Fundamental and Applied Limnology
Archiv für Hydrobiologie
Vol. 171/3: 185–197, April 2008

Spatial and temporal variability in mire pool limnology

C. Kilroy[1]*, B. J. F. Biggs[1], W. Vyverman[2] and **P. A. Broady[3]**

NIWA, Christchurch, NZ

With 4 figures and 4 tables

Abstract: The significance of mires (peat-accumulating wetlands) is increasingly being recognised internationally because of their susceptibility to climate change and their biodiversity values. Mires are best known in the Northern Hemisphere, but numerous examples occur in the South. The objectives of this study were to characterise physico-chemical conditions in a representative mire in New Zealand, and to draw comparisons with similar environments elsewhere. We measured a suite of physical, chemical and nutrient variables over two full annual cycles in mire pools in a subalpine area. Seasonal variation in and temporal coherence of several chemical variables were inconsistent among pools, and this is explained by variation in water source and pool size. For most variables, temporal variability was at least as high as spatial variability. In comparison with peat-based wetlands in northern Europe, these New Zealand sites tended to have higher pH at given concentrations of Ca. Data from mire pools in other regions, including Tasmania and other parts of New Zealand, shared the same characteristics. Inter-Hemispheric differences in rainfall chemistry may partly account for the pH differences, but low levels of organic acids (measured as DOC) appear more likely to be responsible. The mechanisms leading to low DOC are uncertain, but could include the effects of high rainfall, and vegetation differences. All pools were confirmed as ultra-oligotrophic in winter, though summer peaks in productivity exceeded thresholds for mesotrophic conditions. As in the Northern Hemisphere, nutrient patterns were independent of the Ca / pH gradient. Despite significant spatial and temporal heterogeneity of these mire pools, their average water chemistry also differs from that typical in rivers and lakes in New Zealand. Given that mire pools are already known to support higher proportions of endemism in benthic diatoms compared to other freshwater habitats in New Zealand, we suggest they may constitute an unusual environment type on which more detailed aquatic biological studies are warranted.

Key words: wetland, bog limnology, New Zealand, acidification, Ca / pH gradient.

Introduction

Mires (peat-accumulating wetlands) are increasingly being studied because of impacts from global climate changes (Bragg & Tallis 2001, Pastor et al. 2003), their potential contribution to climate change (Mäkilä et al. 2001, Bragg 2002, Pastor et al. 2003), and their ecological values (e.g., Gunnarsson et al. 2000, Watanabe et al. 2000, Lederer & Soukupova 2002). Mires formed following glaciation in areas of poor drainage, cool temperatures and consistent rainfall, which allowed the accumulation of partly decomposed vegetation and development of dystrophic open-water pools (Foster & Fritz 1987). Such wetlands are widespread in the Northern Hemisphere, but less so in the south (see review in Mark et al. 1995). Nevertheless, the glaciated terrain of subalpine regions in New Zealand contains numerous terraces and depressions in which

[1] **Authors' addresses:** National Institute of Water and Atmospheric Research, PO Box 8602, Christchurch, New Zealand.

[2] Laboratory of Protistology and Aquatic Ecology, Department of Biology, University of Gent, Krijgslaan 281 – S8, B-9000 Gent, Belgium.

[3] School of Biological Sciences, University of Canterbury, Christchurch, New Zealand.

* Corresponding author; e-mail: c.kilroy@niwa.co.nz

DOI: 10.1127/1863-9135/2008/0171-0185 1863-9135/08/0171-0185 $ 3.25