SLOVENSKI STANDARD
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Kakovost vode - Navodilo za preiskave višjih vodnih rastlin jezer

Water quality - Guidance standard for the surveying of macrophytes in lakes

Wasserbeschaffenheit - Anleitung zur Erfassung von Makrophyten in Seen

Qualité de l'eau - Guide pour l'étude des macrophytes dans les lacs

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13.060.10	Voda iz naravnih virov	Water of natural resources
13.060.70	Preiskava bioloških lastnosti vode	Examination of biological properties of water

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Water quality - Guidance standard for the surveying of macrophytes in lakes

Qualité de l'eau - Guide pour l'étude des macrophytes dans les lacs

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Foreword

This document (EN 15460:2007) has been prepared by Technical Committee CEN/TC 230 “Water analysis”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2008, and conflicting national standards shall be withdrawn at the latest by April 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

WARNING — Working in or around water is inherently dangerous. This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and to ensure compliance with national regulatory conditions where they exist.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Macrophytes are an important component of aquatic ecosystems and can be used to facilitate monitoring of ecological status. The requirement for the use of macrophytes in monitoring is inherent in numerous European and national directives, e.g. Urban Waste water Treatment Directive (91/271/EEC), and the Nitrates Directive (91/676/EEC). Macrophytes are one of four obligatory biological quality elements identified in the Water Framework Directive (Council Directive establishing a framework for a community action in the field of water policy, 2000/60/EC), and should be used in the ecological classification of all lakes.

In addition to their important ecological role, the use of macrophytes as indicators of ecological status in standing waters is based on the fact that certain species and species groups are indicators for specific standing water types and are adversely affected by anthropogenic impact. In certain situations the lack of macrophytes is also a natural characteristic of certain types of aquatic habitat. For example, in lakes with high humic content or high turbidity, macrophytes may be virtually absent due to the reduction in light penetration. Many lakes show alternating states with clear water in some years and turbid water in others associated with the dominance or absence of macrophytes but with the same anthropogenic impact.

A wide range of sampling and survey methodologies have been developed for specific applications including conservation, drainage impact, management, ecological habitat, enhancement etc. The methodology of this guidance standard is recommended specifically for the surveying of macrophytes in both natural and artificial fresh water lakes, for the purpose of monitoring ecological status or the status of the macrophyte vegetation itself. It could be used, however, as the basis for general monitoring of water quality or other applications.

According to the precise use to which this guidance standard is to be put, it is essential for specifiers and users to agree and clearly record, any necessary variations or optional procedural details prior to use.

1 Scope

This guidance standard defines a method for surveying aquatic macrophytes in lakes - primarily for the purpose of assessing ecological status, using these organisms as an element of biological quality. The information provided by this method includes the composition and abundance of the aquatic macrophyte flora.

For a complete assessment of ecological status, other elements of biological quality should also be assessed.

The general principle of the approach described in this European Standard may also form the basis for the monitoring and assessment of macrophytes in lakes, for example, for conservation purposes.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Not applicable

3 Terms and definitions

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

3.1
amphiphyte
plant that can grow submerged in the water up to completely above the water, typically under fluctuating water level conditions

3.2
aquatic macrophytes
larger plants of fresh water which are easily seen with the naked eye, including all aquatic vascular plants, bryophytes, stoneworts (Characeae) and macro-algal growths (see EN 14184)

NOTE For this method, this term is taken to include macrophytes growing in the water and in the wash zone, including hydrophytes, helophytes, amphiphytes, as well as supra-littoral species in the wash zone (such as *Carex*).

3.3
belt transect
band of defined width oriented at right angles to the shoreline or bank, which starts at the water line including the wash and inundation zones starting at the highest seasonal waterline and in lakes extends to the lowermost limit of the aquatic macrophyte vegetation

NOTE 1 The aquatic vegetation (species composition, abundance, cover) is analysed within this transect. The transect can be virtual or physically delineated.

NOTE 2 The lowermost limit can change over years, either the belt transect is then extended to the lowermost limit that can be expected ever, or the lowermost limit or the belt transect is left variable through the years.

3.4
ecological status
expression of the quality of the structure and functioning of aquatic ecosystems, expressed by comparing the prevailing conditions with reference conditions (see EN 14184)

NOTE As classified in accordance with Annex V of the EC Water Framework Directive (2000/60/EC).

3.5
habitat
specific environment in which a species lives (see EN 13946, EN 14407)

3.6
helophyte
plant that is normally rooted under water with emergent shoots, typically growing in marginal or marshy areas (see EN 14184)

3.7
hydrophyte
aquatic plant that is normally rooted under water with floating or submerged leaves, or totally free floating (see EN 14184)

3.8
maximum depth of the vegetation
lowermost limit of the aquatic macrophytes which are adherent to or rooted in the sediment

3.9
metric
measurable part or process of a biological system empirically shown to change in value along a gradient of human influence

3.10
monitoring site
lake, or body of water within a lake, in which aquatic macrophytes are surveyed for the assessment of ecological status and/or other purposes

3.11
reference site (RefS)
lake or body of water within a lake representing the reference conditions for a given ecological type

3.12
reference conditions
conditions reflecting a totally undisturbed state, lacking human impact, or near-natural with only minor evidence of distortion (see EN 14184)

NOTE Reference conditions can be defined using field sites or, where necessary, using expert judgement or predictive modelling techniques

3.13
sample
smallest unit of area to be sampled, typically a belt transect consists of a series of samples, continuous or discrete (with intervals), but samples may be scattered (stratified) randomly as well (non-transect methods)

3.14
supra-littoral survey location
section of shoreline and adjacent submerged areas surveyed for aquatic macrophytes

3.15
taxon (pl. taxa)
taxonomic unit, for example family, genus or species (see EN 14707)

4 Principle

This European Standard describes a methodological approach for determining the ecological status of lakes using aquatic macrophytes. The status of a lake is assessed by establishing its deviation from the natural conditions of a lake of a similar ecological type. If natural conditions in comparable lakes no longer exist to

serve as a background or a reference site (RefS), it is necessary to reconstruct this background based upon whatever records exist. This may involve using data from lakes of a similar type in other European countries.

NOTE Even within similar lake types there can be significant biogeographical variation in the naturally occurring species.

The presence of aquatic macrophyte taxa in the individual lakes is recorded. Macrophyte abundance, measured in terms of the spatial extension of taxa or macrophyte beds, and/or macrophyte abundance estimates or biomass, is assessed by different methods adapted to the scale and purpose of the study.

Numerical derivatives or metrics of the macrophyte composition and abundance in a lake survey can be used to identify the divergence from type-specific, natural conditions.

5 Equipment: the following equipment list is suggested.

5.1 Equipment common to all surveys

5.1.1 High resolution maps of survey area, preferably laminated.

5.1.2 Range of plastic bags and hard plastic containers, for retaining specimens or the temporary storage of macrophytes requiring laboratory identification.

NOTE Mosquito netting or lace bags are easier to use than plastic bags in water.

5.1.3 Waterproof labels

5.1.4 Pencils or pens, with indelible ink.

5.1.5 Field data recording system, using either waterproof sheets, a small cassette recorder or water-resistant portable computer;

5.1.6 Floras, relevant field keys and identification guides, and iconographs (illustrations), appropriate to the habitats under consideration;

5.1.7 Records from any previous macrophyte surveys of the lakeunder survey

5.1.8 Personal protective clothing

5.1.9 First aid kit

5.1.10 Notebook, preferable with hard back and water repellent paper.

NOTE A pre-prepared *pro forma* is helpful in the field. This can be a *pro forma* count sheet with a list of taxon names and space beside each on which the abundance estimates can be made, or a notebook organised in such a way that taxon identities and numbers can be clearly recorded, or a computer program with facilities for direct entry of data. It is recommendable that design of the recording sheets or programs takes into account the requirements of any Quality Assurance programmes that are in place. Alternatively, field notes can be dictated into a small cassette recorder or digital dictaphone with flash memory.

5.2 Additional equipment for diving surveys

5.2.1 Wet-suit, snorkelling or SCUBA equipment;

5.2.2 Sinkable measuring tape, with concrete weight (or leaded line graduated along its length at appropriate points e.g. 5 m distances) to mark survey transects.

5.2.3 Dive (Alpha) flag, to attach to boat or buoy.

5.3 Additional equipment for boat surveys

5.3.1 Boat suitable for local conditions, with appropriate safety equipment. Where a boat is used, a means of communication from the boat to designated shore-based staff, with access to rescue services.

NOTE The use of an experienced boat handler familiar with local conditions or as a minimum detailed bathymetric maps for the survey area is recommended for safe surveying.

Accurate bathymetric data are crucial in delineating littoral zones, bed slopes etc. Where the data are not available, it should be an integral part of any vegetation survey. At a practical level, the use of transducer depth finders is recommended, which will operate to depths of up to approximately 73 m.

5.3.2 Double-sided rake grapnel and/or multi-point grapnel, attached to a suitable length of rope.

NOTE 1 The double-sided rake grapnel is preferable on relatively smooth, uniform substrates. On stony terrain with large interstices, the multi-point grapnel will tend to be more effective as it can slip into areas that a double rake cannot access. However, grapnels and rakes are inefficient for sampling smaller aquatic macrophyte species, a grab and netting techniques can be more effective.

NOTE 2 Double rake grapnels can be fabricated from two 32 cm garden rakes with 6 cm prongs at 2 cm intervals welded back to back with an attachment point for a rope. Rakes with longer prongs at smaller intervals can be preferred as they can be more efficient in sampling some situations. So called ‘grass rakes’ with 10 cm prongs transversely mounted are more suitable than ordinary garden rakes, especially for smaller specimen on soft sediments.

NOTE 3 The efficiency of rakes can be increased by folding fine maze wire netting around the rake teeth; in very soft sediments and with only very tiny plants a grab and handnet can be used as effective alternatives.

The rope should be of sufficient length to allow the deployment and recovery of the rake/grapnel. It should be of a sufficiently heavy gauge to allow pressure to be applied when the grapnel is snagged but not of excessive thickness that will lead to problems with deployment and recovery. Hemp ropes are less prone to kinking. Alternatively, extendable handles can be used that are effective to depths of approximately 3,5 m [3].

5.3.3 Rake, with rigid extendable handle.

5.3.4 Graduated floating line and weighted mooring buoy

5.4 Additional equipment

5.4.1 Geographical Positioning System (GPS)

5.4.2 Polarising sunglasses

5.4.3 Underwater viewing aid/bathyscope, viewing tube, bucket or box with clear Perspex base.

5.4.4 Camera with polarising lens

5.4.5 Underwater ‘drop’ camera, waterproof camera mounted to a cable or pole, that can lowered into the water.

5.4.6 Sanitised wipes

5.4.7 Binoculars

5.4.8 Hand lens, ×10 and ×20 magnification.

5.4.9 White plastic trays

5.4.10 Equipment to measure water depth, e.g. rod marked with intervals of 1 cm to 2 cm; or for deep, less vegetated areas, a hand-held echo-sounder.

5.5 Equipment for collecting additional data

5.5.1 Conductitivity meter

5.5.2 Depth meter

5.5.3 pH meter

5.5.4 Secchi disc

NOTE A secchi-disc to indicate the depth of light penetration, and equipment to measure the depth and level of the water can be useful in interpreting the resulting data. A hand-held conductivity and pH meter can also be useful, especially if surveying lakes with different water chemistry.

6 Survey planning

6.1 General

Survey planning is very much dependent on the purpose of the study and the procedure described here is primarily for the purpose of assessing ecological status.

At the beginning of a survey the geographic region(s), the hydromorphological lake typology and the expected reference conditions characteristic for the type of lake under investigation should be defined.

6.2 Establishing reference conditions

Ecological reference conditions for each hydromorphological lake type need to be established before the ecological status of a monitoring site can be assessed. This can be achieved either by surveying reference sites (RefS) within a specific type or, where suitable RefS cannot be found, by modelling or expert opinion. Historical data from unimpacted sites may also be invaluable.

Reference sites (lakes, or bodies of water within a lake), should be as close as possible to natural conditions with respect to their species composition and the abundance of each species, physical and chemical variables and hydromorphological background. Hazardous substances should either be totally absent or close to the limit of detection. Nutrient concentrations and the levels of acidification should be close to background levels taking into account the influences of the local geology and geographical location. Catchment pressures from, for example, agriculture and forestry should be low and significant point-discharges should be absent.

The selection of reference sites (RefS) should be based on information from regional or national surveys that have data on the species composition, distribution and diversity of the aquatic vegetation.

6.3 Monitoring sites

The ecological status of a lake or body of water within a lake (a monitoring site) is measured in terms of the deviation of the aquatic macrophyte flora from the reference conditions for the same lake type. For most practical purposes the lake is the waterbody unit and not the individual areas surveyed for macrophytes.

Where the concentration of lakes is high, as for example in Scandinavia, it is impractical and unnecessary to survey macrophytes in all lakes. In these circumstances a representative subset of monitoring sites can be surveyed to reflect the range of lake types represented and the extent to which these are influenced by specific human pressures. When selecting representative lakes from lake clusters use similar criteria to those listed in Clause 6.2.