SNIFFER
SCOTLAND & NORTHERN IRELAND FORUM FOR ENVIRONMENTAL RESEARCH

DEVELOPMENT OF A TECHNIQUE FOR LAKE HABITAT SURVEY (LHS): PHASE 2

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EXECUTIVE SUMMARY

This research project reports the second phase of development of the Lake Habitat Survey (LHS) method, building on the results of the Phase 1 project (SNIFFER Report WFD40, 2004). The need for the work arose from the recognition that within the UK and across Europe more generally, no standard methods existed for assessing the hydromorphological condition of ponds, lakes and reservoirs, or for assessing the physical condition of standing waters in sites designated for conservation. The European Water Framework Directive (WFD), introduced in 2000, has acted as an important driver for LHS, especially because the WFD places a high premium on the development of international standards (e.g. those produced by the European Committee for Standardization). The utility of LHS to provide input data into decision-support systems required for environmental standards was therefore fundamental. However, from its inception, because of the limited choice of available methods, it was recognised that there was scope for this new scheme to be multi-purpose, providing data for management and conservation applications, systematising environmental impact assessment and supporting restoration programmes for degraded lake ecosystems.

The protocol underwent some minor revisions following an expert workshop in March 2005, with further amendments made following training workshops held at four lakes across the UK. The final July-2005 versions of the field form and manual were tested both by contractors and partner environmental agencies (EA, EHS and SEPA) during the 2005 field season (available from the SNIFFER website http://www.sniffer.org.uk). Field trials were also conducted in several European countries including Ireland, Finland, France, the Netherlands, Poland and Serbia-Montenegro. Dialogue between surveyors and contractors proved vital for refining the protocol, improving the consistency of field results and improving surveyor confidence.

In terms of methodological development the two main areas considered were the sampling strategy (i.e. the number and siting of Hab-Plots) and further consideration of the role of remote sensing. For selected sites (Loch Lomond, Loch Earn, and Barton Broad) large numbers of Hab-Plots were collected (38, 15 and 18 respectively), allowing surveys of various size to be simulated with the data. It is demonstrated that the uncertainty in Hab-Plot summary data diminishes with sample size, but it was concluded that minor gains in precision do not necessarily outweigh the benefits of a standardised procedure, particularly when considered in tandem with the perimeter survey results. Viewed in the context of a hierarchical monitoring strategy it is concluded that the standard protocol of 10 evenly-spaced Hab-Plots should be the default method. Where surveillance monitoring suggests particular issues or complexities within a system, investigative monitoring can pursue further samples (in increments of 10 and maintaining the principle of even spacing). Further consideration was given to the use of remote sensing and GIS tools. The use of aerial photographs and high resolution digital maps were complemented by an airborne hyperspectral survey of Torside Reservoir. It was concluded that remote sensing is best considered as a complementary method, rather than as an alternative, to a field-based assessment. Analytical and sampling uncertainties, however, are minimised in the field when surveyors have access to high quality maps and appropriately-scaled air photographs.

Following the 2004-05 field seasons the LHS database now contains c. 200 lake surveys (comprising c. 1400 constituent Hab-Plots). Useful summaries relating to engineering practices as well as the range and intensity of specific pressures can inferred, with the caveat that these data do not comply with the statistical requirements of a probability-based, area-weighted sample (though this is desired in future). Summary metrics, such as the Lake Habitat Modification Score (LHMS) and the Lake Habitat Quality Assessment (LHQA) were also derived. LHMS scores of zero were recorded at c. 5 % of sites within the UK, indicating that these would qualify as being at reference condition with respect to hydromorphological quality elements. A useful distinction was made between hydrologically 'regulated' and 'un-regulated' sites, with the former showing consistently higher LHMS scores and a much wider range of specific pressures. LHQA results were more equivocal, and demonstrated strong scale-dependency, with larger sites such as Loch Lomond having high levels of hydromorphological alteration, but by virtue of their large size they also still contain extensive and diverse natural habitats giving them a higher assimilative capacity with respect to pressures. Analysis of LHS data showed links between macrophyte structure (serving as a proxy for functional groups) and substrate characteristics, which in turn was related to geology and effective fetch. It is concluded that there is considerable potential in analysing the structural data within the database to make inferences about lake habitats. However, further investigations into the linkages between hydromorphological alteration and ecology were constrained by limited access to appropriate biological data.

In terms of the next steps in LHS development, it is concluded that the key challenge remains in more fully exploring the relationships between LHS metrics and comparably scaled biological data. It is noted that integrated field campaigns where macrophyte, macroinvertebrate and fish data have been collected at the same time as LHS surveys offer particular opportunities to advance in this direction. The need for further training and an accreditation programme that will ensure consistency of approach in both field data collection and metric calculation is also recommended. Further innovations relating to the development of electronic field forms, negating database transcription errors and permitting real-time generation of summary metrics inclusive of uncertainty, are further targets for the Phase 3 development of the LHS assessment tool.

Key words: Lake Habitat Survey, Hydromorphology, LHMS, LHQA, Water Framework Directive, Habitats Directive