Transboundary Arctic Marine Spatial Planning – data requirements for harmonized approach

SYKE

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Introduction

Climate change impacts the entire Arctic marine ecosystem due to the disappearance of permanent ice cover, ocean acidification and changing structure of the ocean currents. The effects of these phenomena can be seen in, *e.g.*, changes in the species distribution, species composition and food web (CAFF 2017). Changing environmental conditions enable also the development of the industrial level use of marine resources, tourism and other human uses. Melting ice opens possibilities for establishing new shipping routes, exploitation of new oil and gas production areas, establishment of new fishing grounds and increase in Arctic tourism. Human activities and sea uses influence the marine environment and can cause even severe impacts on marine ecosystems and species. Novel tools to assess and manage the human effects on the Arctic marine environment are needed to develop sustainable use of marine resources and preserve the unique marine environment for future generations.

Marine spatial planning (MSP) is a widely established concept for planning the use of marine space in a sustainable way to preserve the nature and its ecosystem services for the future generations. The most commonly used definition of MSP was described by the United Nations Educational, Scientific, and Cultural Organization Intergovernmental Oceanographic Commission (IOC-UNESCO): "*Marine spatial planning is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process*" (Ehler & Douvere 2009). MSP process includes several steps from establishing goals and objectives, defining existing and future conditions in marine environment and human uses for planning, implementation of spatial plans, monitoring and evaluation to revision and adaptation of the process. Due to the continuous nature of the ocean features and the environment, the demand for MSP does not limit to the national boundaries (van Tatenhove 2017). On its best, utilising cross-sectoral, transboundary and ecosystem-based sea use planning process, sea use can be organized in a sustainable way and the process can be utilized to discover and solve conflicts among stakeholders and between human uses and marine biodiversity. In the end, the planning process is highly political but it can also unite actors representing different views and values.

Ecosystem approach has been defined by the Convention on Biological Diversity (CBD) (COP 5/Decision V/6): *"The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three objectives of the Convention: conservation; sustainable use and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. An ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems."* The ultimate aim is to identify the spatial and temporal management approaches to achieve the defined objectives, usually referring to the ecosystem health and socio-economics.

Spatial data analysis for the Ecosystem-based MSP process

Good quality spatial data is the core of well-established ecosystem-based sea use planning process. Few data-related process descriptions for MSP have been published (e.g. Shucksmith & Kelly 2014, Shucksmith et al. 2014, Stamoulis & Delevaux 2015) describing the data collection and evaluation process. However, when aiming at a transboundary or even Arctic wide MSP process, specific attention should be paid to the harmonization of the baseline condition descriptions, data and analysis methods between Arctic countries. Stakeholder participation should be incorporated in all steps of the data analysis process to ensure inclusion of vast range of knowledge, best available practices and transparency. Ehler & Douvere (2009) have established an approach with 10 detailed steps to give a good understanding of the process to plan, develop, implement and revise the MSP process. Some of the steps in the MSP process are preparatory and administrative whereas several cover and utilize geospatial data and analysis.

Simplified process to gather and analyse spatial data to support ecosystem-based Arctic wide MSP includes several steps, outlined below:

1. Establish planning area. Establishing the planning area includes defining the spatial and temporal scales of the plan, as well as the principles, goals and objectives of the plan. The need for MSP emerges from the possibilities the sea provides for human uses and increasing demand on marine space. Temporal timeframe is required both for current starting point as well as future goals, *i.e.*, how far time period in the future the plan will cover and what development goals will be set for the planning area.

2. Identify and define existing conditions in the planning area, harmonized on transboundary level. Identification and defining existing conditions of the marine environment, human activities and socio-economics can be used as baseline data for the future planning. Here, the time frame definition is essential to define the time period which will be used as conditions for "current situation".
    a. Identify administrative boundaries and regulations. Identify existing legislation concerning MSP and territorial planning including sectoral legislation, *e.g.*, maritime traffic, fisheries and environmental protection.
    b. List and define human activities. List and define all human activities utilizing the marine and coastal areas. Extensive, transboundary descriptions of human activities and their impacts on the marine environment should be produced and land-sea interaction should be included in the process to assess also the effects of coastal areas on the marine environment and society. Important sea uses in the Arctic include, *e.g.*, maritime transportation (*e.g.,* passenger shipping, cargo vessels, tankers, liquefied natural gas carriers), commercial fisheries (pelagic, benthic), recreational activities (leisure boating, fishing, scuba diving), port and harbour development, dredging and deposition of dredged material to the sea, offshore installations (gas, oil, wind farms), military operations, marine protected areas and cultural and historical conservation areas.
    c. List and define ecological features and ecosystem services. Define important ecosystem components, such as species, habitats or functional groups of high ecological value. Also species inhabiting the land-sea interface should be taken into account. Several Arctic wide

databases and assessments provide data for defining Arctic wide ecological components, *e.g.* State of the Arctic Marine Biodiversity Report (CAFF 2017).

d. Identify current environmental conditions. In order to reliably describe the planning area, it is highly valuable to include the existing climatic and environmental conditions as background variables in the MSP process. Baseline conditions *e.g.* annual/permanent sea ice extent, seawater salinity and temperature and bathymetric information can also be used as a base for further analysis on the ecological values and human effects.

3. Gather spatial data, analyse existing conditions and fill in gaps. Existing assessments on the status of the marine environment, human activities and pressures can be utilized as they may provide useful information and enables integration with other processes.
    a. Analyse ecologically important areas. Gather spatial data on important ecological features (habitats, species) defined in the previous step. Assess the vulnerability and recoverability of environmental components to specific human activities and pressures. Gather data on the particularly sensitive and ecologically important areas such as areas of high biodiversity, feeding, nesting/reproduction and haul-out areas of birds, fishes and marine mammals, as well as important migration routes and areas of high productivity. On a transboundary level, the concept of Ecologically or Biologically Significant Marine Areas (EBSAs) may be utilized to identify important areas (Ehler 2011). For filling in gaps in the biological and ecological data, statistical spatial modelling may be utilized to enhance spatial coverage of specific ecological parameters, yet bearing mind that modelling changes the confidence of the data and phenomena.
    b. Analyse main pressures in the planning area. Gather spatial data on all human activities and pressures occurring or effecting at sea area. Often the pressures impacting the marine environment need to be derived through human activity datasets because no direct and comprehensive "pressure data" exist. To better represent the dispersion of the pressures and impacts from the human activities, spatial modelling and GIS analyses can be utilized. General description for transboundary cumulative pressure and impact assessment on a regional scale have been done, *e.g.*, in the Baltic Sea (HELCOM 2017).
    c. Analyse conflicts in the sea use. Once ecological features as well as human activities and pressures are mapped, conduct a conflict analysis. This can be simply done by overlapping human activities that require marine space and using conflict–compatibilities matrices (*e.g.* Ehler & Douvere 2009). In addition, in order to avoid conflicts among human activities and the marine environment, also the cumulative effects on the marine environment should be assessed and acknowledged. General description for transboundary cumulative impact assessments including environmental components have been done, *e.g.*, in the Baltic Sea (HELCOM 2017).

4. Project future environmental conditions and human uses and create future scenarios for the planning process. It is essential to define the time frame for the plan to be able to define the future conditions occurring in the planning area. Definition of future conditions include steps on projecting current trends of human activity development, estimating new, potential demands of sea space use and identifying possible alternative future scenarios, including differing management options (Ehler & Douvere 2009). In addition to projecting the human activities and management options, climate

change and the changing environment might affect the socio-economic scenarios, especially if the MSP process and assessment period is decades.

5. Analyse and assess the cumulative impacts and risks of the future scenarios of transboundary sea use. Analyse the risk and cumulative impacts from different human activities on the environment and assess the potential effects from the sea use planning options. Integrating the assessment of existing cumulative impacts and possible future effects into the planning process enables sustainable use of the marine areas as well as possibility for sustainable development.

6. Share data and experiences. Common understanding and documentation on the available data is a prerequisite for cross-sectoral, transboundary and coherent marine spatial planning. Data and information sharing enables transboundary dialog to identify shared issues and opportunities of co-operation in adjacent marine areas. Sharing knowledge on environmental and societal phenomena within the shared marine area may bring new aspects to neighbouring countries managing the same marine area. Sharing experiences builds capacity when the practices and lessons learned from the neighbouring countries can be utilized.

Stakeholder participation and creating common knowledge. Participation of stakeholders throughout the previous steps is a prerequisite for achieving a holistic and transparent planning process. It also empowers stakeholders in the decision making processes and integrates local knowledge to the scientific data and analysis. It is highly important to validate and discuss the scientific methods and discoveries with local/regional level stakeholders holding an extensive amount of knowledge on environmental and socio-economic values from the planning area. Each stakeholder group has their own views and values and inclusion of these early on the process can help discover and avoid conflicts of interest and commitment to the final Key stakeholders to participate in the MSP process might be indigenous and local people, representatives of different economic sectors and public administration (local, national, regional/international), scientists, non-governmental organizations and the general public.

Data needs for integrated analyses to support Arctic MSP

Due to the rapid changes and increased interest in the Arctic Ocean, large amount of spatial information on ecosystems, human activities and pressures has been produced (Barry et al. 2017). Constantly increasing amount of information brings challenges to the data management and accessibility. Data required for transboundary ecosystem-based MSP needs to be harmonized across borders, gathered with similar methods and contain comparable attribute information. To meet the needs of coherent transboundary ecosystem-based MSP, all data should be easily available in an understandable format filled in with essential metadata descriptions. Existing circumpolar datasets can function as starting point for the production of transboundary MSP.

Arctic Council's Working Groups produce high amount of joint monitoring and assessment data which are not yet available from single source. However, several working groups have their own services to access the datasets. For Arctic wide spatial data on marine biodiversity, Arctic Biodiversity Data Service (https://www.abds.is/) serves as an access point to the data produced by Conservation of Arctic Flora and Fauna working group. The service provides an access to marine related biodiversity data such as Arctic Species Trend Index, Sea Floor Geometry, Ecologically and Biologically Sensitive Areas (EBSAs), Arctic Marine Areas of Heightened Ecological Significance and Marine Protected Areas (MPAs).

At present, various online Spatial Data Infrastructures (SDI's) from different approaches and themes exists. One circumpolar online data service is the Arctic SDI (https://arctic-sdi.org/), built for improving access to geospatial data from the Arctic. It was established through joint effort and cooperation of all Arctic Counties National Mapping Agencies to provide spatial data, maps and tools to be accessible for citizens, scientists, policy makers and governments for their usage in monitoring and decision making processes. Eventually, the Arctic SDI will connect all Arctic Council's Working Group's data. In addition to circumpolar data portals, some regional data access points exist. *E.g.* Barents portal (http://www.barentsportal.com/) containing vast amount of data and information about Barents Sea's human activities and abiotic and biotic components. The portal was established as joint collaboration between Norway and Russia to support transboundary work *i.e.* for establishing integrated management plan for the Barents Sea.

However, in order to support a holistic MSP process, more knowledge and integrated data analysis is needed on the Arctic marine environment and human activities:

Biodiversity and changes in the future
- Habitat forming species and other key species distribution and state
- Ecosystem services produced by marine nature to humans
- Local, regional and Artic biodiversity hotspots

Human activities and future socio-economic trends
- Maritime traffic density
- Benthic and pelagic fisheries intensity
- Oil and gas exploration and production
- Tourism
- Extraction of mineral resources as well as dredging and deposition of the dredged material

Pressures and impacts
- Direct pressures from human uses

- Indirect pressures
- Cumulative pressures
- Conflicts and risks related to current and future use of Arctic marine areas but also the effects of climate change

Conclusions

The possibility to utilize Marine Spatial Planning process as a tool to remediate current or future conflicts among the human society and the Arctic marine environment should be studied taking into account the specific features of the Arctic region. MSP can support sustainable use of the marine resources that provides social and economic benefits also for future generations.

1. Identification of important biological and environmental components, human induced pressures and their impacts to the marine environment should be based on a joint transboundary approach. Arctic wide MSP process requires a common harmonized approach to assess ecosystems, human activities and their impacts on the marine environment.

2. Availability of Arctic marine knowledge should be increased by developing spatial data storing and sharing infrastructures. Currently, there exists a vast amount of information that could benefit a transboundary Marine Spatial Planning processes. Environmental and biological data needs to be collated, harmonized and made available for planners and stakeholders.

3. Planning should take into account the rapidly changing environmental conditions of the Arctic – predicting the possible futures may be a difficult but a necessary process to preserve even a part of the Arctic marine ecosystem for future generations.

4. Participation of indigenous peoples and local communities should be ensured to gather indeterminable information and knowledge about the Arctic environment and livelihood as well as to acknowledge the traditional uses of Arctic marine and coastal areas. Hearing the voices of people can empower local communities in participating decision making processes through which they are also more committed to the resulting marine spatial plans.

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