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MODELLING GROWTH OF *LEMNA* EXPOSED TO METSULFURON-METHYL (MSM) USING A DYNAMIC ENERGY BUDGET APPROACH

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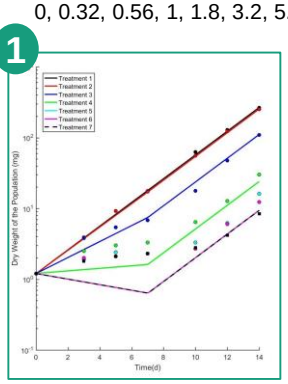
Change of *Lemna* (dry) biomass in laboratory tests is predicted using a dynamic energy budget (DEB) model

Input	TK Model	*Lemna* DEBkiss Model	Output
Exposure	Internal Concentration	Modes of Action (MoA)	Effect
Concentration in water in time	Concentration in *Lemna* population in time	1 Decrease in assimilation 2 Increase in maintenance 3 Increase in costs for structure	(dry) biomass in time

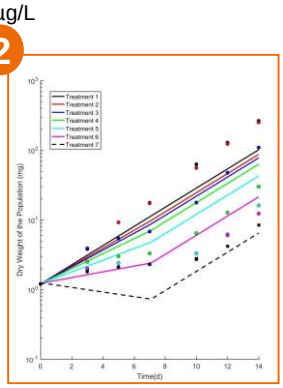
Three possible different modes of actions were calibrated and validated separately

Calibration using data set A: 7 days constant exposure, 7 days recovery (Schmitt et al. 2013);
0, 0.32, 0.56, 1, 1.8, 3.2, 5.6 µg/L

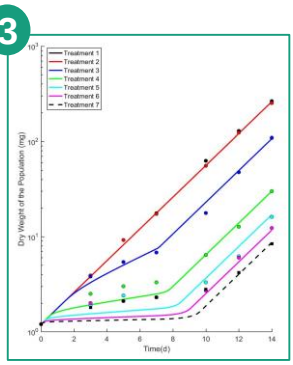
Calibration



r^2 = 0. 999, EF= 0.995



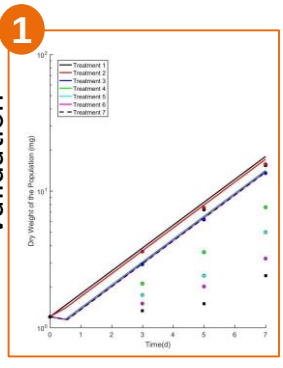
r^2 = 0. 775, EF= 0.486



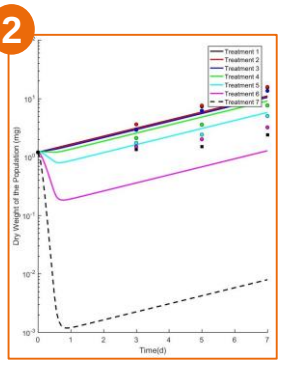
r^2 = 0.999, EF = 0.995

Verification using data set B: 12 hour constant exposure, test duration 7 days;
0, 0.5, 1.7, 5.6, 18.5, 61.7, 206 µg/L

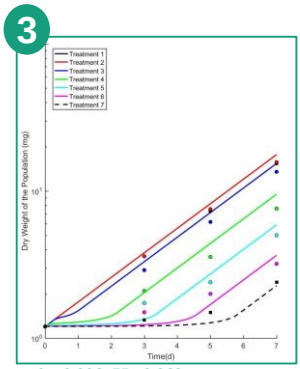
Validation



r^2 = 0.650, EF= 0.277



r^2 = 0.888, EF= 0.790



r^2 = 0.996, EF= 0.962

Dots = data, lines = predictions
r^2 = coefficient of determination, EF = model efficiency

Result

- The goodness of fit depends on the assumed mode of action
- Calibration of MoA 1 and of MoA 3 are both sufficiently good (r^2>0.99)
- MoA 3 clearly provides the best validation which fits to the MoA of MSM (inhibition of biosynthesis)

Conclusions

- The model is able to describe mechanistically the effect of active substances either on assimilation, maintenance or structure
- In comparison to Schmitt et al. 2013, the *Lemna* DEBkiss Model is able to consider different MoA
- Further testing is necessary to observe the model with respect to different data sets of MSM and substances with other MoA

References

Schmitt W *et al.* 2013. Mechanistic TK-TD-model simulating the effect of growth inhibitors on *Lemna* populations. Ecol Model 255:1– 10.
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EFSA PPR Panel 2013. Guidance on tiered risk assessment for plant protection products for aquatic organisms in edge-of-field surface waters. EFSA Journal 2013;11(7):3290, 268 pp.

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Poster, Exhibition hall, ID TU130
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Modelling growth of *Lemna* exposed to Metsulfuron-methyl using a dynamic energy budget approach

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Keywords: herbicide, modelling, DEB theory, macrophytes

The exposure of pesticides are dynamic and variable in time. However due to the complexity of the exposure profile, it is not possible to study every exposure in a laboratory experiment. To allow extrapolation to any predicted exposure profile, we model effects on growth using a simplified dynamic energy budget model (based on DEBkiss). This model is a mechanistic approach relying on mass and energy balance, which is suitable for the sublethal toxicity endpoint growth. We compare our model's performance with another Lemna model, developed by Schmitt et al. 2013. As a case study, we consider the sulfonyl-urea herbicide Metsulfuron-methyl (MSM).