How detailed do we have to model populations to predict extinction probabilities and recovery time?
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Introduction
The interest for the application of population modelling within the pesticide registration is increasing nowadays. In 2007 the LERTox workshop was conducted to discuss the possibilities and obstacles of population modelling for this purpose. One major conclusion from this workshop was that modelling for environmental risk assessment should not focus on realism but on predictiveness. For this reason we investigated the questions which environmental factors have to be included to do protective population modelling.

We used two individual-based population models, which were tested previously on measured data, to investigate the influence of environmental factors on the extinction probability and recovery time. Extinction probability of Daphnia magna populations (IDamP) were calculated at laboratory scale. Recovery time within a mesocosm facility was calculated for Chaoborus crystallinus. Since chaoborids are flying insects a metapopulation approach was used to calculate autarchonous and allochthonous recovery for a typical mesocosm facility and a single treated pond in comparison to mesocosm controls and an isolated control pond.

IDamP-Model
The IDamP model (Preuss et al. submitted): • calibrated on individual level • tested on individual and population level for different food concentrations & scenarios • constant exposure (3,4-Dichloraniline (3,4-DCN), Nonylphenol (p-NP)) • variable exposure (pesticide) Extinction probabilities were calculated for 100 days at constant exposure under semistatic conditions. Substances were selected due to different mode of action, p-NP (narcotic), 3,4-DCN (embryogenesis), pesticide (high toxicity)

Sensitivity 2 to 3 times lower compared to standard food level

Food concentration

Competition

Effect models

IBM-Chaoborus
The individual-based model IBM-Chaoborus: • calibrated on individual level and one mesocosm • tested on mesocosm data for untreated populations • variable exposure scenarios (Insecticide)

Sensitivity 2 to 3 times lower compared to standard food level

Population of interest

Fig. 6: Recovery time for different scenarios

Conclusions
With adequate models sensitivity of populations at different environmental scenarios can be investigated. This will help to estimate safety factors which are protective but not over protective. For this purpose population models should include:

- an appropriate effect model
- food dependency
- important interactions, like competition
- Metapopulation approaches for dispersed migrating species (e.g. Chaoborus)

Here immigration to the stressed population as well as emigration from untreated populations have to be considered.