

# The roles of dispersion, patchiness and environmental conditions in structuring shallow lake communities

*Jorge Salgado*

Natural History Museum & University College London

The processes that determine the patterns of distribution and abundance of co-occurring species are a central issue for conservation biology and restoration ecology. As community ecology has moved towards a greater understanding of open systems, recent studies suggest that freshwater communities are structured not only by a combination of local factors, such as environmental conditions, productivity, predation and competition, but also by regional processes like patchiness, dispersion, colonisation and extinction (e.g. Beisner et al., 2006; Cottenie, 2005).



Jorge Salgado sampling macrophytes at one of the shorelines of Castle Lough.

Within this framework, much attention has been focused on understanding contemporary (1–5 years) assemblages. However, the importance of longer time scales (10 to hundreds of years) that offer more realistic insights into the extinction and colonisation of different species, has largely been ignored. Given this oversight, this study aims to investigate the processes that structure freshwater communities in a landscape of well connected satellite lakes at the Upper Erne Lough System, Fermanagh, Northern Ireland, by using contemporary and palaeolimnological techniques.

The Upper Lough Erne Lough system is situated in Co. Fermanagh in the west of Northern Ireland. It is a Special Area of Conservation (SAC) under the EC Habitats Directive. It consists of a large river-fed, mostly eutrophic lake with a predominantly limestone catchment, including numerous associated satellite lakes with different levels of connection to the main Lough. This large and complex freshwater system is of particular interest, as, despite its conservation status, most of its satellite lakes are affected by eutrophication. Additionally, since the end of the 1990s, the zebra mussel, *Dreissena polymorpha*, has invaded most of these systems, displacing other native mussel species and creating shifts in the water clarity and alterations in the freshwater communities (Rosell et al., 1999). For these various reasons, the Upper Lough Erne Lough system provides an ideal natural study system for assessing the processes that structure aquatic communities from a local to a regional perspective over historical timescales.

Thanks to the support received from the Freshwater Biological Association through the Hugh Cary Gilson Memorial Award in 2008, I have successfully completed the first field expedition to the Upper Lough Erne system. With the award I carried out a 12-day palaeolimnological and contemporary survey of three SAC lakes (Mill Lough, Castle Lough and Lough Head). I retrieved seven short (< 1 m), wide bore sediment cores from three spatially separated stations on Mill Lough and Castle Lough and one from Lough Head. I also conducted detailed contemporary macrophyte surveys of Castle Lough. I found a total of 13 submerged macrophytes in this Lough, including *Nuphar lutea*, *Myriophyllum*

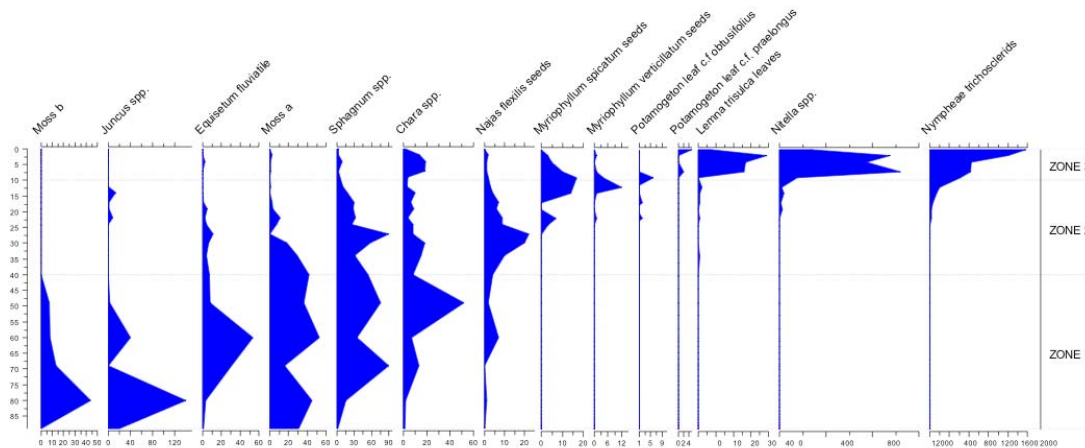


Fig. 1. Selected macrophyte species from preliminary macrofossil analysis in one core of Castle Lough.

*verticillatum*, *Lemna trisulca*, *Elodea canadensis*, *Stratiotes aloides*, *Sparganium emersum*, *Sagittaria sagittifolia*, *Potamogeton praelongus* and *Utricularia vulgaris*.

Thus far I have analysed a total of 20 core samples of between 75 and 80 cm<sup>3</sup> for macrofossils in one core from Castle Lough. Although I am still in the process of analysing the data, my preliminary analyses suggest that there were two major shifts in the aquatic plant and invertebrate community composition. The first shift occurred in the periods corresponding (approximately) to the top 40 and 15 cm of the core. Previously the lake was dominated by charophytes, bryophytes and the endangered species *Najas flexilis* and subsequently these species were replaced by a more typical 'eutrophic' vegetation, including *Myriophyllum spicatum*, *M. verticillatum*, water lilies (possibly *Nuphar lutea*, the only species recorded for the Lough), *Lemna trisulca* and *Potamogeton obtusifolius*. The animal remains exhibit trends which seem to follow the macrophyte community changes, with for example, an initial decrease in concentrations of the bryozoans (*Plumatella* spp. and *Fredericella* spp.) at c. 40 cm. Zebra mussel remains were found in the top c. 5 cm of the core indicating a recent invasion. Overall, these preliminary analyses suggest that community composition has changed dramatically over the time period represented by the core (Fig. 1).

Following the results of a second field trip this summer, I should be in a position to compile a more comprehensive data set from all the SAC lakes of the system allowing me to establish the relative roles of local and regional factors in structuring this changes. Our study will reveal useful information on the implications for assessing regional vs. local management targets for lake systems.

#### References

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