

ANNUAL VARIABILITY IN THE DISTRIBUTION OF SURFACE NUTRIENTS AND PHYTOPLANKTON IN THE OMBLA RIVER ESTUARY

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Abstract

Karstic fresh waters enrich the Ombla River estuary with nutrients, especially with NO_3 , PO_4 and SiO_4 . The concentration of all nutrients decreased from the upper to the lower reaches of the estuary. Peaks of phytoplankton occurred in May and August. The phytoplankton abundance, as with nutrients, decreased towards the lower reaches of the estuary.

Key words: hydrography, nutrients, phytoplankton, estuary, Adriatic Sea

Introduction

The highly stratified and low tidal, 4 km long estuary of the Ombla River is located on the Adriatic coast near Dubrovnik. The region is influenced by karstic fresh and marine waters. This paper aims at determining the annual variability in the distribution of surface nutrients and phytoplankton abundance along the longitudinal axis of the Ombla river estuary.

Results and Discussion

Samples for the analysis of hydrographic, chemical and biological parameters were collected at three stations (Ombla-1, 6 m deep; Ombla-2, 15 m; Ombla-3, 25 m) along the estuary, during 17 cruises from November 1999 to November 2000. Parameters were determined by standard oceanographic methods (1, 2).

Annual variations in the mean values of investigated physico-chemical parameters as well as phytoplankton abundance are presented in Figures 1, 2 and 3.

Temperatures rose from March to end-May and were more or less constant until September. In October, the water column began to cool.

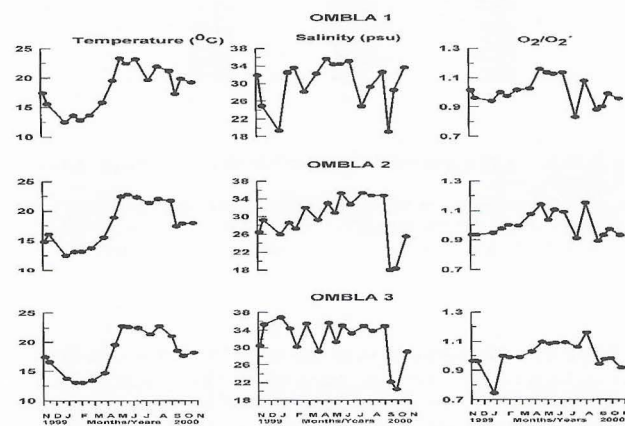


Fig. 1. Annual distribution of temperature, salinity and oxygen saturation (average).

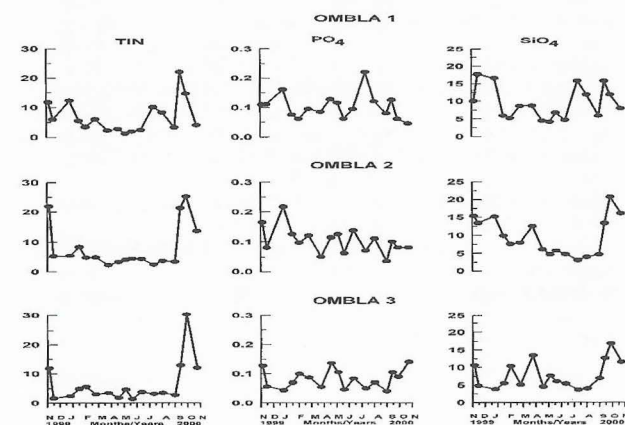


Fig. 2. Annual distribution of nutrients (average, mmol dm^{-3}).

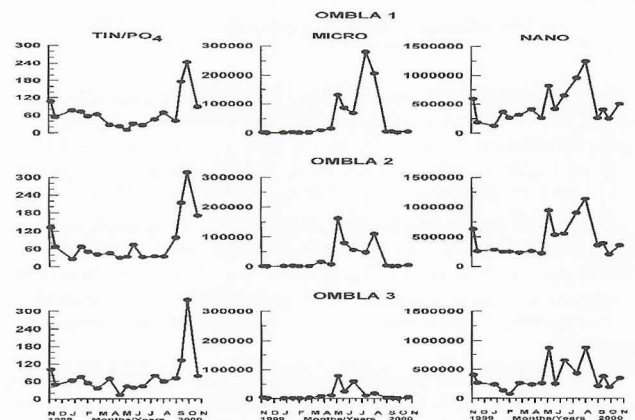


Fig. 3. Annual distribution of Redfield ratio, microphytoplankton and nanophytoplankton abundance (cells/L, (average)).

The minimal salinity value was 17.94 psu, indicating a noticeable influx of seawater throughout the entire estuary. The oxygen saturation indicated a good aeration.

The concentration of all nutrients decreased throughout the estuary for most of the year. The Redfield ratio (TIN/PO_4) values were appropriate for phytoplankton growth from April to August, and means were as follows: 27 (Ombla-1), 31 (Ombla-2), 38 (Ombla-3). The Redfield ratio increased throughout the estuary, as compared to nutrients.

The first peaks of microphytoplankton (cells longer than 20 μm , MICRO), and nanophytoplankton (cells 2-20 μm , NANO), occurred during end-May. This was a time when temperatures reached their high rising value, 22.45 $^{\circ}\text{C}$. The PO_4 concentrations were higher than 0.1 mmol dm^{-3} , and the Redfield ratio values were 14 (Ombla-1), 19 (Ombla-2) and 34 (Ombla-3). The MICRO population was composed of dinoflagellates (>89%), mostly *Prorocentrum triestinum*. Second peaks of MICRO and NANO appeared at end-August. The concentration of all nutrients at the Ombla-1 station was high: TIN -10.27, PO_4 -0.22, SiO_4 -15.91, decreasing towards the lower reaches of the estuary. At Ombla-3 station, it was: TIN -3.55, PO_4 0.07, SiO_4 -4.12 (mmol dm^{-3}). The Redfield ratio values were 34, 37 and 39. The MICRO population (>85%) was made up of the dinoflagellates, mostly *Scrippsiella trochoidea*.

It is generally assumed that, in estuaries, primary production decreases in the landward direction (3). In the Ombla River estuary the phytoplankton population density decreased towards the lower reaches of the estuary. A probable reason could be the decrease of nutrients and the increase of the Redfield ratio.

References

- 1 - Strickland J.D.H. and Parsons T.R., 1972. A practical handbook of seawater analysis. *Bull. Fish. Res. Bd. Can.*, 167, 310 p.
- 2 - Utermöhl, H., 1958. Zur Vervollkommnung der quantitativen Phytoplankton Methodik. *Mitt. int. Ver. Theor. Angew. Limnol.* 9: 1-38.
- 3 - Heip, C.H.R., Goosen, N. K., Herman, P. M. J., Kromkamp, J., Middelburg, J. J., Soetaert, K. 1995. Production and consumption of biological particles in temperate tidal estuaries. *Oceanography and Marine Biology Annual Review* 33: 1-149.