SLOVENSKI STANDARD
SIST EN 16260:2013

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Kakovost vode - Vizualni pregledi morskega dna z uporabo daljinsko vodene vlečne naprave za zbiranje ekoloških podatkov

Water quality - Visual seabed surveys using remotely operated and towed observation gear for collection of environmental data

Wasserbeschaffenheit - Optische Seebodenuntersuchungen mittels ferngesteuerter Schleppgeräte zur Sammlung von Umweltdaten

Qualité de l'eau - Études visuelles des fonds marins utilisant un matériel d'observation tracté et piloté à distance pour la collecte de données environnementales

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13.060.10	Voda iz naravnih virov	Water of natural resources
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English Version

Water quality - Visual seabed surveys using remotely operated and/or towed observation gear for collection of environmental data

Qualité de l'eau - Études visuelles des fonds marins utilisant un matériel d'observation commandé à distance et/ou tracté pour la collecte de données environnementales

Wasserbeschaffenheit - Visuelle Meeresbodenuntersuchungen mittels ferngesteuerter Geräte und/oder Schleppgeräten zur Erhebung von Umweltdaten

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Foreword

This document (EN 16260:2012) 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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

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.

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Introduction

Information on the habitats, biotopes, substrates and species diversity on the seabed is an important part of ecosystem-based environmental management, and necessary in order to evaluate the consequences of various anthropogenic activities. Implementing European Directives and required monitoring of substrates and species diversity will require documentation and monitoring of different types of seabed types using inter-comparable and generally non-destructive methods. Many seabed areas are difficult, if not impossible to investigate using traditional sampling such as grabs and dredges or may host fragile communities such as cold-water coral reefs. Visual surveillance using geo-referenced positions is essential to allow revisiting of locations, documentation of environmental conditions and detection of changes in species composition which otherwise would be difficult to achieve. The equipment and methods described here may also be used in combination with acoustic equipment for seabed characterisation.

The methods presented in this European Standard are particularly suitable for seabed mapping and monitoring at depths below depths achievable using traditional SCUBA diving, and in cases where safety or economical issues limit the use of SCUBA diving. They are also suitable for the description of distribution and occurrence of large and scattered organisms on substrates, where sampling with grabs do not provide representative results. For investigations on soft seabed substrate please refer to EN ISO 16665 [1] and for investigations on shallower hard seabed to EN ISO 19493 [2].

This European Standard is also suitable within the operational depth of SCUBA-diving, e.g. for large scale surveys and mapping of the seabed composition, characteristic plant and animal species occurrence and depth distribution.

Remotely Operated Vehicles (ROVs) and passive tethered observation platforms are used for mapping and environmental surveys of the seabed via video and still photographs. However, the methods used and the results obtained can be rather variable without proposed consideration of geographic positioning, taxonomic precision and quantification. It is therefore important that the methods used are standardised in order to compare results.

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.

1 Scope

This European Standard describes methods, requirements and equipment for remote visual surveillance of organisms and the seabed using still photography and video recording to ensure precise and reproducible data. The main aims of the methods are to record or monitor seabed conditions and organisms on and just above the seabed in a reproducible way at a resolution that is appropriate to the aims of the survey.

In caves and overhangs this standard may not be suitable due to technological limitations related to navigation and movement of the observation platform.

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 14996, *Water quality — Guidance on assuring the quality of biological and ecological assessments in the aquatic environment*

3 Terms and definitions

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

3.1
sonar altimeter
acoustic instrument measuring the elevation above seabed

3.2
box-in-test
test to determine alignment/attitude errors in the navigational data, involving four different positions of the vessel relative to a fixed transponder

3.3
drop camera
video and/or still camera that is either lowered down to the seabed or suspended just above it, generally used for imaging at a single location, or manoeuvred along a set transect using the ships propulsion system on the surface

3.4
frame grab
still image obtained from video record

3.5
geographic precision
accuracy with which a given point can be relocated within a geodetic reference system

3.6
geographic resolution
lowest unit of measurement at which a geographic distribution can be reproduced

3.7
kalman filtration
sequential smoothing method where the most likely result is achieved through a combination of earlier results using the relevant measuring point

Note 1 to entry: This type of data filter is often integrated in navigation software packages, but can also be applied separately [3].

3.8
locality
geographic description of a place or an area where samples are collected, covered by one or more sampling stations

Note 1 to entry: Description is based on habitat, terrain, depth and name of geographic area.

3.9
macrofauna
animal species ranging from 1 mm to 50 mm

3.10
megafauna
animal species larger than 50 mm

3.11
monitoring
investigation via repeated sampling to record eventual changes in environmental conditions or community composition over time

3.12
morphological species
organism that belong to a unidentified species that clearly can be distinguished from other observed, identified or unidentified species, and that may be described based on shape and colour and size

3.13
observation platform
passive sampling gear comprising a supporting construction onto which a video camera and light and/or a still camera (and environmental sensors if required) can be mounted

Note 1 to entry: An observation platform can be tethered to a fixed point or towed.

3.14
PAL-standard
analogue television colour encoding system used as a standard for video recording

Note 1 to entry: Video format used in most European countries

3.15
reference location
location representing presumed natural environmental conditions

3.16
remotely operated vehicle
ROV
remotely operated motorised underwater vehicle equipped with video and/or still camera and often has the capacity to mount additional equipment such as sonar, environmental probes, manipulator arms and sampling equipment

3.17
sample
single photograph, frame grab or uninterrupted video sequence

3.18
sampling station
geographically defined area where still photographs or video recordings are taken

Note 1 to entry: Still photographs cover a defined area, which for practical purposes can be represented by a point on a map. Video recordings carried out by means of a vehicle in motion cover a larger sampling area and the location of the start and end of the line become more important when repeating or relocating sampling stations. Therefore, for video recordings, the starting point is used as the station position.

Note 2 to entry: A station is defined by its geographic position, together with any additional information on features on the seabed (for example rocky outcrops or large stones) recognisable by either direct observation or by acoustic surveillance (for example multi-beam echo-sounder or side-scan sonar). The station is delimited at the given level of precision.

3.19
still image
single photograph or frame grab

3.20
spin-test
test to identify navigational offset errors, involving rotation of the ship above a fixed transponder

3.21

transect
defined and continuous line or belt of pictures or video sequences across a delimited area

Note 1 to entry: The position of the transect can be random or located to reveal different (various gradients of) environmental conditions (for example gradually increasing depth etc.).

3.22
video sequence
continuous part of a video film

4 Principle

Remotely operated vehicles (ROVs) and passive tethered observation platforms are used for mapping and for environmental surveys of the seabed. Still photographs and video recordings are used in a variety of ways to obtain visual data for mapping and/or monitoring the seabed and organisms on or near the seabed. This European Standard gives guidance with respect to sampling strategies, geographic positioning, taxonomic identification and quantification and determination of seabed substrates and/or the organisms living on or above the seabed.

5 Equipment

5.1 General

The technical specifications for the equipment used shall be described when reporting the results. The requirements made for the equipment are dependent on the aims of the survey. For mapping and monitoring, a colour camera should be used together with underwater positioning equipment. The positioning equipmen should have an appropriate error margin for the survey objectives with a minimum of ≤ 2 m, with a relative tolerance of + 5 % of the water depth (measured in metres) for depths equal or greater than 20 m and ≤ 3 m, with a relative tolerance of + 3 % of the water depth for depths shallower than 20 m, respectively.

EXAMPLE Water depth: 15 m appropriate error margin: ≤ 3 m + (15 m × 0,03) ≤ 3,45 m
Water depth: 40 m appropriate error margin: ≤ 2 m + (40 m × 0,05) ≤ 4 m

5.2 Cameras and light

Video recordings and still photographs should not contain electric or electronic noise. The minimum requirements of cameras (video recordings and still photographs) differ for the three types of investigations (pilot surveys, mapping and trend monitoring). For pilot surveys (see 7.4) low light, composite video PAL standard should be used. A colour camera is not a requirement for this type of survey. The minimum requirement for mapping (see 7.5) is a high resolution PAL colour camera (e.g. 400 TV lines). The application of a colour HD (high definition), 1080 interlaced is recommended. Still photographs for use in trend monitoring (see 7.6) should document an area of between 0,25 m^2 and 1 m^2 with a good image quality (focus and contrast) with a minimum resolution of 1 080 x 1 560 pixels (HD-format, equivalent to 300 DPI at 9 cm × 13 cm). Lights should be strong enough to provide a fully illuminated surface, at heights ≤ 3 m above seabed surface.

5.3 Sonar altimeter

The elevation above seabed should be measured by a sonar altimeter or by using trigonometry.

NOTE Estimation of height using trigonometry demands that the distance from camera lens to the centre of the image and the camera's inclination angle is known. The distance is from the lens to the centre of the image from the width of the field view (scaled by parallel laser points) and the angle of view.

A simpler method for keeping constant height above the seabed is to use a rope with weight, or a chain suspended from the observation platform. This method is not suitable for sensitive habitats such as coral habitats and sponge communities. Furthermore, it may also represent a safety hazard since the rope may stick to obstacles on the seabed. As far as possible, an even height (1 m to 3 m for mapping) and speed (0,5 kn to 2 kn for pilot surveys and 0,5 kn to 1 kn for mapping) should be maintained. Ideally the lower the speed, the better; but with certain sites it would be impossible to keep speeds consistently down to these levels without resorting to just working at slack water only. An increased video frame capture-rate would allow better slow-motion replay and therefore allow a camera to travel quicker over the seabed. In all cases the camera should travel at an appropriate speed such that images obtained using video or still photograph are not overly blurred.

5.4 Data recording equipment

Video records should be stored in a format (e. g. storage of video files on a hard disc or directly recorded onto a DVD burner or a DV tape recorder), that avoids loss of data quality when copying. For video recordings, the position should be inserted as text on the image, or logged in a data file where the time of the video recording can be used to synchronize the time logged together with the GPS signal, as well as other environmental data (depth, temperature, angle of camera etc.). Alternatively these data can be stored on the audio track of the video. These audio data should always follow the picture and should not be stored on a (or several) separate file(s).

6 Positioning

6.1 General

Geographic references for observations should be accompanied by information on the accuracy obtained using the combination of equipment and method. Positioning should be carried out with reference to a grid net or geodetic reference system.

NOTE 1 Examples on grid-net systems are EUREF89 (European Reference Frame 1989), and UTM coordinate system (Universal Transverse Mercator coordinate system). Examples for geodetic reference systems are ETRS89 (European terrestrial reference system 1989) and WGS-84 (World Geodetic system 1984).

For the purpose of mapping shallow (< 15 m) coastal areas using a drop camera the ship's GPS can be used without hydro acoustic positioning, except for pilot surveys (see 6.3). If using an ROV in open sea areas and in areas with strong currents, the ROV shall be equipped with a sufficiently strong motor or ”garage” to avoid drift from the targeted locality (at a fixed position or between two fixed positions). If a towed platform is used in similar areas the observation platform should be heavy enough to prevent too large offset, which will disable reliable hydroacoustic positioning.

Geographic references (beyond general locality: approximately ± 100 m) should be based on hydro-acoustic positioning. When using a towed observation platform or drop camera, its position at the seabed can be estimated from the vessel's position by correcting for deviations in relation to the observation platform (cable length, angle and direction). In all cases, the method used shall be documented.

NOTE 2 There are several sources of errors in the positioning of underwater equipment. The main components in underwater positioning provide transmission of satellite signals to the ship and calculation of the distance and direction to the observation platform. The quality of underwater positioning is mainly depending on how the ship is equipped, but the setting and calibration of this equipment is also very important.

6.2 Calibration of positioning equipment

For mapping and monitoring the hydro-acoustic positioning equipment needs to be calibrated on an annual basis. If a calibration has been performed for instance by comparison with a transponder placed on the seabed, values for the error should be provided in the report. If such a calibration has not been made the errors provided by the producers of the equipment should be used instead.

Filtering of navigational data can significantly reduce noise. The recommended method for this is Kalman filtering [3].

NOTE Many GPS navigation systems on the market already “smoothen” the position, based on previous positions and estimated compass direction, before they are shown in the display. The method used for filtering varies, but most common is the *Kalman filtering.* A simpler method for filtering navigational data is to remove deviant recordings that are obvious outliers from the remainder of the recordings. Deviant values can be replaced by a value derived from the running mean of five records (two before and two after the point of the deviant record) in the series of navigational recordings. If filtering of navigational data is used, the method used should be documented when reporting the results.

The geographic resolution can be obtained by comparing the distances covered by video sequences of similar lengths with the distance as calculated using speed.

6.3 Positioning of the different types of survey

For pilot surveys, positioning may refer to the position of the vessel. The positions of video transects should as a minimum be defined by the vessel´s start and end positions. The precision of positional information should fulfil the requirements of Order-2 in S-44 [4] (≤ 20 m, with a relative tolerance of + 5 % of water depth in meter).

Approximate positions along a towed transect may be calculated based on speed of the equipment together with the compass direction.