The effect *of* combined environmental stressors on *Daphnia magna* and *Brachionus calyciflorus*

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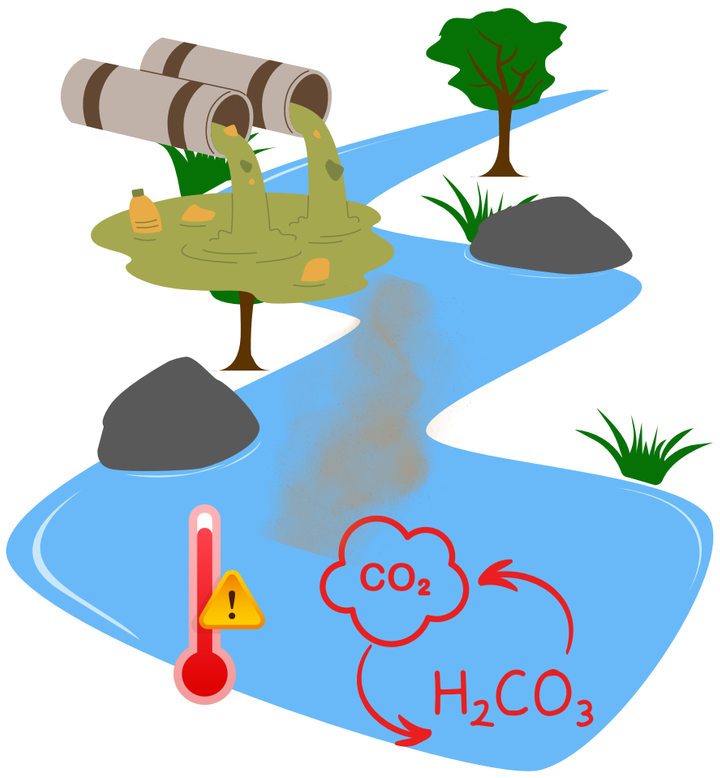
Introduction

Climate change and human activities simultaneously bombard aquatic ecosystems with a multitude of chemical and non-chemical stressors.

Beyond single threats: Traditional research typically examines stressors in isolation, neglecting how they interact to magnify or downplay their impact. Such an approach hinders our understanding of the biggest threats to these vital ecosystems.

Water's delicate balance: Essential factors such as temperature, pH, and conductivity/ salinity become stressors when they deviate from the optimal range for aquatic life.



Objectives

- **To investigate how combinations of non-chemical stressors impact organisms over time during short-term exposures.**
- **The aim is to shed light on the effects of these stressors under realistic, multi-stressor conditions found in natural ecosystems.**

Daphnia magna

Brachionus calyciflorus

Methodology

Temperatures ◦C 15, 20, 25, 30	< 0.5 PSU <1000 µS/cm	0.5 PSU 1000 µS/cm	1 PSU 2000 µS/cm	2.5 PSU 4800 µS/cm	5 PSU 9000 µS/cm
pH 5 MES					
pH 6 MES					
pH 7 MOPS					
pH 8 EPPS					
pH 9 CHES					

EPA Waters	pH	Conductivity µs/cm
Very Soft	6.88	349
Soft	7.55	445
Moderately hard	7.64	457
Hard	8	774
Very Hard	8.45	968

- **Artificially Buffered: Moderately Hard EPA Water +Zwitterionic Good's Buffers+ Artificial Sea water.**
- **EPA Water: Very soft to Very hard with Salinity/Conductivity less than 0.5PSU/~1000 µS/cm.**
- **6 Replicates of each treatment combination and 8 individuals exposed in each replicate.**
- **Water Quality Parameters were monitored at beginning (0hr) and at the end (48hr) of the test.**
- **Endpoint: Mortality (Observed every 12hr)**

Results

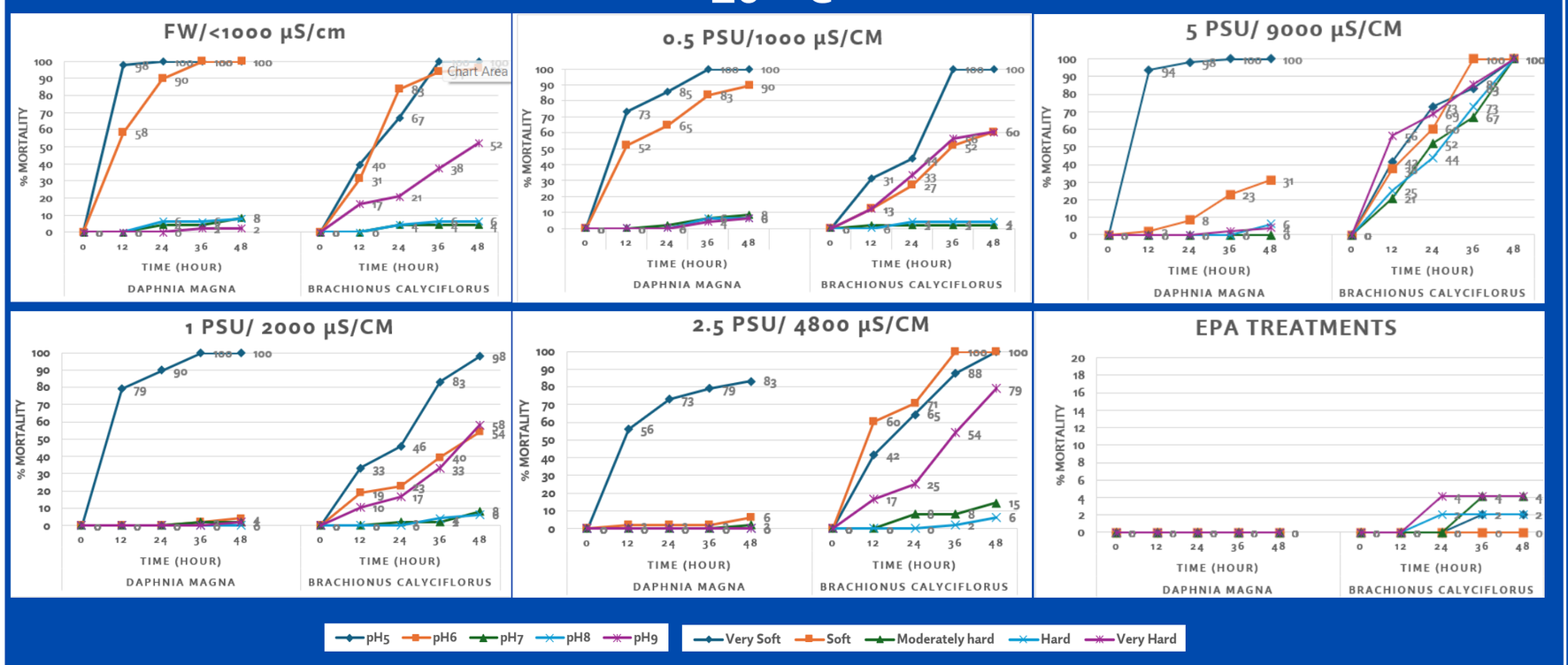


Fig.1.: % Mortality as function of time for various pH and Salinity/Conductivity treatments and EPA treatments at 20 ◦ C showing difference in mortality pattern in buffered solutions

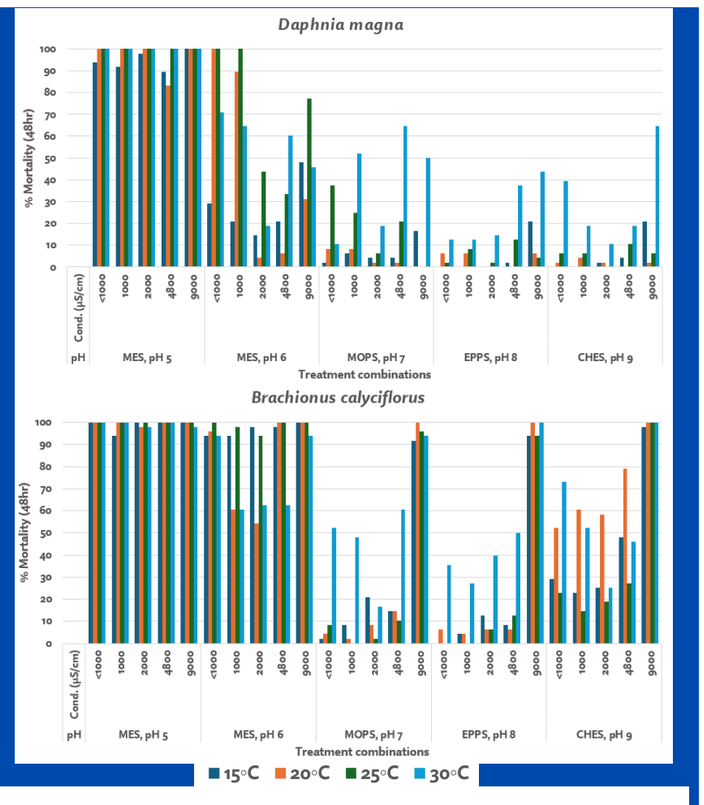


Fig.2.: % Mortality at 48 hr. for both the organisms with respect to various treatment combinations

Conclusion

- **Rotifer species *Brachionus calyciflorus* shows higher sensitivity at most combinations as compared to *Daphnia magna*.**
- **Zwitterionic buffers themselves exert toxicity towards both organisms**
- **Mortality seen at temperatures other than suitable ranges could also be due to heat shock treatment.**

What next?

- **Developing better methodology than Good's buffering system to replicate ecologically relevant scenarios.**
- **Chronic test for better understanding of organisms' adaptations and response.**
- **Gradual temperature increase instead of heat shock**
- **Extend the approach to chronic studies with a suite of organisms, including chemical stressors.**

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