Status of Implementation

of the Ecosystem Approach to Management in the Arctic

May 2017

PAME
Protection of the Arctic Marine Environment

ARCTIC COUNCIL

Status of Implementation of the Ecosystem Approach to Management in the Arctic

Report from the Joint Ecosystem Approach Expert Group

As delivered through PAME to Senior Arctic Officials

May 2017

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Preface

PAME established an Ecosystem Approach Expert Group in 2007 that was broadened as a Joint PAME/AMAP/CAFF/SDWG Ecosystem Approach Expert Group (EA-EG) in 2011. One of the products to be produced as part of the 2015-2017 work plan was a report, *Status of Implementation of the Ecosystem Approach to Management in the Arctic*. The EA-EG convened an International Science and Policy Conference on "The Ecosystem Approach to Management: Status of Implementation in the Arctic" in Fairbanks, Alaska, 23-25 August 2016. The outcome of the conference is used as part of the basis for this report.

This report is structured by noting first the agreed definition and principles of the Ecosystem Approach to Management (EA), followed by a short history of EA work under the Arctic Council. Next, two of the main achievements of the EA-EG is summarized: a framework for EA implementation, and the division of the Arctic marine area into 18 Large Marine Ecosystems. Then follows a description of the EA or EBM recommendations from Kiruna (2013) and the follow-up work by AC working groups and specifically by the EA-EG. The main outcome of the Fairbanks conference is described along with a section on roles the AC can play in facilitating EA implementation by Arctic states. Some notes on national EA implementation is then provided before a final section with conclusions and next steps.

One concept – many terms

The Ecosystem Approach to Management (EA) is known by several names, such as Ecosystem management, Ecosystem-based Management (EBM), or Integrated Ocean Management. These are all the same; EA and EBM are synonymous terms with the same meaning.

Applying the EA (EBM) in specific sectors of human activities, such as fisheries, introduce additional terminology: ecosystem approach to fisheries, ecosystem-based management of fisheries, etc. This illustrates the two 'dimensions' of the EA: a 'horizontal' dimension with integration across sectors of human activities (e.g. shipping, fisheries, oil and gas, etc), and a 'vertical' dimension within a sector such as fisheries, or oil and gas activities.

Definition and principles

The Arctic Council at Kiruna in 2013 (see below) adopted a definition of the EA (or EBM):

Ecosystem-based management is the 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.

This definition, which has also been used in European policy context (e.g. OSPAR and HELCOM), makes it clear that it is the broad 'horizontal' sense which is meant: '*the comprehensive, integrated management of human activities*' across sectors. To be consistent with the definition, management measures based on ecosystem considerations within a single sector (e.g. 'ecosystem approach' to

fisheries) must be part of a wider framework aiming to achieve '*sustainable use of ecosystem goods and services and maintenance of ecosystem integrity*'.

Along with the definition, the Arctic Council in 2013 also adopted a set of principles which are implied in the EA . The principles included aspects such as recognizing that humans are an integral part of the ecosystem, that EA is place-based (with areas identified by ecological criteria) and seeks to balance conservation and sustainable use, and that it addresses combined and incremental effects of human activities ('cumulative' impacts).

History of EA (or EBM) in the Arctic Council

The EA was recognized as a core principle in the Arctic Marine Strategic Plan developed by PAME and adopted by the Arctic Council in 2004. From there, there has been a line of activities and projects that is summarized in (Table 1). PAME established an EA expert group (EA-EG) in 2007 that was broadened with participation of AMAP, CAFF and SDWG in 2011. The EA-EG has developed a framework for EA implementation and revised the map of Arctic Large Marine Ecosystems (LMEs) that was initially prepared by PAME in 2006 as a working map. The EA-EG has completed five workshops between 2011 and 2015 on the topics of LME boundaries, EA framework, data issues, Beaufort and Barents case studies, and ecological objectives, respectively. In August 2016, the EA-EG convened an international conference on the status of EA implementation in the Arctic, held in Fairbanks, Alaska. Workshop reports and progress reports from EA-EG are available on the PAME web site. For readers not online, http://pame.is/index.php/document-library/ea-documents-and-reports.

PAME and SDWG ran the project '***Best Practices in Ecosystem-based Ocean Management in the Arctic***' (BePOMAr, 2007-2009) which summarized information on developments relevant to EA (or EBM) in Arctic States as seven case studies, while an additional case study presented an indigenous perspective on the EA issues. BePOMAr identified eight core elements that characterize the EA, and drew five conclusions regarding best practices for implementation.

PAME carried out the project '***Arctic Ocean Review***' in two phases, 2009-2011 and 2011-2013 (PAME 2013). The AOR project constituted a review of potential opportunities and options to strengthen global and regional instruments, measures and arrangements in order to manage activities in the Arctic marine environment within respective sectors. The AOR Final Report had a chapter on *Ecosystem-based Management* (Ch. 7), which recognized that EA provides a coordinated and integrated approach to achieve all four goals of the Arctic Marine Strategic Plan (AMSP 2004). The AOR made two recommendations; one on use of the six element EA framework in the AC, and the second on promoting a common understanding and sharing of lessons learned through periodic review across Arctic LMEs (PAME/AOR 2013, recommendations 20 and 21, page 5).

A high-level ***EBM expert group (EBM-EG)*** was established by the ministers in Nuuk in 2011, and the group presented their report to the SAOs and the ministerial meeting in Kiruna in 2013. The group reviewed concepts, definitions and principles for EBM (or EA). In addition to the definition and principles for EA (or EBM), the EBM-EG made several recommendations for activities to be

undertaken under headings of *Policy and implementation*, *Institutional*, and *Science and information* (Table 2); see EBM-EG 2013.

The EA recommendations from Kiruna were followed-up under the Canadian Chairmanship, when the SAOs requested information from each Working Group regarding their implementation of the EBM recommendations. The information was compiled by the Arctic Council Secretariat and presented at the SAO meeting in October 2014. At the ministerial meeting in Iqaluit, Canada, in April 2015, the ministers stated (paragraph 34):

"***Recognize*** *the multiple stresses on the Arctic environment and the need for an ecosystem-based approach to management,* ***welcome*** *and continue to* ***encourage*** *progress toward implementation of the ecosystem-based management recommendations approved by Ministers in Kiruna, and* ***request*** *the development of practical guidelines for an ecosystem-based approach to the work of the Arctic Council be completed as soon as possible*".

A workshop was held in Trondheim, Norway, in December 2014 to discuss follow-up activities of the Kiruna EA recommendations, status of their implementation, linkages with activities of the Arctic Council Working Groups, and opportunities for advancing EBM during the period of the U.S. Chairmanship (2015-2017). One follow-up activity was the international conference in Fairbanks in August 2016 to review status of EA implementation. The present report gives a summary of where we are with regard to national implementation and supportive actions by the Arctic Council to facilitate EA implementation in the Arctic.

Table 1. Overview of work on the Ecosystem Approach to Management (EA) (or Ecosystem based Management – EBM) in the Arctic Council.

Year	Activity	Product
2004	Adopting the EA as an overarching principle	Arctic Marine Strategic Plan – AMSP 2004
2006	Delineating and adopting Arctic Large Marine Ecosystems (LMEs)	Working map of 17 Arctic LMEs
2007	PAME establishes an EA expert group (EA-EG)	
2007-2009	PAME and SDWG carry out the project '*Best Practices in Ecosystem-based Ocean Management in the Arctic*' (BePOMAr)	BePOMAr report (Hoel 2009)
2009-2011	PAME carries out the project 'Arctic Ocean Review' in two phases – I (2009-2011) and II (2011-2013)	The Arctic Ocean Review PHASE I Report (2009-2011)
2011	The EA-EG broadened to include AMAP, CAFF and SDWG	
2011	First EA workshop, Tromsø, Norway (LME boundaries)	Workshop Report

2011-2013	'Arctic Ocean Review', phase II	The Arctic Ocean Review Project, Final Report, (Phase II 2011-2013)
2011-2013	Ministers at Nuuk (2011) established an EBM expert group (EG) who works over a two-years period with 3 meetings to deliver a report with EA recommendations (definition, principles, and activities)	Report 'Ecosystem-Based Management in the Arctic'
2012	2nd EA workshop, Stockholm, Sweden (EA framework)	Workshop Report
2012-2013	Revision and adoption of the map of Arctic Large Marine Ecosystems (LMEs)	Report 'Large Marine Ecosystems (LMEs) of the Arctic area. Revision of the Arctic LME map'
2013	3rd EA workshop, Reykjavik, Iceland (Data issues)	Workshop Report
2013	Ministers at Kiruna (2013) adopts the EA recommendations from the EBM EG	Kiruna Ministerial Declaration
2014	Workshop on Implementing Recommendations for Ecosystem-Based Management in the Arctic (Trondheim, Norway)	Workshop report
2014	4th EA workshop, Vancouver, Canada (Beaufort Sea LME)	Workshop Report
2015	5th EA (Bergen) Workshop on Setting Ecological Objectives	Workshop Report
2015	Request from Ministers at Iqaluit (2015) for the development of practical guidelines for an ecosystem-based approach to the work of the Arctic Council	Iqaluit Ministerial Declaration
2016	First PAME/ICES WGICA Meeting- Copenhagen	Meeting Report
2016	International conference on status of implementation of the Ecosystem Approach to Management of Arctic Ecosystems, Fairbanks, Alaska	Report 'Status of implementation of the Ecosystem Approach to management (EA) in the Arctic: a conference summary'.

Framework for EA implementation

The EA-EG has developed a framework for implementation of the EA (or EBM) to management of Arctic marine and coastal environments which consists of six related elements (Fig. 1):

1) Identify the geographic extent of the ecosystem;

2) Describe the biological and physical components and processes of the ecosystem,

3) Set ecological objectives that define sustainability of the ecosystem,

4) Assess the current state of the ecosystem (Integrated Ecosystem Assessment),

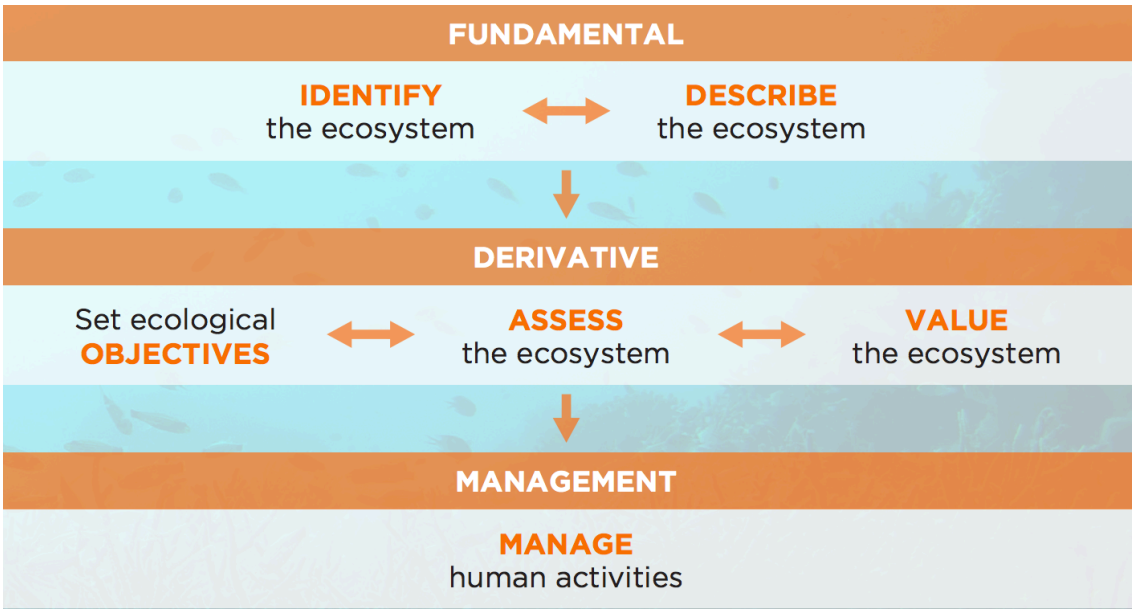
5) Value the cultural, social and economic goods produced by the ecosystem,

6) Manage human activities to sustain the ecosystem.

While they are numbered, the elements do not necessarily need to be sequential although they eventually are linked in an iterative and adaptive operational management cycle.

The first step is to identify the ecosystem using ecological criteria (rather than administrative boundaries). Focusing on the functions, health and integrity requires that the ecosystem be defined in spatial and geographical terms. The identified Arctic LMEs represent this first step, which can be said to have been taken for the marine and coastal environment.

Figure 1: A framework for implementation of the EA (or EBM) to management of Arctic marine and coastal environments.



The next element is to describe the biological and physical components and processes of the defined ecosystem (e.g. LMEs) including humans and their activities. A key to successful EA (or EBM) management is that the ecosystem is understood, in the sense of how it is constructed and how it works. The focus here is therefore on the key characteristics of the ecosystem (both in general and specific terms), which is the epitome of how we understand the particular ecosystem with its underwater landscape, ocean currents, and drifting, resident, and migratory biota ranging from bacteria and viruses to marine mammals. Modern scientific and Traditional and Local Knowledge (TLK) are both sources of information that can be used to define our ecosystem understanding.

There are many projects and assessments by Arctic Council working groups (e.g. AMAP and CAFF) that contribute substantially to descriptions and understanding of the Arctic ecosystems.

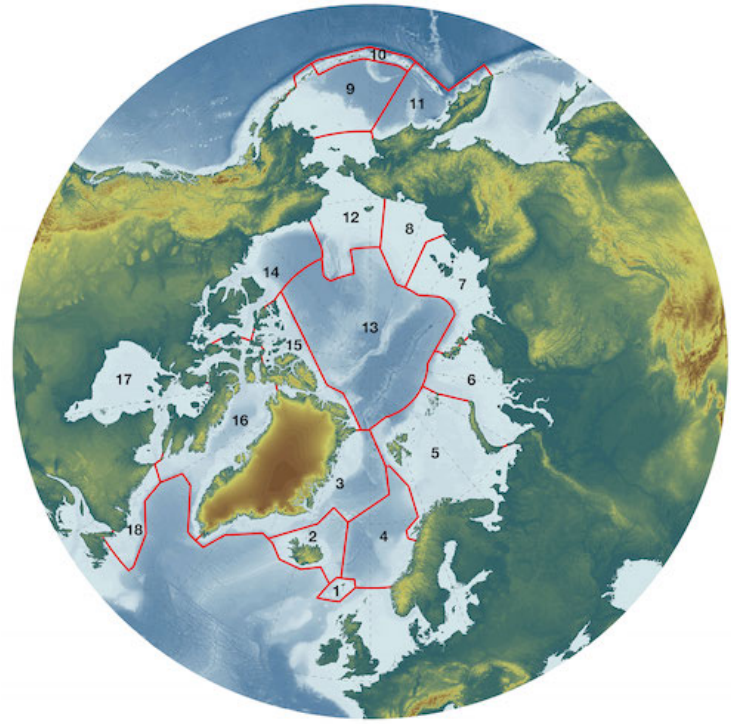
The third element is to set ecological objectives that collectively as a suite or ensemble define the line (or envelope) of sustainability that runs through the ecosystem. Finding the holistic suite of ecological objectives which defines sustainability is scientifically very demanding, not the least because the ecosystems are highly dynamic and changing (now also due to climate change), which makes it difficult to pin down reference 'points' and targets used as 'road signs' on management 'motorways'. Nevertheless, what is difficult is not impossible, and the task of setting ecological objectives as part of EA implementation should be given high priority.

The fourth element is to carry out an integrated assessment of the current state of the ecosystem, including pressures and impacts from human activities, both individually and combined as cumulative effects. This is now commonly called Integrated Ecosystem Assessment (IEA), and approaches and methodology for doing IEA are being developed and tried in several institutional contexts (e.g. by NOAA in the USA, and the International Council for Exploration of the Sea (ICES) for the North Atlantic. Conducting IEA is the key element of an operational EA management system. It requires monitoring results, which provide updated information on the changing states of ecosystem components and processes (including human activities), and it provides the basis for scientific advice for adaptive management measures. The EA EG has pursued international understanding of how to conduct IEA in the Arctic and adjacent areas, most recently through helpng to establish and lead the ICES/PAME working group on integrated ecosystem assessment in the central Arctic Ocean, WGICA.

The fifth element on valuation of ecosystem goods and services is one where limited work has been done so far. Taking the full economic picture of human developments into account, including the downside in the form of costs associated with environmental degradation and loss of biodiversity, is an important part of what has been called 'greening of the economy'. On the other hand, there are spiritual (religious) and cultural values that perhaps should not be equated with money but which nevertheless need to be brought into the 'equation' when options for future development are considered. The basic value systems may differ substantially between Indigenous Peoples and 'western' societies, which needs to be recognized up front.

The final element is the management decisions to regulate human activities in ways that provide benefits from sustainable use of resources while achieving or maintaining the ecosystem in good 'health' (where its integrity is maintained). What is good health (or good environmental status, as it is called in EU legislation) is defined in an operational sense by the ecological objectives (element 3) and its achievement is assessed in the IEA in element 4. The management decisions and measures need to be responsive and adaptive to the changing conditions in the ecosystem as well as in the human populations that lives in and depends on the ecosystem.

Figure 2: Map of the 18 Arctic Large Marine Ecosystems, LMEs, as adopted by the Arctic Council at the Kiruna ministerial in 2013.



The Arctic marine and coastal environment has been subdivided as 18 Large Marine Ecosystems (LMEs). They are identified based on ecological criteria and are meant to be units of space or geography for applying the EA to management. Identifying the LMEs fulfills the first step in the EA framework and allows practical implementation to proceed.

The 18 Arctic LMEs range in size from 0.1 (Faroe Plateau) to 3.3 (Central Arctic Ocean) million km^2, with most of them having areas of 0.5-1.5 million km^2.

Table 2. LME's sizes and national areas.

Nr.	Name of LME	Area (million km^2)	National areas	High Seas
1	Faroe Plateau LME	0.11	KoD	
2	Iceland Shelf and Sea LME	0.51	IS, KoD	
3	Greenland Sea LME	1.20	KoD, NO	
4	Norwegian Sea LME	1.11	KoD, NO, IS, UK	X

5	Barents Sea LME	2.01	NO, RU	X
6	Kara Sea LME	1.00	RU	
7	Laptev Sea LME	0.92	RU	
8	East Siberian Sea LME	0.64	RU	
9	East Bering Sea LME	1.38	US	X
10	Aleutian Islands LME	0.22	US	
11	West Bering Sea LME	0.76	RU	X
12	Northern Bering-Chukchi Seas LME	1.36	RU, US	
13	Central Arctic LME	3.33	CAN, KoD , NO, RU	X
14	Beaufort Sea LME	1.11	CA, US	X
15	Canadian High Arctic-North Greenland LME	0.60	CAN, KoD	
16	Canadian Eastern Arctic-West Greenland LME	1.40	CAN, KoD	
17	Hudson Bay Complex LME	1.31	CAN	
18	Labrador-Newfoundland LME	0.41	CAN	

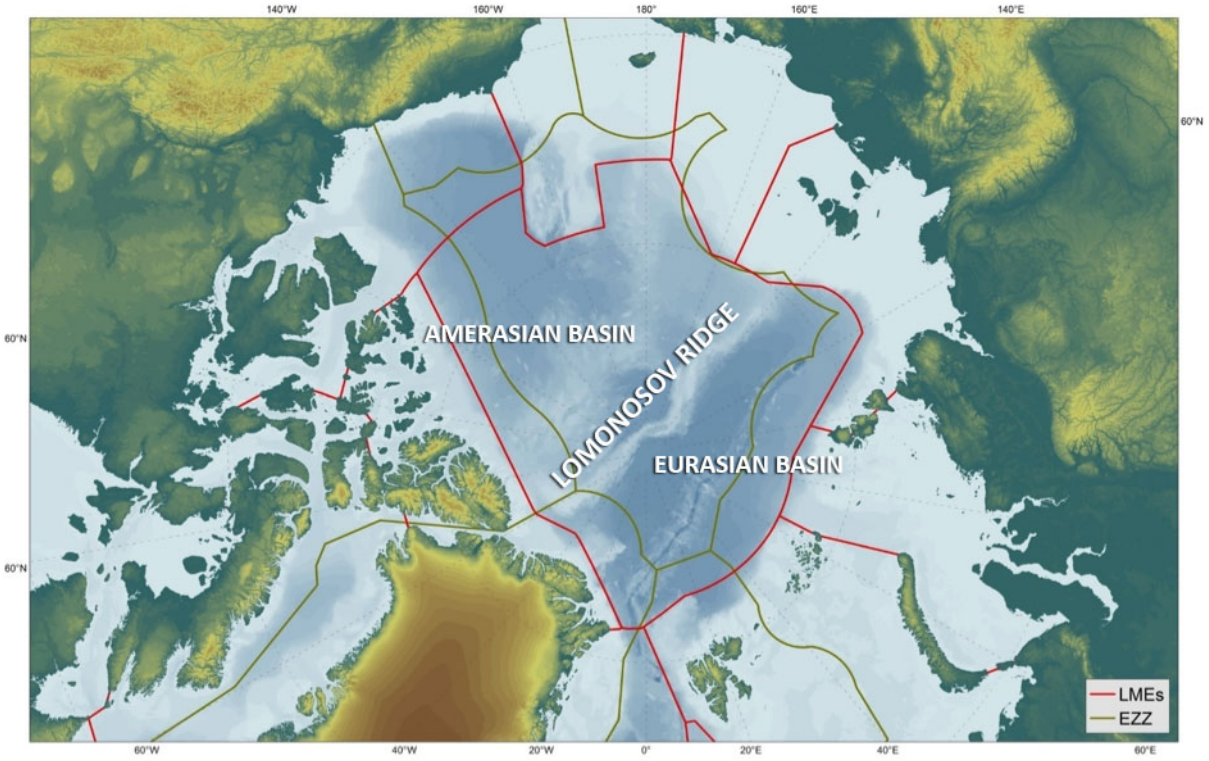
Nine of the 18 LMEs lie fully or mostly within the area of national jurisdiction of one country (Faroe Plateau LME in Kingdom of Denmark, Hudson Bay LME and Labrador-Newfoundland LME in Canada; Kara Sea, Laptev Sea, East Siberian Sea, and West Bering Sea LMEs in the Russian Federation, and the East Bering Sea and Aleutian Islands LMEs in the USA). The remaining nine LMEs are transboundary between two or more countries. Examples of shared LMEs are the Northern Bering-Chukchi Sea LME between Russia and USA, the Beaufort Sea LME between USA and Canada, the Canadian Eastern Arctic-West Greenland LME and the Canadian High Arctic-North Greenland LME between Canada and the Kingdom of Denmark/Greenland, and the Barents Sea LME between Norway and Russia.

High Seas areas of international waters (areas beyond national jurisdiction; see Fig. 2) are found in nine of the LMEs, including the 'Doughnut Hole' in the East and West Bering Sea LMEs, the 'Banana Hole' in the Norwegian Sea LME, and the 'Loophole' in the Barents Sea LME. Most of the High Seas area in the central Arctic Ocean is included in the Central Arctic Ocean LME (Fig. 2) except for portions of the Beaufort Sea LME, Northern Bering-Chukchi seas LME, East Siberian Sea LME, and Laptev Sea LME (Fig. 2). In addition to High Seas, the Central Arctic Ocean LME includes areas of Exclusive Economic Zones of Canada, Kingdom of Denmark/Greenland, Norway and Russia. The

shelves and slopes surrounding the basins of the central Arctic Ocean are parts of the surrounding shelf LMEs with one notable exception. The outer shelf and slope region of the Northern Bering-Chukchi Sea LME, including the protruding geological structures, the Northwind Ridge and the Chukchi Plateau, extends beyond areas of national jurisdiction into the High Seas.

LMEs represent an appropriate scale for assessing the structural and functional integrity of ecosystems, including the separate and cumulative impacts of human activities, as part of IEAs. The boundaries of LMEs are open, with fluxes of water, plankton, and contaminants, and migrations of fish, birds and mammals, across them. The fluxes and migrations across the boundaries are an important part of the characteristics of each LME. Ecology and humans operate on all scales from very small to very large, and scales and scale integration are key issues from both scientific and management perspectives. Use of LMEs offer an orderly way of dealing with scales, addressing larger scale drivers such as climate change and long-range transport of contaminants, and smaller-scale issues related to habitats, protected areas, human settlements, industrial development projects, and more.

Figure 3: Map of the Central Arctic Ocean LME (red line) and the boundaries of national jurisdiction over marine waters of Canada, Russia, Norway, Greenland (Kingdom of Denmark) and USA (brown line).



Implementing the EA is primarily a national responsibility of Arctic states within their areas of national jurisdiction. The transboundary LMEs calls for management cooperation between states with areas of national jurisdiction within an LME. An example is the cooperation between Norway and Russia for management of living resources and the environment of the Barents Sea, where

major fishery resources are shared stocks according to UNCLOS and managed jointly based on advice from ICES.

The Arctic LMEs are contiguous and make up all the space of coastal and marine environment in the Arctic area as used in the Arctic Council. Boundary conditions are part of the system characteristics of adjacent LMEs, and what goes on in one LME (ecologically and management-wise) affects conditions in other adjacent and contiguous LMEs. This necessitates cooperation among Arctic states in using LMEs as management units for applying the EA.

Kiruna Recommendations

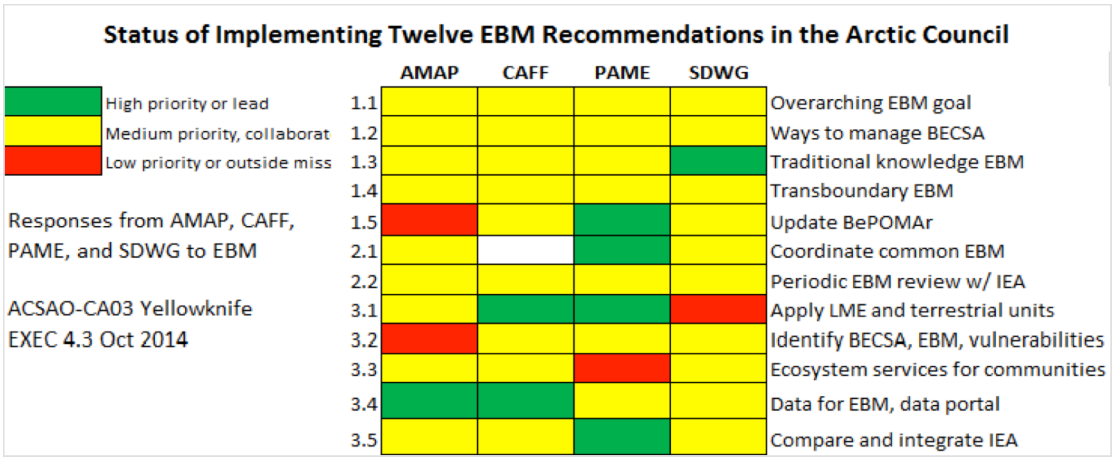
The EBM expert group (see Table 1) made 12 recommendations for activities that could promote the application of EA (or EBM) in the Arctic. The recommendations are listed in Table 3. with numbering according to three subheadings.

Table 3. 'Kiruna EBM recommendations'. Recommendations from the EBM expert group (2013) on activities that could promote the application of EA (or EBM) in the Arctic.

No.	Recommendation
1.	***Policy and implementation***
1.1	Develop an overarching Arctic EBM goal, derived from established Arctic Council goals and visions, and provide guidance on how to develop and operationalize objectives supporting this goal.
1.2	Explore ways in which Arctic States can cooperate to advance conservation and management of biologically, ecologically, and culturally significant areas.
1.3	Develop and adopt a policy and best practices for incorporating traditional knowledge into EBM activities as appropriate.
1.4	Encourage initiatives between two or more Arctic States to advance implementation of EBM in the Arctic and demonstrate how knowledge is collected, shared, processed and used to contribute to EBM in the Arctic.
1.5	Review, update and adjust the Observed Best Practices in Ecosystem-based Ocean Management in the Arctic, endorsed by the 2009 Arctic Council Ministerial, to be applicable to all environments, including marine, coastal and terrestrial.
2.	***Institutional***
2.1	Identify a lead to assure coordination of a common approach to the work of the Arctic Council on EBM in the Arctic and ensure appropriate reporting of progress to the Senior Arctic Officials.
2.2	Institute periodic Arctic Council reviews of EBM in the Arctic to exchange information on integrated assessment and management experiences, including highlighting examples from Arctic States.
3.	***Science and Information***

3.1	Encourage the use of the revised map of 17 Large Marine Ecosystems to inform EBM implementation; and explore the development of terrestrial assessment units (landscape equivalents to LMEs) based upon ecological criteria or existing ecoregions.
3.2	Identify biologically, ecologically, and culturally significant areas in the coastal, marine and terrestrial environments, and consider EBM-related needs for these areas. Identify the coastal, marine and terrestrial areas most vulnerable to human impacts.
3.3	Assess the value of significant Arctic ecosystem services relevant to the well-being of local communities and regional economies, and those of particular global significance.
3.4	Enhance access to, and use of, the multidisciplinary data required for the implementation of EBM by building upon ongoing work in the Arctic Council to contribute to an Arctic Council data portal.
3.5	Exchange information and experiences with integrated assessments of ecosystem status, trends and pressures for coastal, marine, and terrestrial areas and provide guidance on approaches for integrating existing assessments.

Figure 4: Degrees of engagement of Working Groups in implementing the EBM recommendations from Kiruna (2013) based on the responses tendered by Working Groups to SAOs at their meeting in Yellowknife in October, 2014. (As the analysis was presented to stimulate workshop discussions, the degrees of commitment were not officially vetted through the Working Groups, hence the degree of priority for each recommendation may not accurately reflect levels of engagement.)

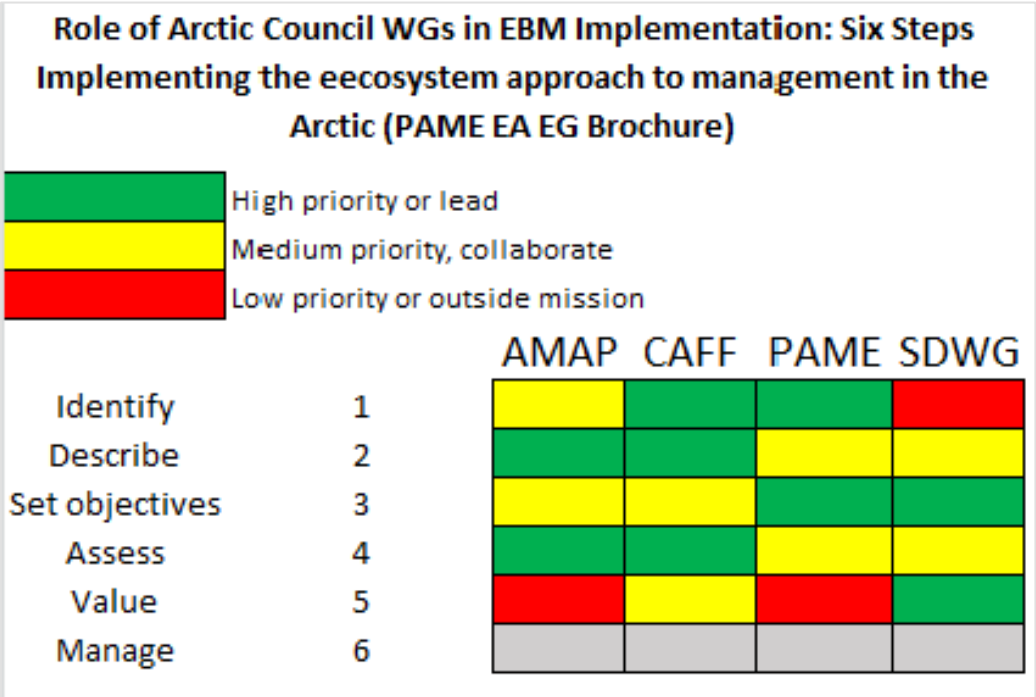


A workshop in December 2014 (Trondheim) was organized to evaluate the extent of progress on the 12 recommendations of the Kiruna EBM Report, and to formulate recommendations on opportunities and actions to further their implementation. Based on the information compiled by the Arctic Council Secretariat, an assessment of the degree of engagement by four Arctic Council Working Groups (AMAP, CAFF, PAME, and SDWG) in the context of the 12 EBM recommendations was presented (Fig. 4).

The outcomes of the workshop identified the need for ongoing collaboration among the four working groups represented at the workshop (PAME, CAFF, AMAP, SDWG) in order to achieve more

effective implementation of the EA (Fig. 4). When grouped according to the elements of the EA implementation framework, it is apparent that the four working groups need to work cooperatively in order to be effective at supporting implementation (Fig. 5).

Figure 5: Roles of Arctic Council Working Groups in implementing EA (or EBM) in the Arctic in terms of the six elements of the implementation framework developed by the Joint (PAME/AMAP/CAFF/SDWG) Ecosystem Approach Expert Group. Gray tone indicates that Working Groups do not have a direct role in managing Arctic resources, but individual Arctic states and individual Working Group members may have such roles.



Two fundamental barriers to EA implementation were identified and discussed at the Trondheim workshop. A lack of progress on the Kiruna recommendation of better coordination among the Working Groups on EBM was identified as a significant barrier to implementation. The experts generally agreed that a top priority action item that the AC implement a process or function or designate a lead to improve EBM coordination among Arctic Council Working Groups and Member States. An additional implementation barrier was identified as the instability of networks that gather the long term observations on biological and environmental variables that are essential to integrated ecosystem assessment, IEA.

Discussions at the Trondheim workshop also focused on some of the other barriers and opportunities going forward and generated a set of EA (or EBM) Action Items, which are important next steps that would not take place without coordinated effort (Table 4).

Table 4. 'Trondheim workshop'. Nine action items identified at the workshop in Trondheim, December 2014, to review progress towards implementation of the Arctic Council's recommendations for advancing EA (or EBM).

No.	Action item
1	Identify a lead to ensure coordination across Arctic Council Member States, PPs, Working Groups, and partners.
2	Ensure Working Group work plans address implementation of the 12 EBM recommendations, as appropriate.
3	Following a review of Arctic Council and non-Arctic Council assessments of ecosystems, provide guidance on approaches for integrating such assessments in both marine and terrestrial environments.
4	Participatory case study approach to illustrate interactions between Traditional and Local Knowledge (TLK) and science in developing and implementing EBM. Ensure participation of relevant Working Groups in a specific case study on monitoring coastal Arctic.
5	The SDWG initiative on addressing TLK should consider the EBM report's recommendation 1.3 regarding integration of TLK.
6	Consider the utility of a regional seas program as a platform for implementing EBM principles in the Arctic marine areas.
7	Arctic Council bodies should express assessment units in a consistent manner. Utilizing the CBMP terrestrial assessment units and other CAFF units, review, develop, and communicate consistent assessment units that are the terrestrial equivalent of, for example, Large Marine Ecosystems or Arctic Marine Areas, and can serve the needs of EBM efforts (e.g. physiographic provinces) across Working Groups. Provide an overview of boundary areas /definitions of the Arctic as they may differ across Working Groups.
8	Following upon the CAFF-led TEEB for the Arctic scoping study and ongoing Adaptation Actions for a Changing Arctic (AACA) efforts related to ecosystem services, encourage Working Groups and PPs to engage in these efforts in the context of the EBM recommendation on ecosystem services. Informed by these efforts, Arctic Council Member States, Working Groups and/or SAOs may suggest and implement next steps related to resilience, EBM and/or valuation of ecosystem services.
9	Working Groups should initiate new efforts and continue existing work to improve interoperability of data and tools from Arctic Council assessments as well as assessments performed by other entities.

Contributions by the Joint EA-EG implementing the Kiruna EA recommendations

The work of the EA-EG has contributed to development of several of the Kiruna EA recommendations (see Table 3).

Recommendation 1.3 – Representatives of Indigeneous Peoples have taken part in the work of the EA-EG and the application of Traditional and Local Knowledge (TLK) is being considered in various aspects of the EA work. Most notable is perhaps the linkages identified between indigenous values and TLK) and the step of defining ecological objectives in the EA framework (see report from the 5th EA workshop in 2015).

Recommendations 1.4 and 1.5 – The Barents Sea LME has been a case involving joint work by Norway and Russia that has been reviewed and used as an example by the EA-EG (e.g. at the 3rd EA workshop in 2013). The 4th EA workshop (Vancouver) in 2014 had the Beaufort Sea LME as a case with presentations on the work by Canada and the USA in this transboundary and shared LME. The EA-EG is also receiving and reviewing information on national EA developments through the members of the group (see section below on status of national implementation).

Recommendations 2.1 – The EA-EG was broadened as a joint group in 2011 and was formally identified as a joint expert group among CAFF, PAME and AMAP in a joint working group meeting in September 2015 in Tromsø. The EA-EG has served as a lead in EA development and implementation according to the 6-element EA framework (Fig. 1).

Recommendation 2.2 – The international conference to review the status of implementation of EA to management of Arctic ecosystems, held in Fairbanks, Alaska, in August 2016, was a first attempt to follow up the recommendation to have periodic Arctic Council reviews of EA or EBM in the Arctic (see summary of key outcomes of the conference below).

Recommendation 3.1 – As made explicitly clear in a previous section, the Arctic LMEs are intended to be used as management units and the EA-EG strives to promote this use through its work on the EA implementation elements.

Recommendation 3.2 (and 1.2) – Biologically, ecologically and culturally significant areas in coastal and marine environments constitute important habitats within the Arctic LMEs. In the AMSA IIC report (2013, jointly by AMAP, CAFF and SDWG), areas of heightened ecological and cultural significance was identified and presented for each of the Arctic LMEs. The ecologically significant areas are of importance for animal populations in their life cycles (breeding, feeding, migration, wintering etc), and they represent important linkages between species and habitats in a management context. How such areas should be included in EA management based on LMEs is included in the work plan for the EA-EG, although limited work has been done so far.

Recommendation 3.3 – This recommendation on value of ecosystem services is related to the EA framework element on valuation on ecosystem goods and services. There has been limited work on this item but plans are to give more emphasis to this element in future work are under discussion.

Recommendation 3.4 - The 3rd EA workshop (Reykjavik) in 2013 addressed data issues related to implementation of EA and the conduct of Integrated Ecosystem Assessment as a core component. The ICES Working groups on IEA for the Barents Sea and Norwegian Sea LMEs (WGIBAR and WGINOR) provide a mechanism for getting access to 'fresh' data arising from monitoring and research through the participation of national experts. This is also the case for the joint ICES/PICES/PAME WGICA for the central Arctic Ocean. In addition to getting access to data, the experts bring with them expertise about interpretation and any limitations of the data.

Recommendation 3.5 – The EA-EG has continued to follow developments in the topical area of IEAs through close ties with the ICES WGs and national developments (such as in NOAA in the USA, and joint Norwegian-Russian work in the Barents Sea). There is still no 'blue-print' for how to do an IEA, and we are learning-by-doing. Through review of these developments and sharing of experiences gained, the EA-EG aims to produce guidance on IEA including a modular build-up based on existing assessments.

Outcome of the Fairbanks International Conference on EA implementation in the Arctic

The EA International Conference was planned and organized by representatives across the Arctic States, AC working groups, Indigenous Peoples organizations, and others. It was held at the facilities of the University of Alaska Fairbanks with local organization by Dr. Larry Hinzman and Cassie Pinkel from the university. The conference was attended by nearly 70 participants who came from Arctic communities, government agencies, private enterprise, academic institutions, and non-governmental and intergovernmental organizations to give talks about their experiences and to share case studies related to implementing the EA to management in the Arctic. Together they brought to the conference diverse terrestrial and marine perspectives from backgrounds in natural resource management, shipping, oil and gas, policy making and governance, scientific research, and Traditional and Local Knowledge (TLK) and culture.

The program was structured with six sessions:

Session I: The Vision and Role of the Arctic Council

Session II: Status and Experiences from National Implementation

Session III: Making EA operational - developing the knowledge base and enabling activities

Session IV. Case studies - steps toward implementation

Session V: Pan-Arctic Marine Science and Policy

Session VI: Status of Implementing the Ecosystem Approach to Management in the Arctic

The conference was conducted in plenary with each of the sessions (except the last) having individual presentations followed by questions and discussion. The sessions were introduced and summarized by a session chair. Altogether there were thirty-eight presentations in sessions 1-5. The final session (number 6) was organized as a panel discussion in two parts. The first focused on status

of implementing the EA in the Arctic, while the second focused on the roles that the AC could play to facilitate the implementation. The conference program, abstracts, downloadable versions of graphic presentations, and audio-visual versions of the presentations are available online (PAME Secretariat 2016). A conference report has been prepared with summaries of presentations and a summary of the panel discussion structured according to the 6 elements of the EA framework.

Key findings from the Conference were:

1. Management of human activities on the scale of the ecosystem to sustain the flow of ecosystem goods and services is not presently occurring widely across the Arctic. At the level of individual Large Marine Ecosystems (LMEs), the situation varies, with encouraging development of integrated management across human activity sectors in some cases (e.g. Barents Sea LME).
2. The geographic extents of the major Arctic marine ecosystems have been defined.
3. The foundational knowledge necessary to move forward with the integrated ecosystem assessment and monitoring is in hand.
4. Common definitions of ecological objectives that define status of attainment of sustainability within an ecosystem approach remain to be established among the Arctic states.
5. A common understanding of integrated ecosystem assessment (IEA) in relation to implementing the ecosystem approach remains to be established among the Arctic states.
6. Valuations of the cultural, social, and economic goods and services produced by Arctic ecosystems is far from complete. Ecosystem valuation is an emerging field and limited resources are available for conducting such studies. It is an important part of an EA process but there has been very limited progress on that front across Arctic State

Roles of the Arctic Council in EA implementation

Possible roles of the Arctic Council (AC) in facilitating the implementation of EA to management of Arctic ecosystems were suggested during the panel discussion of the Fairbanks conference as well as during a round of commenting of the draft panel session report in the months following the conference. The following next steps for implementing the ecosystem approach to management in the Arctic were identified at the conference:

- ***Codes of practice and guidelines for EA implementation***
- ***Adoption of Large Marine Ecosystems, LME, as management units***
- ***Guidelines for ecological objectives for Arctic ecosystems***
- ***Guidelines for conducting Integrated Ecosystem Assessments, IEAs***
- ***Foster and sustain working groups on IEA for transboundary and High Seas Arctic LMEs***
- ***Enable integration, cooperation and communication among international Arctic monitoring programs***

Perhaps the most important role is for the AC to ***develop codes of practice and guideline****s* implementable by Arctic states for achieving and measuring the attainment of sustainable

management of human activities within and across sectors and forums (including environmental organizations, academic institutions, and government agencies).

The 6-element EA framework (Fig. 1) developed under the Arctic Council can serve as a basis for subsequent development of codes of practice and practical guidelines for implementing an ecosystem based approach to management of Arctic marine ecosystems, as requested in the Iqaluit Declaration. The AC should continue to review application of EA in the Arctic to facilitate exchange of information on management experiences, including integrated ecosystem assessment and highlighting examples from Arctic States. Specifically, this could include a compilation of the physical and biological characteristics, and a comparison of the transboundary regulatory experiences of Canada and the US in the Beaufort Sea, and those of Norway and the Russian Federation in the Barents Sea.

The AC should ***promote adoption of Large Marine Ecosystems, LME, as management units*** for the marine Arctic. Many of the LMEs are transboundary and/or include portions of High Seas and this requires management cooperation between two or more Arctic states for LMEs that straddle their boundaries of national jurisdiction. The LMEs have open boundaries, and adjacent LMEs 'communicate' through fluxes of water via ocean currents, transport of plankton and contaminants, and migrations of fish, birds and mammals. The AC could serve a coordinating function for harmonization and collaboration across LMEs as well as with the adjacent land and freshwater systems. Related to this, there is need to continue collaborative work on EBSAs, existing MPA's and other special areas which would provide a possible framework for advancing marine spatial planning and management in the context of the LMEs.

Related to the guidelines of EA implementation mentioned in the foregoing, there is a need for guidelines for specific elements of the EA framework. This includes development of ***guidelines for how to set ecological objectives*** for Arctic ecosystems including the associated information needs to allow assessment of whether objectives are achieved or not. Such guidelines could include information on how to map management actions to the state of ecosystem components as reflected by variables or indicators (e.g. as is done in Ecosystem overviews produced by ICES).

Based on continued review of work on Integrated Ecosystem Assessments (in ICES and elsewhere), the Arctic Council should facilitate the ***development of guidelines for conducting IEAs***. This could be done in collaboration with ICES, which develops and conducts IEA in an EA context to advise on the status, pressures, and management options for marine ecosystems. The Arctic Council may also ***foster and sustain working groups on IEA for transboundary and extraterritorial Arctic LMEs*** using a common IEA approach (e.g. the model under development by the ICES/PICES/PAME Working Group on IEA for the Central Arctic Ocean (WGICA). Foster communication among Arctic states regarding standards of comparison for ecosystem status among LMEs, especially those transboundary and extraterritorial LMEs.

The basis for IEA is updated information on the changing states of ecosystems provided through monitoring. The Arctic Council should ***promote the work of international Arctic monitoring programs***, such as the Sustained Arctic Observing Network (SAON) hosted by AMAP, the Circumpolar Biodiversity Monitoring Programme (CBMP) lead by CAFF and Distributed Biological

Observatory (DBO) sponsored by the Pacific Arctic Group. There is a recognized need for ***better integration, cooperation and communication among the different monitoring programs now operating within the AC community***. The coordination needed within the AC working groups may be less about ensuring and agreeing to similar monitoring methodologies and more about a need for guidelines that will get us to a holistic approach to monitoring, i.e. one where abiotic, biotic and social elements are looked at together based on coordinated monitoring of the various interrelated elements.

National EA implementation by Arctic states

The responsibility for implementing the EA lies with Arctic states for marine waters under their national jurisdiction. However, as pointed out earlier, there is a case for cooperation among Arctic states for transboundary LMEs.

All Arctic states have made a commitment to encourage the implementation of EA and use the EA for management of marine and coastal areas (BePOMAr 2009, 2013 Kiruna Declaration), as most recently expressed in the Arctic Marine Strategic Plan 2015-2025. At the Fairbanks EA conference, there were presentations on national implementation, including examples of steps and activities which could facilitate implementation. A summary of the most recent information on how EA is being followed-up in national policies and strategies is to be provided in a separate document "*Summary of National Policies and Strategies for Implementing the Ecosystem Approach; Appendix to Status of Implementation of EA in the Arctic*". In the meantime the basic national policies and strategies are summarized in BePOMAr (2009).

Findings

1. Implementation of EA to marine management in the Arctic is primarily a national responsibility for Arctic states for waters under their national jurisdiction.
2. The development and implementation of EA to management of Arctic marine and coastal waters is progressing although at variable pace across the pan-Arctic. In this regard, the Joint (PAME/AMAP/CAFF/SDWG) EA-EG can serve as a lead to assure coordination of a common approach to the work of the Arctic Council.
3. The Arctic marine and coastal environment has been delineated into 18 Large Marine Ecosystems to be used as geographical units to implement the EA to marine management. Some Arctic LMEs lie fully (or mostly) within the areas of national jurisdiction of a single Arctic state, while the majority are transboundary, including areas of national jurisdiction of two or more Arctic states. In addition, many Arctic LMEs include smaller or larger portions of international (High Seas) waters.
4. The geopolitics of Arctic LMEs requires management cooperation and collaboration among Arctic states, where the Arctic Council as a forum can play facilitating roles for implementation of EA to the Arctic LMEs as whole ecosystems.
5. The 6-element EA framework can serve as the basis for the development of '*practical guidelines for an ecosystem-based approach to the work of the Arctic Council'* as requested in the Iqaluit Declaration 2015.

6. There is on-going work on Integrated Ecosystem Assessments (IEA) and more coordinated ecosystem and biodiversity monitoring in several contexts (e.g. ICES, CBMP), and we are on a path of 'learning-by-doing'. The Arctic Council should continue to review developments and management experiences as a basis for providing guidelines on IEA (as part of wider EA guidelines).
7. Setting ecological objectives, which collectively define the thresholds' of sustainable use of the ecosystem, is a core component of the EA, but is at the same time very demanding due to the complexity and dynamic variability and change of Arctic ecosystems. Much attention needs to be given to this field of work, including review of developments of defining sets of ecological objectives for waters outside the Arctic (e.g. the EU Marine Strategy Framework Directive).
8. Valuation of ecosystem goods and services is another component of the EA framework that is very challenging. Limited work has been done so far. It is necessary to take the costs associated with environmental degradation and loss of biodiversity into the economic equation ('greening of the economy'). Nonetheless placing a monetary value on subsistence resources is not appropriate. The basic differences in methods of valuation between the cululture of indigenous peoples and the societies of the Arctic States need to be recognized and incorporated into the valuation of ecosystem goods and services.

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