

HELCOM Monitoring Programme topic

Species distribution and abundance / Benthic community

Programme:

Hardbottom species

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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.

Permanent Groups	
<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
Time-limited Groups	
<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
Expert Groups	
<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 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
<input checked="" type="checkbox"/>	EN Benthic – Expert Network on benthic habitats

- IN-EUTROPHICATION - Intersessional Network on Eutrophication
- 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):
- Coordinated monitoring is under development. Indicate by which group/project and by when a recommendation on coordinated monitoring can be expected.
- Not coordinated.

The monitoring of macroalgae follows national methods which have been developed for national EU WFD, MSFD and Habitat Directive assessment. Development of a basis for coordinated assessment, including monitoring, focused on identifying parameters and indicators which are not already bound by national legislation and also on identifying the most relevant spatial scales for assessments in the marine area. The development took place under the HELCOM CORESET II project and considered parameters included various specific macroalgae parameters as well as blue mussel coverage. When core indicators are developed, the discrepancies in methods and elements monitored by countries need to be considered.

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 requirements on monitoring can include number of stations, the sampling frequency and replication.

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
 - Natural oxygen levels
-
- Hazardous substances**
- Concentrations of hazardous substances close to natural levels
 - All fish safe to eat
-

-
- Healthy wildlife
 - Radioactivity at pre-Chernobyl levels
-

Biodiversity

- Natural landscapes and seascapes
 - Thriving and balanced communities of plants and animals
 - Viable populations of species
-

Maritime activities

- No illegal pollution
 - Safe maritime traffic without accidental pollution
 - Efficient response capability
 - No introductions of alien species from ships
 - Minimum air pollution from ships
 - Zero discharges from offshore platforms
-

b.6 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](#)):

The main gap in current monitoring of hardbottom macroalgae is the lack of common methodology for sampling and analysis. The areal coverage of the macroalgae monitoring is quite extensive and the temporal frequency of the sampling is adequate.

Hardbottom epifauna monitoring is not done in many countries and there has been no coordination in the method development. In Finland, blue mussel monitoring has started in selected sites where macroalgae are currently monitored.

In Estonia adequate monitoring is in place covering both macroalgae and epifauna following vertical distribution of species, coverage, biomass and abundance. Current monitoring is concentrated on coastal waterbodies.

In Germany only a few sites are suitable to assess the depth limit of macrophyte species on hardbottom substrates and the substrate availability is not sufficient to follow the depth gradient in sufficient detail. Suitable sites may exist outside the WFD CW area (1Nm zone) in low numbers, but they are currently not monitored although monitoring is planned. Species composition, biomass and cover are not monitored continuously along the depth gradient, only at certain depth intervals,

which were identified as appropriate for WFD purposes.

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 checked="" 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 ¹ and atmospheric sources)	Human activities causing the pressures	Effectiveness of measures
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If this is selected fill in the following questions: c.1b	If this is selected fill in the following questions: c.1c, d	If this is selected fill in the following questions: c.1c, d	If this is selected fill in the following questions: c.1c, d	If this is selected fill in the following questions: c.1c, d

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

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)

¹ 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).

- 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
		<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 checked="" type="checkbox"/> Benthic habitats	<input checked="" 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 checked="" 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 type="checkbox"/> Adverse effects on species or habitats
	<input type="checkbox"/> Acute pollution events
	<input type="checkbox"/> Litter in the environment
	<input type="checkbox"/> Impulsive sound in water
<input type="checkbox"/> 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 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 of anthropogenic sound (impulsive, continuous)
-
- Input of other forms of energy (including electromagnetic fields, light and heat)
-
- 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 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 type="checkbox"/> Transport infrastructure
	<input 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:

c.3 Implementation of Regional Cooperation

([RegionalCooperation_implementation](#))

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

- No coordination
- 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 table²:

Current means of coordination	Features or elements	Parameter	Method	QA/QC	Frequency ³	Spatial resolution (density) of sampling	Link to HELCOM core indicators ⁴	Spatial scope	Monitoring started (year)	CPs monitoring ⁵
	Elements (Features) (Features_num)	Parameters (Parameter) (ParametersOther)	MonitoringMethod (Monitoring Method) MonitoringMethodOther)	(Free text)	MonitoringFrequency	(ProgrammeDescription)	(RelatedIndicator) (RelatedIndicator_name)	(SpatialScope)	(TemporalScope)	(CountryCode_Enum)
National	Macroalgae	Areal extent of habitat	National methods	National	Yearly	Covering a couple of waterbodies per water type (by several transects per waterbody) PL: No monitoring in coastal waters, only open sea.		WFD CW		DE, DK, EE, LT, PL, SE
National	Blue mussels	Population size (abundance)	National methods	National	Yearly FI: once every 1-3 year	Covering a couple of waterbodies per water type (by several transects per waterbody)		WFD CW		FI, SE

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

³ The option "Different for each country - see MORE overview" refers to the [overview](#) carried out in 2013

⁴ Give the name of HELCOM core indicators that are based on the monitoring parameter.

⁵ Provide information on the Contracting Partie(s) that are monitoring the parameter.

Current means of coordination	Features or elements	Parameter	Method	QA/QC	Frequency ³	Spatial resolution (density) of sampling	Link to HELCOM core indicators ⁴	Spatial scope	Monitoring started (year)	CPs monitoring ⁵
National	Blue mussels	Population size (abundance)	National methods	National	Yearly	Selected mussel reefs per subbasin		WFD CW		DK, SE
National	Macroalgae (Fucus), SE all species	Species distributional range/pattern	Assessment of depth limits by video recording or diving along transects	National	Yearly FI: once every 1-3 year	One or several "samples" (=locations) per WFD water body with 5 replicates per sample/location		WFD CW	2006	DE, FI, SE, EE, DK, LV, LT
National	Macroalgae	Species abundance (biomass)	Sampling by divers in certain depth levels and assessment of species specific dry weight in the laboratory	National	Yearly	One or several "samples" (=locations) per WFD water body with 5 replicates per sample/location		WFD CW	2006	DE, EE
National	Macroalgae	Species abundance (numbers or cover)	Sampling by divers in certain depth levels and assessment of species specific cover in the field	National	Yearly FI: once every 1-3 year	One or several "samples" (=locations) per WFD water body with 5 replicates per sample/location		WFD CW	2006	DE, FI, EE, LV, LT

Current means of coordination	Features or elements	Parameter	Method	QA/QC	Frequency ³	Spatial resolution (density) of sampling	Link to HELCOM core indicators ⁴	Spatial scope	Monitoring started (year)	CPs monitoring ⁵
National	Macroalgae (coastal waters) And partly hardbottom fauna in 18 transects in N-2000 areas	Species abundance (numbers or cover)	Sampling by divers in certain depth levels and assessment of species specific cover in the field	National	36 transects Yearly 82 transects once or twice over a 5 years period 18 transects in N-2000 areas once within a 5 year period	Several transects (location) pr. WFD area. Investigated in 2m depth interval with 3 replicate pr. Depth interval (only one replicate/depth interval for fauna in N-2000 sites)		WFD CW + HD (type: 1170 Reef and 1160 (bays and indlets))	1990 Develop over years and hardbottom fauna included recently	DK inshore
National	Macroalgae and hardbottom fauna (off shore)	Species abundance (numbers or cover)	Sampling by divers in certain depth levels and assessment of species specific cover in the field.	National	Yearly at 11 locations and once in a 6 years cycle at 22 locations	33 offshore locations Investigated in 2-3m depth intervals		WFD CW HD type 1170 Reef and 1180 "bubbling reefs" MSFD	1990	DK off shore

Current means of coordination	Features or elements	Parameter	Method	QA/QC	Frequency ³	Spatial resolution (density) of sampling	Link to HELCOM core indicators ⁴	Spatial scope	Monitoring started (year)	CPs monitoring ⁵
National	Quantitative samples of hard bottom species in each of the following habitats: Fucus, Cladophora, Ceraminum/Rhodomela, Battersia, Blue mussels	Abundance and biomass of dominant species of fauna and flora	0,2 x 0,2 m frames = 0,04 m ² for the quantitative samples of Cladophora (n=1), Ceraminum/Rhodomela (n=3), Battersia (n=3) and Blue mussels (n=3). For Fucus 1 algae collected per sample.	National						SE
National	Macroalgae	Species present (whole community or selected species only)	Sampling by divers in certain depth levels and assessment of species specific cover estimations in the field and dry weight in the laboratory	National	Yearly FI: once every 1-3 year	one or several "samples" (=locations) per WFD water body with 5 replicates per sample/location		WFD CW	2006	DE, FI

Current means of coordination	Features or elements	Parameter	Method	QA/QC	Frequency ³	Spatial resolution (density) of sampling	Link to HELCOM core indicators ⁴	Spatial scope	Monitoring started (year)	CPs monitoring ⁵
National	All macrozoobenthos species	Species present, abundance and biomass	sampling by divers	National	4 WB yearly and other 12 WB at least once per 6 years	3 transects per WB		WFD CW	1995	EE
National	All macrozoobenthos species	Species present, abundance and biomass	sampling by divers	National	Yearly at 11 locations and once in a 6 years cyclus at 18 locations	Offshore and coastal transects taken with 2-3m depth intervals at 33 locations		HD type 1170 Reef, 1180 "bubbling reefs" and 1160 (bays and indlets MSFD	1990	DK

PARAMETER

Element/Parameter pair
Macroalgae/Areal extent (lower depth limit of the selected species, such as <i>Fucus vesiculosus</i> , <i>Furcellaria lumbricalis</i> , <i>Polysiphonia fucoides</i> , <i>Rhodomela confervoides</i> and <i>Phyllophora pseudoceranoides</i>).
Macroalgae/Species abundance (numbers or cover)
Macroalgae/Species abundance (biomass)
Macroalgae/Species present (whole community or selected species only)
Blue mussel/Areal extent (optimum depth limit of the blue mussel zone)
Blue mussel/Population abundance (density)
Blue mussels (size of individuals)

METHOD (MonitoringDetails)

Macroalgae/Areal extent
Depth limit is determined in line transects at selected locations along depth gradient (across the currently existing depth limit of the species, not the whole depth range) with a towed video sledge, drop cameras or by divers.
Macroalgae/Species abundance (numbers or cover)
Cover estimations are made by divers at fixed stations, at specified depth intervals (densest part of the vegetation biotope) in an area of 20-25 m ² and within frames (0.25 m ²), frames with 3-5 replicates per location. The cover estimate includes all species (or other relevant taxa) that are identifiable under water and for nonidentifiable species samples are collected. The cover estimate can exceed 100% if the macrophytes grow in several layers.
Macroalgae/Species abundance (biomass)
Macroalgae/Species present (whole community or selected species only)
Biomass- and taxonomic determinations are done in laboratories on samples collected by divers at fixed stations at specified depth intervals (densest parts of the vegetation biotope) in frames (0.0625 m ²) with 5 replicates per location.
In Estonia biomass samples are processed in the laboratory. Coverage estimations are done either by divers or by drop camera. In Poland sampling by divers is done at fixed stations (points), where three replicate samples are collected with (0.25 m ²) per each depth interval.
Blue mussel/Areal extent (optimum depth limit of the blue mussel zone)
Blue mussel/Population abundance (density)
Blue mussels (size of individuals)

In Finland monitoring started in 2015. The method for abundance and size measurements is under development.

QA/QC

Macroalgae/Areal extent

Macroalgae/Species abundance (numbers or cover)

Macroalgae/Species abundance (biomass)

Macroalgae/Species present (whole community or selected species only)

National

Blue mussel/Areal extent (optimum depth limit of the blue mussel zone)

Blue mussel/Population abundance (density)

Blue mussels (size of individuals)

National

FREQUENCY

Frequency

Macroalgae/Areal extent

In Estonia depth distribution of species is determined every year in 4 coastal waterbodies and once per 6 years at 12 waterbodies.

Macroalgae/Species abundance (numbers or cover)

In Estonia species abundance is determined every year in 4 coastal waterbodies and once per 6 years at 12 waterbodies.

Macroalgae/Species abundance (biomass)

In Estonia biomass of phytobenthic communities is determined every year in 4 coastal waterbodies and once per 6 years at 12 waterbodies.

Macroalgae/Species abundance (numbers or cover)

Macroalgae/Species abundance (biomass)

Macroalgae/Species present (whole community or selected species only)

Varies between countries:

Yearly (79%, n=277, DE, DK, EE, LT, PL, SE)

Every 3rd year (13%, n=46, EE, FI, LT, SE)

Every 6th year (6%, n=21, DK)

Twice per year (2%, n=4, PL).

Blue mussel/Areal extent (optimum depth limit of the blue mussel zone)

Blue mussel/Population abundance (density)
Blue mussels (size of individuals)
In Finland 1-2/ 6 years

SPATIAL SCOPE

Spatial Scope

Macroalgae/Areal extent
In EE Along transects (3 transects per coastal waterbody)
In PL monitoring is not conducted in coastal waters, only open sea
Macroalgae/Species abundance (numbers or cover)
In EE Along transects (3 transects per coastal waterbody)
Macroalgae/Species abundance (biomass)
In EE Along transects (3 transects per coastal waterbody)
Macroalgae/Species present (whole community or selected species only)
In EE Along transects (3 transects per coastal waterbody)
Blue mussel/Areal extent (optimum depth limit of the blue mussel zone)
Blue mussel/Population abundance (density)
Blue mussels (size of individuals)
WFD CW

SPATIAL RESOLUTION (DENSITY) OF SAMPLING

Spatial resolution

Macroalgae/Areal extent
In EE sampling is done along the transect from coastline to the deepest occurrence of vegetation. 3 transects per coastal WB.
Macroalgae/Species abundance (numbers or cover)
In EE sampling is done along the transect from coastline to the deepest occurrence of vegetation. 3 transects per coastal WB.
Macroalgae/Species abundance (biomass)
In EE sampling is done along the transect from coastline to the deepest occurrence of vegetation. 3 transects per coastal WB.
)
As hard substrate is scarce along the German coastline, often only one or two locations with macroalgae in sufficient density per water body, the rationale is often to sample where sampling is possible.

In the northern Baltic Sea, hard-bottom monitoring sites are designed to cover at least the coastal water types, where representative water bodies are selected (3-5 replicate sites per monitoring area).

In Finnish waters the sites are selected to include bladder wrack, red algae and blue mussels (if feasible).

In Poland there is no monitoring in coastal waters, only in the open sea areas. There are only 2 transect locations in transitional waters and 4 locations in open sea stations.

In EE sampling is done along the transect from coastline to the deepest occurrence of vegetation. 3 transects per coastal WB.

Blue mussel/Areal extent (optimum depth limit of the blue mussel zone)

Blue mussel/Population abundance (density)

Blue mussels (size of individuals)

In the northern Baltic Sea, hard-bottom monitoring sites are designed to cover selected sites along the coast. In the Finnish waters, the sites are selected to include bladder wrack, red algae and blue mussels (if available).

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)
- Unknown

c.5 Monitoring and assessment requirements

Monitoring requirements:

An appropriate assessment of the state of the hard-bottom fauna and flora along the coast requires monitoring in several coastal waterbodies. Each coastal waterbody/type should be monitored with a few transects, in order to decrease the impact of natural variation in the assessment.

In sites meant for status classification, it is enough to carry out the monitoring every 3rd year. In sites meant for detecting temporal change, annual monitoring is required in order to create reliable time series data. For macroalgae, monitoring is to be carried out during the summer months, the exact timing depending on biogeographical characteristics (may be different in the southern and northern

areas of the Baltic Sea).

The small-scale spatial variation in substrate can potentially affect the measurement outcome, and has to be considered in monitoring of macroalgae depth limits, thus an area of circa 25-49 sqm should optimally be considered in a monitoring location. This can be achieved, for example, by diving horizontally along the lower depth limit of the selected species.

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

Assessment of natural variability

Quantitative. For hard-bottom parameters correlation with water quality parameters is high, however the data resolution produced through monitoring may in some instances be too low to produce statistically significant correlations. Hard bottom parameters can be used to assess GES both from the perspective of biodiversity and eutrophication. The effect of natural variability on the assessment confidence can be reduced by sampling in 3-5 replicate sites close to each other within a same coastal water type. The macroalgae indicators are intercalibrated with neighbouring countries (within same water types) in order to have comparable status classification.

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)

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: [Click here to enter text.](#)
- Provide location of data in international data centre (e.g. RSC, ICES, EEA, EMODnet):

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

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

Estonia: March after the monitoring year.

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

- | | |
|---|---|
| <input checked="" 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 type="checkbox"/> Yearly | <input type="checkbox"/> Continually |
| <input type="checkbox"/> 6-monthly | <input checked="" 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

Estonian Environment Agency

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

- Yes
(partly) 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

c.7 MSFD Criteria (GES criteria)

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

Descriptor 1	<p><input type="checkbox"/> D1C1 – Primary:</p> <p>The mortality rate per species from incidental by-catch is below levels which threaten 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>
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	<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 checked="" type="checkbox"/> D2C1 – Primary:</p> <p>The number of non-indigenous species which are newly introduced via human activity 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 checked="" 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 checked="" 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"> (a) in coastal waters, the values set in accordance with Directive 2000/60/EC; (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 <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"> (c) in coastal waters, the values set in accordance with Directive 2000/60/EC; (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. <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>

	<p>(e) in coastal waters, the values set in accordance with Directive 2000/60/EC;</p> <p>(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.</p> <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> <p>(g) in coastal waters, the values set in accordance with Directive 2000/60/EC;</p> <p>(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.</p> <p><input checked="" 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> <p>(a) in coastal waters, the values set in accordance with Directive 2000/60/EC;</p> <p>(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.</p> <p><input checked="" 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> <p>(a) in coastal waters, the values set in accordance with Directive 2000/60/EC;</p> <p>(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.</p> <p><input checked="" 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> <p>(a) in coastal waters, the values for benthic biological quality elements set in accordance with Directive 2000/60/EC;</p> <p>(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.</p>
Descriptor 6	<p><input type="checkbox"/> D6C1 – Primary:</p> <p>Spatial extent and distribution of physical loss (permanent change) of the natural</p>

	<p>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 checked="" 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</p>

	<p>the following threshold values:</p> <ul style="list-style-type: none"> (a) for contaminants set out under point 1(a) of criteria elements, the values set in accordance with Directive 2000/60/EC; (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; (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>Beyond territorial waters, the concentrations of contaminants do not exceed the following threshold values:</p> <ul style="list-style-type: none"> (a) for contaminants selected under point 2(a) of criteria elements, the values as applicable within coastal and territorial waters; (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><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> <ul style="list-style-type: none"> (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; (b) for additional contaminants, not listed in Regulation (EC) No 1881/2006, threshold values, which Member States shall establish through regional or

	subregional cooperation.
Descriptor 10	<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>
Descriptor 11	<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 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.

Commission Decision (EU) 2018/229 of 12 February 2018 establishing, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, the values of the Member State monitoring system classifications as a result of the intercalibration exercise and repealing

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