



TEMPORAL VARIABILITY OF PHYTOPLANKTON BIOMASS LAST TWO YEARS (2008-2010) IN KOTOR BAY

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SYNOPSIS

Key words:
chlorophyll *a*,
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Chlorophyll *a* and main hydrological parameters were measured at one station in Kotor Bay. The samples were taken from three depths in period February 2008 to January 2010. Maximum chlorophyll *a* concentration measured in December 2008 and 2009 (8.26 mgm^{-3} and 10.11 mgm^{-3} , respectively). These results indicated that this area could be described as eutrophic to hypertrophic during winter period.

INTRODUCTION

Chlorophyll *a* is the principal photosynthetic pigment and is common to all phytoplankton. Since chlorophyll is a unique component of plant matter and essential for photosynthesis, the determination of chlorophyll *a* concentration has been recognized as one of the most useful methods of estimating the algal biomass (Jasprica & Carić, 1997). It has several advantages of this methods including: (1) the measurement is relatively simple and direct; (2) it integrates cell types and ages; (3) it accounts to some extent for cell viability, and (4) it can be quantitatively coupled to important optical characteristics of water. However, the concentration of chlorophyll *a* is an imperfect measure of phytoplankton biomass, as the cellular content of this pigment depends on the composition of the phytoplankton community and ambient environmental conditions.

A number of studies on phytoplankton community and pigments concentrations including their spatial and temporal variations have been conducted in Adriatic Sea (Ahel & Terzić, 1998; Ninčević & Marasović, 1998; Morović, 2002; Viličić et al., 2008).

Kotor Bay area is largely affected by riverine inputs that provide the basin with a significant flow of freshwater and land-derived nutrients. These environmental

conditions made Bay high stratified. It is known that the chlorophyll maximum at the subsurface layer occurs widely in water where the water column is stratified (Takahashi & Hori, 1984). Winter pigment maximum was recognized in Adriatic Sea (Morović, 2002) influenced by the strongest wind and runoff episodes which may cause mixing of shallow bottom sediments and induce optically active substances in the water column.

The aim of this paper is to present temporal variability of phytoplankton biomass represented by chlorophyll *a* concentration throughout 2008-2010 in Kotor Bay.

MATERIALS AND METHODS

The samples were taken from three depths at the one position, located in Kotor Bay (Fig. 1). The sampling was performed weekly from February 2008 to December 2008 and twice a month from January 2009 to January 2010.



Figure 1: Location of sampling station (original, Corel DRAW X3).

Temperature and salinity were measured in situ by multi LINE P4-UNIVERSAL METER. All samples for chlorophyll *a* measurement were pre-filtered through a 330 μm mesh net to remove large zooplankton. After filtration through Whatman GF/F, pigment extraction was performed in 90% acetone, and chlorophyll *a* concentrations were determined by measurement of absorbance with Perkin – Elmer UV/VIS spectrophotometer, and calculation according to JEFFREY et al. (1997). Grapher 7.0 was used for data analysis.

RESULTS

Temperature followed year solar cycles with minimum 8.6 °C in December 2008 on surface and maximum 28.9 °C in July 2009 on surface in investigated

period. The highest temperature changes in water column was recorded in December 2008 (Fig. 2).

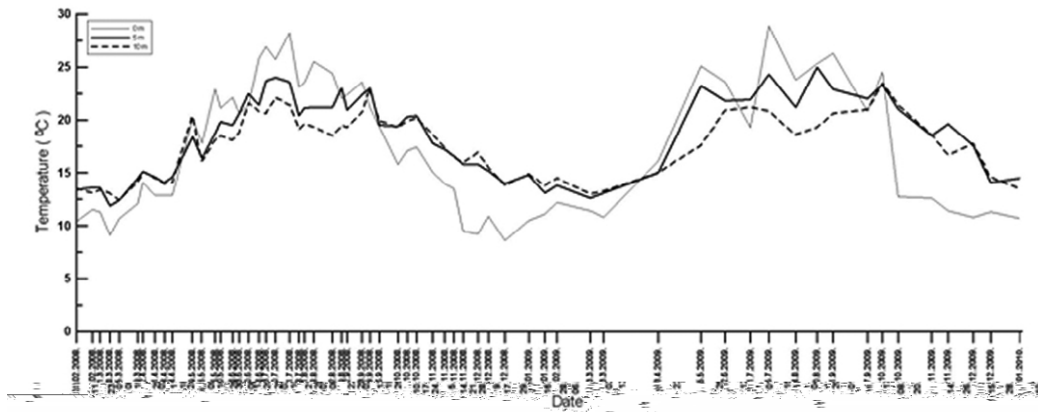


Figure 2: Temporal changes of temperature from February 2008 to January 2010 in Kotor Bay.

Extreme low salinity (Fig. 3) was measured in March 2008 on surface (2.3 PSU) and in December 2008 on surface (3 PSU). Maximum salinity of 37.6 PSU on 10 m depth was measured in April 2009.

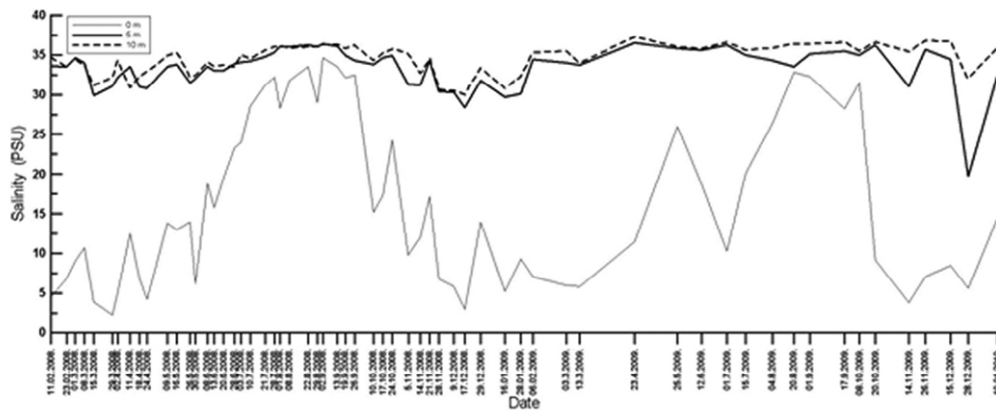


Figure 3: Temporal changes of salinity from February 2008 to January 2010 in Kotor Bay.

Chlorophyll *a* concentrations (Fig. 4) ranged from 0.12 to 9.30 mgm^{-3} at the surface, from 0.54 to 10.11 mgm^{-3} on the 5m and from 0.34 to 4.53 mgm^{-3} on the 10m. In the investigated period maximum chlorophyll concentration measured in December 2008 and 2009 (8.26 mgm^{-3} and 10.11 mgm^{-3} , respectively). Duncan test showed significant statistical differences between mean value in December 2008 and 2009 (4.29 mgm^{-3} and 4.95 mgm^{-3} , respectively) with all samples except last week of Mart 2008 (4.63 mgm^{-3}) and first week of February 2009 (3.89 mgm^{-3}).

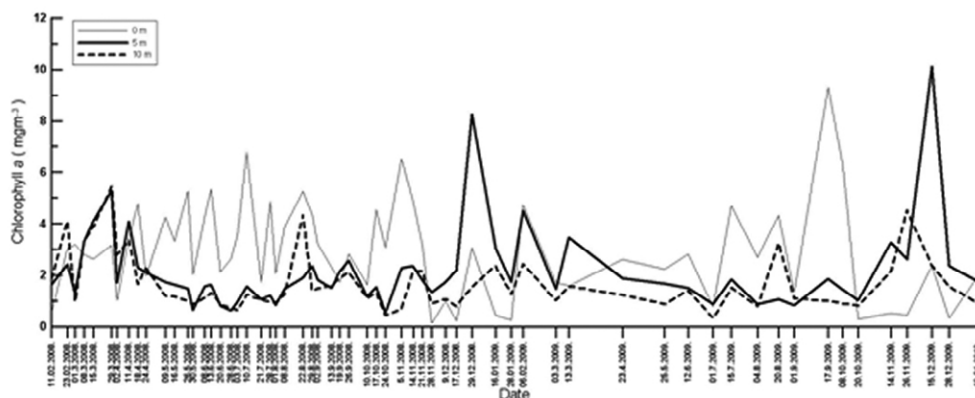


Figure 4: Temporal changes of chlorophyll a from February 2008 to January 2010 in Kotor Bay.

DISCUSSION

The biomass of phytoplankton in terms of chlorophyll *a* was investigated in this study. Maximum value of chlorophyll *a* concentration characterized by the maximum development in winter (8.26 mgm^{-3} in December 2008 and 10.11 mgm^{-3} in December 2009) as already indicated in the Adriatic Sea (Ninčević & Marasović, 1998; Morović, 2002). Chlorophyll *a* values are similar with investigation in Boka Kotorska Bay (Krivokapić, 2008) in period 2003-2004. Both of these data were recorded subsurface on 5m depth in period when was recorded minimum temperature values on surface ($8.6 \text{ }^{\circ}\text{C}$ in December 2008 and 10.8°C in December 2009). In investigation higher subsurface temperature and higher differences between layers caused higher subsurface maximum of chlorophyll *a* concentration. In the period when observed subsurface chlorophyll *a* maximum (Krivokapić et al., 2010) nitrate and phosphate have been almost depleted. High nutrient, ie nitrate concentrations are recorded in the same period when termocline expressed, in December.

The mean monthly values of chlorophyll *a* concentration were high compared to published data elsewhere in the Mediterranean, such as for the Bay of Trieste (Tedesco et al., 2007), the north eastern coastal Adriatic (Viličić et al., 2008), but lower than values from local area of the island of Mallorca (Puigserver et al., 2002).

According to chlorophyll *a* concentration and the criteria of HÅKANSON (1994) the area could be described as eutrophic to hypertrophic during winter period. It seems that heavy rains contributed increased of nutrients concentrations during winter and consequently to higher chlorophyll *a* concentration.

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