

Multi-group diversity partitioning in a pond complex at Tommelen (Hasselt, Belgium) and effects of pond management (dredging)

De Bie T.¹, Colson L.², Declerck S.¹, Denys L.³, Vanormelingen P.⁴, Villena M.⁴, Vanhecke L.⁵, Ercken D.¹, Vyverman W.³, Van der Gucht K.³, Goddeeris B.², Brendonck L.¹, Martens K.² and De Meester L.¹

¹ Laboratory of Aquatic Ecology and Evolutionary Biology, K.U.Leuven, Belgium
² Royal Belgian Institute of Natural Sciences, Freshwater Biology, Brussels, Belgium
³ Research Institute for Nature and Forest (INBO), Brussels, Belgium

⁴ Laboratory of Protistology and Aquatic Ecology, Gent University, Gent, Belgium
⁵ National Botanic Garden of Belgium, 1860 Meise, Belgium

Introduction

Recent research results have demonstrated that small aquatic ecosystems contribute disproportionately to regional biodiversity, largely because of their high beta-diversity. Understanding the factors that determine overall diversity of an area is crucial for the development of conservation strategies. We present some first results of a survey that was carried out in ponds of the bombcrater field Tommelen to unravel and compare patterns in α - and β -diversity for a wide array of organisms (from bacteria to amphibians). Due to the high number of ponds of similar age in a restricted area, we are able to determine the variables that are associated with α - and β -diversity, independent of pond age or biogeographical differences, on a spatial scale that is relevant to many pond restoration projects.



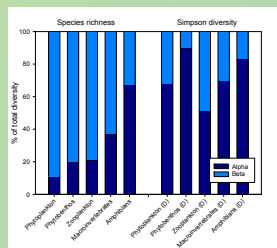
Aerial photo of Tommelen (Hasselt, Belgium)

Diversity partitioning



Overview of the ponds in Tommelen. Semi-permanent ponds are indicated in grey

In additive partitioning, the diversity within and among samples is expressed in the same units of diversity, allowing direct comparison of α and β diversity (Lande, 1996). Our results indicate that, despite the ponds common history and the small spatial scale (11.8 ha), β -diversity accounted for a large part of the total diversity of most groups in the set of studied ponds. Amphibians were omnipresent in the area and, based on their species richness, appeared to be more similar among the ponds than the other groups. To get more insight into the mechanisms regulating the patterns in α and β diversity, we will further investigate to what extent the spatial structure and environmental variables of the ponds are related to those patterns, taking into account the dispersal capacities of all different groups of organisms.



Relative contributions of mean α - and β -diversity to total diversity (based on species richness or Simpson diversity (D)) of phytoplankton, phytobenthos, zooplankton, macroinvertebrates and amphibians in the pond complex of Tommelen.

Management experiment

This pond complex also provides ideal opportunities to evaluate the effects of pond management on a number of replicated systems. One of the most applied management techniques is dredging to prevent ponds from filling in due to natural succession. Fourteen ponds in Tommelen will be dredged at the end of 2008, after which its effects on the composition and diversity of biota will be assessed and compared to non-managed systems and to the pre-management situation.



A second objective is to compare the effect of restoration measures on ponds of different trophic state. The ponds in the southern part of Tommelen are more eutrophic than those of the northern part due to historical contamination. We want to compare the rate and degree of recovery between impaired ponds (southern part) and non-impaired ponds (northern part).

In addition we have randomly selected ponds in which we will re-inoculate a small part of the aquatic vegetation and topsoil immediately upon dredging. It is our hypothesis that the re-inoculation of a part of the removed aquatic vegetation and soil (containing resting stages of different organisms) will enhance biodiversity restoration compared to ponds with no re-inoculation.

Acknowledgements

The study has been performed within the framework of the currently running BELSPO-project "Towards a sustainable management of pond diversity at the landscape level" (PONDSCAPE). We thank J. Coteur (Natuurpunt Hasselt-Zonhoven), R. Jacobs (conservator) and P. Vos (Stad Hasselt) for their cooperation to the project.

Contact

Tom De Bie
 Laboratory of Aquatic Ecology and Evolutionary Biology
 K.U.Leuven
 Ch. Deberiotstraat 32
 B-3000 Leuven
 Tom.DeBie@bio.kuleuven.ac.be
 http://bio.kuleuven.be/de/dea

Co-ordinator Pondscape

Dr. Koen Martens
 Royal Belgian Institute of Natural Sciences
 Freshwater Biology
 Vautierstraat 29
 B-1000 Brussels
 martens@natuurwetenschappen.be

Research project SD/BD/02A

