



SLOVENSKI STANDARD
oSIST prEN 18161:2025
01-marec-2025

Kakovost vode - Navodilo za monitoring populacije sladkovodnih školjk in njihovega okolja

Water quality - Guidance standard on survey and monitoring freshwater mussel populations and their environment

Wasserbeschaffenheit - Anleitung für das Monitoring und Bewertung von Süßwassermuscheln

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ICS:

13.060.70	Preiskava bioloških lastnosti vode	Examination of biological properties of water
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oSIST prEN 18161:2025

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 18161

January 2025

ICS 13.060.70

English Version

Water quality - Guidance standard on survey and monitoring freshwater mussel populations and their environment

Wasserbeschaffenheit - Anleitung für das Monitoring und Bewertung von Süßwassermuscheln

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European foreword

This document (prEN 18161:2025) 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.

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Introduction

This document provides guidance on survey and monitoring populations of unionid mussels (i.e. Order: Unionida, also referred to as naiads) and the environmental features on which they depend. There are 24 species of native unionid bivalves in Europe other than *Margaritifera margaritifera*, which is covered in a CEN standard [1] to provide guidance on survey and monitoring. None of these unionid species can be considered to be secure throughout their range based on IUCN threat assessments. A standard approach to collecting the information required to undertake accurate threat assessments is not available.

Unionid species are distributed according to their natural habitat requirements, the distribution of their host fish, and the historical means by which both mussels and hosts have been distributed, and the biogeographical barriers to their spread. The European unionids fill a wide range of habitat types, and survey, monitoring and condition assessment must be relevant to the individual requirements of each species. Some species are generalists and occupy a wide range of habitats, while others are more restricted by river/ lake/ canal bed substrate, water quality and water flow, in particular lentic or lotic conditions.

Freshwater mussels are threatened by a range of pressures, as outlined in Lopes-Lima et al. [2]:

- a) habitat loss, fragmentation, and degradation;
- b) overexploitation;
- c) pollution and eutrophication;
- d) loss of fish hosts;
- e) invasive species;
- f) water abstraction and climate change;
- g) other threats resulting in mussel declines (e.g. diseases),

where the habitat appears intact with healthy populations of fish, insects, gastropods, and other biota.

Further research is needed to detect new and emerging pressures, requiring consistent and comparable mussel survey and data interpretation. This document aims to assist in the conservation of unionid mussels through facilitating a consistent approach to understanding mussel populations across the species and the bioregions in which they occur, including undertaking environmental impact assessment, and restoring mussel populations. The applications of the standard also include the provision of site-level data that will contribute to reporting under Article 17 of the European Habitats Directive (<https://eur-lex.europa.eu/legal-content/EN/TXT/>).

NOTE Although freshwater mussels are invertebrates, their survey is conducted in a very different way from standard surveys for other benthic macroinvertebrates. Surveys for mussels are concentrated on the restricted habitat of the species of mussel being surveyed, and must also consider the habitat and water quality conditions required to complete its full life cycle. For this reason it is not possible to use EN 16859 ('Guidance standard on monitoring freshwater pearl mussel (*Margaritifera margaritifera*) populations and their environment') for other mussel species. The freshwater pearl mussel is unique among other European mussel species in living in fast-flowing oligotrophic habitats which are unsuitable for other mussel species. It is not possible, either, to use EN 16150 ('Guidance on pro-rata multi-habitat sampling of benthic macro-invertebrates from rivers and streams') as this guidance is focused on finding the macroinvertebrate species present across a full representative range of habitat types within a water body, and is thus unsuitable for a survey of mussels in their restricted habitat. The use of EN 16150 is also confined to rivers and streams rather than the wide range of water bodies, including lakes and ponds, that are important habitats for mussels.

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1 Scope

This document provides the information needed to assess the condition over time of a unionid population, and the level of information for assessing whether a plan or project may be detrimental to their future prospects. It provides guidance on methods for survey and monitoring unionid mussel populations and the environmental characteristics important for maintaining populations in favourable condition. The document is based on best practice developed and used by unionid mussel experts in Europe, and describes approaches that individual countries have adopted for survey, data analysis and condition assessment.

Standard methods for restoring populations are not within the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 16039, *Water Quality — Guidance standard on assessing the hydromorphological features of lakes*

EN 14011:2003, *Water quality — Sampling of fish with electricity*

3 Terms and definitions

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

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

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

3.1

acoustic doppler current profiler ADCP

sonar device that produces a record of water current velocities for a range of depths

[SOURCE: EN 16859:2017, definition 3.1]

3.2

aquatic macrophyte

larger plant of fresh water which is easily seen with the naked eye, including all aquatic vascular plants, bryophytes, stoneworts (Characeae) and macro-algal growths

Note 1 to entry: This definition includes plants associated with open water or wetlands with shallow water.

[SOURCE: EN 14614:2004, definition 2.1]

3.3

bankfull

maximum point on banks at which floods are held within the channel before spilling over onto the floodplain

[SOURCE: EN 14614:2004, definition 2.5]

prEN 18161:2025 (E)**3.4****bathtub ring**

high-water mark, visible at low water levels around the shoreline of a lake, often resulting from the deposition of minerals on previously submerged surfaces

3.5**bathyscope**

bucket with a transparent bottom used for viewing freshwater pearl mussels on the river bed

[SOURCE: EN 16859:2017, definition 3.5]

3.6**brooding period**

length of time that glochidia remain within the body of a gravid pearl mussel

[SOURCE: EN 16859:2017, definition 3.7]

3.7**chemical oxygen demand****COD**

indicative measure of the amount of oxygen that can be consumed by reactions in a measured solution, expressed as mass of oxygen consumed/volume of solution in mg L⁻¹

3.8**cofferdam**

temporary, watertight enclosure built within a body of water, from which water is pumped to provide a dry working environment

3.9**colmation**

blockage of stream-bed interstitial spaces by the ingress of fine sediments and organic material

[SOURCE: EN 16859:2017, definition 3.8]

3.10**culvert**

arched, enclosed or piped structure constructed to carry water under roads, railways and buildings

[SOURCE: EN 15843:2010, definition 3.8]

3.11**flow duration curve**

graphical representation of a ranking of all the flows in a given period, from the lowest to the highest, where the rank is the percentage of time the flow value is equalled or exceeded

Note 1 to entry: These curves may be derived for flows in any time interval, such as daily flows, monthly flows or annual flows

[SOURCE: EN 16859:2017, definition 3.17]

prEN 18161:2025 (E)**3.12****fluvial audit**

method for assessing the condition of a river and its associated human pressures, using information from field survey, remote sensing, historical and recent maps, scientific literature and other sources

[SOURCE: EN 16859:2017, definition 3.18]

3.13**glide**

moderately-flowing water with undisturbed surface other than occasional swirls or eddies, and with constant depth across part of the channel

[SOURCE: EN 14614:2004, definition 2.17]

3.14**glochidium**

mussel larva

Note 1 to entry: The plural is 'glochidia'.

[SOURCE: EN 16859:2017, definition 3.21, modified]

3.15**hydromorphology**

physical and hydrological characteristics of rivers including the underlying processes from which they result

[SOURCE: EN 14614:2004, definition 2.18]

3.16**marsupium**

section of mussel gill expanded to form a pouch to protect eggs

Note 1 to entry: The plural is 'marsupia'.

3.17**monitoring**

comparison of repeated surveys, ideally against pre-defined targets

3.18**penetrometry**

method for assessing the resistance of the river-bed substrate in situ using a standard cone or disc penetrometer

[SOURCE: EN 16859:2017, definition 3.28]

3.19**pool**

habitat feature characterized by distinctly deeper parts of the channel that are usually no longer than one to three times the channel's bankfull width, and where the hollowed river bed profiles are sustained by scouring

[SOURCE: EN 14614:2004, definition 2.24]

prEN 18161:2025 (E)**3.20****recruitment**

survival of juvenile mussels and their addition to a population

[SOURCE: EN 16859:2017, definition 3.30, modified]

3.21**revetment**

retaining wall or facing of masonry or other materials supporting or protecting banks from erosion

3.22**riffle**

fast-flowing shallow water with distinctly broken or disturbed surface over gravel/pebble or cobble substrate

[SOURCE: EN 14614:2004, definition 2.28]

3.23**riparian zone**

area of land adjoining a river channel (including the river bank) capable of directly influencing the condition of the aquatic ecosystem (e.g. by shading and leaf litter input)

Note 1 to entry: In this document, the term 'riparian zone' does not include the wider floodplain.

[SOURCE: EN 14614:2004, definition 2.29]

3.24**salt bridge**

device containing a chemically inert electrolyte which is used to increase electrical conductivity locally

[SOURCE: EN 16859:2017, definition 3.37]

3.25**shear stress**

measure of the force of friction caused by water flowing around a submerged surface or object

[SOURCE: EN 16859:2017, definition 3.38]

3.26**survey**

recording of qualitative or quantitative data using easily repeatable standardized techniques over a restricted period without preconception of the results

3.27**tumidity**

measurement of a mussel at its widest point

Note 1 to entry: While the length and width are measured across the longer and shorter side of a valve, the tumidity is measured across the two valves

prEN 18161:2025 (E)**3.28****turbidity**

reduction of transparency of a liquid caused by the presence of undissolved matter

[SOURCE: ISO 6107-2:2006, definition 145]

3.29**umbonal sculpture**

shape and arrangement of contours at the dorsal protuberance on bivalve shells that generally rises above the hinge

3.30**woody material**

material that falls into rivers and streams, ranging in size from leaf fragments (fine woody material) to branches or whole trees (coarse woody material)

[SOURCE: EN 16859:2017, definition 3.41]

4 Taxonomic summary of the species

The European unionid mussels are divided into two families, the Margaritiferidae and the Unionidae.

In the Margaritiferidae, only two species currently occur in Europe – *Margaritifera margaritifera* (Linnaeus, 1758) and *Pseudunio auricularius* (Spengler, 1793). In the Unionidae, 23 species are divided into two subfamilies: the Unioninae and the Gonideinae. The Unioninae are further subdivided into tribes Anodontini and Unionini.

The European Anodontini includes two genera – the genus *Anodonta* with three species: the widespread *Anodonta anatina* (Linnaeus, 1758), *Anodonta cygnea* (Linnaeus, 1758), and the south-central European *Anodonta exulcerata* Porro, 1838; and the genus *Pseudanodonta* with a single species, *Pseudanodonta complanata* (Rossmassler, 1835).

The Unionini includes 16 valid species belonging to the genus *Unio*. This genus is divided into several groups that correspond to four evolutionary monophyletic clades – the *crassus*, the *pictorum*, the *gibbus* and *tumidus* clades, all of them with at least one species in Europe. The *pictorum* clade includes five valid species: *Unio delphinus* Spengler, 1793; *Unio elongatulus* Pfeiffer, 1825; *Unio mancus* Lamarck, 1819; *Unio pictorum* (Linnaeus, 1758); and *Unio ravoisieri* Deshayes, 1848. The *crassus* clade includes nine species: *Unio bruguierianus* Bourguignat, 1853; *Unio carneus* Kuster, 1854; *Unio crassus* Philipsson in Retzius, 1788; *Unio cytherea* Kuster, 1833; *Unio desectus* Westerlund in Westerlund and Blanc, 1879; *Unio gontierii* Bourguignat, 1856; *Unio ionicus* Drouët, 1879; *Unio tumidiformis* Castro, 1885; and *Unio vicarius* Westerlund in Westerlund and Blanc, 1879. The *gibbus* clade includes the single species *Unio gibbus* Spengler, 1793, only present in a single river in southern Spain. Finally, the *tumidus* clade only includes a single species - the widespread *Unio tumidus* (Philipsson, 1788).

The second subfamily Gonideinae only includes two genera divided into three species in the south of Europe. The genus *Microcondylaea* only includes a single species, *Microcondylaea bonellii* (Férussac, 1827), in south-central Europe. The genus *Potomida* includes two species in Europe, the Western European *Potomida littoralis* (Cuvier, 1798) and *Potomida acarnanica* (Kobelt, 1879) only present in Greece.

A list of the species covered in this document, together with details of their geographical distribution is given in Informative Annex A.