

UNIVERSITEIT GENT

ONDERZOEKSGROEP MILIEUTOXICOLOGIE BIOMATH

## Understanding copper effects on the functioning of aquatic ecosystems

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## Problem and goals

- ✓ Ecological Effects Assessment

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## Problem and goals

- ✓ Current solution: based on single species toxicity

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## Problem and goals

- ✓ Current solution: based on single species toxicity...
- ✓ ...extrapolated with Species Sensitivity Distribution

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## Problem and goals

- ✓ **Goal:** examine influence of chosen ECx / percentile on protective capabilities of the SSD approach for an ecosystem function in a shallow pond
- ✓ Ecosystem function: photosynthesis

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## Methods: control data

- ✓ Optimal parameter values for control data

Calibration: Loehle (1997), Ecol Model, 97: 183

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## Methods: exposure data

- ✓ Recalibration of the model at different exposure concentrations, only adapting...
- ✓ ...a subset of parameters:
  - ✓ maximum ingestion and mortality rate of zooplankton
  - ✓ maximum photosynthesis rate of micro-algae
  - ✓ maximum photosynthesis and mortality rate of macrophyte
- ✓ Rest of parameters constant

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## Methods: exposure data

✓ Optimal subset parameter values for exposure data

Cu <sub>diss</sub> (µg/L)	Maximum ingestion rate (1/d)				Maximum photosynthesis rate (1/d)			Mortality rate (1/d)		
	Copepod	Cladoceran	Rotifer	Diatom	Green	E. densa	Copepod	Cladoceran	Rotifer	E. densa
5	1.2	2.0	3.0	3.0	2.3	0.5	0.06	0.02	0.10	0.001
10	1.2	2.0	2.5	2.5	2.0	0.5	0.06	0.01	0.12	0.001
...	...	...	...	...	...	...	...	...	...	...
160	0.9	0	0	0.5	1.1	0.1	0.12	0.20	0.30	0.030

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## Methods: exposure data

- ✓ Yields concentration - effect data
- ✓ Which can be fitted to common logistic equations
- ✓ Equations proved significant (p < 0.05), except for rotifers
- ✓ Derivation of EC<sub>15</sub>, EC<sub>20</sub>, ... EC<sub>50</sub>

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## Methods

✓ Example: Green algae biomass concentration: calibration results:

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## Methods

✓ Different combinations of ECx's and percentiles

Different copper concentrations

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## Methods

- ✓ Different ECx, Hcy combinations...
- ✓ ...yield different copper concentrations...
- ✓ ...at which ecosystem photosynthesis can be simulated

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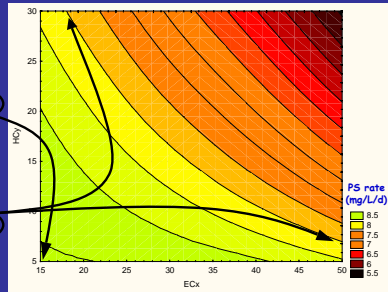
## Results: photosynthesis

✓ Reference situation:  
between 8 and 9  
mg/L/d

✓ Current combinations

✓ Alternatives for  
current combinations?

✓ Benchmark  
combinations?



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## Discussion

- ✓ SSD based on low effect levels  
...overprotective for function  
...in the ecosystem under study
- ✓ Supports redundancy hypothesis
- ✓ Minor influence of chosen percentile when low  
EC<sub>x</sub>'s

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## Further research

- ✓ Other types of ecosystems? More trophic  
levels?
- ✓ Other substances?
- ✓ Other functions?

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