Optimising mesocosm study design to derive reliable and robust community endpoints

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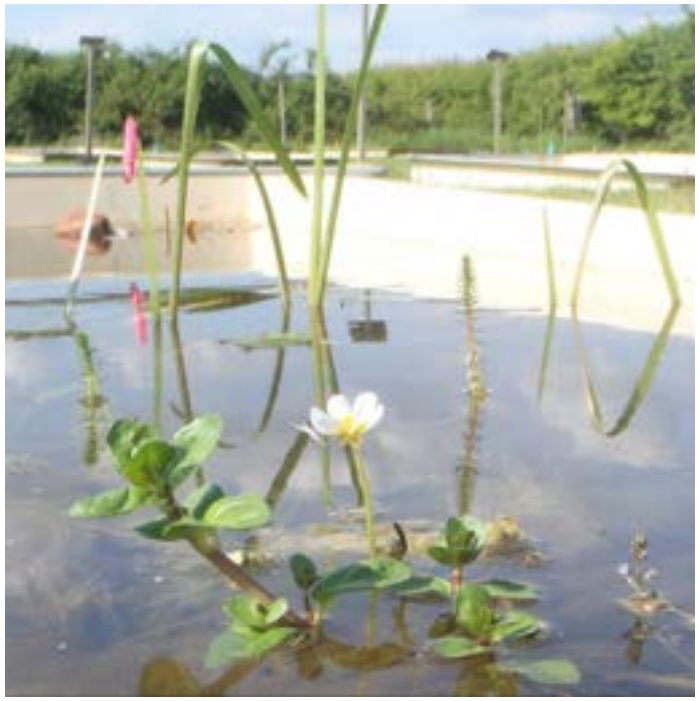
CEA

CAMBRIDGE ENVIRONMENTAL ASSESSMENTS

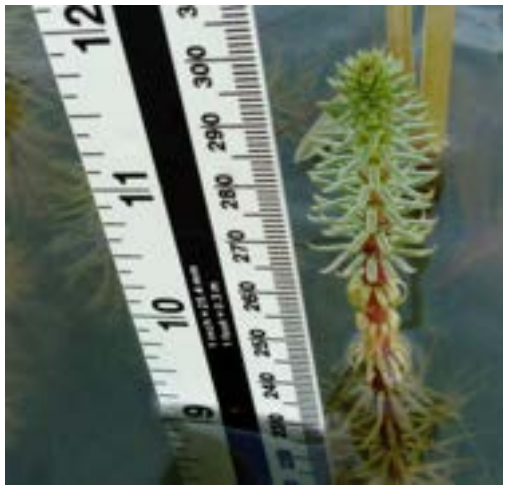
Introduction

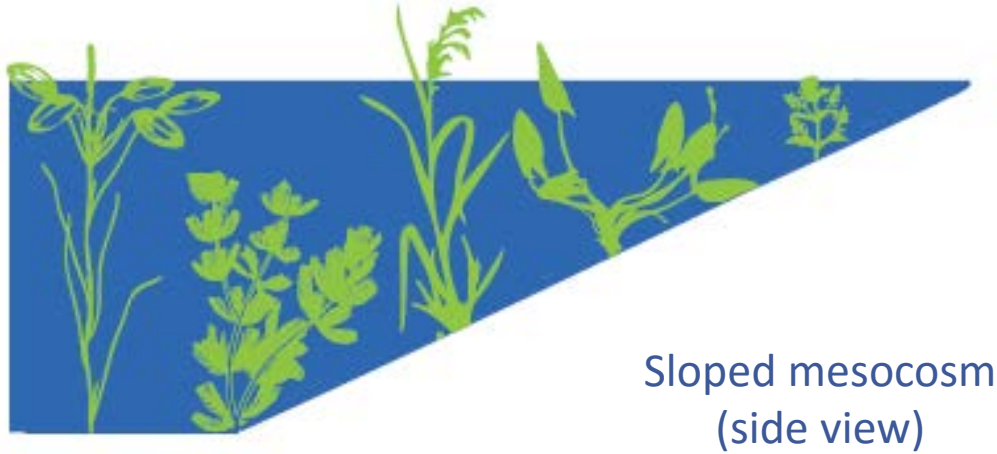
- Why the need to optimise design?
- Design of study affects statistical power and variability of data
- Balance between replication and practicability
- Recommendations for mesocosm study design in EFSA (2013) and Brock *et al* (2015)



Case Study 1: Multiple Plant Health and Growth Measures

- Sloped mesocosm design – Macrophyte community interactions
- Increased number of measurements increases the number of endpoints
- More evidence increases the reliability of the overall endpoint



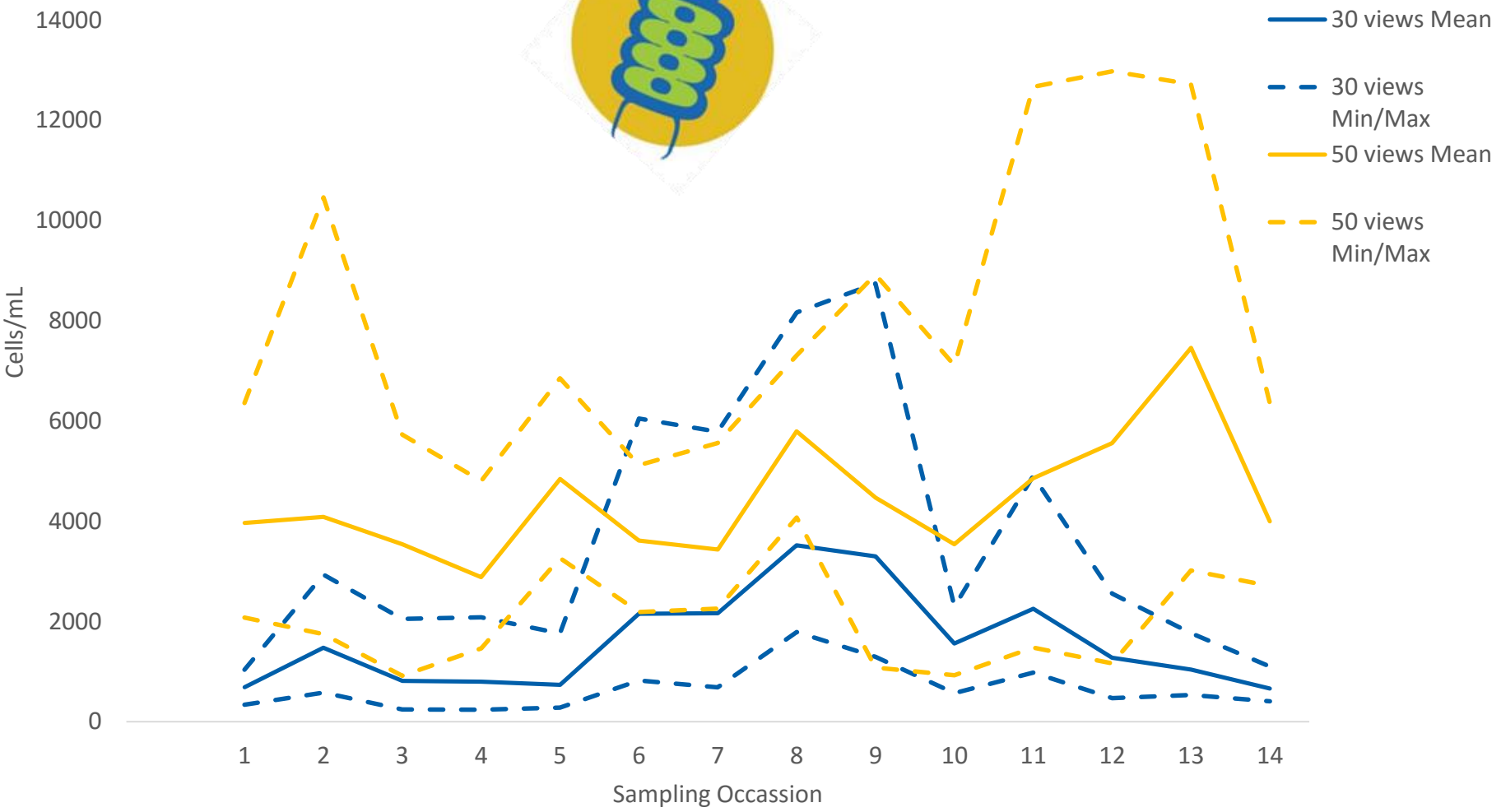


Sloped mesocosm (side view)

Case Study 2: Increasing Sub-sample volume

- Recommendation in Brock *et al* (2015) to increase sampling efficiency
- Improvement to increase the volume of sample for phytoplankton identification and enumeration
- Increased abundance data produced a higher number of reliable MDD values

Mean Total number of Phytoplankton Cells control data



Case Study 2: Increasing Sub-sample volume

Number of Whipple grid views	Number of Identified Taxa	Number of reliable endpoints with category 1 and 2 MDD values
30	43	16
50	54	25

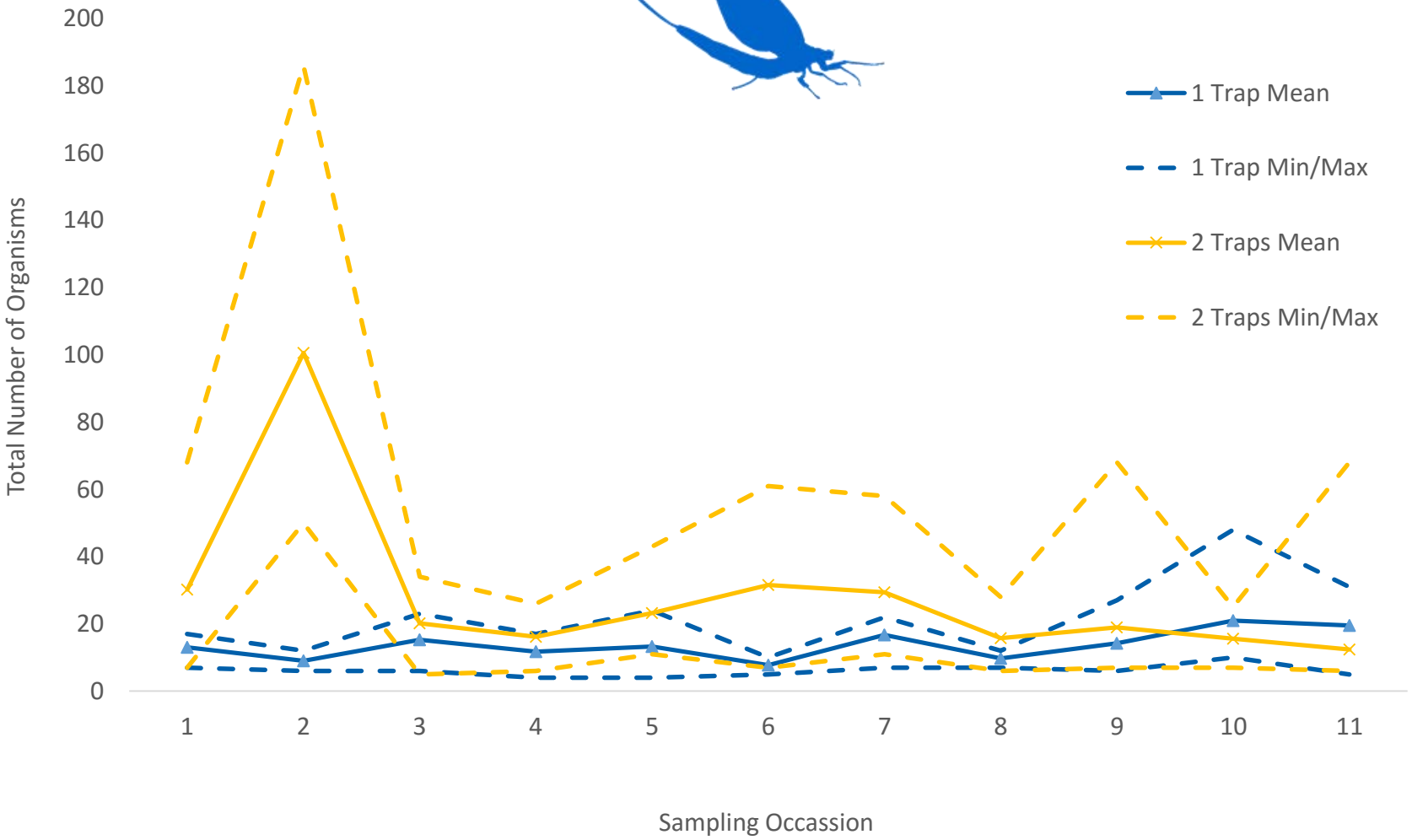
The mean number of cells/mL in the control data was significantly higher in 50 whipple grid views ($t=6.89796$, $P= <0.05$).

Case study 3: Increasing Number of Traps

- Improved sampling efficiency by increasing the number of emergent insect traps deployed in each mesocosm

- Compared number of reliable endpoints for emergent insect taxa

Mean Total Number of Emergent Insects Control Data



Increasing Number of Traps – Emergent Insects

Number of Traps	Number of Identified Taxa	Number of reliable endpoints with category 1 and 2 MDD values
1	15	4
2	21	4

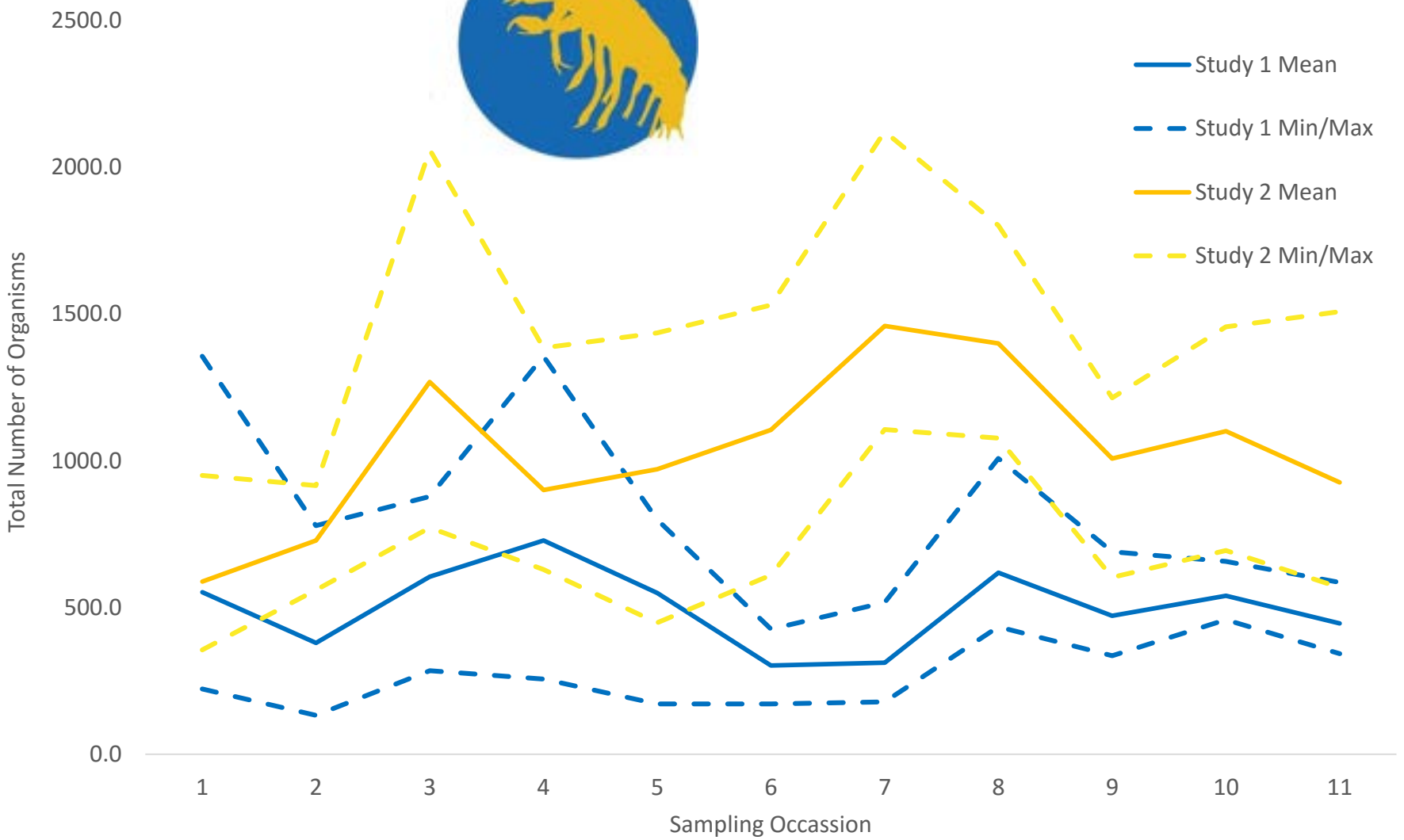
There were no significant differences in the mean total number of emergent insects in the control data (t=1.93343, P= >0.05).

Case Study 4: Increasing Efficiency of Macroinvertebrate Mesocosms

Multiple study design improvements

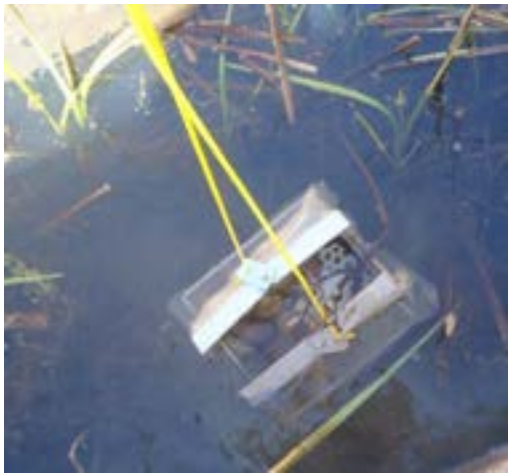
- Longer Pre-application phase for establishment.
- Improvement of techniques used to capture macroinvertebrates.
- More time taken for identification and enumeration.

Mean Total Number of Macroinvertebrates Control Data



Efficiency of Macroinvertebrate Sampling

	Number of Identified Taxa	Number of reliable endpoints with category 1 and 2 MDD values
Study 1	37	6
Study 2	42	16

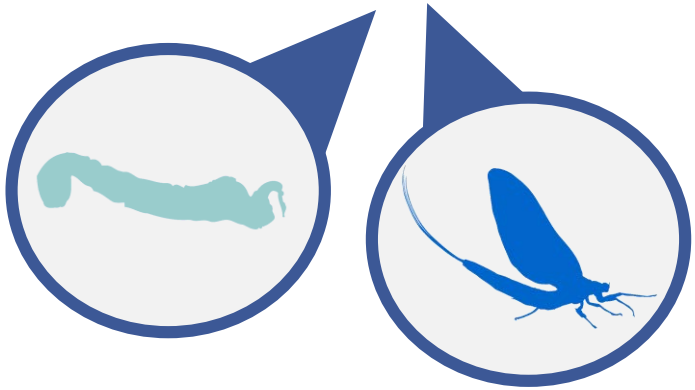


Multiple changes to study design increased organism abundance and data reliability.

Conclusions

Optimising mesocosm study design:

- Increases the **statistical power**.
- Reduces **variability** in data.
- Can derive more **reliable** and **robust** community level endpoints.
- Helps to meet EFSA requirements for 8 **sensitive/vulnerable** taxa with acceptable MDD values.



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Posters

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The value of the ecological recovery option in higher tier aquatic studies

Comparison of laboratory and mesocosm endpoints for risk assessment of pesticides

Any questions?

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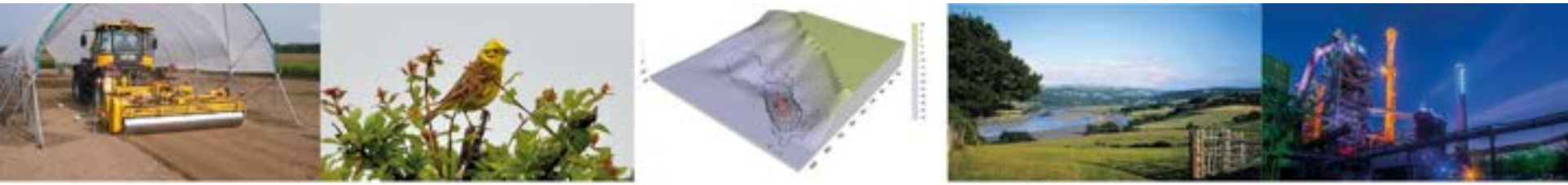

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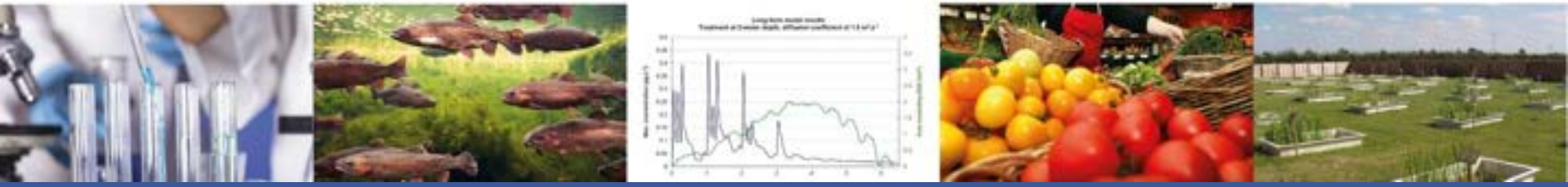
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