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**Vattenundersökningar – Provtagning av fisk med  
elektricitet**

**Water quality – Sampling of fish with electricity**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
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**EN 14011**

March 2003

ICS 13.060.70; 65.150

English version

## Water quality - Sampling of fish with electricity

Qualité de l'eau - Echantillonnage des poissons à l'électricité

Wasserbeschaffenheit - Probenahme von Fisch mittels Elektrizität

This European Standard was approved by CEN on 5 December 2002.

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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 Management Centre has the same status as the official versions.

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## Foreword

This document (EN 14011:2003) 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of an identical text or by endorsement, at the latest by September 2003, and conflicting national standards shall be withdrawn at the latest by September 2003.

Annex A is informative.

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

## Introduction

This is the first of several European Standards developed for evaluation of the composition, abundance and diversity of fish in rivers, lakes and coastal waters. Other European Standards will describe sampling of fish with gill nets and guidance on the scope and selection of fish sampling methods.

If used properly electric fishing is considered to be harmless to the fish. However, irreversible damage can be inflicted on fish that are exposed to electricity. Therefore, the well being of the fish and the avoidance of damage through handling should be considered.

**WARNING — Persons using this standard should be familiar with normal laboratory and fieldwork practice. This 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.**

## 1 Scope

This European Standard provides sampling procedures with electricity procedures to be used by trained persons in evaluating fish communities in streams, rivers and littoral areas for the purpose of classification of ecological status. These procedures allow standardisation of sampling methods for descriptions of fish communities. The use of standardised methods is a critical requirement for the comparability of results.

This European Standard describes an electric fishing method to be used when catching fish for the purpose of characterising composition, abundance and age structure of a given fish community. Sampling-related issues include obtaining permissions, concerns about endangered species, protective measures of importance for the user of the sampling apparatus and co-ordination of activities with other sampling programmes.

The processing of samples covers taxonomic identification, counting, measurement of biologic parameters (length, weight etc.), and examination of fish for external anomalies.

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### 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the last edition of the publication referred to applies (including amendments).

EN 25667-1:1993, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes (ISO 5667-1:1980)*.

IEC 60335-2-86, *Safety of household and similar electrical appliances — Part 2-86: Particular requirements for electric fishing machines*.

### 3 Principle

#### 3.1 General

It shall be recognised that the sampling strategy to be adopted shall provide information on the current status of the fish community health at a given site. The selection of sampling sites (number and size) is of great importance for the evaluation of the collected data. As a general guidance EN 25667-1 shall be consulted, and for more detailed guidance on fish sampling methods forthcoming standards on *Sampling of fish with gill nets* and on *Guidance on the scope and selection of fish sampling methods* are available.

#### 3.2 Fish sampling

Correctly obtained sampling data are directly related to population density. The strategy shall be to sample a defined area of river (see Table 2) using appropriate fishing equipment (clause 4), safety precautions (5.1) and procedures (5.2, clause 6) using qualified personnel (clause 8) to provide estimates of:

- Fish abundance;
- Species composition;
- Population structures (age or size).

Abundance in this context can be either a relative or an absolute measure of assessment based on a single electric fishing run of a known area of water. Where practical or appropriate multiple fishing of the known area shall be carried out to assess the efficiency of the sampling effort to obtain absolute estimates of population density.

To ensure repeatability, fishing effort, fishing equipment and fishing protocols shall be the same on each sampling at the same site. The location of the sampling site shall be identified using GPS or using reference to absolute markers (*e.g.* X m downstream of XXX bridge). Photographic documentation of the sampling site is recommended. When changing equipment, comparative results with old and new equipment shall be generated, to make it possible to compare new and old data.

#### 3.3 Number and size of sampling sites

Depending on the purpose of the study (*i.e.* assessing abundance and age structure for a target population within a river basin or assessing the species composition, abundance and age structure of a fish community for a given site) two different sampling strategies (3.3.1 or 3.3.2) can be used.

##### 3.3.1 Abundance and age structure of populations

To ensure that conclusions on abundance and age structure are valid for the target population(s), a sufficient number of sites (*n*) shall be included. This number depends on the spatial variation among sites and whether assessing temporal trends or comparisons between populations is the main aim. The spatial variation is expressed

as the coefficient of variation  $CV = (\text{standard deviation among sites}) / (\text{population mean})$  for abundance (fish/site). For comparisons among populations, the minimum number of sites (n) for different CVs required is given in Table 1.

**Table 1 — Minimum number of sampling sites**

Coefficient of variation (CV)	Minimum number of sites (n)
0,2	3
0,4	4
0,6	9
0,8	16

The CV can be determined from a pilot study or from data from similar populations. For determination of temporal trends fewer sites may be required.

The selection of sites shall be representative of habitats/biomes within the watershed. Rivers with high environmental stress, where no or only a few specimen are caught on several of the sampling sites, have a high CV, and, therefore, an increased number of sites is required to give a good estimate of abundances and age structures of the species present. Due consideration shall also be given to ease of access and safety of operational personnel.

The timing of sampling shall be linked to an understanding of the life history strategies of the target species. In most circumstances sampling shall be carried out towards the end of the growing season when juveniles are of a sufficiently large size to be caught by electric fishing. However, electric fishing shall not be made at temperatures below 5 °C, because of reduced fish activity and reduced sampling efficiency. At low water temperatures successive (removal) samplings from the same area (e.g. Zippin, 1958) may actually give higher catches in the second compared with the first sampling.

Subsequent sampling of a particular site shall be carried out at the same time of year and under similar flow conditions.

All sampling shall be done in daylight hours. The area of the river to be sampled is dependent upon width, water depth, and habitat variation. The minimum length to be sampled for various waters is given in Table 2.

**Table 2 — Minimum of length to be sampled**

River dimension	Minimum of length to be sampled
Small stream, width < 5 m	20 m, whole width has to be sampled
Small river, width 5 m to 15 m	50 m, whole width has to be sampled
Large river and canal, width > 15 m	> 50 m of river margin either on one side or on both sides
Large shallow water, water depth < 70 cm	200 m <sup>2</sup>
Large water bodies (e.g. lakes)	> 50 m of littoral zone

In small wadable rivers with high densities of small fish (which is often the case in wide salmon spawning streams) a smaller length may be sufficient. As a rough guidance it is enough to catch 200 fish, but the total sampled area shall be at least 100 m<sup>2</sup>.

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### 3.3.2 Assessing fish species composition, abundance and age structure for a given site

Depending on river width and depth, two different sampling methods can be used. When it is possible (small rivers) each site is sampled by wading. In deeper large rivers, sampling shall be undertaken by boat (usually in near shore areas). In all cases, the size of the sample shall be sufficient to include the home range of the dominant fish species, and encompassing complete sets of the characteristic river form (*e.g.* pools, riffles, runs) to ensure a good representativity of the fish community. Concerning the minimum length to be sampled, a review of available literature shows that, because of the variability among streams and rivers within and among regions, in order to ensure accurate characterisation of a fish community at a given site electric fishing shall be conducted over stream (or river) lengths of at least 20 times the stream (or river) width (Angermeier & Karr 1986, Angermeier & Smogor 1995, Simonson & Lyons 1995, Yoder & Smith 1998). In rivers with gradients in water currency across the river channel (especially fast-running rivers) it is important to sample the entire width of the sampling site, or as much of it that is possible. For very large rivers (> 30 m wide), where it is already known that the fish community is uniform, a length of 10 times the river width may be sufficient.

## 4 Equipment

### 4.1 General equipment and materials

**Clothing:** Any part of the operators likely to come into contact with the electric field shall be protected by the use of appropriate waterproof, electrically non-conductive clothing. Adequate protection from climatic conditions (*e.g.* warm clothes in cold weather) and noise from the generator (ear protection) shall be worn if appropriate.

#### 4.1.1 Lifejacket

Lifejacket shall be worn as buoyancy aid when wading in water deeper than knee depth and when sampling from boats (EN 396:1994). The use of a lifejacket is an obligation in some countries.

#### 4.1.2 Nets

Nets shall have handles made from non-conductive material. Mesh used on nets shall be knotless (for fish welfare reasons).

#### 4.1.3 Fish containers

Fish containers shall be of an adequate size for the welfare of the number of fish placed in them. Oxygenation can be used if appropriate. Containers likely to come into contact with electric fields shall be made from electrically non-conducting material.

#### 4.1.4 Communication equipment

Communication equipment (*e.g.* mobile telephones) shall be available for emergency use.

#### 4.1.5 First aid

Appropriate first aid equipment shall be available and shall include guidance notes on CPR (Cardiac Pulmonary Resuscitation) techniques.

#### 4.1.6 Fire extinguisher

If motor generators are used in boats a suitable fire extinguisher shall be carried.

### 4.2 Electric fishing apparatus

Principal components of the electric fishing apparatus are the power source, the control box, cables, safety switches and the electrodes. Either DC (Direct Current) or PDC (Pulsating Direct Current) may be used, but AC