



Biodiversity and ecosystem functioning in ditches: the structural role of macrophytes

Karin Didderen¹

Introduction

Drainage ditches are main aquatic structures in Dutch arable land which have been largely ignored studies of ecology, biodiversity and conservation and corresponding policy. However, because of their significance, expressed in total length of ditches, they could be major landscape-scale determinants of aquatic biodiversity.

Ditches are characterised by high nutrient concentrations, shallowness, high irradiation of sunlight, high connectivity and a central role for macrophyte communities. Macrophytes play an important role in nutrient and oxygen dynamics and they provide food, shelter and reproduction habitat for ditch fauna, indicating a leading role for macrophytes in generating faunal diversity.

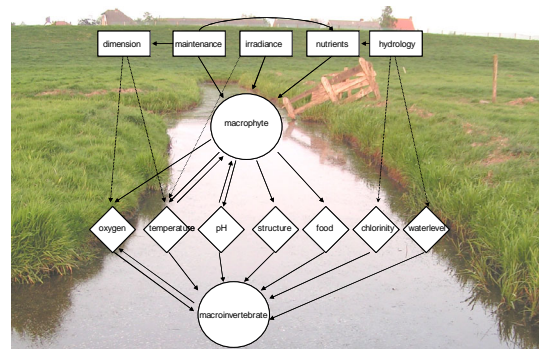
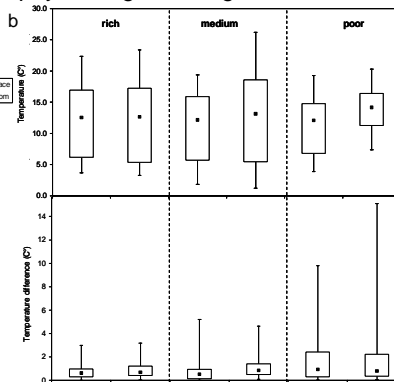
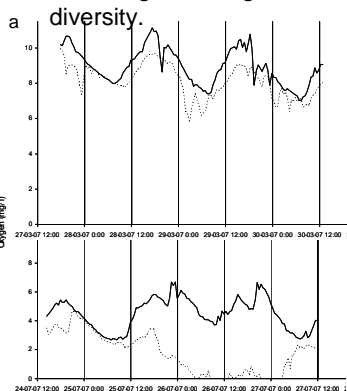


fig 1. Key factors in ditch ecosystems



Habitat complexity or disturbance?

Spatial and temporal heterogeneity of several biotic and abiotic factors, e.g. oxygen and temperature regimes (fig 2) and macrophyte structure are typical for ditches. This study will test if faunal diversity levels are consistent with predictions of the intermediate disturbance hypothesis (IDH) or conversely of equilibrium theories and classify several highly heterogeneous components as either 'disturbance' or 'habitat complexity' factors.

fig 2. a) seasonal and daily shifts in oxygen regime in a ditch b) temperature range and daily temperature shift in 3 ditches differing in macrophyte species richness.

Macrophyte structure

Under the equilibrium theory species diversity increases with area (island biogeography theory) and habitat complexity (niche theory). Former research on macrophyte structure and its effect on faunal diversity has shown it is difficult to distinguish between effects of habitat complexity and habitat area - they often co-vary in the field.

H₀: surface area, complexity and heterogeneity of macrophyte structure jointly contribute to the species richness of macro-invertebrates.

A full factorial field experiment using artificial substrates is conducted. The experiment comprises 3 levels of surface area, 3 levels of complexity (1D, 2D, 3D) and 3 levels of heterogeneity (combinations of different structures) (fig 3). This designs allows to differentiate between the effect of area and complexity.

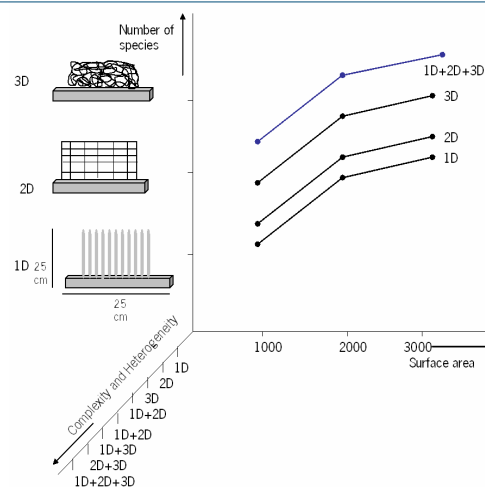


fig 3. Predicted outcome of ongoing experiment