CONSIDERATIONS FOR DESIGNING EMERGENT INSECT TRAPS IN MESOCOSM STUDIES

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CEA
CAMBRIDGE ENVIRONMENTAL ASSESSMENTS

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INTRODUCTION

The emergence of insects from aquatic habitats is a key indicator of ecological integrity and reflects how successfully aquatic insects complete their life cycle within a test system. As such, it provides an integrated signal of population dynamics, contamination effects, and overall ecosystem function. These taxa are known to be sensitive to chemical stressors and are considered a key biological compartment in mesocosm studies. Reliable, representative emergence data are essential for assessing impacts on community structure and function.

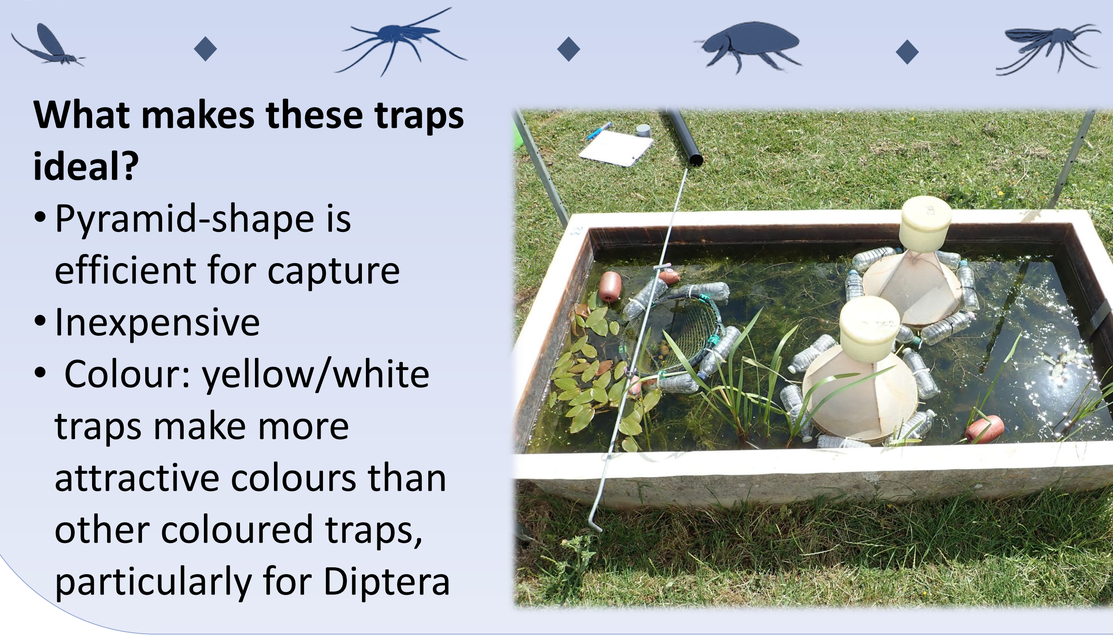
Trap design plays a major role in the accuracy and representativeness of these measurements. Different insect groups use different emergence routes; some emerge directly from the water surface, while others climb macrophytes, or the pond edge. Deployment of a single trap, or even a single trap type, may, therefore, under-represent these important taxa. Effective traps must consider emergence behaviour, placement within the mesocosm, mesh characteristics, and accessibility for sampling.

This poster presents a theoretical comparison of potential trap designs that balance two goals; (1) allow natural ecosystem functioning, including recolonisation, free movement of insects and population recovery, and (2); capture a sufficiently representative proportion of emergent organisms to support reliable trend detection and statistical analysis.

DESIGN 1: FLOATING ALCOHOL TRAPS

Pros:	Cons:
Neutral colour DNA preservation of specimens	Vulnerable to severe weather Low structural preservation
Effective capture and preservation	Not inclusive for macrophyte emergers
Minimal disturbance to ecosystem function	Subject to by-catch

Ideal taxa:
- Diptera
- Gerridae
- EPT
- Dytiscidae
- Hydrophilidae



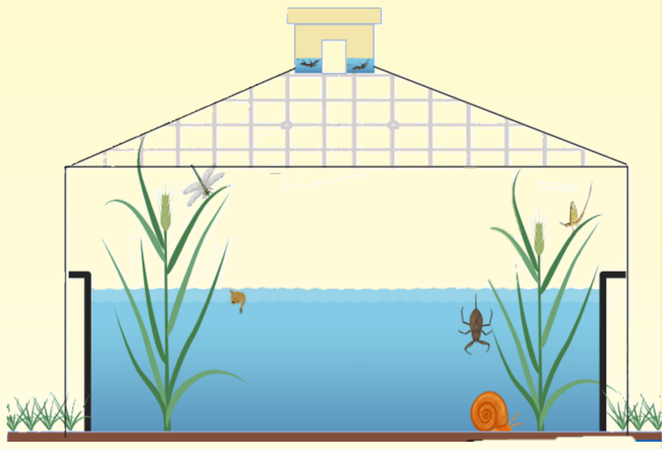
What makes these traps ideal?
- Pyramid-shape is efficient for capture
- Inexpensive
- Colour: yellow/white traps make more attractive colours than other coloured traps, particularly for Diptera

DESIGN 2: ROOF-LIKE FILTER TRAPS

Pros:	Cons:
Concentrated catches via filters	Small sampling area due to trap size
High efficiency and quality preservation	Frequent service requirements
Reduced by-catch	Weather dependency
Durability and portability Versatility in habitat	Obstructive and Costly

Ideal taxa:
- Diptera
- Trichoptera
- Dytiscidae
- Baetidae
- Hydrophilidae

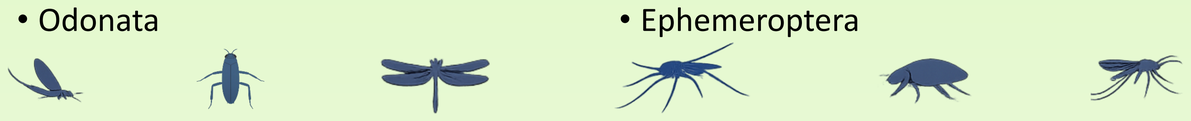
What makes these traps ideal?
- Incorporating the full life cycle
- Uses emergence behaviour
- Abundance of specimens
- Habitat



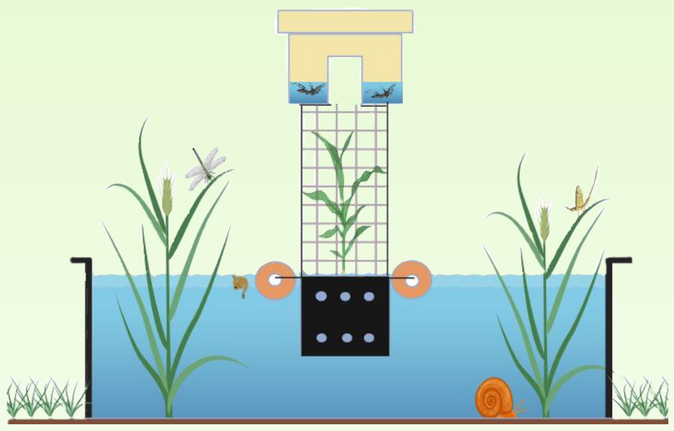
DESIGN 3: FLOATING MACROPHYTE TRAPS

Pros:	Cons:
Prevents insect escape	Macrophyte maintenance Subject to by-catch
Efficient	Atypical habitat creation Potential Taxa bias
Incorporates emergence behaviour	Vulnerable to severe weather

- **Ideal taxa:**
- Diptera
- Odonata
- Hemiptera
- Dytiscidae
- Ephemeroptera



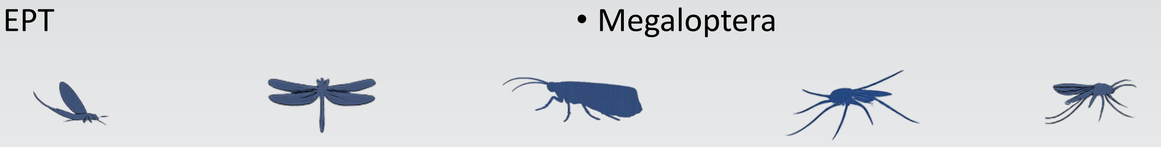
What makes these traps ideal?
- Minimal environmental disruption
- Targeted sampling of specialised fauna
- Capture of highly mobile specimens
- High-quality samples
- Low cost and simple design



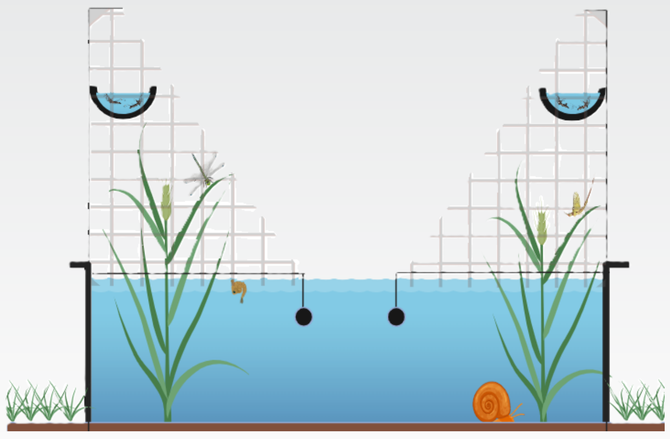
DESIGN 4: GUTTER TRAPS

Pros:	Cons:
Large sampling area of whole mesocosm Potential to catch all emergent insect species	Limited recolonisation
	Cost and labour intensive
Non-invasive to aquatic flora or fauna	Vulnerable to severe weather
	Obstructive to other sampling

- **Ideal taxa:**
- Diptera
- EPT
- Odonata
- Lepidoptera
- Megaloptera



What makes these traps ideal?
- Representation of all emergent insects in a mesocosm
- Minimal environmental disturbance



CONCLUSION

There is no one trap design that can comprehensively and accurately capture the abundance and diversity of emergent insect species. Each of the trap designs depicted here have specific benefits or target specific species over others. Therefore, traps should be selected dependent upon the focus of the study and the species of particular interest. Multiple trap designs utilised together can help to overcome the issue of taxa bias and give a more complete view of insect emergence in mesocosms.

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Figures created in https://BioRender.com
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