Science and Tools for Developing Arctic Marine Protected Area (MPA) Networks: Understanding Connectivity and Identifying Management Models

Report from the First Expert Workshop on Marine Protected Area networks in the Arctic

September 2016 - Washington D.C, USA

PAME

Protection of the Arctic Marine Environment

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22-23 September 2016
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Summaries and Key Discussion Points

Report from a workshop held under the auspices of the Protection of the Arctic Marine Environment (PAME) Working Group of the Arctic Council in 2016: "Area-based conservation measures and ecological connectivity in designing Arctic MPA Networks" (2016).

Editors: Stefan Norris with contributions from the PAME Working Group and invited speakers.

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Background

For a review of the five-year history of the PAME Marine Protected Areas projects, see https://pame.is/index.php/projects/marine-protected-areas

PAME's Framework for a Pan-Arctic marine Protected Areas Network document recognizes that individual Arctic countries pursue MPA development based on their own authorities and priorities, and that MPA networks can be comprised of "both MPAs and 'other' area-based measures that contribute to network objectives".

PAME's "toolbox" project aims to develop guidance to assist countries in advancing MPA networks in the Arctic. The project will produce this guidance in the form of a catalogue of examples of diverse existing area-based measures, including different types of marine protected areas and of "other area-based conservation measures" that contribute to the long-term conservation of important categories of Arctic marine biodiversity (e.g. important species and habitats). The toolbox is intended to be a living document that will be expanded and refined over time.

Over the course of the 2015-2017 work cycle, project leads hosted the following workshops on connectivity in the Arctic:

- 1st MPA Workshop: Science and Tools for Developing Arctic Marine Protected Area (MPA) Networks: Understanding Connectivity and Identifying Management Models (22-23 September 2016 – *this report).*
- 2nd MPA Workshop: Understanding MPA Networks as Tools for Resilience in a Changing Arctic (2-3 February 2017).
- 3rd MPA Workshop: marine protected area (MPA) networks in a changing Arctic climate (21-22 September 2017)

Introduction to the report

This report presents the content and outcome of the 1st MPA workshop: "Science and Tools for Developing Arctic Marine Protected Area (MPA) Networks: Understanding Connectivity and Identifying Management Models"

The report can be used as a supplement to the information on the MPA workshop series provided on the PAME website[1]. The website includes a brief introduction to each workshop and provides links to downloadable versions of the slides / presentations given at these workshops.

This report provides additional information to what is presented on the PAME website, including:

- Summaries and key findings from the presentations.
- Key points from discussions following the presentations, and from facilitated discussions and exercises at the workshops.

[1] https://pame.is/index.php/projects/marine-protected-areas

- Key outcomes from the workshops pertaining specifically to the development of the PAME-led **Arctic MPA Toolbox project**, which explores new approaches to protecting marine ecosystems and their components in an Arctic context.

Workshop Introduction and Setting the Stage

Lauren Wenzel, U.S. NOAA Marine Protected Areas Center, opened the workshop by providing context and an overview of the Arctic Council, the PAME Working Group and its work on marine protected areas. In 2013, PAME developed a Framework for a Pan-Arctic Network of MPAs. This document sets out the goals and objectives for a pan-Arctic network, recognizing that each Arctic state is responsible for network development in their own waters.

The purpose of the workshop was:

"To support a PAME project studying best practices for linking area-based conservation measures to categories of Arctic marine biodiversity in support of the long-term conservation of the Arctic marine environment and associated services and cultural values."

The workshop objectives were:

1. Develop our understanding of ecological connectivity for different marine taxa and ecosystem components (e.g. habitats, fish larvae). What do we mean by connectivity? How it is measured? How it differs between species groups
2. Identify opportunities and priorities for future scientific or other types of collaboration to enhance understanding of ecological connectivity in the Arctic.
3. Based on input provided by Arctic States, share examples of different management tools used to manage categories of marine biodiversity (e.g. habitat, marine taxa).
4. Identify priorities for expansion/refinement of "MPA Toolbox" to support Arctic states' MPA network development.
5. Identify potential next steps to advance understanding and management of MPA networks among Arctic Council Working Groups and other partners.

In addition to presentations on a range of topics of relevance to the workshop objectives, and ensuing discussions and Q&A sessions, the workshop included:

i) a specific discussion on species that highlight the importance of ecological connectivity in the Arctic marine environment, as well as possible approaches and methodologies for mapping selected elements of ecological connectivity for some of those species, and

ii) a discussion linked to a submitted draft list (or "Toolbox") of various area-based conservation measures that benefit different categories of Arctic biodiversity.

Participants are listed in Annex I.

Workshop website and presentations

The presentations given at the workshop can be downloaded from the 1st workshop website, which is hosted by PAME: here

Theme 1: Understanding Physical Connectivity

Under this theme the workshop focused on specific issues linked to connectivity in MPA network design: What do we mean by connectivity? How is it measured? How does it differ between species groups? Several case studies and approaches were presented.

1) Physical connectivity – Issues and possible approaches to mapping physical connectivity in the Arctic.

- **Pat Halpin and Jesse Cleary**, Duke University, USA.
- Download

Key issues discussed

The speakers presented key elements of connectivity modeling in the context of Arctic MPA network design, i.e. how ecological elements are connected in the arctic marine environment. Circulation, and thus connectivity and the distribution of species, habitats, and exchanges of energy and nutrients, is influenced by many complex features and processes, at many scales, for example temperature and salinity gradients, freshwater input, surface wind (dynamic and changing due to climate change), sea ice characteristics and dynamics (also changing), and seasonality. They also discussed how to represent physical and ecological processes of connectivity, and how to ask questions about connectivity in the models.

The speakers presented their data model for modelling connectivity, using larval dispersal, which is driven by hydrodynamics, as the main feature of study. The team takes many of these factors into consideration in their modeling. They use wiring diagrams, like those of an electrician, creating network models, a connectivity matrix, and maps of flows in the ocean. The movement of a 'parcel' of water through the network can be modeled, using a variety of inputs that influence the movement (linked e.g. to wind, currents, ice, food availability, etc).

The effect of MPAs on the movement (circulation and connectivity) of species can be simulated and assessed and mapped.

The network diagram model can thus be used to created spatial hypotheses, which ecologists then can test and validate. e.g with genetic analyses. The speakers presented results from modelling connectivity between coral reefs in the Caribbean, using larval dispersal. They also presented results from their first Arctic connectivity pilot analysis, with examples from "normal" ice year and from "low" ice year modeling, based on analysis of the connectivity of 500 km coastal segments, fish spawning grounds, and important feeding grounds, and projected also with global warming scenarios.

Key findings and conclusions

- Traditional modeling deals with small-scale predator-prey interactions in the water mass (mostly vertical). However, modeling horizontal circulation of the water masses, at multiple scales, is essential, important, and difficult.
- The models work satisfactorily, within the limitations expected with limited data, large-scale complex ongoing processes and features, and climate change uncertainty.
- They provide interesting and useful information on the potential movement of species and species groups in the Arctic marine environment under various climate change scenarios.

Recommendations and next steps

- Complete the initial pilot study on coastal connectivity, using updated information on fish spawning areas, foraging areas, MPAs, and emerging potential deep sea fishing areas
- Identify pan-Arctic trends across ecoregions
- Identifying and using new nodes of connectivity
- Identify further case studies/ applications, including potentially ideal placement of MPAs or other protection measures
- Further develop connectivity tools for use in the Arctic MPA "toolbox"

2) Ecological Connectivity - Overview of techniques that have been used to map larval dispersal and its relevance to MPA design

Mark Carr, University of California, Santa Cruz, USA

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Key issues discussed

The speaker presented a broad, largely conceptual overview of connectivity in the context of Arctic MPAs. Based on research and field studies done primarily on marine species with 'passive' dispersal mechanisms (e.g. larvae, pelagic fish eggs), a.k.a. **'Floaters'**, along the coast of California.

He discussed various types and levels of ecological connectivity:

- population (demographic)
- genetic
- community (movement of multiple species)
- ecosystem (movement of nutrients and energy)

The speaker presented methods of estimating or measuring population connectivity. e.g. by determining how long it takes for a 'passive' larvae to reach a new, attractive locations; measuring differences in the genetic composition of populations at different distances from a source of genetic input (e.g. larvae); analyzing parentage of individuals in various populations; and modeling spatially explicit population components.

Key findings and conclusions

- There are many ways to measure or estimate connectivity. Methods can be used separately or in combination.
- What method to use depends on the availability of information that is required for using the method. It also depends on the planning process being used, the timeline and budget, and on the stakeholders' tolerance or need for complexity.
- The estimated spatial patterns and rates of connectivity ultimately have implications for the size of MPA being planned, spacing between MPAs, and how they are managed inside and outside.

- Connectivity science is new and rapidly developing. Much of this science is theoretical and model-based. More good empirical evidence input to and evaluation of these models will greatly enhance their applicability and utility.

Recommendations and next steps

- To maximize ecosystem connectivity, multiple ecosystems should be included in one protected area – or in multiple smaller MPAs closely spaced together.
- Planning and management of MPAs must take dispersal (of individuals, genes, populations) into consideration. The location, size, shape, and distance from other MPAs must protect the sources of organisms and resources (larvae, genes, individuals) needed to supply, replenish, and sustain populations and ecosystems in both the 'source' (re-supply) area and neighboring MPAs, and also must be suitable recipient environments for the same from other sources outside the MPA.
- Long-term, science-based monitoring programs (using both science and indigenous knowledge) should be developed and used to evaluate ecological connectivity, and MPA managers should use monitoring results from these to manage MPAs and networks of MPAs adaptively. Connectivity may not be constant and that it is important to identify how connectivity may be changing seasonally and over longer timeframes.

3) Case study – Sweden's experience mapping larval connectivity for MPA networks

– **Jonathan Havenhand**: Dept of Marine Sciences, University of Gothenburg, Sweden

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Key issues discussed

The speaker presented the work of Per-Olav Moksnes and Per Jonsson of Gothenburg University. They have developed and used a methodology to model how larvae of marine organisms disperse in the Baltic Sea. The models can be used to estimate and illustrate the optimal size, location, and density of MPAs in the region in terms of maximizing survival and dispersal of larvae.

The team, develops biophysical models (BaltiX) that use complex mathematics and deliver results relating to:

- Hydrodynamics, at different scales,
- Larval dispersal trajectories, and
- A connectivity matrix, which shows the connectivity among various sites.

They also modeled and evaluated the benefits of alternative MPA locations, sizes, densities and connectivity in terms of maximizing survival and dispersal of larvae, with population size of larval species in the MPAs at end of scenario as measure of success.

Key findings and conclusions

- Most marine organisms have planktonic larvae. These move largely passively in and with the water masses. However many also have behaviors that influence how, where and how fast they move.

- Larval dispersal is difficult to study (they are small, numerous, have different behaviors, many of which are little known).
- The depth and location of starting point, and duration of dispersal strongly influence how and where the larvae move.
- Data availability is currently a limitation to model development and use.
- Dispersal distances for algae are generally larger than most MPAs.
- Existing MPA networks are not optimally designed for larval connectivity
- Each dispersal strategy produces a unique connectivity matrix.
- Dispersal modeling, using different larval strategies, can provide valuable information and be a very powerful tool, if good circulation model data are available.
- Carefully chosen small additions (<20%) to existing MPA networks can double population size & resilience of key marine species.
- This modeling approach used can identify dispersal barriers that are important for MPA design and species management.

4) Discussion and Key Points from Theme 1: Understanding physical connectivity

- The modeling approach can be used to incorporate climate change data (temperature and sea level rise, increased acidity) and to project the effects of this on biodiversity, populations dynamics and dispersal.
- Water generally moves less along convoluted coastlines vs. straight coastlines. Accordingly, those organisms move less. One might then choose to have networks within networks along convoluted coastlines. Along straighter coasts, countries can have fewer, larger protected areas. Countries can also classify sites by their contribution to a network, e.g. is it a hub site or a stepping stone site?
- Though not perfect, physical modeling is valuable to determining whether and where MPAs may be needed, and to the design and planning process. A multi-tiered approach is necessary. We can start with basic models and then improve them over time in order to generate information that is needed now. Models should use both relevant science and indigenous knowledge. We need to move quickly.
- To be effective and have an impact, the models need to produce information relating to priority species, either for biodiversity conservation, fisheries and economic development and/or cultural significance/social ecological systems. The models should also utilize information from both traditional and local knowledge and science, (including the relationships between humans, species and ecosystem).
- Lack of data should not stop the development and use of such models. We should use what we have, for example using habitat as a proxy for species presence, and refine models as we proceed. There are examples of good conservation measures taken despite data limitations, e.g. Great Barrier Reef.

Theme 2: Understanding Movement and Connectivity Needs of Arctic Marine Species

A series of presentation were given relating to connectivity issues for various species linked to the marine environment – both “swimmers” and “flyers.”

1) Approaches and considerations for understanding connectivity for marine mammals using various techniques

Howard Rosenbaum, Wildlife Conservation Society &

Francine Kershaw, Natural Resources Defense Council

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Key issues discussed

The presentation included:

- an overview of marine mammals in the Arctic,
- an overview of design principles for MPA networks that are to be effective for protecting marine mammals,
- an overview of ways in which marine mammal populations connect (modes of connectivity), as well as some tools and approaches for understanding such connectivity,
- how a changing Arctic affects marine mammal connectivity.

WCS concentrate their ocean conservation efforts in areas with highest biodiversity, most productivity, and greatest threat. Marine mammals in the Arctic are culturally important and fall into three ecological groups: ice dependent, ice associated, and migratory ‘visitors’.

MPA networks for marine top predators need to incorporate[2]:

- Complex life histories of these species;
- Dynamics of their ocean habitats
- Vast scope of detrimental activities.

There are three main modes of connectivity for marine mammals: 1) Connectivity between suitable habitats; 2) Connectivity linked to different life history stages (e.g. migration), and 3) Population-level connectivity (i.e. genetic).

The speakers presented an overview and discussed pros and cons of tools that can be used to assess marine mammal connectivity, including: 1) Acoustics; 2) Genetics; 3) Photo-ID; 4) Secondary markings; 5) Satellite telemetry; and 6) Stable isotopes.

How a changing Arctic affects marine mammal connectivity and population dynamics:

- It’s a case of winners and losers. Presented a figure showing the expected positive and negative impacts of increasing and decreasing sea ice on ice-dependent (obligate)

[2] From Hooker et al. (2011)

species, ice-associated species, and seasonally migrant species. (Moore and Huntingdon, 2008).

- Trends in marine mammal abundance have been defined by Laidre et al. (2015); however, there are still too many data gaps to assess current trends for most species and subpopulations.

Key findings and conclusions

- "MPA networks should promote species survival by maximizing adequacy and connectivity, through inclusion of multiple life-history stages and the maintenance of site specific (e.g. local abundance; population-age structure) and network wide (e.g. genetic structure, populations range and abundance) characteristics of the focal species." (Hooker et al. 2011)
- Accounting for multiple species, with different habitat preferences and connectivity patterns in a MPA network is not a simple exercise (species prioritization may be needed, and a holistic approach to prioritizing habitat and ecosystem resilience)
- Ice-dependent (obligate) and ice-associated species are expected to decline in response to decreasing sea ice, and seasonal migrants to increase (and vice versa in response to increasing sea ice.
- Some sub-populations of Beluga, hooded seal and polar bear are doing poorly. Some sub-populations of walrus are increasing whereas others are declining. Some sub-populations of bowhead are increasing, but trends for others are unknown. Harp seals are increasing.
- Our limited understanding of how many species interact with their current environment presents challenges when predicting impacts of climate change; immediate actions that reduce stressors improve ecosystem resiliency will help to protect these data-poor species.

Science-led policy processes are underway to address some of these considerations:

- The IUCN Joint SSC/WCPA Marine Mammal Protected Area Task Force is trying to identifying Important Marine Mammal Areas (IMMAs) in a number of ocean regions (not yet the Arctic, however) via regional workshops taking place over the next five years. Guidelines on IMMAs will were be presented at the 4th International Conference for Marine Mammal Protected Areas (ICMMPA) in November 2016. Protection policies are being developed in parallel, with regional expert workshops planned for the next five years. Planning an IMMA expert workshop in the Arctic would provide the opportunity to collate the best available science and expert knowledge and identify important habitats for marine mammals that can then be prioritized for protection.
- The International Whaling Commission (IWC) has identified a number of areas where it could support the Arctic Council and PAME in these efforts if funding were made available.
- There are a number of other regional and national efforts to identify and protect important habitat connections for marine mammals (e.g. expert identified migratory Biological Important Areas (BIAs) in the United States).

Recommendations and next steps

- Connectivity should be protecting marine mammals at multiple scales (spatial, temporal, individual-level, population-level). Cross-institutional collaboration will be needed for this.
- Long-term, dedicated (and integrated) research programs are required
- Best available science and technology should be utilized to make management decisions, and plan for adaptive management.
- Development of approaches to integrate different data types to provide a synthetic understanding of connectivity should be an active area of research.

2) Mapping connectivity for cetaceans in the Alaskan Arctic – CetMap

Janet Clarke, Leidos, Arlington, VA, USA &

Megan Ferguson, NOAA, NMFS, AFSC, Marine Mammal Laboratory

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Key issues discussed

Clarke presented an overview of the process of identifying Biologically Important Areas (BIAs) in the Alaskan Arctic as a part of the 'CetMap' initiative, NOAA's regional cetacean density and distribution mapping efforts (http://cetsound.noaa.gov/cda-index).

There are four types of BIAs: reproductive, feeding, migratory, and small and resident populations. The process is expert-opinion driven, with no quantitative thresholds set and no ranking. The process has four major components: narrative, map, literature cited, and metadata table.

The BIAs identify where certain cetaceans congregate at given times, and many identify areas with negative interactions between humans and cetaceans (with the goal of informing how these interactions can be minimized through management). They are derived by qualitative analyses, not quantitative.

Seven regions are being have been mapped for BIAs in North America. In the Arctic there are BIAs in the Bering Sea and Aleutian Island area, which include feeding areas for beluga, fin, humpback, bowhead, gray, and right whales, migratory corridors for beluga, bowhead, and gray whales, and an important area for the small and resident Bristol Bay beluga whale population. In the Beaufort and Chukchi Sea area, BIAs include migratory corridors for beluga and bowhead whales, and feeding and reproductive areas for beluga, bowhead, and gray whales. The areas are identified using a combination of aerial, satellite, passive acoustic, and other types of best available scientific data.

Key findings and conclusions

- Though based on best-available data, there are limitations to the BIA process. The quantity and type of information used were spatially and temporally heterogeneous (different scales, different data sets).
- BIAs therefore do not equate to habitat or range and require updating and validation.
- Only US waters out to 200 nm were evaluated, and pinnipeds, polar bears, sea otters, and several cetaceans are not included.

- There was much inter-annual variation in feeding areas. Also, the definition of migratory BIAs was constrained by the allowable with spatial restrictions of the BIA corridor. Therefore, BIAs are not comprehensive over the entire range of a species (there is, for example, large 'fan' of migrating bowheads in the Chukchi that is not included as it didn't meet the BIA definition of a "corridor").

Recommendations and next steps

- The process has been a scientific exercise. There was no legal, political, or socioeconomic input, and there will be no direct or immediate regulatory consequences.
- Data gaps should be closed, specifically those identified in Arctic BIAs. For example:

  Beaufort and Chukchi seas

  - Bowhead whale use of western Beaufort Sea in summer and extent of fall migration in the Chukchi Sea;
  - Beluga use of outer continental shelf and slope in the Beaufort Sea;
  - Gray whale spring and fall migration corridors and movement between feeding hotspots

  Bering Sea

  - Reproductive areas, migration routes and timing, and distribution, density and behavior in the off-shelf areas.
- Data from additional resources should be incorporated, including unmanned aerial and underwater vehicles and traditional ecological knowledge
- Expand the areas studied, with regards to both species, regions, and time-frames.
  - Non-US EEZ, particularly Canada and Russia.
  - Several cetacean species should be added, as should walruses, ice seals, polar bears, and sea otters.
- These efforts are dependent on long-term aerial and other types of surveying that require sustained funding. The Marine Mammal Laboratory at the Alaska Fisheries Science Center has ongoing funding from the Bureau of Ocean Energy Management to continue to conduct aerial surveys in the U.S. Beaufort and Chukchi seas. Several other long-term studies are no longer active, however. Maintaining, or reestablishing, the funding stream for these projects is needed in order to assess how species behavior and distribution is affected by climate change in the Arctic in order to inform protection efforts and adaptive management.

3) Local community engagement in mapping and understanding marine mammal connectivity

- Willie Goodwin, Alaska Waterways Safety Commission

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Key issues discussed

Goodwin presented information on the history, context and role of his people (tribe) as stewards and co-inhabitants of the Kotzebue Sound area of northwestern Alaska, as an example of local, indigenous people who have lived on and with the land and sea in the Arctic for centuries.

Key findings and conclusions

According to archaeologists, Kotzebue has been inhabited by humans for at least 4000 years. Goodwin's tribe has a defined hunting area, in which they hunt and from which they harvest. They thus have 'on-the-ground' experience and knowledge, dating back many generations, about what the land and sea produces, the dynamics of these systems, of how they have and are changing, and of how to adapt to such changes. His people are an inherent part of the system, not visitors engaging with a system of which they are not a part.

As such, when he hears that their knowledge [Traditional Knowledge] (Traditional Ecological Knowledge or TEK) is 'anecdotal' he finds this frustrating, humiliating, and experiences that it is not taken seriously.

However, following an invitation from government scientists (led by Kathy Frost) in 2004 his tribe has been actively involved in assisting scientists in locating, capturing, handling, understanding behavior, studying, sampling, and monitoring pinnipeds (seals) and some whales. They have received grant funding for this work. As partners in this collaboration they have also been involved in providing recommendations for management of these species.

Goodwin's tribe has been involved in the following scientific studies:

- Diving behavior, habitat use, and movements of bearded seal pups in Kotzebue Sound, the Bering and Chukchi Seas;
- Migratory routes of male and female bearded seals through the Bering Strait. The adult bearded seal strategy was developed based on TEK from his tribe;
- Habitat-use and seasonal movements of adult and sub-adult bearded seals in Kotzebue Sound, Alaska; and
- Wintering areas and habitat use of ringed seals in Kotzebue Sound, Alaska: A community-based study.

His tribe has also contributed to the oil and gas lease sale assessment #193 for multiple pinniped species, and also the Port Access Route Study for pinnipeds and beluga and bowhead whales. Based on this latter study, recommendations will be made as to which side of the St Lawrence River ships should be directed.

The future of his people depends on gaining access to and participating in the development of local gas and mining industries.

Recommendations and next steps

MPAs covering sea areas inhabited and used by indigenous peoples should be time-specific and area-specific. The MPAs should allow hunting and harvesting by indigenous peoples, and allow them to engage in the development of local industries.

4) Discussion and Key Points for Theme 2: Understanding Movement and Connectivity Needs of Arctic Marine Species – 'Swimmers'

Marine mammals

Marine mammals are culturally important to inhabitants in large parts of the Arctic, and they are essential elements of food security for indigenous people. They are also iconic in terms of the wider public interest and engagement. In these areas, subsistence hunting should be accepted and included as a part of any protection or management plan in areas where this is traditionally practiced. Humans have resided and sustainably utilized these resources in these regions for thousands of years. With a cooperative spirit through equitable partnerships, traditional and local knowledge can inform adaptive management decisions, and should be used systematically for such purposes across the Arctic Council countries.

The relatively simple model of winners and losers for ice-dependent and ice-obligate species, from Moore and Huntingdon, 2008, (see Presentation 1 under Theme 2, by H. Rosenbaum, above) could be useful as a framework for selecting priority species that can / should guide the planning of MPAs or other protection measures. Indigenous knowledge can also inform this planning.

If using models plan and design MPAs or other protection measures, it is important to supplement habitat-based density/abundance models with other types of information, particularly related to life history and changes in animal behavior in a changing environment, as some low-density areas such as migration routes do not show up in the model outputs.

Pat Halpin and the team at Duke University are conducting a literature review to map and assess marine mammal migratory routes in the Arctic, to strengthen the data on this feature in their models. This information on migratory routes, for example from the Bering Strait, should also be made available to others who are involved with the planning, design and management of MPAs and other marine protection measures in the Arctic.

Sea ice

Sea ice could be potentially used as a proxy for where ice-dependent (-obligate) and ice-associated species can be found, when modeling or mapping the distribution of such species. However, subtle differences in types of ice also influence the distribution of various species within and around the ice. It is thus important to also know the specific sea ice characteristics when using ice as a proxy for species' distribution.

Protection of marine and coastal environments that feature sea ice during all or parts of the year will provide an 'umbrella' protection for a range of key species, without necessarily needing to understand their complex connectivity behaviors.

The Convention of Biological Diversity (CBD) process for identifying Ecological and Biologically Significant Areas (EBSAs) has already identified the need to protect two dynamic sea ice features: Multi-year ice and the ice edge. So the precedent for prioritizing such dynamic features for protection has been set. However, practical guidance on how to implement protection and proper management of these ice features is needed. Here there is a role for the Arctic Council working groups to come up with recommendations.

Areas with multi-year or relatively stable sea ice can function as climate refugia for ice-dependent and ice-associated species. These should be identified and prioritized for protection.

A participant asked if there is a suggested distance away from the ice edge that we can specify for industry. The answer is that this is difficult to define as it is dependent on environmental conditions and biological context, and would be hard to practically manage for in the highly dynamic environment (vessel safety concerns, oil spills, etc.). One would need to define the type of vessels and activities that we are concerned about. We would need very clear science-supported "asks" to cross over into the realm of industry needs, conditions and priorities, and we do not have the necessary amount or quality of science-based knowledge to support this yet.

One could theoretically and potentially define buffers for ocean noise pollution by using acoustic propagation modeling. There are now "quiet MPAs" for example. But the science-based recommendations from such modeling would likely specify extremely large areas for such buffers. This would likely be met with arguments of such areas not being realistic, practical, or possible to create and manage, in light of other competing needs. In Norway, scientists, environmental groups, and fishing interests tried to use the ice edge and polar front, with a buffer, to delineate the recommended northern boundary of offshore oil and gas activities (mainly drilling and production). This strategy did not result in protecting large areas of Arctic marine habitat, as the industry interests and government at the time chose to use future forecasting, given climate change, to move their activities further north.

In some cases, vessel operators and extractive industry interests are waiting for climate change to open new areas for development and utilization. They do not want to risk their equipment and investments in the ice, nor risk environmental battles, so are waiting until the ice is gone before expanding activities. As such, using distance from ice edge as a criterion for allowing certain activities, when the ice edge is so dynamic and changing, would difficult and risky. Human activity, such as ships and rigs, can also alter sea ice conditions, by creating leads, breaking off ice, or actually stimulating new ice formation. So to have sea ice as a limit beyond which the sea is protected, when the activities one is trying to manage are themselves shaping the sea ice, would be challenging.

Broader process

We need to support ongoing ecosystem-based protection processes through a suite of area-based measures. We should focus on using simple tools to establish science- and TEK-based boundaries that can be put in place quickly, and not necessarily for long periods of time (e.g maximum 10 years). Periodic review of these areas would be necessary, as the ecosystem is by nature dynamic and particularly as climate change will fundamentally alter the entire ecosystem, including migration etc.

A workshop participant noted that one of the key messages of the presentations is that connectivity is <u>complicated</u>. How do we distill this for policy makers and think about next steps?

The response was that ecological systems, food systems, and how they relate to the currently ongoing geophysical changes in the Arctic, as well as the region's social systems, which include governance structures, are unique and need to be considered throughout the planning, establishment and management phases of any protection process. Decision makers must be introduced to and trained in understanding the complexities and inter-dependences that characterize these ecosystems.

- An example of an effective "simple" approach for policy-makers was presented

(Rosenbaum): The Wildlife Conservation Society carried out satellite tagging in Gabon and then wrote a 2-page policy brief with figures/simple language, which led to a meeting with the President of Gabon. Could take a similar approach when reaching out to Arctic range states.

- Maps are very useful and an intuitive way to communicate complex information to wide audiences. It was noted that there are ways to map connectivity (e.g. Kershaw and Rosenbaum's "geospatial genetics" project).
- It was recognized that scientists may need training and support from communications and policy experts to communicate their work effectively, but that scientists should always take these extra steps.
- An example was also provided from Alaska, where a similar approach to those described from Gabon was taken. Based on that experience, it is evident that a very short and clear summary of the scientific findings and recommendations is needed. It is also strongly recommended that the boundaries of important areas – on maps - also be provided to policy makers (not just the background information) to ease and strengthen decision making.

Dan Laffoley noted that we must also reflect on the context of MPAs in the Arctic in terms of the wider global conservation strategies being set for 2030 and then for 2060. We will be managing a very different Arctic in the near future and we need to get ahead of the curve if we are to be able to provide useful information to decision-makers. What happens in-between your MPAs is as important as what happens within them. As scientists, indigenous peoples, and conservation-oriented experts we need to also work on improving marine management in areas outside the MPAs, which are so vital to ecosystem connectivity and resilience. This requires strong monitoring and observation systems and the effective and rapid use of that information to inform adaptive management. Such an approach can be stronger and more effective than isolated MPAs when ecosystems are dynamic and rapidly changing – such as the Arctic marine systems.

5) *Overview of techniques, such as satellite telemetry and habitat modeling, in the context of Important Bird Areas*

- Grant Gilchrist, Environment Canada

- Download

Key issues discussed

Gilchrist highlighted the importance of the Arctic Council's Arctic Marine Shipping and Assessment report in establishing sound methodologies and programs for monitoring and assessing biological features, such as Important Bird Areas (IBA) in the Canadian arctic.

He also highlighted the importance of TEK in this work. This was exemplified by presenting a relatively accurate map of parts of the northeastern Canadian coastline drawn by a tribe there in the 1920s. Today, First Nation tribes are partnering with scientists in such mapping and monitoring, for example by providing data via social media platforms. Local knowledge contributes significantly to increasing and improving scientific data and knowledge in a range of management-relevant areas, for example Biologically Important Areas (BIA), polynas, mining leases, shipping, national parks, and community and tribal land issues.

He then presented a series of case studies in which different monitoring techniques and data collection approaches have been used in the Canadian Arctic context, and in which Inuit partners have been essential in data collection and interpretation. The case studies presented were on:

- Common eider ducks
- King eider ducks
- Thick billed murres (pelagic)
- Ivory gulls (ice-associated species)

A key goal for Environment Canada in this work is to generate replicable data collection and monitoring practices for key Arctic marine species. This data is to be scientifically and legally defensible, and can contribute to establishing a baseline of information that is required for developing regulatory frameworks and management plans.

Such management planning in Canada is done through a dialogue involving Inuit, industry, government, academia, and the general public. A “Marine Working Group” for the eastern Canadian Arctic, with representatives from of these groups has been established and meets three times a year to discuss and move forward work on these issues.

Key findings and conclusions

According to Gilchrist, essential factors for being able to conduct successful research in the Arctic include:

- Reliable and effective transportation (few scientists in Canada have access to research vessels)
- Funding
- Technical resources
- Qualified staff / human resources. (Capacity is often a limitation in Canada. There are only two Arctic seabird experts in Canada. Alaska has more Arctic biologists than Canada has Arctic scientists).

The ‘BIAs’ for seabirds are also important for marine mammals. Straits often create ecological hotspots of interest to birds, mammals, human communities, and because of this also tourists.

One important such area is the straits between Coates Island and Southampton Island, which is an ecological hotspot, but also a key shipping route for the mining industry. The local community has reached out for help in protecting this area. (This is important, as in Canada local support is required before government can protect an area). There is now multi-year data available that are consistent with the EBSAs identified by DFO - this information is already available and published and could be used by the Arctic Council.

6) Identifying Important Bird Areas and seabird connectivity in the Alaskan Arctic

- Melanie Smith, Alaska Audubon

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Key issues discussed

Identification of Important Bird Areas (IBAs) – administered by Birdlife International -- involves three main stages: Data gathering, data synthesis, and conservation design. The criteria for an area to be designated as an IBA is that the areas contains 1% or more of the biological global population of a species or a congregation of species of concern.

Key findings and conclusions

Data gathering:

- Identifying available data: colony data (C), survey transects (S), telemetry (T), expert papers, genetic studies.
- Connecting data from the annual cycle of the species: breeding, foraging, staging, molting, and wintering.

Data synthesis:

- The 'Foraging radius approach' (Soanes et al. 2016, *Biol Cons*), synthesizes data from within a colony's foraging distance buffer.
- Survey data: IBAs for single species are often overlapped to get IBAs for multiple species.
- Tracking data: Network analysis - assess representation of population (Lascelles et al. 2016 *Diversity & Distributions*)
- Draw area boundaries: Different methods of data synthesis produce different boundary lines.

Conservation design:

- Creation of a composite map of different regions (putting it all in context)
- When defining an IBA it is important to blend multiple data types and methods, and to consider the annual cycle holistically to identify connections.
- Different species behave differently (e.g. colonial seabirds tied to breeding colonies, whereas pelagic 'wanderers' (albatrosses) have no 'base', and migratory species move between locations.
- Connectivity is difficult to define as part of the conservation design process in the marine Arctic environment, because of the dynamic conditions (daily to decadal variability, shifting productivity, etc.).

A similar mapping of priority areas effort is taking place in Russia, but it has been difficult for Alaska Audubon to coordinate with that group. Irina Onufrenya confirmed Russia is systematically mapping important areas for marine mammals.

Recommendations and next steps

- Scientists need to experiment with various methods of data synthesis, and be aware of the implications of the various results in conservation design. e.g. Bering Sea Shelf Break – comparison of expert-defined boundary versus boundary generated by objective data synthesis.

- Scientists and managers should focus on the areas most predictably occupied by species of interest, even given the current changing conditions, to quickly identify areas in need of urgent protection. However, this means that one might be averaging out variability that's needed for connectivity management (e.g. not detecting stop-overs).
- Tracking data is likely the most appropriate methodology for mapping and estimating migratory bird connections.
- Russia and the USA should seek to cooperate and share data and methodologies in connection with their respective mapping of biologically important areas efforts.

7) Discussions and Q & A, Theme 2: Understanding Movement and Connectivity Needs of Arctic Marine Species – 'Flyers'

A participant asked whether there have been any efforts in the Arctic to map connectivity of species and / or features moving <u>out of</u> existing MPAs (i.e. 'inside-out' approach)? Melanie responded that:

- The CAFF Arctic Migratory Bird Initiative has been doing a version of this, but more on the policy level for protection of IBAs. Russia is doing something similar (See presentation by Irina Onufrenya of WWF Russia below).
- Highlighting the value of this might make MPA networks more palatable to managers and Arctic States and increase buy-in.
- This would also provide a tool (as part of the toolkit) for managers to know if their MPA is nationally, regionally, or globally important
- Inside-out lends itself well to the Arctic Council process in terms of forging connections between different members, and could play an important role in linking States through science. It is also feasible without the need for complex modeling

The Arctic is particularly important ecologically for many bird species - e.g. Bering Strait and Hudson Strait. Biological data suggest that these are two important areas for connectivity of various bird habitats. Many migratory birds, and especially the farthest dispersers, can be heavily impacted by issues and activities outside of the Arctic. It's important to remember that <u>it's not just what goes on in the Arctic that matters</u>. International cooperation is essential.

Another participant asked about the status of IBA analyses in the other Arctic states. The answer is that all States probably have a similar process, but the methods are not well documented and shared. The seabird science community is generally further ahead than most other science groups, with well-funded research teams, as seabirds are often national priorities. The "circumpolar seabird group" has reviewed data and has consistent results, and is playing an active role in bringing together partners and collaborators.

Special Arctic considerations that should be addressed with respect to birds include:

- Ice (see previous discussion)
- Role of industry in the Arctic (particularly oil and gas, and mining). Industry can play an important and constructive role in monitoring and mapping, if constructive collaboration is established and maintained. They should be at the table when MPAs are being designed. (It was noted that there were no industry representatives invited to the workshop).

- Subsistence hunting and gathering. For example, collection of eggs, which is quite common, even on cliff faces.
- Transient migrants use these area as a very important part of their life cycle, during which they can be particularly vulnerable (e.g. molting and unable to fly)

Another question focused on what what mapping 'connectivity' means for seabirds that fly between areas of critical habitat? I.e. is area- based management suitable for flyers?

- Birds often reside in one place for one period of time then fly off. Some birds spend more than two months on the water in one place; some species are flightless. This means that 'endpoints' are important, and that the connectivity aspect might not be so important for all species (This is definitely not a blanket statement)**.**
- Wind farms and lights from industry may be key concerns during connectivity movements for flying species.
- Securing connectivity for migratory birds often comes up in international policy debates. Securing 'flyways' as such got a set- back in a recent EBSA meeting when Brazil protested because the suggested migratory EBSA passed through their EEZ, and decided not to put it on the EBSA map.
- We need to come up with a clear idea on how to present our ask (e.g. do we map important areas even if there is not a management option?)
- It is useful to work with theoretical connectivity in terms of a connectivity matrix. Are there issues that change the likelihood of a bird species moving from point A to point B? If so then these issues should be considered, as they may change the connectivity map.

Theme 3: Scientific status of Arctic MPA network design (MPAs and Other Area-Based Measures as Building Blocks of Effective MPA Networks)

On Day 2 of the workshop, participants heard presentations on and discussed topics pertaining to the kind of guidance that could be useful to Arctic states to strengthen and promote their work on designing and developing MPA networks. The participants were then challenged to present and discuss the guidance and support they or their institutions can provide.

1) Identifying candidate sites for an MPA network in the Russian Arctic: accounting for connectivity

- Irina Onufrenya, WWF Russia
- Download

Key issues discussed

WWF-Russia has been supporting the Russian government for a number of years in developing a methodology and them implementing a comprehensive, but rapid survey of priority areas for conservation in the Russian Arctic, followed by development of a plan to design and put in place a network of MPAs to ensure a satisfactory degree of protection of these areas.

The key implementation phase of developing a representative network, not just a random collection of MPAs, started in 2014, and lasted roughly one year. The project was initiated as a part of quality control of a proposal to double the coverage of MPAs in the Russian Arctic, from 100.699 km2 (roughly the size of Iceland) to about twice that.

There was also a realization that such a network was urgently needed, to be prepared to meet the pending development pressures from the growing oil and gas activity in the region (20% of the Russian Arctic is under oil and gas license).

The goal of the initiative was:

“To design **a representative, sufficient, connected,** network of protected and specially managed areas that protects and promotes the resilience of the biological diversity and ecological processes of the Russian Arctic marine environment.”

Key questions asked at the outset of the network initiative:

- Are all these new areas actually needed?
- Are they sufficient?
- Are they representative?
- Will it function as a network or just be a group of ad hoc created MPAs?
- Do they promote the resilience of biological diversity and ecological processes?
- What do we really want to achieve?

As a starting point for the initiative Russia had:

- ~ 200,000 km2 of existing and planning federal MPAs
- 6 Arctic Regions with hundreds of their own existing and planned PAs.
- Thousands of IBAs, important wetlands and peatlands, important marine mammal habitats, coral reefs, etc.
- Dozens of areas recognized by different international process (EBSAS, IMO, AMSA 2c areas, no-go zones, etc.)
- Thousands of Russian Arctic experts with their own ideas, proposals etc.
- The area under consideration was covered by six seas, and five Large Marine Areas (LMEs).
- The area was mapped and assessed using a variety of techniques and approaches, including (see presentation online for more detail):
- Differentiation of the various seas into different zones, based on geophysical characteristics.
- Ice typization and regionalization (ice thickness, concentration, polynyas, edge dynamics, etc)
- Benthic and pelagic biotopes biogeographical classification

The objects to be protected were selected on the basis of specific criteria (based on international best practice, from CBD EBSA/ IUCN MPA/IMO PSSA), including:

- Uniqueness or rarity
- Special importance for life history stages of species

- Importance for threatened, endangered or declining
- species and/or habitats
- Vulnerability, fragility, sensitivity, or slow recovery
- Biological productivity
- Biological diversity

Specific conservation targets were set for each feature, not focusing on saving a single species, but protecting, for example, at least 10% of every biotype of every region, or protecting 70% of breeding areas for polar bear. The goal was to have 100% of the targets achieved. When attempting to link the objects or individual MPAs in an effective network, the criteria used included:

- Representativeness
- Genetic diversity
- Maintenance of functions/structures of ecosystems,
- Areas/species of special importance for indigenous
- population

The identification process of priority conservation 'objects' resulted in:

- High productivity/biodiversity zones (4)
- Biotopes
    - benthic biotopes (36)
    - pelagic biotopes (30)
    - biotopes of ice-associated species & communities (7)
- Red list and keystone species
    - species (19 marine mammals, 18 birds, 22 fish)
    - key habitats (129 bridling, feeding, wintering areas, etc.)

Following this, various methods and approaches were used to prioritize and select which of these priority 'objects' were to be included, and to design the representative MPA network.

The methods included.

- Comprehensive GIS analyses of available spatially referenced data.
- Analyses of socio-economic data (shipping lanes, oil & gas activity, indigenous use)
- Marxan analyses, to calculate how to minimize cost while achieving maximum conservation result. Includes analyses of both geographical and ecological connectivity. (See online presentation for formula and details).

Key findings and recommendations

The exercise resulted in the designation of a new, science-based network of important marine areas in the Russian Arctic, covering ca. 26% of the EEZ. Most of the conservation targets and goals were achieved within the minimum area possible.

Recommendations and lessons learned:

- Before proceeding it is important to see the whole picture ; don't do it ad hoc
- Be clear about goals and targets.
- Try to move forward with available data - don't postpone important conservation initiatives while waiting for sufficient data.
- Design MPA networks to cover conservation needs of a full range of biodiversity, not just for individual species.
- We need to get out of our own (national) boxes and look at the Arctic as a whole. Collaborate between different countries is important because species do not follow country boundaries.
- Start doing such conservation efforts, and getting MPA networks operational - before it is too late.
- It is important to take climate change into account.

Suggested practical ways to address climate change in designing MPA networks:

- Use the most recent possible data (remote sensing).
- Take consideration of the maximum amplitude for dynamic features (marginal ice zone, polynyas, etc.)
- Detect and protect nuclear (core) parts of dynamic features.
- Protect stable biotopes, e.g. multiyear ice zones as conservation features.
- Be sure that an area or feature is protected in more than one PA.
- Protected area borders should be defined not only by geographical coordinates, but by the most important geographical/ecological/biological features (polynya, front zone, current, etc), and these should be monitored.

In response to a question about how much of the 26% planned for protected areas is fully protected, Irina responded that 5% is fully protected, and 26% is a mix of different levels of protection.

Another question focused on whether the process result in decommissioning current networks or protected areas. This will not happen as politically in Russia, protected areas can never be canceled.

A participant suggested a future workshop that recommends sharing frameworks on creating networks between different Arctic countries. Irina agreed that a picture across the Arctic is lacking and needed.

2) The role of protected areas and other area-based conservation measures for marine conservation in a changing world

Dan Laffoley

Senior Advisor, Marine Science & Conservation, Global Marine and Polar Programme, IUCN

Vice Chair-Marine, IUCN's World Commission on Protected Areas

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Key issues discussed

Dan Laffoley presented the status and current progress pertaining to IUCN's international guidance on MPA development; some challenges and follow-up plans related to IUCN's recent Oceans Warming Report; an update on new guidance being developed by IUCN for CBD on Other Effective Area-based Measures (OECMs); and some concluding thoughts.

Protection of the environment is an old concept. However, creating specific MPAs is a relatively new one, with the first proper MPA being established in in 1935 (Fort Jefferson National Monument, Florida). It is important to differentiate between the type and level of protection envisaged for a MPA, whether sustainable managed areas or high level protection. Also important to be clear on the PA terminology being used.

The Aichi targets drive most countries' development of MPAs. The different targets can be used to mutually enhance a country's MPA network. For example, don't just focus on the 10% of coastal marine areas (target 11), but also focus on target 6, which covers sustainable harvesting of fish.

Other Aichi targets that can and should be used to protect seas:

Target 8 – pollution control by 2020

Target 9 – invasive alien species control by 2020

Target 10 – management of pressures on coral reefs by 2015 Target 15 – management of carbon stocks by 2020

IUCN provides PA guidance to the CBD to increase the accuracy and consistency of assignment and reporting of IUCN PA categories. Laffoley then presented the categories, and the current (2008) IUCN definition of a Protected Area. He also described how the guidance can be used in defining which category to designate, given the protection needs, governance, and acceptable level of activity, for example coastal fisheries.

For MPA categories, see: https://cmsdata.iucn.org/downloads/iucn_categoriesmpa_eng.pdf

Though IUCN and CBD have been relatively successful in promoting the designation of MPAs globally, it is important to avoid creation of 'paper parks'. The IUCN Green list promotes success and achievement in biodiversity conservation <u>outcomes</u>, i.e. supports effective management and enforcement.

Laffoley then highlighted the value of ecosystem-based conservation efforts, in light of the importance of overall ocean health and climate change. Ocean health is being affected by:

- Heat, through global warming
- Acidification, through increased CO2 in the atmosphere
- Sea level rise, through heat expansion and melting ice-caps.

In addition to over-exploitation, and pollution.

The oceans are Earth's climate regulators; Since the 1970s, the oceans have absorbed more than 93% of the enhanced heating arising from human activities. This retained heat will affect the oceans and the Earth for centuries, altering species compositions, ecosystems and ecological processes. Laffoley presented climate trajectories and expected impacts for the world's oceans.

IUCN has provided new guidance to CBD on Aichi Target 11, including on other effective area-based conservation measures (OECMs) vs traditional MPAs. The final results are expected in late 2017. The current working definition of an OECM:

> "A clearly defined geographical space, beyond the protected areas network, governed and managed in ways that deliver the long-term and effective conservation of nature and associated ecosystem services and cultural values, regardless of its current dedication"

He then presented screening tools for selecting candidate areas for an OECM, and steps to be taken in testing the area's quality and validity (see online presentation for details).

Key conservation opportunities and benefits of OECMs:

- may augment the current system of protected areas
- can increase numbers of actors and governance models
- recognition of an OECM can gives places greater visibility (which could drive people to take more action) and status.
- It can change the mindset of the people governing and managing that area towards strengthening their focus on conservation outcomes.
- enables useful monitoring of less-impacted areas and effective data collection

Key findings and conclusions

- A changing ocean world is locked-in – This will confound 'us' (so think of things in the long term that will influence what we can do now).
- Changing recognition and achievement of nature protection is locked in – This should hearten us.
- 'Overwhelming effects' bring us together with a common cause, but our 'tool-kit' to act is deficient to tackle 'business as unusual' – This should concern us.
- Protecting Arctic coherence and resilience through integration of efforts across the entire seascape – MPAs + OECMs + 'MSP' of what 'happens in between' – This should engage us.
- 'Visioning' a 'triple lock' of in situ protection, wider sustainability measures, and connectivity action – This should focus us.
- A future 'world' where MPAs and OECMs form part of dynamic, integrated whole-ocean Arctic management – 'beyond 2020' – This should inspire us.
- Now is the time to 'get ahead of the curve'!

3) Elements of a representative and ecologically connected MPA network

Mark Carr, University of California, Santa Cruz

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Key issues discussed

Carr presented the process used to develop a network of MPAs along the coast of California.

The policy framework and political approach are essential to the success of creating such networks. California has a strong Marine Life Protection Act (MLPA), which provided the necessary framework. The California MPA process was solely about conservation, not about integrating fisheries management. It also focuses on fish, not on mammals, birds or other groups of organisms.

The MPA network was largely stakeholder designed. A scientific advisory team developed the guidelines that were offered to the stakeholder regional groups (conservation groups, agency representatives, fishing interests). These generated proposals that were evaluated by the advisory team, then sent back to the stakeholders, and eventually sent to policy advisors.

Key conclusions and findings

Key elements of an MPA network that need to be considered:

- **Ecosystem characteristics, representation**, and **replication** of ecosystem characteristics within the network. (The team developed 'Ecosystem Replication Guidelines' through the MLPA process – which should be shared).
- Individual MPA **size and shape**, (recommendations vary widely, depending on species in question, e.g. mussels vs sharks. Must also consider movement across depth. In general: Min. size = 25 – 50 sq km. Preferred size _ 50-100 sq km).
- **Management** (e.g. fishing restrictions). Here, a 'decision tree' for determining Level of Protection (LOP) of Conservation Areas was useful, and is recommended.
- **Connectivity** (in the California case: mainly focused on larval connectivity). Here again the size, shape, and distance between MPAs is essential. In general: more, smaller, tightly spaced MPAs provide better connectivity and (larval) dispersal opportunities than fewer, larger MPAs spaced far away from each other. (Also multiple small MPAs generally great less conflicts with other interests than a few large ones – thus easier to establish).

The process resulted in:

- Many MPAs being established between 2007 and 2012.
- 63 of these were no-take reserves, covering 1291 km2, which is 9.4% of state waters.
- 124 MPAs were created in total, covering 2.197 km2, which is 16% of state waters.

Recommendations and next steps

Key tools needed for successful MPA network processes:

- Rules of thumb
- Stakeholder design – Marine Map
- Optimality algorithms (e.g., MARXAN)
- Connectivity-based multispecies population models
- Bioeconomic trade-off models (yield vs. biomass).

4) *Understanding categories of Arctic biodiversity to be addressed by the MPA Toolkit (e.g. habitat, species groups)*

Martin Sommerkorn, WWF

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Key issues discussed

Sommerkorn presented the process and preliminary results of a PAME-led initiative to create a 'toolbox' for Arctic countries to use when planning or designing Arctic MPA networks.

PAME's 'Framework for a Pan-Arctic MPA Network' document sets out the vision for an "ecologically connected, representative and effectively-managed network of protected and specially managed areas."

To advance this, the 2015- 2017 PAME work plan includes a "MPA Toolkit" project to develop guidance to assist countries in advancing MPA networks in the Arctic and to start exploring ecological connectivity in the marine environment. Draft supporting material for developing the 'toolkit' currently includes:

- A catalogue presenting important categories of Arctic biodiversity
- A catalogue presenting the characteristics of MPAs and other area-based measures currently in use to protect Arctic biodiversity, compiled from input by PAME members
- A report on various tools available and that have been used, and on lessons learned.

The catalogue of important categories of Arctic biodiversity identifies species, habitats, features and ecosystem processes that are *important* for an MPA network applying the vision of PAME's MPA framework document. The catalogue gives an overview of key species found in Arctic marine ecosystems and provides an approach for identifying important marine habitats and features, pressures and sensitivities. The catalogue does not define what is «important», is not an exhaustive list of marine biodiversity (especially not for invertebrate taxa or algae), and should be developed further for use in the toolkit.

Sommerkorn then sought advice from the audience on how to develop the catalogue further, and on the approach taken. He requested feedback on the level and quality of the information compiled, of the links made between species, habitats and ecosystems, on the approach taken to identify biogeophysical features and on the analysis of threats and pressures in support of describing vulnerability. He asked whether there was a need for increasing the focus on lower trophic levels, geophysical features, and ecosystem services?

Discussion:

Experts discussed the utility and practicality of including lower taxa into the catalogue to better capture ecosystem processes and key functions, such as productivity and mineralization, and in which way higher taxa could serve as proxies or indicators for ecosystem processes. The importance of considering lower taxa due to their vulnerability to ocean acidification was also mentioned, as was a need to consider species important for human harvest and Indigenous Peoples' food security, and the need to consider the different water masses. Further discussions centered on the need to create tools that appeal to MPA managers and decision makers alike and about key opportunities for designing such tools at the level of the Arctic Council. A key point mentioned was to consider designing tools for MPA networks that can get the support of Arctic communities. It was proposed that doing so would mean co-developing measures with indigenous people, requiring sustained indigenous involvement in relevant processes from the start.

5) Canada's Approach to Marine Conservation Targets

Bethany Schroeder, Fisheries and Oceans Canada

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Key issues presented

Canada committed to Aichi target 11 under the CBD in 2010:

> *"…10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes".*

- 10% by 2020 and also 5% by 2017 added by the new government.

Canada has a strong, longstanding and effective co-management process developed together with indigenous peoples, communities, and other stakeholders, at province, territory and national levels. All involved strive to use scientific evidence and the precautionary principle, and take into account climate change, when making decisions affecting fish stocks and ecosystem management.

Currently, the only true MPA in the Canadian Arctic is the Tarium Niryutait MPA. Sprung out of the beluga management strategy for this area. Beluga is a keystone species, and essential to Inuit culture and livelihood.

Canada currently is at 1% marine protection (50.000 km2), and needs to get to 5% in a year. So Environment Canada is considering the marine conservation targets (MCT) 'toolbox' to help address the gaps. Canada ranked 77 out of 150 countries in a 2013 international comparison of marine protection. The 10% target is ambitious and amounts to 575,000 km2 (approximately the area of all Atlantic provinces combined). This leaves a gap of 237,500 km2 to protect by 2017, and a further 287,500 km2 by 2020.

Canada's current Marine Conservation Targets focus on filling this gap:

- Have 5 new proposed MPAs under the Ocean Act (including the large Anguniaqvia Niqiqyuam, in the Inuvialuit Settlement Region (NWT)
- Establish Ocean Act MPAs in pristine areas (no gas leases or any other current threats)
- Protect areas under pressure (imminent threat)

Environment Canada is also developing criteria for Other Effective Area-Based Conservation Measures (OEACM). Bethany Schroeder presented several case studies of areas and measures considered for OEACM, including:

- Davis Strait: legislative fishery closure, to protect narwhale wintering and feeding habitat and coldwater corals.

- Hatton basin: voluntary closure by fishing industry to support protection of benthic communities, including deepwater corals.
- Species At Risk (SARA) critical habitat protection: Cumberland Sound beluga population protection.

Key findings and conclusion

- It is essential to have support and engagement with co-management partners at the outset
- Enhanced communication of science advice to managers and policy makers is important.
- Set targets and report on benchmarks - biodiversity is key.
- Implement adaptive management. Canada will conduct assessments and State of the MPA reporting every five years, and MPA networks will be updated with new data.

A participant asked whether Canada plans to revisit management measures and MPA design. Schroeder responded that Canada will review MPAs five years after they are established, based on indicators. Another participant asked whether fishery closures were permanent and how they are established. Schroeder responded that fishery closures are permanent and go through a legislative designation process, reflected in licensing conditions. DFO can designate such closures.

6) Arctic biodiversity monitoring: linkages to area-based conservation measures

Tom Christensen, Circumpolar Biodiversity Monitoring Program

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Key issues presented

Christensen presented the Arctic Council's Conservation of Arctic Flora and Fauna (CAFF) as the Working Group that addresses biodiversity, and described the working group's Circumpolar Biodiversity Monitoring Program (CBMP). CAFF has also produced the Arctic Biodiversity Assessment (ABA) in 2013. Based on an evaluation of the various findings and recommendations in the ABA, CAFF produced the "Actions for Arctic Biodiversity 2013 – 2021" report, which includes a 'tracking tool' for follow-up actions.

There are at least 30 actions in the Arctic Biodiversity Assessment (ABA) tracking tool that have or can have linkages to the work in regarding the Circumpolar Biodiversity Monitoring Programme (CBMP). Many are working on a similar timeline to the PAME MPA network initiative. Including:

> *"Develop and follow-up on a framework for a Pan-Arctic Network of MPAs; set out common vision for MPA network development and management."*

CAFF (through the CBMP headline indicator work) and PAME together developed the Protected Areas Indicator report in 2017. Christensen recommended that PAME and CAFF consider how to continue work on these efforts.

Under CAFF, the CBMP consists of four expert monitoring groups (EMGs), one of which is marine-focused (others are freshwater, terrestrial, and coastal). These EMGs provide a forum for scientific and traditional and local knowledge (>250 international experts involved).

The CBMP Marine EMG consists of the steering group (that includes representatives from the five marine Arctic Council member states) and six technical expert networks (EN). These EMGs provide a forum for science and community experts (>250 international experts involved across six expert networks:

- Plankton
- Benthos
- Fish
- Sea birds
- Marine mammals
- Sea ice

The EN's works to coordinate, standardize, and harmonize monitoring efforts as part of developing a long-term, ecosystem based adaptive monitoring program. Its purpose is to provide CAFF and stakeholders with information about Arctic biodiversity for conservation, priority setting, and forecasting important issues in the future.

CMBP has recently (2017) produced the first State of the Arctic Marine Biodiversity Report (SAMBR). It is a 180 page peer reviewed report based on CBMP monitoring on Marine Focal Ecosystem Components (FECs). The SAMBR:

- Describes the baseline conditions for FECs identified for Seabirds, Marine Mammals, Benthos, Sea Ice Biota, Plankton and Fish;
- Describes the monitoring and monitoring gaps on these Focal Ecosystem Components (FECs); and
- Includes key findings and scientific recommendations.

The report does not identify exactly where the important areas are. However, the work on the FECs and monitoring methods from the report can probably be used in the wider context, also in analyzing characteristics of specific areas.

Also, traditional and local knowledge has not been included as was hoped in the current version of the report, but sections and box texts in the report include TLK aspects. ICC has been helpful in relation to provide many of these inputs.

Christensen then presented a **case study from Greenland**, also included in the SAMBR, on how spatial data on biodiversity can be used in management planning. In Disko Bay, the CBMP approach produced useful information to identify biologically and ecologically important areas. This information also allowed analysis of how the different important areas are sensitive to shipping and potential associated environmental consequences, including oil spills. This study did include spatial data and analyses.

The case study produced information that can be used to support Ecosystem-Based Management and to include ecological connectivity in MPA planning and design in Greenland.

Greenland does not yet have a network planning process similar to that of Canada, but this is a priority. The CBMP has offered to help the government develop an MPA strategy, and the process has started.

Key findings and conclusions

The SAMBR is a useful tool to identify ongoing Arctic Biodiversity Monitoring efforts, data needs, monitoring gaps, and to prioritize future work. It can be used to target and guide future CAFF/ Marine CBMP work (as needed also in relation to MPAs).

As the program finishes its first *State of the Arctic Biodiversity Reports*, the program needs guidance and input to make it as relevant as possible. CBMP is starting a process to develop a new four-year strategic plan (2018 – 2021). Input to the strategy is being discussed with CAFF board and other stakeholders. This includes:

- Input on relevant management questions (user needs)
- How to prioritize the different ABA recommendations, including those on MPAs, in the continued work.
- How to link with other AC efforts (eg. PAME - MPA work, PAME EA- work, AMSA, AMAP, AC Task force etc.).
- Getting input from government on national priorities.

CBMP's goal is that its products, including SAMBR, will produce relevant information to the Arctic States, Permanent Participants, scientific community and other partners. SAMBR will be a tool to raise awareness on how to integrate monitoring efforts and use monitoring from other sectors to inform clients, including Arctic Council WGs, our work, and also provide a rationale for long-term funding to support these efforts.

The SAMBR will recommend actions to enhance coordinated monitoring of Arctic Marine Biodiversity and fill monitoring gaps (e.g. better inclusion of TEK, better use of vessels etc.)

Christensen suggested that SAMBR findings and recommendations could be presented to the PAME – MPA group after its release in May 2017.

7) Developing an Inuit strategy for safeguarding, monitoring and management of the health of Pikialasorsuaq (North Water Polynya) for future generations

Carolina Behe, Inuit Circumpolar Council

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Key issues presented

The Inuit Circumpolar Council (ICC) is one of six permanent participants to the Arctic Council ICC advocates on behalf of 160 thousand Inuit across has offices in Russia Chuktoka, Alaska, Canada, and Greenland.

Inuit are not "stakeholders." The Arctic has been their home for thousands of years, and they are willing and want to work in partnership with scientists and governments due to their own concerns over current stressors, the rapid change the Arctic is undergoing, and management actions that do not take into account the broader ecosystem, of which they have a deep understanding.

Pikialoasoruaq is the largest polynya in the Northern hemisphere ('the great upwelling'). Three Commissioners jointly held hearings to facilitate and provide local and regional input to government processes, and to safeguard the Polynya. They provide an informed Inuit vision and recommendations for the future of the region – representing approximately 13,000 Inuit that have lived there for at least 10,000 years.

The polynya is an area with substantial upwelling, and it thus attracts high levels if biodiversity - great auks, little auks (the harvest of which is one of the most important means of ensuring winter food security for the local people), and narwhal.

Key concerns of the Inuit in the area include climate change, shipping, resource development, commercial fisheries, seismic testing. Ice dynamics and weather patterns are also changing, leading to unpredictability: more storms, ice movements, and changing currents. This is also leading to a change in migration patterns, and new species in some areas. In addition, there are concerns over political changes and the fact that management is not always based on the best available information (e.g. Inuit are related across Canada and Greenland and have a shared culture, but transfer of information and indigenous knowledge is now restricted due to political borders. They would like free movement across the area to share this information.

Inuit rely on this ecologically important area, where they have found food for centuries, and want to see it preserved. Inuit view themselves as being part of the ecosystem and positioned within the food chain. From the Inuit perspective, you need to be a part of your environment to properly manage and protect it. If you take hunting away you remove that link to the environment. Overall, the conservation goals are the same, but ways of getting there are not the same and shouldn't be.

From a management/governance perspective, Behe emphasized that the Inuit want to, and believe they have the inherent right to – as a key part of the ecosystem - manage their own lands and waters.

8) Examples of Arctic MPAs and "Other area-based conservation measures" in the marine environment (based on submissions by Arctic States to PAME)

Martin Sommerkorn, WWF

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Key issues presented

WWF, at the request of PAME, has compiled a list of examples of 'other' area-based protection measures that can be used in Arctic marine environments to protect key ecosystem elements, as a complement to traditional MPAs. The examples were submitted to WWF by the Arctic countries. They received 18 examples of MPAs, and 19 examples of "other measures".

The submitted examples of 'other' area-based measures included:

- Exclusion Areas
- Seasonal-, rolling-, and conditional closures
- Overflight Restrictions
- Gear Restrictions
- "Stop, Report, and Move or Refrain" measures for fishing vessels
- International Maritime Organization (IMO) Area to be Avoided (ATBA)
- Particularly Sensitive Sea Area (PSSA)

– Voluntary commercial fishery closure in Areas Beyond National Jurisdiction

– Traffic separation schemes

– National salmon rivers and fjords.

Other area-based protection measures can provide opportunities for protecting features that are:

– Dynamic in time,

– Dynamic in space,

– Defined by a particular component of biodiversity (i.e. species- or habitat-specific)

– Vulnerable to a specific threats (activities, industrial sectors, or practices)

– In need for mitigating or eliminating known vulnerabilities of valued biodiversity to human activities , especially where biodiversity is incompletely mapped and/or where the geography of the activity is difficult to constrain a priori,)

– Important for securing or restoring the integrity of marine and coastal seascapes to supply ecosystem services of value.

Sommerkorn asked participants to think about and give input on the list of other area-based measures throughout the workshop, considering in particular:

– Whether the presented analysis of measure characteristics and strengths/weakness analysis was useful or whether there other ways would be preferable?

– What would be a useful format for mapping important biodiversity elements and linking them to various options for protection measures?, and

– What would be additional uses/value/opportunities of other area-based measures for achieving more effective MPA networks in the Arctic?

9) Local Leadership in Achieving Balanced Engagement in the Arctic Marine Environment

Willie Goodwin, Mayor, Kotzebue, Alaska

& Chairman, Arctic Waterways Safety Committee

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Key issues presented

Goodwin presented an overview of processes and situations in which the indigenous people of Alaska were involved or partnered in, and were able to influence the outcome of area protection measures in Alaska.

He argued that local people must always be involved in decision–making concerning land, waters and resources to which they have rights of access and utilization, and that they must retain the right to exploit resources and business opportunities. Often their livelihoods and economic development could be compromised if the areas were strictly protected, banning local people from utilizing them.

Goodwin explained that the Inuit have always adapted to a highly variable and changing environment and that they are good at it. The Inuit depend on the ecosystem for food security and life itself and survive by adapting to those changes. Conflict, for example between industrial development and conservation, can bring diverse interests together. It provides an opportunity to solve a rational problem together.

Based on Goodwin's experience from participating in several such conflict resolution processes linked to local community access to land or resources, he finds that a constructive approach is to:

- Use local knowledge as a starting point,
- Rely on peer-reviewed science,
- Respect cultural needs,
- Understand that subsistence communities need access to resources, that local residents need jobs, and that local business development needs to be profitable for industry to bring jobs to the Arctic.

Successful stakeholder processes that are currently in place include:

- the Red Dog mine → trucking around caribou migration
- Conflict Avoidance Agreement → oil and gas industry works around marine mammal migrations/hunting.
- Arctic Marine Mammal Coalition → consists of five Arctic marine mammal hunter/co-management groups
- Arctic Waterways Safety Committee → safe shipping routes.

A participant asked whether there are efforts to recruit younger people into these engagement processes. Goodwin responded that there are, and there is interest. Young people enjoy hunting, and compromising through active participatory processes on land, water and resource issues can enable them to keep carrying out their subsistence activities – even if the land or sea is regulated for some degree of protection.

Key findings and conclusions

- Successful stakeholders listen and learn.
- Wise policy-makers listen to successful stakeholders - they always know more than policy makers about their own needs
- Let those experiencing a conflict work through to the resolution
- The Arctic is rapidly changing. Be fast to adopt adaptive responses, slow to impose regulatory restrictions.

10) Towards a toolbox: deploying MPAs and other area-based measures to conserve important categories of Arctic marine biodiversity

Martin Sommerkorn, WWF

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Sommerkorn presented the "Arctic MPA Toolbox" that is under development as part of the ongoing PAME MPA initiative. He presented the key components of the toolbox, and sought guidance from the workshops participants on how best to use the toolbox, and on how to develop it further. See other presentations by Sommerkorn for more on what the Toolbox report contains.

11) Discussion and Key points Theme 3: Scientific status on Arctic MPA network design

Sommerkorn clarified that the Arctic States have explicitly asked for this toolkit. States will implement the toolkit at their own pace, as there is no commitment mechanism. PAME can help to fill gaps and create opportunities at the pan-Arctic scale, e.g. on how other area-based measures can provide critical linkages and connectivity between MPAs; or address critical gaps in current protection measures in the view of a changing, more dynamic Arctic.

It is important to address what the Arctic Council can do to ensure that States not only plan, also implement their MPA plans.

Reminder: A key purposes of this workshop was for it to be a conduit for countries to express what they need in terms of MPA planning tools. In this context, having these 'other' area-based protection options leads to a more effective and, for some, more acceptable way of meeting conservation targets. This is valuable in itself.

Feedback on the Toolbox Report:

Tables are not as understandable as narrative, so more narrative would be preferred, and more case studies can also be a good way to illustrate possibilities. Contact information could also be included to help States share knowledge and lessons learned.

If the toolbox is to be read and used by a wider audience it will have to be edited and put in a more accessible and 'popular' form. The "Cultural Resources Toolkit" (https://marineprotectedareas.noaa.gov/toolkit/) was highlighted as a good example of a communication tool, structured around simple, general concepts, details and methods, and a case study with an example for each.

It was agreed that case studies are a good idea, particularly as some of the States are already have good examples. This would allow them to take more ownership of the process rather than being told what to do.

Updates to and insights from the IUCN Other Effective Conservation Measures (OECM) guidance that could inform this process:

On characteristics A and B in the table: One should beware of promoting 'dynamic management' of protected areas, also in marine environments. Such 'dynamic management' can have highly negative impacts. There are examples primarily from land (e.g. rotational clear-cutting of forests), but the same principles apply.

The opinion was raised by some that currently there are some features protected at inappropriate times of the year (e.g. protection of ducks during hunting season). It would be good to 'weed out' such misconceptions from the guidance.

Species not in-situ (Aichi Target 6) and species in-situ (Aichi Target 11) are also relevant to specify and include in the overview.

Some expressed that the group should develop a more limited toolkit of other area-based measures that we think we can particularly recommend:

- Gather examples and have a good feel for the characteristics you're looking for, then characterize them on a scale from MPA to more broad protective measures.

Then develop a narrative around it.

- Measures should be presented as "options", and should be presented laterally (not vertically) to remove idea of hierarchy.

In the California Marine Life Protection Act process, if a site had a longer-term monitoring program the area was ranked higher as a MPA candidate, as the long-term data set could be used to assess effectiveness.

Suggested way to identify and address critical gaps in the PA network:

- Take a systematic approach: models, maps, measures, knowledge, and advice, all with a longer-term view, because there is an investment lag and so we need to get ahead of the curve. We need to kick-start some of the concepts, e.g. with rules of thumb. With a good methodology, this work in the Arctic could be amplified globally.
- Guidance on how you manage in the absence of 'enough' information (provide examples of how this has been done already: Norway, and Arctic fishery closure that the US implemented was because there was not enough information), and reaching out to indigenous knowledge holders.

Co-management approaches are not yet in the MPA Toolbox. This needs to be addressed.

We need an integrated approach <u>across international borders</u>. Currently we don't know who is saving what, which is unfortunate, as we are managing species that are almost entirely transboundary. Again, there are examples that we could cite (e.g. central Arctic ocean fishery closure, and sister parks such as the Gulf of Mexico and Cuba, which was the first agreement between these two States).

What is the international dimension of this work? The 10% target will not necessarily be applied in the Arctic. How are the Arctic MPAs connected to sub-Arctic MPAs in Europe? How do they contribute to those country obligations? How does the Arctic connect to the rest of the world? This should be addressed, and opportunities should be sought for expanding and connecting to wherever these exist.

Theme 4: Conclusions and guidance for Arctic states on strengthening Arctic MPA network design and development

1) Post-it Note exercise

Participants were asked to write down (on post-it notes) a specific action that can be taken, based on the overall summary of connectivity discussion. Specific brainstormed responses are listed in Annex 1. Themes included:

- Focus on tools we can give managers now

  Need for a multipronged approach
- Importance of ecosystem features, services, and processes and relationships
- Importance of cultural/social community needs and resources
- Need to include multiple area-based tools and integrate into broader ocean planning
- Need to build on partnerships

- Identify species we want to work on for connectivity

Final, facilitated summary

Lauren Wenzel summarized some final points from the workshop discussion:

- Need to think hard about conceptualizing this toolkit,
- Species and features are proxies, but we need to focus on ecosystem-based management
- Opportunities to work with CAFF
- Arctic states are taking diverse approaches – some methodological and some not, they need some flexibility
- 'Other measures' provide important opportunities to expand the toolkit and engage with communities and industry
- Need to recognize worldview knowledge and needs of indigenous communities
- we need to think broadly about gaps, and do so with a long term view
- Need to remember all of the Aichi targets -- some of these other area based measures might fit into some different targets (e.g. sustainable fisheries)
- Publicizing success stories in the Arctic through the Arctic Council - we do have a lot of these because the place is relatively intact environment still, but we don't have a lot of writing on proactive securing of intact environment, or increasing resilience in light of things that might come. This is a unique and generally positive narrative for the Arctic.
- There is a need for more information and guidance on how MPA networks can and should operate in a changing climate. The U.S. MPA Federal Advisory Committee is developing guidance for MPA managers on the role of ecological connectivity, including its importance in light of climate change. This and other work should be shared as it becomes available.

We need to be very clear about what we mean by "network" - a collection of replicated representative sites, versus flow of resources and populations. We were not clear enough on this during this workshop. MPAs must be representative, and then need to be thoughtfully connected so that species and other ecosystem features can adapt in the face of climate change.

Annex 1: Workshop Participants

Last Name	First Name	Country	Affiliation	Title
Balton	David	USA	Department of State	Ambassador, Chair of the Senior Arctic Officials
Behe	Carolina	USA	Inuit Circumpolar Council Alaska	Indigenous Knowledge/Science Advisor
Bjarnadottir	Sesselja	Iceland	Department of Oceans, Water and Climate; Ministry for the Environment and Natural Resources	Head of Water and Climate Division
Bock	Nikolaj	Denmark	European Environment Agency	Special Advisor on International Affairs
Carr	Mark	USA	University of California Santa Cruz	Professor, Physical and Biological Sciences
Chan	Amanda	USA	Natural Resources Defense Council	Ray Fellow
Christensen	Tom	Denmark	Aarhus University and Conservation of Arctic Flora and Fauna	Co-Chair of Circumpolar Biodiversity Monitoring Programme
Clarke	Janet	USA	Leidos	Senior Research Biologist
Cleary	Jesse	USA	Duke University	Research Associate, Marine Geospatial Ecology Lab
Ekbom	Jan	Finland	Metsähallitus Natural Heritage Services	Senior Adviser
Fleener	Craig	USA	State of Alaska	Arctic Policy Adviser
Gall	Adrian	USA	ABR, Inc. (Environmental Research & Services)	Senior Scientist, Research Coordinator

Gilchrist	Grant	Canada	Environment and Climate Change Canada	Research Scientist, Marine Birds
Goodwin	Willie	USA	Alaska North Slope Borough	Chair, Arctic Waterways Safety Commission
Halpin	Pat	USA	Duke University	Associate Professor of Marine Geospatial Ecology
Havenhand	Jonathan	Sweden	University of Gothenburg	Researcher
Kelsey	Jonathan	USA	Department of State	Foreign Affairs Officer
Kershaw	Francine	USA	Natural Resources Defense Council	Marine Mammals Science Fellow
Laffoley	Dan	UK	International Union for the Conservation of Nature	Marine Vice Chair, IUCN's World Commission on Protected Areas
Laughlin	Tom	USA		
Lubetkin	Susan	USA		
Morrison	John	USA	World Wildlife Fund United States	Ecologist
Nilsson	Jessica	Sweden	Swedish Agency for Marine and Water Management	Senior Adviser
Noakes	Angela	USA	Wildlife Conservation Society	Senior Officer, U.S. Policy
Norris	Stefan	Norway	World Wildlife Fund	Consultant
Onufrenya	Irina	Russia	World Wildlife Fund Russia	Senior Protected Areas Officer
Rosenbaum	Howard	USA	Wildlife Conservation Society	Ocean Giants Director
Schroeder	Bethany	Canada	Department of Fisheries and Oceans	Oceans Biologist

Sheard	Whit	USA	Circumpolar Conservation Union	Director, International Arctic Program; Ocean Conservancy
Smith	Melanie	USA	Alaska Audubon	Director of Conservation Science
Sommerkorn	Martin	Norway	World Wildlife Fund	Head of Conservation, Global Arctic Programme
Speer	Lisa	USA	Natural Resources Defense Council	Director, International Oceans Program
Stevenson	Todd	USA	Circumpolar Conservation Union	Senior Marine Scientist; Ocean Conservancy
Strickler	Laura	USA	National Oceanic and Atmospheric Administration	International Affairs Specialist
Suatoni	Lisa	USA	Natural Resources Defense Council	Senior Scientist, Oceans Programme
Templeman	Nadine	Canada	Department of Fisheries and Oceans	National Science Advisor
Turnipseed	Mary	USA	Gordon and Betty Moore Foundation	Program Officer, Marine Conservation Initiative
Wenzel	Lauren	USA	National Oceanic and Atmospheric Administration	Director, National Marine Protected Areas Center

Annex 2. Findings from Post-it Note exercise – Theme 4, Workshop 1 (September 2016)

Below are the results of an exercise in which workshop participants were asked to individually brainstorm ideas for follow up on post-it notes and these were then grouped by theme.

<u>**Multi-pronged Approach**</u>

The need for multi-pronged design approaches emerged from discussions on the first day of the workshop. Within this idea, participants discussed approaches that were model driven, based on the best available data and observations, and including multiple time (e.g. seasonality) and geographic (e.g. local, pan-Arctic) scales. In addition, participants discussed that design approaches should integrate indigenous perspectives throughout the process.

Proposed actions to address this need were:

- Strong engagement from Arctic countries in protecting spaces that are important for species that migrate in and out of the Arctic
- Developing a framework for how a protected areas can be designed to be employed seasonally and evolve with changing conditions
- Setting clear and understandable goals and targets for areas
- Synthesizing, analyzing and putting to use the large amount of data that is currently available
- Developing a network modeling approach that can represent: 1) data from quantitative models, telemetry, scientific expert knowledge, and traditional and local expert knowledge; data from multiple scales; and data with multiple levels of confidence
- 2 or 3 assessments of connectivity for key species – as case studies and lessons learned.
- Invest in multi-stakeholder syntheses for a handful of species
- ‘Mining’ existing unpublished data and establish a data repository
- Clear thinking and recommendations for which situations (i.e. current and future threats and climates) are appropriate for MPAs and which are appropriate for other measures
- Comprehensive review on periodic/seasonal-type closures to extract lessons learned from other regions
- Need to get good understanding of how MPAs can help abate threats from climate change and ocean acidification in Arctic context
- We need a clear and easy-to-remember political statement on what is needed to safeguard Arctic biodiversity and associated cultural values in a climate-compromised world.
- Develop a Pan-Arctic circulation model to serve as a foundation for connectivity modeling
- Bio-economic trade off models

- Develop methodologies to identify important habitat areas and connections for marine mammals. Can incorporate data from existing maps, e.g. Reeves/Quakensush/Citta Bowheads; IMMAs/U.S. BIAs
- Review the ICC-AK Food Security conceptual framework (provides management tools and tools to ID connectivity).

Tools for Managers Now – What is needed?

- Examples: Models – assimilative and forward-looking;
- Simpler tools to characterize importance of areas for connectivity (Models can be complex or simpler based on available data;
- Existing data that can be analyzed/synthesized;
- Case studies showing how connectivity science can aid management;
- Proxy data sets for ecosystem importance (e.g. keystone species, analyze and map ecological connections based on objectives of existing MPAs)
- Audubon Ecological Atlas for information on the Bering, Chukchi, and Beaufort Seas (mid-2017)
- Risk assessment models (qualitative matrices)
- Develop/provide a seamless coastal and bottom habitat layer for purposes of spatial planning
- Improve access/visualization of circulation models, ice forecasts, future climatologies, etc.
- Rule of thumb on connectivity and associated conditions for wider sustainable management
- Case study: identifying new areas adding larval connectivity to existing networks of MPAs (2015, Swedish Agency for Water Agency [available from Jessica Nilsson and Jon Havenhand)
- Financial commitment to develop and maintain visualization interfaces for public data sets
- Give them one place that's ready to be protected from science through community support
- Traditional management practices
- Russian MPA Network planning methodology
- Establish a lessons-learned exchange network for managers involved in MPA management throughout the region
- Eigenvalue Perturbation Theory – big words for valuable and existing model to optimize MPA placement (Jensson, et al. [2016], Diversity and Distributions 22, 161-173)
- Important Bird Areas

- By 2017, connectivity of important biodiversity elements outwards of existing Arctic MPAs is modelled (PAME/CAFF)

Importance of Ecosystem Features, Services, Processes and Relationships

This topic provides an opportunity to integrate TLK (e.g. ice edge and multi-year ice; Bering Strait, Hudson Strait).

- It is not an opportunity to integrate IK; it is necessary to utilize both IK and science, which can be done by applying a co-production of knowledge approach
- Need both species-habitat relationships (qualitative or quantitative) and functional-habitat relationships (e.g. nursery habitat, spawning habitat, productivity)
- Support in-situ data collection that complements telemetry studies to understand why areas are being used by marked animals
- Scaled up efforts to limit introduction of alien species to protected areas and important biodiversity areas, in light of climate change (e.g. ban on ballast water exchange/dumping)
- Genetic diversity. Protect distinct genetic populations
- Currents as a proxy for ecological hotspots (e.g. Bering and Hudson Straits)
- Protect sea ice
- CHLA and zooplankton as a proxy for ecological hotspots
- Protect permanent ecological significant features, i.e. those that will not change with climate (e.g. seamounts, currents, canyons)
- Encourage countries to identify ecosystem features to be protected (to sustain processes)

Importance of cultural/social community needs and resources (e.g. food security)

- Mutual respect → knowledge and solutions
- Need use of social, physical, and natural sciences, as well as IK together
- Include Indigenous Peoples in all steps from beginning to end
- Identify places communities do want protected
- As potential, specific sites are considered, invite local participation and input early in the process
- Hold planning meetings in communities close to where the MPA might be established. Engagement in local communities and Indigenous Peoples at the beginning of discussions for any marine conservations tools
- Establish stakeholder working groups to provide input during MPA planning process
- Strengthen general understanding that remote communities need economic opportunities in addition to maintaining subsistence
- Protect marine mammals and hunting season
- Many analytical approaches require: 1) spatial and temporal patterns of fishing, and 2) yield and financial values. A database of this info would be very useful.

Including Multiple Area-Based Tools and Integrating into Broader Ocean Planning

- PAME/CAFF should convene a workshop with conservation, government, and monitoring communities to take stock and produce guidance on how dynamic other measures could work in practice
- By 2018, IUCN, PAME, and CAFF establish guidelines and/or principles and examples for other area-based measures that conserve biodiversity under changing conditions
- High-level commitment from Arctic countries to recognize importance of ice-edge and polar front as dynamic, not fixed, rigid system, which must be protected from all destructive (industrial/commercial) activities (oil/gas, shipping, fisheries, extraction, etc.)
- Develop guidance for implementing seasonal and/or spatially variable management (rather than fixed)

Partnerships

Examples: Getting conservation, government and monitoring communities to talk to each other; within Arctic Council (CAFF, AMAP); and outside Arctic Council (e.g. IWC, UNEP, countries outside Arctic)

- Link to 2030 Agenda (e.g. SDG 14) and CBD Targets
- Interdisciplinary collaborations
- Regional and international collaboration/coordination (e.g. PAME, OSPAR)
- Engage with neighbor regions (EU) – connecting with MPAs, lessons learned, ecological status, tools
- Look into AACA – three reports with a lot to build on
- Present ongoing work and identify potential linkages to CAFF and marine CBMP Steering Group (Lauren, Lisa, Martin to join and present ASAP) Discuss keystone species with CBMP
- Government (generates data) and academic (analysis and publication) partnerships, especially for synthesis to inform design and to evaluate monitoring
- To establish MPAs most will have to form planning groups with many diverse partners ("from industry to Inuit") – start early in the process
- Community driven research and monitoring

Other issues

Some participants added the following:

- Keystone Category
    - One ice-obligate and one ice-associated species to serve as indicator for others
    - Seasonal migrant perhaps not necessary to map at this stage?
    - Beluga whale
    - All food that keystone species eat
    - In the Bering: stellar sea lions, fur seals, otters, harbor porpoise

    - Priorities for mapping connectivity: polar cod, beluga, ivory gull
    - Develop map/assessment with ecological connections across countries for identified keystone species (with CAFF/CBMP/AMAP)
    - Consider energy transfer
    - Importance of prey species (e.g. fish)
- 10-year MPA network is a great idea

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