

 Kartverket	ARHC 9th Conference Murmansk 17 – 19 September 2019	ARHC9-B4 National Report NORWAY
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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 ARHC8 Conference in Longyearbyen, Svalbard, September 2018. Some highlights:

- *Pilot project for digital nautical publications*
- *Pilot project for S-102*
- *Testing of condensed depth curves*
- *Pilot project for Marine Base Maps in Norway*
- *Development of a marine spatial planning tool*
- *Development of a new Hydrographic Infrastructure*
- *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

After having reorganized our Geo Data Department during the first half of 2018, we started reorganizing our Nautical department during the second half of 2018. We have focused on four clearly defined authoritative regulatory functions:

- Nautical Charting Authority
- National Hydrographic Data Manager
- National Tidal Authority
- National Marine Geospatial Information Coordinator

We have visited several other HO's to learn from their production processes.

2. Hydrographic Surveys

Internal conducted surveying 2019

R/V Hydrograf and its two survey launches are working in the coastal waters of Norway and Svalbard.

Norwegian coast

The primary survey areas in 2019 are some exposed areas north of Ålesund and some areas north of Tromsø. Both these areas are surveyed as a part of the coastal marine mapping program.

In addition to the major survey areas, quite a few minor areas along most of the coast were covered by surveys related to development projects in the coastal zone.

Figure 2 on the next page presents the current coverage of surveying in 2019 within the territorial waters.

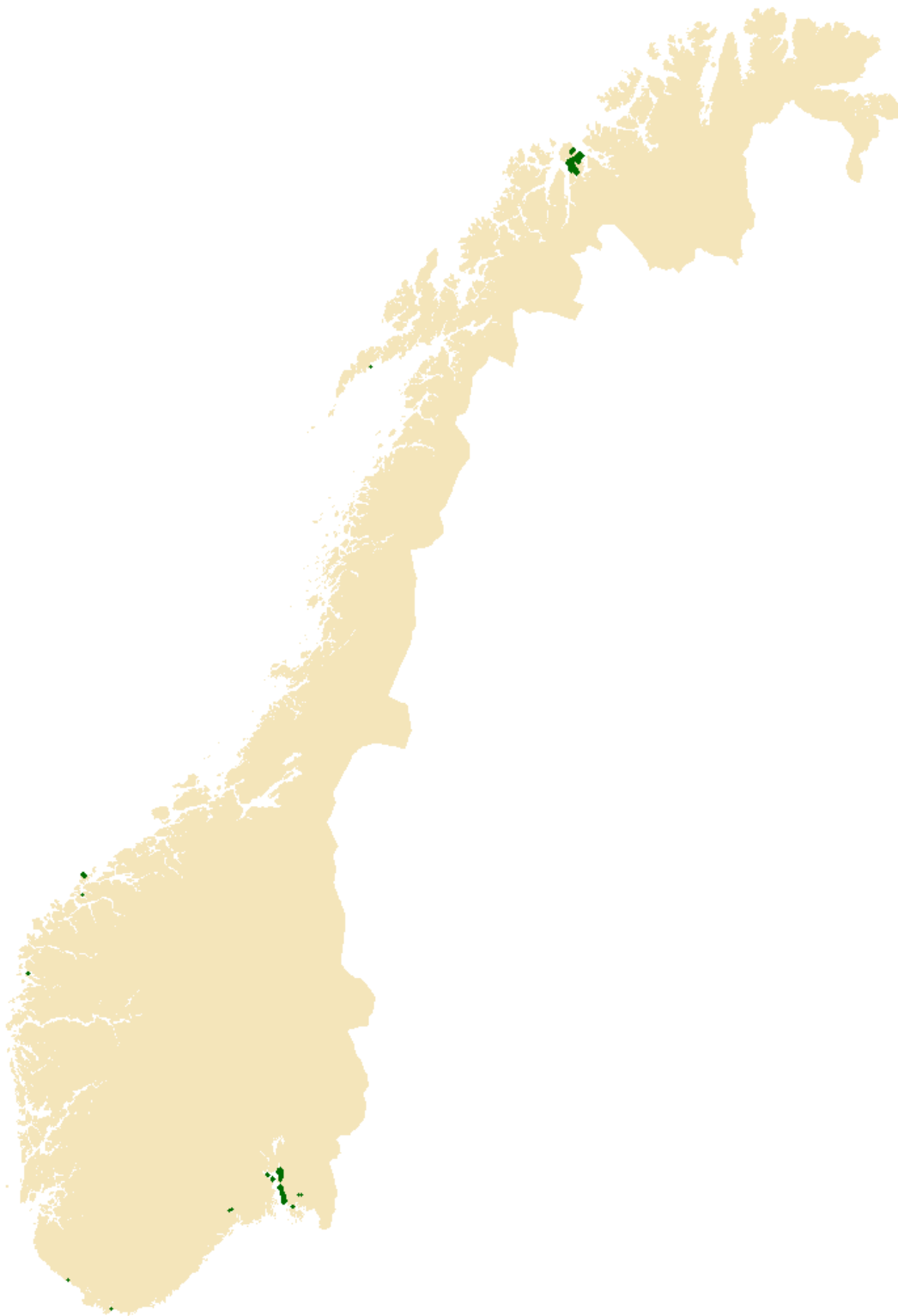


Fig. 1. Area surveyed in territorial waters of Norway during the first 7 months of 2019. Please note that the area sizes are exaggerated to make the smaller areas visible on the plot.

Svalbard

R/V Hydrograf and two survey launches are currently at Svalbard. The survey operation is planned for 10 weeks in 2019. The illustration shows the survey status as per 01 Aug 2019.



Fig. 2. Surveying at Svalbard during the 2019 season

External conducted surveying 2018

Surveys within the MAREANO program are contracted to external companies. The 2019 MAREANO surveys are mainly conducted by the Norwegian company DOF subsea.

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. at a minimum scale of M10000. In 2018, the production continued replacing areas with older survey data with new survey data. Mainly finishing parts of Main Chart Håsteinen-Batalden (026) and finally covering Main Chart Torbjørnskjær-Fulehuk-Rakkebåen (002) with modern measurements closing a gap of Catzoc C. In the Arctic we finished producing maritime primary data along a corridor east of Svalbard supporting full ENC- coverage around 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. Maritime Primary Database is the main support of the production of Notices to Mariners (“Etterretninger for sjøfarende”) and the update and production of all charts/ENCs.

The pilot project The Norwegian Coastal Administration of automated geo-synchronizing was finished december 2017. Based on the report we concluded that there will be no further developing, but focus on the potentials lying in the Geonorge-catalog to download official Norwegian geodata.

Notices to Mariners (Etterretninger for sjøfarende (Efs))

24 editions were published in 2018. 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 ENCs 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 ENCs. During the first half of year 2019, a second ENC including dense depth contours will be made available for the end users for the NHS to gain more experience. This project is a response to requests from the end users.

3.3. ENC production

In first half of 2019, the NHS completed the project producing New Editions of existing ENCs corresponding with chart 28.

A project producing new editions of ENCs in part of Oslo fiord has been ongoing in 2019, and so far 10 ENCs in the Harbour User Band have been produced. Now NHS are working on the other Usage Bands covering the same areas, and will be finalized in 2019.

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 3. In second part of 2019 NHS will be working on two new Coastal ENCs.

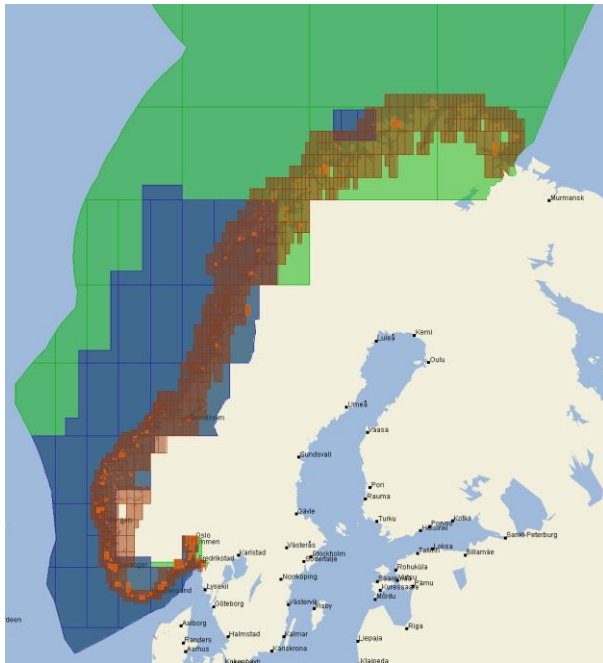


Figure 3.

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

In Svalbard a corridor of multibeam survey data through Storffjorden was produced as new ENCs in the Coastal User Band. Also the existing General ENCs were updated and published as New Editions. 10 ENCs were involved in this project, see Figure 4 and 5. In June 2019 NHS released 4 new Coastal ENCs covering northern part of Hinlopen (red circle in figure 4). Because of this project, users can from now of sail on ENCs around Spitsbergen.

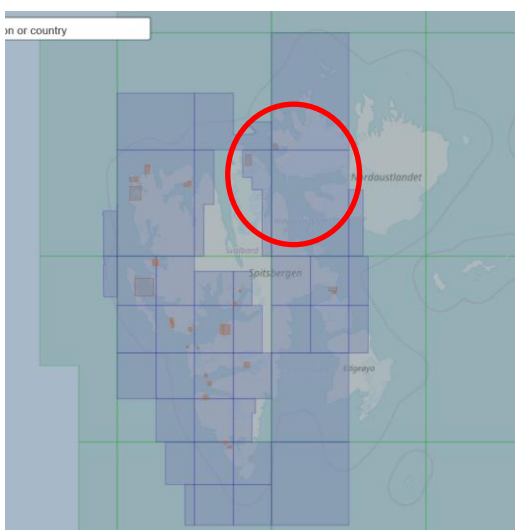


Figure 4.

ENC coverage for Svalbard (ENCs in User Bands 2-6).

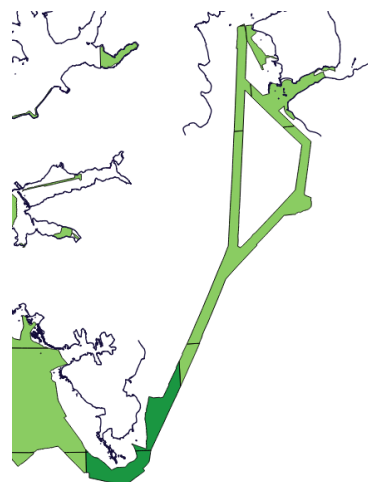
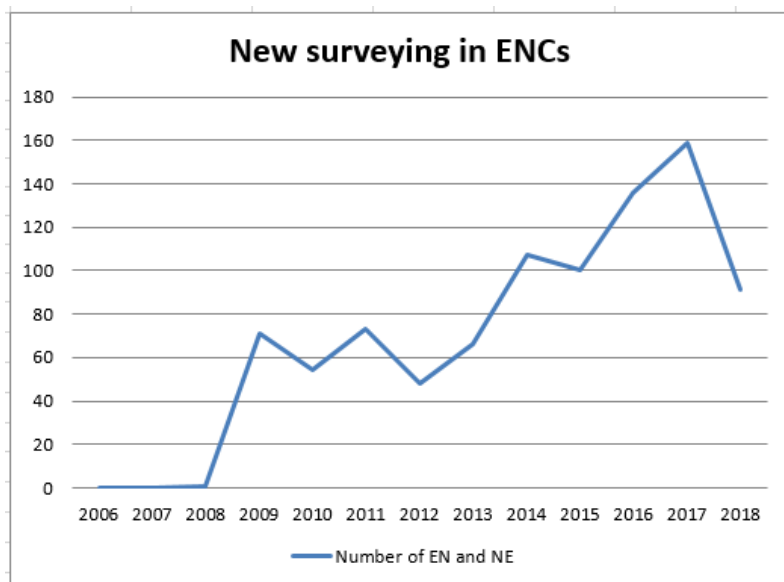


Figure 5.

The new corridor of multibeam survey data through Storffjorden

After request from users another 85 ENC's in the User Bands 2-6 have been upgraded with new survey data in several ports and passages. 9 of them as new ENC's produced in accordance with pilot sketches and 76 published as New Editions of existing ENC's.

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



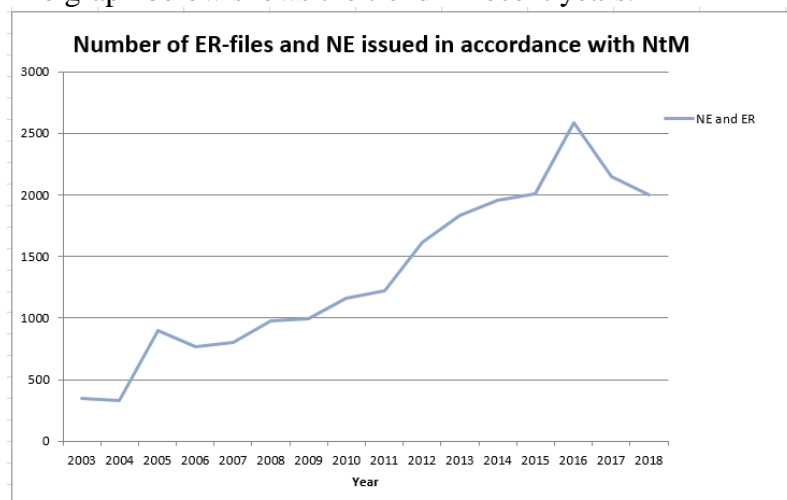
The total number of ENC's was 1189 at the end of 2018.

	Usage Band	Compilation scale	No of ENC's
1	Overview	< 1:1 499 999	3
2	General	1:350 000 – 1:1 499 999	70
3	Coastal	1:90 000 – 1:349 999	80
4	Approach	1:22 000 – 1:89 999	757
5	Harbour	1:4 000 – 1:21 999	213
6	Berthing	> 1: 4 000	66

Table above: Number of ENC's in each usage band per 31 Dec. 2018

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 1998 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 2019:

In 2019, the work with the ENC's corresponding to chart 28 will be completed, one Approach ENC remains, plus Coastal and General ENC's. Some areas in Oslofjorden will be upgraded with new multibeam survey data and published as New Editions. The cells NO4N1309 and NO4H1209 will also be upgraded with new multibeam survey data and published as New Editions.

On Svalbard new ENC's corresponding with chart 537 and 541 will be produced to expand data coverage in Coastal User Band to make it possible to sail on ENC's through Hinlopenstretet.

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

2 **new charts** were issued in 2018, Chart no 528 and 532. Both for Svalbard.

A total of 41 **new editions** of charts were issued in 2018 due to updates from new surveys.

4 harbour charts, 31 main charts, 1 coastal chart, 2 general charts and 3 charts for Svalbard.

New charts/ new editions with new survey data published 2018:

Chart No.	Title	Scale
1. 528	NEW CHART , Storfjorden Sør. Isbukta – Kvalpynten	1:100 000
2. 532	NEW CHART , Storfjorden. Kvalpynten - Agardhbukta	1:100 000
1. 1	Oslofjorden. Færder – Hvaler – Halden	1:50 000
2. 2	Torbjørnskjær - Fulehuk - Rakkeåene	1:50 000
3. 3	Oslofjorden. Fulehuk - Filtvet - Rødtangen	1:50 000

Chart No.	Title	Scale
4. 6	Jomfruland - Risør	1:50 000
5. 7	Risør - Arendal	1:50 000
6. 10	Ny-Hellesund - Lindesnes	1:50 000
7. 16	Tananger – Stavanger – Skudenes	1:50 000
8. 17	Karmsundet - Ryvarden - Skjoldafjorden	1:50 000
9. 19	Ryvarden - Selbjørnsfjorden	1:50 000
10. 21	Selbjørnsfjorden – Bergen	1:50 000
11. 23	Bergen – Fedje	1:50 000
12. 24	Fensfjorden – Sognesjøen	1:50 000
13. 25	Sognesjøen - Stavenes	1:50 000
14. 26	Håsteinen - Batalden	1:50 000
15. 28	Bremanger	1:50 000
16. 29	Stad	1:50 000
17. 30	Haugsholmen - Ålesund	1:50 000
18. 31	Breidsundet - Fjørtoft	1:50 000
19. 33	Harøyfjorden - Molde	1:50 000
20. 55	Straumøyan - Tjøtta	1:50 000
21. 59	Dønna - Lurøya	1:50 000
22. 65	Fleinvær - Bodø - Landegode	1:50 000
23. 72	Lofotodden - Stamsund	1:50 000
24. 80	Harstad - Sjøvegan - Dyrøya	1:50 000
25. 83	Dyrøya – Gibostad	1:50 000
26. 84	Gibostad - Rystraumen - Hekkingen	1:50 000
27. 87	Rystraumen - Tromsø - Grøtsundet	1:50 000
28. 91	Grøtsundet - Lyngstuva - Kågen	1:50 000
29. 120	Hjeltefjorden. Stureterminalen - Mongstad	1:50 000
30. 120	Hjeltefjorden. Stureterminalen - Mongstad	1:50 000
31. 131	Trondheimsfjorden, Levanger - Steinkjer	1:50 000
32. 452	Oslo havn	1:10 000
33. 457	Mandal havn	1:20 000
34. 459	Kristiansand havn	1:10 000
35. 490	Ulvesundet med Måløy hamn	1:10 000
36. 301	INT 10 / Norwegian Sea	1:1 500 000
37. 311	INT 9314 / Støtt - Andenes	1:350 000
38. 505	INT 9311 / Svalbard	1:700 000
39. 526	Hornsund	1:100 000
40. 527	Sørkapp	1:100 000

Chart No.	Title	Scale
41. 533	Storfjorden Nord. Freemansundet - Heleysundet - Sørporten	1:100 000

Planned activities in 2019:

The chart production for 2019 will be focused on production of charts:

- a) In the **Nordfjord** Area (Chart 26, 27, 28, 29 and 123),
- b) Areas in **Oslofjorden** (Chart 1-4, 401, 402, 472, 482 and 486),
- c) Chart in northern part of Hinlopen at Svalbard
- d) and Coastal chart 311

Print On Demand (POD)

The complete Norwegian chart portfolio (233 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:

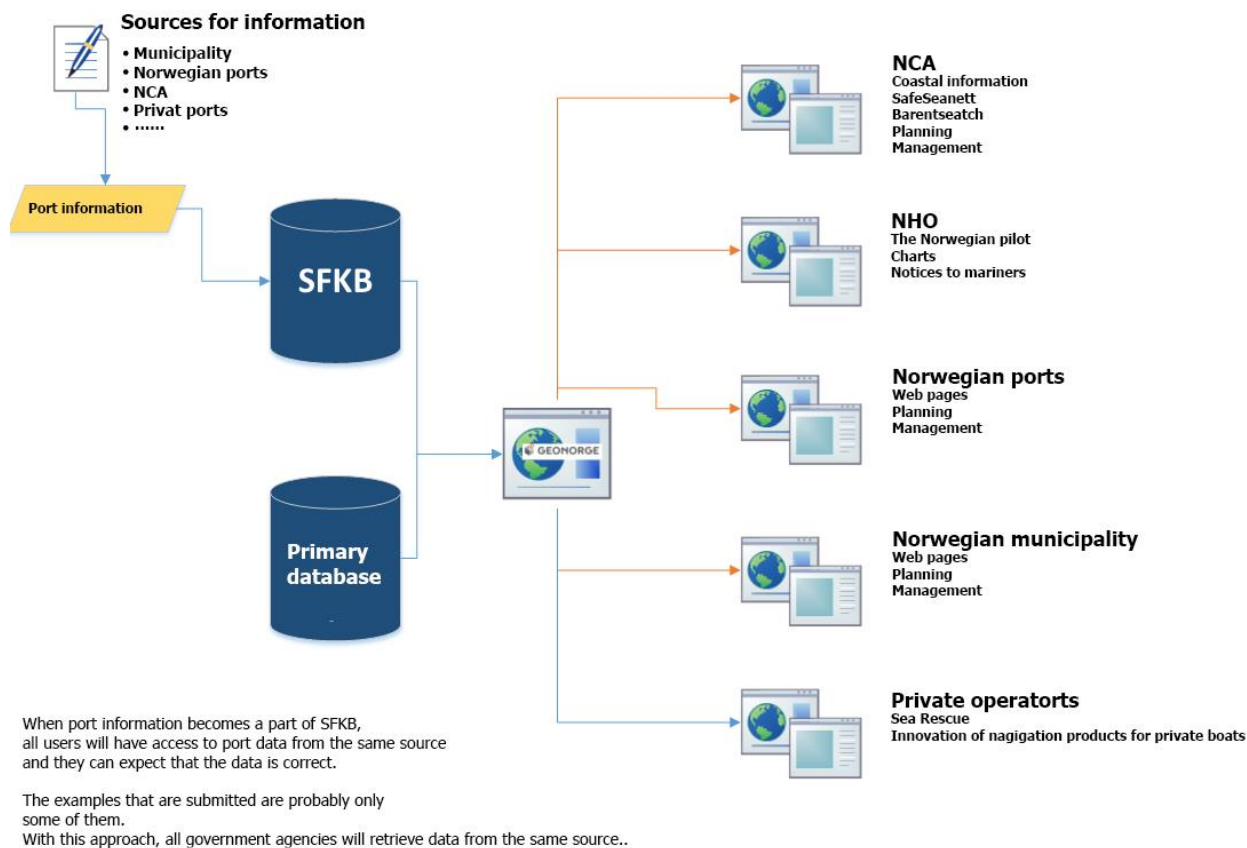


Figure 5: Data model for maritime information

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.

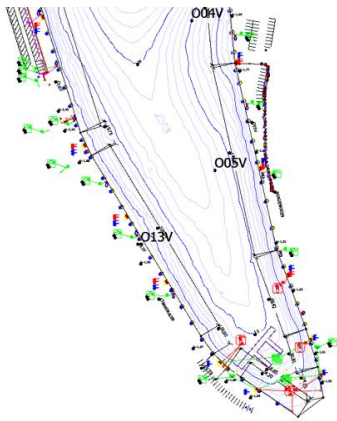


Figure 7. Data from Stavanger port



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 May 2019. 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 lasted until end of 2017. The main goals were 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.

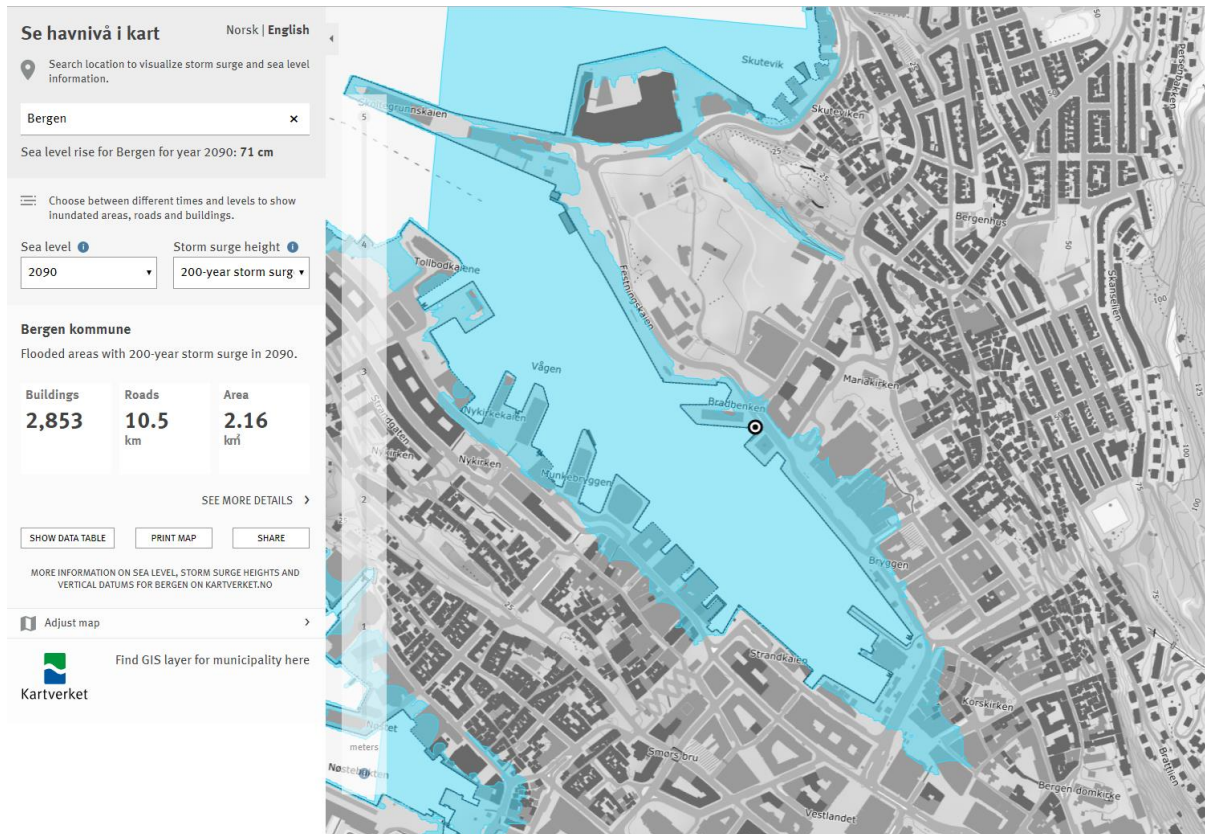
8. Oceanographic activities

The tide gauge network in Norway consist of 24 gauges including one in Ny-Ålesund at Spitsbergen. We do short-term water level measurements at locations between the permanent gauges. These are used to construct the tidal zones used to provide water level data and information for most places along the Norwegian coaste. Professional users can download data from an [API](#) directly. Our website [Se havnivå](#) provides tide tables, observed water level and water level forecast for 5 days (from a model run by the Norwegian Meteorological Institute) . 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. The official Norwegian tide tables are now only available as a Pdf-file that can be downloaded from the website.

We are presently engaged in a project with our Geodetic institute to find a common reference frame between sea and land so that Chart Datum (CD) and land levelling datum can be coupled. In the current phase of the project we focus on finding the mean dynamic topography (MDT) and the dynamic topography (DT) in the longest fjord in Norway, Sognefjorden. Sognefjorden is 200 km long and we will measure water level at 20 sites. Long series (one year) will provide us with information on seasonal effects. Other important data are GNSS measurements, existing gravity measurements and levelling to connect the tide gauges to the land levelling network. In collaboration with the Norwegian Meteorological Institute we also look at hydrodynamic modelling in this project . Comparison of the results from the project with satellite altimetry will be done to see if altimetry can be used inshore. One important goal is to find a method that we can use along the Norwegian coast in a cost effective way. This phase of the project will end by November 1.

In the fall of 2018, together with the Geodetic Institute and the Land Mapping Division, we launched a new web-based climate service in which we combine a detailed elevation model with prediction of future sea levels and present-day storm surges to create inundation maps. In addition to the inundation maps, we make available statistics on buildings, area and roads

affected by coastal flooding. The service is available at our website [Se havnivå i kart](#) and inundation layers can also be downloaded for custom GIS applications.



Figur 9 Illustration from the web service Se havnivå i kart showing consequences of of future sea level rise and a 200-year storm surge event in the center of Bergen.

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 an observer in "Baltic Sea Hydrographic Commission Chart Datum Working Group" (BSHC CDWG). In addition we participate in the GLOSS Group of Experts and the EuroGOOS Tide gauge task team.

9. Other activities

9.1 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 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 2018: The MAREANO program received NOK 107,3 mill in total through earmarked funding. NHS received NOK 66.1 mill. 18 684 km² was surveyed in 2018. In 2018 MAREANO included surveying in transit to contribute to crowd sourcing bathymetry.

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.

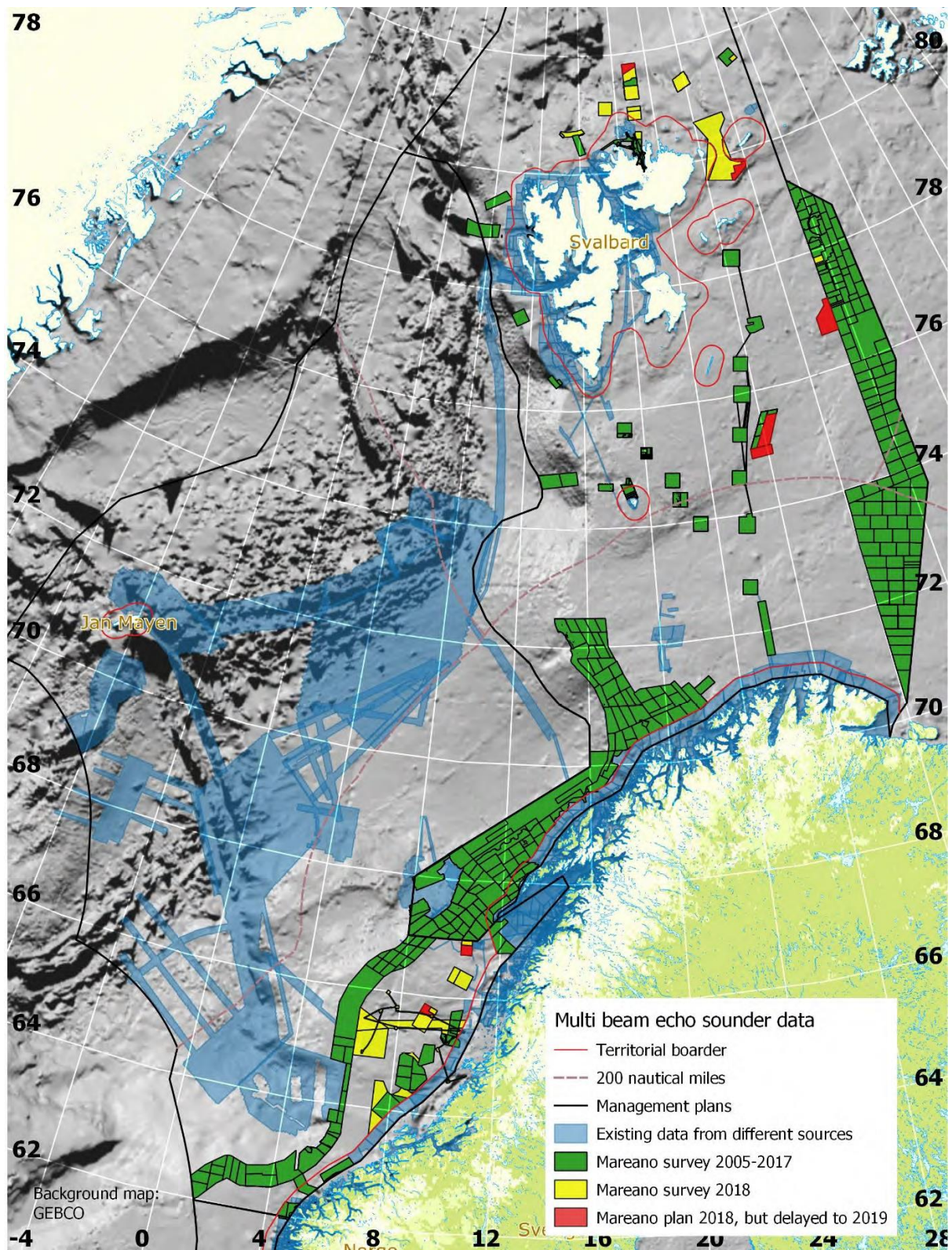


Figure 10. The Management plan areas and coverage of multi beam echo sounder data.

9.2. Marine Spatial Data Infrastructure

MSDI is an integrated component of the [national SDI in Norway](#). The cooperation [Norway digital](#) counts for more than 600 organizations, where over 50% are involved in coastal and/or offshore activities. NHS is a key player in the development of relevant collaboration arenas between data owners, service providers and end-users to improve the user-value of marine and maritime geospatial services to society.

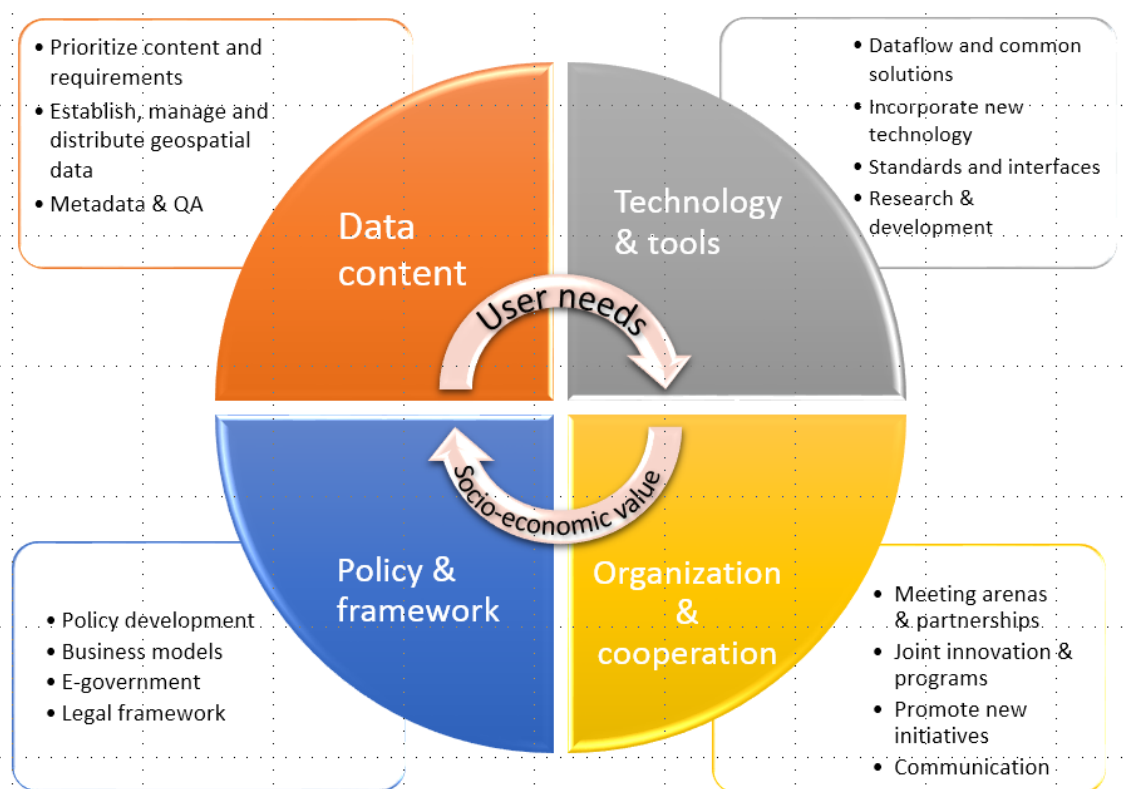


Fig. 6 Norwegian SDI approach

[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.

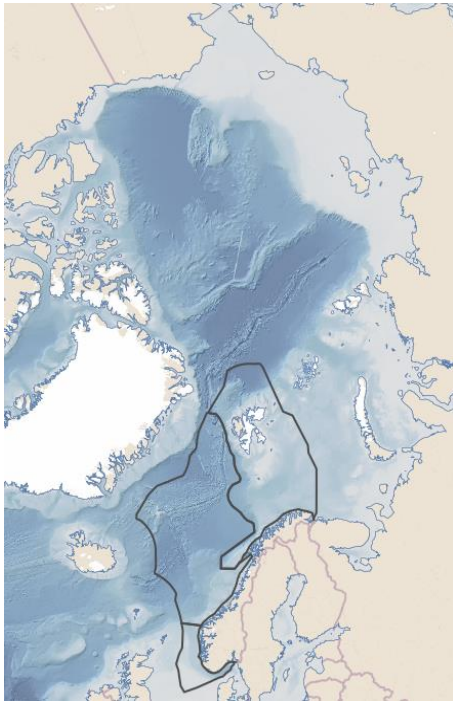
A national governmental geospatial strategy worked out in 2017 has the ambition to improve the value of geospatial information and its usefulness to society in Norway. The main goals for this strategy is to:

- 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

The national geospatial strategy is underpinned by a national action plan containing major priorities ahead.

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.



Although Norway has been working with MSP and produced [integrated management plans for Norwegian sea-areas](#) during the last 13 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 data flows and user-processes, richer data content, etc. A new [version of the MSMT](#) was released in November 2018. The development continues during 2019 to further improve usability of marine data and geospatial services for MSP in Norway.

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 their geospatial services, harmonized and integrated through the Marine Spatial Management

Tool.

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

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](#).

The project produced a User Survey Report in March 2018 as an initial approach to identify the user needs and the data availability.

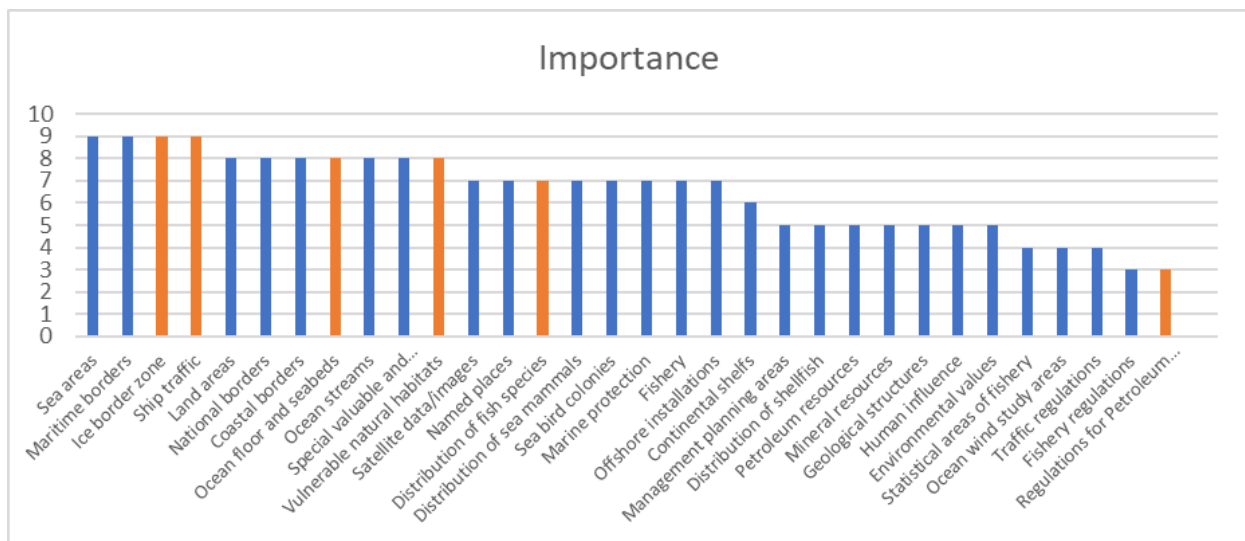


Fig. 8. Importance of data sets from the User Survey Report for Arctic marine areas.

The project will follow up the results from this activity i.a. through ARMSDIWG (Arctic Regional Marine SDI Working Group) and its cooperation with Arctic SDI. Project activities also include making a video explaining MSDI and making the Marine Spatial Management Tool concept available on the Arctic SDI platform.

9.5 Marine Base Maps in Norway

Marine base maps in Norway 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. Marine base maps in Norway 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 3 partners; The Norwegian Hydrographic Service (leading the project), Geological Survey of Norway and the Institute of Marine 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 in three pilot areas along the coast. The pilot projects will investigate and test new technology for data collection and processing and, in addition,

develop a cost-effective model for the implementation of a Marine base maps in Norway program.

Workshops has been held in three pilot areas with planning staff of municipalities and provinces, government agencies and industry / commercial actors. We have identified and documented planning processes in a way that shows 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 offentlige 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, plus 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, IEN, MSDI, CSB, CBSC 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.

The NHS is a member of the UN-GGIM Working Group on Marine Geospatial Information and is represented in the GEBCO Guidance Committee.

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 a major contributor to EMODNET.