

EO5 INTEGRATED MONITORING OF THE ADRIATIC SEA AND COAST AND RELATED ASSESSMENT CRITERIA

Arjana YLLI

Biotechnology Department, Faculty of Natural Sciences,
University of Tirana, Tirana, Albania

Robert PRECALIAND

Centre for Marine Research, Rudjer Boskovic Institute, Zagreb, Croatia

Zamir DEDEJ

National Agency of Protected Areas, Ministry of Tourism and
Environment, Tirana, Albania

ABSTRACT

Eutrophication of Adriatic Sea is a process driven by enrichment of water by nutrients, especially nitrogen and/or phosphorus compounds, leading to: increased growth, primary production and biomass of algae; changes in the balance of nutrients causing changes to the balance of organisms; and water quality degradation. The distribution of nutrient concentrations is determined by a complex combination of biotic and abiotic factors. Ecological Objectives 5 (EO5) integrated monitoring is related to the common indicator, which summarizes data into a simple, standardized and communicable figure. A common indicator is able to give an indication of the degree of threat or change in the marine and coastal ecosystem and can deliver information to decision makers. There are two common indicators related to eutrophication: Indicator 13, related to concentration of key nutrients in water column and Indicator 14, related to chlorophyll-a concentration in water column. We recommend carrying out the EO5 indicators during 2020-2022, and as a first step we propose the sampling at stations located one kilometre from the coast, in full compliance with IMAP Common Indicators. From the list of coastline stations proposed by the National Environment Agency, 6 stations are selected for sampling purposes at different distances from the Adriatic coast and different depths. The selected stations will allow to have a full picture of eutrophication and evaluate the effect of the main pressures from land (rivers, lagoons and urban areas) as from the open sea. The process of eutrophication will be estimated through physico-chemical and biological parameters.

Keywords: EO5, common indicators, eutrophication

1. INTRODUCTION

Marine areas provide significant benefits to people in terms of food and other services, but are exploited in different ways by disturbing the balances in these ecosystems. In order to keep coastal ecosystems “healthy”, continuous assessment should be done through monitoring, identifying alterations or changes in physical, chemical and biological parameters as well as environmental indicators related to these parameters. Monitoring of coastline, sea beds, physical, chemical and biological parameters help to get better image of aquatic ecosystems and the status and conditions of these systems. EU legislation defines clearly the monitoring protocols and methods applicable for the protection of marine environments, one of which is the Maritime Directive (Wise Marine 2017; European Union 2017; European Commission, 2019). Conventions also create opportunities for the protection and assessment of the marine environment. Albanian institutions and agencies have worked for a long time to be part of the evaluation and monitoring process of the Adriatic and Ionian coast according to the scientific criteria of these Conventions.

Eutrophication remains a major environmental problem for Europe's seas, which brings changes in the balance of organisms and degradation of sea water quality. Eutrophication is the process of absorbing large amounts of nutrients, such as phosphorus and nitrogen, that causes the uncontrolled growth of algae in aquatic environments. Such a phenomenon has emerged after climate change identified in the last 20 years in the Mediterranean Sea. For many years the Mediterranean Sea, including also the Adriatic Sea, has become part of many Conventions for the marine protection. Ecological objectives have been set based on specific indicators. Ecological Objectives 5 (EO5) is one of them, related to the minimization of eutrophication of marine waters, based on the concentration of nutrients and chlorophyll-a as indicators.

The enrichment of waters by nutrients can be of a natural origin (natural eutrophication), but it is often dramatically increased by human activity (anthropogenic eutrophication). Human induced eutrophication through erosion and leaching from fertilized agricultural areas, urban sewage and industrial discharges could be minimized, especially its lateral effects, such as biodiversity loss, ecosystem degradation, harmful algal blooms and lack of oxygen in the ground waters (Ferreira *et al.*, 2010). This is one of the EO5 ecological objectives that describes the state of marine waters based on specific indicators.

Albania is a Contracting Party to the Barcelona Convention and its Protocols in the framework of UNEP/MAP (Mediterranean Action Plan). This action plan addresses the level of the environmental status of marine waters

and coasts. All countries after the Barcelona Convention (CP) have adopted an Integrated Monitoring and Assessment Programme (IMAP) based on eleven ecological objectives (Decision IG.22/7), and all the Adriatic countries should amend their national monitoring programs.

The project primary aims to restore the ecological balance of the Adriatic Sea using the ecosystem approach and marine spatial planning. At the same time project aims application of Integrated Coastal Zone Management Protocol and implementation of the Integrated Monitoring and Assessment Program. The project is jointly led by UNEP/MAP, PAP/RAC and SPA/RAC (Integrated Monitoring Programme Albania- Draft, 2021).

2. MATERIAL AND METHODS

There is an ample relevant information available in marine eutrophication literature; here the emphasis is given to factors which, altered by human activities, trigger and maintain man-made eutrophication, and which man can, at least partially control by continuous monitoring of common indicators.

EO5 integrated monitoring is related to the common indicator, which is an indicator that summarizes data into a simple, standardized and communicable figure. A common indicator is able to give an indication of the degree of threat or change in the marine and coastal ecosystem and can deliver valuable information to decision makers (EEA, 2001, 2015, Wise Marine 2017). There are two common indicators related to eutrophication: Indicator 13, related to concentration of key nutrients in water column, and Indicator 14, related to chlorophyll-a concentration in water column (UNEP/MAP/MED POL 2005, UNEP/MAP, 2015, HALCOM, 2017).

Common Indicator 13: Concentration of key nutrients in water column

Physicochemical parameters:

- *Transparency*
- *Temperature*
- *Salinity*
- *Concentration of dissolved oxygen*
- *Concentration of orthophosphate (PO₄-P)*
- *Concentration of total phosphorous (TP)*
- *Concentration of nitrate (NO₃-N)*
- *Concentration of nitrite (NO₂-N)*
- *Concentration of ammonium (NH₄-N)*
- *Concentration of total nitrogen (TN)*
- *Concentration of orthosilicate (SiO₄-Si)*
- *Concentration of total and dissolved organic carbon*

Common Indicator 14: Chlorophyll *a* concentration in water column

Biological parameters:

- *Concentration of chlorophyll a*
- *Numeric concentration of phytoplankton*
- *Phytoplankton community composition*

The Eutrophication Working Group delivered a report as an information document UNEP(DEPI)/MED WG.437/Inf.11 (2019) where common definitions on thresholds, baseline, assessment criteria and review the methods, the criteria and the limit values for assessing eutrophication in Mediterranean and its sub-regions are proposed.

The current practices for monitoring the marine environment, in accordance with IMAP Guidance Factsheets for each of the parameters within Common Indicators for Eutrophication are presented in Monitoring Protocols for Common Indicators related to Pollution (UNEP/MED WG.463/6, 2019), which provide detailed both scientific and technical considerations.

3. RESULTS AND DISCUSSIONS

During last twenty years Albanian monitoring institution and organizations have done progress in development and application of updating methods of sampling, assessment and evaluation, as part of the national integrated monitoring program.

In accordance with the outline of the EO5 objectives for assessing national knowledge gaps, still exists a national knowledge gap assessment for EO5 IMAP indicators 13 and 14 in Albania.

During the last years, anthropogenic eutrophication has been identified as a key ecological problem for the Adriatic Sea, resulted in dramatic alterations in the chemical and biological regimes (EVER-EST, 2020). The phytoplankton community, being the first target of nutrient alterations, is perceived to be a decisive factor for the marine water quality and the ecosystem health. It tends to be the most direct visible consequence of natural and man-induced changes.

Several sampling sites were selected. From the list of coastline stations proposed by the National Environment Agency (Raporti i gjëndjes në mjedis 2014; 2016-2018) we selected 5 transects for sampling at different distances from the Adriatic coast and perpendicular to the coast, at a distance of 0.1, 5 and 10 km from the coastline. The samples were collected 0.5 and 10 m deep, but it is important to mention that sampling in 2.0 m above the bottom is very important, because here oxygen concentration shows the eutrophication process.



Fig.1: Five transects that represent 15 sampling stations.

These 5 transects, which represent the 15 selected stations for water collection and measurement, will allow to have a full picture of eutrophication and to evaluate the effect of the main pressures from land (rivers, lagoons and urban areas) as well as from the open sea. The 5 transects are: Velipoja, Lalzi Bay, Spille – Kavaja, Divjaka – Semani and Vlora (Zverneci).

Sampling frequency is determined by the variability of the measured parameters and is usually determined by how many samples are needed to reliably assess the differences between two neighbouring mean values. The frequency and spatial resolution of the monitoring programme should reflect spatial variation in eutrophication status and pressures following a risk based approach and the precautionary principle.

The first factor promoting eutrophication is nutrient enrichment. This explains why the main eutrophic areas are to be found primarily not far from the coast, mainly in areas receiving heavy nutrient loads. Additionally, the risk of eutrophication is related to the capacity of the marine environment to confine growing algae in the well-lighted surface layer. The geographical extent of potentially eutrophic waters may vary widely (UNEP/MED WG.463/6, 2019).

Good Environmental Status (GES) has two specific targets: i) a) reference nutrients concentrations according to the local hydrological, chemical and morphological characteristics of the un-impacted marine region; b) decreasing trend of nutrients concentrations in water column of human impacted areas, statistically defined; c) reduction of BOD emissions from land based sources; d) reduction of nutrients emissions from land-based sources, and ii) a) chlorophyll *a* concentration in high-risk areas below thresholds; b) decreasing trend in chl-*a* concentrations in high risk areas affected by human activities (UNEP/MAP/MED POL 2005; UNEP/MAP, 2015; HALCOM, 2017; UNEP/MED WG.463/6, 2019).

Selection of parameters for assessment of eutrophication and achievement of GES are done according IMAP Common Indicator Guidance Facts Sheets (UNEP (DEPI)/MED WG.444/5, 2017) and Integrated Monitoring and Assessment Guidance (UNEP (DEPI)/MED IG.22/Inf.7, 2016), as well as Commission Decision (EU) 2017/848.

4. RECOMMENDATIONS

Laboratories carrying out analyses about nutrients and Chlorophyll *a* have to establish a quality management system according to EN ISO/IEC 17025. An accreditation by a recognized accreditation authority is also recommended. Due to reduced capabilities of Albanian monitoring laboratories, we recommend initiating fulfilment of the Ecological Objectives 5 (EO5) indicators during 2020-2022, only with sampling at stations located one kilometre from the coast, in full compliance with IMAP Common Indicators.

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