Effect factors for saltwater toxicity compared to freshwater toxicity and its statistical uncertainties

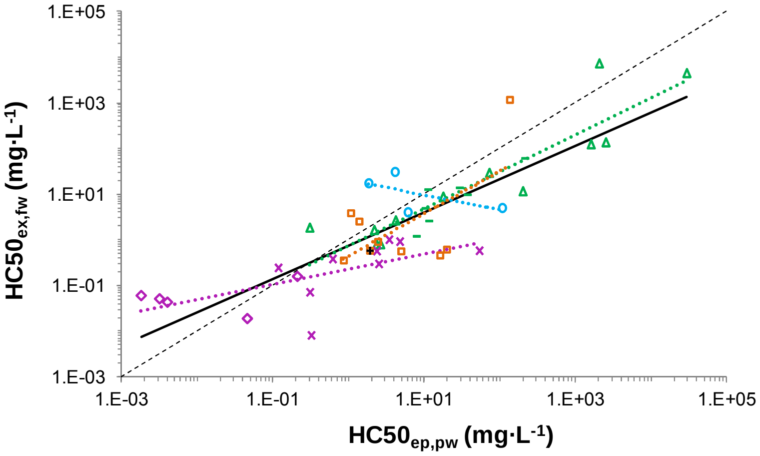
Level:	Bachelor or Master
Start:	Anytime
Project duration:	3 or 6 months
Project form:	Data collection and modeling
Supervision:	Rosalie van Zelm

Background and short content of the project

In contrast to the substantial quantity of information available on the ecotoxicity of chemical substances to freshwater organisms, there are relatively few data on the effects of many such substances to marine and estuarine organisms. Therefore, several researches focused on the extrapolation of freshwater toxicity data to saltwater data in the context of risk assessment (e.g. Hutchinson et al. 1998, Leung et al. 2001, Maltby et al. 2005, Wheeler et al. 2002, Wheeler et al. 2014). The various studies compared HC5 values for up to 21 substances and reported that in most cases freshwater test results are broadly predictive (within a factor of approximately 10) of effects on saltwater. Within a life cycle context, where averages rather than risk limits are used to create a basis of comparison, no research was done on the comparison between saltwater and freshwater toxicity.

The aim of this internship will therefore be to create a database for saltwater toxicity and compare the environmental concentration of a chemical that is toxic to 50% of all species (HC50) to the HC50 of freshwater species. Moreover, we will include the uncertainty related to the HC50, which was done before for terrestrial ecotoxicity (Golsteijn et al. 2013)

Figure 1: Hazardous porewater concentrations (HC50ep,pw) versus hazardous freshwater concentrations (HC50ex,fw), for an oxidative uncoupler (black +), nonpolar narcotic chemicals (green Δ), polar narcotic chemicals (green -), reactive chemicals (blue o), AChE agents (purple X), cyclodiene type neurotoxicants (purple ◊), and herbicides-fungicides (orange □). The dashed line indicates the 1:1 relation, the coloured dotted lines show the log-linear fits for narcotics, reactive chemicals, neurotoxicants and herbicides-fungicides, and the black line shows the log-linear fit for all data (Golsteijn et al. 2013).



A master internship will go beyond a bachelor internship with the following:

- Inclusion of more chemicals
- More additional analyses to the data, e.g. on chemical class level, species level
- A more thorough uncertainty analysis
- The writing of a scientific publication

Literature

Golsteijn L., Van Zelm R, Hendriks A.J., Huijbregts M.A.J. 2013. Statistical uncertainty in hazardous terrestrial concentrations estimated with aquatic ecotoxicity data. Chemosphere, 93(2): 366-372.

Hutchinson TH, Scholz N, Guhl W. 1998. Analysis of the ecetoc aquatic toxicity (EAT) database IV — Comparative toxicity of chemical substances to freshwater versus saltwater organisms. Chemosphere 36 (1): 143-153

Maltby L, Blake N, Brock TCM, Van den Brink PJ. 2005. Insecticide species sensitivity distributions: Importance of test species selection and relevance to aquatic ecosystems. Environmental Toxicology and Chemistry 24 (2): 379–388.

Leung KMY, Morritt D, Wheeler JR, Whitehouse P, Sorokin N, Toy R, Holt M, Crane M. 2001. Can saltwater toxicity be predicted from freshwater data? Mar Pollut Bull 42:1007–1013.

Wheeler JR, Leung KMY, Morritt D, Sorokin N, Rogers H, Toy R, Holt M, Whitehouse P, Crane M. 2002. Freshwater to saltwater toxicity extrapolation using species sensitivity distributions. Environ Toxicol Chem 21:2459–2467.

Wheeler JR, Maynard SK, Crane M. 2014. Are acute and chronic saltwater fish studies required for plant protection and biocidal product active substance risk assessment? Environmental Toxicology and Chemistry 33 (3): 703–707.