

Impact case study (REF3b)

<p>Institution: University of Dundee</p>
<p>Unit of Assessment: 17 Geography, Environmental Studies and Archaeology</p>
<p>Title of case study: Bridging the gap between policy and regulation: new assessment tools for implementing the EU Water Framework Directive</p>
<p>1. Summary of the impact</p> <p>Research by Rowan and ERG colleagues Black, Bragg, Cutler, Duck has addressed the science and policy challenges faced by statutory authorities meeting their duty to implement the EU Water Framework Directive (WFD) 2000. Assessing the sensitivity of aquatic systems to physical, chemical and biological pressures is the central theme, and through a series of commissioned projects funded by UK environment and conservation agencies, the research has:</p> <ul style="list-style-type: none"> • Developed new assessment tools used by statutory regulators to characterise the degree of flow alteration and physical modification to rivers and lakes; • Developed the lake habitat survey (LHS) method, complete with accreditation programme, incorporated as best-practice in a CEN European Guidance Standard; • Been translated directly into legally-binding and currently used environmental standards across the UK and Ireland (through new enabling legislation); • Informed regulatory practices across Europe, particularly in Italy, Poland, France, Norway, Serbia and Montenegro.
<p>2. Underpinning research</p> <p>The introduction of the EU Water Framework Directive in 2000 is widely regarded as the most important environmental legislation introduced in Europe for a generation. Whilst politically ambitious, implementation is very challenging due to gaps in basic data and limited understanding of how rivers and lake respond to multiple pressures.</p> <p>Since 1999 the Environment Research Group (represented by Black, Bragg, Cutler, Duck and Rowan) has undertaken a series of research projects (c. £0.5M) commissioned on behalf of statutory UK and Irish environment agencies. Early funding to Black et al. (2000) developed a modelling framework (DHRAM) quantifying the extent to which river flows and lake water levels deviate from natural due to water use pressures³. Black et al. (2002) developed guidance for determining when the degree of change would qualify as <i>'heavily modified'</i> and hence management targets would have alternative environmental objectives. These studies highlighted the absence of robust field methodologies and decision support tools leading to development of the Lake Habitat Survey over three phased projects (Rowan et al. 2003-2010). This research developed a comprehensive survey scheme, extensively tested by statutory regulators across the UK, Ireland, Italy, Poland, France, Norway, Serbia and Montenegro^{5,6}. The absence of established evidence linking physical impairment to loss of ecological function required the adoption of risk-based approaches, including an important role for expert solicitation to define <i>thresholds of change</i>^{3,4}. Acreman et al. (2008) used workshops and practitioner-based focus groups to define environmental standards for how much water can be abstracted from rivers without unacceptable risk to biota and to set statutory guidance on environmental flow releases from dams^{1,2}. A similar approach was taken by Rowan et al. (2012) in setting thresholds of physical modification in the Lake-MImAS classification and decision-support tool⁷. This research was published under the auspices of the UK Technical Advisory Group (UKTAG) following extensive peer-review and a formal public consultation process before the results were translated (transposed) into legally-binding environmental standards. Overall this was ground-breaking research, with a strong co-production ethos required because the policy aspirations of the legislation were ahead of the science base.</p>

3. References to the research

1. Acreman, M.C. and 13 co-authors inc. **Black, A.R.** 2008. Developing environmental standards for abstractions from UK rivers to implement the EU Water Framework Directive. *Hydrological Sciences Journal*, 53, 1105-1120. **DOI:** 10.1623/hysj.53.6.1105
2. Acreman, M.C. and 15 co-authors inc. **Black, A.R.** 2009. Environmental flows from dams: The Water Framework Directive. *Proc. Inst. of Civil Engineers: Engineering Sustainability*, 162, 13-22. **DOI:** 10.1680/ensu.2009.162.1.13
3. **Black, A.R., Rowan, J.S., Duck, R.W., Bragg, O.M.** and Clelland, B.E. 2005. DHRAM: a method for classifying river flow regime alterations for the EC Water Framework Directive. *Aquatic Conservation – Marine and Freshwater Ecosystems*, 15, 427-466. **DOI:** 10.1002/aqc.707
4. **Bragg, O. M., Black, A. R., Duck, R. W. & Rowan, J. S.** 2005. Approaching the physical-biological interface in rivers: a review of methods for ecological evaluation of flow regimes. *Progress in Physical Geography*, 29, 506-531. **DOI:** 10.1191/0309133305pp460ra
5. CEN 2011. Comité Européen de Normalisation (European Standards Agency). *Water Quality – Guidance Standard on assessing the hydromorphological features of lakes*. EN16039:E, pp. 39. (lead author **Rowan, J.S.**).
6. **Rowan, J.S., Carwardine, J., Duck, R.W., Bragg, O.M., Black, A.R., Cutler, M.E.J., Soutar, I.** and Boon, P.J. 2006. Development of a technique for Lake Habitat Survey (LHS) with applications for the European Union Water Framework Directive. *Aquatic Conservation – Marine and Freshwater Ecosystems*, 16, 637-657. **DOI:** 10.1002/aqc.786
7. **Rowan, J.S.,** Grieg, S.J., Armstrong, C.T., Smith, D.C. and Tierney, D. 2012. Development of a hydromorphological classification and regulatory decision-support tool for lakes. *Environmental Modelling and Software*, 36, 86-98. **DOI:** 10.1016/j.envsoft.2011.09.006

Selected Funding and Underpinning Research

- £2.4 M GLOBOLakes (Global Observatory of lake responses to environmental change). NERC Consortium Grant (NE/J02211X/1) with Universities of Stirling, Glasgow, Edinburgh, CEH & NEODASS. CI, £397k to Dundee (2012-2015). **Cutler (PI), Rowan & Dawson.**
- £20 k Assessing the legacy of historic mining on the hydromorphology and ecology of the Loch Fitty catchment. Funded by Scottish Coal (2010-2011), **Rowan (PI).**
- £16 k Developing a lake hydromorphology typology for the UK. Funded by SNIFFER (2009-2010), SNIFFER Report WFD104 (2010), **Rowan (PI).**
- £142 k Development of a method of Lake Habitat Survey. Funded by SNIFFER (2004-2010). Reports WFD40 (2004), WFD42 (2006), WFD99 (2008) **Rowan (PI), Black, Bragg, Cutler & Duck.**
- £22 k Development of a European Water Quality Guidance Standard on lake hydro-morphological assessment. Funded by the British Standards Institution (2007-2009), **Rowan (PI).**
- £45 k Development of decision-making frameworks for managing alterations to the morphology of lakes. Funded by SNIFFER (2005-2009), SNIFFER Reports WFD49a (2005) and WFD49f (2008). **Rowan (PI).**
- £65 k Development of environmental standards (water resources) for rivers and lakes. Joint award between CEH Wallingford and Dundee. Funded by SNIFFER (2004-2005), SNIFFER Report WFD48 (2006). Acreman (PI) *et al.* CEH, **Black, Rowan & Bragg.**
- £13 k Hydromorphology of lake systems in the UK. Funded by SNIFFER (2002-2003), SNIFFER Report WFD06 (2003). **Duck (PI), Rowan & Bragg.**
- £77 k Assessing Heavily Modified Waters in Scotland. Funded by SNIFFER (2001-2002), SNIFFER Reports SR[02]11A-D (2002) **Black (PI), Rowan, Duck & Bragg.**
- £34 k Anthropogenic impacts upon the hydrology of rivers and lochs: phase 1. CI, funded by SNIFFER (1999-2000), SNIFFER Report SR[00]01 (2000) **Black (PI), Rowan, Duck & Bragg.**

4. Details of the impact

With respect to the water resources (WFD48, 2006) and hydromorphological alteration (WFD49f, 2008) projects, the legislative obligations to implement the WFD meant that the commissioned research was rigorously peer-reviewed, and refined through public and stakeholder consultation, before being transposed into legally-binding environmental standards^{1,2}. These are published under the auspices of the UK Technical Advisory Group (UKTAG), which is responsible for harmonising WFD implementation across the devolved administrations. **Rowan** served as an invited hydromorphology expert in its Lakes Task Team during the period 2006-2010.

The significance of the Dundee-based research is its adoption into regulatory practice and how it informs on-going policy development. In relation to environmental flows and lake hydromorphology findings adopted in UKTAG 2008a&b: *“UKTAG believes the proposals in this report are based on the most robust assessment possible, given current scientific understanding. Our report aims to advise the UK administrations on the standards and conditions that we believe the environment agencies should use for the first River Basin Management Plans”* (UKTAG, 2008b, p. 17). These standards were used to *“help guide decisions on the management of lakes”* (p. 54). Lake-MImAS tool was adopted for classification and impact assessment in the six-yearly cycle of statutory River Basin Management Plans³ and implemented through new enabling legislation, e.g. Statutory Rules Northern Ireland 2011, making its use legally binding for **all current and future** lake management activities within the devolved administrations, as well as in the Republic of Ireland^{4,5,10,11,12,13}.

A key element in the dissemination of the Lake Habitat Survey was the development of an accredited training programme for environment and conservation agency staff⁶. Field-based training workshops, typically running for three days, were held throughout the UK (e.g. Lake Windermere 2008, Lough Neagh 2010) as well as internationally (Novi Sad, Serbia 2008 and Lago Maggiore, Italy 2009). In total, more than 60 environment and conservation agency staff (SEPA, EA, NIEA and EPA) were trained and achieved accreditation by **Rowan** (with inputs from Research Assistants **Bragg**, **Soutar** and **Carwardine**). A number of academics, graduate students and external commercial consultants were also trained⁷. Dissemination was also achieved through a series of international workshops and field demonstrations, e.g. **Rowan** was invited to CEN Mainz 2011; CNR Maggiore 2009; CEN Vienna 2008; UKTAG Dunadry 2008; JNCC Edinburgh 2008.

The international dimension of our research impact is also evident through the translation of our lake research into the 2011 European Committee for Standardisation (CEN) *Water Quality - Guidance standard on assessing the hydromorphological features of lakes* (EN16039), which endorsed the Lake Habitat Survey as the only internationally proven method trialled by statutory authorities in the UK, Ireland, Netherlands, Italy, France, Portugal, Poland, Norway, Spain, Serbia and Montenegro⁸. EN16039 was ratified in 2011 through a formal weighted-voting procedure involving all 34 CEN national member states and thereafter translated into French and German. Supported by the British Standards Institution, **Rowan** led the development of what is now the *de facto* standard method across Europe¹⁰. The significance of standards is that they are *“...one of the most important issues for businesses... crucial in facilitating trade... A standard represents a model specification, a technical solution against which a market can trade. It codifies best practice and is usually state of the art”*. The standard is available in the UK as BS EN 16039:201, published by the British Standards Institution⁹.

The research programme has generated a suite of characterisation, monitoring and assessment tools accompanied by an accredited training programme to promote quality assurance and the adoption of common standards across all of the environment agencies of the UK and Ireland. Research outputs disseminated through a series of commissioned reports, academic papers and stakeholder engagement activities have been drawn formally into UK and Irish statutes, and more widely proven in an international context through the CEN Guidance Standard. The impacts discussed have occurred throughout the current 2008-2013 REF period, and indeed are on-going and will be used in the forthcoming round of River Basin Management Plans within the UK and Ireland.

5. Sources to corroborate the impact

The following links confirm the transposition and on-going application of Dundee lake hydromorphology research directly into national legally-binding standards:

1. UKTAG 2008a. UK Environmental Standards and Conditions (Phase 1) (SR1 – 2006). (<http://www.wfduk.org./resources%20/response-stakeholders%E2%80%99-submissions-standards-and-conditions-phase-1>).
2. UKTAG 2008b. UK Environmental Standards and Conditions (Phase 2) (SR1 – 2006). (<http://www.wfduk.org./resources%20/uk-environmental-standards-and-conditions-phase-2>).
3. Northern Ireland Environment Agency. 2010. River Basin Management Plans. (http://www.doeni.gov.uk/niea/pom_fw_morph.pdf).
4. Statutory Rules of Northern Ireland 2011 No. 10 Environmental Protection The Water Framework Directive (Priority Substances and Classification) Regulations (Northern Ireland) 2011 (<http://www.legislation.gov.uk/nisr/2011/10/made>).
5. EPA (Environmental Protection Agency Ireland) 2011. *Water Framework Status Update based on Monitoring Results 2007-2009*. Ecological Status and Chemical Status of Surface Waters and Chemical and Quantitative Status of Groundwaters. Prepared in fulfilment of Articles 24 and 25 of SI 272 of 2009. ISBN: 978-1-84095-406-7 (<http://www.epa.ie/pubs/reports/water/waterqua/waterframeworkstatusupdate.html>).
6. SNIFFER 2008. Lake Habitat Survey in the United Kingdom. Development of a method of Lake Habitat Survey (LHS): Phase 3 (<http://www.sniffer.org.uk/search?q=wfd99>).
7. Testimonial highlighting importance of being one of the few commercial consultants outside of the statutory authorities to have LHS accreditation (<http://www.linkedin.com/pub/angela-darwell/45/83a/614>).
8. European Committee for Standardisation. Website listing the availability of *CEN Water Quality - Guidance standard on assessing the hydromorphological features of lakes* (EN16039), Standard BS EN (<http://esearch.cen.eu/esearch/extendedsearch.aspx>).
9. BS EN 16039:2011. *Water quality. Guidance standard on assessing the hydromorphological features of lakes*, September 2011, ISBN 978 0 580 69599 5 (<http://shop.bsigroup.com/ProductDetail/?pid=000000000030212175>).

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