IMPULSIVE NOISE SOURCES (D11.1)

Activities in the Danish EEZ reported for 2017 to the ICES impulsive noise register

Technical Report from DCE – Danish Centre for Environment and Energy No. 140 2019

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Data sheet

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Abstract: EU member states are required to record and report impulsive underwater noise sources according to the Marine Strategy Framework Directive. Denmark fulfils this obligation through reporting of activities to the joint impulsive noise register, maintained by ICES. This report describes the activities reported for Danish marine waters in the calendar year 2017.

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1. Foreword

This report presents the data reported by Denmark to the ICES impulsive noise registry for the calendar year 2017. This reporting is part of the obligations of the EU Marine Strategy Framework Directive, which requires the member states to report and assess the environmental status with respect to emission of energy, including underwater noise, to the marine environment (MSFD descriptor 11). This report covers the indicator D11C1, impulsive noise. The reporting is also part of the reporting to HELCOM and OSPAR, as part of their monitoring programs for the Baltic and the North Sea, respectively.

The purpose of the report is to present the data in summary form passed on to the ICES registry, including comments not previously reported together with the data. The report thus serves as a background reference to the data in the ICES registry. The ICES registry should be consulted directly for access to the submitted data. No evaluation of the data has been performed, i.e. the possible effects of the reported activities on the environmental status of the Danish waters have not been assessed.

2. Indicator D11C1 in Danish waters

The Marine Strategy Framework Directive requires reporting of impulsive noise sources, which fulfil the criteria of being a) below 10 kHz in frequency and b) have the possibility to detrimentally affect marine life (European Commission, 2008). Selection and classification of impulsive sources in Danish waters has been conducted in accordance with the guidance provided in Dekeling et al. (2014). These guidelines operate with five different categories of impulsive noise. The data collection procedure for each of the categories is outlined below.

2.1 Airgun arrays

Seismic surveys with airgun arrays are classified into four different magnitude classes.

Table 2.1. Classification of seismic air gun surveys according to Dekeling et al. (2014).

Magnitude	Source level (zero-to-peak pressure)
Very_low	209-233 dB re 1 µPa·m
Low	234-243 dB re 1 µPa·m
Medium	244-253 dB re 1 µPa·m
High	> 253 dB re 1 µPa·m

Information about seismic surveys in the Danish EEZ was obtained from the permitting authorities: the Danish Energy Agency and the Danish Ministry of Foreign Affairs.

One survey was conducted with a single, moving airgun (ALCOR). The activity is reported at the level of ICES-subrectangles for each active day. No information is available about the number of shots fired per square per day.

2.2 Explosions

Underwater explosions are classified into five different magnitude classes.

Table 2.2. Classification of explosions according to Dekeling et al. (2014).

Magnitude	Equivalent TNT mass
Very_low	8 g to 210 g
Low	220 g - 2.1 kg
Medium	2.11 kg - 21 kg
High	22 kg - 210 kg
Very_high	> 210 kg

No explosions are reported to the registry for 2017. This only reflects that no information about explosions was supplied by the Danish Navy or other relevant bodies. It is very likely that numerous underwater explosions were conducted in 2017, connected with UXO (unexploded ordnance) clearance, navy training and civilian construction activities.

2.3 Impact pile driver

Impact pile driving is classified into four different magnitude classes, based on the hammer energy. Furthermore, it is noted whether mitigation measures in the form of sound reduction (air bubble curtains or other) where used.

Table 2.3. Classification of impact pile driving according to Dekeling et al. (2014).

Magnitude	Hammer impact energy
Very_low	< 280 kJ
Low	290 kJ - 2.80 MJ
Medium	2.81 - 28 MJ
High	> 28 MJ

Impact pile driving was reported from one activity: construction of the Horns Reef 3 offshore wind farm (HR3). Air bubble curtains (Big Bubble Curtain, see Nehls and Bellmann, 2016) were used during pile drivings and sound measurements were made on a selected number of pilings. Activities are reported as individual positions.

2.4 Sonar and acoustic deterrents

Sonars (under 10 kHz) and acoustic deterrent devices (for example seal scarers; under 10 kHz) are classified into four different magnitude classes, based on the source level.

Table 2.4. Classification of sonars and acoustic deterrents according to Dekeling et al. (2014).

Magnitude	Source level (zero to peak pressure)[1]
Very_low	176-200 dB re 1 µPa·m
Low	201-210 dB re 1 µPa·m
Medium	211-220 dB re 1 µPa·m
High	> 220 dB re 1 µPa·m

One activity reported the use of sonars below 10 kHz: MSM62 (presumably sub-bottom profiling) of magnitude **high**, but no additional details are provided.

2.5 Other impulsive noise sources

Impulsive sound sources not covered under the four categories above are reported under the category *Generic impulsive sources* and classified into four magnitude classes based on the source energy flux density.

Table 2.5. Classification of other impulsive sources according to Dekeling et al. (2014).

Magnitude	Source level (energy flux density)
very_low	186-210 dB re 1 μPa^2m^2s
low	211-220 dB re 1 μPa^2m^2s
medium	221-230 dB re 1 μPa^2m^2s
high	> 230 dB re 1 μPa^2m^2s

[1] The unit is not stated in Dekeling et al. (2014), but presumed to be zero-to-peak pressure to be consistent with the other categories.

Two activities reported the use of other impulsive sources: ALCOR (sparker) and VHN / VHS (likely sparker, boomer or pinger, but no details given). Activities are reported as ICES subrectangles (ALCOR) and positions (VHN / VHS).

2.6 Overview of reported data

The total contribution of impulse-block days (one day with activity in one ICES subsquare) reported is illustrated in figure 2.1. Note that some activities reported several types of activities or magnitudes on the same day and same area, and that different activities may have occurred in the same block on the same date. This means that the total impulse block-days (177) is smaller than the grand sum of all contributions (207 impulse block-days).

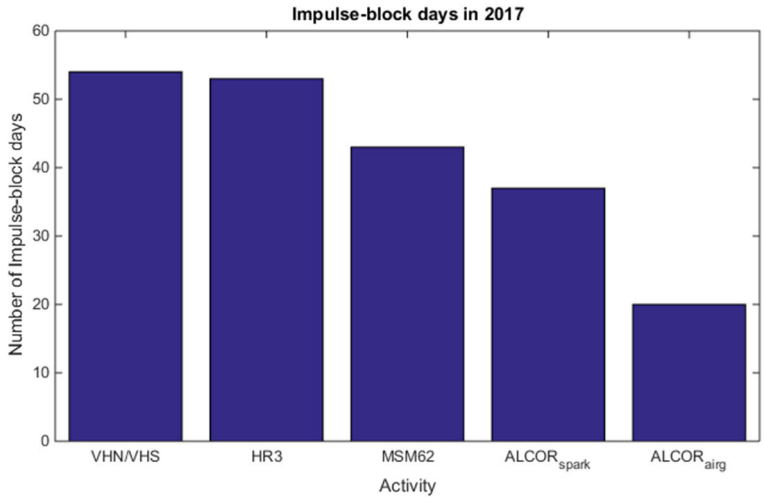


Figure 2.1. Overview of the impulse-block days reported from the Danish EEZ in 2017, divided on activities. Note that some activities may have occurred on the same day in the same block, which means that the total impulse-block days for the Danish EEZ is smaller than the sum of all entries.

Figure 2.2 shows the distribution of impulse block-days with date and the two clusters of activity in late spring and autumn also reflect the two seismic surveys.

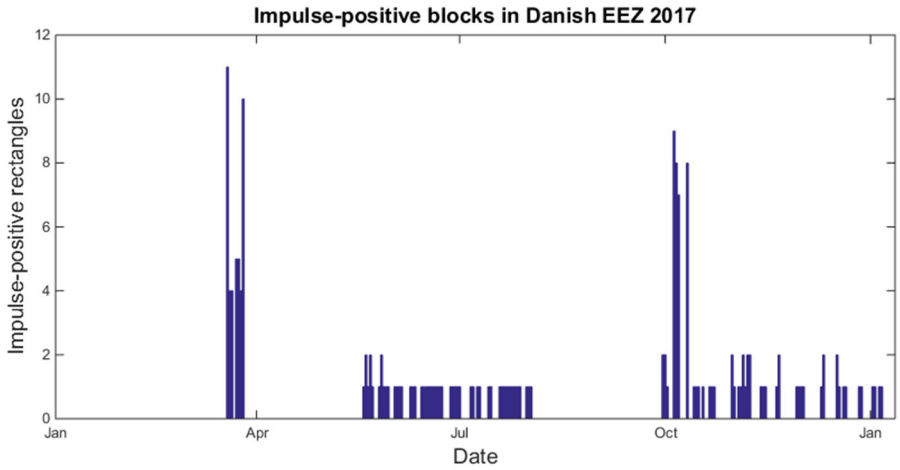


Figure 2.2. Distribution of impulse block-days by date in 2017. Note that 4 impulse-block days in January 2018 are included.

Figure 2.3 shows the 49 ICES subrectangles where activities were recorded in 2017.

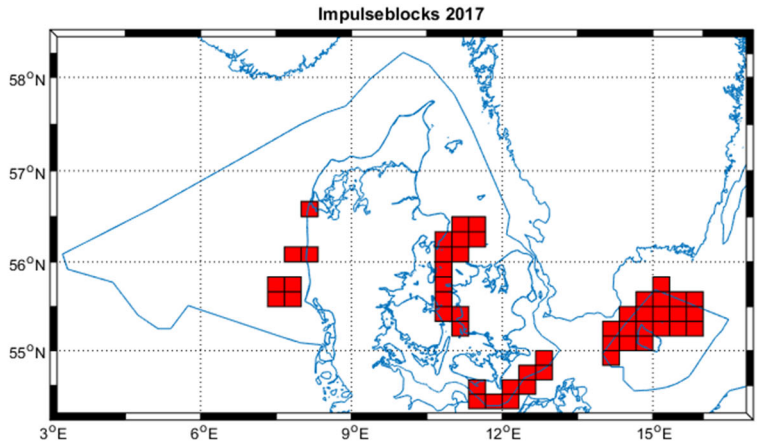


Figure 2.3. Map showing ICES subrectangles, where impulsive noise events were recorded in 2017.

2.7 Possible underreporting

The registry relies on submission of accurate information from permit holders (seismic operators, offshore contractors, etc.) to permitting agencies and that this information is passed on to the Environmental Protection Agency. The procedures for this reporting is still under development and some underreporting is unavoidable.

No large-scale seismic surveys with large airgun arrays were conducted in the Danish EEZ in 2017. Some activities in neighbouring EEZs may have passed briefly through Danish EEZ (during line turns), but not likely. Smaller surveys conducted with single airguns or very small arrays for short periods without a permit are not included, as there is no mechanism to secure reporting of these activities.

The reported figures for impact pile driving are considered accurate for larger pile driving (such as offshore wind turbine foundations), but permitting and reporting mechanisms for smaller pile drivings, in particular in connection to small construction works on harbour piers etc., are under development and very difficult to implement in an efficient way. No such activities are reported for 2017, which is very unlikely to reflect realities.

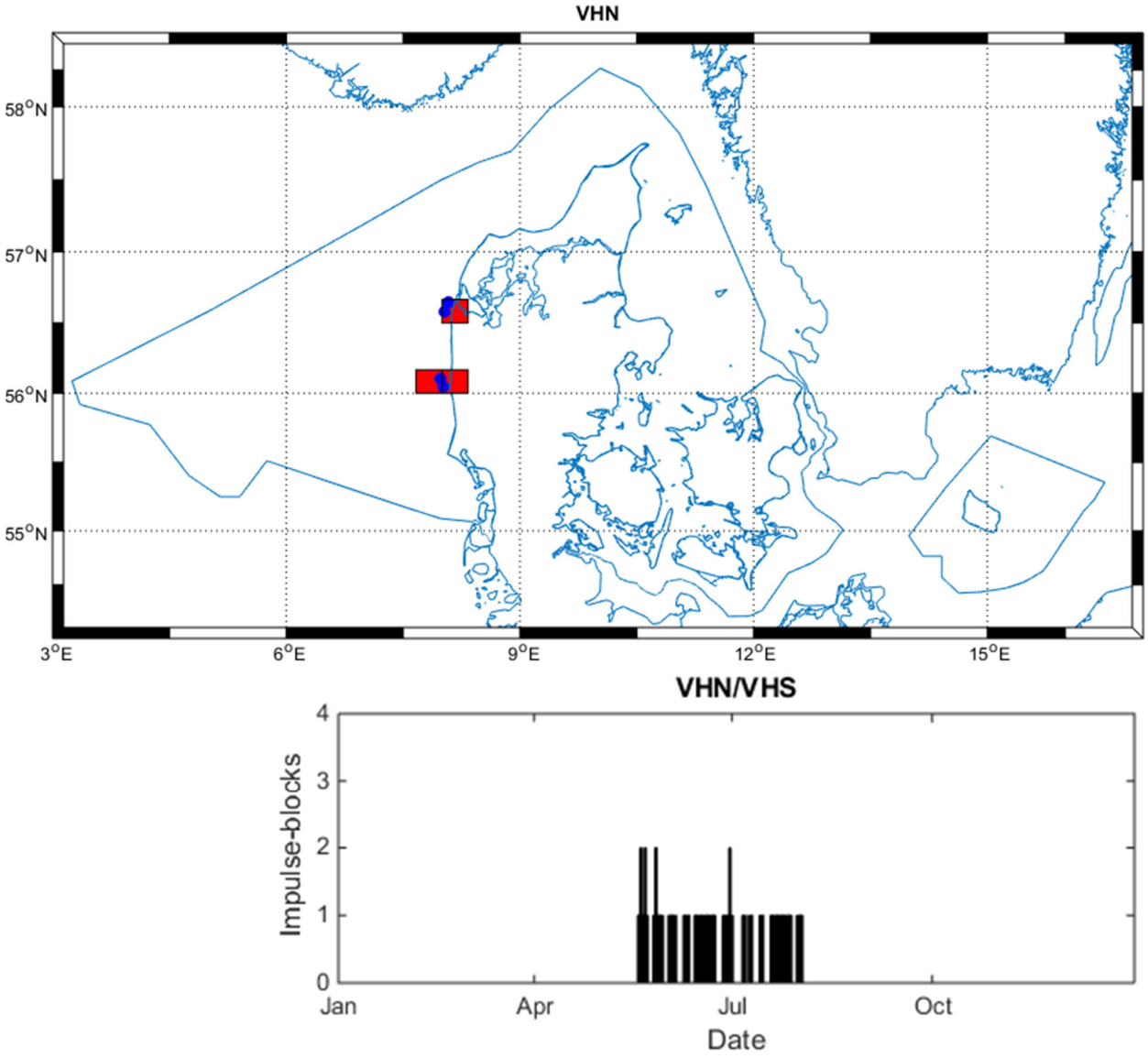
The reported absence of underwater explosions is most certainly incorrect. There is at present no permitting procedure for civilian underwater explosions that can serve as a source of information and the Navy is not obliged to report activities according to the MSFD and has not reported activities for 2017.

The reported figures for sonars and acoustic deterrents is likely too low. The Danish Navy possess sonars that are covered by the MSFD (frequency below 10 kHz), but as for explosions, military activities are granted an exception from reporting requirements in the MSFD and are presently not reported. Acoustic deterrents (seal scarers etc.) covered by the MSFD (frequency below 10 kHz) are not considered to be used in the Danish EEZ.

The reported figures for other impulsive sources are subject to uncertainty. The primarily relevant sources for this category are various equipment for sub-bottom profiling, such as pingers, sparkers and boomers. As there is a permitting procedure for such surveys, the reported figures likely reflects the actual activities in 2017, although some non-permitted activities may have been missed.

3. Reported activities

3.1 VHN/VHS



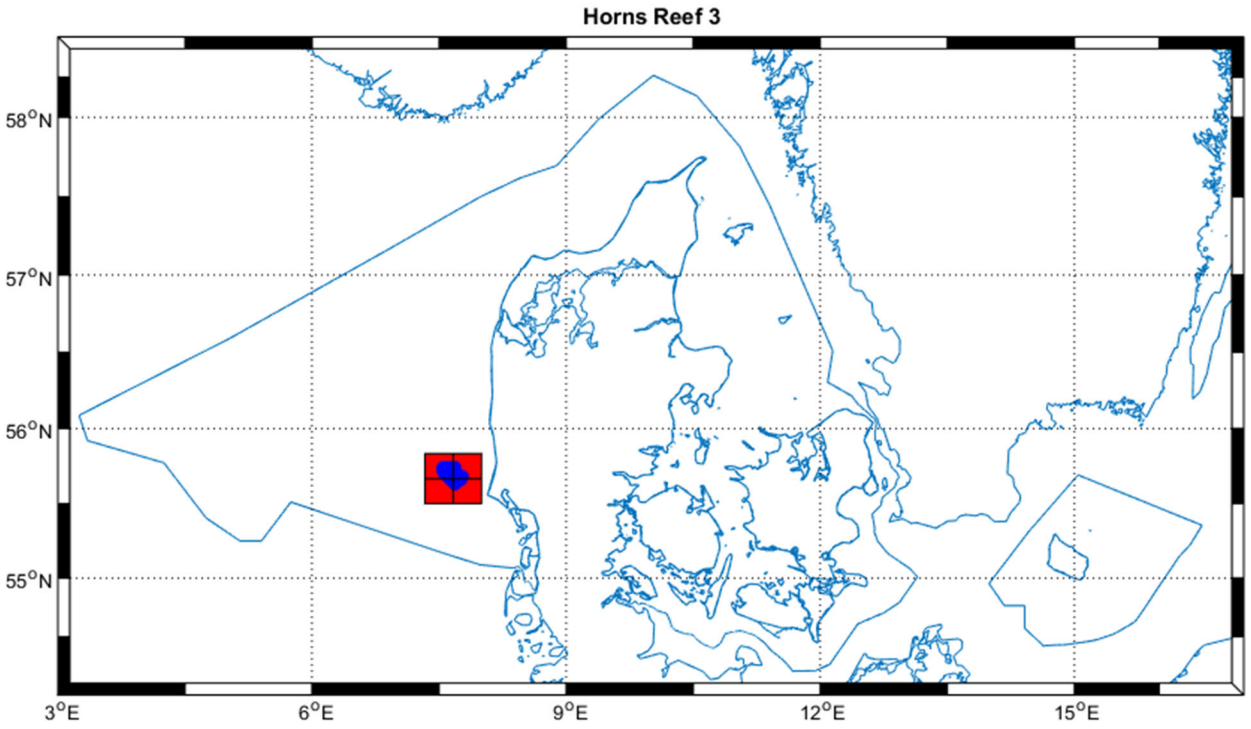
Subbottom profiling with magnitude **very low**. Conducted between 19.5.2017 and 2.8.2017. Source level given as 187 dB re. 1 µPa²s, 221 dB re. 1 µPa peak. 55 impulse-block days, distributed across three ICES subrectangles.

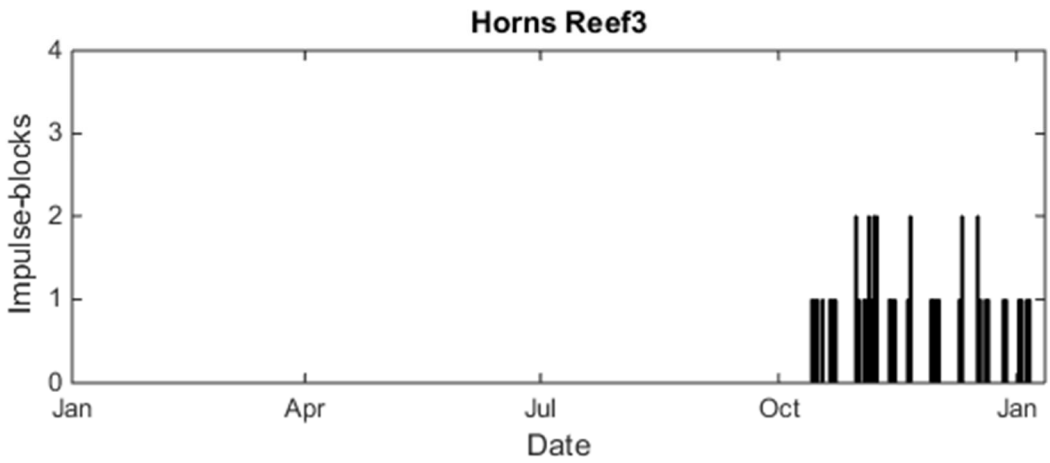
Table 3.1. Summary of impulse-block days

ICES subrectangle	Impulse-block days
41F79	22
41F83	10
42F83	22
Grand Total	**54**

Notes: Entry no 8 – date changed from 30.6.2017 to 30.5.2017

3.2 Horns Reef 3





Pile driving of magnitude low (2500 kJ hammer energy), mitigated by means of a bubble curtain (Big Bubble Curtain). Conducted in period from 14.10.2017 to 5.1.2018. In total 49 impulse-block days in 2017, 4 impulse-block days in 2018, distributed over four ICES subrectangles.

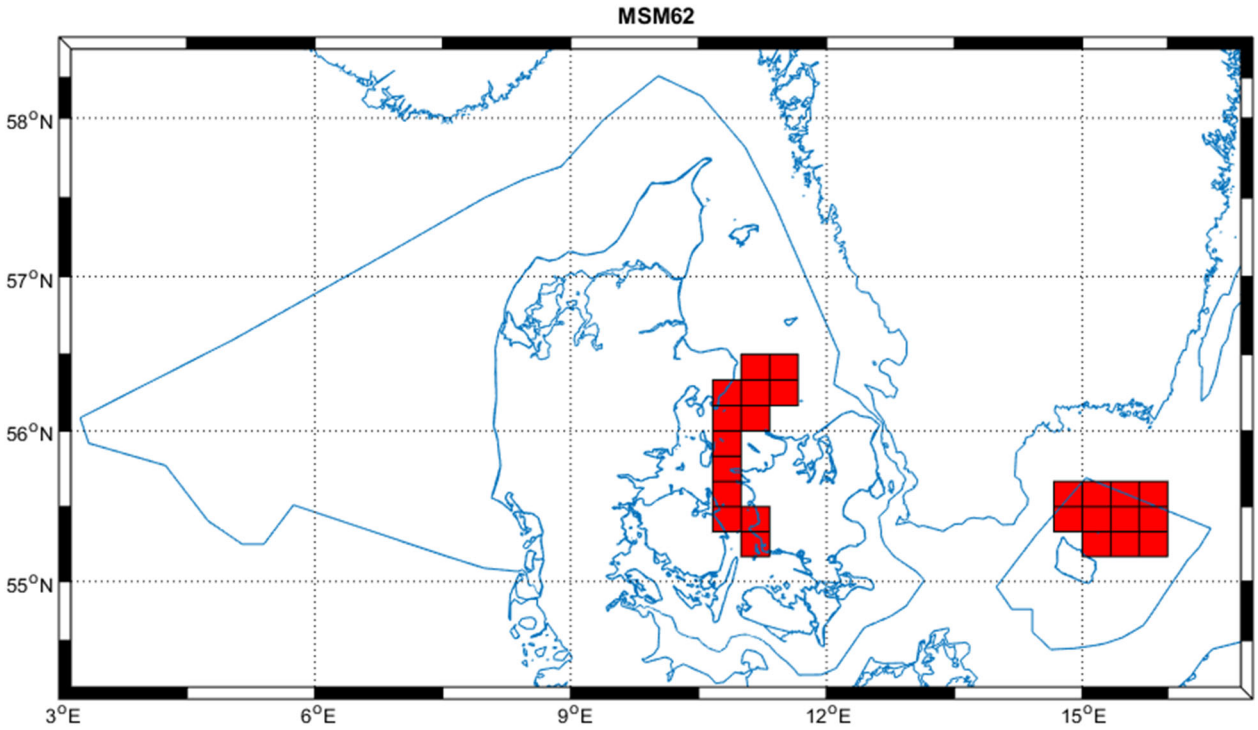
Table 3.2. Summary of impulse-block days in 2017 and January 2018.

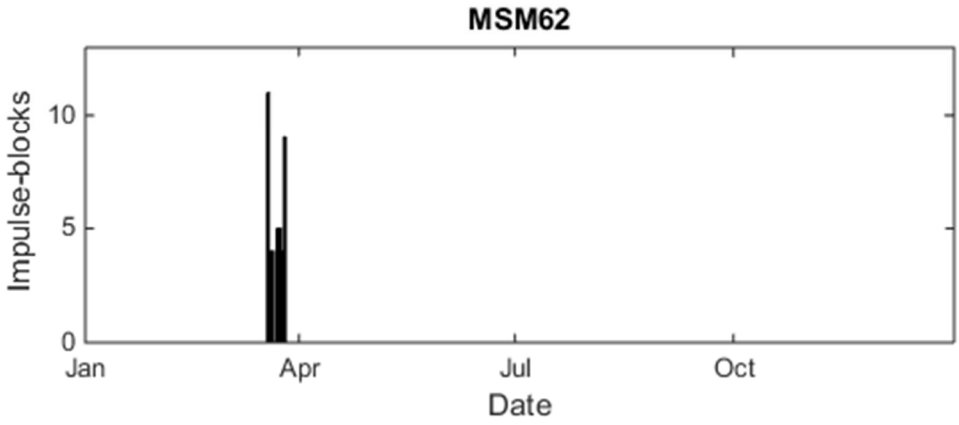
ICES subrectangle	Impulse-block days
40F75	20
40F76	1
40F78	15
40F79	7
Grand Total	**53**

Notes: Four pilings were conducted in January 2018 and included in this submission.

Information about pile driving in connection to construction of transformer platform has not been supplied and is thus not reported.

3.3 MSM62





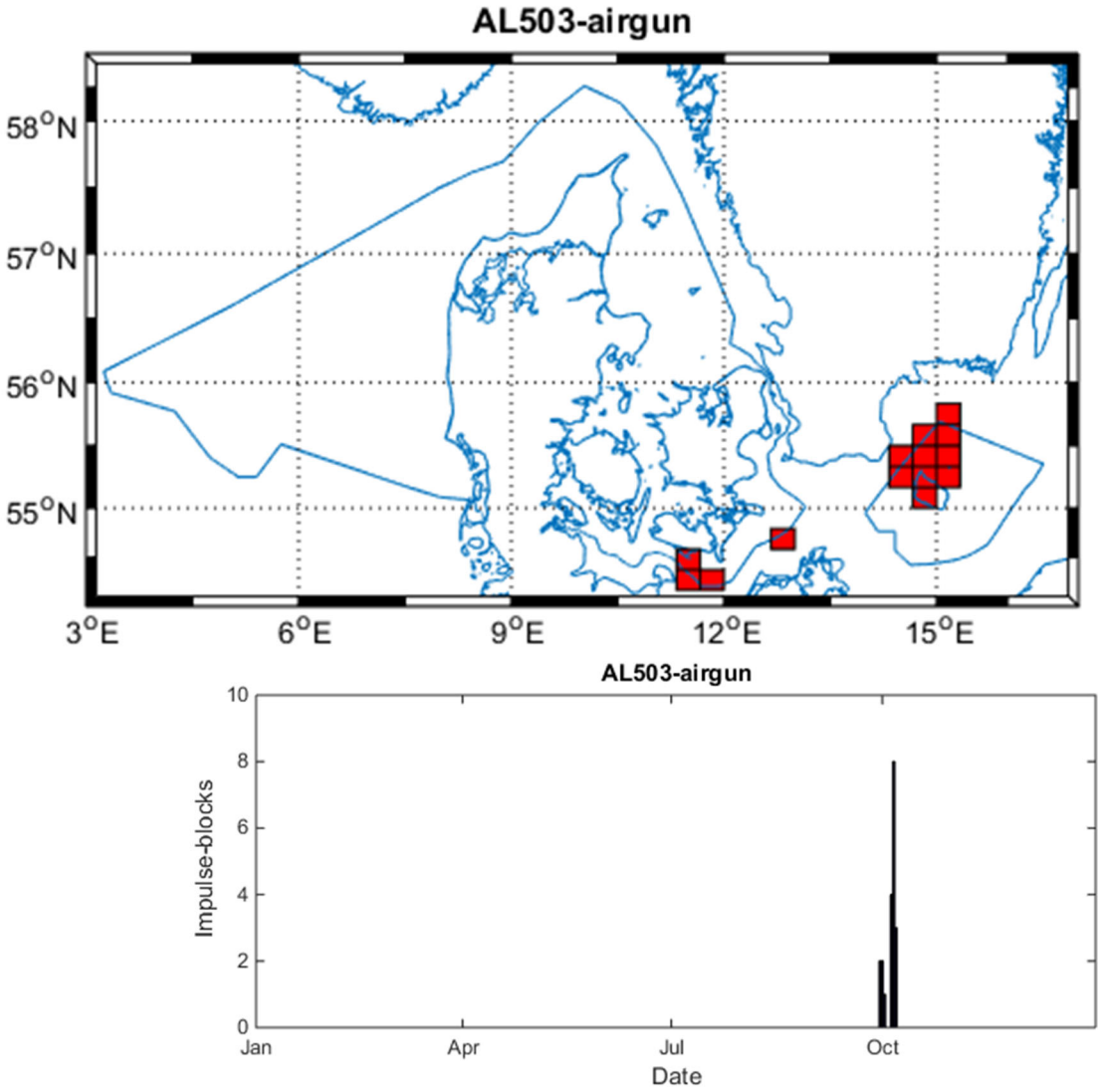
Acoustic survey conducted between 19.3.2017 and 26.3.2017. Type of source not specified further than “Sonar”, of magnitude “high”. A total of 43 impulse-block days distributed across 24 ICES sub-rectangles.

Table 3.3. Summary of impulse-block days

ICES subrectangle	Impulse-block days
39G07	2
39G11	2
39G12	1
39G47	1
39G51	3
39G52	3
39G54	3
39G55	3
39G57	1
39G58	1
40G07	2
40G08	2
40G09	2
40G49	1
40G53	1
40G56	1
40G59	1
41G08	1
41G09	2
41G11	2
41G12	3
41G13	2
41G14	2
41G15	1
Grand Total	**43**

Notes: Entry #5 changed from 40G47 to 39G47 (original entry in Swedish EEZ).

3.4 ALCOR – airgun

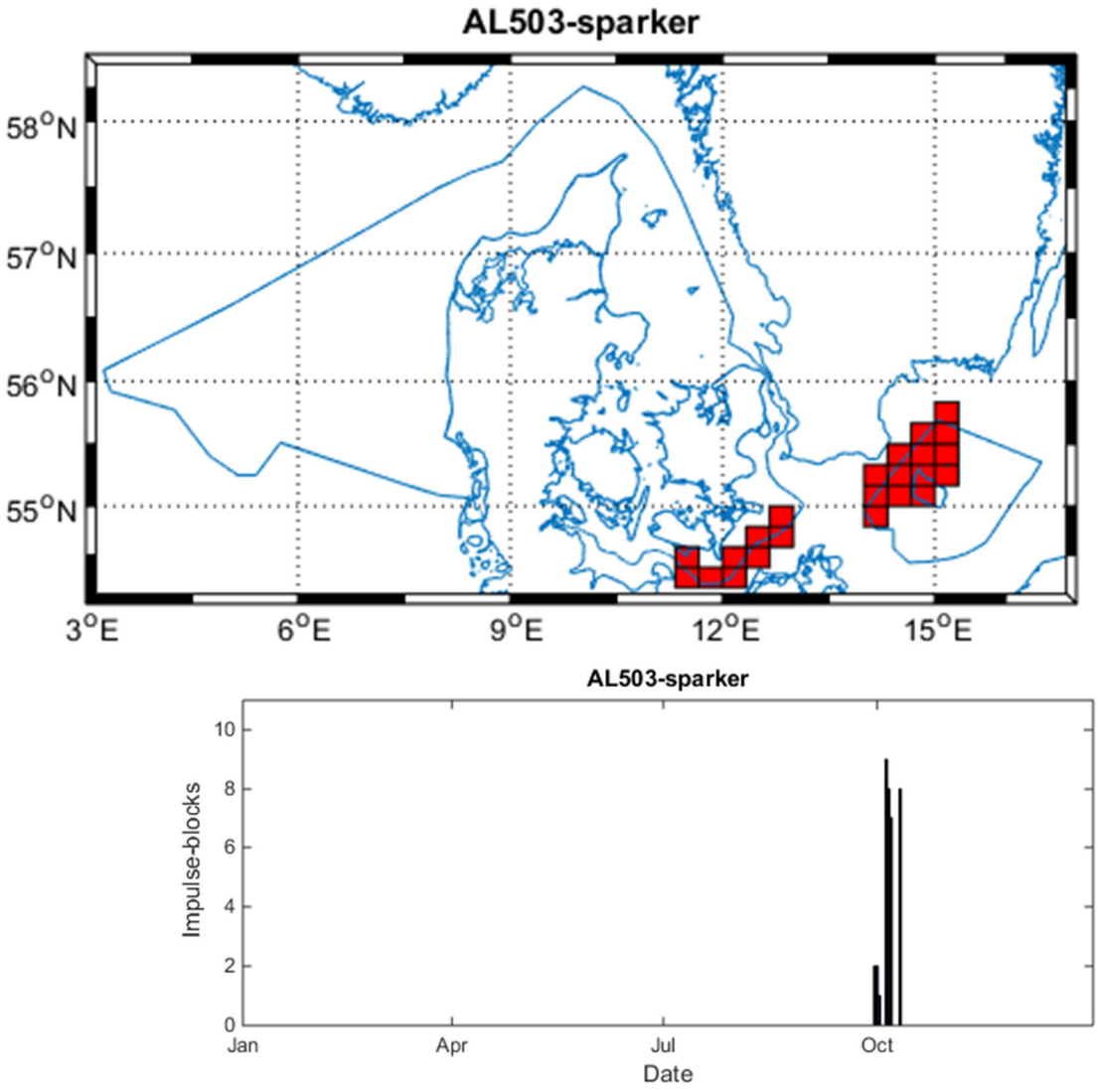


Subbottom profiling with single small airgun (minigun) of magnitude very low. Conducted between 30.9.2017 and 7.10.2017 with a total of 20 impulse-block days.

Table 3.4. Summary of impulse-block days

ICES subrectangle	Impulse-block days
37G14	2
37G17	1
38G16	1
38G28	1
39G44	2
39G45	1
39G47	3
39G48	1
39G49	1
39G51	1
39G52	1
40G49	2
40G52	1
40G53	2
Grand total	20

3.5 ALCOR - sparker



Subbottom profiling with sparker 8Innomar SES-2000 medium) of magnitude high. Conducted between 30.9.2017 and 11.10.2017 with a total of 37 impulse-block days.

Table 3.5. Summary of impulse-block days.

ICES subrectangle	Impulse-block days
37G14	3
37G17	2
37G21	1
38G16	1
38G23	1
38G25	1
38G26	1
38G27	1
38G28	2
38G41	2
39G42	1
39G43	2
39G44	2
39G45	2
39G46	2
39G47	3
39G48	1
39G49	1
39G51	1
39G52	1
40G49	2
40G52	2
40G53	2
Grand Total	**37**

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