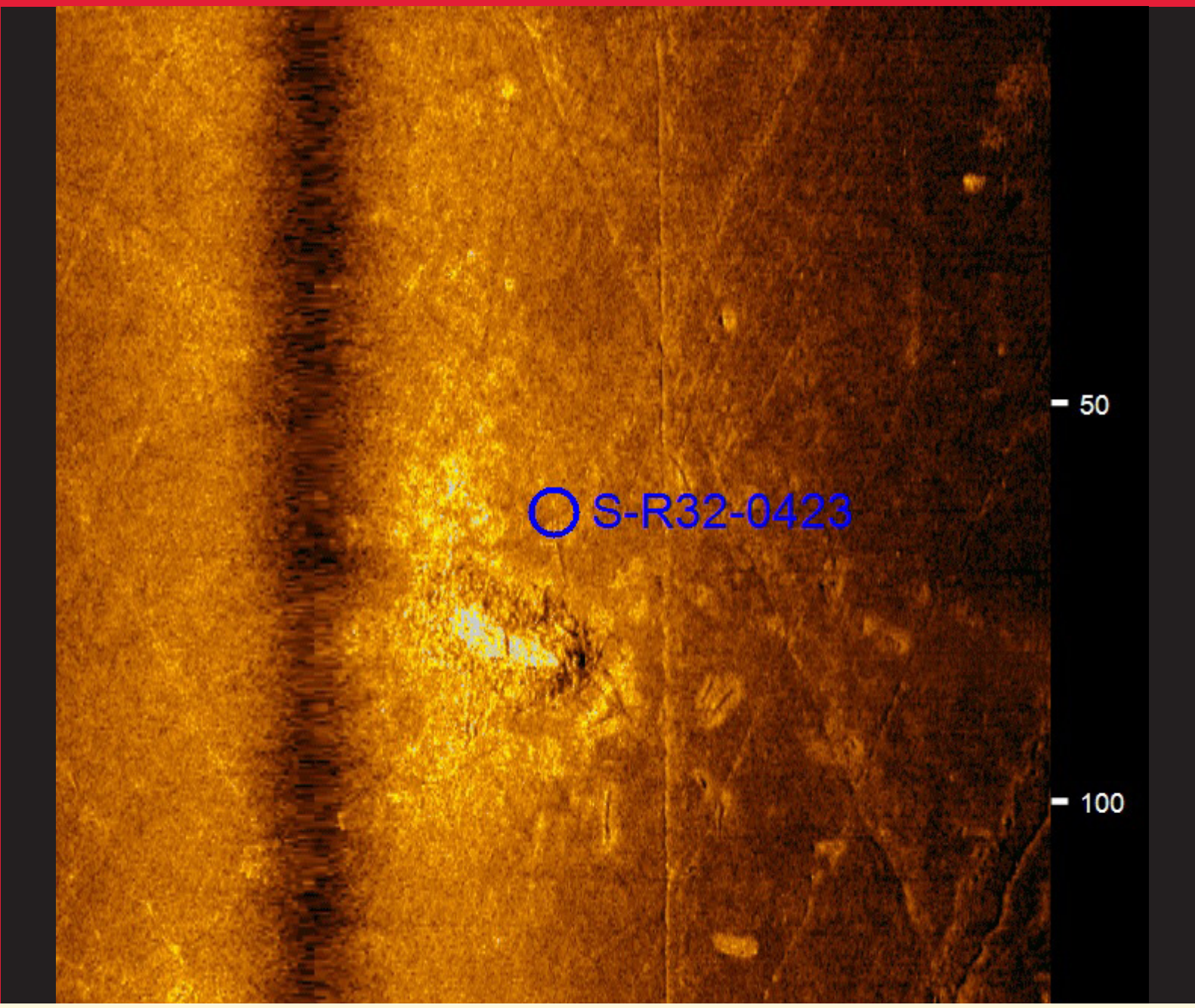
SJÖHISTORISKA MUSEET
ARKEOLOGISK RAPPORT NR 2016:11

Nord Stream 2

Archaeological analysis of geophysical data
Baltic Sea Swedish EEZ

Mikael Fredholm



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MARITIME MUSEUM
ARCHAEOLOGICAL REPORT 2016:11

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Baltic Sea Swedish EEZ

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Cover Sonar image of wreck S-R32-0423 and possible wreck debris around the indication. There are also trawl scars in the bottom. © Fugro, edited by Mikael Fredholm, Maritime Museum.
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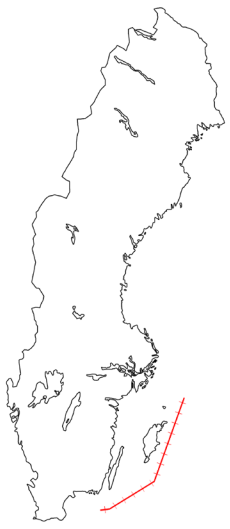
Content

Appendix



Summary

Planning and surveys are ongoing for the new gas pipeline Nord Stream 2, which will run in parallel with the gas pipeline Nord Stream. Fugro Survey LTD. has been commissioned by Nord Stream 2 to conduct geophysical surveys, including side scan sonar.

The Maritime Museum, a part of the Swedish National Maritime Museums (SMM), has on an inquiry from Nord Stream 2 performed an archaeological analysis of sonar data from the planned pipeline route and anchoring corridor in the Swedish economic zone (EEZ). The width of the surveyed area is 2 km and the length about 510 kilometers.

SMM has analysed the group of side scan sonar indications chosen by Fugro to be possible man-made and 118 indications have been deemed as of potential cultural value. SMM recommend ROV inspection of the indications if they can't be avoided by the pipeline or anchoring/construction within 50 meters of the indications.

23 indications are classified as distinct wrecks, 36 indications could be broken and fragmented wrecks and 59 single indications might be part of wrecks or other man-made objects. Around 30 of the indications are possible wreck debris that probably are associated with wrecks in block 30–32. Compared to MMT that surveyed Nord Stream in 2009 Fugro has taken out several possible single ship timber around wrecks, which makes the amount of indications higher. So the actual sites that are recommended for ROV-inspection are around 80.

Background

Planning and surveys are ongoing for the new gas pipeline Nord Stream 2, which will run in parallel with Nord Stream (fig. 1). Fugro Survey LTD. has been commissioned by Nord Stream 2 to conduct hydrographic surveys, including side scan sonar.

SMM presented an offer and investigation plan (2016-04-25) to Nord Stream 2 for analysis of sonar data from the planned pipeline route and anchoring corridor in the Swedish economic zone (EEZ). Nord Stream 2 then submitted a purchase order (2016-04-26, PO 16-5137) for this archaeological analysis to SMM.

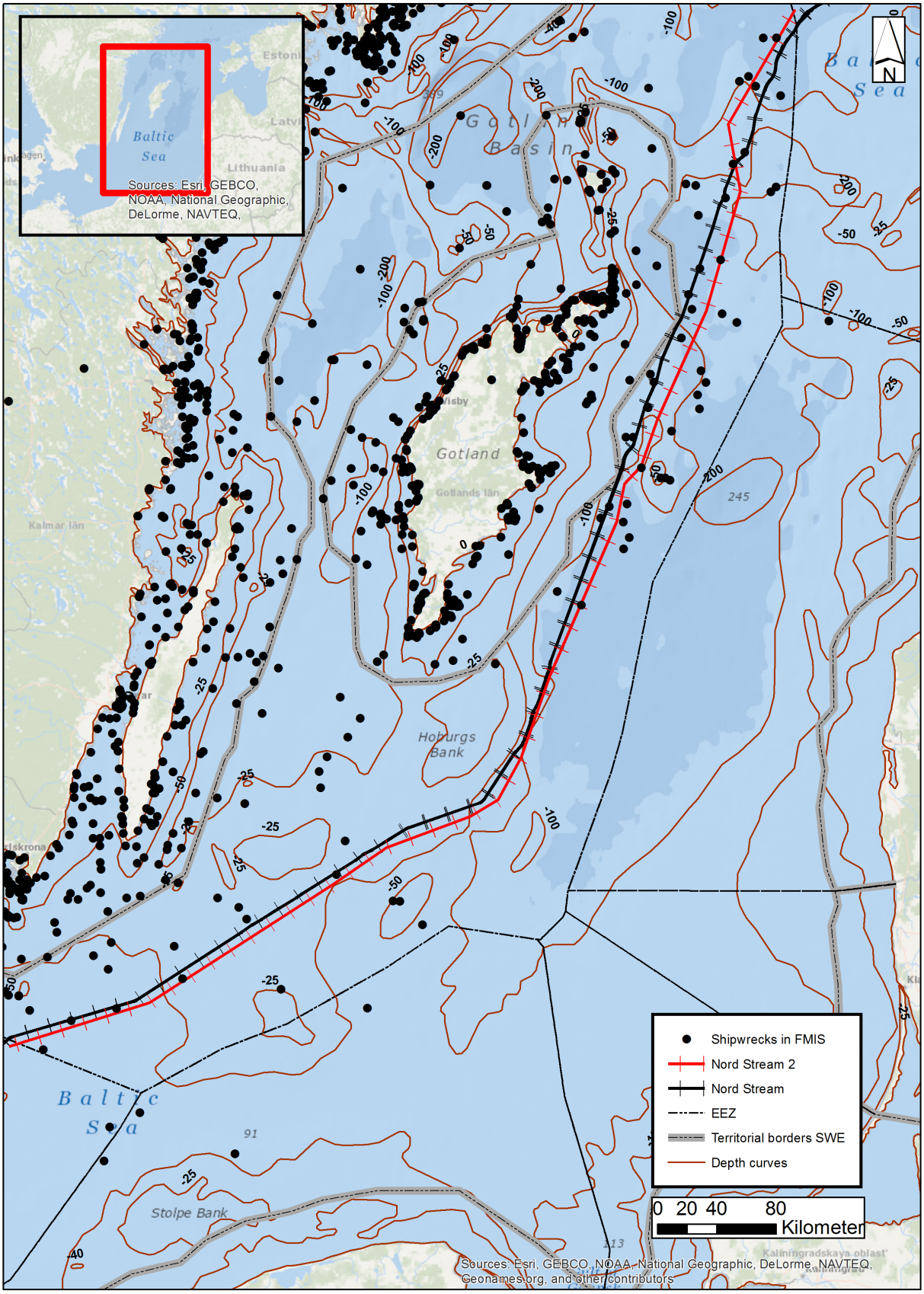


Fig. 1. Nord Stream, Nord Stream 2 and registered shipwrecks in FMIS. © ESRI, edited by Mikael Fredholm, Maritime Museum.

Cultural environment and History

The state of the antiquities in the Baltic Sea is deficient and they constitutes mainly of shipwrecks, but no overall assessment has been made of the Baltic Sea. The previous investigations for Nord Stream and other surveys has given small "windows" of information and what to expect in this area submitted for archaeological analysis in the Baltic Sea.

The approximately 510 km long stretch of Nord Stream 2 through the Swedish EEZ has a varied bottom topography, bottom types and depth of about 30 meters in the waters at Midsjöbankarna in the southern Baltic to almost 200 meters in the northern part of the EEZ (Fig. 1). The known ancient monuments registered in the National Heritage Boards database FMIS close to Nord Stream 2 where found mainly in the Nord Stream project. Except the wrecks found by Nord Stream, the Swedish Maritime Administration made a survey east of Gotland in 2009 and registered several wrecks in the Swedish EEZ close to Nord Stream (from 2 km up to 20 km).

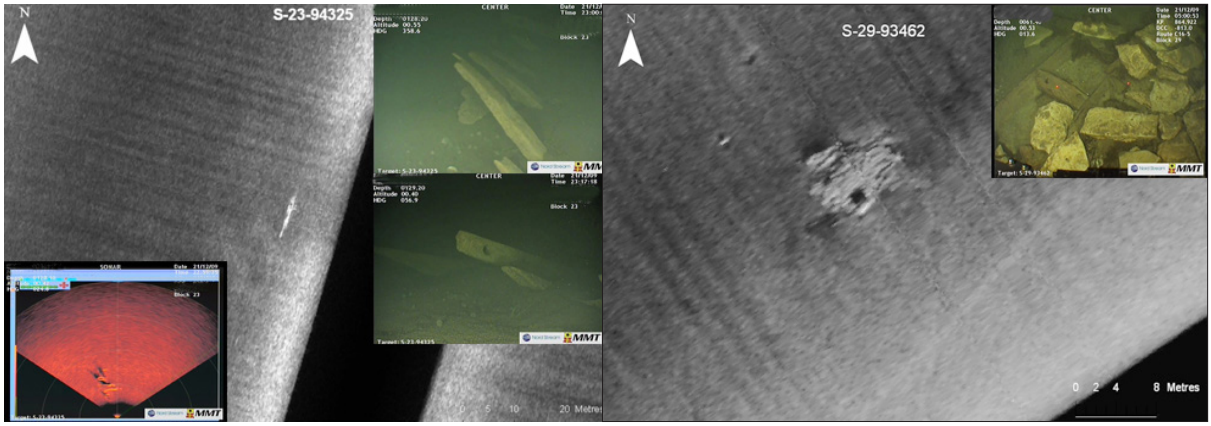


Fig. 2. Examples of sonar indications and ROV-photos of two wrecks from Nord Stream survey 2009 © MMT.

Previous investigations

In 2010–2012 the laying of the Nord Stream gas pipeline was completed. Nord Stream runs from Russia through the Swedish economic zone to Greifswald in Germany. The Maritime Museum performed two archaeological analyses in 2009–2010. Marin Mätteknik AB (MMT) performed the mayor sonar surveys and investigations. In the Nord Stream project the marine surveyors at MMT encountered around 7000 sonar indications throughout the whole corridor, but when SMM gained access to all sonar indications several were already filmed with ROV and concluded as "not man made". About 4000 sonar indications remained for SMM's archaeological analysis of the anchor corridor.

First 1079 sonar indications in the 200 meter wide pipeline corridor were analysed by SMM and 14 sonar indications where singled out for ROV-inspection. Three of these indications are single ship timbers (Fredholm 2009: page 3). A second analysis were made of the 2 km wide anchoring corridor in the Swedish economic zone. In the anchor corridor twelve ships wrecks where found of which nine constituted ancient monuments out of 32 ROV-inspected indications (Fredholm 2010: page 4).

The analysis of the Nord Stream sonar indications and ROV-filming yielded twelve wrecks in total. Ten wrecks were already in MMT's sonar analysis classified as clear wrecks. Two of the unclear indications chosen by SMM as potential wrecks, were concluded as wrecks by the ROV inspection (see fig. 2). These two wrecks shows how difficult it is to find older, broken and decomposed wrecks with side scan sonar (Fredholm 2010).

Purpose, method and evaluation

The main purpose of this archaeological analysis is to evaluate the geophysical observations that may represent cultural heritage or/and ancient monuments. A second purpose is to recommend an offset for the pipeline to the targets.

The purpose of the analysis is further to deliver geophysical observations for ROV-investigations that Nord Stream 2 will perform during 2016–2017. These ROV videos should then be analysed by archaeologists to assess if the encountered objects represent ancient monuments.

Above that, the report on the selected indications with potential cultural heritage value will contain descriptions, dimensions, possible associated wreckage, sonar image, the cultural value on man-made targets and a recommendation of minimum offset for the pipeline on each target group. The selected sonar targets are to be proposed for ROV inspection.

Fugro's side scan sonar that was used is an EdgeTech 4200-MP with operating frequency 300 and 600 kHz. Fugro has used around 200 meters width of each sonar strip. The total width of the surveyed area is 2 km and the length about 510 kilometers. When SMM has analysed Fugro's sonar data in XTF-format the program Sonar Wiz 4

and 6 has been used. GIS-data and mosaics where analysed in Arc Gis 10.3.

Fugro has already in their analyses classified 21 indications as wrecks. The total amount of Fugro's indications are over 20,000, almost tripled compared to previous Nord Stream project 2009–2010, when the total amount of indications where 7000 and twelve wrecks were found. The number of wrecks are higher this time and the total number of indications could well be a result of the more "modern" sonar equipment and software that has enabled Fugro to detect more objects, like Nord Stream 2 described for SMM on the initial meeting in December 2015.

FUGRO's indication lists are analysed and indications of potential cultural value are selected and further analysed into XTF-format or mosaics if deemed necessary. The indications are described and classified according to SMM's classification:

1. Wreck remains. The sonar indication is a clear indication of a wreck.
2. Area with several indications. The sonar indication could be one or more broken fragments of a wreck.
3. Individual item. Indication constituting a single unidentified object, that might be part of a wreck or other manmade object.

The classification is no ranking but describes the indications character.

This analysis will be based on the approximately 1800 sonar indications that FUGRO have classified as "man-made" or "possible man-made" of which 21 are classified as wrecks by FUGRO. SMM will first evaluate and analyse the group of side scan sonar indications chosen by Fugro to be possible man-made. In addition to this, the aim is to make "random" assessments on about 2% of FUGRO's approximately 20–23 000 other objects (or boulders). The assessment is made to assure that FUGRO's judgments are reasonable and that there is no potential wrecks within that group. If the assessment shows that this group has potential wrecks and Fugro's assessment could be inaccurate, SMM's recommendation could be that all indications are assessed by archaeological expertise.

Normally all side scan data is analysed in an archaeological analysis (National Heritage Board, 2012). This means that all the data from a sonar survey are examined by an archaeologist. Practice is primarily based on the knowledge of how the sea bottom looks closer to the coast and the archipelago. Big parts of the bottom in the Swedish EEZ has no likely traces of human influence so a more general analysis is reasonable in relation to the costs and results. The remains which could be expected in the anchoring corridor in the Swedish EEZ are ships remains. It is probably wrecks and traces of merchant shipping from the late medieval period to modern times.

Mainly, the analysis may find shipwreck sites and for a shipwreck to be defined as a cultural monument it should have foundered before 1850 according to the definitions in the Swedish Heritage Conservation Act. A younger monument may be explained to be an ancient monument by the county administrative board if there are special reasons to give it a heritage value. To an ancient monument belongs an area on the ground, sea or ocean floor that is needed to preserve the ancient monument and give it a sufficient space with regard to its nature and importance. This area is referred to as an ancient monument area (1988: 950, 2013:548). A single ship timber in a wreck debris area might be crucial for the understanding and dating of a ship wreck.

According to the National Heritage Board (RAÄ), safety zones around sonar indications has to be established in each case (National Heritage Board, 2012). It could be significant differences in the need for safety zones for an intact wreck or a scattered wreck. RAÄ's recommendations for the investigation area for a pipe conduit is at least 50 meters on each side of the planned stretching. Therefore SMM will use 50 meters as a general recommended minimum offset for the pipeline on each target group, before the target is proven not to be a cultural monument. 50 meter is also what SMM recommended as offset in Nord Stream (Fredholm 2010: page 34).

Results

SMM's assessment of the indications classified as possible man-made has singled out 118 indications of potential cultural value distributed in SMM's three classes:

Class 1: 23 indications
Class 2: 36 indications
Class 3: 59 indications

Compared to MMT's survey of Nord Stream in 2009 Fugro has taken out more possible ship timbers around the wrecks, which makes the amount of indications higher. MMT has as an example in 2009 taken out seven indications for the wreck S-R31-1707 and associated debris (S-32-92558 in 2009) and now Fugro has twenty indications in the wreck area. Around 30 of these class 2–3 indications are possible wreck debris that probably are associated with the wrecks in block 30–32 where trawling seems to have broken down the wrecks. So the actual sites that SMM recommends for ROV-inspection are around 80 out of 118 indications.

SMM recommend ROV-inspection of all indications to assess their cultural value if they can't be avoided (50 m offset) by the pipeline or the anchoring by construction vessels. The wreck S-R28-5046 and S-R31-1707 do not need to be ROV-inspected, as SMM and Nord Stream in 2010 agreed on an offset of 50 meter, which SMM also recommend for the Nord Stream 2 construction.

Below are descriptions of the results, block by block. All clear wrecks are presented as well as some other sonar indications as examples. Attachment 1 contain a complete listing of all the selected sonar indications with potential cultural heritage value, description, dimensions, possible associated wreckage, sonar image, the cultural value on possible man-made targets and a recommendation of minimum offset for the pipeline on each target.

Assessment of the indications classified as boulders by Fugro

SMM has made an assessment of about 2 % of the indications classified as boulders by Fugro. SMM considers Fugro's assessment accurate and that no further examination is needed.

Block 17

This block has mainly indications classified as boulders. SMM has singled out three indications for ROV-inspection; two clear wrecks and one linear indication (S-R17- 0374) that might be a wreck part or other man made object (see appendix 1).

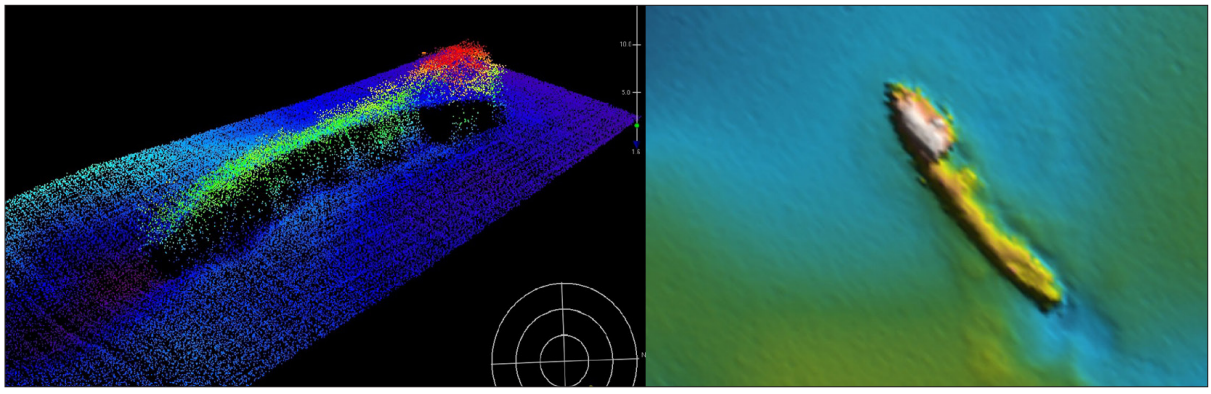


Fig. 3. Sonar images of wreck S-R-17-3360 © Swedish Maritime Administration.

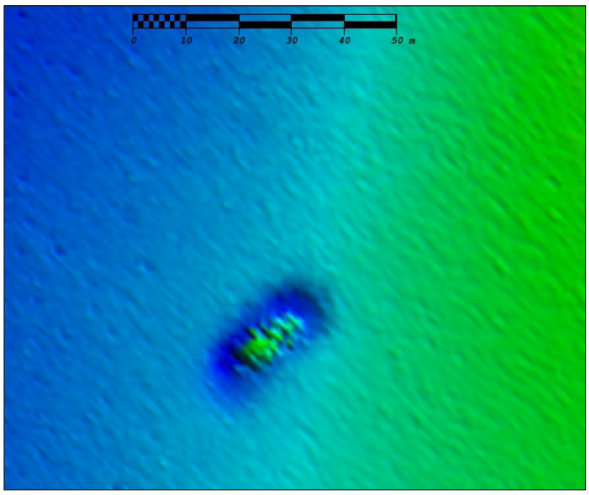


Fig. 4. Sonar image of wreck S-R17-4285 © Swedish Maritime Administration.

S-R17-3360

The wreck was found by the Swedish Maritime Administration in 2009. The 120 meter long wreck lies on its side. Based on Fugro's and the Swedish Maritime Administration's sonar data it seems to be a cargo ship from the 20th century. It is therefore probably not a cultural monument based on the criteria that it has foundered before 1850, but it might be a younger wreck of cultural value.

S-R17-4285

The wreck S-R17-4285 was found by the Swedish Maritime Administration in 2009. This is a 20 meter long wreck and according to the sonar image the wreck seems to be intact. On basis of the sonar image it's impossible to tell if it has foundered before 1850.

Block 18

This block has mainly indications classified as boulders by Fugro. The block crosses Nord Stream and some indications classified as anchor pullout pits are probably from the construction of Nord Stream.

Block 19

SMM has singled out eight indications for ROV-inspection, three are clear wrecks and five other indications that might be a wreck parts or other man-made objects (see appendix 1).

S-R19-0368

The wreck was found by the Swedish Maritime Administration in 2009. The 45 meter long wreck seems to have its bow (or stern) buried deep into the bottom sediment.

Based on Fugro's and the Swedish Maritime Administration's sonar data it seems likely that the wreck has foundered after 1850. It is probably not a cultural monument based on the criteria that it has foundered before 1850, but it could be a younger wreck of cultural value.

S-R19-0998

This indication is an 8 meter long wreck, but based solely on the sonar image it's impossible to tell if it has foundered before 1850. It could be a wooden wreck and therefore a possible cultural monument. According to the sonar image the wreck seems to be relatively intact.

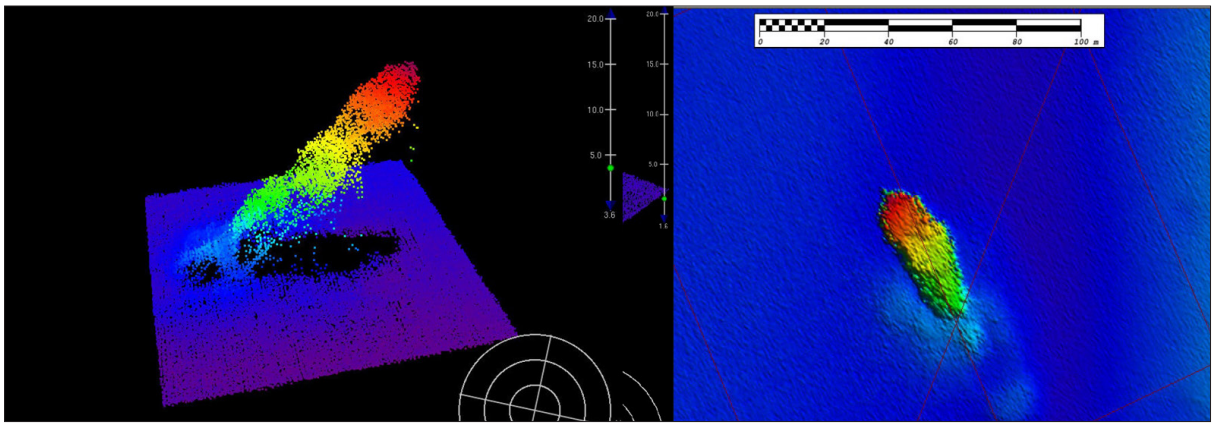


Fig. 5. Sonar images of wreck S-R19-0368 © Swedish Maritime Administration.

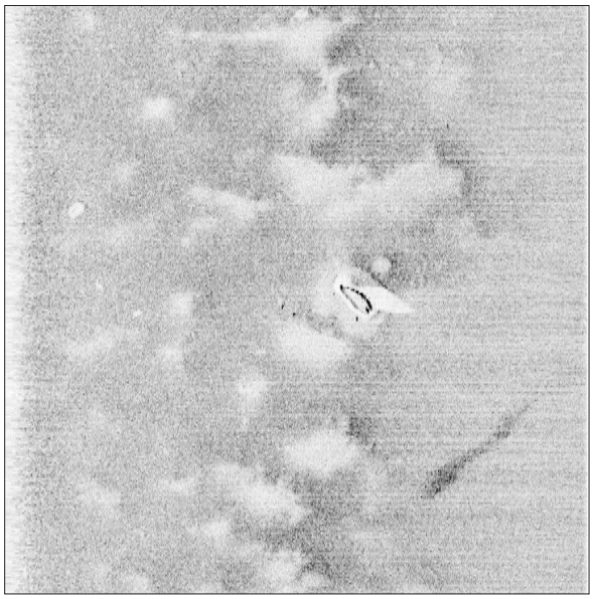


Fig. 6. Sonar image of wreck S-R19-0998 © Fugro.

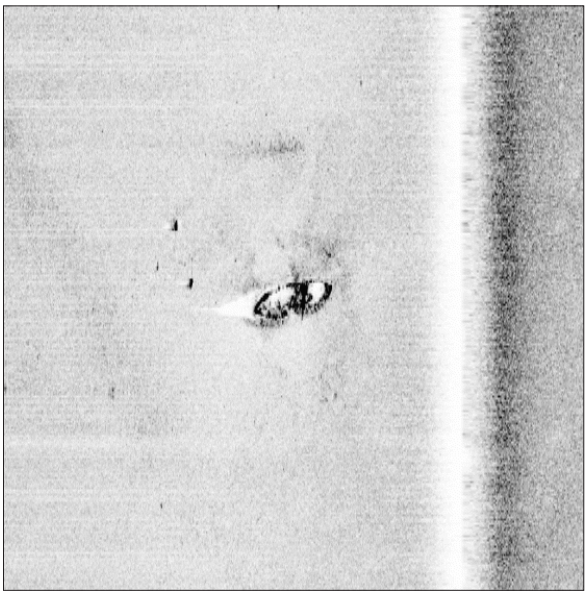


Fig. 7. Sonar image of wreck S-R19-1026 © Fugro.

S-R19-1026

This indication is interpreted as an 18 meter long wreck, but based on the sonar image it is impossible to tell if it has foundered before 1850. It might be a wooden wreck and therefore a possible cultural monument. According to the sonar image the wreck seems to be relatively intact.

Block 20

SMM has singled out three indications that might be wreck parts or other man-made objects for ROV-inspection (see appendix 1). One indication is a clear wreck.

S-R20-276

The sonar indication is a 16 meter long wreck. Based on the sonar image it's hard to tell if it has foundered before 1850. It could be a wooden wreck and therefore a possible cultural monument. According to the sonar image the wreck seems to be relatively intact.

Block 21

The block has mostly sonar indications classified by Fugro as boulders. SMM's analysis has singled out one 10 meter long linear indication (see appendix 1).

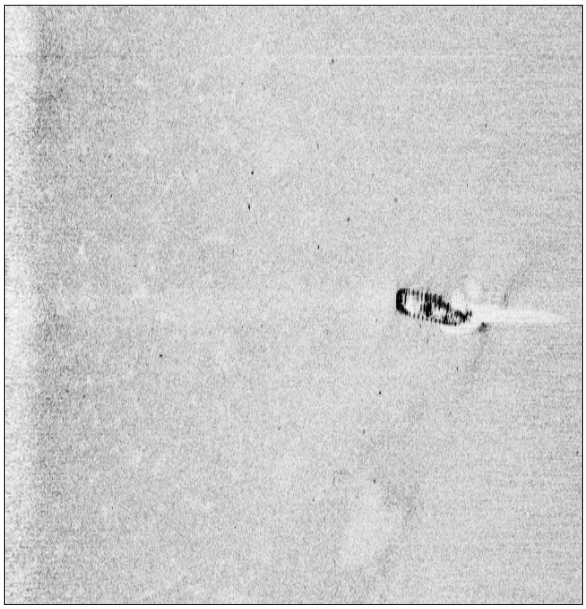


Fig. 8. Sonar image of wreck S-R20-276 © Fugro.

Block 22

The block has four indications of potential cultural value: Two are of linear types and two of debris/mound type that might constitute wreck parts or other manmade objects (see appendix 1).

Block 23

SMM has singled out seven indications of linear types that might constitute wreck parts or other

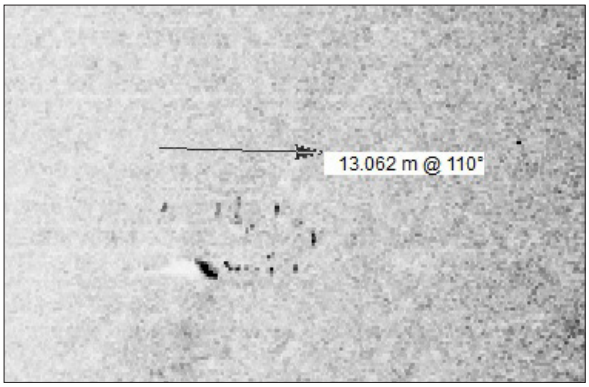


Fig. 9. Sonar image of possible wreck S-R23-2864 © Fugro, edited by Mikael Fredholm, Maritime Museum.

man-made objects of potential cultural value (see appendix 1).

S-R23-2864

The sonar indication consists of several indications that forms a ship like shape of approximately 13 meters length and it is interpreted as a possible wreck (fig. 9).

Block 24

In block 24 SMM has singled out nine indications of potential cultural value, two indications are distinct wrecks with two indications of wreck debris and five other indications (see appendix 1).

S-R24-0735

This 25 meter long wreck was found during the Swedish Maritime Administration's survey in 2009. Based on the sonar image it's impossible to tell if it has foundered before 1850. It could to be a wooden wreck and therefore a possible cultural monument. According to the sonar image the wreck seems to be relatively intact.

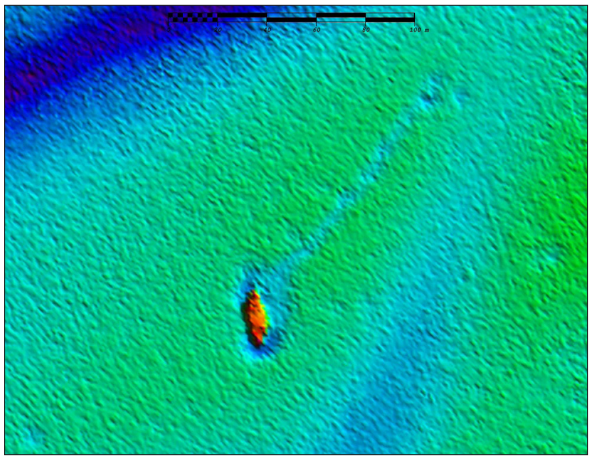


Fig. 10. Sonar images of wreck S-R24-0735 © Fugro and Swedish Maritime Administration.

S-R24-5317

This is an 81 meter long and 9 meter wide wreck. MMT has done a ROV-filming and bathymetry survey of the wreck. The ROV-pictures shows that the wreck appears to be made of steel, with iron rails, navigations lights of metal with "fresnel lens", lifeboats with lifting hooks of iron and a figurehead (fig. 11). MMT interprets it as an old steamer from the early 20th century (MMT 2016a) and it might be so. The details and the size, length/width ratio (1/9) indicates that it could be

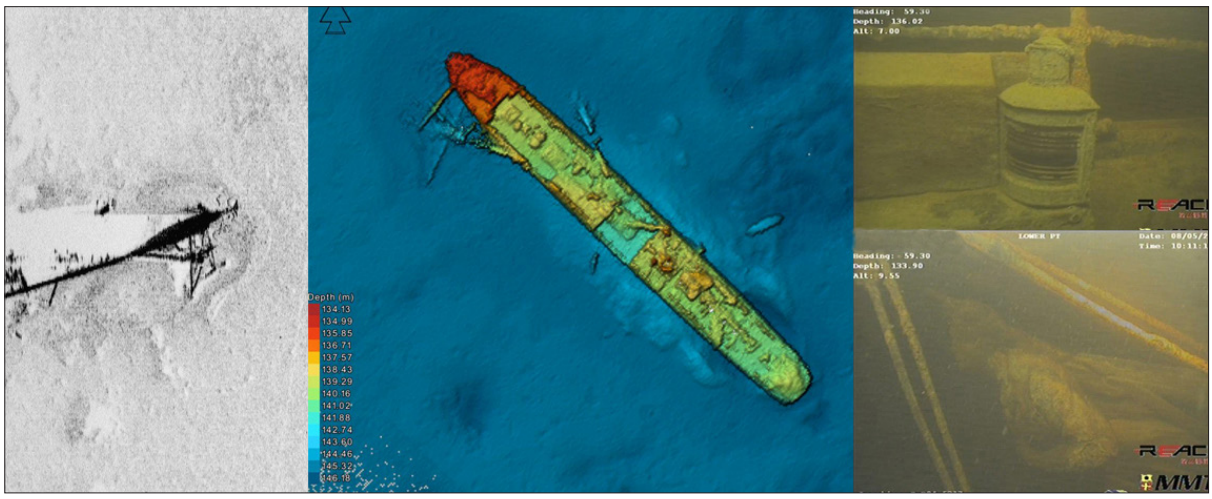


Fig. 11. Sonar image, multibeam image and photos of port navigation light and bow figure head at S-R24-5317 © Fugro and MMT.

a bark ship built around 1900, possibly foundered around the 1st or 2nd world war. Traditional steamers were usually wider and did not have figureheads as often as sail ships.

The size and the details, like the navigation light suggest that the wreck has foundered in the early 20th century, but if it is deemed as of special value it might be considered as a cultural monument by the county administrative board. According to the sonar image the wreck seems to be relatively intact except the associated debris (S-R24-5318 and S-R24-5389) near the wreck.

Block 25

The block has mostly sonar indications classified by Fugro as boulders. SMM's analysis has singled out two indications of possible cultural value (see appendix 1).

Block 26

The block has one clear wreck, S-R26-0941 and in total has SMM's analysis singled out six indications of potential cultural value (see appendix 1).

S-R26-0941

The indication is a 34 meter long wreck. It could be a wooden wreck and therefore a possible cultural monument. According to the sonar image the wreck seems to be relatively intact except some possible debris (S-R26-0942) within 50 meters of the wreck.

S-R26-1912

The indication could be a wreck debris area and therefore a possible cultural monument.

Block 27

SMM has classified three indications as wrecks. SMM's analysis has in total singled out seven indications of potential cultural value (see appendix 1).

S-R27-0148

This indication is classified as a possible wreck by SMM and Fugro's has classified it as a "mound".

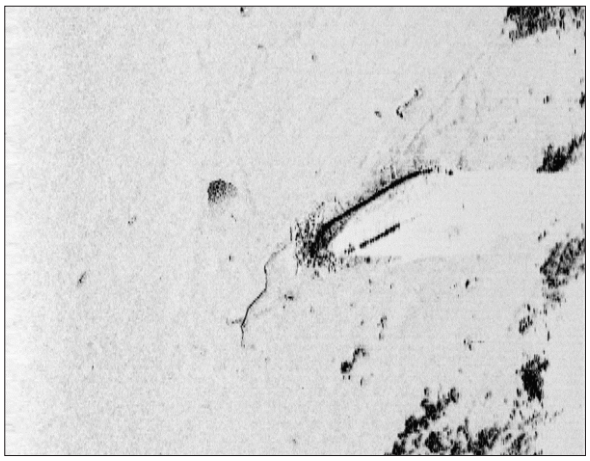


Fig. 12. Sonar image of wreck S-R26-0941 © Fugro.

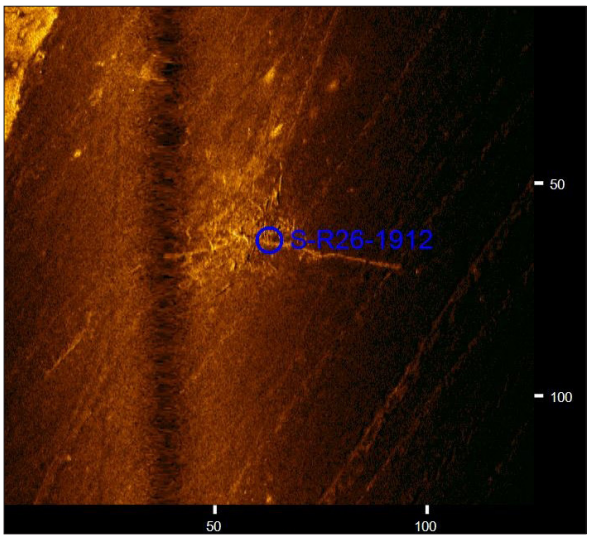


Fig. 13. Sonar image of possible wreck area S-R26-1912. © Fugro, edited by Mikael Fredholm, Maritime Museum.

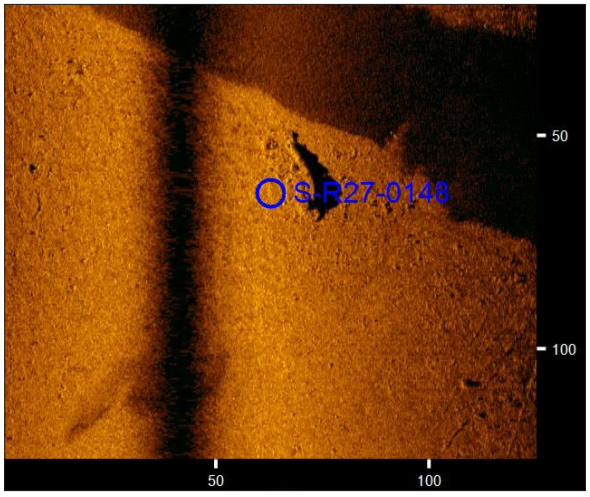


Fig. 14. Sonar image of possible wreck S-R27-0148 © Fugro, edited by Mikael Fredholm, Maritime Museum.

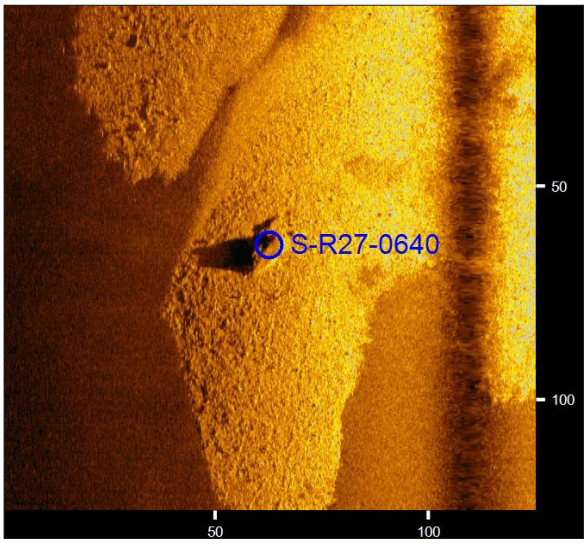


Fig. 15. Sonar image of wreck S-R27-0640 © Fugro, edited by Mikael Fredholm, Maritime Museum.

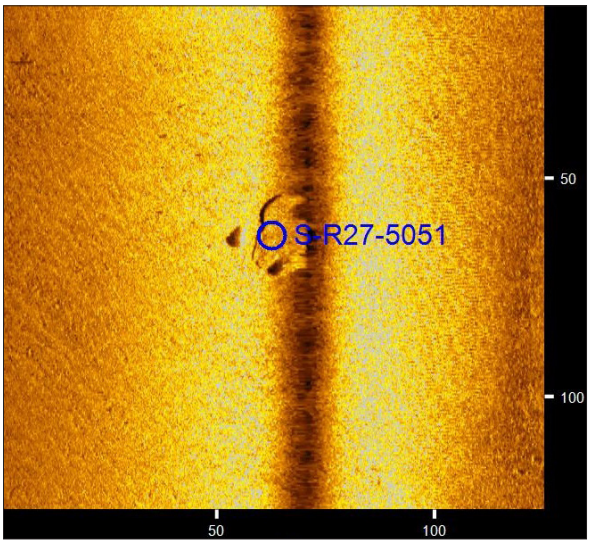


Fig. 16. Sonar image of possible wreck S-R27-5051 © Fugro, edited by Mikael Fredholm, Maritime Museum.

S-R27-0640

This indication is classified as a possible wreck by SMM and Fugro.

S-R27-5051

This indication is classified as a possible wreck by SMM and Fugro. SMM recommend an offset of 50 meter to the indication.

Block 28

The block has one indication (S-R28-5047/5046) already confirmed as a wreck by Nord Stream (MMT) and SMM in 2009. Except this wreck there is one more wreck (S-R28-5297) and one indication (S-R28-5301) that SMM has singled out as of potential cultural value (see appendix 1).

S-R28-5047 and S-R28-5046

The indications are the same as Nord Stream indication S-29-93462. This is a clinker built wooden wreck with ballast/cargo of limestones and iron. It is a cultural monument, possibly a medieval ship (Fredholm 2010: page 27) and the wreck corresponds to the definitions in the Swedish Heritage Conservation Act (1988: 950) as a cultural monument. The main wreck area is concentrated

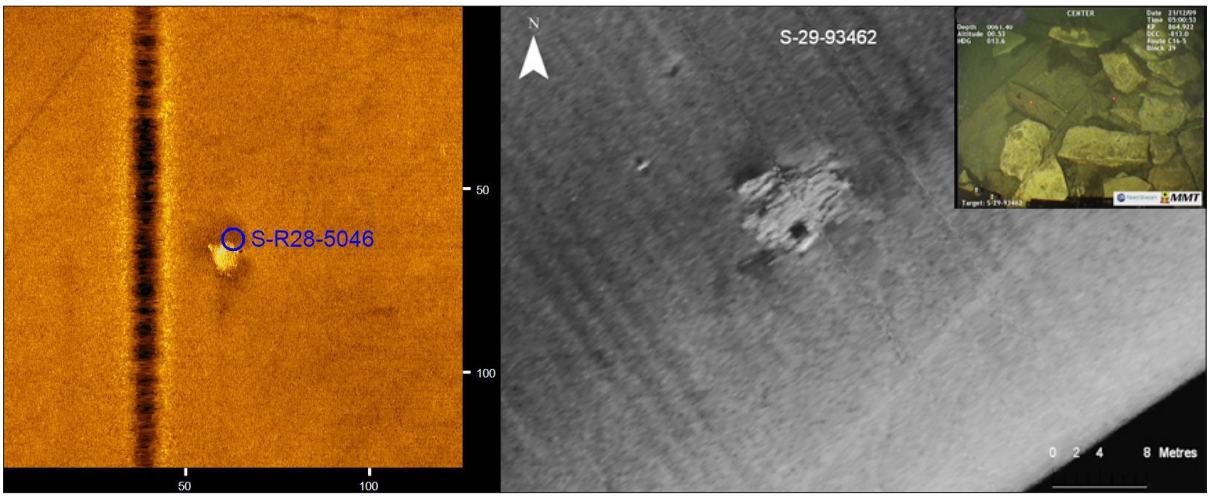


Fig. 17. Sonar image and ROV-photo of wreck S-R28-5046/5047 (S-29-93462) © Fugro and MMT, edited by Mikael Fredholm, Maritime Museum.

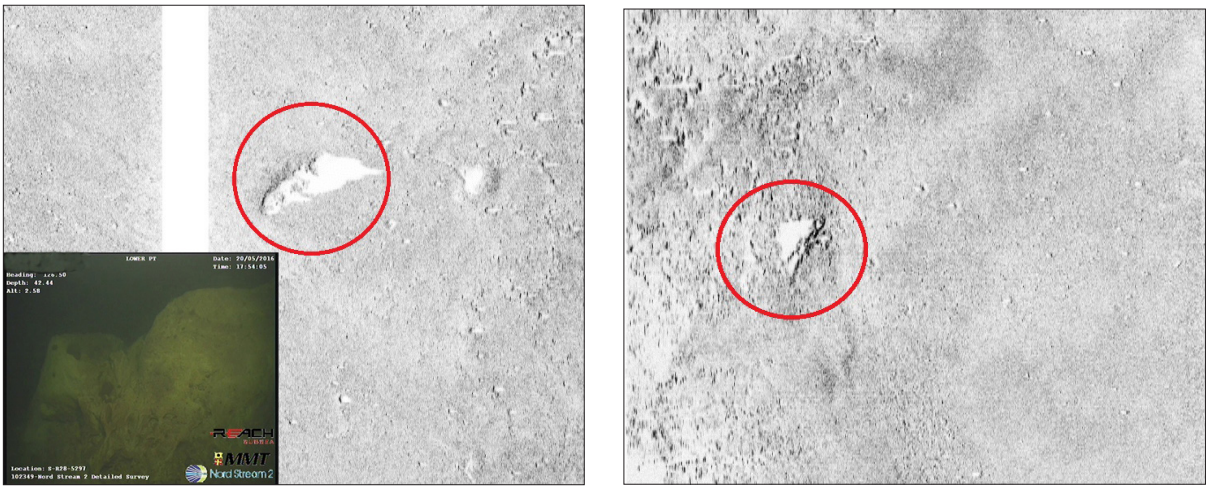


Fig. 18. Sonar image and ROV-photo of indication S-R28-5297 and S-R28-5301. © Fugro, MMT edited by Mikael Fredholm, Maritime Museum.

except an associated container approximately 30 meters southeast of the wreck and a ship timber 15 meter northwest of the wreck. The wreck area is around 30×30m (Nord Stream, 2009).

S-R28-5297 and S-R28-5301

In May 2016 MMT ROV-inspected S-R28-5297 and it was concluded as rocks. S-R28-5301 is an object located 200 meter west of S-R28-5297 and may be a wreck.

Block 29

SMM's analysis has singled out two indications of potential cultural value (see attachment 1).

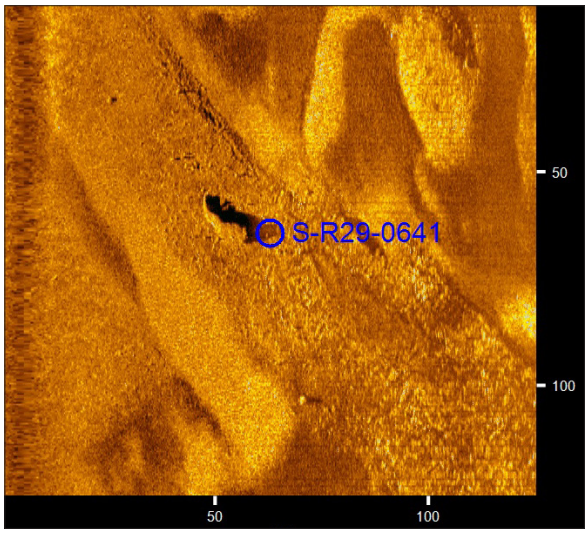


Fig. 19. Sonar image of S-R29-0641 © Fugro, edited by Mikael Fredholm, Maritime Museum.

S-R29-0641

A 12 meter long indication that might be debris, stones, geology or a wreck.

Block 30

In this block SMM has singled out 33 indications, five are wrecks and 22 indications are possible associated wreck debris. The six other indications might as well be man-made objects of potential cultural value (see appendix 1).

Fugro and SMM has five indications of distinct wrecks. S-R30-0997 and S-R30-2712 seems to be relatively intact and has not much scattered wreck debris. S-R30-0615, S-30-3018 and

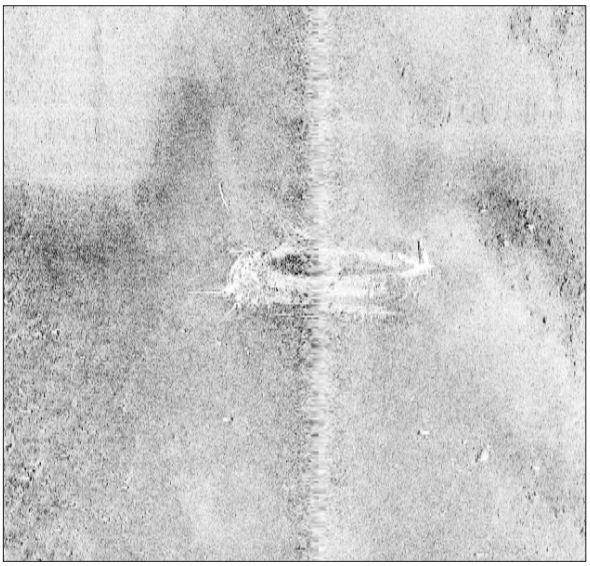


Fig. 20. Sonar image of wreck S-R30-0615 © Fugro.

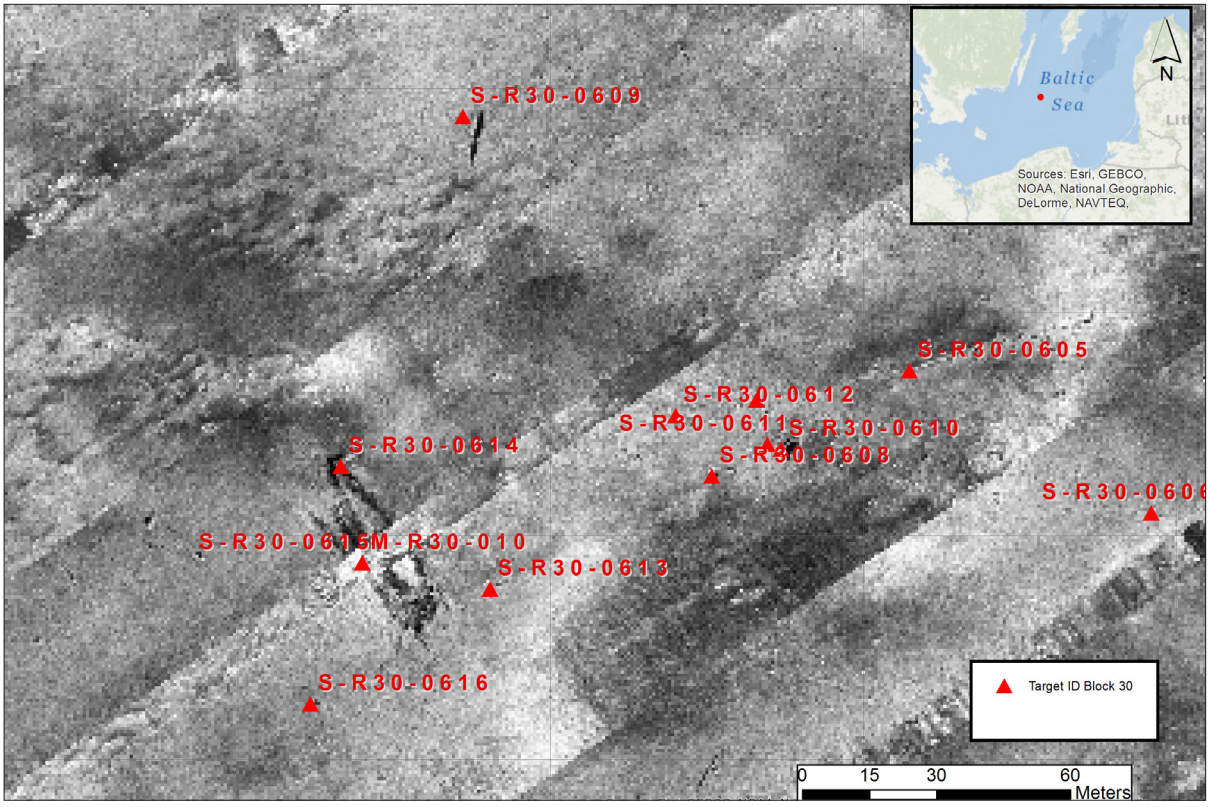


Fig. 21. Sonar mosaic map over the area around wreck S-R30-0615. © ESRI and Fugro, edited by Mikael Fredholm, Maritime Museum.

S-R30-2737 has in total 22 sonar indications of possible wreck debris.

Until the status of all the possible wreck debris is clear (i.e. ROV-inspection) SMM recommend an offset of 50 meter to each indication. Based solely on the sonar images it is not certain that all "wreck debris" are from the same wreck. It could well be pieces of several wrecks.

S-R30-0615

The indication is a clear wreck, but based solely on the sonar image it's impossible to tell if it has foundered before 1850. It is most certainly a wooden wreck and a possible cultural monument. According to the sonar image the wreck seems have associated debris (S-R30-0608 to 0614, and -0859) close by and scattered up to around 100 meters away from the actual wreck (see fig. 21). Before the status of all the possible debris is clear (i.e. ROV-inspection) SMM recommend an offset of 50 meter to each indication. Based solely on the sonar images it is not certain if all "wreck debris" are from the same wreck. It could be pieces of one or more wrecks.

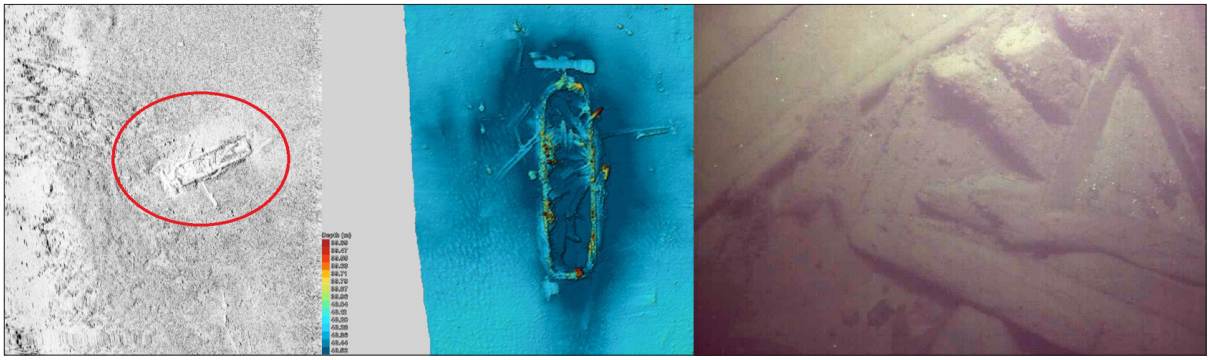


Fig. 22. Sonar image, multibeam image and photo of S-R30-0997 a © Fugro, MMT, MMT.

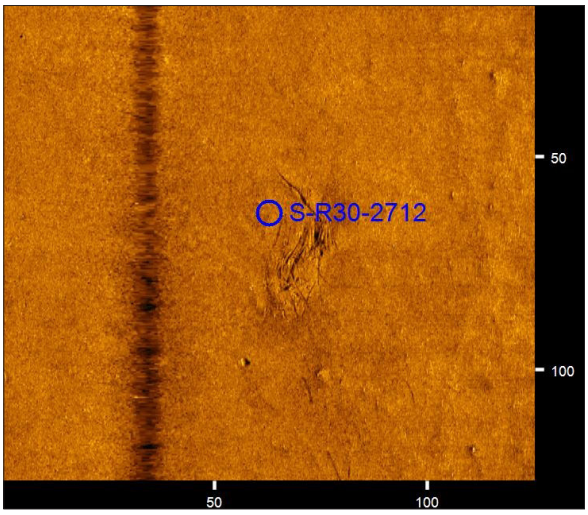


Fig. 23. Sonar image of wreck S-R30-2712. © Fugro, edited by Mikael Fredholm, Maritime Museum.

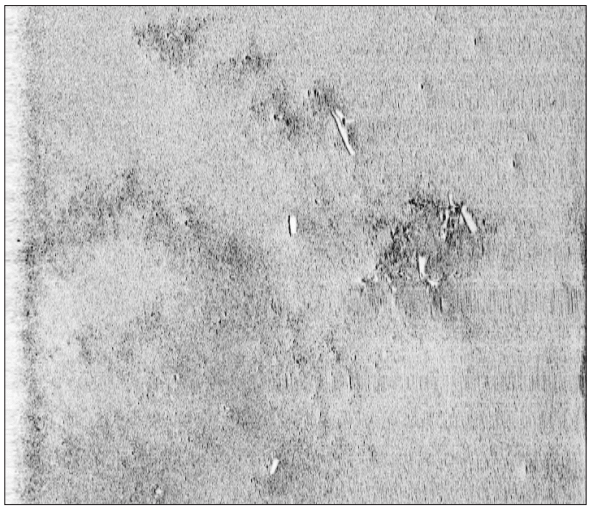


Fig. 24. Sonar image of wreck indication S-R30-2737 and possible debris © Fugro.

S-R30-0997

This is 24 meter long wreck. According to the sonar image the wreck seems to be relatively intact and no wreck debris scattered more than 50 meter away from the wreck. It does not seem to be any trawl scars close to the wreck. MMT has done a ROV and bathymetry survey of the wreck. The ROV-pictures shows clearly that it is a wooden wreck (MMT 2016b) but the still images provided in the report is not enough for an exact dating of the wreck. The wreck seems to be carvel built with inner planking and is probably a cargo ship. The possible stern is located to the north and the bathymetry shows an

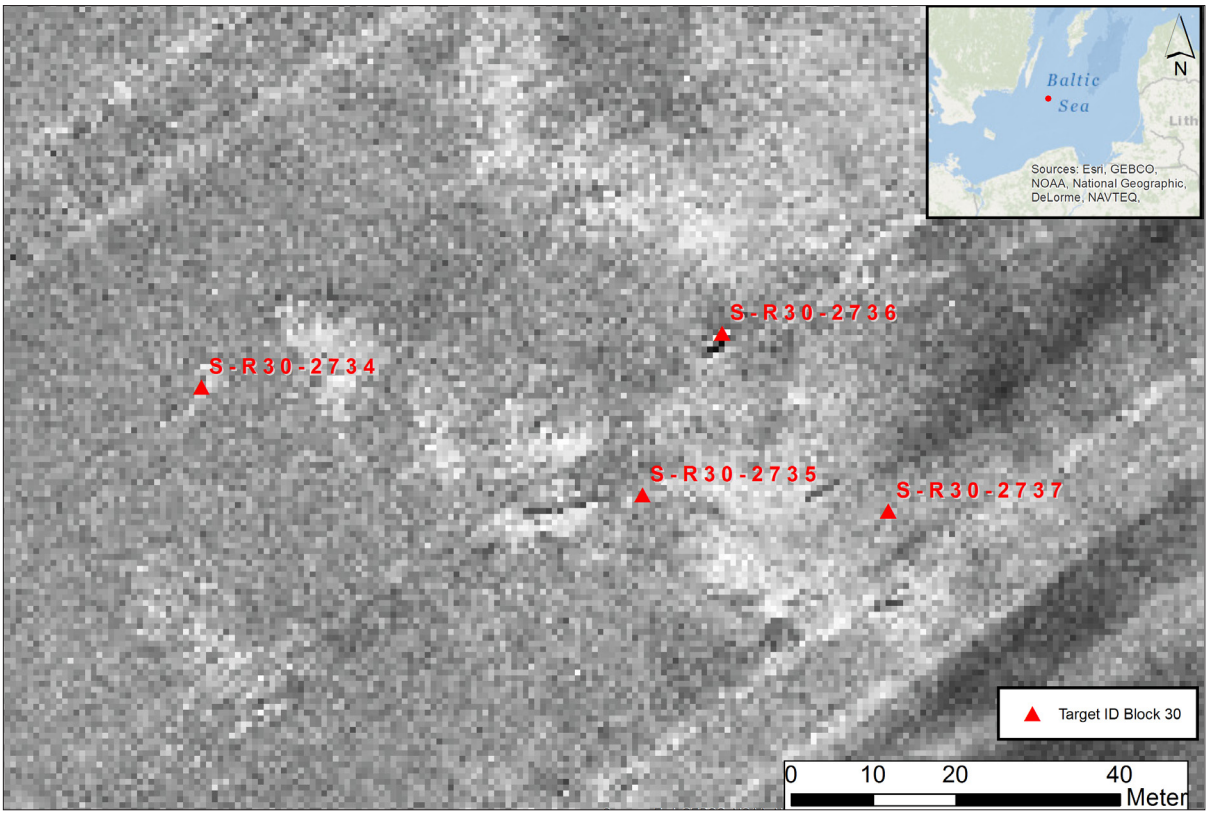


Fig. 25. Sonar mosaic map over the area around wreck S-R30-2737. © ESRI and Fugro, edited by Mikael Fredholm, Maritime Museum.

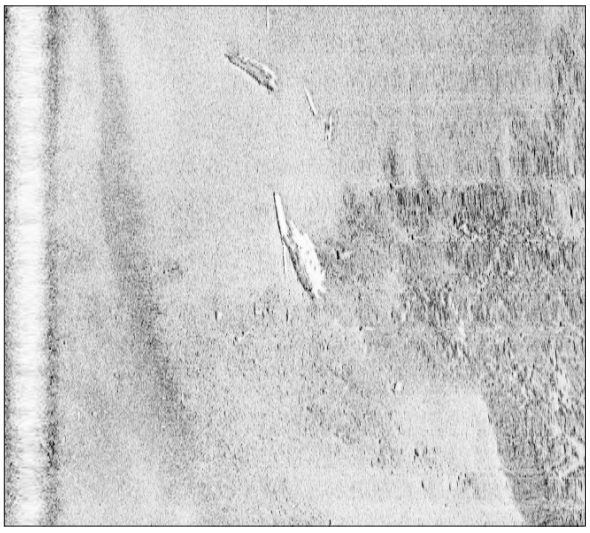


Fig. 26. Sonar image of wreck S-R30-3018 and possible debris © Fugro.

object outside the hull that could be the rudder (fig. 22). The size and shape (bathymetry) of the wreck is similar to the investigated fluit ship Jutholmsvraket from around 1700 (Eriksson 2010), but it might also be a galiot from 18–19th century, that also had similar shapes like the fluit ships. The degree of composition also indicates that the wreck is likely to be older than 1850. The wreck is therefore a possible cultural monument.

S-R30-2712

According to the sonar image it seems to be a broken wooden wreck. The associated wreck debris are within 50 meter from the wrecks center position.

S-R30-2737

This is probably a broken wreck with indications of wreck debris (S-R30-2734, S- R30-2735 and S-R30-2736). It is probably a wooden wreck and therefore a possible cultural monument. According to the sonar image the wreck seems to have associated debris close by and scattered up to around 100 meters away from the actual wreck (see fig. 25). 80 meters to southwest is indication S-R30-3018, that might be another wreck or parts of the same wreck as S-R30-2737. Based solely on the sonar images it's not certain if all "wreck debris" are from the same wreck, it could as well be pieces of one or more wrecks. Before the status of all the possible debris is clear (i.e.

ROV-inspection) SMM recommend an offset of 50 meter to each indication.

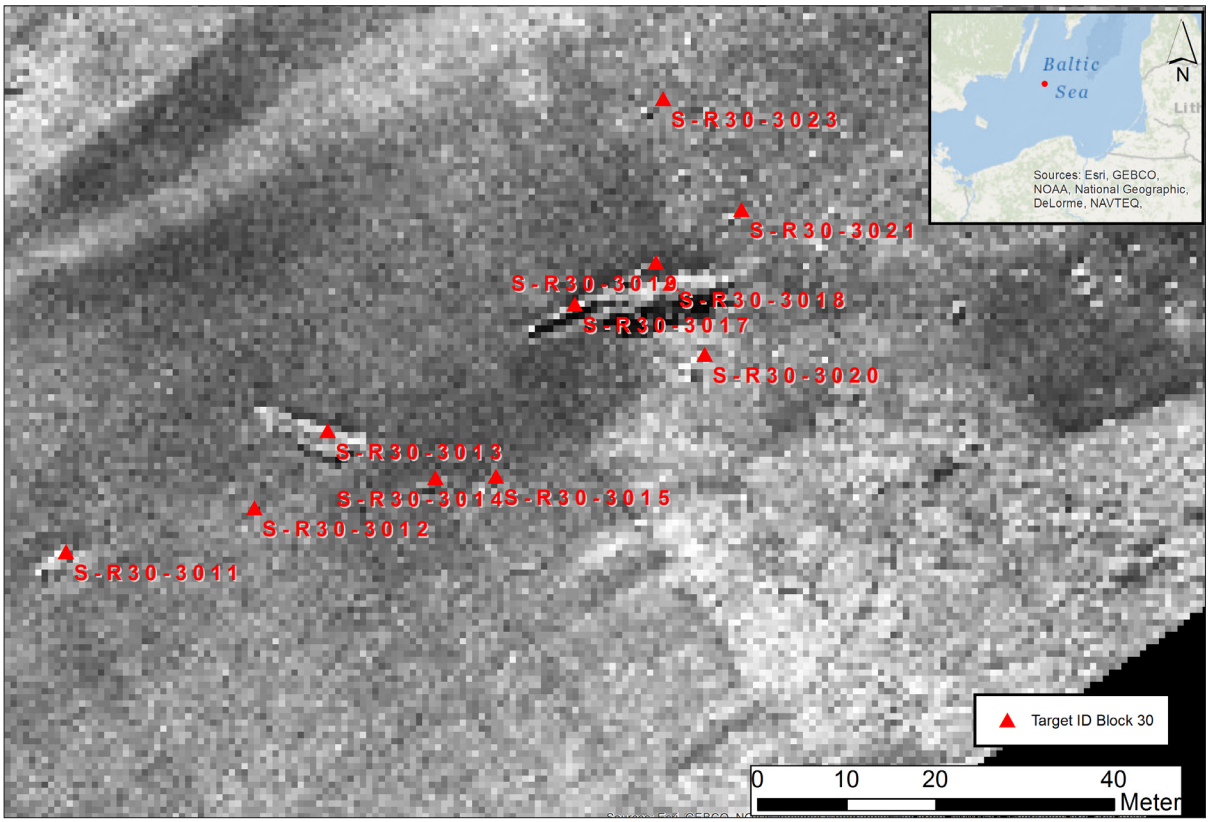


Fig. 27. Sonar mosaic map over the area around wreck S-R30-3018. © ESRI and Fugro, edited by Mikael Fredholm, Maritime Museum.

S-R30-3018

A wreck area with debris S-R30-3011 to S-R30-3023. Based solely on the sonar images it is not clear if all "wreck debris" are from the same wreck. 80 meter to the northwest is indication S-R30-2737 that might be another wreck or parts of the same wreck as S-R30-3018. It could be one or more wrecks. Until the status of all the possible wreck debris is clear (i.e. ROV-inspection) SMM recommend an offset of 50 meter to each indication.

Block 31

There is one confirmed wreck in this block, S-R31-1707, one possible wreck, S-R31-2293 and eight other indications of potential cultural value (see appendix 1).

S-R31-1707

This is the wreck R32-92558 from Nord Stream (Fredholm 2010: page 29) but the wreck is now called S-R31-1707 by Fugro. Associated wreck debris are S-R31-1706 to S-R31-1726 and S-R31-1862 to S-R31-1872.

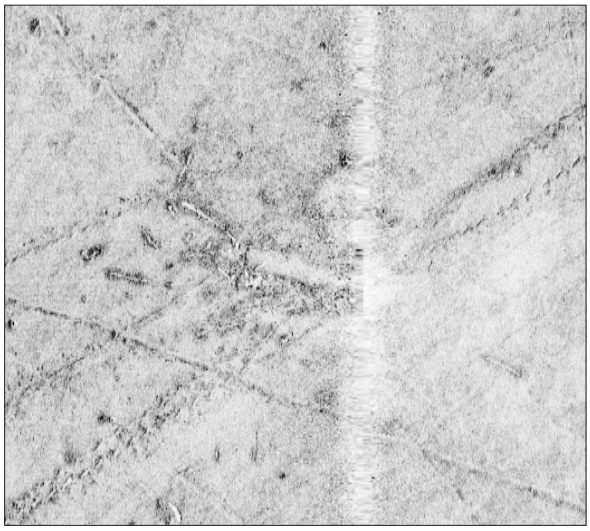


Fig. 28. Sonar image of wreck S-R31-1707 and wreck debris around the indication. There are also trawl scars in the bottom. © Fugro.

The earlier ROV documentation determined that it is a carvel-built vessel of wood. The wreck

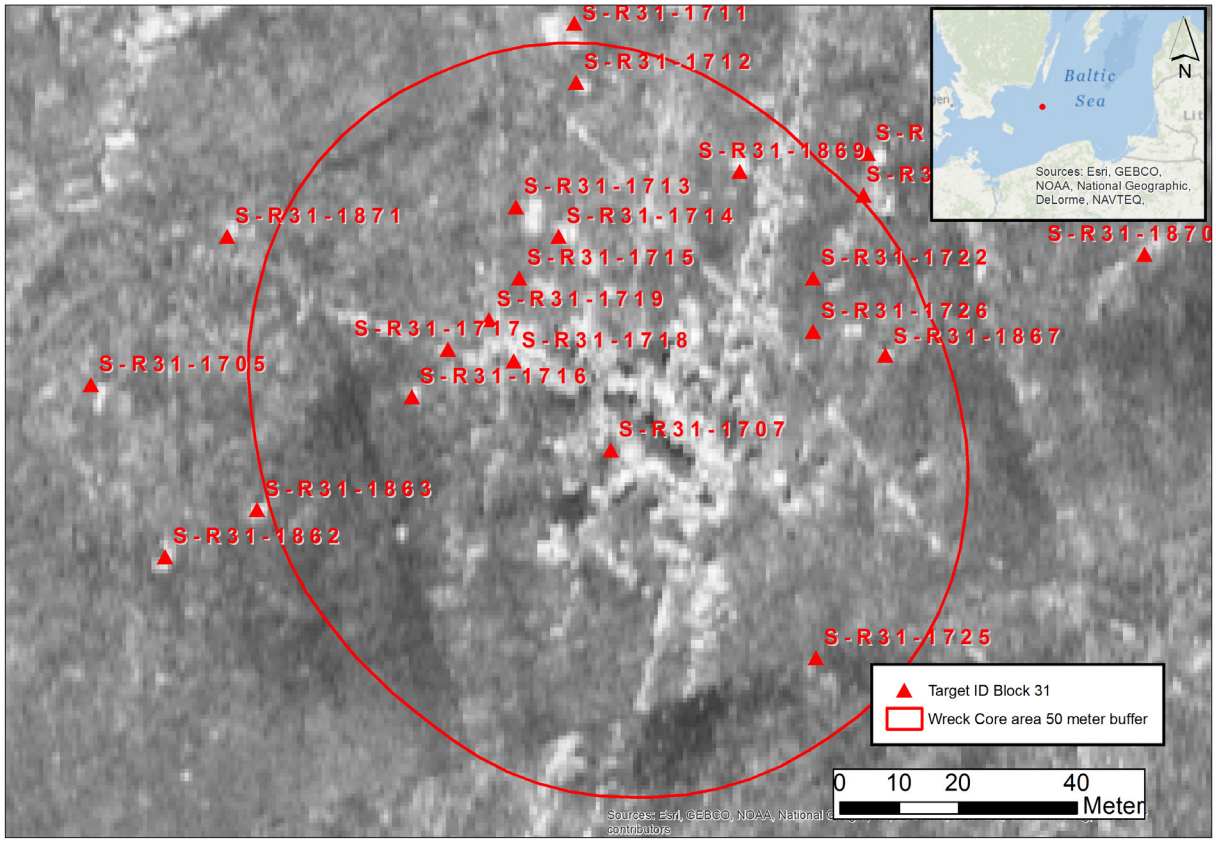


Fig. 29. Sonar mosaic map over the area around wreck S-R31-1707. Core area is the in 2010 agreed 50 meter protection area. © ESRI and Fugro, edited by Mikael Fredholm, Maritime Museum.

Fig. 30. Sonar image of possible wreck S-R31-2293.

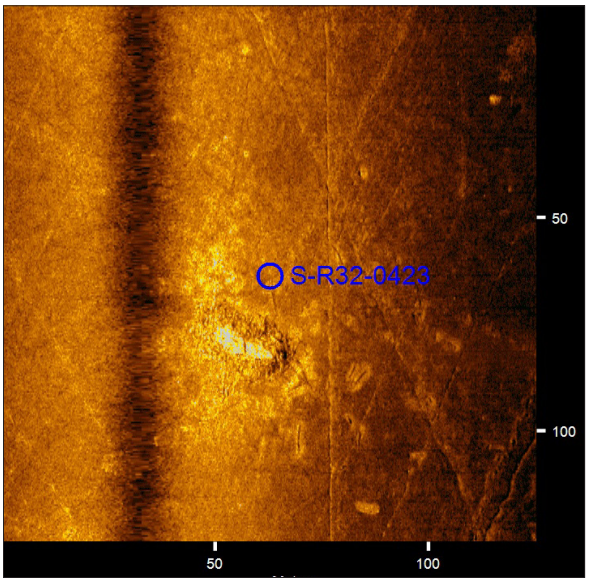


Fig. 31. Sonar image of wreck S-R32-0423 and possible wreck debris around the indication. There are also trawl scars in the bottom. © Fugro, edited by Mikael Fredholm, Maritime Museum.

is degraded and has probably been damaged by trawling. It is spread over an area of approximately 140 × 160 meter, but the main wreckage area is about 30 meters (NW–SE) × 15 meters (SO–NE). Among the wreckage it was possible to discern some bottles – one could be dated to the period 1720–1750 and one to 1720–1780. The windlass has a carved wreath and is typologically dated to

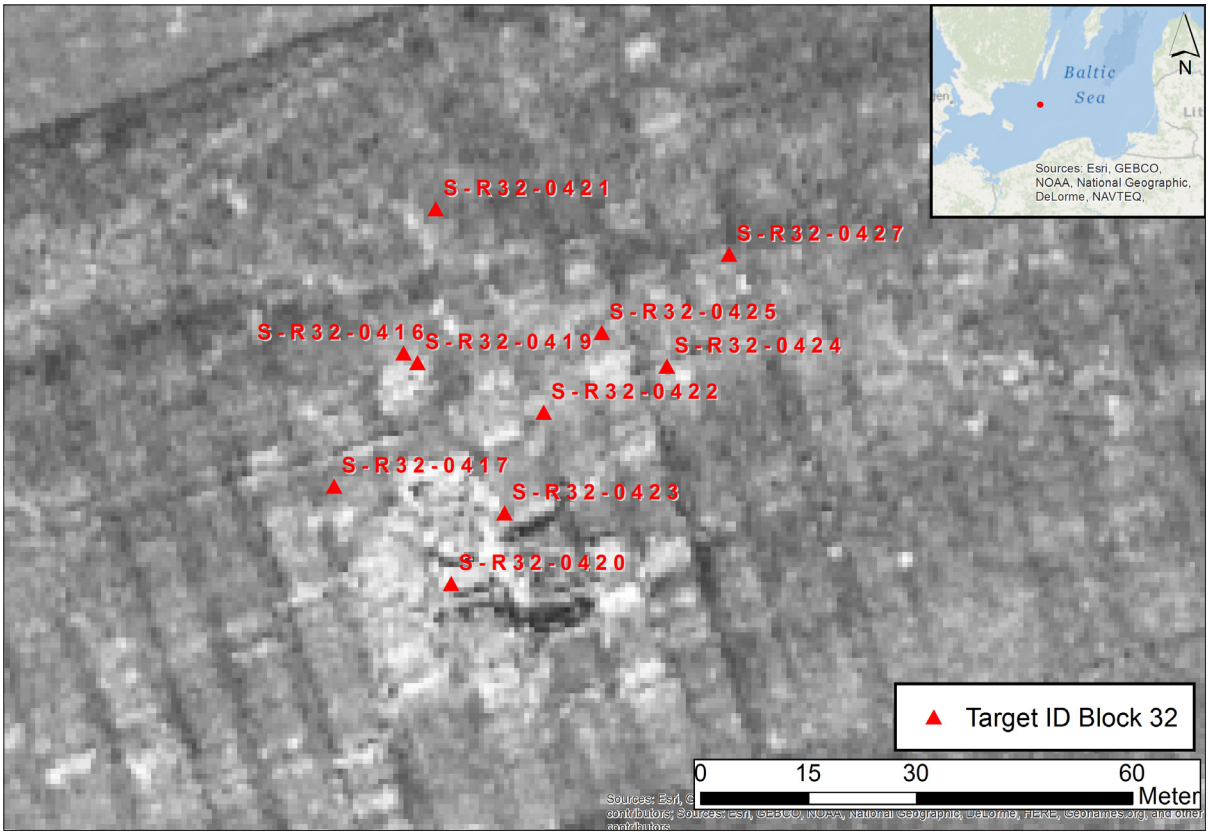


Fig. 32. Map over the area around wreck S-R32-0423 and the possible wreck debris. © ESRI and Fugro, edited by Mikael Fredholm, Maritime Museum.

18th century, same as the bottles. Everything indicates that the ship have foundered in the 18th century (Fredholm 2010: page 29). The wreck corresponds to the definitions in the Swedish Heritage Conservation Act (1988: 950) as a cultural monument. In 2010 after the ROV-inspections Nord Stream and SMM agreed to protect a 50 meter core area of the wreck S-R31-1707 (R-32-92558) as shown in fig. 29. This is now SMM's proposed offset to the pipeline.

S-R31-2293

The indication is an 18 meter long wreck formed shape.
Around the indication there are possible trawl scars in the bottom. ©Fugro.

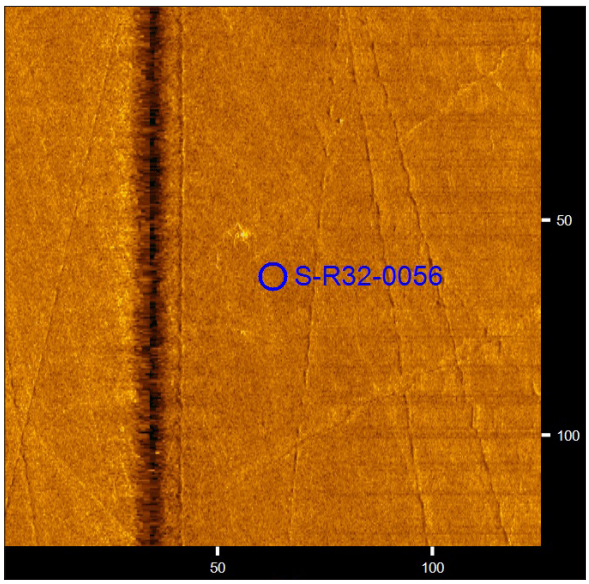


Fig. 33. Sonar image of sonar indication S-R32-0056. Around the indication there are possible trawl scars in the bottom. © Fugro.

Block 32

SMM's analysis has singled out 19 indications, one is a distinct wreck (S-R32-0423) and nine indications are possible associated wreck debris. There are also nine other indications of potential cultural value (see appendix 1).

S-R32-0423

A wreck area with possible wreck debris S-R32-0416 to S-R32-0427 (fig. 32). Until the status of all the possible wreck debris is clear (i.e. ROV-inspection) SMM recommend an offset of 50 meter to each indication.

S-R32-0056

A 19 meter long and diffuse indication, that might be a wire as Fugro describes it, but the shape of the indication can be interpreted as wreck formed atherefore of potential cultural value (fig. 33).

Conclusion

The indications listed in appendix 1 is recommended by SMM for ROV-inspection and analysis to determine their cultural value. Until these sonar indications of potential cultural value are confirmed or removed from the list SMM suggest a 50 meter pipeline and anchoring offset to each indication to protect the possible cultural monuments.

For the possible scattered wrecks like S-R30-3018 and S-R-32-0423 SMM suggest that the wrecks and the associated debris is ROV-inspected. If then the debris is concluded as not highly significant for the understanding and dating of the wrecks SMM might recommend a protected core area like for the wreck S-R31-1707 (R32- 92558 in 2010).

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Printed sources

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Fredholm, Mikael, 2010. *Gasledning genom Östersjön: arkeologisk analys av ankringskorridoren, Östersjön, svensk ekonomisk zon*. Stockholm: Sjöhistoriska museet.

Unprinted sources

Riksantikvarieämbetet (National Heritage Board), 2012, *Rekommendationer för marinarkeologisk sonarkartering*. Stockholm: Riksantikvarieämbetet.

MMT 2016a *Wreck report S-R24-5317*, Västra Frölunda: MMT. MMT 2016b *Wreck report S-R30-0997*, Västra Frölunda: MMT.

Nord Stream, 2009, *Nord Stream wreck report No 100667. ID S-29-93462*.

Maps

© ESRI

Internet sources

FMIS Riksantikvarieämbetet (National Heritage Board), www.fmis.raa.se Kulturmiljölagen (Swedish Heritage Conservation Act 1988:950), http://www.raa.se/lagar-och-stod/kml-kulturminneslagen/

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Place: Baltic Sea, Swedish Economic Zone Type of Investigation: Archaeological analysis
Cause of the survey: Construction of gas pipeline Client: Nord Stream 2
Swedish National Maritime Museums ref: 5.3.1-2016-433 Nord Stream 2 ref: W-PE EIA PSE SOW-800-CULHEREN-01
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GIS / measurement data are archived at the National Maritime Museums servers.

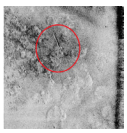
Participant in the work, SMM

Mikael Fredholm.

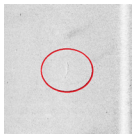
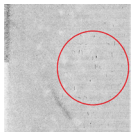
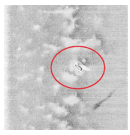
Appendix 1

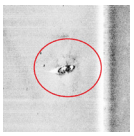
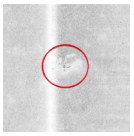
Sonar indications with potential cultural value

Block 17

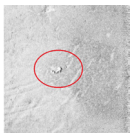
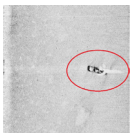
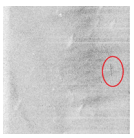
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R17-3360	117,8	19,8	10,4	Wreck		Wreck	1	50
S-R17-0374	19,2	1,2	0,1	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R17-4285	22,1	9,3	3,2	Wreck		Wreck	1	50

Block 19

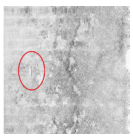
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R19-0202	12,7	0,4	0,1	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R19-0368	64,2	12,2	7,8	Wreck		Wreck	1	50
S-R19-0449	97,5	71,36	0	Debris		An area with several indications	2	50
S-R19-0998	8,2	3,0	1,0	Wreck		Wreck	1	50
S-R19-1025	8,1	0,2	0	Linear object		A linear indication that might be a wreck part or other man made object	3	50

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R19-1026	17,8	7,7	2,6	Wreck		Wreck	1	50
S-R19-1140	6,2	2,1	0,4	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R19-1213	9,7	11,4	0,0	Debris		an area of indications, possible wreck	2	50

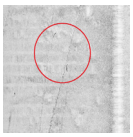
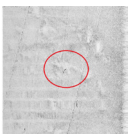
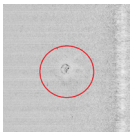
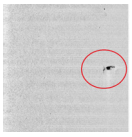
Block 20

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R20-0260	8,1	5,7	0,6	Debris		debris or wreck debris	2	50
S-R20-0276	16,4	5,4	2,5	Wreck		Wreck	1	50
S-R20-328	11,6	0,4	0,0	Linear object		A linear indication that might be a wreck part or other man made object	3	50

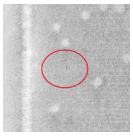
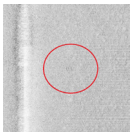
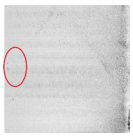
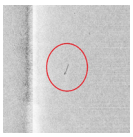
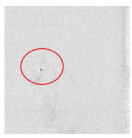
Block 21

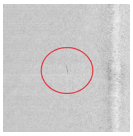
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R21-0277	9,7	0,2	0,2	Linear object		A linear indication that might be a wreck part or other man made object	3	50

Block 22

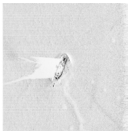
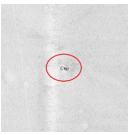
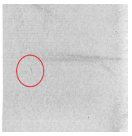
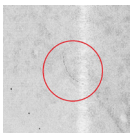
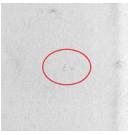
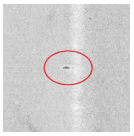
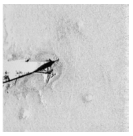
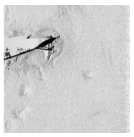
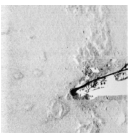
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R22-375	7,4	0,4	0,1	Linear debris		A linear indication that might be a wreck part or other man made object. 70m NE is S-R22-376, that's a similar type of indication	3	50
S-R22-376	0,7	0,6	0,2	Linear debris		A linear indication that might be a wreck part or other man made object. 70m SW is S-R22-375, that's a similar type of indication	3	50
S-R22-535	10,5	9,6	0,2	Debris		Indication that might be a wreck or other man made object.	3	50
S-R22-592	7,3	3,0	1,1	Debris		Indication that might be a wreck or other man made object.	3	50

Block 23

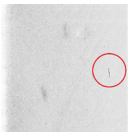
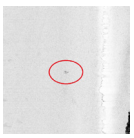
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R23-0050	12,4	0,4	0,1	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R23-1883	4,1	0,4	0,2	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R23-2725	12,3	0,4	0,0	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R23-2817	10,8	0,8	0,1	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R23-2864	3,0	1,3	0,6	Debris		Indications that might be a wreck or other man made object	2	50
S-R23-5866	6,9	0,9	0,0	Linear object		A linear indication that might be a wreck part or other man made object	3	50

S-R23-5997	9,8	0,6	0,0	Linear object		A linear indication that might be a wreck part or other man made object	3	50

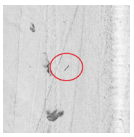
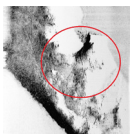
Block 24

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R24-0735	25,6	6,6	5,7	Wreck		Wreck known to SMM since 2010	1	50
S-R24-0966	8,4	3,5	0,0	Debris		Item that might be a wreck part or other man made object	3	50
S-R24-5024	6,9	0,2	0,0	Linear Object		Item that might be a wreck part, timber or other man made object	3	50
S-R24-5067	37,0	0,7	0,4	Linear Object		A line of indications that might be a fragmented wreck or other man made object	2	50
S-R24-5105	9,7	7,1	0,1	Linear Object		Two indications that might be a fragmented wreck or other man made object	2	50
S-R24-5242	12,2	2,6	0,2	Debris		Item that might be a wreck part, possible ballast stones or other man made object	3	50
S-R24-5317	85	10	8	Wreck		Wreck	1	50
S-R24-5318	2,4	1,2	0,1	Debris		Wreck debris from S-R24-5317	2	50
S-R24-5389	6,7	4,8	1,2	Debris		Wreck debris from S-R24-5317	2	50

Block 25

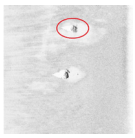
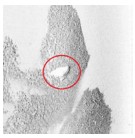
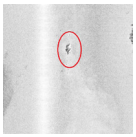
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R25-6130	9,6	0,7	0,1	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R25-7738	4,3	2,6	0,0	Debris		Item that might be a wreck part, possible ballast stones or other man made object	3	50

Block 26

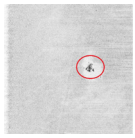
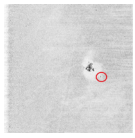
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R26-0169	10,5	0,2	0,2	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R26-0446	5,8	0,5	0,2	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R26-0941	34,0	8,2	4,0	Wreck		Wreck	1	50
S-R26-0942	23,3	0,3	0,1	Linear object		possible wreck debris	3	50
S-R26-1912	41,2	0,0	0,0	Linear object		possible wreck debris	2	50
S-R26-1915	23,2	0,6	0,2	Linear object		possible wreck debris	2	50

Block 27

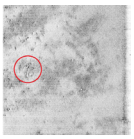
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R27-0148	16,2	4,0	2,1	Mound		Possible wreck	1	50

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R27-0158	6,3	4,8	1,5	Mound		Item that might be a wreck part, possible ballaststones or other man made object	3	50
S-R27-0159	3,0	3,3	0,9	Mound		Item that might be a wreck part, possible ballaststones or other man made object	3	50
S-R27-0640	12,4	3,6	2,2	Wreck		Possible wreck	1	50
S-R27-0743	15,3	0,6	0,0	Debris		Item that might be a wreck part, possible ballaststones or other man made object	2	50
S-R27-5026	13,7	6,5	1,4	Debris		Item that might be a wreck part, possible ballaststones or other man made object	3	50
S-R27-5051	20,1	4,7	1,7	Wreck		Possible wreck	1	50

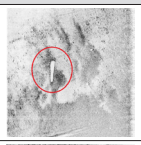
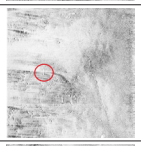
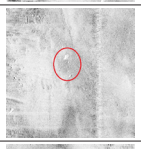
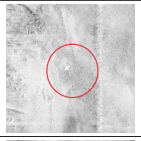
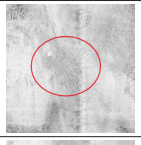
Block 28

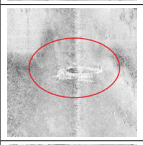
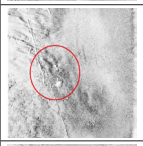
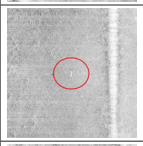
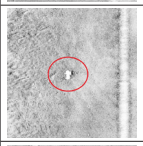
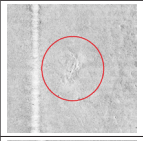
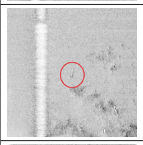
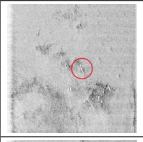
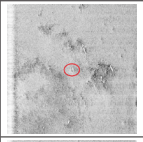
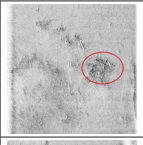
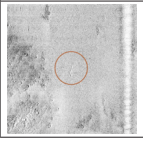
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R28-5301	13,1	3,2	0,9	Debris		Item that might be a wreck part, possible ballast stones or other man made object	3	50
S-R28-5297	20,0	5,1	4,4	Wreck		Wreck	1	50
S-R28-5046	1,0	1,0	0,3	Wreck		Wreck known since previous Nord Stream project.	1	50
S-R28-5047	1,8	1,2	0,2	Same as S-R28-5046		Possible wreck part	1	50

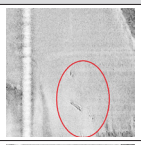
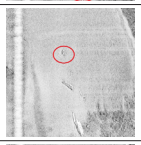
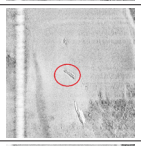
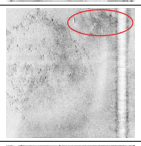
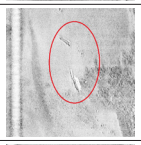
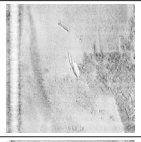
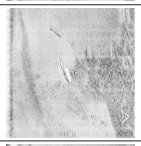
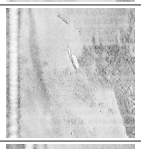
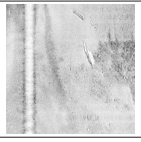
Block 29

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R29-0641	12,2	0,9	1,5	Debris		Item that might be a wreck part, possible ballast stones or other man made object	3	50
S-R29-1434	8,5	0,4	0,0	Linear object		A linear indication that might be a wreck part or other man made object	3	50

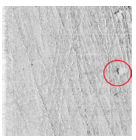
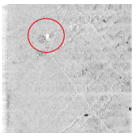
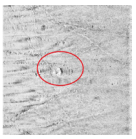
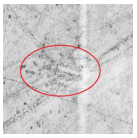
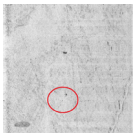
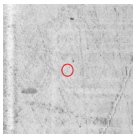
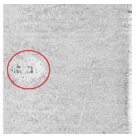
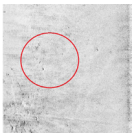
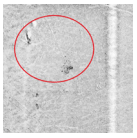
Block 30

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R30-0266	20,7	1,8	0,7	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R30-0583	11,8	1,2	0,2	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R30-0606	6,5	0,4	0,1	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R30-0608	6,8	0,8	0,6	Linear object		Possible wreck debris	3	50
S-R30-0609	10,0	1,0	0,5	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R30-0610	4,9	0,6	1,0	Linear object		Possible wreck debris	3	50
S-R30-0611	7,0	0,6	0,4	Linear object		Possible wreck debris	3	50
S-R30-0612	66,6	0,6	0,3	Linear object		Possible wreck debris	3	50
S-R30-0613	5,5	0,7	0,2	Linear object		Wreck debris	2	50

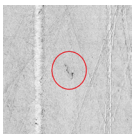
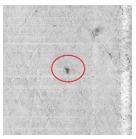
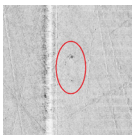
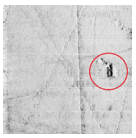
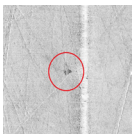
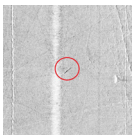
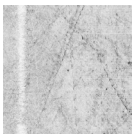
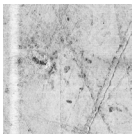
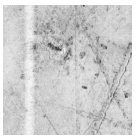
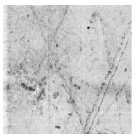
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R30-0614	4,8	0,8	0,7	Linear object		Wreck debris	2	50
S-R30-0615	43,6	12,9	0,0	Wreck		Wreck	1	50
S-R30-0859	133,3	0,4	0,2	Linear object		Possible wreck or wreck debris	3	50
S-R30-0997	24,4	7,0	2,1	Wreck		Wreck	1	50
S-R30-1448	6,1	0,4	0,4	Linear object		A linear indication that might be a wreck part or other man made object	3	50
S-R30-2326	8,4	4,6	1,6	Mound		Indication that might be a wreck, ballast stones	2	50
S-R30-2712	34,3	16,9	0,8	Wreck		Wreck	1	50
S-R30-2734	8,9	0,2	0,1	Linear object		Wreck debris	2	50
S-R30-2735	10,3	0,5	0,3	Linear object		Wreck debris	2	50
S-R30-2736	4,1	0,7	0,4	Linear object		Wreck debris	2	50
S-R30-2737	26,9	16,3	0,3	Wreck		Wreck	1	50
S-R30-2747	13,8	0,3	0,3	Linear object		A linear indication that might be a wreck part or other man made object	3	50

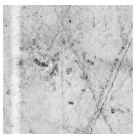
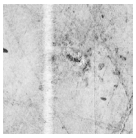
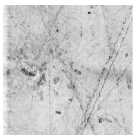
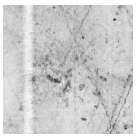
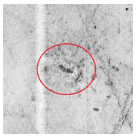
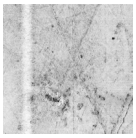
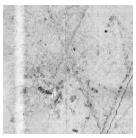
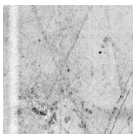
Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R30-3011	4,6	0,6	0,2	Linear object		Wreck debris	2	50
S-R30-3012	4,9	0,4	0,1	Linear object		Wreck debris	2	50
S-R30-3013	12,4	3,1	0,3	Debris		Wreck debris	2	50
S-R30-3014	7,1	0,5	0,1	Linear object		Wreck debris	2	50
S-R30-3015	5,7	1,1	0,2	Debris		Wreck debris	2	50
S-R30-3016	3,1	0,9	0,3	Debris		Wreck debris	2	50
S-R30-3017	9,4	0,6	0,3	Linear object		Wreck debris	2	50
S-R30-3018	13,9	2,5	0,8	Wreck		Wreck	1	50
S-R30-3019	7,4	0,6	0,1	Linear object		Wreck debris	2	50
S-R30-3020	2,1	0,9	0,0	Debris		Wreck debris	2	50
S-R30-3021	2,6	0,4	0,1	Debris		Wreck debris	2	50
S-R30-3023	2,3	0,8	0,4	Debris		Wreck debris	2	50

Block 31

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R31-1370	9,9	7,4	0,7	Mound		a mound, could be stones, bedrock or possible ballast stones from a wreck	3	50
S-R31-1409	1,9	1,0	0,0	Debris		an area of debris or possible wreck debris	2	50
S-R31-1518	10,5	15,6	1,1	Mound		a mound, could be stones, bedrock or possible ballast stones from a wreck	3	50
S-R31-1583	6,3	2,7	0,5	Mound		a mound, could be stones, bedrock or possible ballast stones from a wreck	3	50
S-R31-1707	34,0	13,8	0,0	Wreck		A known wreck since previous Nord Stream project.	1	50
S-R31-2291	2,0	0,6	0,1	Linear Object		possible wreck debris	2	50
S-R31-2292	6,1	0,4	0,0	Linear Object		possible wreck debris	2	50
S-R31-2293	18,3	6,8	0,3	Wreck		wreck	1	50
S-R31-2296	2,7	0,9	0,2	Debris		possible wreck debris	2	50
S-R31-2297	13,3	11,2	0,0	Debris		possible wreck debris	2	50

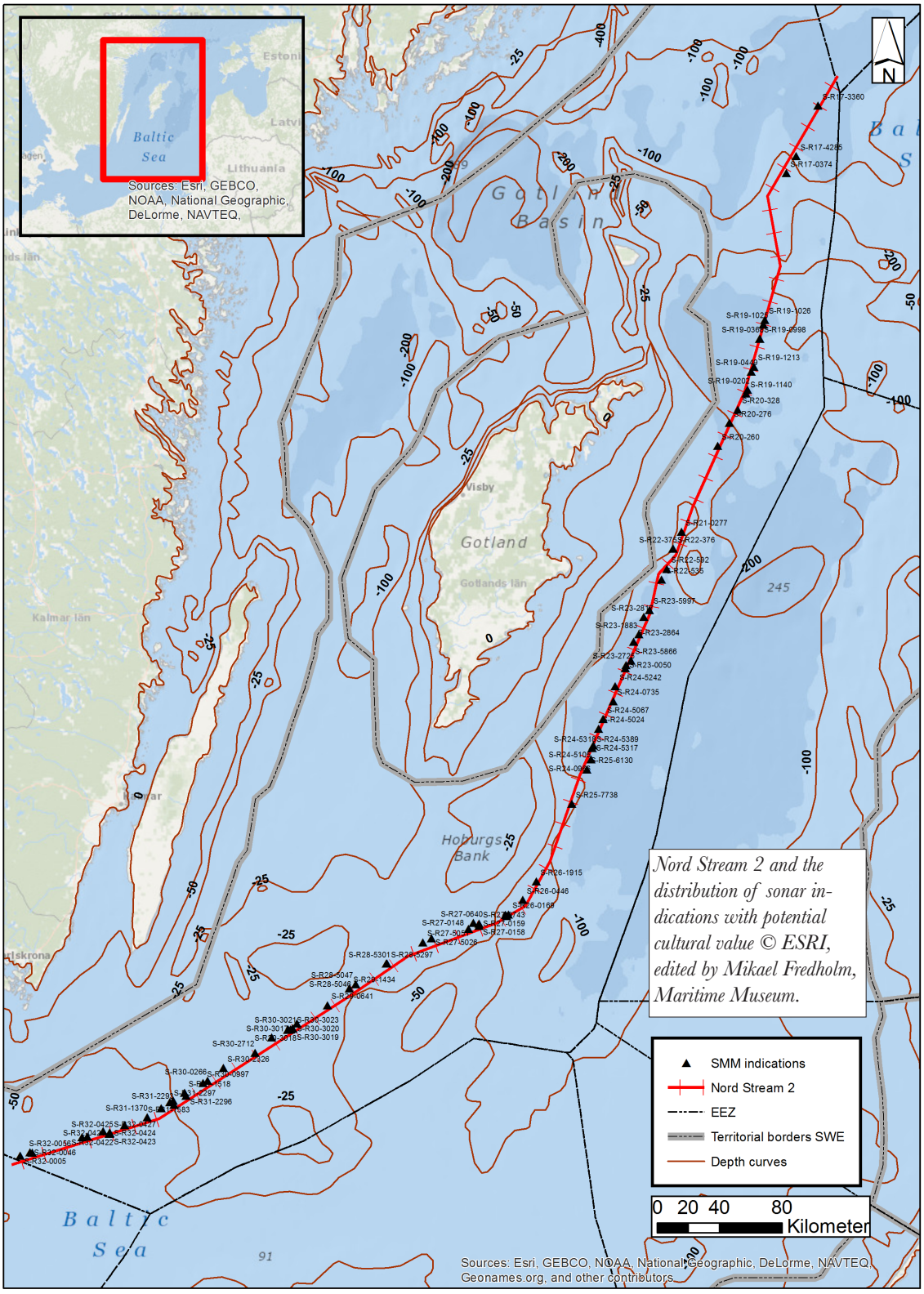
Block 32

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Classification*	*Recommended offset (from center position)*
S-R32-0005	12,7	0,5	0,0	Linear Object		Debris or wreck	2	50
S-R32-0046	6,6	2,7	0,0	Sonar Contact		could be stones/ballaststones	2	50
S-R32-0056	19,1	0,2	0,0	Debris		wreck formed shape	2	50
S-R32-0196	11,9	5,3	0,6	Mound		debris, wreck or wreck debris	3	50
S-R32-0250	8,0	5,1	0,0	Sonar Contact		debris, wreck or wreck debris	3	50
S-R32-0378	8,4	0,8	0,0	Linear Object		linear object, possible wreck debris	3	50
S-R32-0414	3,2	0,6	0,1	Linear Object		Possible associated with wreck S-R32-0423	3	50
S-R32-0415	1,7	1,7	0,1	Boulder		Possible associated with wreck S-R32-0423	3	50
S-R32-0416	6,1	1,8	0,0	Debris		Possible associated with wreck S-R32-0423	3	50
S-R32-0417	7,8	1,3	0,1	Debris		Possible associated with wreck S-R32-0423	3	50
S-R32-0418	1,7	0,8	0,1	Debris		Possible associated with wreck S-R32-0423	3	50

Target ID	*Length, m*	*Width, m*	*Height, m*	*Object Type (FUGRO)*	*Image*	*SMM Description*	*SMM Clas-sification*	*Recommended offset (from center position)*
S-R32-0419	3,8	1,4	0,0	Debris		Possible associated with wreck S-R32-0423	3	50
S-R32-0420	4,0	1,1	0,3	Debris		Possible associated with wreck S-R32-0423	3	50
S-R32-0421	2,3	1,4	0,0	Debris		Possible associated with wreck S-R32-0423	3	50
S-R32-0422	1,1	0,8	0,3	Debris		Possible associated with wreck S-R32-0423	3	50
S-R32-0423	27,0	10,8	1,3	Wreck		Wreck	1	50
S-R32-0424	1,3	0,4	0,1	Debris		Possible associated with wreck S-R32-0423	3	50
S-R32-0425	5,3	1,9	0,0	Debris		Possible associated with wreck S-R32-0423	3	50
S-R32-0427	2,8	1,5	0,1	Debris		Possible associated with wreck S-R32-0423	3	50

Appendix 2

Overview map of the sonar indications with potential cultural value



Nord Stream 2

Planning and surveys are ongoing for the new gas pipeline Nord Stream 2, which will run in parallel with the gas pipeline Nord Stream. Fugro Survey LTD. has been commissioned by Nord Stream 2 to conduct geophysical surveys, including side scan sonar.

The Maritime Museum, a part of the Swedish National Maritime Museums (SMM), has during 2016 on an inquiry from Nord Stream 2 performed an archaeological analysis of sonar data from the planned pipeline route and anchoring corridor in the Swedish economic zone (EEZ). The width of the surveyed area is 2 km and the length about 510 kilometers.

SMM has analysed the group of side scan sonar indications chosen by Fugro to be possible man-made and 118 indications has been deemed as of potential cultural value. SMM recommend ROV inspection of the indications if they can't be avoided by the pipeline or anchoring/ construction within 50 meters of the indications.

23 indications are classified as distinct wrecks, 36 indications could be broken and fragmented wrecks and 59 single indications might be part of wrecks or other man- made objects.

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