# Copper toxicity in mussels: do salinity, organic matter and population history matter?

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Salinity and dissolved organic carbon (DOC) are two abiotic variables that can alter Cu toxicity to marine organisms due to complexation, speciation and ion activity. In this study the sublethal effects of prolonged Cu exposure on juvenile transformed *Mytilus edulis* were assessed under different conditions of salinity and DOC in 2 populations (North Sea (NS) and Bothnian Sea (BS)).

First, separate experiments were set up for each population. Mussels acclimated to 5 salinities were exposed for 2 weeks to 18 different salinity/DOC/Cu combinations, according to a central composite design. At the end of the exposure the clearance rate (CR), oxygen consumption ($VO_2$) and condition index (CI) were measured. Next, both populations were simultaneously assessed. Now DOC was not varied and salinity was identical for the two populations.

For the NS population, no effect of salinity on the CR was observed. An increase in DOC slightly increased the control CR, but the interaction with Cu was marginal. No DOC effect on CR was observed in the BS population. However, salinity had a strong positive effect, increasing control CR without altering Cu toxicity. In the NS population, $VO_2$ slightly increased with increasing DOC without interaction with Cu. An increase in salinity increased control $VO_2$ in NS mussels, but in combination with Cu this resulted in a faster $VO_2$ decline. The effect of salinity was more pronounced in the BS population: an increase in salinity increased the control $VO_2$ without interaction with Cu. An increase in DOC decreased the control $VO_2$ with little influence on Cu toxicity in the BS mussels. Salinity and DOC did not affect the CI in either population. The simultaneous experiment yielded similar results.

*M. edulis* from the BS population live near the edge of the salinity tolerance range. Increasing metabolic activity with increasing salinity demonstrates that under natural conditions this population experiences salinity stress. Nevertheless, when corrected for this change in baseline metabolism, BS mussels are as (or less) sensitive than NS mussels. Contrary to what was expected based on speciation and complexation chemistry, an increase in DOC or salinity did not, or only slightly, decrease the sensitivity to dissolved Cu. Therefore it seems that free Cu ions are not the only toxic Cu species and Cu-DOC complexes might be available for uptake by the mussel. This indicates that the current BLM concept is not applicable to *M. edulis* for the measured endpoints.