

UPDATES ARCTIC HYDROGRAPHY NORWAY

Summery

This report gives an update of the activities that have taken place within the Norwegian Hydrographic Service (NHS) since our last report for ARHC 5 (September 2015).

Some main issues are:

- *New organization in place from 1 January 2016*
- *New director has taken office from 1 September 2016; Ms Birte Noer Borrevik*
- *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*
- *Development of a marine spatial planning tool*
- *Cooperation project with Albania*

1. Hydrographic Office



Figure 1. New organization structure Norwegian Hydrographic Service

The reorganization of the Norwegian Hydrographic Service has resulted in the following major changes:

- 4 departments, organized around our 4 strategic tasks:
 - To coordinate and harmonize bathymetric data collection and dissemination for Norwegian waters (Geodata department)
 - To ensure safe and effective sea transport within our role as nautical chart authority (Nautical department)
 - To operate and further develop the PRIMAR RENC (PRIMAR)
 - To assist in building a national spatial data infrastructure that includes the marine and maritime domain (Marine Infrastructure Department)
- Technology personnel lifted out of their specific production environment to secure a holistic technology development
- Several functions centralized to mother organization Norwegian Mapping Authority: IT, Communication, Procurement, HR, M&S but located physically at the Hydrographic Service

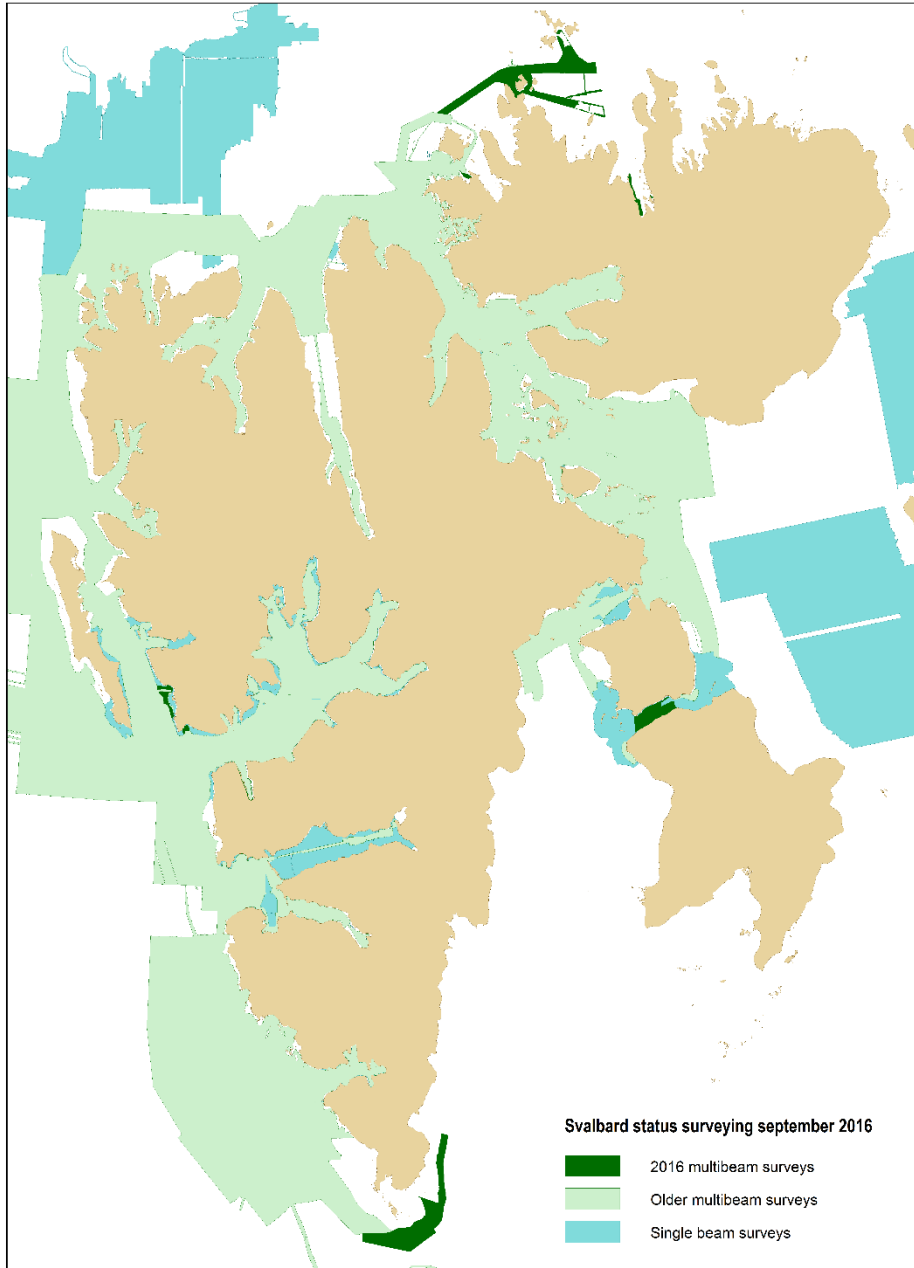
2. Hydrographic Surveys in 2016

Svalbard

NHS conducted two survey operations, each of five weeks duration, within the Svalbard region in 2016. During most of the first survey, Hydrograf (equipped with EM710) surveyed for Mareano in an area between Spitsbergen and the Bear Island. The last part of this first survey was spent surveying coastal areas close to the southern cape of Spitsbergen.

Mareano also mainly financed the second survey. This survey mainly focused on establishing a safe route between the northern part of Hinlopen and Rjipfjorden north of Nordaustlandet. Due to deteriorating ice and weather conditions, the last part of the second survey was moved to areas further south. The coastal areas were mainly surveyed using two survey launches equipped with EM2040 dual RX. The operations were organized 24/7.

In 2016 the NHS Svalbard surveys comprise a total of 1750.8 km². Out of these, 964.5 km² were surveyed as part of the Mareano program. The nearshore surveys are shown in Figur .



Figur 2. Surveyed areas around the coast of Svalbard.

Barents Sea

As part of the MAREANO programme, surveys have taken place along the agreed delimitation line between Norway and the Russian Federation and in the central/western Barents Sea during 2016.

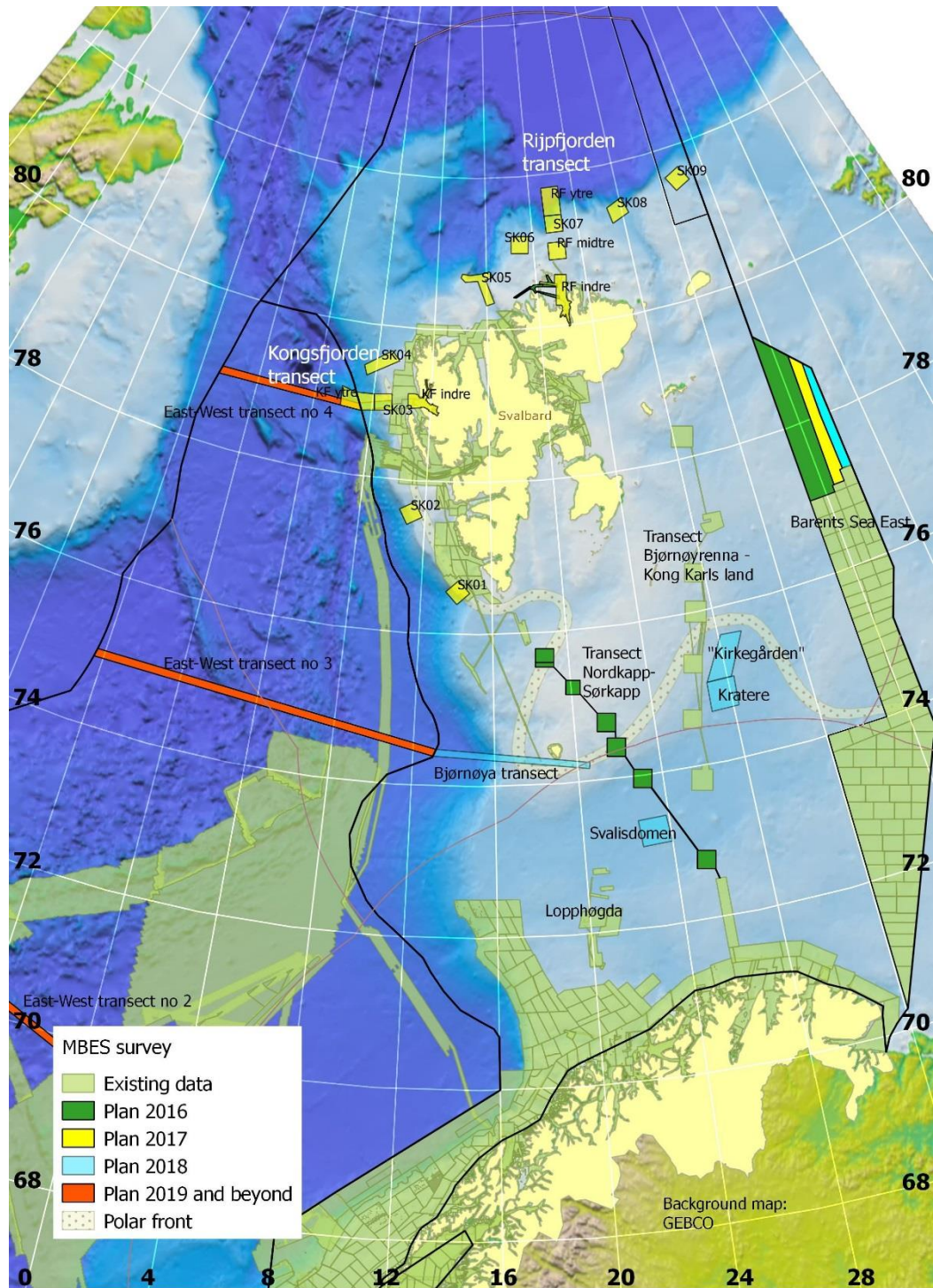


Fig. 3. An overview of the existing multibeam datasets in the Norwegian Arctic waters. The figure also include the planned surveying for the MAREANO programme for 2017 and beyond.

About 13.500 km² will be surveyed by MAREANO in 2016. More information about the Mareano program is available at www.mareano.no.

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 fjords in addition to the surveying off the coast (Mareano project). All the surveyed coastal areas are outside the region of interest to ARHC.

3. New charts and updates

We are in the process of revising the way we make our survey and charting plans.

3.1. Paper charts

The Main chart series at Svalbard is in scale 1:100.000. Since Oct-2015 (previous ARHC report) the following has been done with Arctic Charts:

- New Editions of national charts no 522 and 536 due to new surveys and new data for coastlines.
- New editions of INT9311 (NO505) and INT9313 (NO507) due to new surveys.
- IHOs INTernational Chart Web Catalogue is updated accordingly.

3.2. ENC

Since Oct-2015 (previous ARHC report) the following has been done with Arctic ENC's:

- New ENC's in coastal usage band within chart 536 are produced:

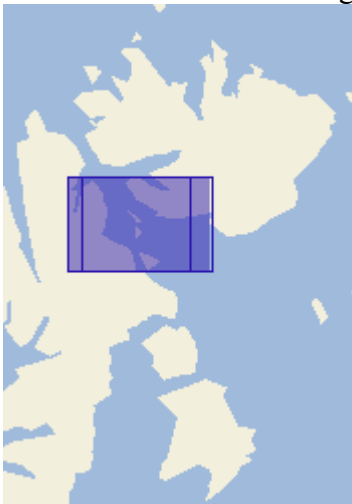


Figure 4. The new ENC's in coastal usage band

- General ENC's covering chart 533 and 536 are updated with new survey and coastlines. They are published as New Editions of the existing ENC's. This has resulted in much better quality and consistency within all usage bands in this area. Remaining general ENC's on Svalbard are based on old small scale paper charts and they have incomplete surveys and poorer quality.

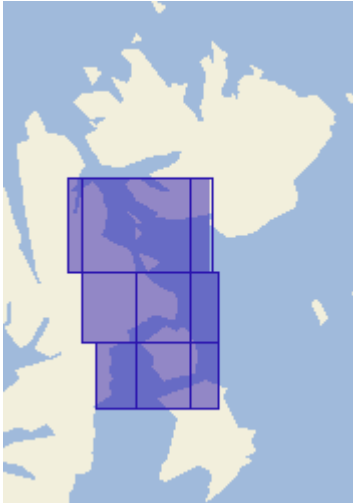


Figure 5. The area which is updated with new survey and coastlines in general usage band

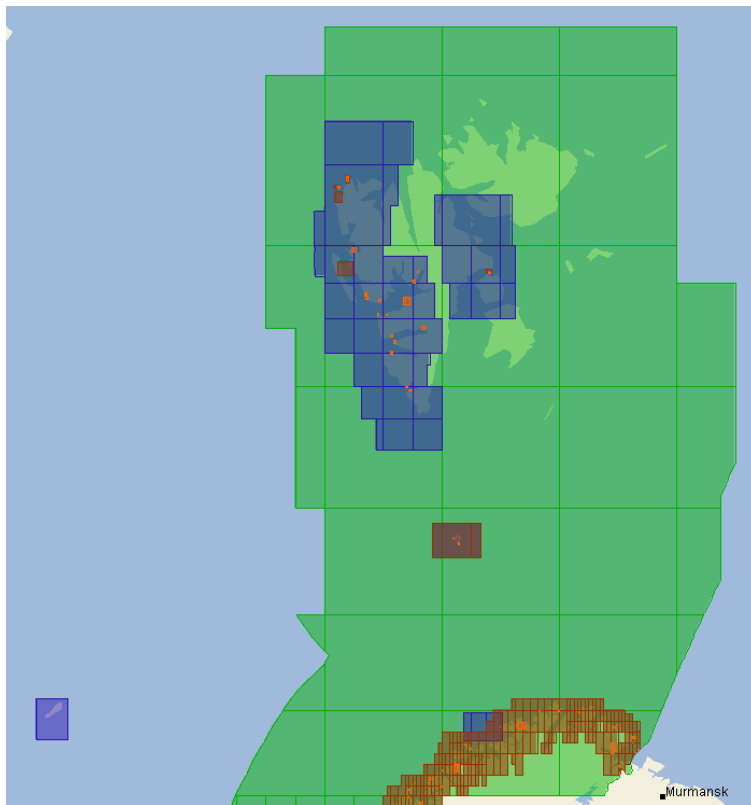


Fig 6. Present ENC coverage Northern Norway and Svalbard

3.3. Print On Demand (POD)

At present 230 charts (the entire Norwegian chart portfolio) are offered as POD.

NHS does not print charts any longer.

4. Nautical Publications

The Norwegian Pilots Guide «Den norske los» is to be revised and more 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. We have started a pilot project that aims to digitize our nautical publications, making them more user-friendly (app) and easier to update. We'll provide a short presentation at the ARHC6 meeting.

Notices to Mariners (Etterretninger for sjøfarende)

A total of 24 editions were published in 2015 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 December 2015.

7. Capacity building

Norway participated in the annual meeting of the IHO Capacity Building Sub-Committee in May 2016. 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 cooperation with Albania in September 2014. The project will last until the end of 2017. The main goals are related to building competence and capacity. Formal education and training in hydrography is ongoing for three persons and planned for one in marine cartography. This year a survey launch fitted with new survey equipment and a new engine will be provided to Albania. A chart production system was installed last year and training is ongoing. The Norwegian Ministry of Foreign Affairs finances the project. The budget is NOK 9.85 mil.

8. Oceanographic activities

Our tide gauge network consist of 25 gauges including one in Ny-Ålesund at Spitsbergen and one at the remote island Jan Mayen. 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/> it is possible to get tide tables, observed water level and water level forecast for 5 days (based on a models run by the Norwegian Meteorological Institute) for most of the sites along the Norwegian coast. We also present figures with different tide levels, land levelling datum and return periods (up to 1000 years). The information in the figures are very important in coastal planning. Frequent users can download data with an API without going via the web page.

We are presently engaged in an important project with our Land and Geodesy divisions 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. The Norwegian coast with long and deep fjords and high mountains make this work difficult. The project involves tide gauges, GNSS and gravity measurements from a boat and land levelling.

9. Other activities

9.1. Socio-economic study

NHS has ordered an independent socio-economic study of the cost/benefit of increased coastal zone mapping. NHS has stipulated that with current budget and technology, it will take approximately 45 years to finish mapping Norwegian coastal waters, including Svalbard, to modern standards. A yearly forecasted technology advance of 1.3 percent reduces this period to 35 years. The study analyses to what extent an increased mapping effort will provide society with a higher return on investment.

The report concludes that it is highly likely that an increased effort will give positive net results if the contribution from the coastal mapping to the sea farm industry growth is only 0.2 percent of the stipulated 600 percent growth in the analysis period. The report recommends that a modest startup of a coastal zone mapping program is beneficial, allowing technology advances such as USVs to happen. Based on the report, the NHS has suggested a program called MAGIN (Marine Base Maps for the Norwegian Coastal Zone) to be started.

9.2. National Bathymetric Data Manager

Hydrographic or bathymetric data capture is not coordinated in Norway. We are at risk and it has already happened that survey takes place in areas where good survey data already exists. In addition to that, not all surveyed data is easily available for all purposes. Seafloor survey is too costly and time consuming to allow for uncoordinated action. The Norwegian Hydrographic Service has therefore started a project that will hopefully result in NHS acquiring the role of national bathymetric data manager. NHS aims to:

- Reduce costs for society of unnecessary surveys.
- Improve routines for management and distribution of hydrographic data.
- Develop procedures, routines and technical solutions to import metadata and bathymetric data from others. This will increase our capacity to manage and distribute hydrographic data.
- Make better quality metadata available to end-users
- Make hydrographic data more easily available to end-users
- Create new services based on registered end-user needs

- Increase the use of hydrographic data for many different purposes through easy access and more and better data.
- Thus become more relevant to society

9.3. Marine Spatial Data Infrastructure

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, to improve the cooperation around common interests and challenges attached to marine geospatial services through a general and coherent SDI perspective.

Other major SDI-tasks during 2016 has been to ensure NSDI support to the national MSP, starting up preliminary development of regional cooperation around CZM, and participation in activities to ensure compliance with INSPIRE.

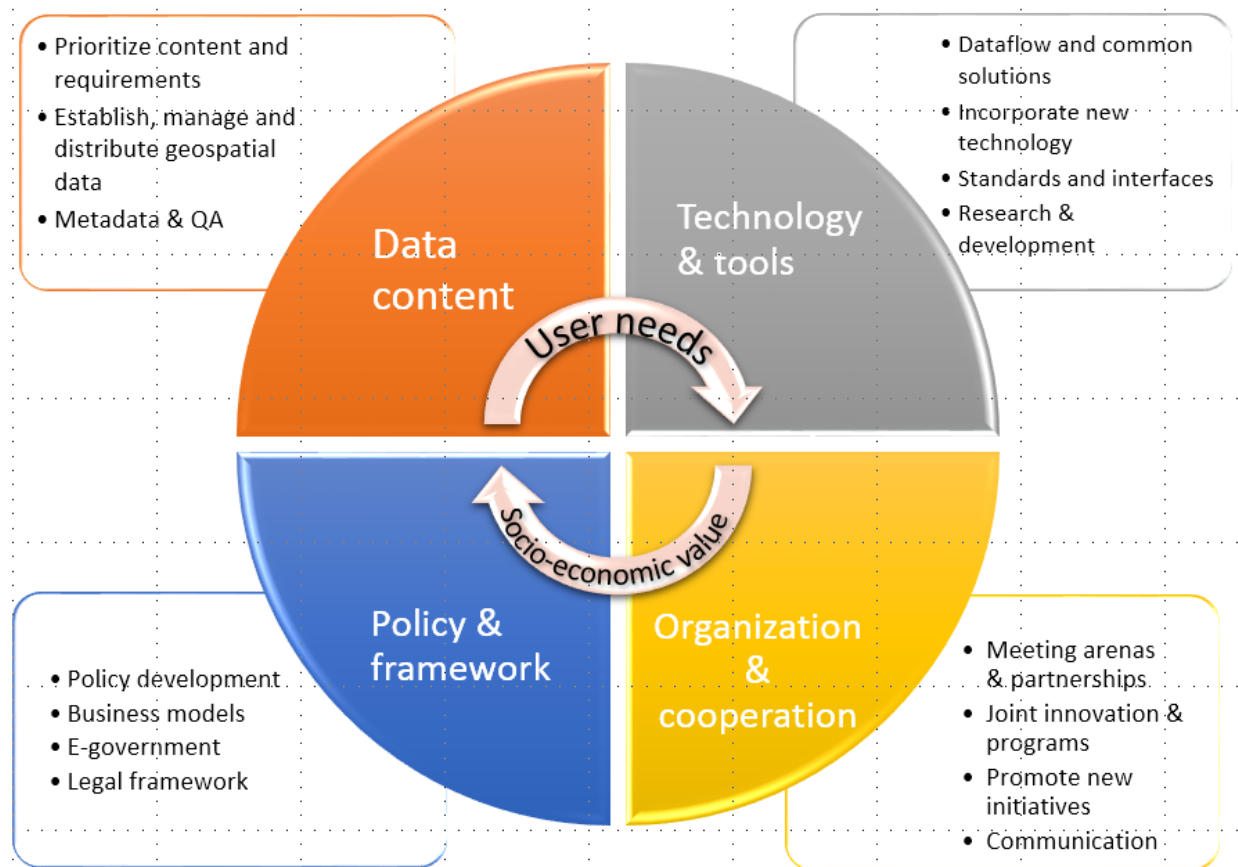


Figure 7. Norwegian SDI approach

9.4. 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 SDI services to underpin the MSP processes and the interaction attached to geospatial information.

Although Norway has been working with MSP and produced integrated management plans for Norwegian sea-areas during the last 10 years, there has been a lack of proper SDI support. One of the objectives is to ensure proper interoperability between the MSMT and the NSDI in a way that will release expected synergistic effects. One example could be the capability of sharing relevant data and services on an international level, through the NSDI. The project will release its first version in November 2016 and the second version in November 2017. It will represent a major step forward in the process to integrate the marine component in the Norwegian SDI.



Figure 8. Norwegian management plans for the Barents Sea, Norwegian Sea, and the North Sea & Skagerrak, representing an area exceeding 2 mill. km².

9.5. 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, CSPC, IEN, MSDI, CSB and WEND. We have participated in the HSSC and the IRCC meetings in 2014. Norway is actively participating in 5 Hydrographic Commissions: ARHC, HCA, NHC, NSHC and SAIHC.

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 a greater part of our coastal waters to the EU project EMODnet.