

Is the avoidance behavior to contamination a sensitive and environmentally protective endpoint? A review with three model contaminants: copper, glyphosate and silver nanoparticles



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Principal Conclusion:

The data of the three assessed contaminants (copper, glyphosate and Ag-NPs) showed that avoidance can be considered as a very sensitive response, even when compared with the most traditional endpoints

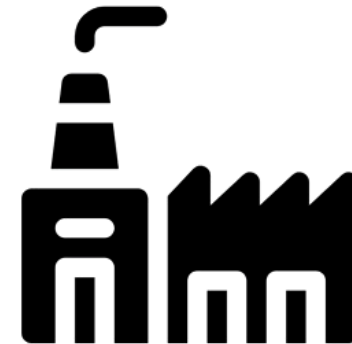


Ecotoxicological Tests



In the first decades, the search for the most sensitive species led researchers to test a high number of species from different:

- biological groups,
- trophic levels and
- geographic distribution



Standard test procedures



Environmental Risk Assessments (ERAs)



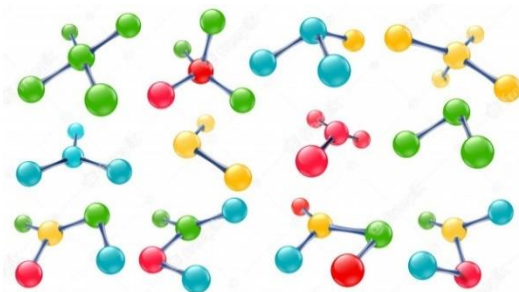
- easy and cheap
- simple and practical

New perspectives

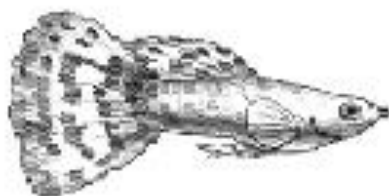


- development of the molecular biology

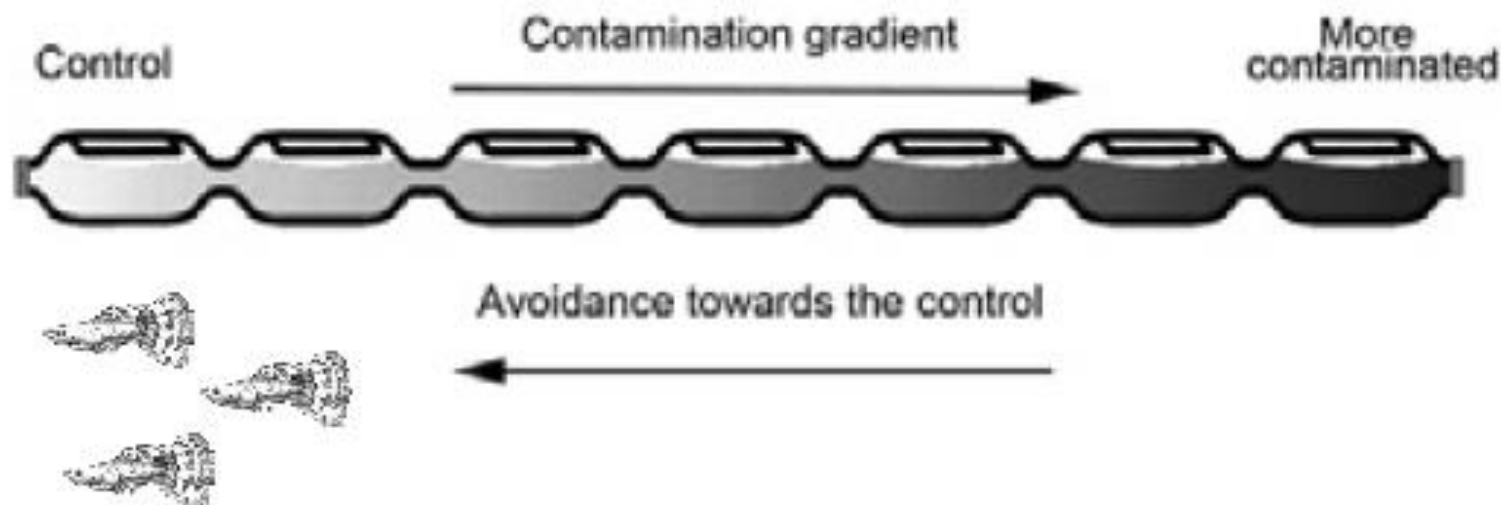
- higher integration of ecological concepts
(since a perspective of ecosystem structure
and functioning)



Environmental Heterogeneity Method



AVOIDANCE ASSAYS NON-FORCED EXPOSURE

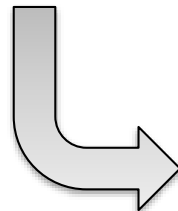


Goals

Assess **how sensitive** is the **avoidance** response measured in **MULTI-COMPARTMENTED exposure systems** in comparison with **different toxic responses** used in ecotoxicology from **FORCED EXPOSURE EXPERIMENTS**



Sensitivity profile by biological groups (SPBG)



copper, glyphosate and silver nanoparticles – Ag-NPs)



**Widely used
contaminants**

Goals

We assessed if:

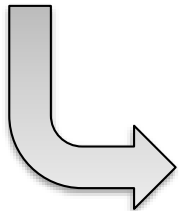
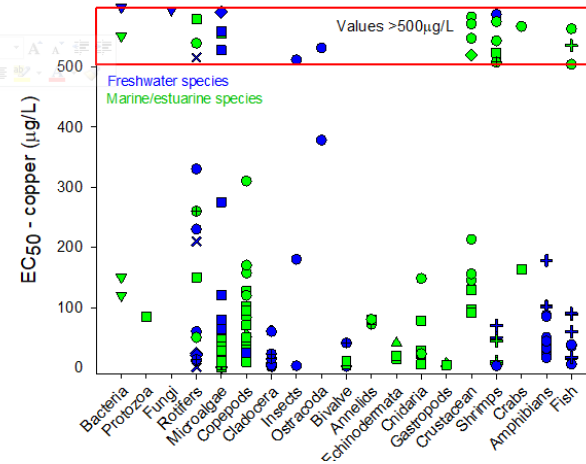
The concentrations that trigger an avoidance response to 50% of the population (**AC₅₀**)

will be among the responses that are expected to occur at

Concentrations considered **hazardous for 5%** of the species based on **Species Sensitive Distribution (SSD)**



SPBG



- Response sensitivity
- Different biological groups
- Most suitable endpoints for certain compounds



EC50

SPBG



Classification of the effect

Mortality/Immobilization

Biochemical

Physiological

Feeding

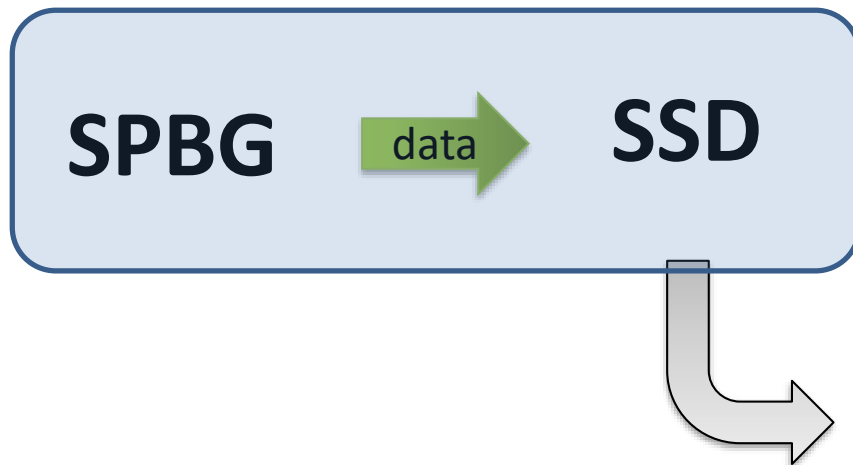
Growth/Reproduction

Morphological

Behavioral

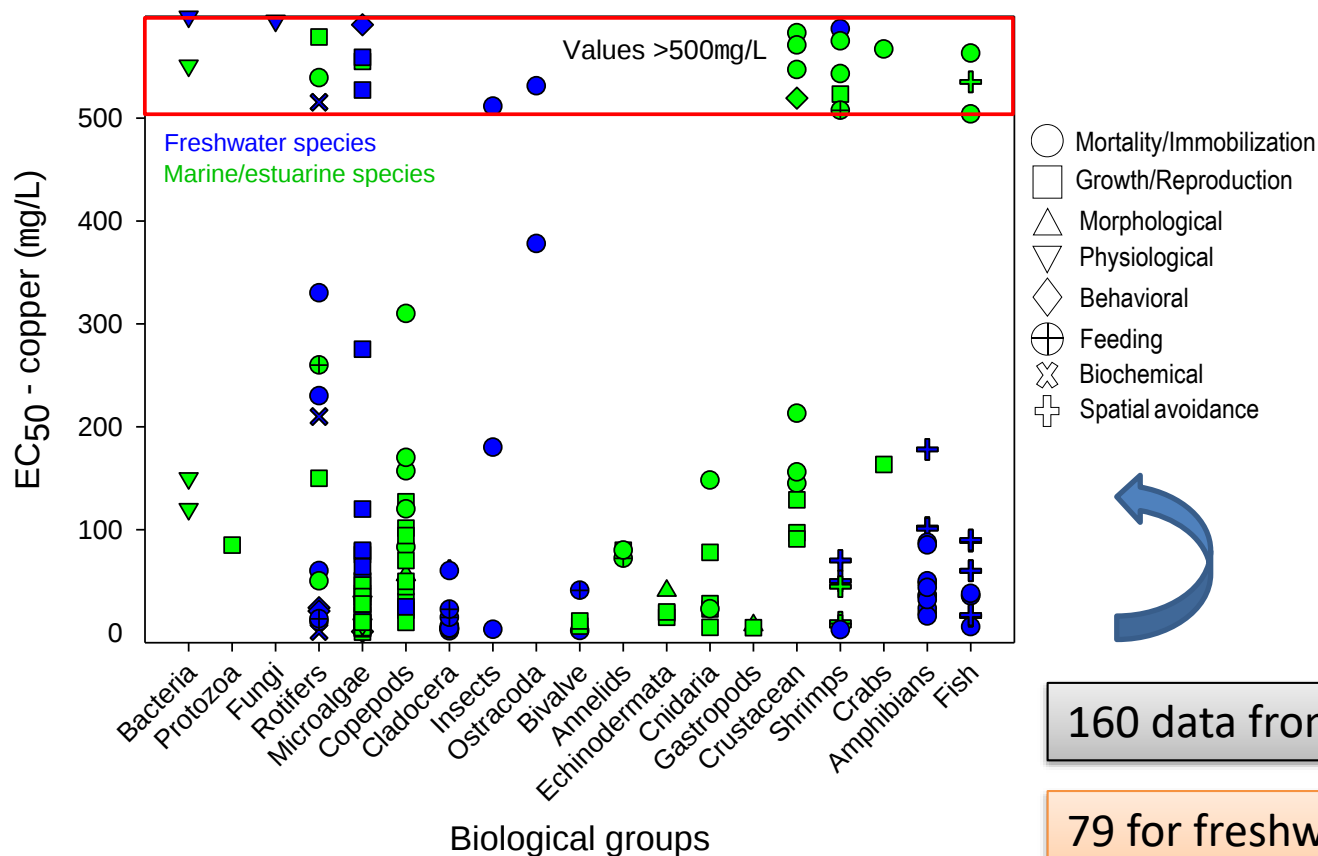
Spatial avoidance

SSD



- the hazard concentration for 5% of the species (HC_5) was calculated
- Compare AC_{50} with HC_5

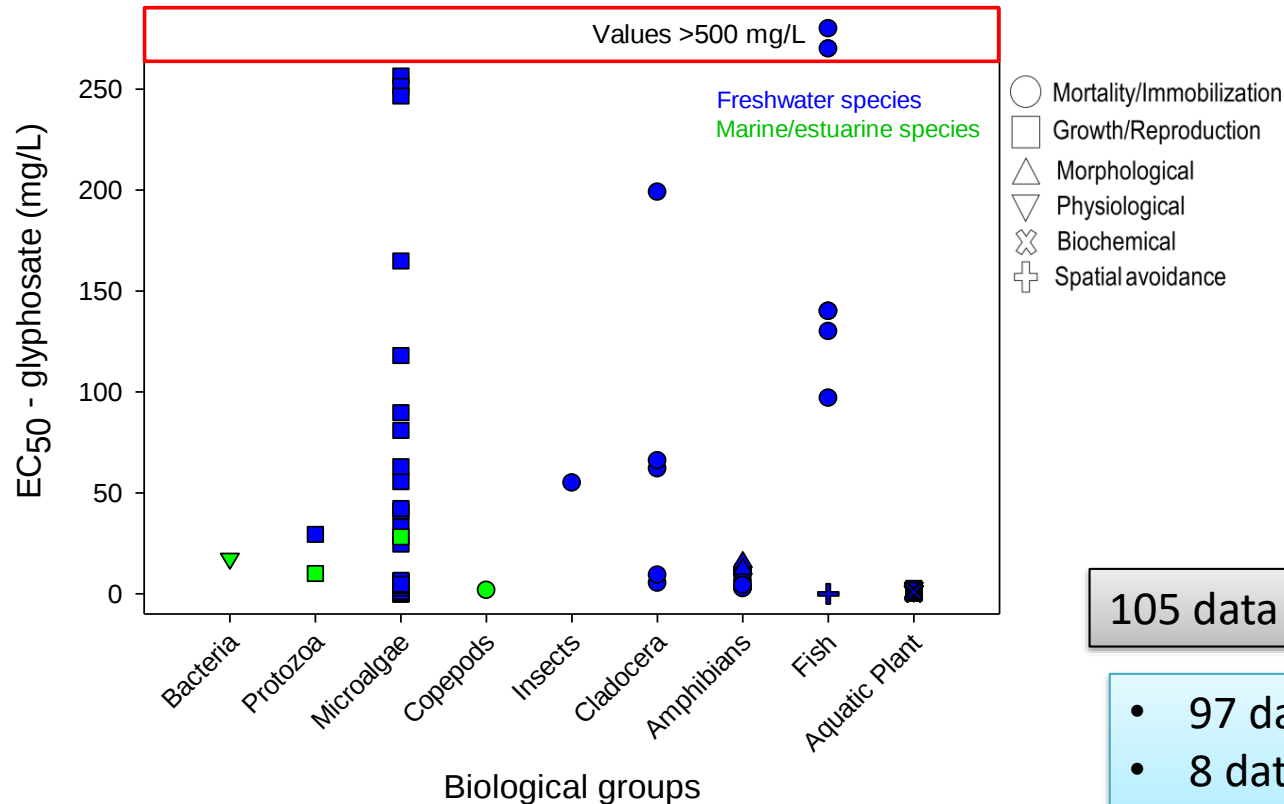
COPPER SPBG



160 data from 19 biological groups

79 for freshwater species
81 for marine/estuarine species

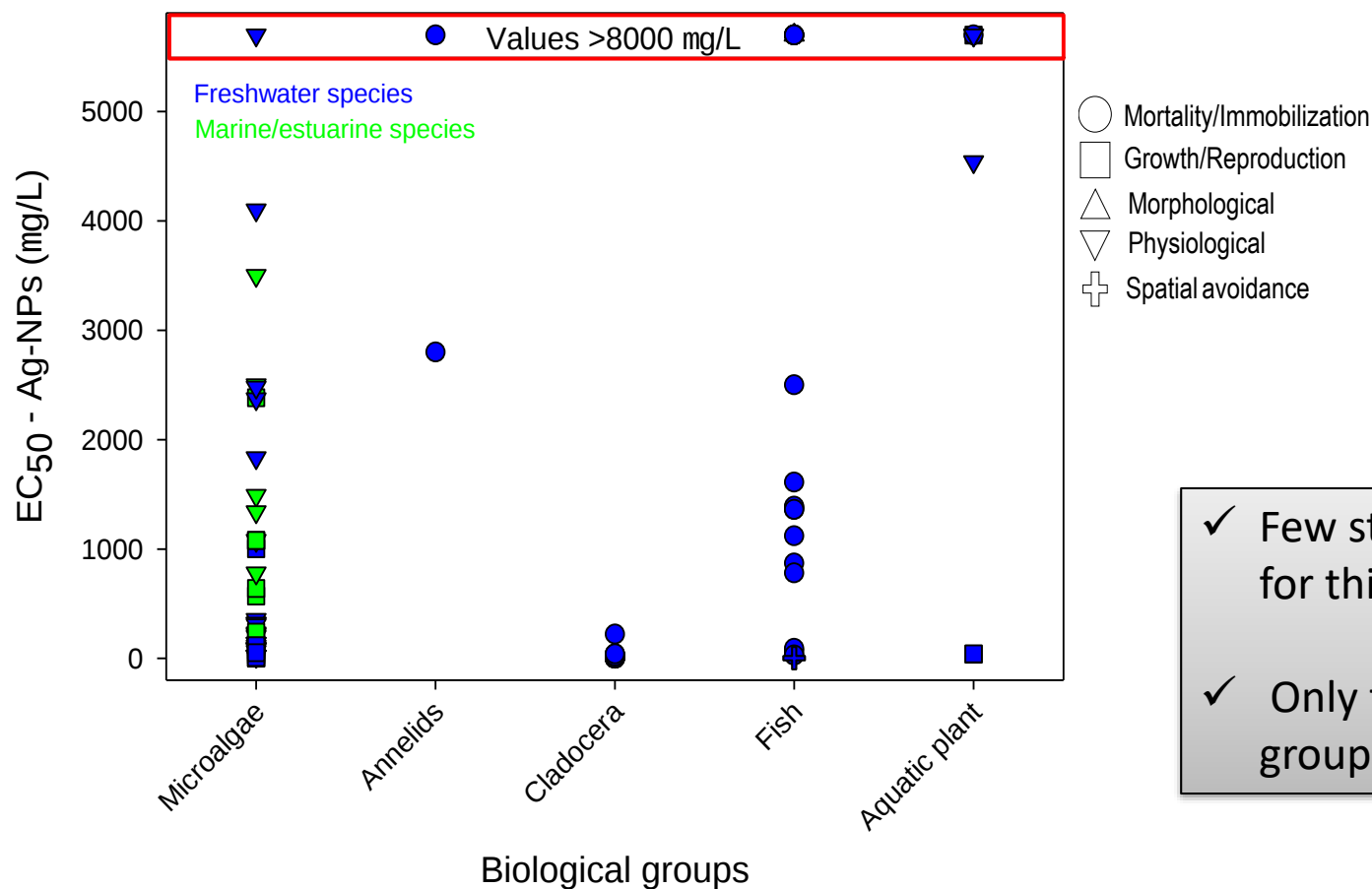
Glyphosate SPBG



105 data from 9 biological groups

- 97 data from freshwater;
- 8 data were used for estuarine/marine species

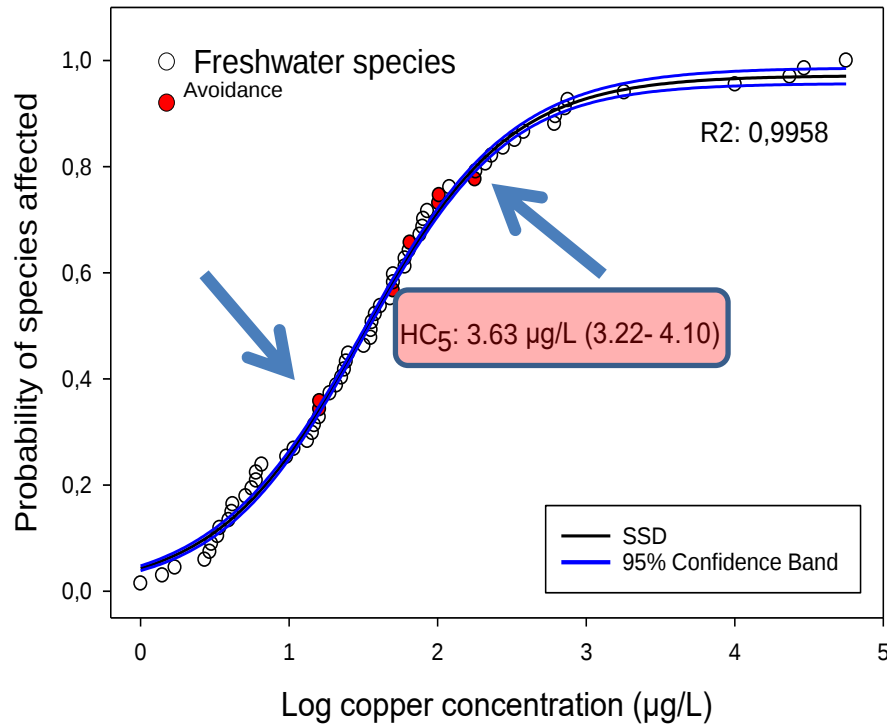
Silver Nanoparticles SPBG



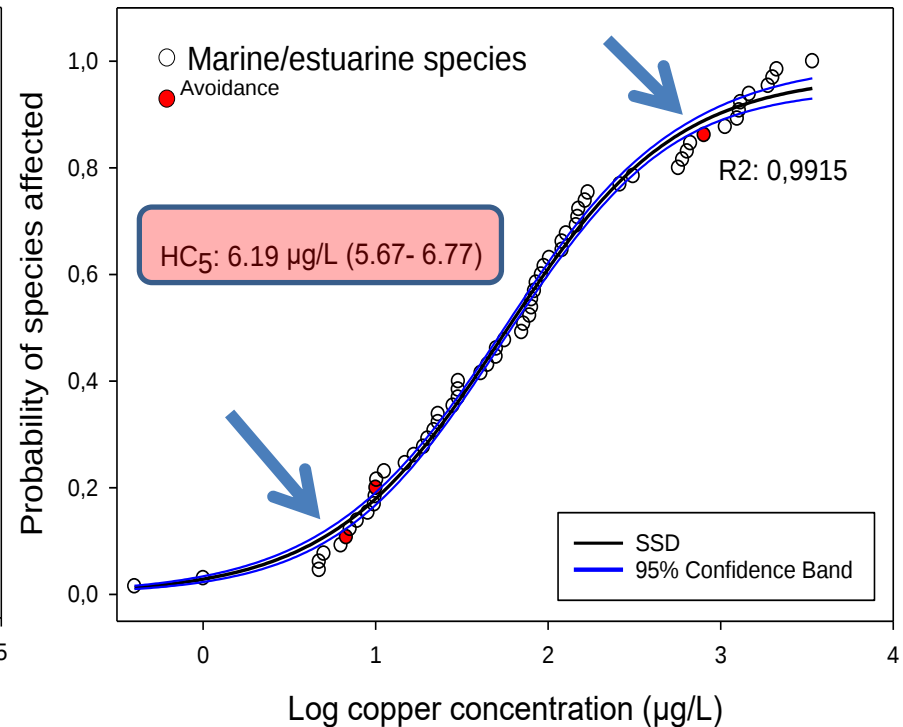
- ✓ Few studies were found for this contaminant.
- ✓ Only five biological groups

COPPER SSG

A



B

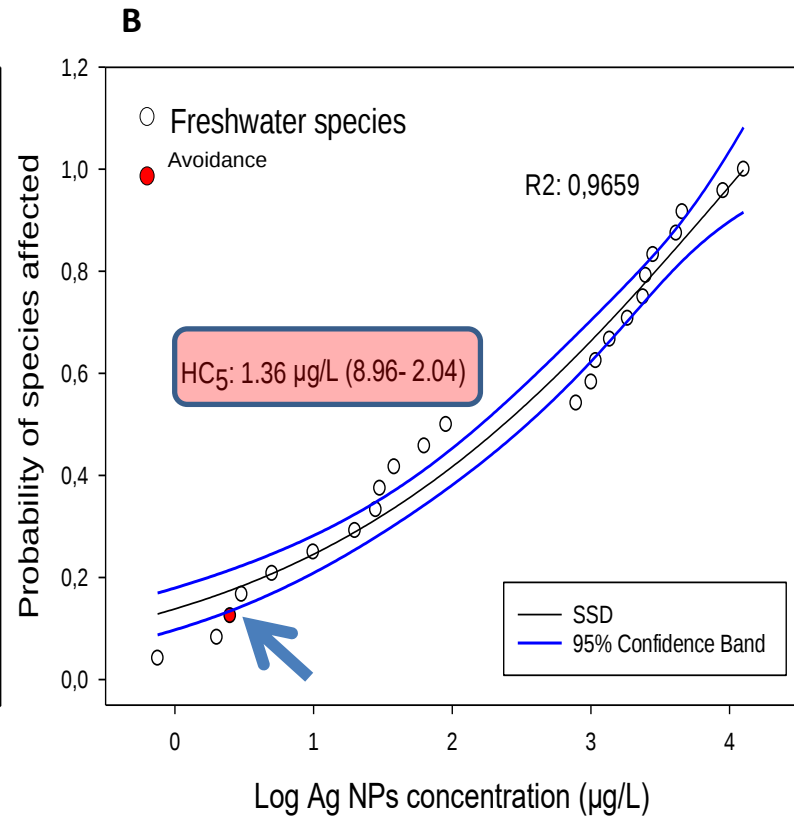
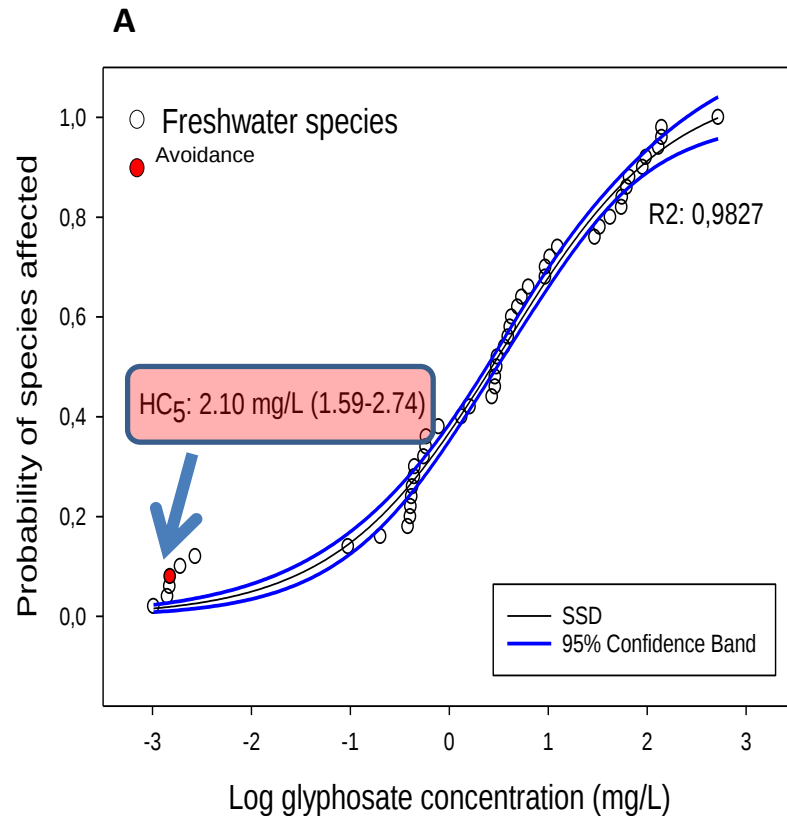


Avoidance: moderately sensitive compared to other responses

A The most sensitive avoidance response was observed at **16 µg/L** (*D. rerio* and *P. reticulata*)

B *Litopenaeus vannamei* : **6.75 µg/L** – The most sensitive specie

Glyphosate and Ag NPs SSG



Avoidance: one of the most sensitive endpoint

Conclusion

- Avoidance can be considered as a very sensitive response and an important endpoint
- Avoidance in multi-compartmented exposure systems provides a complementary vision about the risk that contamination
- More ecological view for ecotoxicology by simulating some real scenarios:
 1. colonization
 2. habitat connectivity/selection
 3. habitat fragmentation
 4. cost-benefits analysis for habitat selection

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Thanks





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