Nord Stream

The new gas supply route for Europe

Results of Environmental and Socio-economic Monitoring 2013

Nord Stream Project

August 2014

Document-No. G-PE-PER-MON-100-080400EN

This report summarises the results of the environmental and socio-economic monitoring for the Nord Stream Project for 2013. The results have been reported in detail to the relevant national authorities. In case of discrepancies between the national environmental monitoring reports and the present publication, the national environmental monitoring reports supersede. For the monitoring activities that will continue in the coming years, the conclusions presented in this report should be regarded as preliminary and subject to change.

Foreword

Since October 2012 both Nord Stream pipelines have been in operation. In terms of environmental impact management, 2012 was the last year with monitoring related to construction activities. The monitoring results confirmed that there were no or minor environmental impacts from construction, limited locally and short term only, and thus in line with the outcome of the environmental impact assessments.

From 2013 and onwards, monitoring activities are focused on operation activities and recovery after construction. The monitoring surveys and the subsequent reporting will continue according to the agreements in the different countries and in accordance with the five national environmental programmes. The programmes were drawn up in compliance with the permit conditions in each country and were prepared in close consultation with the relevant national authorities.

This report is the fourth of six planned annual reports, the purpose of which is to document environmental effects during the construction and the recovery periods. The environmental and socio-economic monitoring is focused on environmentally sensitive areas and other receptors that potentially could be affected by the Nord Stream Project.

Since construction activities are now finalised, the focus of this and future reports will be on the results from ongoing monitoring activities. Therefore the results and conclusions from already finalised and reported monitoring activities are not described herein. For results and conclusions regarding these activities reference is made to the reports of previous years.

This report gives an overview of the national monitoring results from ongoing monitoring activities in each of the five countries the pipeline crosses. Each chapter describes, per target of impact, the activities in each of the five countries the pipeline crosses and includes the purpose of the programme, methods used, locations, results and conclusions.

Additional information can be found on the Nord Stream website www.nord-stream.com.

Dr. Dirk von Ameln
Permitting Director
Nord Stream AG

Table of Contents

Appendices

Abbreviations and definitions

ADCP	acoustic doppler current profiler
ANODE	anode monitoring station (Finland)
BNatschG	Bundesnaturschutzgesetz (German Federal Nature Conservation Act)
BOD_5	biological oxygen demand (for a period of five days)
CTDO	conductivity, temperature, depth and oxygen
CWA	chemical warfare agents
EEZ	exclusive economic zone
EIA	environmental impact assessment
ES	environmental study
GOM	German Oceanographic Museum
HELCOM	the Helsinki Commission
HNB	fish and epifauna monitoring station at a location without seabed intervention works between Hoburgs Banks and Norra Midsjöbanken (Sweden)
HSES	health, safety, environmental and social (management system)
IFC	International Finance Corporation
IMO	International Maritime Organisation
ISO	International Organization for Standardization
KP	kilometre point (starting with KP 0 at the Russian landfall)
LA_{eq}	LA_{eq} values refer to steady-state continuous noise (an average)
LA_{max}	LA_{max} values refer to single noise events
MAC	maximum allowable concentration
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973 (modified 1978)
MBES	multibeam echo sounder
Natura 2000	an ecological network of protected areas in the territory of the European Union
NMR	fish and epifauna monitoring station at a location without seabed intervention works near Norra Midsjöbanken (Sweden)
NMR_{new}	epifauna monitoring station at a location with rock placement near Norra Midsjöbanken (Sweden)
NMT	fish and epifauna monitoring station at a location where the pipeline is trenched into the seabed near Norra Midsjöbanken (Sweden)
NPUE	number per unit effort
NTU	nephelometric turbidity unit (relative measure of light scattering by suspended particles)
OECD	Organisation for Economic Co-operation and Development

PNEC	predicted no-effect concentration
POD	porpoise detector (hydrophones able to detect and log cetacean clicks)
ROV	remotely operated vehicle
SSC	suspended sediment concentration
SSS	side scan sonar
SST	sea surface temperature
WPUE	weight per unit effort

Summary

Nord Stream's environmental and socio-economic monitoring programme has been designed and implemented in order to fulfil the requirements and commitments under the respective jurisdictions of the five countries the Nord Stream Pipeline crosses. Environmental monitoring results are presented in detail in the national reports:

- 2010: Russia /1/, Finland /2/, Sweden /3/, Denmark /4/ and Germany /5/
- 2011: Russia /6/, Finland /7/, Sweden /8/, Denmark /9/ and Germany /10/
- 2012: Russia /11/, Finland /12/, Sweden /13/, Denmark /14/ and Germany /15/
- 2013: Russia /16/, Finland /17/, Sweden /18/, Denmark /19/ and Germany /20/.

The purpose of this report is to present the results and conclusions from the monitoring activities related to the operation of the pipelines and recovery from construction. The figure below lists the subjects monitored in 2013. An executive summary of the monitoring results in each country is provided in the following text.

Subject	Russia	Finland	Sweden	Denmark	Germany
Physical and chemical environment					
Water quality	+	-	-	-	-
Seabed sediments	-	-	-	-	+
Hydrography and seabed topography	+	-	-	-	+
Onshore soil	+	-	-	-	-
Landscape and topography	+	-	-	-	+
Air quality	+	-	-	-	-
Noise and pressure waves	+	-	-	-	-
Biological environment					
Fish and plankton	+	-	+	+	+
Birds	+	-	-	-	+
Marine mammals	+	-	-	-	+
Benthic flora and fauna	+	+	+	+	+
Terrestrial flora and fauna	+	-	-	-	+
Socio-economic environment					
Fisheries	-	-	-	-	-
Cultural heritage	-	+	+	-	-
Social impacts	-	-	-	-	-
Conventional munitions	-	+	-	-	-
+: Monitored in 2013 at selected/relevant locations					
-: Not monitored in 2013					

Figure 0.1 Subjects monitored in 2013

Monitoring in Russia 2013

The 2013 monitoring surveys carried out in Russia covered water quality, seabed topography, onshore soil, landscape, air quality, noise, fish and plankton, birds, marine mammals, benthic flora and fauna, and terrestrial flora and fauna. Data collected in 2013 have been evaluated against data collected in previous years when available.

Water quality. The potential impact on *surface waters* during operation of the pipelines is stipulated by the discharge of clean surface and underground waters from the pig trap area into the unnamed

stream that runs parallel to the eastern part of the Russian landfall. Overall, the results of monitoring in 2013 revealed no significant changes in the water quality compared to the monitoring results in 2010-2012. Therefore, it was concluded that operation of the Nord Stream Pipeline had no observed negative impact on onshore water quality.

Monitoring of *water quality* in the eastern Gulf of Finland was performed in August 2013. Water samples were collected from the surface and from medium water depth at six monitoring stations located along the pipeline in deep waters and one monitoring station in shallow waters at Portovaya Bay. Concentrations of suspended sediment and chemical compounds were below the maximum allowable concentration MAC in all water samples, with the exception of aluminium concentrations, which slightly exceeded the MAC in five samples. The same trend with aluminium was observed during the construction period in 2010-2012 and prior to any construction activities in 2009. Therefore, neither construction nor operation of the Nord Stream Pipeline was the cause of the increased aluminium concentration.

In 2013, when both pipelines were commissioned, the aim of the *satellite monitoring* was to confirm the results of the 2012 investigations and to prove that no thermal effects were present. Analysis of radar images showed no changes in ice cover or ice structure in the winter period. No major alterations in the sea surface temperature (SST) or increases in algal blooms and consequently chlorophyll concentrations were detected along the pipeline route in the summer period. Detected suspended sediment concentration (SSC) fields along the pipeline were low and below the MAC. The results of the satellite monitoring confirmed that the construction of the Nord Stream Pipeline and the transportation of gas through the pipelines did not have any thermal or other impacts on the water body in the Gulf of Finland.

Seabed topography. In 2013, monitoring was carried out in Portovaya Bay in September. Field surveys were performed along six survey tracks perpendicular to the pipeline. Monitoring in 2013 showed that the seabed characteristics were similar to the conditions observed after winter storms in 2011-2012. Analysis of the seabed profiles in 2013 showed the same tendencies as in 2011 and 2012: in shallow waters currents and storms contribute to the flattening of projecting areas and silting of cavities. Results obtained throughout the survey years (2010-2013) showed that there were no considerable changes in the seabed relief compared to the baseline data. Therefore the impact on the seabed caused by construction and operation of the Nord Stream Pipeline is considered negligible.

Onshore soil. Soil monitoring was carried out in 2009 prior to construction activities, in 2010-2012 during construction and in 2013 during operation. Samples were analysed for the following parameters: concentrations of metals, petroleum products and level of toxicity. Concentrations of all tested metals and petroleum products were below the MAC. The test for toxicity showed an acceptable level. The calculated cumulative index of soil pollution classified the examined soil as “clean”. Overall, monitoring results from 2009-2013 confirmed the conclusion of the environmental impact assessment (EIA) that operation of the Nord Stream Pipeline does not have any negative impact on the soil quality at the Russian landfall site.

Landscape and topography. Monitoring was carried out in 2010-2013. In 2013, monitoring was carried out in May and October. The surveys were performed at locations that previously showed some signs of hazardous exogenous geological processes and hydrological phenomena or that had a potential to develop these processes. The monitoring showed that due to reinstatement activities all sources of linear, lateral and bottom erosion were eliminated. A good rate of natural regeneration of coastal vegetation points to the minimal risk of erosion development in this area. The problem of flooding of the northern part of the pig trap area was resolved with the drainage channel system in 2012. No waterlogging was documented in the surveyed area. Similarly, there was no evidence of settlement of the ground in backfilled areas.

Air quality. Monitoring of air quality in 2013 was performed monthly between January and November. Monitoring was carried out at three stations located in the impact area (at the border of the >

right-of-way, near the vent stacks), at the border of the sanitary protection zone and at the border of the village of Bolshoi Bor, the nearest residential area. In 2013 monitored parameters included measurements of concentrations of methane and nitrogen dioxide. The air quality in the onshore section during operation of the Nord Stream Pipeline was in accordance with the requirements of government health norms established for air quality in populated areas.

Noise and pressure waves. Noise levels were monitored once per month in 2010-2012. Noise monitoring was carried out in 2013 monthly from January to November. Noise was also monitored during routine gas releases in July and August. Monitoring was carried out at three stations located within the impact area (at the border of the right-of-way, near the vent stacks), at the border of the sanitary protection zone and at the border of the village of Bolshoi Bor. The measured values of noise levels remained within the allowable levels during normal operation mode and during routine gas releases from the pipeline. Therefore it was confirmed that operation of the Nord Stream Pipeline does not have any significant noise impact on the adjacent areas.

Fish and plankton. Monitoring of *fish populations* was carried out in 2010-2013. Surveys were performed in June-October in the shallow waters of Portovaya Bay using gill nets and in June-November in the deep-water area of the eastern Gulf of Finland using trawls. The results of monitoring in 2013 showed some decrease in fish species diversity and abundance. The decrease in parameters of fish population may be the result of the reduction of monitoring stations from 13 to 5 in 2013 as well as of the earlier completion of monitoring (August in 2013 vs. September-November in 2010-2012), which may have interfered with the detection of migrating and spawning species such as whitefish, vendace or northern lampreys that were documented in the previous surveys. Natural factors, including the morphometric and hydrological peculiarities of the surveyed area, can also contribute to fluctuations in the fish population.

Monitoring of *salmonid species (Salmoninae)* was carried out in 2010, 2011 and 2013. In 2013 salmonid monitoring was carried out in May-June and September-November at three stations in Portovaya Bay. No salmonid species, including juveniles, were detected during any of the monitoring surveys. It is difficult to draw any conclusions on the impact on salmonid species from the construction and operation of the Nord Stream Pipeline because no salmonid species were documented during baseline surveys in 2006 and 2007. Salmonid species occur in low quantities in the survey area.

Monitoring of *plankton* was carried out in 2010-2013 during the summer period in shallow waters and in the deep-water area of Portovaya Bay. In 2013 monitoring took place at seven stations located along the pipeline. Monitoring covered analysis of zooplankton and phytoplankton communities, in correspondence with previous years. In general, species composition, parameters of abundance and distribution of phyto- and zooplankton in the surveyed area corresponded with the natural levels that are typical of the eastern Gulf of Finland. Therefore, the construction and subsequent operation of the Nord Stream Pipeline did not have any significant negative impact on plankton communities.

Birds. Monitoring of seabirds was carried out between 2010-2013 to document the status of migrating and nesting birds during construction and operation of the pipeline. Monitoring activities in 2013 were aimed at obtaining information on species composition, distribution and abundance, with particular focus on rare and protected species. The results of bird monitoring in 2013 showed an ongoing positive tendency in the development of bird populations. On the basis of these results and those of previous years it was concluded that the construction and subsequent operation of the Nord Stream Pipeline had no negative impact on ornithofauna in the region.

Marine mammals. Monitoring of marine mammals was carried out in 2010-2013. Surveys were performed on the coastlines of the islands of Maly Fiskar, Bolshoi Fiskar, Sommers, Gogland and Halikarti. In addition, all encounters with mammals in open waters were recorded. In 2013 additional surveys were performed in the control areas in the central and southern Gulf of Finland located outside of the pipeline route. Very few aquatic mammals were detected along the pipeline route

during the monitoring campaigns. However, the presence of grey seals in 2013 in the vicinity of the pipeline route indicates the absence of any negative effects from pipeline operation on the aquatic mammal population.

Benthic flora and fauna. Monitoring of *benthic infauna* was carried out in 2010-2013. Samples were collected at seven stations in Portovaya Bay and in the deep-water section using a Peterson dredge grab. Samples were analysed for species diversity, abundance and biomass of meio- and macrozoobenthos. Overall, the survey of 2013 showed little change in macrozoobenthos composition, with a slight decrease in diversity of meiozoobenthos in comparison with the previous year. The diversity of meiozoobenthos species in 2013 was comparable to that of 2010 but less than in 2011 and 2012. The decrease in species diversity may be the result of the reduced number of monitoring stations (from 21 to 7); it may also be due to natural fluctuations in the marine environment. It was concluded that variations in the distribution and composition of meio- and macrozoobenthos in 2013 were typical of the eastern Gulf of Finland and operation of the Nord Stream Pipeline did not affect benthic communities.

Monitoring of *benthic flora* was carried out in 2011-2013 in the central part of Portovaya Bay. Macrophyte monitoring included observations of the general condition, composition and structure of helophytes (coastal wetland plants), hydrophytes (fully submerged flowering plants) and benthic flora (algae) communities at five sites. The largest impact on macrophyte communities occurred during dredging and trenching activities in Portovaya Bay in 2010-2011. The results of the monitoring in 2013 confirmed the conclusion drawn in 2012 about the steady recovery of macrophytes in the vicinity of the pipelines. Monitoring during the operation of the pipeline has not shown any negative impact on wetland vegetation.

Terrestrial flora and fauna. Monitoring of *terrestrial flora* was carried out during the summer/autumn periods of 2010-2013. Botanical monitoring in 2013 was performed at 17 monitoring stations in forest, wetland and nearshore areas. Intensive forestry activities resulting in depleted flora and general low species diversity are the key characteristics of the territory under consideration. In 2013 chives were detected within the impact area for the first time. Reinstatement activities aimed at the disturbed soil and vegetation area of the corridor, which were initiated in 2012 and continued in 2013, were proven to be successful. No significant changes in the terrestrial flora, including populations of rare and protected species, at the Russian landfall area have been detected since 2010. To conclude, construction and operation of the Nord Stream Pipeline have little impact on the terrestrial vegetation in the surveyed area.

Monitoring of *terrestrial fauna* was carried out during the summer/autumn periods of 2010-2013. The aim of the monitoring was to describe species composition and distribution of onshore mammals, birds and reptiles/amphibians; to evaluate population structure and vulnerability; and to detect potential changes in the fauna communities due to construction and operation of the pipelines at the Russian landfall site. The results of the monitoring in 2013 showed an increase in species diversity in the surveyed area. Overall, the surveys of 2010-2012 showed no negative impact on fauna that could be directly linked to Nord Stream construction works. Monitoring in 2013 confirmed that operation of the pipeline did not affect animal communities in the vicinity of the pipeline.

Monitoring in Finland 2013

The 2013 monitoring surveys carried out in Finland covered benthic fauna, cultural heritage, and conventional munitions. Data collected in 2013 have been evaluated against data collected in previous years when available.

Benthic flora and fauna. Monitoring of *benthic infauna* was carried out to evaluate impacts and recovery after rock placement and munitions clearance. Benthos samples were taken at monitoring stations in August 2010 and in October 2013. To monitor possible transboundary impacts. The changes in and recovery of benthos communities in the Finnish EEZ have been monitored near the border in >

the Estonian EEZ. The number of species and abundance of individuals was low during both sampling campaigns. On the basis of the data thus far, it can be concluded that the overall conditions at the stations have not altered during the three-year time period between surveys. Therefore no major changes in the diversity of benthos are foreseen for the coming years.

Monitoring of *benthic infauna* took place at three HELCOM (Baltic Marine Environment Protection Commission) stations in 2010-2013. The monitored HELCOM stations have long suffered from more or less permanent oxygen deficit in a water layer nearest to seabed. Based on the results, as was also assessed during the EIA phase, direct impacts of the pipeline construction activities on benthos have been minor. A preliminary conclusion is that the pipeline construction works or the pipelines on the seabed have not caused any irreversible impacts on benthic infauna outside the areas of direct impacts i.e. the seabed cover of the constructed rock berms.

Cultural heritage. The inspection of four wrecks in the Finnish EEZ in 2013 included visual inspection with a remotely operated vehicle (ROV) equipped with cameras and a multibeam echo sounder (MBES). By comparing the positions of the wrecks and the images of the wrecks features with the previous results, it was possible to assess whether the wrecks had been affected by the pipelines during operation. No changes in the location or condition of the wrecks were observed.

Conventional munitions. A digital terrain model acquired during the annual external pipelines inspection survey was used to derive possible targets or objects on the seabed near the pipeline. On the basis of the monitoring results from the inspections in 2013, it was concluded that there were no visible changes to any of the munitions objects and that no displacement of the objects had occurred in comparison with previous surveys.

Monitoring in Sweden 2013

The 2013 monitoring surveys carried out in Sweden covered fish, benthic fauna and cultural heritage. Data collected in 2013 have been evaluated against data collected in previous years where available.

Fish. Monitoring of demersal fish took place in three areas along the pipeline in 2010-2013 using a combination of trawls and gill nets. The structure of the demersal fish community was similar in all years and strongly dominated by cod and herring. Between five and nine fish species were detected in 2013. In general, monitoring results showed a higher abundance and higher biomass in 2011-2013 compared with the 2010 baseline study. It can be verified that the amount of fish along the pipeline has not changed significantly when comparing impact and reference areas within years, and it was concluded that the fish abundance along the pipeline had not decreased due to the presence of the Nord Stream Pipeline.

Benthic fauna. Monitoring of *infauna* took place in 2010-2013. Monitoring was carried out by seabed sampling along two transects between the pipeline and Hoburgs Bank and Norra Midsjöbanken. During the monitoring surveys carried out thus far up to 13 and 10 species of infauna were detected at the two transects, respectively. Since the baseline surveys in 2010, the abundance and biomass of the benthic fauna has increased significantly due to natural variations in both areas. The variations between 2011, 2012 and 2013 are not significant.

The monitoring of *epifauna* in 2011-2013 included inspection of the pipelines with video cameras mounted on an ROV at four locations south of Norra Midsjöbanken. In 2013 the video recordings from the four analysed areas revealed an establishment of blue mussels in one area and a possible establishment in another area. One mobile species of epifauna, the crustacean *Saduria entomon*, was identified to be present on and next to the pipeline in higher numbers compared with previous surveys carried out in 2011 and 2012. In accordance with the expected effects of the new hard-bottom substrate (the pipeline), establishment and a general increase in epifauna has been observed since 2011.

Cultural heritage. Monitoring of cultural heritage in Sweden was carried out before and after pipe-laying. Nine wrecks were included in the monitoring programme. Post-lay inspections of seven of the wrecks took place in either August 2011 or July 2012, whereas the remaining two wrecks were inspected in March 2013. Each monitoring survey involved video recordings of the wrecks using an ROV in addition to a MBES survey covering the full extent of the objects and a stretch of the pipeline in close proximity to the wrecks. The two wrecks (ID R-32-92761/R-32-92762 and R-32-92558) that were monitored in 2013 appeared unchanged compared with the pre-lay survey, despite visibility being worse than during the survey in 2009.

Monitoring in Denmark 2013

The 2013 monitoring surveys carried out in Denmark covered fish and benthic fauna. Data collected in 2013 have been evaluated against data collected in previous years when available.

Fish. Monitoring of fish was carried out in 2010-2013 by a combination of trawl and gill net fishing and covered seven impact stations along the pipeline. The fish composition during the fish survey in 2013 was similar to the 2010, 2011 and 2012 surveys and strongly dominated by cod and herring. The biomass and abundance of cod varied between survey years and between impact and reference areas. An increase of the flatfish species flounder and plaice was observed during the surveys in 2011 and 2012 at the three southernmost locations; however, in the 2013 survey flatfish were documented in lower numbers and no reef effect was documented. The remaining demersal fish species found during fish surveys, including shorthorn sculpin, haddock, turbot, whiting, hook nose, lumpfish, three-bearded rockling and four-bearded rockling, were only documented in low numbers. It can be verified that the abundance of fish along the pipeline has not changed significantly when comparing impact and reference areas within years, and it was concluded that fish abundance along the pipeline has not decreased due to the presence of the Nord Stream Pipeline.

Benthic fauna. Monitoring of infauna was carried out in 2010-2013 by seabed sampling along two transects (B10 and B11) perpendicular to the pipeline route, each comprising 15 stations. The abundance of infauna in the monitoring areas has increased approximately 40%, and the biomass of infauna has increased approximately 30% since the baseline survey in 2010 and the final survey in 2013. However, there are major yearly fluctuations. Apart from a local and weak decrease in species abundance and biomass at the two stations closest to the pipeline at transect B11, no negative impact from the construction of the Nord Stream Pipeline has been detected during this monitoring programme.

Monitoring of *epifauna* was carried out in 2011-2013. Each survey included inspection of the pipelines with video cameras mounted on an ROV at ten locations. In 2013, the first establishment of blue mussels was confirmed along 4 of the 10 pipeline sections. A general increase in epifauna (including mussels, the mobile crustacean *S. entomon*, flatworm and hydroids) has been observed since the first monitoring survey in 2011. The growth as well as increased coverage of blue mussels will most likely continue over the years, and a future establishment of blue mussels within the other areas is expected.

Monitoring in Germany 2013

The 2013 monitoring surveys carried out in Germany covered seabed sediments, seabed topography, fish, seabirds, marine mammals, benthic flora and fauna, and terrestrial flora and fauna (reptiles, breeding birds). Data collected in 2013 have been evaluated against data collected in previous years.

Seabed sediments. Sediment sampling was carried out in 2011-2013 at three monitoring areas: Greifswalder Bodden, Pomeranian Bight/Territorial Waters and Pomeranian Bight/EEZ. During the monitoring in 2013 measurements of median grain size, silt content and loss on ignition (organic matter content) did not reveal any significant differences between the three areas. The recovery process of the sediment in the backfilled trenches was in line with the predictions of the German EIA. The recovery process of natural surface sediment conditions was completed within a period of three years. >

Seabed topography. Monitoring of seabed topography was carried out in 2011-2013. Surveys were conducted along the entire pipeline route in Germany using high-resolution MBES and side scan sonar (SSS) techniques. In general, reinstatement of seabed topography in the trenched areas was within the range of ± 30 cm compared to the planned design. The spatial footprint analysis revealed a total impact area of 3.1 km^2, and only approximately 0.4 km^2 were located beyond the expected impact zone of ± 25 m on either side of the trench of Pipeline 2. Seabed topography of the reinstated trenches and reefs remained very stable during 2012 and 2013.

Landscape. The monitoring of dune vegetation, reptiles and breeding birds in 2013 revealed that reinstatement and management were successful, as all endangered species either survived the construction period or returned afterwards.

Fish. Monitoring of fish was carried out in 2011-2013. In all three years, fish were caught using beach seine samples in the shallow waters off Lubmin. Catches were sorted to species level and registered with individual weight and length. A total of 12 species were recorded in 2013. Gobiids, herring and sand eel prevailed in 2013. In all, 17 species were observed during the three years of investigations, representing a typical shallow water community of young and small fish in Greifswalder Bodden. In general, the results obtained during the recovery phase (2011-2013) mirrored the results obtained during the baseline investigations in 2006 and 2008.

Seabirds. Monitoring of staging seabirds during the recovery phase was carried out in midwinter and spring from 2011 until 2013. The aim of the surveys was to estimate the total number of staging seabirds in Greifswalder Bodden and the Pomeranian Bight. During the monitoring in 2013 the total number of staging seabirds in midwinter and spring was again comparable to the number observed during previous surveys (2006-2012). A maximum was recorded for long-tailed duck *(Clangula hyemalis)* in February, which was almost comparable to the midwinter figures of the 1990s, when long-tailed ducks were by far more numerous than today. A quantitative and spatial comparison between the baseline study in 2006-2008 and the post-construction surveys of 2011-2013 revealed no changes in the overall number for the eight most abundant species. The distribution pattern of scoters changed towards the south, possibly as a result of the implementation of a traffic separation scheme in the Adlergrund channel in December 2010.

Marine mammals. Monitoring of harbour porpoise *(Phocoena phocoena)* was carried out 2009-2013. The presence/absence of harbour porpoises was monitored using stationary hydrophone recordings. Hydrophones were deployed at 13 stations within the Pomeranian Bight. Harbour porpoises were detected on 15% of all recording days between 2010 and 2013. This number is higher than what would be expected on the basis of previous studies in the area. Throughout the monitoring period the majority of harbour porpoises were detected between August and October. These findings correspond to results from former studies in the area and may indicate a migration of harbour porpoises from the Danish Belt Sea into the Pomeranian Bight during late summer/autumn and a migration of Baltic Proper porpoises into the area during February. The presence of harbour porpoises in the Pomeranian Bight increased exponentially between 2005 and 2013. The reasons for this significant trend remain uncertain.

Benthic flora and fauna. Monitoring of *macrophytes* was carried out 2011-2013, and a baseline investigation was carried out in 2007. Field surveys were carried out in the vicinity of the landfall at Lubmin and included physical sampling of macrophytes and aerial photo surveys. The number of recorded macrophyte species during the baseline investigation and the surveys carried out between 2011 and 2013 was similar. Compared with the unaffected areas nearby, the macrophyte cover in the vicinity of the former cofferdam construction area and its surroundings were locally still reduced. The blocking effect of the nearby harbour wall of the industrial harbour Lubmin is considered a potential reason for the slow recovery of the macrophyte vegetation.

Monitoring of *benthic fauna* was carried out 2011-2013. Samples were taken using a Van Veen grab along five transects in Greifswalder Bodden and seven transects in the western Pomeranian

Bight. An additional 14 samples were collected from the trench area and its immediate surroundings. Results from Greifswalder Bodden showed that all native invertebrate species had reinvaded the backfilled trench in abundances similar to those prior to construction activities. However, the overall biomass was still significantly lower (50%) in 2013 in the vicinity of the backfilled trench compared with the other three areas under investigation. Multivariate analysis of community structure in the Pomeranian Bight did not reveal significant differences between the trench and reference areas in 2013. The overall biomass was significantly lower (50%) in the vicinity of the backfilled trench compared with the reference area because of the slow recovery of the population structure of the long-lived clam *Mya arenaria.*

Monitoring of *epifauna* was carried out in August 2011-2013. Inspections of the pipeline were carried out using underwater video recordings and scratch sampling. The results showed that the epifauna community of the reinstated reefs mirrored that in the natural habitat at Greifswalder Bodden and the Boddenrandschwelle. The first spat of blue mussels were found in the vicinity of the deeper reinstated reefs in the western Pomeranian Bight in 2013. Presumably, seasonal anoxia at depths of 15 m prevented meroplanktonic larvae (barnacles and blue mussels) from successfully settling in the previous year.

Terrestrial flora and fauna. Monitoring of terrestrial flora and fauna (dune vegetation, reptiles and breeding birds) was carried out in 2011 and in 2013. Dune management of E3 compensation measure (development concept for sand and neglected grassland locations in the landfall area of the Nord Stream Pipeline near Lubmin), hastened the recovery of the former onshore construction area. The abundance of endangered breeding bird species increased between 2011 and 2013. The abundance is now comparable to that prior to construction. Populations of all five reptile species remain vital, even though their habitat was significantly reduced by installation of the gas receiving terminal in Lubmin. The inoculation of endangered dune plant species was considered successful.

1 Introduction

> The Nord Stream twin pipeline system through the Baltic Sea runs from Vyborg, Russia, to Lubmin, Germany. The pipelines were built and are now operated by Nord Stream AG. The Nord Stream route crosses the EEZs of Russia, Finland, Sweden, Denmark and Germany, as well as the territorial waters of Russia, Denmark and Germany.

The two 1,224 km offshore pipelines constitute a direct connection between the vast natural gas reserves in Russia and the energy markets in the European Union. Pipeline 1 became operational in the last quarter of 2011, and Pipeline 2 became operational in the last quarter of 2012. The pipeline system thus achieved the capacity to transport a combined total of 55 billion cubic metres (bcm) of natural gas per year.

1.1 Purpose

The purpose of this report is to summarise the results and conclusions from the environmental and socio-economic monitoring carried out by Nord Stream in 2013. The monitoring programme was designed and implemented in order to fulfil the requirements and commitments under the respective jurisdictions of the five countries. Further requirements and commitments, arising from the project's financing phase, resulted in Nord Stream implementing the project in conformance with the IFC Standards, the Equator Principles, ISO 14000ff and the OECD Common Approaches.

Nord Stream is continuing the national approach from the permitting process in order to ensure compliance with the national permits during the construction and operations phases. Thus, the national monitoring programmes are based on the findings of the national EIAs (environmental study, ES, for Sweden) found here:

- Russia /21/ /22/
- Finland /23/
- Sweden /24/
- Denmark /25/
- Germany /26/.

1.2 Nord Stream monitoring programme and reporting

Because the Nord Stream monitoring programmes are based nationally, they are aligned with the legislation in each country. However, the international consultation process (the Espoo consultation) as part of the permitting process has enacted environmental monitoring of transboundary impacts, specifically in the Gulf of Finland (Finland/Estonia and Russia/Finland, respectively).

The national and transboundary monitoring programmes are established by the legislation of the individual countries as well as through consultation with the relevant national authorities. The monitoring programmes were planned and developed with the following objectives:

- To verify that the pipelines are installed and operated in accordance with permit conditions;
- To verify that the pipeline construction does not cause unanticipated or greater impacts than anticipated;
- To monitor the recovery of the environment after construction;
- To verify the findings of the national environmental impact assessments;
- To provide the basis for corrective action if necessary; and
- To safeguard the environment.

The Nord Stream environmental and socio-economic monitoring programme, which includes monitoring before, during and after construction of the Nord Stream Pipeline, is described in detail in the national and transboundary programmes for:

- Russia /27/ /28/ /29/ /30/
- Finland /31/ /32/ /33/ /34/
- Sweden /35/
- Denmark /36/
- Germany /37/

and outlined in the Overall Environmental and Social Monitoring Programme /38/. >

Annual status reports covering the entire Nord Stream monitoring programme are elaborated for each year of monitoring.

- 2010 /39/
- 2011 /40/
- 2012 /41/.

The present report is the fourth of six planned annual reports.

The environmental and socio-economic monitoring is focused on environmentally sensitive areas and other receptors that could potentially be affected by the Nord Stream Project. Because these sensitive areas and receptors differ geographically, not all parameters are monitored in all countries. Also, certain investigations are carried out only at selected sites, depending on environmental variations and the nature of the construction works.

Since the construction activities for the Nord Stream Pipeline were finalised in 2012 and the pipelines are now in operation, the remainder of the monitoring programme is focused on operation and recovery after construction. The results of the 2013 monitoring activities are described in Chapters 2 through 17. For each subject and for each country, the purpose of the monitoring is described and a summary of monitoring activities and results achieved during 2013 is provided and compared with previous monitoring results. Maps showing the detailed monitoring locations in each of the five countries are presented in Appendices A-E.

The results from monitoring activities that were finalised before 2013 are not included in the present report. A complete overview of monitoring results in relation to construction undertaken from 2009-2012 is available in the environmental and socio-economic monitoring report from 2012 /41/.

2 Water quality

> The Baltic Sea is the largest brackish (low salinity) water body in the world. More than 250 streams drain into the Baltic Sea, contributing approximately 660 km^3 of fresh water per year. The low saline ecosystem supports unique flora and fauna, including a mixture of marine and freshwater species. Chemical and physical parameters, such as hydrographical conditions, oxygen, turbidity, metals and organic pollutants, play a major role in determining the quality of the environment. The chemical and physical parameters within the Baltic Sea fluctuate depending on depth and location, e.g. whether it is a coastal area or the open sea.

2.1 Monitoring programme for water quality

Potential impacts

The potential impacts from the Nord Stream Project include increased concentrations of sediments in the water during construction, which may cause increased turbidity (cloudiness) and possible dispersion of inorganic and organic contaminants. This can affect the marine flora and fauna in different ways. Impacts during operation include the release of material from sacrificial zinc anodes.

Monitoring activities until 2012

Monitoring of water quality was carried out in Russia, Finland, Sweden, Denmark and Germany. Monitoring was initiated in 2009 and was finalised in 2012 for Denmark, Sweden and Germany.

Monitoring activities in the marine environment during construction included a combination of vessel-based in situ measurements as well as water sampling and fixed-station measurements at selected locations along the pipeline route. The purpose of the monitoring was to document current speed and direction; turbidity levels, including compliance with national threshold values; water stratification; oxygen concentrations; and the simultaneous release of particle-associated nutrients and contaminants during construction, in particular during seabed intervention works such as post-lay trenching, rock placement and dredging.

In Russia, the potential impacts on an unnamed stream running east of the Russian landfall site as well as monitoring of water discharge into Portovaya Bay during pre-commissioning were included in the monitoring programme.

The results and main conclusions from finalised monitoring of impacts on water quality during construction of the pipelines, which took place in Russia, Finland, Sweden, Denmark and Germany from 2009-2012, are detailed in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

For certain parameters the monitoring of water quality in Russia and Finland continues in the operation phase. In Russia, the potential impacts on an unnamed stream running east of the Russian landfall site as well as water quality monitoring in Portovaya Bay took place in 2013. Water quality monitoring in Russia will be continued in 2014 and is planned to be carried out once every three to five years thereafter. In Finland, monitoring related to the release of material from the sacrificial anodes is ongoing. The monitoring started in 2012 and the next campaign will be in 2017. The preliminary results and conclusions from monitoring in 2013 are reported in the following sections.

The locations where water quality is being monitored are shown in Figure 2.1, with an indication of finalised monitoring activities related to construction (2009-2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards).

>

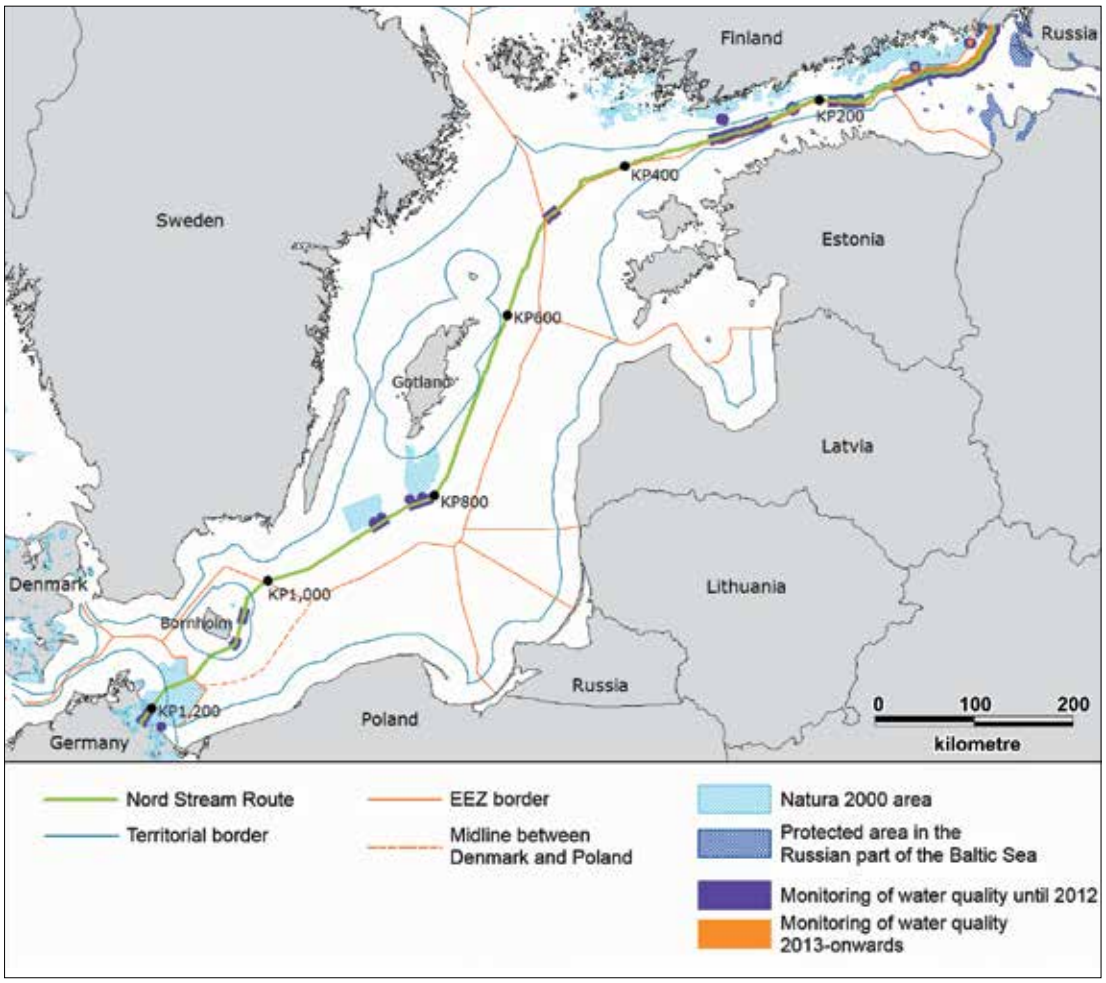


Figure 2.1 Locations for monitoring of water quality along the pipeline route. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

2.2 Russia

The purpose of the remaining water quality monitoring programme in Russia is to observe the effects on onshore and offshore water quality related to operation and recovery after construction of the Nord Stream Pipeline. The time schedule for the remaining monitoring activities is presented in Figure 2.2. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

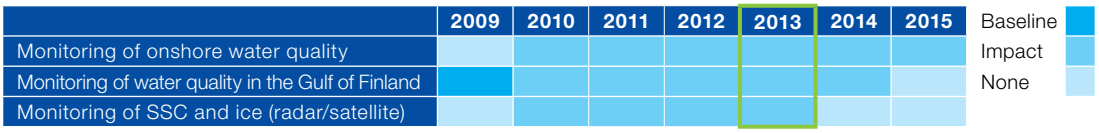


Figure 2.2 Time schedule for the monitoring programme for water quality in Russia. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of onshore water quality

The potential impact on surface waters during operation of the pipelines are from discharge of purified surface and underground waters from the pig trap area into the unnamed stream that runs parallel to the eastern part of the Russian landfall.

Monitoring of onshore water quality in 2013 was performed in March, April, July and October. Field surveys were carried out at four monitoring stations. Two stations were located before and after the water treatment plant (sediment and oil-products trap) to monitor drainage water coming from the pig trap area; two other stations were located at the unnamed stream before and after the drainage water runs into the stream. Each survey included sampling of surface water with subsequent analysis of physical properties (temperature) and chemical parameters (pH, oxygen levels, biological oxygen demand (BOD_5), conductivity, concentrations of suspended sediments, total nitrogen, total phosphorus, total iron, copper, zinc, manganese, lead). Additionally, analysis of sanitary and epidemiological parameters (coliphages, thermotolerant coliform bacteria, total coliform bacteria, pathogenic bacteria, viable helminth eggs) was performed for drainage water at the monitoring station located after the water treatment plant. Determination of the morphometric and hydrological characteristics of the unnamed stream was carried out at one station.

Water samples collected in 2013 showed a normal content of BOD_5 values below the maximum allowable concentration (MAC) in all of the analysed water samples and pH ranging from 6.9 to 7.6. Concentrations of suspended sediments were low, averaging 3.5 mg/dm^3 during the entire monitoring period with the exception of July, when the values exceeded 10 mg/dm^3 at three stations for a short period of time.

Concentrations of heavy metals (copper, zinc and lead) did not exceed the MAC at any of the monitoring stations and were similar to levels of previous years. Concentrations of total iron and manganese exceeded the MAC at all stations.

The concentration of total dissolved iron varied between 0.85 mg/dm^3 and 2.31 mg/dm^3 (MAC 0.3 mg/dm^3); the concentration of manganese varied between 0.06 mg/dm^3 and 0.5 mg/dm^3 (MAC 0.1 mg/ dm^3). Similar high levels were detected during monitoring campaigns in 2010-2012. Such high levels of total iron and manganese are typical of the assessed area with prevailing wetlands. Analysis of sanitary and epidemiological parameters in water showed absence of pathogenic bacteria, coliphages and viable helminth eggs. The level of total coliform bacteria in water samples in 2013 was also below the MAC in all samples, whereas in 2012 the content of coliform bacteria was above the MAC (in the range of 1.2 to 3.4 MAC) in 6 out of 29 samples.

The results of morphometric and hydrological investigations in the unnamed stream showed that the release of drainage water into the stream did not cause any changes in the water regime. >

Overall, the results of monitoring in 2013 revealed no significant changes in the water quality compared to the results of monitoring in 2010-2012. Therefore, it was concluded that the operation of the Nord Stream Pipeline had no observed negative impact on onshore water quality.

Results and conclusions from the monitoring of water quality in Gulf of Finland

On the basis of the monitoring results from 2010-2012, it was concluded that the construction works had no significant impact on water quality in the eastern Gulf of Finland. In addition, the operation of the pipeline is believed to have only a minor impact on the water environment i.e. potential alteration of the chemical composition of seawater near the zinc anodes that protect the gas pipeline against corrosion. Therefore, the number of monitoring stations in Portovaya Bay and the deep-water section was reduced from 21 to 7 stations in 2013 (one in Portovaya Bay, six in the deep-water section).

Monitoring of water quality in the deep-water section and Portovaya Bay was performed in August 2013. Water samples were collected from the surface and from medium water depth level at 7 monitoring stations. Samples were analysed for physical and chemical parameters: temperature, pH, redox potential, dissolved oxygen, salinity, suspended sediments, total nitrogen, total phosphorus and metals (aluminium, total iron, manganese, copper, zinc and lead).

The concentrations of suspended sediment were below the MAC in all water samples in 2013. Concentrations of copper, iron, manganese, lead and zinc did not exceed the MAC. Aluminium concentrations slightly exceeded the MAC in five samples in 2013. The same trend with aluminium was observed during the construction period in 2010-2012 and in 2009, prior to any construction activities. Therefore, neither construction nor operation of the pipelines was the cause of the increased concentration of aluminium.

Measurements of pH, temperature, oxygen and salinity in 2013 were typical for the eastern Gulf of Finland in August and comparable to the results obtained in the previous years of monitoring. Sanitary and bacteriological parameters measured during 2010-2012 complied with the established hygienic specifications. Hence, no surveys were planned for 2013.

On the basis of the monitoring results from 2010-2013, it is concluded that the construction and subsequent operation of the pipeline had no significant impact on water quality in eastern Gulf of Finland.

Results and conclusions of monitoring of SSC and ice with radar and satellite

In 2010 and 2011 satellite monitoring was introduced to assess SSC that may increase during construction activities. In 2012, the aim of satellite monitoring was to investigate whether thermal convection from the pipeline being warmer than the ambient temperature would alter SST, ice cover and structure, SSC and chlorophyll concentrations. In 2013, when both pipelines were commissioned, the aim of the satellite monitoring was to confirm the results of the 2012 investigations and to prove that no thermal effects or other impacts on the water body resulting from gas transportation were present.

A thermal impact on seawater from the pipelines may be caused by the high temperature of gas supplied under high pressure from the Portovaya compressor station. To monitor the state of waters in the Gulf of Finland all informative optical and infrared images of moderate and high resolution were used. Monitoring of ice cover was initiated in January 2013 and finalised in May, when the gulf was again ice free. Further monitoring was aimed at analysing the possible effects of thermal convection from the gas pipelines resulting in a local increase of SST, alterations in SSC distribution and algal bloom.

Analysis of radar images showed no changes in ice cover or ice structure in the winter period. No major alterations in the SST or increase in algal bloom and consequently in chlorophyll concentration was detected in the summer period along the pipeline route. Some local increases in water temperature identified on some images were proven to be of natural origin caused by currents, turbulence or weather conditions (e.g. local water heating due to insolation).

Detected SSC fields along the pipeline were low and below the MAC. Some local anomalies in SSC fields detected in 2013 were shown to be caused by wind/wave action, currents and advection. These observations complied with the results of monitoring in 2010-2012, showing no impact on the SSC levels, and supported the conclusion made in 2010 that naturally caused increases in SSC levels in the Gulf of Finland are greater than the SSC level caused by Nord Stream construction activities.

Thus, the results of satellite monitoring confirmed that the construction of the Nord Stream Pipeline and the transportation of gas through the pipeline did not have any thermal or other impacts on the water body in the Gulf of Finland.

2.3 Finland

The purpose of the water quality monitoring in Finland during pipeline operation is to monitor the impacts of the sacrificial zinc anodes on the water environment. The time schedule for the monitoring is presented in Figure 2.3. A detailed map showing the locations of the monitoring stations in Finland is presented in Appendix B.

	2009	2010	2011	2012	2013	2014	2015
Monitoring of sacrificial anodes					*		

*Sampling takes place every five years, therefore the next sampling round is scheduled for 2017.

Baseline
Impact
None

Figure 2.3 Time schedule for the monitoring programme for water quality in Finland. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of sacrificial anodes (activity carried out in 2012)

The impacts of the sacrificial zinc anodes on seawater quality were monitored by water sampling in the beginning of August 2012 at KP 229.958 (ANODE 1). Water samples were taken by an ROV from both sides of Pipeline 1 at a distance of 1-2 m from the anode and 1 m above the seabed. Two duplicate samples were taken approximately 60 m away from the anode at a reference station to provide background information on the natural level of zinc in seawater.

Concentrations of heavy metals near the anode on both sides of the pipeline were low or under the detection limit. The general level of metal concentration was of the same order of magnitude at the sampling points and in the reference area. The predicted no-effect concentration (PNEC) for zinc (7.8 µg/l) and for cadmium (0.19 µg/l) were not exceeded.

The first monitoring campaign took place in 2012, and the next campaign will be in 2017. Thereafter, monitoring will continue to be carried out every five years until the PNEC value for zinc in seawater near the anode is exceeded. According to the monitoring programme sediment and benthos samples shall also be taken at least once.

3 Seabed sediments

> Every year large amounts of metals, nutrients and other inorganic and organic chemical contaminants enter the Baltic Sea via atmospheric deposition and surface runoff and from anthropogenic sources. The general distribution patterns of contaminants in the Baltic Sea are complex. Many of the contaminants are hydrophobic, i.e. they tend to be adsorbed into non-polar particulate matter and settle on the seabed. This adsorption takes place especially with fine-grained sediments and particulate matter. Other contaminants exist as particulate matter from the beginning. Settled sediments and adsorbed contaminants may be subject to resuspension caused by currents/waves, bio-perturbation, trawling, etc. Eventually, the majority of the transported fine-grained sediments and their associated contaminants end up in accumulation areas for fine-grained sediments, primarily in the deep parts of the Baltic Sea.

3.1 Monitoring programme for seabed sediment

Potential impacts

Potential impacts on seabed sediments from the Nord Stream Project may be caused by dispersion of sediments and sediment-associated contaminants during construction works, import of non-local sediments and changes in seabed temperature due to temperature differences between the gas in the pipeline and the seabed and surrounding water during operation.

Monitoring activities until 2012

Monitoring of seabed sediments was carried out in Russia, Finland, Sweden, Denmark and Germany. Monitoring was initiated in 2009 and was finalised for Russia, Finland, Sweden and Denmark in 2012.

Monitoring of seabed sediments included sampling at selected locations along the pipeline route, including single stations along the route and transects perpendicular to the route. Samples were analysed for a wide range of organic and inorganic contaminants, including chemical warfare agents (CWAs). Other aspects of seabed sediment monitoring included monitoring of the possible impact of the cooler pipeline on the seabed sediments above the buried parts of the pipeline during the first years of operation in Germany.

Monitoring in all five countries evaluated the effects of construction works on the levels of contaminants in the seabed sediment. In Russia and Germany the effects of the major seabed works in these areas were monitored. In Finland monitoring was related to impacts from disturbance of sediment during munitions clearance and rock placement, which also included monitoring of transboundary effects into Estonia. In Sweden, sediment monitoring was carried out in connection with the monitoring programme for water quality. In Denmark, sediment monitoring focused on the dispersion of CWAs east of Bornholm, where remains of chemical munitions were dumped during World War II.

The results and main conclusions from finalised monitoring of impacts on seabed sediment during construction of the pipelines, which took place in Russia, Finland, Sweden, Denmark and Germany from 2009-2012, are detailed in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

The monitoring of contaminant levels in seabed sediments in Germany continued in 2013. The results and conclusions from the monitoring activities in 2013 are reported in the following sections.

Locations with seabed sediment monitoring are shown in Figure 3.1, with an indication of finalised monitoring activities related to construction (until 2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards). >

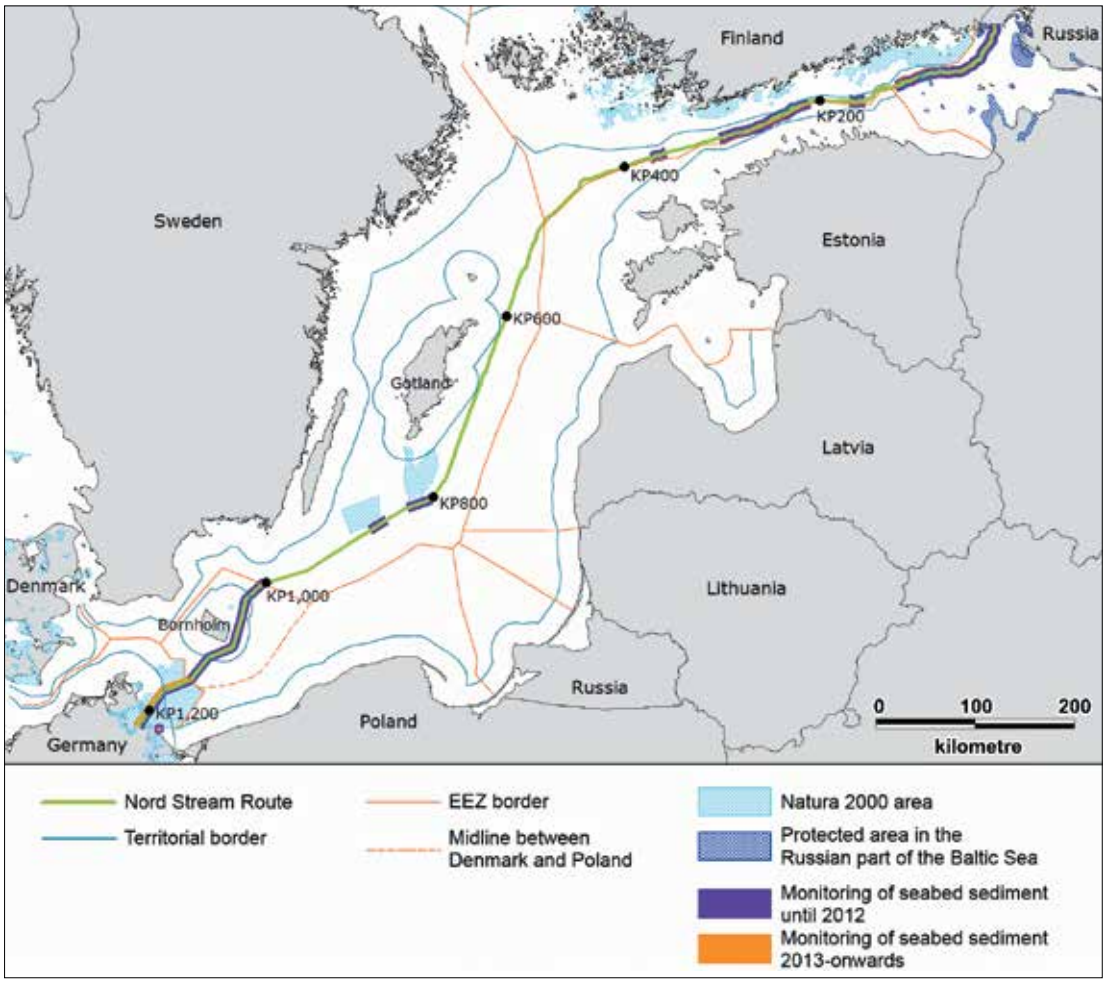


Figure 3.1 Locations of monitoring activities under the seabed sediment monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

3.2 Germany

The purpose of the remaining seabed sediment monitoring programme in Germany is to evaluate the recovery process of physical sediment parameters after construction. The time schedule for the monitoring is presented in Figure 3.2. A detailed map showing the locations of monitoring stations in Germany is included in Appendix E.

Figure 3.2 Time schedule for the monitoring programme for seabed sediment in Germany. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of construction works
Monitoring of seabed sediments was carried out in June 2011, 2012 and 2013. In 2013, monitoring was carried out approximately 2.5 years after the finalised seabed intervention works in German waters during the construction of the pipeline.

Samples were taken at 12 transects perpendicular to the pipeline. An additional 14 samples were collected from the trench area and its immediate surroundings to increase the cluster specific sample size and to lower variance of means during statistical analysis for parameters measured at the impact area, respectively. Four areas were compared: the backfilled trench, the nearby impact zone (situated 25 m from the trench: non-invasive dredging impact zone), the anchor-handling zone (situated 500 m from the trench) and a reference area (situated 1,000 m from the trench). Data analysis was performed for three different pipeline sections/water bodies: Greifswalder Bodden (pipeline trenched into the seabed), Pomeranian Bight/Territorial Waters (pipeline trenched into the seabed) and Pomeranian Bight/EEZ (pipeline laid on the seabed). Samples were analysed for the following parameters, which are relevant for the macrozoobenthic infauna:

- Median grain size
- Silt content
- Organic matter content (loss of ignition).

No analysis of contaminants was conducted in 2013 because none of the parameters analysed in 2011 and 2012 (heavy metals, organic contaminants) exceeded any threshold defined by national regulations.

During the 2013 monitoring, measurements of median grain size, silt content and loss on ignition (organic matter content) did not reveal any significant differences between the impact and reference areas. The results were similar for all three monitoring areas: Greifswalder Bodden, Pomeranian Bight/Territorial Waters and Pomeranian Bight/EEZ.

Thus, the recovery process of the sediment in the backfilled trenches was in line with the predictions of the German EIA. The recovery process of natural surface sediment conditions was completed within a period of three years.

4 Hydrography and seabed topography

> The deep-water renewal processes in the Baltic Sea are complex and depend on specific meteorological circumstances that force substantial amounts of salt- and oxygen-enriched seawater from the Kattegat through the Danish straits into the western Baltic. The saline water accumulates in a thin layer close to the seabed and moves into the Central Baltic basins. It mixes very slowly with the upper waters, resulting in a salinity gradient from top to bottom, with most of the salt water remaining at depths below 40-70 m. From the Baltic Proper there is a large-scale water inflow into the Gulf of Finland, which follows the northern coast of Estonia. A compensating strong current out of the Gulf of Finland is found in the northern part.

4.1 Monitoring programme for hydrography and seabed topography

Potential impacts

Potential impacts on hydrography from the Nord Stream Project may be caused by alterations in the seabed topography affecting the current regime. Impacts on seabed topography may be caused by munitions clearance, construction works, and the presence of the pipeline and/or rock berms on the seabed.

Monitoring activities unitl 2012

Monitoring of *hydrography* was carried out in Finland, Sweden and Denmark. Monitoring was initiated in 2009 and finalised in 2011.

In Finland, measurements of currents in the direct vicinity of Pipeline 1 were carried out to assess the impact of the pipeline on near-seabed currents. The programme also included measurements of currents during rock placement in order to support the water quality monitoring and to verify hydrodynamic modelling. The purpose of the hydrographical monitoring programme in Swedish and Danish waters was to establish documentation for a theoretical analysis of the possible blocking and mixing effects of the water inflow to the Baltic Sea caused by the presence of the Nord Stream Pipeline.

Monitoring of *seabed topography* was carried out in Russia, Finland, Sweden and Germany. Monitoring was initiated in 2009 and finalised for Sweden in 2010.

In Russia and Germany, seabed topography was monitored for changes due to the extensive seabed intervention works. In Finland and Sweden, seabed topography was surveyed prior to and after the clearance of all munitions objects to quantify the amount of sediment release. In Finland, the seabed topography was also surveyed prior to and after rock placement to document the total rock berm footprint. An as-laid survey to monitor changes in the seabed topography was performed in all countries. In Finland and Sweden, the collected information was used, e.g., to update the information on freespans for fishermen.

The results and main conclusions from finalised monitoring of impacts on hydrography and seabed topography during construction of the pipelines, which took place in Finland, Sweden and Denmark from 2009-2011, are detailed in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

In Finland hydrographical monitoring includes measurements of currents in the direct vicinity of Pipeline 1 to assess the impact of the pipeline on the near-seabed currents and side scan sonar (SSS) surveys along Pipelines 1 and 2 to assess whether there have been any changes in sedimentation and erosion patterns.

Monitoring of seabed topography in Russia and Germany is carried out to evaluate the changes in topography and coastline relief in relation to construction of the Nord Stream Pipeline. The results and conclusions from the monitoring activities are reported in the following sections.

Monitoring locations are shown in Figure 4.1 (hydrography) and in Figure 4.2 (topography), with an indication of finalised monitoring activities related to construction (until 2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards). >

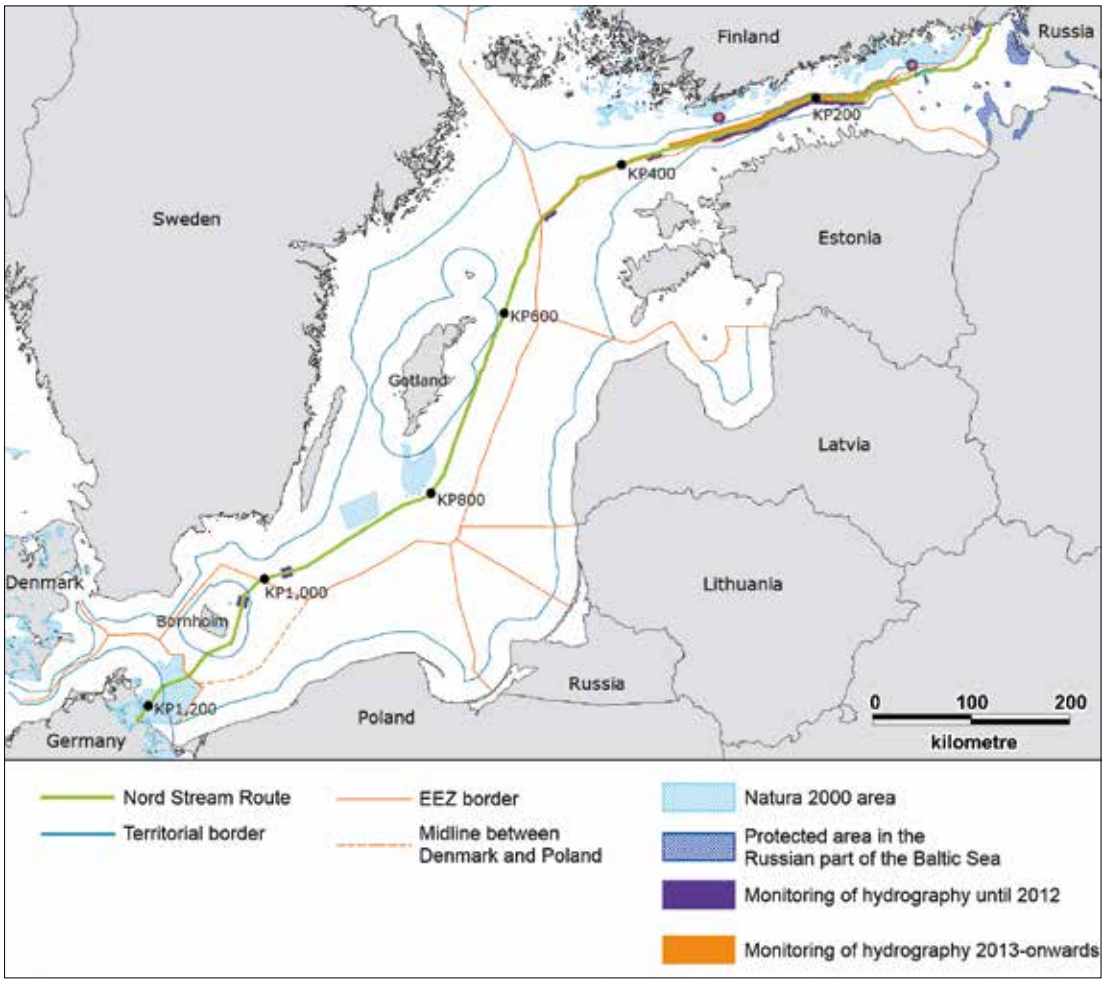


Figure 4.1 Locations for monitoring of hydrographical conditions near the seabed along the pipeline route. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

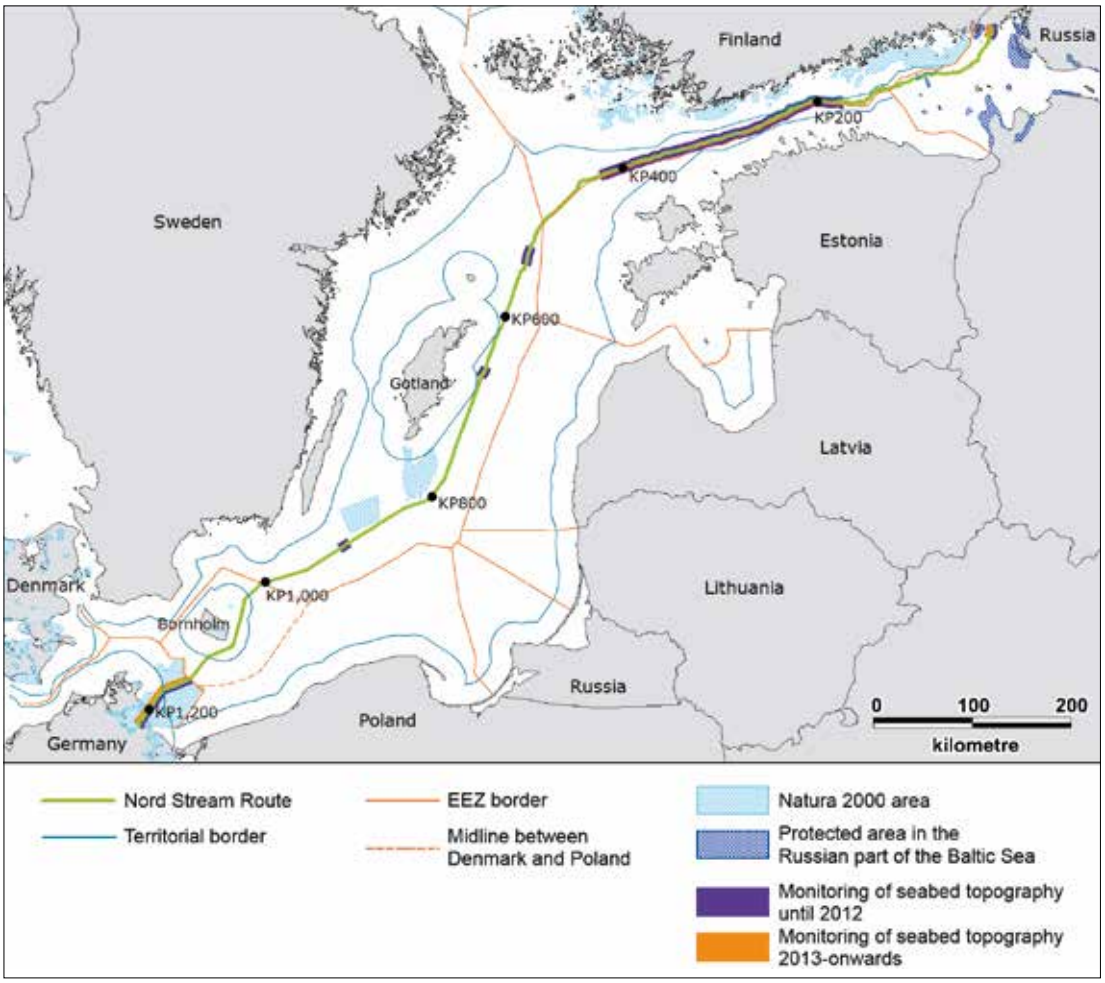


Figure 4.2 Locations for monitoring of seabed topographical conditions along the pipeline route. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

>

4.2 Russia

The purpose of the remaining monitoring programme of seabed topography in Russia is to evaluate changes in the seabed topography and the coastline relief related to construction of the Nord Stream Pipeline. The time schedule for monitoring is presented in Figure 4.3. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

Figure 4.3 Time schedule for the monitoring programme for seabed topography in Russia. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of seabed topography

Monitoring of seabed topography was carried out in 2010-2013 in Portovaya Bay. In 2010, a comparison of seabed profiles prior to construction with those after completion of all dredging activities showed that the impact on the seabed caused by the Nord Stream construction works was relatively little. In 2011 and 2012, a detailed survey of the seabed topography was performed in order to investigate whether autumn, winter and spring storms would eliminate the differences between the initial seabed profile and the profile that was created upon the completion of construction. The results of these surveys confirmed that the seabed characteristics were similar to their initial state.

In 2013, monitoring was carried out in September in Portovaya Bay after all construction activities were completed and both pipelines were in operation. Field surveys were performed along six survey tracks perpendicular to the pipeline. The length of each track was 500 m (250 m to each side of the pipeline) and the distance between tracks was 100 m. Additional observations were conducted at six complementary survey tracks spaced 10 m towards the sea from the main tracks.

Monitoring in 2013 showed that the seabed characteristics were similar to the conditions observed after winter storms in 2011-2012. Analysis of the seabed profiles in 2013 showed the same tendencies as in 2011 and 2012: in shallow waters currents and storms contribute to the flattening of projecting areas and the silting of cavities, i.e. the seabed level tends to be more horizontal, while in deeper waters the relief is more uneven.

Results obtained throughout the survey years (2010-2013) showed that there were no considerable changes in the seabed relief compared to the baseline data. Therefore the impact on the seabed caused by construction and operation of Nord Stream Pipeline is considered negligible.

4.3 Finland

The purpose of the monitoring programme for hydrography in Finland is to measure near-seabed currents and seabed topography during operation in order to evaluate whether the pipeline on the seabed will cause any changes in erosion/sedimentation patterns in the nearby areas. The time schedule for the monitoring is presented in Figure 4.4. A detailed map showing the locations of monitoring stations in Finland is included in Appendix B.

Figure 4.4 Time schedule for the monitoring programme for hydrography and seabed topography in Finland. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of near-seabed currents (activity carried out in 2011)

Monitoring of near-seabed currents was carried out in 2011 in order to determine the effect of the presence of the pipeline on the seabed on the current regime. Results from the monitoring activities are reported in /29/. The average measured current velocities were low (0-5 cm/s), with occasional

peak velocities of 10-15 cm/s. The current directions were mainly perpendicular to the pipeline. The acoustic doppler current profilers (ADCPs), which were located 5 m to either side of the pipeline, recorded changes in current velocity just above the seabed. The results from these recordings indicated the development of small eddies (or vortices) due to turbulence caused by the presence of the pipeline. On the soft seabed areas, where the pipelines are embedded deeper in the sediments than anticipated in the design, the minor impact from the current regime was too small to cause any significant scouring. The instruments located 50 m away from the pipeline did not record any changes that could be attributed to the presence of the pipeline. All measured velocity changes were within or below the expected order of magnitude. The results confirmed the assessment made in the Finnish EIA. The minor, small-scale hydrodynamic impacts near the seabed, if any, were limited to the nearest vicinity of the pipelines.

The sedimentation/scour pattern around the pipeline will be investigated by SSS surveys along the pipeline between KP 123 and KP 350 in 2014 and in 2017. A survey is tentatively scheduled for 2022 and possibly for later years at regular intervals depending on the results in 2014 and 2017. The results from the 2014 survey will be presented in the report covering monitoring activities for 2014, which will be issued in 2015.

4.4 Germany

The purpose of the remaining monitoring programme for seabed topography in Germany is to monitor the seabed bathymetry of the backfilled trenches and reef reinstatement. The time schedule for the monitoring is presented in Figure 4.5. A detailed map showing the locations of monitoring stations in Germany is included in Appendix E.

Figure 4.5 Time schedule for the monitoring programme for seabed topography in Germany. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of seabed topography

Monitoring of seabed topography was carried out in June 2011, August 2012 and August 2013. In 2012, monitoring was carried out two years after the completion of seabed intervention works. Surveys were conducted along the entire route (± 50 m) of Pipeline 1 and Pipeline 2 in Germany using high-resolution MBES and SSS techniques. In addition, re-established reef areas were inspected by underwater video recordings in April. Monitoring activities focused especially on the geological stability of the reinstated seabed.

Results showed that the reinstatement of seabed topography of all trenches was still within the range of ± 30 cm compared to the planned design, with shoulders on the edges and a dip in the centre of the trenches. The “half-pipe” character of the cross profile of the backfilled trench was the results of fluidisation of the topsoil material during backfilling operations. Swells and currents polished the trench profile in shallow and exposed waters (< 5 m water depth, Pomeranian Bight), but not along the deeper trenched sections in Greifswalder Bodden (> 5 m water depth). Changes in the seabed topography exceeding ± 30 cm were detected in only a few local areas and possibly caused by the thrusters of the lay barge. Changes in seabed topography in the vicinity of the former temporary backfill storage area off Usedom Island occurred within ± 50 cm across the site.

The overall sediment balance (gains versus losses) is close to zero. Observations showed that levelling of dredging scours by natural bed load transport (erosion and deposition of sediments through near-bottom currents and waves) was fast, when comparing the shape of scours from construction works in 2010 and 2011 with the shape in 2013. However, almost no changes in bathymetry were detected in 2012 and 2013. Obviously, wave and current energy were not strong enough to initiate any erosion processes during the last two years. The low mobility of sediments in >

Greifswalder Bodden and the Pomeranian Bight was predicted during the application phase and has led to the tremendous mitigation effort during construction (trenching and backfilling). Monitoring results underline again the significance of these measures. As shown in Section 3.2 (seabed sediments) and in Section 12.6 (benthic flora and fauna), reinstatement of the surface seabed was sufficient to enable a complete recovery of the benthic environment.

Physical reef reinstatement was successful along the entire Greifswalder Bodden trench and stable during the three years of monitoring.

The overall spatial footprint revealed a total impact area of 3.1 km^2 within German territorial waters (in comparison, the impact area predicted in the application documents was 3.3 km^2). Approximately 0.4 km^2 of the overall footprint were located outside the predicted impact zone of ± 25 m on either side of the trench. However, the overall spatial impact was not greater than predicted.

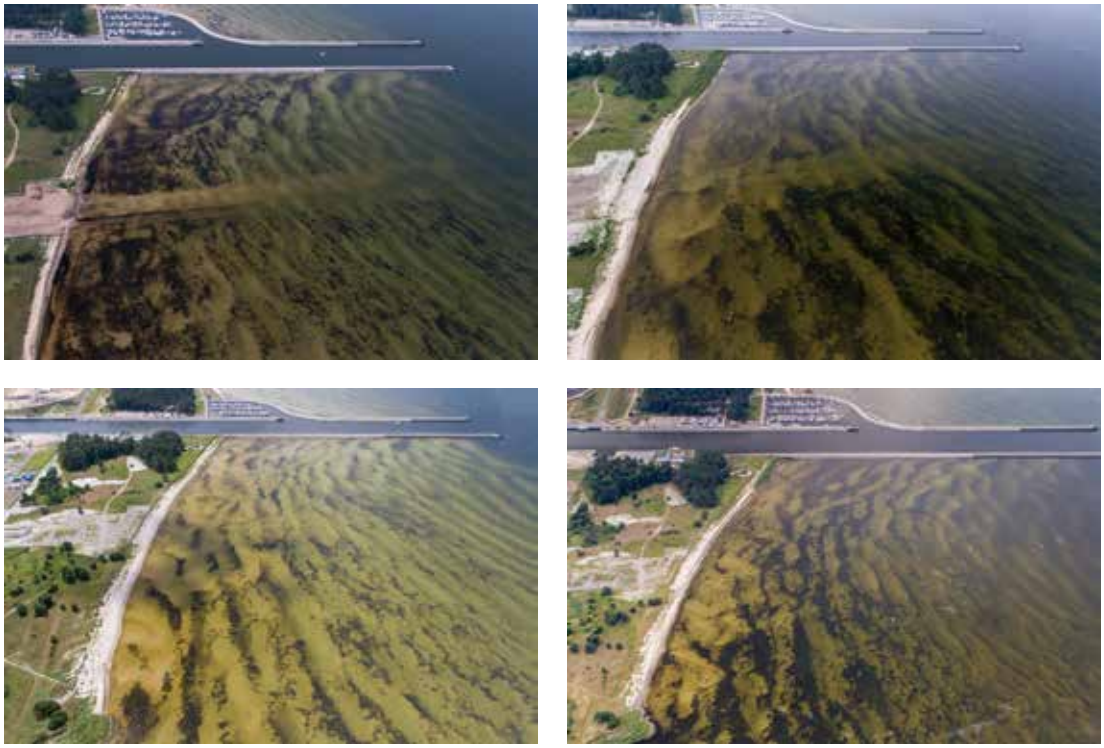


Figure 4.6 Seabed recovery in the German near-shore area after completion of construction works: 2010 (top left), 2011 (top right), 2012 (bottom left) and 2013 (bottom right).

5 Onshore soil

> The physical and chemical properties of soil have a significant influence on the terrestrial ecosystem, and the flora and fauna living in the soil in turn affect soil formation. Soils constitute the fundament and the source of nutrients for biological production and provide important ecosystem services, such as the cleaning of water and decomposition of waste. Threats to the soil, such as erosion, contamination, salinisation and sealing, can compromise its physical and chemical properties and have far-reaching consequences.

5.1 Monitoring programme for onshore soil

Potential impacts

Potential impacts on onshore soil conditions from the Nord Stream Project may be the result of mechanical disturbance of soil and vegetation cover at landfall construction sites.

Monitoring activities until 2012

Monitoring of soil has been carried out only at the landfall area in Russia. The monitoring was initiated in 2009.

Monitoring activities 2013 and onwards

Monitoring of soil conditions continued in Russia in 2013. Monitoring of soil in Russia is related to the land areas that are used for temporary construction activities as well as for permanent installations. The soil in these areas was categorised as "clean" prior to the commencement of construction activities. The monitoring programme documents the quality of the soil during construction works and after the completion of land reinstatement.

The results and conclusions from the monitoring activities are reported in the following section.

5.2 Russia

The purpose of the soil chemistry monitoring programme in Russia is to assess the chemical contamination, the bacteriological and the parasitological content of soils in relation to construction and operation of the Nord Stream Pipeline. The time schedule for the monitoring is presented in Figure 5.1. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

Figure 5.1 Time schedule for the monitoring programme for onshore soil in Russia.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of onshore soil

Soil monitoring at the Russian landfall area was performed three times in 2009 prior to construction activities, in 2010-2012 during construction and once in 2013 during operation.

In 2013 one united soil sample was collected from a 15 m × 15 m plot and analysed for the following parameters: concentrations of metals (lead, zinc, manganese, copper and mercury), concentrations of petroleum products and level of toxicity.

The results of sample analysis showed that the soil in the surveyed area is sub-acid (pH 5.1) with prevailing peat-like horizon. Concentrations of all tested metals and petroleum products were below the MAC. Toxicity determined by alteration in infusoria chemotaxis in extracted water sample showed an acceptable level of soil toxicity. The calculation of cumulative index of soil pollution classified the examined soil as "clean". These results were in line with the monitoring results of 2009-2012.

Overall, the monitoring results of 2009-2013 confirmed the assessment of the Russian EIA that operation of the Nord Stream Pipeline will not have any negative impact on the soil quality at the Russian landfall site.

6 Landscape and topography

> The heavily populated coastline of the Baltic Sea is shared by nine countries: Russia, Finland, Sweden, Denmark, Germany, Poland, Lithuania, Latvia and Estonia. The landscape and topography along the coastline includes sandy beaches, sand dunes, spit, grasslands, steep rocky shores and chalk cliffs, in addition to a large number of manmade constructions, such as bridges, harbours, industrial constructions and cities. The majority of the land surrounding the Baltic Sea is forested (mainly in Finland and Sweden). A significant amount of the land is used for agriculture and pasture, along with large areas of open land, including ecologically important wetland areas.

6.1 Monitoring programme for landscape and topography

Potential impacts

Potential impacts on landscape and topography from the Nord Stream Project may be the result of mechanical disturbance at the landfall construction sites.

Monitoring activities until 2012

Monitoring of landscape and topography has been carried out at the landfall areas in Russia and Germany. Monitoring was initiated in Germany in 2009 and in Russia in 2010. Monitoring of landscape and topography in Russia is related to the landscape alterations caused by construction works. The occurrence of erosion, swamp formation, ice gouging and flooding is monitored.

Monitoring activities 2013 and onwards

Monitoring in Russia continues yearly in 2011-2014 and will be performed once every three to five years beginning in 2015. In 2013 landscape monitoring was carried out in order to document reinstated landscapes and other changes to the landscape.

Monitoring in Germany continued in 2013 to document the recovery process of the dunes after their reinstatement as part of the compensation measure[1] E3 “Development concept for sand and neglected grassland locations in the landfall area near Lubmin”. The purpose of this compensation measure is to refurbish sandy coastal areas and neglected grasslands /42/ to compensate for the disturbance of protected biotopes in the landward landfall corridor of the Nord Stream Pipeline. Ecological supervision will verify the effectiveness of the compensation measures.

The results and conclusions from the monitoring activities are reported in the following sections.

Locations with landscape and topography monitoring are shown in Figure 6.1, with an indication of finalised monitoring activities related to construction (until 2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards). >

[1] Compensation measures were compiled as part of the application documents (landscape plan). Compensation measures aim to compensate for environmental impacts resulting from construction and operation of the Project according to the German Federal Nature Conservation Act (BNatschG).

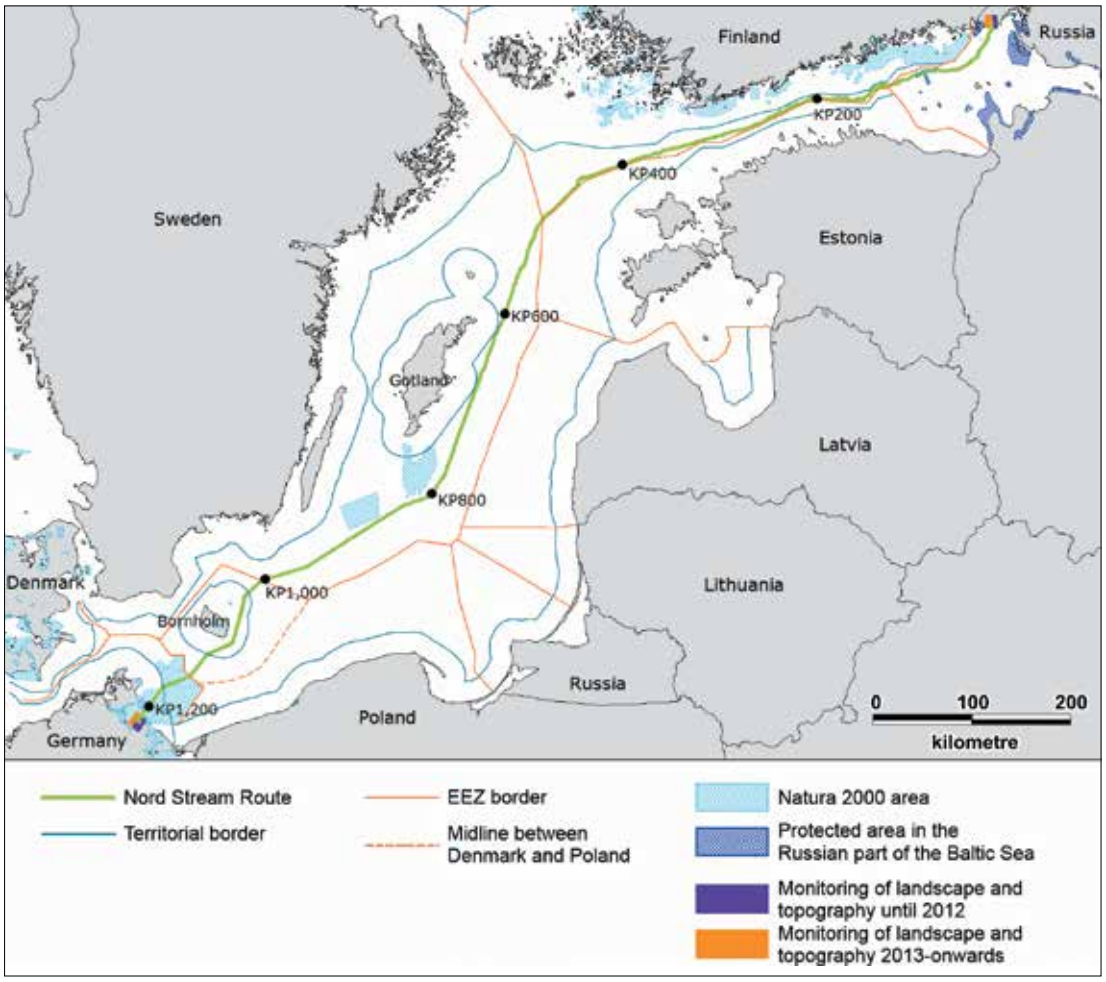


Figure 6.1 Locations of monitoring activities under the landscape and topography monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

6.2 Russia

The purpose of the landscape and topography monitoring programme in Russia is to monitor hazardous geological and hydrogeological processes and phenomena in relation to construction and operation of the Nord Stream Pipeline. The time schedule for the monitoring is presented in Figure 6.2. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

Figure 6.2 Time schedule for the monitoring programme for landscape and topography in Russia. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of landscape and topography

Monitoring was initiated in 2010 and continued in 2011, 2012 and 2013. In 2010, the survey was aimed at identifying key locations for follow-up monitoring.

In 2011 and 2012, monitoring focused on the processes specific to the onshore section, such as settlement in backfilled areas; linear, lateral and bottom erosion along the unnamed stream near the construction site and along former drainage channels; surface erosion due to snow melt and surface water runoff; and seasonal flooding and waterlogging effects due to potential disturbance of the natural surface flow and underground waters during construction and operation of the pipeline. To mitigate anthropogenic effects, technical and biological reinstatement works were initiated in 2012. These works included backfilling of the pipe trenches and other excavations, re-profiling of the disturbed areas and application of topsoil and grass seeding for vegetation recovery. Note 90% of the onshore area reinstatement was accomplished in 2012, while some remaining reinstatement activities were undertaken in 2013.

In 2013, monitoring was carried out twice, in May and October. Surveys were performed at 50 monitoring locations that previously showed some signs of hazardous exogenous geological processes and hydrological phenomena or that had the potential to develop these processes.

Results of the monitoring showed that due to reinstatement activities all sources of linear, lateral and bottom erosion were eliminated. A slight indication of linear erosion in the near-shore area documented in May 2013 did not develop by October. A good rate of natural regeneration of coastal vegetation indicates the minimal risk of erosion development in this area. The problem of flooding of the northern part of the pig trap area was resolved by the creation of a drainage channel system in 2012. No waterlogging was documented in the surveyed area. Similarly, there was no evidence of settlement of the ground in backfilled areas.

6.3 Germany

The purpose of the landscape monitoring programme in Germany is to observe the reinstatement of dune habitats. The time schedule for the monitoring is presented in Figure 6.3. A detailed map showing the locations of monitoring stations in Germany is included in Appendix E.

Figure 6.3 Time schedule for the monitoring programme for landscape in Germany. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from monitoring of the onshore landscape

Dune reinstatement/development of the compensation measure E3 “Development concept for sand and neglected grassland locations in the landfall area of the Nord Stream Pipeline near Lubmin” was carried out successfully in 2010, 2011 and 2012 and involved:

- Construction of an artificial dune on top of the pipelines and partial sand exchange in the east of the project area in autumn 2010.
- Partial sand exchange west of the project area in autumn 2011. Dune reinstatement was physically finalised in late 2011.
- Infrastructure for horse grazing was finalised in 2012 and horse grazing was initiated.

The monitoring of dune vegetation, reptiles and breeding birds in 2013 revealed that reinstatement and management were successful. All endangered species either survived the construction period or returned afterwards.

In the vicinity of the soil exchange patches, succession of dune vegetation followed the expected pattern. Furthermore, all three inoculated plant species established successfully. Winter grazing by horses improved spreading of various annual herb seeds within the managed dune area.

Sand and common lizards (*Lacerta agilis* and *Zootoca vivipara*), as well as blind worm (*Anguis fragilis*) and European adder (*Vipera berus*) maintained their population sizes. Endangered barred warbler (*Sylvia nisoria*), wood lark (*Lullula arborea*), wheather, red-backed shrike (*Lanius collurio*) and common ringed plover (*Charadrius hiaticula*) were recorded as breeding species.

Management of vegetation by horse grazing and monitoring will continue until 2032.

7 Air quality

> Air pollutants of natural and/or human origin come in the form of solid particles, liquid droplets or gases and can be harmful to the environment. The main pollutants are acidifying substances, such as sulphur oxides (SO_x) and nitrogen oxides (NO_x), and greenhouse gases, such as carbon dioxide (CO_2). In the Baltic Sea region, these pollutants originate from ship traffic in particular. The pollutants are transported by wind and precipitation and deposited over land or water bodies or accumulated in the atmosphere.

7.1 Monitoring programme for air quality

Potential impacts

Potential impacts on air quality from the Nord Stream Project may be the result of emission of atmospheric pollutants during construction works.

Monitoring activities until 2012

Monitoring of air quality takes place only at the landfall area in Russia. Monitoring was initiated in 2010 and includes measurement of air quality parameters at stations at and near the landfall site and adjacent populated areas.

At the landfall area in Germany no air quality monitoring took place during construction. Instead, minimal air emissions were ensured through emissions audits in compliance with national requirements.

For offshore construction works, general compliance with IMO guidelines, MARPOL and the HELCOM "Clean Seas Guide 2009" /43/ has been implemented in the Project's Construction Management Plans. These are ensured during the regular health, safety, environment and social (HSES) audits of the contractors for the offshore construction works.

Monitoring activities 2013 and onwards

Monitoring of air quality in Russia continued in 2013. During the operation phase the only possible source of impact on atmospheric air in the onshore area is the pig trap area and special vent stacks used to routinely discharge gas from the linear section of the gas pipeline, with the main contaminant being methane. In 2013 routine outgassing was carried out via the vent stacks twice. The results and conclusions from the monitoring activities are reported in the following section. >

7.2 Russia

The purpose of the air quality monitoring programme in Russia was to ensure compliance with the MAC of the compounds nitrogen dioxide, carbon monoxide, particulate matter and hydrocarbons in relation to construction and operation of the Nord Stream Pipeline. The time schedule for the monitoring is presented in Figure 7.1. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

Figure 7.1 Time schedule for the monitoring programme for air quality in Russia.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of air quality

Monitoring of air quality in 2013 was performed monthly between January and November (no observations in April and May) and includes observations during routine gas releases in July and August. Monitoring was carried out at three stations located in the impact area (at the border of the right-of-way, near the vent stacks), at the border of the sanitary protection zone and at the border of the nearest residential area, the village of Bolshoi Bor. Monitoring during construction in 2010-2012 was carried out monthly at seven stations.

In 2013 the monitored parameters included measurements of concentrations of methane and nitrogen dioxide. The necessity to monitor nitrogen dioxide concentrations was stipulated by the presence of a power supply backup (diesel power plant) at the landfall.

Results of air monitoring in 2013 showed that during normal operation of the pipelines all measured parameters were below the MAC. Similar results were obtained in 2010, 2011 and 2012. Monitoring of the air quality during routine gas discharges in July and August showed the maximum methane concentration to be well below the temporary safe reference action level.

Consequently, it was concluded that the air quality in the onshore section during operation of the Nord Stream Pipeline, as in previous years, was in accordance with the requirements of government health norms established for air quality in populated areas.

8 Noise and pressure waves

> Several anthropogenic activities produce noise pollution in the coastal and marine environment, e.g. ship and boat traffic, drilling, pile-driving, underwater explosions, extractions and wind farm operations, impacting wildlife and humans. Underwater noise can travel long distances, blanketing a large area around the source. Noise pollution can cause displacement effects, disturb location of prey, mask communication between animals, or in severe cases cause species to lose their orientation and physical injury. Airborne noise can also cause adverse health effects in humans, especially in the case of long-term noise impacts.

8.1 Monitoring programme for noise and pressure waves

Potential impacts

Potential impacts from noise and pressure waves from the Nord Stream Project may be the result of munitions clearance activities and general construction works, especially at the two landfalls.

Monitoring activities until 2012

Underwater noise and pressure waves have been monitored in Finland, Sweden and Germany. Monitoring was initiated in 2009 and was completed by the end of 2011.

In Finland and Sweden, the purpose of the underwater noise monitoring programme was to verify the assessment of noise from munitions clearance and to document the peak pulse during clearance of all munitions. In addition, the pressure wave was measured in the vicinity of selected protected objects on the seabed (e.g. wrecks of cultural value or cables) to evaluate potential impacts. In Germany the purpose of the underwater noise monitoring programme was to measure noise caused by construction-related activities such as pile-driving at the landfall, pipe-laying, dredging and backfilling of the pipeline trench.

In Russia and Germany, the *airborne noise* from the construction area was measured in order to ensure that standards for noise levels were not exceeded. The first monitoring activities began in 2010 and were completed in Germany in 2012 and in Russia in 2013.

In Russia, the monitoring was carried out to verify whether the level of airborne noise from construction of the pipeline was in accordance with applicable Russian guidelines. In Germany, onshore vibration measurements near the work site were carried out in 2010 during the construction of the cofferdam.

The results and main conclusions from finalised monitoring of impacts from noise and pressure waves during construction of the pipelines, which took place in Russia, Finland, Sweden and Germany from 2009-2012, are reported in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

Monitoring of noise continued in Russia in 2013 to verify whether the airborne noise from operation of the pipeline is in accordance with applicable Russian guidelines. The results and conclusions from the monitoring activities are reported in the following section.

Locations with noise and pressure wave monitoring are shown in Figure 8.1, with an indication of finalised monitoring activities related to construction (2009-2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards).

>

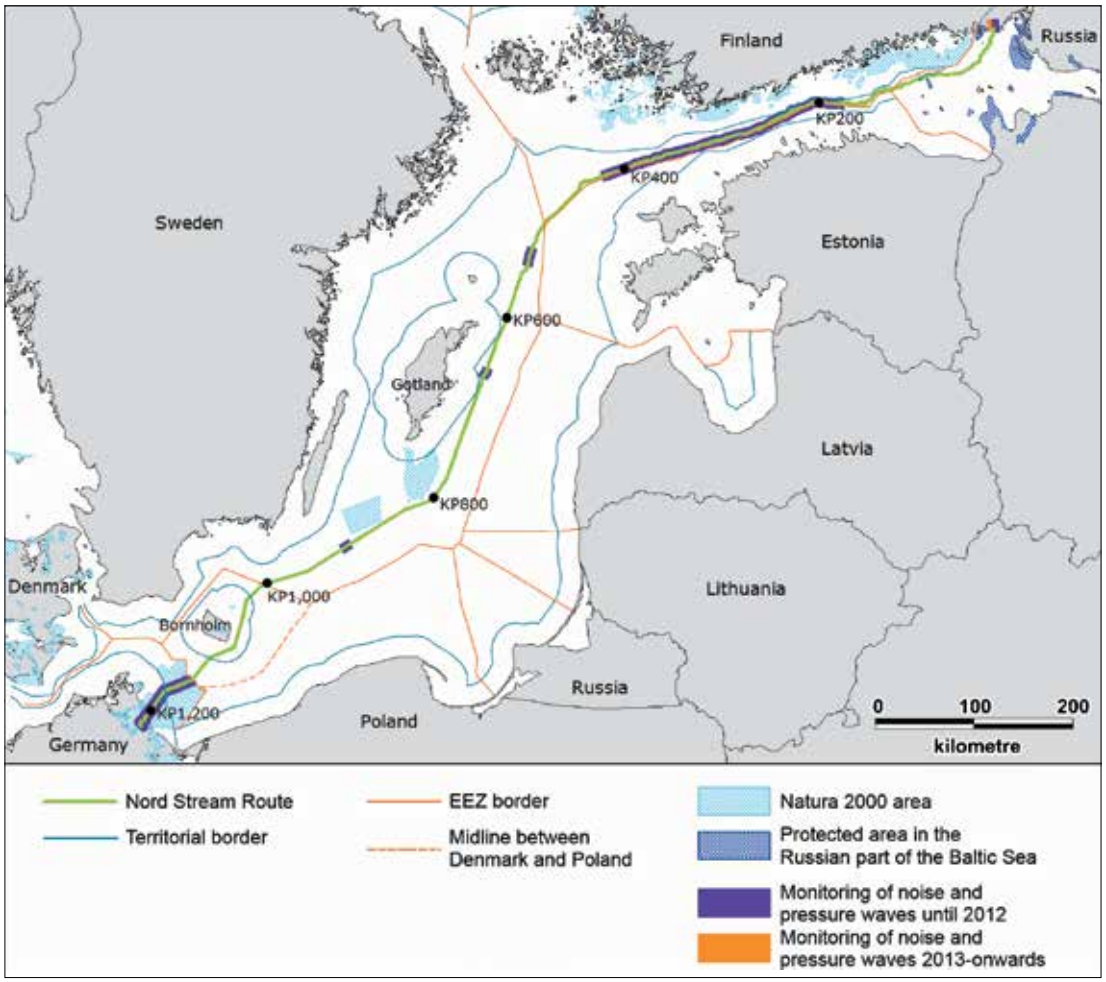


Figure 8.1 Locations of monitoring activities under the noise and pressure waves monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

8.2 Russia

The purpose of the noise monitoring programme in Russia was to verify that airborne noise from construction works and operation activities did not exceed residential health standards at nearby settlements. The time schedule for the monitoring is presented in Figure 8.2. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

Figure 8.2 Time schedule for the monitoring programme for noise in Russia.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of noise

Noise levels were monitored monthly in 2010, 2011, 2012 and 2013.

Although there were no instrumentally proven noise impacts during the operation of Pipeline 1 in 2011-2012, noise monitoring was performed in 2013. The noise monitoring in 2013 was carried out in order to confirm the former results when both lines are in operation and approve the final version of the sanitary protection zone. Noise monitoring was carried out monthly from January to November 2013. Noise was also monitored during routine gas releases in July and August.

Potential noise sources during operation of the pipelines in 2013 were defined as traffic on the local roads, activities in the pig trap area during routine gas releases and natural background noises. The locations of the monitoring stations were selected to better characterise the impact from the above- mentioned noise sources on the nearest residential area, the village of Bolshoi Bor. Thus, monitoring was carried out at three stations located within the impact area (at the border of the right-of-way, near the vent stacks), at the border of the sanitary protection zone and at the border of the village of Bolshoi Bor.

Similar to the monitoring carried out during construction and installation operations in 2010, 2011 and 2012, measurements performed in 2013 included recordings of the noise levels (LA_{eq} and LA_{max}[2]) as well as sound pressure levels in the octave frequency bands of 31.5, 63, 125, 250, 500, 1,000, 2,000, 4,000 and 8,000 Hz, in accordance with applicable Russian guidelines.[3] The measured values of noise levels did not exceed the allowable levels (55 dBA during day hours for LA_{eq} and 70 dBA for LA_{max}) during normal operation mode or during routine gas releases in July and August. Therefore it was confirmed that operation of the pipelines does not have any significant noise impact on the adjacent areas.

[2] LA_{eq} values refer to steady-state continuous noise, whereas LA_{max} values refer to noise events.
[3] SN 2.2.4/2.1.8.562-96, Noise in the workplace, on the premises of residential and public buildings and at residential development sites.

9 Fish and plankton

> The Baltic Sea hosts approximately 70 species of saltwater fish and another 30 to 40 species of brackish or freshwater fish, all of which inhabit the central and coastal regions of the Baltic Sea. Cod, herring and sprat dominate the fish community in biomass, as well as in quantity. These three species are also most important from a commercial perspective, accounting for approximately 95% of the fish catch in the Baltic Sea. Plankton is the main feeding resource for fish and seabirds in the Baltic Sea. Among the plankton several species are recognised as indicator species (any biological species that defines a trait or characteristic of the environment).

9.1 Monitoring programme for fish and plankton

Potential impacts

Potential impacts on fish, fish stocks and plankton communities from the Nord Stream Project may be the result of sediment dispersion and sedimentation caused by construction activities. In addition, fish species are sensitive to noise and physical disturbance during construction and operation activities. Beneficial impacts include the physical presence of the pipeline at the seabed, which may act as an artificial reef, and the release of organic particles during seabed intervention works, which may stimulate plankton growth.

Monitoring activities until 2012

Monitoring of *fish* has been carried out in Russia, Finland, Sweden, Denmark and Germany. Monitoring was initiated in 2009 and will be completed by the end of 2014 in all countries with the exception of Russia, where from 2015 onwards the monitoring will be carried out once every three to five years. Monitoring of fish in Finland was finalised in 2010.

Monitoring of fish is carried out using a combination of trawls, gill nets, MBES, still photos and video recordings at selected areas that have been deemed sensitive. The objective of the monitoring programme is to document potential impacts or changes in fish communities and fish stocks close to the Nord Stream Pipeline caused by construction and operation activities. As a mitigation measure, acoustic fish surveys by sonar were carried out in connection with munitions clearance in Finland and Sweden to detect the presence of fish shoals in the vicinity of munitions clearance sites. The number of fish fatalities was assessed by observers after detonations using nets. Monitoring of fish in Finland was carried out only during munitions clearance.

Monitoring of *plankton* is carried out only in Russia. Monitoring was initiated in 2010 and will be repeated yearly until 2014. From 2015 onwards the monitoring will take place once every three to five years. The purpose of the plankton monitoring is to document potential changes in the plankton community caused by elevated SSC. Increased SSC was observed only during dredging and rock placement activities. Monitoring covered both zooplankton and phytoplankton.

The results and main conclusions from finalised monitoring of impacts on fish and plankton during construction of the pipelines are reported in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

Monitoring of fish stocks in 2013 took place in Russia, Sweden, Denmark and Germany at selected areas that were deemed sensitive. Monitoring of fish is carried out using a combination of trawls, gill nets, MBES, still photos and video recordings. Monitoring of plankton was carried out only in Russia. The results and conclusions from ongoing monitoring activities are reported in the following sections.

Locations with fish and plankton monitoring are shown in Figure 9.1, with an indication of finalised monitoring activities related to construction (2009-2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards).

>

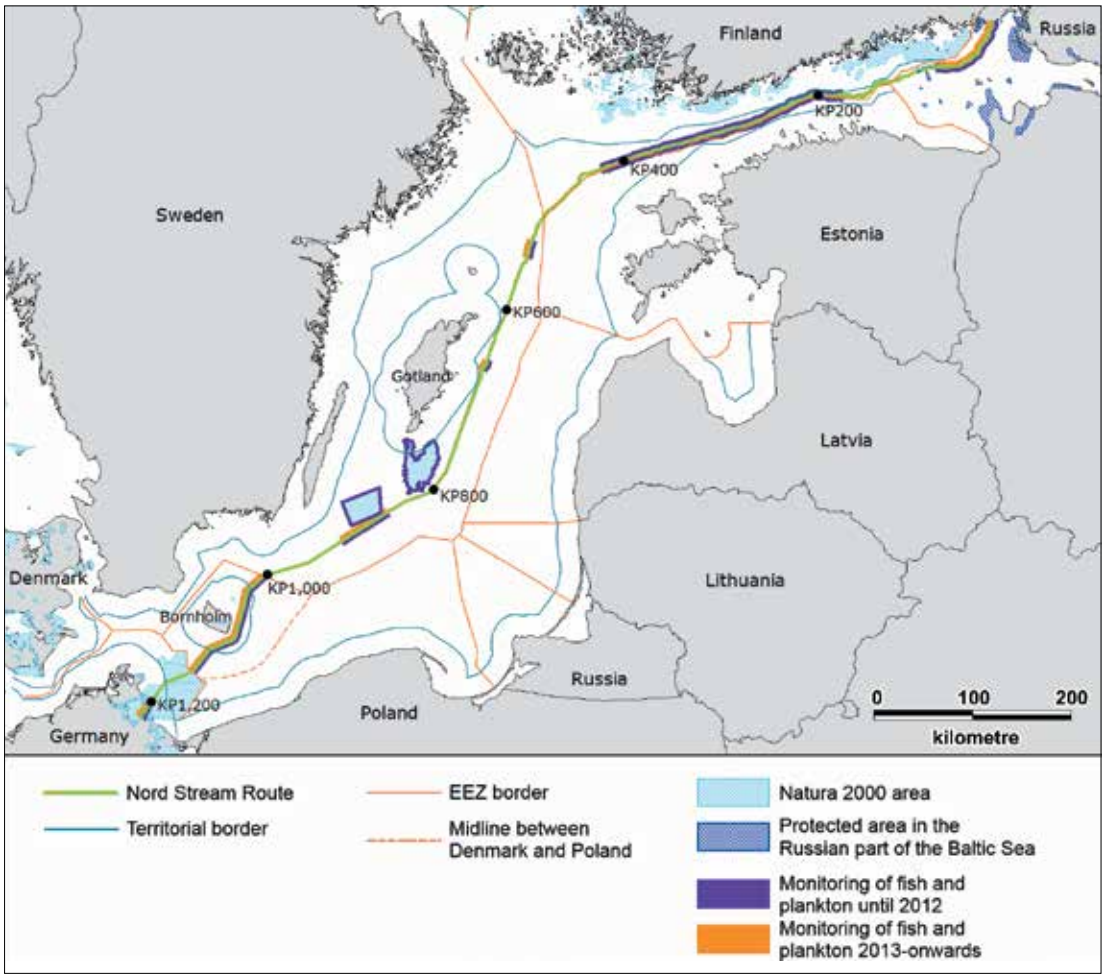


Figure 9.1 Locations of monitoring activities under the fish and plankton monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

9.2 Russia

The purpose of the fish and plankton monitoring programme in Russia is to assess the condition of fish populations, to monitor migration of salmon populations in relation to the construction of the Nord Stream Pipeline and to document potential changes in the plankton community caused by elevated SSC during dredging and rock placement activities. The time schedule for the monitoring is presented in Figure 9.2. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

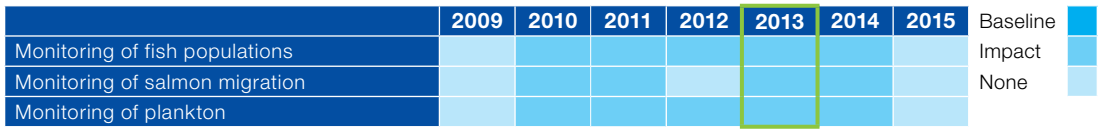


Figure 9.2 Time schedule for the monitoring programme for fish and plankton in Russia. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of fish populations

Monitoring of fish populations started in 2010 and continued in 2011, 2012 and 2013. Surveys were performed in June-October in shallow waters of Portovaya Bay using gill nets and in June-November in the deep-water area of the eastern Gulf of Finland using trawls. In 2010-2012 fish were caught at 13 stations (9 gill net stations and 4 trawl stations). In 2013 the number of stations was reduced to five, comprising three net stations and two trawl stations. The monitoring stations correlated with those used in previous years.

In 2013 monitoring took place in June and August. A total of 12 fish species comprising 5 families were documented. In Portovaya Bay species belonging to the Cyprinidae and Percidae families – roach (*Rutilu rutilus*), ruffe (*Gymnocephalus cernuus*) and perch (*Perca fluviatilis*) – dominated in numbers and in biomass. At the deep-water stations the most abundant species were Baltic herring (*Clupea harengus membras*), European sprat (*Sprattus sprattus*), smelt (*Osmerus eperlanus*) and three-spined stickleback (*Gasterosteus aculeatus*). Baltic herring was the dominant species, accounting for up to 95% of abundance and up to 96% of biomass.

The results of 2013 monitoring showed some decrease in fish species diversity and abundance. However, the occurrence of detected species was comparable to the results of previous years of monitoring. The most prominent changes in the structure were observed in Portovaya Bay, where species diversity decreased from 14 in 2012 to 11 in 2013. Species diversity in the deep-water section in 2013 did not undergo any changes compared with the previous year, while the biomass of fish decreased. Such decreases in the parameters of the fish population may be the result of a reduced number of monitoring stations in 2013 as well as of the earlier completion of monitoring (August in 2013 vs. September-November in 2010-2012), which may interfere with the detection of migrating and spawning species, such as whitefish (*Coregonus*), vendace (*Coregonus albula*) or northern lampreys (*Petromyzontidae family*), in the previous surveys. Natural factors, including morphometric and hydrological peculiarities of the surveyed area, gradients of temperature and salinity in water and wind-driven currents, can also contribute to fluctuations in fish populations.

>

Results and conclusions from the monitoring of salmon migration

Monitoring of salmonid species (*Salmoninae*) was carried out in 2010, 2011 and 2013. Surveys in 2010 and 2011 were performed in June-August and October in Portovaya Bay and in June-September and November at nine locations in the vicinity of the island of Maly Fiskar.

In 2013 salmonid monitoring was carried out in May-June and September-November at three stations in Portovaya Bay. During each of these periods fishing was performed weekly using multi-mesh gill nets.

Similar to the results of the 2010 and 2011 surveys, no salmonid species, including juveniles, were detected during 2013 monitoring. It is difficult to draw any conclusions on the impact on salmonid species from the construction and operation of the Nord Stream Pipeline because no salmonid species were documented during baseline surveys of 2006 and 2007. Additionally, salmonid species occur in low quantities in the survey area due to extensive commercial fishing in the past and a high anthropogenic load on waters in the eastern Gulf of Finland.

Results and conclusions from the monitoring of plankton

Monitoring of plankton was carried out in 2010, 2011, 2012 and 2013 during the summer period in shallow waters of Portovaya Bay and in the deep-water area. Surveys in 2010-2012 were performed at 21 stations, while surveys in 2013 were performed at 7 stations.

In 2013 plankton monitoring was performed once at two stations in Portovaya Bay and at five stations in the deep-water section. In correspondence with previous years, monitoring covered analysis of zooplankton and phytoplankton communities. The following parameters were registered: species composition, total abundance and biomass, abundance and biomass of the main systematic groups, and spatial distribution. In addition, concentrations of photosynthetic pigments were measured for phytoplankton.

Zooplankton in 2013 was represented by 36 taxa with 13 Rotifera species, 11 Cladocera species and 12 Copepoda species. Species composition was comparable between monitoring stations, with higher diversity in Portovaya Bay (35 species) than in the deep-water section (26 species). Copepoda species were dominant in both the shallow and deep-water areas, accounting for 47-87% in abundance and 84-94% in biomass. Total abundance varied between 7,070-20,040 individuals/m^3 with an average of 12,960 individuals/m^3; total biomass ranged between 0.3-0.9 g/m^3 with an average of 0.58 g/m^3. Species diversity in 2013 slightly decreased compared with 2011-2012 but was higher than in 2010. At the same time, abundance and biomass were highest in 2013.

Phytoplankton in 2013 consisted of 40 species belonging to 5 phyla: Cyanophyta (9 species), Dinophyta (6 species), Cryptophyta (5 species), Bacillariophyta (8 species) and Chlorophyta (12 species). Vegetation levels and species diversity were lower than in the previous monitoring years. Total abundance was in the range of 2,223-18,159 cells/m^3, averaging 7,600 cells/m^3; total biomass ranged between 0.36-1.77 g/m^3, with an average of 1.08 g/m^3. The lowest level of phytoplankton vegetation and species diversity was registered in Portovaya Bay. In the deep-water area these levels were rather low but comparable to the results of the 2012 survey. The taxonomic structure of the phytoplankton communities during the 2010-2013 surveys was quite stable, with blue-green algae dominating, followed by Dinophyta algae. Prevalence of Cyanophyta was approximately 54-94% of the total biomass, with *Aphanizomenon flos-aquae*, *Planktothrix agardhii* and *Limnothrix planctonica* species indicating eutrophic conditions in the surveyed area. The average concentration of chlorophyll a in the analysed samples was 1.82 µg/l; the carotenoid concentration was 2.53 µg/l; and the proportion of phaeopigments was 37.2%. The development of photosynthetic pigments in 2013 was relatively low but within a natural fluctuation interval.

Table 9.1. Mean values of phyto- and zooplankton biomass (g/m³) in 2010-2013.

	2010		2011		2012		2012	
	Phyto-plankton	Zoo-plankton	Phyto-plankton	Zoo-plankton	Phyto-plankton	Zoo-plankton	Phyto-plankton	Zoo-plankton
Portovaya Bay	3.41	0.08	2.44	0.38	4.29	0.39	0.42	0.69
Deep-water section	2.45	0.33	2.90	0.46	1.12	0.28	1.35	0.53
Total	2.93	0.21	2.67	0.43	2.70	0.34	1.08	0.58

In general, species composition, parameters of abundance and distributions of phyto- and zooplankton in the surveyed area corresponded to the natural levels typical of the eastern Gulf of Finland. Therefore, the construction and subsequent operation of the Nord Stream Pipeline did not have any significant negative impact on the plankton communities.

9.3 Sweden

The purpose of the monitoring programme for fish in Sweden is to evaluate the qualitative and, if possible, the quantitative changes in demersal fish communities in the areas adjacent to the Nord Stream Pipeline and to evaluate and document the potential effects of construction activities (especially post-lay trenching) on fish fauna within the two Natura 2000 areas Hoburgs Bank and Norra Midsjöbanken. The time schedule for the monitoring is presented in Figure 9.3. A detailed map showing the locations of monitoring stations in Sweden is included in Appendix C.

Figure 9.3 Time schedule for the monitoring programme for fish in Sweden.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of fish along the pipelines

Field surveys were carried out in September-November 2010, September 2011, September 2012 and September 2013. Each survey involved CTDO measurements, Secchi depth measurements (water transparency) and survey fishery using gill nets or bottom trawling. The monitoring stations covered areas where the pipeline was laid directly on the seabed (areas HNB and NMR) and areas where the pipeline was post-lay trenched into the seabed (area NMT). Each monitoring area included an impact station (a stretch parallel to and 75 m west of the pipeline) and a reference station (a stretch parallel to and 1 km west of the pipeline).

Catches of cod were continuously high throughout the sampling from 2010 until 2013. Other demersal fish species, such as shorthorn sculpin (*Myoxocephalus scorpius*), flounder (*Plathichtys flesus*), plaice (*Pleuronectes platessa*) and whiting (*Merlangius merlangus*) (semipelagic), were only documented in low numbers.

Hydrographical conditions at the impact and reference stations were generally equivalent within each year of monitoring.

In area NMT, a total of five different fish species were caught during the fish surveys from 2010 to 2013. The demersal fish composition in the NMT impact area differed between years for both biomass and abundance. During the last three years (2011-2013), catches of cod increased in comparison with the baseline survey in 2010 however this was observed both at impact and reference stations and therefore no reef effect within the impact area could be detected. The baseline survey in 2010 was delayed until late October in area NMT due to bad weather. The fish surveys in 2011, 2012 and 2013 were conducted during September, a period that also represents the end of the spawning period for cod in the area. These differences could provide a basis for variations for biomass as a parameter in the NMT area.

>

In area NMR, a total of nine different fish species were caught during fish surveys in 2010-2013. In area NMR, there was a significant difference in demersal fish composition between the baseline survey and surveys in 2011, 2012 and 2013 with respect to biomass. Furthermore, the parameter abundance showed differences in fish composition between all years. However, there was no significant difference between impact and reference areas for either biomass or abundance, indicating a natural variation between years.

In the HNB area, a total of eight different fish species were caught during the surveys from 2010 to 2013. In the HNB area the most similarities between the baseline study and subsequent surveys in 2011, 2012 and 2013 were observed compared with the NMR and NMT areas. The demersal fish assemblage did not show any differences in composition between impact versus reference or between years (2010-2013). No differences were detected for biomass or abundance of the dominant demersal fish species, cod.

Average abundance (NPUE) of cod caught using trawling and gill nets are presented in Figure 9.4 and Figure 9.5 respectively for all three areas.

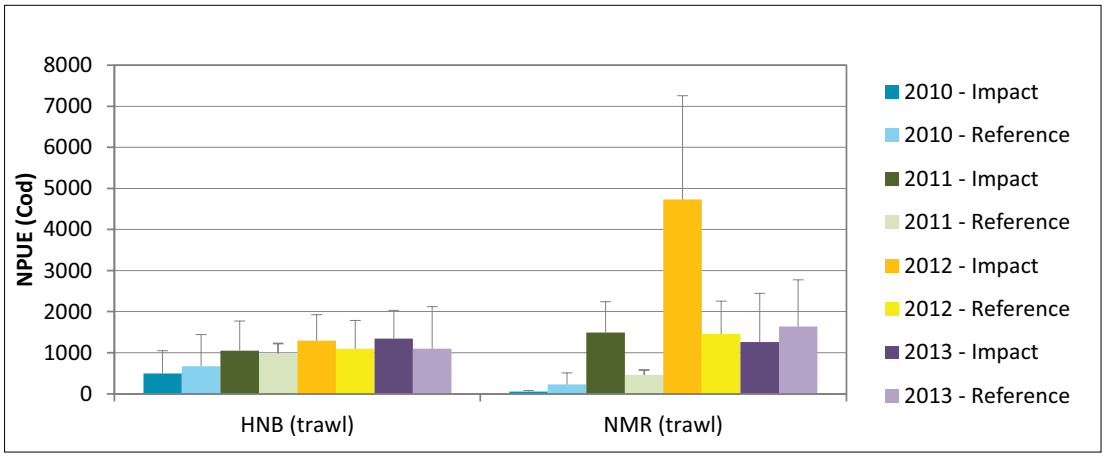


Figure 9.4 Average abundance (NPUE) of cod caught using trawling with standard deviation for 2010, 2011, 2012 and 2013 at the monitoring areas HNB and NMR.

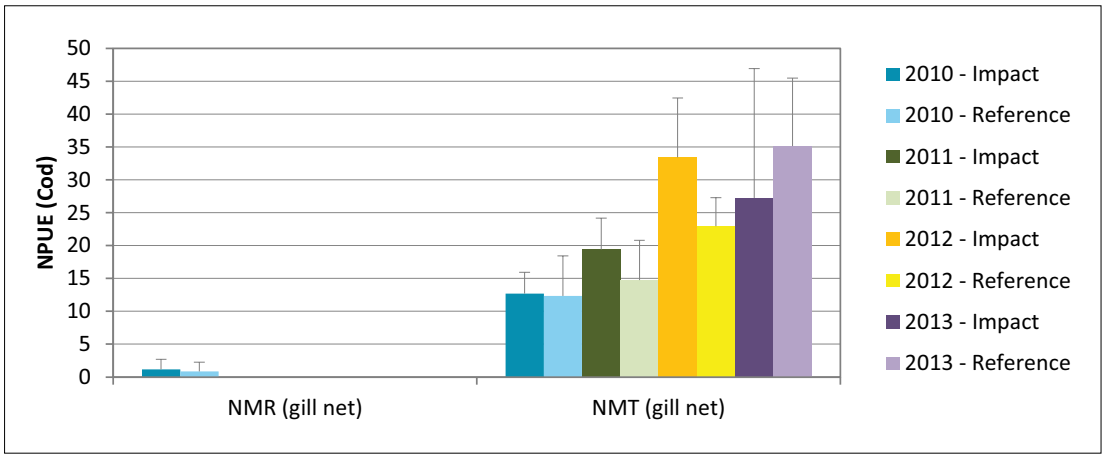


Figure 9.5 Average abundance (NPUE) of cod caught using gill nets with standard deviation for 2010, 2011, 2012 and 2013 at the monitoring areas NMR and NMT. Monitoring with gill nets at NMR was carried out only in 2010.

9.4 Denmark

The purpose of the monitoring programme for fish in Denmark is to evaluate and document the qualitative and, if possible, the quantitative changes in the demersal fish communities in the areas adjacent to the Nord Stream Pipeline. The time schedule for the monitoring is presented in Figure 9.6. A detailed map showing the locations of monitoring stations in Denmark is included in Appendix D.

Figure 9.6 Time schedule for the monitoring programme for fish in Denmark.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of fish along the pipelines

Monitoring activities were carried out in October-November 2010, and in September 2011, 2012 and 2013. In 2010 and 2011, monitoring covered nine impact stations distributed over the entire pipeline route in Danish waters. However, due to hypoxia, two stations in the northern part of the EEZ were removed from the monitoring programme. Thus, in 2012 and 2013 the monitoring covered seven impact stations, of which three included reference stations. Four of the stations are located on "hotspots" identified by Danish fishermen as being of particular importance for fishery. Each survey included CTDO measurements, Secchi depth measurements (water transparency) and survey fishery using gill nets or bottom trawling. The monitoring stations covered areas where the pipeline was laid directly on the seabed and areas where the pipeline was post-lay trenched into the seabed.

The fish composition during the survey in 2013 was similar to the 2010, 2011 and 2012 surveys and strongly dominated by cod. The biomass and abundance of cod varied between years of surveys and between impact and reference areas. However, no difference between the impact and reference stations within each year was detected, and therefore no reef effect on cod can be determined after four years of surveys. In comparisons between years, an increase of the flatfish species flounder and plaice was observed during the surveys in 2011 and 2012 at the three southernmost locations: (impact and reference areas). However, in the 2013 survey flatfish were documented in lower numbers and no reef effect was documented.

The results thus far should be regarded as short-term ecological effects on the demersal fish community in the Baltic Sea. Nevertheless, in comparison with the baseline study in 2010 it can be verified that no effects on the composition of demersal fish that can be attributed to the presence of the pipeline have been documented.

>

Average abundance (NPUE) of cod caught using trawling and gill nets are presented in Figure 9.7 and Figure 9.8 respectively.

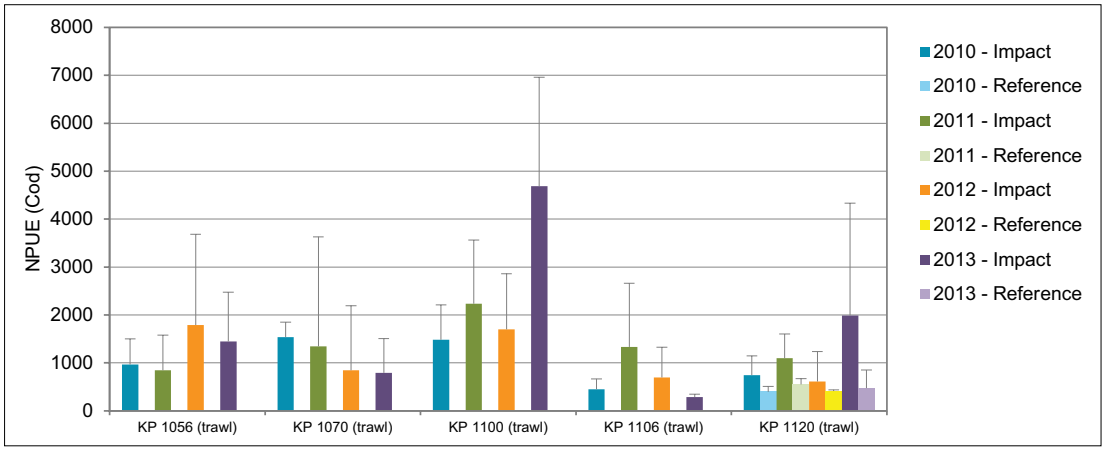


Figure 9.7 Average abundance (NPUE) of cod caught using trawling with standard deviation for 2010, 2011, 2012 and 2013 from areas where the pipelines are established on the seabed. A reference station has been included for KP 1120 only.

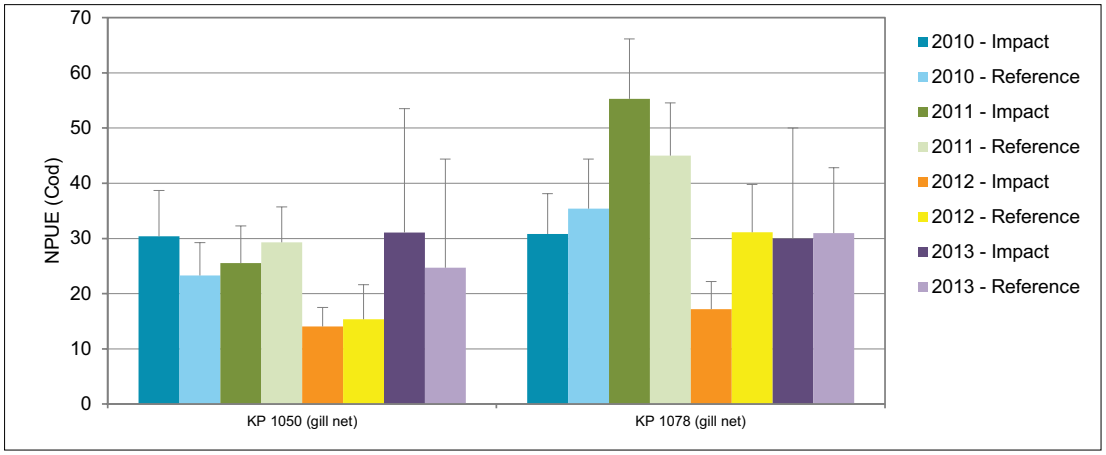


Figure 9.8 Average abundance (NPUE) of cod caught using gill nets with standard deviation for 2010, 2011, 2012 and 2013 from areas where the pipelines are post-lay trenched into the seabed.

9.5 Germany

The purpose of the monitoring of fish in Germany is to evaluate potential impacts from construction works. The time schedule for the monitoring is presented in Figure 9.9. A detailed map showing the locations of monitoring stations in Germany is included in Appendix E.

Figure 9.9 Time schedule for the monitoring programme for fish in Germany.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of fish populations

Monitoring of fish was carried out in June 2011, June 2012 and June 2013. In all three years, fish were caught using beach seine samples in the shallow waters off Lubmin. Catches were sorted to species level and registered with individual weight and length.

Altogether 17 species were observed during the three years of investigations, representing a typical shallow water community of young and small fish in Greifswalder Bodden. During the first two years of investigations, the most abundant species were three-spined stickleback, common goby (*Pomatoschistus microps*), and sand goby (*Pomatoschistus minutus*). Roach, which was a dominant species in 2011, was absent in 2012. Sand eel (*Ammodytes tobianus*), a dominant species in 2012, was absent in 2011. Gobiids, herring (*Clupea harrengus*) and sand eel prevailed in 2013.

Minor differences in the measured parameters (abundance, biomass, diversity) were found between years (2006-2013), which is interpreted as a result of interannual and spatial differences in the macrophyte cover. No significant differences were observed between samples from the former Nord Stream cofferdam and samples from a reference area nearby. In general, the results obtained between 2011 and 2013 were similar to the results obtained during the baseline investigations in 2006 and 2008.

10 Birds

> In the Baltic Sea, there are several highly important staging, wintering and breeding areas for seabirds. The offshore banks constitute habitats for species of diving ducks and auks, and the Baltic Sea is an important migration route, especially for waterfowl, geese and waders nesting in the Arctic tundra. Every spring, immense numbers of birds move northwards along the Baltic Sea coastline to their nesting grounds. Some of the birds use the coastline for resting and foraging (staging) during their migration. An important feature of the distribution of wintering seabirds in the Baltic Sea, in relation to the pipeline, is the assemblage of bird fauna in more shallow areas (< 30 m). This habitat is especially important for benthic-feeding species, which comprise at least 75% of the Baltic winter bird fauna. The more open and deeper parts of the Baltic Sea, where the pipeline is located for most of its length, are generally occupied by pelagic-feeding species.

10.1 Monitoring programme for birds

Potential impacts

Potential impacts on birds from the Nord Stream Project may be the result of sediment dispersion and sedimentation, noise, physical disturbance and bird strikes (collisions with the lay vessel) during construction.

Monitoring activities until 2012

Monitoring of birds was carried out in Russia, Finland, Sweden and Germany. Monitoring was initiated in 2009 and was finalised for Finland and Sweden in 2010. The monitoring of birds in Russia and Germany will continue into the operation phase for certain parameters.

The purpose of the bird monitoring programme in Finland and Sweden was to mitigate impacts on birds during munitions clearance and to register any impacts on birds after clearance operations.

The results and main conclusions from finalised monitoring of impacts on birds during construction of the pipelines are reported in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

Monitoring of birds in 2013 took place in Russia and Germany with the purpose of monitoring the recovery of species (both breeding and migration) following the construction work. The monitoring of birds will continue in Russia in 2014 and then be performed every three to five years from 2015 onwards. In Germany monitoring is planned for 2014. The results and conclusions from ongoing monitoring activities are reported in the following sections.

Locations with bird monitoring are shown in Figure 10.1, with an indication of finalised monitoring activities related to construction (2009-2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards). >

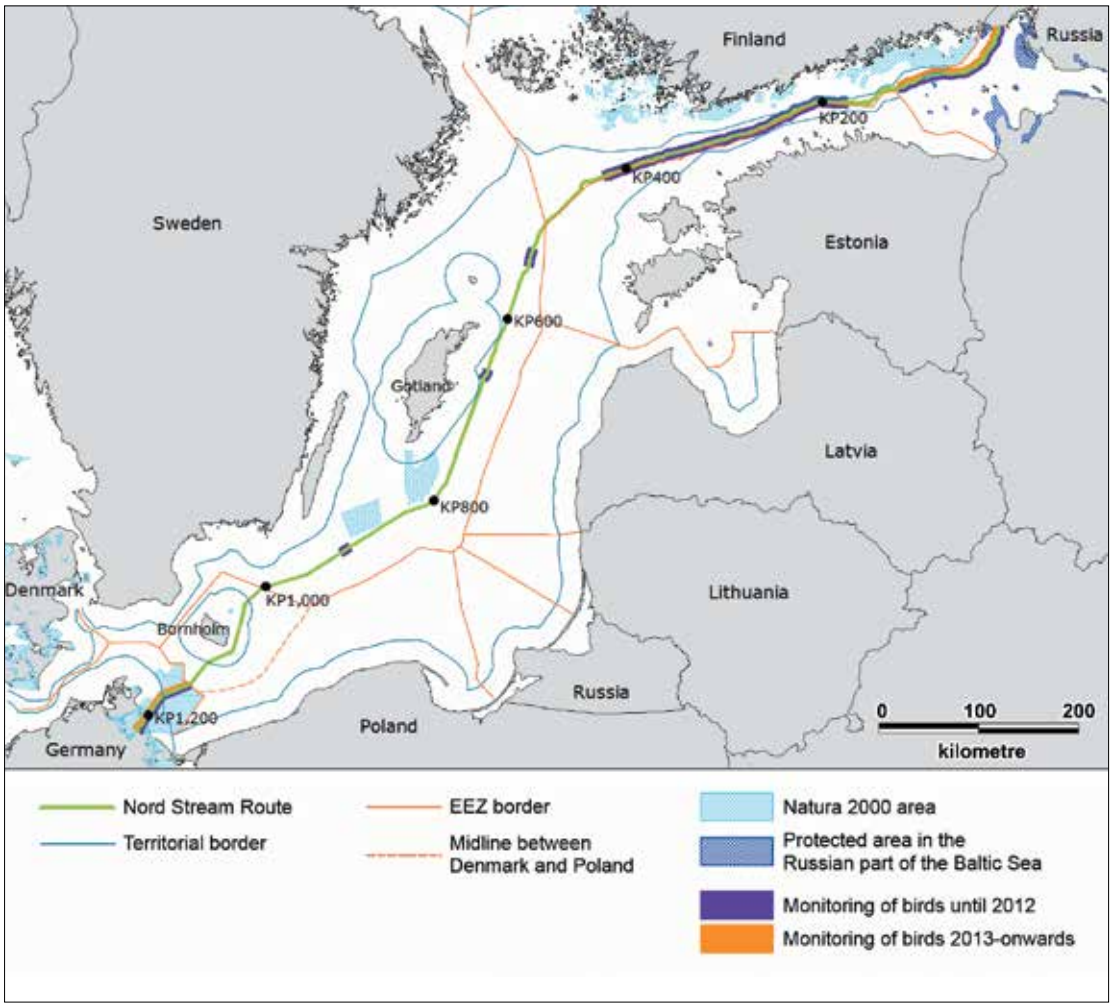


Figure 10.1 Locations of monitoring activities under the bird monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

10.2 Russia

The purpose of the bird monitoring programme in Russia is to monitor the population dynamics of nesting and migratory birds, as well as vulnerable bird populations, in relation to the construction of the Nord Stream Pipeline. The time schedule for the monitoring is presented in Figure 10.2. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

Figure 10.2 Time schedule for the monitoring programme for birds in Russia.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of birds

Monitoring of seabirds was carried out between May-November 2010 and 2011, June-September 2012 and May-October 2013 to document the status of migrating and nesting birds during the construction and operation of the pipelines.

Observations were carried out in the impact area, which represented a 2 km corridor along the pipeline route including adjacent islands, and a control area at considerable distance from construction activities. The impact area included the shallow waters of Portovaya Bay and the islands of Malyi Fiskar, Bolshoi Fiskar, Sommers and Gogland. Various control areas were monitored during the construction and operation periods, including the group of islands (Beryozovie ostrova, Dolgiy Kamen, Seskar, islands Khallikarti, Nerva, Moshchniy, Virgund, Bolshoi and Malyi Tjuters).

Similar to ornithological surveys of 2010-2012, monitoring activities in 2013 were aimed at obtaining information on species composition, distribution and abundance, with a particular focus on rare and protected species.

During the observations in 2013, 64 waterbird species were detected, of which 34 were found to be nesting and migrating, 2 were found to be nesting and 28 were found to be migrating. Among the detected bird species 3 belonged to the *Gavia* species, 1 to the *Podicipedidae* species, 1 to the *Pelecaniformes* species, 1 to the *Ciconiiformes* specie, 26 to the *Anseriformes* species, 1 to birds of prey, 3 to the *Gruiformes* species and 28 to the *Charadriiformes* species. In total, 32 bird species discovered during monitoring in 2013 had rare or protected status. Species composition in 2013 was higher compared with the results of the 2010-2012 surveys (54 species in 2010, 62 species in 2011 and 43 species in 2012). The abundance of nesting and migrating birds documented in 2013 increased compared with the previous year and was comparable to the abundance in 2010-2011. Such a positive tendency can be explained either by natural annual fluctuations in bird populations or by stabilisation of the environmental state along the pipeline route after completion of all construction activities.

Overall, the results of bird monitoring during the operation phase in 2013 showed an ongoing positive tendency in the development of bird populations in the areas that might be affected by the pipeline construction. This includes increases in species diversity and abundance as well as the emergence of rare and protected species, such as white-tailed eagle, in the vicinity of the pipelines. Therefore, it was concluded that the construction and subsequent operation of the Nord Stream Pipeline had no negative impact on ornithofauna in the region.

>

Figure 10.3 Great cormorants (*Phalacrocorax carbo*), Archipelago Bolshoi Fiskar.

10.3 Germany

The purpose of the bird monitoring programme in Germany is to record the number of bird strikes and to document displacement effects on birds due to construction activities. Furthermore, the regeneration phase of the bird population is monitored. The time schedule for the monitoring is presented in Figure 10.4. A detailed map showing the locations of monitoring stations in Germany is included in Appendix E.

Figure 10.4 Time schedule for the monitoring programme for birds in Germany.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of staging seabirds

Monitoring of staging seabirds during the recovery phase was carried out in midwinter and spring from 2011 until 2013. The aim of the surveys was to estimate the total number of staging seabirds in Greifswalder Bodden and the Pomeranian Bight. Data were collected during aerial surveys in Greifswalder Bodden and on line-transect ship and aerial surveys in the Pomeranian Bight.

Due to a relatively small spatial extension of the Nord Stream seabed footprint (3 km^2) in the seabird wintering area of almost 7,000 km^2, it was not possible to perform a detailed effect analysis.

The estimated number of scaup (*Aythya affinis*) and long-tailed duck in Greifswalder Bodden recorded during spring 2011 was similar to the estimates of the pre-construction surveys in 2006 and 2007 (approximately 35,000 scaup and 30,000 long-tailed ducks).

Due to extensive ice cover in the Pomeranian Bight, no ship surveys could be performed during midwinter 2011. In 2012, the number of staging species detected in March 2012 was similar to the number of species detected during the baseline study in 2006-2008 and the post-construction survey of 2011. A new maximum was recorded for red-throated diver (*Gavia stellata*) and slavonian grebe (*Podiceps auritus*). However, because of a relatively significant daily variation in the number of staging birds in spring compared with winter, the results were difficult to interpret.

The survey in midwinter 2013 revealed a rather high estimate of staging long-tailed duck (180,000 individuals) in the German part of the Pomeranian Bight. Such a high figure has not been recorded during any other winter in the last decade. Estimates for other abundant seabird species (divers, scoters, slavonian grebes) were comparable to other midwinter surveys during the period 2006-2013.

A large-scale differential before-after analysis (2006-2008 versus 2011-2013) revealed no changes in bird density/abundance estimates for any of the eight most abundant seabird species in the Pomeranian Bight (long-tailed duck, common scoter, velvet scoter, arctic diver, red-throated diver, slavonian grebe, razorbill, black guillemot) during the midwinter and spring seasons, respectively. Significant large-scale spatial shifts were observed for scoters, a genus known to be very sensitive to ship traffic. The implementation of a ship separation scheme in the Adlergrund channel in December 2010 is the most likely reason for this change.

11 Marine mammals

> Four marine mammal species – the harbour porpoise, the harbour seal, the grey seal and the ringed seal – are native to the Baltic Sea. Harbour porpoises and harbour seals are found primarily in the southernmost parts of the Baltic Sea. Grey seals occur all year throughout the Baltic Sea, but only in small numbers in the southern region. Ringed seals are found in areas that typically have ice cover during winter, mostly in the Gulf of Bothnia and the Gulf of Riga; small populations are also observed in the Archipelago Sea and the eastern (Russian) parts of the Gulf of Finland.

11.1 Monitoring programme for marine mammals

Potential impacts

Potential impacts on marine mammals from the Nord Stream Project may be the result of noise and physical disturbance during construction.

Monitoring activities until 2012

Monitoring of marine mammals has been carried out in Russia, Finland, Sweden and Germany. Monitoring was initiated in 2009 and was finalised for Finland and Sweden in 2011 and 2010, respectively. The monitoring of marine mammals in Russia and Germany will continue into the operation phase for certain parameters.

The objective of the monitoring programme is to document the size and distribution of the marine mammal population in the landfall areas and to document the potential impacts on marine mammals from the construction of the Nord Stream Pipeline. In Finland and Sweden, observations of marine mammals were carried out as part of the mitigation measures during munitions clearance during 2009 and 2010. In Finland, marine mammals were also monitored during rock placement in 2011.

The results and main conclusions from finalised monitoring for marine mammals during construction of the pipelines are reported in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

Monitoring of marine mammals in 2013 took place in Russia and Germany. The objective of the ongoing monitoring activities in Russia and Germany is to document the size and distribution of the marine mammal population in the landfall areas and to document the recovery of the marine mammal population after construction of the Nord Stream Pipeline. Monitoring of marine mammals is conducted using a combination of vessel-based surveys, aerial surveys (Germany only) and acoustic data loggers (Germany only). The results and conclusions from ongoing monitoring activities are reported in the following sections.

Locations of marine mammal monitoring are shown in Figure 11.1, with an indication of finalised monitoring activities related to construction (until 2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards).

>

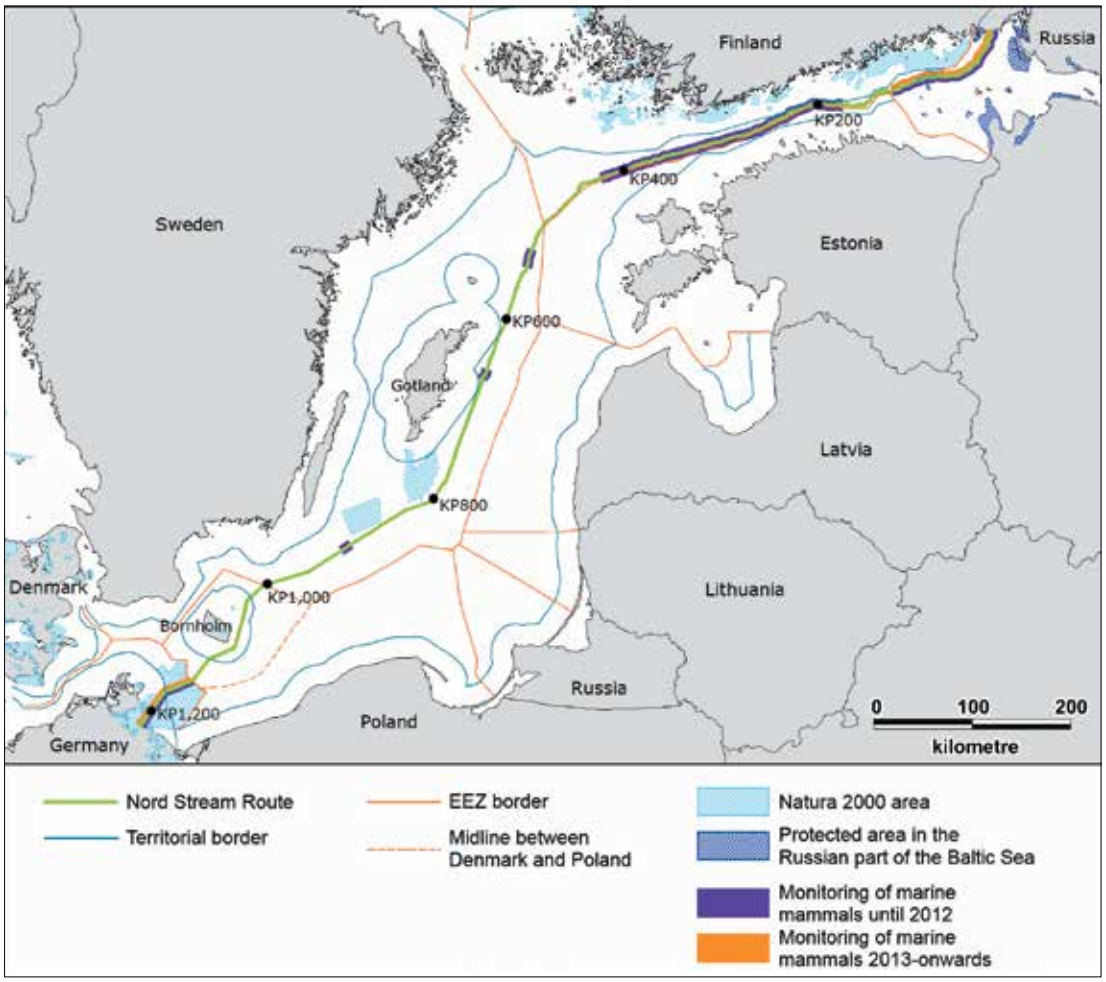


Figure 11.1 Locations of monitoring activities under the marine mammals monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

11.2 Russia

The purpose of the marine mammal monitoring programme in Russia is to observe impacts on population size and distribution on the islands and in adjacent areas in relation to the construction of the Nord Stream Pipeline. The time schedule for the monitoring is presented in Figure 11.2. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

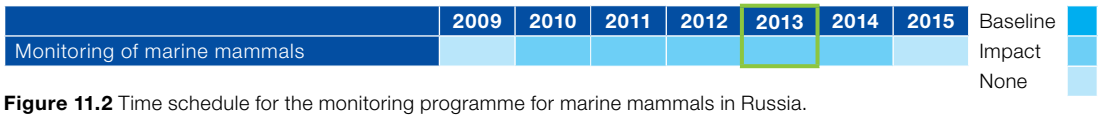


Figure 11.2 Time schedule for the monitoring programme for marine mammals in Russia. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of marine mammals

Monitoring of marine mammals was carried out in May-November of 2010-2012 and in May-October of 2013. Surveys were performed on the coastlines of the islands of Maly Fiskar, Bolshoi Fiskar, Sommers, Gogland and Halikarti. In addition, all encounters with mammals in open waters were recorded. In 2013 additional surveys were performed in the control areas in the central and southern Gulf of Finland located outside of the pipeline route.

The Nord Stream Pipeline route passes through the habitats of two aquatic mammals – the grey seal (*Halichoerus grypus*) and the ringed seal (*Phoca hispida botnica*). Monitoring in 2010-2012 showed a very scarce presence of these mammals in the vicinity of the pipeline. Thus, no species were encountered during monitoring surveys in 2010 and 2012. One grey seal outside the pipeline route and several American mink (semiaquatic species) in the nearshore area were documented during monitoring in 2011.

In 2013 several ringed seals were documented in the control locations. In most cases these were single animals, but a group of five ringed seals was observed once, at a haul-out together with grey seals. Grey seals were encountered more often in the vicinity of the pipelines and in the more distant regions. One haul-out of grey seals was found close to the archipelago Bolshoi Fiskar, and several animals were detected near the island of Halikarti. Note it was the first time the grey seal haul-out was registered in the area of potential impact from the pipeline construction. The majority of grey seals were found in the control area outside the pipeline route.

Since few marine mammals were detected along the pipeline route during monitoring campaigns in 2010-2013 it was not possible to draw any conclusions on the impact from construction of the Nord Stream Pipeline. However, the presence of grey seals in the vicinity of the pipeline route in 2013 indicates the absence of any negative effects from operation of the pipeline on marine mammals. >

Figure 11.3 Grey seals (*Halichoerus grypus*) near the archipelago Bolshoi Fiskar.

11.3 Germany

The purpose of the marine mammal monitoring programme in Germany is to document the effects of increased turbidity and disturbance and to document disturbance of marine mammals by underwater noise. The time schedule for the monitoring is presented in Figure 11.4. A detailed map showing the locations of monitoring stations in Germany is included in Appendix E.

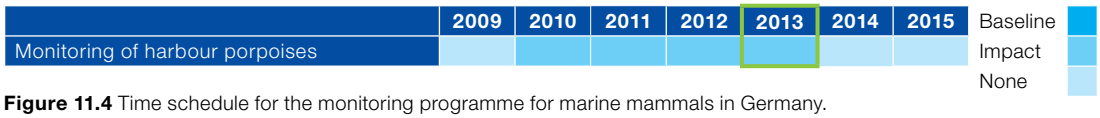


Figure 11.4 Time schedule for the monitoring programme for marine mammals in Germany. The schedule only include monitoring programmes still ongoing 2013 and onwards.

11.4 Results and conclusions from the monitoring of harbour porpoises

Monitoring of harbour porpoises (*Phocoena phocoena*) was carried out continuously between July 2009 and the end of December 2013, starting before commencement of the Nord Stream construction activities and ending more than a year after completion thereof. The presence/absence of harbour porpoises was monitored using stationary hydrophone recordings (porpoise detectors, PODs). Two types of hydrophones have been deployed; the old (T-POD) or new (C-POD) hydrophones. Hydrophones were deployed at 13 stations within the Pomeranian Bight. A total of seven T-PODs and 13 C-PODs were installed, with a double deployment of C-PODs and T-PODs at seven former pod positions of the German Oceanographic Museum (GOM) and a single deployment of C-PODs along six positions in close vicinity to the pipeline. The use of both types of equipment aims for a long-term trend analysis under consideration of data recorded either with T-POD or C-POD hydrophones.

Harbour porpoises were detected on 15% of all recording days. Porpoise activity showed a north-south gradient, with more recordings at northerly positions and in the vicinity of the Nord Stream Pipeline. Throughout the monitoring period the majority of harbour porpoises were detected between August and October. In addition, a small detection peak was observed in late February/March in some years. The findings correspond to results from former studies in the area and may indicate a migration of harbour porpoises from the Danish Belt Sea into the Pomeranian Bight during late summer/autumn and a migration of Baltic Proper porpoises into the area during February.

The highest number of porpoise detections coincided with Nord Stream construction periods during autumn. No displacement effect of construction works on harbour porpoises was detected, and the overall seasonal pattern of porpoise presence did not seem to be affected. Since harbour porpoises are rarely present in the study areas, it was not possible to detect any small-scale effects. Thus, no conclusions can be drawn about whether porpoises in close vicinity to the construction vessels were negatively affected.

The presence of harbour porpoises in the Pomeranian Bight between 2005 and 2013 exponentially increased in the summer season. The reasons for this increase remain unclear and may be attributed to increase of the Belt Sea population or shift in spatial pattern.

12 Benthic flora and fauna

> Benthic flora depends on light and is rarely found below 35 m. This means that potential impacts on benthic flora are limited to the coastal areas and offshore shallow banks. The existence of benthic fauna depends on oxygen concentrations being above the critical level of 2 mg/l. Under conditions with low oxygen concentrations development of hydrogen sulphide is possible, which is toxic for fish and macroinvertebrates. Consequently, large parts of the seabed in the deeper parts of the Baltic Sea are without benthic fauna.

12.1 Monitoring programme for benthic flora and fauna

Potential impacts

Potential impacts on benthic flora and fauna from the Nord Stream Project may be the result of sediment dispersion and sedimentation caused by construction-related activities and due to the occupation of seabed areas by the pipelines, rock berms, concrete mattresses, etc. Potentially this can cause interference with long-term monitoring results and affect the representativeness of national/regional monitoring stations.

Monitoring activities until 2012

Monitoring of benthic fauna has been carried out in Russia, Finland, Sweden, Denmark and Germany. Monitoring of benthic flora has been carried out in Russia and Germany. Monitoring was initiated in 2010, and the activities will be completed by the end of 2015 in all countries with the exception of Russia, in which monitoring is planned to be carried out once every three to five years from 2015 onwards.

Monitoring included baseline surveys prior to construction, surveys of the status upon completion of construction and monitoring of recovery in the years following construction. The purpose is to document changes in the benthic flora and fauna communities caused by sediment dispersion and other impacts from construction and changes in geomorphology and seabed substrate caused by the presence of the pipelines on the seabed. Particular objectives include documenting the conditions close to existing and proposed Natura 2000 areas, the potential changes caused by munitions clearance and rock placement, the development of epifauna on the pipeline surface, and the regeneration of benthos. Monitoring also includes monitoring of transboundary effects into Estonia. Seabed sampling, underwater video surveillance and aerial photos are used in the monitoring of benthic flora and fauna.

The results and main conclusions from finalised monitoring of benthic flora during construction of the pipelines are reported in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

Monitoring of benthic flora and fauna in 2013 took place in Russia, Finland, Sweden, Denmark and Germany with the purpose of documenting the changes in the benthic flora and fauna caused by the presence of the pipelines on the seabed and impacts related to recovery from changes in geomorphology from the construction work. The results and conclusions of the ongoing monitoring activities are presented in the following sections.

Locations of benthic flora and fauna monitoring are shown in Figure 12.1, with an indication of finalised monitoring activities related to construction (until 2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards).

>

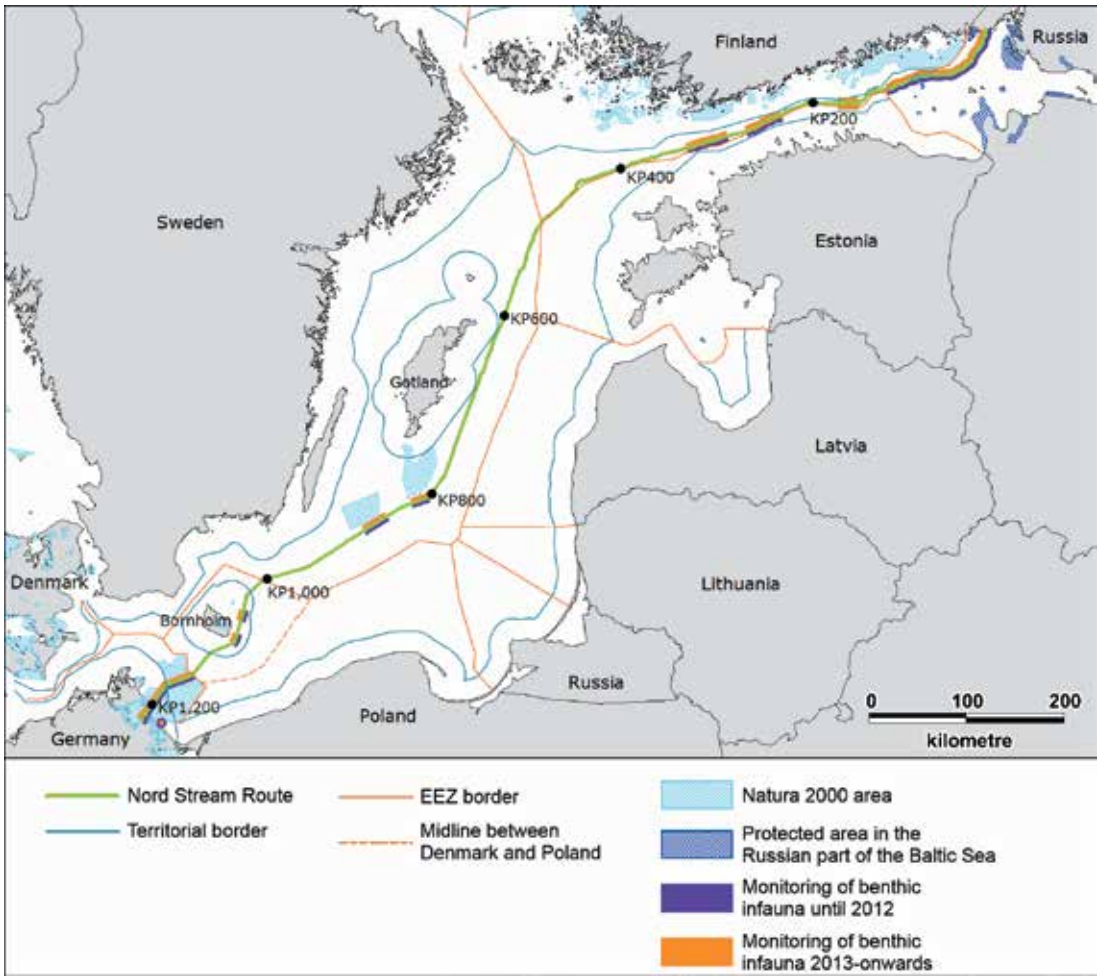


Figure 12.1 Locations for the monitoring of benthic flora and fauna along the pipeline route. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

12.2 Russia

The purpose of the benthic flora and fauna monitoring in Russia is to evaluate impacts on the infauna and flora communities caused by construction works and the recovery thereof. The time schedule for the monitoring is presented in Figure 12.2. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

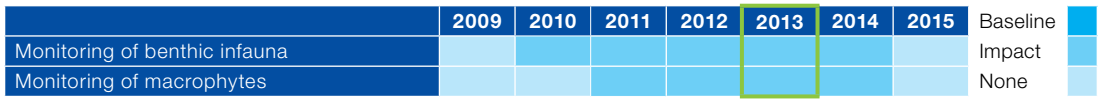


Figure 12.2 Time schedule for the monitoring programme for benthic flora and fauna in Russia. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of infauna

Monitoring of benthic fauna was carried out three times in August-October 2010, twice in June-August 2011-2012 and once in July-August 2013. Samples were collected in the shallow waters of Portovaya Bay and in the deep-water section using a Petersen dredge grab. Seven stations were located along the pipeline route in 2013, compared with 21 stations in 2010-2012. In 2013 two stations were located in shallow waters and five stations were located in the deep-water section of the eastern Gulf of Finland. Samples were analysed for species diversity, abundance and biomass of meio- and macrozoobenthos.

Macrozoobenthos in 2013 was represented by three main communities: freshwater species (Oligocheta and Chironomidae larvae), brackish water species (Mollusca and Polychaeta) and seawater species (Crustacea). Macrozoobenthos in Portovaya Bay comprised three groups of invertebrates: Oligocheta (five species), Chironomidae (one species) and Polychaeta (one species). Total abundance varied between 280-900 individuals/m^2. Oligocheta species dominated in abundance and biomass. Macrozoobenthos in the deep-water section was composed of species from three taxa: Crustacea (two species), Polychaeta (one species) and Mollusca (one species). Total abundance varied between 20-2,940 individuals/m^2. The dominant species was Polychaeta represented by *Marenzelleria neglecta*. In total, the 2013 survey of macrozoobenthos revealed 10 different species belonging to 5 groups.

Meiozoobenthos in Portovaya Bay was composed of eight taxa: Nematoda, Harpacticoida (four species), Cyclopoida (three species), Cladocera (one species), Ostracoda (four species), Oligochaeta (three species and groups), Mollusca and Turbellaria. Total abundance in shallow waters varied between 15,080-29,080 individuals/m^2. The most abundant were Nematoda species (64-69%), followed by *Tubificidae* belonging to Oligochaeta (up to 48%). In the deep-water section meiozoobenthos was comprised of four taxa: Nematoda, Harpacticoida (two species), Polychaeta (one species) and Amphipoda (one species). Total abundance varied between 240-135,600 individuals/m^2. The main structural components were Nematoda, Harpacticoida and Polychaeta species that dominated in abundance and biomass. In general, meiozoobenthos in 2013 consisted of 21 species belonging to 10 groups, including several Nematoda species.

Overall, the surveys in 2013 showed little change in macrozoobenthos composition, with some decrease in diversity of meiozoobenthos in comparison with the previous year. Abundance and biomass of macrozoobenthos in shallow waters was highest in 2013 compared with results of 2010-2012. In the deep-water section these parameters were at the same level as in 2010-2011. Maximum macrozoobenthos development in the deep-water area, which is determined by the presence of Polychaeta species, was registered in 2012.

The diversity of meiozoobenthos species in 2013 was comparable to that of 2010, but it was less than in 2011 and 2012. Decreased species diversity may be the result of the reduced number of monitoring stations (from 21 to 7); it can also be due to natural fluctuations in the marine environment. >

It was concluded that variations in the distribution and composition of meio- and macrozoobenthos in 2013 were typical for the eastern Gulf of Finland and that the operation of the Nord Stream Pipeline did not affect benthic communities.

Results and conclusions from the monitoring of macrophytes

Monitoring of benthic flora was carried out in August 2011, 2012 and 2013 in the central part of Portovaya Bay. Macrophyte monitoring included observations on the general condition, composition and structure of helophytes (coastal wetland plants), hydrophytes (fully submerged flowering plants) and benthic flora (algae) communities.

Monitoring of the major plant communities was conducted at five sites within two types of shallow water areas: in sandy shallow waters surrounding the pipeline (four sites) and in a rocky and sandy littoral area on the western side of the pipeline (one site). Additionally, botanical sections were defined along three transects perpendicular to the pipeline and one transect parallel to the pipeline.

In 2013, a total of 59 species of macrophytes were detected in the surveyed part of Portovaya Bay. The majority of detected species were flowering aquatic plants belonging to 52 species from 20 families and 2 classes. Of these, 10 species are listed in the regional Red Lists. One species belonging to the class of Equisetopsida was documented in the central part of Portovaya Bay. Macroalgae (macrophytobenthos) were represented by six species belonging to five families from four phyla.

Results of 2013 monitoring showed no changes in general pattern of wetland plant distribution in comparison with results of 2011 and 2012 surveys. Visually the area covered with coastal helophytes and submerged hygrohelophytes increased over the monitoring period 2011-2013.

In 2013 species diversity slightly decreased compared with 2012 (66 species), but it was higher in comparison with 2011 (51 species). The reduction in diversity and abundance mainly affected submerged plants and algae, which may be the result of storms preceding the macrophyte monitoring.

Two Red List species (*Ruppia brachypus* and *Alisma wahlenbergii*) documented for the first time in 2012 were not found in 2013. However, baseline surveys of 2005-2006 did not show the presence of these species either. Note two new coastal species were registered in 2013: *Odontites vulgaris* and *Cicuta virosa*.

The largest impact on macrophyte communities occurred during dredging and trenching activities in Portovaya Bay in 2010-2011. The results of monitoring in 2013 confirmed the conclusion drawn in 2012 about the steady recovery of macrophytes in the vicinity of the pipelines. The monitoring during the operation of the pipelines has not shown any negative impact on wetland vegetation. Increased regeneration of helophytes in the shallow waters and coastal areas was documented in 2013 will further contribute to the stabilisation of the seabed above the pipelines.

12.3 Finland

The purpose of the monitoring programme for benthos on soft seabed is to describe and evaluate the impacts caused by munitions clearance and rock placement activities and the recovery of the benthos communities on both soft and hard seabed. As a transboundary impact possible changes in and recovery of benthos communities after the Nord Stream construction activities in the Finnish EEZ have been monitored near the border in the Estonian EEZ. The purpose of the monitoring at the HELCOM stations is to assess whether the pipelines pose any threat to the representativeness of the long-term monitoring results. The time schedule for the monitoring of infauna is presented in Figure 12.3. A detailed map showing the locations of monitoring stations in Finland is included in Appendix B.

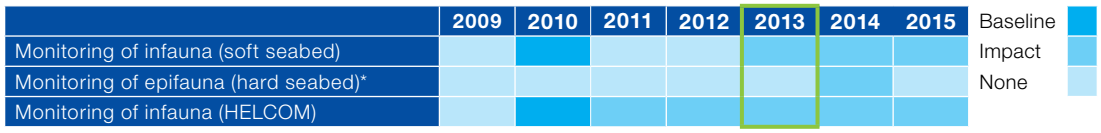


Figure 12.3 Time schedule for the monitoring programme for benthic fauna in Finland The schedule only include monitoring programmes still ongoing 2013 and onwards. *Baseline monitoring took place in 2008

Results and conclusions from the monitoring of benthic infauna (soft seabed)

Benthos samples were taken at benthos monitoring stations in the Finnish EEZ in August 2010 and October 2013. Samples were taken at monitoring station BENT2 along a transect 50 m, 100 m, 200 m, 400 m, 800 m, 1,600 m and 3,200 m directly north of the rock placement activity. Because the benthos sampling transect at station BENT3 intercepted Pipeline 1, this station could not be sampled in 2013. Station BENT3 was therefore relocated from station VOM3 (KP 243) to station VOM1 (KP 366) and renamed as BENT3a. This change was necessary because the munition cleared at VOM3 was located in the security corridor of Pipeline 2. Benthos sampling at the new BENT3a station had not been performed earlier.

The transboundary monitoring station BENT3 (EST) in Estonian waters is located approximately 2.8 km from a 2010 detonation site. Stations BENT4 (EST) and BENT5 (EST) in Estonia were established for the monitoring of transboundary impacts from rock placement in Finland near the Finnish-Estonian EEZ border.

At all monitoring transects three replicates were taken per location with a Van Veen grab (1.0 mm and 0.5 mm sieves). In addition oxygen concentration, temperature and salinity measurements were carried out in the water column near the seabed at each sampling location.

During the monitoring in 2013 all locations along transect BENT2 no benthic infauna was present, whereas during post-activity sampling in 2010 a polychaeta *Marenzelleria* spp. was sporadically present at two locations. However, oxygen concentration (average 3.7 mg/l) in autumn 2013 near the seabed was clearly better than three years earlier (average 0.5 mg/l) in summer 2010. The reason for the total absence of macrozoobenthos was related to the quality of surface sediments. Hydrogen sulphide was present at four locations, indicating a deficit of oxygen during sampling or in the recent past.

In 2013 benthic fauna was only present at two locations along transect BENT3a, and was dominated by *Macoma baltica*. The highest number of individuals observed for *Macoma baltica* was 63 ind./m^2 at one location. No sulphide mud was observed. Oxygen concentrations near the seabed were generally good with values between 6.3 and 7.1 mg/l. No sampling was performed at this station in 2010.

In 2010 at all locations along transect BENT3 (EST) no or almost no benthic fauna was present. In autumn 2013 no macrozoobenthos individuals were observed, even though the oxygen concentration near the seabed was quite good (4.3-7.3 mg/l) at two locations of the station. However, the >

smell of hydrogen sulphide was present in sediment at all locations, and at one location the surface sediment was black in colour, indicating sulphide mud and poor oxygen conditions. The analysis of sediment quality in 2010 revealed that the surface sediments were characterised by large natural variations in the physical-chemical properties, such as the concentrations of organic matter, between the locations.

At transect BENT4 (EST) oxygen concentrations in seawater near the seabed were lower in 2010 (average 3.6 mg/l) than in 2013 (average 5.6 mg/l). The reason for this was sampling during different seasons between the years. Although the oxygen level in the seawater was good, there were signs of hydrogen sulphide at the seabed at two locations out of three, meaning that the living conditions were not optimal. Therefore the abundance of benthos species (1 mm mesh size) was low or very low. The highest number of individuals was observed for *Macoma baltica* (330 ind./m^2) at one location. Other species found were *Marenzelleria* spp. (9 ind./m^2) and *Halicryptus spinulosus* (18 ind./m^2).

At transect BENT5 (EST) the conditions were the same as BENT4 (EST). Oxygen concentrations in the lowermost water layer were on average 0.6 mg/l and in 2013 3.8 mg/l in 2010 and 2013, respectively. In addition, sulphide mud and the strong odour of hydrogen sulphide indicated a deficit of oxygen in the surface sediment. *Marenzelleria* spp. and *Macoma baltica* were the only species found, with very low abundances (6 ind./m^2 and 33 ind./m^2, respectively).

Conducting sampling campaigns during different seasons in 2010 and 2013 resulted in some uncertainty in the comparison of the results between years. The number of species and abundance of individuals was low during both sampling campaigns. On the basis of the data thus far it can be concluded that the overall living conditions at the stations have not altered during the three-year time period. Therefore no major changes in the diversity of benthos are foreseeable during the coming years.

Results and conclusions from the monitoring of benthic epifauna (hard seabed)

The Natura 2000 area nearest to the pipeline route in Finnish EEZ is Sandkallan Southern Marine Area (FI0100106). On 3 March 2012 the Council of State decided to propose to the European Commission that the area be protected due to the nature value of its reef habitats. The Sandkallan area is located 2.9 km from the pipeline route, in the section where the dynamically positioned lay barge was used, and 3.3-3.9 km from the nearest rock placement sites in an area with hard seabed. The potential changes in the benthic invertebrate epifauna in this area will be documented from an approximately 5 km transect (BENT6) by means of a visual inspection via ROV in 2014. The baseline study against which the results will be compared took place in August 2008.

Results and conclusions from the monitoring of infauna at HELCOM stations (soft seabed)

Monitoring of HELCOM long-term benthos stations and their potential compensatory sites was carried out in October 2010, in May and October 2011, in May 2012 and in May 2013. Monitoring activities took place at three HELCOM stations (LL5, LL6 and LL7) and at six compensatory stations (LL5BEN-A, LL5BEN-B, LL6ABEN-A, LL6ABEN-B, LL7BEN-A and LL7BEN-B) situated parallel to the pipelines. At each station, monitoring involved measurements of conductivity (salinity), temperature and oxygen throughout the water column, and three Van Veen grab samples for analysis of infauna.

In 2013 the oxygen levels 1 m above the seabed varied between 0.7-1.5 mg/l. This is lower than 2012. Throughout the monitoring period (2010-2013) the lowest and highest measured oxygen levels were 0.3 mg/l (spring 2011) and 3.2 mg/l (autumn 2011) respectively.

The only species present during all the monitoring years was *Marenzelleria* spp. In spring 2013 the abundance of *Marenzelleria* spp varied between 0-50 ind./m^2. Other species observed in 2013 at one or two sites were *Harmothoe sarsi* and *Monoporeia affinis*. The average abundance of Marenzelleria detected in 2010, 2011, 2012 and 2013 is presented in Figure 12.4.

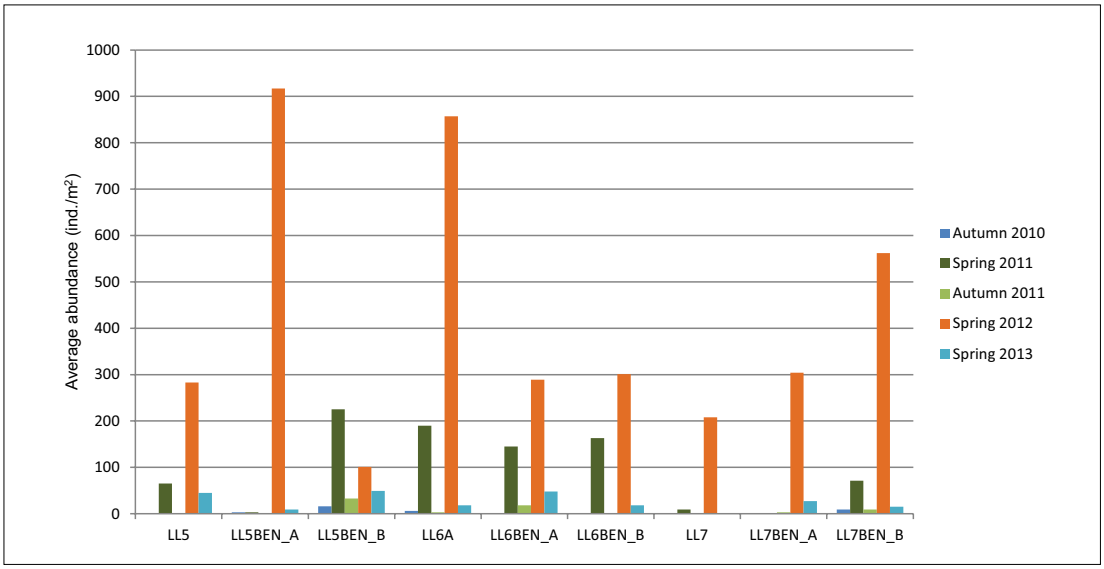


Figure 12.4 Average abundance of *Marenzelleria spp.* (ind./m²) detected in 2010-2013.

The monitored HELCOM stations have long suffered from more or less permanent oxygen deficit in a water layer nearest to seabed. Based on the results, as was also assessed during the EIA phase, direct impacts of the pipeline construction activities on benthos have been minor.

A preliminary conclusion of the monitoring results is that the pipeline construction works have not caused any irreversible impacts on macrobenthos outside the areas of direct impacts (i.e. seabed cover of the constructed rock berms).

12.4 Sweden

The purpose of the monitoring of benthic fauna in Sweden is to evaluate changes in the benthic infauna communities due to post-lay trenching and to describe the colonisation of the pipeline and rock berms by epifauna. The time schedule for the monitoring is presented in Figure 12.5. A detailed map showing the locations of monitoring stations in Sweden is included in Appendix C.

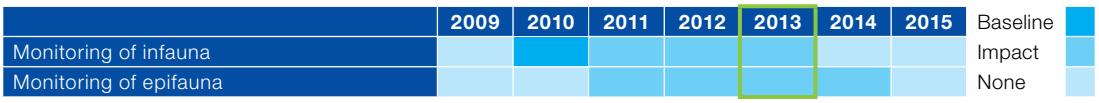


Figure 12.5 Time schedule for the monitoring programme for benthic fauna in Sweden. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of infauna

Field surveys were carried out in June 2010, 2011, 2012 and 2013. The transects comprise 10 monitoring stations and one reference station at Hoburgs Bank and nine monitoring stations and one reference station at Norra Midsjöbanken. At each station, monitoring involved an underwater video recording of the seabed; measurements of conductivity (salinity), temperature, depth and oxygen throughout the entire water column; sediment sampling for analysis of selected physical and chemical variables; and three Van Veen grab samples for analysis of infauna.

Norra Midsjöbanken and Hoburgs Bank are rather shallow areas with no stratification in salinity and low salinity close to the bottom. In the period 2010-2013 the oxygen concentration close to the bot-

>

tom was high and far above the critical level for benthic fauna. The temperature was stratified, and a pronounced decline in temperature was normally observed between 20 m and 30 m depth. The temperature close to the bottom was low and between 3 °C and 5 °C, depending on the depth and year.

During the monitoring in 2013 at Hoburgs Bank a total of 11 species and higher taxa were recorded. In comparison, 11 species were recorded in 2010 and 2011. Thirteen species were recorded in 2012. The two species recorded in 2012 but not in 2013 were crustaceans, which were recorded in only a few replicate samples. The abundance of the benthic fauna was high, ranging between 2,630-6,257 individuals/m^2 in 2013.

During the monitoring at Norra Midsjöbanken a total of nine species and one higher taxon (Oligochaeta) were recorded in 2013 compared with 10 species and taxa recorded in 2010 and 2011 and 11 species and taxa in 2012. In 2013 the average abundance of the benthic fauna was 1,429 individuals/m^2.

Since the baseline surveys in 2010 the abundance and biomass of the benthic fauna has increased significantly due to natural variations. The variations between 2011, 2012 and 2013 are minor.

The monitoring results showed that deployment and trenching of Nord Stream Pipelines 1 and 2 did not have any measurable immediate or prolonged negative impact on the qualitative or quantitative composition of the benthic fauna and the structure of the benthic community at the two banks. Average abundance of infauna detected from 2010-2013 at Hoburgs Bank and Norra Midsjöbanken is presented in Figure 12.6 and Figure 12.7, respectively.

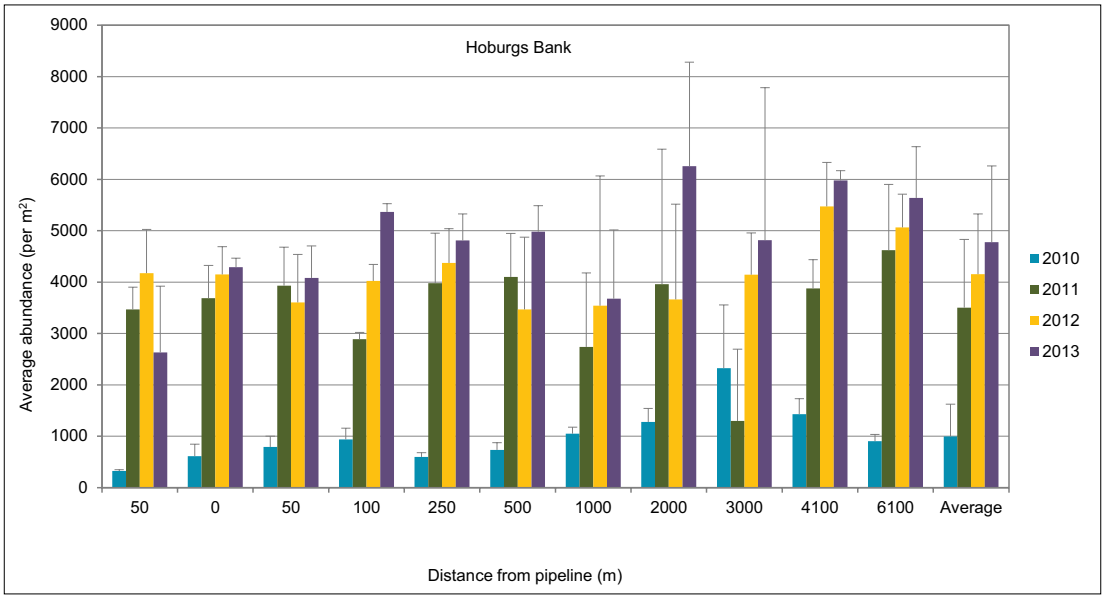


Figure 12.6 Average abundance individuals/m^2 (error bar indicated with standard deviation) of infauna detected at Hoburgs Bank in 2010-2013.

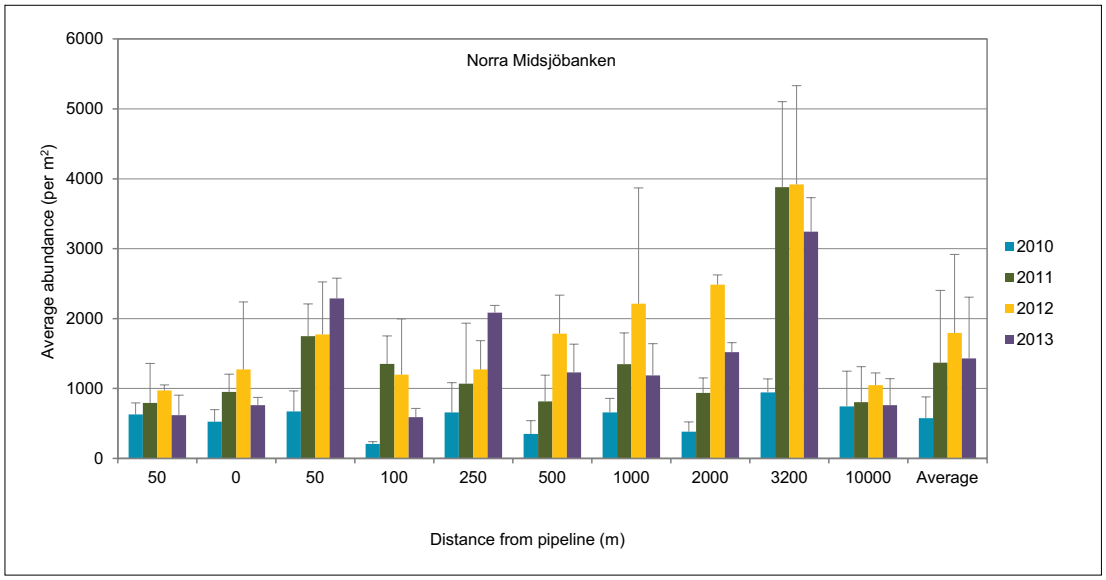


Figure 12.7 Average abundance individuals/m² (error bar indicated with standard deviation) of infauna detected at Norra Midsjöbanken in 2010-2013.

Results and conclusions from the monitoring of epifauna

Field surveys were initiated in June 2011 and repeated in October 2012 and in August 2013. Each survey included inspection of the pipelines with video cameras mounted on an ROV at four locations south of Norra Midsjöbanken. The monitoring locations were chosen in order to cover areas where the pipelines were laid directly on the seabed (stations HNB and NMR), where the pipelines were post-lay trenched into the seabed (station NMT) and where the pipelines were supported by rock berms (station NMR_{new}). At each station, recordings of the top and sides of the pipelines were performed along a stretch of 250 m.

In 2013 the video recordings from the four analysed areas in Swedish waters revealed an establishment of blue mussels in the NMR_{new} area and a possible establishment in the HNB area. One mobile species of epifauna, the crustacean *S. entomon*, was identified to be present on and next to the pipeline in higher numbers compared with previous surveys carried out in 2011 and 2012.

In accordance with the expected effects of the new hard-bottom substrate (the pipeline), a general increase in epifauna has been observed since 2011.

12.5 Denmark

The overall objective of the monitoring programme is to evaluate changes in the benthic infauna communities due to post-lay trenching, and to document the potential establishment and growth of epifauna on the pipelines. The time schedule for the monitoring is presented in Figure 12.8. A detailed map showing the locations of monitoring stations in Denmark is included in Appendix D.

	2009	2010	2011	2012	2013	2014	2015	
Monitoring of infauna								Baseline
Monitoring of epifauna								Impact
								None

Figure 12.8 Time schedule for the monitoring programme for benthic fauna in Denmark. The schedule only include monitoring programmes still ongoing 2013 and onwards.

>

Field surveys were carried out in July 2010, June 2011, June 2012 and June 2013. The monitoring activities included seabed sampling along two transects (B10 and B11) perpendicular to the pipeline route, each comprising 15 stations. The survey at each station included underwater video recording of the seabed; measurements of conductivity, temperature, depth and oxygen throughout the entire water column; sediment sampling for analysis of selected physical and chemical variables; and three Van Veen grab samples for analysis of the infauna.

The spatial variations in salinity, temperature and oxygen close to the seabed followed changes in water depth and were not pronounced in 2013. The salinity close to the seabed in 2013 along transect B10 was slightly lower than in 2010, 2011 and 2012. The oxygen concentrations were slightly higher in 2013 than in previous years. Along transect B11 the salinity in 2010 and 2013 was approximately 2 psu lower than in 2011 and 2012, and the oxygen concentration was lowest in 2011 and highest in 2013. The temperature close to the seabed was similar at both transects in 2010, 2011 and 2012, but approximately 1-1.5°C lower in 2013.

In 2013 a total of 22 species including two higher taxa (Oligochaeta and Nemertea) were recorded along transect B10. A similar number of species (between 20 and 22) was detected in 2010, 2011 and 2012. A total of 18 species, including two higher taxa (Oligochaeta and Nemertea), were recorded in 2013 along transect B11. A similar number of species was found in 2010 and 2011, which is slightly lower than the 23 species detected in 2012.

In conclusion the abundance of infauna has increased approximately 40% and the biomass of infauna has increased approximately 30% in the monitoring areas between the baseline survey in 2010 and the final survey in 2013. There are, however, major yearly fluctuations. Apart from a local and weak decrease in species abundance and biomass at the two stations closest to the pipeline at transect B11 no negative impact from the construction of the Nord Stream Pipeline has been detected during this monitoring programme.

The average abundance of infauna at transect B10 and B11, based on data collected in 2010, 2011, 2012 and 2013, is presented in Figure 12.9 (transect B10) and Figure 12.10 (transect B11).

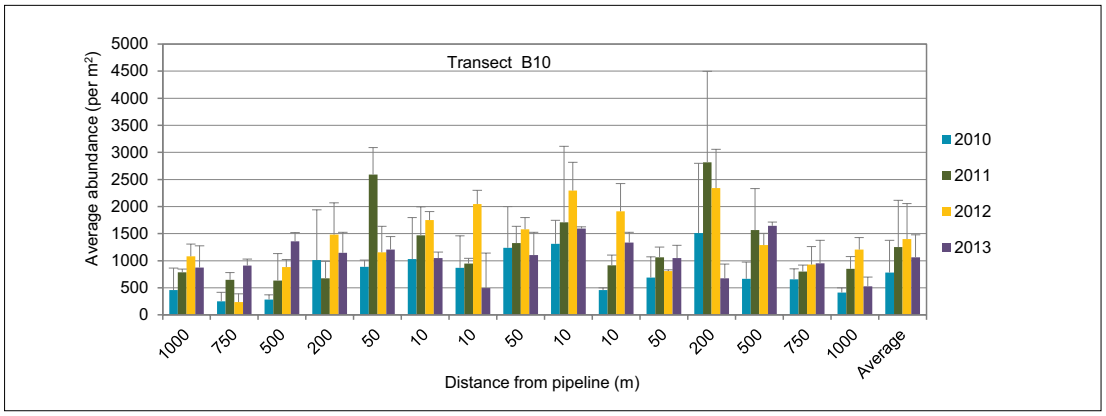


Figure 12.9 Average abundance and standard deviation of infauna registered at the B10 transect in 2010, 2011, 2012 and 2013.

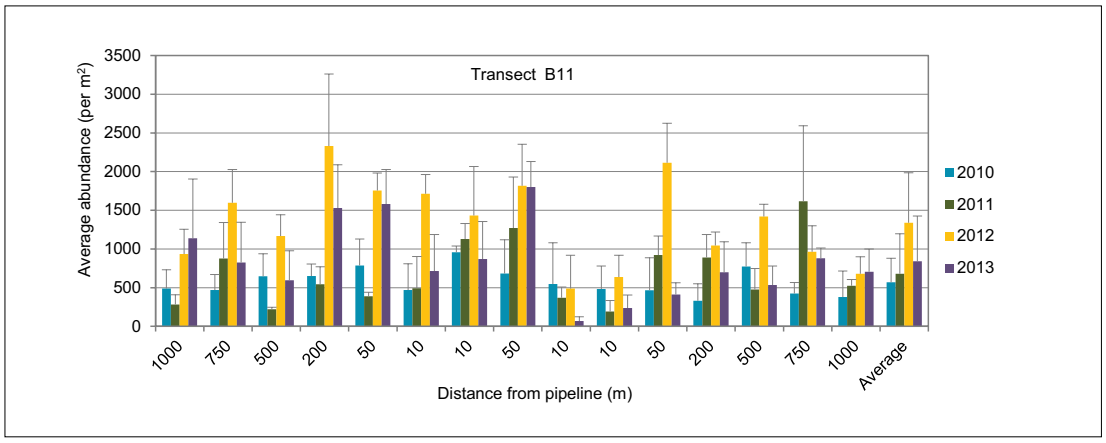


Figure 12.10 Average abundance and standard deviation of infauna registered at the B11 transect in 2010, 2011, 2012 and 2013.

Results and conclusions from the monitoring of epifauna

Field surveys were initiated in June 2011 and repeated in July 2012 and in August/September 2013. Each survey included inspection of the pipelines with video cameras mounted on an ROV at 10 locations. The monitoring locations were chosen in order to cover areas where the pipelines were laid directly on the seabed and areas where the pipelines were post-lay trenched into the seabed. At each station, recordings of the top and sides of the pipelines were performed along a stretch of 250 m.

In 2013, the first establishment of blue mussels was confirmed along four of the 10 pipeline sections. In addition the mobile crustacean *S. entomon* was detected at the pipeline in 2011, 2012 and 2013 in increasing numbers. A smaller number of unidentified species including the flatworm (*Turbellaria* sp.) and hydroids were also detected in 2013. A general increase in epifauna has been observed since 2011.

In conclusion, a confirmed settlement of blue mussels has occurred along parts of the pipeline in Danish waters. The growth as well as increased coverage of blue mussels will most likely continue over the years and a future establishment of blue mussels within the other areas is expected.

12.6 Germany

The purpose of the monitoring of benthic flora and fauna in Germany is to evaluate potential impacts from construction works. The time schedule for the monitoring is presented in Figure 12.11. A detailed map showing the locations of monitoring stations in Germany is included in Appendix E.

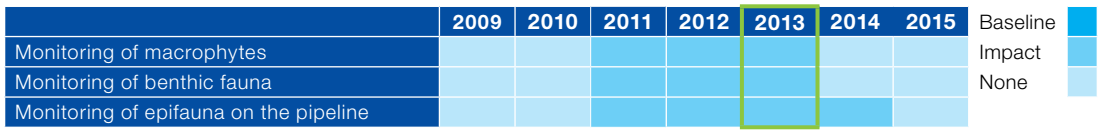


Figure 12.11 Time schedule for the monitoring programme for benthic flora and fauna in Germany. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of macrophytes

Monitoring of macrophytes was carried out in the summer of 2011, 2012 and 2013. Field surveys were carried out in the vicinity of the landfall at Lubmin and included physical sampling of macrophytes and aerial photo surveys.

The overall macrophyte cover in the surroundings of the former cofferdam construction area was similar throughout the recovery monitoring period. Species diversity was also similar between the baseline investigation carried out in 2007 and the monitoring in 2011-2013. Compared with an >

unaffected area nearby, the macrophyte cover in the vicinity of the former cofferdam construction area was locally still significantly reduced, even three years after construction. However, the remaining affected area was only approximately 0.5 ha, i.e. 30% of the former construction site. The blocking effect of the nearby harbour wall of the industrial harbour Lubmin, causing a permanent interruption of the nearshore bed load particle transport and seed/oocyte transport band, is considered a potential reason for the slow recovery of the macrophyte vegetation.

Results and conclusions from the monitoring of benthic fauna

Monitoring of benthic fauna was carried out in June 2011, 2012 and 2013. Samples were taken using a Van Veen grab along five transects in Greifswalder Bodden and seven transects in the western Pomeranian Bight. An additional 14 samples were collected from the trench area and its immediate surroundings to increase the cluster-specific sample size and to lower the variance of means during statistical analysis for parameters measured at the impact area, respectively. Four areas were compared: the backfilled trench, the nearby impact zone (situated 25 m from the trench: non-invasive dredging impact zone), the anchor-handling zone (situated 500 m from the trench) and a reference area (situated 1,000 m from the trench). Data analysis was performed for three different pipeline sections/water bodies: Greifswalder Bodden (pipeline trenched into the seabed), Pomeranian Bight/Territorial Waters (pipeline trenched into the seabed) and Pomeranian Bight/EEZ (pipeline laid on the seabed).

Results from Greifswalder Bodden showed that all native invertebrate species had reinhabited the backfilled trench in abundances similar to those prior to construction activities. Multivariate analysis of community structure revealed no significant difference between the impact areas and reference areas. However, the overall biomass was still significantly lower (50%) in 2013 in the vicinity of the backfilled trench compared with the other three areas under investigation. The recovery of the bivalve *Mya arenaria* proceeded more slowly than expected, which may be due to a lower bedload import than expected. The soft-shell clam comprises approximately 80-90% of the total biomass. The shell length of the *Mya arenaria* recruits since 2011 has increased to about 15 mm. Thus, at least the size range of suitable food for benthophagous sea ducks has fully recovered as expected.

Similar results were obtained in the Pomeranian Bight. Multivariate analysis of community structure did not reveal significant differences between the trench and reference areas in 2013. The overall biomass was significantly lower (50%) in the vicinity of the backfilled trench compared with the reference area because of the slow recovery of the population structure of the long-lived clam *Mya arenaria*.

Results and conclusions from the monitoring of epifauna

Monitoring of epifauna was carried out in August 2011, 2012 and 2013. The Nord Stream pipelines, exposed on the seabed, offer an artificial reef habitat for hard-bottom invertebrates and fish. Inspections of the pipeline were carried out using underwater video recordings (along a 100 m long pipeline section) and scratch sampling.

Both pipelines are overgrown by the blue mussel *Mytilus edulis* where exposed in the Pomeranian Bight (German EEZ). The growth cover decreased from west to east with increasing water depth (from 18 m to 25 m). No neozooans were found on the pipelines in 2013. In 2011, members of the genus Jassa were detected. Species of this genus are not indigenous to the Baltic Sea but are known to live in tubes adhered to the hulls of vessels (known as biofouling). Thus, it is possible that the transport of these species was mediated by vessels potentially functioning as carriers. It was not expected that members of this genus would be able to successfully reproduce/establish in the brackish waters of the Baltic Sea. This assumption was already supported by results obtained in 2012 showing reproductive failure for the species, probably due to low salinity. It is noted that members of the genus were already present in the Baltic Sea before the start of the Nord Stream Project.

Results also showed that the epifauna community of the reinstated reefs mirrored that found in the natural habitat at Greifswalder Bodden and the Boddenrandschwelle. The first spat of blue mussels

were found in the vicinity of the deeper reinstated reefs in the western Pomeranian Bight in 2013. Presumably, seasonal anoxia at depths of 15 m prevented meroplanktonic larvae (barnacles and blue mussels) from successfully settling in the previous year.

Figure 12.12 Epifauna on Nord Stream pipelines exposed on the seabed in the German EEZ. Both pipelines are fully overgrown by blue mussels (Mytilus spec.) at water depths between 18 m and 25 m.

13 Terrestrial flora and fauna

> The various habitats along the coast of the Baltic Sea support rich and unique flora and fauna. In a heavily populated area such as the coastline of the Baltic Sea, there is an increased risk of habitat destruction and fragmentation. Habitat destruction vastly increases an area's vulnerability to natural disasters and may eventually lead to loss of ecosystem services. A number of areas of specific environmental importance are protected in order to preserve the unique ecosystems of the Baltic Sea.

13.1 Monitoring programme for terrestrial flora and fauna

Potential impacts

Potential impacts on terrestrial flora and fauna from the Nord Stream Project may be the result of the removal of soil, vegetation and fauna cover during construction works at the landfall areas.

Monitoring activities until 2012

Monitoring of terrestrial flora and fauna is carried out in Russia and in Germany. Monitoring was initiated in 2010 and will be finalised in Germany by the end of 2014. The monitoring in Russia will continue yearly until 2014 and then be carried out once every three to five years from 2015 onwards.

The monitoring in Russia comprises reconnaissance surveys and botanical description along preselected routes and plots. The monitoring programme for the impacts on and the recovery of terrestrial flora and fauna in Germany will document the recovery process of the dune after its reinstatement as part of the compensation measure E3 “Development concept for sand and neglected grassland locations in the landfall area of the Nord Stream Pipeline near Lubmin”.

The results and main conclusions from finalised monitoring for terrestrial flora and fauna during construction are reported in the Environmental and Socio-economic Monitoring Report for 2012 /41/.

Monitoring activities 2013 and onwards

Monitoring of terrestrial flora and fauna was carried out in 2013 in Russia and in Germany. In Russia the purpose of these monitoring activities was to document possible changes to the rare and protected species at the Russian landfall. In Germany the purpose of the monitoring was to document the recovery process of the dune after its reinstatement. The preliminary results and conclusions from ongoing monitoring activities are reported in the following sections.

Locations with terrestrial flora and fauna monitoring are shown in Figure 13.1, with an indication of finalised monitoring activities related to construction (until 2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards). >

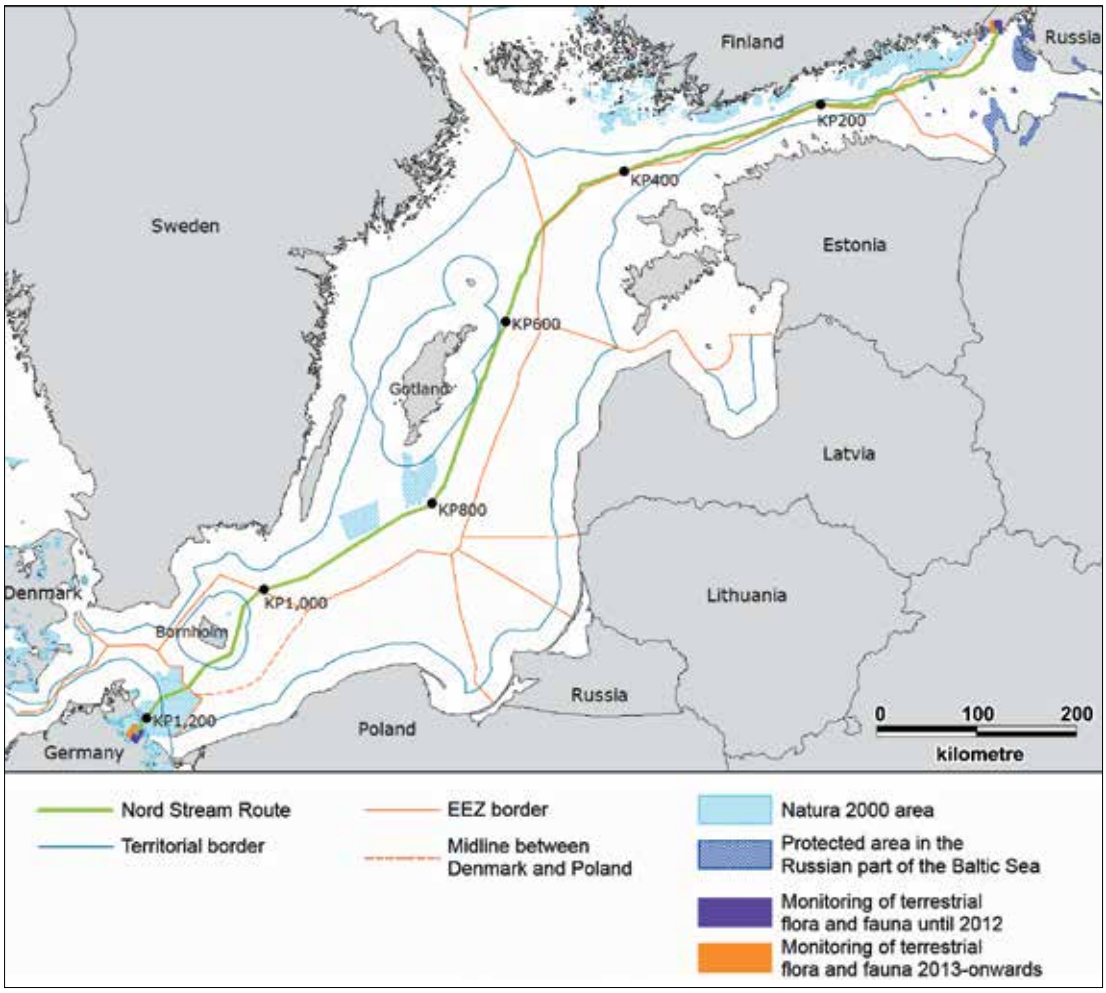


Figure 13.1 Locations of monitoring activities under the terrestrial flora and fauna monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

13.2 Russia

The purpose of the terrestrial flora and fauna monitoring programme in Russia is to assess the condition and population dynamics of the flora and fauna communities in relation to construction and their recovery. The time schedule for the monitoring is presented in Figure 13.2. A detailed map showing the locations of monitoring stations in Russia is included in Appendix A.

Figure 13.2 Time schedule for the monitoring programme for terrestrial flora and fauna in Russia. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of terrestrial flora

Monitoring of terrestrial flora was carried out during the summer/autumn periods in 2010-2013. In 2013, monitoring was performed in June and September. Similar to previous years, botanical monitoring in 2013 was performed at 17 monitoring stations (20 m × 20 m for forest communities and 10 m × 10 m for wetlands and nearshore areas) located within or on the border of the right of way (impact areas) and approximately 1-2 km outside the construction site (control areas). Additional field observations along the pipeline route and around the gas transportation facilities were performed for better description of the onshore vegetation.

The purpose of the monitoring was to determine the general status of vegetation cover and to determine productivity, diversity and potential changes in the flora communities on the Russian landfall site that were affected by construction activities in 2010-2012. In 2013 the aim of the botanical monitoring was to continue describing the plant communities in the affected areas and to confirm recovery processes during operation of the pipelines.

Intensive forestry activities resulting in depleted flora and general low species diversity are the key characteristics of the territory under consideration. The majority of the explored area is covered by overgrown clearings, 15-25 years old, where young pines and fir trees are growing /17/. Botanical monitoring from 2010-2012 showed that onshore plant formations were disturbed only in the 60-100 m corridor created for the pipe-laying. The surveyed area is characterised by spruce forests, secondary parvifoliate birch and alder forests with valley and shore meadows. Changes in the plant communities outside of the right of way were caused by former anthropogenic impacts and not by construction of the pipelines. According to the surveys of 2010-2013 the phytocoenotic and floristic state of vegetation corresponded to normal levels; no synanthrope species were detected. Rare and protected species listed in the regional and federal Red Lists, such as bog myrtle (*Myrica gale*), rusty woodsia (*Woodsia ilvensis*), dwarf cornel (*Chamaepericlymenum suecicum*), seaside centaury (*Centaurium littorale*) and chives (*Allium schoenoprasum*), were identified outside of the construction site. In 2013 chives were detected within the impact area for the first time. Additionally, reinstatement activities aimed at the disturbed soil and vegetation area of the corridor initiated in 2012 and continued in 2013 were proven to be successful.

To conclude, construction and operation of the Nord Stream pipelines had little impact on the terrestrial vegetation in the surveyed area.

Results and conclusions from the monitoring of terrestrial fauna

Monitoring of terrestrial fauna was carried out during the summer/autumn periods of 2010-2013 at a number of monitoring stations and routes within and outside of the impact area. The aim of the monitoring was to describe species composition and the distribution of onshore mammals, birds and reptiles/amphibians; to evaluate the population structure and vulnerability; and to detect potential changes in the fauna communities due to construction and operation of the pipelines at the Russian landfall site.

>

In 2013, monitoring was performed in June and September in the same biotopes where onshore flora was studied. Due to the mobility of some animal species, large home ranges, behavioural peculiarities, high degree of response against anthropogenic disturbances, etc., monitoring of the onshore fauna was not limited to the assigned stations and routes but included a number of adjacent biotopes.

The area surrounding the Russian landfall site is characterised by a high degree of disturbance of the natural habitats and long-term anthropogenic pressure, primarily manifested by tree felling resulting in reduced species diversity in the region. At the same time, the coastal area hosts a considerable number of waterfowl and semiaquatic birds, which most likely actively populate the explored coastal zone during the summer period and appear there during seasonal migrations.

The results of monitoring in 2013 indicated an increase in species diversity in the surveyed area with some changes in the frequency of occurrence for some species. Thus, less frequent encounters were documented for the mountain hare (*Lepus timidus*), squirrel (*Sciurus vulgaris*) and fieldfare (*Turdus pilaris*). Considerably greater occurrences were documented for the raccoon dog (*Nyctereutes procyonoides*) and moose (*Alces alces*), including a female with a youngster. Interestingly, these species were also detected in close vicinity to the pipeline. Such observations suggest that in the absence of disturbing factors, e.g. noise from the construction activities, animals start to gradually use the affected area. In July the remains of a grey seal (*Halichoerus grypus*) were found in Portovaya Bay. The state of the remains led to the assumption that the animal had died in the open sea and was cast ashore with the tide. Birds were mostly represented by residential species typical for the region. For the first time the viviparous lizard (*Zootoca vivipara*) was found in the surveyed area. It is worth noting that all areas with open wetlands contained traces of dogs, including large breeds.

Overall, the surveys in 2010-2012 showed no negative impact on fauna that could be directly linked to Nord Stream construction works. Monitoring in 2013 confirmed that operation of the pipeline also did not affect animal communities in the vicinity of the pipelines. A high anthropogenic load in the region due to decades of commercial forestry as well as frequent use of the area by local people has a significantly greater impact on the animal communities.

13.3 Germany

The purpose of the monitoring of terrestrial flora and fauna in Germany is to document the recovery process of the dune after its reinstatement as part of the compensation measure E3 “Development concept for sand and neglected grassland locations in the landfall area of the Nord Stream Pipeline near Lubmin”. The purpose of this compensation measure is to develop coastal sandy and neglected grasslands to compensate for the disturbance of protected biotopes in the landward landfall corridor of the Nord Stream Pipeline. The time schedule for the monitoring is presented in Figure 13.3. A detailed map showing the locations of monitoring stations in Germany is included in Appendix E.

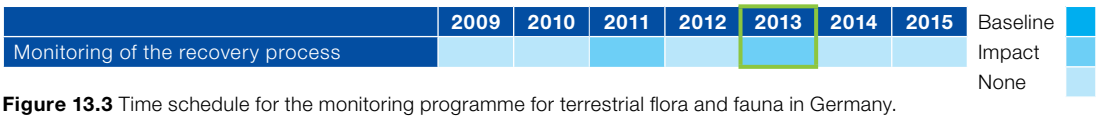


Figure 13.3 Time schedule for the monitoring programme for terrestrial flora and fauna in Germany. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of the recovery process

Monitoring of terrestrial flora and fauna was carried out in 2011 and in 2013. Monitoring covered dune vegetation, reptiles and breeding birds. Monitoring of birds was carried out in the vicinity of the industrial harbour, Lubmin. This area, used by breeding birds, has changed significantly since the EIA

baseline investigations of 2006/2007. The changes include clear-cutting of forests and construction of industrial infrastructure supporting a number of industrial projects. Consequently, the number of breeding territories of the target bird species (woodlark (*Lullula arborea*), red-backed shrike (*Lanius collurio*) and barred warbler (*Sylvia nisoria*) decreased to approximately half their original size.

The reinstated dune habitat was maintained as a suitable breeding habitat for endangered breeding birds. The number of species increased between 2011 and 2013 (new species: common sandpiper (*Charadrius hiaticula*), Wheatear (*Oenanthe oenanthe*)). Monitoring of dune vegetation was carried out at 15 permanent observation plots. Results from 2013 still showed an early successional stage of common, widespread species. Inoculation of plant material and seeds of Red Listed species in 2012 was quite successful. Furthermore, horse grazing has already led to a measurable spread of certain herbs across the management area. The plots will be investigated throughout the entire E3 management period of 20 years. A total of five indigenous reptile species – blind worm (*Anguis fragilis*), sand lizard (*Lacerta agilis*), viviparous lizard (*Zootoca vivipara*), ring snake (*Diadophis punctatus*) and European adder (*Vipera berus*)) – again showed considerable abundance in the area, and the preconditions for their future survival in the area are considered positive.

14 Fisheries

> Commercial fishing is important to a number of coastal communities in the countries around the Baltic Sea. Pelagic trawls are used mainly to capture herring and sprat, and bottom trawls are used mainly for cod and flatfish. The intensity of trawling varies from area to area. The area around Bornholm is by far the most important bottom-trawling area, attracting fishermen from nearly all of the countries around the Baltic. It is particularly important in terms of cod. Other important areas include the area southeast of Gotland and, to a lesser extent, the area at the mouth of the Gulf of Finland – although this area tends to be fished by pelagic trawlers targeting herring and sprat. The landfall area in Germany, Greifswalder Bodden, constitutes an important fishing area for herring and to a lesser extent a variety of pelagic species. Herring are also caught in the eastern Gulf of Finland outside Portovaya Bay, while pelagic species are caught closer inshore. Fishing in this area is largely carried out with passive gear.

14.1 Monitoring programme for fisheries

Potential impacts

Potential impacts on fisheries from the Nord Stream Project may be the result of the presence of the pipelines on the seabed. This might lead to a reef effect due to the introduction of a hard-bottom substrate and thereby a new habitat on the seabed, especially in areas with soft sediment. A possible reef effect would be expected to attract demersal fish species to areas in the immediate vicinity of the pipelines, which might lead to changed fishery patterns. When fishing in the vicinity of (free-spanning) pipelines, fishermen may also need to take additional precautions by adjusting their trawling depth and angle.

Monitoring activities until 2012

Monitoring of fisheries is carried out in Finland and Sweden. Monitoring was initiated in 2010 and is expected to be completed by the end of 2017.

The monitoring describes and evaluates the experiences of the fishermen fishing in the vicinity of the pipelines, possible changes in commercial fishery patterns, and fish catches after installation of the pipelines. In Finland, changes in commercial fishery due to the Nord Stream Pipeline will be documented by a questionnaire survey. The results of the pipeline free-span and embedment study will be utilised when evaluating the impacts on fishery. In Sweden, changes in bottom-trawling patterns and changes in fish species and catch levels (kg) in the immediate vicinity of the pipelines will be evaluated in particular. This is due to the fact that a possible reef effect would be expected to attract demersal fish species to areas in the immediate vicinity of the pipeline.

The results from the monitoring in Finland and Sweden, in combination with the results from the fish monitoring, will be applied to evaluate the effects on fisheries in the other countries in general. In Germany, there is no monitoring of fisheries. Instead, herring fishery was suspended during the period of 10-20 April 2011 following the main construction works to offset the impact of dredging for the project, which took place during herring spawning season (spring to autumn).

Monitoring activities in 2013 and onwards

No monitoring activities for fisheries took place in 2013. The results from ongoing monitoring activities which will be monitored again in 2014 in Sweden and in 2015 in Finland are included in the following sections.

Locations with fishery monitoring are shown in Figure 14.1, with an indication of finalised monitoring activities related to construction (until 2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards).

>

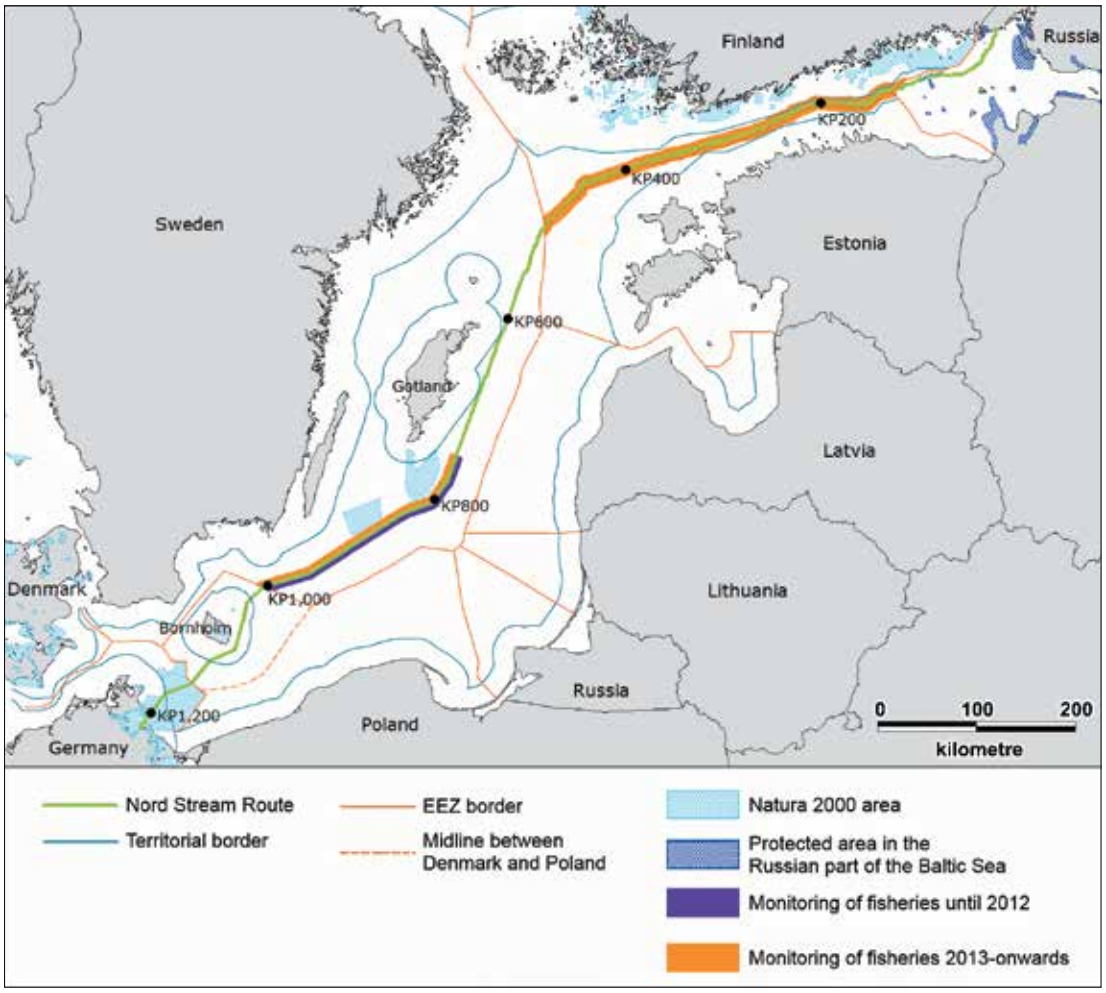


Figure 14.1 Locations of monitoring activities under the fisheries monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

14.2 Finland

The purpose of the fishery monitoring programme in Finland is to evaluate whether the Nord Stream Pipeline has an effect on commercial fisheries. The time schedule for the monitoring is presented in Figure 14.2. A detailed map showing the locations of monitoring stations in Finland is included in Appendix B.

Figure 14.2 Time schedule for the monitoring programme for commercial fisheries in Finland. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of commercial fishery

A specific survey targeting fishermen will be performed. A "fishery questionnaire" will be developed for this purpose. The target group includes all fishermen trawling in the Gulf of Finland. The survey will be carried out to obtain a better perspective on how fishermen have experienced the construction of the pipelines and how the presence of the pipelines has affected their fishing practices. In addition to the questionnaire, avoidance of the pipeline area by fishing vessels and changes in fishing patterns will be monitored. For this purpose, tracking data gathered prior to construction will be compared with tracking data gathered two years after construction of the pipelines. The results and conclusions of the monitoring of fisheries in Finland covering the period 2007-2014 will be presented in the report covering the monitoring activities for 2015. This report will be issued in 2016. A follow-up, covering the period 2007-2016, will be reported in 2017.

14.3 Sweden

The purpose of monitoring fisheries in the waters along the Nord Stream Pipeline in the Swedish EEZ is to evaluate changes in bottom-fishery patterns and fish catches. The desk study performed in 2010 covering the years 2000-2009 will function as a baseline for later monitoring after the pipelines have been established in 2014. The time schedule for the monitoring is presented in Figure 14.3. A detailed map showing the locations of monitoring stations in Sweden is included in Appendix C.

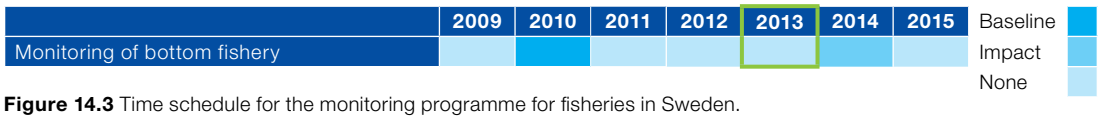


Figure 14.3 Time schedule for the monitoring programme for fisheries in Sweden. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of bottom fishery (monitoring carried out in 2010)

Monitoring of bottom fishery in Sweden was carried out in 2010 and is reported in/39/. The monitoring was a baseline desk study based on data for bottom net and trawling density from the Swedish fishing fleet from 2000-2009. The results of the analysis showed that bottom trawling was limited to an area west of the pipeline between KP 930 and KP 950 and had declined over the last six years. Bottom-net fishery was conducted in areas approximately 20 km northwest of the pipeline route, from KP 900 to KP 950. Data for landings showed that cod (*Gadus morhua*), herring (*Clupea harengus*), sprat (*Sprattus sprattus*) and plaice (*Pleuronectes platessa*) were the dominant quota-regulated fish species landed, and flounder (*Platichthys flesus*), turbot (*Scophthalmus maximus*) and whiting (*Merlangius merlangus*) comprised the dominant non-quota fish species landed. The first impact monitoring was initially planned for 2012. However, in agreement with the Swedish authorities it was decided to postpone the monitoring on changes in fishery so that the assessment will cover the full period 2010-2014. The results will be presented in the report covering monitoring activities for 2014, which will be issued in 2015.

15 Cultural heritage

> The maritime cultural heritage in the Baltic Sea primarily consists of wrecks. Wreck sites reflect a diverse group of vessels that vary in age, size and type. Some wrecks are of no archaeological interest, whereas others are unique due to either construction method, degree of preservation, historical context or other factors. The integrity of wreck sites depends on a number of factors, particularly the manner in which the vessel sank, conditions on the seabed and subsequent disturbance of the wreck or wreck site.

To ensure the integrity of cultural heritage sites during pipe-laying, rock placement and munitions clearance, detailed security and anchor corridor surveys were performed along the entire route. The security and anchor corridor surveys consisted of a geophysical assessment, visual inspection and an expert evaluation of the findings. Findings of unexpected items during construction works are dealt with by a Chance Finds Procedure, which provides guidelines for actions to be taken in dealing with chance finds as well as their documentation and reporting. The pipe-laying contractor followed specific procedures to ensure that the handling of anchors, chains and wires was done without disturbing protected wrecks (directly or indirectly).

15.1 Monitoring programme for cultural heritage

Potential impacts

Potential impacts on cultural heritage from the Nord Stream Project may be the result of physical disturbance during construction or the result of erosion around and on wrecks due to changes in current patterns during the operation phase. The wrecks may also carry objects on board, such as munitions, the condition of which requires monitoring to ensure safe pipeline operation.

Monitoring activities until 2012

Monitoring of cultural heritage was carried out in Russia, Finland, Sweden and Denmark. Monitoring was initiated in 2009 and was completed in Russia in 2011.

Monitoring includes visual inspections by ROV of selected wrecks along the pipeline route. The wreck selection was made in close cooperation with the relevant authorities in the countries affected. The ROV was lowered to the archeologically significant wreck sites, where selected prominent features of the wrecks were visually inspected using underwater video cameras. The purpose of the monitoring is to document that wrecks have not been damaged by munitions clearance and pipeline construction, including anchor-handling, post-lay trenching and rock placement.

The results and main conclusions from finalised monitoring for cultural heritage during construction of the pipelines, which took place in Russia, Finland, Sweden and Denmark from 2009-2012, are reported in the Environmental and Socio-economic Monitoring Report covering monitoring activities in 2012 /41/.

Monitoring activities 2013 and onwards

Monitoring of cultural heritage continues throughout the operation phase in Finland. In Sweden, 2013 was the last year of monitoring, and in Denmark monitoring will continue until 2016. Monitoring of cultural heritage in Finland in 2013 was carried out as part of the external pipeline inspection surveys. No monitoring of cultural heritage was carried out in Denmark in 2013. The aim of the monitoring is to document whether the presence of the pipelines causes enhanced erosion around the wrecks and whether the condition and position of wrecks and potential objects on board with respect to the pipeline have remained unchanged. In Sweden monitoring was carried out in 2013 at two wrecks that were not monitored in 2012. Preliminary results and conclusions from ongoing monitoring activities are reported in the following sections.

The locations of cultural heritage monitoring are shown in Figure 15.1, with an indication of finalised monitoring activities related to construction (until 2012) and ongoing monitoring activities related to operation and recovery after construction (2013-onwards).

>

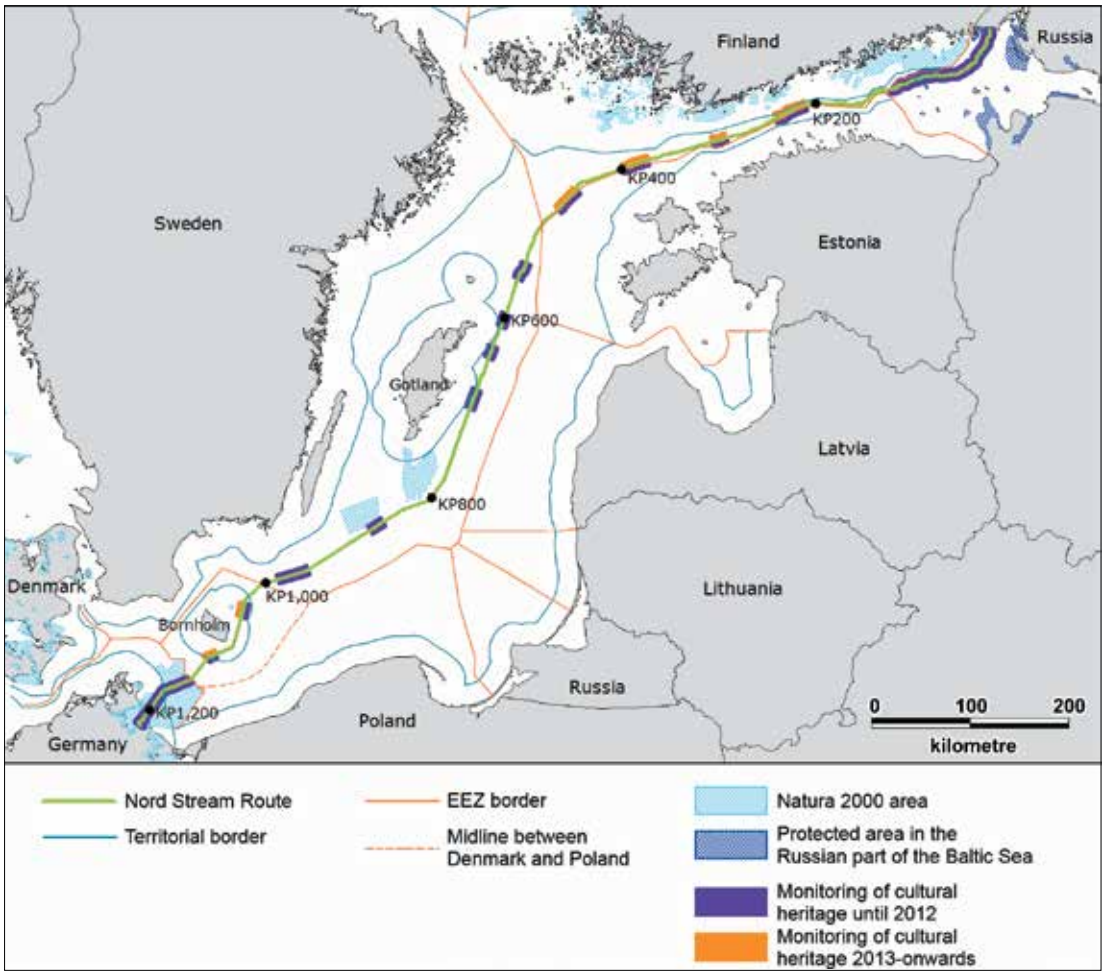


Figure 15.1 Locations of monitoring activities under the cultural heritage monitoring programme. For results and conclusions for monitoring activities finalised in 2012 or earlier, please refer to /41/.

15.2 Finland

The purpose of monitoring of cultural heritage in Finland is to assess whether Nord Stream operations have affected four wrecks located in close proximity to the pipelines. The time schedule for the monitoring is presented in Figure 15.2. A detailed map showing the locations of monitoring stations in Finland is included in Appendix B.

Figure 15.2 Time schedule for the monitoring programme for cultural heritage in Finland.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of cultural heritage

The inspection of wrecks in the Finnish EEZ was performed between 18 May and 4 July 2013. The survey included ROV visual inspection and an MBES survey. The ROV was equipped with a colour camera, obstacle avoidance sonar, an altimeter and a depth sensor. The MBES survey covered the full extent of the wrecks. The selected wreck features were compared with the results of the previous survey. By comparing the positions of the wrecks and images of the wreck features, it can be assessed whether the wreck had been interfered with or otherwise affected by pipeline operation.

The four wrecks included in the monitoring programme are:

- Wreck 1 (3 m from Pipeline 2)
- Wreck 2 (27 m from Pipeline 1)
- Wreck 3 (124 m from Pipeline 2)
- Wreck 4 (91 m from Pipeline 2).

No changes in the location or condition of the wrecks were observed during the monitoring of the pipelines in 2013 in comparison with previous surveys.

15.3 Sweden

The purpose of the cultural heritage monitoring programme in Sweden is to verify that construction in the vicinity of culturally significant wrecks has proceeded as planned. The time schedule for the monitoring is presented in Figure 15.3. A detailed map showing the locations of monitoring stations in Sweden is included in Appendix C.

Figure 15.3 Time schedule for the monitoring of cultural heritage in Sweden.
The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of cultural heritage

Monitoring of cultural heritage in Sweden was carried out in December 2009 (pre-lay), in August 2011 (post-lay), in July 2012 (post-lay) and in March 2013 (post-lay). During the anchor corridor survey carried out in 2009 a total of nine wrecks of cultural significance were identified. All nine wrecks were included in the monitoring programme. Seven wrecks were inspected post-lay in either August 2011 or July 2012, whereas the inspection of two wrecks (R-32-92762 and R-32-92558) was conducted in March 2013.

Each monitoring survey involved video recordings of the wrecks using an ROV in addition to a MBES survey covering the full extent of the objects and a stretch of the pipeline in close proximity to the wrecks. An assessment of potential impacts on the wrecks caused by construction of the pipelines was carried out by comparing positions and images of selected features of the wrecks obtained before and after installation of the pipelines.

>

The Swedish National Maritime Museum compared and evaluated footage of the cultural heritage sites before and after installation of the Nord Stream Pipeline in the Swedish EEZ. The conclusion from their assessment was that four of the wrecks (R-18-37250, R-32-92558, R-20-110213 and R-21-95650) were in the same condition as prior to construction of the Nord Stream Pipeline. One wreck (R-23-94325) was difficult to inspect in 2012 due to low visibility. However, no apparent changes in the condition of this wreck were detected. The wrecks R-23-94498 and R-29-93462 were in the same condition, but slightly more covered with sediment, since construction of the Nord Stream Pipeline. One wreck, R-19-37854, was impacted by an anchor chain during construction of the Nord Stream Pipeline.

The two wrecks (R-32-92761/R-32-92762 and R-32-92558) that were revisited in 2013 appeared to be unchanged since the pre-lay survey, despite visibility being worse than during the survey in 2009.

15.4 Denmark

The purpose of the cultural heritage monitoring programme in Denmark is to verify that construction in the vicinity of culturally significant wrecks proceeded as planned and that the presence of the pipelines on the seabed does not cause erosion around the wrecks. The time schedule for the monitoring is presented in Figure 15.4. A detailed map showing the locations of monitoring stations in Denmark is included in Appendix D.

Figure 15.4 Time schedule for the monitoring programme for cultural heritage in Denmark. The schedule only include monitoring programmes still ongoing 2013 and onwards.

Results and conclusions from the monitoring of cultural heritage

Monitoring of cultural heritage objects in Danish waters was carried out in October (pre-lay monitoring) and November 2010, January 2011 and July 2012 (post-lay). During the anchor corridor survey carried out in 2009 a total of 41 wrecks/cultural heritage objects were identified. The monitoring programme includes the two wrecks situated closest to the Nord Stream Pipeline, a wooden wreck (S-DK1-2-36-4472) and an iron wreck (S-S33-3802). Each monitoring survey involved video recordings of the wrecks using an ROV in addition to a MBES survey covering the full extent of the objects and a stretch of the pipeline in close proximity to the wrecks. An assessment of potential impacts on the wrecks caused by construction of the pipelines was carried out by comparing positions and images of selected features of the wrecks obtained before and after installation of the pipelines.

Video recordings and 3D images obtained during the 2012 survey showed that both wrecks were in the same condition as in 2010 and 2011. Thus, no detectable changes in the condition of the wrecks have been documented.

Monitoring is planned in 2014 and 2016 to document that the presence of the pipelines on the seabed does not cause erosion around the wrecks. The first results will be presented in the report covering 2014, which will be issued in 2015.

16 Social impacts

> The social impact of a project refers to an impact on people, the community or society that causes changes in human welfare or the distribution of welfare. Potential social impacts can be direct (such as worry, fear or diminished residential comfort) or indirect (such as changes in scenery or nature that have an impact on human well-being).

16.1 Monitoring programme for social impacts

Potential impacts

Potential social impacts from the Nord Stream Project include all potential impacts on people, the community and society.

Monitoring activities until 2012

Monitoring of social impacts is carried out only in Finland. A postal survey conducted during the EIA phase took place in Finland from 2008-2009.

Monitoring activities 2013 and onwards

No monitoring activities for social impacts took place in 2013 in Finland. A concluding survey will be carried out in 2014.

16.2 Finland

The purpose of the social impacts monitoring programme in Finland is to assess whether the results of the social impact assessment during the EIA phase can be confirmed. The time schedule for the monitoring is presented in Figure 13.2.

Figure 16.1 Time schedule for the monitoring programme for social impacts in Finland.

Results and conclusions from the monitoring of social impacts

Social impacts will be monitored using questionnaires. The data will be collected through a postal survey similar to the survey conducted during the EIA phase. The use of the same methodology makes it possible to compare the results from 2008-2009 with the results from 2014. The recipients will be randomly selected households (both recreational and permanent) of the 33 municipalities[4] where the EIA programme and report were displayed for public inspection. The suggested number of questionnaires to be delivered is 4,000. The questionnaire will be almost similar to the earlier one in order to make the monitoring and comparison reliable. The data collected will be processed by means of a statistical programme and analysed as an expert assessment.

Monitoring activities for social impacts in Finland will be performed in 2014. The results and conclusions will be presented in the report covering monitoring activities for 2014, which will be issued in 2015.

[4] Some of these municipalities are no longer independent.

17 Conventional munitions

> The Baltic Sea was heavily mined during World War II, and even though known mine areas were swept after the war, thousands of mines are still present on the seabed today. The largest quantity of mines is located in the Gulf of Finland. All identified sea mines within the Nord Stream installation corridors were removed before construction commenced. This was achieved by placing a small charge next to the identified munitions objects on the seabed using an ROV. The charges were then detonated from a ship located a safe distance from the targets, thereby destroying the munitions object. Munitions outside the construction corridor were left as is.

17.1 Monitoring programme for conventional munitions

Potential impacts

Potential impacts on the Nord Stream Pipeline from munitions can be caused by the remaining munitions in the vicinity of the pipeline being displaced closer to the pipeline, thereby posing a risk to safe operation of the pipeline.

Monitoring activities until 2012

Monitoring of conventional munitions displacement is carried out in Finland. The monitoring was initiated in 2012. The displacement/movement of the known munitions or munitions-related objects inside the installation corridors is monitored. Monitoring is carried out with ROV mounted cameras.

Monitoring activities 2013 and onwards

Monitoring of munitions in Finland continues regularly throughout the operation phase and was also undertaken in 2013. Monitoring of conventional munitions is performed as part of the annual external pipeline inspection surveys. The frequency of future surveys will depend on the results of previous surveys and may decrease over the years.

17.2 Finland

The purpose of munitions monitoring in Finland is to monitor the location of 25 munitions that are located in the vicinity of the pipelines and to verify that the munitions have not been displaced or dragged in close proximity to the pipelines (+/- 7.5 m). In addition, possible new objects and targets in the pipeline installation corridor will be surveyed. The time schedule for the monitoring is presented in Figure 17.1. A detailed map showing the locations of monitoring stations in Finland is included in Appendix B.

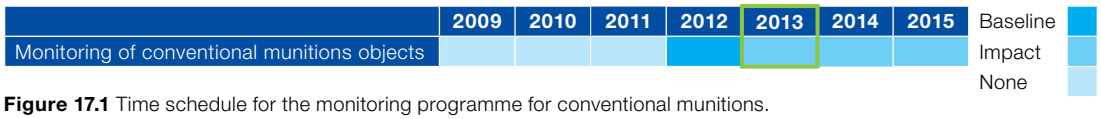


Figure 17.1 Time schedule for the monitoring programme for conventional munitions. The schedule does not include monitoring programmes that are already finalised.

Results and conclusions from the monitoring of conventional munitions

A digital terrain model acquired during the ROV baseline inspection survey of Pipelines 1 and 2 was used to derive possible targets or objects on the seabed near the pipelines. These objects were compared against the existing GIS target database, and any new targets were visually inspected by ROV. In addition, a detailed ROV survey was performed for the known 25 munitions located nearest to the security corridor of the pipelines in order to assess and monitor their potential displacement. The ROV equipped with a laser measuring device conducted a full 360 degree video inspection at each target location. The ROV surveys that were performed in July-August 2012 and in May-July 2013 included the absolute position of the munitions objects and the position with respect to the pipeline route. The dimensions of the munitions objects were also recorded and images were taken.

On basis of the monitoring results from the inspections in 2012 and 2013, it was concluded that there was no visible change of any of the munitions and that no displacement of the objects had occurred.

18 References

/1/ NORD STREAM AG, 2011, „Environmental monitoring report for the Russian offshore section of the Nord Stream gas pipeline pursuant to the requirements of the Russian Natural Resources Ministry for the year 2010. Doc. no. G-PE-LFR-MON-000-COFF10YE-00“.

/2/ RAMBOLL, 2011, „Nord Stream Gas Pipeline construction in the Finnish EEZ. Environmental monitoring 2010 annual report. Prepared for Nord Stream AG. Doc no. G-PE-EMS-MON-100-0306ENG-A“.

/3/ NORD STREAM AG, 2011, „Environmental monitoring in Swedish waters, 2010. Prepared by Ramboll O&G. Doc. no. G-PE-PER-MON-100-04100000-A“.

/4/ NORD STREAM AG, 2011, „Environmental monitoring in Danish waters, 2010. Prepared by Ramboll O&G. Doc. no. G-PE-PER-MON-100-05070000-A“.

/5/ NORD STREAM AG, 2011, „Einführung zum Monitoringbericht für Deutschland 2010. Doc no. G-PE-LFG-MON-000-MONB2010-A“.

/6/ NORD STREAM AG, 2012, „Environmental monitoring report for the Russian offshore section of the Nord Stream gas pipeline pursuant to the requirements of the Russian Natural Resources Ministry for the year 2011. Doc. no. G-PE-LFR-MON-000-COFF11YE-00“.

/7/ RAMBOLL, 2012, „Nord Stream gas pipeline construction and operation in the Finnish EEZ, Environmental monitoring 2011, Annual report. Prepared for Nord Stream AG. Doc. no. G-PE-EMS-MON-100-0319ENG0-A“.

/8/ NORD STREAM AG, 2012, „Environmental monitoring in Swedish waters, 2011. Prepared by Ramboll O&G. Doc. no. G-PE-PER-MON-100-04100011-A“.

/9/ NORD STREAM AG, 2012, „Environmental monitoring in Danish waters, 2011. Prepared by Ramboll O&G. Doc. no. G-PE-PER-MON-100-05070011-A“.

/10/ NORD STREAM AG, 2012, „Einführung zum Monitoringbericht für Deutschland 2011. Doc. no. G-PE-LFG-MON-000-MONB2011-A“.

/11/ NORD STREAM AG, 2013, „Environmental monitoring report for the Russian offshore section of the Nord Stream gas pipeline pursuant to the requirements of the Russian Natural Resources Ministry for the year 2012. Doc. no. G-PE-LFR-MON-000-COFF12YE-00“.

/12/ RAMBOLL, 2013, „Nord Stream Gas Pipeline construction in the Finnish EEZ. Environmental monitoring 2012 annual report. Prepared for Nord Stream AG. Doc. no. G-PE-EMS-MON-100-0321ENGO-B“.

/13/ NORD STREAM AG, 2013, „Environmental monitoring in Swedish waters, 2012. Prepared by Ramboll O&G. Doc. no. G-PE-PER-MON-100-04100012-A“.

/14/ NORD STREAM AG, 2013, „Environmental monitoring in Danish waters, 2012. Prepared by Ramboll O&G. Doc.no. G-PE-PER-MON-100-05070012-A“.

/15/ NORD STREAM AG, 2013, „Einführung zum Monitoringbericht für Deutschland 2012. Doc. no. G-PE-LFG-MON-000-MONB2012-A“.

/16/ NORD STREAM AG, 2014, „Environmental monitoring in Swedish waters, 2013. Prepared by Ramboll O&G. G-PE-PER-MON-100-04100013-A“.

/17/ NORD STREAM AG, 2014, „Results of Industrial Environmental Monitoring during Operation of the Russian Section of the Offshore Gas Pipeline Nord Stream in 2013, C-PE-EMS-MON-500-MOFL13RU“.

/18/ RAMBOLL, 2014, „Nord Stream Gas Pipeline operation in the Finnish EEZ, Environmental Monitoring 2013 Annual report. Prepared for Nord Stream AG. G-PE-EMS-MON-100-0360ENGO-A“.

/19/ NORD STREAM AG, 2014, „Environmental monitoring in Danish waters 2013. Prepared by Ramboll O&G. G-PE-PER-MON-100-05070013-A“.

/20/ NORD STREAM AG, 2014, „Einführung zum Monitoringbericht für Deutschland 2013. Doc. no. G-PE-LFG-MON-000-MONB2013-A“.

/21/ NORD STREAM AG, 2009, „Construction of Nord Stream offshore pipeline (Russian sector). Volume 8: Environment protection. Book 1: Offshore section. Part I. Environmental Impact Assessment. Prepared by PeterGaz. Doc. no. G-PE-LFR-EIA-101-08010100-A“.

/22/ NORD STREAM AG, 2008, „Construction of Nord Stream offshore pipeline (Russian Sector). Volume 8: Environment protection. Book 2: Onshore section. Part I. Environmental Impact Assessment. Prepared by PeterGaz. Doc. no. G-PE-LFR-EIA-101-08020100-A“.

/23/ NORD STREAM AG, 2010, „Baltic Sea natural gas pipeline, environmental monitoring programme - Finland. Doc. no. G-PE-PER-REP-000-ENVMONFI-E“.

/24/ NORD STREAM AG, 2008, „Offshore pipelines through the Baltic Sea, environmental study - Nord Stream Pipelines in the Swedish EEZ, October 2008. Prepared by Ramboll O&G. Doc. no. G-PE-PER-EIA-100-48000000-B“.

/25/ NORD STREAM AG, 2009, „Offshore pipelines through the Baltic Sea. Environmental Impact Assessment. Danish Section (based on Act no. 548 of 06/06/2007, and Order no. 884 of 21/09/2000). Prepared by Ramboll O&G. Doc. no. G-PE-PER-EIA-100-42920000-A“.

/26/ NORD STREAM AG, 2008, „Environmental Impact Study (EIS) for the Nord Stream Pipeline from the Boundary of the German Economic Exclusion Zone (EEZ) to the Landfall Point. Prepared by IfAÖ. Doc. no. G-PE-LFG-EIA-107-UVSBAPP-A“.

/27/ NORD STREAM AG, 2008, „Programme of regular observations of a water body and its water protection area (during construction work), agreed by the Nevsko-Ladoga Basin Water Administration on 12 August 2008. Doc. no. G-PE-EMS-MON-000-RUSMON01-00“.

/28/ NORD STREAM AG, 2010, „Programme of environmental monitoring during the construction of the Russian sector of the Nord Stream offshore gas pipeline. Doc. no. G-PE-EMS-MON-000-RUSWMPCO-00“.

/29/ NORD STREAM AG, 2010, „Programme of observations to assess the impact on aquatic bioresources and their reproductive habitat during the construction of the russian sector of the Nord Stream gas pipeline, agreed by the North-West Regional Directorate of the Russian Federal Fisheries Agency on 15 June 2010. Doc. no. G-PE-EMS-MON-000-RUSMON02-00“.

/30/ NORD STREAM AG, 2012, „Programme of Industrial Environmental Monitoring during Operation of the Russian Section of the Offshore Gas Pipeline Nord Stream, C-PE-EMS-PRO-000-IEMP12RU-A“.

/31/ NORD STREAM AG, 2010, „Monitoring programme for munitions clearance Finland. Doc. no. G-PE-PER-REP-000-EMPFINMU-G“.

/32/ NORD STREAM AG, 2010, „Transboundary monitoring programme Finland. Doc. no. G-PE-PER-REP-000-TRAMOFI-A“.

/33/ NORD STREAM AG, 2010, „Environmental monitoring programme - Finland. Doc. no. G-PE-PER-REP-000-ENVMONFI-E“.

/34/ NORD STREAM AG, 2014, „Environmental Monitoring Programme during Operation from 2013 Onwards - Finland, G-PE-PER-REP-000-ENVMONFI-F“.

/35/ NORD STREAM AG, 2010, „Environmental Monitoring Programme Sweden. Prepared by Ramboll O&G. Doc. no. G-PE-PER-REP-000-EnvMonSE-B“.

/36/ NORD STREAM AG, 2010, „Environmental monitoring programme Denmark. Prepared by Ramboll O&G. Doc. no. G-PE-EMS-MON-100-05110000-C“.

/37/ NORD STREAM AG, 2010, „Monitoringkonzept Deutschland. Doc. no. G-PE-LFG-SOW-000-MONITGER-C“.

/38/ NORD STREAM AG, 2010, „Overall environmental and social monitoring programme. Prepared by Ramboll O&G. Doc. no. G-PE-EMS-MON-100-0810000-A“.

/39/ NORD STREAM AG, 2011, „Results of environmental and social monitoring 2010. Prepared by Ramboll O&G. Doc. no. G-PE-PER-MON-100-08010000-A“.

/40/ NORD STREAM AG, 2012, „Results of environmental and socio-economic monitoring 2011. Prepared by Ramboll O&G. Doc. no. G-PE-PER-MON-100-08020000-A“.

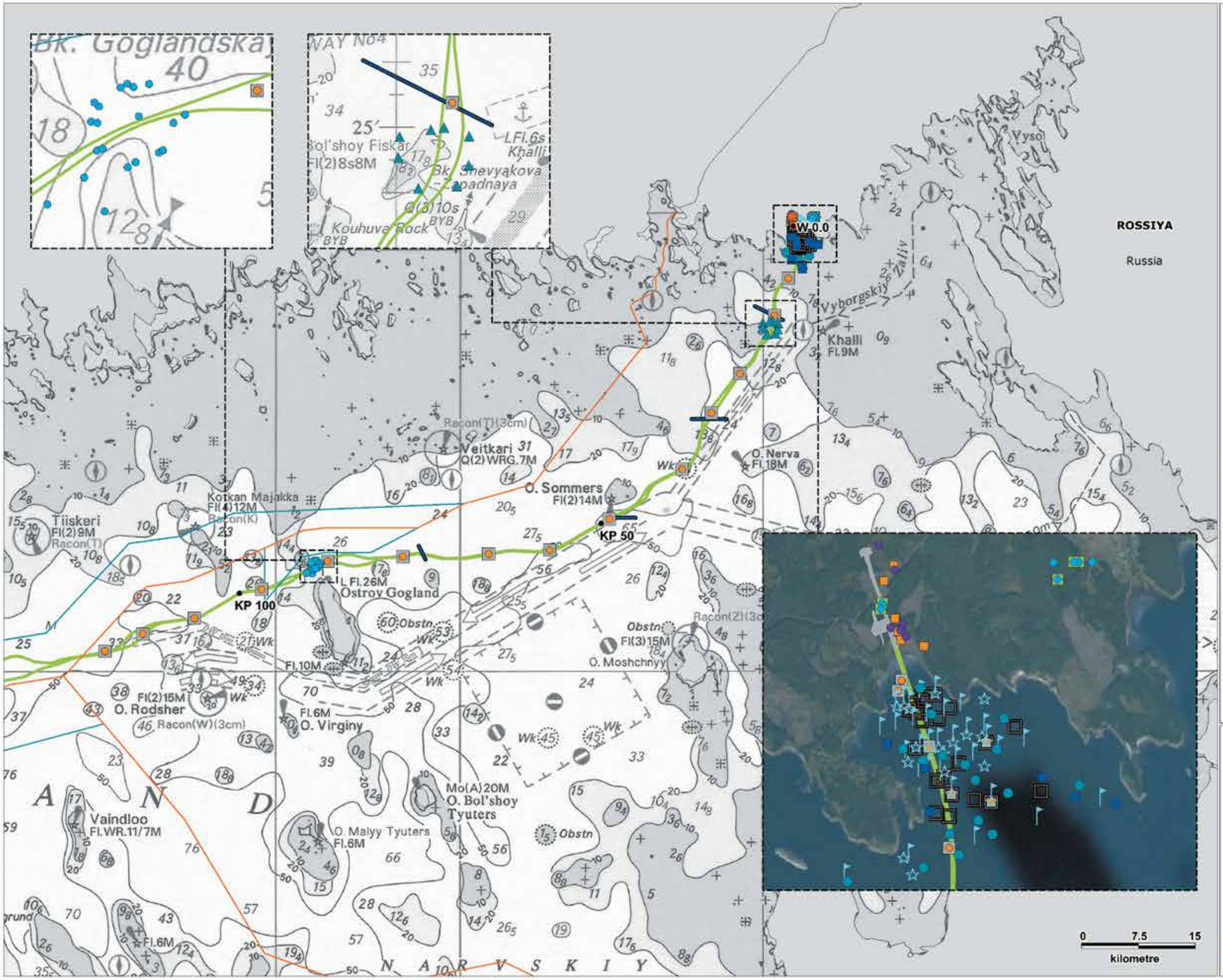
/41/ NORD STREAM AG, 2013, „Results of Environmental and Socio-economic Monitoring 2012. Prepared by Ramboll O&G. G-PE-PER-MON-100-08030000-A“.

/42/ NORD STREAM AG, 2008, „Conservation support plan (Landschaftspflegerischer Begleitplan, LBP) for project: Nord Stream pipeline in the 12 nm zone and the landfall area. Prepared by IfAÖ and Büro für ökologische Studien. Doc. no. G-PE-LFG-REP-107-LBPS BAPP-A“.

/43/ HELCOM, 2009, „Clean Sea Guide. The Baltic Sea Area. A MARPOL 73/78 special area“.

/44/ DHI WATER-ENVIRONMENT-HEALTH, 2014, „Monitoring of benthic fauna and chemical warfare agents in Sweden and Denmark. Monitoring report for Danish waters in 2013. Doc. no. G-PE-EMS-MON-188-M132MRDIN-B“.

Appendices



Legend

- Nord Stream Route
- Territorial border
- EEZ border
- Nord Stream construction site (aerial photo)

Water quality

- Surface water sampling station
- Water quality sampling station
- Water quality - rock placement
- Water quality - dredging operation
- Water quality - pipelay (Castoro Sei)
- Water quality - pipelay (Solitaire)
- Water quality - during trench backfilling
- Water quality - after completition of trench backfilling

Benthic flora and fauna

- Phyto- and zooplankton sampling station

Soil

- Soil sampling station

Fish

- Fish monitoring station
- Fish monitoring transect

Air quality

- Air quality monitoring station

Noise monitoring

- Noise monitoring station

General references:
- Pipeline rev. C.16.5 (May 2009).
- Limits of Exclusive Economic Zones and Territorial Waters: IBRU January 2010.
- Background sea charts are "Not to be used for navigation".
- Background sea chart; © Crown Copyright. Reproduced by permission of the Controller of Her Majesty's Stationery Office and the UK Hydrographic Office (www.ukho.gov.uk).

Appendix A

Monitoring stations in Russia - monitoring during construction and operation

Nord Stream®
Grafenauweg 2
Zug 6304 Switzerland
www.nord-stream.com

Legend

- Nord Stream Route
- Territorial border
- EEZ border

Seabed sediment

- VOM
- VOHE1
- SED and SED(EST)

Water quality

- VOFIXIW
- CONTROL
- LAY
- FIX
- VOHE1
- VOHE3
- VOM

Benthic flora and fauna

- HELCOM station and its parallel stations
- BENT and BENT(EST)

Hydrography

- VOFIXIW
- CONTROL
- VOHE3
- Side scan sonar

Noise

- NOISE (pressure sensor)

Current monitoring

- Bottom close currents
- CUR1

Anodes

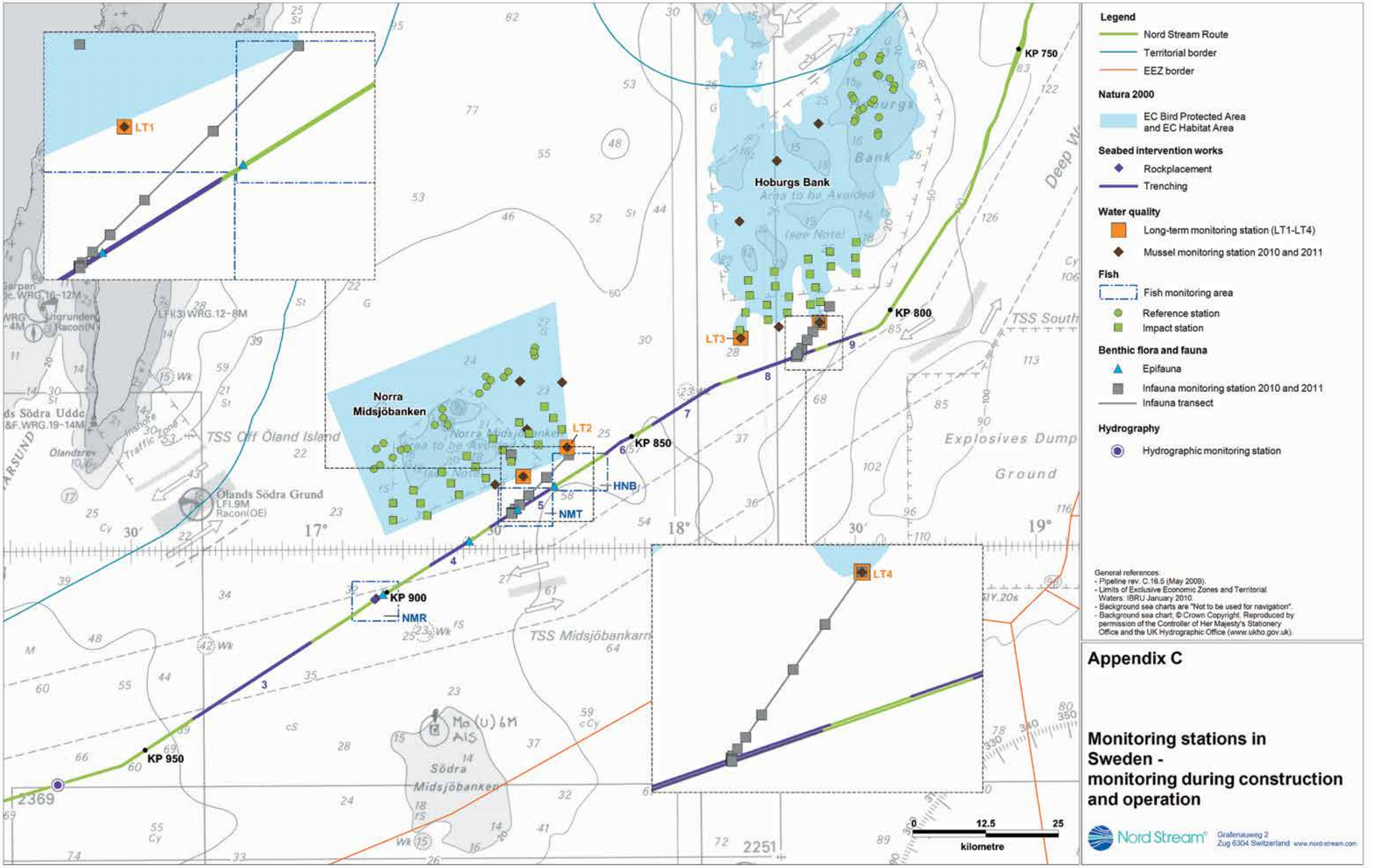
- Anode monitoring

General references:
- Pipeline rev. C.16.5 (May 2009).
- Limits of Exclusive Economic Zones and Territorial Waters: IBRU January 2010.
- Background sea charts are "Not to be used for navigation".
- Background sea chart: © Crown Copyright. Reproduced by permission of the Controller of Her Majesty's Stationery Office and the UK Hydrographic Office (www.ukho.gov.uk).

Appendix B

Monitoring stations in Finland - monitoring during construction and operation

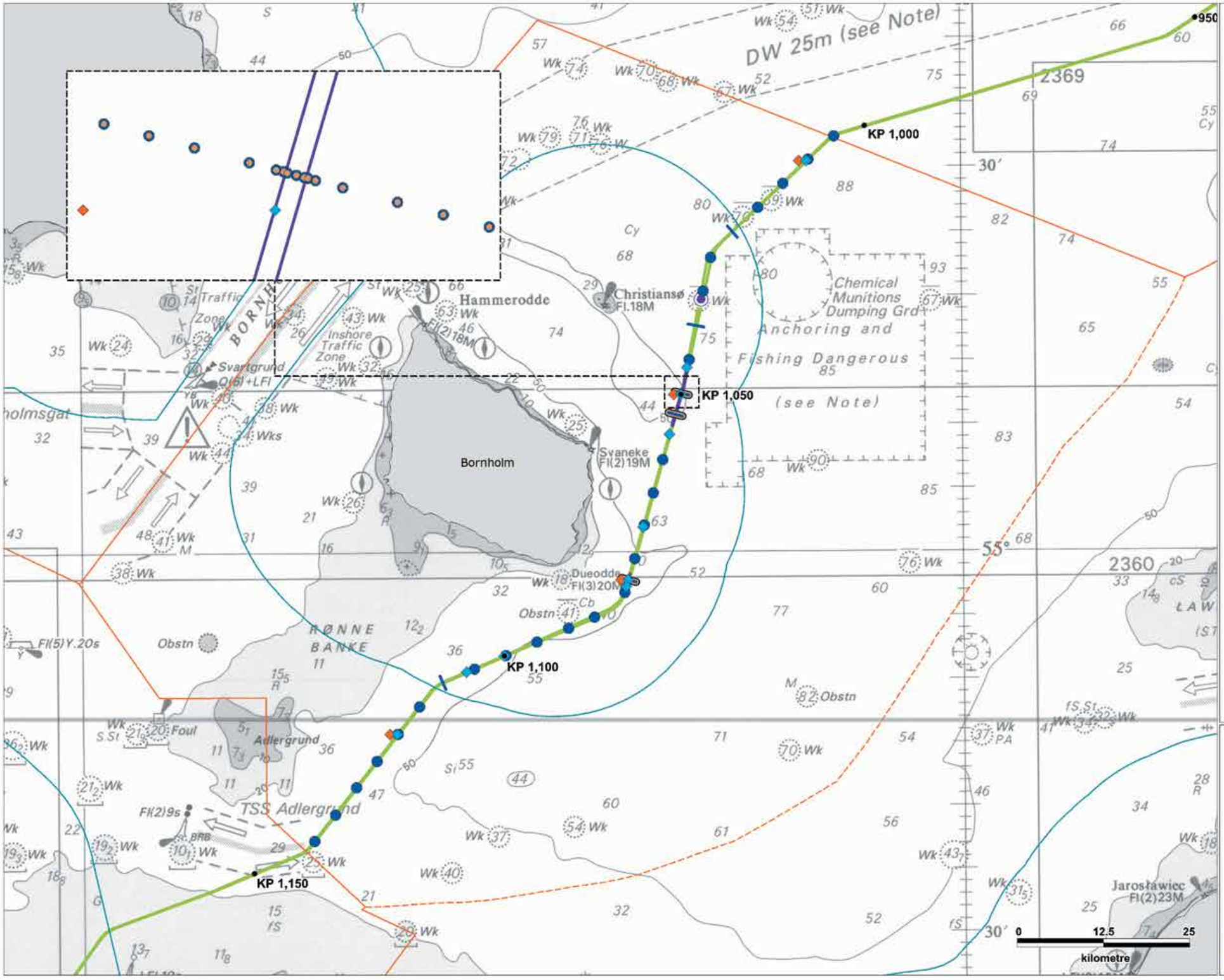
Nord Stream® Grafenauweg 2 Zug 6304 Switzerland www.nord-stream.com



Appendix C

Monitoring stations in Sweden - monitoring during construction and operation

Nord Stream®
Grafenauweg 2
Zug 6304 Switzerland
www.nord-stream.com



Legend

- Nord Stream Route
- Territorial border
- EEZ border
- Midline between Denmark and Poland

Seabed intervention works

- Trenching

Seabed sediment

- CWA monitoring station
- CWA transect

Fish

- Fish monitoring station
- Reference station

Benthic flora and fauna

- Infauna transect
- Infauna monitoring station
- Epifauna monitoring station
- Reference station

Hydrography

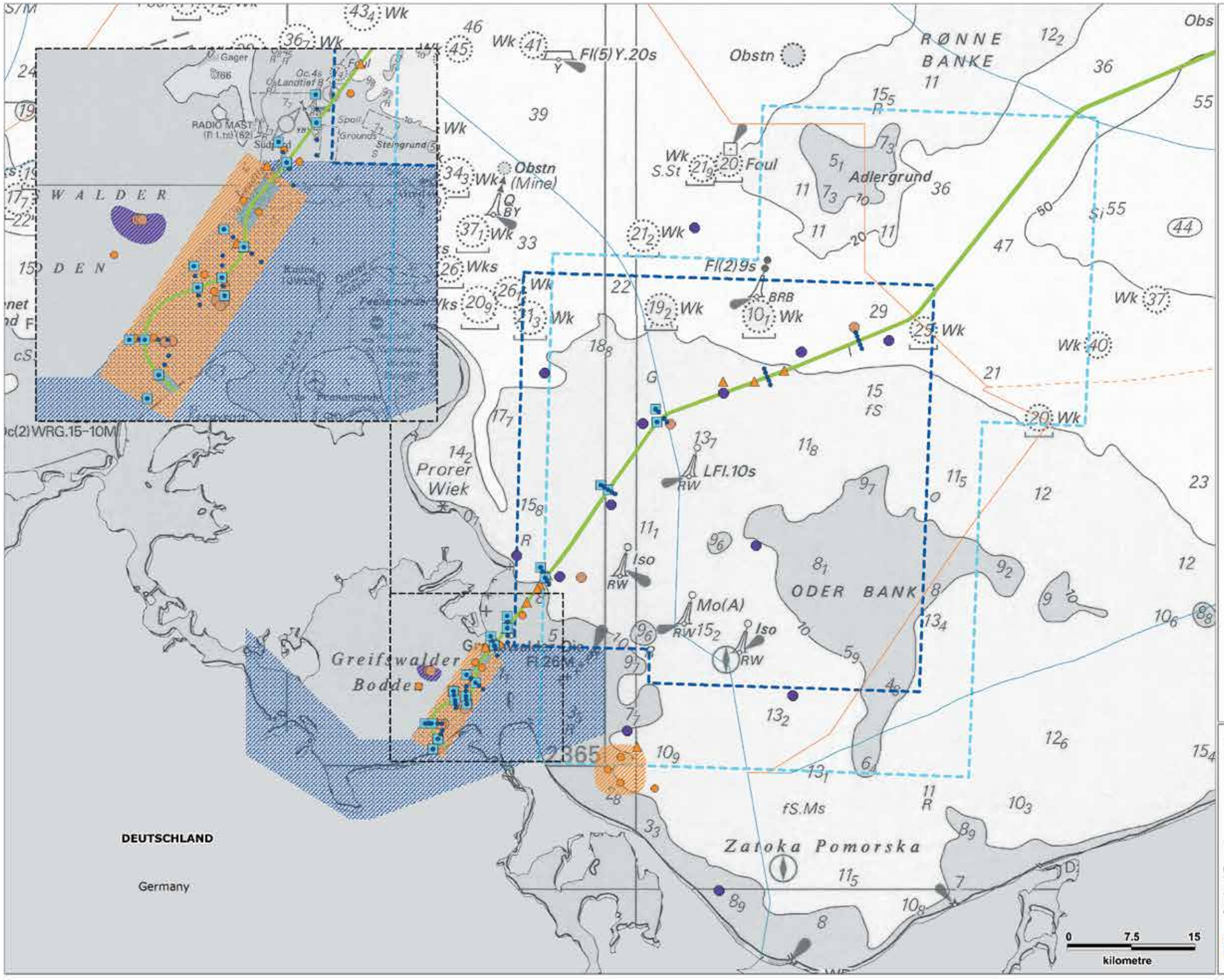
- Hydrographic monitoring station

General references:
- Pipeline rev. C.16.5 (May 2009).
- Limits of Exclusive Economic Zones and Territorial Waters: IBRU January 2010.
- Background sea charts are "Not to be used for navigation".
- Background sea chart: © Crown Copyright. Reproduced by permission of the Controller of Her Majesty's Stationery Office and the UK Hydrographic Office (www.ukho.gov.uk).

Appendix D

Monitoring stations in Denmark- monitoring during contruction and operation

Nord Stream®
Grafenauweg 2
Zug 6304 Switzerland www.nord-stream.com



Legend

- Nord Stream Route
- Territorial border
- EEZ border
- Midline between Denmark and Poland

Water quality (turbidity)

- Turbidity monitoring station
- Starting positions of the dredgers (ADCP)
- Area for aerial photography/ image analysis

Seabed sediment

- Chemical sediment parameters
- Geophysical sediment parameters

Hydrography

- Underwater noise

Marine mammals

- Harbour porpoise monitoring station
- Grey seal survey area

Birds

- Survey area for birds by aircraft
- Survey area for birds by ship
- Survey area for scaup and long-tailed ducks during herring spawning in spring

Benthic flora and fauna

- Infauna station
- Benthic flora monitoring area

General references:
- Pipeline rev. C.16.5 (May 2009).
- Limits of Exclusive Economic Zones and Territorial Waters: IBRU January 2010.
- Background sea charts are "Not to be used for navigation".
- Background sea chart: © Crown Copyright. Reproduced by permission of the Controller of Her Majesty's Stationery Office and the UK Hydrographic Office (www.ukho.gov.uk).

Appendix E

Monitoring stations in Germany - monitoring during construction and operation

Nord Stream®
Grafenauweg 2
Zug 6304 Switzerland
www.nord-stream.com

Nord Stream
The new gas supply route for Europe

Contact

Head Office:
Nord Stream AG
Industriestrasse 18
6304 Zug/Switzerland
Phone: +41 41 766 91 91
contact@nord-stream.com
www.nord-stream.com

Results of Environmental and Socio-economic Monitoring 2013
Document-No. G-PE-PER-MON-100-080400EN

Submitted August, 2014 by Nord Stream AG, Industriestrasse 18, CH-6304 Zug. Tel. +41 41 766 91 91