



Microbial response to temperature induced anoxia in a marine carst lake

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INTRODUCTION

Lake Rogoznica is a saline carst lake located at the Eastern Adriatic coast. Its protected location between high limestone cliffs, small freshwater input and peculiar geochemical setting lead to the occurrence of seasonal stratification, interrupted only by a single annual mixing event. During unusually warm years, the mixing is accompanied by sulfidic and anoxic events, during which elevated sulfide concentrations in surface waters and the formation of colloidal elemental sulfur (S⁰), indicated by a milky turbidity (Fig. 1), have been observed.

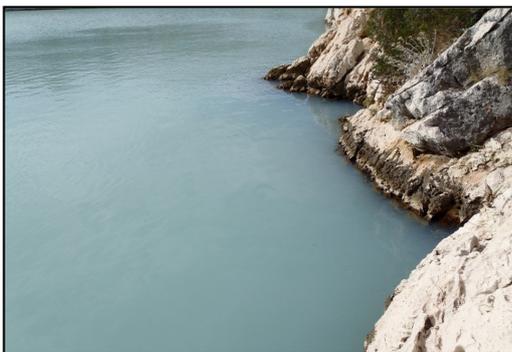


Figure 1: Colloidal elemental sulfur (S⁰) formation, visible as milky turbidity, in Rogoznica lake during a mixing event in October 2011.

AIMS & METHODS

We used culture independent methods (16S rRNA gene diversity analysis and CARD-FISH) to determine the microbial community composition and its vertical distribution before (June) and during (October) an anoxic mixing event in 2011. In addition, chemical and physical properties of the lake (temperature, salinity, oxygen concentration and reduced sulfur species (RSS) concentration) were monitored.

Our aim was to identify the microbial communities above, at and below the chemocline during stratified conditions, and the explore changes in the microbial community caused by mixing and anoxia.

OUTLOOK

- design of **CARD-FISH probe** targeting the **SUP05 related organisms** → verify their by sequencing indicated dominance during anoxic mixing
- perform gammaproteobacterial *soxB* gene specific **gene-FISH** → confirm involvement of **SUP05 related organisms in sulfur cycling**
- resolve the role of the lakes' microbial community for S⁰ formation during anoxic mixing events
- obtain deeper insight into the microbial community **below the chemocline** during stratified conditions, trough 16S rRNA amplicon 454-pyrosequencing

RESULTS & CONCLUSIONS

- total cells numbers range are between 3-7 x 10⁶ (Fig. 3) → **highly productive system**

STRATIFIED CONDITIONS

- oxic water layers are dominantly populated by marine pelagic organisms, belonging to the **SAR11 clade** and other **Alphaproteobacteria** (Fig. 2)
- anoxygenic phototrophes, belonging to the **Chlorobi** dominate the microbial community at the chemocline (Fig. 2; Fig. 3) → **H₂S depletion and S⁰ formation**

ANOXIC MIXING EVENT

- both RSS and oxygen are almost depleted throughout the water column (Fig. 2) → **aerobic RSS oxidation is an important process**
- **Gammaproteobacteria** from the **SUP05 cluster** take over the lakes microbial community, while the **Chlorobi** population diminishes (Fig. 2) → **anoxia/mixing induced community composition shift**

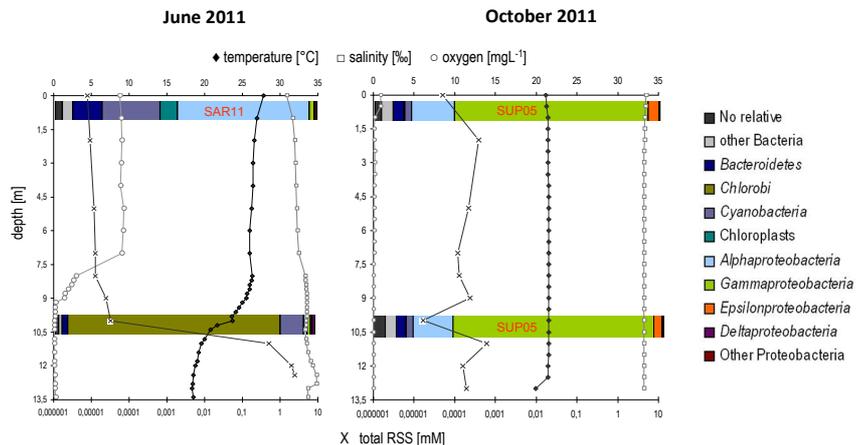


Figure 2: Temperature (♦), salinity (□), oxygen (○) and RSS (×) profiles and 16S rRNA gene diversity as revealed by 454-pyrosequencing of the V3-V4 hypervariable region, in the surface layer and at 10 m water depth during June and October 2011.

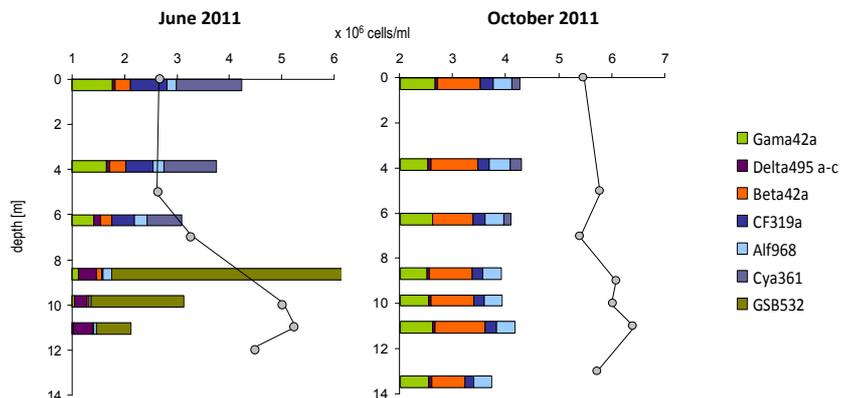


Figure 3: Total Cell Counts (cell/ml) and CARD-FISH results revealing the vertical microbial distribution in Rogoznica lake during June and October 2011. Gama42a – *Gammaproteobacteria*; Beta42a – *Betaproteobacteria*; Delta495 a-c – *Deltaproteobacteria*; CF319a – *Bacteroidetes*; Alf968 – *Alphaproteobacteria*; Cya361 – *Cyanobacteria*; GSB532 – *Chlorobi* ('Green Sulfur Bacteria')

ACKNOWLEDGEMENTS