

Impact case study (REF3)

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| Institution: University of Hull | | |
| Unit of Assessment: 14 Geography & Environmental Studies | | |
| Title of case study: Informing and shaping policies to conserve, restore and enhance inland fisheries | | |
| Period when the underpinning research was undertaken: January 2002 to July 2020 | | |
| Details of staff conducting the underpinning research from the submitting unit: | | |
| Name(s): | Role(s) (e.g. job title): | Period(s) employed by submitting HEI: |
| Prof. Ian Cowx | HIFI Director/Professor | 1989 to present |
| Dr Jonathan Harvey | Senior Lecturer | 1995 to present |
| Dr Richard Noble | Post-Doctoral Researcher | 2003 to present |
| Dr Andy Nunn | Post-Doctoral Researcher | 2005 to present |
| Dr Jonathan Bolland | Post-Doctoral Researcher | 2008 to present |
| Period when the claimed impact occurred: 1 August 2013 to 31 December 2020 | | |
| Is this case study continued from a case study submitted in 2014? No | | |
| 1. Summary of the impact (indicative maximum 100 words) | | |
| <p>Research undertaken at Hull International Fisheries Institute (HIFI), University of Hull has shaped key UK policies aimed at the conservation of fish species and the protection of fish populations impacted by water-resource management. This case study details specific areas of HIFI's research that contributed directly to the:</p> <ul style="list-style-type: none"> • formation of the Joint Nature Conservation Committee (JNCC) Common Standards Monitoring (CSM) guidance, which is used by all five UK regulatory authorities, all five conservation agencies, and all researchers and contractors in the UK and Ireland when establishing the conservation status of designated freshwater fish species, and; • UK government complying with, and implementing, key requirements of the European Union (EU) Habitats and Water Framework Directives. | | |
| 2. Underpinning research (indicative maximum 500 words) | | |
| <p>Effective conservation, restoration and enhancement of inland fisheries in the UK requires accurate assessment of the status of fish populations, and precise understanding of relevant, key environmental drivers such as river flow. Research conducted by Harvey, Cowx, Noble, Nunn and Bolland developed and tested protocols to establish the status of 'conservation fish' species and habitats [1-3, 7-11] and to develop robust scientific understanding of the flow requirements of UK fish species for migration, spawning and natural behaviour [4-6, 12-13]. The underpinning research that developed UK protocols for assessing the conservation status of fish and the impacts of flow on their sustainability is as follows:</p> | | |
| <p>1) The EU Conservation of Natural Habitats and of Wild Fauna and Flora Directive (known as the EU Habitats Directive) requires member states to: maintain or restore natural habitats and wild species to a favourable conservation status to promote the maintenance of biodiversity; provide robust protection for habitats and species of European conservation importance; undertake surveillance of habitats and species every six years; and ensure the long-term survival of Europe's most valuable and threatened species and habitats. Seven UK fish species (Atlantic salmon; allis and twaite shad; brook, river and sea lamprey; and bullhead) are of European conservation importance. Effective protection of these 'conservation fish' species requires accurate estimates of their populations. However, there was no standard UK methodology or approach for establishing these estimates that met the EU Directive's requirements. The underpinning research [1-3, 7-11] developed new, robust and rigorous standard monitoring methods and sampling strategies to establish the 'conservation fish' populations. Data derived via these methods therefore underpinned the UK Government's compliance with the EU Habitats Directive, and allowed individual UK country-level Article 17 (of the Directive) assessments and associated evidence (which regulate species conservation across the EU) to be successfully aggregated, submitted to and accepted by the EU.</p> | | |
| <p>2) Water companies in England and Wales, and the regulator (the Environment Agency (EA)), have historically lacked reliable information on the impact of water abstraction (for industrial, domestic or agricultural use) on fish populations and communities. Similarly, they lack</p> | | |

knowledge of how different flow regimes affect the sustainability of fisheries and habitats. HIFI's research evaluated the potential impact of differing flow and water levels on coarse fish, on conservation species and on other fish populations in UK rivers [4-6, 12-13]. The flow requirements of different species were applied to various river reach examples in the UK, and then adjusted for the generic seasonal flows and water level regimes required for the key life stages of freshwater fish species. This research contributed significantly to the development of a standard policy for managing flows and water resources in UK rivers. All English and Welsh water companies and the EA use the standard policy (and HIFI also assessed Yorkshire Water's programme to design ecologically-suitable flows in rivers impacted by reservoirs). This research, and the resultant standards ensures the compliance of water companies with the regulator (EA) and with the EU Water Framework Directive, while meeting societal needs for water abstraction.

3. References to the research (indicative maximum of six references)

1. Cowx I.G. and Fraser D. (2003). *Monitoring the Atlantic Salmon, Salmo salar*. Conserving Natura 2000 Rivers Monitoring Series No. 7, English Nature, Peterborough.
<http://publications.naturalengland.org.uk/publication/113031>
2. Cowx I.G. and Harvey J.P. (2003). *Monitoring the Bullhead, Cottus gobio*. Conserving Natura 2000 Rivers Monitoring Series No. 4, English Nature, Peterborough.
<http://publications.naturalengland.org.uk/publication/80012>
3. Harvey J. and Cowx I. (2003). *Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus*. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.
<http://publications.naturalengland.org.uk/publication/69040>
4. Cowx I.G., Noble R.A., Nunn A. D., Harvey J. P., Welcomme R. L. and Halls A. (2004) Flow and level criteria for coarse fish and conservation species. Environment Agency Science Report,
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291545/scho1204bilg-e-e.pdf
5. Cowx I.G., Noble R.A., Nunn A.D., Bolland J., Walton S., Peirson G. and Harvey J.P. (2012) Flow requirements of non-salmonids. *Fisheries Management and Ecology* 19, 548-556.
<https://doi.org/10.1111/fme.12017>
6. Baker N.J., Taylor M.J., Cowx I.G., Harvey J.P., Nunn A.D., Angelopoulos N.V., Smith M.A., Noble R.A., Tinsdeall M., Baxter J. and Bolland J.D. (2020). The response of river-resident fish to reservoir freshet releases of varying profiles intended to facilitate a spawning migration. *Water resources research*. <https://doi.org/10.1029/2018WR024196>

Relevant grants & contracts:

7. A standardised survey and monitoring protocol for the assessment of Atlantic salmon, *Salmo salar*, populations in SAC rivers in the UK, English Nature, £7,000 (2002-2003) (Cowx)
8. A standardised survey and monitoring protocol for the assessment of Lampreys, Bullhead and Shad populations in SAC rivers in the UK, English Nature £37,300 (2002-2003) (Harvey, Cowx, Noble, Nunn)
9. Determine the conservation status of larval river, sea and brook lamprey (ammocoetes and transformers) in the Yorkshire Ouse and Derwent SACs. Environment Agency, £15,200 (2004-2005) (Harvey, Nunn, Cowx, Noble and Bolland)
10. Determine the conservation status of river, sea and brook lamprey, bullhead and shad in the Rivers Wye and Usk SACS £63,370 (2005-2007) Countryside Council of Wales (Harvey, Noble, Cowx, Nunn and Bolland)
11. Determine the exploitation rate of the commercial fisheries and the run size of river lamprey in the Ouse system to support assessment of condition status in the Humber SAC. Environment Agency, £19,180 (2012-2013) (Bolland, Noble, Cowx)
12. Flow and level criteria for coarse fish and conservation species. Environment Agency, £36,017 (2003-2004) (Cowx, Noble, Nunn, Harvey)
13. Yorkshire Water Adaptive Management flow and drought research. Yorkshire Water £1,036,292 (2013-2020) (Harvey, Bolland, Nunn, Noble, Cowx)

4. Details of the impact (indicative maximum 750 words)

1) The Joint Nature Conservation Committee (JNCC) advises the UK Government on UK and international nature conservation. The JNCC “Common Standards Monitoring Guidance for Freshwater Fauna Monitoring Protocols (2015)” [A] is used by conservation and regulatory agencies to determine the status of ‘conservation fish’ species and whether their populations meet UK and EU regulatory requirements. HIFI’s research established survey and testing methodologies to produce standard protocols for seven fish species of conservation concern, five of which are highlighted in the references to the research [1-3, 7-11]. HIFI research contributed significantly to the standard survey and monitoring protocols in the JNCC policy. Cowx, Harvey and Nunn also served on an August 2014 panel of fisheries experts from UK conservation and regulatory agencies that reviewed the lamprey population assessment methodologies which shaped the JNCC protocols for lamprey analysis and monitoring. The key HIFI contributions to the JNCC process were recognised extensively in the JNCC Common Standards Monitoring (CSM) document [A], which directly cites HIFI’s contributions as follows:

Protocol 5 – For Atlantic salmon: “The general approach in this protocol is broadly similar to Cowx and Fraser (2003)” (p.44); “Cowx and Fraser (2003) list the range of environmental variables and catch data that should be recorded at each sampling site, regardless of the survey method employed” (p.45).

Protocol 7 – For Brook, river and sea lamprey: “This protocol is based on a report produced as part of the LIFE in UK Rivers Project (Harvey and Cowx 2003)” (p.56); Harvey and Cowx (2003) is also quoted (p.67); and Cowx, Harvey and Nunn are credited with providing additional advice on the 2014 expert panel: “The UK conservation agencies are indebted to these people for their advice” (p.65).

Protocol 8 – For Bullhead: “Section 2 outlines how to undertake monitoring surveys where bullhead is the target species (based on Cowx and Harvey 2003)” (p.77); “The survey area may be smaller depending on the level of historical densities in the tributary. See Cowx and Harvey (2003) for further guidance” (p.77); “A statistical method for selecting a suitable number of sites is detailed in Cowx and Harvey (2003)” (p.78), with Cowx and Harvey (2003) also quoted (p.78).

HIFI’s research therefore shaped key areas of the JNCC CSM policy document: providing UK and Ireland government agencies with scientifically robust protocols to assess the status of ‘conservation fish’ species. These standards also met UK and EU statutory reporting requirements. As a result, UK conservation agencies possessed sufficient, legally-recognised monitoring evidence to inform and implement policies to ensure sustainable fish populations. Examples of HIFI research impacting upon additional conservation agencies include:

Inland Fisheries Ireland (IFI) is the statutory agency responsible for inland fisheries in Ireland (within the Department of Communications, Climate Action and Environment (DCCA)). HIFI’s research on lampreys was credited by IFI in the National Programme: Habitats Directive and Red Data Book Fish Species (2019) report [B] which functions to “fulfil legal obligations of our Fisheries Minister in regard to undertaking monitoring and surveillance of the fish species listed in Annex II of the Habitats Directive”. The report states:

“A semi-quantitative sample was taken at each site by electrofishing for 2 minutes in a defined area (1 m²) of suitable nursery habitat comprising silty deposits (after Harvey & Cowx 2003).” and “Of particular interest is the process of status assessment for larval lamprey. An important guidance document was provided by Harvey and Cowx (2003) covering this area and it has provided a basis for reporting for the Habitats team” (p.7 and p.67).

IFI’s Senior Research Officer further states [C]:

“In excess of 2,400 individual sites have been sampled for larval lamprey via Harvey and Cowx (2003)... I would suggest that HIFI has done all of us in the lamprey world a great service in generating the protocols as described in Harvey and Cowx (2003) and I envisage us continuing to use the procedure within IFI into the future”.

Site Condition Monitoring is a **Scottish Natural Heritage (SNH)**, now named **NatureScot** rolling programme to monitor the special features of protected areas, including their condition, their management, and any wider environmental factors which contribute to their condition. HIFI's underpinning research on lampreys was recognised as the standard methodology used by SNH to provide site condition lamprey monitoring across all Scottish Special Areas of Conservation (SAC), including Endrick Water Site of Special Scientific Interest (SSSI) [D]. HIFI's research thus ensured SNH could undertake site condition monitoring to the required standard for reporting to the EU [D]. The SNH report [D] credits HIFI's research:

"The survey consisted of electrofishing optimal or sub-optimal habitat within 100 m long stretches of river (Harvey and Cowx, 2003). Quantitative samples were collected by depletion fishing within net frames (quadrats) as described by Harvey and Cowx (2003)." (p.2 and p.3).

In addition, NatureScot's Freshwater Adviser (Geodiversity Group) states [E]:

"Credible population data are the backbone of meaningful site condition assessments. These data can be derived only by the application of well researched, robust, and repeatable methods; the work undertaken by the University [of Hull] has been instrumental in the successful evaluation of sites designated for one or more species of lamprey in Scotland, and has indirectly informed remedial management measures."

Natural England (NE) provides advice to the UK government on natural environments and resources and has a wide remit of other roles and responsibilities [F]. NE is required by EU legislation to report on species conservation status in freshwaters, and to deliver this role it uses the JNCC CSM (2015) guidance [A]. Therefore, HIFI research allows NE to fulfil its legal requirement to report to UK and EU governments. NE's Freshwater Fish and Fisheries Specialist states [F]:

"The provision of evidence for the suitability of the various monitoring protocols provided by HIFI has enabled Natural England to fulfill both their statutory and advisory roles when reporting to, and informing, the UK Government."

The Scottish Fisheries Co-ordination Centre (SFCC) is an association of 23 Fisheries Trusts, the Scottish Government, Scottish Environment Protection Agency (SEPA) and Scottish Natural Heritage (SNH). It provides evidenced-based management of freshwater fisheries in Scotland. To standardise the collection of fisheries data by its members, the SFCC adopted a range of monitoring protocols including the 'key underpinning research' of Harvey and Cowx (2003) for lamprey monitoring [G]. The SFCC's Manager and Senior Biologist (Forth Rivers Trust) / Chair states [H]:

"SFCC members follow these protocols adhering to UK standardized approaches to fisheries monitoring and assessment at the highest possible level for reporting under European Union (EU) Habitats Directive and Water Framework Directive (WFD). One such protocol adopted by SFCC, and its members, is the EU LIFE lamprey monitoring protocol (Harvey & Cowx, 2003) which was key underpinning research on lamprey for the Joint Nature Conservation Council (2015) Common Standards Monitoring Guidance for Freshwater Fauna... The protocol has been useful in Scotland in delivering compliance with the EU Habitats Directive and provides benefit to our members who are often required to quantify larval lamprey communities to ensure their protection during developments involving in-channel works. To our knowledge, it is the only widely accepted standard method available and we have found it very useful."

In summary HIFI's research on fish conservation species contributed significantly to the development of the JNCC CSM (2015) guidance and its subsequent successful application in the UK and Ireland by government conservation agencies. This application of HIFI's research ensures the UK and Ireland use a robust, rigorous and standardised survey approach to meet reporting requirements for 'conservation species' for UK and EU governments.

2) The second strand of our impact arises from HIFI's research for the UK Environment Agency, which developed a clear understanding of the water flow and level requirements needed for rivers to sustain coarse fish and 'conservation fish' species [4-5, 12]. The UK Technical Advisory

Group (UKTAG) on the Water Framework Directive (WFD) makes recommendations to the UK and Republic of Ireland Governments on implementing the WFD. The UKTAG (December 2013) policy outlines a consistent method for designing appropriate flow regimes across the UK (and for flow regimes that also comply with the EU WFD). HIFI's work was integral to the UKTAG (2013) policy: River Flow for Good Ecological Potential. This document [I] outlined recommendations "to help UKTAG's member agencies design appropriate mitigation flow regimes for good ecological potential in heavily modified rivers". The document [I] states:

"In developing guidance on the different flow building blocks, we have considered current scientific knowledge of the flows required: by fish species, including coarse fish, salmonids and lamprey" [the report cites: "Cowx et al. 2004, Noble et al., 2004, Cowx et al. 2012]. HIFI work is noted as providing "current scientific knowledge of the flows required by fish species" [I] (page 6, footnote 14).

The UKTAG (2013) report impacts upon organisations subject to the regulatory requirements of the EU WFD, namely UK and Republic of Ireland governments, water companies and water abstractors. An appropriate example is Yorkshire Water (YW), a major water company in England, that utilises the UKTAG (2013) policy to manage its water resources. YW also contract HIFI to help them to address their UK/EU regulatory and environmental targets better.

YW funded HIFI research to identify how flows and habitats associated with reservoirs can be managed more comprehensively to enhance fisheries and ensure the resilience of fish populations (despite increasing pressure for water resources) [6, 13]. HIFI's research ensured that YW met regulatory requirements by improving **9.39 km** of rivers for fish populations, thus avoiding statutory financial penalties to YW of over **£1 million**. The research also improved brown trout populations and habitat in these rivers. The impact also led to water savings of **57 million litres per annum**, ensuring the increased resilience of water supply and savings to YW, and potential financial savings to YW customers [J]. Evidence of HIFI's impact for YW is provided by their Environmental Assessment Manager who states [J]:

"In summary, HIFI's research for YW has provided considerable impact by helping YW meet regulatory requirements while protecting the environment and providing water resources for the people and businesses of the Yorkshire region".

5. Sources to corroborate the impact (indicative maximum of 10 references)

A. Common Standards Monitoring Guidance for Freshwater Fauna (2015). Joint Nature Conservation Committee. <http://data.jncc.gov.uk/data/9b80b827-b44b-4965-be8e-f3b6cb39c8e/CSM-FreshwaterFauna-2015.pdf>

B. Gallagher T., O'Gorman N.M., Rooney S.M., Coghlan B., and King J.J. (2019) National Programme: Habitats Directive and Red Data Book Species Summary Report 2017. Inland Fisheries Ireland. <https://www.fisheriesireland.ie/extranet/fisheries-research-1/habitats/1581-habitats-directive-and-red-data-book-fish-species-summary-report-2017/file.html>

C. Letter from Senior Research Officer at Inland Fisheries Ireland

D. Bull C., Perfect C. & Watt J. (2016) Site condition monitoring of lamprey in the Endrick Water SSSI and SAC 2012. *Scottish Natural Heritage Commissioned Report No 911*

E. Letter from Freshwater Adviser (Geodiversity Group) at NatureScot

F. Letter from Freshwater Fish and Fisheries Specialist at Natural England

G. Scottish Fisheries Co-ordination Centre (SFCC) Adopted Protocols (2019).

<https://www.sfcc.co.uk/resources/more-protocols.html> and EU LIFE lamprey monitoring protocol" [file://adir.hull.ac.uk/home/351/351036/Downloads/lamprey_monitoring\[1\].pdf](file://adir.hull.ac.uk/home/351/351036/Downloads/lamprey_monitoring[1].pdf)

H. Joint letter from Manager and Chair/Senior Biologist (Forth Rivers Trust) at SFCC

I. UKTAG (2013) River flow for good ecological potential. Final recommendations.

<http://www.wfduk.org/sites/default/files/Media/Assessing%20the%20status%20of%20the%20water%20environment/UKTAG%20River%20Flow%20for%20GEP%20Final%202004122013.pdf>

J. Letter from Environmental Assessment Manager at Yorkshire Water