Better access to geospatial data for Arctic marine areas

User Survey Report

Assignment no.: 2603206

Client: Statens Kartverk

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The Norwegian Mapping Authority has received funds from the Arctic 2030 program through the Norwegian Ministry of Foreign Affairs to carry out a pilot project to investigate for better access to geospatial data covering the Arctic marine and ocean areas, and how geospatial data can serve user communities in the Arctic area in the best possible way

Norconsult has been engaged by Kartverket (the Norwegian Mapping Authority) to facilitate a user survey targeting four of the Arctic Council working groups, PAME, AMAP, CAFF and EPPR to find out what their needs for geospatial data are, and what requirements are made for these data

The survey and follow-up meetings to the survey discovered a need for some specific datasets, but above all the need for a unified approach to every aspect of creating, maintaining and distributing relevant datasets and services.

The results from the survey was analyzed generating specific search criteria used to find available and relevant data sets on the web.

Both general web searches and searches in the Spatineo data catalogue were executed. Search results showed a wide array of datasets, services, portals, and projects covering the arctic area to source data from. The huge volume, uneven quality and lack of standardisation didn't bring the expected results within the scope of the project.

"It's often said when considering the Arctic that we need more information, more data and more science – while this is true there is also a lot of existing information out there being generated by scientists, indigenous peoples and local communities. The challenge is how we better coordinate and standardise such activities and information so that it can be better integrated, accessed and used to help inform decisions being taken on the Arctic". - CAFF

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1 Background of the assignment

The Norwegian Mapping Authority is engaged through the Arctic SDI initiative in developing and establishing a spatial data infrastructure for the arctic region. The SDI aims to establish a spatial data structure and provide geospatial information services meeting the requirements for spatial and mapping data for the arctic land and marine areas. This activity is carried out in cooperation with national mapping agencies from 7 other Arctic countries.

The primary target group for the assignment are the Arctic Council working groups (WG) aiming to provide specific and direct support to their activities. The work seeks a close cooperation between Arctic SDI (8 national mapping agencies), Arctic Regional Marine SDI Working Group (7 national hydrographic organizations), and the Arctic Council's working groups. This initiative will imply a continuation of the cooperation between the Arctic SDI and the Arctic Council.

In order to perform this mission as effectively as possible, there is a need for standardized data and circumpolar datasets. Still, much of the information related to the Arctic region does not exist in a unified and accessible form (digital, written documents, protocols). Additionally, different coordinate systems, data formats, and geographic dispersal of information limits the usability of collected data.

The assignment is funded through the Norwegian Ministry of Foreign Affairs Arctic 2030 grant scheme. The Artic 2030 program aims to promote responsible and knowledge-based management of environmental and natural resources in the High North. The funding for this project will contribute in the development of relevant geospatial information services within this aim. The marine environment was especially prioritized in 2017.

1.1 Methodology used in the assignment

The methodology used in the assignment was based on the guidelines given in the contract with the NMA. The assignment was divided in two parts needing different approaches.

The first part was to conduct a user survey to obtain facts about the requirements for marine datasets and their usage to the Arctic Council most relevant WG (working groups). The two-part survey was conducted with CAFF, AMAP, EPPR and PAME WG. The first part is a questionnaire distributed by email to get a general feel for working group needs, and the second part is a follow-up meeting via Skype for detailed questions and open feedback.

Replies to the questionnaire were received from all work groups by early January 2018. The responses were reviewed and followed up with interviews of key representatives in the WGs. The questions asked were based on an analysis of the responses to the initial survey.

The feedback from the WGs were analysed and consolidated into this report. The findings were used to prepare an agenda and factual basis for the proceedings in a workshop.

The second part of the assignment was to retrieve information of available datasets and portals in the arctic marine domain from relevant organisations. Results from the first part, however, indicated that there was a huge amount of information available. This led to the decision to use professional search services to aid us in the assignment.

The Finnish company Spatineo was contacted. Spatineo offers professional search and web analysis services. A list was prepared with keywords based on relevant data categories. Spatineo provides a data catalogue based on this list. All the information received was consolidated and quality assured to remove duplicates and false results.

A report and guidance document with an overview of available and desired data sets and services was prepared. Additionally, a plan for better access to geographic data for the Arctic marine areas through Arctic SDI as a common platform for data sharing was compiled.

2 The Arctic areas

The Arctic as an area is essentially an ocean surrounded by the land north of the Arctic circle (66032' N) that covers a region larger than the African continent. Altogether about 4 million people live in the Arctic parts of eight countries: Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and United States (Alaska). The main portion of the region is oceanic, approximately one-third is occupied by land above water, another one-third consists of offshore continental shelves covered by less than 500 meters of water, and the remainder is under water deeper than 500 meters. It is a region of vast natural resources and a clean environment, compared with most other areas of the world.

The Arctic includes substantial natural resources (oil, gas, minerals, forest—if the sub-arctic is included—and fish) to which modern technology and the economic opening-up of Russia have added significant new opportunities. The tourism industry is also expanding due to intense interest in the region and its unique environment. The Arctic is one of the last and most extensive continuous wilderness areas in the world, and its significance in preserving biodiversity is without question. The increasing presence of humans within the region fragments and damages vital habitats. The Arctic is particularly susceptible to the abrasion of groundcover, and to the disturbance of the rare spawning grounds of the animals that are characteristic to the region. The Arctic also holds 1/5 of the Earth's fresh water supply.

Over the past century, climate change has affected this region as well as the rest of the world. With rising temperatures and increasing precipitation (https://www.arctic-council.org/index.php/en/our-work/environment-and-climate), sea ice, snow cower, glaciers and permafrost are all diminishing. This means changed living conditions for the people of the arctic, with rising sea levels, changes in hunting ground, and, as the permafrost thaws, the ground that has been stable for decades may become unstable. As a consequence of the climate change, there is an increase in activities such as transportation, oil exploration and fishing in the arctic region.

3 The Arctic Council mission and role

3.1 The Arctic Council’s mission

The Arctic Council was established in Ottawa on September 19, 1996 as an intergovernmental high- level forum to promote cooperation, coordination, and interaction between the Arctic states. The Arctic indigenous peoples and other inhabitants of the High North should actively engage in joint arctic issues. The Arctic Council addresses common arctic issues and its goal is to increase the welfare of the inhabitants of the Arctic, to protect the arctic environment while promoting sustainable development throughout the region, and to preserve the arctic indigenous cultural heritage and industrial routes. The Arctic Council's mandate is limited to research and environmental issues.

Ice, oil and gas extraction, marine traffic, and industrial development are some of the many challenges facing the vulnerable Arctic region. The Arctic Council was created as a mechanism for cooperation in the region and focuses on sustainable development and environmental protection.

The standing Arctic Council Secretariat was formally launched in 2013 in Tromsø, Norway. It was established to provide administrative capacity, increased communication, presence and general support

for the Arctic Council's activities. The Arctic was, when the council was founded, a field of “special interest”. Today, the North is a global concern, and the Arctic Council's work is being followed from all corners of the world. Several non-Arctic states and organizations now wish to join the Council.

3.2 Participants in the Arctic Council

Based on the Ottawa Declaration, the following countries are members of the Arctic Council: Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States.

In addition, six organizations representing arctic indigenous peoples have status as regular participants. The “permanent participant” category was created to provide active participation and full consultation with the Arctic indigenous people in the Council. They include: Aleut International Association, Arctic Athabaskan Council, Gwich'in Council International, Inuit Circumpolar Council, Russian Federation for Indigenous Peoples in the Nordic Region and Sami Council. Observatory status in the Arctic Council is open to non-Arctic states, along with intergovernmental, international, global, regional and voluntary organizations that the Council decides to contribute to its work. The Arctic Council's observers primarily contribute through their involvement in the Council at the level of the working group

3.3 The tasks of the Arctic Council

Council work is mainly conducted in six working groups.

- Arctic pollution action program (ACAP) acts as a management and support organization to encourage national measures to reduce pollutant emissions.
- Arctic Monitoring and Assessment Program (AMAP) monitors the Arctic, Arctic Ecosystems and Population, and provides scientific advice to support the authorities when dealing with pollution and harmful effects of climate change.
- The Arctic Flora and Fauna Conservation Group (CAFF) is working on monitoring and conserving biodiversity in the Arctic and ensuring that the arctic living resources are taxed in a sustainable manner.
- The Working Group on Emergency Prevention, Preparedness and Response (EPPR) is working to protect the Arctic environment from the threat or impact of accidental pollutant emissions.
- Protection of the Arctic Maritime Environment (PAME) is the focus of the Arctic Council's activities relating to the conservation and sustainable use of the Arctic marine environment.

 • The Working Group for Sustainable Development (SDWG) is working to promote sustainable development in the Arctic and to improve the conditions of Arctic society as a whole.

The Council may also establish working groups or expert groups to perform specific work.

- Arctic Working Group on Arctic Cooperation (TFAMC)

- Working Group on Enhanced Arctic Connection (TFICA)
- Expert group in support of the implementation of the action plan for black carbon and methane (EGBCM)

The Arctic Council regularly produces environmental, ecological and social assessments through its working groups.

The Council has also established a forum for negotiation of three important legally binding agreements among the eight Arctic states. The first agreement on cooperation on aviation and maritime search and rescue in the Arctic was signed in Nuuk, Greenland, at the 2011 ministerial meeting. The second agreement on emergency preparedness in the Arctic was signed in Kiruna, Sweden, at the ministerial meeting in 2013. The third agreement on improving international arctic scientific cooperation was signed in Fairbanks, Alaska at the ministerial meeting in 2017.

The Arctic Council's assessments and recommendations are the result of analyses and work carried out by the working groups. Decisions by the Arctic Council are taken in agreement with the eight Arctic Councils, with full consultation and involvement of the permanent participants. Arctic Council Presidency rotates every other year among arctic states. The first country that stood for the Arctic Council was Canada (1996-1998), followed by the United States, Finland, Iceland, Russia, Norway, Denmark and Sweden.

The Arctic Council has not and cannot implement or enforce its guidelines, assessments or recommendations. That responsibility belongs to each Arctic state. The Arctic Council's mandate, as formulated in the Ottawa Declaration, explicitly excludes military security.

The Arctic Council is a forum. All projects or actions are funded by one or more Arctic states. Some projects also receive support from other devices.

3.4 Presentation of the four Arctic Council work groups

3.4.1 AMAP – Arctic Monitoring and Assessment Programme

AMAP on the web: **https://www.amap.no**

AMAP is an Arctic Council working group providing reliable and sufficient information on the status of, and threats to, the Arctic environment. AMAP has a mandate to monitor and assess the status of the Arctic region with respect to pollution (e.g., persistent organic pollutants, heavy metals, radionuclides, acidification, and petroleum hydrocarbons) and climate change issues by documenting levels and trends, pathways and processes, and effects on ecosystems and humans, and by proposing actions to reduce associated threats for consideration by governments. This mandate is fulfilled through the implementation of a circumpolar monitoring and assessment programme as outlined in this strategic framework and in a separate monitoring plan document:[1]

- Produce scientific assessments and information products from which strong science-based policy recommendations can be made.
- Identify gaps and key questions that are needed for the best possible assessment of cumulative environmental stressors, their causes, and impacts on ecosystems and people, and recommend appropriate actions.

[1] https://www.amap.no/documents/doc/amap-strategic-framework-2010/126

 • Develop a closer cooperation with other AC Working Groups, Permanent Participants, governments, observers, educational institutions (e.g., University of the Arctic), the media and other organizations to promote AMAP results.

• Effectively communicate the results of AMAP activities to meet the needs of stakeholders.

• A sustained, robust circumpolar monitoring network effective at detecting change and discerning trends over the entire Arctic Region related to a range of environmental stressors including pollutants, climate change and the interaction between them.

• Develop and maintain circumpolar monitoring guidelines for the standardized collection and analysis of samples and data, including new parameters that meet evolving monitoring needs.

• Work with, and support, Indigenous Peoples groups' community-based monitoring projects.

3.4.2 CAFF – Conservation of arctic flora and fauna

CAFF on the web: **https://www.caff.is/**

CAFF's mandate is to address the conservation of Arctic biodiversity, and to communicate its findings to the governments and residents of the Arctic, helping to promote practices which ensure the sustainability of the Arctic's living resources. It does so through various monitoring, assessment and expert group activities.

CAFF's projects provide data for informed decision making to resolve challenges arising from trying to conserve the natural environment and permit regional growth. This work is based upon cooperation between all Arctic countries, indigenous organizations, international conventions and organizations, and is guided by the CAFF Strategic Plan for the Conservation of Arctic Biological Diversity and biennial Work Plans.

To successfully conserve the natural environment and allow for economic development, comprehensive baseline data is required, including the status and trends of Arctic biodiversity, habitats and ecosystem health. CAFF is developing the framework and tools necessary to create a baseline of current knowledge, and to provide dynamic assessments over time. This evolving, sustainable, and responsive approach can produce more regular, timely and flexible analyses.

Perform a broad range of task from maps creation, visualization to modelling. A lot of data is available on their portal, for instance "protected areas" that were asked for by one of the other groups. CAFF is the Biodiversity group of the Arctic council.

Output from CAFF is to communicate its findings to the governments and residents of the Arctic, helping to promote practices which ensure the sustainability of the Arctic's living resources. It does so through various monitoring, assessment and expert group activities.

3.4.3 EPPR – Emergency Prevention, Preparedness, and Response

EPPR on the web: **https://arctic-council.org/eppr/**

The EPPR (Emergency Prevention, Preparedness, and Response) Working Group was established under the Arctic Environmental Protection Strategy (AEPS) in 1991. The EPPR Working Group holds meetings twice a year to discuss projects, proposals, and guidance from the Ministers and Senior Arctic Officials. In addition, the group uses the meetings as a venue for sharing best practices on the infrastructure and procedures needed to prevent, prepare, and respond to emergencies in the Arctic

EPPR is mandated to contribute to the prevention, preparedness and response to environmental and other emergencies, accidents, and Search and Rescue (SAR). While not an operational response organization, members of the Working Group conduct projects to address gaps, prepare strategies, share information, collect data, and collaborate with relevant partners on capabilities and research

needs that exist in the Arctic. Projects and activities include development of guidance and risk assessment methodologies, coordination of response exercises and training, and exchange of information on best practices with regards to the prevention, preparedness and response to accidents and threats from unintentional releases of pollutants and radionuclides, and to consequences of natural disasters.[2]

EPPR cooperates with other Arctic Council Work Groups, the Northern Forum and other relevant organizations on their work, which in the EPPR Strategic plan is described having five objectives:

- Define the risk potential for emergencies due to commercial activities, nuclear/radiological material, and natural disasters that pose a threat in the Arctic
- Improve prevention measures aimed at reducing accidents which could result in environmental emergencies in the Arctic
- Improve emergency preparedness and response programs at local, national, regional and international levels, including arrangements for mutual assistance, to ensure they are commensurate with the level of risk that exists.
- Increase international information sharing between academic, governmental, industrial research
- Work to effectively implement relevant agreements among the Arctic States and arrangements of the Arctic Council in order to advance emergency prevention, preparedness and response capabilities.

3.4.4 PAME – Protection of the Arctic Marine Environment

PAME on the web: **https://pame.is/**

The PAME Working Group's activities are directed towards protection of the Arctic marine environment.

Increased economic activity and significant changes due to climatic processes are resulting in increased use, opportunities and threats to the Arctic marine and coastal environments. These predicted changes require more integrated approaches to address both existing and emerging challenges of the Arctic marine and coastal environments.

PAME's mandate is to address policy and non-emergency pollution prevention and control measures related to the protection of the Arctic marine environment from both land and sea-based activities. These include coordinated action programmes and guidelines complementing existing legal arrangements

PAME operates largely within these themes:

• Arctic Shipping: Increasing regional and coastal marine transport to support the exploration and extraction of oil, gas and hard minerals, coupled with the increasing presence of the global marine tourism industry, have brought a complex set of users to the maritime Arctic. The potential impacts of these new marine uses - social, environmental, cultural and economic - are unknown, but will be significant for Arctic indigenous people and the marine environment already undergoing significant changes due to climate change. Simultaneous with the globalization of the Arctic, marine access in the Arctic Ocean has been changing in unprecedented ways driven by global climate change. Arctic sea ice is undergoing an historic transformation - thinning, extent reduction in all seasons and substantial reductions in the area of multi-year ice in the central Arctic Ocean - which has significant implications for longer seasons of navigation and new access to previously difficult to reach coastal regions.

• Ecosystem Approach to Management: PAME established an Ecosystem Approach Expert Group in 2007. Six elements have been identified as the main components of an EA framework:

[2] http://arctic-council.org/eppr/wp-content/uploads/2010/04/EDOCS-3877-v1-2016_03_16_EPPR_Strategic_Plan_Final.pdf

18 Arctic Large Marine Ecosystems have been defined. LME's are defined as regions of ocean space of 200 000 km2 or greater, that encompass coastal areas from river basins and estuaries to the outer margins of a continental shelf or the seaward extent of a predominant coastal current. LMEs are defined by ecological criteria, including bathymetry, hydrography, productivity, and tropically linked populations
• Marine Protected Areas(MPA): Marine Protected Areas is defined as a clearly defined geographical space recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.
CAFF and PAME have developed an indicator report. It provides an overview of the status and trends of protected areas in the Arctic Resource Exploration and Development. The data used represents the results of the 2016 update to the Protected Areas Database submitted by each of the Arctic Council member states[3]:
• Marine Litter in the Arctic: Marine litter is one of the most pervasive pollution problems affecting the marine environment globally. UNEP defines it as 'any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment'. Marine litter consists of items that have been made or used by people and deliberately discarded into the sea or rivers or on beaches; brought indirectly to the sea with rivers, sewage, storm water or winds; or accidentally lost,

including material lost at sea in bad weather.
PAME has developed a project plan, which is included in the PAME 2017-2019 Work Plan for the project; Desktop Study on Marine Litter including Microplastics in the Arctic. Based on its outcomes, PAME will explore the possibility of developing an outline for a framework on an Arctic regional action plan on marine litter

[3] http://geo.abds.is/geonetwork/srv/eng/catalog.search#/metadata/2e56ee1f-50a9-4983-88f4-edaa8588950d

Figure 1 Ecosystem approach framework

4 Example of geospatial support for marine spatial planning and marine management in Norway

The project “Marine Spatial Management Tool” appear as one example on how to operate cross-sectoral geospatial services within marine spatial planning and marine management.

Report no.37 to the Norwegian Parliament (2012-13) “*Helhetlig forvaltning av det marine miljø i Nordsjøen og Skagerrak”* (Ecosystem-based marine management of the North Sea and Skagerrak) emphasizes the need to strengthen the area-based work on the Norwegian marine management plans. The report states that there is a need for a tool capable of handling cross-sectoral geospatial data in a more coherent and uniformed way.

Barentswatch, the Norwegian Mapping Authority and the Norwegian Environment Agency have been working together through a common project to create this Marine Spatial Management Tool. The purpose of the project is to develop a spatial management tool that make the updating processes with marine management plans more efficient, providing a more coherent and uniformed overview of geospatial situations and decisions, and contributes to a greater transparency and strengthening of stakeholders' involvement in marine management.

Governmental agencies and research institutions contributing with geospatial data for this purpose, manage their own thematic datasets within their own organizations, making them available through network-based services. One of the challenges has been to establish a single comprehensive tool accessible to all users, organizations and communities involved in the processes of making the marine management plans, utilizing the same geospatial content at the same time. Primary goals is to:

- Improve information to the community through a common geospatial information platform
- Improve the production and updating of the map content utilized in the management plans
- Increase information quality and efficiency to the processes of the management plans according to the knowledge creation, calculations, analysis tasks, decision-making and information processes
- Improve the foundation for co-operation and interaction with other countries on marine management and marine spatial planning

In order to achieve these goals, there has been a strong emphasis on working together with the users according to the user needs and the data owners according to making datasets and services available through necessary standards and harmonization work. Key points in this work is to:

• Develop user stories to clarify user needs

• Develop unified solutions for sharing and making geospatial datasets available for integrated use

• Clarify and implement unified solutions on cartography (symbol usage, map content presentations, etc.)

• Provide sufficient associated information to the geospatial content

• Make the marine geospatial datasets and services available through the national spatial data infrastructure Geonorge through metadata and discovery services

• Making the Marine Geospatial Management Tool available through the Barentswatch portal

• Improve the marine management processes and routines through common geospatial tools

• Develop, promote and implement potential development proposals where standards and solutions prove to be inadequate or inhibitory to the value chain of marine spatial planning and marine management

The project has also identified and adopted several important principles:

• Utilization of each governmental organisation's own thematic geospatial services, ensuring access to original authoritative data and documentation

• Online consumption of geospatial services preferred to downloading and local usage of geospatial data from a data warehouse

 • Use of WFS is preferred to WMS for a richer geospatial content and an extended interactive and

flexible use

• Mandatory registration of metadata in the national spatial data infrastructure Geonorge to ensure efficient availability and reuse of these marine geospatial data and services. Ref. https://www.geonorge.no/

To improve usability of the tool and the geospatial content, the project has been working on a terminology and a thematic structure categorized and adapted to the marine spatial planning and marine management processes.

The Norwegian Marine Spatial Management Tool is accessible (currently only in Norwegian) at https://kart.barentswatch.no/arealverktoy.

5 Response from the workgroups

5.1 Response from AMAP

AMAP use geographic information for production of maps, geospatial and statistical analyses, geocoding and preparation/construction of geospatial datasets.

Important use cases in AMAP WG:

- To perform analyses based on satellite/remote-sensing datasets
- Combine data from multiple sources for data products required by AMAP
- Production of maps included in AMAP assessment reports
- Analyses in connection with AMAP oil and gas and radioactivity assessments
- Mapping point source locations in connection with estimating global mercury emission
- Geospatial distribution of mercury emissions; distribution of PAHs (Polyaromatic hydrocarbons) in Barent Sea sediments

Many geospatial datasets used by AMAP are acquired from external sources that produce and maintain them.

AMAP needs Arctic-wide and in some cases global data for multiple themes:

- satellite imagery
- boundary data, administrative, topographic/bathymetric,
- locations of pollution sources/monitoring data; monitoring data
- shipping
- natural resources
- ice-, snow- cover; meteorological data; land cover/land use

It is important for AMAP to use reliable sources of information, to have easy access to datasets/services and be able to track changes in the data.

5.2 Response from CAFF

The primary objective for CAFF is to monitor the biodiversity in the Arctic region. CAFF have their own data-management framework, **Arctic Biodiversity Data Service** (ABDS), and its programs and activities include the Circumpolar Biodiversity Monitoring Programme (CBMP)[4]. It is an online, interoperable data management system that serves as a focal point and common platform for all CAFF programs and projects as well as a dynamic source for up-to-date circumpolar Arctic biodiversity information and emerging trends.

The goal of the ABDS is to increase access to Arctic biodiversity data for the common good of scientists, policy makers and other stakeholders both inside and outside of the Arctic. It is intended to allow for discovery, archiving and access to data at various scales. Such a framework is essential to ensure effective, consistent, and long-term management of the data resulting from CAFF and its partners activities.[5]

Among the work the group products are arctic species trend index and migratory birds index.6 To define the abundance trends of migrant bird species which breed in the Arctic and leave the area for the northern hemisphere in winter, time-series data starting as early as 1970 are used.

[4] http://www.caff.is/monitoring [5] https://abds.is/index.php/about [6]

https://caff.is/asti/asti-publications/322-arctic-species-trend-index-migratory-birds-index

The Arctic Species Trend Index (ASTI) is part of a suite of indicators and indices developed by CAFFs CBMP. It tracks trends in over 300 Arctic vertebrate species and comprises the Arctic component of the Living Planet Index. It is important to identify how wildlife and ecosystems are changing in order to develop effective conservation and adaptation strategies in the Arctic, an environment undergoing dramatic changes. The ASTI describes overall trends across species, taxonomy, ecosystems, regions and other categories.[7]

More than a specific need for certain dataset, CAFF points out that there is not necessarily a shortage of data but a lack of expertise and knowledge in the work groups which is the biggest challenge. Rather than provide more data, they feel that it is more important or efficient to use what is already available in a better way. There is already a significant quantity of information in today's data sets that is not sufficiently utilized. Consolidating the vast amount of disaggregated data across all Arctic sub- regions and biomes will improve access to biodiversity status and trends, information and promote a deeper understanding of inter-relationships at the local, regional, circumpolar, and global scale.

5.3 Response from EPPR

The EPPR work focuses, in short, on risk analysis, assessments, and preparedness. They produce maps and analysis of resources at risk from oil spills in the Arctic and work to share information about how to act in case of an environmental emergency.[8]

EPPR also contributed data to the ERMA (The Environmental Response Management Application) project. ERMA is a web-based geographic information system (GIS) tool that helps emergency responders and environmental resource managers deal with incidents that may adversely impact the environment. ERMA combines real-time and static data to display a single interactive map that makes it easy for users to visualize a situation.

In all work done in the Arctic area, it is vital that the people living there are considered. In the identification of emergency response assets, risk assessments and response actions, the involvement

[7] http://geo.abds.is/geonetwork/srv/eng/catalog.search#/metadata/8f4d5a7e-ccd2-45cd-9901-b15057252c0b [8] https://arctic-council.org/eppr/completed-work/auto-draft/

 of local and indigenous people should be increased. The increase of public awareness and of public participation is invaluable for emergency prevention, preparedness and response actions.[9]

EPPR requires input data from multiple data owners including data from some of the other work groups under the Arctic Council. This includes accident and incident datasets, infrastructure datasets showing

harbours, roads, airports, cities, and environmental datasets including ocean currents and meteorological data. These datasets are then combined to create and maintain prediction maps in case of oil spills and accidents.

EPPR emphasises the need for good infrastructure data, showing roads, harbours, cities and airports so that they can be able to evaluate risk and prepare analysis. Data should be of good quality with an emphasis on thorough attribute data, for instance harbours with depths in meters and roads with widths in meters. It is also important to have easy access to datasets and services showing populations and vulnerable areas and habitats. Datasets and services should be available in such a manner that they are easy to access, and use. It must be easy to access and integrate datasets from multiple providers regardless of the source country or institution, and it should also be easy to get information on when the datasets and services were last updated.

5.4 Response from PAME

PAME's main working areas are Arctic Shipping, Ecosystem Approach to Management, Marine Protected Areas(MPA) and Marine Litter in the Arctic.

Change detection and tracking of changes in the data are important options for PAME. A good example of how this can be done in a web portal is https://havbase.no/havbase_arktis

See also video demonstration of the capabilities of the Havbase system here: https://youtu.be/8a3wrI_ojN0

The Arctic Ship Traffic Data (ASTD) project is an initiative from PAME to collect historical information about shipping activity in the Arctic. The project will collect historical information on shipping activity in the Arctic from the Arctic Council member states for trend analysis and related purposes under the realm of the Arctic Council. You can find a video presentation of the project here: https://youtu.be/MLOwVcr4Jr0

The ASTD project will allow the Arctic Council member governments and the Arctic Council as a whole, to facilitate trend analysis on ship traffic in the Arctic, including the number of ships in the Arctic, types of ships, exact routes and other related and relevant information. The trends can be used for the council member's Arctic affairs. Products will benefit a wide-range of audiences, as the data repository will allow for the production of graphics, maps and tables of ship traffic information to be used in reports/analyses and other initiatives.

PAME and the ASTD project need reliable sources of information and it is important to have easy access to datasets and services containing ship traffic in the Arctic, harbour statistics, air pollution from ships and data for risk analysis. PAME also need easier access to uniform meteorological data, ice, wind, currents, waves and fog. It is also important to have easier access to better background maps in a polar projection

5.5 Consolidated response

On the second part of the questionnaire the work groups were asked to classify the importance of datasets as high, medium or low for their work. The scores were translated to numeric scores High=3, medium=2 and low=1 and summed up. Based on replies from the AMAP, PAME and EPPR

[9] http://arctic-council.org/eppr/wp-content/uploads/2010/04/EDOCS-3877-v1-2016_03_16_EPPR_Strategic_Plan_Final.pdf

 questionnaires a total score of “importance” is shown in figure 4. This gives an indication of which datasets\services are more important and could serve as a guide in which order more information should be acquired about the datasets\services.

When working with the Spatineo catalogue, and searching for datasets and services on the web, the search has focused on the 10 categories with the highest scores in Figure 3, because of time constraints

Figure 3 Shows importance of datasets

The groups have expressed specific needs for datasets in the questionnaires and the skype meetings. The table Table 3 Consolidated response on datasets from the working groups in the appendix, shows the response from the workgroups and their needs for data. The table shows what type of datasets\services are in use today, and where possible some examples of datasets. Working groups who expressed need for such data are also shown in the table. Expressed shortcoming of datasets\services are shown in the column “Identified shortage”.

A simple web search for datasets\services has been done to search for more data to try to complement what is already available. The results from the web search are shown in the column “WEB search”. The table is a non-exhaustive list of datasets\services.

5.5.1 Expressed needs, Technology - conditions

In the meetings with the working groups and on the questionnaires several technical requirements and preconditions regarding how the data should be delivered, have been mentioned. To make a reliable and usable data portal the datasets must fulfil these conditions if they are to be useful in context with the work the work groups are doing. These preconditions make no distinction between the work groups, as there seem to be a consensus.

Preconditions:

- We need to create more knowledge among the users of the Arctic SDI to better understand the information in the datasets. There is a lot of data available today, but the benefit of the data is not used as good as it could be.
- We need better coordination and integration of datasets

 • We need datasets to be easily discoverable, downloadable, and well documented (metadata such as CAFF use for their datasets) - AMAP

• We need data accessible through Web services and showing a footprint of available datasets are useful.

• Data quality needs greater attention in the ASDI - quality is more important than quantity, especially when it comes to maintaining datasets over time. - AMAP

Technology:

• Downloadable GIS datasets (any standard formats); ascii tables; standard raster/image formats. – PAME, AMAP, EPPR

• Useful to have data that is appropriate for a range of spatial scales (e.g. rivers from local to global) - AMAP

• WMS, WFS, CSV or API is in most cases preferred. WFS preferred over WMS – PAME, AMAP, EPPR

• Properly time-stamped datasets (for both historical and contemporary periods) - few are routinely maintained as up-to-date geospatial data. - AMAP

6 Data availability searches

6.1 Spatineo searches

The Finnish company Spatineo created a searchable data catalogue named "Better Access to Geodata for Arctic Marine Areas" aiming to assemble data services from the web relevant to the arctic domain. Spatineo provided links and credentials to access and search the catalogue.
The catalog can be found on the webadress: https://arctic-sdi-catalogue.spatineo-devops.com/geonetwork/. and included on the 01.02.2018 25473 searchable items of which 392 are classed as services. The remainder are classed as datasets, maps and register data.
Several searches were executed using specific keywords found in the responses from the work groups. These searches were also extended to aliases and synonyms where the results were lacking or irrelevant. The following table lists the search strings used to search the data catalogue. The number in the parenthesis shows the number of hits for each specific string.

Table 1 Table with search strings

Sea areas Sea areas(80)
Maritime borders Maritime borders(2), Maritime boundaries(0), economic zone(0)
Ice border zone Ice border zone(0), Ice(173),Sea Ice(17)
Ship traffic Ship traffic(0), ship movement(0), vessel, AIS(0)
Land areas Land areas(110)
National borders National borders(3), National boundaries(55)
Coastal borders Coastal border(0), Marine border(0), border(15)
Ocean floor and seabed Ocean floor(0), ocean seabed(0), bathymetry(33)
Ocean streams Ocean streams(0),streams(33), ocean Current(7)
Special valuable and vulnerable areas

18 Special valuable and vulnerable areas(66)

Vulnerable natural habitats Vulnerable natural habitats(0), habitat(9)
Satellite data and images Satellite data(336), Satellite images(77)
In our contact with Spatineo we were warned that the catalogue is still very much work in progress. The present state is based on a rudimentary method of identifying services relevant for the Arctic and once the data flows to the Arctic SDI catalogue, the identification method will be improved. There will also be false positives in this catalogue. The selection is also too broad since it looks at the arctic areas in general and not focusing on marine.

 The results from the searches were exported from the webpage into a CSV file, structured, and imported into an Excel spreadsheet. The data included the following headers (columns)for each find:

Table 2 Extracted information from the Spatineo data catalogue

uuid
id title
abstract
category
metadatacreationdate
date-revision
date-publication
keyword
keyword-1
keyword-2
contact-pointOfContact

Constraints

link

6.2 Web searches

To enrich the selection of datasets and services available found by using Spatineo, an attempt has been made to search for requested datasets and services on the web. There are several different approaches to try when searching for datasets and services on the web. Both Google searches and catalogue searches can be used:

Google searches examples

- Ocean current:GetCapabilities
- Ocean current file type:wfs

Catalogue searches

- http://inspire-geoportal.ec.europa.eu/discovery/
- http://gptogc.esri.com/geoportal/catalog/search/search.page
- http://www.geoportal.org/#
- http://polar.geodacenter.org/polarhub/
- https://www.geonorge.no/

Identified datasets and services in the column “WEB search” in Table 3 in the appendix have been found mostly by using Google searches. These datasets and services do not necessarily address every aspect of the identified shortcoming of the datasets and services in use, as the intended use of the dataset or service found by manually searching, could serve a completely different purpose.

7 Analysis

7.1 Analysis of the consolidated response

In chapter “5.5 Consolidated response”, the questionnaires and meetings show a need for some datasets, and above all the need for a unified approach to every aspect of creating, maintaining and distributing relevant datasets and services. In this regard we have focused on the data that are expressed as needed, and in the continuation of this project it will be most important to focus on unified processes. Projects such as “The Norwegian Marine Spatial Management” and EMODnet Arctic could be used as inspirational projects to get some ideas on distribution and how to unify.

Awareness - Large number of datasets, but difficult to find what you need

There are a vast number of datasets covering areas of interest for all the workgroups already existing, and many solutions\portals focusing on solving one or more issues. In many cases data is available, but it is difficult to find, or to use without understanding the original purpose.

Response given on the questionnaires reflect this:

"It is often said when considering the Arctic that we need more information, more data and more science – while this is true there is also a lot of existing information out there being generated by scientists, indigenous peoples and local communities. The challenge is how we better coordinate and standardise such activities and information so that it can be better integrated, accessed and used to help inform decisions being taken on the Arctic." -CAFF

Suggested follow-up action:

It could be beneficial to look at "The Norwegian Marine Spatial Management tool" where the Norwegian Mapping Authority and Barentswatch have created a thematic model for datasets. This model could be reused and adapted as an attempt to categorize datasets and to create awareness for datasets and processes that are currently available.

Awareness - Unified access to datasets

Most datasets today lack a unified format where a primary key such as a location can be used to find all relevant information about that location. Even among data that follow such a format, some may have different file formats requiring conversion, some may not be accessible through online APIs, and older records may not even be available digitally.

The task of finding datasets and acquiring knowledge about the official datasets you need, for instance who produce them, when they last were updated, how they were made and the quality of the datasets, seems quite complex and overwhelming. This is a problem that was highlighted during the talks with the working groups. This has also been a challenge when combining datasets from the Atlantic Council http://www.atlanticcouncil.org, which may be considered as the equivalent of the Arctic Council for the Atlantic regions. Information from that project could be used at a later stage to streamline this project

Suggested follow-up action:

Create or use a unified access point like Spatineo for datasets and services to create an "official" access point. Create standards or "convention" for datasets, metadata, file type, projection, etc.

Chapter 5.5.1 presents the working groups needs on technology. Generally, more feature rich technology is preferred over less feature rich technology. API's would be preferred, and WFS is preferred over WMS

Suggested follow-up action:

Work with owners of data relevant to the Arctic SDI to ensure services are delivered with a minimum of WMS, but preferably WFS or API

Importance

Figure 3 Shows importance of datasets as reported by the working groups on the questionnaires. This importance score can be used as a guide as to what kind of datasets and services to search for, and to build a catalogue by.

Suggested follow-up action:

Build a custom Spatineo catalogue with relevant Arctic marine datasets and services corresponding to the categories in figure 3. Starting with the "most important" categories.

7.2 Analysis of the data searches

7.2.1 Spatineo searches

The complete list of the results from the searches in the Spatineo data catalogues can be found in the attached file Spatineo_search_results.

An analysis of the Spatineo search results showed that the relevancy of the results was poor. As much as half the results for several criteria was not related to the intention. This is probably because the original methodology used to collect items for the catalogue was inadequately defined. For example, the catalogue lists many services and maps related to land use which is not relevant in this setting.

Another issue with Spatineo is that geographic metadata like format of service/map, extent, quality and validity is not collected and cannot be extracted from the catalogue. Anyone using the catalogue must access and investigate the source data to obtain this information. This makes the current version of the Spatineo data catalogue of limited use to the task in the assignment.

However, a catalogue service like Spatineo has the potential to provide precise filters and thematic searches to find datasets. This is a service that should be tested again in conjunction with the process of acquiring multiple datasets. It is important that this approach is tested in the next phase of the project and again after the workshops, when the total picture of needed datasets is clearer.

But to be usable for the Arctic SDI the searches need to be refined; they should collect more metadata and the Spatineo webpage should be extended to allow more complex searches.

7.2.2 Web searches

Manually searching for relevant datasets and services show that there are many datasets, services, portals, and projects covering the arctic area to source data from. The volume alone makes it difficult for the users in

the work groups to find data. The web searches show that it is possible to manually search for, and find datasets and services relevant to the Arctic, but this is not very practical. The manual approach seems to be to random with no guarantee that the searches will find data even if it exists.

Table 4 Results from web searchesTable 4 in the appendix shows the results from the web searches. Manually searching for datasets and services does not necessarily reveal information about metadata or the quality of the datasets, coverage, or statistics about uptime or availability.

Figure 4 Show type of information in table 2 in the appendix.

Some of the catalogue services, like http://inspire-geoportal.ec.europa.eu/discovery/ do, however, provide some information on metadata and quality. These services can show how complete a metadata document is with respect to metadata implementing rules and also how interoperable a resource is with respect to technical guidance requirements.

Figure 5 Inspire metadata with indication of how complete metadata is

The consolidated response from the working groups show a need for datasets covering sea areas and maritime borders. The manual web searches for these categories of datasets and services are shown in Table 4 in the appendix. Datasets and services within these categories are available both as WMS and WFS and probably also as REST services. The working groups have reported that different versions of these datasets exist over time, and that history or time for these datasets would be useful. The user could use a time slider to choose a point in time, or year, and would be able to see the corresponding dataset for that year.

There is a need for good infrastructure data with good quality attribute data. Harbours with depths has been mentioned by EPPR as a dataset that is wanted. The World port index database is in use on the interactive map on the Arctic Portal but not at Arctic SDI at the moment. The database shows some ports with depths but should be updated for a more complete picture.

Figure 6 World Port Index in use at the interactive map on the Arctic Portal

7.2.3 Conditions and limitations on use of existing data sets

During the investigation of the available and relevant data sets and services it was found that information on Terms of Use or Conditions of Use for the separate data sets was not easy accessible and for several of the providers missing. This state is aggravated by the fact that no common framework is used for distribution of data and metadata. On the contrary, the findings are characterised by a huge diversity in provided data formats and metainformation.

This situation is probably in part caused the different target groups the data providers aim for when publishing the data. Some data providers are research institutions, others are governmental organisations. Yet, it seems that several of the investigated datasets are specified as public data, free to access, use or share. A typical example of free-to-use license is Creative Commons Attribution 4.0 International (CC BY 4.0) or Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0). The CC BY-NC non-commercial license prohibits commercial use of the dataset. Investigated datasets are also commonly provided without any warranties concerning uptime and availability.

For some of the datasets, rules and regulations in national legislations also apply.

In summary it is difficult to conclude within the scope of this report. On the other hand, the WG's response are quite clear on the requirements for metainformation in the portal. See chapter 7 for an analysis of the

responses from the working groups.
A future Arctic SDI Portal providing seamless and traceable data should also provide the data in common format using a standardised framework and a consistent data catalogue. The Arctic SDI portal can be a data redistributor itself or can provide links and access to the original data providers. If a redistributor approach is chosen, one must allow for an extensive amount of work on data import and maintenance. Even if only links are provided, the portal users will expect detailed information on the datasets before they access the data at the original provider. As a minimum, a data catalogue with necessary information must be available in the portal.
A common framework for distribution of spatial data is available in Europe as the INSPIRE initiative from the European Commission. The INSPIRE data specification covers some of the features required by the responders. The INSPIRE specifications are also highly adaptable to the specific requirements of the stakeholders in an eventual Arctic SDI Portal

8 Summary

The questionnaires and meetings show a need for some datasets but above all they suggest a strong need for a unified approach to every aspect of creating, maintaining, and distributing relevant datasets and services.

Additionally, new and ongoing data collection efforts should emphasize completeness, and quality. Datasets and services should be standardised and coordinated, so that they can be easily integrated and accessed to help inform decisions being taken on the Arctic. “The Norwegian Marine Spatial Management tool” has created a model on how to categorise datasets and worked on an approach on how to work with datasets and services and could serve as a template.

We find that there is a general need for better and more topographic\bathymetric data. It would be preferred if it was possible to use these datasets to run risk analysis either by downloading the datasets, or by API. Meteorological data such as snow cover, ice cover and iceberg tracking are also data of significant interest for risk analysis.

Good quality datasets with metadata, showing landcover, land use, administrative borders, and other boundaries are wanted datasets. To cover large areas, remote sensing data from satellites and space shuttles are can be used. Datasets showing natural resources would be valuable, both for risk assessment and analysis, but also as supplement for other datasets such as shipping, to be able to put shipping into a context.

We also find that tools capable of locating relevant datasets (Spatineo) show promise, but currently show poor result relevance to our specific applications. As much as half the results for several criteria was not related to the intention. This is probably because the original methodology used to collect items for the catalogue was inadequately defined. For example, the catalogue lists many services and maps related to land use which is not relevant in this setting.

However, a catalogue service like Spatineo has the potential to provide precise filters and thematic searches to find datasets. This is a service that should be tested again in conjunction with the process of acquiring multiple datasets. It is important that this approach is tested in the next phase of the project and again after the workshops, when the total picture of needed datasets is clearer.

Manually searching for relevant datasets and services reveals that current datasets exist in a distributed format across different services, portals, and projects without a central archive or index to source data from. The volume of data, and difficulty in identifying all reliable data makes it difficult for working groups to find data critical to their intended functions. The web searches show that it is possible to manually search for, and find datasets and services relevant to the Arctic, but this is not practical. We find that in addition to requiring significant amounts of time, the manual approach seems to be to random with no guarantee that the searches will find data even if it exists.

9 Appendix

9.1.1 Consolidated response on the expressed need for datasets

Table 3 Consolidated response on datasets from the working groups

Thematic datasets C_{AFF}

Dataset\service in Use Identified shortage WEB search

Base maps\infrastructure

Harbours, cities, roads, ice roads, airports X X General datasets from various sources AMATII Database Need better attribute World port index data with depth of DB harbour, width of road etc

Base maps\boarders and administrative

Sea areas X X Various sources We need better maps (web service) maps with arctic projection Marine regions

Land areas X X X Various sources Lakes and rivers at appropriate scales (for most countries) Arcticdem

National borders X X X Typically ESRI Datasets Desired administrative units not always available

National\local data

Coastal borders X X X Typically ESRI Datasets Need more accurate data

European Environment Agency - Coastline for analysis

Marine base data

Topographic/bathymetric datasets X X Various bathymetry

datasets (primarily IBCAO supplemented for regions not covered)
EMODnet Bathymetry
Ocean currents X X X Major current systems
(generalisations)
OSCAR_L4_OC_thi rd-deg
Reference data
Boundary data, administrative borders, land cover/land use/EEZ/IHO/LME, etc
Mapping of current systems at various depths based on observational data
X X X Boundary data (CAFF) Different versions exist
Marine regions over time - History\Time?
Named Places X X X X Various (ESRI, national,
etc.)
Attention to consistent naming, especially indigenous names / reflection of changes over time in administrative units
Natural resources
Geological and Mineral resources X X X CAFF + external Soils and related
parameters

AMAP

PAME

EPPR

Client: Statens Kartverk **Assignment no.:** 2603206 **Document no.:** **Version:** CAFF Biodiversity data X https://www.abds.is/
Distribution of fish species X X X AMAP-related work
Aquaculture areas? (IMR) (generalisation)
Distribution of sea mammals X X X AMAP-related work
Migration, etc. (IMR) (generalisation)
Distribution of shellfish X X X
Sea bird colonies X X X AMAP-related work
(IMR) (generalisation)

26 Migration, colony numbers, breeding vs wintering areas
Plans and regulations
National parks, protected areas X X Protected areas,
WCMC, OSPAR, WWF
Activities
Incidents (spills) X X Arctic Spill Response Database Query Tool
Sea accidents X X AMSA\ARCTIS-
Database http://www.arctis- search.com/About+AR CTIS
Offshore installations X National sources
Activities (oil) X National sources
Shipping X X AIS shipping (with
statistics) \ ASTD project
Marine traffic
Fishery X X X Various sources Marine traffic
Human influence X X Many activities / limited
sources
Environmental conditions
Locations of pollution sources/monitoring data;
Need contemporary data (traffic routes but also associated data on parameters such as type of activity, engine size, fuels used) as well as modelled projections of future traffic
X Air pollution from ships Must be time-stamped
AMAP Global mercury emissions X AMAP Global mercury
emissions
Must be time-stamped
Deposition/input estimates X Must be time-stamped
Ocean temperature/salinity, etc. X Must be time-stamped

OA parameters X Must be time-stamped
Permafrost areas; characteristics/active layer depth
X Must be time-stamped
Meteorological data
Snow cover X X X
Ice cover X X X Sea ice thickness -
temporally resolved data available and needed. We have average
Global Sea Ice
Client: Statens Kartverk **Assignment no.:** 2603206 **Document no.: Version:** monthly ice , but need
better resolution
PolarView
Ice berg X X X Iceberg
monitoring
SAR Sea Ice berg
Other
Population X Must be time-stamped
Human health status X Must be time-stamped
Air traffic X Must be time-stamped
SAR Sectors (Sar agreement) X
High Seas X
Remote sensing X X
Satellite imagery X X X

Use table 4 to see search results for thematic datasets\services.

9.1.2 Data availability searches – Web searches

Table 4 Results from web searches

Sea areas IHO Sea
Areas

27 WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Sea areas FAO
Fishing Areas
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Sea areas Large
Marine Ecosystem s of the World
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Sea areas ICES
Ecoregions
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Sea areas ICES Areas WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Sea areas ICES
Statistical Rectangles
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Sea areas OSPAR
Boundaries
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Sea areas Longhurst
Biogeograp hical Provinces
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Sea areas The
SeaVoX
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Client: Statens Kartverk **Assignment no.:** 2603206 **Document no.: Version:** Salt and Fresh Water Body Gazetteer, version 16
(2015)
Sea areas The World
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities Marine Heritage Sites
Maritime borders

28 WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Maritime borders
EEZ Polygons
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Maritime borders
EEZ Boundaries (lines)
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities
Maritime borders
Marine Regions: intersect of IHO Sea Areas and Exclusive Economic Zones
Marine and
WFS http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities land zones: the union of country boundaries and Exclusive Economic Zones
Sea ice Sea Ice
index
GeoTIFF FTP https://nsidc.org/data/search/#keywords=sea+ice/sortKeys=score,,desc/fa
cetFilters=%257B%257D/pageNumber=1/itemsPerPage=25
Sea ice Sea Ice
trends
GeoTIFF FTP https://nsidc.org/data/search/#keywords=sea+ice/sortKeys=score,,desc/fa
cetFilters=%257B%257D/pageNumber=1/itemsPerPage=26
Sea ice Sea Ice
thickness
GeoTIFF FTP https://nsidc.org/data/search/#keywords=sea+ice/sortKeys=score,,desc/fa
cetFilters=%257B%257D/pageNumber=1/itemsPerPage=27
Sea ice Sea Ice
edge
various http://www.osi-saf.org/?q=content/sea-ice-products
Sea ice NCEO
Theme 5: Cryosphere and Polar Oceans
This Theme
http://catalogue.ceda.ac.uk/uuid/eba1f035928bb74b99a50c5bede41472 in the National Centre for Earth Observation aims to use new EO data to quantify changes in the mass balance of the cryosphere and to develop new models to represent the relevant processes in coupled climate
Client: Statens Kartverk **Assignment no.:** 2603206 **Document no.: Version:** prediction models.
Ship Traffic Ship traffic API https://www.marinetraffic.com/en/ais-api-services
Land areas ArcticDEM High-
resolution, high-quality digital surface model (DSM) of the Arctic

29 DEM https://www.pgc.umn.edu/data/arcticdem/
National borders
National datasets\se rvices
National datasets\services
Coastal borders
Europe coastline
Downloadab le coastline for analysis 1:100000
shape https://www.eea.europa.eu/data-and-maps/data/eea-coastline-for-
analysis-1
Ocean floor and seabeds
EMODnet Bathymetri
WMS: http://ows.emodnet-bathymetry.eu/wms
Ocean floor and seabeds
EMODnet Bathymetri
WFS: http://ows.emodnet-bathymetry.eu/wfs
Ocean floor and seabeds
EMODnet Bathymetri
WMTS: http://ows.emodnet-bathymetry.eu/wmts
Ocean floor and seabeds

EMODnet Bathymetri
WCS: http://ows.emodnet-bathymetry.eu/wcs
Ocean streams
OSCAR_L4 _OC_1deg
contains near-surface ocean current estimates
ftp https://podaac.jpl.nasa.gov/dataset/OSCAR_L4_OC_1deg
Ocean streams
OSCAR_L4 _OC_third- deg
contains near-surface ocean current estimates
ftp https://podaac.jpl.nasa.gov/dataset/OSCAR_L4_OC_third-deg
Ocean streams
Global Ocean Currents Database
The Global Ocean Currents Database (GOCD) is a collection of quality controlled ocean current measureme nts
https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.nodc:0093183
Vulnerable valuable areas\habit ats
Ecologicall y or biologically significant marine areas EBSA
(Served from CAFF)
Shape https://www.cbd.int/ebsa/about

9.1.3 Parallel initiatives

There are several parallel initiatives and relevant organizations to source data from. The following list is a non- exhaustive list of data providers and current and previous projects whom must be considered relevant in this regard.

• Arctic Portal

The Arctic Portal is a comprehensive gateway to Arctic information and data on the internet, increasing information sharing and co-operation among Arctic stakeholders and granting exposure to Arctic related information and data. The Arctic Portal is operated in consultation and co-operation with members of the Arctic Council and its Working Groups, Permanent Participants, Observers and other Stakeholders.
The Arctic Portal is a network of information and data sharing and serves as host to many web sites in a circumpolar context, supporting co-operation and outreach in science, education, and policy making.
Visualize Arctic related information in Inter-map is very simple. Once opened the page you can choose as many layers as desired. Layers are listed in alphabetical order on the left side, or sorted out by category on the right side:
You can visualize all data contained in the Arctic Portal Inter-Map system, there is no limit to the number of layers you can visualize simultaneously (be aware that too many layers may slow down the system). Although it is not possible to export the file created, users can contact Arctic Portal Staff and request the file.

Client: Statens Kartverk **Assignment no.:** 2603206 **Document no.:** **Version:** All data utilized to create our maps are provided either from our partners (see Arctic Portal Community) or from the best reliable databases currently available. Sources are always quoted clearly. Arctic Portal staff is continuously working to update the mapping system and to create new maps. If you want to suggest new maps, or you if you think there is any error, please contact info@arcticportal.org

• ArcticWeb

Obtaining information about offshore arctic areas is a challenge. The problem in many cases is not the lack of information, but an inability to easily access information and determine its reliability and quality. Seven operators on the Norwegian Continental Shelf joined forces to tackle this challenge, and together with KADME and Acona developed the ArcticWeb to simplify

access to public data sources in the Arctic Region. From July 2014 to July 2017 ArcticWeb was owned and administrated by Aker Solutions. Since July 2017, KADME has become the owner and administrator of the portal. The technological platform, Where oil, is supplied and hosted by the Norwegian data solutions firm KADME.

The information is used by oil and service companies for the purpose of exploration, early field development, environmental risk analysis, emergency preparedness, safety assessments and more. Information is presented to the users via search and map interfaces, for exploration and analysis. Information can also be exported as Excel and Shapefile format for use in corporate data systems. (http://www.arcticweb.com/about-arcticweb/)

• ASTD Purpose: “The Arctic Ship Traffic Data (ASTD) project is an initiative from The Protection of the Arctic Marine Environment (PAME), a working group of the Arctic Council. The project will collect historical information about shipping activity in the Arctic from the Arctic Council member governments to use for trend analysis and related purposes under the realm of the Arctic Council”. Objective: “To develop a long-term, sustainable collection of Arctic shipping activities consisting of a data repository with selected ship traffic information provided by the Arctic Council governments and a web application/tool to extract information from the repository, allowing for periodic trend analysis” (https://oaarchive.arctic- council.org/handle/11374/1746) ASTD will develop a service for users to download AIS positions and tracks for ships sailing in the Arctic. The information can be downloaded by the users, which will be the 8 Arctic Council member states.

The ASTD project wants to use Havbase (Sea Database) https://havbase.no/havbase as a platform.

Find more information about Havbase here:
https://havbase.kystverket.no/havbase_report/doc/Havbase.pdf

Havbase contains AIS position data. These positions are then combined with emission coefficients and estimated distance traveled. The emission numbers are estimated on the basis of ship speed and information from the IHS Fairplay ship register regarding engine power / type, type fuel, ship size and crew. The possibility to integrate the database with various ship registers makes us able to extract and present detailed location information on designated distance and emission aggregated over areas and time for both individual ships and different types of ships.

An arctic Havbase has been established https://havbase.no/havbase_arktis which contains the following area sections that can be used for reporting:

Figure 7 “Havbase” The outer limit for data storage is presented with red line
Figure 8 LME – Large Marine Ecosystems , IHO – Havområdeinndeling,EEZ- Exclusive Economic Zone:
It is possible to download data and export of data to Arctic SDI can be relevant.
The database contains historical data, and you can use timelines / sliders to view changes over time. The

database shows the types of ships and it is possible to produce statistics and reports for operating hours and emission

Client: Statens Kartverk

Assignment no.: 2603206 **Document no.:** **Version:** • ERMA The **Environmental Response Management Application**® (ERMA) is a web-based Geographic Information System (GIS) tool that assists both emergency responders and environmental resource managers in dealing with incidents that may adversely impact the environment. ERMA integrates and synthesizes various real-time and static datasets into a single interactive map, thus provides fast visualization of the situation and improves communication and coordination among responders and environmental stakeholders. (https://erma.noaa.gov/arctic/erma.html#/layers=3+12864+676+8480&x=-161.91096&y=64.76126&z=4&panel=legend)

• AROME-Arctic

AROME-Arctic is a regional short-range high-resolution forecasting system for the European Arctic with 2.5 km grid spacing and 65 vertical levels (Müller et al. 2017). The model system is based on the HARMONIE-AROME configuration of the ALADIN-HIRLAM numerical weather prediction system (Bengtsson et al. 2017). The HARMONIE-AROME system is part of the code base of the IFS/ARPEGE system of ECMWF and Meteo-France, and it uses the same non-hydrostatic dynamical core as AROME-France described by Seity et al. (2010). (https://www.met.no/en/projects/The-weather-model-AROME-Arctic/about)

• AMSA\ARCTIS -Database

As part of the AMSA database, a summary of the incidents and accidents occurring in the Arctic region between1995-2004 was developed. No one source of data was found to be sufficient to cover the circumpolar region; therefore, a compilation of a number of sources was necessary to create the summary. The main sources of information used were the Lloyds MIU Sea Searcher database, the Canadian Hydraulics Centre Arctic Ice Regime System database and the Canadian Transportation Safety Board (Marine.) Though this combined dataset is limited, it provides a basis for a very broad analysis of what type of incidents are occurring in the Arctic region and what areas may be more prone to incidents and therefore at a greater risk of further ones in the future. (http://www.arctis- search.com/Incidents+and+Accidents+in+the+Arctic)

• EMODnet Arctic

The objective of the project is to examine the current data collection, observation, surveying, sampling and data assembly programs in the Arctic sea basin, analyze how they can be optimized and deliver the findings through this internet portal.

The Arctic Ocean includes the following water bodies: Baffin Bay, Barents Sea, Beaufort Sea, Chukchi Sea, East Siberian Sea, Greenland Sea, Hudson Bay, Hudson Strait, Kara Sea, Laptev Sea, Northwest Passage, and other tributary water bodies. (http://www.emodnet-arctic.eu/content/dashboard.php?menu=37)

• In addition there are several similar councils and working groups for other areas like the Atlantic and the Pacific.

9.2 Proposed workshop agenda

Our proposal is to arrange 2 workshops over 1,5 day each.

Participants from CAFF, PAME, EPPR and AMAP.

Norwegian Mapping Authority and Norconsult will be responsible for the workshops and our proposal is to arrange them in Norway and Canada.

Agenda day 1:

09:00 AM Presentation of the project

09:30 AM Presentation of the user survey

10:30 Break

11:00 AM Presentation of ASTD and Arktisk havbase

11.30 AM Presentation of The Norwegian Marine Spatial Management tool

12:00 PM Lunch

01:00 PM Workshop in groups

Use of datasets. High/medium/low

02:00 PM Group presentation

02:30 PM Break

03:00PM Workshop in groups

Improvement of datasets.

Coverage/development over time

Attribute information

04:00 PM Group presentation

04:30 PM Questions & Answers

05:00 PM Dismiss

Agenda day 2:

09:00 AM Presentation CAFF

09:30 AM Presentation Spatineo

10:30 AM Break

11:00 AM Workshop in groups

Categorization of datasets – create a thematic model

12:00 PM Group presentation

12:30 PM Questions & Answers

13:00 PM Lunch

14:00 PM Dismis

Hyperlinks used in the report

Arctic SDI Arctic Regional Marine SDI Working Group https://www.arctic-council.org/index.php/en/our-work/environment-and-climate https://www.amap.no https://www.caff.is/ https://arctic-council.org/eppr/ https://pame.is/ https://www.geonorge.no/ https://kart.barentswatch.no/arealverktoy https://havbase.no/havbase_arktis https://youtu.be/8a3wrl_ojN0 https://youtu.be/MLOwVcr4Jr0 https://arctic-sdi-catalogue.spatineo-devops.com/geonetwork/ http://inspire-geoportal.ec.europa.eu/discovery/ http://gptogc.esri.com/geoportal/catalog/search/search.page http://www.geoportal.org/# http://polar.geodacenter.org/polarhub/ https://www.geonorge.no/ http://www.atlanticcouncil.org http://inspire-geoportal.ec.europa.eu/discovery/ Creative Commons Attribution 4.0 International (CC BY 4.0) Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) World port index DB Marine regions Arcticdem European Environment Agency - Coastline for analysis EMODnet Bathymetry OSCAR_L4_OC_third-deg Boundary data (CAFF) Marine regions Protected areas, WCMC, OSPAR, WWF Arctic Spill Response Database Query Tool Marine traffic Marine traffic Global Sea Ice PolarView Iceberg monitoring SAR Sea Ice berg IHO Sea Areas FAO Fishing Areas Large Marine Ecosystems of the World ICES Ecoregions ICES Areas ICES Statistical Rectangles OSPAR Boundaries Longhurst Biogeographical Provinces The SeaVoX Salt and Fresh Water Body Gazetteer, version 16 (2015) The World Marine Heritage Sites EEZ Polygons http://geo.vliz.be/geoserver/MarineRegions/wfs?Request=getCapabilities EEZ Boundaries (lines) Marine Regions: intersect of IHO Sea Areas and Exclusive Economic Zones Marine and land zones: the union of country boundaries and Exclusive Economic Zones http://ows.emodnet-bathymetry.eu/wms http://ows.emodnet-bathymetry.eu/wfs http://ows.emodnet-bathymetry.eu/wmts http://ows.emodnet-bathymetry.eu/wcs Inter-map info@arcticportal.org Aker Solutions KADME Where oil KADME https://oaarchive.arctic-council.org/handle/11374/1746 https://havbase.no/havbase https://havbase.kystverket.no/havbase_report/doc/Havbase.pdf https://havbase.no/havbase_arktis https://erma.noaa.gov/arctic/erma.html#/layers=3+12864+676+8480&x=-161.91096&y=64.76126&z=4&panel=legend https://www.met.no/en/projects/The-weather-model-AROME-Arctic/about http://www.arctis-search.com/Incidents+and+Accidents+in+the+Arctic