SLOVENSKI STANDARD
SIST EN 14757:2015

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Nadomešča:
SIST EN 14757:2005

Kakovost vode - Vzorčenje rib s pomočjo zabodnih mrež (gillnets)

Water quality - Sampling of fish with multi-mesh gillnets

Wasserbeschaffenheit - Probenahme von Fisch mittels Multi-Maschen-Kiemennetzen

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

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

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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

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

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Foreword

This document (EN 14757:2015) 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of an identical text or by endorsement, at the latest by November 2015, and conflicting national standards shall be withdrawn at the latest by November 2015.

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.

This document supersedes EN 14757:2005.

This document contains the following technical changes compared with the previous edition:

a) this European Standard was revised to clarify that using pelagic gillnets is an option for fish sampling with gillnets;

b) the sampling design for the location of benthic gillnets was revised;

c) the requirements for the planning, sampling duration and sampling procedure were revised;

d) the requirements for data collection, data storage and data processing were revised;

e) the specifications concerning the handling of effects caused by gillnet selectivity were revised and shortened;

f) details and references for alternative sampling methods were included;

g) details for age and growth analyses where excluded from the normative part and added in an informative annex (Annex B).

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

Introduction

This is one of several European Standards developed for evaluation of species composition, abundance and age structure of fish in rivers, lakes and transitional waters. Other standards describe “Sampling of fish with electricity” (EN 14011), “Guidance on the scope and selection of fish sampling methods” (EN 14962) and “Guidance on the estimation of fish abundance with mobile hydroacoustic methods” (EN 15910).

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 usual 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 health and safety practices and to ensure compliance with any national regulatory conditions.

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

1 Scope

This European Standard specifies a method for the sampling of fish in lakes, using benthic multi-mesh gillnets and gives recommendations on sampling of fish with pelagic multi-mesh gillnets. The method provides a whole-lake estimate for species occurrence, quantitative relative fish abundance, biomass expressed as Catch Per Unit Effort (CPUE) and size structure of fish assemblages in temperate lakes. It also provides estimates that are comparable over time within a lake and between lakes.

This European Standard specifies routines for sampling, data handling and reporting, and provides information on applications and further treatment of data. It also provides guidance for the sampling of fish for age and growth analyses. According to the principles of this standard other lentic water bodies can be sampled.

2 Normative references

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

EN 14962:2006, *Water quality - Guidance on the scope and selection of fish sampling methods.*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14962:2006 and the following apply.

3.1
sampling effort
number of gillnet-nights

Note 1 to entry: A gillnet-night is one gillnet fishing during one night. For example a sampling effort of 8 gillnet-nights is 8 gillnets fishing during one night, or 4 gillnets fishing during 2 nights etc.

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 from 5 mm to 55 mm knot to knot following a geometric series. Similar nets can be applied also for sampling of pelagic fish. In larger and deeper lakes and reservoirs sampling of pelagic fish with multi-mesh gillnets is highly recommended. The sampling effort (number of gillnet-nights) necessary to allow detection of 50 % changes in relative abundance between sampling occasions, ranges between 8 gillnet-nights for small, shallow lakes, up to 64 gillnet-nights for lakes of about 5 000 ha. If less accurate estimates of abundance are needed, an inventory sampling procedure may be used, thereby reducing the necessary sampling effort.

5 Equipment

5.1 Benthic gillnets

The multi-mesh gillnets have been designed for catching all types of freshwater fish species. Each gillnet shall be 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 shall have the same order of mesh panels (see Table 1).

If experience has shown that large fish of certain species (e. g. bream *Abramis brama*, carp *Cyprinus carpio*, pikeperch *Sander lucioperca*, pike *Esox lucius*, tench *Tinca tinca*) are difficult to catch with the mesh sizes shown in Table 1, it is possible to add larger mesh sizes. However, this modification shall be recorded in the report (fishing protocol) and the catch in the standardized mesh sizes shall be recorded separately from the catch in the added mesh sizes to allow comparisons between lakes and years.

Table 1 — Mesh-size distribution (knot to knot) and thread diameter in 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

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 (see Table 1). The hanging ratio is 0,5 for all mesh sizes.

NOTE All mesh panels are commercially available.

5.2 Pelagic gillnets

Each pelagic gillnet should preferably consist of the same mesh sizes in the same order as in the benthic gillnets. The height of the pelagic gillnets may be higher than the benthic gillnets, and the height used should always be recorded. When using all the 12 mesh sizes, the length is 30 m. The buoyancy line is 30 m, and the lead line is 33 m to 45 m, depending on the height of the net, with a hanging ratio of 0,5. The weight of the lines is determined by the gillnet height. A gillnet manufacturer should provide such lines to ensure correct gillnet performance.

6 Sampling design and procedure

6.1 Sampling design

Fish are not randomly distributed in 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 shall be used. The lake shall be stratified in depth strata and a random sampling should be performed within each depth stratum. Each gillnet shall be placed to represent an independent sample of the fish assemblage. By randomising the location of each gillnet within each depth stratum an independent sample of the fish in each stratum will be achieved. It is important that the entire gillnet is within the correct depth stratum. Randomisation is performed prior to fishing by the aid of depth maps and a co-ordinate grid.

Large lakes or elongated reservoirs may be treated as two or more separate parts. Then randomising gillnet locations should be made within sub-basins or longitudinal parts.

6.2 Planning

In order to maximise the output of the sampling effort, a thorough planning shall precede all fish sampling. When a lake has been selected for sampling, permission from the fishing right owner(s) shall be obtained. To avoid misunderstandings, the responsible persons should be informed about the aim and magnitude of the fishing activities, and the results should be communicated to responsible persons afterwards.

If a map of the lake with depth contours is available, it could be used to determine the necessary sampling effort. The map with depth contours is used to divide the lake into appropriate depth strata and to determine the number of gillnet-nights in each stratum. If the lake is to be sampled for the first time, a randomisation of the gillnet locations should be performed in advance. If data on depth of the lake is lacking, the sampling shall be preceded by a sounding. This could be performed using a simple echo sounder and by running the boat in predetermined transects over the lake before gillnets are set for the first time. The beam angle of the echo sounder should be as narrow as possible (maximum 10°). Wider angles cause underestimation of the depth at sloped bottoms.

If possible, supplementary information about the lake and the surroundings should be collected before sampling. Relevant information about geography, water quality, the fishery and introduced fish species in the lake should be collected.

6.3 Sampling period

The results of fish sampling using passive gears is highly influenced by water temperature, life history and time for spawning of specific fish species. 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. To level the effects of different weather conditions, yearly sampling may be distributed to several days and by distributing the nets in all depth strata every day.

For example, fish sampling in northern Europe should take place between July 15 and August 31. During this period most freshwater fish species 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 extend the sampling period, because the catch may decline substantially when epilimnion temperature drops below 15 °C. Some species, and especially cyprinids, might also change their behaviour during autumn, thereby affecting the representativeness of the sampling. Only if it is known that the catch is good for the present species even at temperatures down to 10 °C, the sampling season may be extended until September 15.

6.4 Sampling

The setting time for the gillnets should ensure that the activity peaks of each fish species will be included. Activity peaks of most European species are best covered when gillnets are set 2 h to 3 h before the sunset and lifted 2 h to 3 h after sunrise. During each sampling period the catches will be affected by saturation as well as fish escaping the net after being temporarily entangled. Saturation and fish escapes decrease estimated fish density in a nonlinear way. Avoid calculating abundance relative to hours of setting time as gillnet catch is dependent on setting time in a nonlinear way. In dense fish communities where saturation effect is expected to be great, sampling of only evening peak of fish activity with appropriate correction is a possibility.

The water depth of the most shallow and deepest points where the net is placed shall be recorded. The distribution of gillnets for each fishing night should be such that all depth strata are included, in order to avoid bias due to differences in weather conditions between nights. A GPS (Global Positioning System) instrument is recommended to locate and record gillnet positions. The co-ordinates of both ends of the gillnet should be recorded using GPS. Thereby, the gillnet angle to the shoreline is also recorded.

The catches should be treated by nets and within a net, separation by mesh sizes is strongly recommended due to the following reasons:

1) representative subsamples for reliable size distribution estimates can be obtained;

2) assorting to species and size classes is easier;

3) quality control and back-tracking of mistakes is possible;

4) correction for gillnet selectivity is possible.

After the nets have been emptied they should be cleaned and dried until the next setting. Further handling and measurements of the fish should be performed as soon as possible. If the weather is warm, the caught fish shall be kept cold, either in a cold-storage room or by use of ice.

6.5 Safety instructions

During all fish sampling activities the safety instructions for fieldwork on water should be followed. There should always be at least two persons able two swim on board the fishing vessel. The personnel should be equipped with life jackets, a device for communication such as a mobile phone or a flag, megaphone or whistle to alert people on land, and a first-aid box.

7 Time series sampling

7.1 Sampling effort

When the sampling aims at quantifying relative abundance or biomass of different fish species, and comparing differences over time and between lakes, the variance of the estimate of the mean shall be quantified. All fish should have approximately the same probability of getting caught, and, therefore, a representative sampling in a lake shall be performed. The sampling effort needed at each sampling occasion is determined both by the minimum sampling effort needed to catch all catchable fish species and by the required precision of the mean value. Usually the number of gillnet-nights needed to catch all catchable fish species is lower than the number required for 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 sampling effort needed is determined by the precision, the lake area and the maximum depth of the lake. The higher the desired precision, and the larger and deeper the lake, the higher the sampling effort. The number of gillnet-nights 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 are divided into six size classes (≤ 20 ha, 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 gillnet-nights is based on multiples of 8, which is a usual workload for a one night sampling made by two persons.

Table 2 — Number of gillnet-nights 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 gillnet-nights 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 gillnet-nights (see also 8.1).

Whole-lake estimates of the relative fish abundance in lakes larger than 5 000 ha usually require such a large sampling 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 or lakes with steep banks may also be subjected to a modified stratification of gillnets.

7.2 Depth stratification of benthic gillnets

The depth strata are determined in relation to the surface area 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 standardized scheme for stratification. For most lakes an approximation of the depth strata can be based on morphometric lake data. Each lake is 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 EN 14962). If the exact proportions of the surface area covered by different depth strata are not known, 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 for large lakes (251 ha to 5 000 ha). Experience has shown that fish can be caught in these gillnets,