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Monitoring programme: Eutrophication, Biodiversity - Water column habitats

Programme topic: Hydrochemistry

## SUB-PROGRAMME: WATER COLUMN CHEMICAL CHARACTERISTICS

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### REGIONAL COORDINATION

The monitoring of this sub-programme is: **Fully coordinated for and H<sub>2</sub>S and O<sub>2</sub>**. Not coordinated for pCO<sub>2</sub>

- Common monitoring guidelines: [H<sub>2</sub>S](#), [pH](#), [total alkalinity](#), [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 Biodiversity
	Ecological objectives	Natural oxygen levels
<b>Marine strategy framework directive (MSFD)</b>	Descriptors	D1 Biodiversity – Seabed habitats D1 Biodiversity – Water column habitats D5 Eutrophication D7 Hydrographical changes
	Criteria ( <a href="#">Q5a</a> )	1.6 Habitat condition 5.3 Indirect effects of nutrient enrichment 7.2 Impact of permanent hydrographical changes
	Features ( <a href="#">Q5c</a> )	Physical and chemical features: Annual and seasonal temperature regime and ice cover, current velocity, upwelling, wave exposure, mixing characteristics, turbidity, residence time. Spatial and temporal distribution of nutrients (DIN, TN, DIP, TP, TOC) and oxygen. pH, pCO <sub>2</sub> profiles or equivalent information used to measure marine acidification.
<b>Other relevant legislation (<a href="#">Q8a</a>)</b>	Water Framework Directive	

Assessment of: ([Q4k](#))

State/Impacts	<b>X</b>	temporal trends, spatial distribution, 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	<b>X</b>
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	

## 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)	Dissolved oxygen (O <sub>2</sub> )	Concentration of oxygen	In situ measurement (HELCOM COMBINE manual, <u>Part C, Annex C2, Chapter 4.3</u> )	HELCOM COMBINE manual, <u>Part B, Annex B2, B3, B4, B5, B6</u> and Annex B8 <u>Appendix 2 and 3</u>	<u>See map for details</u>	Station grid sampling, high frequency cruise sampling. <u>See map for details.</u>	Deep bottom oxygen debt	5.3.2	EEZ	Data available from 1891, coordinated monitoring started 1979	All HELCOM Contracting Parties
Regional (COMBINE)	Hydrogen ion concentration (pH)	pH	Sampled in conjunction with O <sub>2</sub> (see HELCOM COMBINE manual, <u>Part B, Annex B14 and Annex C5</u> )	HELCOM COMBINE manual, <u>Part B, Annex B14</u>	<u>See map for details</u>	Station grid sampling, high frequency cruise sampling. <u>See map for details</u>	-	-	EEZ	Data available from 1921, coordinated monitoring started 1979	All HELCOM Contracting Parties
Regional (COMBINE)	Hydrogen sulphide (H <sub>2</sub> S)	Other parameter	Sampled in conjunction with O <sub>2</sub> (see HELCOM COMBINE manual, <u>Part C, Annex C2, Chapter 4.4 and Annex C5</u> )	HELCOM COMBINE manual, <u>Part B8, Appendix 4</u>	<u>See map for details</u>	Station grid sampling, high frequency cruise sampling. <u>See map for details</u>	-	-	EEZ	Data available from 1966, coordinated monitoring started 1979	All HELCOM Contracting Parties
National	Carbon dioxide (pCO <sub>2</sub> )	Concentration of chemical/nutrient/pollutant in water column	Ship of opportunity	Other	Monthly	24 stations	-	-	EEZ	1992	FI

## 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.

Element / parameter	O <sub>2</sub> / Concentration of oxygen
<b>Method</b>	Measured in the water column, see <a href="#">HELCOM COMBINE manual</a> .
<b>QA/QC</b>	<p>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) - standardisation authorities.</p> <p>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 (<a href="#">Part B Annex B3</a> in the <a href="#">HELCOM COMBINE manual</a>).</p> <p>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 (<a href="#">Part B Annex B4</a> in the <a href="#">HELCOM COMBINE manual</a>).</p> <p>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). (<a href="#">Part B Annex B5</a> in the <a href="#">HELCOM COMBINE manual</a>)</p> <p>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 (<a href="#">Part B Annex B6</a> in the <a href="#">HELCOM COMBINE manual</a>).</p>

<b>Frequency</b>	Mapping of oxygen conditions in the near bottom waters should take place a few times per year at set stations. It is important that this is carried out in late summer or autumn in certain critical areas. High frequency cruise station sampling should be done >12 times per year (basically monthly sampling but weekly in the vegetative period). pH is generally measured in conjunction with oxygen.
<b>Spatial Scope</b>	Assessment should be done on HELCOM subbasin scale, including coastal areas.
<b>Spatial resolution</b>	Samples are taken on COMBINE stations (listed in <a href="#">Part C Annex C1</a> of the <a href="#">HELCOM COMBINE manual</a> ). <a href="#">See map for details.</a>

<b>Element / parameter</b>	<b>pH / pH</b>
<b>Method</b>	Measured in the water column, see <a href="#">HELCOM COMBINE manual</a> .
<b>QA/QC</b>	<a href="#">Part B Annex B14</a> of the <a href="#">HELCOM COMBINE manual</a> .
<b>Frequency</b>	pH is generally measured in conjunction with oxygen.
<b>Spatial Scope</b>	-
<b>Spatial resolution</b>	Based on data from ICES Data centre, ICES Station Dictionary

<b>Element / parameter</b>	<b>H<sub>2</sub>S / Concentration of H<sub>2</sub>S</b>
<b>Method</b>	Measured in the water column, see <a href="#">HELCOM COMBINE manual</a> . H <sub>2</sub> S is also noted but not measured from benthic samples.
<b>QA/QC</b>	See <a href="#">Annex B8 Appendix 4</a> of the <a href="#">HELCOM COMBINE manual</a> .
<b>Frequency</b>	H <sub>2</sub> S is generally measured in conjunction with oxygen.
<b>Spatial Scope</b>	All sub-basins.
<b>Spatial resolution</b>	Based on data from ICES Data centre, ICES Station Dictionary

## 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.

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<b>Monitoring requirements</b>	For assessment purposes, at least 15 observations should be made yearly in each assessment unit. The compilation of observations is expected to be distributed spatially within the assessment unit in a non-biased way.
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<b>Gaps</b>	For pCO <sub>2</sub> there is only national monitoring for the time being
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### 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.

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<b>Adequate data?</b>	Yes (but not for pCO <sub>2</sub> )
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<b>Established methods for assessment?</b>	Yes
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<b>Adequate understanding of GES?</b>	Yes
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<b>Adequate capacity to perform assessments?</b>	Yes
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## Assessment of natural variability (Q5e)

Quantitative.

### DATA PROVIDERS AND ACCESS

<b>Data access point</b>	HELCOM, ICES database
<b>Data type (Q10c)</b>	Processed Data sets
<b>Data availability (Q10c)</b>	<u>ICES database</u>
<b>Data access (Q10c)</b>	Open access
<b>INSPIRE standard (Q10c)</b>	
<b>When will data become available? (Q10c)</b>	The data currently available is from 2012 and before, the 2013 data will be 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>Has the data been used in HELCOM assessments?</b>	Yes, O <sub>2</sub> data e.g. used in <u>BSEP143</u> Eutrophication status of the Baltic Sea 2007-2011 - A concise thematic assessment.
<b>Data is used in the following Baltic Sea Environment Fact Sheets (BSEF)</b>	Hydrography and Oxygen in the Deep Basins

### REFERENCES

Gieskes, J.M., 1969. Effect of temperature on the pH of seawater. Limnol. Oceanogr. 14, 679-685

Grasshoff, K., Erhardt, M. and Kremling, K. (eds), 1983. Methods of seawater analysis. Verlag Chemie, Weinheim, Germany

HELCOM COMBINE Manual 2012

ISO. 1994. Water quality—Determination of pH. ISO 10523. Radiometer, Copenhagen.

Poisson, A., Culkin, F. and Ridout, P., 1990. Intercomparison of total alkalinity and total inorganic carbon determinations in seawater. UNESCO Tech. Pap. Mar. Science, 59, 69pp.

UNESCO, 1987. Thermodynamics of the carbon dioxide system in seawater. Report by the carbon dioxide sub-panel of the joint panel. UNESCO Technical Papers in Marine Science, 51, 54pp.

Wedborg, M. et al., 1994. In: Humic substances in the global environment. Eds.: N. Senesi and T.M. Miano, Elsevier

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