SLOVENSKI STANDARD
SIST EN 14757:2005

01-december-2005

Kakovost vode ï Vzorļ enje rib s pomoļ jo zabodnih mreģ (gillnet)

Water quality - Sampling of fish with multi-mesh gillnets

Wasserbeschaffenheit - Probenahme von Fisch mittels Multi-Maschen-Kiemennetzen

Qualité de l'eau - Echantillonnage des poissons a l'aide de filets maillants

Ta slovenski standard je istoveten z: EN 14757:2005

ICS:

13.060.70	Preiskava bioloških lastnosti vode	Examination of biological properties of water
65.150	Ribolov in ribogojstvo	Fishing and fish breeding

SIST EN 14757:2005 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14757

August 2005

ICS 13.060.70; 65.150

English Version

Water quality - Sampling of fish with multi-mesh gillnets

Qualité de l'eau - Echantillonnage des poissons à l'aide de filets maillants

Wasserbeschaffenheit - Probenahme von Fisch mittels Multi-Maschen-Kiemennetzen

This European Standard was approved by CEN on 27 June 2005.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

page

Foreword

This European Standard (EN 14757:2005) 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of an identical text or by endorsement, at the latest by February 2006, and conflicting national standards shall be withdrawn at the latest by February 2006.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, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This is the second of several European Standards developed for evaluation of the species composition, abundance and age structure of fish in rivers, lakes and transitional waters. Other standards describe “Sampling of fish with electricity” (EN 14011) and “Guidance on the scope and selection of fish sampling methods” (prEN 14962).

In most countries the use of the method specified in this European Standard requires permits from landowners and national or regional authorities. In many countries permits are also required from authorities for animal rights and animal welfare demands. Both fish diseases and diseases specific for other organisms, such as freshwater crayfish, may be spread by placing equipment contaminated with pathogens or parasites in the lake. The user of this method should check which national legislation is applicable.

WARNING — Persons using this European Standard should be familiar with normal laboratory and fieldwork practice. This European Standard 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 standard be carried out by suitably trained staff.

1 Scope

This European Standard describes a standardised method for sampling fish in lakes, using multi-mesh gillnets. The method provides a whole-lake estimate for species occurrence, quantitative relative fish abundance and biomass expressed as Catch Per Unit Effort (CPUE), and size structure of fish assemblages in temperate lakes. It also provides estimates, which are comparable over time within a lake and between lakes. This European Standard provides information on sampling routines, data handling and reporting, sampling of fish for age and growth analyses as well as applications and further treatment of data. Selected references in support of this European Standard are given in the Bibliography.

2 Normative references

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

prEN 14962:2004, *Water quality — Guidance on the scope and selection of fish sampling methods*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in prEN 14962:2004 apply.

4 Principle

The sampling procedure is based on stratified random sampling. The sampled lake is divided in depth strata and random sampling is performed within each depth stratum. Sampling of benthic fish is performed with specially designed multi-mesh gillnets which are 30 m long and 1,5 m deep. The gillnets are composed of 12 different mesh-sizes ranging between 5 mm to 55 mm knot to knot following a geometric series. Gillnets used for sampling pelagic fish are 27,5 m long and 6 m deep, with the smallest mesh-size being 6,25 mm. The sampling effort needed to allow detection of 50 % changes in relative abundance between sampling occasions, range between 8 gillnets per night (efforts) for small, shallow lakes, up to 64 efforts for lakes of about 5 000 ha. When less accurate estimates of abundance are needed, an inventory sampling procedure may be used, thereby reducing the number of efforts needed.

5 Sampling design and equipment

5.1 Sampling design

Fish are not randomly distributed over a lake. Depth distribution varies between fish species and with the ontogeny of the fish. The horizontal distribution may also be influenced by habitat heterogeneity. Neither is the distribution constant over the year, but will vary with temperature and season.

To cope with this uneven distribution a stratified random sampling design is used. The lake is stratified in depth strata and a random sampling is performed within each depth stratum. Each gillnet is placed to represent an independent sample of the fish assemblage. By randomising the location of each gillnet within each depth stratum and by randomising the angle of the gillnet in relation to shoreline, an independent sample of the fish in each stratum will be achieved. Randomisation is performed prior to fishing by the aid of depth maps and a co-ordinate grid. If needed, the angle of the gillnet in relation to the shoreline shall be adjusted so that the gillnet is within the corrected depth stratum.

5.2 Benthic gillnets

The multi-mesh gillnets have been designed for catching all types of freshwater fish species. Each gillnet is composed of 12 different mesh-sizes ranging from 5 mm to 55 mm (knot to knot). The mesh-sizes follow a geometric series, with a ratio between mesh-sizes of about 1,25. All gillnets have the same order of mesh panels (see Table 1).

If experience has shown that large fish of certain species (e.g. bream, pike, tench) are difficult to catch with the mesh sizes shown in Table 1, then these may be modified as required. However, a note on such modification shall be given in the report (fishing protocol).

Table 1 — Mesh-size distribution (knot to knot) and thread diameter in the multi-mesh benthic gillnets

Mesh no	Mesh size mm	Thread diameter mm
1	43	0,20
2	19,5	0,15
3	6,25	0,10
4	10	0,12
5	55	0,25
6	8	0,10
7	12,5	0,12
8	24	0,17
9	15,5	0,15
10	5	0,10
11	35	0,20
12	29	0,17

The gillnets shall be made out of homogeneous, uncoloured nylon. Each gillnet shall be 30 m long and 1,5 m deep. Each mesh panel shall be 2,5 m long and mounted on a 30 m long buoyancy line (with a recommended linear density in water of 6 g/m), and a 33 m long lead line (recommended linear density in air 22 g/m and in water 9,9 g/m) made out of plastic in light grey colour. The diameter of the thread varies between 0,10 mm for the 5 mm mesh, to 0,25 mm for the 55 mm mesh (Table 1). All mesh panels are commercially available. The hanging ratio is 0,5 for all mesh sizes.

5.3 Pelagic gillnets

Each pelagic gillnet is 27,5 m long and 6 m deep. Gillnets used for sampling pelagic habitats are similar to the benthic gillnets with the following exception. The smallest mesh (5 mm) has been excluded, because it has not been possible to manufacture 5 mm panels mesh as deep as 6 m. The buoyancy line is 30 m, and the lead line is 45 m with a hanging ratio of 0,5. The weight of the lines may be different from that of the benthic nets. The pelagic nets are divided in half at 3 m depth by inserting a darkish colour (e.g. made of spun nylon) in order to separate the catches below and above 3 m depth.

5.4 Time for sampling

The result of fish sampling using passive gears is highly influenced by water temperature, life history and time for spawning of specific fish species. Therefore, the sampling period has to be chosen in such a way that each single species is neither over nor under-represented in the catch. This means that the optimal sampling period may differ between countries and regions. To minimise between-year variation, due to differences in activity between species, the sampling period should be defined for each lake or region to be sampled in order to make sampling data between different lakes and years comparable.

For instance, in northern Europe the sampling should normally take place between July 15 and August 31. During this period most freshwater fish species living in lakes do not spawn, and the epilimnion temperature usually exceeds 15 °C in most non-alpine areas. Due to decreasing epilimnion water temperature in September it is not recommended to prolong the sampling period as the catch may decline substantially when epilimnion temperature drops below 15 °C. Some species, and especially cyprinids, may also change their behaviour during autumn, thereby affecting the representativity of the sampling. When it is known that the catch is good for the species present even at temperatures down to 10 °C, then the sampling season may be extended until September 15.

5.5 Sampling period

The setting time for the gillnets should ensure that the activity peaks of each fish species will be included. It should also be so short that the fish does not degrade nor will be damaged by predatory fish while being caught in the gillnet. This usually means that the gillnets should be set before dusk and lifted after dawn. To avoid calculating abundance relative to hours of setting time, a standard fishing period of 12 h is recommended. This is accomplished by setting the gillnets between 6 p.m. and 8 p.m. and lifting the nets between 6 a.m. and 8 a.m.

In highly productive lakes with abundant fish populations, it may be necessary to shorten the setting time. Otherwise the gillnets (or at least some mesh-panels in the gillnets) may be saturated with fish, thereby affecting the outcome of the sampling. Saturation might bias the catch when more than 0,12 kg fish per m^2 in a 19 mm mesh, or 0,34 kg per m^2 in a 70 mm mesh, are caught. Assuming a random distribution of fish over all mesh-sizes, this means that saturation in a multi-mesh gillnet may start to affect the outcome when about a 6 kg fish is caught. In such cases, it is recommended to calculate the catch per unit effort (CPUE) relative to hours of fishing time.

5.6 Gillnet selectivity

Correction factors for gillnet selectivity of the multi-mesh gillnets have been estimated for six fish species. The sampling method provides abundance estimates only for fish larger than about 50 mm total length of fish species catchable in gillnets. Abundance estimates of some less catchable species, such as eel (*Anguilla anguilla*), burbot (*Lota lota*), bullhead (*Cottus* sp.) and pike (*Esox lucius*), as well as small Y-O-Y (young of the year) individuals, may be underestimated.

6 Time series sampling

6.1 Sampling effort (gillnet-nights)

When the sampling aims at (1) quantifying relative abundance or biomass of different fish species, and (2) comparing differences over time and between lakes, the variance of the estimate of the mean has to be quantified. All fish should have the same probability of getting caught in a gillnet, and, therefore, a representative sampling in a lake shall be performed. The number of gillnets used at each sampling occasion is determined both by the minimum number of efforts needed to catch all catchable fish species and by the required precision of the mean value. Usually the number of efforts needed to catch all catchable fish species is lower than the number of efforts (net-nights) required to provide an acceptable precision of the estimate.

A commonly used minimum requirement for time series sampling has been to detect a 50 % difference between sampling occasions in relative abundance of the most abundant fish. The amount of gillnet-nights

needed is determined by the precision, the lake area and the maximum depth of the lake. The higher the desired precision is, and the larger and the deeper the lake is, the higher is the number of gillnet-nights. The number of gillnets required to achieve a precision, which makes it possible statistically to determine a 50 % difference between sampling occasions, is given in Table 2. By convenience the lakes have been divided into six size classes (≤ 20, 21 ha to 50 ha, 51 ha to 100 ha, 101 ha to 250 ha, 251 ha to 1 000 ha, 1 001 ha to 5 000 ha), and the number of efforts based on multiples of 8, which is a normal workload for a one night sampling made by two persons.

Table 2 — Number of efforts with benthic gillnets required to allow the detection of 50% changes between sampling occasions in relation to lake area and maximum depth

Depth (m)	Lake area (ha)					
	≤ 20	21 to 50	51 to 100	101 to 250	251 to 1 000	1 001 to 5 000
0 to 5,9	8	8	16	16	24	24
6 to 11,9	8	16	24	24	32	32
12 to 19,9	16	16	24	32	40	40
20 to 34,9	16	24	32	40	48	56
35 to 49,9	16	32	32	40	48	56
50 to 74,9			40	40	56	64
≥75					56	64

For small (<10 ha) and shallow lakes even 8 nets could overexploit the fish community, and especially deplete the reproducing stock of certain species too much. The sampling effort should, however, never be less than 4 gillnets (see also 7.4).

Whole-lake estimates of the relative fish abundance in lakes larger than 5 000 ha usually require such a large effort that it is practically impossible to use the recommended technique. In cases when larger lakes shall be sampled, it is recommended that the lake is divided into separate basins, and that each basin is treated as a separate lake. In large lakes, where whole-lake estimates of the fish fauna are not of main priority, sampling can be performed at specific stations.

Stratification of gillnets is basically related to depth. The principles for depth stratification are given below. In lakes with vegetation cover and in large shallow lakes, other stratification principles shall be considered. However, it should be considered that depth is less variable over time than vegetation, and, therefore, stratification related to vegetation shall be reconsidered at each successive sampling in a particular lake. Reservoirs with steep banks may also be subjected to a modified stratification of gillnets.

6.2 Depth stratification of benthic gillnets

The depth zones are determined in relation to the volume of each stratum in such a way that each depth stratum approximately equalises the same volume of water. Even if lake morphometry may vary considerably between lakes, it is convenient to use a standardised scheme for stratification. For most lakes an approximation of the depth strata can be based on morphometric lake data. Each lake is then divided in approximately equal water volumes resulting in the following depth strata: 0 m to 2,9 m, 3 m to 5,9 m, 6 m to 11,9 m, 12 m to 19,9 m, 20 m to 34,9 m, 35 m to 49,9 m, 50 m to 74,9 m, > 75 m. Lakes deeper than 75 m are rarely subjected to fish sampling using this type of benthic gillnets (see prEN 14962). The number of benthic gillnets recommended in each depth stratum is given in Annex A. The table in Annex A includes optional benthic gillnets at depth > 75 m in the largest lakes (251 m to 5 000 ha). Experience has shown that fish can be caught in these nets, e.g. smelt, arctic char and bullhead. The information obtained from this effort should be determined on a case-to-case basis.

To achieve a better estimate of the total fish abundance in lakes with extreme morphometry, the volume of each depth stratum should be calculated, and the number of gillnets used at each stratum should be distributed in relation to the volume of each stratum. Whenever the deepest stratum is too small to be used for

setting benthic gillnets which are independent of each other, it should be excluded in calculations of the total number of gillnets used. When distributing gillnets over the lake, this depth stratum is treated as a part of the stratum just above it.

6.3 Location of benthic gillnets

The location of each gillnet in the lake is determined in such way that the total catch should constitute an unbiased sample of the catchable part of the fish assemblage in the lake. "Catchable" fish means fish species which are usually caught in gillnets. Some predatory species with a typical ambush behaviour, such as northern pike (*Esox lucius*), and some benthic species living very close to the bottom substrate, such as eel (*Anguilla anguilla*), burbot (*Lota lota*) and bullhead (*Cottus sp.*), are often underrepresented in the gillnet catch.

Within the different depth strata, gillnets are set randomly over the whole lake. This could be performed by the use of a pre-prepared co-ordinate grid placed over the depth map of the lake. By a randomisation procedure each sampling location is located in each depth stratum, respectively (Figure 1). Gillnets are set in straight lines and at random angles to the shoreline.

As the catch in each gillnet should be treated as an independent sample for that particular depth zone, no gillnets shall be attached to each other.

6.4 Depth stratification of pelagic gillnets

To include samples also from the pelagic habitat, sampling with benthic gillnets should be supplemented by sampling with pelagic gillnets in lakes with maximum depth greater than about 10 m. Even if there are no apparent pelagic species in the lake, several fish species have a pelagic preference during part of their life history. In contrast to sampling with benthic gillnets, the pelagic sampling does not provide an estimate over the total water volume. Instead, pelagic sampling is performed as a depth profile over the deepest part of the lake. The number of pelagic gillnets to be used is determined by the maximum depth of the lake. In more shallow lakes, the benthic gillnets will provide a sufficient estimate of the pelagic fish in most cases.

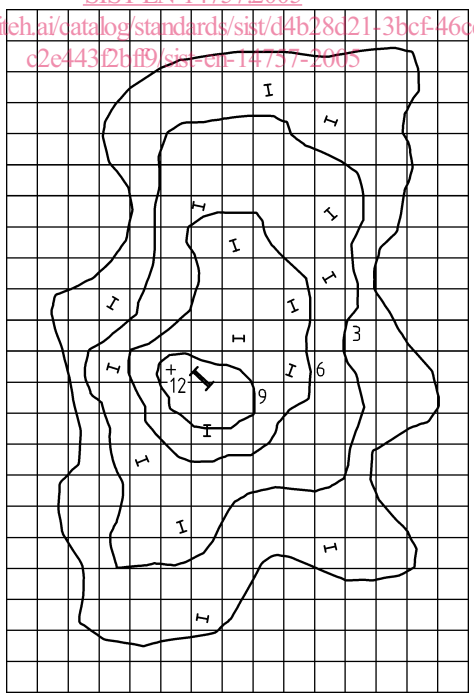

Figure 1 — Morphometric map of a hypothetical 40 ha lake with 12 m maximum depth. Co-ordinate grid, depth contours at 3 m, 6 m and 9 m, location of benthic gillnets (small marks) and pelagic gillnet (large mark) are shown