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Editorial

Eyes of the landscape – Value, conservation and management of European ponds

Preface

Ponds are a vital freshwater resource representing around 30 percent of the global surface area of standing water (Downing et al., 2006). In Europe, ponds are still a highly abundant and varied aquatic habitat in spite of net losses of up to 90% in some countries (EPCN, 2008). There is also increasing evidence, that ponds have significant value in terms of ecosystem biodiversity, functions and services (Boix et al., 2012; Davis et al., 2008; Downing, 2010; Oertli et al., 2009; Søndergaard et al., 2005; Williams et al., 2004). Partly because our understanding of the importance of ponds is so new, the protection of ponds lags behind current knowledge, with ponds little considered in European policy and legislation. In a recent review of Member States River Basin Management Plans (Environment Directorate General of the European Commission, 2012) the European Commission expressed concern that small water bodies are currently being overlooked in spite of the requirements of the Water Framework Directive to protect all waterbodies. More generally, there is now an urgent need for greater protection and resources to maintain the value and quality of ponds across Europe.

The European Pond Conservation Network (EPCN; www.europeanponds.org) was launched in Geneva in 2004 to promote awareness, understanding and conservation of ponds in European landscapes. EPCN conferences have subsequently been held every two years, attracting an increasing number of attendees with widely diverse backgrounds from scientific research to practical pond conservation and management. Conference papers have been regularly published in peer-reviewed proceedings from the conferences in Geneva 2004 (Oertli et al., 2004, 2005), France 2006 (Nicolet et al., 2007; Céreghino et al., 2008), Spain 2008 (Oertli et al., 2009; Miracle et al., 2010) and Berlin 2010 (Boix et al., 2012). In Spain 2008 an important milestone was achieved through the publication of the "Pond Manifesto" (EPCN, 2008) which presents the case for conserving European ponds. Available in 6 languages, the Manifesto provides an outline strategy for much needed conservation action across and beyond the continent.

The 4th EPCN-Conference Berlin 2010

Berlin (Erkner), Germany, was the host of the 4th Conference of the European Pond Conservation Network (EPCN) in June 2010. It was organised by the EPCN and the Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany, with the support of various partners.

The motto of the conference was "Eyes of the landscape – the value of ponds in the 21st century" based on the premise that the quality and characteristics of ponds provides an insight into the impacts of both natural and land use changes across Europe. The focus of the meeting was also highly topical following as it did "Countdown 2010 – year of biodiversity", and the subsequent statements for "Global Biodiversity Outlook 3": 1. We have ongoing global losses in biodiversity and habitats; 2. Preservation of biodiversity is not possible given the continued conflicts between land use change and nature conservation.

Against this background, one of the main objectives of the 4th EPCN-Conference was to promote the exchange of experiences of pond experts from both basic sciences and applied work on conservation and management, to address the issues of the Pond Manifesto (EPCN, 2008). The goal was to increase understanding of the importance and value of ponds in terms of their conservation value and function, to identify important areas for ponds and to know how to better value and protect ponds.

A total of 118 pond researchers and practitioners (25% students) from 22 countries attended the 4th EPCN-Conference, which included 61 oral and 64 poster presentations on a wide range of topics including:

1. Pond typology, functions and ecosystem services in landscapes.
2. Methods for ecological monitoring and assessment.
3. Pedogenesis and paleolimnology.
4. Hydrology, biogeochemistry and pollution.
5. Habitat function, biodiversity and bioindication.
6. Practical use, conservation and management.
7. Decision aids for policy, legislation and pond users.
8. Education on the functioning, value and wise use of ponds.

A selection of 12 contributions presented at the 4th EPCN-Conference in Berlin has recently been published in a special issue of Hydrobiologia (Boix et al., 2012). An additional selection of ten papers is part of this special issue of Limnologica.

Special issue content

The manuscripts selected for this issue of Limnologica reflect the main objective of the conference, to bring together scientific research from across Europe on pond function, pond communities, pond type and importantly how this relates to the practical conservation of the pond resource.

For many pond types and taxonomic groups there is still a lack of scientific evidence on which to base pond management

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decisions. Gołdyn et al. (2012) has continued the work of others to redress this imbalance for the large branchiopod crustaceans, many of which are considered threatened in Europe and which can be indicator species for the conservation status of temporary ponds. A lack of data on the occurrence and status of these species in Poland has resulted in a paucity of conservation policy for this group. The findings of this recent study show that the diversity of globally threatened large branchiopods is still relatively high in this region. However, their distribution was not widespread and was concentrated in areas of suitable habitat where dispersal between multiple waterbodies was possible as part of a metapopulation. This connection between high species richness, high species rarity and maintenance of pond networks at a landscape scale is apparent in many taxonomic groups and is an important message for pond creation programmes (Gibbs, 2000; Williams et al., 2004; Cayrou and Céreghino, 2005; Jeffries, 2005; De Bie et al., 2008; Oertli et al., 2008). Armitage et al. (2012) investigates the contribution of manmade temporary trackway pools to regional biodiversity, showing that they have both high species richness and high species rarity. This results from both the seasonal nature of the habitat and the heterogeneity of landscape type within which these ponds are found.

One of the biggest threats to freshwater biodiversity globally is a decline in water quality, but the small scale of ponds means that they can often be located in semi-natural catchments receiving 'clean-water' within regions which are otherwise impacted (Williams et al., 2004, 2008). Waldon (2012) clearly illustrates this following an inventory of vascular plants from 450 ponds in the Krajeńskie Lakeland of North Western Poland. These ponds have high biodiversity value supporting over 400 native species and around 30 legally protected taxa. However the study reveals that over 35% of the ponds were now connected to the drainage network and as a result showed deterioration from urban and agricultural discharges. The richest ponds for biodiversity were those isolated from settlements or from agricultural surroundings by a buffer strip of natural vegetation. In western Slovakia Illyová and Pastuchová (2012) demonstrate the impact of eutrophication from human activities on the zooplankton communities of small water reservoirs resulting in high nutrient concentrations and lower species richness in the impacted catchment.

Ponds may be particularly sensitive to the impacts of surrounding land use due to their small size and small catchment area, however there is a poor level of understanding as to the variation in response according to pond type (Céreghino et al., 2008). Sahuquillo et al. (2012) assess whether hydroperiod and water source play a role in the sediment phosphorus and nitrogen concentrations of Mediterranean ponds. Temporary rain fed ponds used by domestic sheep had high turbidity and high TP concentrations, but low planktonic chlorophyll due to low P-bioavailability in the water. Whereas, permanent groundwater fed ponds surrounded by intensive agriculture had high chlorophyll a correlated with high TP. Ponds with a shorter hydroperiod also had less organic matter and less TN due to biogeochemical transformations during the period of desiccation. In Northeast Germany, kettle hole ponds have become increasingly threatened by intensification of agriculture and the pond type is now afforded legal protection. However, Pätzig et al. (2012) draw attention to the fact that these ponds differ significantly due to the influence of different environmental factors which may have important consequences for ecological assessment and protection prioritisation. Length of hydroperiod, depth, shore width, area, pH, conductivity, water hardness and levels of dissolved oxygen were identified as key indicators for macrophyte species richness and community composition. Ruhí et al. (2012) investigate the processes driving successional patterns between cold temperate and Mediterranean regions. They conclude that climate-dependent environmental variables may condition the assembling mechanisms of a community and subsequent community succession – less time under favourable conditions for dispersal in temperate regions and intrinsic hydrological variability in Mediterranean wetlands. Differences in the biogeochemistry of ponds and the number of hydrogeomorphic pond types in each region should therefore be taken into account when establishing ecological thresholds to assess water quality and could have important consequences for the prediction of ecosystem development in newly created wetlands under future climate change scenarios.

The need for more research on the consequences of pond management is widely recognised and was a theme picked up by the conference. Olmo et al. (2012) investigated difference in zooplankton community reestablishment and changes in Mediterranean temporary ponds following extensive dredging of the sediments for the purposes of pond restoration. The results showed that although there were differences in community composition relating to restoration age, taxonomic richness was high in all ponds and similar to the regional species pool, regardless of time since restoration. This suggests that dispersal was not a limiting factor for this group of organisms in this region which had a high density of wetland habitats and therefore the recovery of zooplankton communities may be achieved within a short time period following this method of restoration. In urban areas, where the rate of pond loss and the impacts of pollution on water quality are often amplified, Herrmann (2012) investigates the role that artificially created stormwater wetlands can have in increasing regional biodiversity whilst at the same time fulfilling their function to retain nutrients, sediments and metal concentrations. In the five years following their construction the results suggest that it may be possible for these wetlands to be efficient in both reduction of pollutants and to increase freshwater biodiversity. However, over time, the wetlands appear to be most efficient at retention of nitrogen leading to an increase in the dominance of competitively dominant emergent vegetation and the subsequent loss of more restricted plant species. The same pattern was observed in the invertebrates which showed high levels of colonisation initially followed by a decline in species richness in subsequent years.

Pond restoration and construction is more and more accompanied by breeding and translocation programs. However, the appropriateness of translocations as a tool for conservation has been widely debated, as it can cause biodiversity loss through genetic homogenization and may disrupt local adaptation, eventually leading to outbreeding depression. Schröder et al. (2012) have shown that for an amphibian translocation programme for Fire-bellied Toad *Bombina bombina*, one population showed the typical genetic composition of surrounding populations, the other was extremely diverged without clear affinity to its putative source. In this population they detected a profound impact of allochthonous individuals: 100% of the analyzed individuals exhibited a highly divergent mitochondrial haplotype. These individuals generally increased the genetic variability of the affected population without wiping out locally adaptive genotypes. Thus, outbreeding depression might be less apparent than sometimes thought and natural selection may be strong enough to maintain locally adaptive alleles, at least in functionally important immune system genes.

In a European context, the research presented at the conference strongly reflect the concerns emerging from pond practitioners that (1) pond networks and landscape scale heterogeneity of pond types are important for pond conservation in addition to the importance of individual ponds (Williams et al., 2004; Gibbs, 2000; Jeffries, 2005); (2) the development of a pond typology is essential to understand ecological processes, identify areas at greater ecological risk and allow appropriate ecological thresholds for conservation management to be implemented (EPCN, 2010); (3) more research is needed to understand the implications of pond management and to assess the success of conservation programmes. This theme also

forms the basis for the next EPCN Conference, particularly in the context of a changing water environment.

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