

Monitoring Specifications

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Morphology Substrate





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

Physical Monitoring - Morphology - Substrate

1.2 Definition

Description of the composition and structure of the seabed

- Quantity, composition and structure of the substrate (transitional waters)
- Composition and structure of the substrate (coastal waters)

1.3 Competent authority/ies

Federal Government:	BfG , BfN , BSH , WSV
Mecklenburg-Vorpommern:	LUNG , STAUN
Lower Saxony:	NLPV NI , NLWKN
Schleswig-Holstein:	LLUR , LKN-SH

1.4 Working group

Ad Hoc Working Group on Hydrography, Hydrology and Morphology

2 Monitoring requirements

2.1 Necessity

[MSFD \[1\]](#)

Article 11, Annexes III and V

Comments

Monitoring programmes that survey the following morphological parameters must be drawn up under the Marine Strategy Framework Directive:

- Structure and substrate composition of the seabed

Article 8(1) [2]

Comments

The results of substrate mapping are also required for the initial assessment of marine waters. The parameters mentioned in Article 11 must be surveyed for this purpose.

[HD \[3\]](#)

Article 11 [4]

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.

Hydromorphology plays an important role in the assessment of typical habitat structures (see the additional parameters for assessment purposes in the monitoring specifications for the different habitat types and the corresponding assessment schemes).

[WFD \[5\]](#)

Article 8(1)

Comments

Under the WFD, morphological changes are to be surveyed every six years as a quality element. These include the following parameters: quantity, composition and structure of the substrate.

[TMAP \[6\]](#)

Wadden Sea Plan (Stade Declaration, 1997)

Comments

The monitoring of the geomorphological characteristics of the Wadden Sea has the objective of assessing possible climate changes (e.g. rising sea levels, increase in storm events) and their impacts on habitats, species and communities.

Technical necessity

Overview of monitoring frequencies and cycles:

	WFD	HD	OSPAR	HELCOM	TMAP	MSFD
Frequency	Once	N.a.	?	?	N.a.	Coherent
Monitoring cycle	Every six years	N.a.	?	?	N.a.	Coherent

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 [...], taking into account the indicative lists of pressures and impacts set out in [...] Annex III."

HD

See the assessment schemes for the various habitat types.

WFD

Annex 5, 1.2.3 and 1.2.4:

Transitional waters

The quantity, structure and substrates of transitional water beds, and the structure and condition of the intertidal zones correspond to conditions consistent with the achievement of the values specified for the biological quality elements.

Coastal waters:

The structure and substrates of the coastal bed, and the structure and condition of the intertidal zones correspond to conditions consistent with the achievement of the values specified for the biological quality elements.

TMAP

Targets for the Wadden Sea:

- A natural dynamic situation

An increased area of geomorphologically and biologically undisturbed tidal flats and subtidal areas.

2.3 Threats

Natural morphodynamics are disturbed by:

- construction activities,
- deepening projects

2.4 Spatial allocation

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

1) Under the WFD: baseline plus one nautical mile

3 Monitoring concept

3.1 Description of monitoring network

Combination of point and area-wide investigations.

3.2 Monitoring activities

North Sea and Baltic Sea

Morphology: Substrate Composition and Structure

Methods:

Both organogenic and clastic components, seabed-physical parameters such as roughness (surface structure) and hardness (density, compaction), the rheological properties of the substrates and, sometimes, suspended load are investigated during the monitoring of the seabed's structure, the substrate and, in transitional waters, the quantity of the substrate.

According to CIS 2.4 Coast Guidance, the substrate is to be divided into four classes: mud, sand-gravel, mixed sediments and bedrock. This classification allows only a very rough description that does not include structural properties.

In consequence, the mean particle size distribution, the approximate mineralogical composition and two general seabed-physical properties, roughness and hardness, are also surveyed in the course of measurements for surveillance monitoring.

Further analytical parameters are to be investigated, depending on the reason for the operative or surveillance monitoring.

In methodological terms, sediment is appraised/designated firstly as a supporting parameter in the context of the investigation of benthic biotic communities using grabs, sediment cores and samples taken by divers/dip sampling. Secondly, whole water bodies are mapped with what is practically a area-wide approach using hydroacoustic and remote sensing procedures, as well as targeted in situ sampling.

Wadden Sea/eulittoral zone

- Analysis of sediments:
 - Investigations of sediment structure and properties at selected stations recorded using standardised protocols
 - Determination of grain size distributions and seabed-physical parameters (water content, consolidation) at further stations
- Remote sensing procedures: evaluation of aerial or satellite images in accordance with the OFEW method (STELZER, K., BROCKMANN, C. (2007): "Operationalisierung von Fernerkundungsmethoden fürs Wattenmeermonitoring (OFEW) - Abschlussbericht").

Open sea/sublittoral zone

- depth-sounder bearing with additional hydroacoustic seabed classification (Acoustic Ground Discrimination System, AGDS) with a view to the characterisation of the structure and composition of the substrate, including shellfish banks and seagrass meadows.
- Side-scan-sonar investigations for the characterisation of substrates, colonies and their spatial distribution (approx. every six to 12 years).
- Sampling during biological sampling by divers, grabs or video monitoring.

WFD Reporting Summary Sampling Method (2000 Characters):

As a rule, the quantity, structure and substrate of the seabed are surveyed/measured using hydroacoustic, optical and in situ procedures. Depending on the technical capacities of the authority that carries out the monitoring, the following state-of-the-art methods are deployed: Echosounding using the sediment classification system and side-scan sonar in the sublittoral zone, and multispectral optical remote sensing in the eulittoral zone. In addition to this, in situ samples are taken with core drills and grabs, and an accompanying rough appraisal/designation carried out in the field.

Furthermore, sediments are surveyed as supporting parameters when benthos is sampled.

WFD Reporting Summary Analysis Method (2000 Characters):

The results of the substrate investigations are gathered in decentralised and central archives, and made available by the individual providers in analogue or digital forms as sedimentological maps of the seabed (ESRI shapes, map services).

Seabed classification, remote sensing and sonar data are classified during postprocessing in accordance with the CIS 2.4 substrate classes.

Operative Monitoring:

WFD Reporting Summary Frequency Method (2000 Characters):

The operative monitoring of morphological conditions (distribution of hard substrates) is only required in the outer coastal waters of the Baltic Sea. It is carried out once a year at selected points.

WFD Reporting Summary Cycle Description (2000 Characters):

The operative monitoring of morphological conditions (hard substrates) is carried out each year in the outer coastal waters of the Baltic Sea.

Surveillance Monitoring:

WFD Reporting Summary Frequency Method (2000 Characters):

The surveillance monitoring of substrates is carried out at irregular intervals, mostly in the context of R&D projects.

WFD Reporting Summary Cycle Description (2000 Characters):

At present, the surveillance monitoring of substrates in the coastal and transitional waters of Germany's river basin districts does not comply with the prescribed minimum cycles of six years.

Frequency:

Seabed sediments and structures are surveyed at irregular intervals depending on the conditions for the deployment of remote sensing, ship-based procedures and in situ sampling. They should be scheduled/covered in such a way that significant changes in the substrate of the North Sea and Baltic Sea can be recorded within six years.

Parameter:

- Sediment grain size distribution
- Sediment structure
- Sediment type
- Sediment volume
- Substrate of the river and sea bed

3.3 Additional parameters

4 Assessment

4.1 Assessment procedures

North Sea and Baltic Sea

Title

North Sea and Baltic Sea Substrate Assessment - Distribution, Composition and Structure

Authors

Ad Hoc Working Group on the Hydrography, Hydrology and Morphology of Coastal Waters

Guideline:

Various directives

Comments:

The composition and structure of substrates are assessed using the assessment matrix put forward by the Ad Hoc Working Group on Hydrography, Hydrology and Morphology.

5 Quality assurance

- Quality Assurance Panel (at the UBA (workshops, intercalibration exercises, first abstract/scheme of a species list, standardisation with DIN, CEN and ISO, support for 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 DIN EN ISO/IEC 17025 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 Hydrography, Hydrology and Morphology.

5.1 Monitoring institutions

5.2 Guidance documents

- 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.
- BLMP Quality Assurance Panel at the UBA, 2010, in prep.: Prüfverfahren-SOP Sedimentansprache und Korngrößenverteilung (Testing Procedure SOP: Sediment Appraisal/designation and Grain Size Distribution); Federal Environment Agency.
- CIS 2.4 Coast Guidance

5.3 Standards

- WFD Reporting Summary Standards (2000 Characters): The surveying of sediments complies with the state of the art and is carried out using comparable methods in accordance with SOP: Sediment Appraisal/designation and Grain Size Analysis.
- WFD Reporting Summary Confidence (2000 Characters): *Has not yet been completed - but would be desirable in future!*

5.4 Current status

Intercalibration exercises

- Not yet available?

Workshops

- Still to be completed

6 Literature

7 Activities required to implement the concept

7.1 Changes to the current monitoring programme

General

Studies of the composition and structure of the substrate should concentrate on dynamic regions in which the morphology is changing naturally or as a result of relevant interventions. Natural changes can be identified from Landsat images in the eulittoral zone and using side-scan sonar or multibeam echosounder in the sublittoral zone.

North Sea

Studies of substrate composition like those described by van Bernem et al. (1994) or Reimers (2003) should be repeated at time intervals of six to 12 years for the purposes of the Central Command for Marine Emergencies Germany, on the one hand, and the HD and WFD, on the other. The results encompass/include both information on the sediments at approx. 3,000 Wadden Sea stations and information about macrozoobenthos/(benthic) macroinvertebrates species composition and abundance.

Future investigations will have to concentrate on areas that exhibit particularly high levels of dynamism. In the eulittoral zone of the Wadden Sea, these are the edges of the subtidal channels, while the dynamic areas in the sublittoral zone can be surveyed with side-scan sonar. In the Elbe estuary, the Medemgrund constitutes a very dynamic region where, for example, the 1 m depth contour shifts by as much as 50 or 100 m a year.

Baltic Sea

At present, there are still no comprehensive records for the Baltic Sea that could be used to describe the composition and structure of its substrates. Such records can be drawn up on the basis of historical data. Potential gaps in the data are to be closed by appropriate studies.

The need for the data to be updated is not as pressing as in the North Sea on account of the lower levels of dynamism.

7.2 Working steps required

Priorities

- Integration of monitoring activities for the surveying of substrate composition into marine monitoring
- Upgrading of data management (see below)

Incorporation of hydroacoustic and remote-sensing procedures into monitoring.

General

- The current activities undertaken with the aim of describing the composition and structure of the substrate are important for the implementation of the HD, WFD and MSFD, and also comply with the requirements of the trilateral Wadden Sea programme. It therefore appears expedient for the results obtained in the course of future marine monitoring to be collated in order to secure the flow of information between the relevant specialist institutions.
- Hydroacoustic investigations, e.g. using echosounding, should be carried out on as many trips as possible, providing/in so far as the technology this requires is available.
- The surveying of the sublittoral distribution of mussel banks, geogenic reefs and sandbanks, and seagrass meadows using sonar procedures should be further developed. Thanks to this technology, it appears possible for surveying of the occurrence and distribution of these habitats and biotopes to be implemented in future/with this technology, it appears possible to measure the occurrence and distribution of these habitats and biotopes in the near future.

Quality assurance

The participating institutions are striving/ambitious to build up and introduce uniform QA standards by means of the introduction of a DIN EN ISO/IEC 17025 quality management system (BLMP Study Group decision, 2006), which would ideally lead to the accreditation of these institutions. The establishment of DIN EN ISO/IEC 17025 quality management systems under the BLMP should be concluded by 1 January 2012.

In this context, apart from the development of uniform quality standards (QM system), efforts should also be made to ensure that the participating institutions work largely in accordance with shared guidelines when the SOPs are being drafted/developed. To this end, the current Sample Quality Management Manual is to be amended and Testing Procedure SOP: Sediment Appraisal/designation and Grain Size Distribution drawn up. / Therefore the Testing Procedure SOP "Sediment Appraisal/designation and Grain Size Distribution" will be developed in addition to the current Sample Quality Management Manual. The intention is for this SOP to be completed in the first six months of 2010.

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/procedure characteristics/method features,
- storage of reference and comparative collections,
- 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.

Data availability

- Measurements of grain size composition taken in the course of/line with macrozoobenthos/(benthic) macroinvertebrate studies must be incorporated into the databases in which the morphological measurements are compiled.
- Compilation of sediment data that are obtained in the course of individual studies (e.g. degree dissertations), research projects, proceedings for the collection/conservation/preservation of evidence/monitoring activities, etc.
- Only data (pieces of information) that have been evaluated and quality assured should be provided to relevant users and institutions.

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 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.

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

(4) 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.

(5) 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.

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