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Water quality - Guidance on the scope and selection of fish sampling methods

Wasserbeschaffenheit - Anleitung zur Anwendung und Auswahl von Verfahren zur Probenahme von Fischen

Qualité de l'eau - Guide sur le domaine d'application et la sélection des méthodes d'échantillonnage de poissons

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Water quality - Guidance on the scope and selection of fish sampling methods

Qualité de l'eau - Guide sur le domaine d'application et la
sélection des méthodes d'échantillonnage de poissons

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

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Foreword

This document (EN 14962:2006) 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of an identical text or by endorsement, at the latest by October 2006, and conflicting national standards shall be withdrawn at the latest by October 2006.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 United Kingdom.

Introduction

This document is developed to select appropriate fish sampling methods for the evaluation of the species composition, abundance and age structure of fish in rivers, lakes and transitional waters.

WARNING — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

IMPORTANT — It is absolutely essential that tests conducted according to this document be carried out by suitably trained staff.

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1 Scope

This document defines methods for sampling fish and procedures for selection of methods in order to evaluate fish populations in rivers, lakes and transitional waters. A selected literature with references in support of this document is given in the bibliography. This document refers to the standards "Water quality - Sampling of fish with electricity" (EN 14011) and "Water quality - Sampling of fish with multi-mesh gillnets" (EN 14757).

2 Normative references

Not applicable

3 Terms and definitions

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

3.1
river
natural body of water flowing continuously or intermittently along a well-defined course into an ocean, sea, lake, inland depression, marsh or other water-course
[ISO 6107-2:1997]

NOTE   A body of inland water flowing for the most part on the surface of the land but which may flow underground for part of its course (Directive 2000/60/EC)

3.2
lake
inland body of water of considerable area
[ISO 6107-2:1997]

NOTE   A body of standing inland surface water (Directive 2000/60/EC).

3.3
transitional water
body of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows (Directive 2000/60/EC)

3.4
water categories
rivers and transitional waters are categorized according to width and maximum depth, and lakes are categorised according to area and the presence or absence of a pelagic or profundal zone

NOTE   Other categories may be used in limnological science or other standards.

3.5
fish habitat
place where the fish is to be sampled

3.6
species composition
species list from the target water which may include the relative dominance (number of fish of species A in relation to the total number of fish of all species [$100\% \cdot N_A/N_{Tot}$])

3.7
fish abundance
total number of fish of species A (N_A) per water area (N_A /m^2, N_A /ha), water volume (N_A /m^3) or river or bank length (N_A /m, N_A /100 m); the catch per unit of effort (CPUE) as an index of abundance may also be used

NOTE   CPUE is the catch of fish, in numbers or in weight, taken by a definite unit of fishing effort. The effort can be the number of nets set during the night, the length of a stretch sampled by electrofishing etc.

3.8
age structure
number (N_{Ai}) or relative number (100 % · N_{Ai}/N_A) of fish of species A in age group i

NOTE   Age groups may be derived by age determination of fish from e.g. reading scales or from length-frequency data.

4   Principle

In order to evaluate the population parameters, species composition, abundance and age structure of fish populations in rivers, lakes and transitional waters, appropriate sampling methods are required. The appropriate sampling method depends on the objective itself as well as on the water type and category, the target fish species and their body length.

Sampling methods are selected with respect to the broad variety of inland waters and to the diversity of species and their habitats. The suitability of the given methods was classified in order to achieve a valid evaluation. Their applicability for routine monitoring was taken into account.

5   Categories of rivers, lakes and transitional waters

For the appropriate use of fish sampling methods rivers, lakes and transitional waters have been categorized. The different water categories were selected for the purpose of this standard independent of other categories used in the terminology of limnological science or other standards.

Categories for rivers and transitional waters are not defined directly by water velocity, although water velocity is partly depending on river width and depth. However, sampling methods should be chosen to be appropriate for the specific water velocity in the river (see also 6.4, Table 4).

The categories are as follows:

Table 1 — Categories for rivers

Category	Width m	max. Depth m
River category 1 (brook)	< 5	< 1
River category 2	> 5	< 2
River category 3	< 30	> 2
River category 4	30 to 100	> 2
River category 5	> 100	> 2

Table 2 — Categories for lakes

Category	Presence or absence of a pelagic or profundal zone	Area km²
Lake category 1	With or without a pelagic or profundal zone	< 0,5
Lake category 2	Without a pelagic or profundal zone	> 0,5
Lake category 3	With a pelagic and profundal zone	> 0,5

Table 3 — Categories for transitional waters

Category	Width m	max. Depth m
Transitional water category 1	< 5	< 1
Transitional water category 2	> 5	< 2
Transitional water category 3	< 30	> 2
Transitional water category 4	30 to 100	> 2
Transitional water category 5	> 100	> 2

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Within a river or transitional water, categories according to the Tables 1 and 3 usually change from lower to higher ones according to longitudinal changes. But also within a relatively short stretch of a river or transitional water, categories can change from lower to higher ones and vice versa. In this case, the area itself of a river or transitional water, and not the whole river or transitional water, should be classified according to the given categories.

6 Fish sampling

6.1 General

Sampling methods are separated into methods by capture (6.2) and data sampling without fish capture (6.3). The principles are explained and the target water types or categories and fish species are given. The suitability of the methods is evaluated depending on the different water categories and their habitats as well as the target species. Target species are those species which can efficiently be caught by a particular method. Tables 4 to 6 provide a synopsis on sampling methods suitable or useful for the determination of the population parameters.

Methods not described below may be used in order to obtain additional information. They shall not be used exclusively.

6.2 Fish sampling by capture

6.2.1 Principle of fish capture

Fish may be caught by active gear (6.2.2 to 6.2.4) or passive (6.2.5 to 6.2.10). For all gear seasonal aspects shall be taken into account. The efficiency of active gear (electric fishing, seining, trawling) especially may vary considerably depending on the time (day/night) of use. Active gear is characterized by a comparatively short-term use, whereas passive ones normally are exposed over longer time periods. The fishing devices used shall be adapted to the local conditions as well as to the expected fish community. If it is intended to

determine the species composition and age structure, an adaptation of fishing gear mesh size(s), day time and season of exposure is required.

In order to determine species composition and fish abundance of a certain water body the analysis of professional or non-professional fishery statistics[1] may be considered as suitable, providing the statistics are based on binding regulations. Whether such types of statistics can be used or not, depends on the reliability and exactness of the fishermen's records. In order to estimate fish abundance from fisheries statistics, information on fishing effort has to be included. The age structure shall be determined by additional sampling. Professional fishermen do not necessarily fish on all species occurring.

Here species composition, fish abundance and age structure of the professionally unfished species shall be determined by additional sampling.

6.2.2 Electrofishing

6.2.2.1 General

Electricity is led into the water by a special apparatus and fish are caught by the anodic effect (galvanotaxis). Catching fish with electricity is restricted to relatively shallow areas and to stretches of transitional waters with a relatively low conductivity ($\gamma < 6$ mS/cm). Electrofishing can be carried out by wading or from a boat.

Electric fishing is described in the standard "Sampling of fish with electricity" (EN 14011).

6.2.2.2 Electrofishing by wading

Principle: For electrofishing by wading a backpack, other portable device or a generator placed at the bank or in a boat is used. The member(s) of staff using one or more anodes wades/wade through the water and covers/cover all relevant fish habitats.

Water types and categories: Electric fishing by wading can be carried out in rivers or transitional waters, categories 1 and 2 and in the littoral zone of larger rivers, transitional waters and lakes, where wading is possible without any risk.

Target species: All fish species and sizes living in the areas can be caught.

Suitability: Electrofishing is highly suitable for rivers categories 1 and 2, where the whole width of a river can be covered by one or more anodes. The efficiency can be increased by using stop nets at the beginning and at the end of the target zone and by multiple fishing runs. Due to the relatively high conductivity electric fishing is only of medium suitability for transitional waters. Under the conditions described above, samples for species composition, fish abundance and age structure can be collected.

6.2.2.3 Electrofishing from a boat

Principle: A generator in combination with the required equipment is placed in a boat, sometimes also on the bank, and the member(s) of staff fish from the boat.

Water types and categories: Electric fishing from a boat is possible in rivers where the max. depth does not exceed 2 m and at the relatively shallow sides near the banks and shorelines of deeper rivers, lakes and transitional waters with $\gamma < 6$ mS/cm. With adjusted electrofishing equipment the depth range may be extended up to a water depth of 3 m beside the banks or shorelines [27].

Target species: All fish species and sizes which stay in the areas described can be sampled.

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1) For the use of angling statistics see 6.2.10.

Suitability: The efficiency is high in category 2 rivers. It may be increased by using stop nets. This method is also highly suitable for the littoral habitats of deeper rivers and lakes up to a maximum depth of 2 m. Electric fishing in other regions of deeper waters may be useful only to obtain additional information on species composition. Trammel nets set parallel to the bank of the target study stretch can be used to catch fish trying to escape into deeper zones. Generally, electric fishing cannot be carried out successfully in the middle of rivers or lakes, maybe with the exception of category 3 rivers. Such fishing may be useful only to complete samples on species composition obtained by other methods.

6.2.3 Seines

6.2.3.1 General

An area is surrounded with a net and pulled through. The enclosed fish are forced to flee towards the cod-end[2] or a net bag from where they can be removed. Several types of seines may be used for sampling fish in lakes, rivers or transitional waters.

6.2.3.2 Beach seine

Principle: Seining in the littoral, non vegetated zone using nets mostly < 50 m in length, < 3 m in height and mesh size preferably < 10 mm. The whole water column from bottom to surface can be sampled. The seine is pulled towards the bank by hand.

Water types and categories: Generally, beach seines can be used in littoral habitats of deeper rivers or transitional waters cat. 3 to 5 as well as lakes. A beach seine may also be used in transitional waters categories 1 and 2 in order to complete samples obtained by electrofishing.

Target species: Many species, especially their juveniles, are recorded.

Suitability: Beach seines are especially useful in order to determine natural reproduction and in waters where electric fishing is difficult or impossible.

6.2.3.3 Normal (bottom) seine

Principle: Seining in deeper areas using nets mostly > 50 m in length, > 3 m in height and mesh size > 10 mm in the cod-end or the central panel. The mesh sizes of the net walls of a seine are normally larger than those in the cod-end. The whole water column can be sampled. The seine is pulled with ropes towards a bank, but can also be pulled into a boat. Normal seines are moved by manpower or by engine power.

Water types and categories: Normal seines can be used in lakes, rivers (cat. 3 to 5) or transitional waters (cat. 3 to 5) with a relatively even bottom without underwater obstacles. The height of the seine shall be adapted to the depth of the target water or zone.

Target species: The mesh size of the cod-end or the central panel of the seine affects the species and size distribution of the catch. Therefore it may be difficult to catch juveniles and small species.

Suitability: The length of a seine can be up to a few hundred meters, and accordingly a relatively large area can be surrounded. Fish abundance or at least a CPUE can often be estimated. Depending on the mesh size of the cod-end only fish exceeding a certain size can be caught. The samples on species composition and age structure from the respective area should be completed by samples collected with other methods.

6.2.3.4 Pelagic seine (Purse seine)

Principle: Pelagic seines are mostly used in deeper lakes and samples are taken from the upper water layers. Purse seines can be hundreds of metres in length and several metres in height.

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2) The cod-end is a long-stretched net bag at the end of a seine or a trawl.