IMPULSIVE NOISE SOURCES (D11.1)

Activities in the Danish EEZ reported for 2018 to the ICES impulsive noise register

Technical Report from DCE – Danish Centre for Environment and Energy No. 197 2021

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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 2019.

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Contents

1 Foreword

This report presents the data reported by Denmark to the ICES impulsive noise registry for the calendar year 2019. 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). The report covers criterion 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 passed on to the ICES registry in summary form, including comments not otherwise 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 beyond quality control, meaning that 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 reporting has been further adapted to Danish conditions, see Tougaard (2020). 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.

Two surveys were reported in the Danish North Sea in 2019, one small survey with likely only a single airgun (site survey or well testing, Halfdan) and a larger 4D array with a larger airgun array (Tyra). 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

Except for two, all underwater explosions reported to the registry for 2019 were conducted by the Danish Navy, in connection with clearing of unexploded ordnance (UXO) and training / exercises. Two small explosions used as seismic sources for geophysical surveys were reported for the Baltic Pipe in 2019.

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 a sheet pile wall at Kalundborg Harbour. A large number of sheet piles were installed over a period of many months.

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

No sonars or acoustic deterrent devices below 10 kHz were reported for 2019.

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

Two activities reported the use of other impulsive sources: Thor offshore wind farm survey and the WGP cable survey, both geophysical surveys (subbottom profiling).

[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.

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. Some operators may report several types of activities or magnitudes on the same day and same area, and different operators may operate in the same block on the same date. However, this did not happen in 2019. The geological surveys connected to the Thor Offshore Wind Farm dominates the dataset, with 737 impulse-block-days, equal to 73% of the total reported impulse-block-days. However, see further below on possible over-reporting, also for the Kalundborg Harbour (85 impulse-block-days, equal to 8% of total).

Of the 1009 total impulse-block-days, 877 (87%) occurred in the North Sea Marine Biogeographic region, 125 (12%) in the Baltic Marine Biogeographic region, and seven (<1%) in blocks shared between the two regions (northern Great Belt).[2]

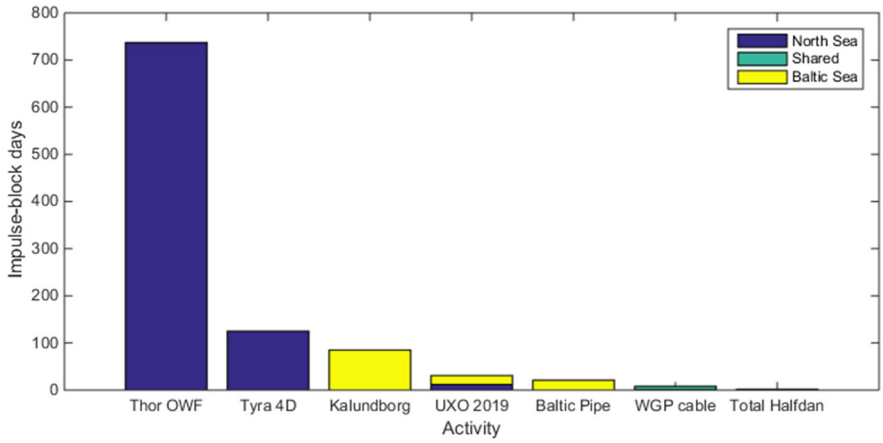


Figure 2.1. Overview of the impulse-block days reported from the Danish EEZ in 2019, divided on activities and separated into the two marine biogeographical regions North Sea and Baltic Sea.

Figure 2.2 shows the distribution of impulse block-days with date. Most activities happened in the second half of 2019.

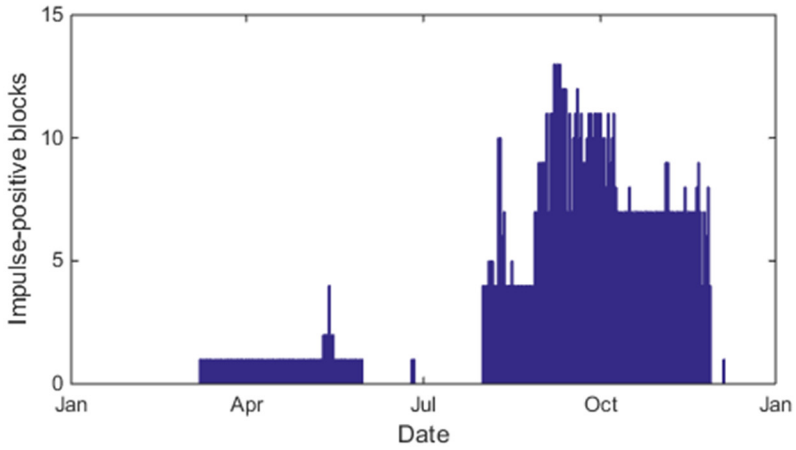


Figure 2.2. Distribution of impulse block-days by date in 2019.

[2] The border between the North Sea and Baltic marine biogeographic regions is a line from Djursland to Sjællands Odde and across Øresund at Drogden.

Figure 2.3 shows the 42 ICES subrectangles where activities were recorded in 2019.

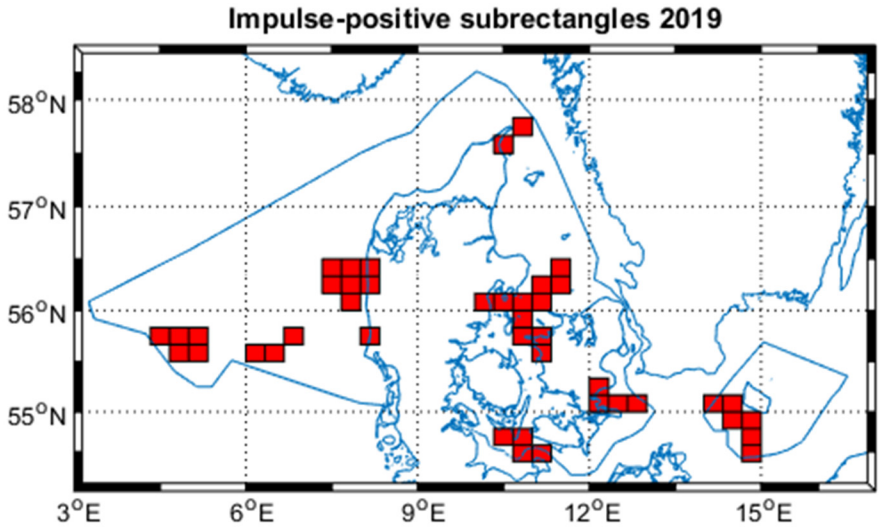


Figure 2.3. Map showing ICES subrectangles in the Danish EEZ, where impulsive noise events were recorded in 2019.

2.7 Possible over- and underreporting

The registry relies on submission of accurate information from permit holders (seismic operators, offshore contractors, etc.) to permitting agencies and further 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. Over-reporting can also occur, especially for surveys of long durations in the same area, if shorter pauses lasting only a few days (due to weather or otherwise) are not reported. This may be the case for the geophysical survey for the offshore wind farm Thor, where 2½ months of consecutive impulse-block-days were reported for four of the reporting rectangles. Also the sheet piling at Kalundborg Harbour is almost certainly overreporting, as no breaks due to weekends or holidays were recorded.

No large-scale seismic surveys with large airgun arrays were reported from the Danish EEZ in 2019. 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. It is not known whether such activities took place in 2019, but it is likely.

No offshore wind turbine foundations were installed in 2019, and thus no large percussive pile drivings were reported. A smaller number of isolated pile drivings of for example conductor pipes for oil and gas wells may have been conducted without reporting, but there are no indications that such activities took place. 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. Only one activity, Kalundborg Harbour, was reported for 2019. It is likely that other, unreported construction work of similar nature (but smaller scale) took place and escaped reporting.

Thirty-one impulse-block-days were reported for military explosions. It is believed that they were all related to clearance of unexploded ordnance (UXO) or training of personnel for UXO clearance. It is possible that smaller explosions in connection with training and exercises of the Navy in general are unreported. It should be noted that military activities are exempted from the reporting obligations of the MSFD and that the reporting of explosions received is a highly welcomed courtesy of the Danish Navy. Two civilian explosions were reported, which may reflect the actual level of such activities in 2019.

No sonars or acoustic deterrents were reported for 2019. The absence of reported activities for sonar does not reflect that sonars were not used. 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. This leads to an underreporting, and the magnitude of this is unknown. This underreporting will eventually propagate into the assessment of Good Environmental Status of the Danish waters and bias the conclusions to an unknown degree. Acoustic deterrents (seal scarers etc.) covered by the MSFD (frequency below 10 kHz) are not considered used in the Danish EEZ, besides when used as mitigation devices for pile driving. In such cases, the pile driving is the primary activity and the activity, which is reported to the registry.

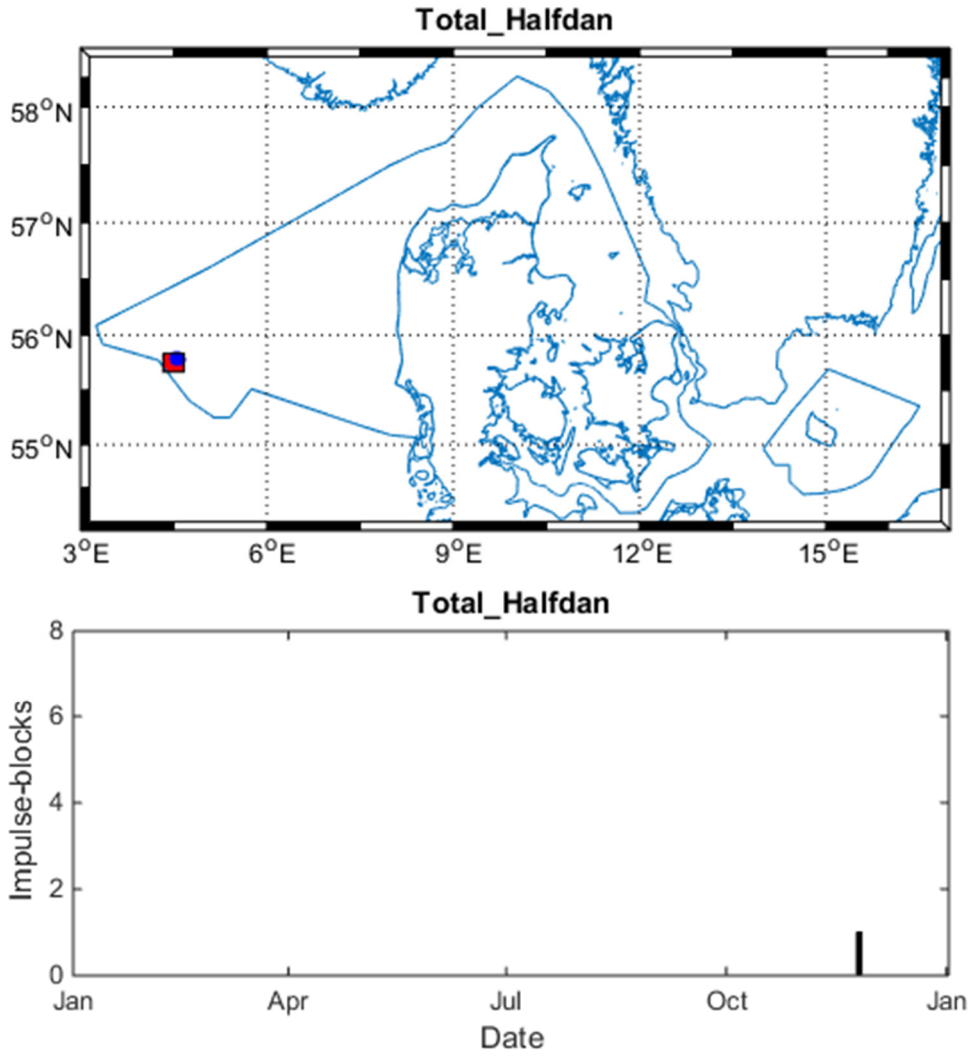
The reported figures for other impulsive sources are subject to uncertainty. The primarily relevant sources for this category are various equipment for sub-bottom profiling, such as pingers, sparkers and boomers. Although there are permitting procedures in place for these activities (two reported in 2019), it is believed that there is underreporting, in particular of smaller activities.

2.8 Registered, but not reported activities

A number of activities were forwarded from the responsible agencies, but do not fall under the categories of activities, which must be reported and data was therefore not uploaded to the ICES database. This applies to pile driving from Rønne Harbour (activities in 2018, already reported) and the German oceanographic survey HE532 (did not conduct reportable activities). See appendix 1 for a complete list of reports received and data submitted.

3 Reported activities

3.1 Total Halfdan

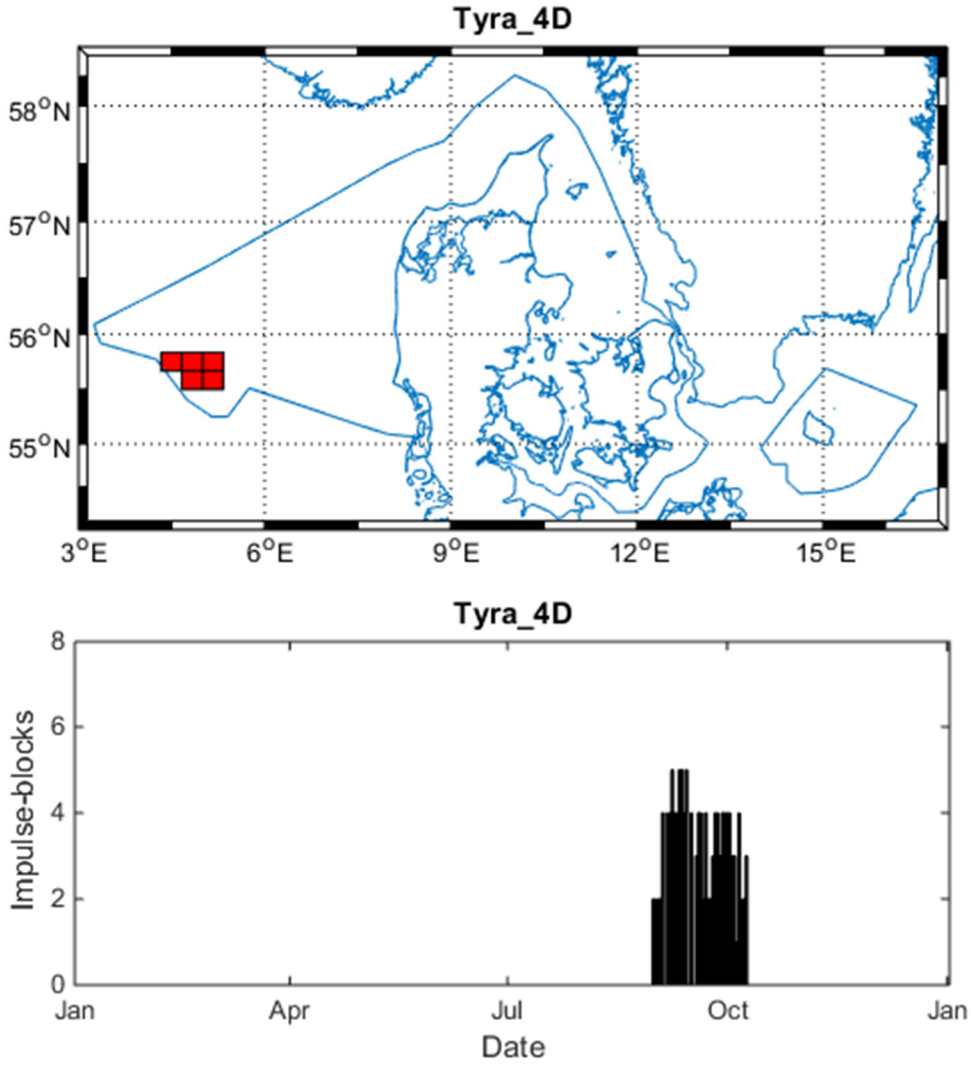


Seismic survey in the North Sea Marine Biogeographic region with small air-gun of magnitude **very low**. Conducted on the 25.11.2019 and 26.11.2019. Total 22 positions.

Table 3.1. Summary of impulse-block days

ICES subrectangle	Impulse-block days
40F45	2
Grand Total	**2**

3.2 TYRA 4D

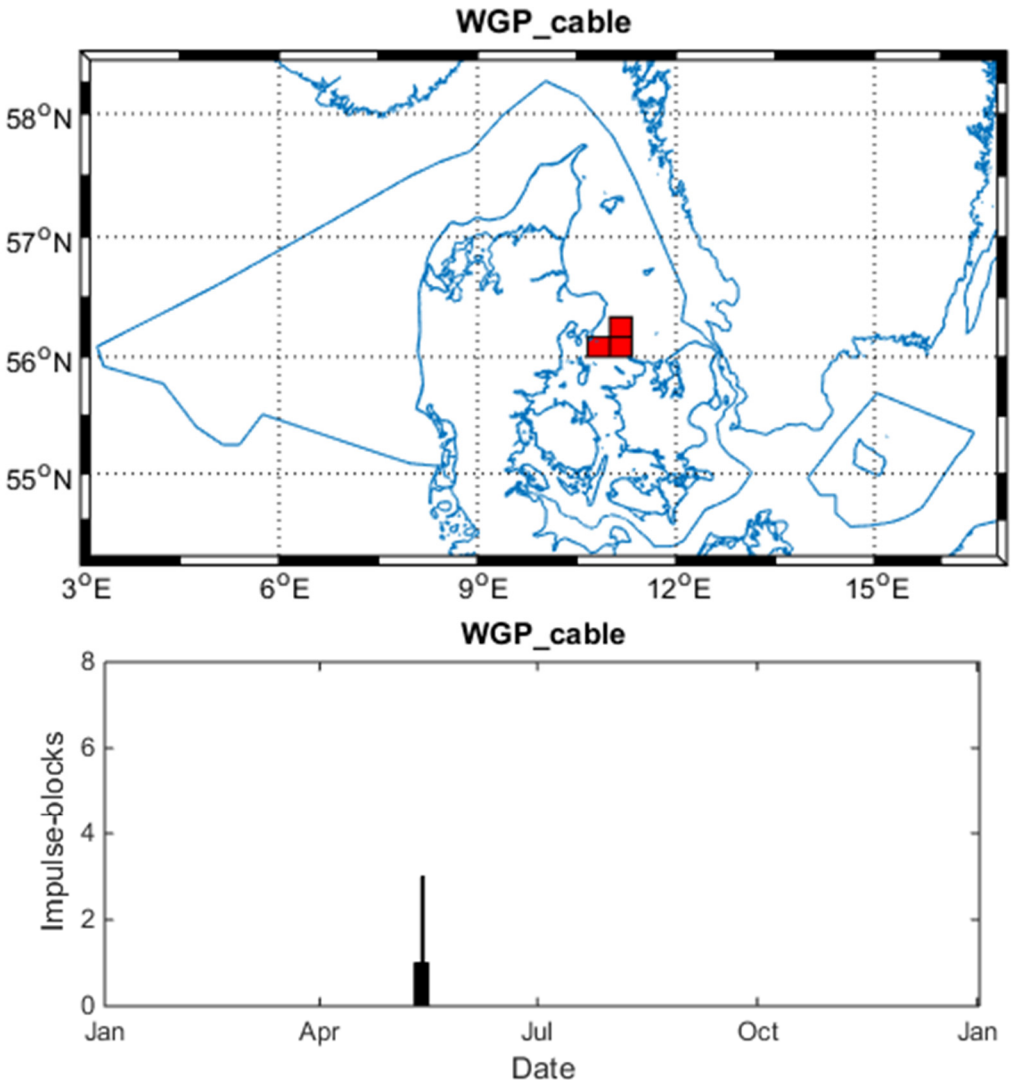


Seismic survey in the North Sea Marine Biogeographic region with airgun of magnitude **high**. Conducted between 31.8.2019 and 9.10.2019 with a total of 125 impulse-block days.

Table 3.2. Summary of impulse-block days

ICES subrectangle	Impulse-block days
40F45	32
40F48	36
40F49	27
40F52	6
40F53	24
Grand total	**125**

3.3 WPG cable survey

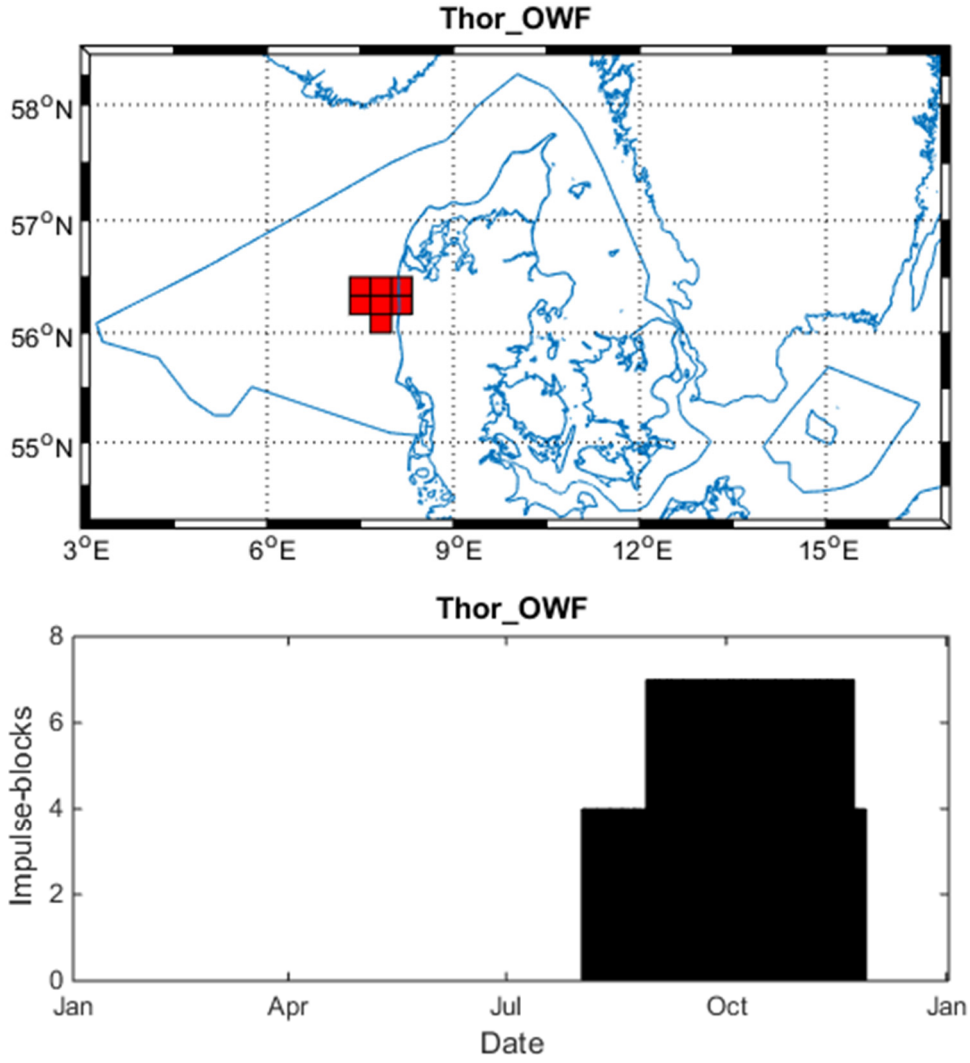


Subbottom profiling in northern Great Belt, i.e. right on the border between the Baltic Marine Biogeographic region and the North Sea Marine Biogeographic region. Equipment used was presumably a sparker of magnitude **medium**. Conducted between 11.5 and 16.5 2019, with a total of eight impulse-block days.

Table 3.3. Summary of impulse-block days

ICES subrectangle	Impulse-block days
41G09	6
41G12	1
41G13	1
Grand total	8

3.4 Thor Offshore Wind Farm

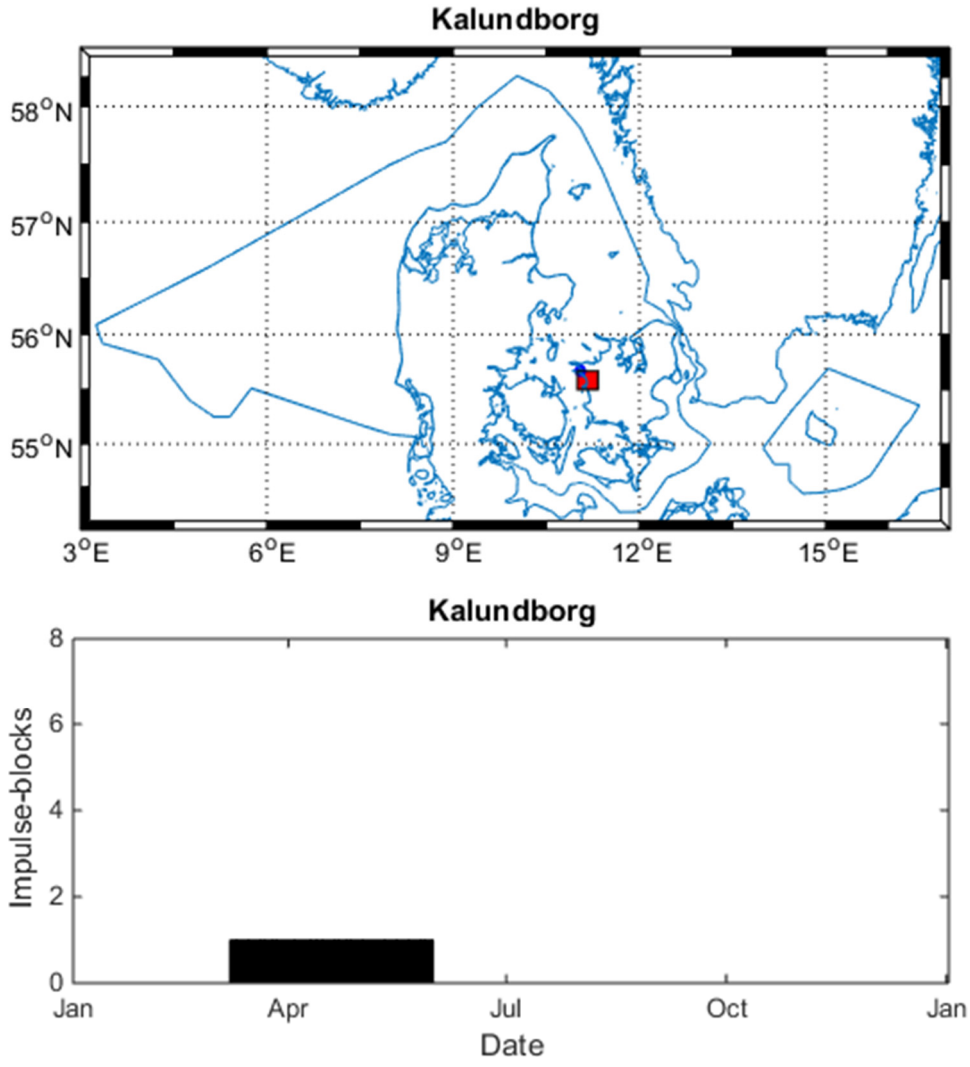


Geotechnical survey in the North Sea Marine Biogeographic region with Innomar SES-2000 and Geosparker 200 sources, classified as generic impulsive sources of magnitude **high**. Conducted from beginning of August 2019 to end of November 2019, totalling 737 impulse-block-days.

Table 3.4. Summary of impulse-block days in 2019

ICES subrectangle	Impulse-block days
41F74	92
41F75	92
41F77	92
41F78	119
41F79	114
41F81	114
41F82	114
Grand Total	**737**

3.5 Kalundborg harbour

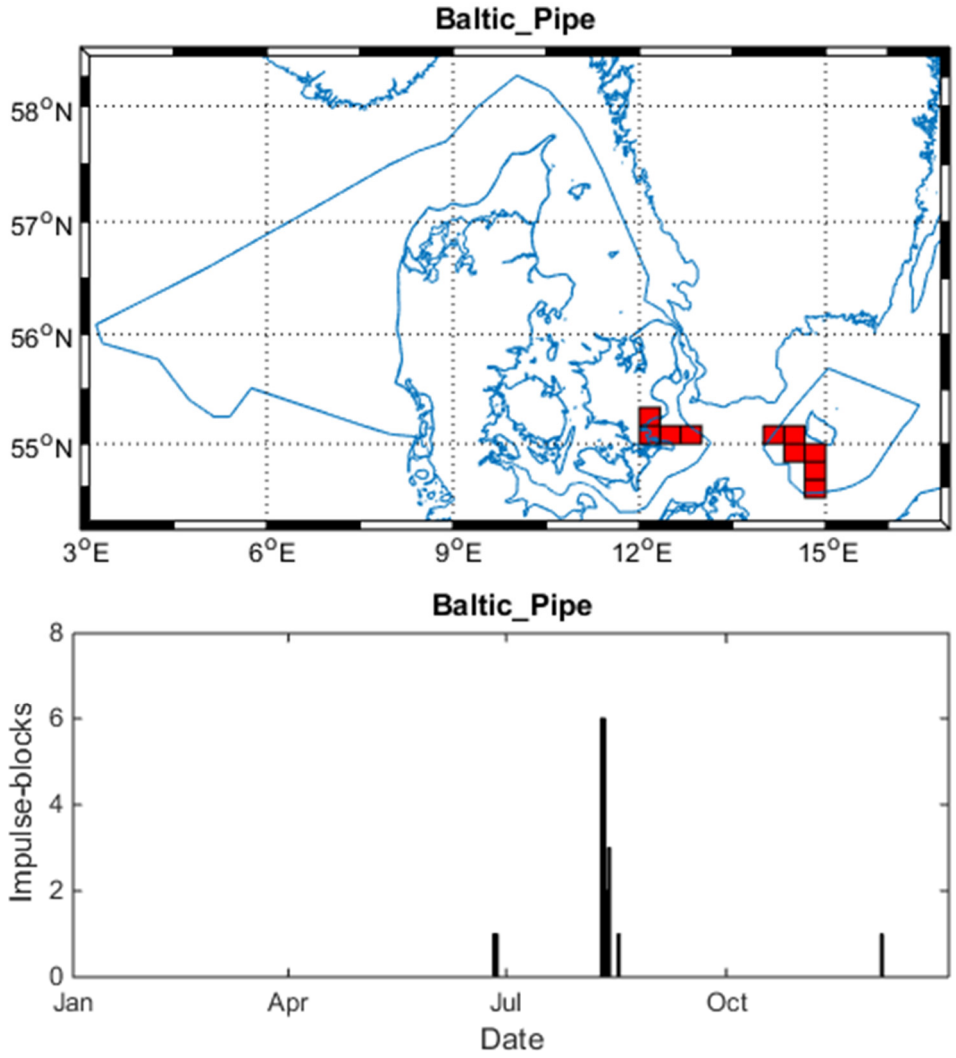


Sheet piling of harbour wall in Kalundborg harbour of magnitude **very low**. Conducted from beginning of March to end of May 2019, totalling 85 impulse-block-days.

Table 3.5. Summary of impulse-block days in 2019

ICES subrectangle	Impulse-block days
40G13	85
Grand Total	**85**

3.6 Baltic Pipe

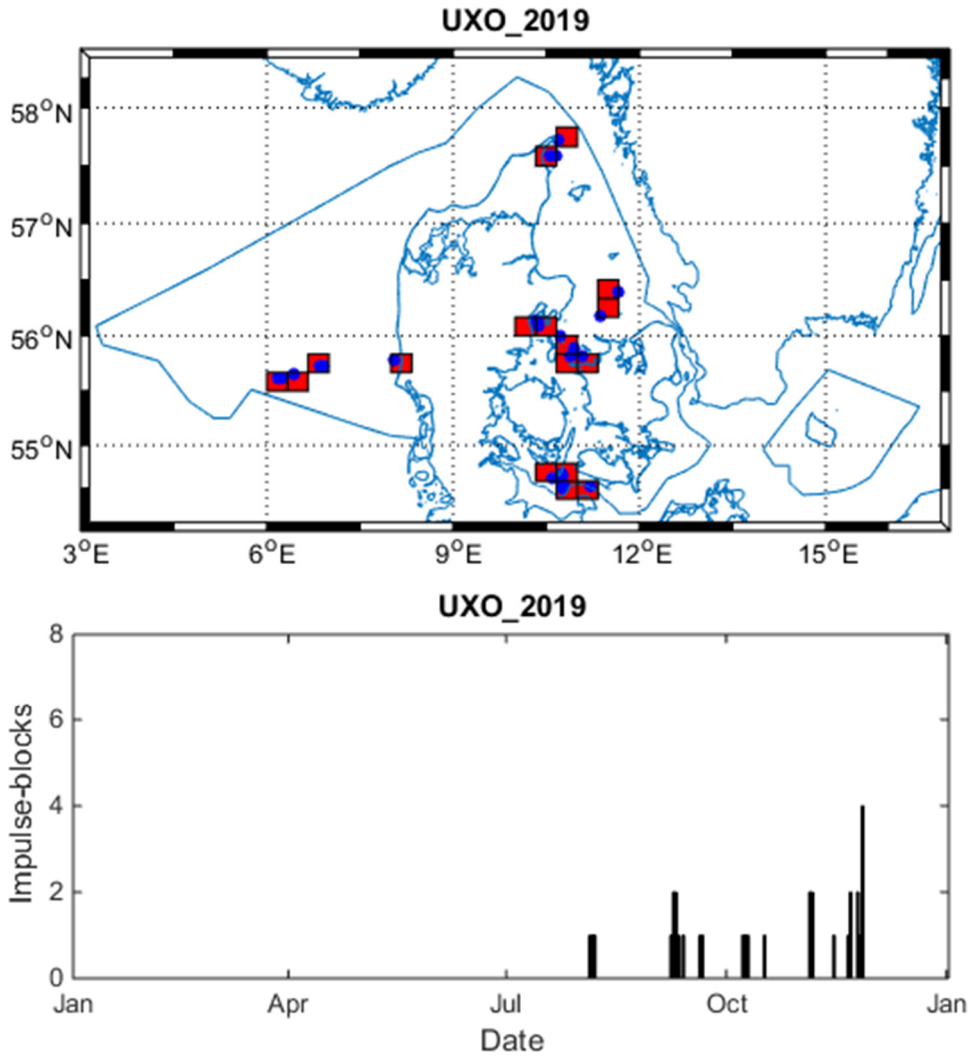


Geophysical surveys in the Baltic Marine Biogeographic region with an airgun of magnitude **very low** and two explosive sources of magnitude **very low**. Total 21 impulse-block-days.

Table 3.6. Summary of impulse-block days in 2019

ICES subrectangle	Impulse-block days
38G44	2
38G47	2
38G48	2
38G49	2
39G22	5
39G23	1
39G26	2
39G29	1
39G43	2
39G46	2
Grand Total	**21**

3.7 Explosions by the Danish Navy



Underwater explosions of magnitudes **high** and **very high,** in both the Baltic and the North Sea Marine Biogeographic regions. Total 31 impulse-block-days. Map shows positions of explosions as blue dots in addition to the ICES subrectangles in red.

Table 3.7 Summary of impulse-block days in 2019

ICES subrectangle	Impulse-block days
38G05	1
38G08	7
38G09	3
38G13	1
40F63	2
40F66	1
40F68	2
40F82	1
40G07	2
40G08	1
40G12	1
41G03	1
41G06	2
41G14	1
41G15	1
44G06	3
44G08	1
Grand Total	**31**

4 References

Dekeling, R.P.A., M.L. Tasker, A.J. Van der Graaf, M.A. Ainslie, M.H. Andersson, M. André, J.F. Borsani, K. Brensing, M. Castellote, D. Cronin, J. Dalen, T. Folegot, R. Leaper, J. Pajala, P. Redman, S.P. Robinson, P. Sigray, G. Sutton, F. Thomsen, S. Werner, D. Wittekind, and J.V. Young. 2014. Monitoring Guidance for Underwater Noise in European Seas, Part I: Executive Summary, JRC Scientific and Policy Report EUR 26557 EN, Publications Office of the European Union, Luxembourg.

European Commission. 2008. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive).

Tougaard, J. 2020. Indrapportering af impulsstøj Dokumenttype: Teknisk anvisning nr. M33, Roskilde.

Tale 4.1.

Source	Original file name	XML-file	Processed	Submitted	Comments
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AU	NoiseRegister_WGP_pcable_test_Mej 2019	WPG_cable	30-11-2020	Dec 2020	
Energinet	2020-03-11 NoiseRegister - Thor site investigations 2019	Thor_OWF	30-11-2020	Dec 2020	
FES	Indberetning af marin støj - FES - 2019	UXO_2019	01-12-2020	Dec 2020	
Niras	Indberetning om støj	Kalundborg	02-12-2020	Dec 2020	
Aarsleff	Registreringsskema-Impulsstøj fra ramning_Rønne Havn_Etape 1			Not submitted	Reported in 2019
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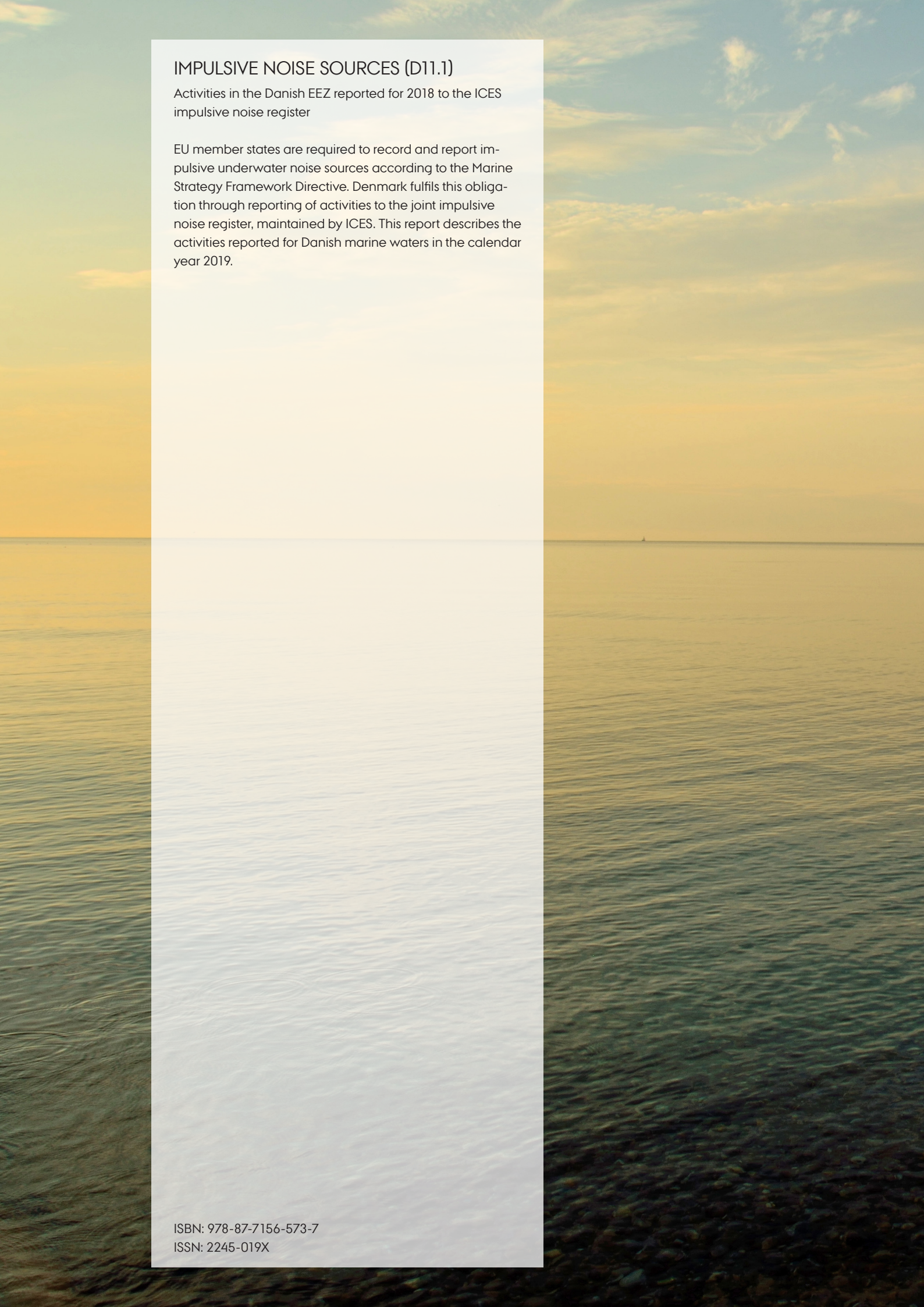

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