

UPDATES ARCTIC HYDROGRAPHY NORWAY

Summary

This report gives an update of the activities that have taken place within the Norwegian Hydrographic Service (NHS) since our last report for ARHC 7 (August 2017).

Some highlights are:

- *Restructuring of the organization*
- *Additional budget from Norwegian program Arktis 2030 for project to improve access to marine geospatial information for the Arctic*
- *Continued high activity in the Mareano project in both coastal and open sea arctic areas*
- *Pilot project for digital nautical publications*
- *Pilot project for S-102 sponsored by Norwegian Research Council*
- *Planning of the MAGIN (Marine Base Maps in Norway) program*

1. Hydrographic Office

The Norwegian Hydrographic Service (NHS) has for the last two years worked to implement the new system and procedures for prioritizing and production planning, and the labor is starting to bear fruit. The procedures and checklists help us to filter out the important needs and requests from the less important ones, thus giving us time to focus our efforts where they are needed the most. As a result of this, two major areas were focused on since last the last ARHC conference. Firstly, the NHS were approached by the Norwegian Pilot service and AECO regarding Svalbard. Both organizations raised the issue of chart coverage on Svalbard. As a result of this dialogue, and of our procedures for prioritizing and planning, the NHS was able to focus all its effort on Storfjorden. A complete 5km wide corridor running the length of Storfjorden was surveyed during the summer months of 2017, and new ENC's and nautical charts were released in due time before the 2018 cruise season. This enabled circumnavigation of Svalbard on official charts.

Another area that has been a point of focus has been surveying for MAGIN (Marine Base Maps in Norway, see para 9.5). We have received survey requests from the project. The requests were accompanied by a socio economic analysis that showed that the potential benefits to Norway were so high that they outweighed the cost of performing the surveys. Aside from MAREANO, this is the first time the NHS has dedicated so much resources to surveys primarily conducted to support the use and management of marine resources, and not solely to the safety of navigation. This truly marks the starting point of the broadening of focus at the NHS. We will not shift away from safety of navigation, but we will to a greater extent include all marine interests in our work.

In 2018, the NHS has undergone a restructuring process. The main aim of the process has been two fold. Most importantly, we have worked to make a clear distinction between the two very different roles of production and authority. At NHS, there has historically been a very close link between the two. Now, production and authority have been organized in two different departments. Ownership over the specifications for bathymetric surveys and for depth data have been placed in one department and the surveying and processing of data are in a separate department. This way, the areas of responsibility are transparent. Especially now, when the NHS has begun certifying private survey companies according to our survey standard, it would be unfortunate if we are unable to document that we conduct our own operations in accordance to our own standard.

During the remainder of 2018, a similar process will be conducted for the nautical department. The focus will be on separating the two roles of authority and production so that there is a clear distinction between the two.

2. Hydrographic Surveys in 2017

Svalbard

In 2017 NHS conducted three survey operations in the Svalbard area. The two first surveys were both of five weeks duration and the last operation lasted for three weeks. During the two first operations, Hydrograf surveyed fairways in Storfjorden mainly using EM710. The last operation was a near-shore survey for Mareano in Rjipfjorden (north of Nordaustlandet). The shallow areas were mainly surveyed using two survey launches equipped with EM2040 dual RX. The operations were organized 24/7.

In 2017 the NHS Svalbard surveys comprise a total of 1897.8 km². Out of these, 159.5 km² were surveyed as part of the Mareano program. The survey areas are shown in figure 1.

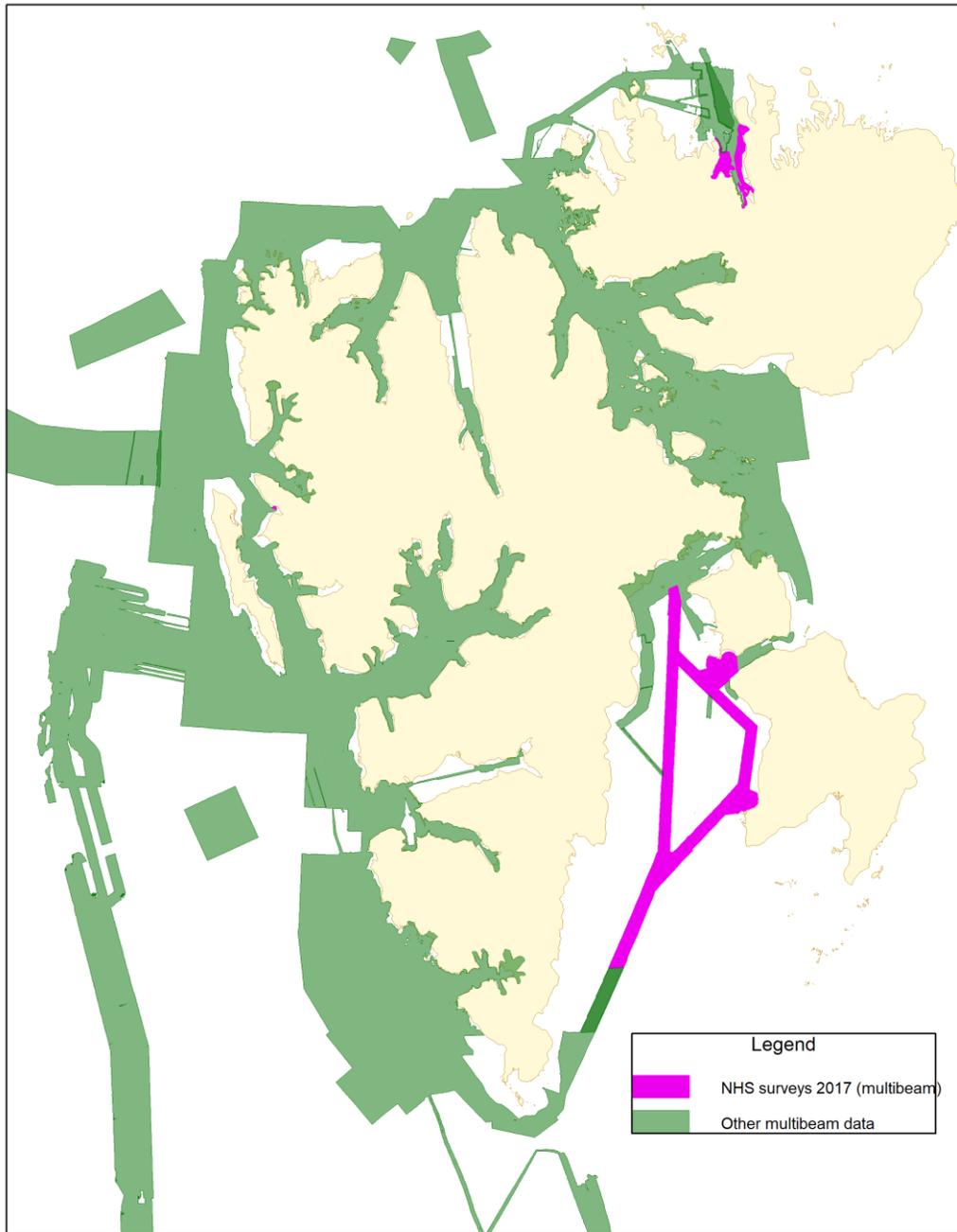


Fig. 1. Surveyed areas around the coast of Svalbard

Norwegian coast

Two survey launches, equipped with EM2040D, have been operating 12-hour daily, when available. Our R/V Hydrograf has contributed with the EM710 multibeam echo sounder in some deeper areas. All the surveyed coastal areas are outside the region of interest to ARHC.

As part of the MAREANO programme, surveys have taken place north and east of Svalbard, along the agreed delimitation line between Norway and the Russian Federation and in the central/western Barents Sea during 2017.

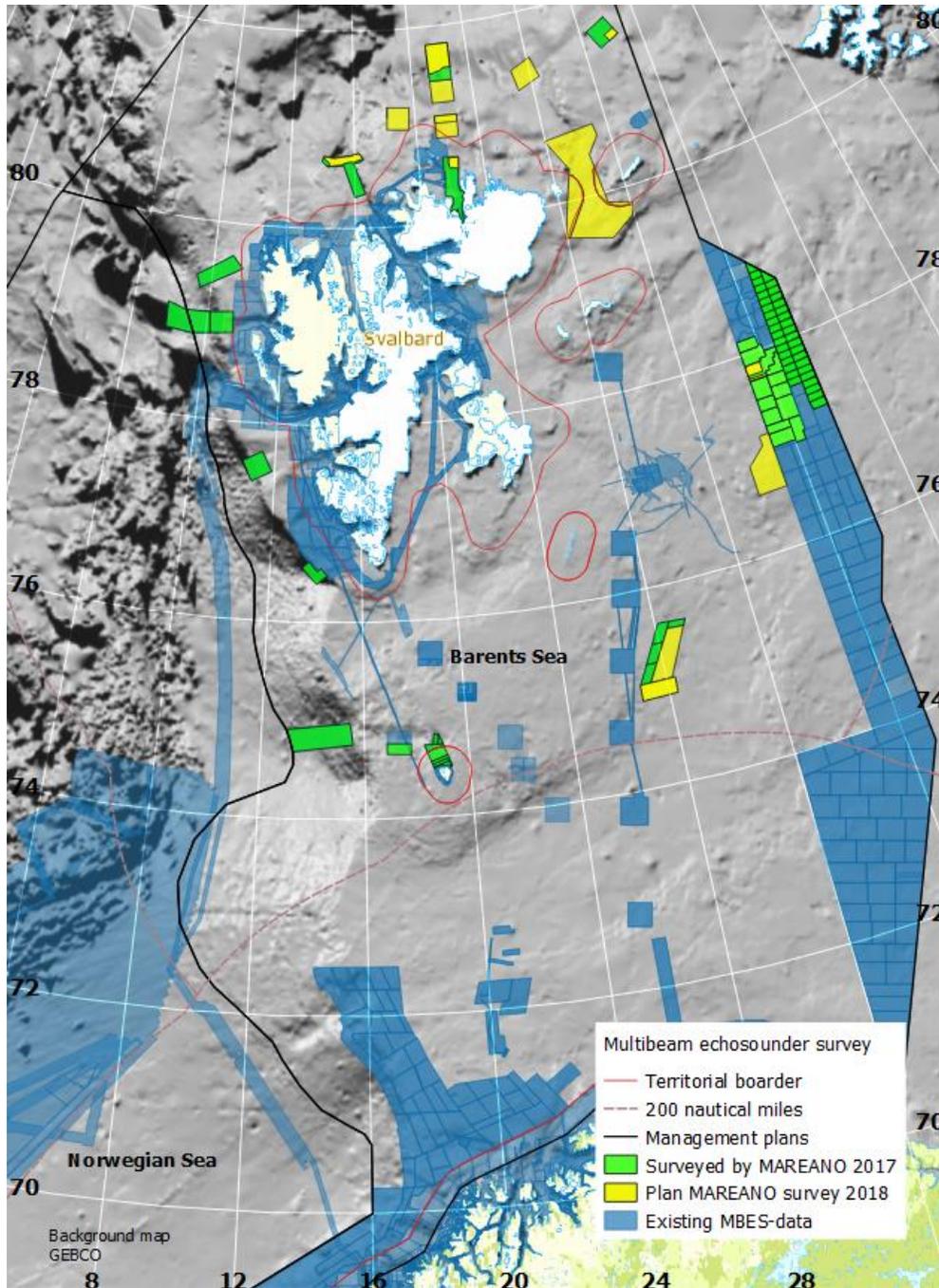


Fig. 2. An overview of the existing multibeam datasets in the Norwegian Arctic waters. The figure also include the planned surveying for the MAREANO programme for 2018.

About 19.579 km² was surveyed by MAREANO in 2017.

More information about the Mareano program is available at www.mareano.no.

3. New charts and updates

We are still in the process of revising the way we make our survey and charting plans. We are working on a structured system to help us prioritize these areas based on safety of navigation and economic benefit to society.

3.1. Paper charts

The Main chart series at Svalbard is in scale 1:100.000. Since Aug-2017 (previous ARHC report) the following has been done with Arctic Charts:

- New Edition, national charts no 537 “Hinlopenstretet N. Fosterøyane – Nordporten” issued.
- New Chart, national charts no 528 “Storfjorden Sør. Isbukta – Kvalpynten” issued covering new sailing routes.
- New Chart, national charts no 532 “Storfjorden. Kvalpynten – Agardhbukta” issued covering new sailing routes.
- New Edition, national charts no 533 “Storfjorden Nord. Freemansundet – Heleysundet – Sørporten” issued covering new sailing routes.

3.2. ENC

Since the previous ARHC report a new sailing route based on multibeam survey data has been published through Storfjorden in Coastal usage band.



Fig. 3. The new sailing route through Storfjorden

In addition, several ports and passages in Northern Norway have been upgraded in the ENC's with new multibeam survey data.

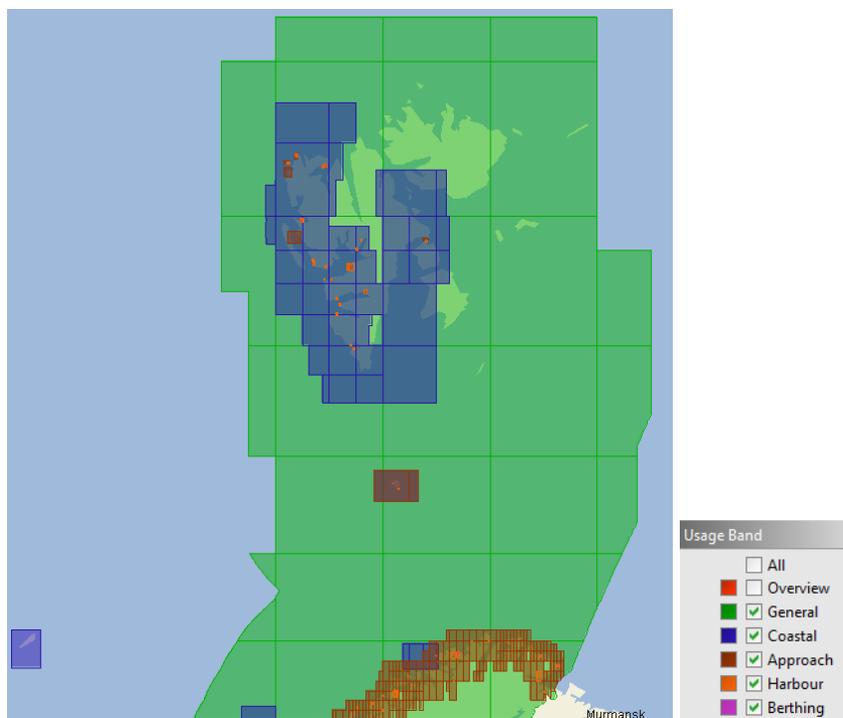


Fig. 4. Present ENC coverage Northern Norway and Svalbard

3.3. Print On Demand (POD)

All 233 paper charts (the entire Norwegian chart portfolio) are offered as POD. NHS does not print charts any longer.

4. Nautical Publications

The Norwegian Pilot Guide «Den norske los» is to be revised and customized for the professional users. The current updated pdf versions of the Pilots can be download from The Norwegian Hydrographic Service's homepage: www.kartverket.no. The Pilots are updated twice per year (May and November). Important changes are reported in the Notice to Mariners. The project, aiming to digitize our nautical publications, is making good progress and the goal is to complete the project in 2018.

Notices to Mariners (Etterretninger for sjøfarende)

A total of 24 editions were published in 2017 through our official digital version kartverket.no/efs. All Norwegian paper charts have a QR-code. Using your smart phone, you are directed to the NtMs' relevant for that specific chart.

As a supplement to the NtM a digital tracings service is fully operationally on the same website.

5. MSI

The Norwegian Coastal Administration is the national authority responsible for MSI in Norway.

6. C-55

Last update of C-55 was sent to IHB in February 2018.

7. Capacity building

Norway participated in the annual meeting of the IHO Capacity Building Sub-Committee in May/June 2018. The IRCC and the CBSC encourage Member States from the most developed regions to be involved in capacity building by assisting CBSC activities or by other means.

NHS entered into a three year cooperation with Albania in September 2014. We are now engaged in a follow-up project to secure that the achieved results gain higher sustainability. The main goals are related to building competence and capacity. Formal education and training in hydrography three persons and for one in marine cartography is completed. The total budget is NOK 11.6 mil. NHS also started a new capacity building project in Montenegro, aiming at supporting survey operations for their prioritized port approaches and providing Cat B training for their staff.

8. Oceanographic activities

Our tide gauge network consists of 23 gauges along the Norwegian coast and one in Ny-Ålesund at Spitsbergen. The tide gauge at the remote island Jan Mayen has not been operational since 2016. Short-term water level measurements at locations between the permanent gauges (more than 400 series) have made it possible to construct tidal zones that are used to calculate water level in the zones based on the permanent gauges. On our web page <http://www.kartverket.no/sehavniva/> contains tide tables, observed water level and water level forecast for 5 days (based on a model run by the Norwegian Meteorological Institute) for most of the sites along the Norwegian coast. We also present information about the different tide levels, land levelling datum and return periods (up to 1000 years), which is very important in coastal planning. Frequent users can download data via an API.

Later this year, the web page will include a map based web service for visualization of the sea level. Here we combine the detailed elevation model with estimated return heights for storm surges and sea level projections. The web service is meant for the general public as well as a more specialized service for professional users such as coastal development planners, decision makers etc.

We are continuing the important work together with our Geodesy division to find a method for describing the Chart Datum (CD) surface relative to the ellipsoid, and to establish a connection between CD and land levelling datum. This year we focus in particular on the challenges with the long and deep fjords surrounded by high mountains typical for Norway.

9. Other activities

9.1 Southern Sunnmøre projects.

The three projects in the Southern Sunnmøre area just south of Ålesund are finalized. The common reference frame is progressed into new areas, and the visualization of sea level is soon to be a national web service, see also section 8.

Here follows a summary of the third project, summing up the experiences with the full scale survey of shallow coastal areas using airborne green laser conducted by the Norwegian Mapping Authority during 2017.

The technology using green laser sensors to survey shallow waters is currently not able to provide a full coverage. The green laser does not give returns if the seabed is dark, and in this survey, the coverage is less than half of the planned seabed area.

In the areas where we acquire data, we get a high point density, returns from greater depths than the required 5 meters below chart datum, and good accuracy when compared to existing data.

There is a lot to benefit from improving the classification for laser data in coastal areas. This was improved a great deal during the project, but can (and will) be developed further based on these experiences.

There is less to gain from improving how the survey was conducted. However, one should look into using a combination of supplementary sensors for coastal mapping. In particular, combining green laser and hyperspectral sensors looks promising.

The datasets from this project are available through the web portal hoydedata.no. This portal also includes topographic laser data (including all data sets related to the Norwegian Elevation Modell). For the region on Sunnmøre (south of Ålesund) where this project was run, all available high resolution bathymetric data have also been included in the portal. Here one can see that the project has partly managed to cover the gap between the existing topographic and bathymetric datasets, in particular for some of the islands.

Direct link to the green laser data sets:

<https://hoydedata.no/LaserInnsyn/?x=15712&y=6932213&level=9&utm=33&projects=876&layers=&raster=8:100&background=wmtsTopo2Graatone>

9.2. Marine Spatial Data Infrastructure

MSDI is an integrated component of the national SDI in Norway. NHS is taking active part in building the [national spatial data infrastructure in Norway](#) through the Marine Infrastructure Department, which has a central role in the coordination of activities in the marine and maritime

domain. The national spatial data infrastructure cooperation, [Norway digital](#), counts for more than 600 organizations, where over 50% are involved in coastal and/or offshore activities.

NHS has been one of the key players in the establishment of a marine and maritime interest group under Norway digital. The aim is to develop the cooperation between data owners, service suppliers, and end-users to improve the user-value of marine and maritime geospatial services to society.

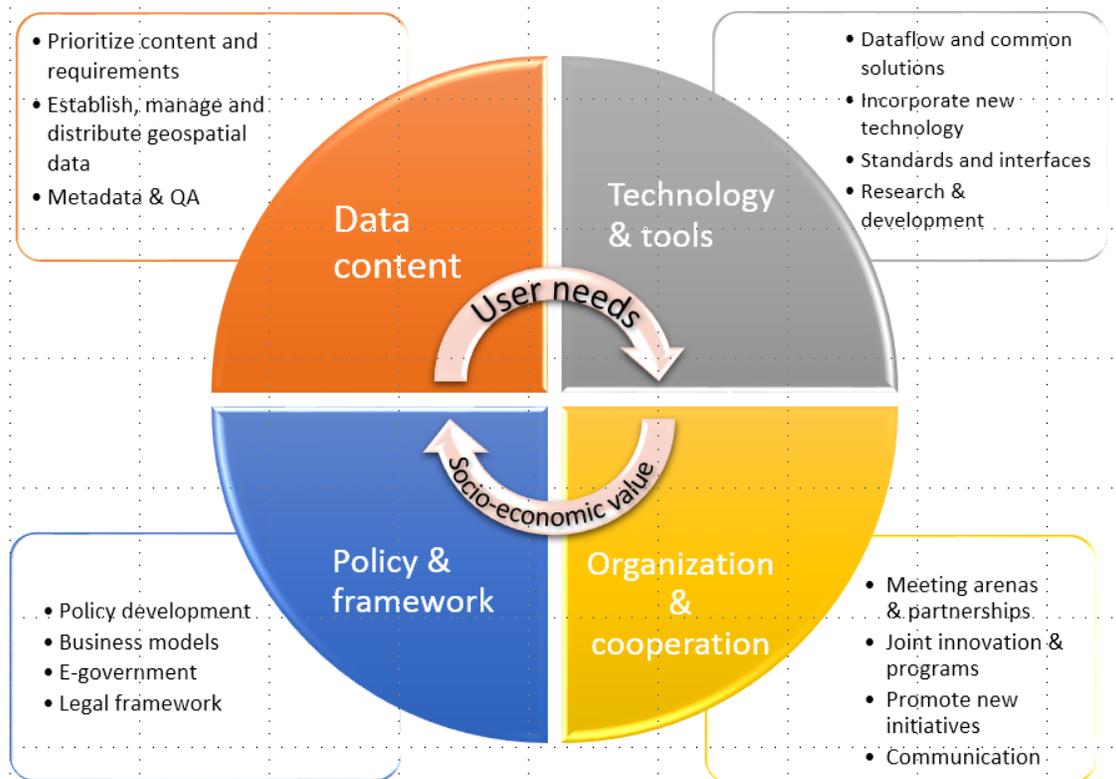


Fig. 6 Norwegian SDI approach

[Geonorge](#) is the national website for geospatial information in Norway. One of the core services offered, is the Geonorge Map Catalogue Service, where the users can search for, discover, and access geospatial data and services offered by public authorities in Norway.

A national governmental geospatial strategy worked out in 2017 has the ambition to improve the value of geospatial information and its usefulness to society in Norway. The main goals for this strategy are to:

- Establish a national platform of knowledge through geospatial information, in accordance to the user-priorities
- Incorporate technological tools and interoperability to increase efficiency and improve innovation
- Improve and further develop cross-sectorial cooperation and collaboration arenas
- Adapt policies and framework conditions to meet the challenges within geospatial infrastructure, e-governmental services and the digital society in general

A national action plan is under development in 2018.

9.3. Marine Spatial Planning

NHS is participating in the development of the Marine Spatial Management Tool (MSMT) for MSP in Norway. The MSMT project “Arealverktøyprosjektet” is a national cross-sectoral cooperation, developing and assembling standardized and harmonized geospatial services to underpin the MSP processes with integrated, multi-thematic geospatial information relevant for the marine management plans for the Norwegian sea-areas.

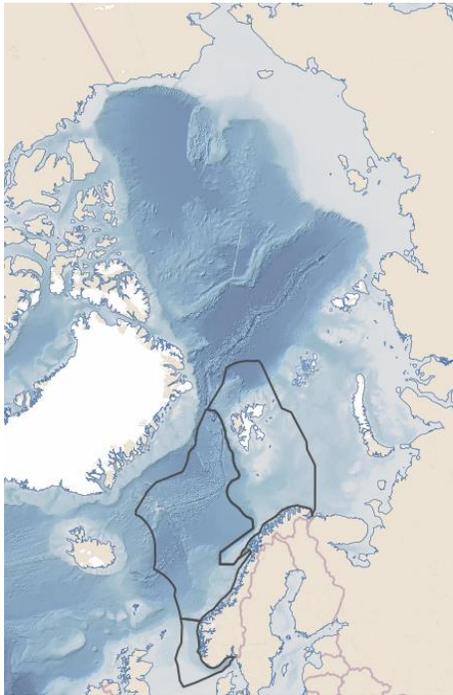


Fig. 7. Norwegian management plans for the Barents Sea, Norwegian Sea, and the North Sea & Skagerak, representing an area of 2.3 mill. km².

Although Norway has been working with MSP and produced [integrated management plans for Norwegian sea-areas](#) during the last 12 years, there has been a lack of proper SDI support. One of the objectives is to ensure proper interoperability between the MSMT and the national SDI in a way that will release expected synergistic effects like re-use of data and services, improved user-processes, etc. An [official version of the MSMT](#) was released in November 2017, with some incomplete tasks. The project continues in 2018 to fulfill the remaining tasks and do further improvements according to user feedbacks.

The MSMT represent a major step forward in the process of integrating the marine component in the Norwegian SDI. So far, 11 governmental agencies have developed and are sharing their authoritative data (at present some 50 datasets) through harmonized geospatial information services. The harmonization work includes the data content, geospatial services, cartography, and the system of concepts.

9.4. Improved access to marine geospatial data for Arctic areas

The Norwegian Mapping Authority has received funds to carry out a project to investigate how to improve access to geographic information for the Arctic marine and ocean areas. This pre-project will prepare an overview, a guide and a plan to achieve better access to geospatial data and services through the [Arctic Spatial Data Infrastructure](#) (Arctic SDI) as a common platform for data sharing. The primary users for this project are [the Arctic Council working groups](#).

This project is a cooperation between the Arctic SDI, representing the eight national mapping agencies of the Arctic nations, the Arctic Regional Marine SDI Working Group, and the Arctic Council working groups.

The project produced a User Survey Report in March 2018 as an initial approach to identify the user needs and the data availability. The project will follow up the results from this activity through a closer communication process with the primary users, i.a. on the forthcoming Arctic Biodiversity Congress 2018. Further planning for 2019 is in process.

9.5 MAGIN (Marine Base Maps in Norway)

MAGIN is all about gathering detailed information and boosting the knowledge of the sea bed and marine coastal systems along Norway's coast. The aim is to provide new business opportunities, stimulating and/or optimising the growth of industries, better public administration and effective coastal zone management. MAGIN will (i) map on a large scale the sea beds physical, biological and chemical environments (ii) analyse the data and (iii) distribute a set of standardised products in formats that would cater to the different needs of end users. The marine data collected can be distributed as stand-alone or combined with other datasets to create "Marine Base Maps".

It is a cooperation project with 4 partners; The Norwegian Hydrographic Service (leading the project), Geological Survey of Norway, the Institute of Marine Research and the Norwegian Institute for Water Research. This cooperation will allow for a streamlined process from data collection to distribution. It also has the added advantage of better coordination and management of resources.

We are currently running a pre-project (pre-MAGIN) planning a pilot project in a confined area. The pilot project will investigate and test new technology for data collection and processing and, in addition, develop a cost-effective model for the implementation of a MAGIN program. The goal is to start the pilot project in 2019

Workshops will be held in three pilot areas with planning staff of municipalities and provinces, government agencies and industry / commercial actors. The goal is to identify and document planning processes in a way that will show what type of marine geospatial information is needed, what the requirements are (level of detail, quality, update frequency) and what are the requirements for distribution of the data. In addition we aim to identify datasets that can become part of our official national geographical information baselayer (in Norwegian: DOK: det offisielle kartgrunnlaget) containing all official datasets required for planning and building processes in Norway. Once a geospatial information dataset is part of "DOK", it

- meets specific ISO-standards,
- is INSPIRE compliant
- is available in WMS, WFS and WCS, pluss has atom feed
- can be harvested from our national geoportal “Geonorge”

9.6. International activities

The NHS is involved in several Working Groups, Committees and Commissions related to IHO. Norway has representatives in the following Working Groups: S-100, DQ, ENC, NC, NIP, TWC, CBSC, IEN, MSDI, CSB and WEND. We have participated in the HSSC and the IRCC meetings in 2018. Norway is actively participating in 5 Hydrographic Commissions: ARHC, HCA, NHC, NSHC and SAIHC but had to refrain from participation at HCA and SAIHC this year.

Norway has joined the UN-GGIM Marine Geospatial Information WG and intends to be an active contributor to and ambassador for the Seabed 2030 project.

As operator of PRIMAR we participate in all related meetings.

During the last few years, we have contributed with a substantial part of high resolution bathymetric data, obtained through the Mareano project, to the GEBCO (and IBCAO) database. We have delivered data with resolution 50x50 meter for the majority of our coastal waters to the EU project EMODnet.