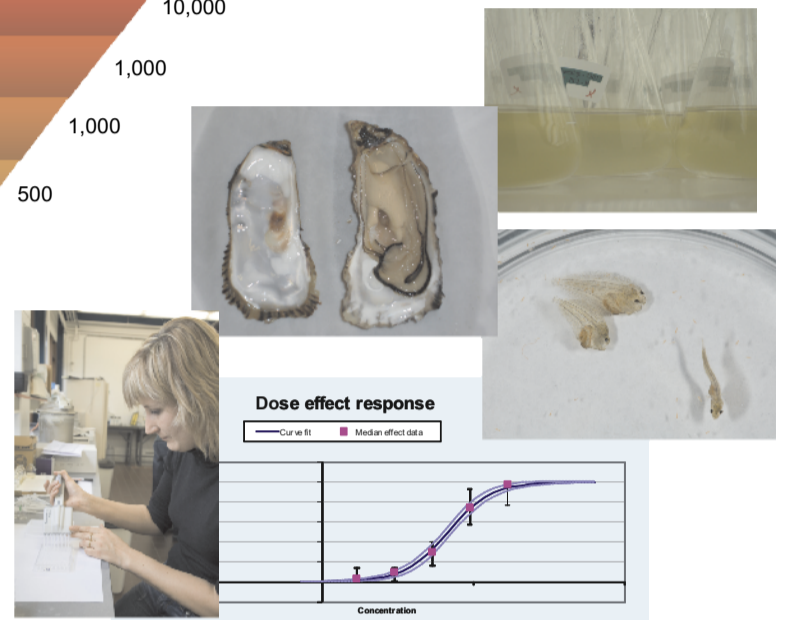
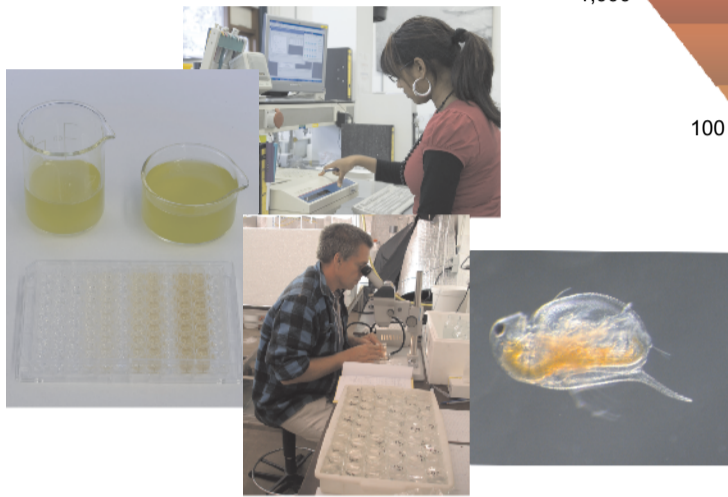
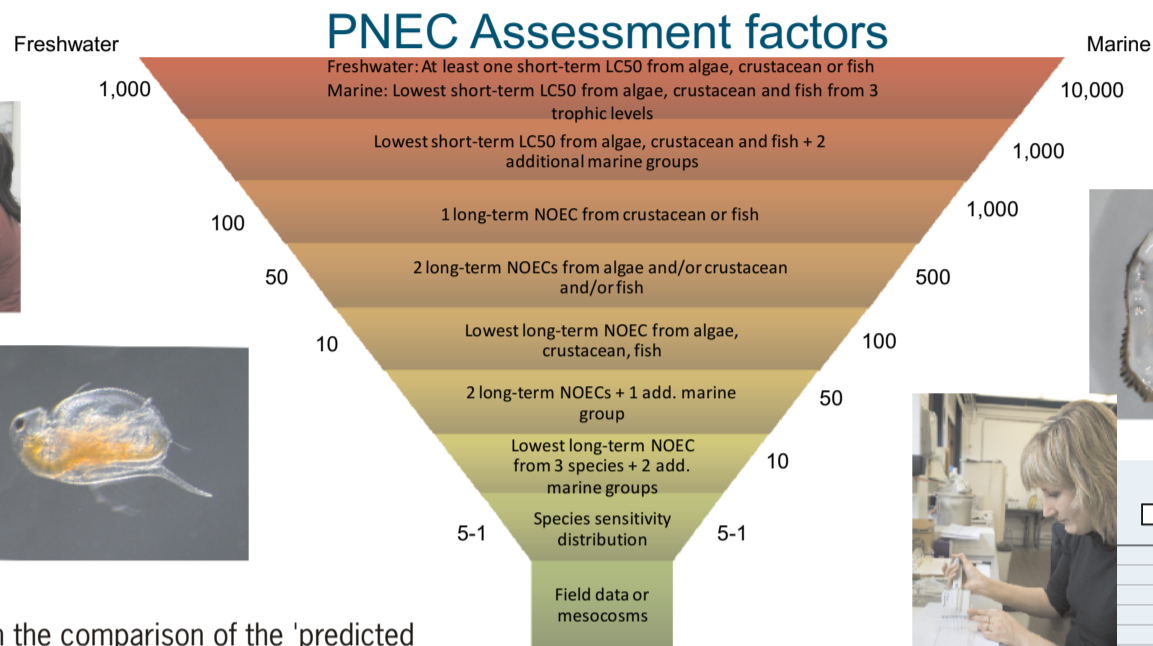




# The Use of Mesocosms in Risk Assessment of Active Substances in Ballast Water Treatment

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**Basic risk assessment** is based upon the comparison of the 'predicted environmental concentrations' (PEC), with the 'predicted no adverse effect concentration' (PNEC). Uncertainties related to the extrapolation of single-species laboratory data to multi-species ecosystems are addressed by assessment factors to calculate a PNEC. In order to address the higher diversity in marine ecosystems, assessment factors are more conservative. Assessment factors can be reduced by increasing data quality.

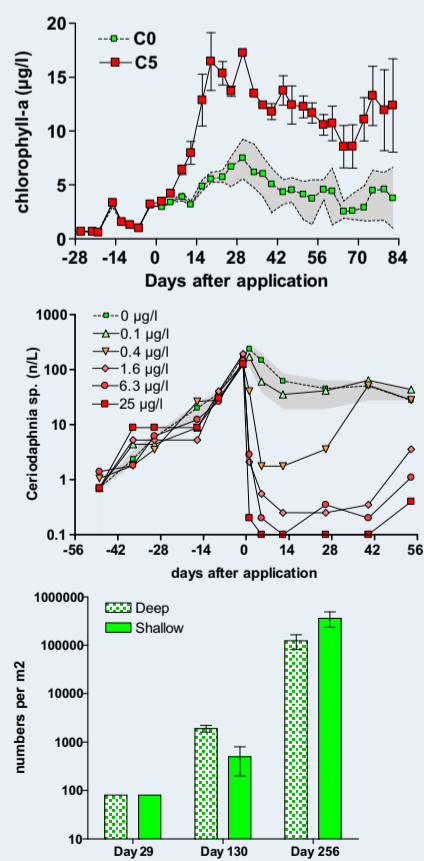
Active substances used in ballast water treatment are typically chemicals with a very short residence time. Chronic laboratory tests are not appropriate to study the toxicity for such compounds.



**Mesocosms** (experimental ecosystems) enable integrated testing of the effects caused by an active substance in a freshwater or marine community, including the benthic compartment. Organisms from different taxonomic and functional groups are exposed simultaneously under realistic environmental conditions and exposure regimes. This allows for the assessment of direct and indirect toxic effect on a suit of interacting organisms (the ecosystem), including recovery of the community after the toxic stress has disappeared.

**Conclusions:** Mesocosms can be a valuable tool for ecological risk assessment of active substances used in the treatment of ballast water. In accordance with pesticide regulations, the NOEAEC (No Observed Ecological Adverse Effect Concentration) can be applied as PNEC, without additional assessment factor.

Further research is needed to develop guidance on the direct assessment of ecological risks of treated ballast water in order to distinguish between toxic effects and dilution effects in the mesocosms.



Impact of constant exposure to a toxicant on the phytoplankton development in marine mesocosms. Presented are the average values of the triplicated treatments. The gray field indicates the range of the observations in the control mesocosms.

Impact of a single application (on day 0) of a rapid degradable insecticide in freshwater mesocosms on a zooplankton group. Presented are the average values of the duplicated treatments. The gray field indicates the range of the observations in the triplicated control (0 µg/l) mesocosms. Treatment level 0.1 µg/l has no impact, treatments 0.4 µg/l shows severe impact with recovery after 40 days. Higher treatment levels show indication of recovery at the end of the study. Example from a mesocosm study conducted in 2000 by IMARES

Average number of mudshrimps (*Corophium volutator*) based upon sampling of two mesocosms per treatment on April 21<sup>st</sup>, 2008 and August 25<sup>th</sup>, 2008. The animals were introduced on January 11<sup>th</sup>, 2008 (day 29). In each mesocosm two 30 cm<sup>2</sup> subsamples of the sediment were taken.