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Temperature, salinity, transparency, turbidity

Monitoring programme: Biodiversity - Water column habitats, Eutrophication, Hydrographical changes

Programme topic: Hydrography

SUB-PROGRAMME: WATER COLUMN HYDROLOGICAL CHARACTERISTICS

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REGIONAL COORDINATION

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

- Common monitoring guidelines: [Guidelines for determination of salinity and temperature using CTD](#), [Guidelines for measuring turbidity](#), [Guidelines for measuring Secchi depth](#), [HELCOM COMBINE manual](#).
- Common quality assurance programme: [HELCOM COMBINE manual](#), national and ICES Data Type
- Common database: [ICES](#)

PURPOSE OF MONITORING (Q4K)

Follow up of progress towards:

Baltic Sea Action Plan (BSAP)	Segments	Eutrophication Maritime activities
	Ecological objectives	Clear water
Marine strategy framework directive (MSFD)	Descriptors	D5 Eutrophication D7 Hydrographical changes
	Criteria (Q5a)	5.2 Direct effects of nutrient enrichment
	Features (Q5c)	<p>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 salinity.</p> <p>Habitat types: The predominant (seabed and) water column habitat type(s) with a description of the characteristic physical and chemical features, such as depth, water temperature regime, currents and other water movements, salinity, (structure and substrata composition of the seabed).</p> <p>Other features: A description of any other features or characteristics typical of or specific to the marine region or subregion.</p>
Other relevant legislation (Q8a)	Habitats Directive	

Assessment of: (Q4k)

State/Impacts	X	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	
HELCOM assessment unit Level 2: Subbasin	
HELCOM assessment unit Level 3: Subbasins with coastal and offshore division	X
HELCOM assessment unit Level 4: Subbasins with coastal WFD division	

MONITORING CONCEPTS

Coordination	Elements Q9a (Q5c)	Parameter Q9a (Q5c)	Method Q9c , Q9d	QA/QC Q9e , Q9f	Frequency Q9h , Q9i	Spatial resolution Q9g , Q9i	Link to HELCOM core indicators	Link to MSFD GES characteristics Q5b	Spatial scope Q4i	Monitoring started Q4h	CPs monitoring
Regional COMBINE	Physical oceanography: Temperature	Temperature	in situ (HELCOM COMBINE manual , Annex C-2 Chapter 4)	National, ICESDataType Guide, HELCOM COMBINE manual, Part B Annex B8 , Appendix 1 and MyOcean NRT methods .	See map for details	COMBINE Stations, see map for details	-	-	EEZ	Data available since 1877, coordinated monitoring started in 1979	All HELCOM Contracting Parties

Regional COMBINE	Physical oceanography: Salinity	Salinity	in situ (HELCOM COMBINE manual, Annex C-2 Chapter 4)	National, ICESDataType Guide, HELCOM COMBINE manual, Part B Annex B8, Appendix 1 and MyOcean NRT methods.	see map for details	COMBINE Stations, see map for details	-	-	EEZ	Data available since 1877, coordinated monitoring started in 1979	All HELCOM Contracting Parties
Regional COMBINE	Physical oceanography - water transparency, using Secchi depth as proxy	Transparency of water column	in situ (HELCOM COMBINE manual, Annex C-2 Chapter 4)	National, ICESDataType Guide. HELCOM COMBINE manual, Part B Annex B2	see map for details	COMBINE stations (see map for details) and WFD stations, where not identical	Water clarity (summer)	5.2.2 Water transparency related to increase in suspended algae	EEZ	Coordinated monitoring started 1979.	All HELCOM Contracting Parties
Regional COMBINE	Physical oceanography - water transparency, using Secchi depth as proxy	Transparency of water column	in situ (HELCOM COMBINE manual, Annex C-2 Chapter 4)	National, ICESDataType Guide, HELCOM COMBINE manual, Part B Annex B2 and Annex B3	Variable	Coastal stations		5.2.2 Water transparency related to increase in suspended algae		DE: 2006 DK: 2010 SE: 2010 FI: 1985	DE, DK, FI, SE
National	Physical oceanography: Temperature (satellites)	Temperature (Satellites)	-	National	Daily	Whole Baltic Sea	-	-	EEZ	1999	FI
Coordination via Alg@line	Physical oceanography: Temperature and salinity (Alg@line)	Temperature and salinity (Alg@line)	-	National and MyOcean NRT methods.	Continuous	Ship routes	-	-	EEZ	2002	FI, EE, SE
National	Physical oceanography: Secchi (satellites)	Secchi (Satellites)	-	National	Daily	Whole Baltic Sea	-	-	EEZ	2014	FI

National	Physical oceanography: Turbidity (satellites)	Turbidity (Satellites)	-	National	Daily	Whole Baltic Sea	-	-	EEZ	2020	FI
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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.

Parameter	Temperature
Method	Measured in situ in the water column from boat. Mode of sampling: CTD, reverse thermometers or other, fixed station (stations listed in Annex C-1 in the HELCOM COMBINE manual). In Finland, temperature measurements are supported by satellite measurements and Alg@line measurements.
QA/QC	The quality system is formalized in the COMBINE 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).
Frequency	Temperature should be measured always as a supporting parameter. Satellite measurements are made daily and Alg@line measurements are continuous during the 10-30 ship trip per year.
Spatial Scope	Covers whole Baltic from coast to EEZ relation to MDFD Descriptor 5, Eutrophication.
Spatial resolution	In situ samples are taken on COMBINE stations (listed in Annex C-1 of the HELCOM COMBINE manual). See map for details.
Parameter	Salinity

Method	<p>Measured in situ or in collected samples in the water column from boat. Mode of sampling: CTD, discrete water samples from rosette sampler, reversing bottles or other, fixed station (stations listed in Annex C-1 in the HELCOM COMBINE manual).</p> <p>In Finland, salinity measurements are supported by Alg@line measurements.</p>
QA/QC	<p>The quality system is formalized in the COMBINE 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).</p>
Frequency	<p>Salinity should be measured always as a supporting parameter.</p> <p>Alg@line measurements are continuous during the 10-30 ship trip per year.</p>
Spatial Scope	Covers whole Baltic from coast to EEZ relation to MDFD Descriptor 5, Eutrophication.
Spatial resolution	In situ samples are taken on COMBINE stations (listed in Annex C-1 of the HELCOM COMBINE manual). See map for details.
Parameter	<u>Secchi-depth/Transparency of the water column</u>
Method	<p>Measured in situ in the water column from boat. Mode of sampling: CTD or other, fixed station (stations listed in Annex C-1 in the HELCOM COMBINE manual).</p> <p>In Finland, Secchi measurements are supported by satellite measurements.</p>
QA/QC	<p>The quality system is formalized in the COMBINE 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.</p>
Frequency	<p>For assessment purposes, measurement should be made at least during the summer period (June – September). Secchi depth should be measured at all stations whenever possible, i.e. in day light and when the sea is relatively calm. Light attenuation shall always be measured if primary production measurements are performed (HELCOM COMBINE manual).</p> <p>Satellite measurements are made daily.</p>

Spatial Scope	Covers the whole Baltic from coast to EEZ in relation to MSFD Descriptor 5, Eutrophication.
Spatial resolution	In situ samples are taken on COMBINE stations (listed in Annex C-1 of the HELCOM COMBINE manual). See Figures 3-4 for station network and data mapped to Station dictionary. See map for details.
Parameter	Turbidity/Transparency of the water column
Method	Measured in situ or in collected samples in the water column from boat. Mode of sampling: CTD, discrete water samples from rosette, reversing samplers, turbidimeter or other, fixed station (stations listed in Annex C-1 in the HELCOM COMBINE manual).
QA/QC	The quality system is formalized in the COMBINE 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).
Frequency	In coastal waters turbidity sampling depends on the station, but satellite measurements are made daily.
Spatial Scope	Covers coastal waters.
Spatial resolution	Turbidity is analyzed in situ only in coastal stations in Finland, but satellite measurements are made for the entire sea area.

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.

Monitoring requirements

Open sea: For assessment purposes, at least 15 observations for a high confidence assessment (see [BSEP 143](#)) during the period June-September 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.

Coastal areas (between shore and baseline + 1 nm): For an assessment of the coastal water bodies (= WFD water bodies), less than 15 observations per year may be available for the period May(June)-September due to a limited number of stations per assessment unit (=water body).

In Germany, measurements of temperature, salinity and transparency (secchi depth) are carried out at each station 5-10 times p.a. depending on station and area (less frequently in the open sea – 5 to max. 10 times p.a., more often in the coastal areas where a monthly frequency (12 times p.a.) is attempted, but 10 times is realistic due to bad weather conditions etc.). In national assessments of transparency, we have used the summer months (May-September) up to now.

Gaps

Secchi-depth: Existing coordinated monitoring programme ([HELCOM COMBINE manual](#)) does not provide sufficient temporal coverage to achieve high confidence in the core indicator status estimate ([BSEP 143](#)).

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.

Adequate data? Yes

Established methods for assessment? Yes

Adequate understanding of GES? Yes

Adequate capacity to perform assessments? Yes

Assessment of natural variability (Q5e)

Quantitative.

DATA PROVIDERS AND ACCESS

Data access point	<u>HELCOM, ICES Database</u>
Data type (Q10c)	Processed Data sets
Data availability (Q10c)	<u>ICES Database</u>
Data access (Q10c)	Open access for environmental data (covered by ICES data policy)
INSPIRE standard (Q10c)	
When will data become available? (Q10c)	The data currently available is from 2011/2012 and before, the 2013 data will be reported in May 2014 and become available by November 2014.
Data update frequency (Q10c)	Yearly
Describe how the data and information from the programme will be made accessible to the EC/EEA	The data is open access and available to the EEA through HELCOM and ICES Web access points
Contact points in the Contracting parties	Contact point to national monitoring programmes will be added
Has the data been used in HELCOM assessments?	Yes
Data is used in the following Baltic Sea Environment Fact Sheets (BSEF)	<u>Development of Sea Surface Temperature in the Baltic Sea</u> <u>Hydrography and Oxygen in deep basins</u> <u>Water Exchange between the Baltic Sea and the North Sea, and conditions in the Deep Basins</u>

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Grasshoff, K., Ehrhardt, M., and Kremling, K. (Eds.) 1983. Methods of sea water analysis. Verlag Chemie, Weinheim.

HELCOM COMBINE manual

HELCOM, 1988. HELCOM BSEP 27D. Guidelines for the Baltic Monitoring Programme for the Third Stage. Part D. Biological Determinands.

ISO/IEC/EN 17025 Requirements for the Competence of Testing and Calibration of Laboratories

CEN/TC 230 European Committee of Standardization. Water analysis

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