An ecotoxicological assessment of Lake Mondsee, Austria: a two year survey

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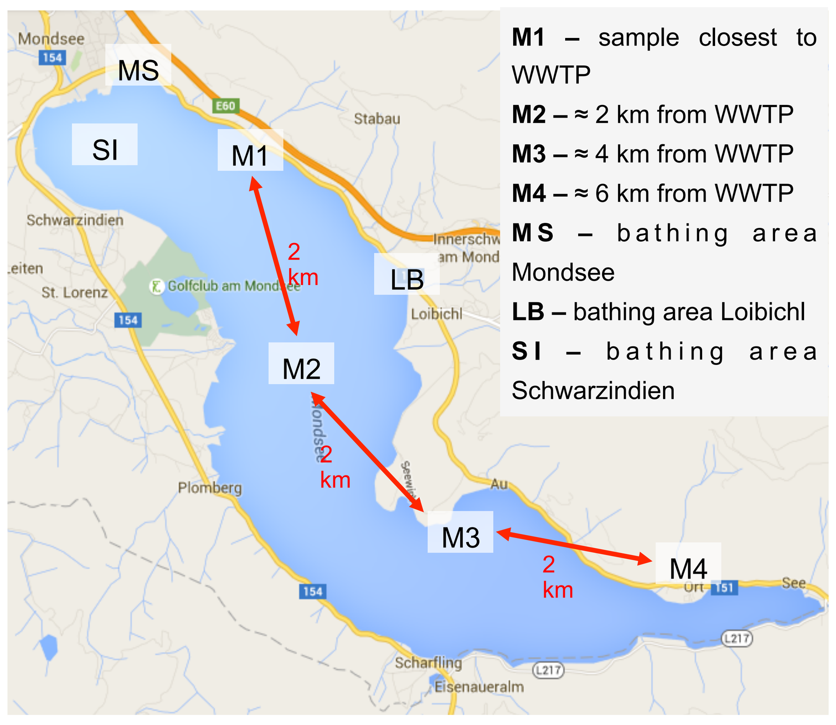
Introduction & Objectives

Lake Mondsee is a recreational area in Austria for both bathing and water activities/sports. Nearby exists a wastewater-treatment plant (WWTP) which can represent a point emission for the lake's contamination, since it receives several discharges.

The overall objective of this study was to perform an ecotoxicological assessment of Lake Mondsee. Water (W) and sediment (S) samples were collected from Lake Mondsee and the reference site, Lake Irrsee, on three different seasons: 1) summer 2015 (preliminary toxicity assessment), 2) spring 2016 (possible best-case scenario, since the lake was frozen for the winter) and 3) summer 2016 (worst-case scenario, tourist activities peak). The Waste Water Treatment Plant (WWTP) inflow (I) and outflow (O), plus pre-thickened (PT) and thickened (T) sludge (SL) were also collected from the WWTP when possible. Filtered W and WWTP samples of each sampling site were also prepared and tested when possible. Therefore, a pre-screening was carried out with the samples collected in Summer 2015 and used to design the new approach for samples collected during Spring and Summer 2016, by increasing the number of bioassays, which included species belonging to different trophic levels.

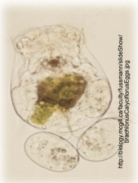
Materials & Methods

LAKE MONDSEE



LAKE IRRSEE

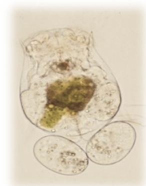
SUMMER 2015 – PRELIMINARY TOXICITY ASSESSMENT



- ***Brachionus calyciflorus*** short-chronic Rotoxkit F test (48 h)
  - W and WWTP samples

- ***Vibrio fischeri* (Microtox)** bacteria bioluminescence inhibition (15')
  - W, WWTP, S & SL samples

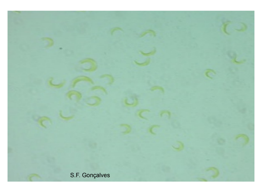
SPRING & SUMMER 2016 – INCREASED ECOTOXICOLOGICAL RELEVANCE



- ***Brachionus calyciflorus*** short-chronic Rotoxkit F test (48 h)
  - W and WWTP samples

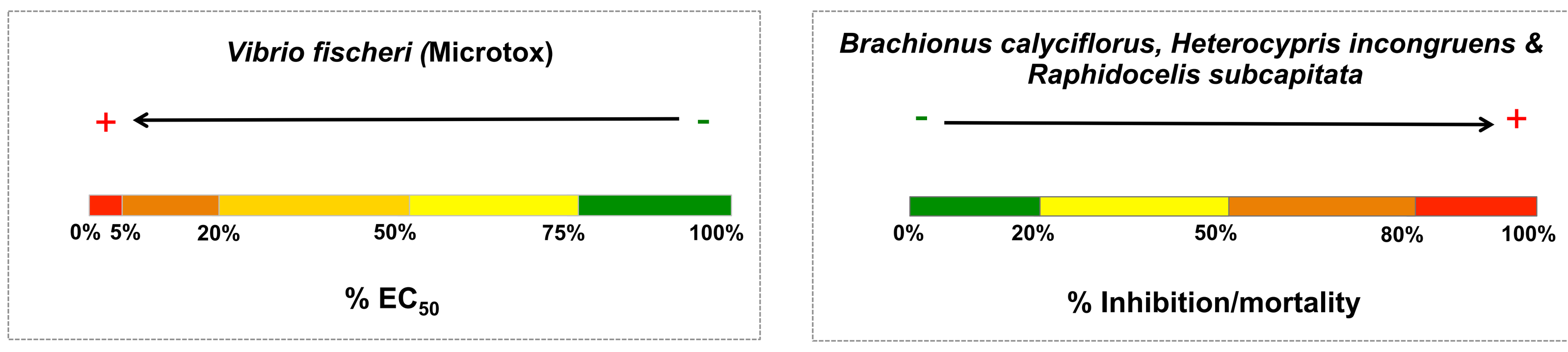
- ***Vibrio fischeri* (Microtox)** bacteria bioluminescence inhibition (15')
  - W, WWTP, S & SL sample

- ***Heterocypris incongruens*** chronic Ostracodkit F test (6 days)
  - S & SL samples



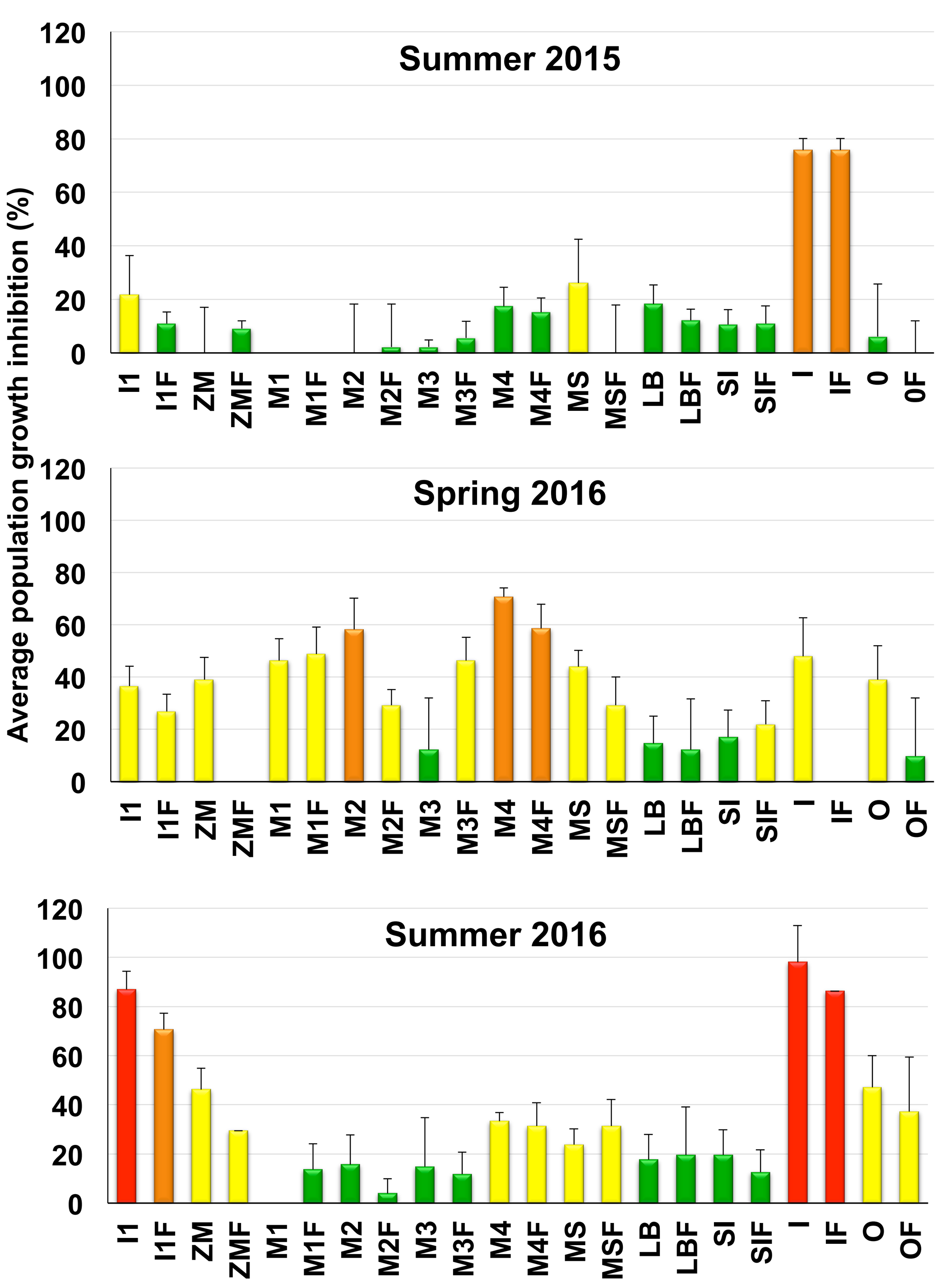
- ***Raphidocelis subcapitata*** growth inhibition test (72 h)
  - W & WWTP Samples

Toxicity categorization



Results

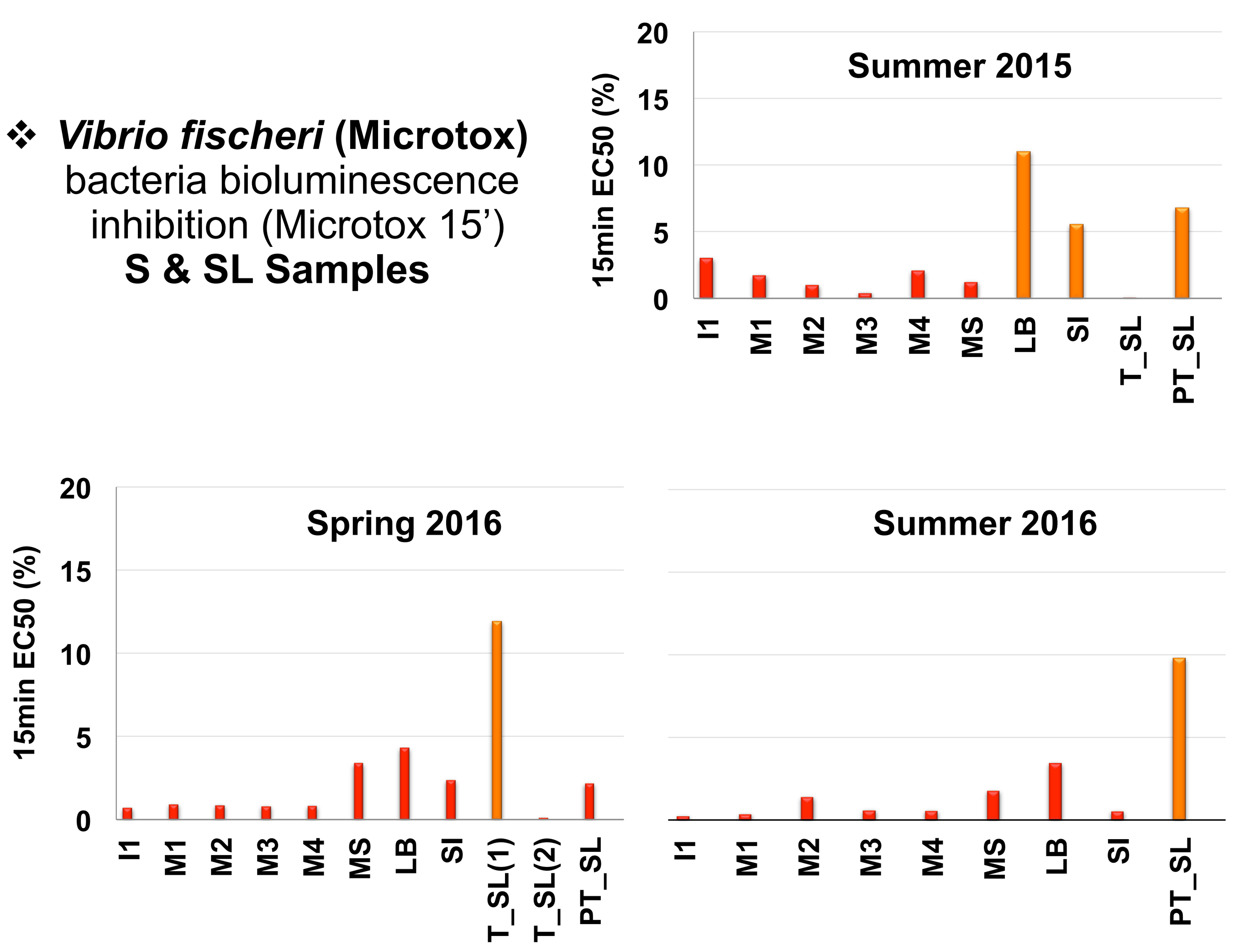
❖ ***Brachionus calyciflorus*** short-chronic Ostracodkit F test (48 h)



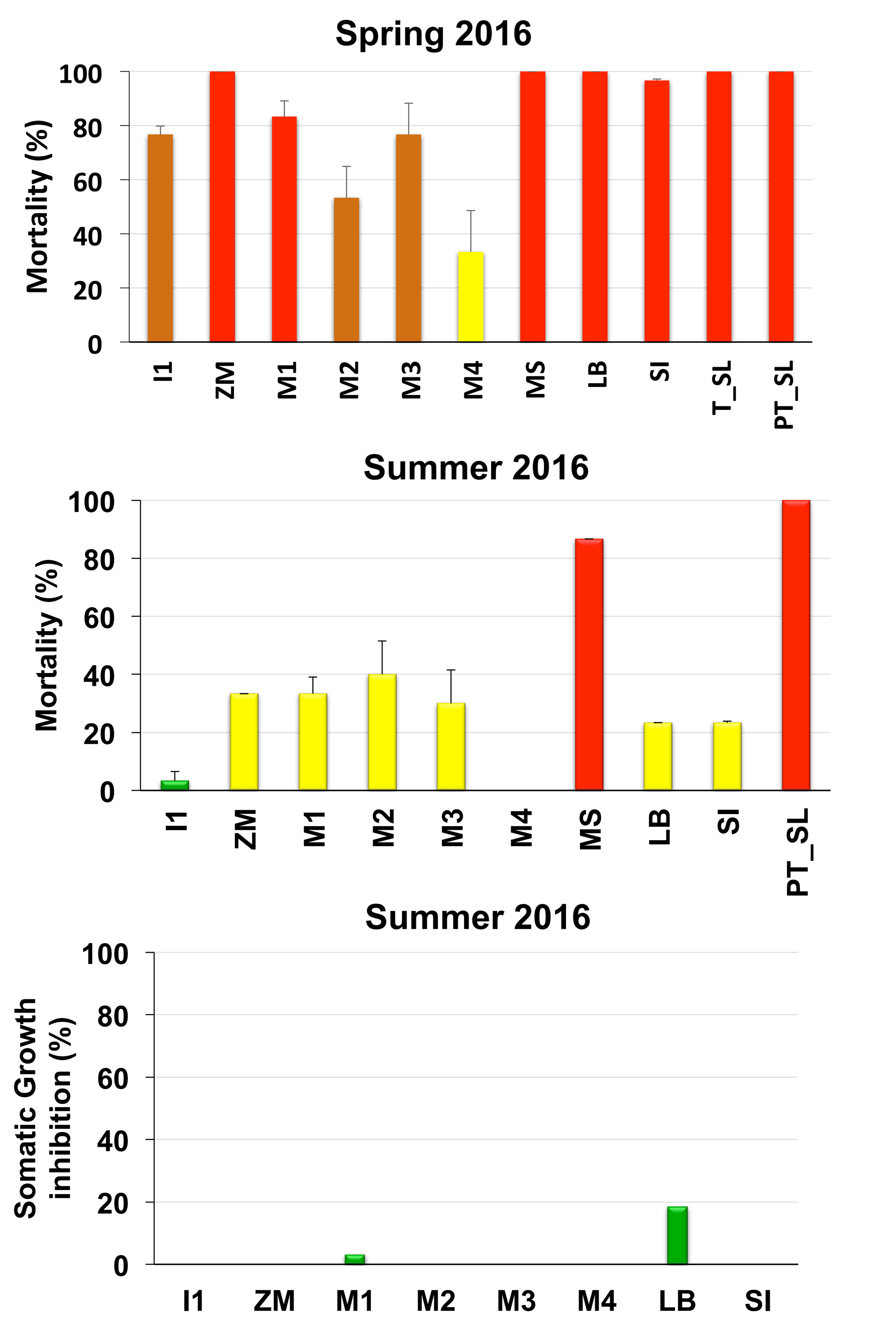
☞ ***Raphidocelis subcapitata*** growth inhibition (72 h) was **< than 30%** for all **W & WWTP Samples** Spring & Summer 2016 campaign).

☞ ***Vibrio fischeri* (Microtox)** bacteria bioluminescence inhibition (15') showed no toxicity for all **W & WWTP samples** and **the ZM S sample** (Summer 2015, Spring & Summer 2016).

❖ ***Vibrio fischeri* (Microtox)** bacteria bioluminescence inhibition (Microtox 15') **S & SL Samples**



❖ ***Heterocypris incongruens*** chronic test (6 days)



Discussion & Conclusions

- The summer 2015 preliminary toxicity assessment, showed low to no toxicity for all W samples & the WWTP O sample, contrary to the S & SL samples that were extremely toxic, except sample ZM. Silver was detected in S samples M1 to 4 - 0.98, 0.1, 0.12 and 0.09 µg/L, respectively, and WWTP samples I & O - 0.59 and 0.21 µg/L, respectively.
- For the Spring 2016 campaign, the average population growth inhibition of *B. calyciflorus* for most W & WWTP samples was between 20 and 50% and no toxicity was observed for *R. subcapitata* and *Vibrio fischeri*, while S & SL were once again extremely toxic (except ZM). Thus, the best-case scenario prediction for this sampling period, since the lakes were frozen for the winter, was rejected.
- For the last campaign (Summer 2016), W samples from I1 and WWTP I sample were highly toxic for *B. calyciflorus*, but no toxicity was observed for *R. subcapitata* and *V. fischeri*. S & SL samples were again extremely toxic to *V. fischeri* (except ZM) but regarding *H. incongruens*, toxicity decreased for most sampling sites. Silver was detected in the WWTP I sample: 0.2 µg/L.
- General conclusions: W & WWTP samples showed lower toxicity levels compared to S & SL for all campaigns, since the S & SL samples were extremely/high toxic to at least one of the sediment bioassay performed); the WWTP's activity must be higher in the summer since I samples showed higher toxicity levels in both summer campaigns; although silver was detected in the I samples for both summer campaigns, other elements must be present and responsible for the toxicity observed.
- Further chemical analysis are necessary to clarify the high toxicity observed in the sediments.

Acknowledgements

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