PELAGIC METABOLISM OF THE SCHEDLT ESTUARY MEASURED BY THE OXYGEN METHOD

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INTRODUCTION

Estuaries are defined as semi-enclosed zones where continental dissolved and particulate material transfer to the coastal zone. These systems are usually characterized by strong physico-chemical gradients and enhanced biological activity due to high inputs of organic matter and nutrients from rivers. The Scheldt estuary is a turbid, eutrophic coastal plain estuary in the southwest of the Netherlands (see fig. 1). It drains about 21,380 km² of land in one of the most densely populated and highly industrialised regions of Europe. The residence time of water in the entire estuary is approximately 75 days. We present results of pelagic primary production, respiration and nitrification, measured by the oxygen Winkler method, from a 10-day campaign in November 2002 (EUROTROPH program). Four stations along the estuary and one in the plume (North Sea) were investigated, corresponding to a salinity range of 0.5-34 (see fig. 1).

RESULTS

1) Surface hydrological parameters

Very low oxygen concentrations and high pCO₂ were found in the inner part of the estuary (st. Ruppel), respectively 4% of saturation (10 µmol O₂ L⁻¹) and 4700 µmol CO₂ m⁻³ (see fig. 3). Ammonium and nitrate concentrations were not measured in the same stations. Nitrate concentrations were high in the inner part of the estuary. An increase of NO₂⁻ is observed between salinities 0.5 and 6. This is well correlated with a strong increase of O₂ concentration between the same stations. Ammonium and nitrate concentrations were high in the inner part of the estuary. An increase of NO₂⁻ is observed between salinities 0.5 and 6. This is well correlated with a strong increase of O₂ concentration between the same stations.

2) GPP and NCP

Gross Primary Production rates in surface waters (100% light) exhibited low values particularly for stations Antwerp (sal 3), Hansweert (sal 6) and Prosperpolder (sal 19). This may partially be attributed to a difference in light conditions during these incubation days (Daily average irradiance of 130 vs 330 µmol photons m⁻² s⁻¹ for stations Oostende and Ruppel). Net Community Production shows highest values at Oostende station (5.6 µmol O₂ L⁻¹ d⁻¹ at 100% light) where all the euphotic zone seems to be autotrophic (NCP > 0) in this period. On the contrary, inner Scheldt stations (Ruppel, Antwerp and Hansweert) exhibited negative (heterotrophic) values throughout the incubations.

DISCUSSION & CONCLUSION

This study showed the strong heterotrophic status of the turbid Scheldt estuary during this period of the year. Net Community Production rates measured during this campaign are among the lowest reported in the literature, leading to elevated pCO₂ and low oxygen concentrations in surface waters, especially in the inner part of the estuary. The nitrification process accounted for a significant part of the oxygen consumption especially at station Antwerp in good agreement with the increase and decrease of nitrate and ammonium respectively.

In order to improve the comprehension of the estuary functioning over an annual cycle, this study will be repeated every months during year 2003.

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