
**Marine technology — Marine
environment impact assessment
(MEIA) — General protocol for
observation of meiofaunal community**



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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 13, *Marine technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

For environmental impact assessments (EIA) of plans for seabed mineral resource exploitation, objective, comprehensive and easy-to-apply analysis techniques are required (see ISO 23730). Traditionally, relatively large organisms have been used as indicators for environmental impact assessments, and labour-intensive surveys using morphological characteristics were mainstream. Compared to larger macrofauna and megafauna, meiofauna in the deep sea have high abundance and biomass and are an important component of deep-sea ecosystems^[2]. In addition, meiofauna have a considerable influence on the nutrient cycling in the sediments and sediment stability. Therefore, meiofauna are important as biological indicators used to monitor natural or anthropogenic disturbances^[3]. The International Seabed Authority (ISA) guidelines for contractors on the assessment of possible environmental impacts due to exploration activities (see Reference ISBA/25/LTC/6) mandate the reporting of the abundance and diversity of seafloor biotic communities, including meiofauna. Therefore, meiofauna, being ubiquitous as well as sensitive to environmental perturbations, have been chosen as indicator organisms for the analyses in this document. However, traditional methods for meiofaunal community analysis are extremely time-consuming, which is economically problematic due to the costs of conducting EIA as part of resource development. In addition, advanced expertise is required for the identification of meiofauna to the species, genus, or even family level, and the number of experts qualified to do this is limited. Also, if a technician does not have the training or knowledge to identify meiofauna, a dissemination of inaccurate data could result. For these reasons, accurate, efficient and objective analytical tools for the identification of meiofauna are needed.

Thus, the purpose of this document is to establish a convenient protocol for MEIA using meiofauna as biological indicators. The role of EIA is the determination of fluctuation or change in the community structure after environmental impacts. Data of species level composition and population size are essential information to assess the effect of impacts.

Therefore, a meiofaunal analysis, following two methods is proposed, including:

- 1) imaging flow cytometry;
- 2) environmental metagenomic analysis.

By this protocol, the population density (number of individuals per unit area) is obtained by analysis using an imaging flow cytometer, and the species composition is acquired by metagenomic analysis. These methods obtain data faster than traditional analysis methods that have been done so far. Further, it is possible to compensate for the disadvantages of both methods with each other. By using both methods complementarily, it becomes possible to grasp communities of meiofauna in the environment objectively, comprehensively, quickly and easily (it is a method aligned to the ISA recommendation, see ISBA/25/LTC/6, mandating to obtain data on population density, biomass and species composition for meiofauna).

Marine technology — Marine environment impact assessment (MEIA) — General protocol for observation of meiofaunal community

1 Scope

This document specifies a general protocol for the observation of the meiofaunal community in the deep seabed.

The standardized method can be used in any phase [baseline data acquisition, monitoring during and after mining (testing)] accompanying resource development, making it easier to compare data beyond differences in workers and waters.

This document is intended for marine environment impact assessments and other occasions where long-term image-based data are required.

2 Normative references

The following document is referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISA¹⁾ ISBA/25/LTC/6, *Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area*, 2013. Available at <https://www.isa.org.jm>

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISBA/25/LTC/6 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

meiofauna

animals of the benthic community that are intermediate in size between macrofauna and microfauna, operationally defined as $> 32 \mu\text{m}$ and $< 250 \mu\text{m}$

[SOURCE: ISBA/25/LTC/6:2013, Annex II.]

3.2

PCR

polymerase chain reaction

DNA sequence synthesis reaction repeated to amplify DNA fragments of target regions of hundreds of thousands of times of genes using template DNA, and two types of short DNA fragments (primers), and DNA polymerases

1) ISA: International seabed authority.