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Water quality - Guidance on mapping of seagrasses and macroalgae in the eulittoral zone

Wasserbeschaffenheit - Anleitung zur Kartierung von Seegras und Makroalgen in der Eulitoralzone

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Water quality - Guidance on mapping of seagrasses and macroalgae in the eulittoral zone

Wasserbeschaffenheit - Anleitung zur Kartierung von Seegras und Makroalgen in der Eulitoralzone

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 17211:2017) has been prepared by Technical Committee CEN/TC 230 “Water analysis”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

Introduction

Investigation of marine angiosperms (e.g. seagrasses) and macroalgae is an important part of marine environmental monitoring, facilitating the assessment of general ecological quality and the monitoring of ecological status. The requirement for using marine angiosperms and macroalgae in marine monitoring is inherent in numerous European and national directives: e.g. Marine Strategy Framework Directive (Directive 2008/56/EC), Water Framework Directive (WFD) (Directive 2000/60/EC), Urban Waste Water Treatment Directive (91/271/EEC), Habitats Directive (92/43/EEC) and the OSPAR and HELCOM conventions. Extensive green macroalgal beds are considered an indicator of eutrophication. Seagrasses and some macroalgae species are important contributors to biodiversity, as well as IUCN threatened species and they are investigated in very similar ways. They respond to environmental changes - primarily availability of light, nutrients, temperature and are impacted by physical disturbance. Monitoring of extent of area, biomass and species composition may therefore in many cases be used to characterize the environment and the degree of impacts.

The characterization of environmental conditions based on marine angiosperms and macroalgae requires the use of quantitative and qualitative mapping methods.

WARNING — Persons using this document should be familiar with normal fieldwork practice. This document does not cover safety aspects arising from its use. It is the responsibility of the users to take sufficient health and safety precautions, and to ensure that national regulations are complied with.

1 Scope

This document provides guidance for survey design, equipment specification, survey methods, sampling and data handling of macroalgae and marine angiosperms such as *Zostera* in the intertidal soft bottom environment. It does not include polyeuryhaline terrestrial angiosperms that are found in saltmarshes. *Ruppia* is a genus of angiosperms that can be found in brackish water. This document can also be applied to the study of *Ruppia* in these environments.

The document comprises:

— development of a mapping and sampling programme;

— requirements for mapping and sampling equipment;

— procedures for remote sensing data collection;

— procedures for direct mapping and sampling in the field;

— recommendations for taxon identification and biomass determination;

— data handling.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
biomass
total mass of living material in an area (m^2)

[SOURCE: ISO 6107-3:1993, definition 12, modified – "a given body of water" has been replaced by "an area (m^2)"]

3.2
ground-truth
information that are confirmed in an actual field investigation which is done at a defined location

Note 1 to entry: Used to confirm the findings of, or to calibrate quantitative observations, from remote sensing.

3.3
eulittoral zone
intertidal zone
marine intertidal zone which is submersed and emerged, either periodically due to tides or aperiodically due to irregularly occurring factors, as in the enclosed seas of the Baltic or the Mediterranean

Note 1 to entry: Biologically, this zone is defined as the zone between the upper limit of barnacles and the upper limit of laminarians. In the Baltic where there is no tide, the eulittoral zone is the zone of short-lived annual algae.

[SOURCE: EN ISO 19493:2007, 2.7]

3.4
littoral zone
shallow marginal zone of a body of water where light penetrates to the bottom

[SOURCE: ISO 6107-3:1993, definition 40]

4 Principle

Surveys of marine angiosperms and macroalgae are undertaken using ground surveys and/or remote sensing methods. This document gives guidance on the survey design, geographic positioning on the ground, field data collection and sample processing for biomass. It does not cover the use of specialist remote sensing software or data handling approaches beyond that of their general application.

5 Survey strategy

5.1 Mapping plan

The mapping and sampling plan shall be defined according to the aims of the survey and the required precision of results and their intended use before the survey is initiated. Remote and direct sampling, methods, location and number of sampling stations on the ground, and methods for data processing will vary between different types of studies. During development of the programme, consideration should be given to local tidal regimes and general environmental conditions. Knowledge from previous surveys and from local information sources is important in locating beds and in planning safe and representative survey locations and resources. For guidance on the design of sampling programme, see EN ISO 5667-1.

The survey plan can require work to take place over a defined substrate type. This should be defined by the survey objectives. The use of existing habitat maps or sediments maps may be used to define this area.

Eulittoral surveys should begin at a certain time before low tide and should end accordingly after low tide. This time will depend on the local tidal flat morphology and the tidal conditions and can vary by 2 hours or more either side of low water. Particular caution has to be paid to tidal channels and the rising tide.

The eulittoral survey may be a

— full field survey, where all data are collected from work on the ground; e.g. where beds are large, a survey may not be completed during one low tide and has to be done in several stages or by using underwater survey techniques;

— combined field and remote sensing survey, where the field data are used to validate the remote sensing results and to collect any biomass and supporting data;

— remote sensing only survey. It is recommended that this approach is conducted by an experienced surveyor or for pilot surveys (see 5.3) only as the results are not validated by ground- truth data.

NOTE Screening survey is a term used for pilot survey.

Table 1 indicates the suitability in relation to scale of a number of different approaches. However, methods are dependent on specific aims of the survey and restrictions in available survey resources.

Table 1 — Decision matrix for the suitability of littoral/intertidal sampling methods for macroalgae and angiosperms (H = high suitability survey option, M = moderate suitability survey option, L = low suitability survey option, *N* = Not suitable)

Area (km^2)	Direct visual field sampling/mapping only	Visual aerial survey[a]	Aerial photo[a]	Digital aerial sensor[a]	Satellite[a]
< 0,01	H	M	M	N	N
0,01 to 1	H-M	H-M	H-M	H	N
1 to 100	M	H	H	H	M
> 100	L	H	H	H	H

[a] Require ground validation

5.2 Timing and frequency of sampling

For baseline monitoring (see 5.4), sampling shall be carried out at least once in the year within the peak vegetation period. This will vary with latitude, and thus should be based on local knowledge. At important bird sites, consideration should be given to ensure minimum disturbance to birds. It should be noted that the arrival of overwintering geese can lead to a reduction on bed extent (particularly seagrass) due to grazing.

For trend monitoring (see 5.5), sampling shall be carried out at least once every two or three years. The investigation shall include the peak vegetation period.

Aerial surveys and ground surveys shall be undertaken preferably synchronously, at least within a restricted period of time between the two survey types. For aerial surveys where the field data are key to validating the aerial imagery, e.g. when using multispectral imagery; aerial flights and ground truthing surveys shall be no more than three weeks apart.

Aerial and ground surveys shall avoid quantitative surveys during the period of plant breakdown, as highly variable results will be obtained.

5.3 Pilot survey

Initial visual surveys or predictive models may be used to locate areas of angiosperms and macroalgae beds in order to focus a baseline mapping survey. This can also be achieved using existing aerial or satellite images, etc. These surveys may not accurately quantify density, biomass or species composition.

Such surveys assist the planning of the more detailed surveys and help focus remote sampling programmes or data collection, ensuring they are cost effective. They may also be useful in confirming a lack of significant plant cover in some locations.

Methods appropriate to this work include:

— analysis of recent remote sensing images. The value of this will depend on the age and optical resolution of the images;

— optical surveys of the intertidal environment e.g. using telescopes from a high point or vessel nearby. Typically, a survey done obliquely will foreshorten the view and provide an underestimate of extent of cover.

5.4 Baseline survey

Baseline surveys are carried out to determine the distribution, extent and density of angiosperms and macroalgae beds.

NOTE Mapping is also a term used for baseline survey.

Repeat surveys in subsequent years may be necessary to establish temporal trends in extent or density of growth. Detailed analyses shall be carried out on mapping the

— size, shape and position of beds;

— abundance which can be represented by density (as a percentage) of cover or shoot density or biomass (g or kg/m^2) as wet weight or dry weight of macroalgae;

— species composition;

— other environmental parameters such as epiphyte cover or sediment type, etc.

The survey provides the basis for characterizing environmental conditions in the relevant areas in accordance with set criteria or by comparison with angiosperms or macroalgae communities in other representative areas. The requirements for scientific documentation and replicability are relatively high.

The surveys shall be carried out using quantitative methods. There shall be specified requirements for numbers of stations, which is determined in accordance with the aims of the investigation (the geographical resolution required) and the size and density variation of the area to be mapped. The principal aim should be to obtain an appropriate number of records that adequately reflect the variation in density and cover for the algae and angiosperms within the waterbody. Care shall also be taken not to oversample small beds as this could lead to destruction of the bed through trampling.

The detailed survey design shall be a regular (e.g. grid, transect along a depth contour), random or random stratified approach. Randomly stratifying the survey design in the field will allow for more effective use of resources and produce less variability in results where density or cover of beds is complex.

Methods shall be chosen such that the data can be used as a basis for comparison with baseline surveys in other areas. The design of the surveys shall be appropriate to match the level of accuracy and precision required. Ground validation is required when remote sensing options are chosen.

Aerial remote sensing methods should be chosen that provide suitable representative information, for example digital aerial sensors, aerial photography or satellites. Suitable new methods may emerge as technology develops in this area e.g. use of unmanned aerial vehicles.

See Annex A for more information on existing aerial remote sensing options. The resolution of the aerial images shall match the survey objectives.

5.5 Temporal trend monitoring

In areas where potential changes in environmental conditions are to be monitored, such as in impacted areas or where there are activities that may cause environmental impacts, a baseline survey shall first

be carried out, and then follow-up monitoring surveys. Local knowledge may be used to add to the data collected.

The survey data collected should allow production of a temporal description of natural variations of the extent and abundance of the angiosperms and macroalgae beds communities and document any gradual changes (trend monitoring). The survey shall be carried out to a specific survey design and follow a carefully defined method.

The options for detailed survey design should follow those defined for baseline surveys.

5.6 Specialized surveys

Specialized surveys are recommended to assess the health of seagrass and macroalgal beds and any associated impact of extensive macroalgal growth on infaunal communities. In these surveys, additional measurements will need to be collected.

For opportunistic macroalgal surveys these may include sediment particle size information and benthic infaunal community abundance and species composition. For guidance on sampling soft sediment macrofauna, see EN ISO 16665.

For seagrass health investigations, additional information on the extent of the protist disease causing seagrass die-back should be considered as well as physical and environmental data. Environmental data to consider collecting includes salinity, nutrient, turbidity, particle size, oxygen, and temperature data. Hydromorphological data such as physical disturbance should also be considered.

6 Equipment

6.1 General

The lists in 6.2, 6.3 and 6.4 indicate the equipment that may be required for a field or aerial based survey.

WARNING — Working shall be done with care. Risks associated with such work shall be managed and all phases of the investigation should conform to current health and safety regulations. All personnel shall be trained in safe working procedures. Appropriate protective equipment shall be available.

6.2 Field survey

At the beginning of a survey it should be checked that the equipment is in good condition, without damage to the grids and that the weighing scales have been calibrated and are in good working condition.

All equipment shall be operated in accordance with the relevant vendor's instruction manual and shall be maintained and cleaned in such a way that the equipment functions flawlessly. The equipment should be serviced as required.

Equipment required will vary according to the type of survey methodology but may include:

6.2.1 Boat or light hovercraft, with safety equipment.

6.2.2 Global Positioning System (GPS) device or Differential Global Positioning System (DGPS) for higher accuracy.

6.2.3 Secchi disk, measured according to prEN ISO 7027-2.

6.2.4 Thermometer/salt content sensor.

6.2.5 Sampling frames.