Baltic Marine Environment Protection Commission

Working Group on the State of the Environment and Nature Conservation

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Document title	Draft guidelines for measuring turbidity
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Category	CMNT (LATE)
Agenda Item	Revision of HELCOM monitoring
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Submitted by	Finland

Background

This document contains the draft guidelines for measuring turbidity produced by Finland. Comments to the guidelines have been provided by Poland, Sweden, and Germany.

Action requested

The Meeting is invited to:

- consider and amend as needed the draft guidelines for measuring turbidity,
- endorse and agree to include the guidelines in the HELCOM Monitoring Manual.

A template for HELCOM monitoring guidelines: TURBIDITY (DRAFT 3)

Mika Raateoja, SYKE, 21.3.2016

1st draft	9th Mar, 2016	Mika Raateoja
Revision	15th Mar, 2016	Elzbieta Łysiak-Pastuszak
	15th Mar, 2016	Sieglinde Weigelt-Krenz
	15th Mar, 2016	Johan Håkansson
2nd draft	17th Mar, 2016	Mika Raateoja
Revision	21st Mar, 2016	Petra Schilling
3rd draft	21st Mar, 2016	Mika Raateoja

1. Background

1.1 Introduction

Water transparency serves as a measure of the trophic status of a water body and often reflects eutrophication through changes in the phytoplankton abundance; increase in the ambient nutrient status in the water leads to higher phytoplankton biomass that diminishes the propagation of light in the water.

Water transparency is dependent of the amounts of chromophoric dissolved organic matter (CDOM) as well as of total suspended solids (i.e., organic and inorganic particles) in the water. Being unaffected by CDOM, turbidity estimates the impact of light scattering due to particles on the level of light attenuation in the water column.

The organic particles are mainly autochthonous (phytoplankton, zooplankton, bacterial cells) and thus are related to trophic status whereas the inorganic particles are largely allochthonous (e.g., sediments). This source of error has to be taken into consideration whenever eutrophication status is assessed using turbidity in the Baltic Sea that is optically classified as a Case II water body (Morel and Prieur 1977), i.e., the body of water relatively higher in inorganic particles than in phytoplankton. The representativeness of turbidity as an eutrophication metrics increases towards offshore areas; here, an increasing share of particles causing turbidity is of autochthonous origin. This has been utilized in SOOP and EO products.

The scope of this guideline is turbidity measured with bench turbidity meters in a laboratory, with turbidity sensors in the SOOP systems, and with EO[1].

1.2 Purpose and aims

The purpose for turbidity monitoring is to describe spatiotemporal trends in water transparency.

Turbidity provides information of water transparency that can be a direct effect of eutrophication (with certain limitations shown above). It is thus an element of eutrophication monitoring, although only as a supporting parameter.

2. Monitoring methods

2.1 Monitoring features

Turbidity is expressed in a formazine nephelometric unit (FNU; measurement of diffuse radiation, applicable to water of low turbidity). It measures the radiation back scatter introduced by the total suspended solid content of the sample water to the scatter caused by the formazine polymer suspension of

[1] EO approach is not included in this 1st draft, because the responsible persons were preparing an application for the BONUS call with a deadline of 10th Mar.

known concentration. The FNU is measured with an infrared light source according to the ISO 7027-1 standard.

2.2 Time and area

Turbidity measurement, probing inherent optical properties of the water, can be done all year round. However, to supplement eutrophication monitoring, it should be monitored during the period of significant biologic activity.

Turbidity monitoring is carried out by a number of HELCOM contracting parties, and the monitored area covers the entire Baltic Sea area, both the open sea and coastal areas.

2.3 Monitoring procedure

2.3.1 Monitoring strategy

Diffuse radiation technique is the only quantitative method applicable to natural waters of low turbidity (opposed to high turbidity of, e.g., waste waters).

2.3.2 Measuring method(s) and equipment

Turbidity of water is measured quantitatively by diffuse radiation using turbidity meters according to guidelines of ISO 7027-1.

2.3.3 Sample handling and analysis

Turbidity of water is measured from individual samples, *in situ* in the water column, or from the water flow against the instrument calibration curve.

Before starting measurements, the instrument has to be calibrated according to the manufacturer's calibration instructions. Then a measurement is performed on a well-mixed sample in accordance with the manufacturer's instructions. The turbidity value is read from the prepared calibration curve or directly from the instrument scale, if the scale has been verified as calibrated.

2.4 Data analysis

No calculations or conversions required.

3. Data reporting and storage

The results are included in the station data, stored by the contracting parties, and reported annually to the COMBINE database hosted by ICES.

Depending on the magnitude of a turbidity value, report the results (in units), as follows:

- turbidity < 0.99 FNU; report to the nearest 0.01 FNU
- 1.0 < turbidity < 9.9 FNU; report to the nearest 0.1 FNU
- 10 < turbidity < 40 FNU; report to the nearest 1 FNU.

4. Quality control

4.1 Quality control of methods

A turbidity meter and a turbidity sensor are calibrated at constant intervals against a dilution series of a traceable commercial standard.

In a laboratory premises, the daily quality control is carried out by commercial gel control samples producing data for X-bar charts. Alternatively, a secondary standard suspension can be used as a daily calibration check, being monitored periodically for deterioration using one of the primary standards.

Repeatability of the measurement is inspected by replicate measurements amongst the sample series.

4.2 Quality control of data and reporting

For general data reporting guidelines, see HELCOM (2015).

5. Contacts and references

5.1 Contact persons

Mika Raateoja, Finnish Environment Institute

Jukka Seppälä, Finnish Environment Institute

5.2 References

HELCOM (2015). Eutrophication Assessment Manual, Annex 3A. http://www.helcom.fi/helcom-at-work/projects/eutro-oper/. Last revision in 2015.

ISO 7027-1. Water quality - Determination of turbidity - Part 1: Quantitative methods.

5.3 Additional literature