PS2339

Do aquatic mesocosms represent real edge of field water bodies in the UK?

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Cambridge Environmental Assessments
Introduction

• Key questions
• Objectives
• Data collection
• Results
  – Macroinvertebrates
  – Phytoplankton
  – Zooplankton
• Questions
Key questions

• Are mesocosms sufficiently ecologically representative of UK water bodies in the UK agricultural landscape?
• Do mesocosm studies with spring/summer applications represent the ‘worst-case’ scenario?
• Do seasonal changes in community structure increase the uncertainty associated with mesocosm endpoints when applied to autumn pesticide applications?
Objectives

1. ID significant differences & similarities between waterbody types and landscape classes for each taxonomic group.
2. Determine how ecologically representative mesocosms are of field sites by comparing taxonomic composition.
3. Assess temporal variation within and between field sites and mesocosms for each taxonomic group.
4. ID environmental variables potentially influencing taxonomic composition in field sites for each taxonomic group.
Data collection

- Abundance data for macroinvertebrates, zooplankton and phytoplankton.
- Ponds, ditches and streams sampled from four distinct landscape classes (36 sites)
- Four mesocosm facilities provided data
- Environmental variables also measured at field and mesocosm sites
- Sampling duration: Monthly samples for 2 years
Objective 1

ID significant differences and similarities between waterbody types and landscape classes for macroinvertebrates, zooplankton and phytoplankton.
Macro-invertebrates
Macroinvertebrates: Taxa Richness

Year 1

Streams

Ditches

Ponds

Meso M

Meso G

Meso C

Group 1: Mayflies, Stoneflies and Diptera

Group 2: Caddisflies, Dragonflies and Alderflies

Group 3: Water bugs, Beetles and Mites

Group 4: Macrocrustacea

Group 5: Non-arthropod Invertebrates
Macroinvertebrates: Taxa Richness

Year 2

Streams
Ditches
Ponds
Meso M
Meso A
Meso G
Meso C

Group 1: Mayflies, Stoneflies and Diptera
Group 2: Caddisflies, Dragonflies and Alderflies
Group 3: Water bugs, Beetles and Mites
Group 4: Macrocrustacea
Group 5: Non-arthropod Invertebrates
Macroinvertebrates: Relative Abundance

Year 1

Streams

Ditches

Meso M

Meso G

Meso C

Ponds

Group 1: Mayflies, Stoneflies and Diptera

Group 2: Caddisflies, Dragonflies and Alderflies

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Macroinvertebrates: Relative Abundance

Year 2

Streams

Ditches

Ponds

Meso M

Meso A

Meso G

Meso C

Group 1: Mayflies, Stoneflies and Diptera

Group 2: Caddisflies, Dragonflies and Alderflies

Group 3: Water bugs, Beetles and Mites

Group 4: Macrocrustacea

Group 5: Non-arthropod Invertebrates
Macroinvertebrates: TWINSPLAN

Gammaridae  Sphaeriidae  Tipulidae  Limnephilidae  Psychodidae

Chaoboridae  Corixidae

Hydrophilidae  Staphylinidae

Chironomidae  Gammaridae  Asellidae  Glossiphonidae  Sphaeridae

Curculionidae  Hydrophilidae

Gammaridae  Helodidae  Simuliidae

Lymnaeidae  Oligochaeta  Dytiscidae  Planorbidae

Baetidae  Corixidae  Culicidae  Notonectidae  Chironomidae

Asellidae  Chaoboridae

Chironomidae  Ostracoda  Chaoboridae  Chrysomeliidae

Ostracoda  Oligochaeta  Dytiscidae

325 stream samples
224 ditch samples
280 ponds samples

4 sites  27 sites  154 sites  126 streams  471 sites  194 streams  175 ditches  102 ponds

27 sites  124 sites  114 ponds  13 sites  9 sites

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Macroinvertebrates: TWINSPAN
Summer field sites

- Gammaridae
- Erpobdellidae
- Sphaeriidae
- Limnephilidae
- Tipulidae
- Chaoboridae
- Corixidae

- Oligochaeta
- Ostracoda
- Hydrophilidae

- Staphylinidae
- Gammaridae
- Chironomidae
- Planorbidae
- Lymnaeidae
- Hydrophilidae
- Culicidae

- Elmidae
- Hydrophilidae
- Tipulidae
- Psychodidae
- Gammaridae
- Chironomidae
- Planorbidae
- Lymnaeidae
- Hydrophilidae
- Culicidae

- Chaoboridae
- Corixidae
- Chironomidae
- Glossiphonidae
- Oligochaeta
- Dytiscidae
- Chironomidae
- Ostracoda
- Hydrophilidae

- 3 sites
- 4 sites
- 37 sites
- 201 sites
- 40 sites
- 42 sites
- 7 sites
- 16 ditches
- 54 ditches
- 135 streams
- 27 ponds
- 61 ponds
- 13 ditches
- 25 ponds
- 162 streams
- 107 ditches
- 140 ponds
Macroinvertebrates: Indirect DCA for all field data

- Ditch
- Stream
- Pond
- Warpland
- Eutropho
- PQC
- Chalk
Phytoplankton
Phytoplankton: Relative Abundance

Year 1

- Bacillariophyceae
- Chlorophyceae
- Chrysophyceae
- Craspedophyceae
- Cryptophyceae
- Cyanophyceae
- Dinophyceae
- Euglenophyceae
- Hormogoneae
- Pedinophyceae
- Xanthophyceae
- Zygnematophyceae
Phytoplankton: Relative Abundance

Year 2

Streams
Ditches
Ponds

Meso A
Meso M
Meso G
Meso C

Bacillariophyceae
Chlorophyceae
Chrysophyceae
Craspedophyceae
Cryptophyceae
Cyanophyceae
Dinophyceae
Euglenophyceae
Hormogoneae
Pedinophyceae
Xanthophyceae
Zygnematophyceae
Phytoplankton: TWINSPAN

- **Volvocales**
  - **Cryptomonadales**
  - **Chromulinales**
  - **Chrysophyceae**
  - **Ochromonadales**

- **Chaetophorales**
  - **Ulotrichales**
  - **Oedogoniales**

- **Centrales**
  - **Scourfieldiales**
  - **Monosigales**

- **Chromulinales**
  - **Ulotrichales**

- **Chroococcales**
  - **Chlorococcales**
  - **Centrales**

- **Gymnodiniales**

- **Pennales**
  - **Ochromonadales**
  - **Monosigales**
  - **Centrales**

- **Oscillatoriales**
  - **Chaetophorales**
  - **Euglenales**
  - **Chrysophyceae**

**Locations:**
- 2 sites
- 7 sites
- 12 sites
- 16 sites
- 84 sites
- 83 sites
- 13 sites
- 20 sites
- 11 ponds
- 9 ponds
- 6 ditches
- 17 ponds
- 24 ditches
- 43 streams
- 27 ponds
- 15 ditches
- 41 streams
- 10 ponds
- 10 streams
Phytoplankton: Indirect DCA for all field data
Zooplankton
Zooplankton: Relative Abundance

- Group 1 - Cladocera
- Group 2 - Microcrustacea
- Group 3 - Insects
- Group 4 - Rotifera
- Group 5 - Macrocrustacea
Zooplankton: No. Organisms

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
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<tbody>
<tr>
<td>Group 1</td>
<td>Cladocera</td>
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<tr>
<td>Group 2</td>
<td>Microcrustacea</td>
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Zooplankton: No. Organisms

- Group 1 - Cladocera
- Group 3 - Insects
- Group 5 - Macrocrustacea
Zooplankton – No. Taxa

- Cladocera
- Microcrustacea
- Insects
- Rotifera
- Macrocrustacea

Bar chart showing the number of taxa in different types of water bodies:
- Streams
- Ditches
- Ponds
- Meso C+M
- Meso A
- Meso G
Zooplankton: Indirect DCA for pond and ditch field data
Objective 2

Determine how ecologically representative mesocosms are of field sites by comparing taxonomic composition for Spring/Summer (April-September).
Macroinvertebrates: Indirect DCA for field and mesocosms
Macroinvertebrates: Indirect DCA for field and mesocosms

[Graph showing various taxa and environmental conditions]
Phytoplankton: Indirect DCA for field and mesocosms
Phytoplankton: Indirect DCA for field and mesocosms
Zooplankton: Indirect DCA for field and mesocosms
What does it mean?

• Communities in different water body types (not landscapes) are different however, mesocosms can be generally representative of edge of field water bodies

• Mesocosms contain organisms known to be sensitive to PPPs but some inter-mesocosm variability can lead to uncertainty

• Spring/summer applications are worst case in that community similarities are more close in spring/summer when compared to winter

• More up to date technical guidance is required
Future presentations

• Influence of temporal variation within and between field sites and mesocosms for macroinvertebrates, zooplankton and phytoplankton.
• Determine which environmental variables influence taxonomic composition in field sites for macroinvertebrates, zooplankton and phytoplankton.
• Use of SPEAR to determine relative sensitivity of UK agricultural waterbodies and mesocosm facilities
• Regulatory recommendations
Thank You for your attention

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