How microhabitat and watertype differ seasonally in their importance for aquatic invertebrates

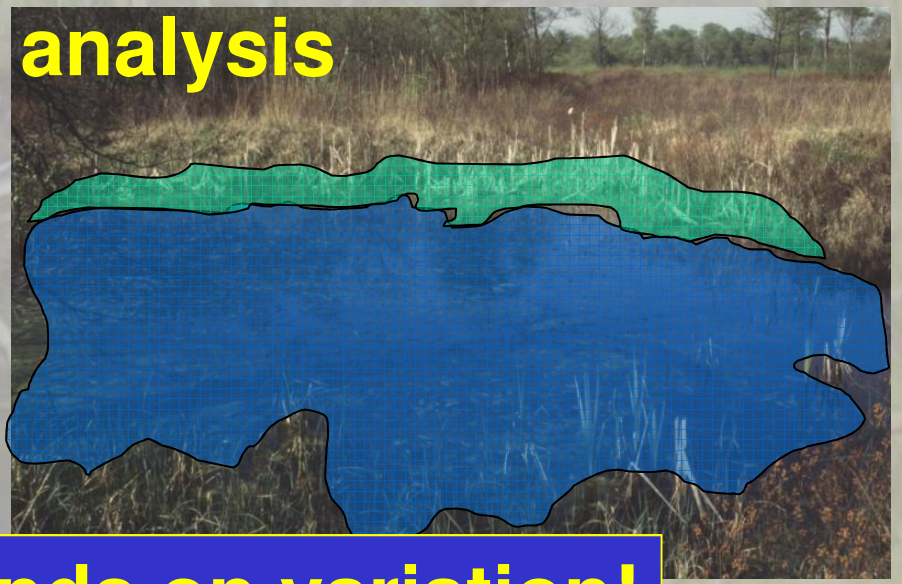
Wilco Verberk
Hein van Kleef
Hans Esselink

Katholieke Universiteit Nijmegen

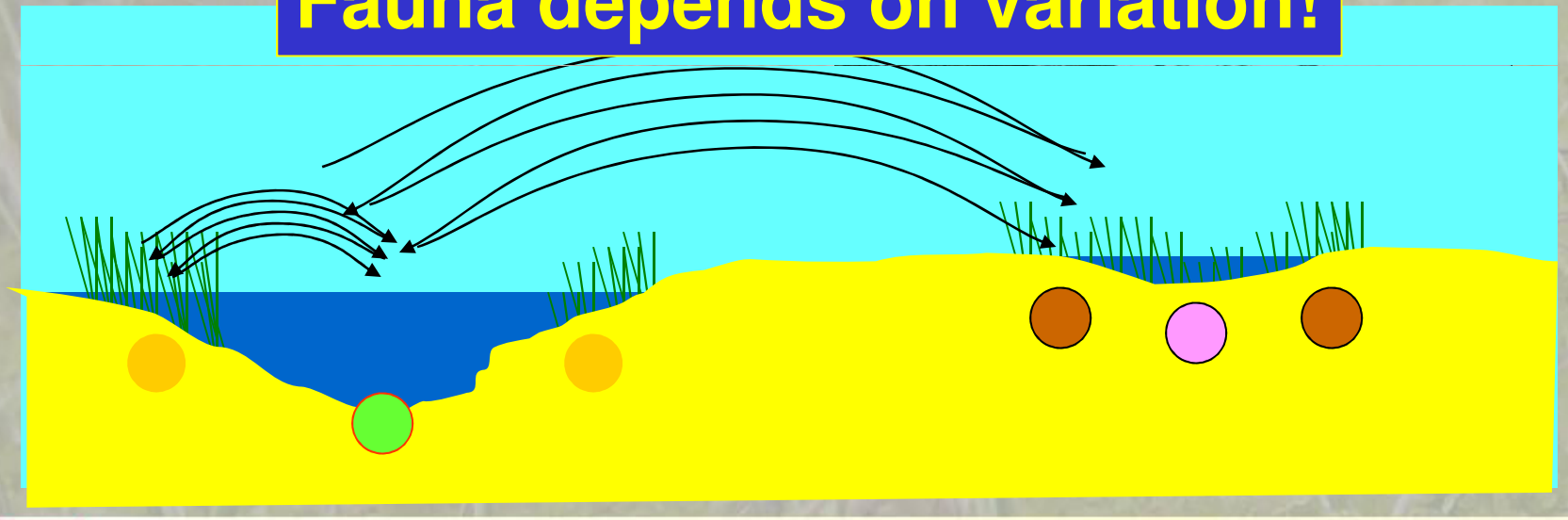
Stichting Bargerveen

Problem analysis

- food
- hiding
- reproduction
- pupating



Fauna depends on variation!



Problem analysis

ready flyer
good swimmer } spatial use

longevity >1 year
selective oviposition } life history

‘match’ between fauna and landscape

watertypes
configuration (scale)

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Research question

How do species use the landscape?

- Space
  watertype (dispersal)
  microhabitat (locomotion)

- Time (seasons)
  synchronisation

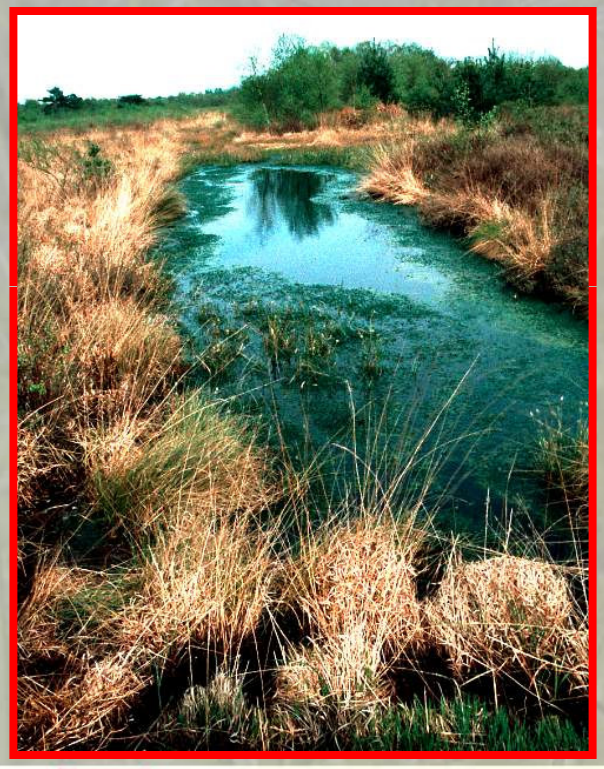
Katholieke Universiteit Nijmegen

Stichting Bargerveen

Research setup

3 watertypes

- oligotrophic, acid
- mesotrophic, slightly buffered
- eutrophic, buffered



Katholieke Universiteit Nijmegen

Stichting Bargerveen

Hypotheses



Nutrient status	-	+	++
Acidity	++	+	-
Production	-	+	++
Decomposition rate	-	+	++

weak synchronisation	strong synchronisation
low species turnover	high species turnover

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Research setup

3 watertypes
-oligotrophic, acid
-mesotrophic, slightly bufferd
-eutrophic, bufferd

4 seasons
-winter (February 2003)
-spring (April 2003)
-summer (June 2003)
-autumn (September 2003)

7 Microhabitat
-shore - bottom - open water

65 samples
209 taxa aquatic invertebrates
18,000 individuals

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Patterns

Seasonal differences in use of

- watertype

- microhabitat

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Patterns

Seasonal differences in use of

- watertype

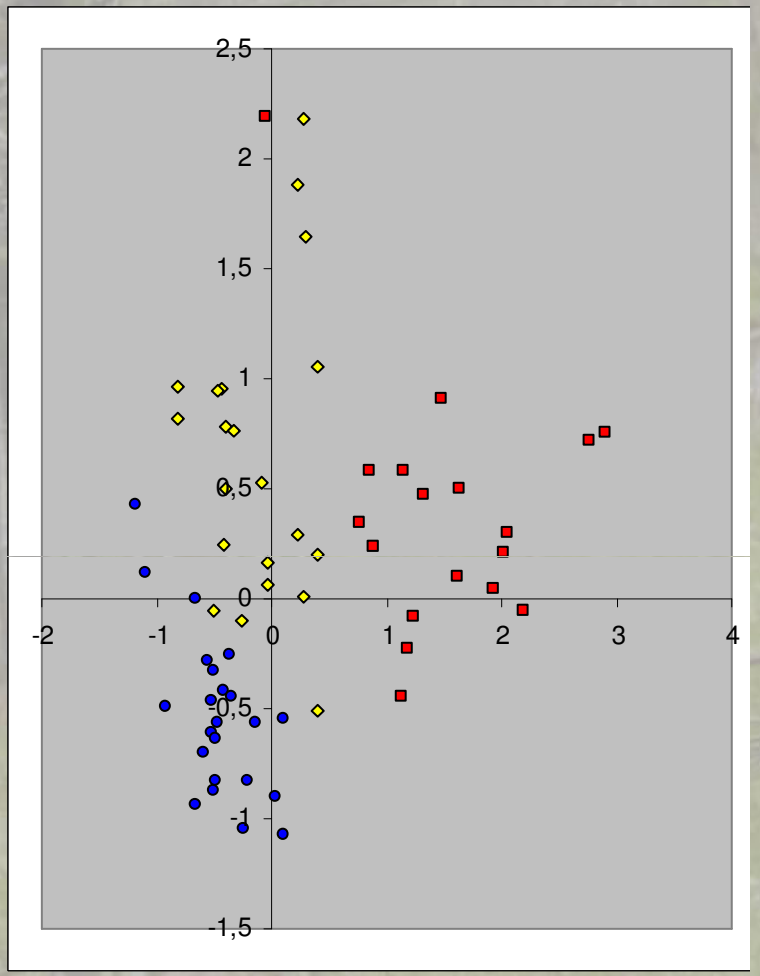
- microhabitat

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Species composition

influence of watertype



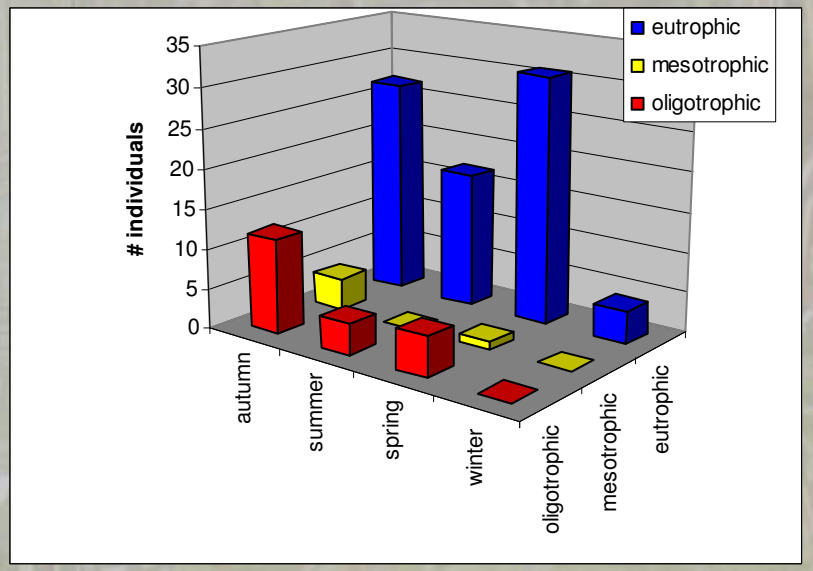
Katholieke Universiteit Nijmegen

Stichting Bargerveen

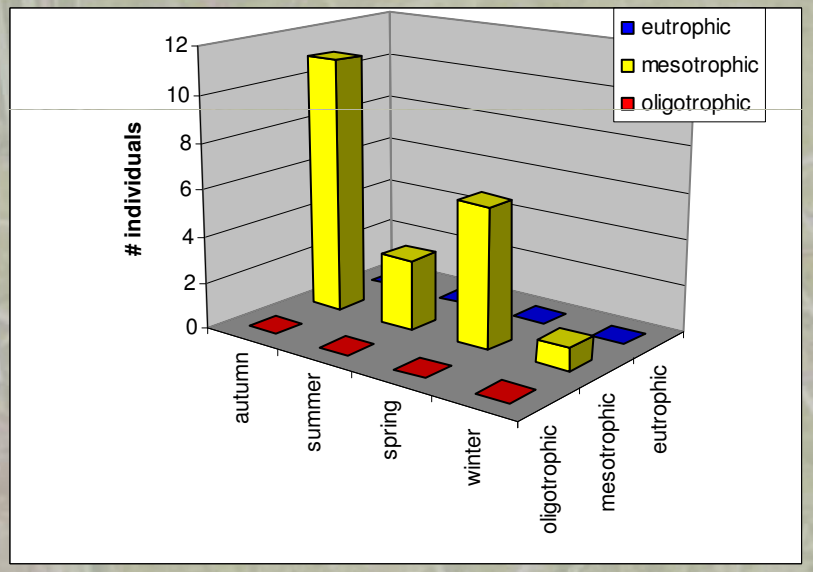
Example

species differing in watertype

Noterus crassicornis (Coleoptera: Noteridae)



Noterus clavicornis (Coleoptera: Noteridae)

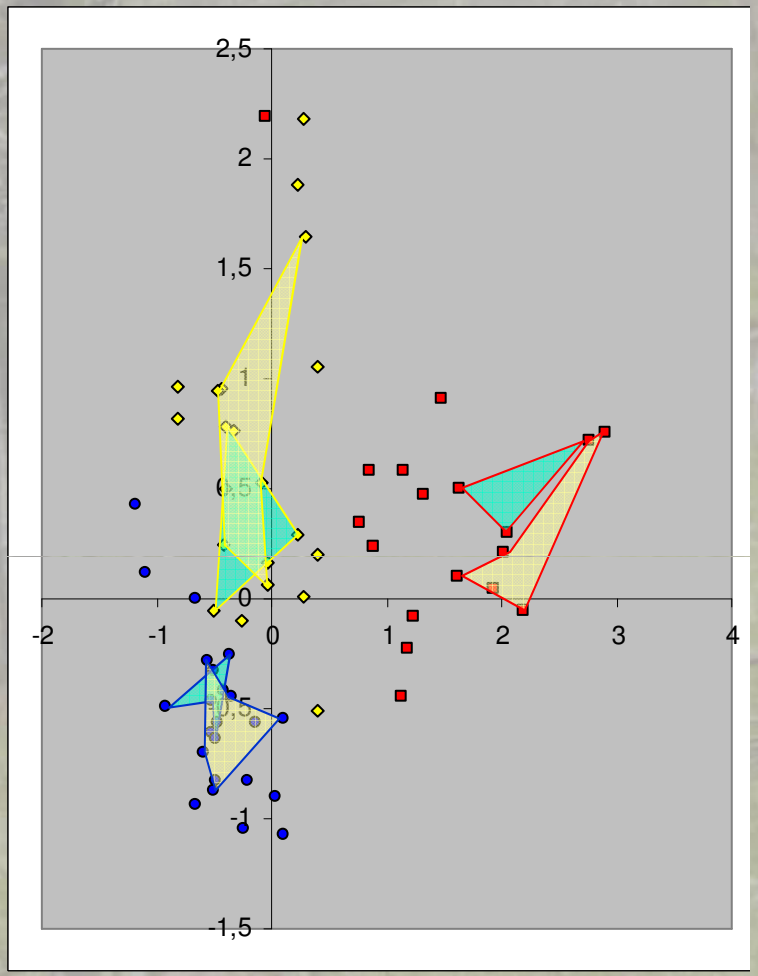


Katholieke Universiteit Nijmegen

Stichting Bargerveen

Species composition

influence of watertype



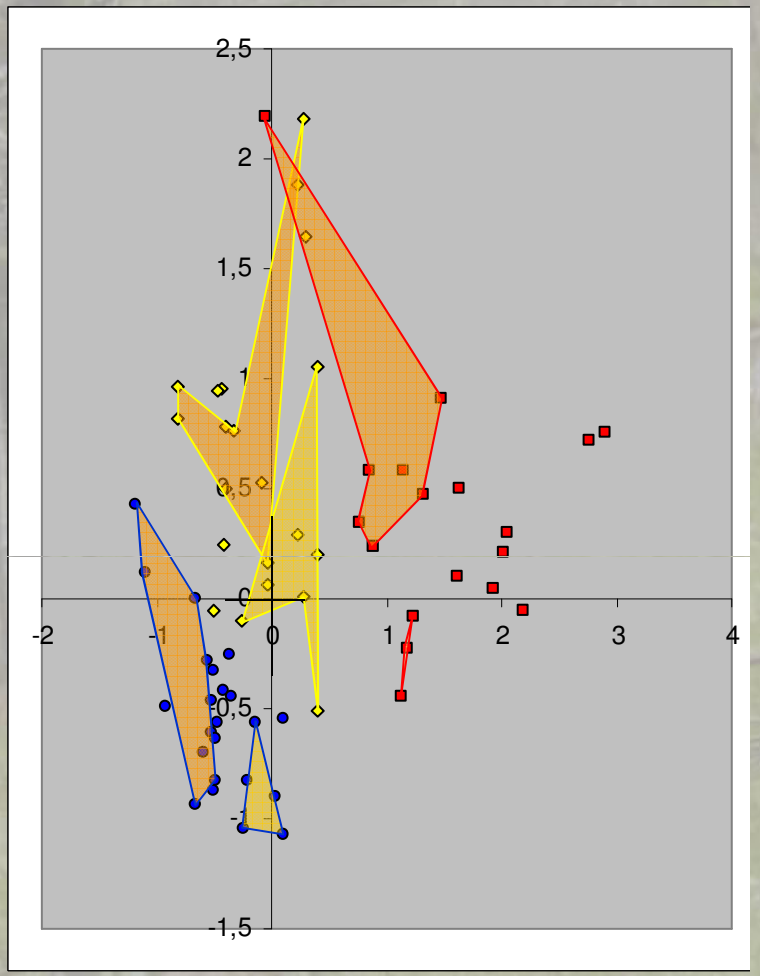
Katholieke Universiteit Nijmegen

Stichting Bargerveen

Species composition

influence of watertype

less important
later on in the season



Katholieke Universiteit Nijmegen

Stichting Bargerveen

Patterns

Seasonal differences in use of

- watertype (less important later on in the season)

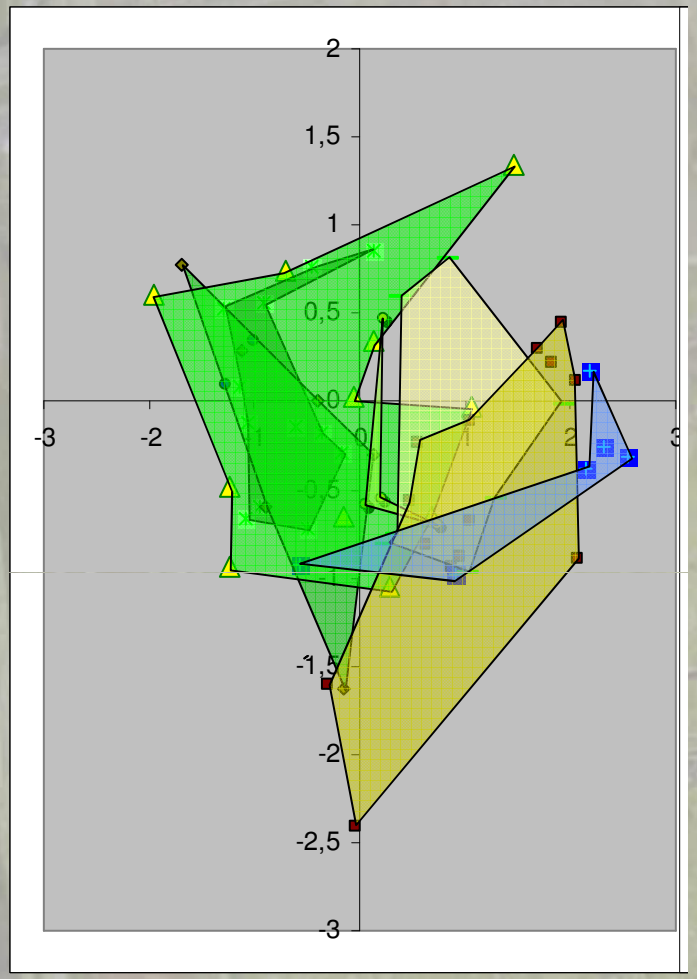
- microhabitat

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Species composition

influence of microhabitat

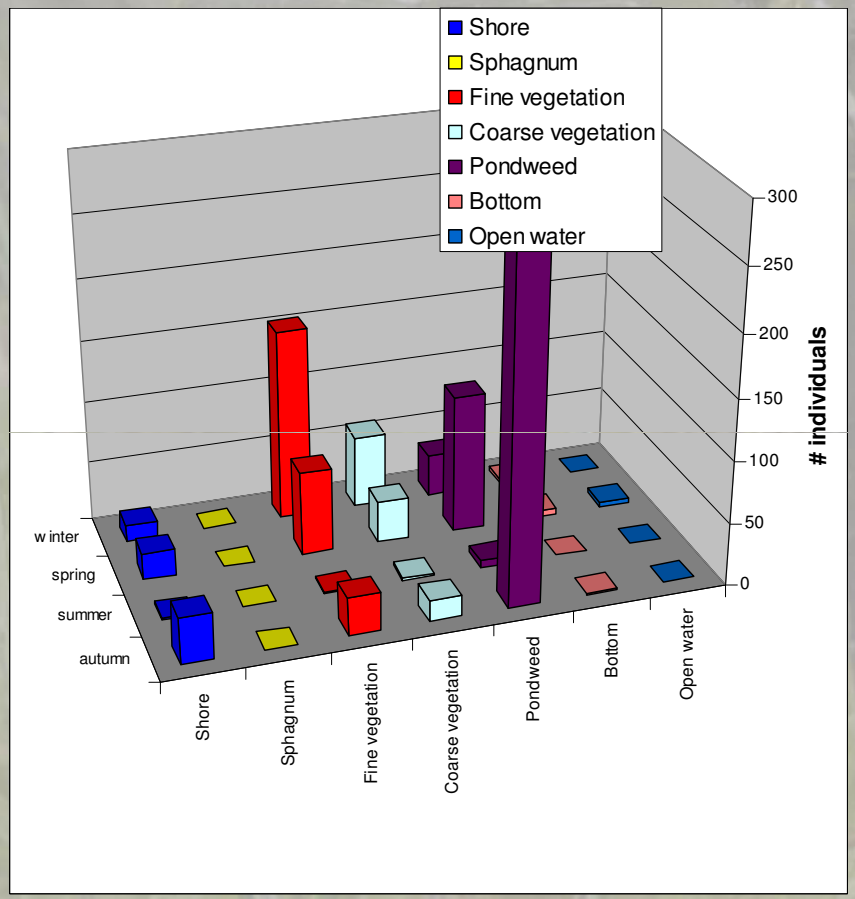


Katholieke Universiteit Nijmegen

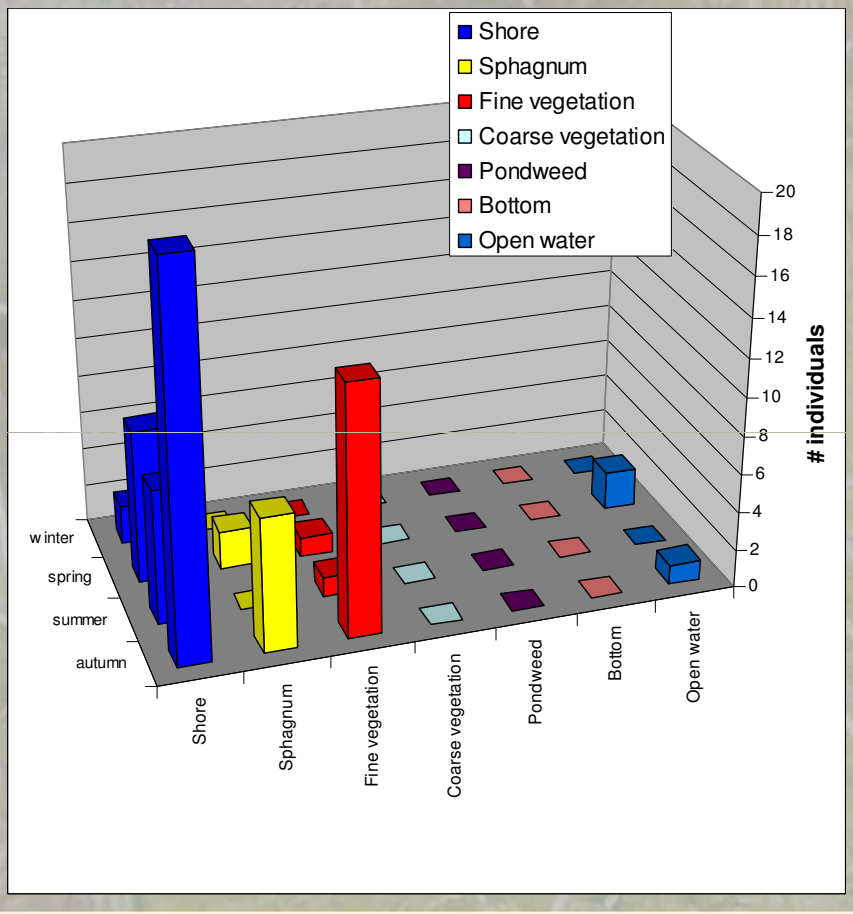
Stichting Bargerveen

Example - species differing in microhabitat

Coenagrion puella/pulchellum
(Odonata: Coenagrionidae)



Pyrrhosoma nymphula
(Odonata: Coenagrionidae)

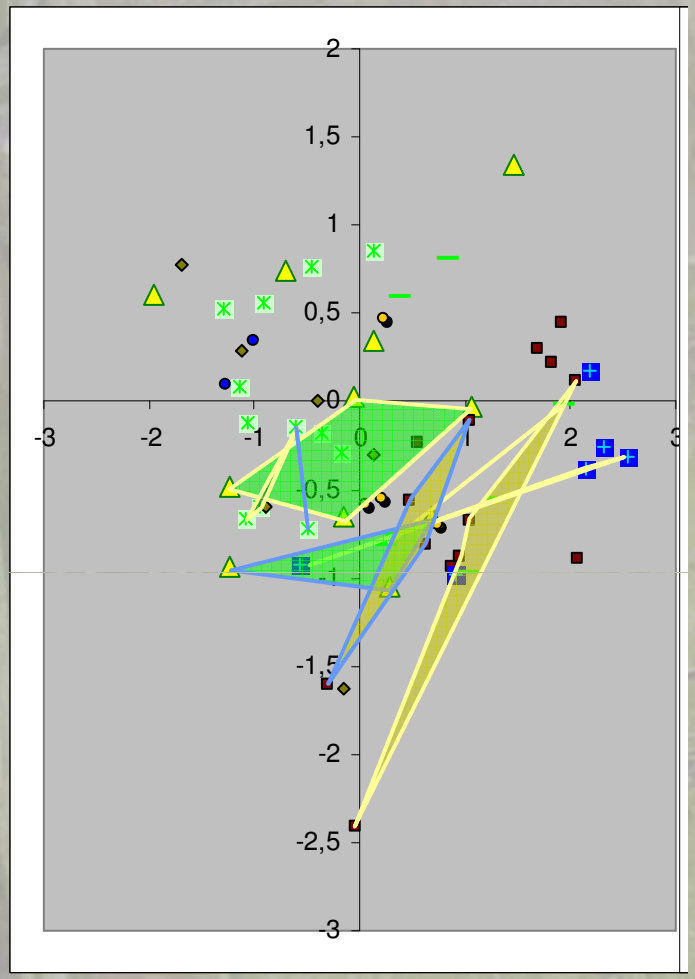


Katholieke Universiteit Nijmegen

Stichting Bargerveen

Species composition

influence of microhabitat



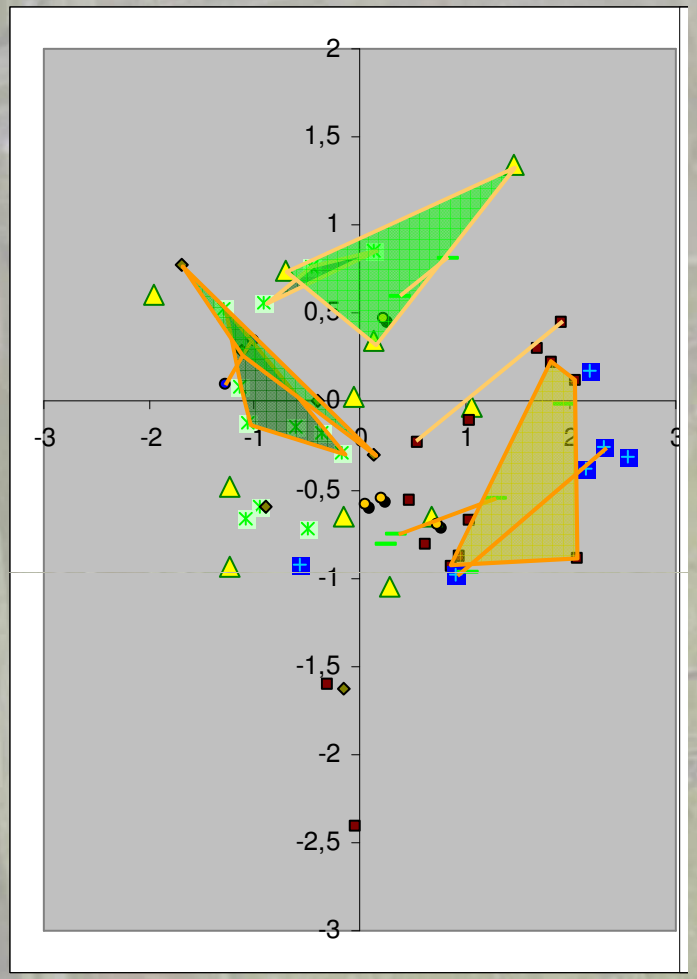
Katholieke Universiteit Nijmegen

Stichting Bargerveen

Species composition

influence of microhabitat

more/equally important
later on in the season



Katholieke Universiteit Nijmegen

Stichting Bargerveen

Patterns

Seasonal differences in use of

- watertype (less important later on in the season)

- microhabitat (equally important later on in the season)

Explanations?

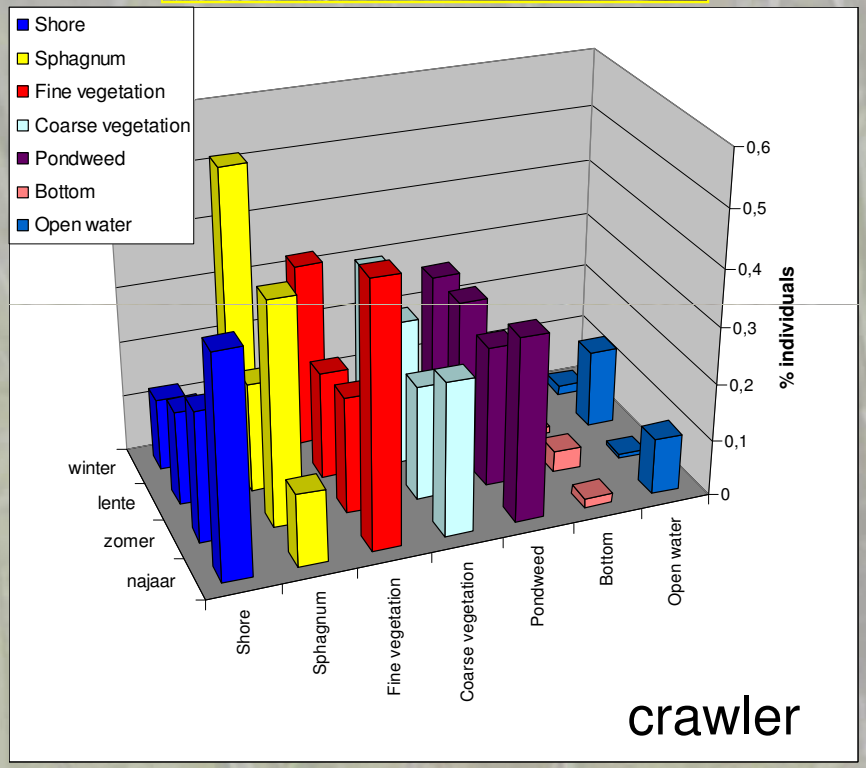
- microhabitat

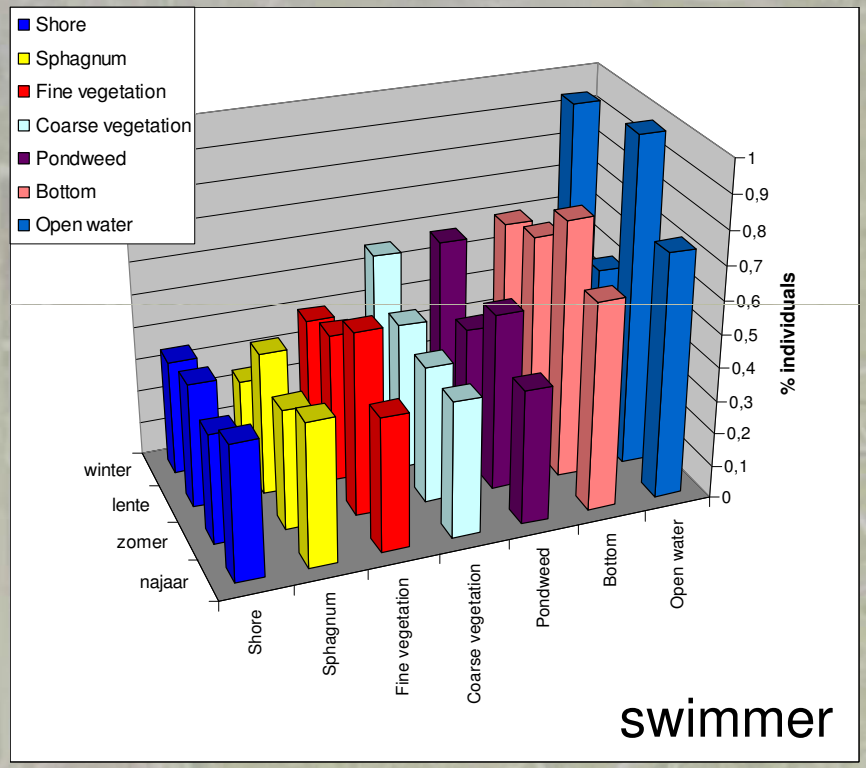
- watertype

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Microhabitat use and locomotion





Katholieke Universiteit Nijmegen

Stichting Bargerveen

Patterns

Seasonal differences in use of

- watertype (less important later on in the season)

- microhabitat (equally important later on in the season)

Explanations?

- microhabitat (locomotion)

- watertype

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Hypotheses



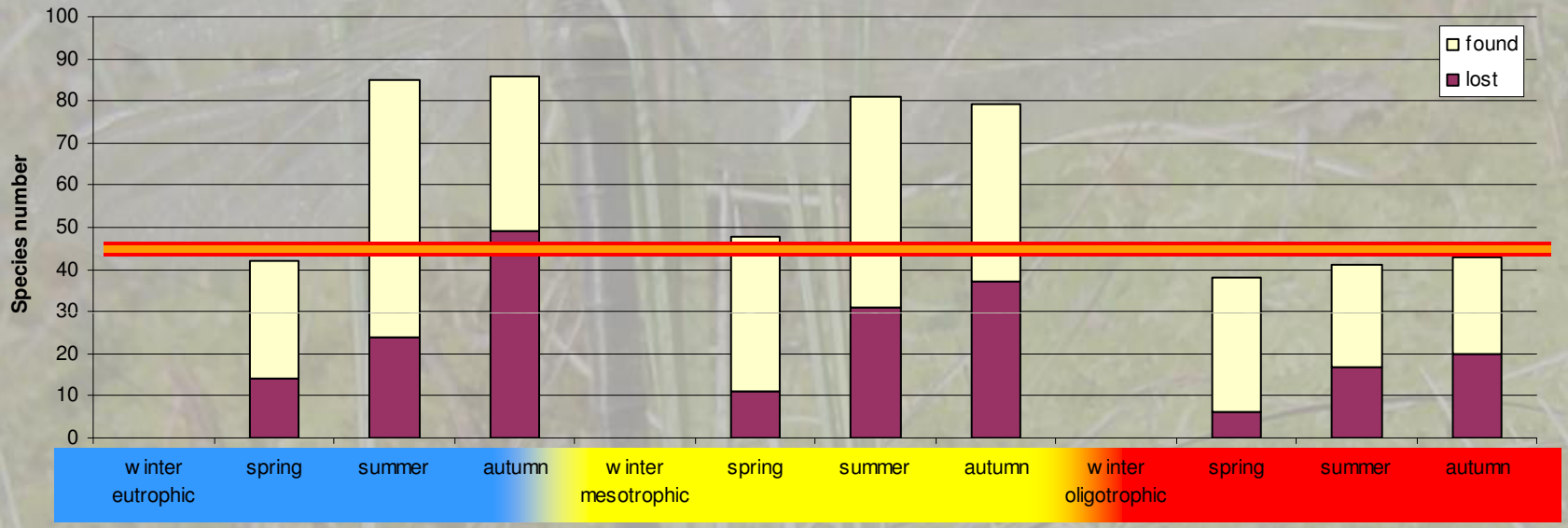
Nutrient status	-	+	++
Acidity	++	+	-
Production	-	+	++
Decomposition rate	-	+	++

weak synchronisation	strong synchronisation
low species turnover	high species turnover

Katholieke Universiteit Nijmegen

Stichting Bargerveen

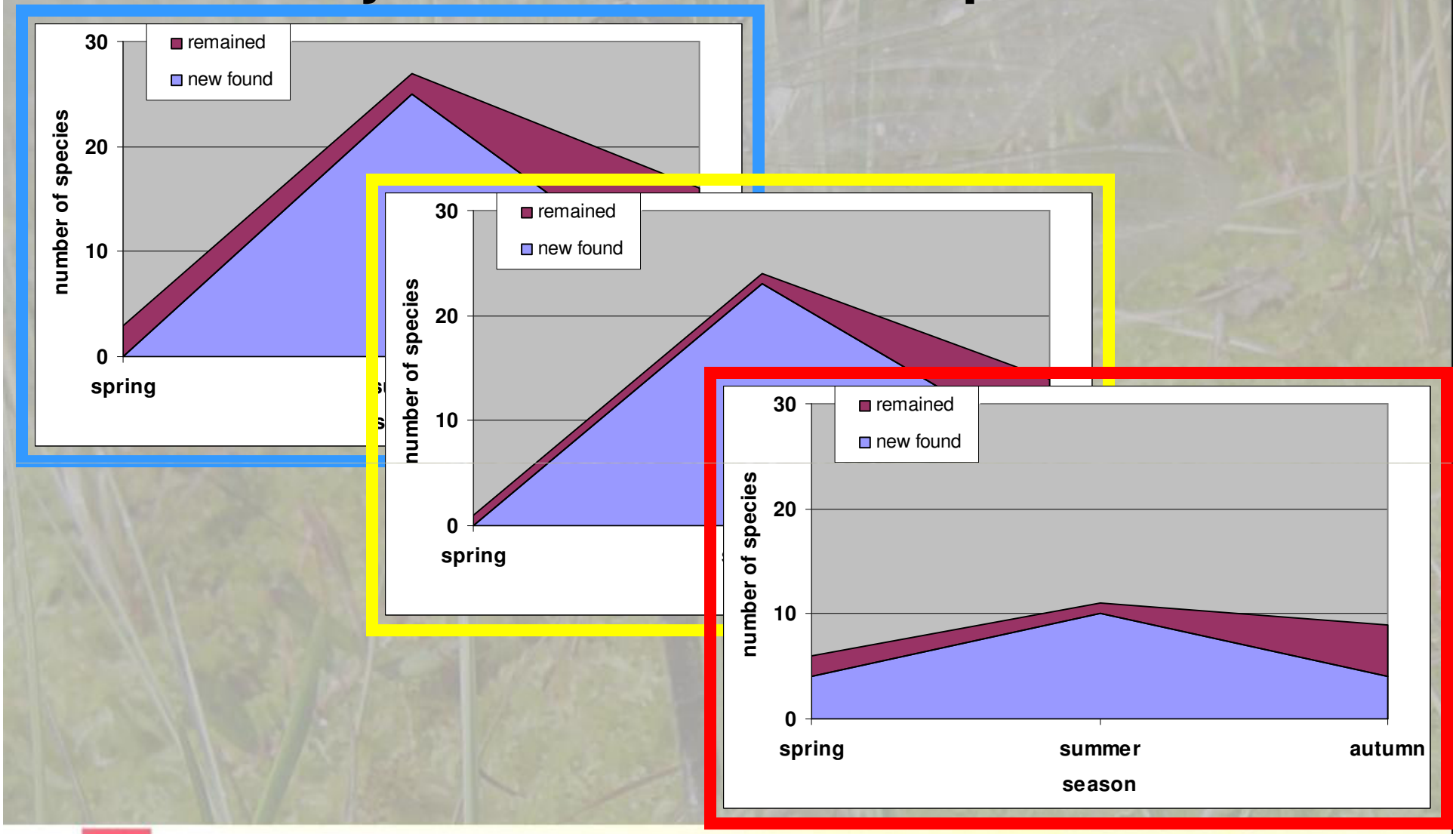
Species turnover



Katholieke Universiteit Nijmegen

Stichting Bargerveen

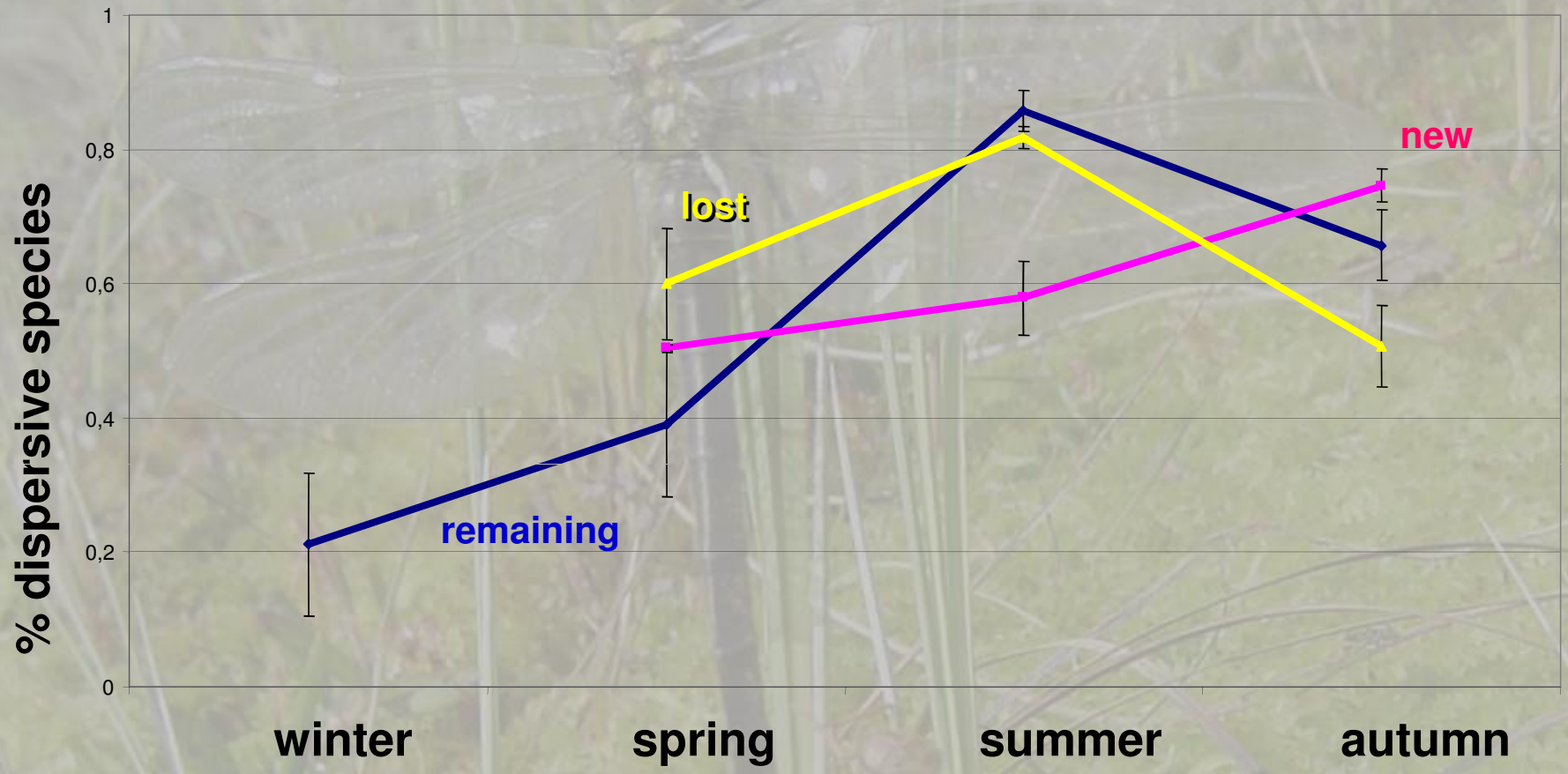
Summer synchronisation for reproduction



Katholieke Universiteit Nijmegen

Stichting Bargerveen

Autumn oppertunistic feeding



Katholieke Universiteit Nijmegen

Stichting Bargerveen

Patterns

Seasonal differences in use of

- watertype (less important later on in the season)

- microhabitat (equally important later on in the season)

Explanations?

- microhabitat (locomotion)

- watertype (higher species turnover in summer and autumn)
  → reproduction → dispersal

Katholieke Universiteit Nijmegen

Stichting Bargerveen

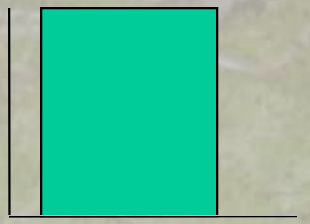
Discussion

Mesotrophic and Eutrophic (as opposed to Oligotrophic)
-high species turnover
-strong synchronisation
-many oppertunistic mobile species

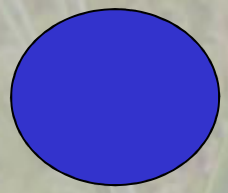
Winter
low abundance

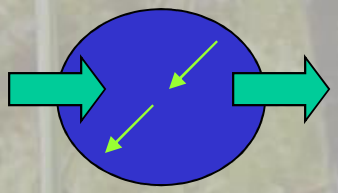
Spring
directed migration

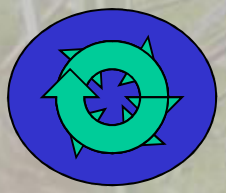
Summer
reproduction

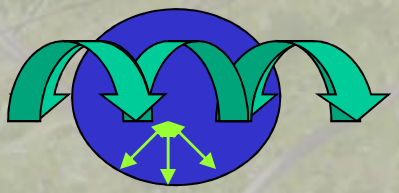


Autumn
opportunism









Katholieke Universiteit Nijmegen

Stichting Bargerveen

Discussion

Seasonal changes in food & vegetation structure (watertype & microhabitat)

Species use (and depend) on this heterogeneity

Provides knowledge on species life history

Neccesary for restoration (focus on heterogeneity)

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Thank you for your attention!

Financed by:

In cooperation with:

Verberk WCEP, van Kleef HH, Dijkman M, van Hoek P, Spierenburg P & Esselink H (2005) Seasonal changes on two different spatial scales: response of aquatic invertebrates to water body and microhabitat. *Insect Science* 12: 263-280.

Katholieke Universiteit Nijmegen

Stichting Bargerveen

Questions or suggestions? Contact me: wilco@aquaticecology.nl