

# ASSESSMENT OF THE ECOLOGICAL STATUS OF THE NORTHERN ADRIATIC COASTAL WATERS: TESTING AND ADAPTING TWO PHYTOPLANKTON INDICES

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## Abstract

As stated in the WFD, the response of phytoplankton to eutrophication of coastal waters needs to be assessed by evaluating biomass, composition and abundance, and blooms. We present the application of two indices ( $I_E$ ,  $I_{SS}$ ), which goes beyond the only metrics (Chlorophyll *a* concentrations) considered till now in the Mediterranean intercalibration group.

*Keywords: Adriatic Sea, Phytoplankton, Monitoring, Bio-Indicators, Coastal Waters*

## INTRODUCTION

Few classifications of the phytoplankton ecological status of European coastal waters that consider all parameters (biomass, composition, abundance, and frequency and intensity of blooms) listed in the Water Framework Directive (WFD, 2000/60/EC), have been tentatively described to date. All attempts to construct a useful index are from coastal waters of North-East Atlantic and Baltic Sea [1, 2, 3].

Phytoplankton biomass is the only parameter that has been calibrated in the Mediterranean intercalibration group (2008/915/EC), pointing out the difficulty of describing the phytoplankton community and its changes with proper metrics especially in the relatively oligotrophic Mediterranean Sea as compared to north-western European seas. This work presents the application of two still not fully developed indices in the northern Adriatic coastal waters (Gulf of Trieste).

## MATERIAL AND METHODS

Phytoplankton data were obtained during Slovenian national monitoring program at five coastal stations. Reference conditions (RC) were determined on a data set of a site in the Gulf of Trieste with slight anthropogenic influence. Assessment period of two years only (2007-2008) was considered to estimate the recent trophic conditions of five sampling stations. Two indices described by Devlin et al. [3] were tested. 1. Index of elevated phytoplankton counts ( $I_E$ ) is composed of frequency of elevated Chl-*a* records, frequency of high phytoplankton counts and frequency of high count of any single taxa. 2. Index of seasonal succession ( $I_{SS}$ ) assesses the shift of the seasonal cycle of phytoplankton functional groups from RC.

## RESULTS AND DISCUSSION

Values of  $I_E$  separate the five stations into two groups: stations F, MA and C4 with  $I_E$  lower than reference value, and stations K and DB2 with higher values (Tab. 1). We estimate that, subjected to additional analysis, this preliminary results could be used to set the boundary between very good and good ecological status.

The second index,  $I_{SS}$ , needs an initial construction of reference standardized seasonal occurrence curves for the four functional groups. There is a difference between the values of the total  $I_{SS}$  among stations (Tab.1), but the results nevertheless offer no possibility to distinguish between ecological statuses of the stations.

We consider  $I_{SS}$  less suitable classification tool as compared to the  $I_E$  for at least two reasons. First, the stations are too similar as regards the phytoplankton community structure and, secondly, seasonal succession of phytoplankton species can be hardly assessed solely on monthly basis due to their fast generation times. There were several problems encountered during this initial phase of phytoplankton index testing. One problem is represented by the limited number of available data, e.g. two years of monthly data in comparison to 6 years assessment period foreseen in the WFD. The second and major problem relates to biomass and structural changes observed in the last decades in the phytoplankton community [4], which makes the establishment of the reference conditions a difficult task.

Tab. 1. Preliminary results of the application of two phytoplankton indices,  $I_E$  and  $I_{SS}$ , in the coastal waters of the Gulf of Trieste for the period 2007-2008.

Index $I_E$					
RC value: 16.12%					
station	F	MA	C4	DB2	K
$I_E$ (%)	9.72	6.95	13.89	18.06	19.45
Index $I_{SS}$					
station	F	MA	C4	DB2	K
functional group	F	MA	C4	DB2	K
nanoflagellates	91.67	91.67	87.50	91.67	95.83
diatoms	95.83	87.50	87.50	91.67	95.83
dinoflagellates	100.00	87.50	95.83	87.50	95.83
coccolithophorids	100.00	91.67	83.33	83.33	79.17
$I_{SS}$ (%)	96.88	89.58	88.54	88.54	91.67

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