Cambridge Environmental Assessments

PS2339
Do Aquatic Mesocosms Represent Real Edge-of-field Water Bodies in the UK?

Alan Lawrence, Seamus Taylor,
Naomi Blake, Greg Hughes

Outline

- Introduction to project
- Key questions
- Selection of landscape classes and water body types
- Preliminary results
  - Community composition in mesocosms and edge-of-field water bodies
  - Relative sensitivity of different waterbodies to pesticides using SPEARpesticide
  - Seasonal changes in community sensitivity
- Limitations, future work

Introduction

- Data from *protected* waterbodies have demonstrated diverse and abundant aquatic communities
  - Mesocosms have been demonstrated to be less diverse than these waterbodies (e.g. Williams *et al*, 2002)
- Limited information on some edge-of-field water bodies e.g. ponds and ditches
- Uncertainty exists with regards to representivity of mesocosms
  - How do the ecological communities in mesocosms relate to those in real edge of field water bodies?
  - Data would allow contextualisation of mesocosm results

Key questions

- Are mesocosms sufficiently ecologically representative of 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?

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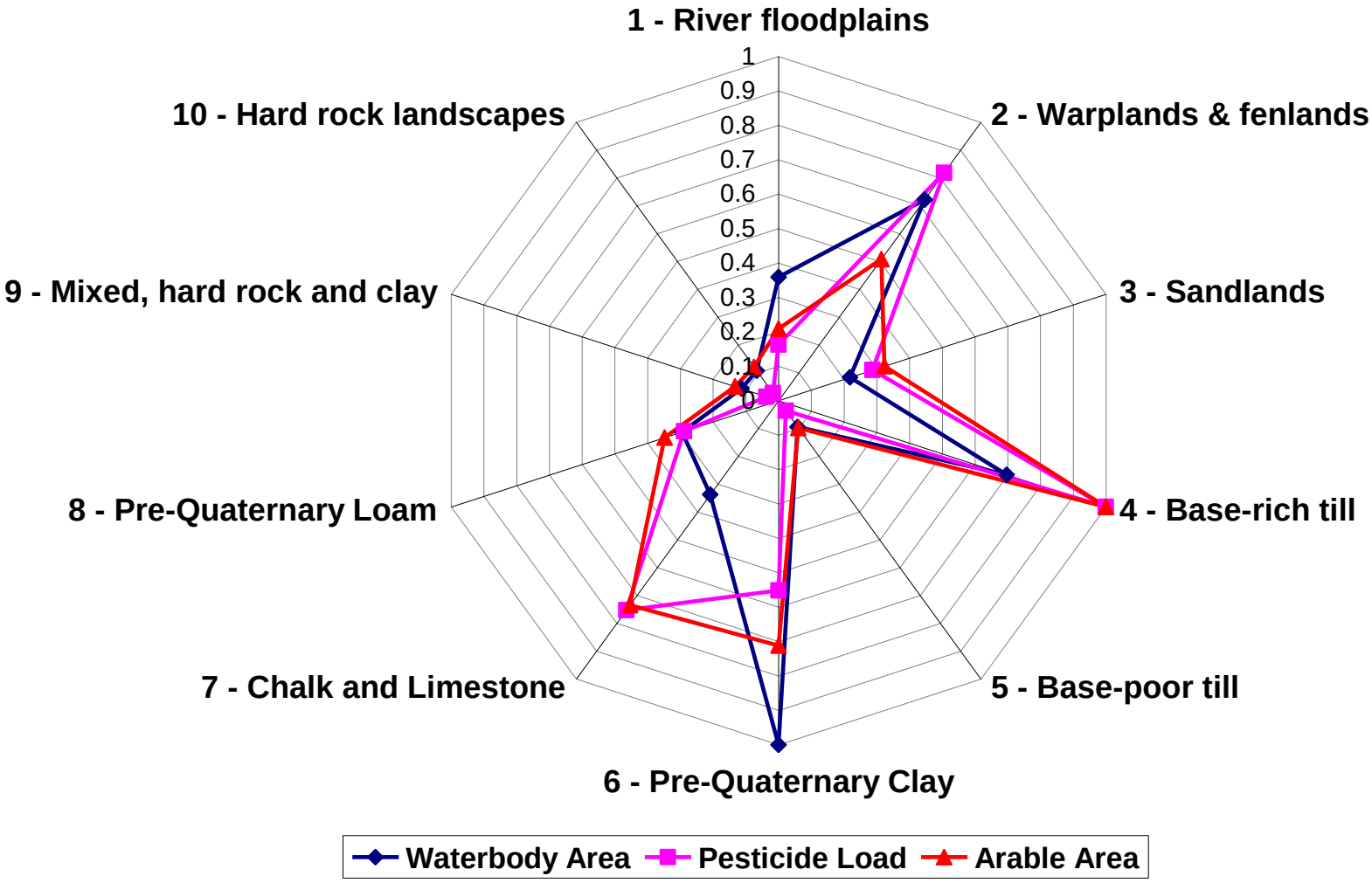
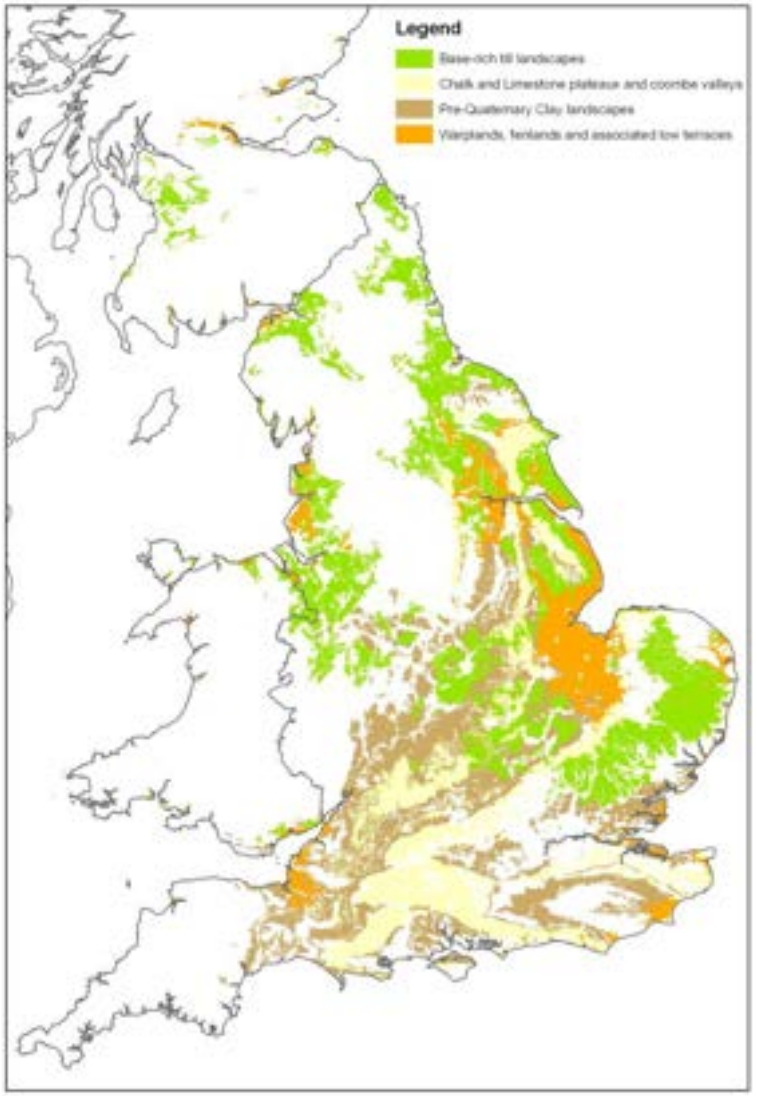
Landscape selection



Landscape selection

- Final landscapes selected
  - Eutrophic tills (Cambs, Suffolk)
  - Chalk and limestone (various locations)
  - Pre-quaternary clays (Oxfordshire)
  - Warplands and fens (Lincolnshire)



Site selection

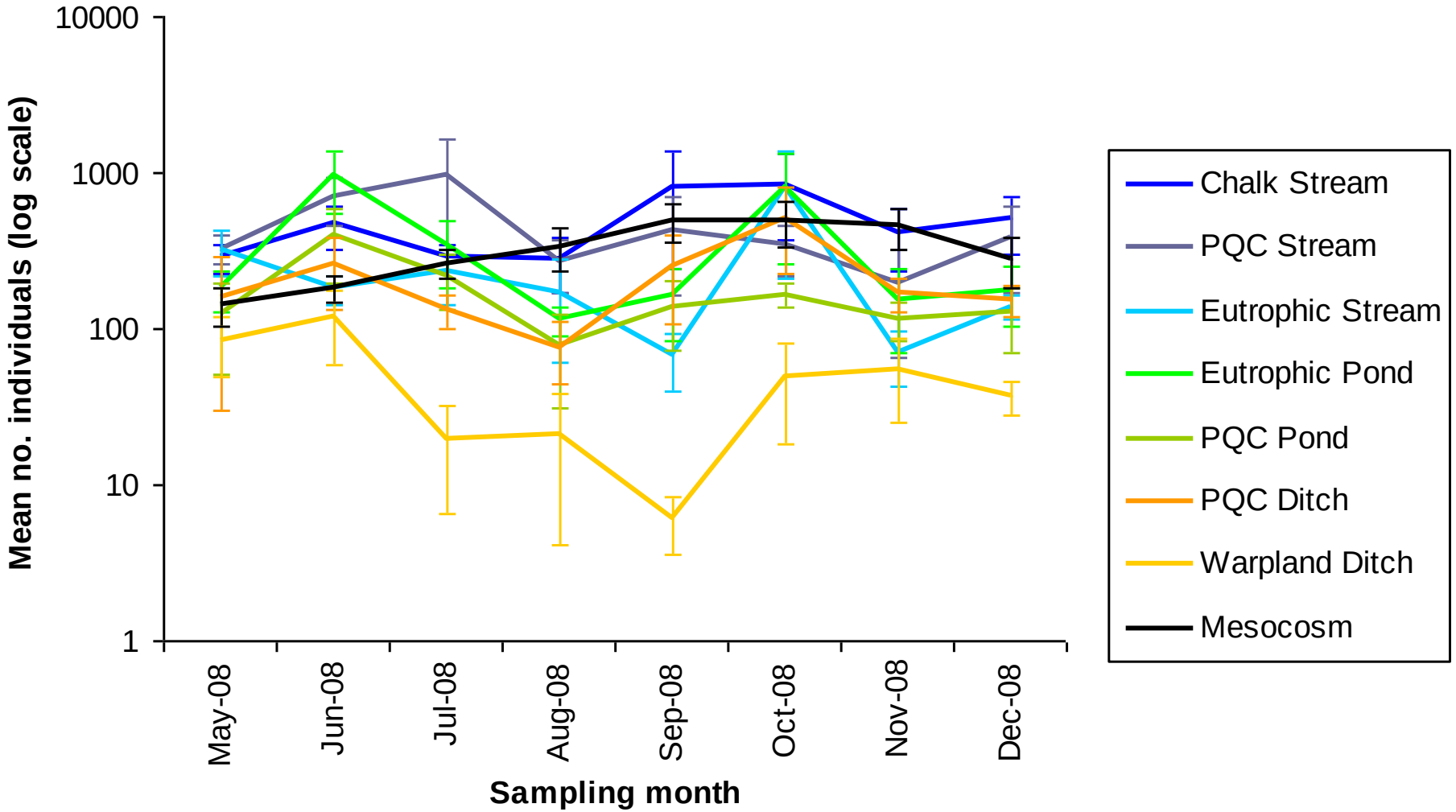
- Aerial photography and GIS used to identify potential sites
- Short list of suitable sites (>100 sites) were visited to assess representivity and suitability
- Sites selected to be representative of water bodies in arable landscapes in the UK

Landscape	Ponds	Ditches	Streams	**Total**
Warplands	0	6	0	**6**
Eutrophic tills	7	0	6	**13**
Pre-quarternary clays	5	4	4	**13**
Chalk & limestone	0	0	4	**4**
Total	**12**	**10**	**14**	**36**

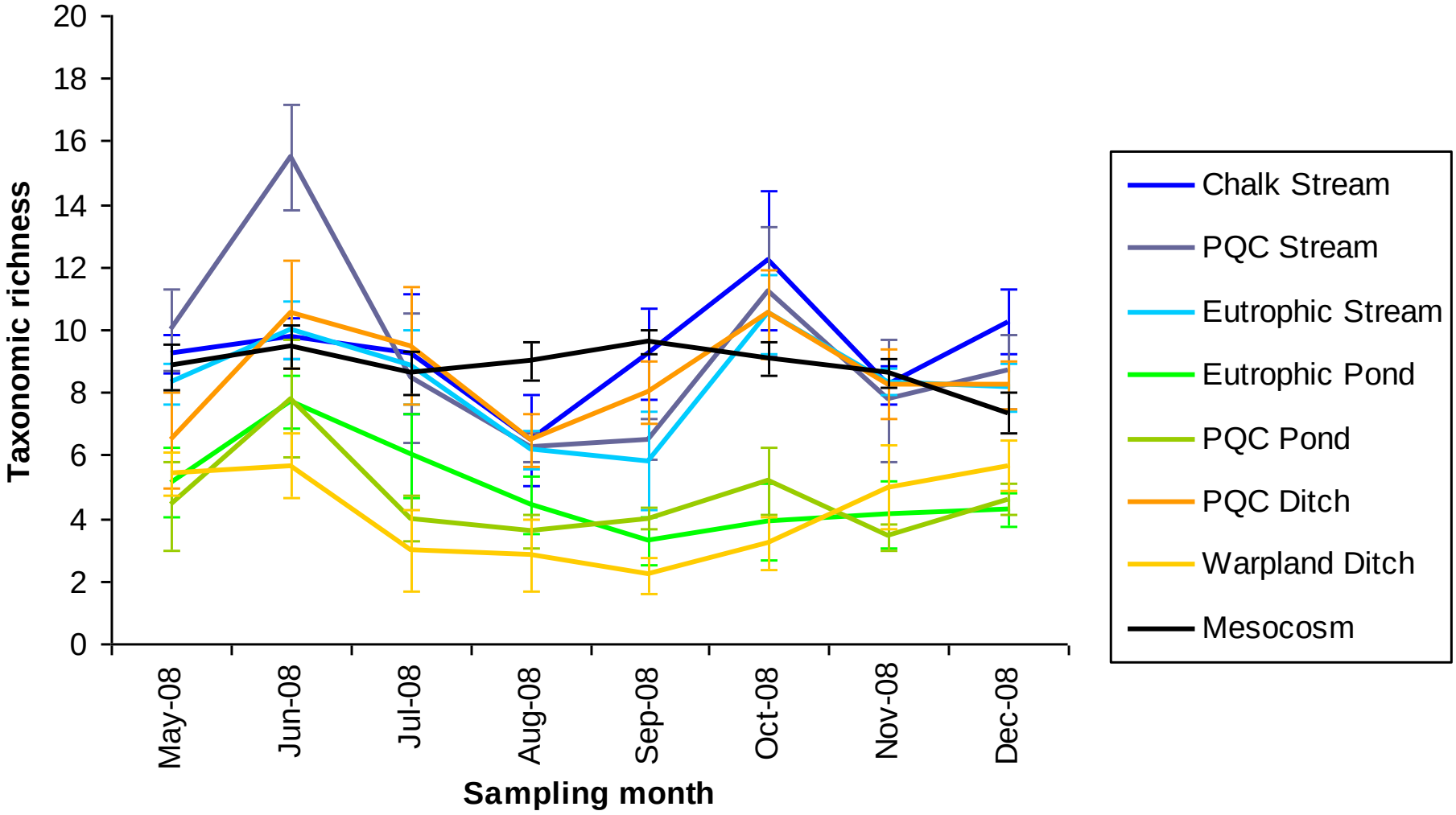
Sampling of sites

- Monthly sampling from May 2008 for two years
- Sampling natural waterbodies and three independent mesocosm facilities
  - Macro-invertebrates
  - Zooplankton
  - Phytoplankton
  - Macrophytes
  - Physico-chemical
  - Land use assessment

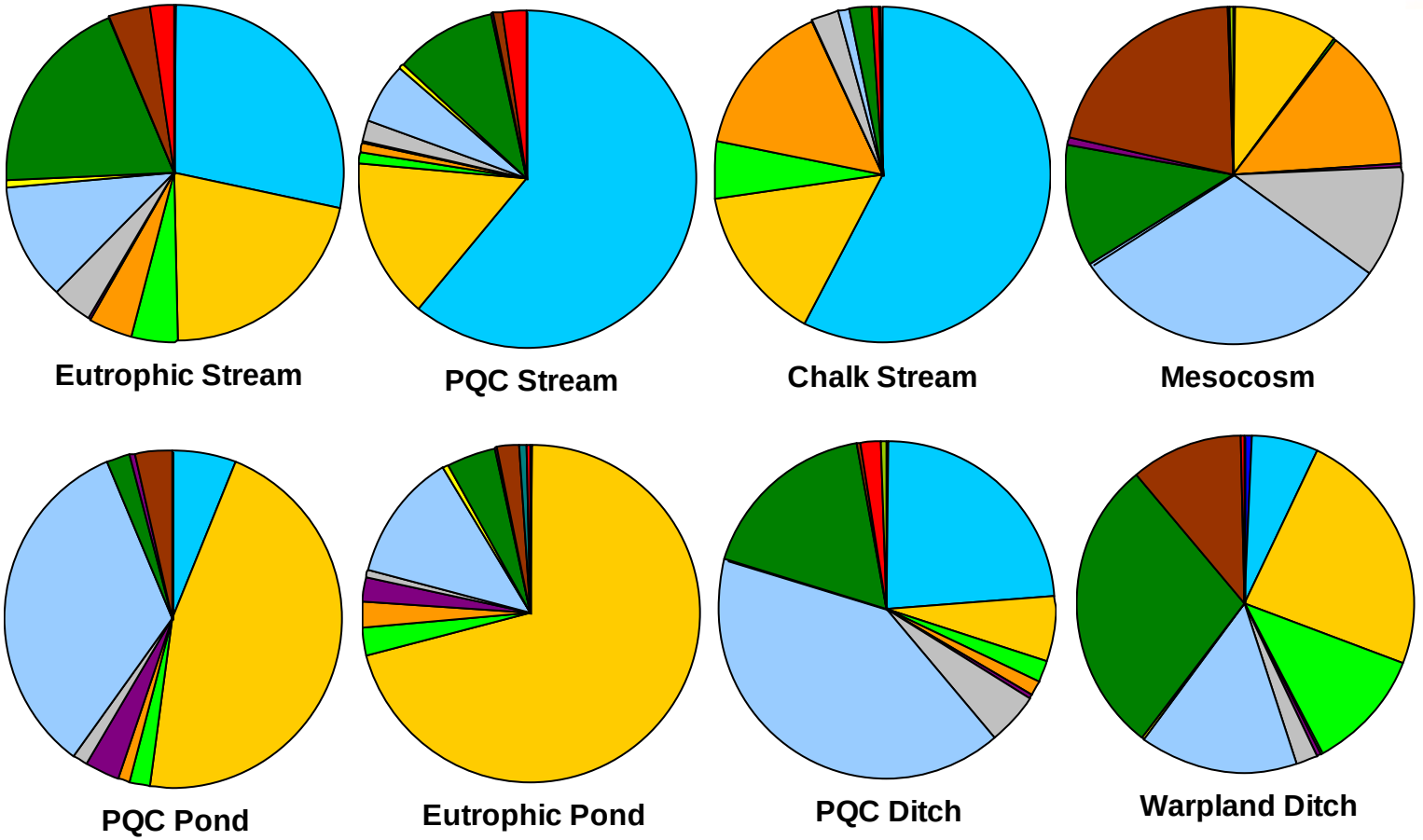
Mean abundances for field data



Taxonomic richness (family)



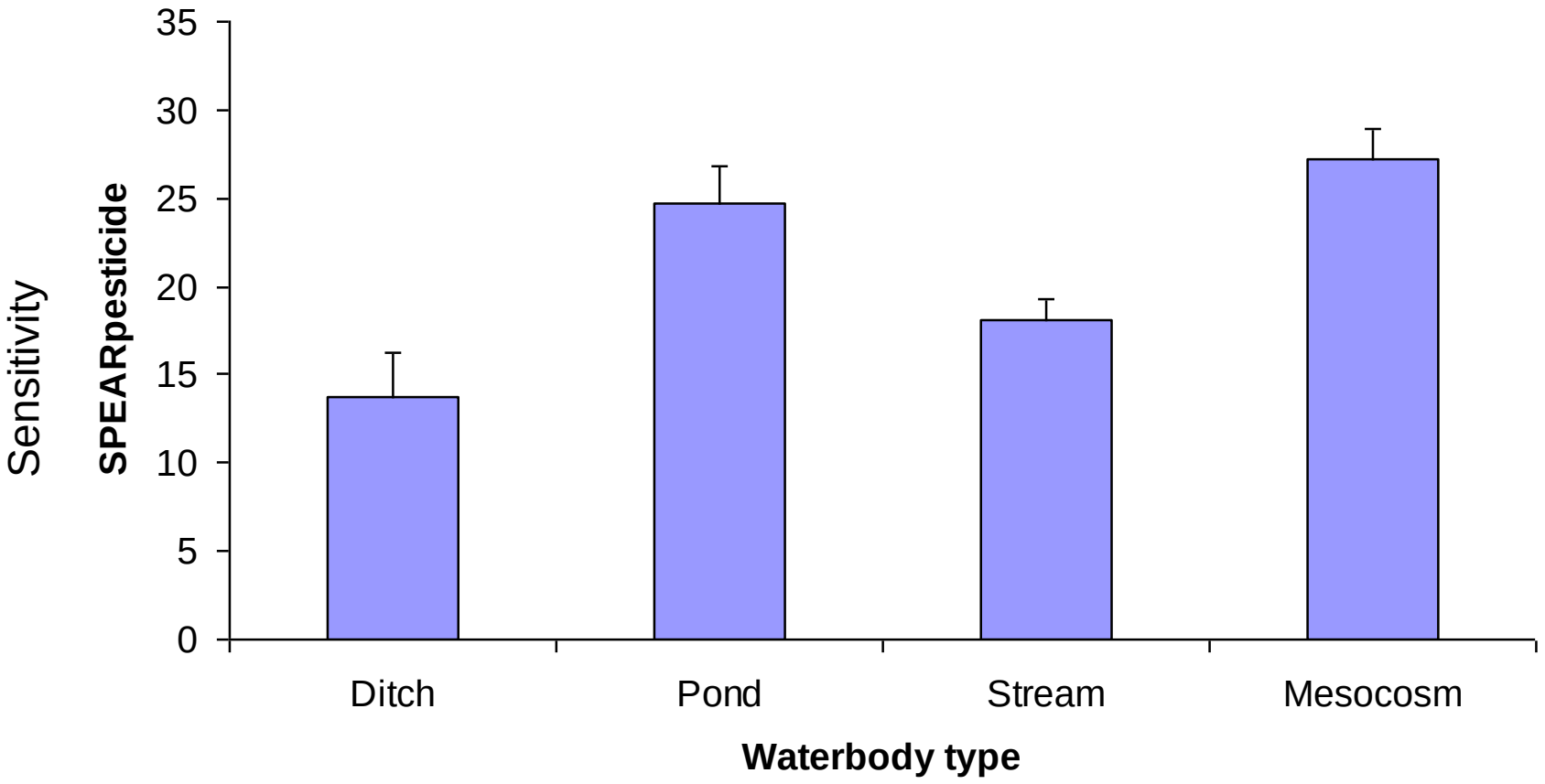
Taxonomic composition



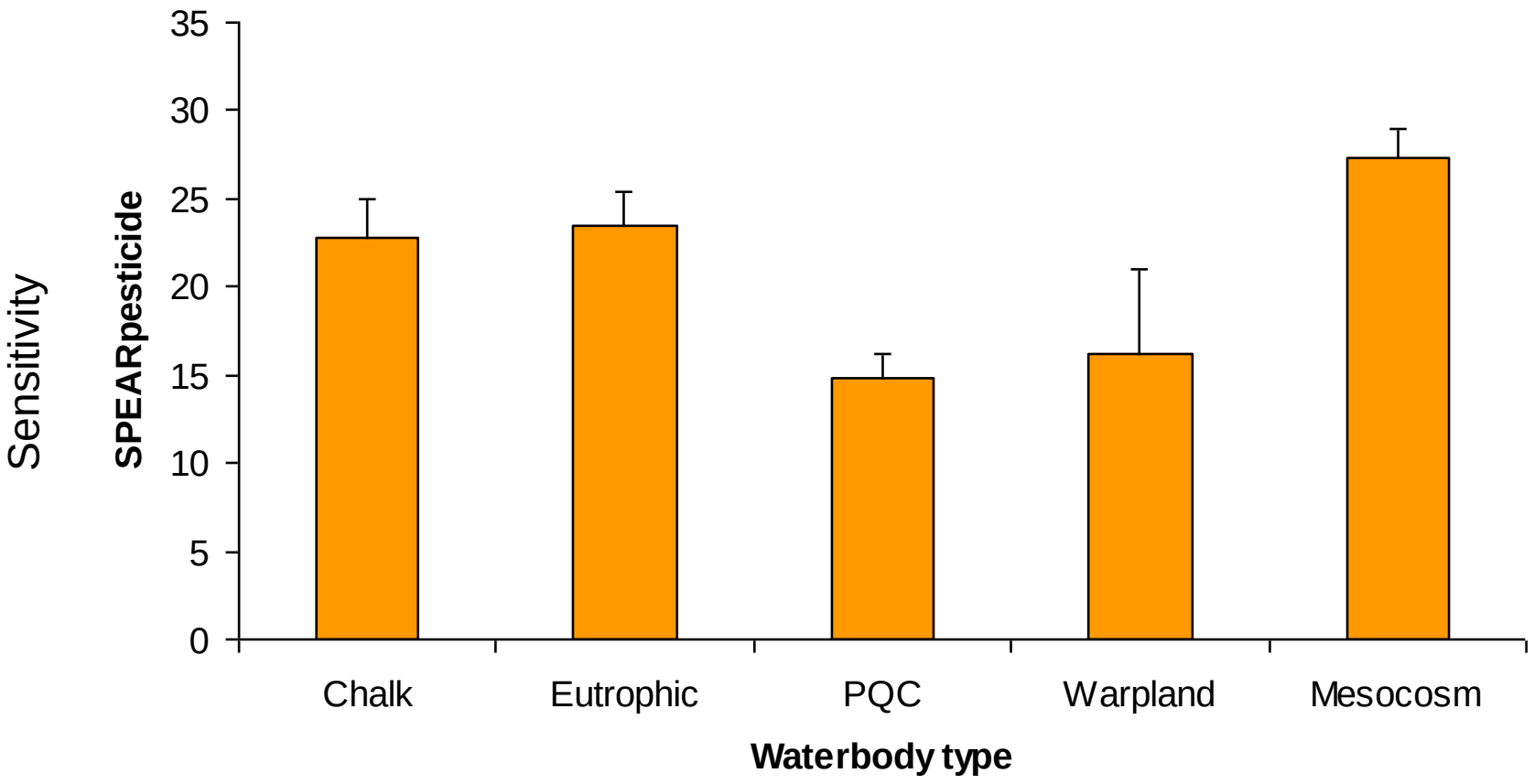
Overview of SPEAR$_{pesticide}$ to evaluate community sensitivity

- Pesticide-specific bioindicator system linking pesticide exposure and effects (Liess *et al.*)
- Taxa are ranked according to biological traits that influence sensitivity to pesticide exposure
- Sensitivity of community is calculated from the relative abundance of each taxa
- Recent papers have provided UK specific rankings and indicate family resolution data can be used
- Information on SPEAR can be found at http://systemecology.eu/SPEAR/Start.html

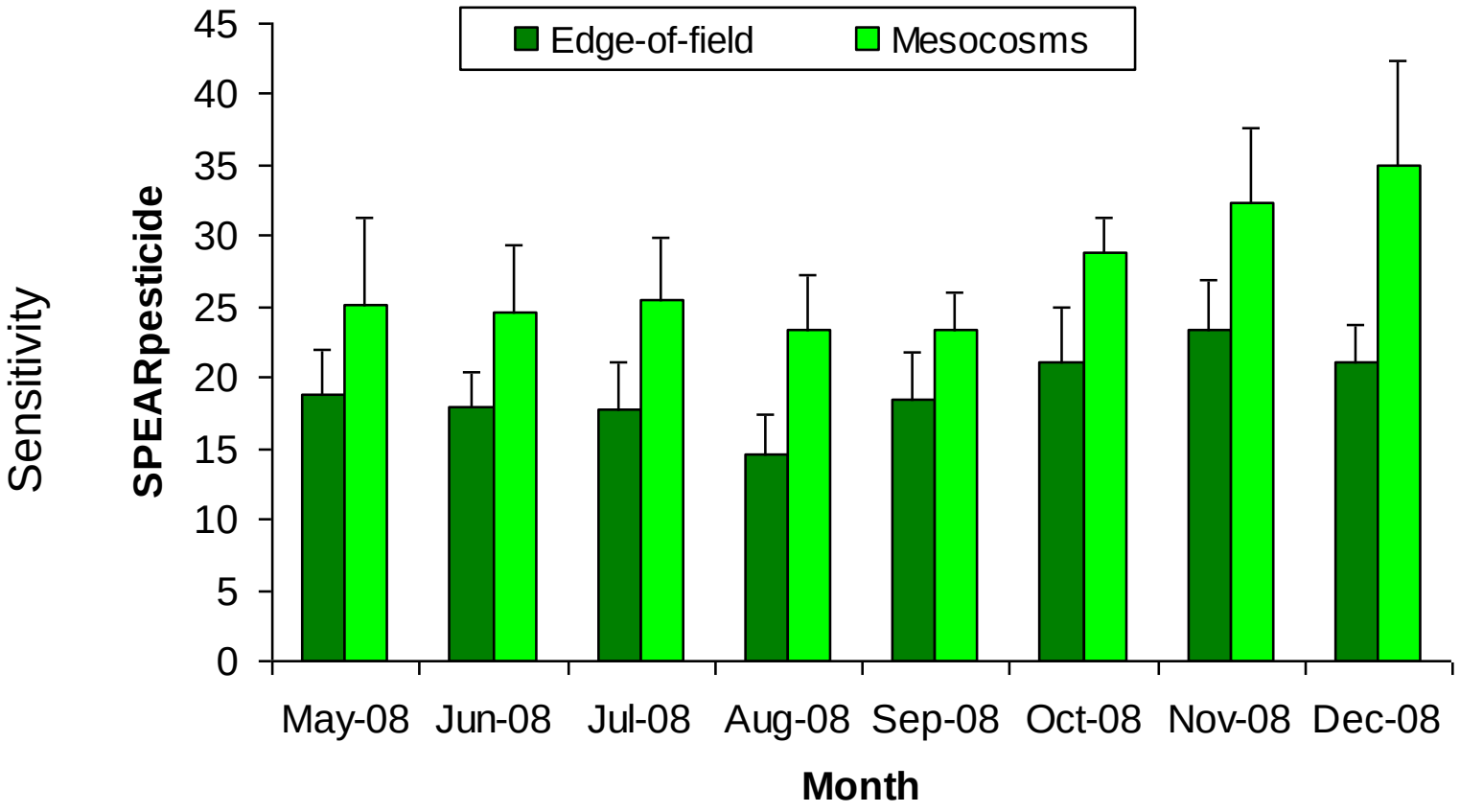
Influence of water body type on SPEAR$_{pesticide}$



Influence of landscape class on SPEAR$_{pesticide}$



Influence of season on SPEARpesticide



Summary

- *Are mesocosms sufficiently ecologically representative of UK water bodies in the UK agricultural landscape?*
  - Abundance and taxonomic richness similar
  - Species composition is different
  - SPEAR sensitivity of mesocosms is similar to ponds and greater than that of streams and ditches

- *Do mesocosm studies with spring/summer applications represent the 'worst-case' scenario?*
  - Mesocosm SPEARpesticide in spring/summer include taxa of representative sensitivity for edge-of-field water bodies

Summary

- *Do seasonal changes in community structure increase the uncertainty associated with mesocosm endpoints when applied to autumn pesticide applications?*
  - SPEARpesticide sensitivity, based on biological traits, indicate changes in community structure do not increase uncertainty associated with mesocosm endpoints

Limitations, future

- Inherent study limitations
  - Sample size
- Current results
  - Indicative, preliminary – further data & analysis
  - Pooling of data – variability
- Output
  - Background information, identify key trends, context
  - Aim is not to be prescriptive with regards to AF
- Future investigations
  - Pesticide use monitoring – relate to trends in biota
  - SPEAR – which traits are driving sensitivity

Thank you for your attention

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Seamus.Taylor@cea-res.co.uk

Naomi.Blake@cea-res.co.uk

Alan.Lawrence@cea-res.co.uk