

C-12: Nutrients in coastal seawaters

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1) General description

1.1) *Brief definition*

This indicator shows average annual and seasonal concentrations of phosphates (expressed as PO₄-P) and nitrates (expressed as NO₃-N), in coastal seawaters.

1.2) *Units of measurement*

Concentrations of phosphates are expressed as mg of P/litre, the concentration of nitrates is expressed as mg of N/litre.

1.3) *Context*

Relation to other indicators from the Guidelines - This indicator relates to indicators “C-11: Nutrients in freshwater” and „C-13: Concentration of pollutants in coastal seawater and sediments (except nutrients)“.

2) Relevance for environmental policy

2.1) *Purpose*

The indicator provides a measure of the state of coastal seawaters in terms of nutrient concentrations. Nutrients (biogenic substances) in coastal seawaters are used by plants and autotrophic bacteria to maintain vital activity, and are affecting the biological productivity and ecological condition of coastal waters.

2.2) *Issue*

Nitrates, as well as phosphates, are the basis for the development of marine phytoplankton nutrient compounds. Their absence leads to the inhibition of algae, reduce the intensity of the process of ammonia nitrogen is consumed by phytoplankton during photosynthesis. Nitrogen and phosphorus enrichment can result in a chain of undesirable effects, starting with excessive growth of plankton algae, which increases the amount of organic matter settling to the seabed. This development may be exacerbated by changes in the species composition and functioning of the pelagic food chain (e.g. the growth of small flagellates

rather than larger diatoms) and by intensification of eutrophication processes, which leads to lower grazing by copepods and increased sedimentation of organic matter. The consequent increase in oxygen consumption can, in areas with stratified water masses, lead to oxygen depletion, changes in community structure and death of the benthic fauna. Eutrophication can also increase the risk of algal blooms, some of them consisting of harmful species that cause the death of benthic fauna and wild and caged fish and may lead to shellfish poisoning of humans. Increased growth and dominance of fast-growing filamentous macroalgae in shallow sheltered areas is another effect of nutrient overload which can change coastal ecosystems, increase the risk of local oxygen depletion and reduce biodiversity and the availability of nurseries for fish.

2.3) International agreements and targets

a) Subregional level

The European Union has adopted the Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). The Directive provides that Member States shall take the necessary measures to achieve or maintain a “good environmental status” in the marine environment by the year 2020 at the latest.

Further international agreements include: The Convention on the Protection of the Marine Environment of the Baltic Sea (Helsinki, 1974); the Convention on the Protection of the Mediterranean Sea against Pollution (Barcelona, 1976); the Convention on the Protection of the Black Sea against Pollution (Bucharest, 1992); the Framework Convention on the Protection of the Marine Environment of the Caspian Sea (Tehran, 2003).

3) Methodology and guidelines

3.1) Data collection and calculations

A basic monitoring programme should specify biogenic substances including phosphates and nitrates. The number of sampling points and their spatial location should enable the collection of information on the content of biogenic substances throughout the gradient of loads – from background water landing sea areas to coastal seawater areas exposed to substantive anthropogenic loads. In the case of high number of sampling points on the coastal zone, the countries should select at least five representative points for the calculation of average concentrations to have a balanced representation of water quality. In order to take into account the time mutability of the content of biogenic substances, average concentrations should be reported for designated time periods in summer, autumn, winter, and spring for each of the sampling points. Based on this, the average annual and seasonal concentrations aggregated for the respective coastal zone, as well as the maximum and minimum of the seasonal concentrations can be calculated. Methodological and metrological

uniformity of surveillance and data processing should be a goal; microbiological and chemical-analytical activities should be conducted by accredited laboratories with measurement quality control systems.

3.2) Internationally agreed methodologies and standards

General rules for reporting are presented in the International Recommendations for Water Statistics (IRWS), United Nations 2012. The concentration of nitrates is determined using the ISO 7890-3:1988 method, based on spectrometric measurement of levels of the compound resulting from the reaction of nitrate with sulfosalicylic acid and its subsequent treatment with alkali. Phosphate concentrations are determined using the ISO 6878:2004 method, which is in compliance with the corresponding method used by countries of South-Eastern and Eastern Europe, Caucasus and Central Asia.

4) Data sources and reporting

The countries of South-Eastern and Eastern Europe, Caucasus and Central Asia have departmental and, in some cases, national databases on biogenic substances contained in coastal seawaters. Several coastal countries publish data on concentrations of nutrients in seawater, including coastal waters, in annual reports on seawater quality.

5) References at the international level

- Convention on the Protection of the Black Sea against Pollution: <http://www.blacksea-commission.org/>
- Convention on the Protection of the Marine Environment of the Baltic Sea Area: <http://www.helcom.fi/>
- Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)
- Environmental Indicator Report 2012, EEA 2012
- European Commission – Water Policy: http://ec.europa.eu/environment/water/index_en.htm
- European Environment Agency (EEA): <http://www.eea.europa.eu/themes/water>

- Europe's Environment, The fourth Assessment, EEA 2007
- Eurostat: <http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators>
- Food and Agriculture Organization (FAO): <http://www.fao.org>
- Framework Convention for the Protection of the Marine Environment of the Caspian Sea: <http://www.tehranconvention.org/spip.php?article4>
- GEMS/WATER Operational Guide, 3rd ed. (WHO, 1992)
- Global water information system of the Food and Agriculture Organization (AQUASTAT): http://www.fao.org/ag/agl/aglw/aquastat/water_res/waterres_tab.htm
- International Recommendations for Water Statistics (IRWS): <http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf>
- ISO Water Quality – determination of BOD after five days, ISO 5815 (1989)
- Standard Methods for the Examination of Water and Wastewater, 19th ed. (American Public Health Association, 1992)
- The European Environment-State and Outlook 2010: Synthesis, EEA 2010
- United Nations Statistics Division (UNSD): <http://unstats.un.org/unsd/environment/>
- United Nations Statistics Division (UNSD)/United Nations Environment Programme (UNEP) Questionnaire on Environment Statistics (2013):
- <http://unstats.un.org/unsd/environment/questionnaire2013.html>
- World Health Organization (WHO): <http://www.euro.who.int/en/home>
- World Meteorological Organization (WMO): www.wmo.ch