

# HELCOM Monitoring Programme topic

## Underwater noise

Programme:

**Continuous noise**

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## a. Metadata on monitoring strategies and monitoring programmes

### a.1 Responsible HELCOM subsidiary body

Please indicate the relevant expert group/network if available, otherwise the responsible HELCOM Working Group.

<b>Permanent Groups</b>	
<input type="checkbox"/>	Gear – Group on the Implementation of the Ecosystem Approach
<input type="checkbox"/>	Maritime – Maritime Working Group
<input type="checkbox"/>	Pressure – Working Group on Reduction of Pressures from the Baltic Sea Catchment Area
<input type="checkbox"/>	Response – Response Working Group
<input checked="" type="checkbox"/>	State and Conservation – Working Group on the State of the Environmental and Nature Conservation
<b>Time-limited Groups</b>	
<input type="checkbox"/>	Agri – Group on Sustainable Agricultural Practices
<input type="checkbox"/>	Fish – Group on Ecosystem-based Sustainable Fisheries
<input type="checkbox"/>	HELCOM-VASAB MSP WG - Joint HELCOM-VASAB Maritime Spatial Planning Working Group
<b>Expert Groups</b>	
<input type="checkbox"/>	AIS EWG – Expert Working Group for Mutual Exchange and Deliveries of AIS data
<input type="checkbox"/>	EN Hazardous Substances – Expert Network on hazardous substances
<input type="checkbox"/>	EN Marine Litter – Expert Network on Marine Litter
<input checked="" type="checkbox"/>	EN Noise – Expert Network on Underwater Noise
<input type="checkbox"/>	ESA – Expert Network on Economic and Social Analyses
<input type="checkbox"/>	EWG OWR – Expert Working Group on Oiled Wildlife Response
<input type="checkbox"/>	EWG SHORE – Expert Working Group on Response on the Shore
<input type="checkbox"/>	Green Technology and Alternative Fuels Platform for Shipping
<input type="checkbox"/>	HELCOM/OSPAR TG BALLAST – Joint HELCOM/OSPAR Task Group on Ballast Management Convention Exemptions

- IN Benthic habitat – Intersessional Network on habitat monitoring
- IWGAS – Informal Working Group on Aerial Surveillance
- JWG Bird – HELCOM-OSPAR-ICES Joint Working Group on Seabirds
- MORS EG – Expert group on monitoring of radioactive substances in the Baltic Sea
- PRF Cooperation Platform – Cooperation Platform on Port Reception Facilities in the Baltic Sea
- SAFE NAV – Group of Experts on Safety of Navigation
- SUBMERGED – Expert Group on Environmental Risks of Hazardous Submerged Objects

## a.2 Regional Cooperation (Regional Cooperation)

The monitoring of this programme is:

- Fully coordinated
- Partly coordinated. Indicate missing component(s):

A HELCOM database to which monitoring data is to be reported is available and hosted by ICES. National monitoring was initiated by the BIAS project in 2014 and has continued on a subset of the stations in several countries since 2014. HELCOM monitoring guidelines on continuous noise was adopted in 2019 (<https://helcom.fi/media/documents/Guidelines-for-monitoring-continuous-noise.pdf>), thus there is a regional coordination of monitoring. There is a lack of an assessment system and thresholds for D10C2. ,, .

- Coordinated monitoring is under development. Indicate by which group/project and by when a recommendation on coordinated monitoring can be expected.

## b. Monitoring strategies

### b.1 Descriptor

The programme supports the following obligatory MSFD Monitoring Strategies. Tick one or more relevant boxes.

- D1** Biodiversity
- D2** Non-indigenous Species
- D3** Commercial fish and shellfish
- D4** Food webs
- D5** Eutrophication
- D6** Seafloor integrity

- D7** Hydrographical conditions
- D8** Contaminants
- D9** Contaminants in seafood
- D10** Marine litter
- D11** Energy including underwater noise

## b.2 BSAP segments

The sub-programme serves the following BSAP segments. Tick one or more relevant boxes.

- Eutrophication
- Hazardous substances
- Biodiversity
- Maritime activities

## b.3 Monitoring strategy description

**Monitoring strategy:** Monitoring is to be carried out to fulfill assessment requirements of HELCOM ecological objectives that are specified through HELCOM core indicators. The monitoring of the sound pressure level of continuous low frequency anthropogenic sounds in the Baltic Sea sub-regions is done by each Contracting Party, coordinated by EN-Noise following the [HELCOM monitoring guidelines](#).

Monitoring consists of a measurements component and a soundscape modelling component. The measurements component consists of monitoring of actual underwater noise levels at a sufficiently large number of stationary monitoring stations throughout the Balt Sea, covering all sub-basins. Monitoring at these stations is the responsibility of national governments, which are also responsible for quality assurance and processing of recordings. Processed data are to be uploaded to the common HELCOM database for continuous underwater noise, hosted by ICES.

The soundscape modelling component consists of a joint modelling of the antropogenic contribution to the underwater soundscape in the Baltic. This modelling is based on measurements from the HELCOM database and information about relevant noise sources (such as, but not limited to, AIS and VMS tracking data), supplied by member states. Soundscape modelling is coordinated by EN-Noise, who also coordinates the use of the modelled data for joint assessment purposes, such as HOLAS.

## b.4 BSAP Ecological objectives

Choose only the most relevant option(s). Tick one or more boxes below.

- 
- Eutrophication**
- Concentrations of nutrients close to natural levels
  - Clear water
  - Natural level of algal blooms
  - Natural distribution and occurrence of plants and animals
-

	<input type="checkbox"/> Natural oxygen levels
<b>Hazardous substances</b>	<input type="checkbox"/> Concentrations of hazardous substances close to natural levels <input type="checkbox"/> All fish safe to eat <input type="checkbox"/> Healthy wildlife <input type="checkbox"/> Radioactivity at pre-Chernobyl levels
<b>Biodiversity</b>	<input type="checkbox"/> Natural landscapes and seascapes <input checked="" type="checkbox"/> Thriving and balanced communities of plants and animals <input checked="" type="checkbox"/> Viable populations of species
<b>Maritime activities</b>	<input type="checkbox"/> No illegal pollution <input type="checkbox"/> Safe maritime traffic without accidental pollution <input type="checkbox"/> Efficient response capability <input type="checkbox"/> No introductions of alien species from ships <input type="checkbox"/> Minimum air pollution from ships <input type="checkbox"/> Zero discharges from offshore platforms

## b.5 Gaps in monitoring

In relation to the GES criteria addressed, indicate when sufficient monitoring was in place or by when sufficient coverage will be in place ([Coverage\\_GEScriteria](#)):

- Adequate monitoring was in place in 2014
- Adequate monitoring was in place by 2018
- Adequate monitoring is in place by July 2020
- Adequate monitoring will be in place by 2024
- Monitoring is not being put in place for this descriptor due to a low risk
- Monitoring for this descriptor is not relevant

Description of the implementation gaps and plans to complete the establishment and implementation of this descriptor monitoring strategy ([Gaps\\_Plans](#)):

In order to understand the temporal and spatial variation in the anthropogenic contribution to the underwater soundscape, long term data series and a suitable spatial coverage of monitoring is required, combined with adequate spatiotemporal modelling. The monitoring of ambient noise started for most HELCOM Member States through the BIAS project, that obtained measurements and produced spatiotemporal maps covering the entire Baltic for the year 2014. After that, the measurements have continued to a varying extent in several Member States and a common HELCOM database for continuous underwater noise measurements has been established in 2020, hosted by ICES. The coverage of the Baltic Sea is inadequate, with some sub-basins having only recently gained a monitoring station.

In addition, the monitoring effort is not well coordinated, creating uncertainties in the use of the developed standard regarding measurements and processing and their related quality control. No data has been shared on a regional scale since the end of the BIAS project, although such sharing is anticipated from 2020, when Member States start to upload data to the common database.

Soundscape maps at Baltic Sea scale has been created only for one year (2014, with monthly resolution). Although decided by HOD that a joint soundscape mapping should commence, the infrastructure to make it happen is still under development and key decisions regarding coordination of the mapping effort remains unresolved. Also, recreational boating noise is currently not monitored and hence not covered by the soundscape maps. In coastal areas, boating noise can at least seasonally contribute much to the background noise.

More fundamentally, there is still uncertainty about the exact quantity/-ies to be used as core indicators. HELCOM EN-Noise is working with this key question, paying particular attention to experience stemming from the JOMOPANS project and guidance expected from EU TG-Noise in 2020-2021. The core issues are definition of baseline level and quantification of antropogenic contribution. Uncertainties are not feeding downwards into the monitoring itself, however, as only the post-measurement analysis is affected and the delay in decisions regarding analysis does therefore not affect the usability of data already collected.

The lack of coordination of monitoring effort, gaps in spatio and temporal coverage, and especially the lack of soundscape maps have created a knowledge gap in the understanding of the temporal and spatial changes in continuous underwater noise and thus, affecting the assessment of the pressure. The suggested monitoring program for the future will make such soundscape maps available for Member States and HOLAS. An improved monitoring with measuring stations will greatly increase the reliability of the soundscape maps and provide the continuous and consistent time series needed for a science-based assessment of the state of the Baltic with respect to underwater noise and allow tracking of developments in the pressure.

## c. Monitoring programmes

### c.1 Purpose of monitoring

#### *c.1a Assessment purpose in general*

The programme supports the assessment of:

Tick the relevant box.

Temporal trends	Spatial distribution	State classification
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

The **programme** supports the assessment of: (MonitoringPurpose).

Note that the answer to this question will be decisive for whether to answer upcoming questions e.g. upcoming questions on pressures should only be answered if the monitoring is defined as supporting the assessment of pressures.

Tick the relevant boxes.

Environmental state and impacts	Pressures in the marine environment	Pressures at source (land-based, riverine, sea-based <sup>1</sup> and atmospheric sources)	Human activities causing the pressures	Effectiveness of measures
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
If this is selected fill in the following questions: <a href="#">c.1b</a>	If this is selected fill in the following questions: <a href="#">c.1c, d</a>	If this is selected fill in the following questions: <a href="#">c.1c, d</a>	If this is selected fill in the following questions: <a href="#">c.1c, d</a>	If this is selected fill in the following questions: <a href="#">c.1c, d</a>

Give any other monitoring purpose e.g. if the programmes include supporting parameters for other monitoring programmes

Provides input to assessments under HD (pressures to protected or noise-sensitive species).

For questions 1b-1d, select when applicable for the sub-programme, the link from the Reporting on the 2020 update of Article 11 for the Marine Strategy Framework Directive ([MSFD Guidance Document 17, 2020](#)) ([Features](#)) to:

- Ecosystem components (relevant for monitoring and assessment for Article 8(1a) for D1C2-C5, D3, D4, D6C3-C5, D7C2)
- Pressures and impacts in the marine environment (relevant for monitoring and assessment for Article 8(1b) for D1C1, D2, D5, D6C1-C2, D7C1, D8, D9, D10, D11)
- Pressure inputs to the marine environment (relevant for monitoring and assessment for Article 10)
- Uses and human activities (relevant for monitoring and assessment for Article 8(1c) and 13)

**[c.1b • Ecosystem components \(Features\)](#)**

Choose only the most relevant option(s). Tick one or more boxes below.

Theme	Sub-theme	Label feature
Species	<input type="checkbox"/> Birds	<input type="checkbox"/> Grazing birds
		<input type="checkbox"/> Wading birds
		<input type="checkbox"/> Surface-feeding birds
		<input type="checkbox"/> Pelagic-feeding birds
		<input type="checkbox"/> Benthic-feeding birds
	<input type="checkbox"/> Mammals	<input type="checkbox"/> Small toothed cetaceans
		<input type="checkbox"/> Deep-diving toothed cetaceans
		<input type="checkbox"/> Baleen whales

<sup>1</sup> Sea-based 'Pressures at source' refers to monitoring pressures from sea-based activities where the monitoring is directly at the activity rather than at a distance from or time period after it is generated by the activity (e.g. D1 incidental by-catch when fishing, D2 ballast water discharges, D6 use of bottom fishing gear, D8 contaminant discharges and pollution events from a vessel or pipeline, D11 impulsive sound events from a vessel or platform).

	<input type="checkbox"/> Seals
<input type="checkbox"/> Reptiles	<input type="checkbox"/> Turtles
<input type="checkbox"/> Fish	<input type="checkbox"/> Coastal fish <input type="checkbox"/> Pelagic shelf fish <input type="checkbox"/> Demersal shelf fish <input type="checkbox"/> Deep-sea fish <input type="checkbox"/> Commercially exploited fish and shellfish
<input type="checkbox"/> Cephalopods	<input type="checkbox"/> Coastal/shelf cephalopods <input type="checkbox"/> Deep-sea cephalopods
Habitats	<input type="checkbox"/> Benthic habitats <input type="checkbox"/> Benthic broad habitats <input type="checkbox"/> Other benthic habitats
	<input type="checkbox"/> Pelagic habitats <input type="checkbox"/> Pelagic broad habitats <input type="checkbox"/> Other pelagic habitats
Ecosystems	<input type="checkbox"/> Physical and hydrological characteristics
	<input type="checkbox"/> Chemical characteristics
	<input type="checkbox"/> Ecosystems, including food webs <input type="checkbox"/> Coastal ecosystems <input type="checkbox"/> Shelf ecosystems <input type="checkbox"/> Oceanic/deep-sea ecosystems

**c.1c • Pressures and impacts in the marine environment (Features)**

Choose only the most relevant option(s). Tick one or more boxes below.

Theme	Label: Feature
Biological	<input type="checkbox"/> Newly introduced non-indigenous species
	<input type="checkbox"/> Established non-indigenous species
	<input type="checkbox"/> Species affected by incidental by-catch
Physical and hydrological	<input type="checkbox"/> Hydrographical changes
	<input type="checkbox"/> Physical disturbance to seabed
	<input type="checkbox"/> Physical loss of the seabed
Substances, litter and energy	<input type="checkbox"/> Eutrophication
	<input type="checkbox"/> Contaminants - non UPBT substances
	<input type="checkbox"/> Contaminants - UPBT substances
	<input type="checkbox"/> Contaminants – in seafood
	<input checked="" type="checkbox"/> Adverse effects on species or habitats

- Acute pollution events
- Litter in the environment
- Impulsive sound in water
- Continuous low frequency sound

*c.1d • Pressure inputs to the marine environment (Features)*

Theme	Label: Feature
Biological	<input type="checkbox"/> Input or spread of non-indigenous species
	<input type="checkbox"/> Input of microbial pathogens
	<input type="checkbox"/> Input of genetically modified species and translocation of native species
	<input type="checkbox"/> Loss of, or change to, natural biological communities due to cultivation of animal or plant species
	<input checked="" type="checkbox"/> Disturbance of species (e.g. where they breed, rest and feed) due to human presence
	<input type="checkbox"/> Extraction of, or mortality/injury to, wild species (by commercial and recreational fishing and other activities)
Substances, litter and energy	<input type="checkbox"/> Input of nutrients — diffuse sources, point sources, atmospheric deposition
	<input type="checkbox"/> Input of organic matter — diffuse sources and point sources
	<input type="checkbox"/> Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) — diffuse sources, point sources, atmospheric deposition, acute events
	<input type="checkbox"/> Input of litter (solid waste matter, including micro-sized litter)
	<input checked="" type="checkbox"/> Input of anthropogenic sound (impulsive, continuous)
	<input type="checkbox"/> Input of other forms of energy (including electromagnetic fields, light and heat)
	<input type="checkbox"/> Input of water — point sources (e.g. brine)

*c.1e • Uses and human activities (Features)*

Choose only the most relevant option(s). Tick one or more boxes below.

Theme	Label: Feature
Physical restructuring of rivers, coastline or seabed (water management)	<input type="checkbox"/> Land claim
	<input type="checkbox"/> Canalisation and other watercourse modifications
	<input type="checkbox"/> Coastal defence and flood protection
	<input type="checkbox"/> Offshore structures (other than for oil/gas/renewables)

	<input type="checkbox"/> Restructuring of seabed morphology, including dredging and depositing of materials
Extraction of non-living resources	<input type="checkbox"/> Extraction of minerals (rock, metal ores, gravel, sand, shell)
	<input type="checkbox"/> Extraction of oil and gas, including infrastructure
	<input type="checkbox"/> Extraction of salt
	<input type="checkbox"/> Extraction of water
Production of energy	<input type="checkbox"/> Renewable energy generation (wind, wave and tidal power), including infrastructure
	<input type="checkbox"/> Non-renewable energy generation
	<input type="checkbox"/> Transmission of electricity and communications (cables)
Extraction of living resources	<input checked="" type="checkbox"/> Fish and shellfish harvesting (professional, recreational)
	<input type="checkbox"/> Fish and shellfish processing
	<input type="checkbox"/> Marine plant harvesting
	<input type="checkbox"/> Hunting and collecting for other purposes
Cultivation of living resources	<input type="checkbox"/> Aquaculture — marine, including infrastructure
	<input type="checkbox"/> Aquaculture — freshwater
	<input type="checkbox"/> Agriculture
	<input type="checkbox"/> Forestry
Transport	<input checked="" type="checkbox"/> Transport infrastructure
	<input checked="" type="checkbox"/> Transport — shipping
	<input type="checkbox"/> Transport — air
	<input type="checkbox"/> Transport — land
Urban and industrial uses	<input type="checkbox"/> Urban uses
	<input type="checkbox"/> Industrial uses
	<input type="checkbox"/> Waste treatment and disposal
Tourism and leisure	<input type="checkbox"/> Tourism and leisure infrastructure
	<input type="checkbox"/> Tourism and leisure activities
Security/defence	<input type="checkbox"/> Military operations (subject to Article 2(2))
Education and research	<input type="checkbox"/> Research, survey and educational activities

## c.2 Other legislation

The sub-programme links with the following other international legislation ([OtherPoliciesConventions](#)). Tick one or more relevant boxes.

Bathing Water Directive

- Common Fisheries Policy and Data Collection Framework
- Habitats Directive
- Birds Directive
- Nitrates Directive
- Urban Waste Water Treatment Directive
- Water Framework Directive
- OSPAR Convention
- Trilateral Wadden Sea Convention
- Other, Specify: Maritime Spatial Planning Directive

### c.3 Implementation of Regional Cooperation

#### (RegionalCooperation\_implementation)

Indicate the level of implementation by selecting one of the following:

- Agreed data collection methods
- Common monitoring strategy (spatial and temporal design of programme)
- Coordinated data collection (delivered separately by each country)
- Joint data collection (multinational delivery using same platform and/or algorithms)

## c.4 Monitoring concepts

Monitoring concepts table<sup>2</sup>:

Current means of coordination	Features or Elements	Parameter	Method	QA/QC	Frequency <sup>3</sup>	Spatial resolution (density) of sampling	Link to HELCOM core indicators <sup>4</sup>	Spatial scope	Monitoring started (year)	CPs monitoring <sup>5</sup>
	Elements (Features) (Features_number)	Parameters (Parameter) (ParametersOther)	MonitoringMethod (Monitoring Method) (MonitoringMethodOther)	(Free text)	MonitoringFrequency	(ProgrammeDescription)	(RelatedIndicator) (RelatedIndicator_name)	(SpatialScope)	(TemporalScope)	(CountryCode_Enum)
National	Sound pressure level	Measured level of sound in third-octave bands, time averaged over a period not exceeding 20 seconds	<a href="#">HELCOM Monitoring Guidelines for Continuous noise</a>	<a href="#">HELCOM Monitoring Guidelines for Continuous noise</a>	Monitoring was conducted for one year in some cases, and continued in others.	DE: 2 DK: 4 EE: 1 permanent station (and 2-3 portable stations)  PO: 6 SE: 1	–	EEZ	2014	DE, DK, EE, FI, PO and SE

<sup>2</sup> Needed codelists can be found on 2020 update of Article 11 for the Marine Strategy Framework Directive (MSFD Guidance Document 17, 2020).

<sup>3</sup> The option “Different for each country - see MORE overview” refers to the [overview](#) carried out in 2013

<sup>4</sup> Give the name of HELCOM core indicators that are based on the monitoring parameter.

<sup>5</sup> Provide information on the Contracting Partie(s) that are monitoring the parameter.

Current means of coordination	Features or Elements	Parameter	Method	QA/QC	Frequency <sup>3</sup>	Spatial resolution (density) of sampling	Link to HELCOM core indicators <sup>4</sup>	Spatial scope	Monitoring started (year)	CPs monitoring <sup>5</sup>
HELCOM	Sound excess level	Modelled exceedance of natural ambient sound caused by antropogenic sources	BIAS guidelines, <a href="#">HELCOM Monitoring Guidelines for Continuous noise (to be updated)</a> <a href="#">EU TG-Noise guidance (pending)</a>	BIAS guidelines <a href="#">HELCOM Monitoring Guidelines for Continuous noise (to be updated)</a>	Only one year monitoring was conducted. Yearly updates envisioned	Whole Baltic Sea in the soundscape maps	–	EEZ	2014	

## PARAMETER

### Element/Parameter pair

Sound pressure level and excess level/ Spatial and temporal distribution

## METHOD (MonitoringDetails)

### Element/parameter

Underwater acoustic sensors are used to measure continuous or intermittent underwater sound. This can be realised by deployment of autonomous loggers on fixed positions or through real-time feeds from hydrophones cabled to shore. For guidance on technical specifications of equipment, methodology for measurements including deployment, signal processing and data handling, see [HELCOM Guidelines for monitoring continuous noise](#). Briefly, the monitoring station should be able to cover the relevant frequency range 10 Hz to 20 kHz and with a sensitivity matched to the local conditions (sensitive enough to capture natural ambient noise under calm conditions, yet not overload by the exposure to loud events, such as ships passing close by). Recordings are processed according to the [HELCOM Guidelines for monitoring continuous noise](#) and shared through the continuous noise database as one-third octave levels, time averaged over a period not exceeding 20 seconds.

Acoustic soundscape maps are produced by combining modelled contributions from natural sources (wind and waves) and antropogenic sources (primarily ships). Natural ambient noise is modelled from wind and wave data supplied by meteorological models combined with local transfer functions linking wind speed with underwater noise (Knudsen/Wenz curves). These transfer functions are derived from the measurements at the stationary monitoring stations.

Antropogenic contribution to the noise is modelled from combining information about the presence of individual sources (such as ships) from appropriate data sources (such as AIS and VMS) with models for source characteristics of the individual sources (such as the RANDI3 model for ship noise, linking the source properties of the ship to the size and speed of the ship). Sound propagation properties of the surrounding waters to each individual source is modelled from bathymetrical, hydrographical data and sediment properties, calibrated against actual measurements at the monitoring stations of identified ships at known distances from the recording station. The total antropogenic contribution is modelled in individual instances (snap shots), where sound propagating from all individual sources at a given instant in time is added point by point in the modelling grid covering the Baltic Sea. Modelling is repeated for a large number of snapshots with regular intervals (for example every hour) and the statistics (distribution) of the sound pressure level is derived for each modelling point. In this way, maps of individual exceedance levels can be produced for one month at a time, with each map expressing the sound pressure level within a specific frequency band exceeded for a specified proportion of the time.

Once natural ambient noise and antropogenic contributions have been modelled, these can be combined in different ways. They can be added to provide spatial explicit estimates of the total sound pressure level in a given

frequency band. These levels can then be used in assessments, but also compared with actual measurements from the monitoring stations to assess the quality of the modelling. The ratio between the natural ambient and anthropogenic component can also be calculated, providing a measure of the degree to which the noise in a particular location is dominated by anthropogenic (ship) noise. This ratio provides a useful measure of the pressure of ship noise on the Baltic Sea and can be used for assessment purposes, such as HOLAS.

## QA/QC

### Element/Parameter pair

Measurements and processing of these are done on a standardized way according to the HELCOM Guidelines for monitoring continuous noise. Quality control is done nationally on all data before uploading it to the data-sharing platform.

Modelling is also performed according to common standards (HELCOM Guidelines for monitoring continuous noise).

## FREQUENCY

### Frequency

#### Element/Parameter pair

Raw measurements consists of time series of recording. Duration of each recording can be from 15 minutes every hour to continuous over several months. Raw recordings are processed into one-third octave levels, averaged over a period not more than 20 seconds. These are data uploaded to and shared through the continuous noise database. Processed monitoring data are uploaded to the data base yearly.

Soundscape maps are produced as monthly and yearly aggregates and uploaded yearly.

## SPATIAL SCOPE

### Spatial Scope

#### Element/Parameter pair

Monitoring is performed by Member States in their EEZ to capture the local soundscape. Monitoring stations should be distributed across the sub-basins in a coordinated fashion.

The modelled soundscape maps would cover the whole HELCOM area with a resolution not coarser than 1 km x 1 km.

## SPATIAL RESOLUTION (DENSITY) OF SAMPLING

### Spatial resolution

### Element/Parameter pair

The Minor monitoring is performed at selected (by Member States) prioritized locations in Member States EEZ, covering all Baltic Sea subbasins. The Major monitoring is performed at a greater number of stations decided based on the data request by the soundscape model to be updated.

The distribution of stations is as follows:

- Denmark: 4 stations operational from 2018.
- Estonia: 1 station permanently operational since 2014 (BIAS20 in the Gulf of Finland). and 2-3 portable monitoring stations, used where and when needed (sporadic measurements).
- 
- Germany: 2 stations operational.
- Poland: Investigations started in 2015 with 6 new stations and monitoring is regularly conducted there since 2018.
- Sweden: 1 station operational.

**Provide considerations for the scale of aggregation of data for an indicator-based assessment** Tick one or more relevant boxes below:

HELCOM assessment unit Level 4: Subbasins with coastal WFD division

HELCOM assessment unit Level 3: Subbasins with coastal and offshore division

HELCOM assessment unit Level 2: Subbasin

HELCOM assessment unit Level 1: Baltic Sea

MSFD Region

EU

Other (specify) Subareas are defined based on distribution of sensitive species and habitats, paying attention to the local acoustic conditions (acoustic basins).

Unknown

## c.5 Monitoring and assessment requirements

### Monitoring requirements:

Underwater continuous low frequency sound, including the pressure from anthropogenic sound on the marine environment, may be directly monitored through in situ acoustic measurements of noise combined with acoustic modelling of soundscapes. In order to assess the pre-core indicator on 'Continuous low frequency anthropogenic sound', an annual monitoring will take place at prioritized locations in Member States waters, supplemented by spatial mapping of the soundscape based on modelling of natural ambient sound (from wind and waves) and propagated contribution from anthropogenic sources (primarily ships). The sound propagation parameters and source characteristics for the soundscape modelling are derived from measurements in years with a Major monitoring effort with extensive field measurement programme (for an example, see Nikolopoulos et al. 2016). Subsequent years have a Minor monitoring effort, consisting of a

reduced field measurement programme and soundscape modelling based on input parameters from the most recent Major monitoring, except for the anthropogenic sources, which are continuously updated (from data such as AIS and VMS). With regular intervals, either dictated by increasing deviance between modelled pressure levels and actually measured levels, or by the need for specific actions or results dictated by HELCOM processes (such as HOLAS), a Major monitoring effort is conducted. Collected data are processed, quality controlled and sent to the data sharing platform by Member States, and later visualized in the soundscape planning tool. The frequencies which must be reported, based on the EU MSFD Descriptor 11, criteria 11.2, are the 1/3 octave bands 63 and 125 Hz. However, the inclusion of all third-octave frequency bands from 10 Hz to 20 kHz are recommended to provide coverage of the frequencies used by most marine species and allow for future development of impact indicators.

Soundscape maps are to be produced to allow not only assessment of the natural and anthropogenic sound at any specific location in the Baltic Sea, but also to serve as input for assessment of Good Environmental Status, to be held against EU MSFD thresholds and possible target values determined for the Baltic Sea (as a whole, or for individual sub-basins) agreed by HELCOM. The maps can be used in regional assessments (such as HOLAS) together with maps derived from available data on distribution and/or abundance of species and habitats sensitive to underwater noise. These combined maps can be used as a first step to set environmental targets for underwater noise.

#### Adequacy for assessment of GES:

Monitoring should provide adequate data and information to enable the periodic assessment of environmental status, and distance from and progress towards GES as required by MSFD under Article 9 and Article 11.

	Yes	No
Adequate data?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Established methods for assessment?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Adequate understanding of GES?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Adequate capacity to perform assessments?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Assessment of natural variability

Underwater noise levels are inherently very variable, both spatially and temporally. Continuous monitoring at monitoring stations will provide very good estimates of the noise level, including its variation, quantified through selected percentile levels (see for example Mustonen et al. 2019). There is a general lack of knowledge to the natural year-to-year variation in underwater noise levels, which means that the long-term natural variability cannot be assessed reliably until data has been collected in a coordinated and systematic way over a period of several years.

## c.6 Data providers and access

From which database the data can be made available? Tick the relevant boxes below:

HELCOM    HELCOM PLC    HELCOM MORS  
COMBINE

Other:

If the previous answer is "Other" please fill in the next questions (In case the answer is a HELCOM database, the HELCOM Secretariat will do it)

**Data type** Tick the relevant boxes below:

- Unprocessed/raw Data  
 Processed Data sets  
 Data Products  
 Modelled data

**Data management: General description of data management** ([DataManagement](#), Free text)

Raw data (actual recordings of underwater sound from monitoring stations) are stored nationally. Processed and quality assured data are stored in and shared through a regional database (HELCOM continuous noise database, hosted by ICES).

Modelled soundscape maps are to be produced jointly and stored and shared through a database (section under development within the available HELCOM continuous noise database). Processing algorithms are shared to the highest degree possible.

**What method/mechanism will be used to make the data available?** Tick the relevant boxes below and provide location ([DataAccess](#)):

- Providing URL to view data:  
 Providing URL to download data:  
 Provide location of data in national data centre: <https://marinears.bsh.de>. (DE)  
 Provide location of data in international data centre (e.g. RSC, ICES, EEA, EMODnet): <https://www.ices.dk/marine-data/data-portals/Pages/Continuous-Noise.aspx>

**When will the data first become available?** ([DataPublicationDate](#))

Enter the date of reporting, or even a past date if desired (MM/YYYY):

Uploading to the database will commence during 2020. First data will be available in autumn 2020. Data from 2014 available through the BIAS data sharing platform.

**How frequently are the data expected to be updated thereafter?** Tick the relevant box below:

- |  |  |
|--|--|
| <input type="checkbox"/> Every 6 years     | <input type="checkbox"/> Weekly          |
| <input type="checkbox"/> Every 3 years     | <input type="checkbox"/> Daily           |
| <input type="checkbox"/> Every 2 years     | <input type="checkbox"/> Hourly          |
| <input checked="" type="checkbox"/> Yearly | <input type="checkbox"/> Continually     |
| <input type="checkbox"/> 6-monthly         | <input type="checkbox"/> One-off         |
| <input type="checkbox"/> 3-monthly         | <input type="checkbox"/> As needed       |
| <input type="checkbox"/> Monthly           | <input type="checkbox"/> Other (specify) |
| <input type="checkbox"/> 2-weekly          | <input type="checkbox"/> Unknown         |

**List providing contact points in the Contracting Parties**

EN-Noise
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**Has the data been used or is it planned to be used in HELCOM assessments?** Tick the relevant box below:

- Yes       No

**Select if data is used in the following Baltic Sea Environment Fact Sheets (BSEF)** Tick the relevant boxes below:

**Biodiversity**

- Abundance and distribution of marenzelleria species
- Abundance and distribution of Round goby
- Abundance and distribution of the Zebra mussel
- Biopollution level index
- Observed non-indigenous and cryptogenic species in the Baltic Sea
- Population development of Great Cormorant
- Population development of Sandwich Tern
- Population development of Southern Dunlin
- Population Development of White-tailed Sea Eagle
- Temporal development of Baltic coastal fish communities and key species

**Eutrophication**

- Bacterioplankton growth
- Chlorophyll-a concentrations, temporal variations and regional differences from satellite remote sensing
- Cyanobacteria biomass

- Cyanobacterial blooms in the Baltic Sea
- Cyanobacteria bloom index
- Impacts of invasive phytoplankton species on the Baltic Sea ecosystem in 1980-2008
- Nitrogen atmospheric deposition to the Baltic Sea
- Nitrogen emissions to the air in the Baltic Sea area
- Phytoplankton biomass and species succession
- Shifts in the Baltic Sea summer phytoplankton communities in 1992-2006
- Spatial distribution of the winter nutrient pool
- Unusual phytoplankton event

### **Hazardous substances**

- Atmospheric deposition of heavy metals on the Baltic Sea
- Atmospheric deposition of PCDD/Fs on the Baltic Sea
- Atmospheric emissions of heavy metals in the Baltic Sea region
- Atmospheric emissions of PCDD/Fs in the Baltic Sea region
- Cesium-137 in Baltic Sea sediments
- Temporal trends in contaminants in Herring in the Baltic Sea in the period 1980-2010
- Emissions from Baltic Sea shipping
- Illegal discharges of oil in the Baltic Sea
- Liquid discharges of Cs-137, Sr-90 and Co-60 into the Baltic Sea
- Trace metal concentrations and trends in Baltic surface and deep waters

### **Hydrography**

- Development of Sea Surface Temperature in the Baltic Sea
- Hydrography and Oxygen in the Deep Basins
- Ice season
- Total and regional runoff to the Baltic Sea
- Water Exchange between the Baltic Sea and the North Sea, and conditions in the Deep Basins
- Wave climate in the Baltic Sea

### **b.6 MSFD Criteria (GES Criteria)**

Choose only the most relevant option(s). Tick one or more boxes below.

Descriptor 1	<input type="checkbox"/> D1C1 – Primary: The mortality rate per species from incidental by-catch is below levels which threaten
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	<p>the species, such that its long- term viability is ensured.</p> <p>Member States shall establish the threshold values for the mortality rate from incidental by-catch per species, through regional or subregional cooperation.</p> <p><input type="checkbox"/> D1C2 – Primary:</p> <p>The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured.</p> <p>Member States shall establish threshold values for each species through regional or subregional cooperation, taking account of natural variation in population size and the mortality rates derived from D1C1, D8C4 and D10C4 and other relevant pressures. For species covered by Directive 92/43/EEC, these values shall be consistent with the Favourable Reference Population values established by the relevant Member States under Directive 92/43/EEC.</p> <p><input type="checkbox"/> D1C3 – Primary for commercially- exploited fish and cephalopods and secondary for other species:</p> <p>The population demographic characteristics (e.g. body size or age class structure, sex ratio, fecundity, and survival rates) of the species are indicative of a healthy population which is not adversely affected due to anthropogenic pressures.</p> <p>Member States shall establish threshold values for specified characteristics of each species through regional or subregional cooperation, taking account of adverse effects on their health derived from D8C2, D8C4 and other relevant pressures.</p> <p><input type="checkbox"/> D1C4 – Primary for species covered by Annexes II, IV or V to Directive 92/43/EEC and secondary for other species:</p> <p>The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions.</p> <p>Member States shall establish threshold values for each species through regional or subregional cooperation. For species covered by Directive 92/43/EEC, these shall be consistent with the Favourable Reference Range values established by the relevant Member States under Directive 92/43/EEC.</p> <p><input type="checkbox"/> D1C5 – Primary for species covered by Annexes II, IV and V to Directive 92/43/EEC and secondary for other species:</p> <p>The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species.</p> <p><input type="checkbox"/> D1C6 – Primary</p> <p>The condition of the habitat type, including its biotic and abiotic structure and its functions (e.g. its typical species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), is not adversely affected due to anthropogenic pressures.</p> <p>Member States shall establish threshold values for the condition of each habitat type, ensuring compatibility with related values set under Descriptors 2, 5 and 8, through regional or subregional cooperation.</p>
Descriptor 2	<p><input type="checkbox"/> D2C1 – Primary:</p> <p>The number of non-indigenous species which are newly introduced via human activity</p>

	<p>into the wild, per assessment period (6 years), measured from the reference year as reported for the initial assessment under Article 8(1) of Directive 2008/56/EC, is minimised and where possible reduced to zero.</p> <p>Member States shall establish the threshold value for the number of new introductions of non-indigenous species, through regional or subregional cooperation.</p> <p><input type="checkbox"/> D2C2 — Secondary:</p> <p>Abundance and spatial distribution of established non-indigenous species, particularly of invasive species, contributing significantly to adverse effects on particular species groups or broad habitat types.</p> <p><input type="checkbox"/> D2C3 — Secondary:</p> <p>Proportion of the species group or spatial extent of the broad habitat type which is adversely altered due to non-indigenous species, particularly invasive non-indigenous species.</p> <p>Member States shall establish the threshold values for the adverse alteration to species groups and broad habitat types due to non-indigenous species, through regional or subregional cooperation.</p>
Descriptor 3	<p><input type="checkbox"/> D3C1 — Primary:</p> <p>The Fishing mortality rate of populations of commercially-exploited species is at or below levels which can produce the maximum sustainable yield (MSY). Appropriate scientific bodies shall be consulted in accordance with Article 26 of Regulation (EU) No 1380/2013.</p> <p><input type="checkbox"/> D3C2 — Primary:</p> <p>The Spawning Stock Biomass of populations of commercially-exploited species are above biomass levels capable of producing maximum sustainable yield. Appropriate scientific bodies shall be consulted in accordance with Article 26 of Regulation (EU) No 1380/2013.</p> <p><input type="checkbox"/> D3C3 — Primary:</p> <p>The age and size distribution of individuals in the populations of commercially-exploited species is indicative of a healthy population. This shall include a high proportion of old/large individuals and limited adverse effects of exploitation on genetic diversity.</p> <p>Member States shall establish threshold values through regional or subregional cooperation for each population of species in accordance with scientific advice obtained pursuant to Article 26 of Regulation (EU) No 1380/2013.</p>
Descriptor 4	<p><input type="checkbox"/> D4C1 — Primary:</p> <p>The diversity (species composition and their relative abundance) of the trophic guild is not adversely affected due to anthropogenic pressures.</p> <p>Member States shall establish threshold values through regional or subregional cooperation.</p> <p><input type="checkbox"/> D4C2 — Primary:</p> <p>The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures.</p>

	<p>Member States shall establish threshold values through regional or subregional cooperation.</p> <p><input type="checkbox"/> D4C3 — Secondary:</p> <p>The size distribution of individuals across the trophic guild is not adversely affected due to anthropogenic pressures.</p> <p>Member States shall establish threshold values through regional or subregional cooperation.</p> <p><input type="checkbox"/> D4C3 — Secondary (to be used in support of criterion D4C2, where necessary):</p> <p>Productivity of the trophic guild is not adversely affected due to anthropogenic pressures.</p> <p>Member States shall establish threshold values through regional or subregional cooperation.</p>
Descriptor 5	<p><input type="checkbox"/> D5C1 — Primary:</p> <p>Nutrient concentrations are not at levels that indicate adverse eutrophication effects.</p> <p>The threshold values are as follows:</p> <ul style="list-style-type: none"> <li>(a) in coastal waters, the values set in accordance with Directive 2000/60/EC;</li> <li>(b) beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation</li> </ul> <p><input type="checkbox"/> D5C2 — Primary:</p> <p>Chlorophyll a concentrations are not at levels that indicate adverse effects of nutrient enrichment.</p> <p>The threshold values are as follows:</p> <ul style="list-style-type: none"> <li>(c) in coastal waters, the values set in accordance with Directive 2000/60/EC;</li> <li>(d) beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation.</li> </ul> <p><input type="checkbox"/> D5C3 — Secondary:</p> <p>The number, spatial extent and duration of harmful algal bloom events are not at levels that indicate adverse effects of nutrient enrichment.</p> <p><input type="checkbox"/> D5C4 — Secondary:</p> <p>The photic limit (transparency) of the water column is not reduced, due to increases in suspended algae, to a level that indicates adverse effects of nutrient enrichment.</p> <p>The threshold values are as follows:</p> <ul style="list-style-type: none"> <li>(e) in coastal waters, the values set in accordance with Directive 2000/60/EC;</li> <li>(f) beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation.</li> </ul>

	<p><input type="checkbox"/> D5C5 — Primary (may be substituted by D5C8):</p> <p>The concentration of dissolved oxygen is not reduced, due to nutrient enrichment, to levels that indicate adverse effects on benthic habitats (including on associated biota and mobile species) or other eutrophication effects.</p> <p>The threshold values are as follows:</p> <ul style="list-style-type: none"> <li>(g) in coastal waters, the values set in accordance with Directive 2000/60/EC;</li> <li>(h) beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation.</li> </ul> <p><input type="checkbox"/> D5C6 — Secondary:</p> <p>The abundance of opportunistic macroalgae is not at levels that indicate adverse effects of nutrient enrichment.</p> <p>The threshold values are as follows:</p> <ul style="list-style-type: none"> <li>(a) in coastal waters, the values set in accordance with Directive 2000/60/EC;</li> <li>(b) should this criterion be relevant for waters beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation.</li> </ul> <p><input type="checkbox"/> D5C7 — Secondary:</p> <p>The species composition and relative abundance or depth distribution of macrophyte communities achieve values that indicate there is no adverse effect due to nutrient enrichment including via a decrease in water transparency, as follows:</p> <ul style="list-style-type: none"> <li>(a) in coastal waters, the values set in accordance with Directive 2000/60/EC;</li> <li>(b) should this criterion be relevant for waters beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation.</li> </ul> <p><input type="checkbox"/> D5C8 — Secondary: (except when used as a substitute for D5C5):</p> <p>The species composition and relative abundance of macrofaunal communities, achieve values that indicate that there is no adverse effect due to nutrient and organic enrichment, as follows:</p> <ul style="list-style-type: none"> <li>(a) in coastal waters, the values for benthic biological quality elements set in accordance with Directive 2000/60/EC;</li> <li>(b) beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation.</li> </ul>
Descriptor 6	<p><input type="checkbox"/> D6C1 – Primary:</p> <p>Spatial extent and distribution of physical loss (permanent change) of the natural seabed.</p> <p><input type="checkbox"/> D6C2 – Primary:</p> <p>Spatial extent and distribution of physical disturbance pressures on the seabed.</p>

	<p><input type="checkbox"/> D6C3 – Primary:</p> <p>Spatial extent of each habitat type which is adversely affected, through change in its biotic and abiotic structure and its functions (e.g. through changes in species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), by physical disturbance.</p> <p>Member States shall establish threshold values for the adverse effects of physical disturbance, through regional or subregional cooperation.</p> <p><input type="checkbox"/> D6C4 – Primary:</p> <p>The extent of loss of the habitat type, resulting from anthropogenic pressures, does not exceed a specified proportion of the natural extent of the habitat type in the assessment area.</p> <p>Member States shall establish the maximum allowable extent of habitat loss as a proportion of the total natural extent of the habitat type, through cooperation at Union level, taking into account regional or subregional specificities.</p> <p><input type="checkbox"/> D6C5 – Primary:</p> <p>The extent of adverse effects from anthropogenic pressures on the condition of the habitat type, including alteration to its biotic and abiotic structure and its functions (e.g. its typical species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), does not exceed a specified proportion of the natural extent of the habitat type in the assessment area.</p> <p>Member States shall establish threshold values for adverse effects on the condition of each habitat type, ensuring compatibility with related values set under Descriptors 2, 5, 6, 7 and 8, through cooperation at Union level, taking into account regional or subregional specificities. Member States shall establish the maximum allowable extent of those adverse effects as a proportion of the total natural extent of the habitat type, through cooperation at Union level, taking into account regional or subregional specificities.</p>
Descriptor 7	<p><input type="checkbox"/> D7C1 – Secondary:</p> <p>Spatial extent and distribution of permanent alteration of hydrographical conditions (e.g. changes in wave action, currents, salinity, temperature) to the seabed and water column, associated in particular with physical loss(1) of the natural seabed.</p> <p><input type="checkbox"/> D7C2 – Secondary:</p> <p>Spatial extent of each benthic habitat type adversely affected (physical and hydrographical characteristics and associated biological communities) due to permanent alteration of hydrographical conditions.</p>
Descriptor 8	<p><input type="checkbox"/> D8C1 – Primary:</p> <p>Within coastal and territorial waters, the concentrations of contaminants do not exceed the following threshold values:</p> <p>(a) for contaminants set out under point 1(a) of criteria elements, the values set in accordance with Directive 2000/60/EC;</p>

	<p>(b) when contaminants under point (a) are measured in a matrix for which no value is set under Directive 2000/60/EC, the concentration of those contaminants in that matrix established by Member States through regional or subregional cooperation;</p> <p>(c) for additional contaminants selected under point 1(b) of criteria elements, the concentrations for a specified matrix (water, sediment or biota) which may give rise to pollution effects. Member States shall establish these concentrations through regional or subregional cooperation, considering their application within and beyond coastal and territorial waters.</p> <p>Beyond territorial waters, the concentrations of contaminants do not exceed the following threshold values:</p> <p>(a) for contaminants selected under point 2(a) of criteria elements, the values as applicable within coastal and territorial waters;</p> <p>(b) for contaminants selected under point 2(b) of criteria elements, the concentrations for a specified matrix (water, sediment or biota) which may give rise to pollution effects. Member States shall establish these concentrations through regional or subregional cooperation.</p> <p><input type="checkbox"/> D8C2 – Secondary:</p> <p>The health of species and the condition of habitats (such as their species composition and relative abundance at locations of chronic pollution) are not adversely affected due to contaminants including cumulative and synergetic effects.</p> <p>Member States shall establish those adverse effects and their threshold values through regional or subregional cooperation.</p> <p><input type="checkbox"/> D8C3 – Primary:</p> <p>The spatial extent and duration of significant acute pollution events are minimised.</p> <p><input type="checkbox"/> D8C4 – Secondary (to be used when a significant acute pollution event has occurred):</p> <p>The adverse effects of significant acute pollution events on the health of species and on the condition of habitats (such as their species composition and relative abundance) are minimised and, where possible, eliminated.</p>
Descriptor 9	<p><input type="checkbox"/> D9C1 – Primary:</p> <p>The level of contaminants in edible tissues (muscle, liver, roe, flesh or other soft parts, as appropriate) of seafood (including fish, crustaceans, molluscs, echinoderms, seaweed and other marine plants) caught or harvested in the wild (excluding fin-fish from mariculture) does not exceed:</p> <p>(a) for contaminants listed in Regulation (EC) No 1881/2006, the maximum levels laid down in that Regulation, which are the threshold values for the purposes of this Decision;</p> <p>(b) for additional contaminants, not listed in Regulation (EC) No 1881/2006, threshold values, which Member States shall establish through regional or subregional cooperation.</p>

<p>Descriptor 10</p>	<p><input type="checkbox"/> D10C1 – Primary:</p> <p>The composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed, are at levels that do not cause harm to the coastal and marine environment.</p> <p>Member States shall establish threshold values for these levels through cooperation at Union level, taking into account regional or subregional specificities.</p> <p><input type="checkbox"/> D10C2 – Primary:</p> <p>The composition, amount and spatial distribution of micro-litter on the coastline, in the surface layer of the water column, and in seabed sediment, are at levels that do not cause harm to the coastal and marine environment.</p> <p>Member States shall establish threshold values for these levels through cooperation at Union level, taking into account regional or subregional specificities.</p> <p><input type="checkbox"/> D10C3 – Secondary:</p> <p>The amount of litter and micro-litter ingested by marine animals is at a level that does not adversely affect the health of the species concerned. Member States shall establish threshold values for these levels through regional or subregional cooperation.</p> <p><input type="checkbox"/> D10C4 – Secondary:</p> <p>The number of individuals of each species which are adversely affected due to litter, such as by entanglement, other types of injury or mortality, or health effects. Member States shall establish threshold values for the adverse effects of litter, through regional or subregional cooperation.</p>
<p>Descriptor 11</p>	<p><input type="checkbox"/> D11C1 – Primary:</p> <p>The spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals.</p> <p>Member States shall establish threshold values for these levels through cooperation at Union level, taking into account regional or subregional specificities.</p> <p><input checked="" type="checkbox"/> D11C2 – Primary:</p> <p>The spatial distribution, temporal extent and levels of anthropogenic continuous low-frequency sound do not exceed levels that adversely affect populations of marine animals.</p> <p>Member States shall establish threshold values for these levels through cooperation at Union level, taking into account regional or subregional specificities.</p>

## d. References

Make a list of cited references and literature for further supportive information.

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A. Nikolopoulos, et al. BIAS Implementation Plan Monitoring and assessment guidance for continuous low frequency sound in the Baltic Sea. s.l. : BIAS LIFE11 ENV/SE/841., 2016.

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