

Monitoring Specifications

Date: 2011-10-19

Hydrochemistry





ARGE BLMP - Working Group for the North Sea and Baltic Sea Monitoring Programme

At the 34th North German Environmental Ministerial Meeting held on 17 April 1997, the competent departments of the German Federal Government and of the federal states of Hamburg, Mecklenburg-Vorpommern, Lower Saxony and Schleswig-Holstein agreed to establish a joint working group co-ordinating the monitoring of the marine environment of the North and Baltic Seas (ARGE BLMP Nord- und Ostsee).

Members of ARGE BLMP are:

- Federal Ministry of Food, Agriculture and Consumer Protection
- Federal Ministry of Transport, Building and Urban Development
- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
- Federal Ministry of Education and Research
- Authority for Urban Development and Environment of the Free and Hanseatic City of Hamburg
- Mecklenburg-Vorpommern Ministry for Agriculture, the Environment and Consumer Protection
- Lower Saxony Ministry for the Environment and Climate Protection
- Schleswig-Holstein Ministry for Agriculture, the Environment and Rural Areas

The Monitoring Manual describes the current measuring programme implemented under BLMP. The monitoring requirements of the different EC Directives (Marine Strategy Framework Directive, Water Framework Directive, FFH, Birds Directive), marine protection conventions (OSPAR, HELCOM, Trilateral Monitoring and Assessment Program) and other bodies of regulations have been taken into account in the Manual. The Monitoring Manual is available free of charge on the BLMP website at www.blmp-online.de/Seiten/Monitoringhandbuch.htm

Editorial information

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1 General

1.1 Subject area

Chemical Monitoring - Hydrochemistry

1.2 Definition

Nutrients, organic carbon and marine acidification (pH values; pCO₂ profiles)
(oxygen conditions, see [Hydrography](#))

1.3 Competent authority/ies

Federal Government:	BSH , UBA
Hamburg:	BSU
Mecklenburg-Vorpommern:	LUNG
Lower Saxony:	NLWKN
Schleswig-Holstein:	LLUR

1.4 Working group

Ad Hoc Working Group on Nutrients and Plankton
Ad Hoc Working Group on Hydrography, Hydrology and Morphology

2 Monitoring requirements

2.1 Necessity

[MSFD \[1\]](#)

Article 11 [2]

Comments

On the basis of the initial assessment made pursuant to Article 8(1), Member States shall establish and implement coordinated monitoring programmes for the ongoing assessment of the environmental status of their marine waters on the basis of the indicative lists of elements set out in Annex III and the list set out in Annex V, and by reference to the environmental targets established pursuant to Article 10.

Article 8(1) [3]

Comments

The results of nutrient monitoring are required for the initial assessment of marine waters. To this end, the following parameters must be monitored in order for physico-chemical features to be described:

Annex III, Table 1

- spatial and temporal distribution of nutrients (DIN, TN, DIP, TP, TOC) and oxygen;
- pH, pCO₂ profiles or equivalent information used to measure marine acidification.

[HD \[4\]](#)

Article 11 [5]

Comments

Member States shall undertake surveillance of the conservation status of the natural habitats and species referred to in Article 2 with particular regard to priority natural habitat types and priority species.

Consideration of nutrient inputs in the assessment of habitat impairments. See the assessment schemes for habitat types.

[WFD \[6\]](#)

Article 8(1)

Comments

Under the WFD, nutrient status is to be monitored as one of the physico-chemical quality elements every three months in coastal waters that are subject to ecological assessment. The mandatory parameters are total nitrogen, total phosphorus, NO₃ and PO₄. See also Annex V, 1.3.4.

[Nitrates Directive \[7\]](#)

General [8]

[HELCOM](#)

COMBINE

Comments

[PART C: Eutrophication and its effects](#)

Annex C2, Hydrographic and hydrochemical variables:

This guideline is intended to achieve the aims of the HELCOM monitoring programme. The following core variables are measured:

Hydrochemistry:

- Nutrients: phosphate, total phosphorus, ammonium, nitrate, nitrite, total nitrogen, silicate

Supporting parameters:

- Temperature
- Salinity
- pH value
- Secchi depth

See also [Hydrography](#)

OSPAR

JAMP Common Procedure

Comments

Common Procedure (OSPAR Agreement 2005-3) for the Identification of the Eutrophication Status of the OSPAR Maritime Area.

Assessment of the eutrophication status of the OSPAR area

"Problem areas" and "potential problem areas":	Annually
"Non problem areas":	Every three years

It is mandatory for the following parameters to be monitored:

Hydrochemistry:

- Nutrients: phosphate, total phosphorus, ammonium, nitrate, nitrite, total nitrogen, silicate
- Oxygen saturation (see [Hydrography](#))

Supporting parameters:

- pH value
- Temperature
- Salinity
- Secchi depth

JAMP RID Monitoring Programme [9]

Comments

Joint Monitoring and Assessment Programme - Riverine Inputs and Direct Discharges.

Annual surveying of riverine inputs of selected substances into the marine environment. The parameters to be monitored under OSPAR are listed in the documents cited.

TMAP [10]

Wadden Sea Plan (Stade Declaration, 1997)

Comments

See [TMAP-Manual, Chapter 2](#), 2.1, Nutrients:

- The monitoring of nutrients has the objective of assessing the effects of changes in the input of nutrients on ecological elements and processes.
- Apart from this, the intention is to document the effectiveness of policy targets. To this end, two strategies are to be pursued:
 1. Winter concentrations (weekly to monthly from November to February along salinity gradients)
 2. Nutrient effects and seasonal fluctuations (monthly measurements together with plankton measurements)

2.2 Environmental targets

MSFD

Article 10: 'On the basis of the initial assessment made pursuant to Article 8(1), Member States shall, in respect of each marine region or subregion, establish a comprehensive set of environmental targets and associated indicators for their marine waters.'

HD

See assessment schemes for habitat types.

WFD

Annex V, 1.2.3 and 1.2.4, General conditions: 'Nutrient concentrations do not exceed the levels established so as to ensure the functioning of the ecosystem and the achievement of the values specified above for the biological quality elements.'

HELCOM

Ecological Quality Objectives:

Nutrient concentrations close to natural levels.

OSPAR

Eutrophication strategy:

In line with OSPAR's general aims, eutrophication is to be prevented and a healthy marine environment, in which eutrophication no longer occurs, achieved and conserved by 2010.

Ecological Quality Objectives for Nutrients and Eutrophication Effects: 'winter nutrient concentrations'.

Winter concentrations of dissolved anorganic nitrogen and/or phosphorus should exceed salinity-related natural background levels by a maximum of 50 %. By 2010, all areas of the North Sea should be classified as non-problem areas in respect of eutrophication.

2.3 Threats

2.4 Spatial allocation

	EEZ	12- nm zone	Coastal waters 1)	Transitional waters
MSFD	x	x	-	-
Birds Directive	-	-	-	-
HD	x	x	x	x
WFD	-	-	x	x
HELCOM	x	x	x	-
OSPAR	x	x	x	x
TMAP	-	-	x	x

1) Under the WFD: baseline plus one nautical mile

3 Monitoring concept

3.1 Description of monitoring network

The influences exerted by tides (North Sea) and wind (North Sea and Baltic Sea) make the North Sea and Baltic Sea very dynamic waters. Although it is possible to distinguish between the individual water bodies, they shift their positions within certain bounds and there is continuous exchange between them. A relatively dense monitoring network is required if account is to be taken of this high degree of variability.

North Sea

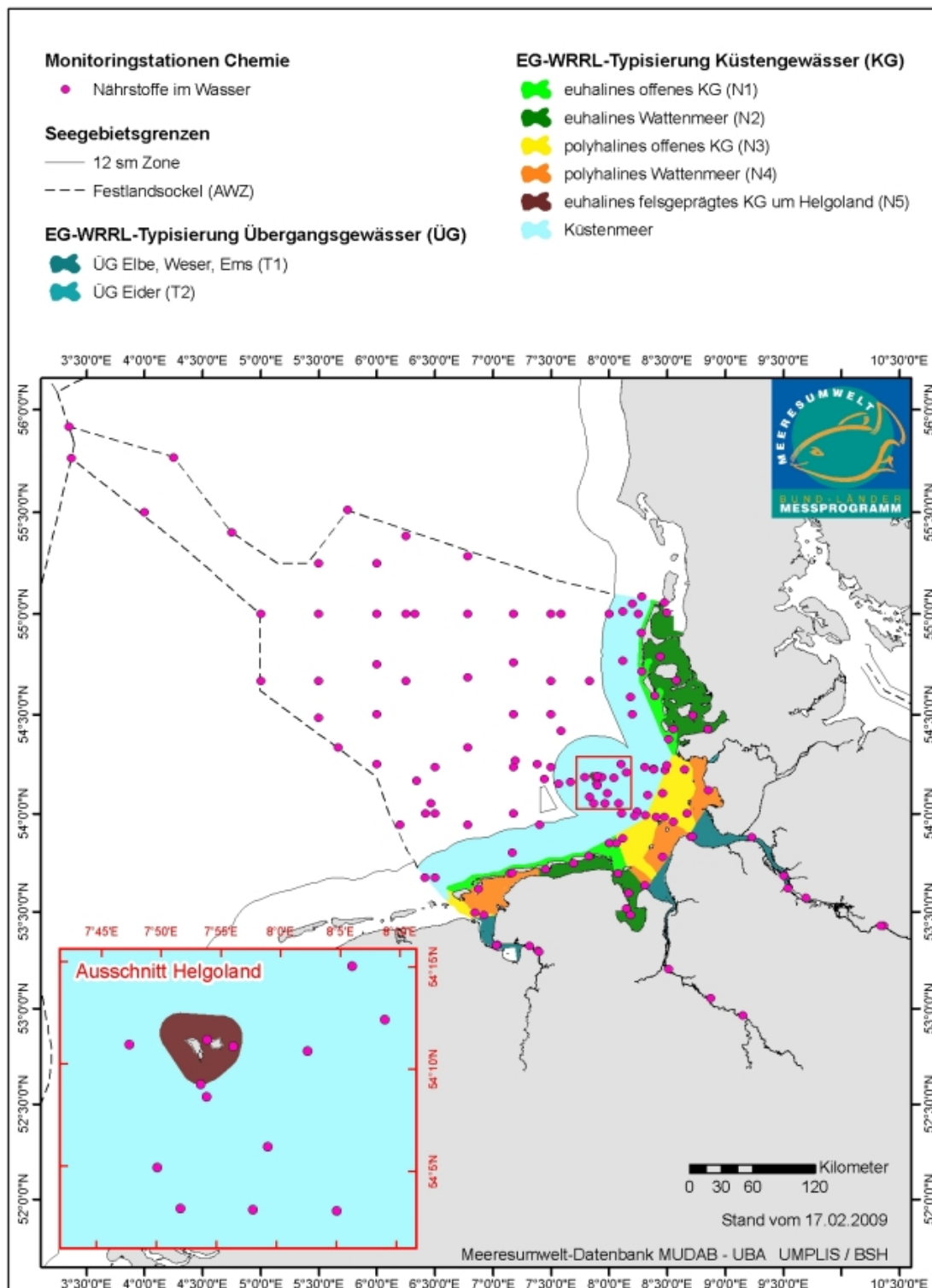


Figure 1: German Marine Monitoring Programme (BLMP) activities in the North Sea: Monitoring of Nutrients in Water

[Figure 1 as PDF document](#)

BSH:

40 monitoring stations:

Three times a year: nitrite+nitrate, ammonium, phosphate, silicate, TP and TN

12 monitoring stations (biology stations):

additional twice a year: nitrite+nitrate, ammonium, phosphate, silicate, TP and TN

Sampling depths: surface (5 m), near bottom and below the thermocline

The measurements at the monitoring stations should be supplemented with continuous measurements using automatic nutrient analysers between the stations in order to obtain measurements on transects with a high degree of temporal resolution.

LLUR:

2009 monitoring network: 21 stations, nine stations for the BLMP in the North Sea and another 12 stations for the WFD in the coastal waters/neritic zones of the Eider and Elbe.

Monitoring frequencies: There are six BLMP stations where samples are taken just three times a year by the water monitoring ship M/S Haithabu.

At another 15 stations, samples are taken both by the water monitoring ship M/S Haithabu and by helicopter. However, helicopters are only deployed seasonally for the algae early detection system (AlgFES) in the period from May to September/October.

Monitoring variables: Filtered samples are analysed to quantify the concentrations of various nutrients, ammonium, nitrite, nitrate, total nitrogen, phosphate, total phosphorus and silicate. In addition to this, unfiltered samples are also analysed to quantify total nitrogen and total phosphorus. These measurements are carried out at the Schleswig-Holstein Land Laboratory in Neumünster.

The samples are always taken from a standard depth one metre below the surface. At the stations sampled by the M/S Haithabu, CTD vertical profiles are always taken with a multiparameter probe as well.

NLWKN:

Nutrient distribution in winter (one helicopter sampling in the 1st and 4th quarter each): nitrite+nitrate, ammonium, ortho-phosphate, silicate, DOC, TP, and TN at 17 stations.

Sampling for these parameters is additionally carried out throughout the year at another 7 stations - weekly (2 stations), 2-weekly (2 stations), or once per quarter (4 stations); see [phytoplankton](#) specifications.

Permanent monitoring station

The area west of Heligoland is represented by the UFSDB (Unmanned Lightship Deutsche Bucht) monitoring network station (54°10' N, 07°27' E). Apart from hydrographic parameters (T, S, oxygen), the BSH also carries out continuous nutrient measurements at this station.

Baltic Sea

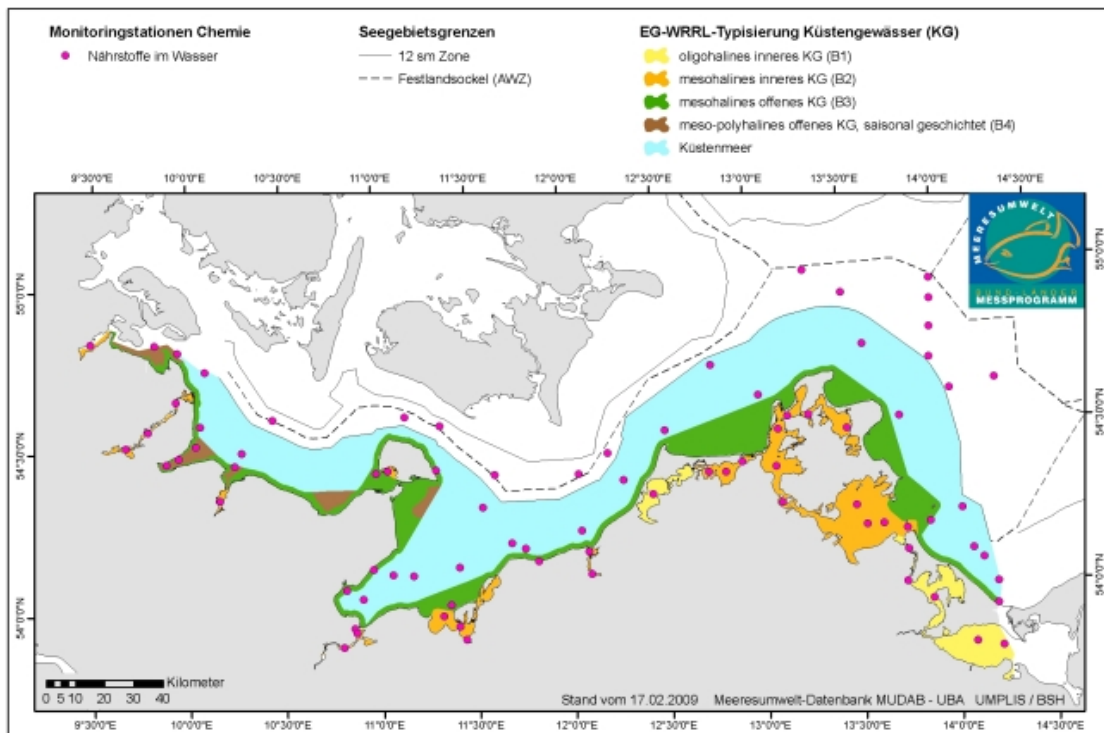


Figure 2: BLMP activities in the Baltic Sea: Monitoring of Nutrients in Water.

[Figure 2 as PDF-Document](#)

IOW:

Five times a year: NO₃, NO₂, PO₄, SiO₄

Selected stations: TN, TP and NH₄, as well as DOC, POC, DON

Sampling depths: 1, 10, 20, 30, 40 m and seabed

Certain stations: 5 m and 15 m as well

LLUR

2009 monitoring network: 25 stations: 13 stations for the BLMP in the Baltic Sea and another 12 stations for the WFD in the coastal waters/neritic zones of the Schlei and the Trave.

Monitoring frequencies: 24 stations: ten samples are taken each year by the water monitoring ship M/S Haithabu. 18 to 20 samples are taken at an intensive monitoring station in the Outer Kiel Fjord.

Monitoring variables: In coastal waters/neritic zones with low suspension levels, nutrients are quantified in unfiltered samples, while in the Schlei and the Trave filtered samples are analysed to quantify ammonium, nitrite, nitrate, total nitrogen, phosphate, total phosphorus and silicate. In addition to this, unfiltered samples from the stations in the Schlei and the Trave are also analysed to determine total nitrogen and total phosphorus. These measurements are carried out at the Schleswig-Holstein Land Laboratory in Neumünster.

The samples are always taken from standard depths one metre below the surface and, at stations with water depths greater than 12 metres, one metre above the seabed. CTD vertical profiles measured with a multiparameter probe are always taken as well at all stations.

LUNG:

38 monitoring stations: ten to 12 times a year: NO₃, NO₂, NH₄, TN, PO₄, TP, SiO₄, DOC, TOC

Sampling depths: 1 m and, at stations with water depth >6 m, 1 m above the seabed

CTD profiles at stations with water depth >6 m

Comments:

The 'Baltic Sea Hole' in the Hohwacht Bight is a military restricted area (sea range). The water body is similar to that around the Kiel Lighthouse station, which is why this station is also representative for the restricted area.

Vertical resolution

When samples are taken at offshore stations, the standard depths should be sampled where there are stratifications.

3.2 Monitoring activities**North Sea and Baltic Sea****Hydrochemistry****Methods:**

North Sea:

Total N

Oxidative pressure digestion with potassium peroxodisulphate, followed by determination as nitrate.

Modified in accordance with DIN EN ISO 11905-1.

Ammonium

Filtration of water samples. Analysis of ammonium. Modified in accordance with DIN EN ISO 11732-4 (continuous flow analysis).

Nitrate

Filtration of water samples. Reduction with cadmium and determination as nitrite. Modified in accordance with DIN EN 26777 or EN ISO 13395, continuous flow injection analysis with automatic detection.

Total P

Oxidative pressure digestion with potassium peroxodisulphate, followed by determination as phosphate.

Photometric procedure using ammonium molybdate.

Modified in accordance with DIN EN ISO 6878 (manual method).

Phosphate

Filtration of water samples (DIN EN 1189), continuous flow injection analysis with automatic detection.

Modified in accordance with DIN EN ISO 15681-2 for flow injection analysis and continuous flow analysis.

Silicate

Filtration of water samples. Modified in accordance with DIN EN ISO 16264 for flow injection analysis and continuous flow analysis.

NLWKN: The analyses are made using inductively coupled plasma optical emission spectrometry (ICP-OES) analogous to DIN EN ISO 11885 (E 22), (September 2009)

Baltic Sea:

IOW

Total N

Alkaline oxidative pressure digestion with potassium peroxodisulphate (microwave), followed by determination as nitrate.

Total P

Alkaline oxidative pressure digestion with potassium peroxodisulphate (microwave), followed by determination as phosphate.

NH₄

Indophenol blue, manual detection using photometer.

PO₄

Molybdenum blue.

NO₃

Reduction to nitrite, determination as azo dye.

NO₂

Determination as azo dye.

SiO₄

Molybdenum blue.

All four parameters are quantified in an autoanalyser (Evolution III, Alliance) using filtered samples.

The methods are based on Grasshoff et al., 1983.

Parameter:

- NH₄
- NO₂
- NO₂ + NO₃
- Organic carbon (particulate)
- PO₄
- SiO₄
- Total nitrogen (TN)
- Total phosphorus (TP)
- pH value

3.3 Additional parameters

The following parameters are required additionally for the assessments::

- Biovolume (biomass)
- Chlorophyll a (biomass)
- Oxygen saturation
- Salinity
- Secchi depth
- Temperature
- pH value

4 Assessment

4.1 Assessment procedures

North Sea

Title

Hydrochemistry - OSPAR - North Sea

Guideline:

OSPAR

Comments:

The assessment is carried out using the OSPAR Common Procedure (OSPAR, 2005-3).

The elevated values used for the assessment are given in Table 1.

Cat.	Parameters	Dimension	Estuaries	Wadden Sea	Coastal Waters	Off-shore	Central North Sea
	Salinity		0-19	25-30	28-34,5	>34,5	>34,5
I	TN TP	µM	20-33 0,5-1,2	17-21 0,9-1,1	17-18 1,0-1,1	13 0,83	13 0,83
	River discharges	Kt/y	Tab. 5.2.1.1.1				
	DIN PO ₄	µM	17-26 0,2-0,5	11-14 0,6	11-12 0,6	8 0,5	8 0,5
	Nutrient ratios TN/TP DIN/DIP	M/M	65 47-225	24-33 27-38	24 26	18 20	18 20

Table 1: Assessment table, Brockmann, U., D. Topcu and M. Schütt: Assessment of the eutrophication status of the German Bight according to the OSPAR Comprehensive Procedure; OSPAR, ICG; COMP2:008Rev.1, ICG:COMP2:00109a-g; 54 pp; London, 2007

Baltic Sea

Title

Hydrochemistry - Baltic Sea

Guideline:

Various directives

Comments:

Water type	Salinity Ø	Background value					Elevated value (1.5 x background value)				
		TN [Year]	DIN [Winter]	NO ₃ [Winter]	TP [Year]	PO ₄ [Winter]	TN [Year]	DIN [Winter]	NO ₃ [Winter]	TP [Year]	PO ₄ [Winter]
B1	1,8-3,5	10	7	5	0,5-0,3	0,22-0,13	15	10,5	7,5	0,8-0,5	0,3-0,2
B2	5-18	13-8	8-6	5-3	0,6-0,3	0,26-0,14	20-12	12-9	7,5-4,5	0,9-0,5	0,4-0,2
B3	6,5-15	12-9	7	5	0,6-0,4	0,25-0,17	18-14	10,5	7,5	0,9-0,6	0,40-0,25
B4	10,5-20	10	7	5	0,6-0,5	0,24-0,18	15	10,5	7,5	0,9-0,8	0,36-0,27
Arkona Sea	7-9	10	2,5-2,0	2,5-2,0	0,45	0,30-0,25	15	3,8-3,0	3,8-3,0	0,70	0,45-0,38

The reference period applicable in each case is stated; winter: November - February

Table 1: Mean background and elevated values for nutrients (µM) in the coastal water types found in the Baltic Sea (Brockmann et al., 2005)

Water type	Salinity Ø	Background value					Elevated value (1.5 x background value)				
		TN [Year]	DIN [Winter]	NO ₃ [Winter]	TP [Year]	PO ₄ [Winter]	TN [Year]	DIN [Winter]	NO ₃ [Winter]	TP [Year]	PO ₄ [Winter]
B1	1,8-3,5	0,14	0,10	0,07	0,016-0,009	0,007-0,004	0,21	0,15	0,11	0,025-0,016	0,009-0,006
B2	5-18	0,18-0,11	0,11-0,08	0,07-0,04	0,019-0,009	0,008-0,004	0,28-0,17	0,17-0,13	0,11-0,06	0,028-0,016	0,012-0,006
B3	6,5-15	0,17-0,13	0,10	0,07	0,019-0,012	0,008-0,005	0,25-0,20	0,15	0,11	0,028-0,019	0,012-0,008
B4	10,5-20	0,14	0,10	0,07	0,019-0,016	0,007-0,006	0,21	0,15	0,11	0,028-0,025	0,0118-0,008
Arkona Sea	7-9	0,14	0,035-0,030	0,035-0,030	0,014	0,009-0,008	0,21	0,05-0,04	0,05-0,04	0,022	0,014-0,012

Table 2: Mean background and elevated values for nutrients (mg/L) in the coastal water types found in the Baltic Sea (Brockmann et al., 2005)

5 Quality assurance

- [QUASIMEME](#) (Quality Assurance Laboratory Performance Studies for Environmental Measurements in Marine Samples)
- Quality Assurance Panel (Quality Assurance Panel at the UBA (workshops, standardisation with DIN, CEN and ISO, support for the establishment of QM systems, drafting of sample SOPs, performance of audits))

Comments

The Quality Assurance Panel at the Federal Environment Agency is responsible for the coordination of quality assurance under the BLMP. Each of the monitoring institutions bears responsibility for establishing and administering its own quality management systems. The institutions involved in the BLMP coordinate their activities within the framework of the Working Group on Quality Assurance and the Ad Hoc Working Group on Nutrients and Plankton.

5.1 Monitoring institutions

- [IOW](#)
- [LLUR](#)
- [BSH](#)
- [LUNG](#)
- [NLWKN](#)
- [AWI](#)
- [ARGE ELBE](#)

5.2 Guidance documents

- AQS-Merkblatt zu den Rahmenempfehlungen der Länderarbeitsgemeinschaft Wasser (LAWA) für die Qualitätssicherung bei Wasser-, Abwasser-, und Schlammuntersuchungen, 2004: 'Kontrollkarten (A-2)'.
• DEV zur Wasseruntersuchung, 1997: 39. und 45. Lieferung: I: Strategien für die Wasseranalytik: Verfahrensentwicklung, Validierung und Qualitätssicherung in der Routine; 74 pp.
- BLMP Quality Assurance Panel at the UBA, 2004: [Leitlinie zur Methodvalidierung](#).
- BLMP Quality Assurance Panel at the UBA, 2008: *Muster-Qualitätsmanagementhandbuch für Laboratorien des Bund/Länder-Messprogramms nach DIN EN ISO/IEC 17025 (BLMP Sample Quality Management Manual)*; Version: 01 of 1 February 2008; Federal Environment Agency.
- HELCOM, COMBINE Manual, 'Annex B-10: Technical note on determination of nutrients'.
- HELCOM, COMBINE Manual, 'Annex B-11: Chemical analysis of anoxic waters'.
- HELCOM, COMBINE Manual, 'Annex B-15: [Technical note on the measurement of pH in seawater](#)'.
- HELCOM, COMBINE Manual, 'Annex B-16: Technical note on the measurement of total alkalinity in seawater'
- HELCOM, COMBINE Manual, 'Annex B-18: Technical Note on the determination of organic carbon in seawater'
- HELCOM, COMBINE Manual, 'Annex B-9: Technical note on the determination of hydrographic parameters'.
- JAMP, ASMO, 1997: Eutrophication Monitoring Guidelines: [Nutrients](#).
- JAMP, ASMO, 1997: Eutrophication Monitoring Guidelines: [Oxygen](#).

5.3 Standards

- ISO 10304-1, 2007: Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate.
- DIN EN ISO 11732, 2005-05: Water quality - Determination of ammonium nitrogen - Method by flow analysis (CFA and FIA) and spectrometric detection.
- DIN EN ISO 13395, 1996-12: Water quality - Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analysis (CFA and FIA) and spectrometric detection.
- DIN EN ISO 15681-2, 2005-05: Water quality - Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) - Part 2: Method by continuous flow analysis (CFA).
- DIN EN ISO 5667-3, 2004-05: Water quality - Sampling - Guidance on the preservation and handling of water samples (ISO 5667-3: 2003).
- ISO 5667-9, 1992-10: Water quality - Sampling - Part 9: Guidance on sampling from marine waters.
- DIN EN ISO 6878, 2004-09: Water quality - Determination of phosphorus - Ammonium molybdate spectrometric method.
- DIN EN ISO 10304-2, 1996-11: Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 2: Determination of bromide, chloride, nitrate, nitrite, orthophosphate and sulphate in waste water.
- DIN EN ISO 11905-1, 1998-08: Water quality - Determination of nitrogen - Part 1: Method using oxidative digestion with peroxodisulfate.
- DIN EN ISO 15681-1, 2005-05: Water quality - Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) - Part 1: Method by flow injection analysis (FIA).
- DIN EN ISO 16264, 2004-05: Water quality - Determination of soluble silicates by flow analysis (FIA and CFA) and photometric detection.
- DIN EN 6777, 1993-04: Water quality - Determination of nitrite - Molecular absorption spectrometric method.
- DIN EN ISO/IEC 17025, 2005: General requirements for the competence of testing and calibration laboratories.

5.4 Current status

A BLMP Study Group decision (2006) obliged the BLMP laboratories to establish DIN EN ISO/IEC 17025 quality management systems. For this purpose, a Sample Quality Management Manual was drawn up in 2006/2007 by the Quality Assurance Panel in cooperation with the Quality Assurance Sub-Working Group on Quality Management. This manual has been available for subscription from the Quality Assurance Panel at the UBA since mid-2008 and is to be used as the basis for internal QM documentation at laboratories. The manual is designed as a loose-leaf collection, so that regular updates can be added as required. The intention is for it to be gradually supplemented with sample SOPs coordinated within the BLMP as necessary. At present, no sample SOPs for nutrients are in preparation.

The BSH is already DIN EN ISO 17025 accredited.

Further basic requirements placed on quality assurance at the laboratories are the deployment of validated sampling and analysis methods, the use of certified reference materials and regular participation in intercalibration exercises.

Intercalibration exercises

- QUASIMEME intercalibration exercises: Nutrients in Sea Water, twice a year

Workshops

- UBA/BLMP-WS 2001: Analytical Procedures and Quality Assurance for the Determination of Nutrients, Heavy Metals and Organic Pollutants in Marine Water (report, 2001)

6 Literature

- Brockmann, U., Topcu, D. und M. Schütt, 2007: Assessment of the eutrophication status of the German Bight according to the OSPAR Comprehensive Procedure; OSPAR, ICG; COMP2:008Rev.1, ICG:COMP2:00109a-g; 54 pp; London, 2007.

7 Activities required to implement the concept

7.1 Changes to the current monitoring programme

7.2 Working steps required

Quality assurance

The establishment of DIN EN ISO/IEC 17025 quality management systems under the BLMP should be concluded by 1 January 2012.

A documented process for the verification and validation of testing procedures was drawn up in 2009 to complement the Sample Quality Management Manual. This process will be presented to the BLMP Study Group in February 2010 for approval.

The DIN EN ISO/IEC 17025 quality management system includes the following elements:

- documented validation/verification of the investigation methods deployed for the determination of performance characteristics,
- ongoing validation of the accuracy and precision of each procedure for the specific intended use, e.g. by the use of control charts and the deployment of (certified) reference materials, as far as possible,
- the qualification and regular training of personnel for the procedures deployed,
- the regular performance of internal and external audits,
- regular participation in national and international interlaboratory comparisons, intercalibration exercises, training courses and workshops, and their evaluation.

The laboratories must guarantee the prompt and complete communication of the investigation results to MUDAB on the basis of the MUDAB data formats, including the QA data that have been defined as a minimum, which meet international standards (ICES).

Footnotes

(1) Marine Strategy Framework Directive; Directive 2008/56/EC of 17 June 2008. This also applies to transitional waters and coastal waters covered by Directive 2000/60/EC, where pertinent aspects of the protection of the marine environment not dealt with in Directive 2000/60/EC are at issue.

(2) Version: proposal of the Secretariat-General of 13 November 2006.

This also applies to transitional waters and coastal waters covered by Directive 2000/60/EC, where pertinent aspects of the protection of the marine environment not dealt with in Directive 2000/60/EC are at issue.

(3) Version: proposal of the General-Secretariat of 13 November 2006.

This also applies to transitional waters and coastal waters covered by Directive 2000/60/EC, where pertinent aspects of the protection of the marine environment not dealt with in Directive 2000/60/EC are at issue.

(4) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

(5) Article 11 (monitoring of habitats and all species listed in Annexes II, IV and V) imposes the obligation to monitor the conservation status of all habitats (listed in Annex I) of Community interest. In consequence, this provision is not limited to NATURA 2000 areas, but habitat types outside the Habitat Directive areas are also to be included in the monitoring as appropriate.

(6) EC Water Framework Directive; Directive 2000/60/EC. The coastal waters subject to ecological assessment under the WFD extend 1 nautical mile beyond the baseline.

(7) The Nitrates Directive requires the following activities connected with monitoring and reporting:

- drawing up and implementing suitable monitoring programmes to assess the effectiveness of action programmes,
- monitoring the nitrate concentration in fresh water and
- reviewing the eutrophic state of fresh surface waters, estuarial waters and coastal waters.

(8) The Nitrates Directive formulates the following activities connected with monitoring and reporting:

- drawing up and implementing suitable monitoring programmes to assess the effectiveness of action programmes
- monitoring the nitrate concentration in fresh water and
- reviewing the eutrophic state of fresh surface waters, estuarial waters and coastal waters.

(9) Annual surveying of surface runoff and riverine inputs of selected substances into the marine environment. See also the information on nutrients and pollutants. The parameters to be monitored under OSPAR are listed in the documents cited.

(10) The monitoring requirements under TMAP were specified in the Wadden Sea Plan ([Sylt, 2010](#)) (see also [TMAP Manual, section 2](#)).