Assessing Chronic Effects of Chemical Pollution on Biodiversity Using Mean Species Abundance Relationships

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Introduction

- Long-term effects of **chemical pollution** on **biodiversity** need to be assessed further

- Prediction of **Species Sensitivity Distributions (SSDs)** is possible with the presented methodology

- Methodology was extended to arrive at **Mean Species Abundance (MSA)**

- The Mean Species Abundance Relationship (MSAR) **links biodiversity to chemical concentration**

- **Predicting MSARs for chronic levels** provides insights into long-term impacts on species number

- **Predictive tool** to estimate chronic effects based on acute data is presented

Material and Methods

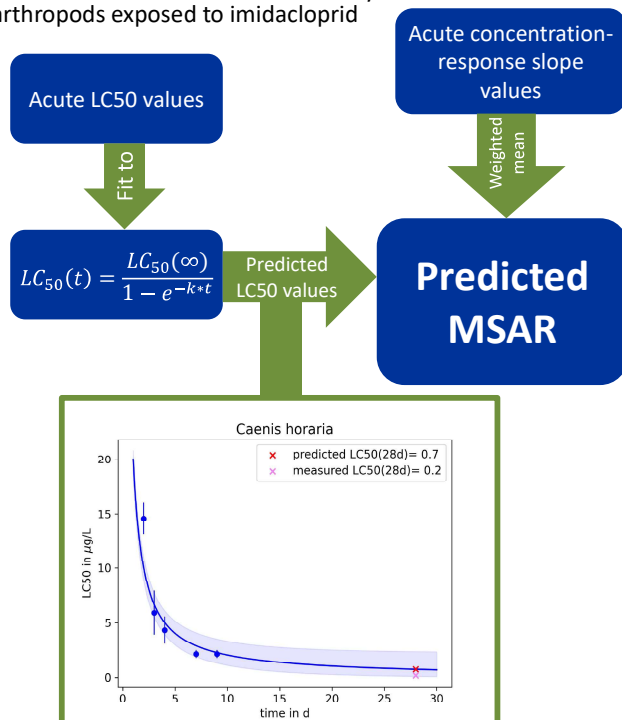- Validated with data from a case study with 6 freshwater arthropods exposed to imidacloprid

Acute LC50 values

Fit to

$$LC_{50}(t) = \frac{LC_{50}(\infty)}{1 - e^{-k*t}}$$

Predicted LC50 values

Acute concentration-response slope values

Weighted mean

Predicted MSAR

Figure 1: Example LC50(t) fit with predicted vs. measured LC50 values for day 28

Results

- Predictions show similar curves compared to the calculated MSARs & 1-PAF

- Predictions underestimate the effect of imidacloprid

- Confidence Intervals (CIs) overlap completely with calculated MSARs

- Mean difference between calculated and predicted MSAR:
  - 21 days: 6%
  - 28 days: 6%
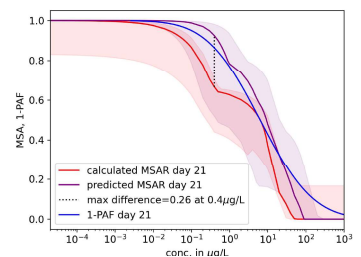
- Calculated MSARs lay below 1-PAF

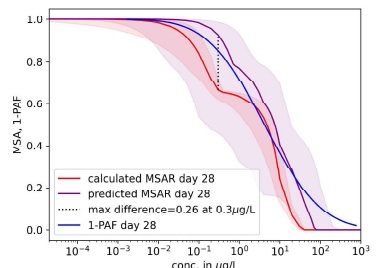Figure 2: Predicted MSAR vs. Calculated MSAR & 1-PAF for day 21

Figure 3: Predicted MSAR vs. Calculated MSAR & 1-PAF for day 28

Discussion

- MSARs could be a better indicator for the effect of chemicals than the 1-PAF

- MSAR also includes reproduction
  - No EC50 data available

- Chronic LC50 prediction accuracy is species dependent

- Imidacloprid biotransforms into imidacloprid-olefin
  - Is hypothesized to bind irreversible
  - Accuracy of prediction could be affected

- Chronic effect of imidacloprid on MSA still observable in prediction

Conclusion

- Predictions were able to represent the calculated MSARs with a mean difference of 6%

- Uncertainty should be taken into account for risk assessment

- Testing on more species and chemicals is advised

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