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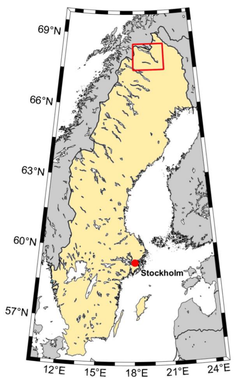
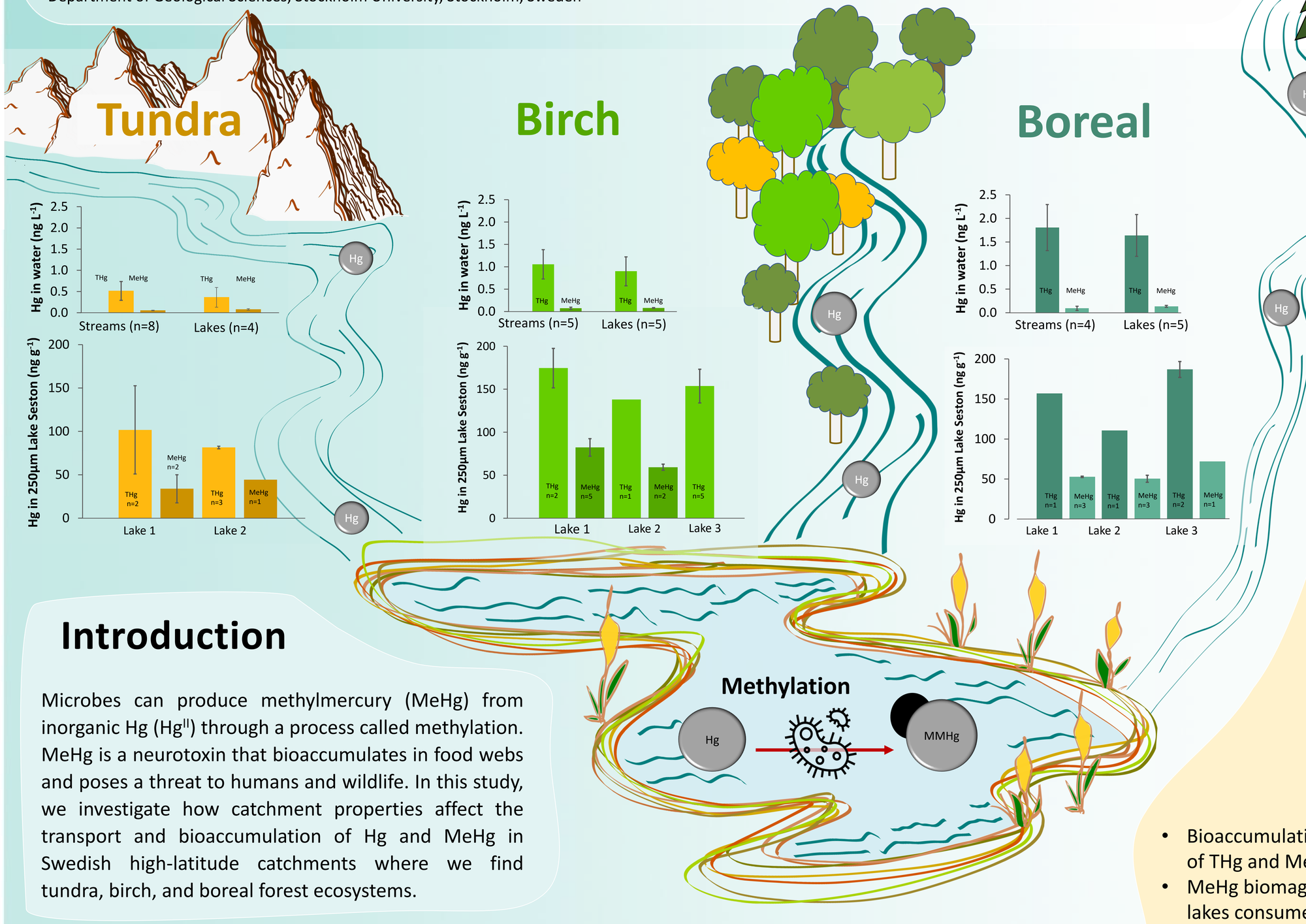


Sonja.Gindorf@aces.su.se

The Role of Catchment Properties for Mercury Transport and Bioaccumulation

Sonja Gindorf[a], Carluvy Baptista-Salazar[a], Van Liem-Nguyen[a], Reiner Giesler[b], Carl-Magnus Mörth[c], Sofi Jonsson[a]

[a] Department of Environmental Sciences, Stockholm University, Stockholm, Sweden
[b] Department of Ecology and Environmental Science, Climate Impacts Research Centre, Umeå University, Umeå, Sweden
[c] Department of Geological Sciences, Stockholm University, Stockholm, Sweden



Introduction

Microbes can produce methylmercury (MeHg) from inorganic Hg (Hg^{II}) through a process called methylation. MeHg is a neurotoxin that bioaccumulates in food webs and poses a threat to humans and wildlife. In this study, we investigate how catchment properties affect the transport and bioaccumulation of Hg and MeHg in Swedish high-latitude catchments where we find tundra, birch, and boreal forest ecosystems.

Bioaccumulation factors

Tundra
THg 4 x 10^5
MeHg 4 x 10^5

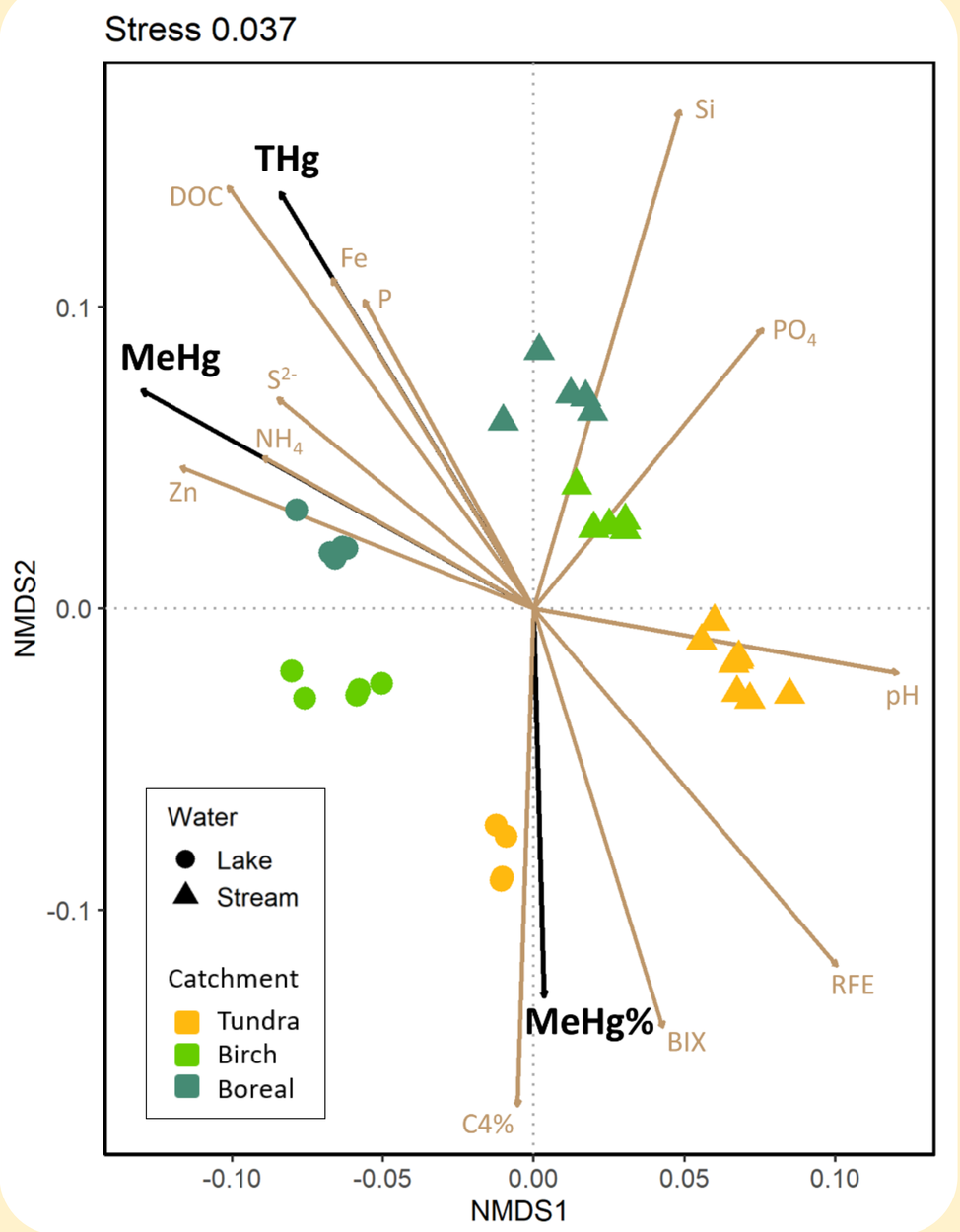
Birch
THg 2 x 10^5
MeHg 11 x 10^5

Boreal
THg 0.8 x 10^5
MeHg 4 x 10^5

- Bioaccumulation factors represent the enrichment of THg and MeHg in seston vs. water
- MeHg biomagnification: in the birch and boreal lakes consumer species might have been collected
- For all catchments bioaccumulation factors are in a similar order of magnitude

Multivariate Analysis

- Water type and catchment system differences are evident in ancillary parameters
- THg, DOC, and Fe levels rank as Boreal > Birch > Tundra in lakes and streams
- Opposing trends of THg and RFE suggest terrestrial matter as the source of aquatic THg
- Lakes exhibit higher MeHg and MeHg%
- MeHg correlates positively with NH_4 which is an indicator for anoxic conditions known to favor microbial methylation[1].
- Sulfide and pH influence MeHg and THg levels via their impact on Hg solubility[2]
- MeHg% positively correlates with C4%, a protein-like component, suggesting increased microbial activity linked to in-situ methylation and elevated aqueous MeHg[3]



BIX Biological Index
C4% % of parafac component 4
MeHg% MeHg fraction of THg in % MeHg% is a proxy for net MeHg formation[4]
DOC Dissolved Organic Carbon
RFE Relative fluorescence efficiency RFE is an indicator of the relative amount of algal over non-algal dissolved organic matter (DOM)5

Fe Iron
Si Silicium
PO_4 Phosphate
P Phosphorous
Zn Zink
NH_4 Ammonium
S^{2-} Sulfide
THg Total Mercury
MeHg Methylmercury

Conclusions

- Our data suggest that in the Tundra lakes in-situ methylation is higher compared to the two catchments with higher terrestrial inputs
- This indicates that despite significantly lower inputs of Hg, biota accumulation at the base of the food web may be highest in the Tundra
- In the Arctic, large quantities of Hg are stored in permafrost soils[6] which are thawing rapidly due to climate change thereby remobilizing Hg
- Our data suggests that catchment properties may play an important role for the transport and bioaccumulation of Hg

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