

Invertebrate-habitat associations in the littoral and riparian ecotone of Lough Carra, Co. Mayo, Ireland

-Non technical summary

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Introduction

Traditionally, water quality assessment has focused on controlling and regulating emissions standards to surface waters, but with little reference to the ultimate ecological consequences (Moss et al., 2003). This approach has been replaced by the Water Framework Directive (WFD) (Directive 2000/60/EC) published by the European Commission in December 2000. The aim of the Directive is that all surface waters achieve 'good ecological status' by 2015, and it recognises hydromorphological alteration as a potential impact on the composition and abundance of lake fauna. Paulsen (1997) stated that physical habitat alteration is likely the biggest threat to aquatic ecosystems, exceeding all other anthropogenic pressures. The Water Framework Directive has been an important driver for the development of survey tools such as Lake Habitat Survey (LHS), which provides a method for characterising and assessing the physical habitat of lakes and reservoirs (Rowan *et al.*, 2004, 2006). LHS includes quantitative descriptions of canopy, macrophytes along the lake shore, the amount of shoreline affected by human activities, and the dominant littoral substrate. This shore zone of lakes is functionally important, providing shelter against predation and wave action, feeding zones and habitat (Schiemer *et al.*, 1995).

Research

1) Relationship between lake habitat diversity and macroinvertebrates

This study tested the usefulness of the Lake Habitat Survey as a surrogate of taxon richness and abundance for both aquatic and terrestrial macroinvertebrate phases, within a single lake. Macroinvertebrates were sampled within their adult flying phase and their larval phase within each of the sites. The adults were caught using emergence traps (Plate 1), which were put in place within the lake to catch the macroinvertebrates as they emerged in adult form; and sticky traps (Plate 2), which

were put in place on the shore beside the lake, to catch adult invertebrates as they flew in this area. A scoring system was developed from the established Lake Habitat Quality Assessment (LHQA) score to describe and score the quality of the habitat within each site surveyed and relate it to the macroinvertebrates present.



Plate 1: Emergence traps *in situ* in Lough Carra August 2006.



Plate 2: Sticky traps *in situ* in the riparian zone of Lough Carra.

This was the first test of the relevance of the Lake Habitat Survey method for describing ecological quality. The work demonstrated a link between the LHS scores and macroinvertebrate taxon richness, and abundance of particular taxa and demonstrated the high influence of macrophytes in the assessment. A general increase in macroinvertebrate taxon richness was found with increasing HabQA score. This means that as the quality of the habitat was deemed to be increasing, so too was the diversity of the macroinvertebrates in these areas.

2) Effect of macrophytes complexity on lake macroinvertebrates

A follow on study from this looked at the effect of different types of macrophyte stands on macroinvertebrate abundance and biomass. The plants in these macrophyte beds can act as sites for attachment of eggs, larvae and pupae, provide visual protection for predators and prey, and attached algae to feed invertebrate grazers (Gerrish and Bistrow, 1979). Dense macrophyte stands increase the number of niche spaces and abundance of food available for macroinvertebrates and fish (Tolonen *et al.*, 2003). This study examined the effect of macrophyte complexity on macroinvertebrate community structure and biomass, while investigating the fish predation refuge offered by the habitats. Four habitats were chosen to represent a

scale of structural complexity: Cobble, *Phragmites*, *Cladium* and *Chara*. Within each of these habitats a fish exclusion cages were put in place to determine the impact of fish predation on the macroinvertebrates within these areas. Cages comprised a wood structure 0.8 m², and 4 mm polythene mesh, attached to the wood. Mesh surrounded the perimeter of the cage, but the top and bottom were left open. Cages were lowered over the vegetation, secured in place with weights on all four corners, and the bottom sealed by pushing the mesh into the sediment and securing it with boulders (Plate 3).



Plate 3: Fish exclusion cages *in situ* in Lough Carra, 2007

The exclosures were put in place and left for 10 weeks, from June until August 2007. Macroinvertebrates were sampled at the end of the ten week period. Habitat, in the form of macrophyte complexity, was found to be important for macroinvertebrate metrics. Overall biomass and abundance increased with increased dry mass of macrophytes, and particular groups altered in various habitats according to their ecology. Fish predation was not found to impact on the macroinvertebrates in this time period, and this may be owing to light predation pressure within the lake, or an insufficient experimental set up. The Lough Carra/Mask SAC is an important site for Odonata diversity in Ireland. Odonata abundance was greatest in the emergent

macrophyte habitats *Cladium* and *Phragmites*, which are impacted by ongoing agricultural practices such as land clearing and nutrient enrichment, thus threatening the future diversity and abundance of Odonata within this lake. These results have important implications for conservation and monitoring, as in order to maintain species diversity and abundance, macrophyte diversity, health and complexity must be conserved.

References

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