SEASONAL MICROPHYTOPLANKTON VARIABILITY IN A EUTROPHIC AND OLIGOTROPHIC REGION IN THE NORTHERN ADRIATIC SEA (A PRELIMINARY STUDY)

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Abstract
Seasonal pattern of microphytoplankton community based on the fifteen-year data set (1990-2004) was determined at the surface and bottom of the two sampling sites in the northern Adriatic Sea. Sites were chosen to represent the eutrophic and oligotrophic region in the northern Adriatic Sea, whereas the depths surface and bottom are intended to represent the extremes of the seawater column.
Keywords : Phytoplankton, Eutrophication, Adriatic Sea.

Introduction
The northern Adriatic Sea is predominantly influenced by fluvial allochthonous input of the Italian rivers, especially Po River [1]. Freshwater inputs facilitate stratification of the seawater column, modifying main circulation and water masses exchange pattern between the northern and middle Adriatic Sea [1], whereas nutrient inputs [2] influence the microphytoplankton composition, succession and biomass [3, 4, 5].

Material and Methods
Samples were collected on monthly basis from 1990 to 2004 at two sampling sites, SJ108 and SJ107, along a Rovinj (Croatia) - Po River Delta (Italy) transect. Microphytoplankton analysis was performed by a Zeiss inverted microscope using the Utermöhl settling technique [6]. As microphytoplankton were considered cells or colonies larger than 20 mm, in one dimension at least.

Results and Discussion
Microphytoplankton blooms (Fig. 1.) occurring during the February to April period and again during the September - November are consequence of the regenerated nutrients distributed evenly throughout the region due to efficient circulation and vertical mixing [1]. From May to August circulation closes and seawater column stratifies, causing enhanced impact of nutrient rich freshwater inflows which consequently increase microphytoplankton abundance in eutrophic region.

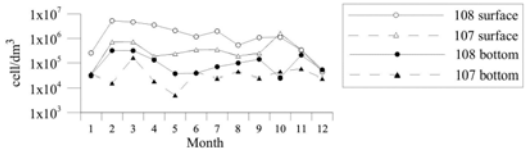

Fig. 1. Seasonal cycle of microphytoplankton abundance at both depths of eutrophic (SJ108) and oligotrophic (SJ107) regions. Each monthly average was obtained from the entire data set during the study period.

In December and January, minimal freshwater inputs, efficient circulation and mixing lead to uniformity in the microphytoplankton abundance in the northern Adriatic Sea. Substantial discrepancy between the surface microphytoplankton abundances in the eutrophic region and bottom values in both regions as well as surface values in the oligotrophic region, for the majority of the year, explains the fact that under-surface layers of the water column in eutrophic region and complete oligotrophic region are of the same origin and under the same influence, that is, of the central Adriatic Sea waters [7].
Microphytoplankton community analysis indicated *Pseudo-nitzschia delicatissima* (*P del*) as the major dominant species during the majority of the year (Tab. 1). From January to April, *Skeletonema costatum* (*S cos*) was found to be the prominent bloom constituent in the eutrophic region. Minor importance of *Skeletonema costatum* in the oligotrophic region during shorter period (in February and March) confirms this diatom as a possible eutrophication indicator [8]. *Cerataulina pelagica* (*C pel*) is an important bloom species at the surface of both regions during warm period. From May until the end of the year, *Nitzschia longissima* f. *tenuirostris* (*N ten*) is frequent at the bottom of both regions. Dominance of *Asterionellopsis glacialis* (*A gla*) at the end of the year in the bottom layer of the eutrophic region, when seawater column is well mixed in both regions, emerges as an interesting topic, which is to be investigated further. Other species are occasionally dominant/ frequent, in either or both regions, however, none of them was recognized as a possible indicator species of either eutrophic or oligotrophic conditions. More detailed study of microphytoplankton species in relation with physical and chemical parameters could lead to detection of possible indicators, as well as to better understanding of the microphytoplankton ecology.

Tab. 1. Dominant and frequent microphytoplankton species at both depths of the eutrophic (SJ108) and oligotrophic (SJ107) region throughout the year.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SJ108, surface	*S cos*	*S cos* *P del*	*S cos* *P del*	*S cos* *P del*	*P del* *C soc*	*P del* *C pel* *N ten*	*P del* *C pel* *C sp.*	*P del*	*P del* *C sp.*	*P del*	*C soc* *C sp.*	*N ten*
SJ108, bottom	*S cos* *N ten*	*S cos* *P del*	*S cos* *P del*	*S cos* *P del*	*P del* *N ten*	*P del* *N ten*	*P del* *N ten*	*P del* *N ten*	*P del* *A gla*	*P del* *N ten* *A gla*	*C soc* *C sp.*	*N ten* *A gla*
SJ107, surface		*S cos* *P del*	*S cos* *P del*	*P del*	*P del* *D fra* *C ins*	*P del* *C pel* *C sp.*	*P del* *C pel* *C sp.*	*P del* *C pel* *D fra*	*P del*	*P del* *C sp.*	*C sp.* *C soc* *N ten* *L dan*	*C soc* *N ten*
SJ107, bottom	*C sp.*		*P del* *S cos*	*P del*	*C sp.* *P del* *N ten*	*C sp.* *P del* *N ten*	*C sp.* *P del* *N ten*	*P del* *N ten*	*P del* *N ten*	*P del* *N ten*	*C sp.* *N ten* *C soc*	*N ten*

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