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Report of the PAME (Joint EA-EG) / ICES Workshop on the development of guidelines for Ecosystem Approach to management (EAM) in the Arctic (WKEAMA)

9-11 January 2018

Seattle, USA

PAME Protection of the Arctic Marine Environment

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

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Background

The Arctic Council ministers in the Fairbanks Declaration from 11 May 2017, reaffirmed the need for an ecosystem approach to management in the Arctic, and encouraged future efforts to develop practical guidelines for implementing an ecosystem approach.

The Protection of the Arctic Marine Environment (PAME) working group of the Arctic Council has Ecosystem Approach (EA) as an item on its work program. PAME established an EA expert group (EA-EG) in 2007 that was broadened in 2011 as a joint group with participation also of other Arctic Council working groups (AMAP, CAFF, and SDWG). The EA-EG has convened five EA workshops in 2011–2015, and a first international EA conference in August 2016 (in Fairbanks, Alaska).

PAME has on the 2017–2019 work plan to prepare guidelines for EA implementation in Arctic marine ecosystems. The 6th EA workshop is a first step in the work of developing EA guidelines. Integrated Ecosystem Assessment (IEA) is a core component of implementing the EA, and it was included as an additional (although related) item for the workshop. The International Council for Exploration of the Sea (ICES) agreed to co-sponsor the workshop as a joint activity with PAME through the EA-EG.

Framework for implementing the Ecosystem Approach to management (EA) in the Arctic

The EA-EG has developed a framework for implementing the EA to management of marine (and coastal) ecosystems in the Arctic. This framework has 6 elements (Figure 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.

This framework has been agreed as a basis for the work by the Arctic Council to support the implementation of the EA in the Arctic. The Arctic marine and coastal environment has been subdivided as 18 Large Marine Ecosystems (LMEs; Figure 2). They are identified based on ecological criteria and are meant to be geographical management units for applying the EA. Identifying the LMEs fulfills the first step in the EA framework and allows practical implementation to proceed.

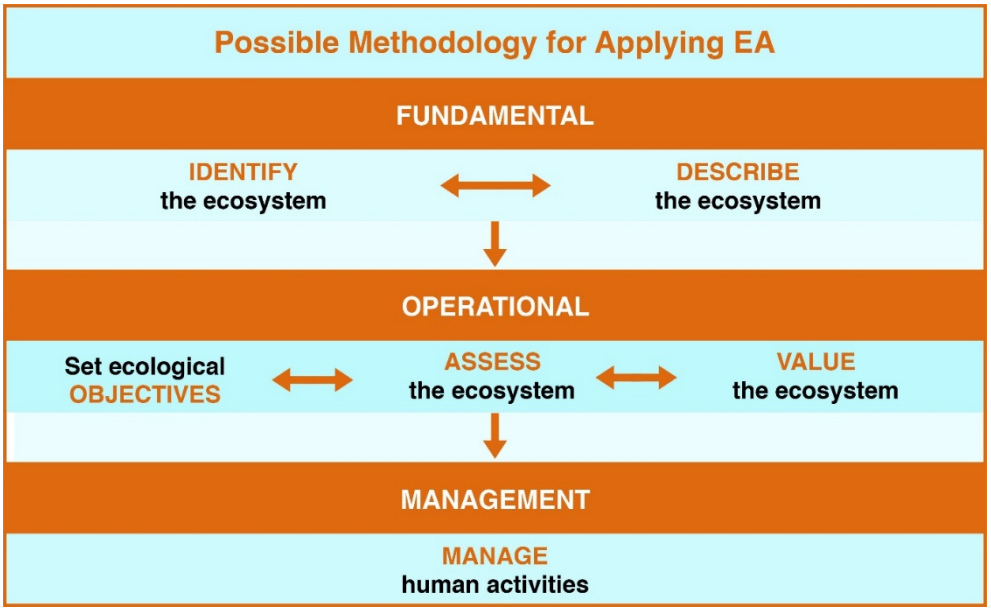

Figure 1. Joint Ecosystem Approach Expert Group (EA-EG) framework for implementing the EA to management of marine ecosystems in the Arctic

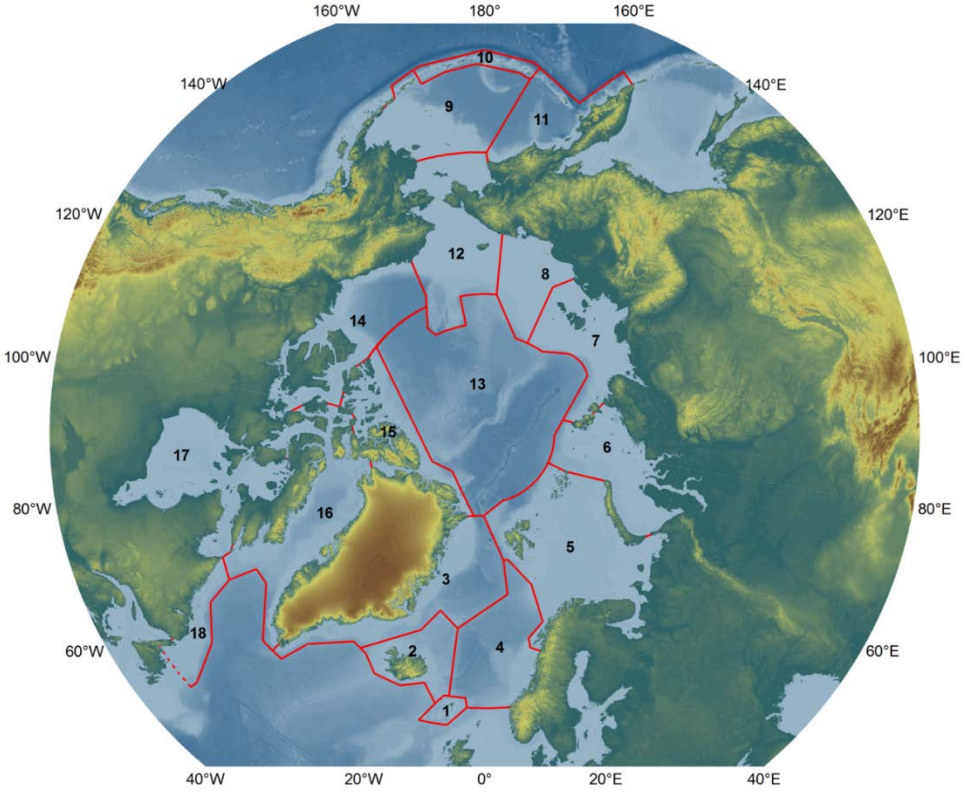

Figure 2. The 18 Large Marine Ecosystems: 1 – Faroe Plateau, 2 – Iceland Shelf and Sea, 3 – Greenland Sea, 4 – Norwegian Sea, 5 – Barents Sea, 6 – Kara Sea, 7 – Laptev Sea, 8 – East Siberian Sea, 9 – East Bering Sea, 10- Aleutian Islands, 11 – West Bering Sea, 12 – Northern Bering-Chukchi Seas, 13 – Central Arctic, 14 – Beaufort Sea, 15 – Canadian High Arctic-North Greenland, 16 – Canadian Eastern Arctic-West Greenland, 17 – Hudson Bay Complex, 18 – Labrador-Newfoundland.

1 Workshop objectives

1. Scope and start work on development of guidelines for Ecosystem Approach to management (EA) in the Arctic.
2. Review status of work on developing and doing Integrated Ecosystem Assessment (IEA) to develop best practices for Arctic IEA.

The two objectives reflect related though separate topics for the workshop. The first topic is the start of work to develop practical guidelines to help implement the EA to management in the Arctic. This includes IEA as a core component (element number 4) of the EA framework. The second topic is to provide a summary of where we are in terms of methods and skills to perform IEAs.

2 Workshop planning

2.1 Planning group

A planning group was established to help prepare the program for the workshop. The planning group was made up of representatives of the co-lead countries for the EA topic (Norway and the USA), other members from the EA expert group (Canada and Finland), members from indigenous organizations (Inuit Circumpolar Council (ICC) and Saami Council), and representatives from ICES, the US NOAA IEA program, and AMAP, CAFF, and PAME.

- Elizabeth Logerwell (USA co-lead)
- Phil Mundy (USA co-lead)
- Hein Rune Skjoldal (Norway co-lead)
- Lis L. Jørgensen (Norway)
- Leah Brown (Canada)
- Hermanni Kaartokallio (Finland)
- Carolina Behe (ICC)
- Gunn-Britt Retter (Saami Council)
- Mark Dickey-Collas (ICES)
- Mette Mauritzen (ICES)
- Kirstin Holsman (USA NOAA)
- Rebecca Shuford (USA NOAA)
- Jon Fuglestad (AMAP)
- Kári Fannar Lárusson (CAFF)
- Sophia Gudmundsdottir (PAME)

The planning group had three meetings (by phone or WebEx) to prepare the program for the workshop (1 and 22 November, and 13 December 2017).

2.2 Background documents

The EA-EG prepared the report 'Status of implementation of the Ecosystem Approach to management in the Arctic' in 2016. This report was forwarded through PAME to the Senior Arctic Officials (SAOs) and was welcomed by the ministers in the Fairbanks Declaration (paragraph 32). The report provided a brief history of the work on the EA under the Arctic Council, presented the EA framework (see above) including the map of 18 Arctic Large Marine Ecosystems (LMEs), and considered possible roles of the Arctic Council in developing and promoting implementation of the EA to management of Arctic marine and coastal ecosystems.

The status of implementation report was a main background document for the workshop. In addition, a shorter guidance document was prepared with questions to be addressed under each of the two main topics for the workshop (EA guidelines and IEA). These two background documents were made available to participants prior to the workshop.

3 Conduct of the workshop

3.1 Venue

The workshop was held at the NOAA Alaska Fisheries Science Center at Sand Point in Seattle, Washington state, USA. The plenary part of the meeting was held in the Traynor conference room, with additional rooms for breakout groups nearby. Speaker phones allowed some external participants to follow the meeting remotely. Preordered lunch boxes were brought to the meeting facility, which allowed a compact and efficient running of the workshop.

3.2 Participants

A total of 59 persons registered for the workshop; the list of registrants is included as Annex 1. The participants were from five countries: Canada, Finland, Japan, Norway, and USA. In addition, there were representatives from international organizations (ICES, OSPAR, HELCOM, CAFF, SDWG, and PAME). We were fortunate to have the mayor of the North Slope Borough in Alaska, Harry Brower Jr., present, along with several other participants from indigenous communities and organizations.

3.3 Workshop program

The workshop program is included as Annex 2. The meeting started at 9 am on Tuesday 9 January and closed at 4 pm on Thursday 11 January.

The workshop was organized with 5 sessions, following a welcoming, introduction and guidance session (session 0) by the two co-chairs of the workshop, Elizabeth ('Libby') Logerwell (USA) and Hein Rune Skjoldal (Norway).

Session 1 provided background and perspectives for the following sessions on the main topics of the workshop. Libby Logerwell presented the EA framework developed by the EA-EG and other work by the Arctic Council to support development of the EA. Raychelle Daniel provided Indigenous Knowledge perspectives on EA, while Mark Dickey-Collas provided ICES perspectives on operationalizing the EA. Finally, in this session, Bill Tweit provided a fisheries perspective from the North Pacific Fisheries Management Council.

Development of EA guidelines was dealt with in two sessions. **Session 2** on the first day was planned as a scoping exercise, considering how to develop the guidelines. **Session 4** on the last day of the workshop, was intended as a working session to start the actual work to develop guidelines. For both of these sessions, the meeting participants were divided into three breakout groups which considered the same set of questions contained in the workshop guidance document. The same breakout groups were used for both sessions 2 and 4. The groups were moderated by Becky Shuford and Libby Logerwell (group A), Mark Dickey-Collas and Lis Jørgensen (group B), and Cathy Coon, Raychelle Daniel and Hermanni Kartokallio (group C).

The three groups reported back to plenary, followed by discussion, in sessions 2 and 4 (moderated by Cecilie von Quillfeldt, and Libby Logerwell and Hein Rune Skjoldal, respectively).

The second main topic for the workshop, Integrated Ecosystem Assessment (IEA), was dealt with in **session 3**, with four parts, starting in the afternoon of the first day and continuing the full second day.

The first part was an **ICES session 3A** with four presentations. Mette Mauritzen (chair of the ICES IEA Steering Group) presented information on the ICES work on IEAs,

followed by presentations of the work in three ICES working groups (WG). Elena Eriksen presented the work on IEA for the Barents Sea by Working Group on the Integrated Assessments of the Barents Sea (WGIBAR), John Bengtson presented the work on the Central Arctic Ocean by the joint ICES/PICES/PAME WGICA, while Becky Shuford presented work in WGNARS for the Northwest Atlantic between Canada and USA. The presentations were followed by a panel discussion moderated by Mette Mauritzen.

Session 3B, starting on the second day, was on the NOAA IEA program. The session began with presentations on IEA work in three geographical areas: East Bering Sea by Kirstin Holsman, Gulf of Alaska by Jamal Moss, and California Current by Chris Harvey. This was followed by a panel discussion introduced and moderated by Kirstin Holsman. The panelists were Stephani Zador, Raynita ('Taqulik') Hepa, Harry Brower, Dan Lew, Steve Kasperski, and Jameal Samhouri, who gave brief introductions on various aspects of the NOAA IEA work.

Session 3C provided examples and experiences on assessments from other organizations. Two presentations were on work under the Arctic Council, two were on work by environmental commissions (HELCOM and OSPAR) in Europe, and two were given by traditional knowledge holders.

Hermanni Kaartokallio presented a project on Environmental Impact Assessment (EIA) carried out by SDWG under the Finnish chairmanship of the Arctic Council. John Bengtson presented the 'State of the Arctic marine biodiversity' report produced by the Circumpolar Biodiversity Monitoring Program (CBMP) under CAFF. AMAP was unfortunately not able to present the recently completed assessments, Adaptation Actions for a Changing Arctic (AACA) and Snow, Water, Ice, and Permafrost in the Arctic (SWIPA).

Hermanni Kaartokallio presented the HELCOM Holistic Assessment II, and Charlotte Mogensen presented the OSPAR Intermediate Assessment 2017. Leah Brown and Gerald Inglangasuk gave a presentation on interactions between Traditional and Local Knowledge (TLK) and science in conducting IEA, while Nicole Kanayurak presented perspectives and examples of Ecosystem Approach to management from the North Slope Borough.

The presentations in session 3C were followed by a panel discussion moderated by Leah Brown.

Session 3D was a general discussion on the topic of IEA lead by Becky Shuford and Mette Mauritzen.

The last **session 5** of the workshop was to draw conclusions and identify next steps in the work on EA guidelines and IEA. This was led by the two co-chairs Libby Logerwell and Hein Rune Skjoldal.

3.4 Presentations

Abstracts of the presentations given at the workshop are included as Annex 3. The presentations themselves are available as PDF files from the workshop website (https://pame.is/index.php/projects/ecosystem-approach/ea-documents-and-workshop-reports/6th-ea-workshop).

3.5 Minutes of the meeting

The moderators and appointed rapporteurs provided written summaries from sessions 2 and 4 on EA guidelines, and from session 3 on IEA. The reports were used as basis

for the condensed versions of the outcomes for the two main topics of the workshop as reflected in the next section of this report. Lightly edited versions of the reports are posted on the workshop site as detailed minutes of the meeting for reference and use in further development of EA guidelines.

4 Outcome of the workshop

4.1 Development of EA guidelines

4.1.1 General aspects and principles

Many expressed views as to the nature of the guidelines and to the process of developing them. We should strive to keep the guidelines ***simple***, using clear language, rather than them being excessively detailed and complicated. The process of developing the guidelines should be ***inclusive***, involving all relevant participants and stakeholders. The principle of inclusiveness should be clearly reflected in the guidelines, allowing a participatory process in the conduct of EA to management. ***Communication*** was emphasized as very important in order to achieve a common understanding and support of the integrated management system which EA represents. The guidelines should also be ***flexible***, to allow for different and changing conditions (e.g. ecological, social, cultural, and economic).

When preparing the guidelines, these general points should be recognized and reflected. The Arctic Council adopted a set of principles for EA in the Kiruna Declaration from 2013. Reference to the EA principles should be made to ensure consistency with what has already been agreed in the context of the Arctic Council.

4.1.2 Using the EA framework as a basis for developing guidelines

The EA framework with six elements (described earlier in this report) was thought to be an appropriate starting point for development of EA guidelines. The breakout groups in session 4 used the framework to note points to be considered under each of the six elements.

The EA framework (for integrated management of human activities) has management actions as one component (no. 6). Management can therefore be understood in a narrow sense (as element no. 6) or in a wider sense as the whole EA framework with all six elements. This dual meaning of 'management' may cause some confusion. Some of the points listed under element no. 6 refer equally or more appropriately to the whole EA framework level. This is an editorial issue when drafting the EA guidelines to decide what goes at the preamble or framework level and what goes under element no. 6 on specific management decisions.

4.1.3 The scale issue

The scale of Large Marine Ecosystems (LMEs) has been considered an appropriate scale for implementing the EA to marine management in the Arctic. The main justification for this is that 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 an IEA. The boundaries of LMEs are obviously open, and the fluxes e.g. of water and plankton and migrations of animals across them are important system characteristics. Use of LMEs as management entities allows integration across scales, both smaller and larger, to be done in an orderly fashion, while retaining the focus on the integrity of the larger ecosystem.

A first set of guidelines can be developed at the scale of LMEs based on the EA framework. This set of guidelines must be general and balanced to avoid being too detailed and prescriptive. How to deal with scale integration should be addressed in the guidelines.

More detailed guidelines for management at smaller and local scales within an LME may have to be more specific and can be developed in a second phase. Most residents of the Arctic interact with the environment on a much finer geographic scale and additional focus will be required to provide documents that meaningful capture how Arctic residents interact with the environment. It is important, however, that such guidelines should be nested within, and be consistent with, guidelines for the management of the larger ecosystem, e.g. an LME.

4.2 Integrated Ecosystem Assessment

4.2.1 ICES and IEA (Session 3A)

As chair of the ICES Steering Group on IEA, Mette Mauritzen described the ICES work on IEA. Quoting from the *ICES Strategic Plan,* ICES is committed to building a foundation of science around one key challenge: **integrated ecosystem understanding**. ICES will produce **integrated ecosystem assessments** in regional seas as a fundamental link between ecosystem science and the advice required in applying the ecosystem approach. ICES has established working groups to do IEA for eight ecoregions, corresponding in most cases to LMEs (Figure 3). Three of these regions lie within the Arctic area, with the working groups for the Norwegian Sea (WGINOR[1]), the Barents Sea (WGIBAR[2]), and the central Arctic Ocean (WGICA[3]). ICES is giving increased attention to the 'human dimension' in work on IEA.

Elena Eriksen described the work in WGIBAR for the Barents Sea ecosystem, building on a long-standing cooperation between Norway and Russia in monitoring fish stocks and environment that goes back more than 50 years. Analyses of time-series of information on hydrography, plankton, and fish form a core component of the Barents Sea IEA, whereby the current conditions and ongoing changes can be viewed against the development of the ecosystem over many decades. The Barents Sea has warmed substantially (by nearly 2°C) since 1980, with a corresponding loss of half the winter sea ice cover. Substantial changes in the ecosystem has been observed, including a northwards expansion of boreal species such as Atlantic cod, and a reduction and withdrawal of Arctic species.

[1] ICES Working Group on the Integrated Assessments of the Norwegian Sea

[2] ICES Working Group on the Integrated Assessments of the Barents Sea

[3] ICES/PICES/PAME Working Group on Integrated Ecosystem Assessment (IEA) for the Central Arctic Ocean

Figure 3. The eight ICES ecoregions.

The IEA for the Barents Sea focuses on fisheries and climate variability and change, but is also addressing other issues such as contaminants, litter, benthos, marine mammals, and seabirds.

John Bengtson described the work of the joint ICES/PICES/PAME WGICA for the central Arctic Ocean. The IEA for this ecosystem is different in that time-series of observations are largely lacking apart from satellite observations on sea-ice and surface oceanographic conditions. The assessment is made up of components addressing primary production, zooplankton, ice biota, abundance and occurrence of fish, and distributions of marine mammals and seabirds through review of scientific literature, including 'grey literature' reports and traditional knowledge where applicable. The plan is to use these overviews and summaries as bases for assessing the biological and ecological impacts of the already substantial loss of sea ice (75% by volume of summer ice) during the last two decades, and to assess the sensitivity and potential vulnerability of the central Arctic Ocean ecosystem to increased shipping in future.

A third case from the ICES IEA work was presented by Becky Shuford who described the work of WGNARS for the Northwest Atlantic. WGNARS provides an example of IEA work at smaller (sub-LME) scale in the Gulf of Maine/Georges Bank/Scotian Shelf region. A key part of this IEA process is the development of conceptual models (General System Models) as organizing and communication tools. Risk Assessment is also a key feature, including ecological, economic, social and management risks. The hu-

man dimension is given much emphasis in the work, which includes collection of socio-economic information that is used along with natural science information about the conditions in the ecosystem.

In discussion, it was noted that ICES is 'learning-by-doing' through the work of the regional IEA groups. While the groups have taken different approaches and use a variety of methods for doing IEA, there is also a degree of commonality in the work. Thus, all groups are using trend analysis of multivariate datasets to describe and evaluate recent and ongoing changes in the ecosystem which is being assessed. Indicators do not play a prominent role in the work of many of the regional groups, while modelling tools are used to varying degree. The diversity in approach and methods is a reflection of the different conditions and situations among the regions and is seen as an asset as we move upwards on the learning-curve of how to do IEA. In discussion, it was also noted that there is a learning curve in integration of TEK in current IEA approaches.

4.2.2 NOAA IEA program (Session 3B)

The National Oceanic and Atmospheric Administration (NOAA) in the USA operates a program for IEA that is developing and implementing an approach to support Ecosystem-Based Management (EBM, or EA) (https://www.integratedecosystemassessment.noaa.gov/index.html). The program is being implemented in 5 regions across the USA: Northeast Shelf, Gulf of Mexico, California Current, Alaska Complex, and West Hawaii.

NOAA's approach to IEA provides a common iterative, adaptive, and scalable science-based framework to support marine resources decision-making in an ecosystem context (Figure 4). This national framework, however, is flexible and allows for regional variation in implementation, depending on the management question(s) being addressed and/or ecosystem of interest. The approach (or process) includes identifying priority management objectives or targets, assessing the status and trends of the components of the ecosystem, analyses the risk to those components, evaluates the likely future state of the system and outcomes and trade-offs of alternative management scenarios to inform management decisions, and monitoring and evaluation after management action has been taken (adaptive management). Select products derived through this process that support management decision-making include ecosystem status reports, risk assessments, and management strategy evaluations. Finally, while NOAA's IEA approach has the ability to support full multi-sector EBM, it also serves more traditional single sector or species management partners by bringing a more holistic ecosystem context to those decisions.

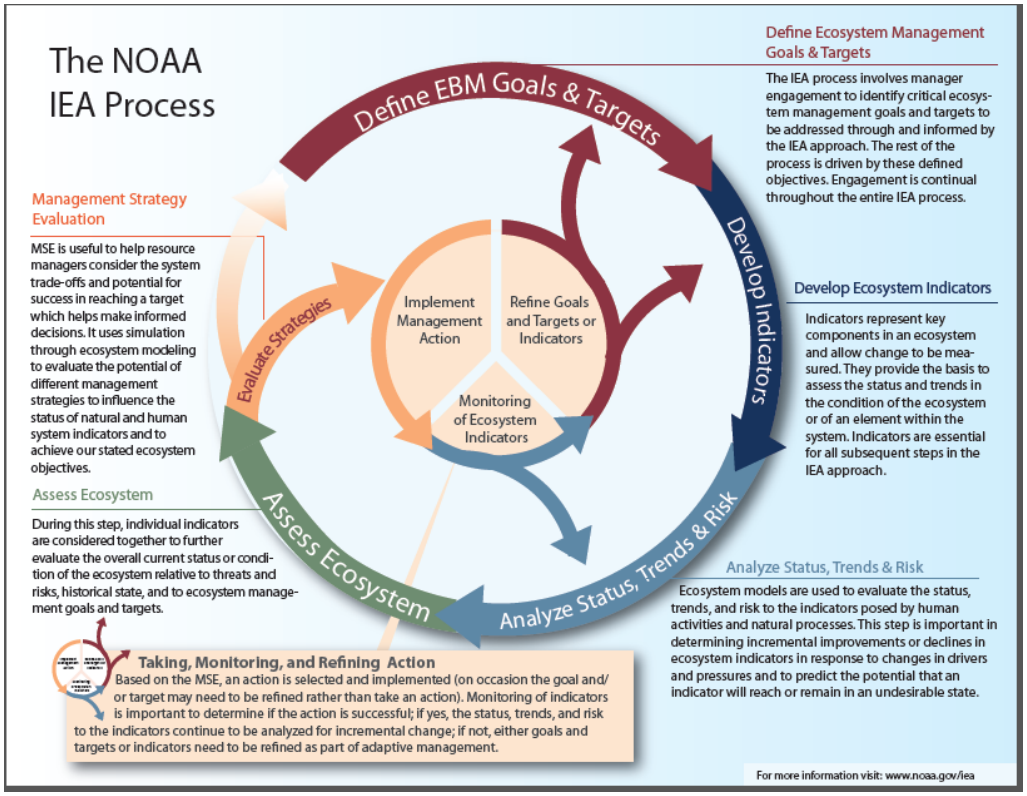

Figure 4. The NOAA IEA Process.

4.2.3 Experiences from assessment work in other contexts (Session 3C)

Assessment work in two Arctic Council working groups were presented.

Hermanni Kaartokallio described a project on Environmental Impact Assessment (EIA) carried out by **SDWG** under the Finnish chairmanship. A set of guidelines for EIA was prepared in 1997, and there is a need now to update them. The project is carried out with several workshops and will end in spring 2019 with a compiled report of findings from the various workshops. Emphasis has been on incorporating Indigenous knowledge (IK) in EIA, and the aim is to provide good practice recommendations for EIA including public participation that may be helpful to future IEA approaches and methods in different LMEs. EIA has similarities with EA and IEA, in that both seek to manage human activities, and both benefit from increased knowledge of arctic ecosystems and humans. A clear difference is that EA/IEA concerns management of the whole ecosystem, whereas EIA is typically done for a specific project. It was noted that an EIA would benefit from being carried out within the wider frame of an IEA, and vice versa, that EIAs could provide important information for use in IEA.

The **CAFF** working group has developed the Circumpolar Biodiversity Monitoring Program (CBMP) with program elements for the marine, coastal, freshwater, and terrestrial Arctic environments. CBMP-marine completed last year the 'State of the Arctic Marine Biodiversity Report' (SAMBR), which was presented by John Bengtson. SAMBR was produced by network of experts on plankton, sea ice biota, benthos, fish, birds, and marine mammals. The report describes pan-Arctic patterns and trends of change in many components of the Arctic marine biodiversity. CBMP-marine can provide relevant information to the work on IEA in Arctic marine ecosystems, as shown in the case of the SAMBR report.

AMAP was regrettably not able to take part in the workshop, but two of their recent assessments were noted. One was the Adaptation Actions for a Changing Arctic (AACA) which was carried out for three regions: the Barents region, Baffin Bay and Davis Strait, and the Bering-Chukchi-Beaufort seas. AACA had a large socio-economic component and is an example of an assessment with much emphasis on the human dimension (https://www.amap.no/adaptation-actions-for-a-changing-arctic-part-c). The second assessment was 'Snow, Water, Ice and Permafrost in the Arctic' (SWIPA). This is a follow-up on AMAPs work on climate, and the SWIPA report was released in 2017 (https://www.amap.no/swipa2017).

Work in Regional Seas conventions

OSPAR and HELCOM are regional seas conventions for the North-East Atlantic and the Baltic Sea, respectively. They both play roles for the implementation of the EU Marine Strategy Framework Directive (MSFD) by providing coordination among EU member states which share maritime waters of defined geographical regions (the Baltic Sea for HELCOM, and the North Sea and other marine ecoregions for OSPAR). The OSPAR convention area includes part of the Arctic in the Atlantic sector, e.g. the Norwegian and Greenland seas. Both conventions have recently completed assessments of their marine waters.

Hermanni Kaartokallio presented the **HELCOM** Holistic Assessment of Ecosystem Health of the Baltic Sea (HOLAS II) which was completed in 2017. The assessment builds on a system of goals and ecological objectives for water quality and biodiversity, which are turned into indicators with target levels. The indicators are scored and combined in a spatial grid which provides an assessment of overall conditions in the various geographical parts of the Baltic Sea.

The **OSPAR** Intermediate Assessment 2017 was presented by Charlotte Mogensen. This assessment was based on MSFD descriptors and indicators for the various regions of the OSPAR maritime area. The EU MSFD has Good Environmental Status (GES) as the overall goal, and GES is defined and expressed by eleven qualitative descriptors with associated criteria and indicators. The Intermediate Assessment 2017 is to be followed by a more comprehensive Quality Status Report (QSR) in 2020. Previous QSRs were produced in 2000 and 2010, and for the North Sea also in 1993.

Indigenous knowledge

Two presentations provided indigenous perspectives on assessments and co-management. Leah Brown and Jerry Inglangasuk spoke on interactions between Traditional and Local Knowledge (TLK) and science in conducting IEAs. They identified a need for more institutional support for the work in the Canadian Arctic, especially for resources for TLK to be equitably incorporated. They shared that they monitor both biological and ecological aspects of the Beaufort LME where they co-manage a variety of species. More cooperation with Alaska for the Beaufort region was desirable, and successful examples for indigenous government to government cooperation were given by the Inuit-Inuvialuit Beluga Whaling Commission (IIBWC) and the Inuit-Inuvialuit Polar Bear Commission (IIPBC). It was noted that a bottom–up approach that used the involvement of local user groups was a good way to ensure success. It was stressed that this method would require confidence and trust among managers of the LME.

Nicole Kanayurak provided perspectives and examples of Ecosystem Approach to management from the North Slope Borough. Communities drive the science and monitoring, which provides a good opportunity to implement EA. It was noted that the traditional Inuit way of adapting subsistence harvests based on need according to

changing conditions, and sharing practices, contributed resilience to the communities and subsistence resources in face of changes in the ecosystem they are a part of. She elaborated that communities also have initiated and created premier management systems for their environment.

Panel discussion

The presentations were followed by a panel discussion moderated by Leah Brown. It was noted that there is scope for cooperation and further streamlining of the assessment activities for the Arctic marine areas. An example of this is the assessment activities of AMAP and CAFF where AMAP assesses the impacts of climate and pollution on Arctic species and ecosystems, while CAFF assesses the status of Arctic species and ecosystems.

One aspect of the coordination and streamlining relates to scale. While AMAP and CAFF provide assessments for the whole pan-Arctic area, biodiversity (species and habitats) reside within geographically limited regions such as the LMEs. This is exemplified by use of LMEs in the AMAP AACA assessment and use of regions largely corresponding to LMEs by CAFF in the SAMBR report. At the LME scale, there are the IEAs by ICES working groups for the Barents Sea, Norwegian Sea, and central Arctic Ocean (jointly with PICES and PAME), which takes place largely outside the Arctic Council (although many of the experts are the same). If we had IEAs for more of the Arctic LMEs (ideally all), than pan-Arctic reporting could be based on them. Conversely, pan-Arctic perspectives and information could inform the IEAs for specific LMEs. We are not there yet, but this could be a goal to work towards.

A bottom–up (community driven) approach can be advantageous for starting IEA activities, building on traditional and local knowledge and involving Indigenous and local users and knowledge-holders at various scales depending on the extent of knowledge by communities in each LME. With a design as a participatory process, a merging of the two approaches, bottom–up and top–down, would be possible and preferable to fully implement the EA at the scale of LMEs, while at the same time providing for scale-integration down to local scale. Cooperation of implementation of EA should be explored to effectively merge the approaches in an adaptive manner.

The question was raised whether the time was ripe for providing best practices for IEA or whether we should still allow some time for additional learning-by-doing. It was felt that this is an iterative process where best practices could be identified from what we know at present, and then the best practices can be updated as we gain more experience. A possibility is that ICES as a scientific advisory organization could be asked to address this issue, drawing upon experience also from the IEA working groups for areas outside the Arctic.

4.3 Workshop conclusions and next steps

4.3.1 EA guidelines

Keep it simple, flexible and inclusive – The guidelines should be written in clear and plain language and be kept as simple as possible. They should also allow the necessary flexibility for adaptive management practices in relation to different and shifting ecological, social, and cultural conditions. Furthermore, the guidelines should be inclusive to allow a participatory process in the conduct of EA to management.

1st set of guidelines – A fist set of guidelines could be developed based on the 6-element EA framework at the scale of LMEs. This set of guidelines should be kept general and

in accordance with the agreed definition and principles for EA. The need for scale integration should be addressed as part of the guidelines.

Further development of guidelines – Development of guidelines should proceed with the aim to produce more specific guidelines for elements of the EA framework (e.g. how to set ecological objectives, and how to carry out IEA) including the application of the principles of EA at smaller scale (e.g. local communities). The many specific views and suggestions expressed and reflected in the notes from the workshop will be kept and used for reference in the further work on the EA guidelines.

Human dimension – The human dimension should be recognized and integrated in the EA guidelines to be developed. This is to reflect that we are developing guidelines for management of coupled socio-ecological systems where humans are part of the natural ecosystems, yet exert pressures that to some extent are extrinsic to the system (e.g. climate change, long-range transport of pollutants). Methods should be careful to address for what purposes or for whom IEAs are conducted.

Communication – Communication with Arctic communities and other participants and stakeholders of an EA management system is important to increase awareness and understanding and to achieve support for more resilient and robust implementation. This is related to the principle of inclusiveness and engagement which will be reflected by the guidelines.

4.3.2 Integrated Ecosystem Assessment

Diversity of approach and methods – There is a diversity of approaches and methods used in doing Integrated Ecosystem Assessments (IEAs). This applies among others to the roles indicators and quantitative models play, and the ways they are used. It also applies to risk assessment, management strategy evaluation, and the way human pressures and their effects in the environment are expressed and linked. However, there are also considerable commonalities, such as use of time-series for environmental conditions and biological resources (e.g. fish stocks) to express and analyse changing states in the ecosystems.

Learning by doing – In ICES and other places, we are learning by doing as we carry out IEAs. In ICES, this is done in formal working groups that meet annually to examine status and ongoing changes in regional ecosystems. Arctic council working groups or subgroups (e.g. CBMP-marine) also meet annually to assess biological ecosystem components and consider how to proceed towards full ecosystem assessment on a Pan-Arctic scale. Collectively, we are still on a learning curve as a community of IEA practitioners.

Comparisons across LMEs – We can learn more about similarities and differences in doing IEA through more detailed and in-depth comparisons of approach and methods applied in different LMEs. This should also include comparisons at different scales within and between LMEs. Such evaluations may be a step towards developing guidance on best practices for doing IEAs. Two candidate ecosystems which could be compared are the Barents Sea and the East Bering Sea LMEs, which are assessed by ICES and NOAA, respectively.

4.3.3 Next steps

Draft first set of EA guidelines – The two co-leads of the EA-EG will prepare a first draft set of guidelines for implementation of the EA to management of the marine Arctic, based on the outcome from the workshop and in consultation with members of the EA-EG.

Comparison of IEAs – An activity should be carried out to compare approaches and methods for doing IEAs for selected LMEs, e.g. the Barents Sea and East Bering Sea LMEs. This may require a project and be put on a future work plan for the EA-EG. However, it should be attempted to start the work as a collaboration between the EA-EG, ICES, and the NOAA IEA program, with participation also of other interested parties such as OSPAR.

2nd EA conference – According to the work plan for the EA-EG, a second EA conference is scheduled for late 2018. This could preferably be delayed till early 2019. One topic for the conference will be the draft EA guidelines, and outcome of the conference will be used to adjust the draft guidelines with the aim to present them to SAOs and the ministers at the end of the Finnish chairmanship in spring 2019. A second topic for the conference can be IEA with emphasize on comparisons across LMEs and identification of best practices. A third topic may be social-ecological systems and linkages with human dimension.

New IEA working groups – Establishment of new working groups for doing IEA of more Arctic LMEs should be considered, in line with one of the EBM recommendations from Kiruna in 2013 Two candidate LMEs could be the Northern Bering-Chukchi Sea LME and the Beaufort Sea LME. Both LMEs include waters under national jurisdiction of two countries as well as international 'High Seas' waters, and both are arenas for cooperation between Indigenous Peoples organizations with co-management arrangements.

Communication – One or more meetings in northern communities should be arranged to improve communication on important aspects of the EA and IEA, such as use of TLK in IEA, involvement of Indigenous and local communities, and co-management.

Annex 1: List of Registrants

Last name	First name	Institution	Country
Allen Akselrud	Caitlin	University of Washington	USA
Brower, Jr.	Harry	North Slope Borough	USA
Brown	Leah	Fisheries and Oceans Canada	Canada
Busby	Morgan	NOAA Fisheries - Alaska Fisheries Science Center	USA
Chan	Laurie Hing Man	University of Ottawa	Canada
Cieciel	Kristin	NOAA Fisheries - Alaska Fisheries Science Center	USA
Coon	Cathy	DOI BOEM	USA
Daniel	Raychelle	The Pew Charitable Trusts	USA
Dickey-Collas	Mark	ICES	International
Eisner	Lisa	NOAA Fisheries - Alaska Fisheries Science Center	USA
Eriksen	Elena	Institute of Marine Research	Norway
Gisclair	Rebecca	Circumpolar Conservation Union	USA
Guðmunds-dóttir	Soffía	PAME Secretariat	Iceland
Harvey	Chris	NOAA Fisheries – North-west Fisheries Science Center	USA
Haynie	Alan	NOAA Fisheries - Alaska Fisheries Science Center	USA
Henry	David	Pew Charitable Trusts	USA
Hepa	Raynita "Taqulik"	North Slope Borough	USA
Holsman	Kirstin	NOAA Fisheries - Alaska Fisheries Science Center	USA
Inglangasuk	Gerald	Fisheries Joint Management Committee	Canada
Johnston	Lucia	North Slope Borough	USA
Kaartokallio	Hermanni	Finnish Environment Institute	Finland
Kanayurak	Nicole	North Slope Borough	USA
Karp	Bill	University of Washington	USA
Kasperski	Steve	NOAA Fisheries - Alaska Fisheries Science Center	USA
Kimmel	David	NOAA Fisheries - Alaska Fisheries Science Center	USA
Leavitt	Sondra	North Slope Borough	USA
Lew	Dan	NOAA Fisheries - Alaska Fisheries Science Center	USA
Lindal Jørgensen	Lis	Institute of Marine Research	Norway

Last name	First name	Institution	Country
Livingstone	David	Inuvialuit Environmental Impact Screening Committee	Canada
Logerwell	Libby	NOAA Fisheries - Alaska Fisheries Science Center	USA
Mack	Leanna	North Slope Borough	USA
McDermott	Susanne	NOAA Fisheries - Alaska Fisheries Science Center	USA
Mogensen	Charlotte	OSPAR Commission	United Kingdom
Mooney-Seus	Marjorie	NOAA Fisheries - Alaska Fisheries Science Center	USA
Moore	Sue	NOAA/Fisheries ST7	USA
Moss	Jamal	NOAA Fisheries - Alaska Fisheries Science Center	USA
Napp	Jeff	NOAA Fisheries - Alaska Fisheries Science Center	USA
Newton	Jan	University of Washington	USA
Poe	Melissa	University of Washington, Sea Grant and NOAA Fisheries – Northwest Fisheries Science Center	USA
Romanenko	Olga	The Pew Charitable Trusts	USA
Rooper	Chris	NOAA Fisheries - Alaska Fisheries Science Center	USA
Samhouri	Jameal	NOAA Fisheries – Northwest Fisheries Science Center	USA
Shuford	Rebecca	NOAA Fisheries – Office of Science and Technology	USA
Skern-Mauritzen	Mette	Institute of Marine Research	Norway
Skjoldal	Hein Rune	Institute of Marine Research	Norway
Sommerkorn	Martin	WWF Arctic Programme	Norway
Speer	Lisa	NRDC/CCU	USA
Stevenson	Todd	Ocean Conservancy	USA
Tweit	Bill	North Pacific Fishery Management Council	USA
Van Pelt	Thomas	UW JISAO	USA
Vollenweider	Johanna	NOAA Fisheries - Alaska Fisheries Science Center	USA
von Quillfeldt	Cecilie	Norwegian Polar Institute	Norway
Wassilie	Carl	Alaska Inter-Tribal Council-consultant	USA
Williams	Greg	NOAA Fisheries – Northwest Fisheries Science Center	USA
Wise	Sarah	NOAA Fisheries - Alaska Fisheries Science Center	USA
Yamamura	Orio	Hokkaido University	Japan

Last name	First name	Institution	Country
Yeung	Cynthia	NOAA Fisheries - Alaska Fisheries Science Center	USA
Zador	Stephani	NOAA Fisheries - Alaska Fisheries Science Center	USA

Annex 2: Workshop Program

6th EA Workshop

Program

The 6th EA Workshop on **Ecosystem Approach Guidelines and Integrated Ecosystem Assessment**, co-sponsored by the Joint Ecosystem Approach Expert Group (PAME, AMAP, CAFF, SDWG) and the ICES.

Venue: National Oceanic and Atmospheric Administration Western Regional Centre

7600 Sand Point Way NE, Seattle, WA, USA

Registration and Logistics:

- Registration (deadline 15 Dec.) here
- 6th EA Workshop website here

Background Document: The planning group for the workshop has prepare a background document (here) that provides more information and guidance for the work to be carried out at the workshop.

Co---conveners

PAME Protection of the Arctic Marine Environment

CAFF Conservation of Arctic Flora and Fauna

AMAP Arctic Monitoring and Assessment Programme

Sustainable Development Working Group

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

ICES CIEM

DAY 1

Tuesday 9 January

09.00
09.45

Welcome, introduction, background and agenda (45 min)

09.45
10.45

Session 1: Definitions, concepts and EA framework (1 h)

- The EA framework and how Arctic Council Working Groups can contribute to EA (Libby Logerwell and Hein Rune Skjoldal) (15 min)
- Indigenous Knowledge perspective on EA (Raychelle Daniel) (15 min)
- ICES perspective on Operationalizing EA (Mark Dickey-Collas) (15 min)
- NPFMC perspective on EA (Bill Tweit, NPFMC) (15 min)

10.45
11.00

Health break (15 min)

11.00
12.30

Session 2: Guidelines for EA implementation in the Arctic (1.5 h)

3 breakout groups will each discuss the following:
3 moderators: Becky Shuford (NOAA), Mark Dickey-Collas (ICES), Cathy Coon (BOEM)

- What is meant by "guidelines"?
- Who is the target audience?
- How do we see the guidelines – at what level of detail and specificity?
- How should we proceed to develop the guidelines?

12.30
13.30

Lunch (1 h)

13.30
14.30

Session 2 *--- Breakout Group Reports*

Moderator: Cecilie von Quillfeldt

14.30
17.30

Session 3: Practical experience with IEA (3.0 h)

Session 3A --- ICES work and experiences in IEA

Presentations (20 min. each)

- IEA in ICES: approaches and experiences (Mette Mauritzen)
- IEA of the Barents Sea LME – WGIBAR (Elena Eriksen)
- IEA of the Central Arctic Ocean --- WGICA (John Bengtson)

15.30
15.45

Health break (15 min)

15.45
17.30

- IEA of the NW Atlantic – WGNARS (Rebecca Shuford)

Panel discussion (1.5 h)
Moderator: Mette Mauritzen

DAY 2

Wednesday 10 January

09.00
09.30

Recap Day 1 or other guidance from workshop leads (0.5 h)

09.30
12.30

Session 3: Practical experience with IEA (continued) (3.0 h)

Session 3B – NOAA IEA program

- IEA in Alaska (30 min):
  - Eastern Bering Sea (Kirstin Holsman)
  - Gulf of Alaska (Jamal Moss)
- IEA in California Current (Chris Harvey) (15 min)
- Panel introduction (Libby Logerwell, AFSC) (15 min)

10.30
10.45

Coffee break

10.45
12.30

Session 3: Practical experience with IEA (continued)

- Panel discussion (1 h 45 min)
  moderator: Kirstin Holsman
  - Ecosystem Status Reports/ Ecosystem Considerations (Stephani Zador AFSC)
  - Local and Traditional Knowledge (Harry Brower)
  - Non-market Valuation (Dan Lew, AFSC)
  - Human Dimensions (Steve Kasperski, AFSC)
  - Risk Assessment (Jameal Samhouri, NWFSC)

12.30
13.30

Lunch (1 h)

13.30
17.30

Session 3: Practical experience with IEA (continued)

Session 3C – Experiences from IEA work in the Arctic Council and other jurisdictional frameworks

- Presentations (15. min each):
  - CAFF: Circumpolar Biodiversity Monitoring Program (CBMP) and State of the Arctic Marine Biodiversity report (SAMBR) (John Bengston)
  - SDWG: Environmental Impact Assessment (EIA) project under Finnish Chairmanship (Hermanni Kaartokallio)
  - OSPAR: Intermediate Assessment 2017 (Charlotte Mogensen)
  - HELCOM Holistic Assessment II (Hermanni Kaartokallio)
  - Interactions between Traditional and Local Knowledge (LTK) and science in conducting IEA (Leah Brown and Gerald Inglangasuk)
  - Perspectives and examples of Ecosystem Approach to management from the North Slope Borough (Nicole Kanayurak)

DAY 2 (cont.)

Wednesday 10 January

15.15
15.30

Health break

15.30
17.30

Session 3: Practical experience with IEA (continued) (3.0 h)

Panel Discussion (1.0 h)

moderator: Leah Brown

Session 3D – General discussion of status and Quo vadiz, best practices for IEA work (1 h)

moderators: Becky Shuford and Mette Mauritzen

DAY 3

Thursday 11 January

09.00
09.30

Guidance for breakout groups

09.30
12.30

Session 4: Developing an outline/sketch of EA guidelines (3.0 h)

3 breakout groups

3 rapporteurs

moderators: Libby Logerwell, Lis Lindahl Jørgensen, Hermanni Kaartokallio

12.30
13.30

Lunch

13.30
15.30

Session 4: Developing an outline/sketch of EA guidelines (continued) (2.0 h)

moderators: Libby Logerwell and Hein Rune Skjoldal

- Breakout group reports (1 h)
- Group discussion (1 h)

15.30
15.45

Health break

15.45
17.30

Session 5: Workshop conclusions and next steps

moderators: Libby Logerwell and Hein Rune Skjoldal

Annex 3: Abstracts of Presentations

Session 1: Definitions, concepts and EA framework

Indigenous Knowledge Perspective on EA

Raychelle Daniel (The Pew Charitable Trusts)

Carolina Behe (Inuit Circumpolar Council)

The Arctic is home for many Indigenous Peoples, and this presentation came from a Yup'ik perspective. Yup'ik, Inupiat, Cup'ik and St. Lawrence Island Yupik have called the Arctic home from time immemorial and acquired a knowledge system shaped by the environment. An ecosystem approach (EA) is inherent in Inuit Indigenous Knowledge, management, and world view. Alaskan Inuit defined food security and created a food security conceptual frame work, through a project led by ICC Alaska (ICC 2015). The report demonstrates an ecosystem view in which multiple systems (e.g. ecological, physical, cultural, social) are brought together under one framework – this is Indigenous Knowledge. Here the Indigenous Knowledge stresses that the components making up the framework are interconnected - all equally important. To gain an overall better understanding of the Arctic, it is important to understand the interconnecting components, to take a holistic view and to utilize both Indigenous Knowledge and science. Both knowledge systems have different approaches and methodologies in explaining the environment around us. The development of EA guidelines in the Arctic will require a coproduction of knowledge approach to bring together both the Indigenous Knowledge and science. A coproduction of knowledge approach is being increasingly recognized by the scientific community at large. However, in many instances it is incorrectly applied (e.g. multidisciplinary). Equity is a cornerstone of a coproduction of knowledge approach. Indigenous Knowledge should be respected and valued as its own knowledge. We encourage moving away from viewing Indigenous Knowledge to support science and from using science to validate Indigenous Knowledge. Science is specific when referenced; similarly, Indigenous Knowledge holds its own methodologies and evaluation systems. Both knowledge experts should be included in determining which information is gathered, what questions are asked, which methodologies are used, and how analyses are conducted. It is important to recognize the sovereign rights of Indigenous Peoples over their own knowledge. Another important component of a coproduction of knowledge framework is capacity-building for both the scientific community and Indigenous communities. For Indigenous Knowledge holders this includes the need (e.g. funding, time, materials) to actively participate in all research throughout all phases of the project as co-investigators. Capacity-building for scientists includes training and education about Indigenous philosophies, cosmologies, and methodologies. One of the most important factors for building long-term success is fostering relationships and working towards true partnerships. A good first step is an understanding of the lay of the land where you will be working (e.g. learning about existing governance systems, Indigenous networks, institutions and organizations). Partnership and participation do not equate; and it is important to understand partnership building from an indigenous view.

Inuit Circumpolar Council-Alaska (ICC-AK). 2015. Alaskan Inuit Food Security Conceptual Framework: How to Assess the Arctic from an Inuit Perspective. Technical Report.

ICES Perspective on Operationalizing EA

Mark Dickey-Collas (ICES)

ICES is an intergovernmental science network that focuses on the North Atlantic and the Arctic (with partners including PICES and Arctic Council working groups). It is a knowledge provider to policy formers and decision-makers, and has a clear vision about providing the knowledge base for ecosystem based management (http://www.ices.dk/explore-us/Documents/ICES%20and%20EBM.pdf). The network is incrementally and iteratively operationalizing its role in ecosystem based management. There are key phrases that illustrate the central tenet of the ICES ecosystem approach: management of human activities, consideration of collective pressures, achievement of good environmental status, sustainable use, optimization of benefits among diverse societal goals, regionalization, trade-offs, and stewardship for future generations. The study of the knowledge and management system is as important as the study of the ecosystem state and dynamics. ICES sees integrated ecosystem assessments (IEA) as a key tool for delivering the ecosystem approach.

It was emphasized that delivering IEAs will take much longer than expected; the process is always frustrating, may not succeed resulting in great pain. The dialogue/discourse will challenge our academic training; and we must learn how to work deliberately with what we perceive as imperfection. It is important to establish equitable partnerships; listening to others underpins our capacity to connect, to build trust, adapt and evolve.

North Pacific Fishery Management Council (NPFMC) perspective on EA

Bill Tweit and Diana Evans (NPFMC)

The North Pacific Fishery Management Council has developed two different ecosystem-based fishery management approaches to the two sections of the Arctic that are under its jurisdiction. For US waters of the Arctic north of Bering Strait, including portions of the Beaufort and Chukchi Seas, the NPFMC adopted an Arctic Fishery Management Plan that adopts a proactive and precautionary approach to developing commercial fisheries in these waters, which currently are fished for subsistence purposes only. Under this FMP, commercial fisheries will not be conducted until sufficient information is available to managers to support informed decisions about stock biomass, productivity and ecosystem relationships, in order to ensure that fisheries are sustainable and that ecosystem functions are protected. Prior to initiating commercial fisheries, the NPFMC will also develop programs for coastal community involvement in emerging commercial fisheries, potentially similar to the existing Community Development Quota program in the eastern Bering Sea. The NPFMC is currently drafting a best practices report on exploratory fishing, as it considers alternatives for implementation of the Arctic FMP.

In the eastern Bering Sea, the NPFMC continues to evolve its existing groundfish FMP to incorporate ecosystem-based fishery management approaches. This FMP prescribes conservative biological reference points for establishing allowable harvest levels, to account for uncertainty and ecosystem considerations. This ecosystem-based approach has a three-decade record of success: consistently yielding 2 million metric tonnes of groundfish harvest annually without overfishing. With new ecosystem models that are based on an intensive five-year scientific assessment of the eastern Bering Sea in hand, the NPFMC and the science community are transitioning the current management framework from a single-species approach to a multispecies approach. The NPFMC is developing a Fishery Ecosystem Plan for the eastern Bering Sea to guide this transition

and to facilitate adaptation of the fisheries as climate change and other stressors impact the ecosystem. This FEP is expected to function as both a strategic planning tool to accomplish the above objectives and also a communication tool for interaction with coastal communities, subsistence users, stakeholders and other government agencies.

Session 3: Practical experience with IEA
Session 3A: ICES work and experiences with IEA

IEA in ICES: approaches and experiences

Mette Skern-Mauritzen (IMR)

Integrated Ecosystem Assessments (IEAs) can be defined as a synthesis and quantitative analysis of information on relevant physical, chemical, ecological and human processes in relation to specified ecosystem management objectives. IEA is a core element in the ICES Strategy for 2014–2018, committing ICES to 'building a foundation of science around one key challenge: integrated ecosystem understanding. ICES will produce integrated ecosystem assessments in regional seas as a fundamental link between ecosystem science and the advice required in applying the ecosystem approach'. ICES has now established eight regional IEA groups; for the Mediterranean Sea, western European Shelf Seas, North Sea, Baltic Sea, Norwegian Sea, Barents Sea, Northwest Atlantic Regional Seas, and the Arctic Ocean. While covering the larger ecoregions, most of the IEA working groups have recognized the need to focus on smaller regions within the ecoregions, due to smaller scaled, geographic variation in drivers, pressures and ecosystem state.

While most ICES IEA working groups so far have focused on analytical approaches to assess ecosystem state, trends and in identifying drivers and pressures, their activities are now broadening the scope to include more of what is often referred to as the Levin cycle (based on a paper by Levin and colleagues from 2009); identifying management objectives, including stakeholder engagement, identifying and testing management strategies, and provide management advice by pointing at areas of concern and test and provide management options. However, while Levin and colleagues focused predominantly on using indicators for assessing state, the ICES IEA groups use a plethora of information sources, including observations, indicators, aggregated data, model output, and published results. Also, the IEAs in ICES perspective are flexible frameworks that differ among IEA working groups, depending on the available information, the structure, dynamics and pressures of the focal system, and on the interests, capacity and competence of the scientists involved. It is anticipated that the current focus on management objectives and stakeholder involvement will motivate further development of more targeted approaches relative to management objectives.

IEA of the Barents Sea LME – WGIBAR

Elena Eriksen (IMR)

Working Group on the Integrated Assessments of the Barents Sea (WIGBAR) is a ICES working group, which focuses on describing the status and changes in the Barents Sea. The group updates the existing time-series data (more than 50) and develops additional time-series (around 20) to describe ecosystems components and their variation using diverse statistical tools. Since the 1980s the Barents Sea has gone from a situation with high fishing pressure, cold conditions and low demersal fish stock levels, to the current situation with high levels of demersal fish stocks, reduced fishing pressure and warm conditions.

The WGIBAR report "The state and trends of the Barents Sea ecosystem" is used as a status report for the Norwegian-Russian environmental commission, as well as by the Work Programme for the Norwegian-Russian environmental cooperation associated with the Joint Russian Norwegian Environmental Commission and Fisheries commission.

IEA of the Central Arctic Ocean – WGICA

ICES, PICES, and PAME have formed a "Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA)". The co-chairs are John Bengston (NMFS, NOAA, Seattle, WA), Hein Rune Skjoldal (IMR, Bergen, Norway) and Sei-ichi Saitoh (Hokkaido University, Japan). In November 2017, there was an "Agreement to prevent unregulated high seas fisheries in the Central Arctic Ocean". Support for this agreement comes from a precautionary, ecosystem approach and leads to the need for Integrated Ecosystem Assessment and a Joint Program of Scientific Research and Monitoring. The WGICA Terms of Reference are:

- Approach and methodology for doing an IEA;
- Assemble data and information, carry out appropriate analyses;
- Prepare an IEA for the current status of the CAO ecosystem;
    - Productivity–phyto-and zooplankton;
    - Fish stocks –potential production, abundance;
    - Vulnerability–to anthropogenic and natural impacts (Sea ice biota, plankton, benthos, fish, marine mammals, birds);
- Requirements and design of future research and monitoring;
- Identify priority research issues.

Key questions include: What projected shifts in climate and oceanography are likely to impact ecosystems in the Central Arctic Ocean? What is the productivity of plankton, benthic organisms, and sea ice biota in the Central Arctic Ocean? What is the potential productivity of fish stocks in the Central Arctic Ocean? What is the vulnerability of ice-associated marine mammals and birds in the Central Arctic Ocean to climate change, shipping, potential commercial fishing, and other anthropogenic activities?

WGICA held their second meeting, at NOAA in Seattle, on 19–21 April 2017. 23 persons from four countries (Canada, Japan, Norway, USA) attended. A Report is available online (http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/SSGIEA/2017/WGICA/WGICA%202017.pdf). Progress since the 2016 meeting included the delineation of focal areas for IEAs: Amerasian Basin/Pacific Gateway, Eurasian Basin/Atlantic Gateway, Central Arctic Ocean, High seas basins plus relevant slopes and shelves. Also work on Arctic fisheries with links to the new fisheries agreement and the Fisheries Scientists of the Central Arctic Ocean (FiSCAO) work; and the CAFF/CMBP State of the Arctic Marine Biodiversity Report. Work on ecosystem description has also progressed, comprised of descriptions of key features, seasonal aspects, climate linkages and conceptual models of: climate and sea ice, oceanography, primary production, sea ice biota, zooplankton, benthos, fish, marine mammals and birds. The WG is also considering Ecosystem Vulnerability by examining sources of potential impacts to the ecosystem (climate, shipping, commercial fisheries, and others). Ecosystem components under consideration for the impacts assessment include sea ice biota, plankton, benthos, marine mammals (polar bear, ringed seal, bowhead whale, beluga and narwhal) and seabirds (Ivory and Ross' gulls).

Next steps for the WG include to prepare an initial draft text of vulnerability (April 2018) and assemble a first version of an IEA (April 2018). The 3rd WGICA meeting will be held on 24–26 April 2018 in St. John's Newfoundland, Canada.

IEA of the NW Atlantic – WGNARS

Rebecca Shuford (NOAA)

The "WGNARS", or ICES Working Group on the Northwest Atlantic Regional Sea, was initiated in 2009. This is a binational group that includes partners from both Canada and the United States (US). Since its inception WGNARS has been working to build capacity to support Integrated Ecosystem Assessments (IEA) for the Northeastern US and Atlantic Canada, with the key being to ultimately develop management advice in an ecosystem context. To achieve this, WGNARS has adopted the NOAA IEA framework as the underpinning approach (www.noaa.gov/iea). The key objective of this effort is to draw on as broad a base of expertise as possible, ranging from managers to scientists, and across disciplines in a manner that describes the ecosystem from large-scale abiotic physical processes through the human benefits derived.

As with other ICES WGs, the WGNARS functions under 3-year Terms of Reference (ToR). The WG is currently one year into its 3rd cycle of TORs. In the first cycle, the group started as an "expert" group sharing information across disciplines and developing an inventory of possible indicators for assessment of the system. In the second cycle, the group focused on identifying objectives for the IEA by drawing from existing regulations and guidance documents – beginning to build a strawman for management if you will. From there, the objectives and indicators served as an essential baseline and guidance to develop collaborative and holistic interdisciplinary conceptual qualitative models of the systems of interest. The work from 2017 to present has really focused on engaging with managers, and the strawmen developed in previous years played an indispensable role in that engagement.

Now and moving forward the knowledge and building blocks gained from the previous years of the WGNARS IEA development process is beginning to be applied to the US Fishery Management Process, most recently in the development of a risk assessment for the Mid-Atlantic Fishery Management Council (approved and adopted by the Council in December, 2017: http://www.mafmc.org/s/SOE_MAB_RiskAssess-lzyt.pdf). The risk assessment is expected to be formally used to inform the Council's next 5-year strategic plan and to develop a management strategy evaluation which looks to mitigate the major risks in the system.

Session 3B – NOAA IEA Program

IEA in Alaska

Jamal Moss and Kirstin Holsman (NOAA)

Alaska integrated ecosystem assessment (AK IEA) is a set of best practices, a process, a product, and a NOAA program. AK IEA products include fisheries ecosystem plans, conceptual models, ecosystem models, ecosystem indicators, ecosystem assessment documents, risk assessments, and management strategy evaluations. The AK IEA program is divided into 4 large marine ecosystems. They are the Gulf of Alaska, Aleutian Islands, East Bering Sea, and the Arctic.

A key feature of the East Bering Sea IEA is the Ceattle model. This multispecies model estimates the abundance of walleye pollock, arrowtooth flounder, and Pacific cod. Annual recruitment estimates are treated as the unit of comparison in generalized linear

regressions for each species, where recruitment follows a logistic function of spawning biomass in the previous year.

The GOA IEA is in the initial steps of development but has a 3-part plan for development. The first step is to develop a conceptual model that touches on aspects of biological and physical drivers, community health and resilience, and species-specific responses to the environment. We will begin with qualitative network models because they are simple and measure responses in positive and negative vectors. The second step is to develop a place-based IEA in Sitka, Alaska and the third objective is to engage other coastal community stakeholders. Our main stakeholders in the GOA are coastal communities and the North Pacific Fisheries Management Council.

Knowledge and understanding are always evolving, so we are building the AK IEA to allow for that evolution. If an IEA reflects a narrow viewpoint, or a discrete set of priorities it will become obsolete. Therefore, it is extremely important to create formal collaborations that intentionally span perspectives and backgrounds. IEA can then provide the consistent place for ecosystem knowledge to be discussed and shared.

IEA in the California Current

Chris Harvey and Jameal Samhouri (NOAA)

The California Current Integrated Ecosystem Assessment (CCIEA) team has been conducting ecosystem-scale research along the west coast of the USA since 2010. The CCIEA team approaches the California Current Large Marine Ecosystem as a social-ecological system with strong linkages among natural and human components at scales that can span well beyond the presumed boundaries of the system. The CCIEA team has partnered with the Pacific Fishery Management Council (PFMC) since 2010, but is expanding to include other partners focused on protected resources, place-based management, and non-fisheries sectors. The CCIEA team provides extensive ecosystem status reporting to the PFMC, and is generating more integrative products such as risk assessments and management strategy/trade-off evaluations. It is fair to say that the CCIEA team invested much of its early energy in tool development and capacity building rather than engagement with managers and stakeholders, and management uptake of our products has been slow; however, we are unsure if that would have been different if we had focused initially on engagement rather than tool development. We also are finding that IEA implementation is most effective when focused upon specific management questions at local or regional scales, rather than trying to "study everything" in the entire ecosystem, which is beyond our capacity. Among the other lessons learned from the CCIEA experience thus far are:

- Conceptual models are valuable for getting scientists, managers and stakeholders on the same page;
- Social scientists are in short supply and should be engaged, recruited and funded;
- Small-scale IEA projects are valuable learning and development experiences;
- External, facilitated, expert review is essential to an IEA effort;
- Take advantage of "opportunities" such as large environmental perturbation events;
- Learn to present findings in multiple ways to diverse audiences;
- A small amount of money can go a long way (workshops, leveraging other projects, etc.);
- Incentivize products beyond just scientific publications (e.g. models, surveys, communication tools, status reports, management tools)

- The national and international IEA network is strong and growing; take advantage of it.

Session 3C – Experiences from IEA work in the Arctic Council and other jurisdictional frameworks

CAFF: Circumpolar Biodiversity Monitoring Program (CBMP) and State of the Arctic Marine Biodiversity Report (SAMBR)

The Circumpolar Biodiversity Monitoring Program (CBMP), part of the Arctic Council's Conservation of Arctic Flora and Fauna (CAFF) Working Group, is working with partners across the Arctic to harmonize and enhance long-term marine monitoring efforts. These efforts are led by a Marine Steering Group with expertise from six Marine Expert Networks.

In April 2011, these scientists and community experts released the Arctic Marine Biodiversity Monitoring Plan, an agreement between six Arctic coastal nations and many national, regional, Indigenous and academic organizations on how to monitor Arctic marine ecosystems. The Plan has been endorsed by Senior Arctic Officials of the Arctic Council.

CBMP published The State of the Arctic Marine Biodiversity Report (SAMBR) in 2017. SAMBR is a synthesis of the state of knowledge of biodiversity in Arctic marine ecosystems, detectable changes, and important gaps in our ability to assess state and trends in biodiversity across six focal ecosystem components (FECs): marine, mammals, seabirds, marine fish, benthos, plankton, and sea ice biota.

By compiling available information, the report provides an important first step to identify knowledge gaps in circumpolar biodiversity monitoring efforts. Current biodiversity monitoring is not sufficient to describe the status and trends for many of the FECs.

The SAMBR builds on the Arctic Biodiversity Assessment and is an important first step towards better understanding and management of our living resources in the Arctic marine environment. It helps understand the limitations of what existing biodiversity monitoring is able to tell us about the Arctic environment and provides a path forward for improving knowledge.

Monitoring the status and trends of Arctic biodiversity and attributing causes of change are challenging. Complexity, logistics, funding, international coordination, natural variability, and availability of expertise and technology combine to limit available data and knowledge. These limitations affect biotic groups unevenly.

SDWG: Environmental Impact Assessment (EIA) project under Finnish Chairmanship

Hermanni Kaartokallio (Finnish Environment Institute)

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development before the decision-making, taking into account interrelated socio-economic, cultural and human health impacts, both beneficial and adverse. **"Good Practice Recommendations for Environmental Impact Assessment and Public Participation in the Arctic"** – Arctic EIA in short – is a project endorsed by the Sustainable Development Working Group of the Arctic Council (www.sdwg.org). The Arctic EIA project is led by Finland during the Finnish chairmanship of the Arctic Council in 2017–2019 and co-led by Canada and the Kingdom of Denmark. The project aims at providing Arctic-specific EIA recommendations that can be applied in the vulnerable and changing Arctic environment, taking into account the indigenous peoples and other inhabitants living there. Since economic activities are

likely to increase in the Arctic, the role of EIA in the project planning will be increasing. Mapping good practices, sharing experiences, learning from each other and co-creating recommendations form the core of the project. The project is collecting best practices by a questionnaire and is organizing series of workshops across the Arctic in 2017 and 2018. EIA and EA have different primary spatial and temporal scales as EIA typically is done for a specified, concrete project or activity before its commencement, whereas EA is taking place at ecosystem scales and is continuous and cyclic. Both share need for integration across sectors and impact types as well as balancing natural ecosystem components with sustainable human use. Public and local community participation is crucial to both. EA holistic approach could be useful in developing Arctic EIA practices for the future.

OSPAR: Intermediate Assessment 2017

Charlotte Mogensen (OSPAR Commission)

The OSPAR Commission's activities under the North-East Atlantic Environment Strategy are guided by the application of the Ecosystem Approach. Understanding and assessing cumulative effects is at the heart of implementing an ecosystem-based approach to the management of human activities in the OSPAR Maritime Area.

The presentation focused on the outcome of the OSPAR Intermediate Assessment 2017 (IA 2017), highlighting the work of the OSPAR Convention, which works through a mix of legally binding Decisions, and Recommendations and Agreements/guidelines and the objectives under the North-East Atlantic Environment Strategy (the OSPAR Strategy) and the Thematic Strategies guiding the work of the 5 Committees under OSPAR.

In implementing an ecosystem approach to the management of human activities, OSPAR cooperates with international organizations, such as the North-East Atlantic Fisheries Commission, Arctic Council, the International Maritime Organization, the International Council for the Exploration of the Sea and the Intergovernmental Oceanographic Commission.

Since the publication of the OSPAR Quality Status Report (QSR) 2010, OSPAR has been working with other Regional Seas Conventions and the European Commission to develop common and widely applicable assessment tools; many new indicators of the state of the marine environment have been identified and assessment methods developed, while other long-standing assessment methods have matured. These are required for delivery of both the OSPAR Strategy and the European Union (EU) Marine Strategy Framework Directive (MSFD).

The IA 2017 details human pressures on the North-East Atlantic, and their effects. Some of the indicators of pressure reported back in the QSR 2010 have been refined such that in the IA 2017 there is a significant regional component to the assessment. The IA 2017 comprises 47 assessments, representing a stepping stone in the process of assessing the status of the North-East Atlantic which requires ongoing advancement of current indicators and the introduction, testing and approval of new indicators. This continual process represents delivery, by OSPAR, of key information to allow the management of human activities impacting on the North-East Atlantic.

The IA 2017 further develops OSPAR's understanding of the marine environment of the North-East Atlantic and its current status. It demonstrates OSPAR's progress towards realizing its vision of a clean, healthy and biologically diverse North-East Atlan-

tic, used sustainably. OSPAR's previous holistic assessment, the QSR 2010, was a culmination of ten years of joint assessment and monitoring by OSPAR Contracting Parties. Seven years on, and with the benefit of significant developments in monitoring and assessment methodology, the IA 2017 provides an update on the 2010 assessment as well as presenting some new indicators and assessment methodology.

Although an OSPAR Report, OSPAR Contracting Parties that are also EU Member States have the opportunity to use the information presented in the IA 2017 for their update in 2018 to the EU on the initial assessment (2012) for the MSFD. However, it should be noted that at this point in time, OSPAR IA 2017 indicator assessment values are not to be considered as equivalent to proposed EU MSFD criteria threshold values.

The upcoming QSR 2023 will include an assessment of cumulative effects, which was not undertaken for the IA 2017. The next QSR will focus on efforts to undertake a cumulative effects assessment that is integrated with the OSPAR common Indicator Assessments and their associated data.

https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/

HELCOM Holistic Assessment II

Hermanni Kaartokallio (Finnish Environment Institute)

The Baltic Sea is a Subarctic marginal sea with annual ice cover, low salinity of water and very high impact of human activities from nearly 90 million inhabitants surrounding the sea. The Baltic Marine Environment Protection Commission (HELCOM) is one of the Europe's regional sea conventions aimed at minimizing harmful impacts of human activities on the marine environment and restoring the good environmental status. HELCOM convention entered into force in 1974 and all Baltic Sea coastal states are its contracting parties. HELCOM administers periodic assessments of ecosystem health of the Baltic Sea with an overarching holistic assessment being produced every six years. The HOLAS II project (2014-2018) will produce a second holistic assessment and give an update on the overall state of ecosystem health in the Baltic Sea. The assessment will follow up on the hierarchical system of vision-goals-objectives laid out in the HELCOM Baltic Sea Action Plan. The results will support reporting under the EU Marine Strategy Framework Directive (MSFD) by those Contracting Parties to the Helsinki Convention that are also EU member states. The first version of the report was released in mid-2017 and can be accessed via the project web page stateofthebalticsea.helcom.fi. The updated report will be finalized by mid-2018.

Interactions between Traditional and Local Knowledge (LTK) and science in conducting IEA

John Noksana, Jr. (Fisheries Joint Management Committee)

Leah Brown (DFO)

The Canadian Beaufort Sea - An example of collaboration.

In the Inuvialuit Settlement Region (ISR) a governance structure has been established to address marine issues and act as a forum for collaboration among stakeholders. Under the Inuvialuit Final Agreement, a number of co-management bodies were created including: the Inuvialuit Game Council; the Fisheries Joint Management Committee; the Environmental Impact Screening Committee; the Environmental Impact Review Board; the Wildlife Management Advisory Council (Northwest Territories) and the Wildlife Management Advisory Council (North Slope, Yukon).

There are a number of examples illustrating how these co-management bodies and locals partner with government to better understand and manage the marine space. The governance structure in the ISR is in place and ready to take advantage of opportunities to do IEAs. There is a desire to continue working with Alaska.

Perspective and examples of Ecosystem Approach to management from the North Slope Borough

Nicole Kanayurak (North Slope Borough, Department of Wildlife Management)

The North Slope Borough Department of Wildlife Management is responsible for helping to assure participation by Alaska North Slope residents in the management of wildlife resources, by keeping these resources at healthy population levels, and to assure that residents can continue their subsistence harvest. Our studies help provide the factual documentation of the state of the environment for the subsistence needs of our residents.

Our communities are an integral part of the development of our priorities. Our involvement in Arctic research and management organizations spans across scales and boundaries. Being involved directly with both the communities across the Arctic at the regional level all the way up to our involvement in international organizations on a variety of arctic species and ranging across the North Slope and adjacent water allows our department to have comprehensive knowledge of where we live.

The Borough is geographically, the largest municipal government in the United States. It spans the North Slope of Alaska, an area covering 89 000 square miles (230 000 sq km) (and two LMEs). Further, the Borough has adopted a Code of Ordinances that explicitly provides for cooperative management of North Slope wildlife resources.

The Wildlife Department monitors the population and health of fish and wildlife species. This is accomplished through regular research, cooperation and collaboration with federal and state partners. Those with Indigenous knowledge like on beluga and polar bear share knowledge across borders as well. Ease of monitoring and managing across borders and the resources and partnerships to do this need to be supported stronger into the future including support from our management partners.

Our Department has been in existence since 1981. Alone, we have more than 500 journal article publications our staff at the Department have co-authored ranging from baleen and siuti (ear) aging of bowhead whales to providing stock assessments to the International Whaling Commission (IWC). Other research spans across species including the tagging and tracking of ice seal species, caribou, snow geese, it includes monitoring ocean currents, and acoustic monitoring surveys and gathering satellite telemetry data for species important to our communities.

Our Communities drive our science and traditional knowledge research. We have biologists working along-side our subsistence research coordinators to make the difficult task of on the ground monitoring and projects occur across the two LMEs.

Impacts to our environment require resources at the regional level to address and practically implement monitoring and management plans. To be able to monitor these changes and have the knowledge base requires sustainable funding and staff capacity in our department to be involved in for local input.

There is an opportunity for an ecosystem approach if implemented correctly involving the people residing in the Arctic to ease the burden of research fatigue on communities

and streamline living resource management. So, looking at management beyond a single species and increased flexibility in regulations on subsistence is needed to deal with the annual variation and growing unpredictability of sea ice and hunting seasons. Opportunity to take resources in a traditional manner based on the environmental conditions is our right.

The Alaska Eskimo Whaling Commission is a good example that our department supports which has a good system of monitoring and providing input for increased activity like vessel traffic to minimize conflicts and mitigate impacts. That is how the Arctic Waterways Safety committee was established, on a local grassroots level because of vessel traffic concern. The above slide displays how we monitor for ship strikes and line entanglements on our bowhead species.

The NSB would like to see more comprehensive management of resources we depend on. Regulations and management of wildlife resources is becoming unpredictable and we have to keep track of management of all living resources in the Arctic, which is costly from the polar bear co-management committee to the Alaska migratory bird commission.

We would like to see the continued participation by the next generation of North Slope residents in the management of wildlife resources and youth continue to want to live where we live, by keeping these resources at healthy population levels, and to assure that youth can continue their subsistence harvest.