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EDITED BY
Caterina Maria Fortuna,
Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Italy

REVIEWED BY
Peter Wilhelm Linde,
Ministry of Foreign Affairs of Denmark, Denmark

*CORRESPONDENCE
Nicole Wienrich
nicole.wienrich@iass-potsdam.de

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The ecosystem approach to marine management in the Arctic: Opportunities and challenges for integration

Nicole Wienrich[1]*, Victoria Qutuuq Buschman[2,3], Catherine Coon[4], Susanna Fuller[5], Janos Hennicke[6], Christoph Humrich[7], Christian Prip[8] and Lauren Wenzel[9]

[1]Arctic Governance and Ocean Governance Group, Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany, [2]International Arctic Research Center, University of Alaska, Fairbanks, AK, United States, [3]Greenland Institute of Natural Resources, Nuuk, Greenland, [4]Department of the Interior, Bureau of Ocean Energy Management, Anchorage, AK, United States, [5]Oceans North, Halifax, NS, Canada, [6]Head of Division, Federal Agency for Nature Conservation, Putbus, Germany, [7]Department of International Relations and International Organization, University of Groningen, Groningen, Netherlands, [8]Senior Researcher, Fridtjof Nansen Institute, Lysaker, Norway, [9]National Marine Protected Areas Center, National Oceanic and Atmospheric Administration (NOAA), Silver Spring, MD, United States

Climate change is strongly impacting Arctic marine ecosystems, and the Arctic coastal communities whose identities, traditions and livelihoods are closely interconnected with the marine environment. The Ecosystem Approach (EA) is a promising approach for understanding and managing the occurring shifts in the Arctic marine ecosystems. Based on our analysis, we find that assessments conducted by international and regional instruments and institutions, most notably the Arctic Council, as well as the wealth of Indigenous knowledge present in the region, provide valuable starting points for the implementation of EA in the Arctic. Yet, mechanisms for translating knowledge into joint coordinated and integrated action in accordance with EA are currently lacking. Our analysis suggests that incremental steps can be taken now to promote the implementation of EA, while working to establish a more comprehensive governance framework. In our view, bottom-up initiatives may provide the most promising avenue for promoting the application of EA in the region under the current geopolitical circumstances. Support by civil society, Indigenous and conservation organizations, as well as global momentum will be necessary to coordinate, finance and elevate community-driven initiatives. Other opportunities we identify for advancing EA is to engage with sectoral management bodies and to advance EA through climate change adaptation measures.

KEYWORDS

ecosystem approach, ecosystem-based management (EBM), Arctic, Arctic Council, marine conservation, regional ocean governance, sectoral integration, multi-level integration

Introduction

Global climate change is transforming the Arctic. Melting sea ice, ocean warming, sea-level rise, and rapidly acidifying waters are altering the Arctic marine environment at an unprecedented rate and directly impact the Arctic coastal communities whose identities, traditions and livelihoods are closely interconnected with the marine environment (Meredith et al., 2019; AMAP, 2021). In addition, the loss of sea ice is allowing for the expansion of economic activities such as shipping, offshore oil and gas, and access to mining, affecting both the marine environment and the people living in the Arctic (Young, 2019; Balton and Zagorski, 2020). Against this background, there is an urgent need to understand and holistically manage the transformations in the Arctic marine environment.

The Ecosystem Approach (EA) is a promising approach in this regard as it provides a systematic method for assessing and managing the effects of multiple stressors affecting Arctic marine ecosystems. Through its inclusive, flexible and adaptive nature, EA is well-suited to take into account ecological, but also social and economic goals and address the rapid changes in the Arctic (Arctic Council, 2013a).

This article aims to provide an overview of the relevant EA instruments and frameworks at work, and the obstacles and opportunities for EA application in the Arctic marine environment. Based on the findings, recommendations on how to promote EA application in the Arctic are provided.

In the 2013 Kiruna Declaration, ministers of the Arctic States agreed to adopt the definition of EA as "Comprehensive, integrated management of human activities based on best available scientific and traditional knowledge about the ecosystem and its dynamics, in order to identify and take action on influences that are critical to the health of ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity" (Arctic Council, 2013b). As there is no universally accepted definition of EA, the above definition will be used as a starting point for guiding the discussions of this paper. EA and Ecosystem-based Management (EBM) are often used interchangeably (Long et al., 2015). As they do not substantially differ (see Agardy et al., 2011; Delacámara

FIGURE 1
Map of the Arctic region depicting the CAFF Arctic boundary as well as Large Marine Ecosystems (LME) identified by the Protection of the Arctic Marine Environment (PAME) Working Group of the Arctic Council for circumpolar EA application. Inuit Nanungat, major population centers and states' Exclusive Economic Zone (EEZ) boundaries are shown for context. IASS/Oceans North visualization based on PAME (2014); CAFF (2017); Flanders Marine Institute (2019); GRID-Arendal (2019); Crown-Indigenous Relations and Northern Affairs Canada (2019); GEBCO Compilation Group (2020); Copernicus Climate Change Service/ECMWF (2021a); Copernicus Climate Change Service/ECMWF (2021b).

et al., 2020), this paper will use the term EA for consistency, even when referring to papers that use the term EBM.

The aspect of integration is often stressed as one key aspect of EA (Long et al., 2015; Delacámara et al., 2020) and Lieberknecht (2020) proposed the following five categories of integration for Ecosystem-Based Integrated Ocean Management: integration of governance, integration of knowledge, integration of stakeholders, transboundary integration, and integration of system dynamics. Considering these integration categories, we address the following four categories in this analysis: 'vertical' integration across geographic scales from international to local, transboundary integration across administrative boundaries, 'horizontal' integration across sectors, and integration of scientific disciplines and knowledge systems.

We adhere to the delineation of the Arctic established by the Conservation of Arctic Flora and Fauna Working Group of the Arctic Council (CAFF). The CAFF boundary includes waters of the Russian Federation, Norway, Iceland, the Faroe Islands, Greenland, Canada, and the United States, as well as areas beyond national jurisdiction, including the Central Arctic Ocean (Figure 1).

'Vertical' integration across geographic scales from international to local

EA should be applied at the appropriate level and scale to the activities or threats being managed (Long et al., 2015). Depending on the ecosystem boundaries, this may require global or regional cooperation or might imply management by local communities (Delacámara et al., 2020). In the Arctic, a number of global, regional, national and local regimes apply with respect to the protection of Arctic marine ecosystems and the services they provide for Arctic communities.

On the international level, two key legal instruments of relevance to EA are the UN Convention on the Law of the Sea (UNCLOS) and the UN Convention on Biological Diversity (CBD). UNCLOS provides the overall legal framework for marine and maritime activities and includes some broad provisions on protecting the marine environment, although it does not explicitly include the EA concept. The CBD covers terrestrial as well as marine biodiversity and was the first international treaty to adopt EA as the primary framework for action under the Convention (CBD. 1995. COP 2 Decision II/8).

At the regional level, EA can first and foremost be advanced by creating context-specific platforms through which states, stakeholders and regional and global management organizations can communicate, coordinate, and collaborate in their efforts. The Arctic Council is the leading body for the cooperation and coordination among the Arctic states, Arctic Indigenous Peoples, and other actors on issues related to sustainable development and environmental protection in the Arctic. The Arctic Council has done extensive circumpolar work regarding EA. Main achievements include establishing an expert group on EA (2007), as well as elaborating on the principles of EBM (2013), the status of implementation of EA to management in the Arctic (2015), and guidelines for implementing EA to management in the Arctic (2017). Another regional instrument with relevance to EA in the Arctic is the OSPAR Convention, which has EA as a guideline, but is geographically limited to the North-East Atlantic (O'Hagan, 2020).

While the Arctic Council has provided a good knowledge base on EA, it is the national governments which are mostly responsible for the application of EA (Zagorski and Todorov, 2018). Except for Norway, no Arctic coastal state has so far developed an explicit national approach regarding the implementation of EA (Rudd et al., 2018). Several Arctic states have, however, established co-management programs to share responsibilities regarding marine management among Indigenous communities and governments. These programs are mainly present in the United States, Canada, and Greenland, whereas there are relatively few examples in Norway and the Russian Federation (Johnson et al., 2016). While not all co-management arrangements adopt EA as a framework, many of them reflect key principles of EA and offer opportunities to work towards EA. An example for this is provided by the Northern Bering Sea Climate Resilience Area. The designation of the area provides a mechanism for the more than 70 Tribes in the region to exercise self-determination and contribute to policy decisions facing the Northern Bering Sea. An U.S. Presidential Executive Order halts oil and gas development and allows commercial fishing only if agreed to by local indigenous communities (The White House, 2016; Steffen et al., 2021).

Transboundary integration across administrative boundaries

The transboundary nature of marine ecosystems calls for international cooperation and information exchange between the Arctic states as well as with regimes applying to areas beyond national jurisdiction (ABNJ).

Several transboundary assessments of the Arctic marine environment have been conducted. The CBD has been assigned the role of identifying and describing Ecologically or Biologically Significant Marine Areas (EBSAs) and conducted an Arctic regional workshop to identify EBSAs in Arctic waters within and beyond national jurisdiction. The working group on Protection of the Arctic Marine Environment (PAME) under the Arctic Council identified 18 large marine ecosystems (LMEs) which are meant to form the basis of EA implementation in the

Arctic (Figure 1). The International Council for the Exploration of the Seas (ICES), and the North Pacific Marine Science Organization (PICES) have been instrumental in supporting the development of integrated ecosystem assessments for different marine regions in the Arctic.

Yet, while assessments have been conducted across administrative boundaries, coordination between the Arctic states in the form of legally binding agreements remains challenging. These are currently restricted to the Agreement to prevent Unregulated High Seas Fisheries in the central Arctic Ocean (between the 5 Arctic coastal states and Iceland, Japan, China and the Republic of Korea), the Polar Bear Agreement (between the 5 Arctic Ocean coastal states) and the agreements on Arctic Search and Rescue and Cooperation on Marine Oil Pollution Preparedness and Response (between the 7 Arctic Council states, but not formally under the Arctic Council).

An example of species-related co-management across boundaries is the InuvialuitInupiat agreement which provides for cooperation by Indigenous institutions in Canada and the United States in the research and management of shared populations of polar bears in the southern Beaufort Sea (Joint Secretariat, 2017). In the Barents Sea, Norway and Russia cooperate on fisheries management within the Joint Norwegian-Russian Fisheries Commission (JNRFC). In the Bering Sea, Russia and the United States cooperate regarding matters relating to fisheries, maritime safety and environmental stewardship. Since 2014, there has been little contact between the United States and Russian governments in response to Russian actions in Ukraine (Pincus, 2020). Cooperation between Norway and Russia in the Barents Sea has also been challenged by the 2022 invasion of Ukraine by Russia. The latter event also caused the pausing of cooperation within the Arctic Council (Jonassen, 2022), indicating that political circumstances pose a major challenge for transboundary integration in the Arctic.

Ongoing efforts to manage and conserve Pikialasorsuaq,a large polynya (an area of open water in sea ice) located between Nunavut and Greenland is an example of ongoing efforts towards transboundary integration. The Inuit Circumpolar Council (ICC) initiated the Pikialasorsuaq Commission to conduct consultations and give Inuit communities in Canada and Greenland a voice for their vision for the area. As a result of the consultations, the Pikialasorsuaq Commission recommended establishing an Inuit-led management regime for the area which would include a protected area comprised of Pikialasorsuaq itself, a larger management zone, and the creation of a free travel zone for Inuit across the region (Pikialasorsuaq Commission, 2017). Negotiations between national and regional bodies have been ongoing since 2017, yet little progress has been made on formalizing a management regime for Pikialasorsuaq, showing the difficulty of bringing together different governance frameworks and regulations in a coherent manner.

With regards to ABNJ, negotiations are currently underway under the umbrella of UNCLOS on the establishment of an international legally binding instrument on biodiversity in areas beyond national jurisdiction (referred to as BBNJ), which foresees EA as guidance. At the time of writing, the modalities on identification, designation, and management of area-based management tools, including marine protected areas, are still under negotiation, but the new instrument is expected to fill current governance gaps by providing a legal framework for a future protective regime for ABNJs, including the Central Arctic Ocean (De Lucia, 2019).

'Horizontal' integration across sectors

EA requires coordination efforts and collective action among different rights holders, stakeholders and policy domains (Rudd et al., 2018). In the Arctic, many sector-based organizations and agreements have been established to provide advice and coordinate the management of certain species or activities. Species-focused organizations and agreements include regional fisheries management organizations, as well as the International Whaling Commission (IWC), the North Atlantic Marine Mammal Commission (NAMMCO), the Convention of Migratory Species (CMS), and the Agreement on the Conservation of Polar Bears. Activity-based organizations and agreements include the International Maritime Organization (IMO), as well as conventions dealing with pollutants, waste, seabed mining, safety at sea, oil spill preparedness, conducting science in the Arctic, etc.

As mentioned previously, the Arctic Council supports the synthesis of information regarding the marine ecosystem through assessments. However, it does not have a management mandate and thus cannot implement EA. In addition, some issues central to EA, such as fisheries management, are not currently being dealt with by the Arctic Council.

At the national level, Norway provides an example for an overall approach to EA across sectors (Olsen et al., 2016; Rudd et al., 2018; Lieberknecht, 2020). The system is based on the development of integrated regional management plans for the Norwegian Seas. These plans are developed under the direction of an Interministerial Steering Committee which is led by the Ministry of the Environment and includes representatives of other relevant ministries. Implementation of the plans is carried out by representatives from relevant government agencies and research institutions in the so-called Management Forum and three permanent working groups (Lieberknecht, 2020).

In Canada and the United States, routine horizontal integration techniques, such as inter-departmental committees, regional associations of governors, etc. exist, but these may not always be sufficient to support the integration necessary for EA (Rudd et al., 2018). There are however efforts to provide for cross sectoral integration in specific areas. In Canada for instance, the ongoing establishment and management planning processes for

Talluruptiup Imanga and Tuvaijuittuq protected areas is expected to result in the prohibition of oil and gas, mining, dumping and bottom trawling, pending agreement among Inuit governance agencies and the Canadian government. Management planning processes for the protected areas is also expected to enable better cross-sectoral management of shipping, marine mammal protection, and community-based fisheries (Government of Canada, 2022a; Government of Canada, 2022b).

Integration of scientific disciplines and knowledge systems

As described in the Malawi Principle 11 developed under the CBD, EA should consider all forms of relevant information, including scientific, local, and Indigenous knowledge, innovations, and practices.

In the Arctic, Indigenous communities have long established knowledge systems that provide both a holistic world view and detailed knowledge of the environment. These knowledge systems, referred to as Indigenous Knowledge, or traditional ecological knowledge, shape daily life including traditional and subsistence practices (Heeringa et al., 2019). In response to increasing change across their homelands, many Arctic communities are initiating or participating in community-based monitoring (CBM) programs. CBM efforts often draw on both Indigenous and scientific knowledge, approaches, and methodologies and may support local or national decision making. An online atlas has been created to provide an overview of many CBM projects (Danielsen et al., 2020). The atlas forms part of the broader Sustaining Arctic Observing Networks (SAON) initiative which promotes, coordinates and supports observations in the Arctic.

Efforts towards knowledge partnerships can be observed among many institutions, including the Arctic Council working groups, ICES, PICES, as well as among sectoral institutions. The North Pacific Fishery Management Council (NPFMC) in the United States, for instance, has begun managing the Bering Sea LME based on EA through the Bering Sea Fisheries Ecosystem Plan. This plan recently has applied a module to incorporate local and Indigenous knowledge and food security perspectives (NPFMC, 2019).

Despite these efforts, the wealth of Indigenous Knowledge and co-production of knowledge efforts present in the Arctic is not always considered in decision making (Yua et al., 2022). The prioritization of Indigenous perspectives, values, and ways of life have been historically hampered by researchers', managers', and policy makers' complicity in perpetuating historical injustices such as the displacement and exclusion of Indigenous Peoples and their practices within protected areas and the misuse of Indigenous Knowledge in ways that have limited sovereignty and self-determination, and in some cases, have even led to the criminalization of Indigenous Peoples in their own homelands (Burnett et al., 2016; Bruno, 2017; Moola and Roth, 2018). In addition, scientific research has often played a role in justifying management decisions which were imposed on communities without their participation or consent, especially regarding wildlife management (Johnson et al., 2016; ICC Alaska, 2020).

In an attempt to provide guidance for researchers, decision-makers and others on how to consult and cooperate with of Inuit, the ICC has developed Circumpolar Inuit Protocols on Equitable and Ethical Engagement (or EEE Protocols) which involved Inuit from across Alaska, Canada, Greenland, and Chukotka (ICC, 2021; ICC, 2022b). In Canada the Inuit Tapiriit Kanatami has developed a National Inuit Strategy for Research, aiming inter alia to advance Inuit governance in research, enhance the ethical conduct of research, align funding with Inuit research priorities, ensure Inuit access, ownership, and control over data and information; and build capacity (ITK, 2018).

Discussion

International and regional instruments and institutions play an important role in providing transboundary assessments for the management of the Arctic marine environment. The knowledge base provided by the Arctic Council working groups, the assessments from science organizations such as ICES and PICES, as well as the wealth of Indigenous Knowledge present in the region are valuable starting points for the implementation of EA in the Arctic.

Strengthening Arctic regional cooperation on management of protected areas, science and restoration, such as the development of ecologically connected networks of protected areas can help build regional partnerships to implement EA.

However, mechanisms for translating the knowledge into joint action are currently lacking. The overall governance framework for Arctic marine areas provides a fragmented picture with international and regional instruments that are restricted in their capacity to support implementation of EA in the Arctic due to their limited geographical and/or substantial scope. A strengthened mechanism for marine governance in the Arctic in the form of a regional seas program has been proposed but failed to garner political support among the Arctic Council member states (Prip, 2019). At the national level, a lack of political will appears to be the key factor which prevents the more comprehensive application of EA (see Rudd et al., 2018).

Furthermore, changes in the geopolitical environment, such as those created by the Russian invasion of Ukraine followed by the suspension of work of the Arctic Council, pose obstacles to the progress of EA in the region which will make it more challenging to overcome the presented barriers to achieving

horizontal, vertical, and transboundary integration, as well as integration of scientific disciplines and knowledge systems.

Against this background of lack of political will at the national level, regional mechanisms not in place, and, most recently, geopolitical unrest, community-based, bottom-up initiatives may currently provide one of the most promising avenues for promoting EA application in the region. Establishing and supporting Indigenous-led and co-management arrangements for specific areas provides a mechanism to engage in co-production and bring Indigenous Knowledge into decision making. With support from civil society, Indigenous and conservation organizations may be able to coordinate and elevate community-driven initiatives that reflect an EA approach (ICC Alaska, 2016). Another opportunity for advancing EA is to engage with sectoral management bodies, such as those responsible for fisheries.

At the same time, global momentum brought about by the CBD Post-2020 Global Biodiversity Framework, the BBNJ negotiations, the ongoing UN Decades (2021-2030) on "Ocean Science for Sustainable Development" and "Ecosystem Restoration", and several ocean as well as climate change related conferences are opportunities to raise awareness about the need for EA and secure financial support for co-management initiatives.

As another avenue, climate change adaptation planning, which addresses current and expected impacts experienced across multiple sectors and scales, provides opportunities for advancing EA in the Arctic.

All the identified opportunities are incremental steps that can be taken to promote EA implementation while working to establish a more comprehensive governance framework capable of achieving integration across disciplines and knowledge systems as well as horizontal, vertical and transboundary integration.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

The production of the manuscript was coordinated by NW. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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