

# HELCOM Monitoring Programme topic

## Hydrochemistry

Programme:

Nutrients

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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 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 type="checkbox"/>	IN Benthic habitat – Intersessional Network on habitat monitoring

- |                                     |  |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | IN-EUTROPHICATION - Intersessional Network on Eutrophication                                   |
| <input type="checkbox"/>            | IWGAS – Informal Working Group on Aerial Surveillance  |
| <input type="checkbox"/>            | JWG Bird – HELCOM-OSPAR-ICES Joint Working Group on Seabirds                                   |
| <input type="checkbox"/>            | MORS EG – Expert group on monitoring of radioactive substances in the Baltic Sea               |
| <input type="checkbox"/>            | PRF Cooperation Platform – Cooperation Platform on Port Reception Facilities in the Baltic Sea |
| <input type="checkbox"/>            | SAFE NAV – Group of Experts on Safety of Navigation  |
| <input type="checkbox"/>            | SUBMERGED – Expert Group on Environmental Risks of Hazardous Submerged Objects                 |

## a.2 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.

- |  |
|--|
| <ul style="list-style-type: none"> <li>• Common monitoring guidelines: <a href="#">Nitrite</a>, <a href="#">Nitrate</a>, <a href="#">Ammonium</a>, <a href="#">Phosphate</a>, <a href="#">Total nitrogen (TN)</a>, <a href="#">Total phosphorus (TP)</a>, <a href="#">Silicate</a>, <a href="#">HELCOMCOMBINE manual</a>.</li> <li>• Common quality assurance programme: <a href="#">HELCOM COMBINE manual</a>.</li> <li>• Common database: ICES.</li> </ul> |
|--|

## 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** :

Full description in HELCOM COMBINE manual. Detailed information on monitoring frequency and spatial resolution has not yet been collected from all countries but will be added.

## 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

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Viable populations of species

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**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.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](#)):

Existing coordinated monitoring in some sub-basins does not provide sufficient temporal coverage to achieve high confidence in the core indicator status estimate ([BSEP143](#)) during the assessment season.

## 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 <sup>1</sup> and atmospheric sources)	Human activities causing the pressures	Effectiveness of measures
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" 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)
- 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 checked="" 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 checked="" 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

- 
- 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 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 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 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:

- 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	Parameters and 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_enum)	Parameters (Parameter) (ParametersOther)	MonitoringMethod (Monitoring Method) (MonitoringMethodOther)	(Free text)	MonitoringFrequency	(ProgrammeDescription)	(RelatedIndicator) (RelatedIndicator_name)	(SpatialScope)	(TemporalScope)	(CountryCode_Enum)
Regional (COMBINE)	DIN: NH <sub>4</sub> in situ	Concentration of chemical/nutrient/pollutant in water column	Fixed station in situ (HELCOM COMBINE manual, <a href="#">annex C-2, Chapter 4.5</a> )	ICESData TypeGuide	<a href="#">See map for details</a>	<a href="#">See map for details</a>	Concentrations of dissolved inorganic nitrogen (winter)	EEZ	Data available from 1957, Coordinated COMBINE monitoring started 1965	All HELCOM Contracting Parties
Regional (COMBINE)	Tot-N in situ	Concentration of chemical/nutrient/pollutant in water column	Fixed station in situ (HELCOM COMBINE manual, <a href="#">annex C-2, Chapter 4.5</a> )	ICESData TypeGuide	<a href="#">See map for details</a>	<a href="#">See map for details</a>	None at the time but considered in EUTRO-OPER	EEZ	Data available from 1966, Coordinated COMBINE monitoring started 19XX	All HELCOM Contracting Parties

<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	Parameters and elements	Parameter	Method	QA/QC	Frequenc y <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>
Regional (COMBINE)	DIN: NO <sub>3</sub> -N in situ	Concentration of chemical/nutrient/pollutant in water column	Fixed station in situ (HELCOM COMBINE manual, <a href="#">annex C-2, Chapter 4.5</a> )	ICESData TypeGuide	<a href="#">See map for details</a> (NOTE: NO <sub>3</sub> -NO <sub>2</sub> map)	<a href="#">See map for details</a> (NOTE: NO <sub>3</sub> -NO <sub>2</sub> map)	Concentrations of dissolved inorganic nitrogen (winter)	EEZ	Data available from 1955, Coordinated COMBINE monitoring started 1979	All HELCOM Contracting Parties
Regional (COMBINE)	DIN: NO <sub>2</sub> -N in situ	Concentration of chemical/nutrient/pollutant in water column	Fixed station in situ (HELCOM COMBINE manual, <a href="#">annex C-2, Chapter 4.5</a> )	ICESData TypeGuide	<a href="#">See map for details</a> (NOTE: NO <sub>3</sub> -NO <sub>2</sub> map)	<a href="#">See map for details</a> (NOTE: NO <sub>3</sub> -NO <sub>2</sub> map)	Concentrations of dissolved inorganic nitrogen (winter)	EEZ	Data available from 1928, Coordinated COMBINE monitoring started 1979	All HELCOM Contracting Parties
Regional (COMBINE)	Tot-P in situ	Concentration of chemical/nutrient/pollutant in water column	Fixed station in situ (HELCOM COMBINE manual, <a href="#">annex C-2, Chapter 4.5</a> )	ICESData TypeGuide	<a href="#">See map for details</a>	<a href="#">See map for details</a>	None at the time but considered in EUTRO-OPER	EEZ	Data available from 1966, Coordinated COMBINE monitoring started 1979	All HELCOM Contracting Parties
Other	DIN: NO <sub>2</sub> +NO <sub>3</sub> -N - SoO in situ	Concentration of chemical/nutrient/pollutant in water column	Ship-of-opportunity in situ. <a href="#">HELCOM COMBINE manual</a>	<a href="#">HELCOM COMBINE manual</a> and other QA/QC systems	Monthly / weekly		Concentrations of dissolved inorganic nitrogen (winter)	EEZ	1999	EE and FI

Current means of coordination	Parameters and 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>
Other	DIP: PO <sub>4</sub> -P - SoI in situ	Concentration of chemical/nutrient/pollutant in water column	Ship-of-opportunity in situ. <a href="#">HELCOM COMBINE manual</a>	<a href="#">HELCOM COMBINE manual</a> and other QA/QC systems	Monthly / weekly		Concentrations of dissolved inorganic phosphorous (winter)	EEZ	1999	EE and FI
Regional (COMBINE)	Silicate (SiO <sub>4</sub> )	Concentration of chemical/nutrient/pollutant in water column	Fixed station in situ (HELCOM COMBINE manual, <a href="#">annex C-2, Chapter 4.5</a> )	ICESData TypeGuide	<a href="#">6 times/year</a> plus 1 high frequency station 12 year	<a href="#">See map for details</a>	None	EEZ	1992 (COMBINE), 1977 national programmes	DK and PL

## PARAMETER

Element/Parameter pair
Nutrients in situ/ Concentration of nutrient in water column

## METHOD (MonitoringDetails)

Element/parameter
Platform: boat
Mode of sampling: fixed station (stations listed in <a href="#">Annex C-1</a> in the <a href="#">HELCOM COMBINE manual</a> ).
Sampling details, depth: The depths at which sampling should take place are as follows (in metres): 1, 5, 10, 15, 20, 25 (obligatory in the Kattegat and the Belt Sea), 30, 40, 50, 60, 70, 80, 90, 100, 125, 150, 175, 200, 225, 250, 300, and 400 metres, and as close to the bottom as possible (preferably less than 1 metre from the sediment surface to get near bottom oxygen concentration). Not all Danish stratified stations > 10 m depth are sampled with the given depth frequency (1m, 5m, 10m, 15m etc). Some are sampled only surface/bottom. The same is the case for the German sampling stations. Poland also samples at 2.5m.
For unstratified water less than 10m depth, samples will be taken from 1m or an integrated sample is taken. The regional conditions and circumstances have to be considered, when choosing the sampling depth.
In Estonia 1, 5, 10 m and in the near bottom layer.
Sampling details, replicas: At least two samples should be collected.
Denmark does not collect water samples in duplicate for each depth.
Method sampling: Samples are collected using a CTD system which is attached to a rosette sampler or a cast of reversing water samplers (e.g., Niskin or Nansen bottles) equipped with reversing thermometers.
Method of sample analysis: The determination of nutrients is based on colorimetric methods (c.f. Grasshoff et al., 1983, Kirkwood, 1996).

## QA/QC

Element/Parameter pair
The quality system is formalized in the quality manual ( <a href="#">Part B Annex B2</a> in the <a href="#">HELCOM COMBINE manual</a> ).
Guidance on the interpretation of ISO/IEC/EN 17025 'General Requirements for the Competence of Testing and Calibration of Laboratories' (formerly EN 45001 and ISO Guide 25) was given by a joint international EURACHEM/WELAC Working Group (EURACHEM/WELAC, 1992). Specific guidance to Analytical Quality Control for Water Analysis was elaborated by European - CEN/TC 230 (EN 14996) - as well as by international - ISO/TC 147 SC 7 (ISO/TR 13530) - standardization authorities.
The analytical requirements are specified, including definition of the type and nature of the sample and its environment, concentration range of interest and

permissible tolerances in analytical error ([Part B Annex B3](#) in the [HELCOM COMBINE manual](#)).

It has been established, by laboratory studies, that the performance characteristics (selectivity, sensitivity, range, limit of detection and accuracy) of the method meet the specifications related to the intended use of the analytical results ([Part B Annex B4](#) in the [HELCOM COMBINE manual](#)).

According to international standard, e.g. ISO 17025, a defined analytical quality has been achieved, maintained, and proven by documentation. The establishment of a system of control charts is a basic principle applied in this context. For further information for control charts refer to ISO/TR 13530 (1997). ([Part B Annex B5](#) in the [HELCOM COMBINE manual](#)).

The comparability of the data has been ensured through an external quality assessment, such as participation in external quality schemes, ring text and/ or use of external experts ([Part B Annex B6](#) in the [HELCOM COMBINE manual](#)).

## FREQUENCY

### Frequency

#### Element/Parameter pair

For assessment purposes, measurements should be made at least during the winter period (December-February). Mapping the winter pool of nutrients should be done a few times per year at set stations. High frequency cruise station sampling should be done at least 12 times per year (basically monthly sampling but weekly in the vegetative period) for N and P. Ship-of-opportunity sampling frequency should be about every 200 m, and nutrients about every 10 km and every 1 - 3 weeks.

For ships-of-opportunity and helicopter sampling a single sample from the mixed surface layer can be taken.

## SPATIAL SCOPE

### Spatial Scope

#### Element/Parameter pair

Relation to D5 (eutrophication). Nutrients are measured in all HELCOM subbasins in the Baltic.

## SPATIAL RESOLUTION (DENSITY) OF SAMPLING

### Spatial resolution

#### Element/Parameter pair

[See map for details](#)

## PARAMETER

### Element/Parameter pair

**Nutrients Ship of opportunity / Concentration of nutrient in water column**

## METHOD (MonitoringDetails)

### Element/parameter

See [HELCOM COMBINE manual](#).

Platform: boat (Ship-of-opportunity).

Mode of sampling: Sampling is done en route, at fixed longitudes.

Sampling details, depth: Sampling is done at appr. 5 m depth, and represents the mixed surface layer.

Sampling details, replicas: At least two samples should be taken.

Method sampling: Water is continuously pumped through a system, taking water samples according to programming (Ferrybox sampling programme). The samples are stored in a dark refrigerator for max. 2 days.

Method of sample analysis: The determination of nutrients is based on colorimetric methods (c.f. Grasshoff et al., 1983, Kirkwood, 1996).

## QA/QC

### Element/Parameter pair

The quality system is formalized in the quality manual ([Part B Annex B2](#) in the [HELCOM COMBINE manual](#)).

Guidance on the interpretation of ISO/IEC/EN 17025 'General Requirements for the Competence of Testing and Calibration of Laboratories' (formerly EN 45001 and ISO Guide 25) was given by a joint international EURACHEM/WELAC Working Group (EURACHEM/WELAC, 1992). Specific guidance to Analytical Quality Control for Water Analysis was elaborated by European - CEN/TC 230 (EN 14996) - as well as by international - ISO/TC 147 SC 7 (ISO/TR 13530) - standardisation authorities.

The analytical requirements are specified, including definition of the type and nature of the sample and its environment, concentration range of interest and permissible tolerances in analytical error ([Part B Annex B3](#) in the [HELCOM COMBINE manual](#)).

It has been established, by laboratory studies, that the performance characteristics (selectivity, sensitivity, range, limit of detection and accuracy) of the method meet the specifications related to the intended use of the analytical results ([Part B Annex B4](#) in the [HELCOM COMBINE manual](#)).

According to international standard, e.g. ISO 17025, a defined analytical quality has been achieved, maintained, and proven by documentation. The establishment of a system of control charts is a basic principle applied in this

context. For further information for control charts refer to ISO/TR 13530 (1997). ([Part B Annex B5](#) in the [HELCOM COMBINE manual](#)).

The comparability of the data has been ensured through an external quality assessment, such as participation in external quality schemes, ring text and/ or use of external experts ([Part B Annex B6](#) in the [HELCOM COMBINE manual](#)).

## FREQUENCY

### Frequency

#### Element/Parameter pair

Sampling is done between March – December, during the ice-free season. Samples are taken biweekly / monthly.

## SPATIAL SCOPE

### Spatial Scope

#### Element/Parameter pair

All sub-basins.

## SPATIAL RESOLUTION (DENSITY) OF SAMPLING

### Spatial resolution

#### Element/Parameter pair

Some tens of samples along the ship routes.

**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:

For assessment purposes, at least 15 observations should be conducted during the period December-February made every winter in each assessment unit. The compilation of observations is expected to be distributed spatially within the assessment unit in a non-biased way.

### 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 checked="" type="checkbox"/>	<input 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?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Assessment of natural variability

## 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: HELCOM, [ICES database](#), Algabase

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)

Open access to data covered by ICES data policy

**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): Open access to data covered by ICES data policy

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

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

The ICES database contains currently data up to 2018.

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

- Every 6 years
- Weekly
- Every 3 years
- Daily
- Every 2 years
- Hourly
- Yearly
- Continually
- 6-monthly
- One-off
- 3-monthly
- As needed
- Monthly
- Other (specify)
- 2-weekly
- Unknown

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

Contact point to national monitoring programmes will be added.

**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
- Eutrophication status of the Baltic Sea 2007-2011 – A concise thematic assessment

### **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</p>
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	<p>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 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</p>

	<p>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 checked="" 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>

(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.

D5C3 — Secondary:

The number, spatial extent and duration of harmful algal bloom events are not at levels that indicate adverse effects of nutrient enrichment.

D5C4 — Secondary:

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.

The threshold values are as follows:

(e) in coastal waters, the values set in accordance with Directive 2000/60/EC;

(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.

D5C5 — Primary (may be substituted by D5C8):

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.

The threshold values are as follows:

(g) in coastal waters, the values set in accordance with Directive 2000/60/EC;

(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.

D5C6 — Secondary:

The abundance of opportunistic macroalgae is not at levels that indicate adverse effects of nutrient enrichment.

The threshold values are as follows:

(a) in coastal waters, the values set in accordance with Directive 2000/60/EC;

(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.

D5C7 — Secondary:

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:

(a) in coastal waters, the values set in accordance with Directive 2000/60/EC;

(b) should this criterion be relevant for waters beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member

	<p>States shall establish those values through regional or subregional cooperation.</p> <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> <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 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,</p>

	through cooperation at Union level, taking into account regional or subregional specificities.
Descriptor 7	<input type="checkbox"/> D7C1 – Secondary: 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.  <input type="checkbox"/> D7C2 – Secondary: Spatial extent of each benthic habitat type adversely affected (physical and hydrographical characteristics and associated biological communities) due to permanent alteration of hydrographical conditions.
Descriptor 8	<input type="checkbox"/> D8C1 – Primary: Within coastal and territorial waters, the concentrations of contaminants do not exceed the following threshold values: <ul style="list-style-type: none"> <li>(a) for contaminants set out under point 1(a) of criteria elements, the values set in accordance with Directive 2000/60/EC;</li> <li>(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;</li> <li>(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.</li> </ul> Beyond territorial waters, the concentrations of contaminants do not exceed the following threshold values: <ul style="list-style-type: none"> <li>(a) for contaminants selected under point 2(a) of criteria elements, the values as applicable within coastal and territorial waters;</li> <li>(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.</li> </ul> <input type="checkbox"/> D8C2 – Secondary: 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.  Member States shall establish those adverse effects and their threshold values through regional or subregional cooperation.  <input type="checkbox"/> D8C3 – Primary: The spatial extent and duration of significant acute pollution events are minimised.  <input type="checkbox"/> D8C4 – Secondary (to be used when a significant acute pollution event has occurred):

	<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>
<p>Descriptor 9</p>	<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>

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

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