



# ATLAS

Environmental Impact Assessment, Denmark  
South-eastern route

Nord Stream 2

April 2019

W-PE-EIA-PDK-DWG-805-DA0200EN-07

## OFFSHORE PIPELINES THROUGH THE BALTIC SEA

# ATLAS

Environmental Impact Assessment, Denmark  
South-eastern route

Nord Stream 2

April 2019

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## Introduction

**Nord Stream 2** is a pipeline through the Baltic Sea planned to deliver natural gas from vast reserves in Russia directly to the EU gas market to fill the growing gas import demand.

The twin approximately 1,230 kilometre subsea pipelines will have the capacity to supply 55 billion cubic metres of gas per year in an economic, environmentally safe and reliable way, compensating for the drop in the EU's domestic production.

The privately funded €9.5 billion infrastructure project will ensure long-term access to an important, low emissions energy source, thereby contributing to the EU's climate protection efforts. Additional supplies will boost competition in the market and support the EU's global industrial competitiveness.

**Nord Stream 2** follows in the footsteps of the successful experience of construction and operation of the existing Nord Stream Pipeline, which has been recognised for its high environmental and safety standards, green logistics, open dialogue and public consultation.

## Atlas maps

This Atlas is part of the Environmental Impact Assessment (EIA) for the Danish section of the planned NSP2 pipeline system. The EIA and the Atlas maps include both the combination of the proposed NSP2 route with V1 and the combination of the proposed NSP2 route with V2, both of which are considered feasible route options in Danish waters.

The purpose of this Atlas is to describe the general geographical distribution of physical, chemical and biological parameters in the Baltic Sea around the planned offshore pipelines.

When reading the text part of the Environmental Impact Assessment there will be references to the Atlas. The individual Atlas maps are presented in a sequence that reflects the structure of the report.

The maps that are presented in the Atlas are based on information from authorities, organisations and international databases and data gained from the existing Nord Stream pipeline project. The references used are shown in the Atlas maps' legends.

Please be aware that the marked routes of the pipeline on the maps are not representative of the actual pipeline width. They serve merely as an indication of the placement of the routes.

An overview of the topics covered by the Atlas and of the individual Atlas maps is shown overleaf.

### Note:

General references on all Atlas maps:

- Limits of Exclusive Economic Zones (EEZ) and Territorial Waters: IBRU May 2010
- Agreement between the Republic of Poland and the Kingdom of Denmark concerning the delimitation of maritime zones in the Baltic Sea, signed in Brussels on 19 November 2018
- Background sea charts are "Not to be used for navigation"
- Background sea chart; © Crown Copyright and/or database rights. Reproduced by permission of the Controller of Her Majesty's Stationery Office and the UK Hydrographic Office ([www.ukho.gov.uk](http://www.ukho.gov.uk))

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### **Tourism**

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### **Noise modelling**

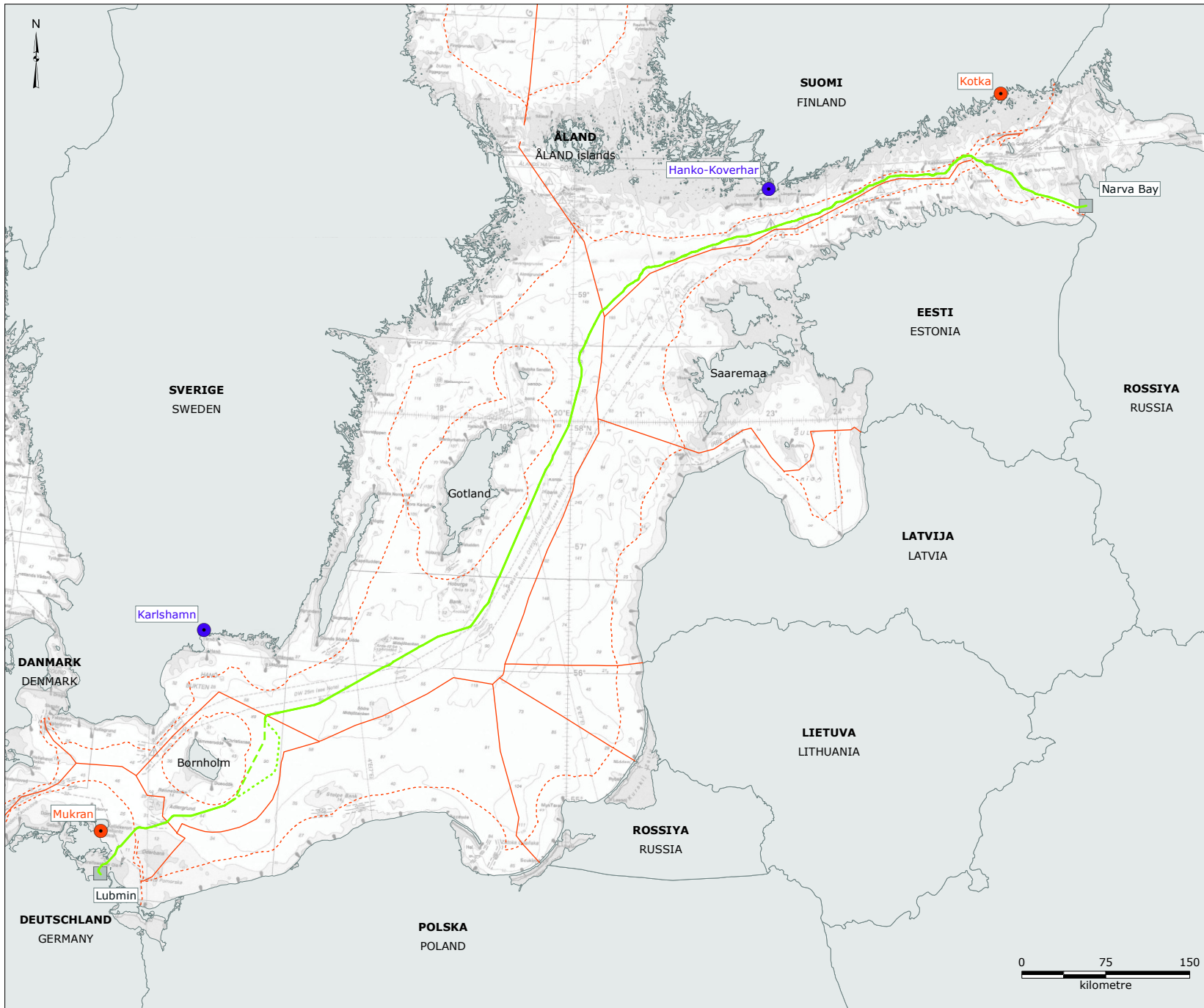
Map NM-01 Baltic Sea underwater soundscape  
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### **Sediment modelling**

Map SM-01-D Suspended sediments – trenching and rock placement

# PROJECT DESCRIPTION

DESCRIPTION OF THE PROJECT AND ALTERNATIVES



**Legend:**

- NSP2 route
- - - NSP2 route V1
- · · NSP2 route V2
- - - Territorial water border
- EEZ border
- Landfall

**Storage yards:**

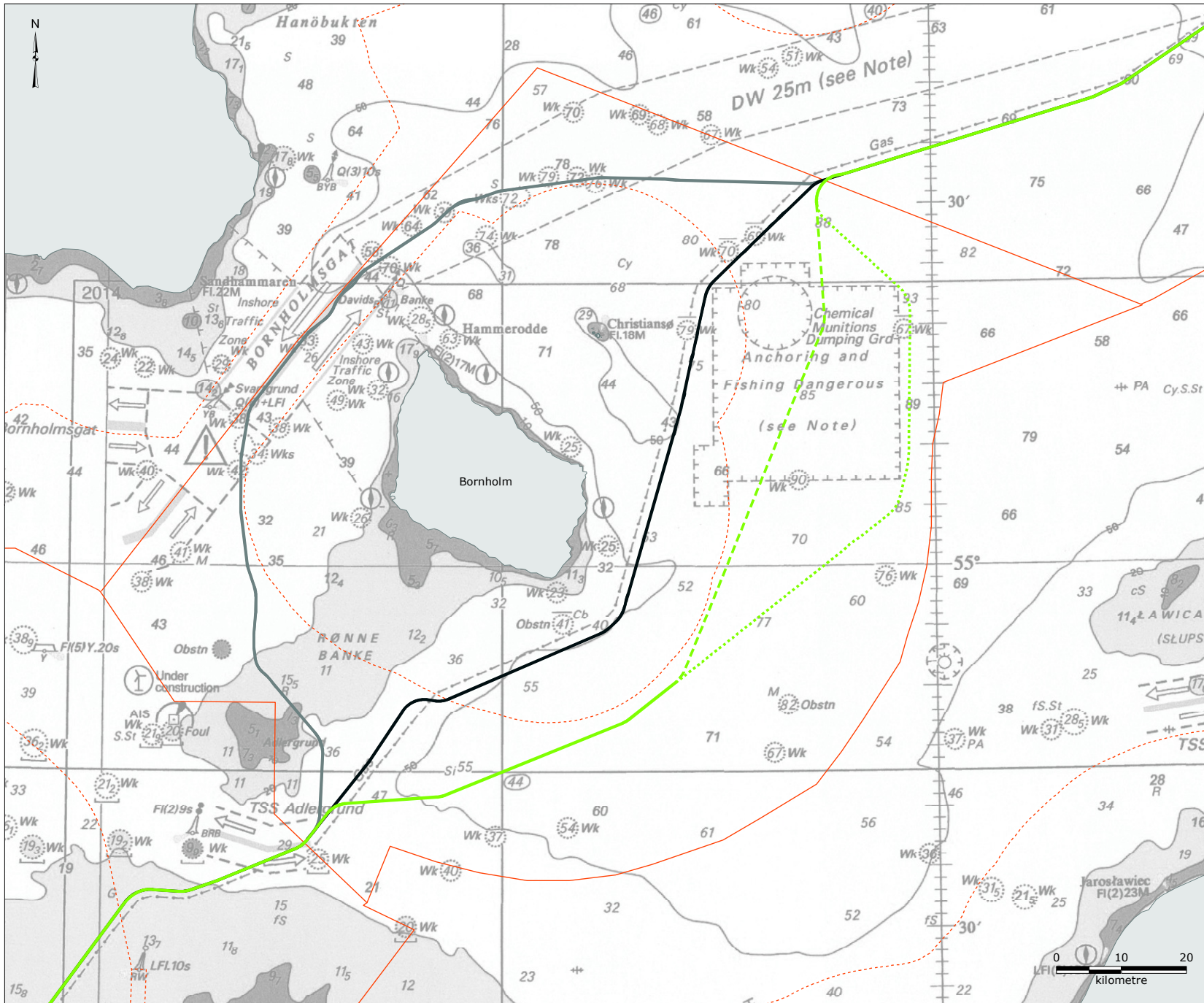
- Pipe coating plant / pipe storage site
- Pipe storage site

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**PR-01**

**NSP2 pipeline route and onshore facilities**

**RAMBOLL**



**Legend:**

NSP2 route alternatives:

- Base case route
- NW route
- SE route
- - - SE route V1
- SE route V2
- ··· Territorial water border
- EEZ border

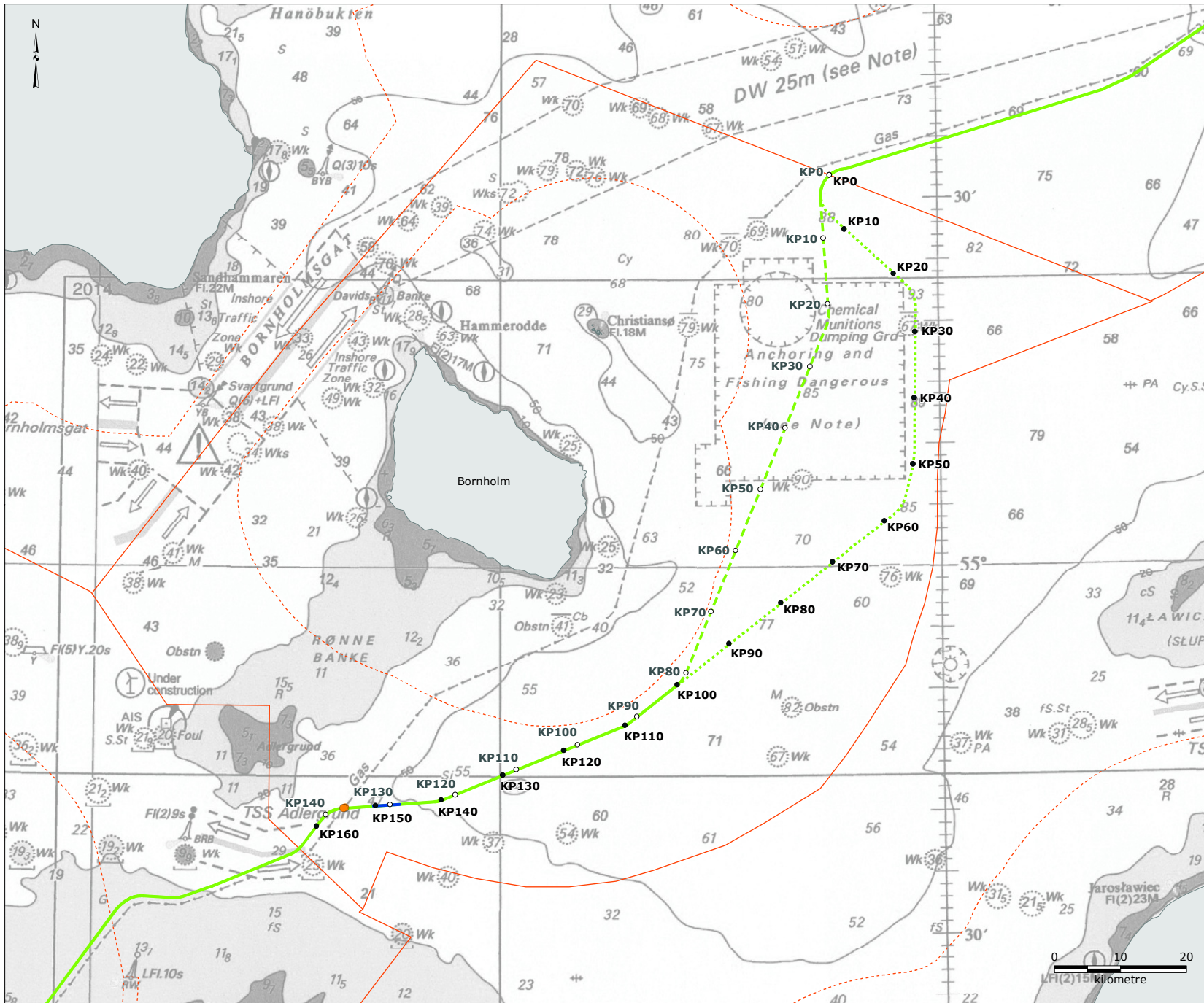
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 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK/CASO

**PR-02-D**

**Alternative pipeline routes**







**Legend:**

- NSP2 route
- - - NSP2 route V1
- . . . NSP2 route V2
- - - Territorial water border
- EEZ border
- Post-lay trenching or rock placement
- Spot rock placement, pipeline crossing
- KP (kilometre point) - NSP2 route V1
- KP (kilometre point) - NSP2 route V2

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**PR-03-D**

**NSP2 pipeline route and anticipated seabed intervention works**



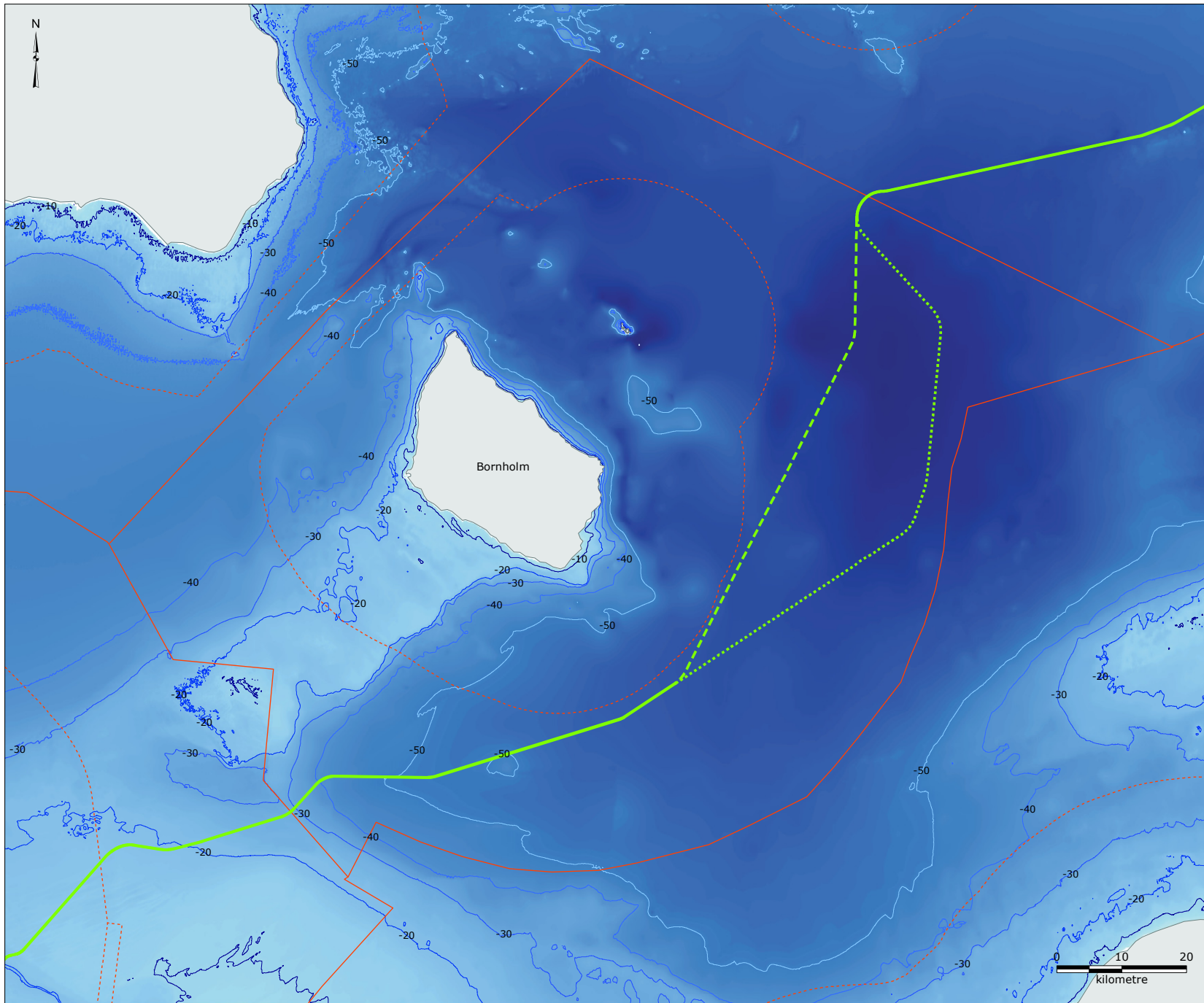
# PHYSICAL-CHEMICAL ENVIRONMENT

BATHYMETRY AND HYDROGRAPHY

WATER QUALITY

GEOLOGY AND SEABED

CLIMATE



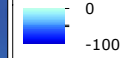
**Legend:**

- NSP2 route
- - - NSP2 route V1
- . . . NSP2 route V2
- - - Territorial water border
- EEZ border

**Depth contour (m):**

- -10
- -20
- -30
- -40
- -50
- -100

**Bathymetry [depth (m)]:**



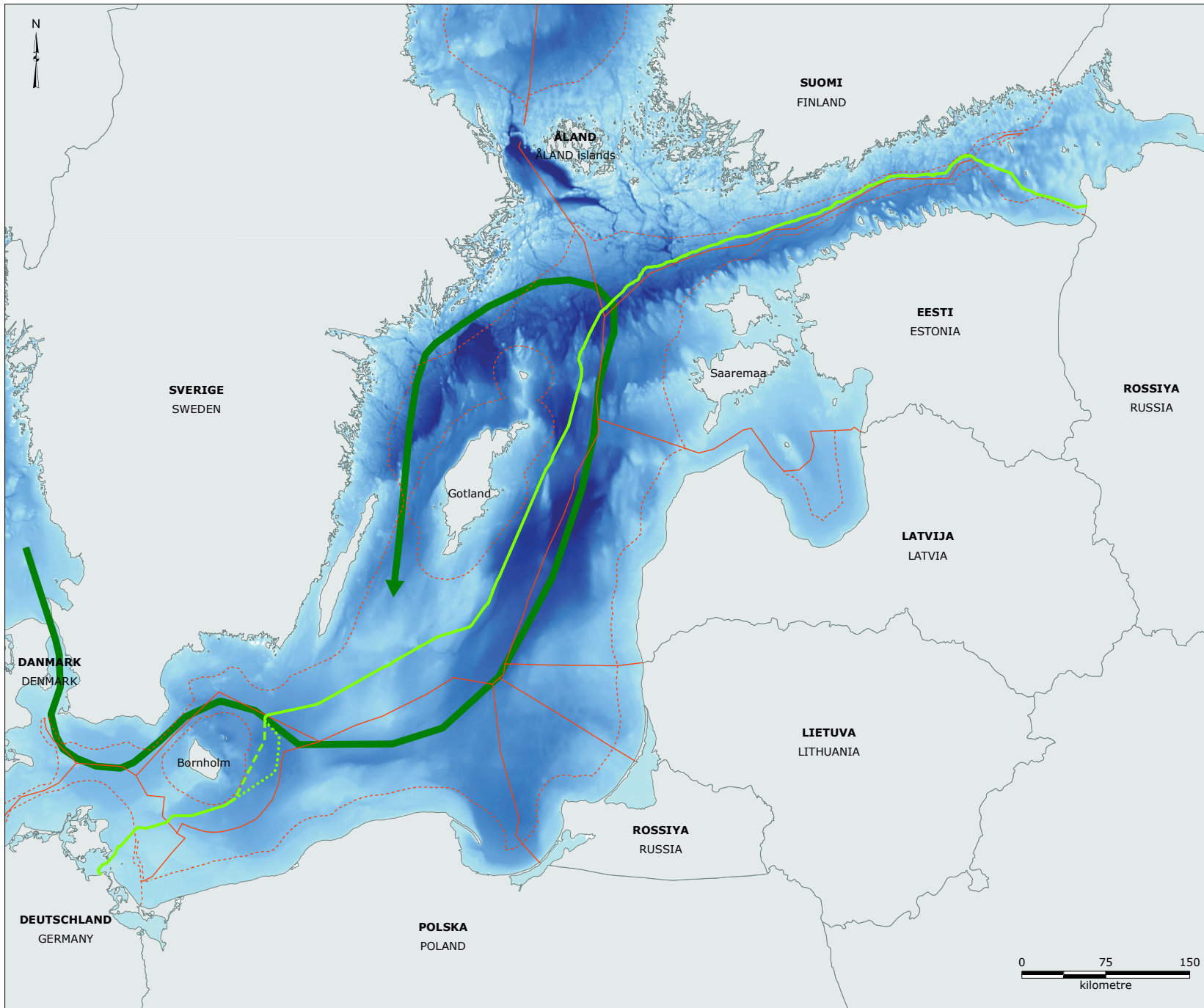
Reference:  
 -EMODnet, 2018,  
<http://portal.emodnet-bathymetry.eu/?menu=19>,  
 Date accessed: 2019-01-23

Version: 05  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: KEBS

**BA-01-D**

**Bathymetry**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- ⋯ NSP2 route V2
- - - Territorial water border
- EEZ border
- Inflow of oxygen-rich water

**Bathymetry [depth (m)]:**

- High : 0
- Low : -200

**References:**

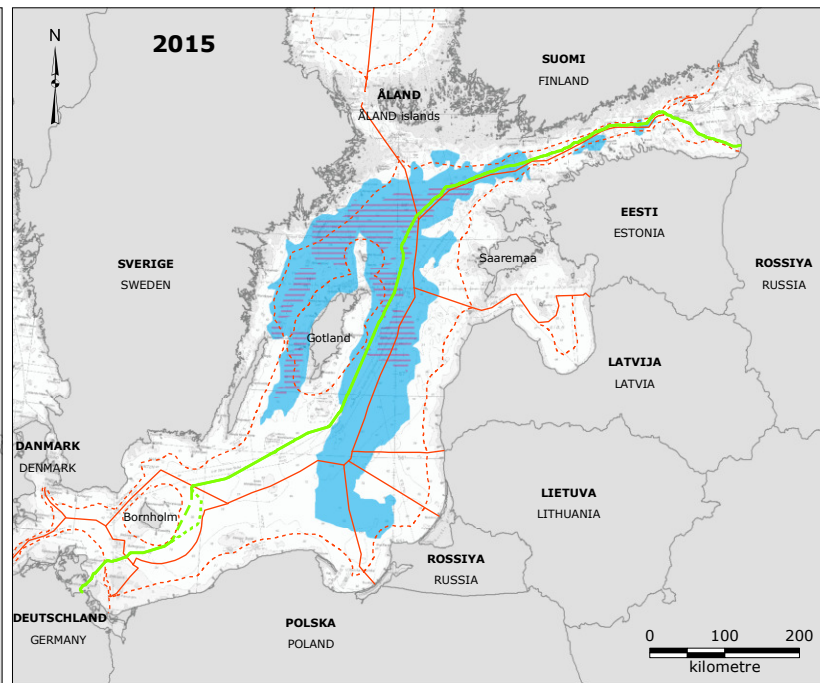
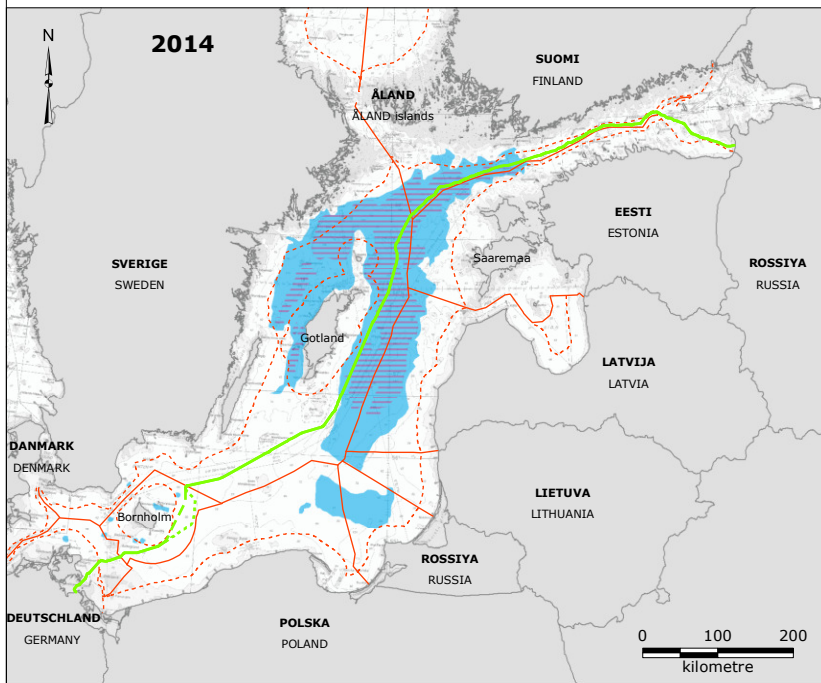
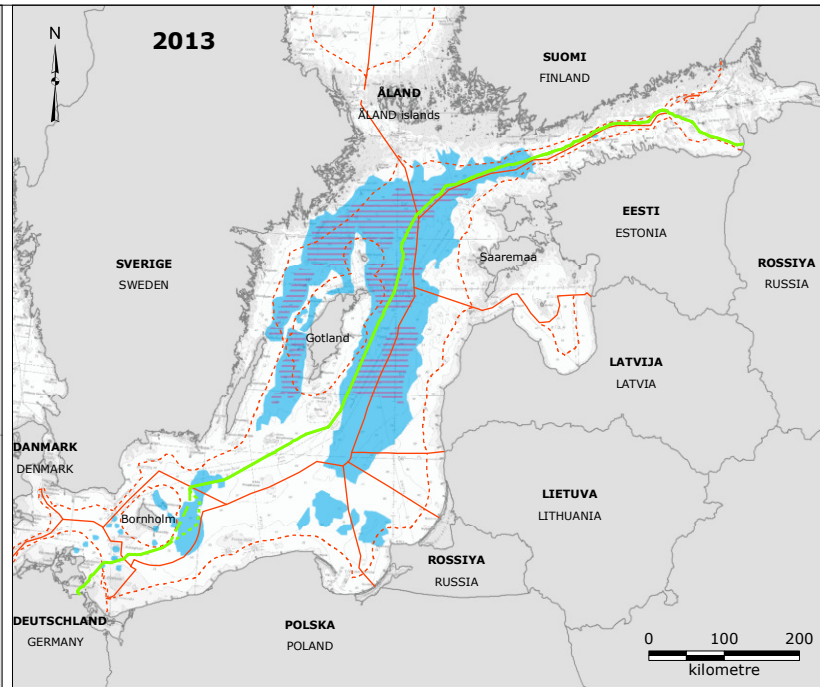
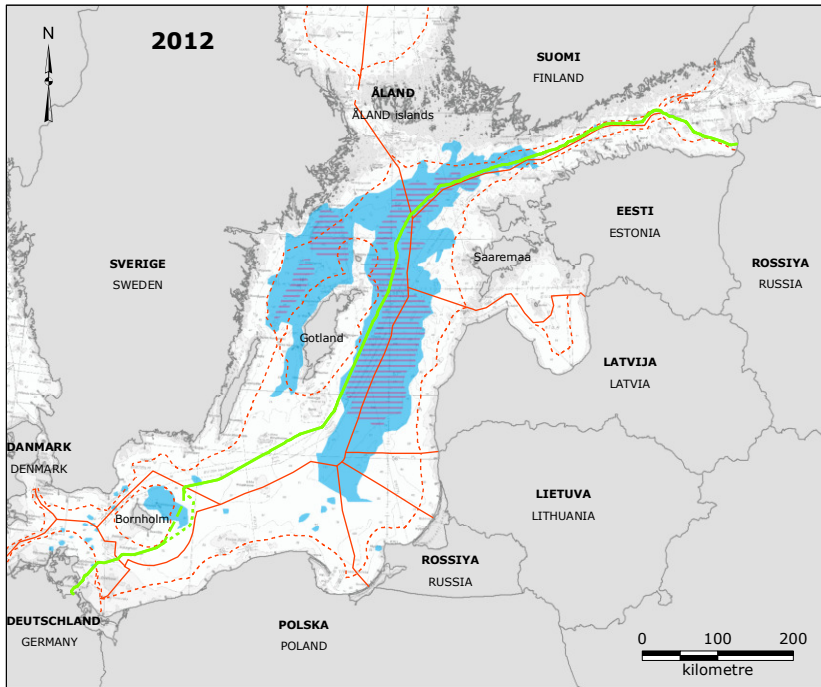
- Binczewska, A., Moros, M., Asteman, I. P., Slawinska, J., Bak, M., 2017, Changes in the inflow of saline water into the Bornholm Basin (SW Baltic Sea) during the past 7100 years - evidence from benthic foraminifera record. Boreas 47, 297-310.  
 - EMODnet, 2018, <http://portal.emodnet-bathymetry.eu/?menu=19>, Date accessed: 2019-01-23

Version: 05  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: KEBS

**BA-02**

**Inflow of oxygen-rich water to the Baltic Sea**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- · · NSP2 route V2
- - - Territorial water border
- EEZ border
- Hypoxic (oxygen content ≤ 2 mg/l)
- Anoxic (oxygen content = 0 mg/l)

Note:  
- Anoxic and hypoxic areas in the Baltic Sea, Autumn 2012, 2013, 2014 and 2015

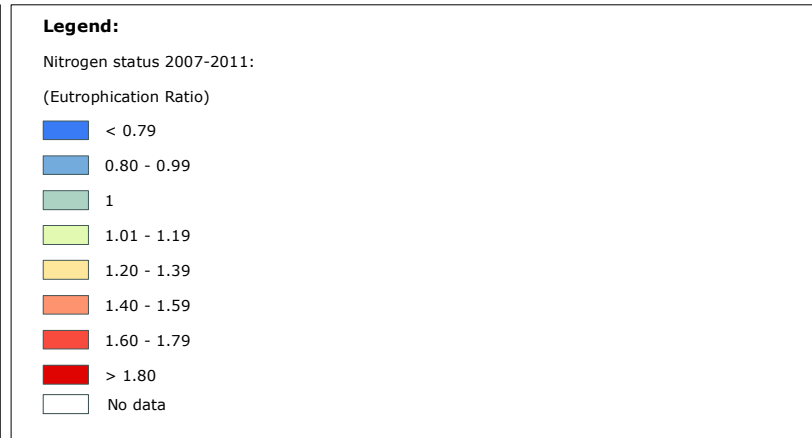
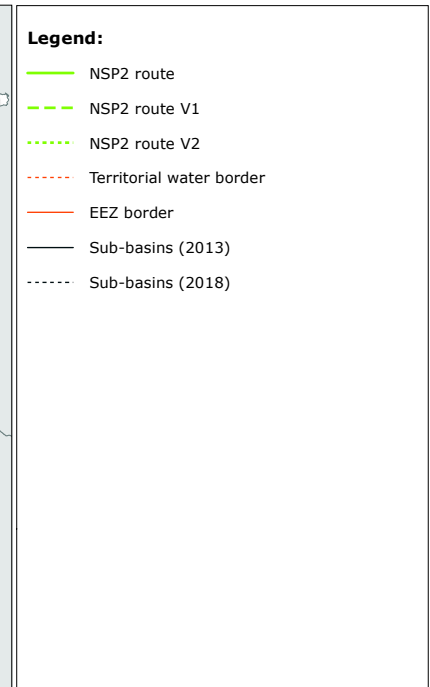
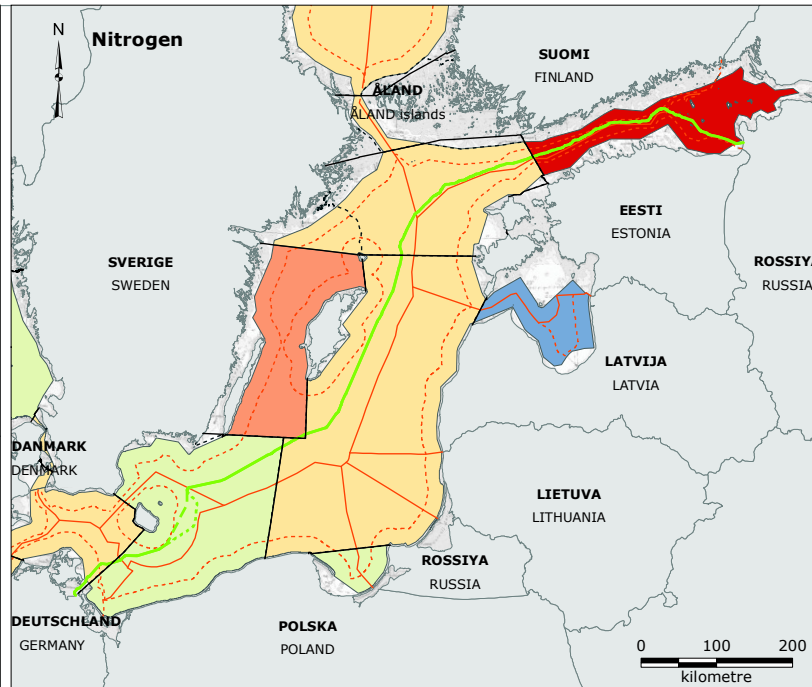
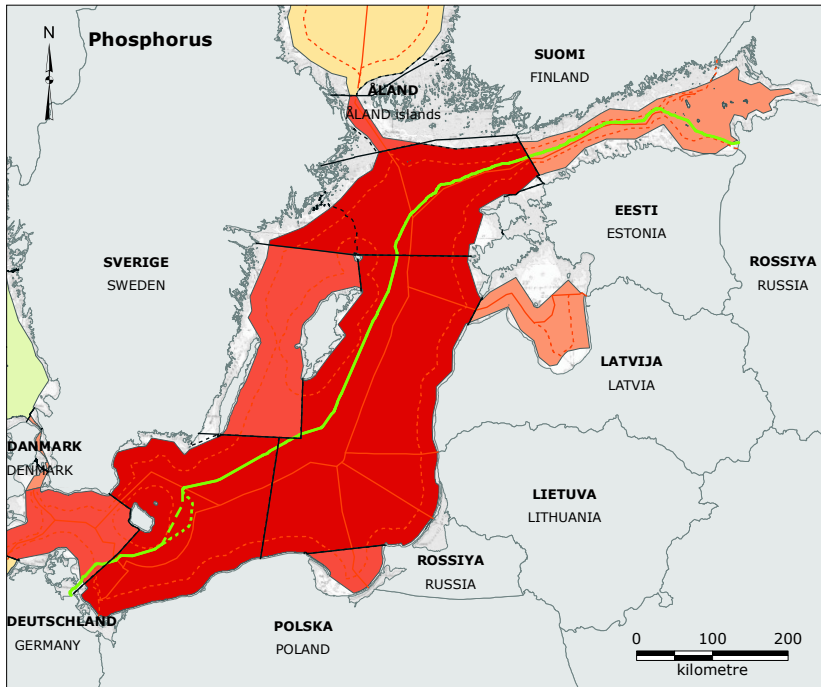
References:  
- SMHI, 2013, "Oxygen Survey in the Baltic Sea, 2013 - Extent of Anoxia and Hypoxia, 1960-2013". SMHI Report Oceanography No. 49  
- SMHI, 2015, "Oxygen Survey in the Baltic Sea, 2015 - Extent of Anoxia and Hypoxia, 1960-2015". SMHI Report Oceanography No. 53

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**WA-01**

**Anoxic and hypoxic areas**





Note:

- Left: Eutrophication Ratio: Concentration of Dissolved Inorganic Phosphorus (DIP) in surface water (0-10 m) as winter average 2007-2011, relative to target concentration of Good Environmental Status (GES). The GES-boundary is set at ER ≤ 1.00.
- Right: Eutrophication Ratio: Concentration of Dissolved Inorganic Nitrogen (DIN) in surface water (0-10 m) as winter average 2007-2011, relative to target concentration of Good Environmental Status (GES). The GES-boundary is set at ER ≤ 1.00.
- Phosphorus and nitrogen data are presented in relation to HELCOM sub-basins as designated in 2013. However, as HELCOM has updated its sub-basin designations in 2018, these boundaries are also shown.

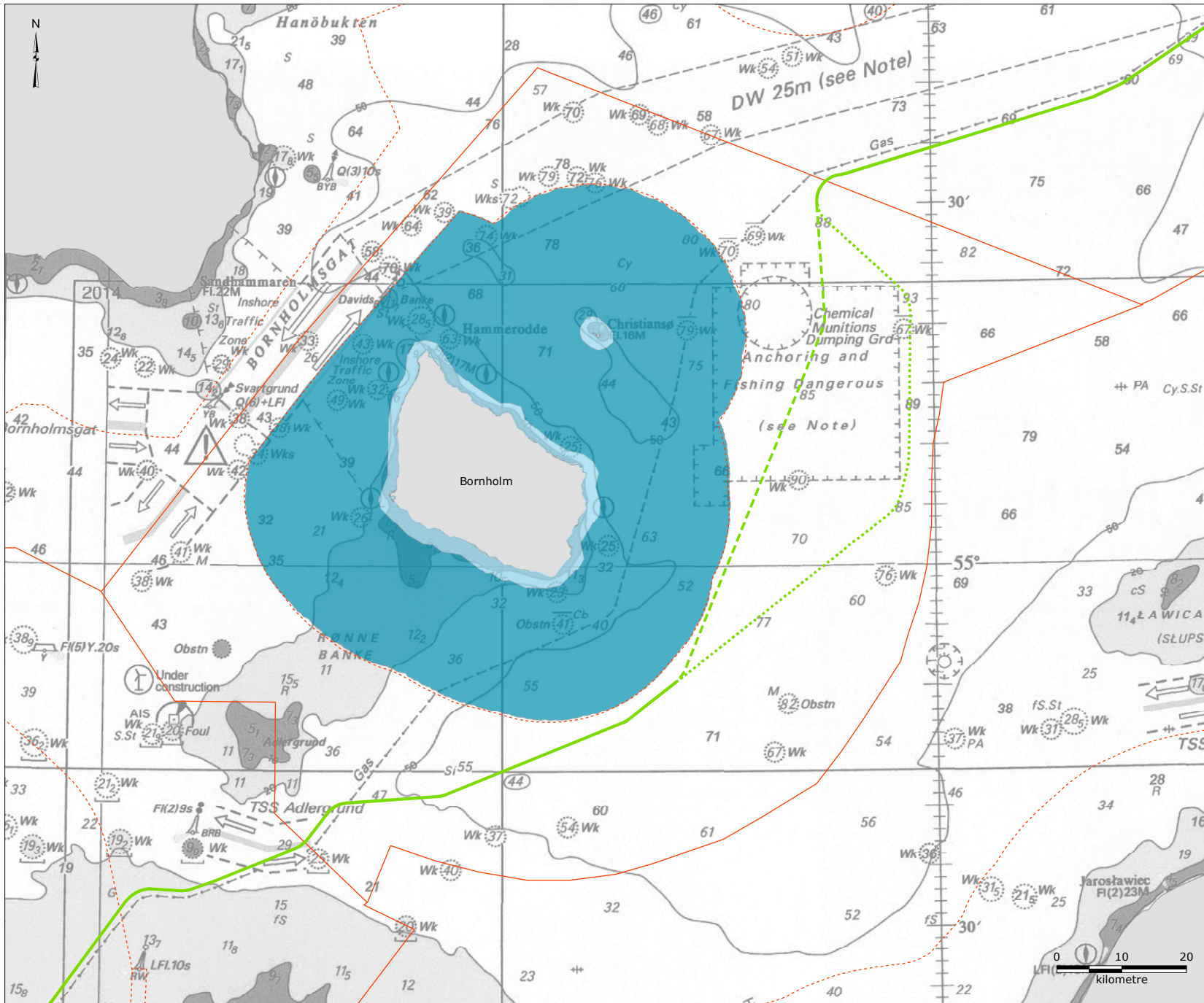
References:

- HELCOM, 2018, "HELCOM subbasins" <http://maps.helcom.fi/website/mapservice/index.htm>, Date accessed: 2019-03-05
- HELCOM, 2013, "HELCOM subbasins", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2016-3-30
- HELCOM, 2017, "Phosphorus status distance to target 2007-2011", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2019-03-05
- HELCOM, 2017, "Nitrogen status distance to target 2007-2011", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2019-03-05

Version: 06  
Date: 2019-04-10  
Prepared: MRIH  
Controlled: KEBS

**WA-02**

**Eutrophication**



**Legend:**

- NSP2 route
- - - NSP2 route V1
- ⋯ NSP2 route V2
- - - Territorial water border
- EEZ border

Water management plans - Denmark:

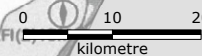
- 1 nm areas
- 12 nm areas

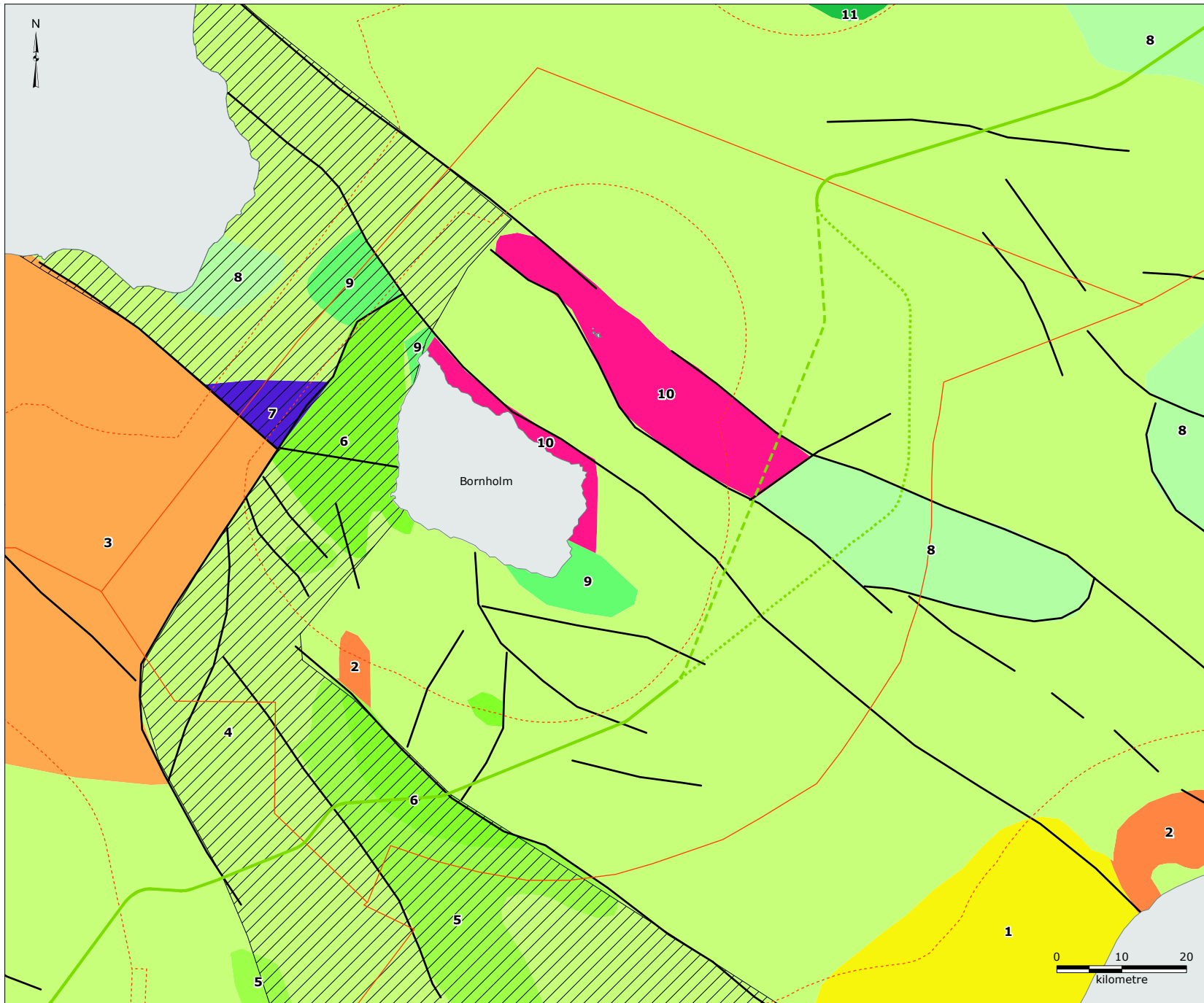
Reference:  
 - The Danish Environmental Protection Agency, 2016,  
 "Water management plans 2015-2021",  
<https://mst.dk/service/miljoegis/vandplaner/>,  
 Date accessed: 2019-05-06

Version: 01  
 Date: 2019-05-06  
 Prepared: MRH  
 Controlled: KEBS

**WA-03-D**

**Water management plans**





**Legend:**

- NSP2 route
  - NSP2 route V1
  - NSP2 route V2
  - Territorial water border
  - EEZ border
  - Faults
  - Tornquist zone
- Geology:**
- (1) Neogene
  - (2) Paleogene
  - (3) Danian limestones
  - (4) Cretaceous chalk and limestones
  - (5) Cretaceous mudstones and sandstones
  - (6) Cretaceous; mainly sandstones and mudstones
  - (7) Triassic; mainly mudstones and sandstones
  - (8) Silurian; mainly limestones, marls, mudstones and shales
  - (9) Cambrian-Ordovician
  - (10) Precambrian crystalline basement
  - (11) Ordovician limestones and shales

References:  
 - Per Ahlberg, 1986: "Den svenske kontinentalsockelns berggrund". Geological Survey of Sweden, Rapporter och meddelanden nr. 47.  
 - Curt Fredén (editor), 1994. "Berg och jord". Sveriges Nationalatlas, SNA Förlag, Stockholm, 208 pp.  
 - Tapio Koistinen (editor), 1994. "Precambrian basement of the Gulf of Finland and surrounding area". 1:1 mill. Geological Survey of Finland, Espoo

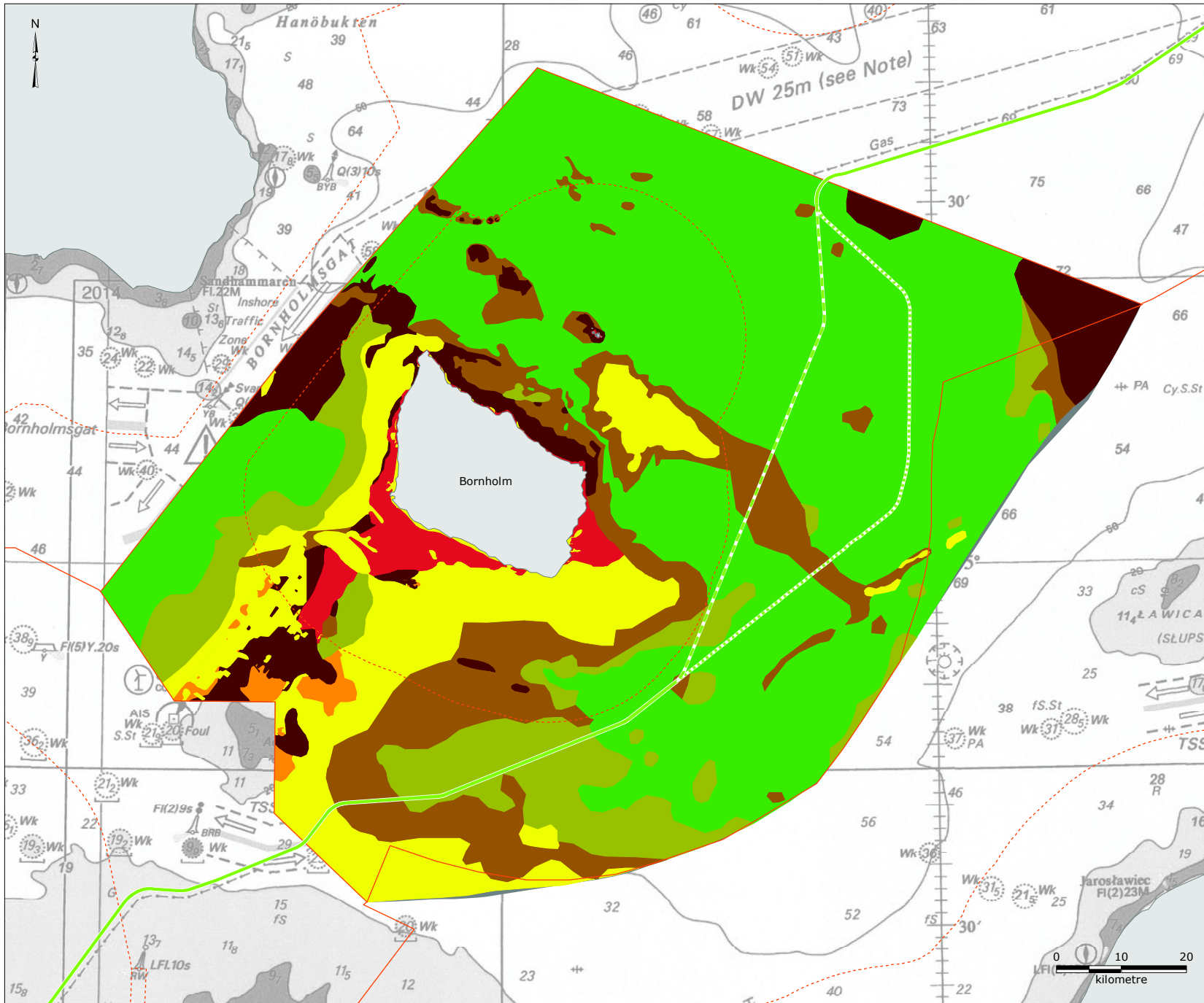
Version: 05  
 Date: 2019-04-10  
 Prepared: MRH  
 Controlled: KEBS

**GE-01-D**

**Geology**







**Legend:**

- NSP2 route
- - - NSP2 route V1
- ⋯ NSP2 route V2
- - - Territorial water border
- EEZ border

**Sediment types:**

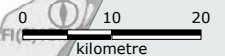
- Mud and sandy mud
- Muddy sand
- Sand
- Gravel and coarse sand
- Till/diamicton
- Quaternary clay and silt
- Sedimentary rock
- No data available

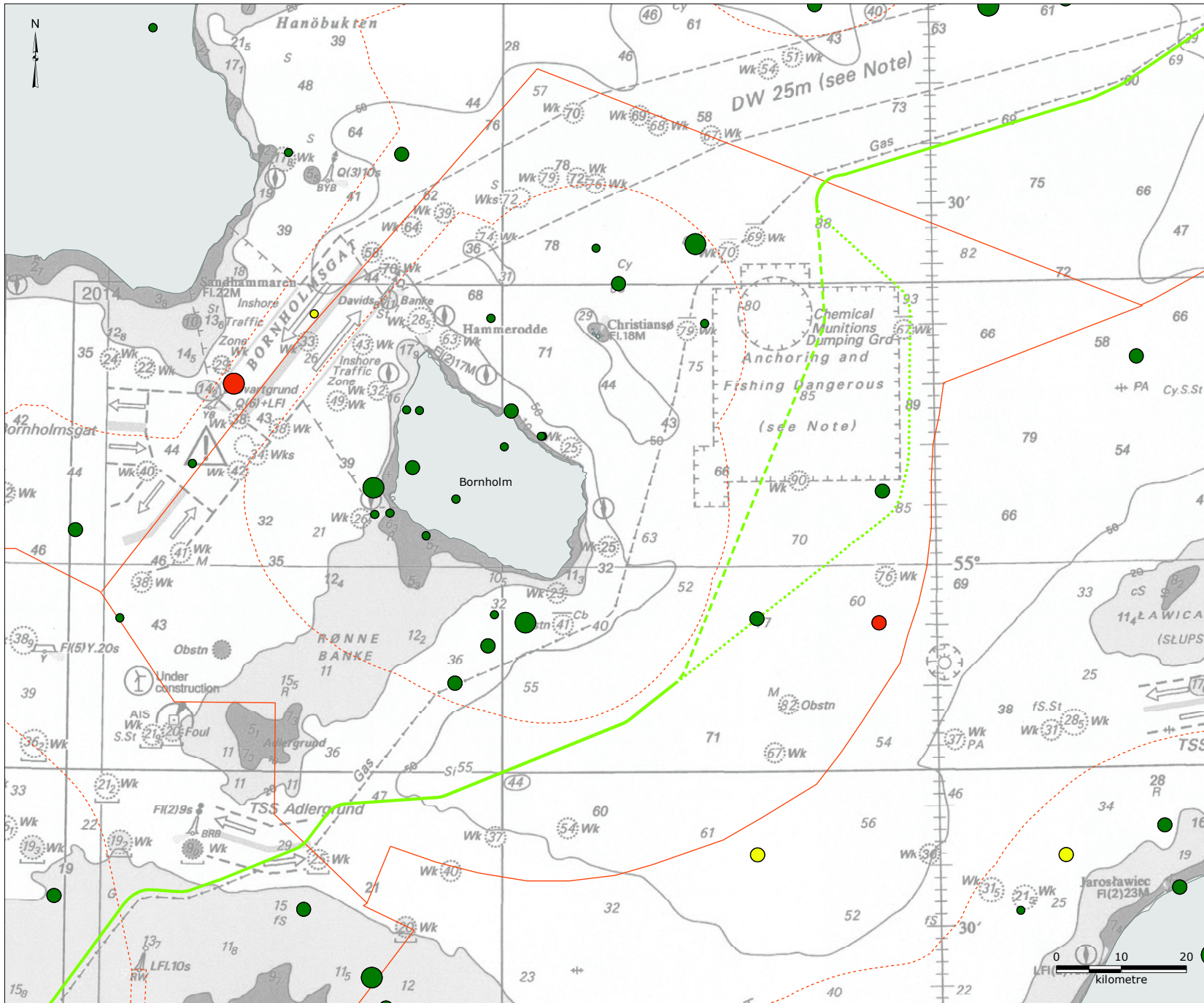
Reference:  
 - GEUS, 2014, "Danmarks digitale havbunds-sedimentkort 1:250.000", Denmark, Date accessed: 2019-03-05

Version: 06  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK/CASO

**GE-02-D**

**Seabed sediments**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- · · NSP2 route V2
- - - Territorial water border
- EEZ border

Magnitude of earthquakes (Richter scale):

- 0 - 1
- > 1 - 2
- > 2 - 3

Depth of earthquakes (km):

- 0 - 35
- > 35 - 70
- > 70 - 150

Note:  
- Seismic activity (epicenter of earthquake) measured in 2000-2018

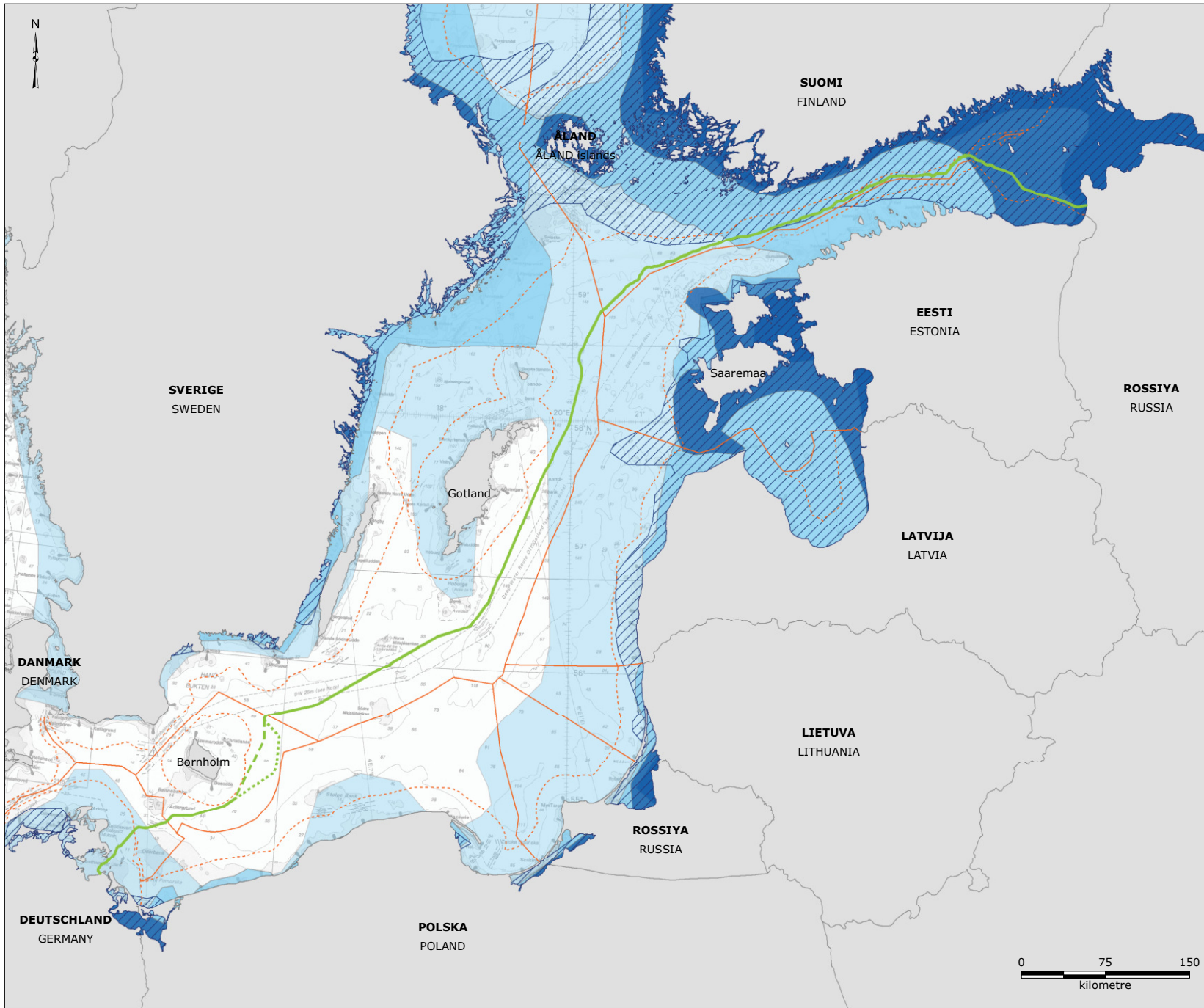
Reference:  
- GEUS, 2019, "Registrerede jordskælvi",  
<https://www.geus.dk/natur-og-klima/jordskaelv-og-seismologi/registerede-jordskaelv-i-danmark/>,  
Date accessed: 2019-03-05

Version: 05  
Date: 2019-04-10  
Prepared: MRIH  
Controlled: MJK/CASO

**GE-03-D**

**Seismic activity**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- ⋯ NSP2 route V2
- - - Territorial water border
- EEZ border
- Ice cover in 2017-2018 (average winter)
- Ice cover in 2016-2017 (mild winter)
- Ice cover in 2014-2015 (mild winter)
- Ice cover in 2012-2013 (average winter)
- Ice cover in 2010-2011 (severe winter)

Reference:  
 - Finnish Meteorological Institute (FMI),  
<http://ilmatieteenlaitos.fi/jaatalvet>,  
 Date accessed: 2019-03-08

Version: 06  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK/CASO

**CL-01**

**Ice cover**



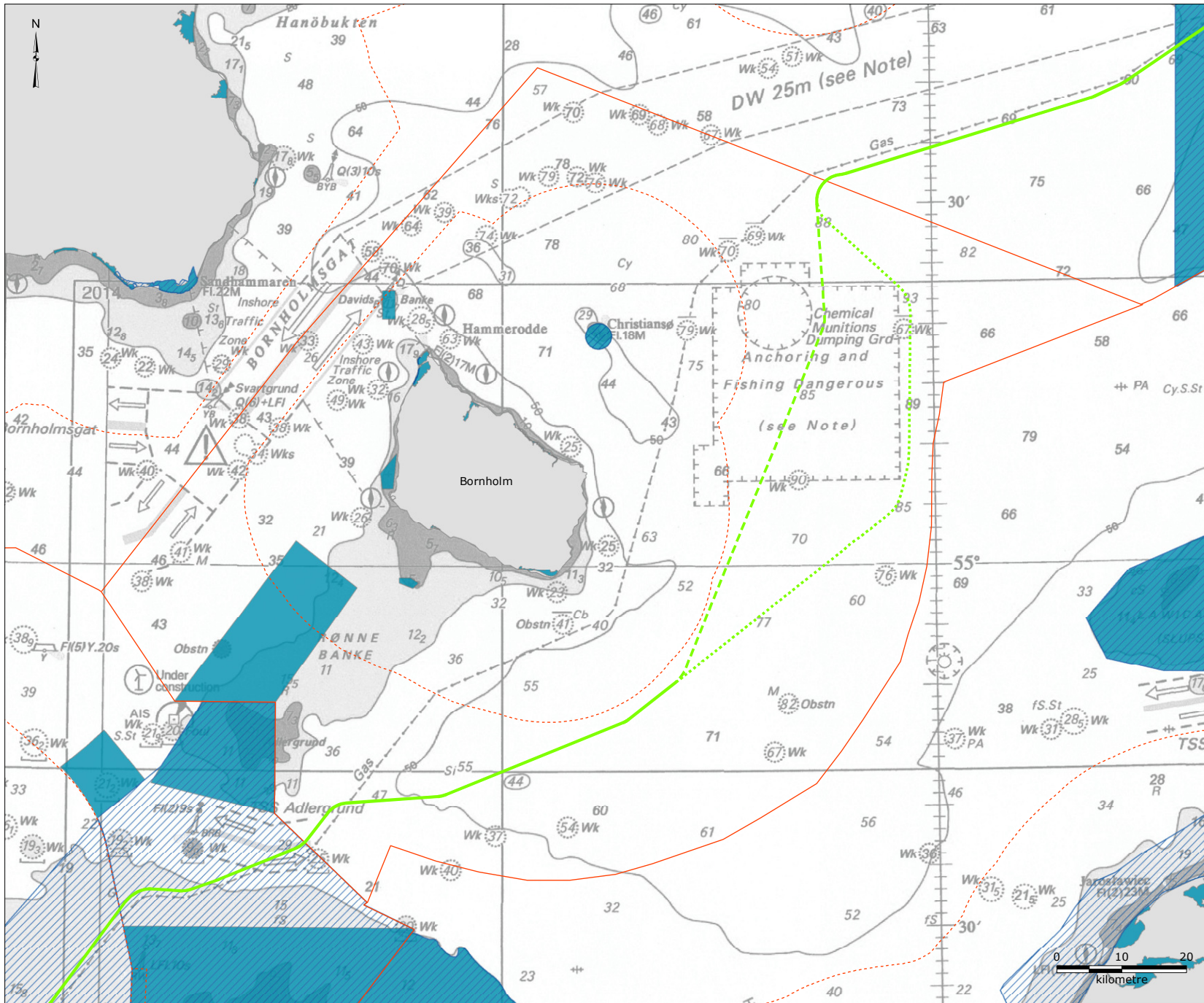
# BIOLOGICAL ENVIRONMENT

PROTECTED AREAS

FISH

MARINE MAMMALS

BIRDS



**Legend:**

- NSP2 route
  - - - NSP2 route V1
  - ⋯ NSP2 route V2
  - - - Territorial water border
  - EEZ border
- Natura 2000 sites:
- Special Protection Area (SPA)
  - Special Area of Conservation/ Special Conservation Interests (SAC/SCI)

References:

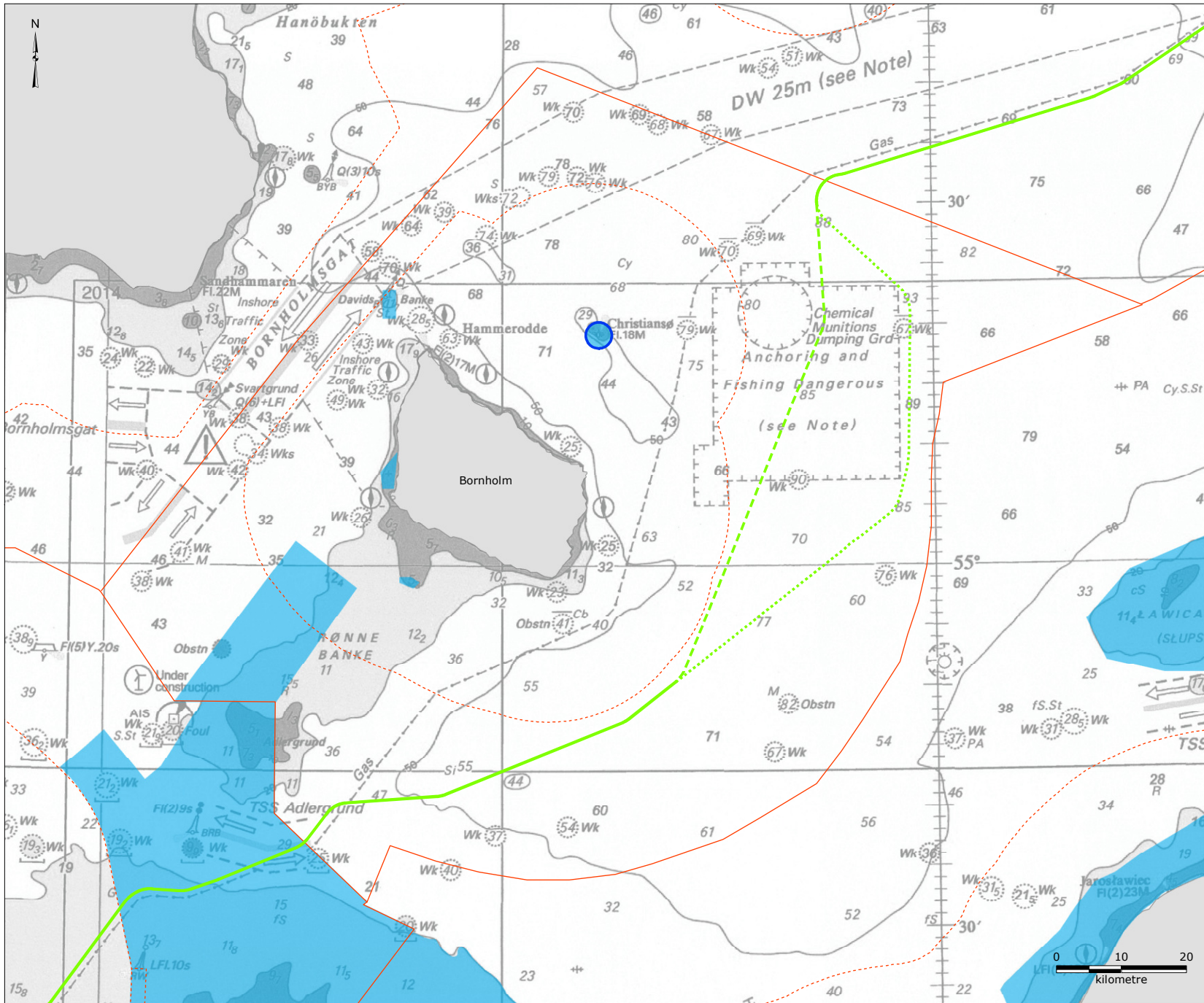
- European Environment Agency, 2017, "Natura 2000 data - the European network of protected sites", <https://www.eea.europa.eu/data-and-maps/data/natura-9>, Date accessed: 2019-03-05
- The Danish Environmental Protection Agency, 2018, "Applicable Natura 2000 sites as of 2018-11-01", <http://miljogis.mim.dk/spatialmap?profile=natura2000-afgrensning-nov2018gaeldende>, Date accessed: 2019-03-05

Version: 05  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK/CASO

**PA-01-D**

**Natura 2000 sites**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- ⋯ NSP2 route V2
- - - Territorial water border
- EEZ border
- Ramsar site
- HELCOM MPA

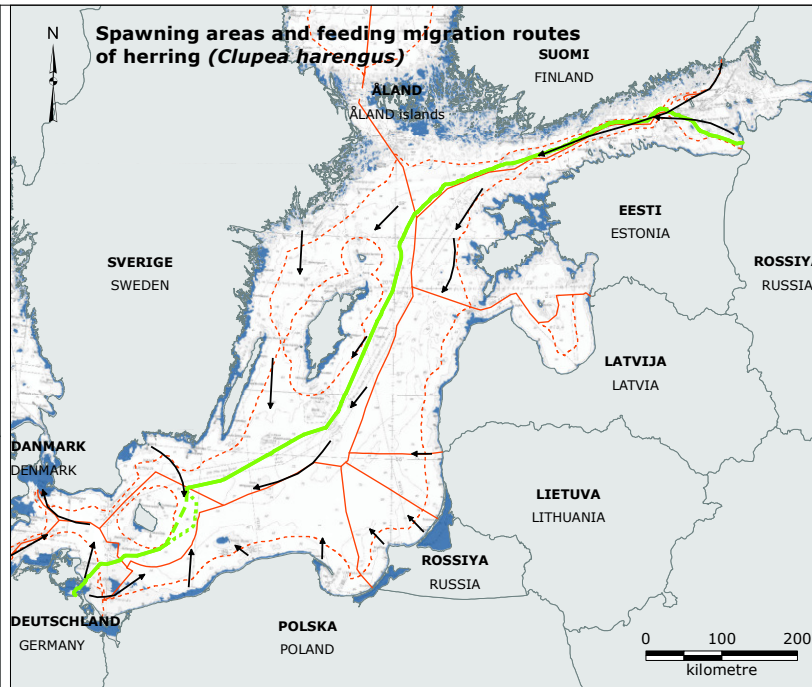
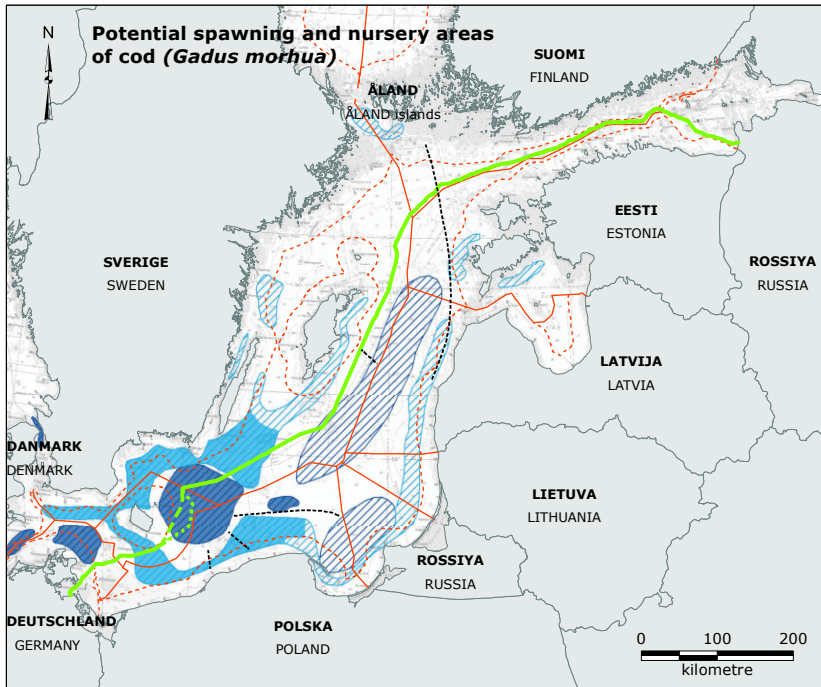
References:  
 - HELCOM, 2017, "Ramsar sites",  
<http://maps.helcom.fi/website/mapservice/index.html>,  
 Data accessed: 2019-03-05  
 - HELCOM, 2019, "HELCOM MPAs",  
<http://maps.helcom.fi/website/mapservice/index.html>,  
 Date accessed: 2019-03-05

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**PA-02-D**

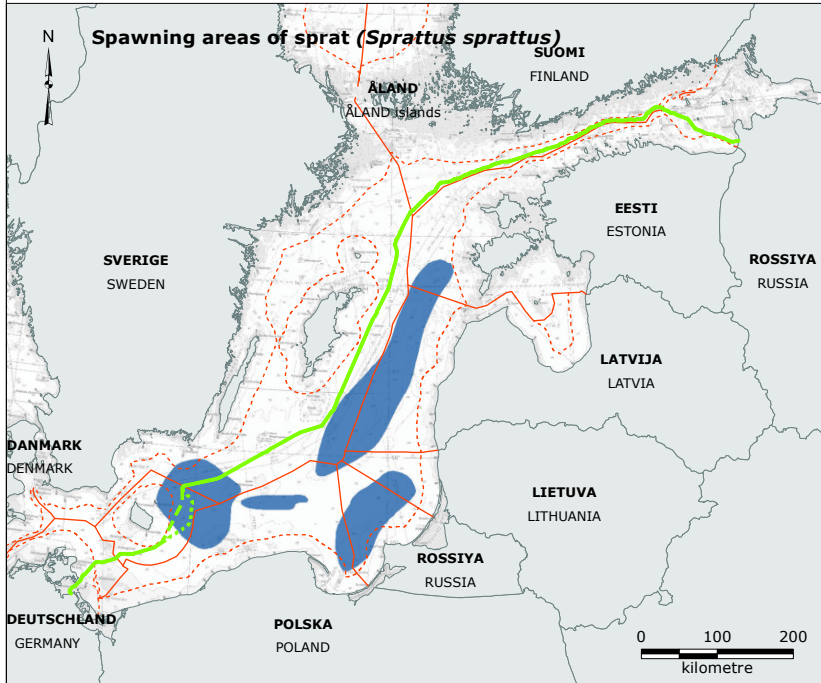
**Ramsar sites and Marine Protected Areas (MPAs)**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- · · NSP2 route V2
- - - Territorial water border
- EEZ border
- Nursery area
- Spawning area
- Previous nursery area
- Previous spawning area
- Spawning migration
- Migration routes to feeding areas



Note:  
 - Spawning migration: Movement of individual fish from non-spawning to spawning site  
 - Where areas are referred to as 'previous', this refers to up to the year 2000 /ICES 2012/

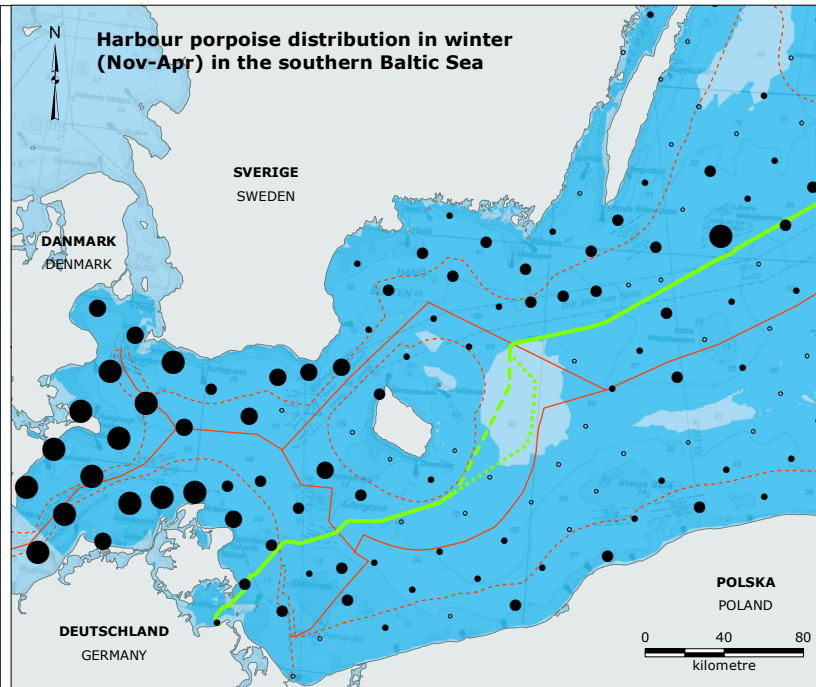
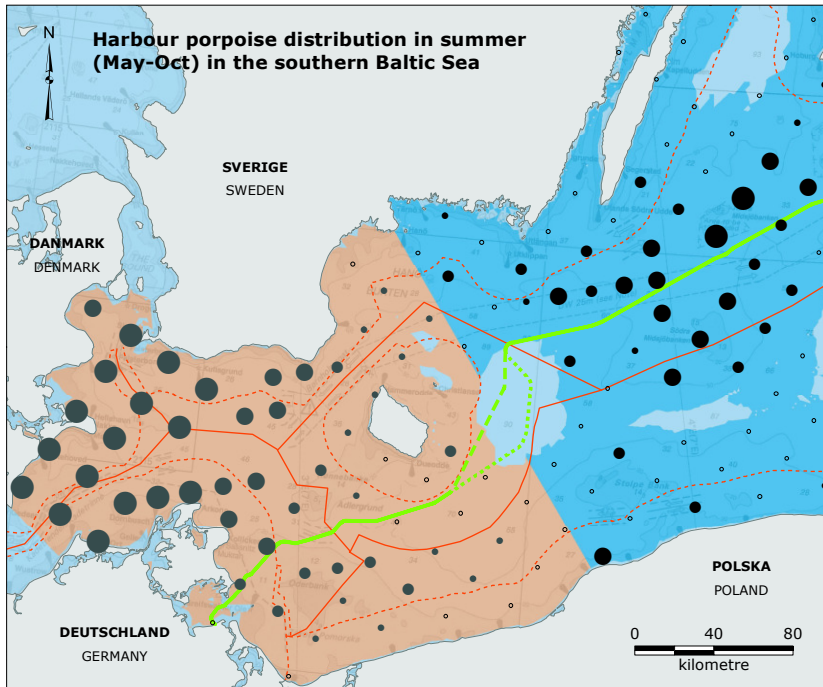
References:  
 - Bagge, O., Thurøw, F., Steffensen, E., Bay, J. 1994. "The Baltic Cod", Dana, 10, pp. 1-28  
 - Cardinale, M., Svedång, H., 2011. "The beauty of simplicity in science: Baltic cod stock improves rapidly in "cod hostile" ecosystem state". Marine Ecology Progress Series, 425, pp. 297-301  
 - ICES, 2012, "Report of the ICES Advisory Committee". ICES advice 2012, Book 8. ICES, Copenhagen.  
 - ICES, 2006. "ICES advice. Book 9. Widely distributed and Migratory stocks".  
 - Pliks and Aleksjevs, 1998. "Latvijas baba". Riga  
 - Aro, E., 2000. "The spatial and temporal distribution patterns of cod (*Gadus morhua callarias*) in the Baltic Sea and their dependence on environmental variability implications for fishery management". Academic dissertation. University of Helsinki and Finnish Game and Fisheries Research Institute. Helsinki, 2000

Version: 06  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK/ CASO

**FI-01**

**Spawning areas of cod, herring and sprat**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- . . . NSP2 route V2
- - - Territorial water border
- EEZ border

**Legend:**

Population area:	Baltic, Summer (May - Oct)	Belt Sea, Summer (May - Oct)
<span style="background-color: #00FFFF; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Baltic	Porpoise Positive Seconds per day:	Porpoise Positive Seconds per day:
<span style="background-color: #FFDAB9; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Belt Sea	• 0.002 - 0.1	• 0.023 - 1
<span style="background-color: #ADD8E6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> No Data	• > 0.1 - 1	• > 1 - 10
	• > 1 - 10	• > 10 - 100
	• > 10 - 248	• > 100 - 3015
		◦ Zero detections

**Legend:**

Population areas:	Baltic, Winter (Nov - Apr)
<span style="background-color: #00FFFF; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Baltic	Porpoise Positive Seconds per day:
<span style="background-color: #ADD8E6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> No Data	• 0.003 - 1
	• > 1 - 10
	• > 10 - 100
	• > 100 - 1856
	◦ Zero detections

Notes:  
 - Harbour porpoise (*Phocoena phocoena*) distribution in winter (Nov-Apr) and summer (May-Oct)  
 - It is only possible to separate the Baltic Sea and Belt Sea harbour porpoise populations in summer  
 - Porpoise Positive Seconds is the encounter rate, measured as proportion of click positive seconds per second  
 - Data collected by CPODs under the Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise project

References:  
 - SAMBAH, 2016, "Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise (SAMBAH). Final report under the LIFE+ project LIFE08 NAT/S/000261", Kolmårdens Djurpark AB, SE-618 92 Kolmården, Sweden. 81pp.  
 - DCE, 2018, "Marine mammals report, NSP2 alternative route"

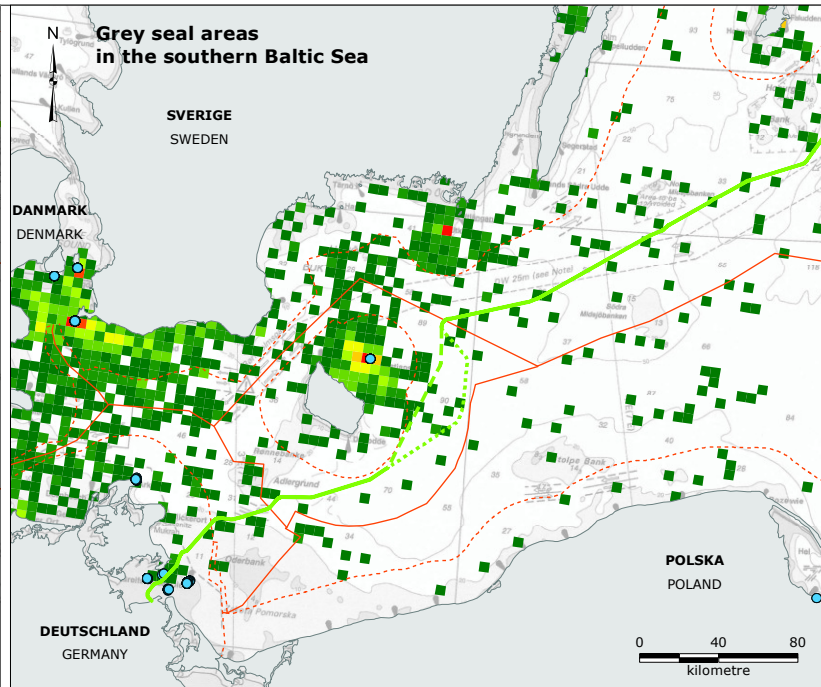
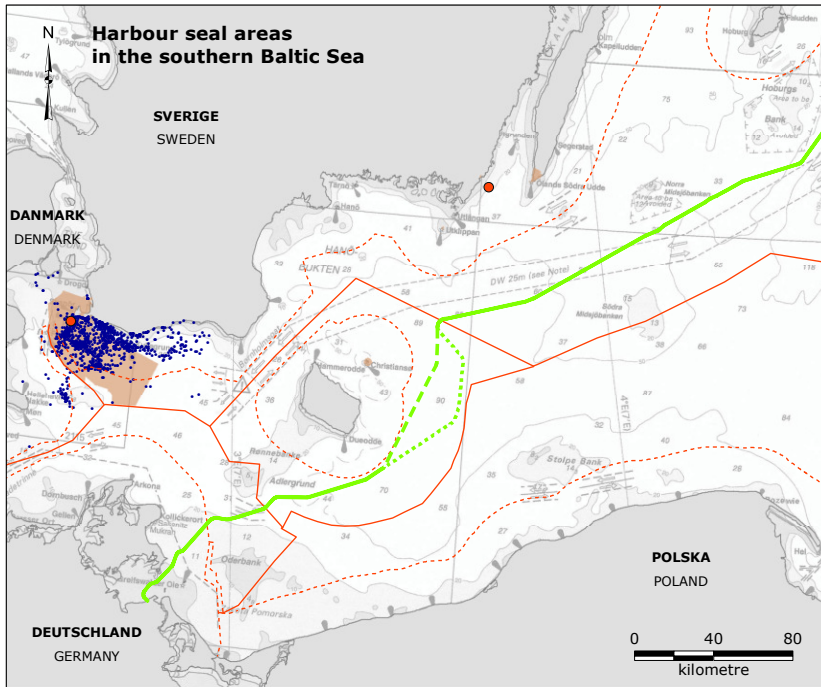
Version: 05  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK

**MA-01**

**Harbour porpoise distribution**







**Legend:**

- NSP2 route
- - - NSP2 route V1
- · · NSP2 route V2
- - - Territorial water border
- EEZ border

**Legend:**

Harbour seals (*Phoca vitulina*):

- Satellite tracking location
- Harbour seal haul out
- Natura 2000 site designated for harbour seal

**Legend:**

Grey seals (*Halichoerus grypus grypus*):

- Grey seal colony
- |                                                                                                              |                                                                                                            |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Grey seal distribution:                                                                                      | <span style="background-color: yellow; width: 15px; height: 15px; display: inline-block;"></span> 18 - 25  |
| (Number of observations)                                                                                     | <span style="background-color: orange; width: 15px; height: 15px; display: inline-block;"></span> 26 - 45  |
| <span style="background-color: darkgreen; width: 15px; height: 15px; display: inline-block;"></span> 1 - 2   | <span style="background-color: red; width: 15px; height: 15px; display: inline-block;"></span> 46 - 77     |
| <span style="background-color: green; width: 15px; height: 15px; display: inline-block;"></span> 3 - 6       | <span style="background-color: orange; width: 15px; height: 15px; display: inline-block;"></span> 78 - 113 |
| <span style="background-color: lightgreen; width: 15px; height: 15px; display: inline-block;"></span> 7 - 11 | <span style="background-color: red; width: 15px; height: 15px; display: inline-block;"></span> 114 - 432   |
| <span style="background-color: limegreen; width: 15px; height: 15px; display: inline-block;"></span> 12 - 17 |                                                                                                            |

Note:  
 - Satellite tracking based on number of tagged seals  
 - Regular occurrence represents maximum tagging distance from colony

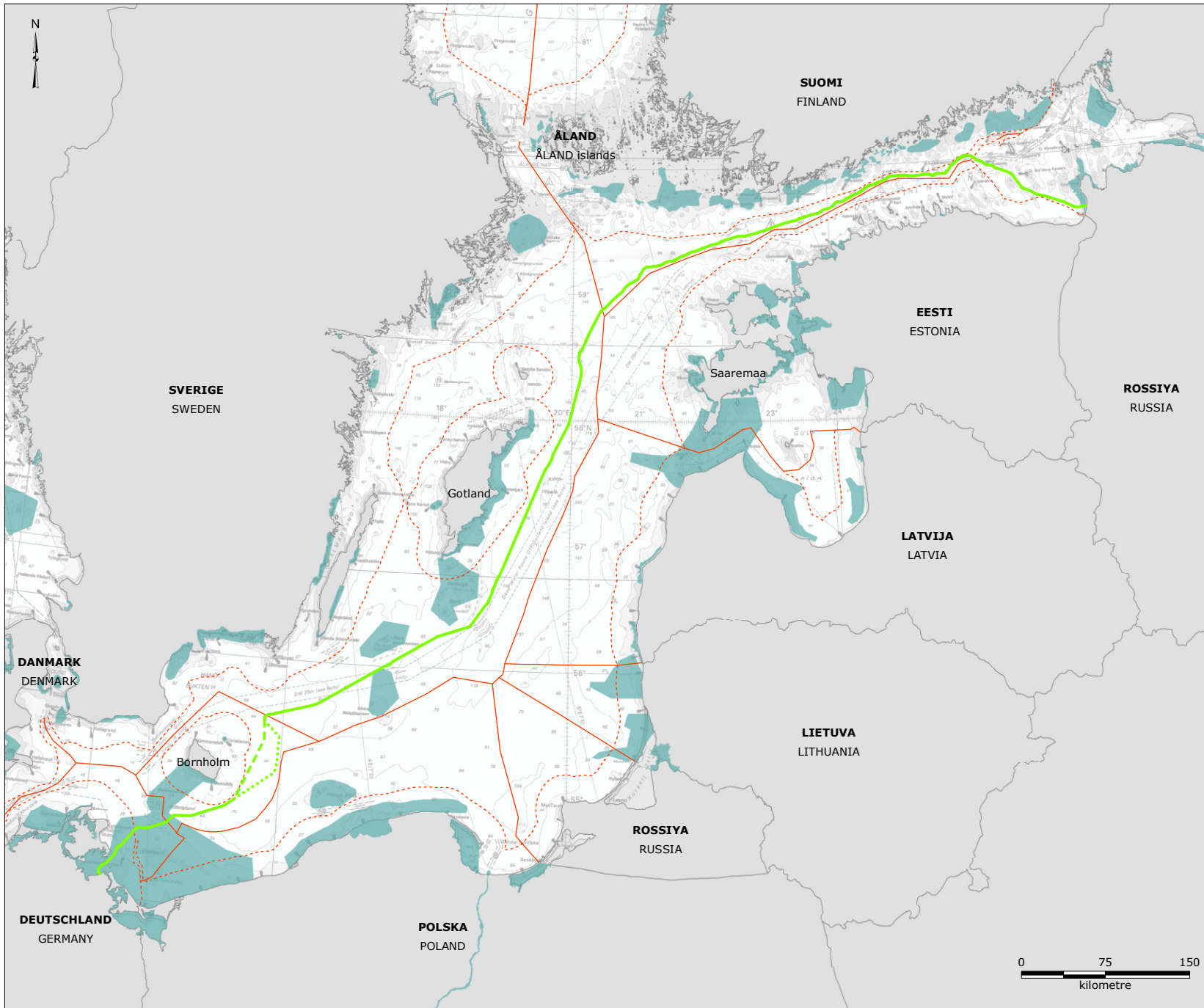
References:  
 - HELCOM, BALSAM, 2015, BALSAM\_GreySeal\_5KGrid", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2018-07-10  
 - DCE, 2018, "Marine mammals report, NSP2 alternative route"

Version: 05  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK

**MA-02**

**Harbour seal and grey seal areas**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- . . . NSP2 route V2
- - - Territorial water border
- EEZ border
- Important Bird and Biodiversity Areas (IBA)

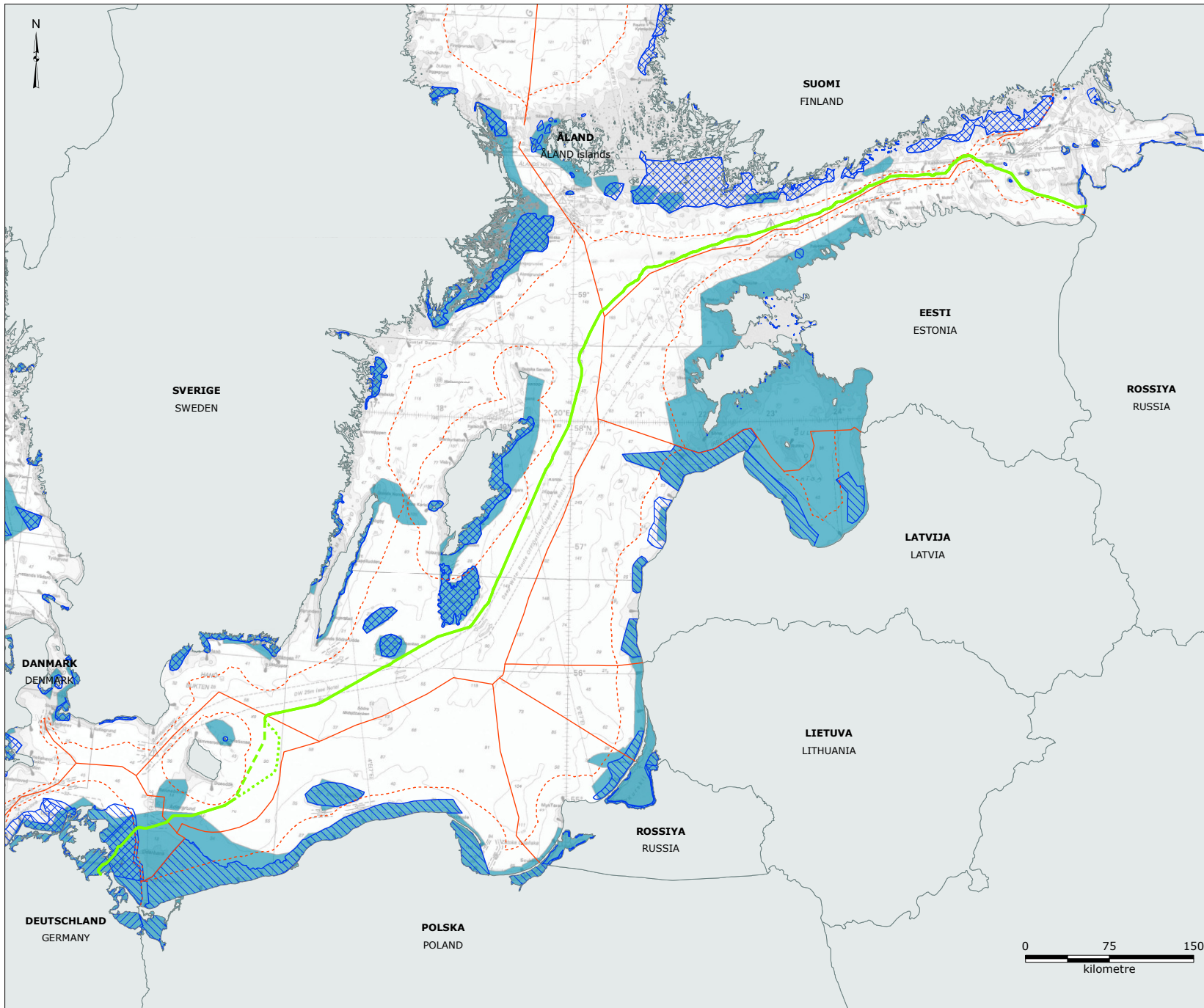
References:  
 - BirdLife International, 2016, "Marine IBA e-atlas", <http://maps.birdlife.org/marineIBAs/default.html>, Date accessed: 2016-03-01  
 - BirdLife Finland, 2016, <http://www.birdlife.fi/suojelu/paikat/iba/iba-suomen-tarkeat-lintualueet.shtml>, Date accessed: 2016-09-15  
 - HELCOM, 2003, "Important Bird Areas - digital map", <http://maps.helcom.fi/website/Biodiversity/index.html>, Date accessed: 2015-06-11

Version: 06  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK/CASO

**BI-01**

**Important Bird and Biodiversity Areas (IBAs)**





**Legend:**

- NSP2 route
- - - NSP2 route V1
- ⋯ NSP2 route V2
- - - Territorial water border
- EEZ border
- ▨ Waterbirds during migration (spring and autumn)
- ▩ Waterbirds during breeding season (spring and summer)
- Wintering areas for sea and shore birds in the Baltic Sea

References:  
 - HELCOM, 2017, "Staging areas migrating sea shore birds (BRISK)", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2019-03-05  
 - HELCOM, 2017, "Breeding areas birds region (BRISK)", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2019-03-05  
 - HELCOM, 2017, "Wintering areas sea and shore birds (BRISK)", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2019-03-05

Version: 06  
 Date: 2019-04-10  
 Prepared: MRIH  
 Controlled: MJK/CASO

**BI-02**

**Bird wintering and staging areas during migration**

