

 <p>Kartverket</p>	<p>NHC 62nd Meeting Arkö 11-12 April 2018</p>	<p>NHC National Report NORWAY</p>
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NATIONAL REPORT ***NORWAY***

Executive Summary

This report gives the summary of the activities and events that have taken place within the Norwegian Hydrographic Service (NHS) since the last report given at the NHC61 Conference in Elsinora, March 2017. Some highlights:

- *Pilot project for digital nautical publications (separate presentation)*
- *Pilot project for S-102*
- *Pilot project for Marine Base Maps in Norway (separate presentation)*
- *Development of a marine spatial planning tool*
- *Continued high activity in the Mareano project in both coastal and open sea arctic areas*
- *Capacity Building projects with Albania and Montenegro*

1. Hydrographic Office

No major organizational changes since last meeting. A process has started to ensure a clearer division between our authoritative regulatory functions and our survey and production functions.

2. Hydrographic Surveys

Internal conducted surveying 2017

During 2017, R/V Hydrograf and its two survey launches have been working in the coastal waters of Norway and Svalbard.

Norwegian coast

The primary survey area within the western part of Chart 2 between Tønsberg and Larvik was completed in 2017. The remaining areas within the northern part of Chart 19 (between Haugesund and Bergen) was also completed.

In addition to the major survey areas, quite a few minor areas along most of the coast were covered by revisory surveys. This also includes some larger areas close to Bodø

The total area surveyed along the Norwegian coast in 2017 was 626 km². Figure 2 presents the coverage of surveying within the territorial waters.

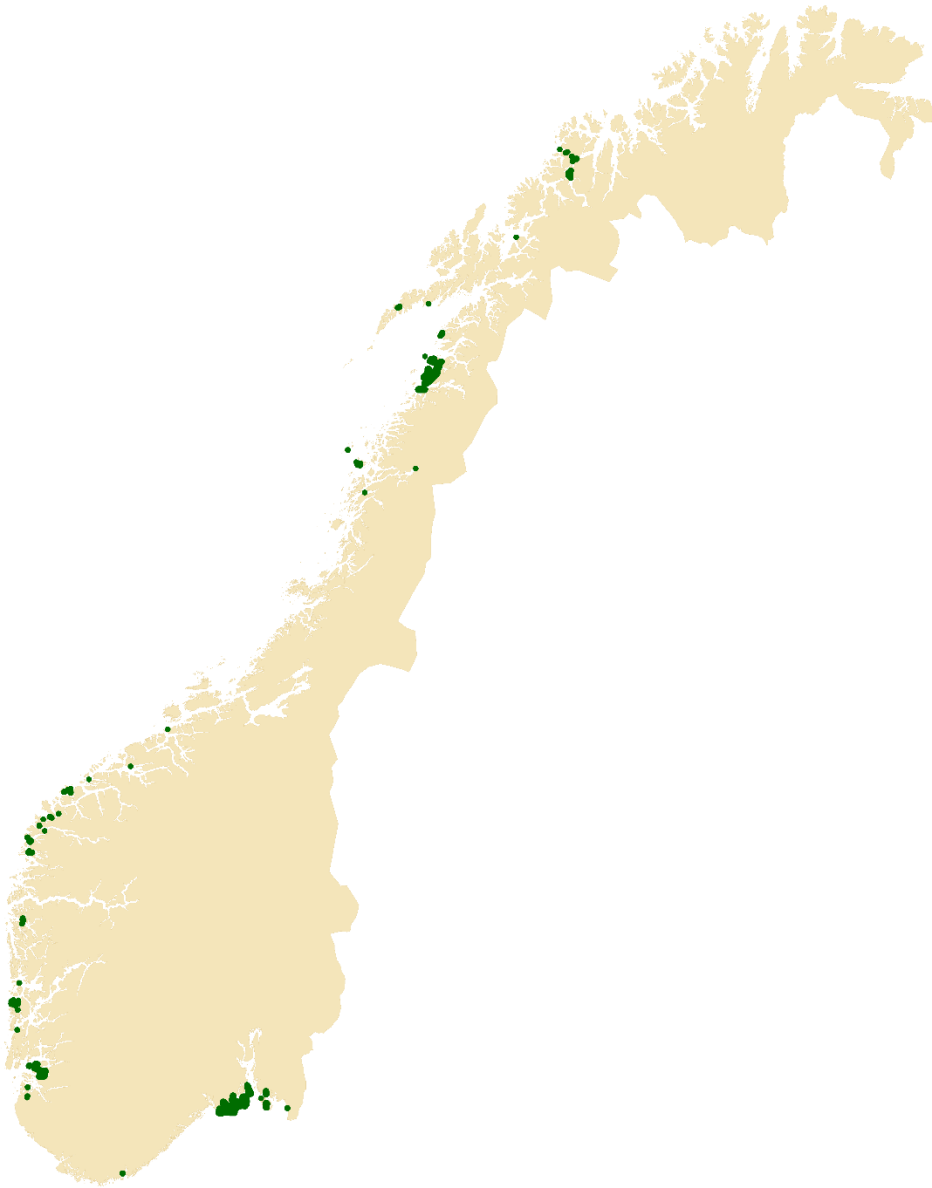


Fig. 1. Area surveyed in territorial waters during 2017. Please note that the area sizes are exaggerated to make the smaller areas visible on the plot.

Svalbard

R/V Hydrograf and two survey launches operated at Svalbard for 13 weeks in 2013. Totally 1734 km² was surveyed, see figure 3.



Fig. 2. Surveying at Svalbard during the 2017 season

External conducted surveying 2017

Only surveys within the MAREANO program were contracted to external companies. The 2017 MAREANO surveys were mainly conducted by the German company Fugro Germany Marine GMBH. Some of the areas were surveyed by the Norwegian Defence Research Establishment.

3. Nautical Charts

3.1. Maritime Primary Database

The Maritime Primary Database consists of selected bathymetry, coastline, shoreline constructions, pontoons, lights and nav aids, submarine cables and pipelines, overheads cables, anchor berthing, marine farms, wrecks and obstructions, restrictions, precautionary area, traffic separation zones etc. In 2017, the production comprised replacing areas with older survey data with new survey data mainly finishing the work of Main Chart Bremanger (28) and continuing the work of Hinlopenstredet (537). After the survey campaign during the summer on Svalbard, we started working in these surveying of corridors east of Spitsbergen. Besides the new surveyed areas, we received updates continuously from many different governmental partners, contractors and customers. These updates enter into the Maritime Primary Database immediately. The production of Notices to Mariners (“Etterretninger for sjøfarende”) and the production of all charts/ENCs are based on the information extracted from the Maritime Primary Database.

The Norwegian Coastal Administration is responsible for the fairways and its aids to navigation. They maintain a database with all navigational lights, marks, buoys etc. At present, it is still a semi-digital communication of information and changes (new lights, move of buoys, etc) for updating our Primary Database and publish in NtM. The pilot project of automated geo-synchronizing was finished december 2017 but the potential reported has not yet any conclusion in the two departments.

Notices to Mariners (Etterretninger for sjøfarende (Efs))

24 editions were published in 2017. The publication is only available on the Internet, free of charge for downloading, at the Efs service www.kartverket.no/efs. The Internet solution also allows searches for all messages (also T&P) sorted for each chart index. The Efs service provide tracings as a supplement to the notices.

3.2. Chart production

Since autumn 2008, when the NHS completed the major task of covering the Norwegian coast with ENC's and modernised paper charts, the production has been concentrating on replacing areas with old survey data with new data. NHS prioritize these areas based on safety of navigation and economic benefit to society.

The Chart production section have an ongoing project looking into use of dense depth contours in specific areas in large scale ENC's. This project is a response to requests from the end users.

3.3. ENC production

In 2017, the NHS completed the project producing New Editions of existing ENC's corresponding with chart 455. In this connection, 6 ENC's in the Approach, Coastal and General user bands were updated with new survey data, new coastline and other updated objects. A project producing New Editions of existing ENC's corresponding with chart 469 and 491 has started. So far, 10 ENC's in the Berthing and Harbour user bands are produced. This job will continue in 2018.

One new Coastal ENC between 67°N and 69°N was produced and the corresponding General ENC was published as New Edition as a part of the expansion of coverage in the Coastal user band to all Norwegian waters, see Figure 4.

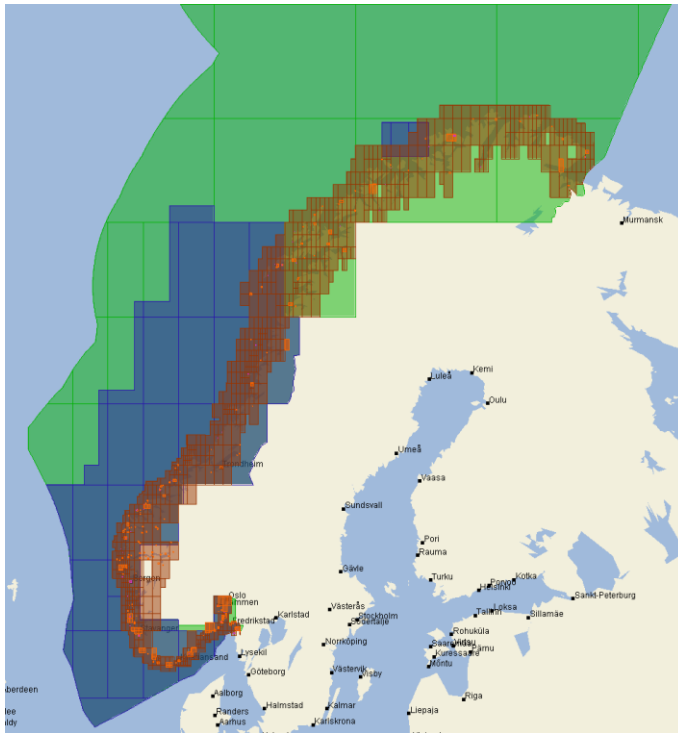


Figure 3.

ENC coverage for the Norwegian coastal waters (ENCs in User Bands 2-6).

In Svalbard a safe sailing route between the northern part of Hinlopen and Rijpfjorden north of Nordaustlandet has been published in the existing ENC, see Figure 5.

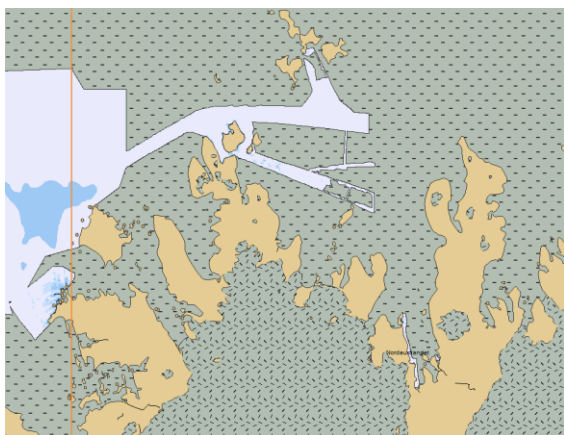
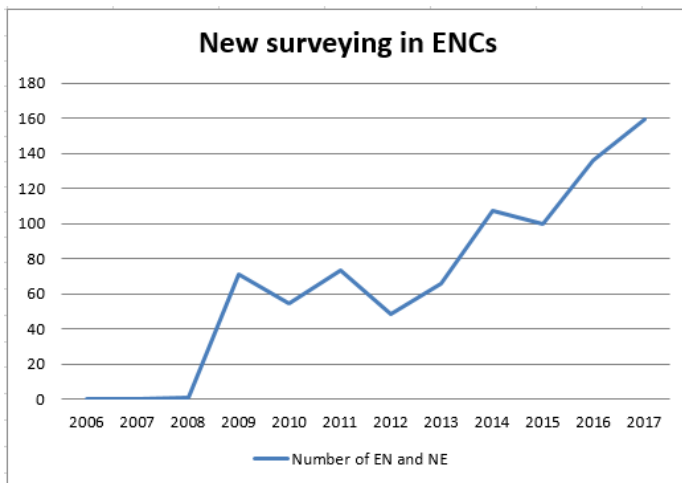


Figure 4.

A safe route north of Nordaustlandet in General usage band.

After request from users another 159 ENCs in the user bands 2-6 have been upgraded with new survey data in several ports and passages. 18 of them as new ENCs produced in accordance with pilot sketches and 141 published as New Editions of existing ENCs.

The graph below shows the trend in upgrading the ENC's with new survey information in recent years.



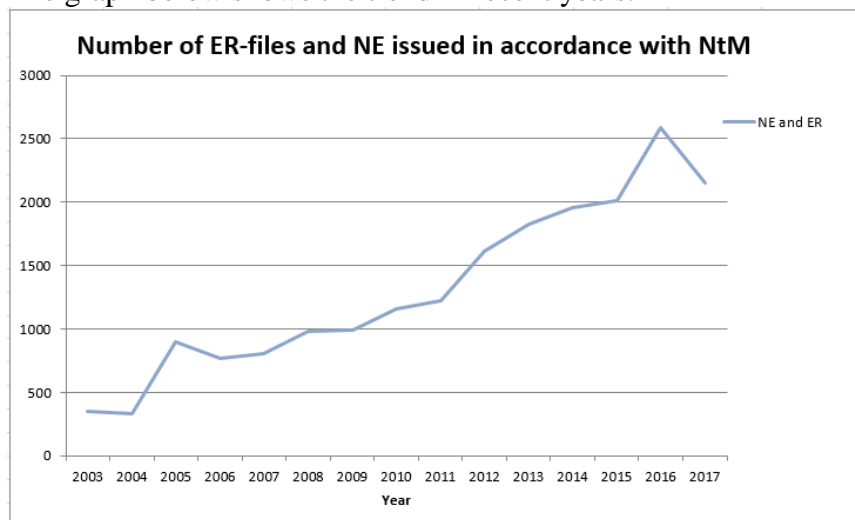
The total number of ENC's was 1173 at the end of 2017.

	Usage Band	Compilation scale	No of ENC's
1	Overview	< 1:1 499 999	3
2	General	1:350 000 – 1:1 499 999	69
3	Coastal	1:90 000 – 1:349 999	78
4	Approach	1:22 000 – 1:89 999	754
5	Harbour	1:4 000 – 1:21 999	209
6	Berthing	> 1: 4 000	60

Table above: Number of ENC's in each usage band per 31 Dec. 2017

The updating via ER profiles were issued in accordance with the Notices to Mariners (NtM) and other updates, and distributed through Primar. A total of 2148 ER files and NE were issued as part of the continuous maintenance of the ENC's. Temporary (T) and Preliminary (P) notices are since 2011 published as ER files. They are included in the numbers.

The graph below shows the trend in recent years.



Planned activities in 2018:

In 2018, the work with the ENC's corresponding to chart 469 and 491 will be completed, Approach, Coastal and General ENC's remains. Existing ENC's corresponding with chart 28 will be published as New Editions based on new multibeam survey data.

On the eastern side of Svalbard a corridor of multibeam survey data will be produced through Storfjorden.

New Coastal ENC's between 67°N and 71°N will be produced.

Publishing New Editions and new ENC's with new survey data after request from users will proceed.

Updating via ER profiles in accordance with the NtM will continue.

3.4. Paper chart production

A total of 37 new editions of charts were issued in 2017 due to updates from new surveys.

13 harbour charts, 21 main charts, 1 coastal chart and 2 charts for Svalbard.

New charts/ new editions with new survey data published 2017:

Chart No.	Title	Scale
311 / INT 9314	NEW CHART , Støtt – Andenes	1:350 000
541	NEW CHART , Nordporten – Sjøøyane	1:100 000
1	Oslofjorden. Færder – Hvaler – Halden	1:50 000
9	Lillesand – Ny-Hellesund	1:50 000
12	Lista – Svåholmen	1:50 000
14	Ogna – Tananger	1:50 000
16	Tananger – Stavanger – Skudenes	1:50 000
21	Selbjørnsfjorden – Bergen	1:50 000

Chart No.	Title	Scale
23	Bergen – Fedje	1:50 000
24	Fensfjorden – Sognesjøen	1:50 000
34	Romsdalsfjorden, Molde – Åndalsnes	1:50 000
39	Trondheimsfjorden. Agdenes – Thamshamn – Buvika	1:50 000
43	Agdenes – Lauvøya	1:50 000
48	Gjæslingan – Dolmsundet	1:50 000
67	Leines – Grøtøya – Steigen	1:50 000
73	Ure – Gimsøystraumen – Svolvær	1:50 000
83	Dyrøya – Gibostad	1:50 000
113	Hamningberg – Vardø	1:50 000
119	Osterfjorden og Sørfjorden	1:50 000
121	Ytre Sognefjorden	1:75 000
123	Nordfjord	1:80 000
132	Høgsfjorden – Lysefjorden	1:50 000
139	Nordfolda	1:50 000
454	Kristiansund havn	1:10 000
455	Stavanger havn med innseilinger	1:25 000
456	Ålesund havn	1:20 000
459	Kristiansand havn	1:10 000
460	Bergen havn	1:10 000
462	Svolvær – Kabelvåg	1:10 000
464	Fredrikstad havn	1:10 000
469	Nordre Karmsund med Haugesund havn	1:10 000
470	Singlefjorden, Iddefjorden med Halden havn	1:25 000
471	Kvitsøy og Skudeneshavn	1:20 000
474	Oslo – Rødtangen – Drammen	1:50 000
478	Ryfylkefjordane. Sjernarøyane - Sauda	1:50 000
491	Kårstø og Karmsundet	1:20 000
521	Femtebreen – Gråhuken	1:100 000

Planned activities in 2018:

The chart production for 2018 will be focused on production of charts in the Stavanger/Haugesund area, 2 new charts in Storfjorden (Svalbard) and in Bremanger (chart 28).

Print On Demand (POD)

The complete Norwegian chart portfolio (231 charts) is produced for POD only.

4. Nautical Publications

The Norwegian Pilots Guide «Den norske los» is to be digitized and more customized for the professional users. The new solution will be available for browsers and tablets as an webapp. The information content will be based partly on our charts and partly on georeferenced information from external partners (like refueling locations, mooring positions, electricity supply etc.

By digitizing the Norwegian pilot we have to involve developing a new national port standard.

We do not have a common port standard today and we see the need to achieve a common port standard where all ports and municipalities themselves are responsible for their own data.

By compiling the data into a common map database based on port information, we will have all the information in one place, which means that all information is correct and will be updated.

If we establish a common database and process the data via the Norwegian national geoportal Geo Norge, the data model could look like this:

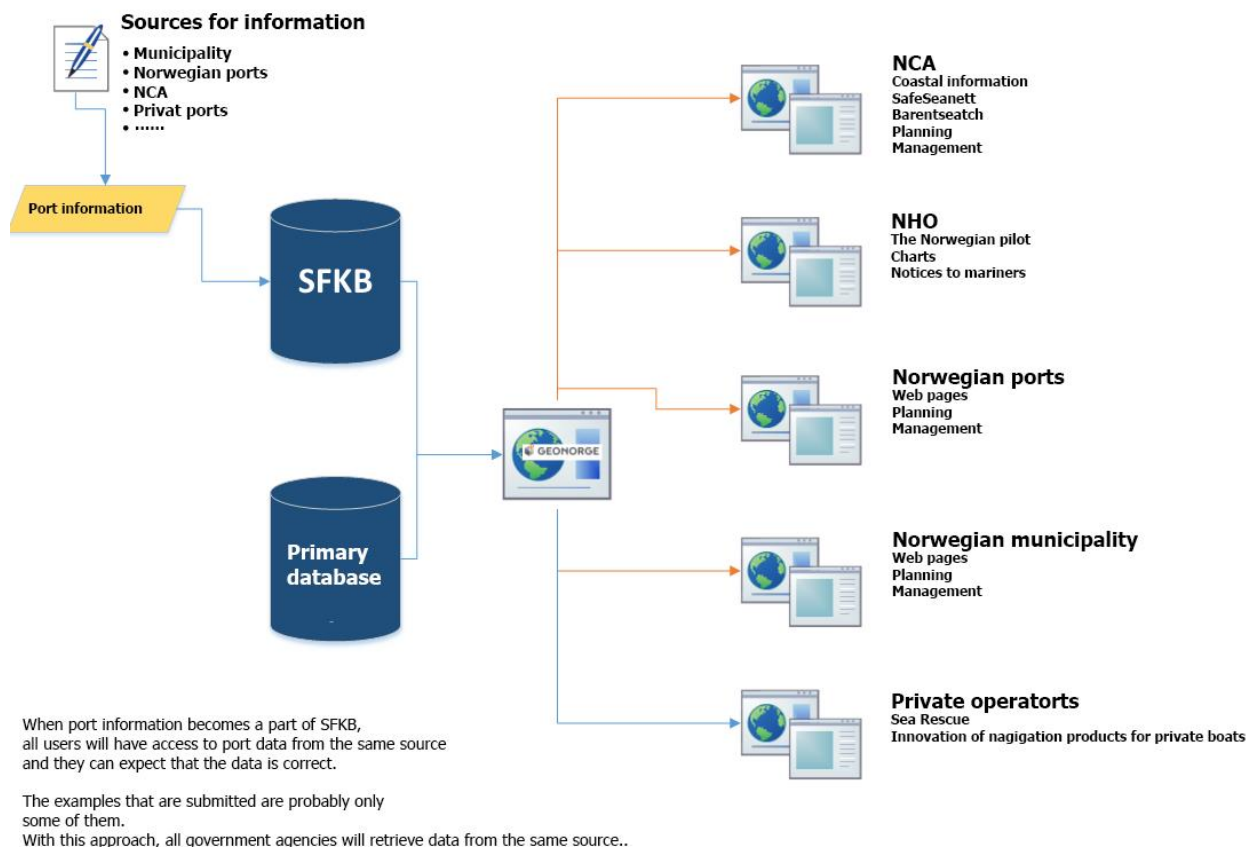


Figure 5: Data model for maritime information

This will make sure that we always have the correct data, everyone knows where the data exists and it will be easier to keep the data up to date and to share on different devices.

We did a test on data from FKB (the Norwegian common map database) without port information, versus a common map database including port information, they looked like this:



Figure 6. Illustration without port information from common map database. Like it is today.

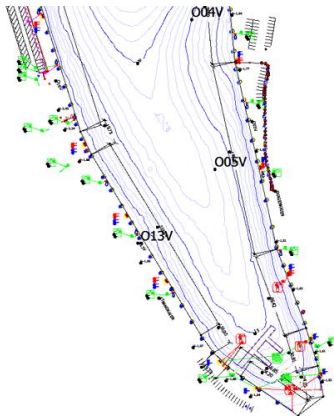


Figure 7. Data from Stavanger port

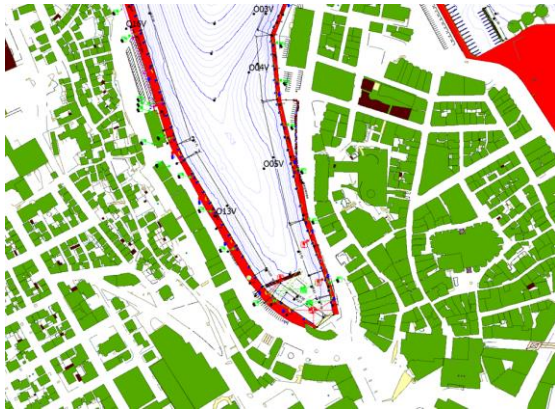


Figure 8. When we got the data into the common map database.

Combining all the data this way proves very useful to the mariner and is something municipalities and ports should keep updated themselves.

The municipalities and ports are making a standard regarding which data to deliver and what format it should be delivered in. Today, data is delivered into .dwg (AutoCAD) which is transformed into Shape, geojson, gml, xml and sosi data (Norwegian standard). All data will be available for download via GeoNorge, Primar and APIs in the same format. It is a goal of NHO that all data should be used on different devices in the future.

5. MSI

The Norwegian Maritime Directorate is the responsible body for MSI in Norway.

6. C-55

The last update of C-55 was sent to IHB in March 2018.

7. Capacity building

Norway participated in the annual meeting of the IHO Capacity Building Sub-Committee in June 2017. 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 mid 2018. The main goals are related to building competence, survey, and ENC production capacity. Two students have finalized a Cat B course (one at Skilltrade and one at the Italian HO) and one has participated in surveying at NHS. One student has finalized a Cat A course at the university of Genoa. A Data management and Chart Production system have been acquired and are operational. Relevant training has been delivered. A MBES with motion sensor has been acquired and installed on a survey launch that is provided to the project. The survey launch is in operation.

To ensure long term results, Norway has decided to stay committed to Albania for an additional three years (2018 – 2020) with follow-up support. In addition Norway is engaged

with Capacity Building in Montenegro aiming to achieve modern survey of prioritized harbor and coastal areas through regional cooperation with Croatia.

8. Oceanographic activities

The tide gauge network in Norway consist of 24 gauges including one in Ny-Ålesund at Spitsbergen. Short-term water level measurements (more than 400 series) at locations between the permanent gauges 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 <https://www.kartverket.no/en/sehavniva/> it is possible to get tide tables, observed water level and water level forecast for 5 days (from a model run by the Norwegian Meteorological Institute) for most of the sites along the Norwegian coast. We also present figures showing 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 projects with our Geodesy institute and Land Mapping Division to find a common reference frame between sea and land and to visualize sea levels on maps with high vertical resolution (see section 9.1).

We have delegates in the IHO-working groups "North Sea Hydrographic Commission Tidal working Group (NSHC-TWG)", "Tides, Water Level and Current Working Group (TWCWG)" and observer in BSHC CDWG.

9. Other activities

9.1 Søre Sunnmøre projects.

The Søre Sunnmøre region (just south of Ålesund) is a pilot and testbed area for several of our activities. High resolution bathymetric and topographic data is available and enables us, from a data viewpoint, to make a seamless high resolution 3D land-sea terrain model.

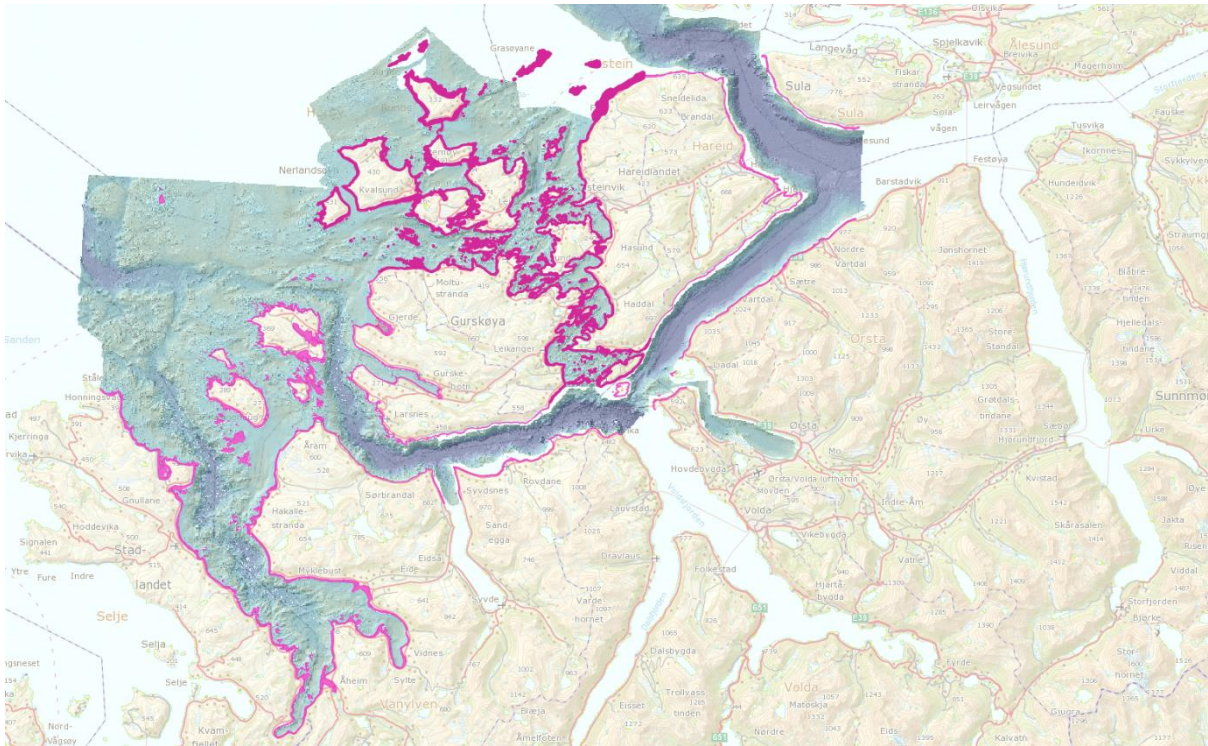


Fig 9. Søre Sunnmøre region with area planned for green laser survey in pink (92km²)

We have in 2017 been engaged in three projects in this region.

One project aimed to close the data gap along the coastline (roughly MSL to 4m water depth (LAT)), depicted in pink in figure 5. A survey using airborne green laser has been conducted, resulting in a coverage of less than half of the area. The main challenge is dark sea bottom (dark rocks or marine vegetation) where there are no returns from the laser. Where the bottom is light, we have good quality data sets.

The second project aims to find a common reference frame between sea and land so that Chart Datum (CD) and land levelling datum can be coupled. There is increased focus on activities in the coastal zone. In the project, we combine water level measurements with pressure sensors, GNSS measurements from a boat, gravity measurements from both a boat and air, and land levelling to find the best relation between the different reference levels. One important goal is to find a method that we can use along the Norwegian coast in a cost effective way. The final report from this project is written, and the next phase has started.

The second phase will focus on the longest fjord in Norway, Sognefjorden. We want to find the mean dynamic topography (MDT) and the dynamic topography (DT) in long fjords. Sognefjorden is 200 km long and we will measure water level at 20 sites. Long series (one year) will give us a possible seasonal effect. Other important parameters are GNSS measurements, existing gravity measurements and levelling to connect the tide gauges to the land levelling network. We will also test the use of hydrodynamic modelling for this purpose. Comparison of the results from the project with satellite altimetry will be done to see if altimetry can be used inshore.

In the third project “Visualization of the sea level” we have combined the detailed elevation model with information on historic storm surges and prediction of future sea levels and future storm surges. The project has resulted in a map based web service meant for the general public and professional users such as coastal development planners, decision makers etc. The project has formally ended and the map tool will be made public and added to the webpage www.kartverket.no/en/sehavniva.

9.2. The MAREANO Programme

Background: MAREANO is a multidisciplinary marine mapping and documentation programme aiming at providing the foundation for ecosystem based sustainable management of the Norwegian coastal and sea areas. The primary focus has been The Management plan for the Barents Sea and the management plan for the Norwegian Sea (see figure 5 below). The aim is to bridge the knowledge gap in poorly mapped but very sensitive areas. High quality multibeam bathymetry is regarded as a premise for further geological, biological and chemical investigations. The NHS is responsible for bathymetric data acquisition (including backscatter and water column data), and effective data management and distribution of survey data, derived products and services. An important facet of the programme is the web-based geodata distribution, and distributed data management as part of a National Spatial Geodata Infrastructure (NSDI)

Organization: The NHS is a programme partner in the MAREANO Executive Group with the Institute of Marine Research (IMR, programme management) and the Geological Survey of Norway (NGU).

Results 2017: The MAREANO program received NOK 106,6 mill in total through earmarked funding. NHS received NOK 48.7 mill. 19 579 km² was surveyed in 2017.

Data distribution: The multibeam data has been modeled in digital terrain models with grids of various resolutions. The terrain is visualized through shaded relief maps as a Web Map Service included in the map services on the MAREANO webpage www.mareano.no.

NSDI: According to the MAREANO data policy all geodata from the MAREANO programme will be published in the Norwegian spatial data infrastructure; *Geonorge* www.geonorge.no .

MAREANO will be a major undertaking for the NHS in the years to come, and is mainly aimed at non-navigational purposes.

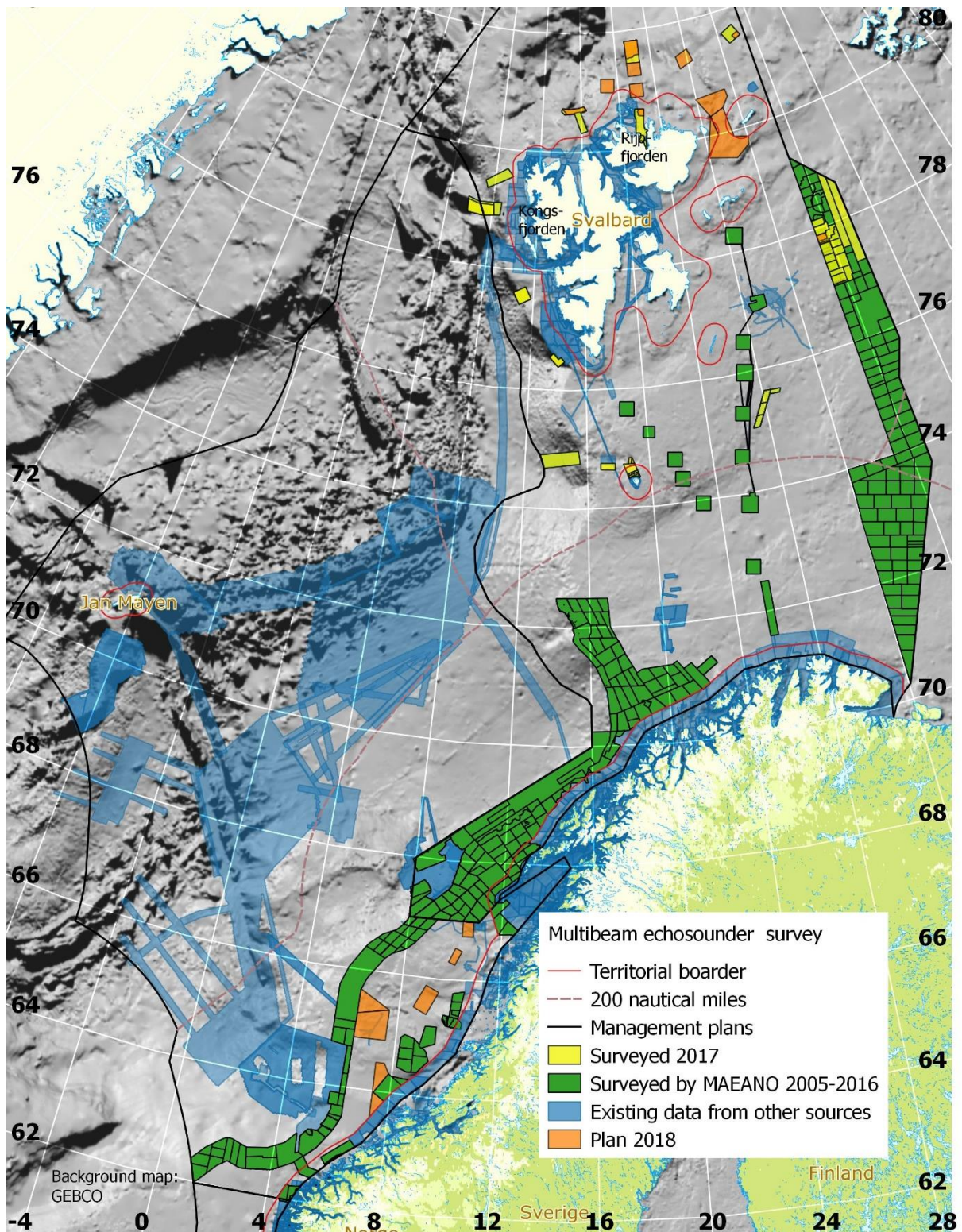


Figure 10. The Management plan areas and coverage of multi beam echo sounder data.

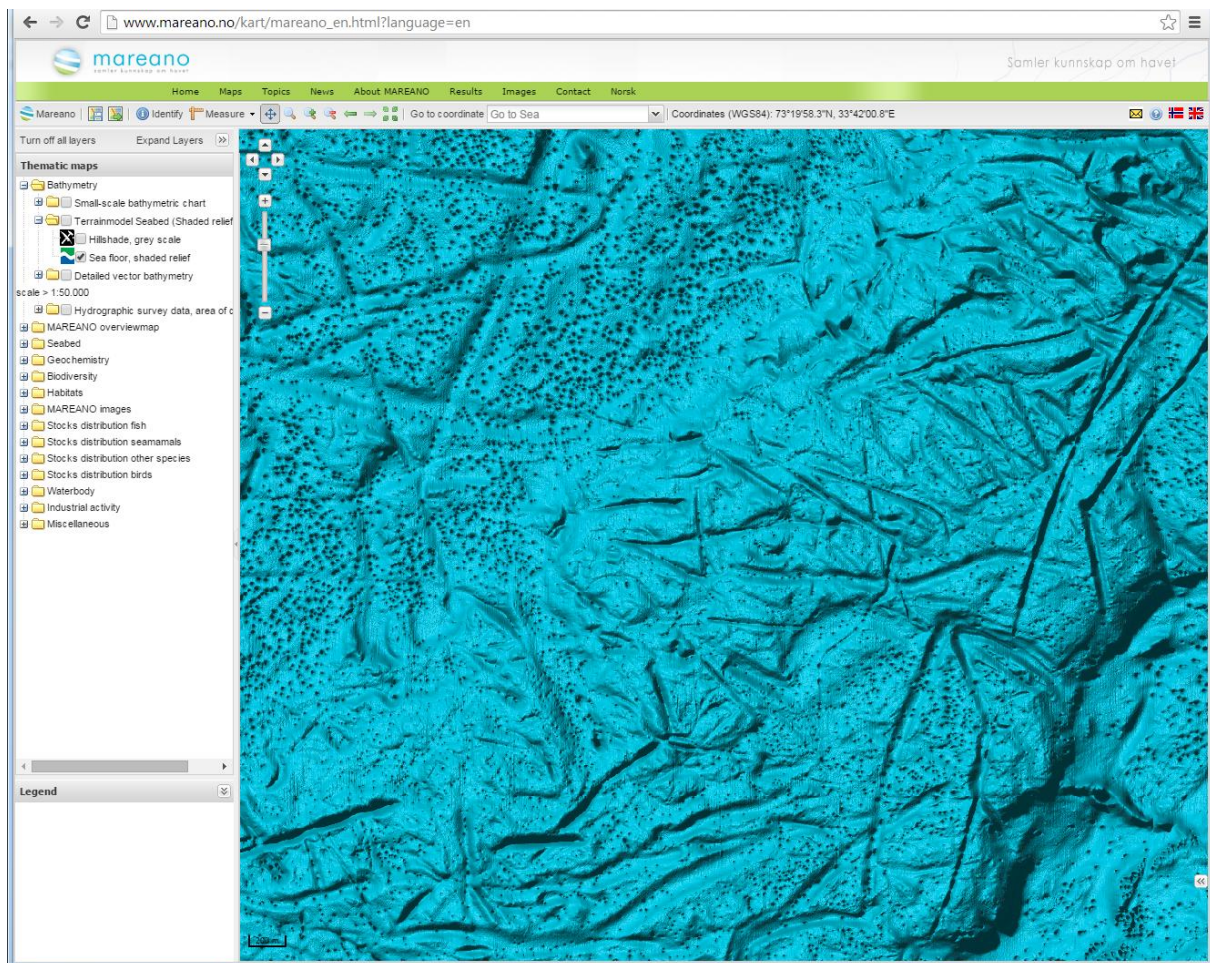


Figure 11. An example from the WMS shadow relief map service showing seabed with pockmarks and iceberg plough marks in the Barents Sea (screenshot from map service on www.mareano.no)

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, 50% of them are involved in coastal and/or offshore activities.

NHS has been one of the key players in establishing the Marine and Maritime Forum under Norway digital in January 2017. 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.

NHS has been taking part in the SDI support against the national MSP, looked into possibilities of regional cooperation around CZM, and participated in activities to ensure compliance with INSPIRE.

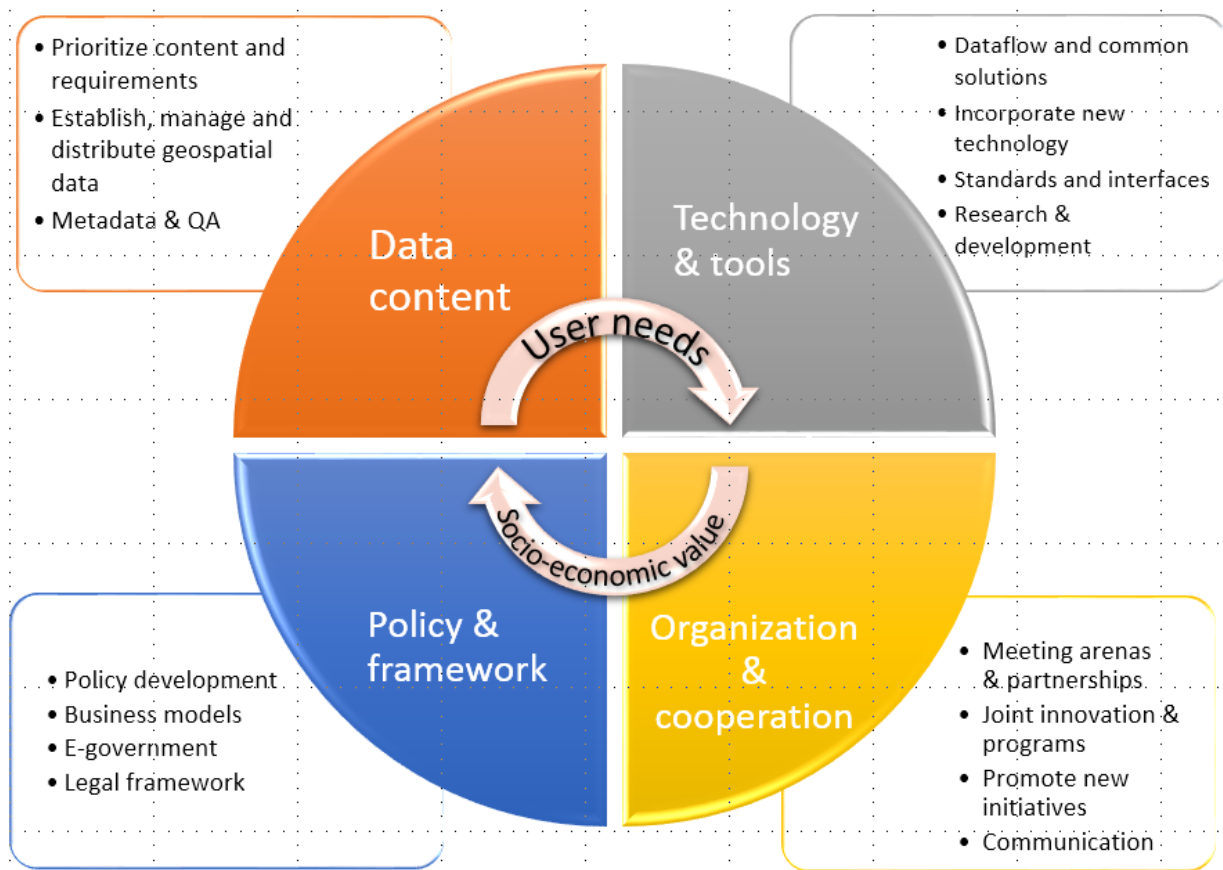


Figure 12. Norwegian SDI approach

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 is 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 for delivery this summer (2018).

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 with integrated, multi-thematic geospatial information.

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 NSDI in a way that will release expected synergistic effects like re-use of data and services, improved planning and decision making through one common geospatial knowledge platform, 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 work with 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 through harmonized geospatial information services. The harmonization work includes the data content, geospatial services, cartography and the system of concepts.

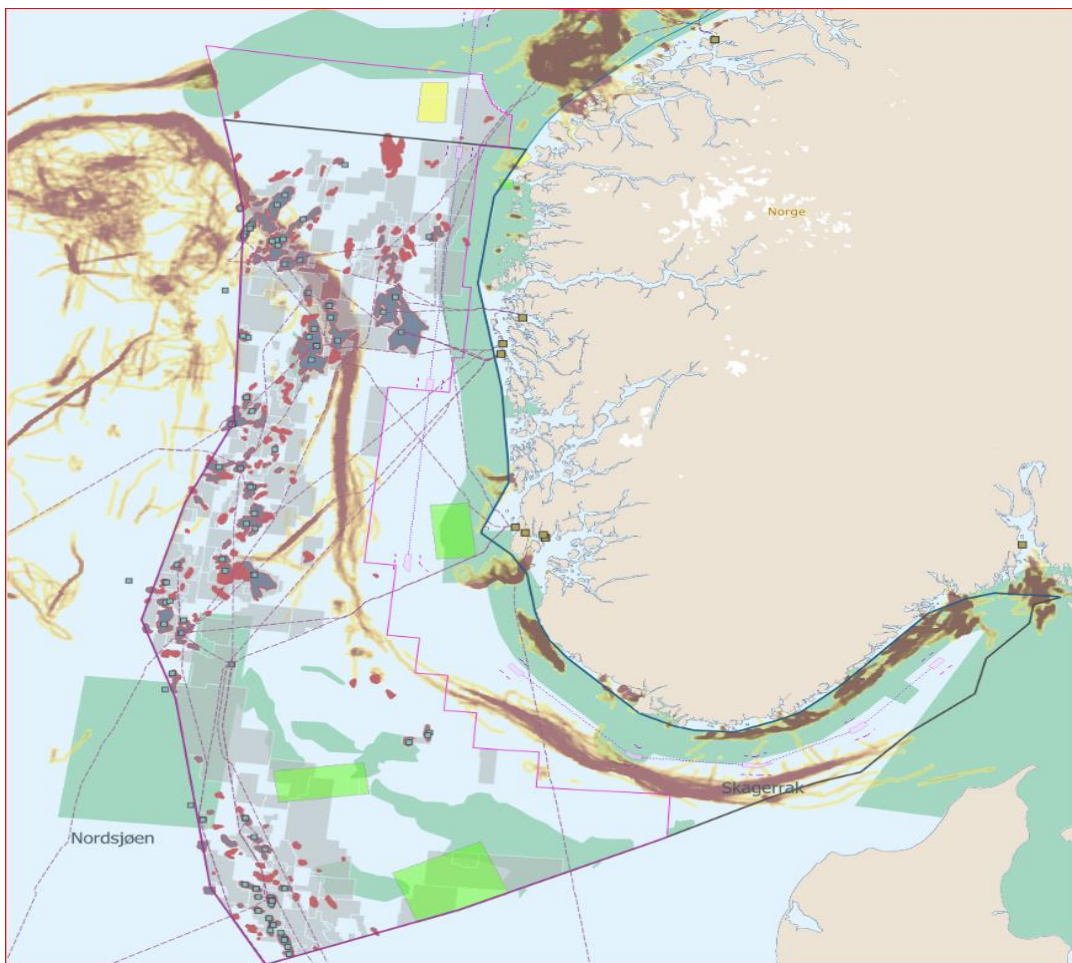


Figure 13. Visualization of a thematic composition within the North Sea area by connecting network based services in the Marine Spatial Management Tool, streaming geospatial information from 6 governmental agencies online.

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, IEN, MSDI, CSB, CBSC and WEND. We have participated in the HSSC and the IRCC meetings in 2016. Norway is actively participating in 5 Hydrographic Commissions: ARHC, HCA, NHC, NSHC and SAIHC.

The NHS has become a member of the newly established UN-GGIM Marine Domain Working Group.

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.

A model with grid size of 50x50 meter, based on all available survey data from Norwegian coastal waters, has been developed. The information is made available to EMODnet.

NHS is an active partner in the EU project Coastal Mapping and is part of the new consortium that has won the contract for the EMODNET High Resolution Seabed mapping project.