



ATLAS

Environmental Impact Assessment, Denmark
North-western route

Nord Stream 2

August 2018

W-PE-EIA-PDK-DWG-805-RN0700EN-03

OFFSHORE PIPELINES THROUGH THE BALTIC SEA

ATLAS

Environmental Impact Assessment, Denmark
North-western route

Nord Stream 2

August 2018

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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 1,200 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 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, data gained from the existing Nord Stream pipeline project and on data from Nord Stream 2 field surveys carried out in 2017 – 2018 along the planned pipeline corridor. The references used are shown in the Atlas maps' legends.

Please be aware that the marked route of the pipeline on the maps is not representative of the actual pipeline width. It serves merely as an indication of the route.

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 and Territorial Waters: IBRU May 2010

- Background sea charts are "Not to be used for navigation"

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This Atlas "Nord Stream 2, Environmental impact assessment, Denmark, North-western route" has been translated from the English original version to a Danish version "Nord Stream 2, Vurdering af Virkninger på Miljøet, Danmark, Nord-vestlige rute". In the event that the translated version and the English version conflict, the English version shall prevail.

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- **BIOLOGICAL ENVIRONMENT (7-10)**
- **SOCIO-ECONOMIC ENVIRONMENT (11-17)**
- **MATHEMATICAL MODELLING (18-19)**
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2. **DESCRIPTION OF ALTERNATIVES**
3. **BATHYMETRY AND HYDROGRAPHY**
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5. **GEOLOGY AND SEABED**
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16. **TOURISM**
17. **CULTURAL HERITAGE**
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20. **ENVIRONMENTAL SURVEY STATIONS**

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Map GE-03-D Seabed sediments along the pipeline route

Map GE-04-D Chemical and physical characteristics of seabed sediments

Map GE-05-D Seismic activity

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Map NM-03-D Sound exposure levels

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Environmental survey stations

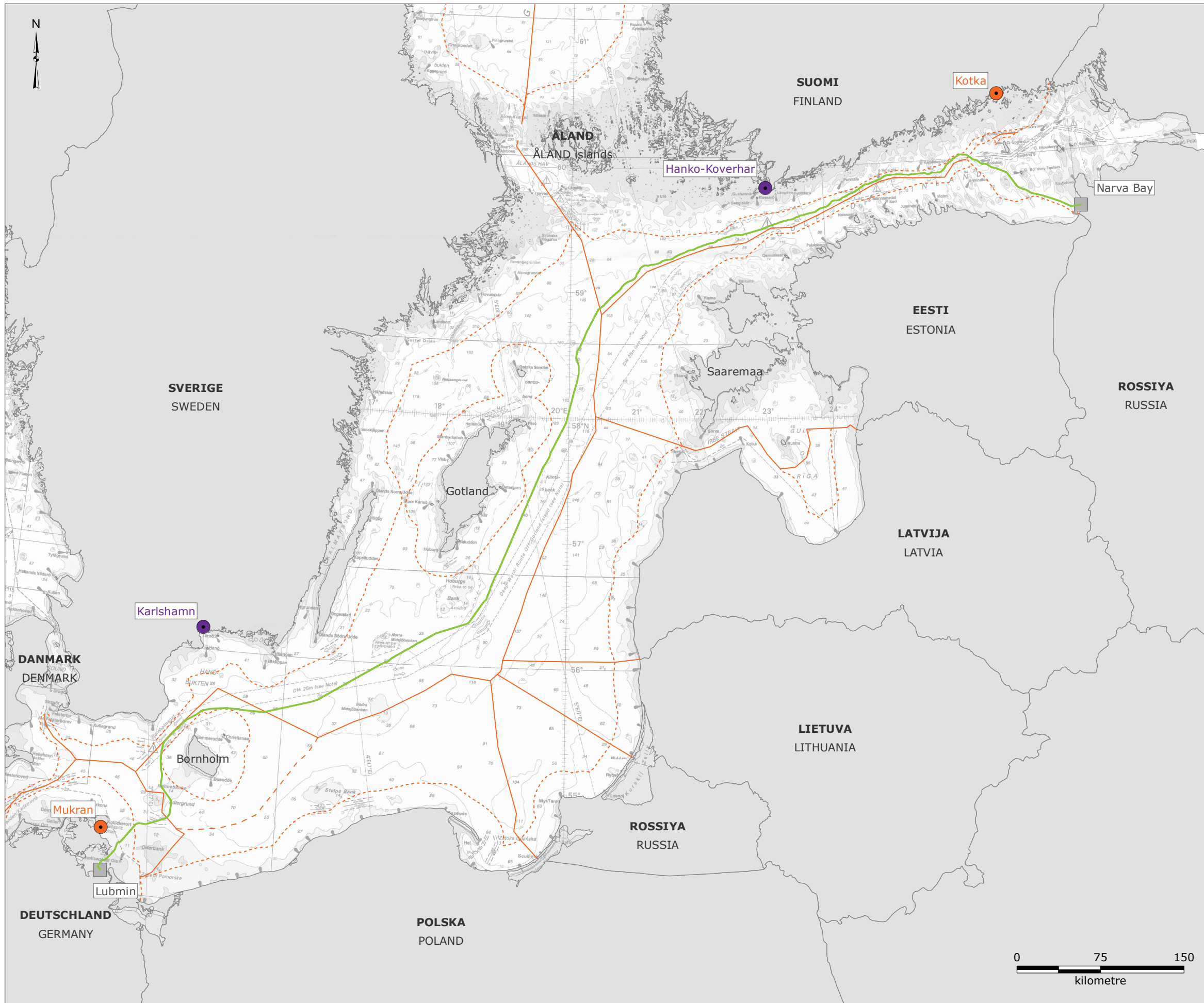
Map SS-01-D Survey stations for water column and seabed conditions

Map SS-02-D Survey stations for chemical warfare agents

PROJECT DESCRIPTION

DESCRIPTION OF THE PROJECT

DESCRIPTION OF ALTERNATIVES



Legend:

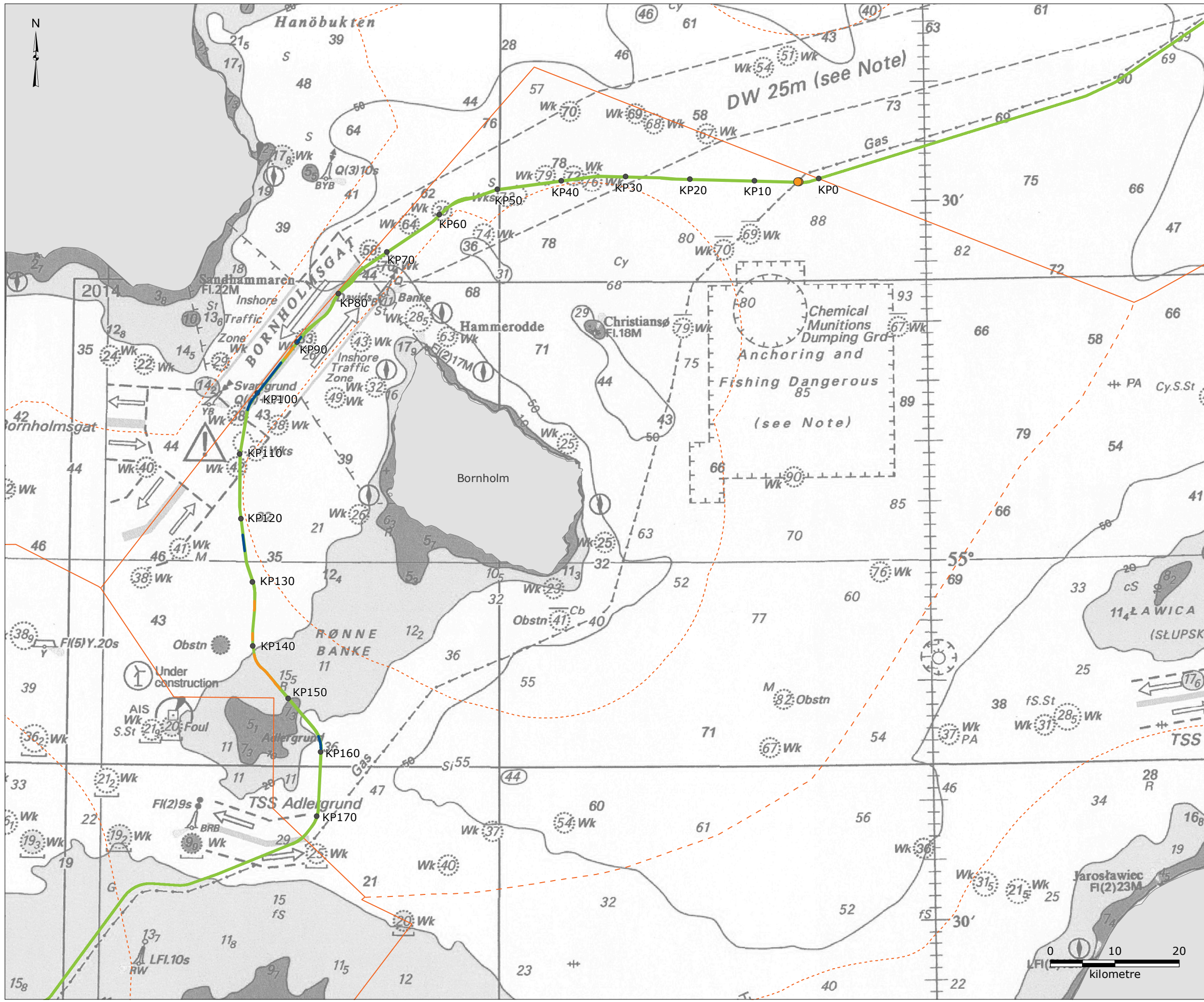
- NSP2 Route
 - Territorial water border
 - EEZ border
 - Midline between Denmark and Poland
- Storage yards:
- Pipe coating plant / pipe storage site
 - Pipe storage site
 - Landfall

Version: 02
 Date: 2018-07-03
 Prepared: MSTB/MRIH
 Controlled: JCXS/DMM

PR-01

NSP2 pipeline route and onshore facilities





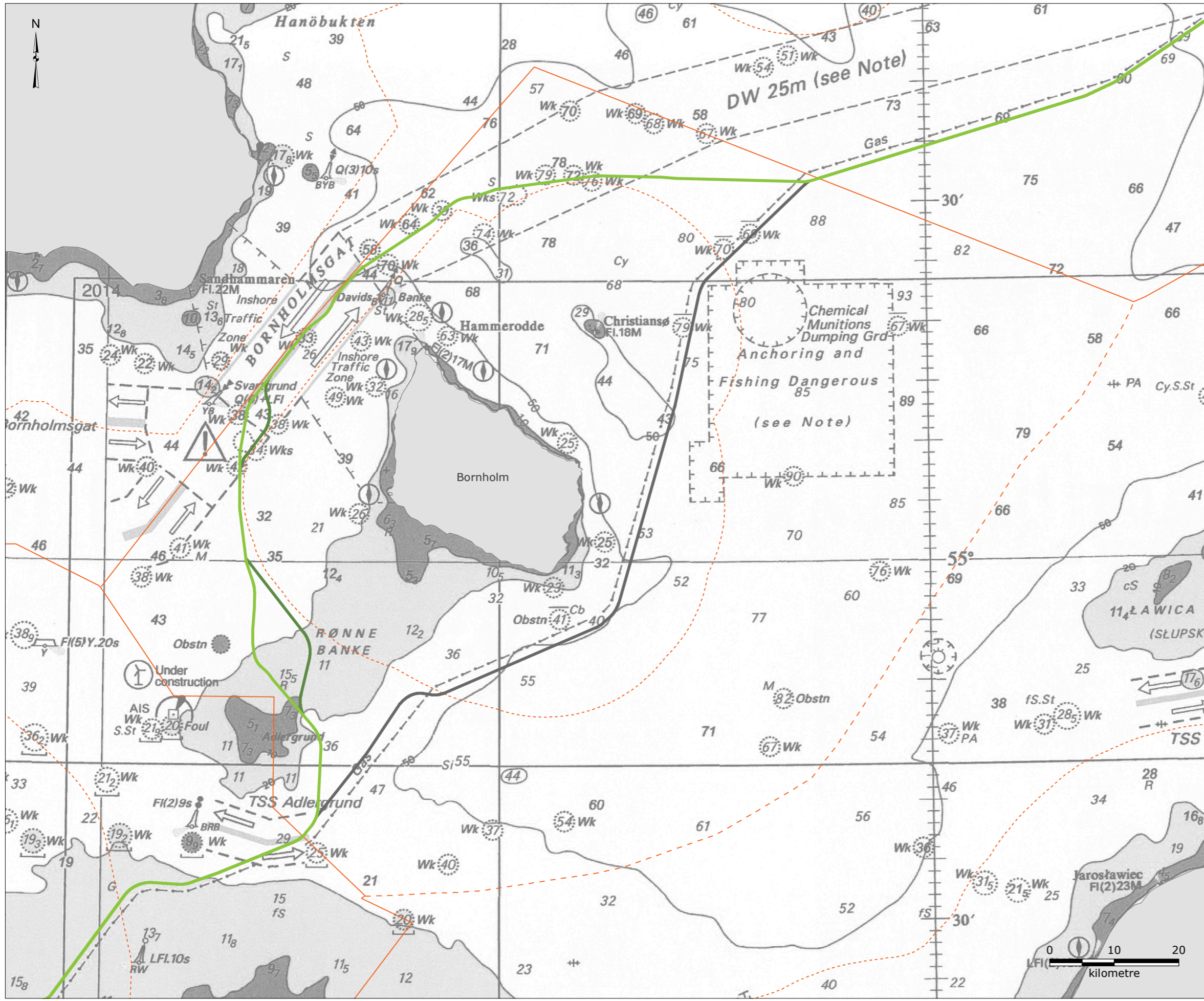
- Legend:**
- NSP2 Route
 - Territorial water border
 - EEZ border
 - Midline between Denmark and Poland
 - Post-lay trenching
 - Spot rock placement
 - Spot rock placement, pipeline crossing
 - KP (kilometre point)

Version: 02
 Date: 2018-07-03
 Prepared: MRIH
 Controlled: JCXS

PR-02-D

NSP2 pipeline route and anticipated seabed intervention works



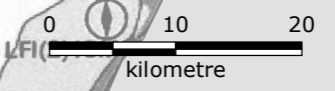


- Legend:**
- NSP2 Route - base case
 - NSP2 Route variants:
 - NW route
 - NW route alternative
 - - - Territorial water border
 - EEZ border
 - - - Midline between Denmark and Poland

Version: 02
 Date: 2018-07-10
 Prepared: MSTB/ MRIH
 Controlled: JCSX

AL-01-D

Alternative pipeline routes



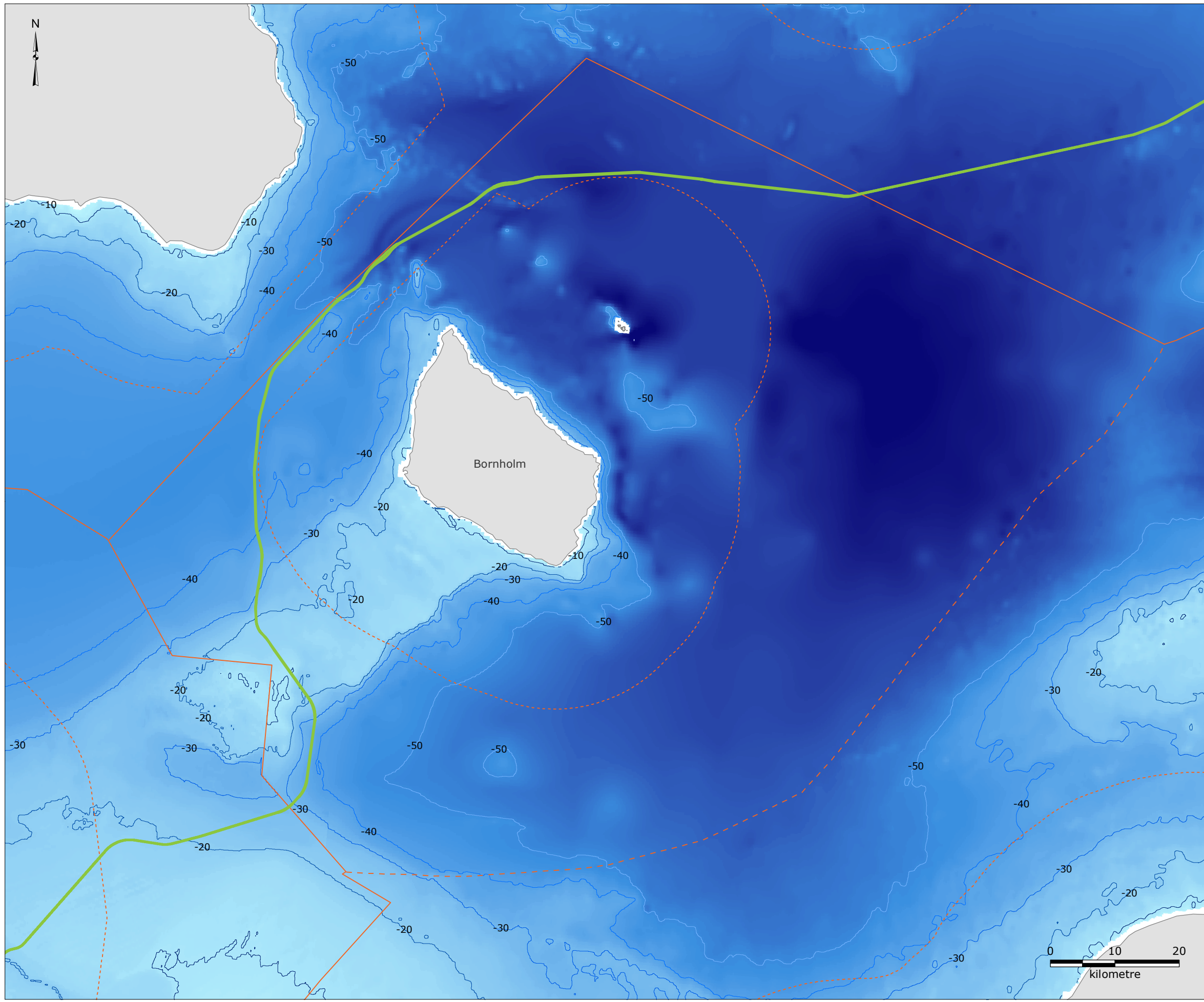
PHYSICAL-CHEMICAL ENVIRONMENT

BATHYMETRY AND HYDROGRAPHY





WATER QUALITY

GEOLOGY AND SEABED

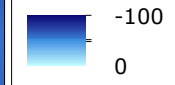
CLIMATE









Legend:

-  NSP2 Route
-  Territorial water border
-  EEZ border
-  Midline between Denmark and Poland

Bathymetry [depth (m)]:



Depth contour (m):

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

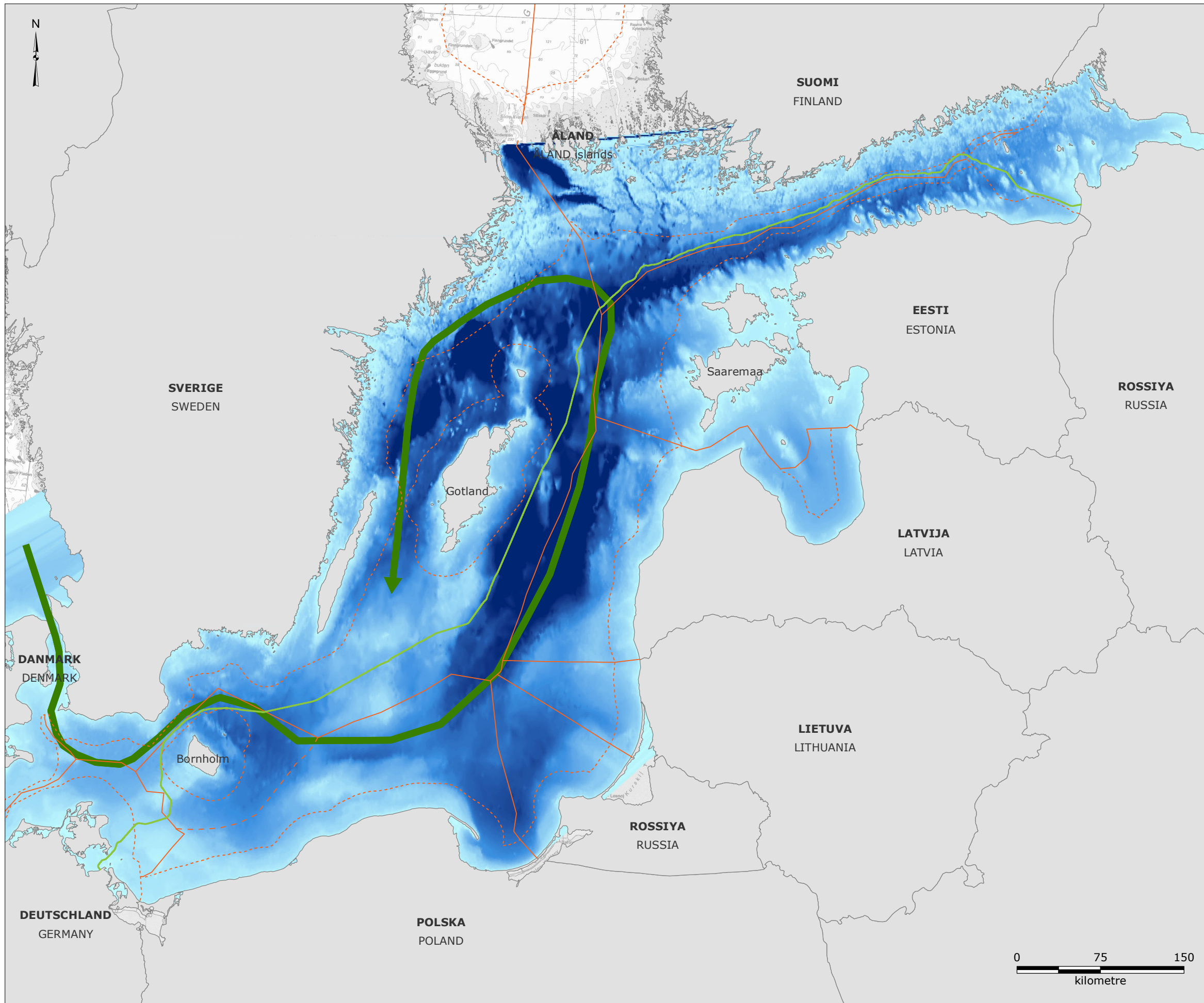
Reference:
 -EMODnet, 2017,
<http://portal.emodnet-bathymetry.eu/?menu=19>,
 Date accessed: 2017-10-24

Version: 02
 Date: 2018-07-03
 Prepared: MSTB/MRIH
 Controlled: JCXS/DMM

BA-01-D

Bathymetry





Legend:

- NSP2 Route
- - - Territorial water border
- EEZ border
- - - Midline between Denmark and Poland
- Inflow of oxygen-rich water in 2003

Bathymetry [depth (m)]:

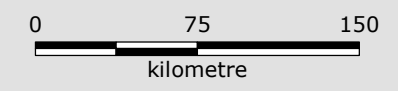
0
-430

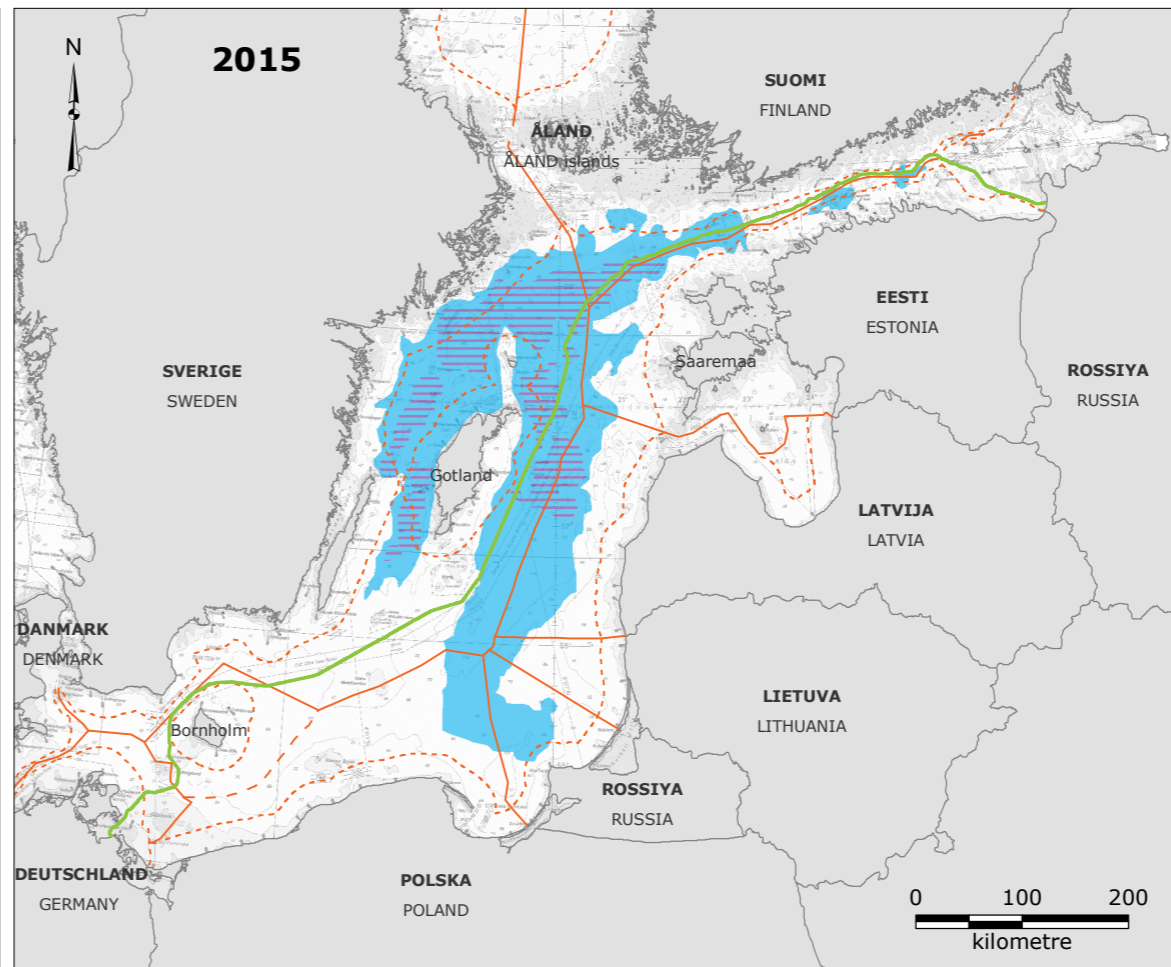
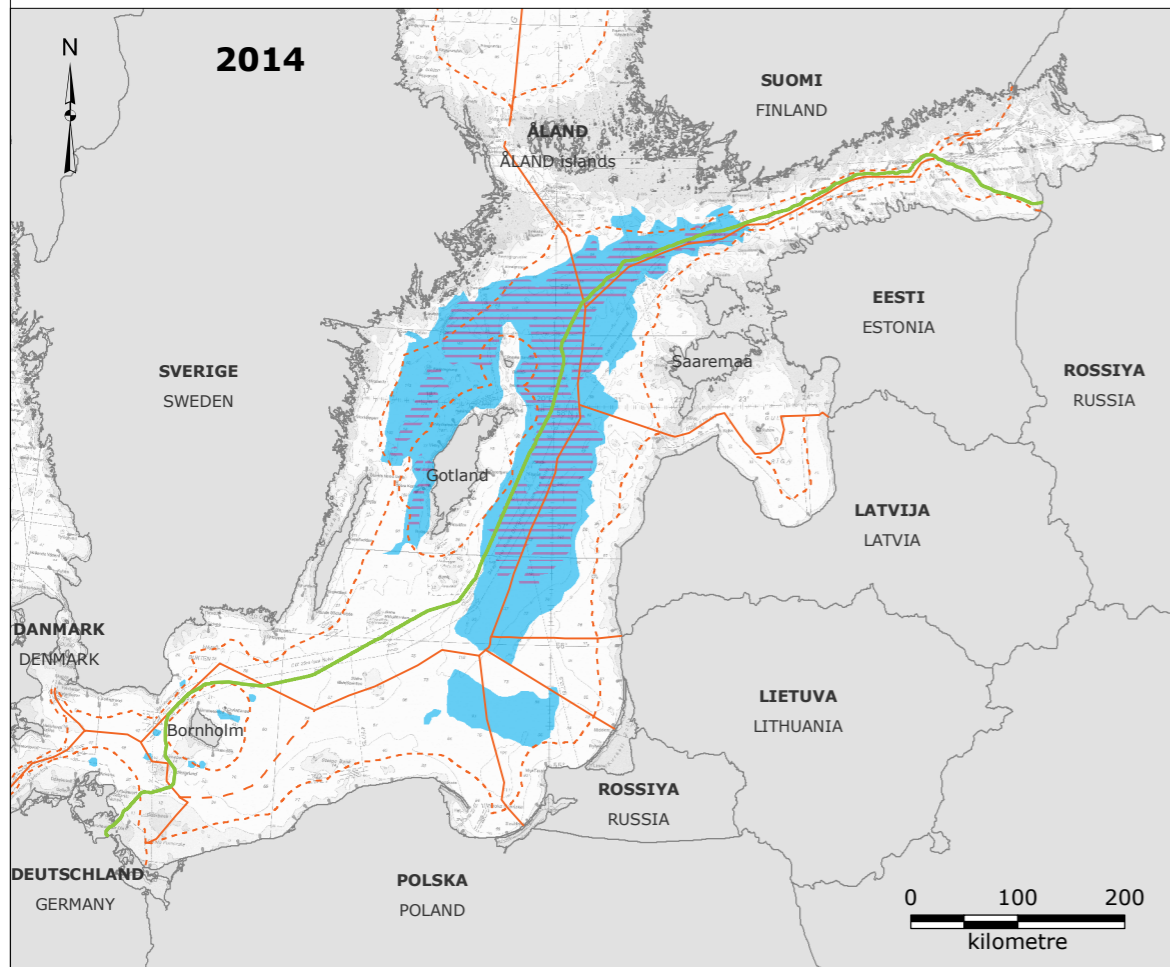
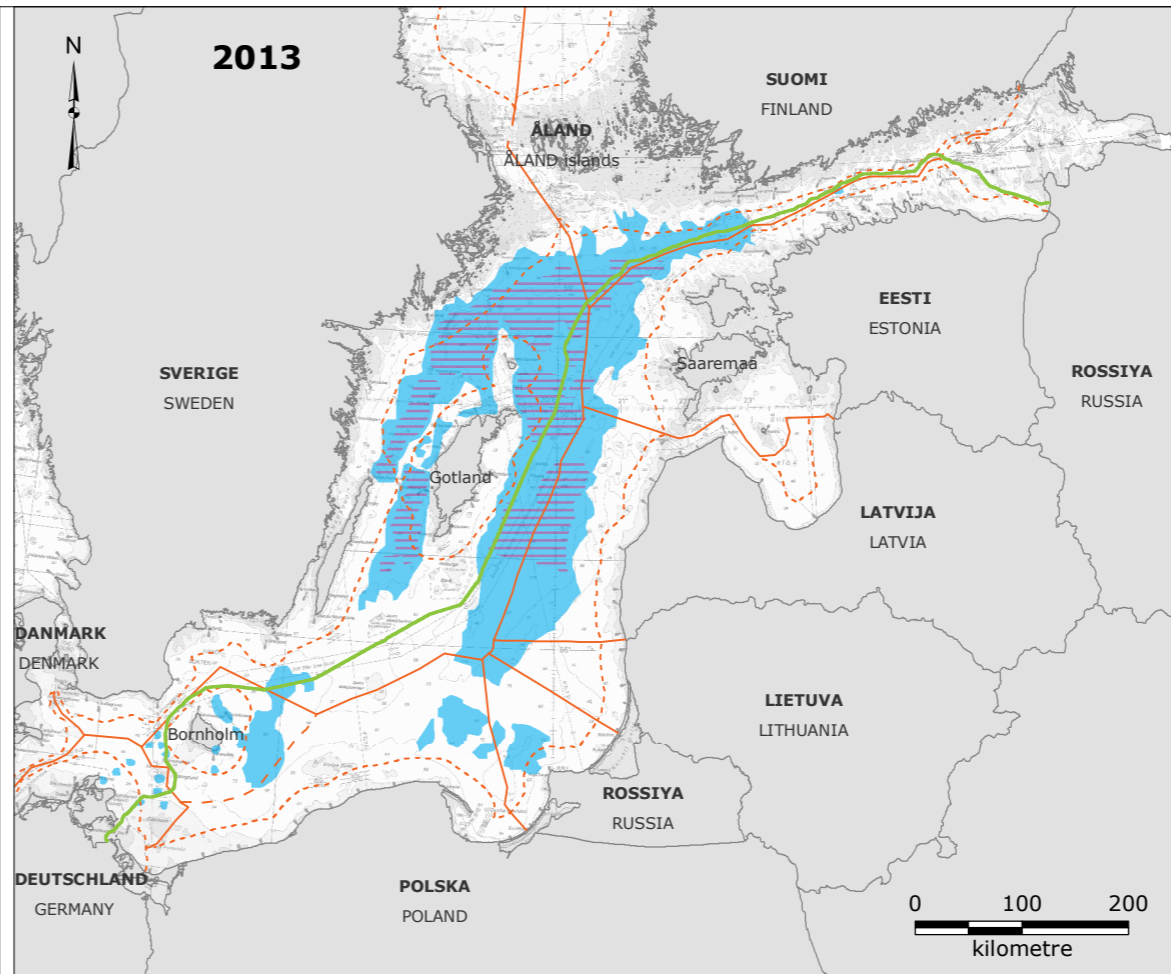
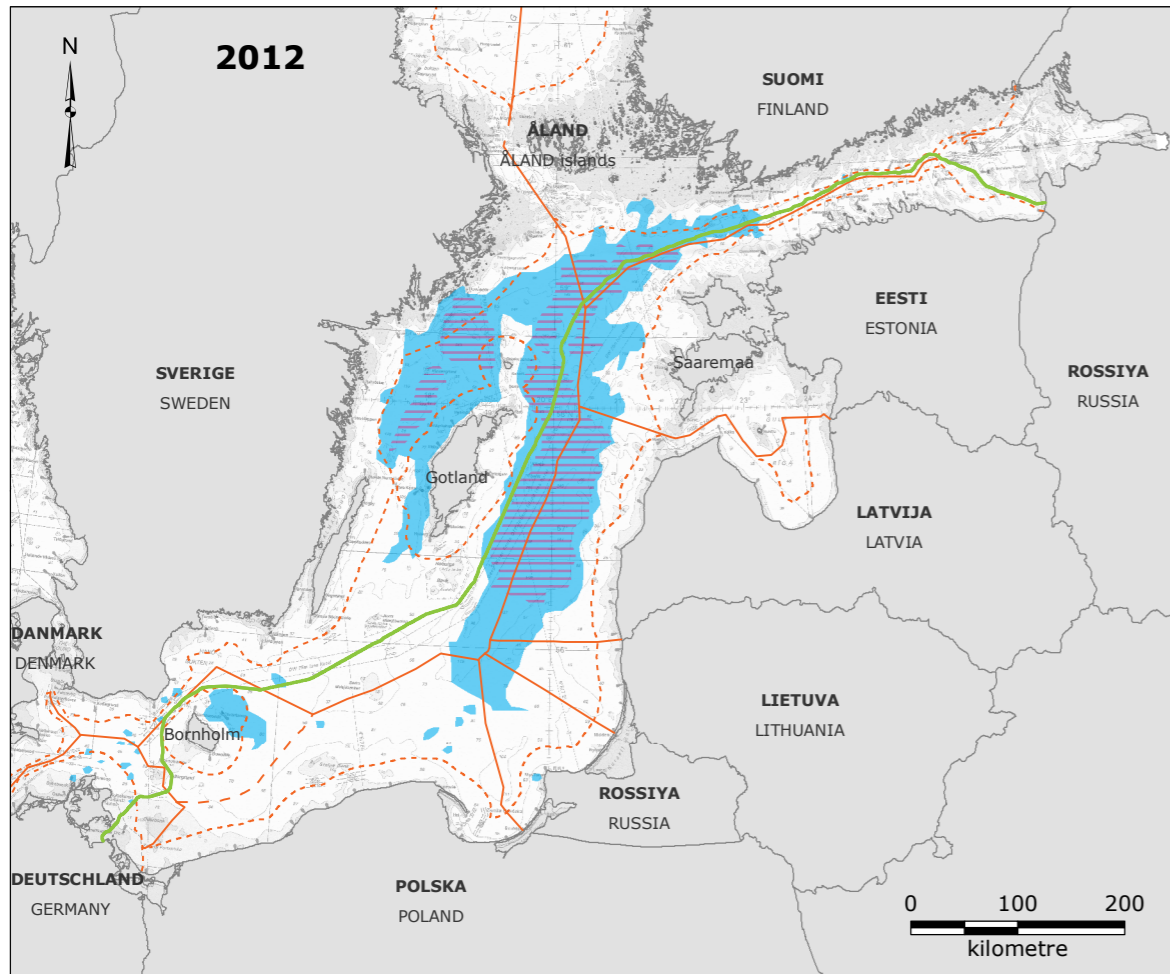
References:
 - Bernes, C., 2005, "Förändringar under ytan, Monitor 19, Sveriges havsmiljö granskad på djupet", Naturvårdsverket, pp. 192
 - MIKE C-map database, February 2012

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 Prepared: MSTB/ MRIH
 Controlled: KEBS

BA-02

Inflow of oxygen-rich water to the Baltic Sea





- Legend:**
- NSP2 Route
 - - - Territorial water border
 - EEZ border
 - - - Midline between Denmark and Poland
 - 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

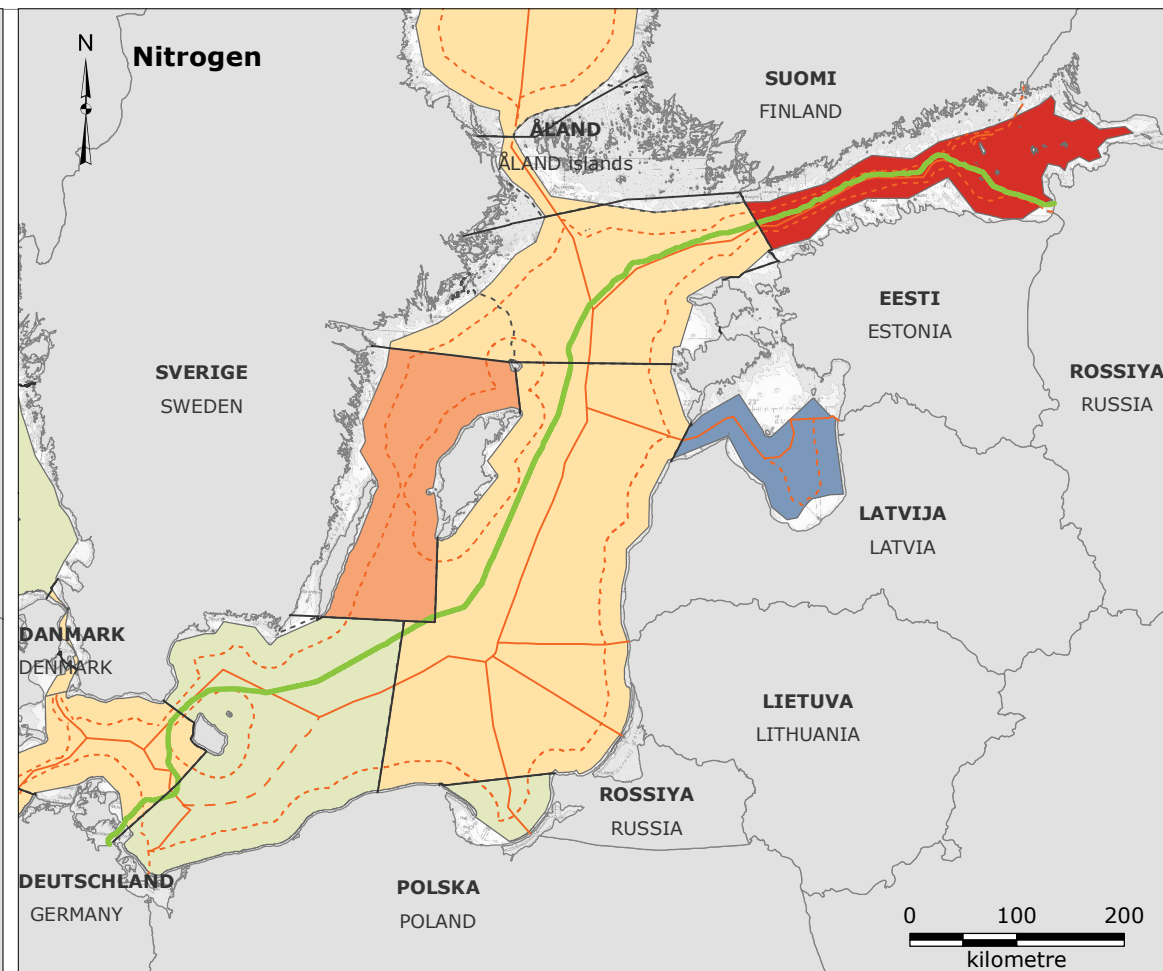
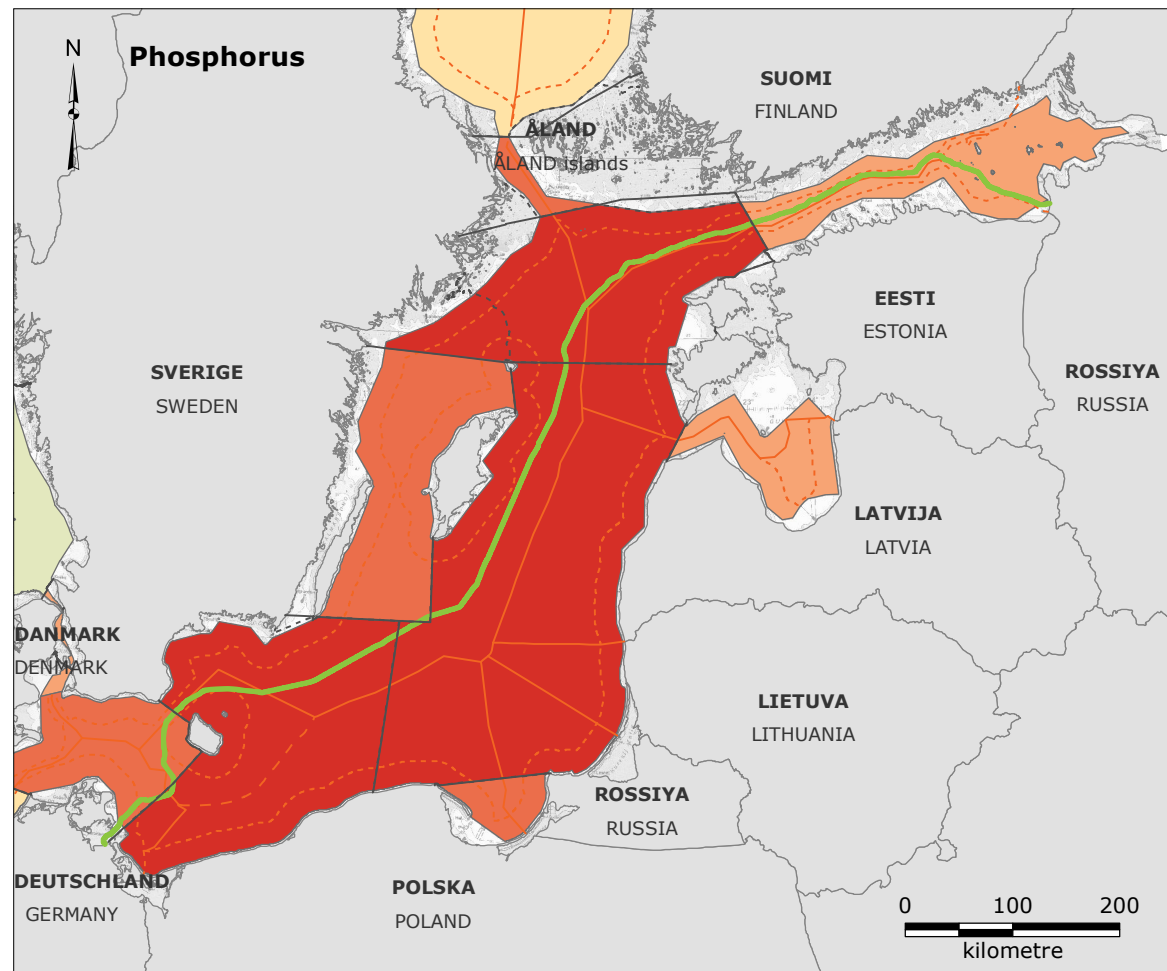
References:
 - SMHI, 2013, "Oxygen Survey in the Baltic Sea, 2013 - Extent of Anoxia and Hypoxia, 1960-2013". SMHI Report Oceanography No. 49
 - SMHI, 2015, "Oxygen Survey in the Baltic Sea, 2015 - Extent of Anoxia and Hypoxia, 1960-2015". SMHI Report Oceanography No. 53

Version: 02
 Date: 2018-07-03
 Prepared: MSTB/MRIH
 Controlled: KEBS

WA-01

Anoxic and hypoxic areas





- Legend:**
- NSP2 Route
 - Territorial water border
 - EEZ border
 - Midline between Denmark and Poland
 - Sub-basins (2013)
 - Sub-basins (2017)

Legend:
Phosphorus status 2007-2011:

(Eutrophication Ratio)

- < 0.79
- 0.80 - 0.99
- 1
- 1.01 - 1.19
- 1.20 - 1.39
- 1.40 - 1.59
- 1.60 - 1.79
- > 1.80
- No data

Legend:
Nitrogen status 2007-2011:

(Eutrophication Ratio)

- < 0.79
- 0.80 - 0.99
- 1
- 1.01 - 1.19
- 1.20 - 1.39
- 1.40 - 1.59
- 1.60 - 1.79
- > 1.80
- No data

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 2017, these boundaries are also shown.

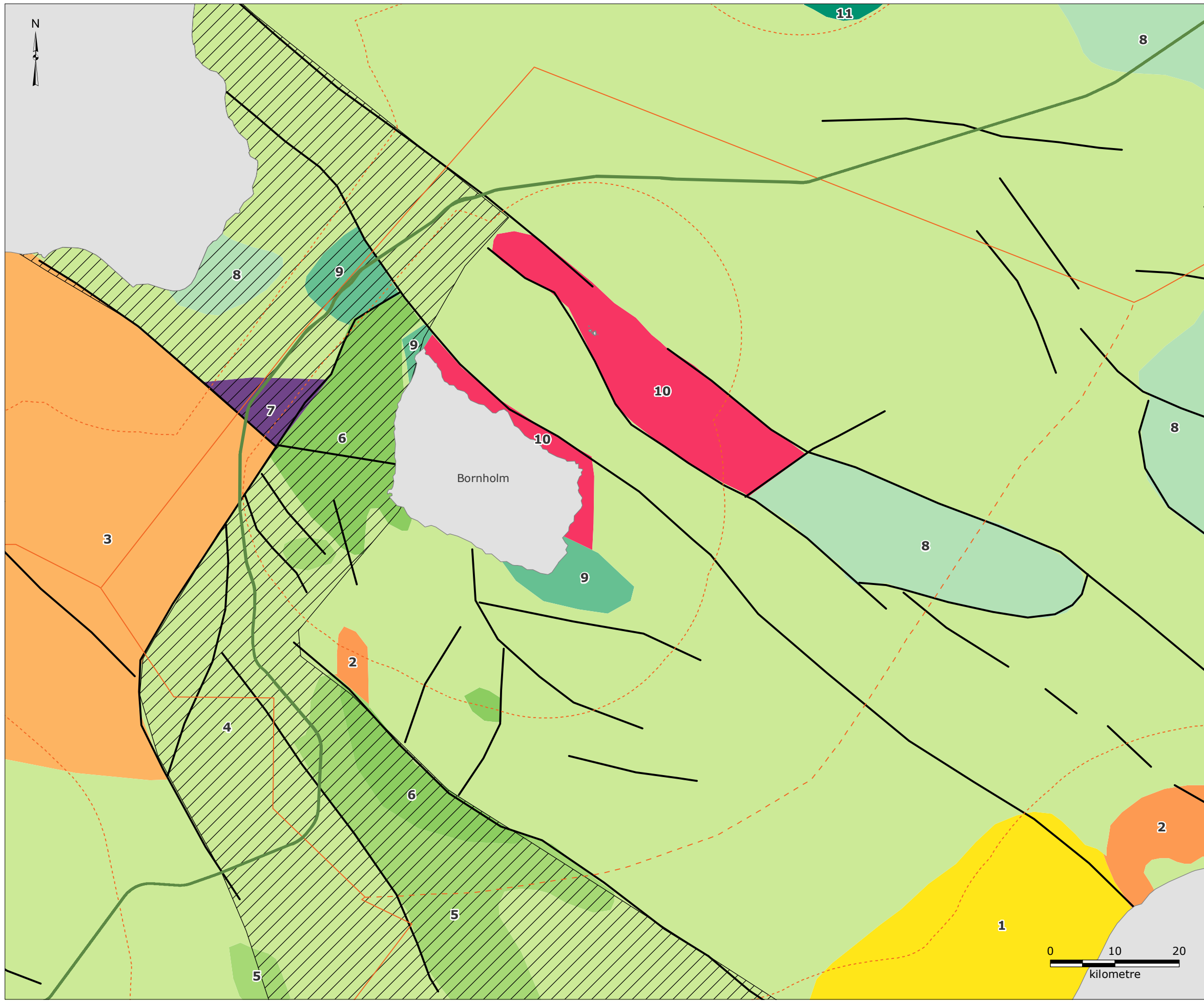
References:
- HELCOM, 2017, "HELCOM subbasins", <http://maps.helcom.fi/website/mapservice/index.htm>, Date accessed: 2018-5-28
- HELCOM, 2013, "HELCOM subbasins", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2016-3-30
- HELCOM, 2013. "Phosphorus status distance to target 2007-2011", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2018-5-28
- HELCOM, 2013. "Nitrogen status distance to target 2007-2011", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2018-5-28

Version: 02
Date: 2018-07-10
Prepared: MSTB/ MRIH
Controlled: KEBS

WA-02

Eutrophication





- Legend:**
- NSP2 Route
 - - - Territorial water border
 - EEZ border
 - - - Midline between Denmark and Poland
 - Faults
 - ▨ Tornquist zone

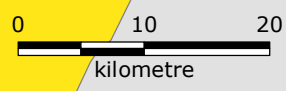
- Geology:**
- (1) Neogene
 - (2) Paleogene
 - (3) Danian limestones
 - (4) Cretaceous chalk and limestones
 - (5) Cretaceous mudstones and sandstones
 - (6) Cretaceous; mainly sandstones and mudstones
 - (7) Triassic; mainly mudstones and sandstones
 - (8) Silurian; mainly limestones, marls, mudstones and shales
 - (9) Cambrian-Ordovician
 - (10) Precambrian crystalline basement
 - (11) Ordovician limestones and shales

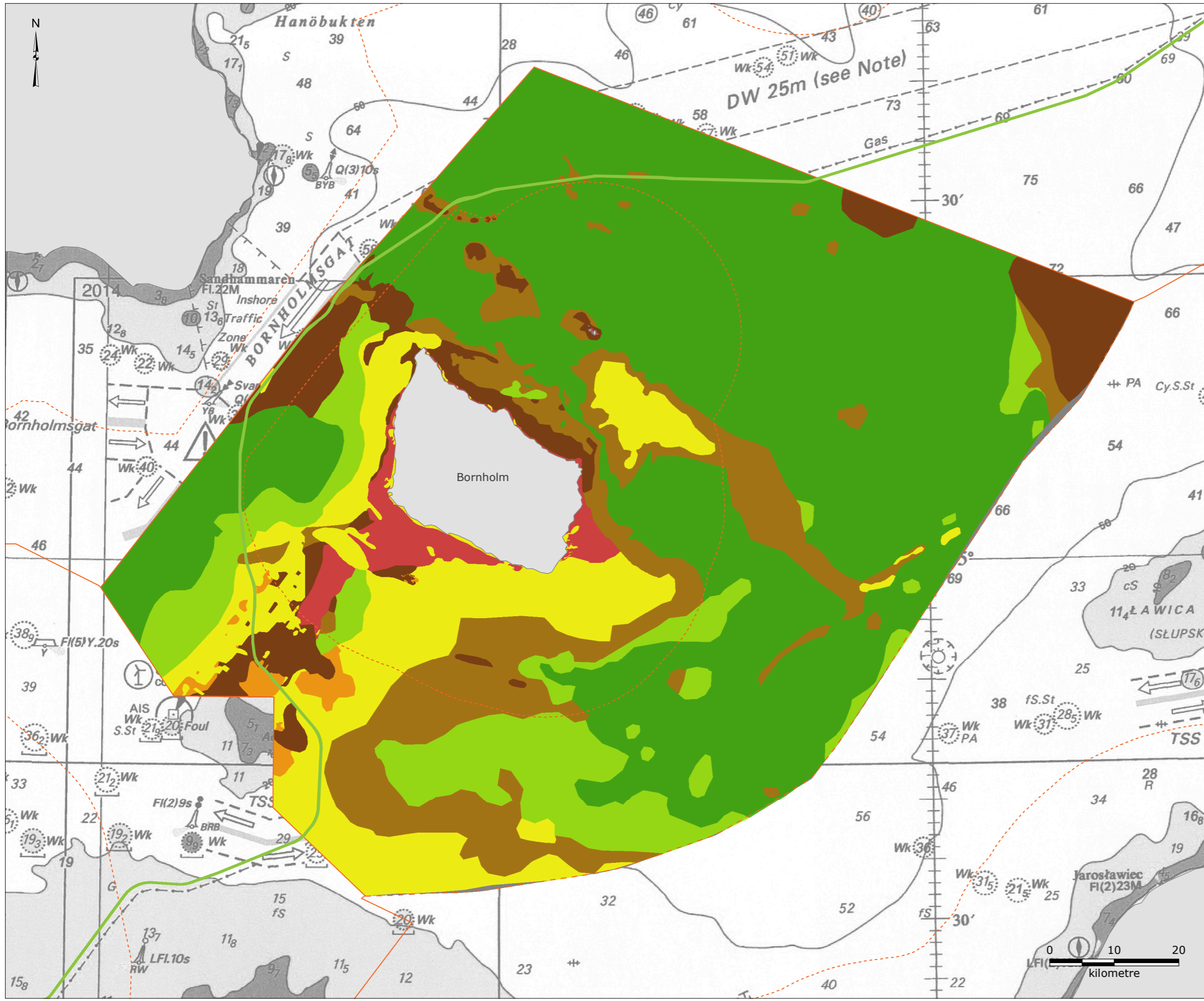
References:
 - Per Ahlberg, 1986: "Den svenske kontinentalsockelns berggrund". Geological Survey of Sweden, Rapport och meddelanden nr. 47.
 - Curt Fredén (editor), 1994. "Berg och jord". Sveriges Nationalatlas, SNA Förlag, Stockholm, 208 pp.
 - Tapio Koistinen (editor), 1994. "Precambrian basement of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

Version: 02
 Date: 2018-07-03
 Prepared: MSTB/ MRIH
 Controlled: KEBS

GE-01-D

Geology





- Legend:**
- NSP2 Route
 - Territorial water border
 - EEZ border
 - Midline between Denmark and Poland
- Sediment types:
- Mud and sandy mud
 - Muddy sand
 - Sand
 - Gravel and coarse sand
 - Till/diamicton
 - Quaternary clay and silt
 - Sedimentary rock
 - No data available

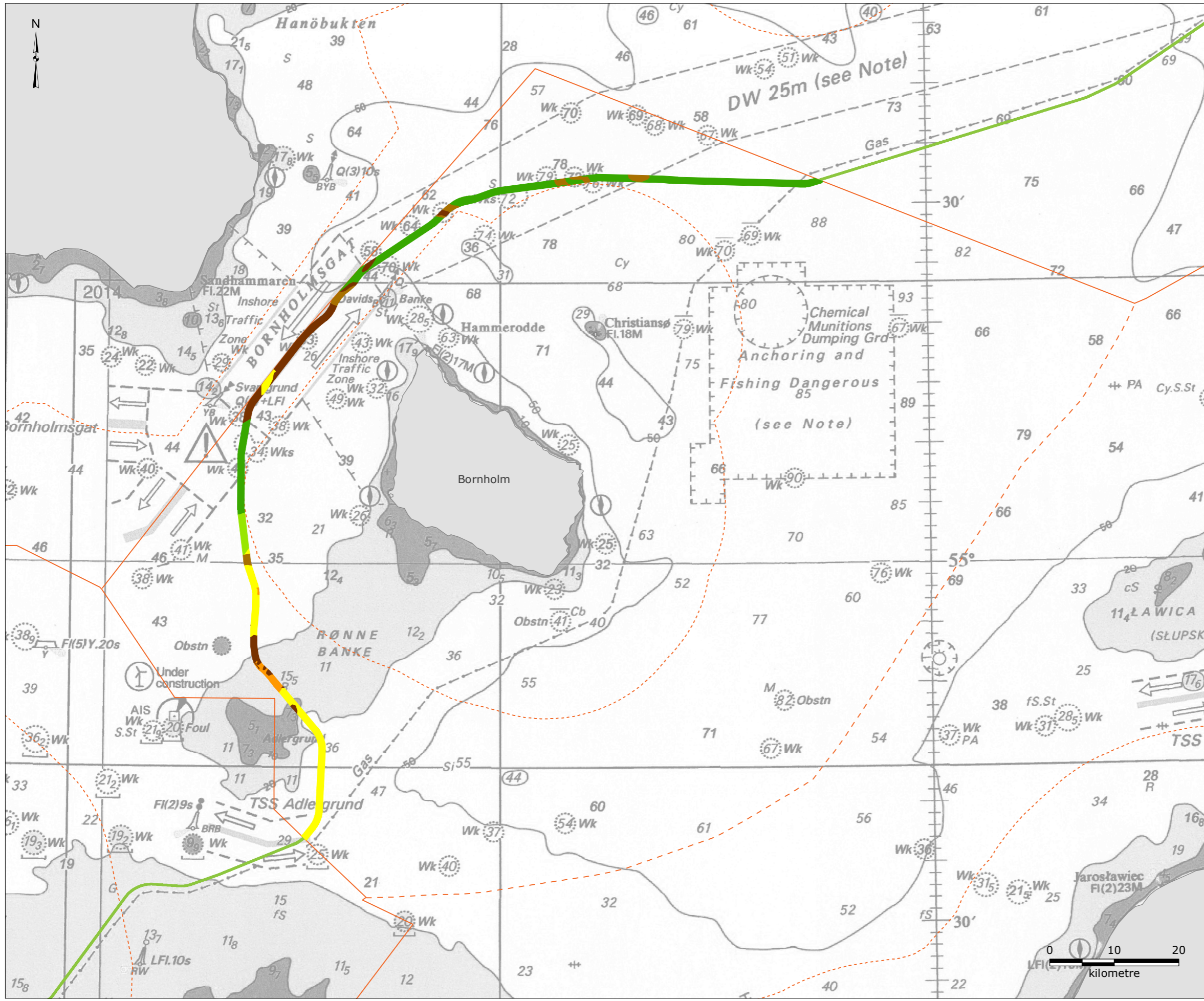
Reference:
 - GEUS, 2014, "Danmarks digitale havbundssedimentkort 1:250.000", Denmark

Version: 01
 Date: 2018-05-15
 Prepared: MSTB/ MRIH
 Controlled: KEBS

GE-02-D

Seabed sediments





Legend:

- NSP2 Route
- Territorial water border
- EEZ border
- Midline between Denmark and Poland

Sediment types:

- Mud and sandy mud
- Muddy sand
- Sand
- Gravel and coarse sand
- Till/diamicton
- Quaternary clay and silt
- Sedimentary rock

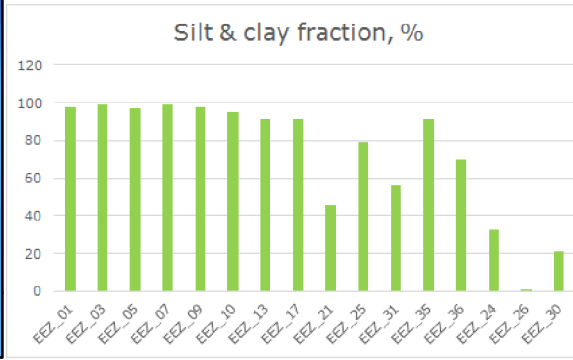
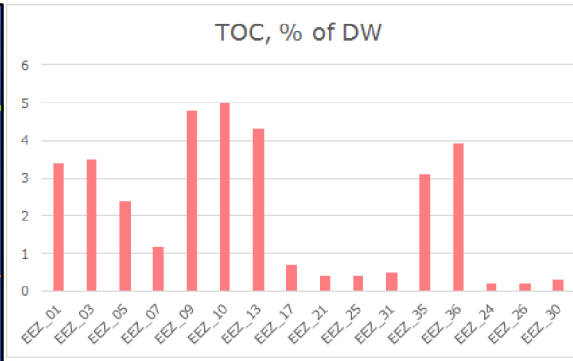
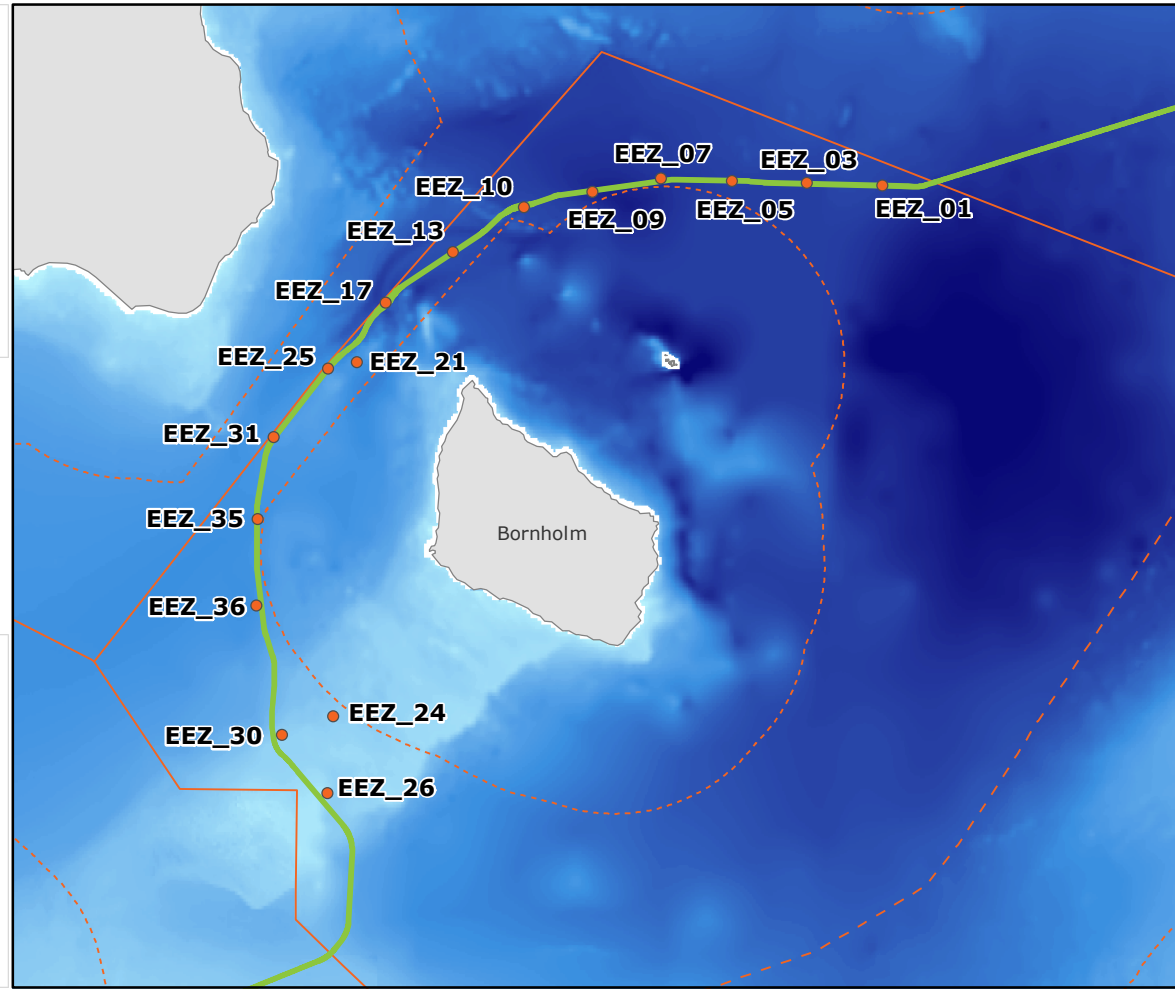
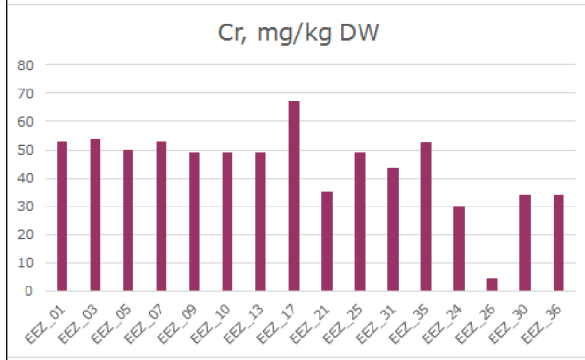
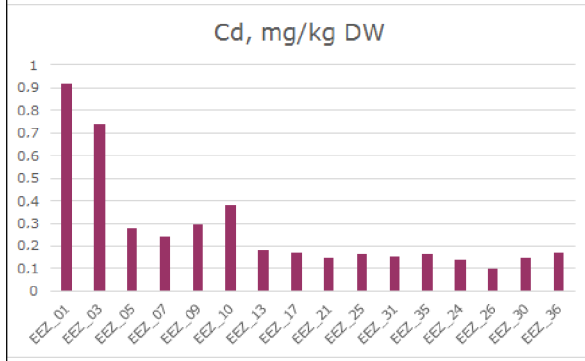
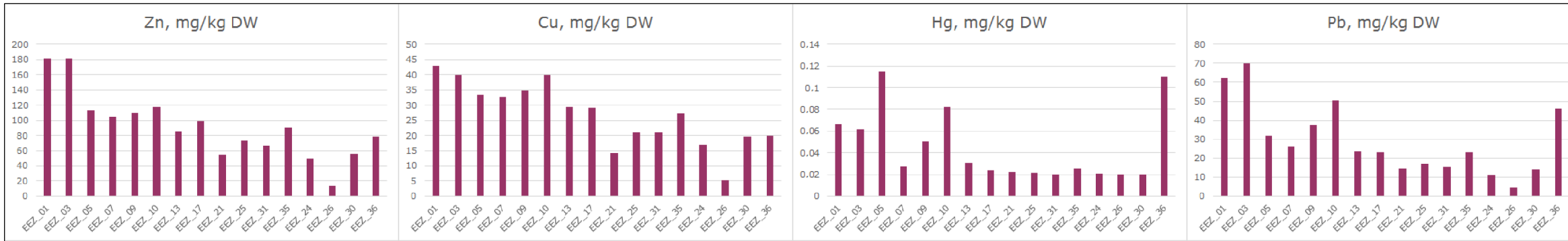
Reference:
 - Nord Stream 2, 2018, "Geophysical survey in the Danish EEZ, Northern route",
 Doc. No. W-SU-DET-PDK-DWG-808-367211EN

Version: 03
 Date: 2018-07-27
 Prepared: DMM
 Controlled: KEBS

GE-03-D

Seabed sediments along the pipeline route





Legend:

- NSP2 Route
- Territorial water border
- EEZ border
- Midline between Denmark and Poland

Bathymetry [depth (m)]:

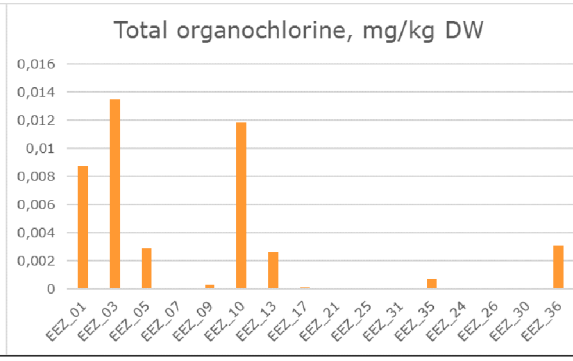
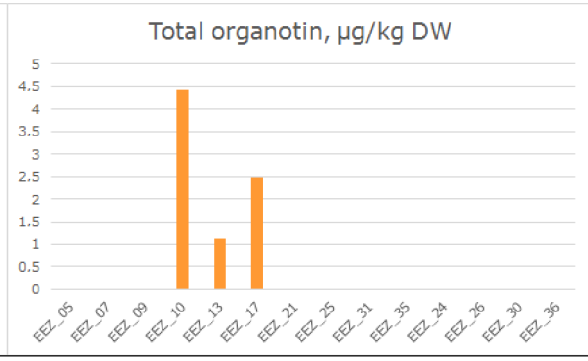
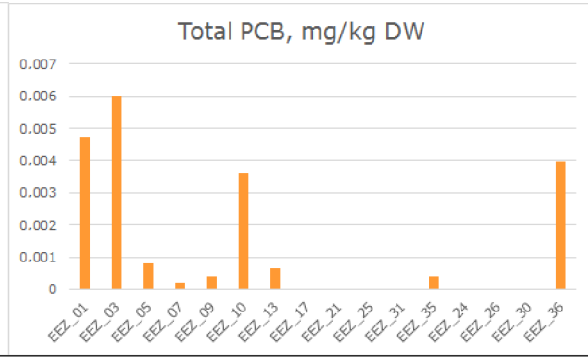
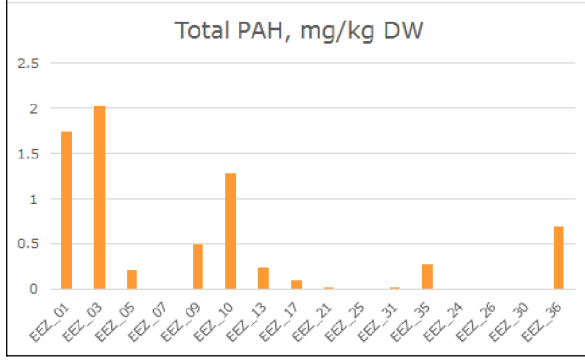
- 100
- 0

Measured parameters:

- Metals
- Organic compounds
- Organic carbon
- Grain size
- Surface sediment station

Note:
 Measured parameters:
 - Metal concentrations: Zn, Cu, Hg, Pb, Cd, Cr
 - Organic compounds concentrations: total PAH (polycyclic aromatic hydrocarbons), total PCB (polychlorinated biphenyls), total organotin, and total organochlorine
 - TOC - total organic carbon
 - DW - dry weight

References:
 -Orbicon, 2018, "Environmental Baseline Surveys in the Danish and Swedish EEZ in 2017 and 2018, Northern Route, Field survey report for the Danish and Swedish EEZ", Doc. No. W-PE-EIA-PDK-REP-805-RNORBIEN-04 -EMODnet, 2017, <http://portal.emodnet-bathymetry.eu/?menu=19>, Date accessed: 2017-10-24

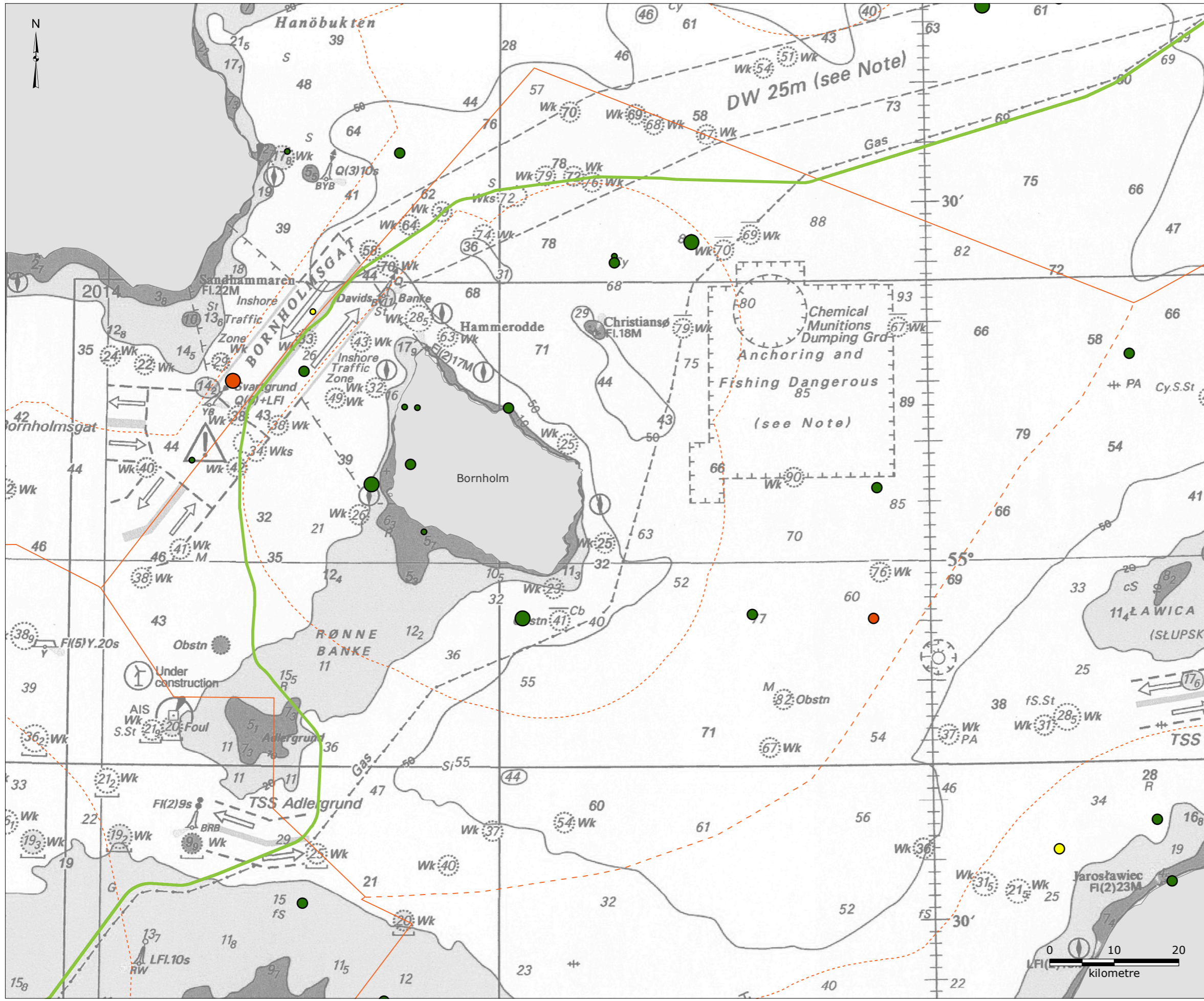


Version: 03
 Date: 2018-07-27
 Prepared: MRIH/DMM
 Controlled: KEBS

GE-04-D

Chemical and physical characteristics of seabed sediments





Legend:

- NSP2 Route
- - - Territorial water border
- - - EEZ border
- - - Midline between Denmark and Poland

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 2000-2017

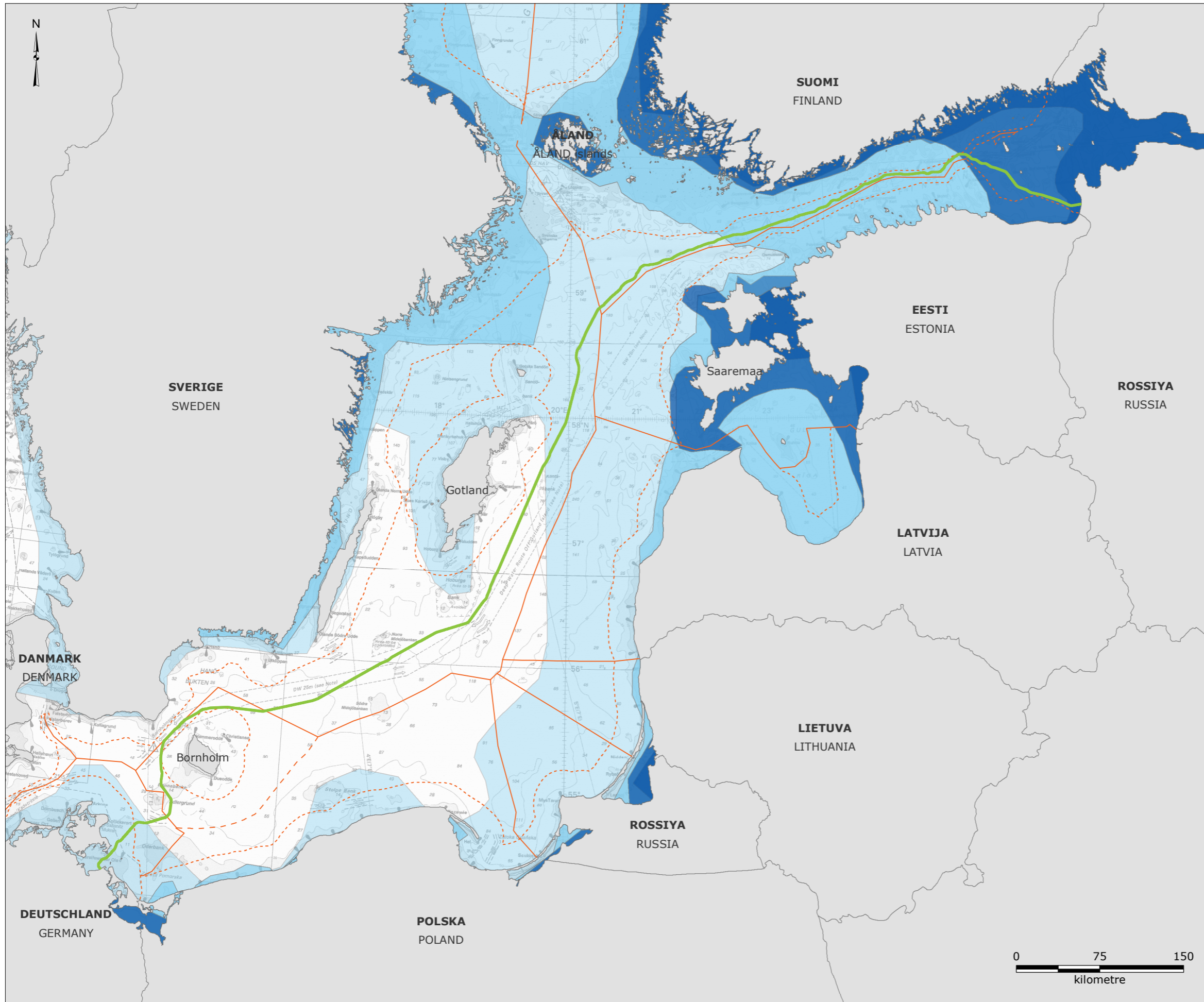
Reference:
 - GEUS, 2017, "Registrerede jordskælvs", http://www.geus.dk/DK/nature-climate/natural-disasters/seismology/Sider/seismo_reg-dk.aspx, Date accessed: 2017-12-20

Version: 02
 Date: 2018-07-04
 Prepared: MSTB/ MRIH
 Controlled: KEBS

GE-05-D

Seismic activity





- Legend:**
- NSP2 Route
 - Territorial water border
 - EEZ border
 - Midline between Denmark and Poland
 - 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: 2018-05-29

Version: 01
 Date: 2018-06-06
 Prepared: MIRS/ MRIH
 Controlled: KEBS

CL-01

Ice cover



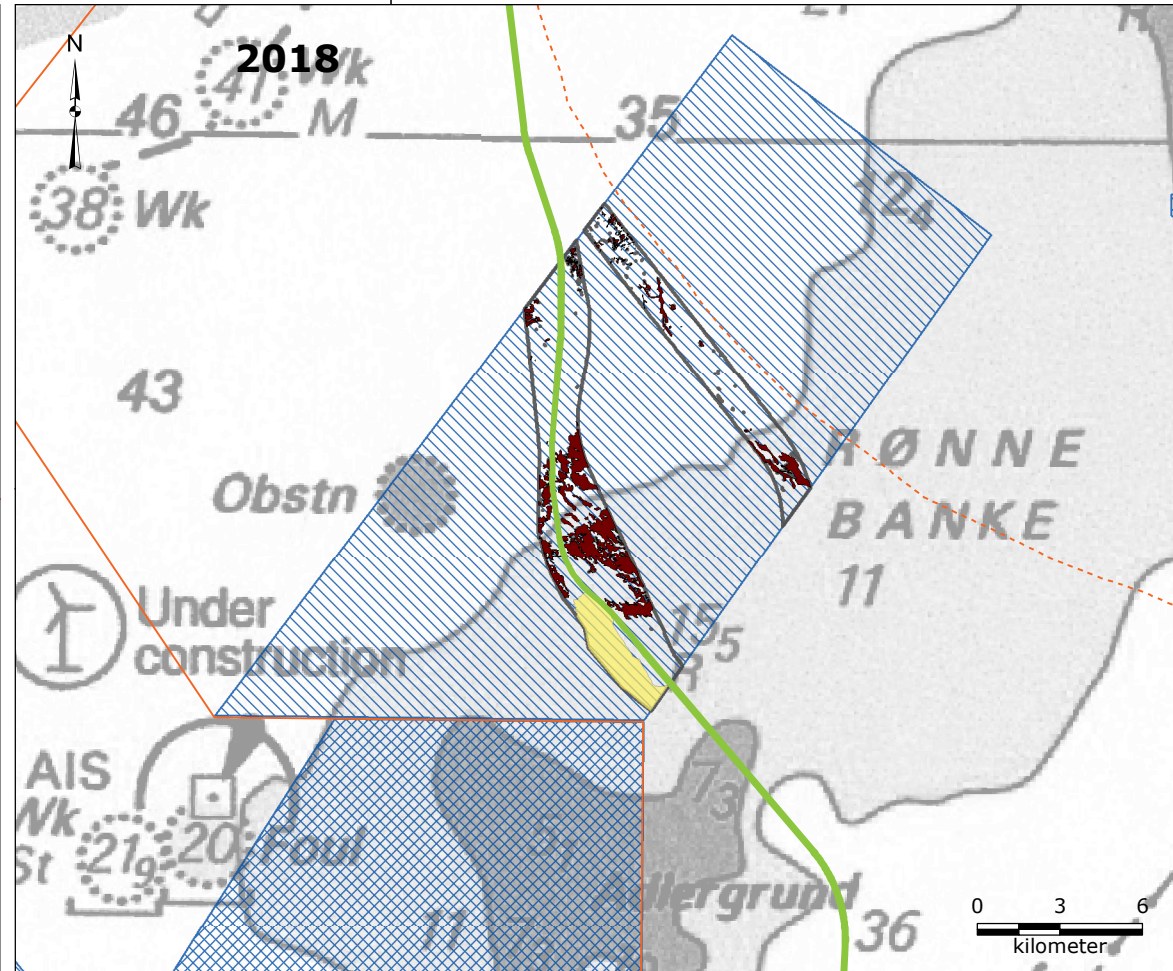
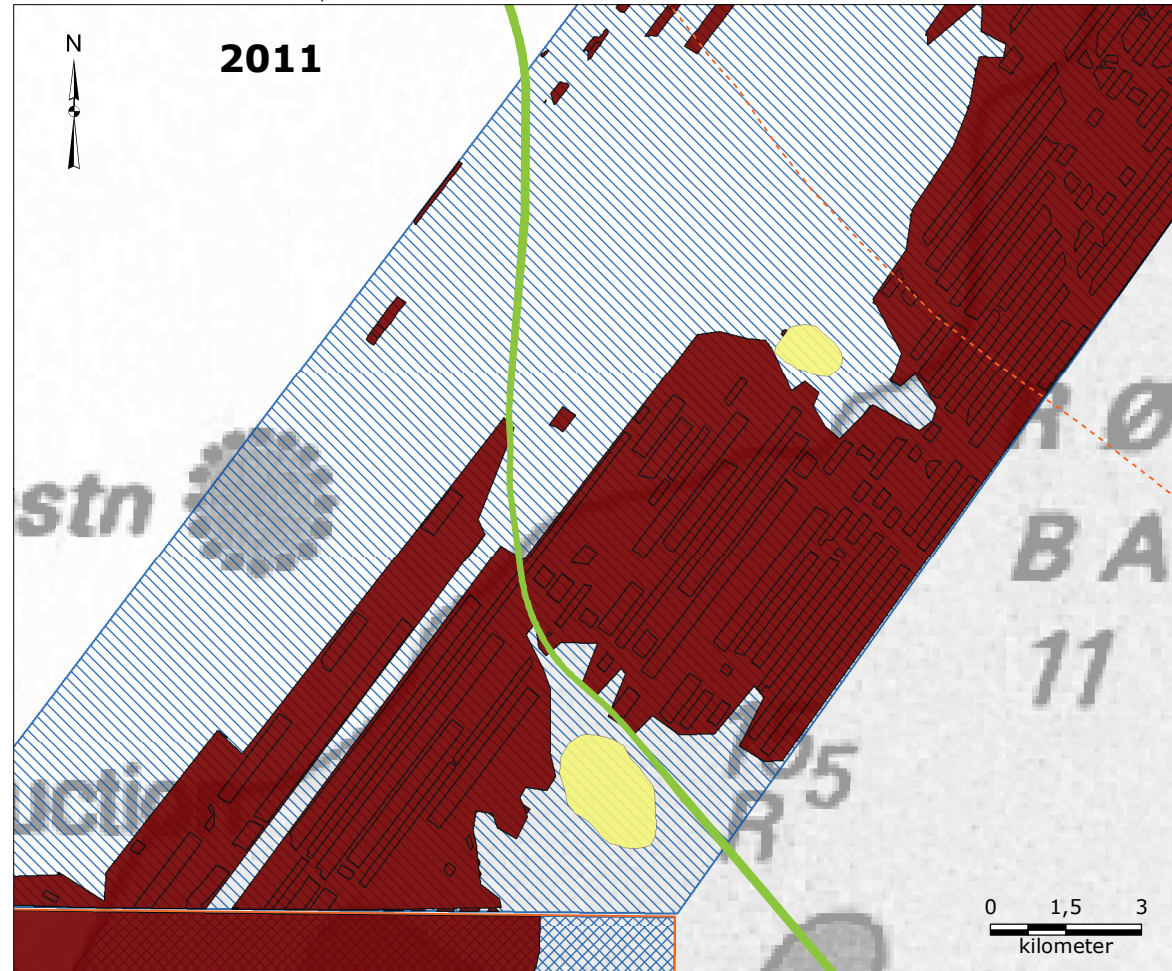
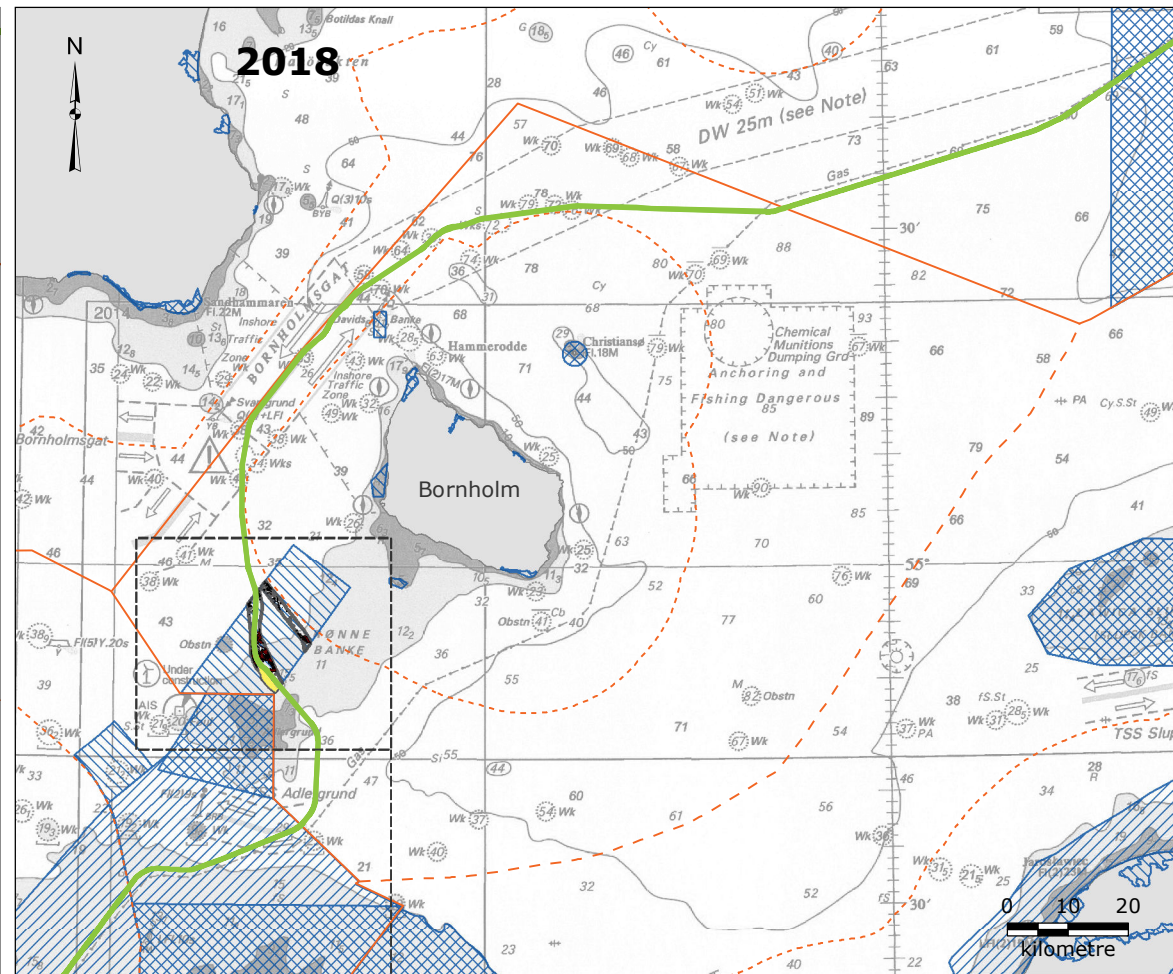
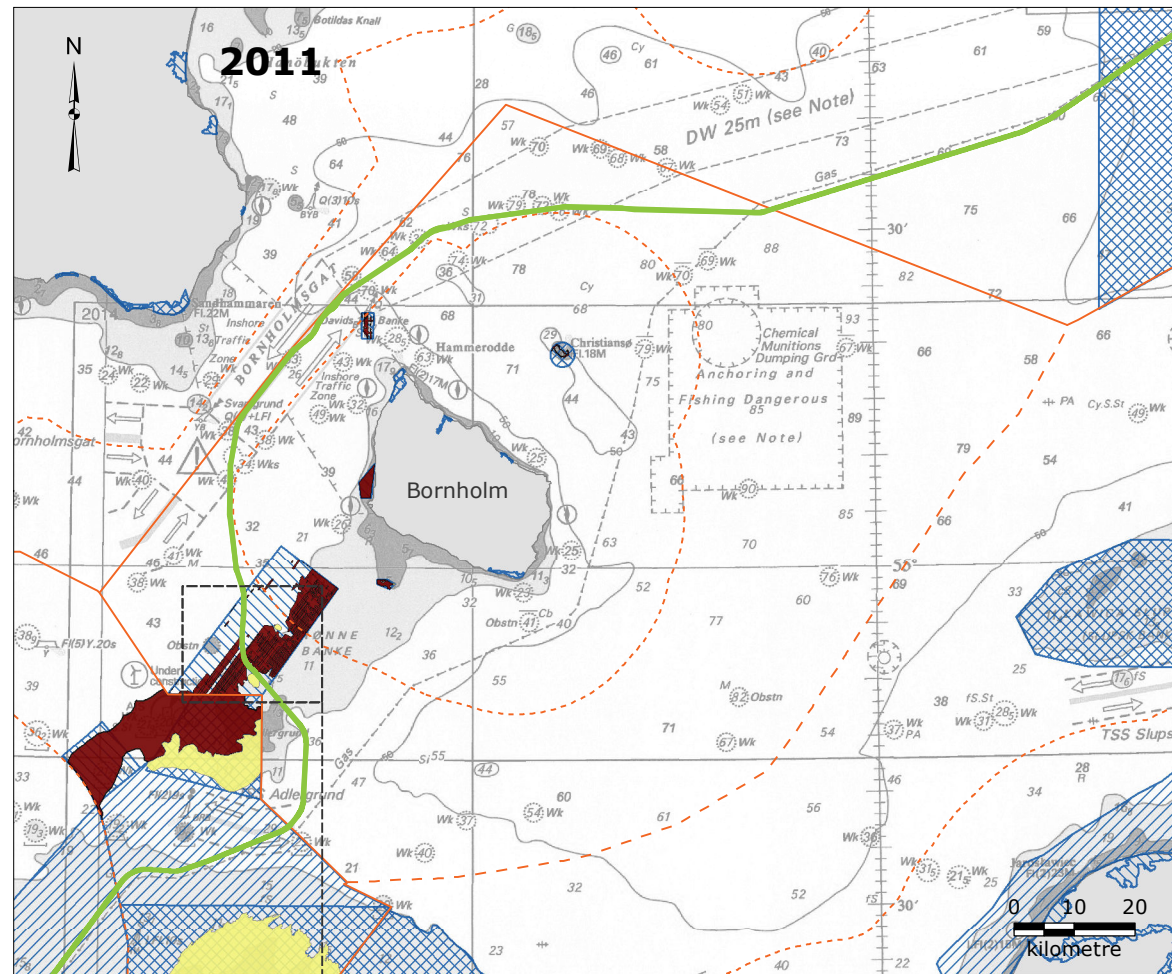
BIOLOGICAL ENVIRONMENT

PROTECTED AREAS





FISH

MARINE MAMMALS



BIRDS






Legend:

-  NSP2 Route
-  Territorial water border
-  EEZ border
-  Midline between Denmark and Poland

Natura 2000 sites:

-  Special Protection Area (SPA)
-  Special Area of Conservation/
Special Conservation Interests (SAC/SCI)

Habitat types:

-  Reef
-  Sandbank
-  Area of interpretation

References:
 - European Environment Agency, 2017, "Natura 2000 data - the European network of protected sites", <http://www.eea.europa.eu/data-and-maps/data/natura-8>, Date accessed: 2017-9-8
 - Styrelsen for Vand og Naturforvaltning, 2016. "Forslag til Natura 2000-planer 2016-2021"
 - Orbicon, 2018, Nord Stream Project 2 - Report for the Biotope survey in Natura 2000 site "Adler Grund og Rønne Banke". Ref NSP2-NR-TR-006

Version: 03
 Date: 2018-07-06
 Prepared: MRIH
 Controlled: DMM

PA-01-D

Natura 2000 sites and habitat types





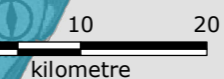
- Legend:**
- NSP2 Route
 - Territorial water border
 - EEZ border
 - Midline between Denmark and Poland
 - Ramsar site
 - HELCOM MPA

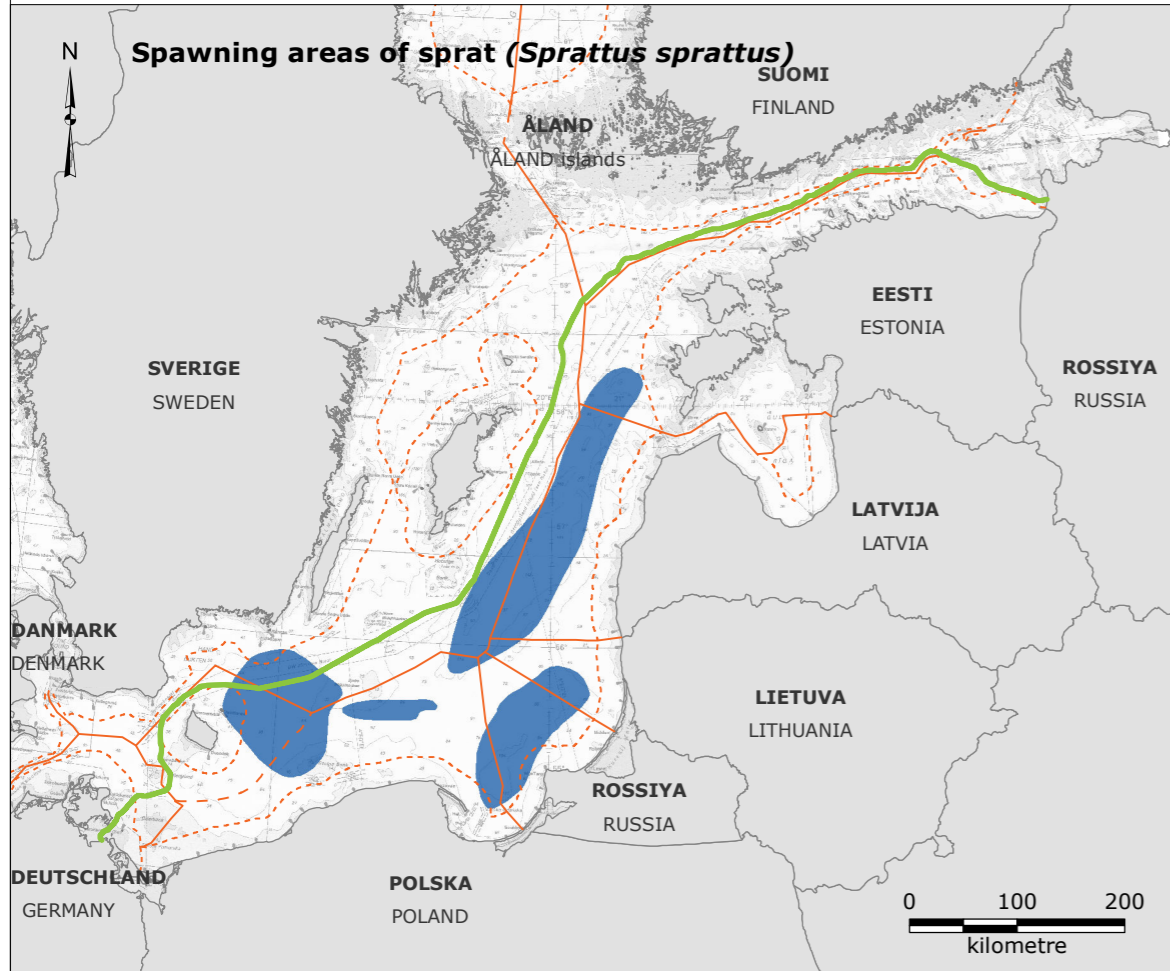
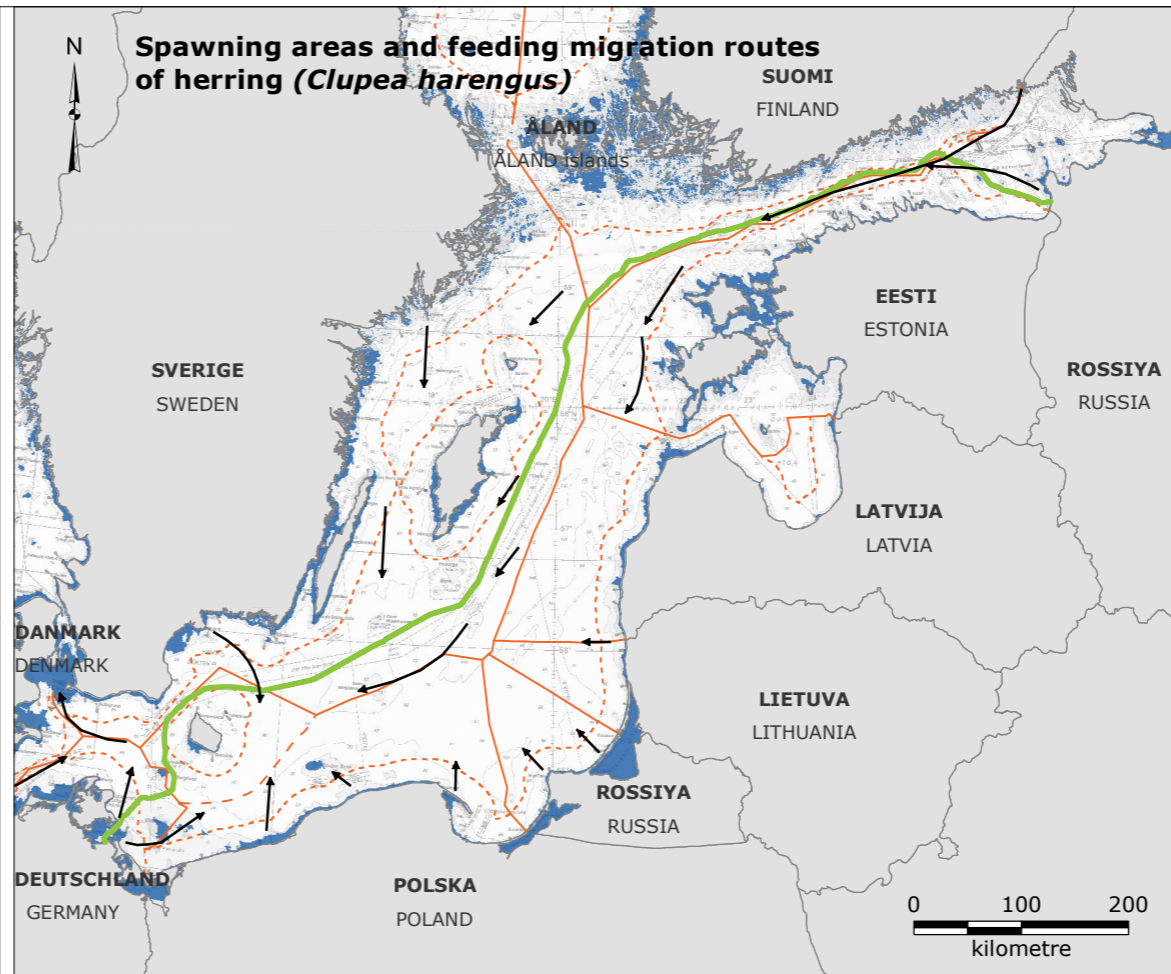
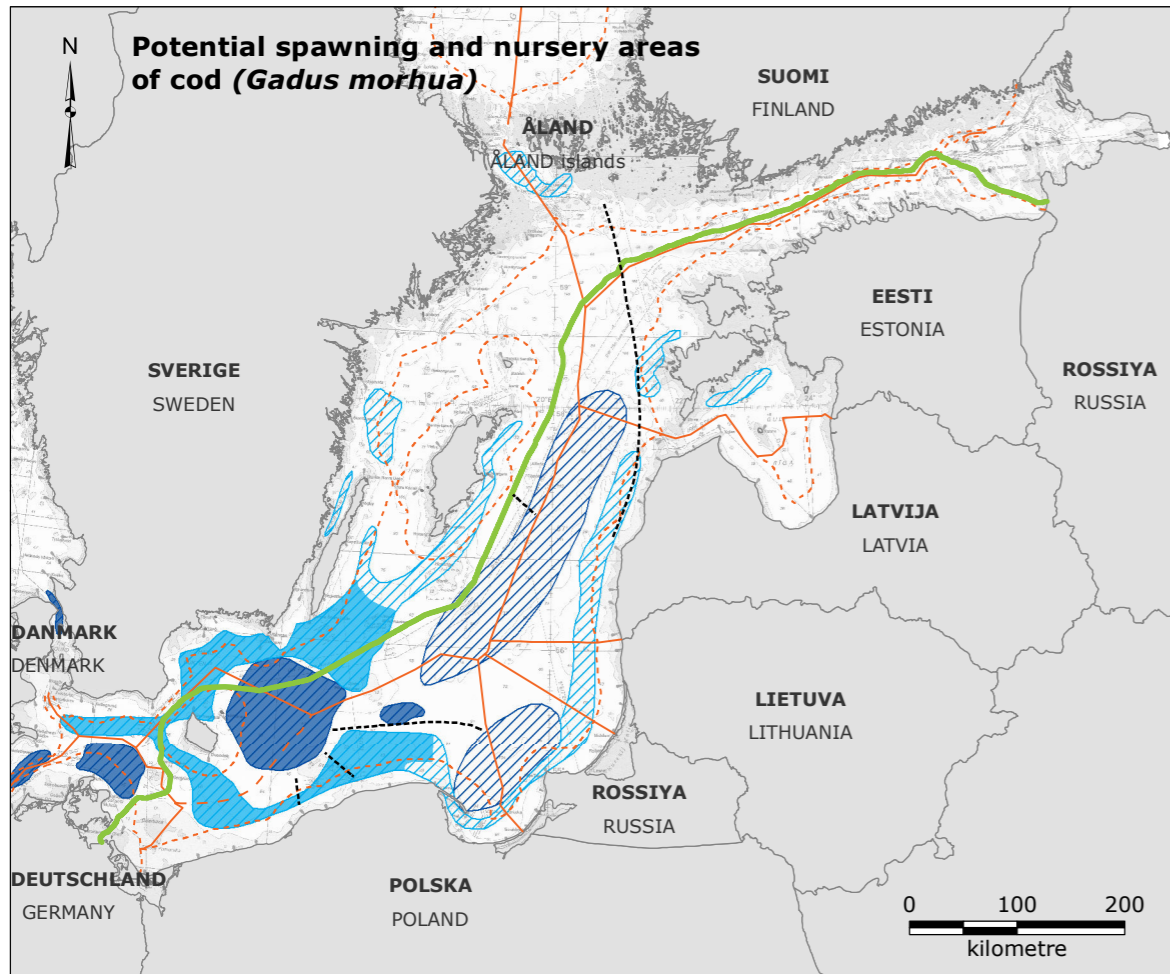
References:
 - European Environment Agency and HELCOM, 2016, "Ramsar sites", <http://maps.helcom.fi/website/mapservice/index.html>, Data accessed: 2018-05-06
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Version: 01
 Date: 2018-05-15
 Prepared: MSTB/ MRIH
 Controlled: DMM

PA-02-D

Ramsar sites and Marine Protected Areas (MPAs)





- Legend:**
- NSP2 Route
 - - - Territorial water border
 - EEZ border
 - - - Midline between Denmark and Poland
 - 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:

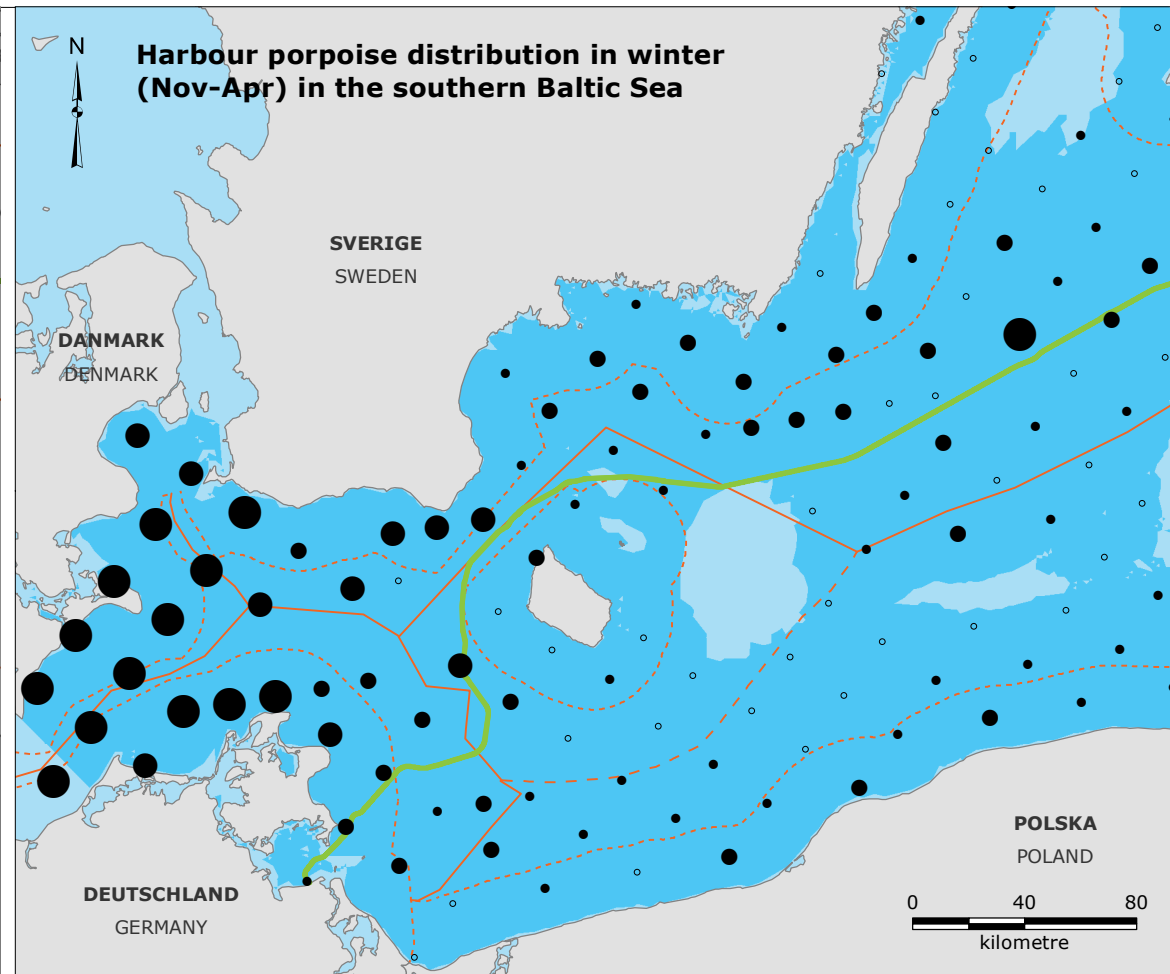
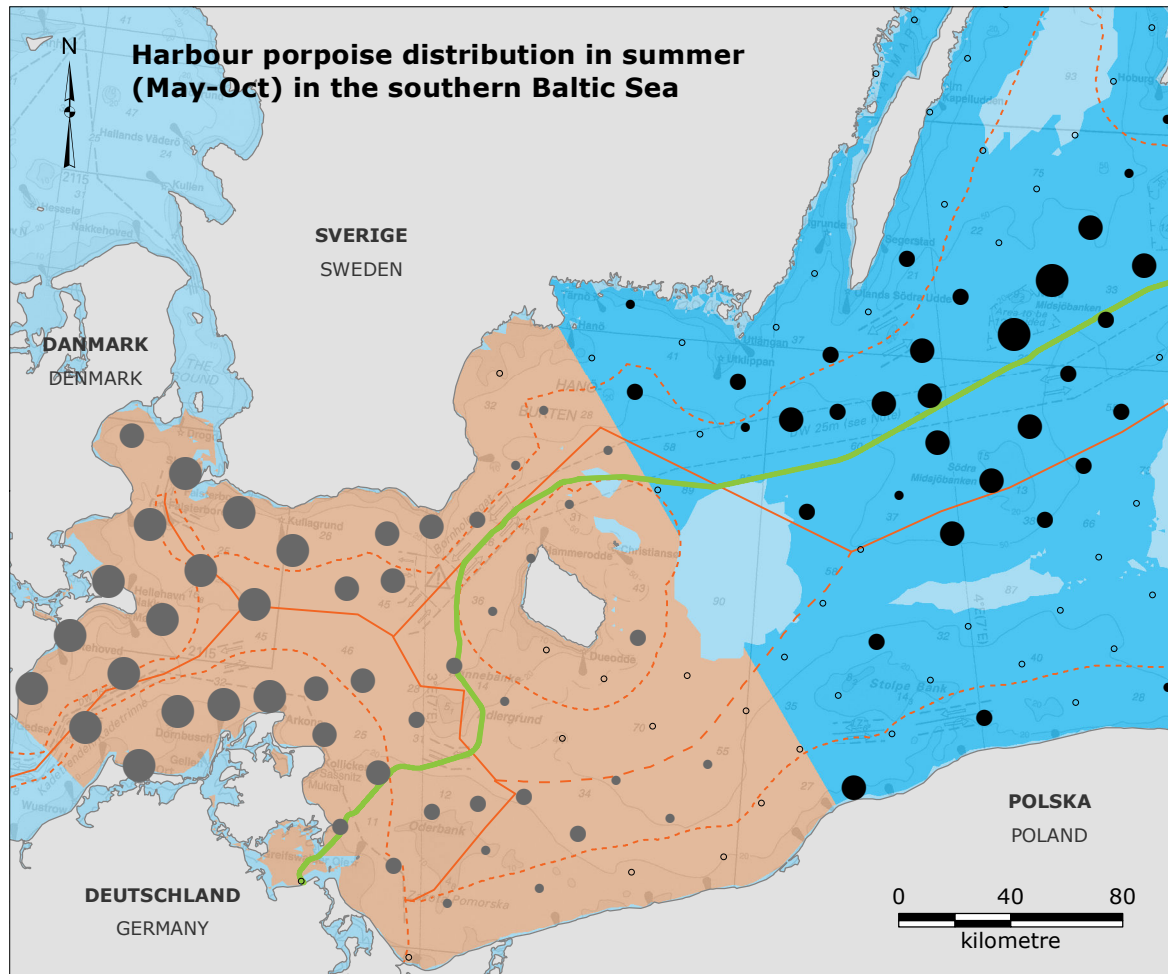
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- Cardinale, M., Svedäng, H., 2011. "The beauty of simplicity in science: Baltic cod stock improves rapidly in "cod hostile" ecosystem state". Marine Ecology Progress Series, 425, pp. 297-301
- ICES, 2012, "Report of the ICES Advisory Committee". ICES 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: 02
 Date: 2018-07-11
 Prepared: MSTB/ MRIH
 Controlled: MCO/ DMM

FI-01

Spawning areas of cod, herring, and sprat





- Legend:**
- NSP2 Route
 - Territorial water border
 - EEZ border
 - Midline between Denmark and Poland

Legend:

Population area:	Baltic, Summer (May - Oct)	Belt Sea, Summer (May - Oct)
■	Baltic	■
■	Belt Sea	■
■	No Data	

Porpoise Positive Seconds per day:	0.002 - 0.1	0.023 - 1
●	> 0.1 - 1	●
●	> 1 - 10	●
●	> 10 - 248	●
●	> 100 - 3015	●
○	Zero detections	○

Legend:

Population areas:	Baltic, Winter (Nov - Apr)
■	Baltic
■	No Data

Porpoise Positive Seconds per day:	0.003 - 1
●	> 1 - 10
●	> 10 - 100
●	> 100 - 1856
○	Zero detections

Note:
 - 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

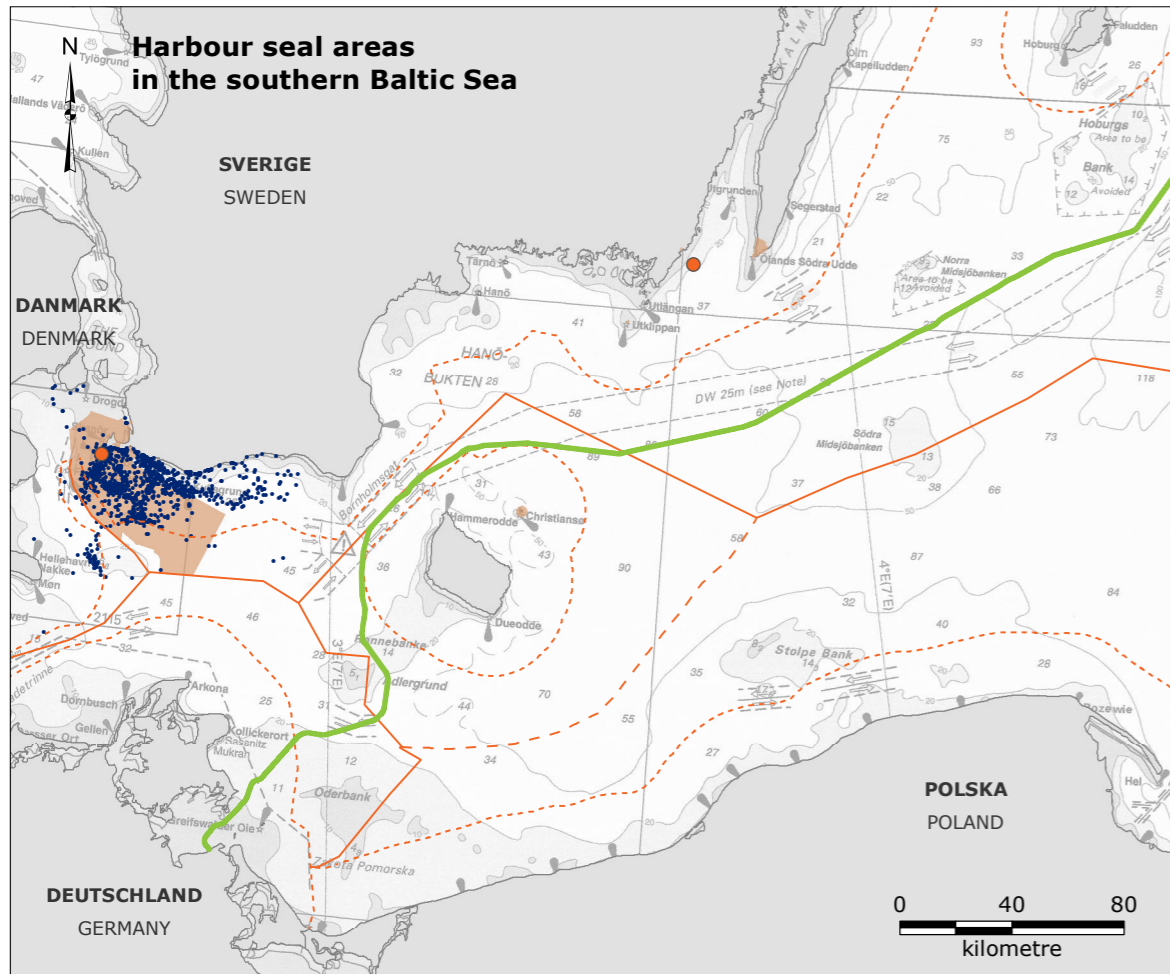
References:
 - SAMBAH, 2016, "Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise (SAMBAH). Final report under the LIFE+ project LIFE08 NAT/S/000261", Kolmårdens Djurpark AB, SE-618 92 Kolmården, Sweden. 81pp.
 - DCE, 2018, "Marine mammals report, NSP2 alternative route"

Version: 02
 Date: 2018-07-04
 Prepared: MSTB/ MRIH
 Controlled: DMM

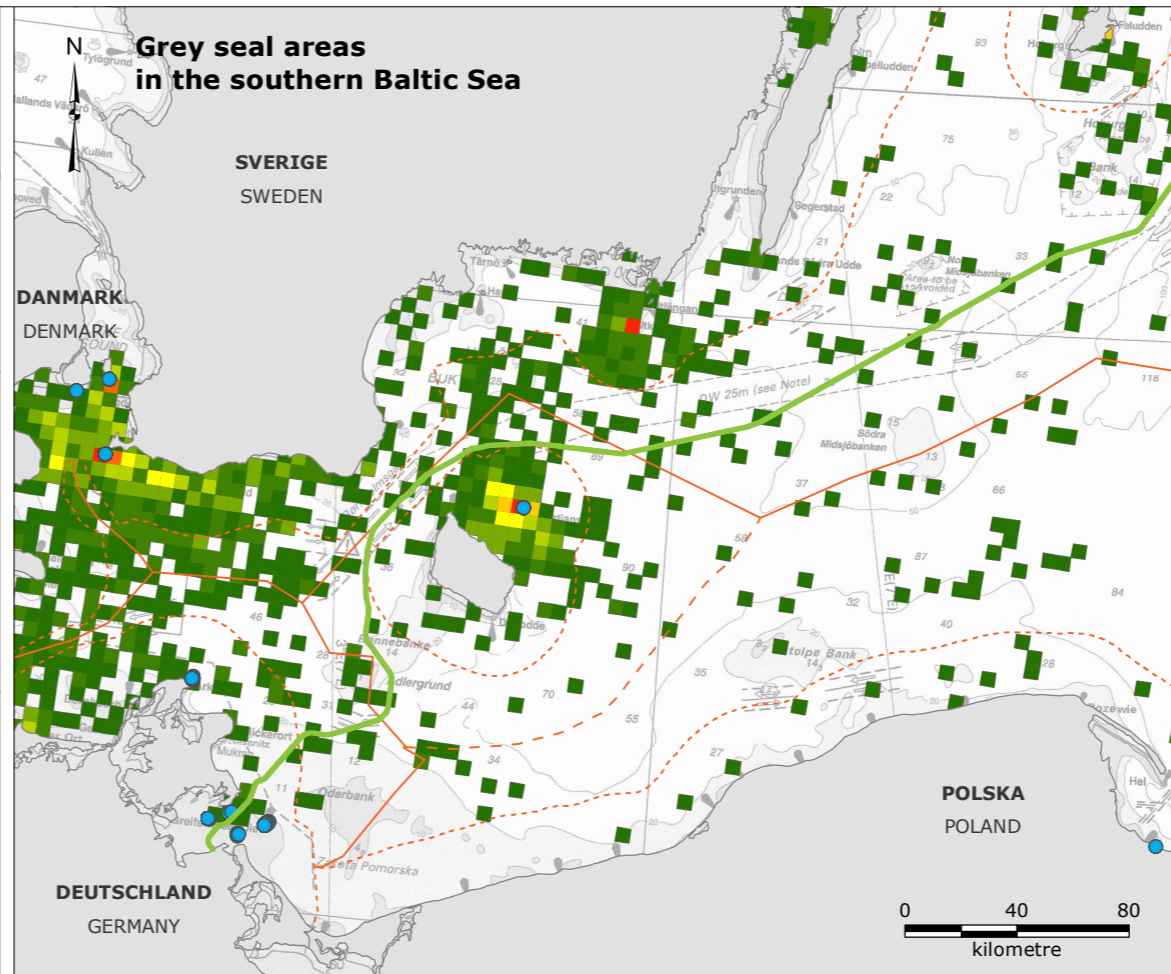
MA-01

Harbour porpoise distribution





- 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:
(Number of observations)
- | | |
|-----------|-------------|
| ■ 1 - 2 | ■ 18 - 25 |
| ■ 3 - 6 | ■ 26 - 45 |
| ■ 7 - 11 | ■ 46 - 77 |
| ■ 12 - 17 | ■ 78 - 113 |
| | ■ 114 - 432 |

- Legend:**
- NSP2 Route
 - - - Territorial water border
 - - - EEZ border
 - - - Midline between Denmark and Poland

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

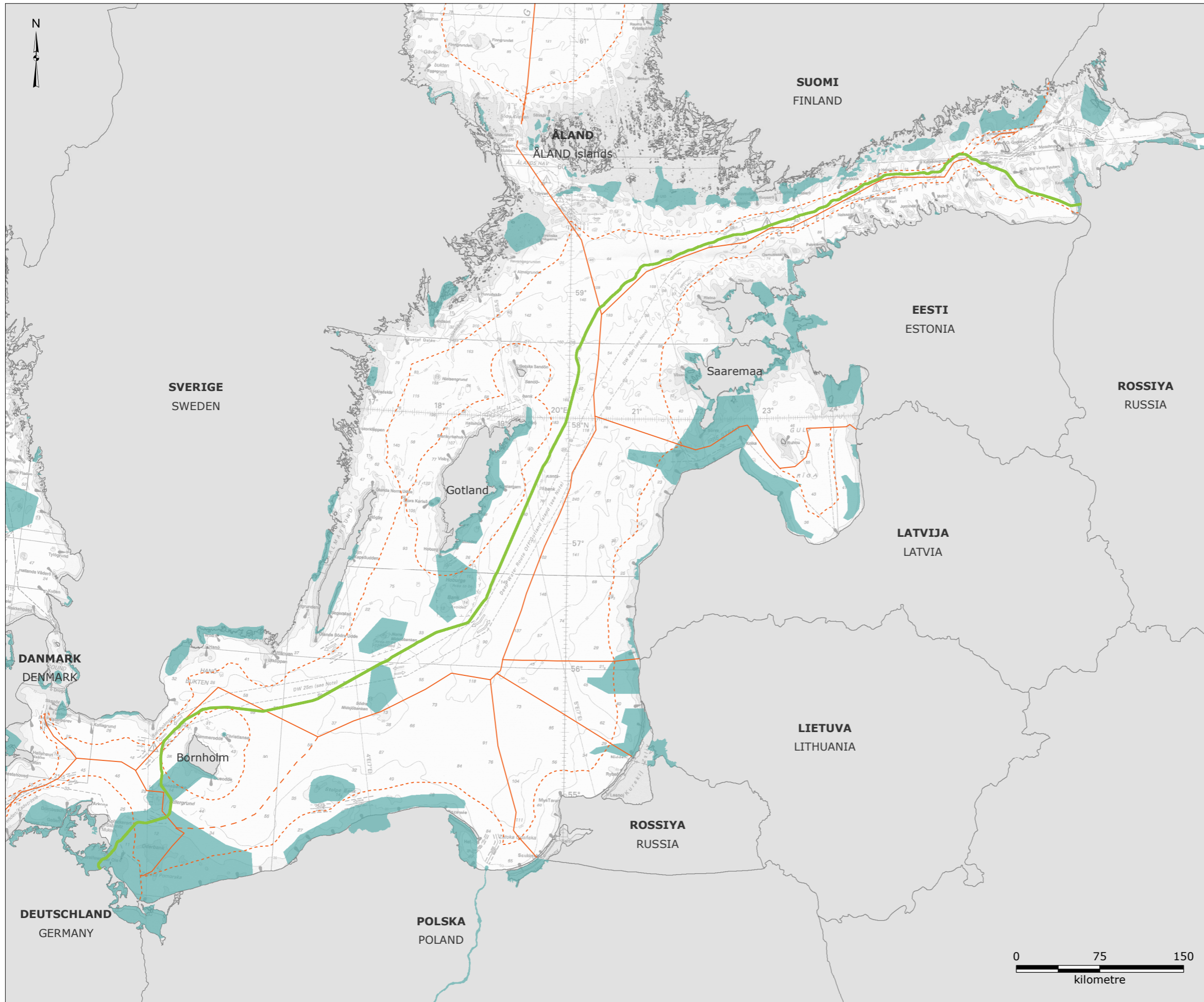
References:
 - Eco Express, 2016, "Baseline - Book 4"
 - HELCOM, BALSAM, 2015, BALSAM_GreySeal_5KGrid", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2018-07-10
 - DCE, 2018, "Marine mammals report, NSP2 alternative route"

Version: 02
 Date: 2018-07-04
 Prepared: MIRS/ MRIH
 Controlled: DMM

MA-02

Harbour seal and grey seal areas





- Legend:**
- NSP2 Route
 - Territorial water border
 - EEZ border
 - Midline between Denmark and Poland
 - Important Bird and Biodiversity Areas (IBA)

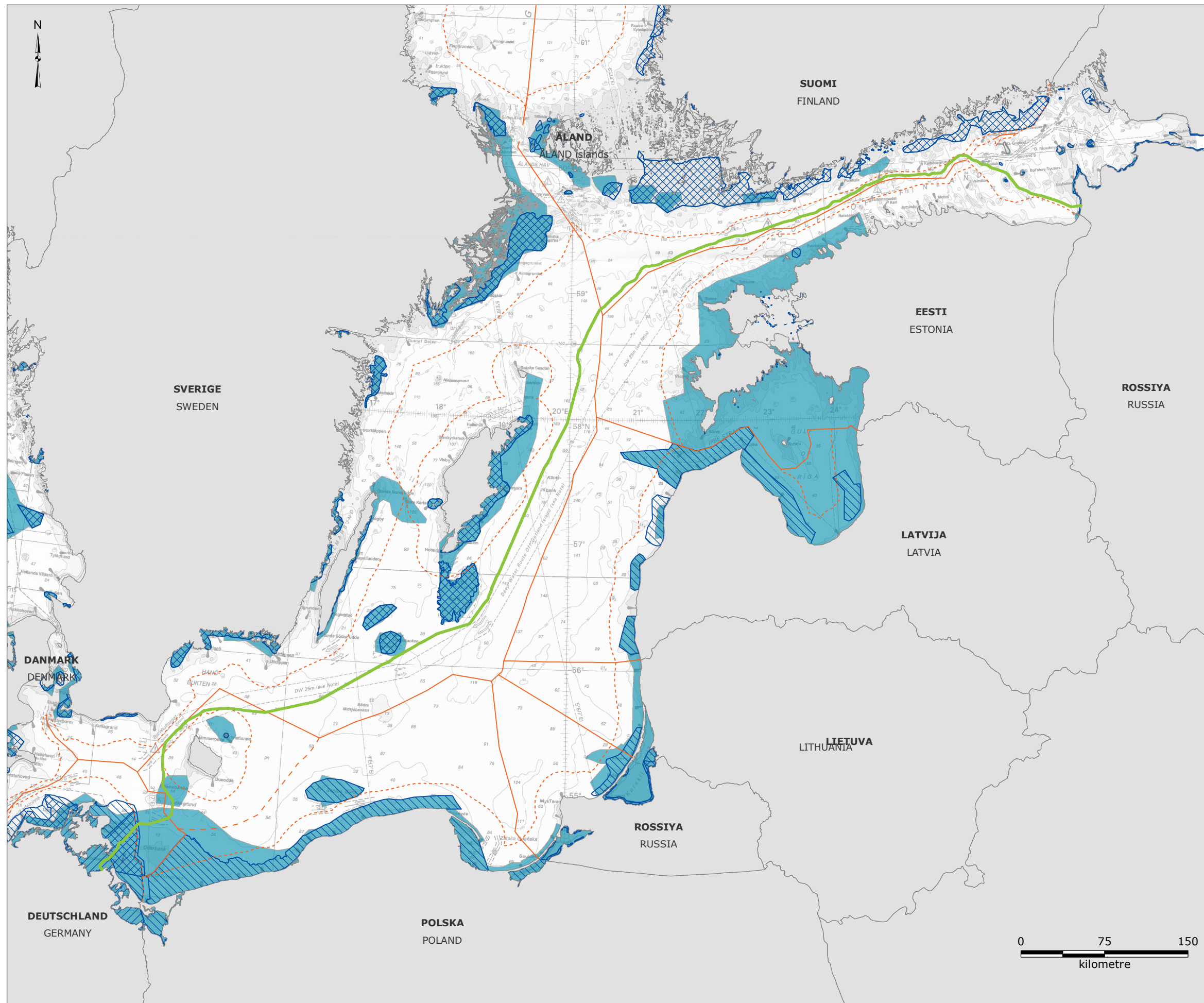
References:
 - BirdLife International, 2016, "Marine IBA e-atlas", <http://maps.birdlife.org/marineIBAs/default.html>, Date accessed: 2016-03-01
 - BirdLife Finland, 2016, <http://www.birdlife.fi/suojelu/paikat/iba/iba-suomen-tarkeat-lintualueet.shtml>, Date accessed: 2016-09-15
 - HELCOM, 2003, "Important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

Version: 01
 Date: 2018-05-15
 Prepared: MSTB/ MRIH
 Controlled: DMM

BI-01

Important Bird and Biodiversity Areas (IBAs)





- Legend:**
- NSP2 Route
 - - - Territorial water border
 - EEZ border
 - - - Midline between Denmark and Poland
 - / / Waterbirds during migration (spring and autumn)
 - X X 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: 2018-06-05
 - HELCOM, 2017, "Breeding areas birds region (BRISK)", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2018-06-05
 - HELCOM, 2017, "Wintering areas sea and shore birds (BRISK)", <http://maps.helcom.fi/website/mapservice/index.html>, Date accessed: 2018-06-05

Version: 01
 Date: 2018-06-08
 Prepared: MSTB/ MRIH
 Controlled: DMM

BI-02

Bird wintering and staging areas during migration

