# Seasonality in the Arkona basin

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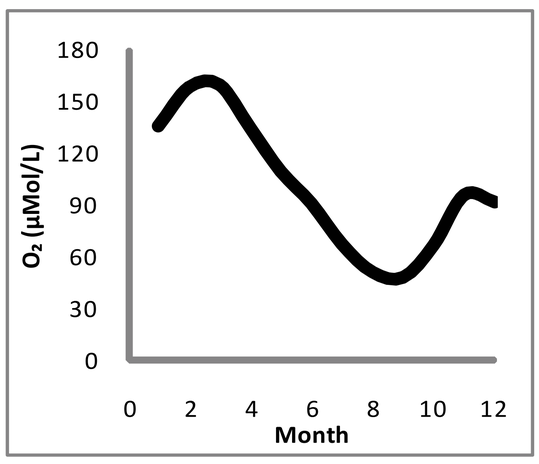
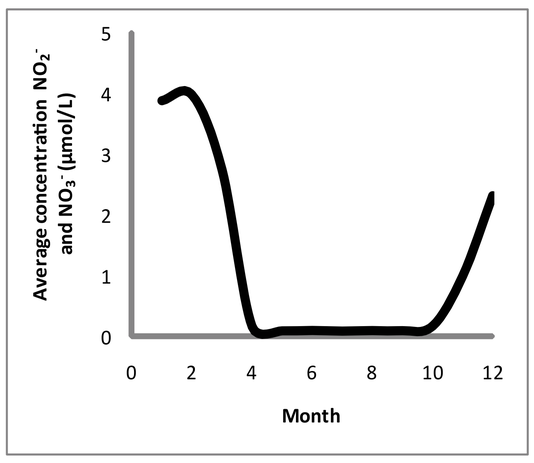
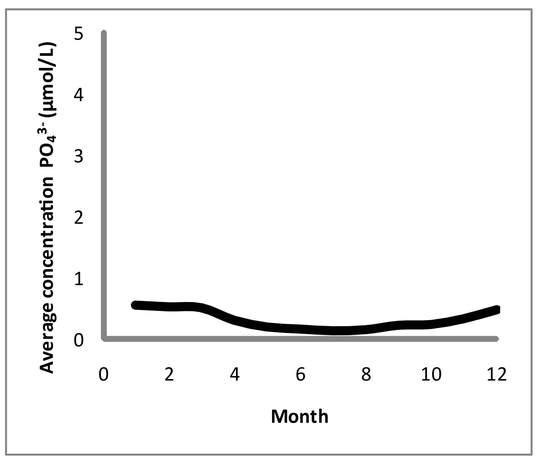
## Introduction

As in much of the Baltic, the water column at the Arkona basin remains permanently stratified throughout the year (Baltic Environmental Database at Stockholm University, 2009). The basin experiences a strong seasonal cycle of productivity and temperature, influencing the oxygen consumption. During the periods of algal bloom, the water near the sediment surface becomes hypoxic: the oxygen concentration drops below 2 ml per litre (Conley et al., 2009). The period of hypoxia is observed in late summer, i.e. September (Mort et al., 2009). So far it is known that there is seasonality in the water column, but the mechanisms by which sediment and porewater geochemistry influence and are influenced by the water column remains poorly understood. To increase understanding, a phosphorus fractionation and bulk sediment chemical analysis were performed on the BY2 core from the HYPER cruise (June 2009). In this study, data from Mort et al. (2009) was compared to the new data to assess the seasonality in the phosphorus cycle in the sediment and porewater. The results will be regarded in light of existing models on seasonality of nutrient cycles in the water column.

## Water column seasonality



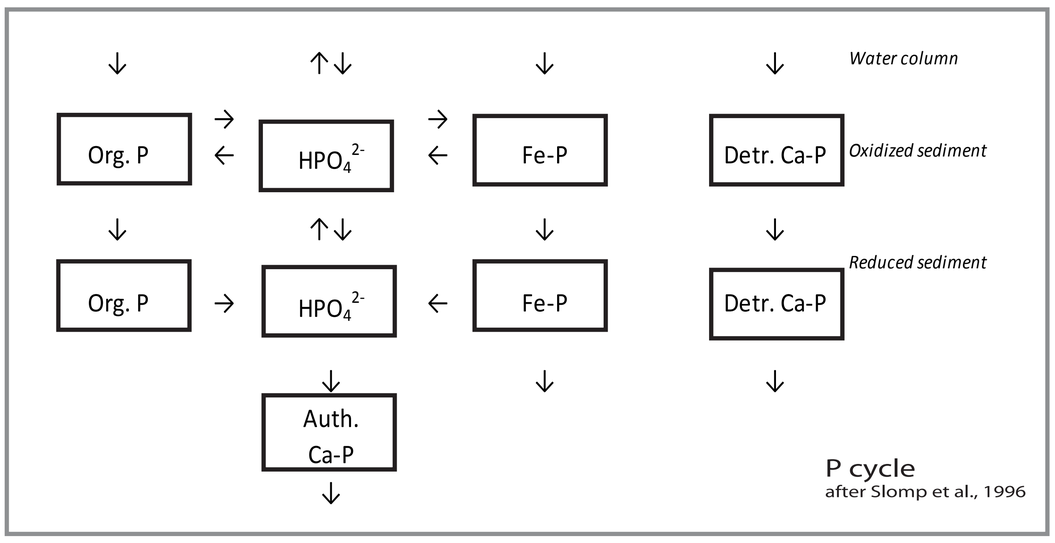




Baltic Environmental Database at Stockholm University, 2009

## Summary

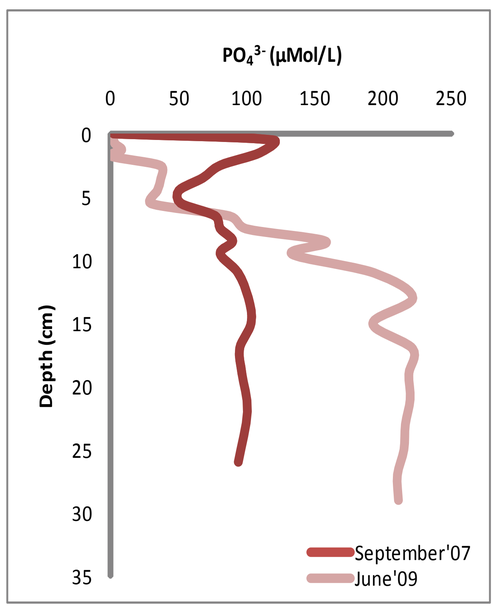
Water column seasonality in the Baltic Sea is well documented and understood, but the responses and influences of sediment geochemistry are largely unknown. A sequential phosphorus fractionation and bulk sediment chemical analysis are combined to determine major fractions and phosphate fluxes to the water column. Enrichments of iron oxides are observed in the oxidized surface layer in June but absent in September due to a lack of oxygen in the sediment. These iron oxides strongly bind phosphorus, yielding a reduced phosphate flux to the water column in June compared to September. The results indicate a strong seasonality in sediment geochemistry, and support existing theories on nutrient behaviour.

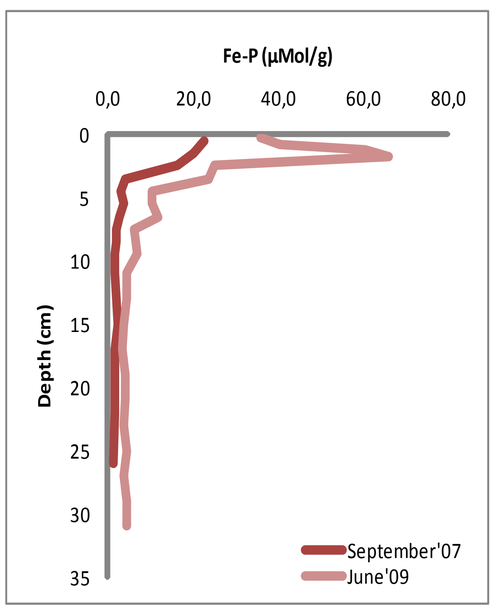
## Sediment seasonality

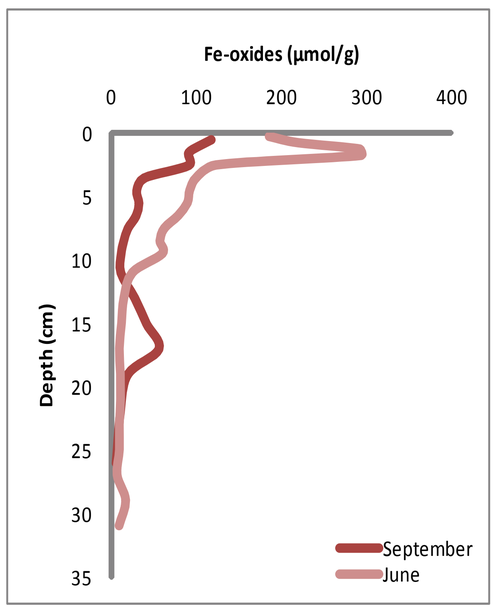


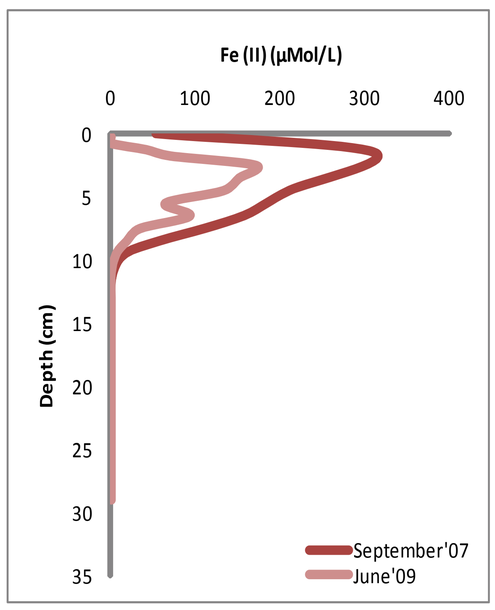

If an oxidized surface layer is absent, due to the occurrence of seasonal hypoxia at Arkona, dissolution of the iron-oxides occurs. The phosphate previously adsorbed by iron-oxyhydroxides (Fe-P) is released into the pore water. Hypoxic events thus influence the amount of phosphate that is released from the sediments.

In June the P flux from the sediment to the bottom water was approximately 25 µmol per square meter per day. In September the flux was roughly 800 µmol per square meter per day. These calculations clearly show that the diffusive flux varies seasonally, due to the presence or absence of iron oxides in the surface layer. The observed patterns in the sediment and porewater, and the magnitude of the diffusive fluxes are also reflected in the water column.

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BONUS
Baltic Organisations Network for Funding Science EEIG

Universiteit Utrecht

NWO
Netherlands Organisation for Scientific Research

Stockholm University

Baltic Nest Institute

Baltic Sea 2020

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