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Monitoring programme: Eutrophication, Biodiversity - Water column habitats

Programme topic: Hydrochemistry

## SUB-PROGRAMME: NUTRIENTS

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### REGIONAL COORDINATION

The monitoring of this sub-programme is: **fully coordinated**

- Common monitoring guidelines: [Nitrite](#), [Nitrate](#), [Ammonium](#), [Phosphate](#), [Total nitrogen \(TN\)](#), [Total phosphorus \(TP\)](#), [Silicate](#), [HELCOM COMBINE manual](#).
- Common quality assurance programme: [HELCOM COMBINE manual](#).
- Common database: ICES.

### PURPOSE OF MONITORING (Q4K)

Follow up of progress towards:

<b>Baltic Sea Action Plan (BSAP)</b>	Segments	Eutrophication
	Ecological objectives	Concentrations of nutrients close to natural levels
<b>Marine strategy framework directive (MSFD)</b>	Descriptors	D5 Eutrophication
	Criteria ( <u>Q5a</u> )	5.1 Nutrients levels
	Features ( <u>Q5c</u> )	Physical and chemical features: Spatial and temporal distribution of nutrients (DIN, TN, DIP, TP, TOC) and oxygen.
<b>Other relevant legislation (<u>Q8a</u>)</b>	Nitrates Directive Water Framework Directive	

### Assessment of: (Q4k)

State/Impacts	<b>X</b>	temporal trends, status classification
Pressures		
Human activities causing the pressures		
Effectiveness of measures		

### Scale of data aggregation for assessments: (Q10a)

HELCOM assessment unit Level 1: Baltic Sea	
HELCOM assessment unit Level 2: Subbasin	
HELCOM assessment unit Level 3: Subbasins with coastal and offshore division	
HELCOM assessment unit Level 4: Subbasins with coastal WFD division	<b>X</b>

## MONITORING CONCEPTS

Coordination	Elements <u>Q9a (Q5c)</u>	Parameter <u>Q9a (Q5c)</u>	Method <u>Q9c, Q9d</u>	QA/QC <u>Q9e, 9f</u>	Frequency <u>Q9h, 9i</u>	Spatial resolution <u>Q9g, 9i</u>	Link to HELCOM core indicators	Link to MSFD GES characteristics <u>Q5b</u>	Spatial scope <u>Q4i</u>	Monitoring started <u>Q4h</u>	CPs monitoring
Regional (COMBINE)	DIN: NH <sub>4</sub> in situ	Concentration of chemical/nutrient/pollutant in water column	Fixed station in situ (HELCOM COMBINE manual, <u>annex C-2,</u> <u>Chapter 4.5)</u>	ICESData TypeGuide	<u>See map for details</u>	<u>See map for details</u>	Concentrations of dissolved inorganic nitrogen (winter)	5.1.1 Nutrient concentrations in the water column 5.1.2 Nutrient ratios	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, <u>annex C-2,</u> <u>Chapter 4.5)</u>	ICESData TypeGuide	<u>See map for details</u>	<u>See map for details</u>	None at the time but considered in EUTRO-OPER	5.1.1 Nutrient concentrations in the water column 5.1.2 Nutrient ratios	EEZ	Data available from 1966, Coordinated COMBINE monitoring started 19XX	All HELCOM Contracting Parties
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, <u>annex C-2,</u> <u>Chapter 4.5)</u>	ICESData TypeGuide	<u>See map for details</u> (NOTE: NO <sub>3</sub> -NO <sub>2</sub> map)	<u>See map for details</u> (NOTE: NO <sub>3</sub> -NO <sub>2</sub> map)	Concentrations of dissolved inorganic nitrogen (winter)	5.1.1 Nutrient concentrations in the water column 5.1.2 Nutrient ratios	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, <u>annex C-2,</u> <u>Chapter 4.5)</u>	ICESData TypeGuide	<u>See map for details</u> (NOTE: NO <sub>3</sub> -NO <sub>2</sub> map)	<u>See map for details</u> (NOTE: NO <sub>3</sub> -NO <sub>2</sub> map)	Concentrations of dissolved inorganic nitrogen (winter)	5.1.1 Nutrient concentrations in the water column 5.1.2 Nutrient ratios	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 moment. Considered by EUTRO-OPER.	5.1.1 Nutrient concentrations in the water column 5.1.2 Nutrient ratios	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)	5.1.1 Nutrient concentrations in the water column 5.1.2 Nutrient ratios	EEZ	1999	FI, SE, EE
Other	DIP: PO <sub>4</sub> -P - 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 phosphorus (winter)	5.1.1 Nutrient concentrations in the water column 5.1.2 Nutrient ratios	EEZ	1999	FI, SE, EE

## Brief description of monitoring

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.

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Element / parameter	Nutrients in situ/ Concentration of nutrient in water column
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**Method**

Platform: boat

Mode of sampling: fixed station (stations listed in [Annex C-1](#) in the [HELCOM COMBINE manual](#)).

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). 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 EE 1, 5, 10 m and in the near bottom layer

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

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**

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) - 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 test and/ or use of external experts ([Part B Annex B6](#) in the [HELCOM COMBINE manual](#)).

**Frequency**

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 >12 times per year (basically monthly sampling but weekly in the vegetative period) for d 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**

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

**Spatial resolution**

[See map for details](#)

**Element / parameter**

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

**Method**

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**

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](#)).

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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**

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

<b>Spatial Scope</b>	All sub-basins.
<b>Spatial resolution</b>	Some tens of samples along the ship routes.

## ASSESSMENT REQUIREMENTS

### Monitoring requirements and gaps

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>Monitoring requirements</b>	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.
<b>Gaps</b>	Existing coordinated monitoring in some sub-basins does not provide sufficient temporal coverage to achieve high confidence in the core indicator status estimate ( <a href="#">BSEP143</a> ) during the assessment season.

### Adequacy for assessment of GES ([Q5d](#))

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 11.

<b>Adequate data?</b>	Yes
<b>Established methods for assessment?</b>	Yes
<b>Adequate understanding of GES?</b>	Yes
<b>Adequate capacity to perform assessments?</b>	Yes



## Assessment of natural variability (Q5e)

Quantitative.

### DATA PROVIDERS AND ACCESS

<b>Data access point</b>	HELCOM, <a href="#">ICES database</a> , Algabase
<b>Data type (Q10c)</b>	Processed Data sets
<b>Data availability (Q10c)</b>	<a href="#">ICES database</a> . To be specified for Ferrybox-data
<b>Data access (Q10c)</b>	Open access to data covered by ICES data policy
<b>INSPIRE standard (Q10c)</b>	
<b>When will data become available? (Q10c)</b>	The data currently available is from 2011/2012 and before, the 2013 data is reported in May 2014 and will become available by November 2014.
<b>Data update frequency (Q10c)</b>	Yearly
<b>Describe how the data and information from the programme will be made accessible to the EC/EEA</b>	Through HELCOM web portal/via ICES
<b>Contact points in the Contracting parties</b>	Contact point to national monitoring programmes will be added
<b>Data is used in the following Baltic Sea Environment Fact Sheets (BSEF)</b>	
<b>Has the data been used in HELCOM assessments?</b>	Yes, e.g. <a href="#">BSEP143</a> Eutrophication status of the Baltic Sea 2007-2011 - A concise thematic assessment.

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