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Can freshwater toxicity models (FIAM and BLM) be applicable to marine ecosystem?

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Introduction

- Predictive models for metal ecotoxicity such as Biotic Ligand Models (BLM) or Free Ion Activity Models (FIAM) are scarce for saltwater organisms.
- Metal uptake rates by saltwater organisms are comparable to those of freshwater (FW) organisms, while several studies reported higher sensitivities of saltwater (SW) organisms to toxic metals.
- In hypothesis, the difference of toxicity may be caused by difference in ionic strength of saltwater when compared with freshwater.

The aim of this work is to test the applicability of freshwater FIAMs and BLMs to predict ecotoxicity of copper to saltwater organisms.



culated with extrapolated BLM for saltwater fish.

BLM predicted saltwater fish $[Cu^{2+}]_{EC50}$ values shows up to .5 orders of magnitude difference with empirical data.

culated with BLM for saltwater crustacean.

Within a narrow range of test media, BLM predicted a narrow range of $[Cu^{2+}]_{EC50}$ for crustacean, while empirical data gives a much wider range up to 4 orders of magnitude difference.





- freshwater organisms.
- tivities of freshwater and saltwater organisms are the same).

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Fig.3 [Cu²⁺]_{EC50} predicted with FIAMs and BLMs as affected by ionic strength.

- Copper ecotoxicity for saltwater organisms is 2 orders of magnitude lower than for

- A good correlation is obtained between freshwater FIAM geomeans and BLMs.

Interestingly, a good correlation is observed between saltwater FIAM geomeans, and BLM predicted saltwater organisms $[Cu^{2+}]_{EC50}$ (assuming that intrinsic sensi-

Comparison of freshwater FIAMs and saltwater FIAMs

Acute total-metal based Cu EC_{50} (mortality) and media composition for various saltwater fish and crustaceans are obtained from literature. Speciation modeling (WHAM 6.0) is done to derive $[Cu^{2+}]_{EC50}$. Results are compared with FIAMs derived for freshwater fish (F. minnow) and crusta $cean (D. magna)^{1}$.

Comparison of freshwater BLMs and extrapolated saltwater **BLMs**

Published BLMs for freshwater fish $(P. promelas)^2$ and crustacean (D. magna)³ are used to calculate $[Cu^{2+}]_{EC50}$. These models are also employed to calculate theoretical $[Cu^{2+}]_{EC50}$ for various saltwater fish and crustaceans, taking differences in ionic strength into account.





Method

References

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