration of what can be called the safe-operational space for trade-offs. The ICES data centre is leading European initiatives to improve collaboration between fisheries/resource management researchers and conservation/biodiversity researchers by building common vocabularies and data sharing between organisations such as FAO fisheries, EUROSTAT and OBIS (Ocean biogeographic information system). It is also working with the ICES working groups on marine spatial planning, habitat mapping, and fisheries spatial data to make the provision of spatial data consistent across various data sources, to enable clear and traceable provenance of information for decision making.

The ICES integrated ecosystem assessment groups are developing methods and tools to make the ecosystem approach operational. Their ecosystem assessments include ecosystem trend analyses, the building of Bayesian networks and methods to qualify, quantify and prioritise regional anthropogenic pressures. The impact of climate change on marine ecosystems and fishers, from the Baltic Sea, or Barents Sea across to Georges Bank in the western Atlantic is a key issue that ICES builds into its consideration.

Application of evidence base to EBFM

ICES uses three building blocks to deliver EBFM within EBM; advice of fishing opportunities, fisheries overviews, and ecosystem overviews. These blocks are continually developing to address the challenges of ecosystem dynamics, legislative changes, and changes in the drivers of fisheries. Spatial management and regional priorities are dealt with through all of the advice being given by [ecoregion](#). The ICES ecoregions are bio-political in nature, reflecting the realities of the bio-geography of the marine ecosystems and the management of those ecosystems through national and regional authorities.



ICES advice on fishing opportunities has evolved from the traditional focus on single species catch options. It now includes an assessment of the stock status, the exploitation rate in relation to maximum sustainable yield, and projections of the consequences of fisheries actions for each stock impacted by fisheries in the European ICES area. The assessments are a mixture of analytical and knowledge limited (proxy) approaches which encompass target species, bycatch species, deep sea and elasmobranch fisheries. Where evidence exists of productivity changes in the ecosystem or fish stocks, researchers are encouraged to consider the evidence and implications for management of these changes. ICES advises on fishing opportunities using advice rules (harvest control rules in management plans/strategies) with reference points that reflect policy objectives (Maximum Sustainable Yield, Precautionary Approach). This advice informs of the consequences of catches to meeting agreed objects for fish stocks. The ecosystem approach is integrated in the reference points, which are based on the current state of the ecosystem and updated to reflect any ecosystem impacts on stock dynamics. Where appropriate, such as with forage fish, or cannibalistic fish, estimates of the temporal variation of natural mortality are built into the stock assessments to consider the implications for fish for top predators, or density effects on stock dynamics.

The fisheries overviews are summaries of the activities and impacts of fishing fleets in the ICES area. They describe the fleets operating in each ecoregion, the composition of their catches, and their interactions with the ecosystem, thus documenting the goods and services derived from fishing. The ICES mixed fisheries considerations, which describes the consequences and options for management of mixed fisheries are part of these overviews. Mixed fisheries advice highlights the difficulty of reconciling the objective of maximum sustainable yield for all stocks and addresses the trade-offs between different management strategies. ICES has developed methods to include information on the impact of fisheries on the sea bed and the impact of bycatch of endangered, protected, or threatened species within the fisheries overviews. The fisheries overviews also describe the multispecies dynamics in each ecoregion, with fishing fleets interacting with variable fish community compositions.

Building the evidence base for EBM

The [ecosystem overviews](#) put fishing activities into the context of the trends and status of the marine ecosystem as a whole. The ecosystem overviews use qualitative methods to identify and focus on the top five priority human activities and resulting pressures that can be locally managed within each ICES ecoregion. ICES is currently developing quantitative methods to further assess these pressures. In many ecoregions, ICES considers that fishing contributes major anthropogenic pressures on the ecosystems. The approach of assessing activities, pressures, and state of the ecosystem provides the flexibility to monitor for cumulative effects of the pressures on the ecosystem. ICES is working with the regional sea commissions, OSPAR, HELCOM and ICES Member Countries to keep these overviews relevant to the knowledge needs of management.

In addition to these three blocks, ICES is regularly asked to provide bespoke advice on issues relating to EBFM and EBM, e.g. estimating ranges of maximum sustainable yield, pressure maps of fishing, assessing the status of information poor stocks, monitoring recreational fishing, assessing biodiversity of seals and cetaceans, commenting on the impact of aquaculture. ICES hosts and maintains the impulsive noise register, marine litter datasets (collected in conjunction with ICES coordinated surveys), a biodiversity portal (aimed at seals and bird populations) and the North Atlantic Vulnerable Marine Ecosystem (VME) portal which all provide a valuable resource to our partner environmental and fisheries organisations. They also facilitate the production of advice that are integrated into the overall framework for EBM in a strategic and responsive manner.

Engagement with society

People are central to EBM. Any process that engages with society needs to be transparent, adaptive, and inclusive. The evidence base and methodologies used by ICES to provide knowledge products are openly documented and available in the highest resolution that the underlying data sources allow. All major new innovations and advice are reviewed by independent experts. In addition, ICES processes are open to observer participation and training courses are offered to build the capacity needed to understand the science advice. ICES works hard to ensure the legitimacy and credibility of its advice. The “benchmark” is now widely used throughout ICES to enable stakeholder input into method development and knowledge acquisition. Industry/science partnerships feed information through to ICES products. ICES has working groups looking at the provision of goods and services, and its strategic initiative on the human dimension challenges ICES and its partners to incorporate trans-disciplinary approaches to the provision of knowledge for society. ICES also liaises with international bodies (such as regional advisory councils) and research projects to maintain relevance. ICES seeks to ensure that the provision of knowledge remains independent and yet also open and challengeable.

Summary

In the ICES Strategic Plan 2014-2018, ICES is committed to building a foundation of science around one key challenge: integrated ecosystem understanding. Part of this integrated approach is the implementation of EBM as a continuous and iterative process. The principles of EBFM and EBM are clear, and are being incorporated into every facet of ICES work across its data, science, and advisory programmes. EBM requires ICES to consider broader issues, where the impacts of marine sectors intersect and society needs information on trade-offs between such activities and with marine ecosystems. Regular reviews of progress are made to ensure the momentum of incorporating EBFM and developing methods for EBM are being maintained.