Developments in Inland Fisheries Ireland Research

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Iascach Intíre Éireann
Inland Fisheries Ireland

Welcome to the Newsletter

One metric by which researchers measure their output is through peer-reviewed publication, in which they formally report their results to the scientific community to be scrutinised and inspected, to be accepted and validated and, ultimately, to enhance our knowledge of the world.

In this issue, we highlight how statistical modelling helps IFI Research achieve this goal by mining new information from our long-term monitoring survey datasets and by anticipating future challenges for Ireland's fish stocks.

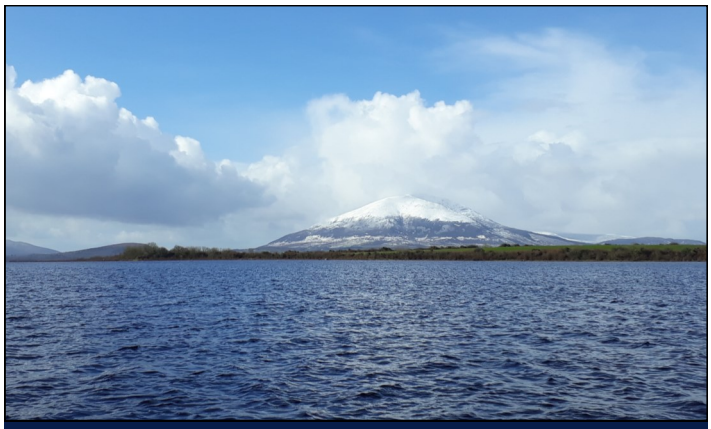
As always, we thank all IFI staff who contribute to our research programmes and to this newsletter.

Slán,

Dr. Cathal Gallagher, Head of Research & Development

In this issue

Known Unknowns — Building New Understanding of Data-Limited Stocks from Historical Data



Lough Conn, an important lake fishery for wild brown trout

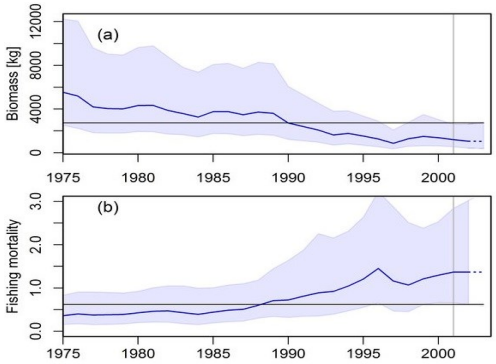
Trout caught in a stock survey in Lough Conn

In an infamous statement about knowledge, the known unknowns are those phenomena which are perceived and recognised, but which are not yet fully understood. This concept can be applied to some recreational fisheries, which may be complex, dynamic and regionally important but which may nonetheless lack enough data to support quantitative assessment. Methods to assess these so-called data-poor or data-limited stocks have been widely developed in marine fisheries science; these methods are now being used in IFI Research to reveal the valuable information hidden within our historical datasets.

In August in *Fisheries Management and Ecology*, Colm Fitzgerald and colleagues of IFI Research reported a case study that aimed to provide this crossover between marine and inland fisheries science and to highlight accessible data-limited assessment methods. Using sources such as angler catch statistics, competition results and stock surveys, Colm and colleagues pooled data on brown trout in Lough Conn between 1975 and 2013 and used it to assess the stock status using length-based indicators and surplus production models. The study demonstrates how these data-limited stock assessment methods can describe the dynamics of an important recreational lake fishery and are potentially very informative for management policy.

Applying data-limited modelling is now an important strategy in IFI Research. This work is often international and relies on sharing of expertise across research groups. For example, earlier this year in *Fisheries Research*, Sam Shephard of IFI Research and colleagues collaborated on a paper on length-based indicators for sea-trout exploitation in Wales. Several members of IFI Research are involved with ICES working groups that develop methods for data-limited species, such as migratory fish and elasmobranchs.

As shown by these papers and other research featured in this issue, applied modelling techniques to assess historical datasets have the potential to transform data—simply the available facts and figures—into meaningful information that can help guide management of Ireland's fisheries stocks.



Model output: predicted trout biomass and fishing mortality over time

The Pike & Trout Relationship — Untangling a History of Dynamic Ecological Interactions

Pike and brown trout are both highly valued by anglers, but there is considerable debate about how to manage the fisheries that these species share and pike's impact as an apex predator within them. IFI Research has mined historical data to model the ecological interaction of pike and trout, and new papers now deepen our understanding of these species' relationship over recent decades.

In September in the *Journal of Fish Biology*, Paul McLoone and colleagues of IFI Research reported statistical modeling of environmental factors and fish data in 891 lakes from 1951 to 2015. The results showed that pike and brown trout are more likely to coexist in relatively large, deep lakes with good stream connectivity; in small, isolated lakes, however, pike introductions potentially have a devastating impact on trout stocks.

Pike

Brown trout

The environmental conditions in which pike and trout coexist are far from static, however. In November in *Transactions of the American Fisheries Society*, Sam Shephard of IFI Research and colleagues reported that long-term data spanning 1978–2015 from Lough Sheelin showed that pike predation of trout changed significantly with the invasion of an abundant new prey: roach, which thrives in warm, nutrient-rich waters. Temperature and eutrophication also had effects on trout numbers that modified the effectiveness of pike removal as a management tool.

Ultimately, modeling the pike–trout relationship will enable scientifically based decision-making in the development of fisheries policies. For FAQs, a public briefing note and the full report on IFI's pike research programme, please visit **https://tinyurl.com/y79yswmu**.

A Web of Impacts & Interactions — Monitoring Impacts of Climatic Change on Ireland's Fish

Climatic changes projected for Ireland include high summer temperatures; undoubtedly, this will have impacts on Ireland's freshwater fish communities. In October in the *Journal of Fish Biology*, Emma Morrissey of IFI Research and colleagues reported their latest modelling of the impacts of climatic change on Arctic char abundance.

Emma and colleagues reported that warmer temperatures and non-native species, such as perch and roach, have negative effects on Arctic char. In lakes with non-native species, char inhabit colder waters and actively avoid warmer waters inhabited by non-natives. The paper concludes that char's coexistence with non-natives is facilitated by deep thermal refuges but that competing species are a serious threat to its survival.

This summer, the National Research Survey Programme installed a network of data loggers in rivers and lakes in the Owenriff and other catchments around the country. This network will provide data that IFI Research will use to assess climatic impacts on fish and their habitat. With further publications on the impacts of climate on fish in press, the impacts of climatic change on Ireland's fish communities is set to remain a hot topic for IFI Research in 2019.

A poor condition char: at risk from climatic change & non-natives?

Data loggers & drones: applying new technology to survey fish habitat

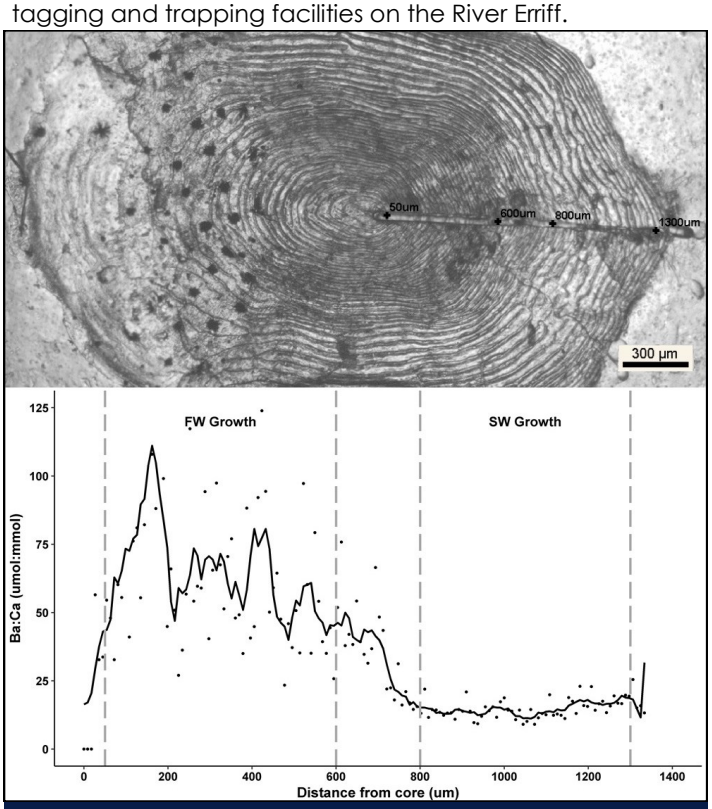
CHASES Update — A New Method for Estimating Growth in Sea Trout Using ICP-MS

Sea trout

Traditionally, the growth of sea trout is estimated by scale reading: examining a scale from a fish of known length at high magnification and measuring the visible increments. This method has its disadvantages: it is subjective, with results varying between readers, and it requires a high level of expertise. In November in *Fisheries Research*, Diarmuid Ryan and colleagues of IFI Research report a new objective approach to determine precisely when sea trout migrate into marine waters and to measure their marine growth.

Diarmuid operates IFI Research's facilities for laser ablation inductively coupled plasma mass spectrometry (ICP-MS). This equipment uses a laser beam to burn out tiny specks of material from a sample, which are then ionised in extremely hot plasma to measure their trace-metal content. Fish incorporate trace metals from their environment into calcified tissues, such as scales, over their lifetime. In their paper, Diarmuid and colleagues report that in tagged sea trout of known age, they were able to use ICP-MS to accurately delineate the transition of migrating sea trout from freshwater to the sea and to detect their marine growth phase using scale barium:calcium (Ba:Ca) ratios.

Diarmuid and colleagues conclude that Ba:Ca profiling is an accurate alternative to visual scale reading and could potentially handle high-volume sample processing in suitably equipped laboratories. This work was part of CHASES—a collaborative project led by the Norwegian University of Science & Technology (NTNU) and in IFI Research by Willie Roche—to explore the effect of human activities on the growth and movements of sea trout in their marine habitat. As well as relying on IFI Research's ICP-MS capabilities, this study was made possible by staff working at the National Salmonid Index Catchment tagging and trapping facilities on the River Erriff.



Finnock scale sampled for ICP-MS with corresponding Ba:Ca profile

Research Seminar: Migratory Fish and Recolonisation of Rivers

On November 19th, staff at IFI Citywest enjoyed a talk by Catarina Mateus of the Marine & Environmental Research Centre (MARE) at the University of Évora in Portugal. While visiting IFI Research with her colleague Ines De Castro Da Silva Oliveira to work with the Habitats team, Catarina gave an interesting presentation on projects in Portugal to remediate rivers impounded by weirs and to monitor recolonisation of rivers by migratory fish.

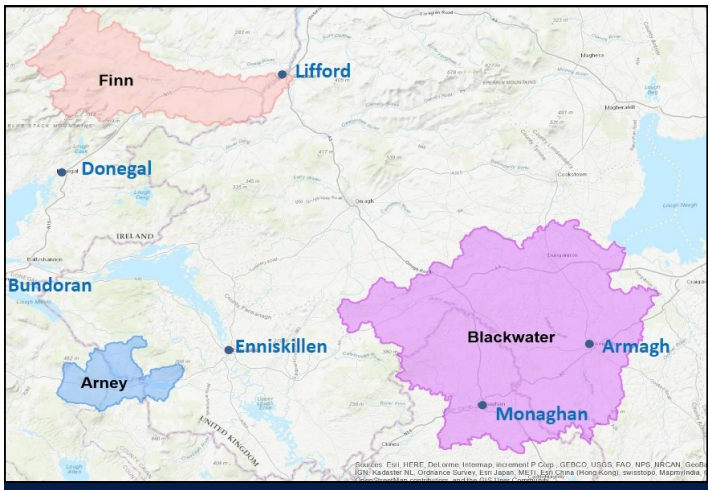
Catarina uses genomic techniques to study the evolution of migratory fish. After transforming into adults, river lamprey migrate downstream to sea and return to rivers to spawn, whereas the closely related brook lamprey spend their entire lifecycle in rivers. IFI Research's Habitats team are working with Catarina to identify the key genes that differentiate these species' alternative life histories.

Catarina and the Habitats team hope that the results will provide insights into the evolution of lamprey migration and their capacity to recolonise river habitat.

Catarina Mateus talks about challenges facing migratory fish

Introducing CatchmentCARE: Cross-Border Action to Improve River Water Quality

The EU-funded INTERREG VA CatchmentCARE (**C**atchment **A**ctions for **R**esilient **E**cosystems) project to improve water quality is gaining momentum. Led by Donegal County Council, CatchmentCARE is a cross-border partnership between eight local authorities, research institutions and government agencies, including IFI, which will deliver a pilot scoping workpackage in three river catchments: the Finn (Donegal & Tyrone), Blackwater (Monaghan, Armagh & Tyrone) and Arney (Cavan & Fermanagh).



CatchmentCARE river systems: the Finn, Arney and Blackwater

IFI will lead a Scoping and Action Targeting workpackage to provide a detailed analysis of factors affecting water quality that will help to optimise any potential intervention works. This scoping project will inform the development of policy actions to address water quality issues related to hydromorphology, point and diffuse sources of pollution, farm nutrient management practices, characterisation and monitoring of groundwater quality, lag times in response to implementation of measures. An economic analysis will examine the costs of achieving the objectives of the Water Framework Directive in the three catchments.

So far, Maria Diaz Redondo and Darren Craig of IFI Research's CatchmentCARE team have led electrofishing surveys in almost 100 sites in the Arney and Blackwater catchments with the help of staff from IFI Ballyshannon based at Corlismore and from Northern Ireland's Agri-Food and Biosciences Institute (AFBI). The CatchmentCARE team is also conducting hydromorphology and barrier surveys to evaluate conditions in river channels and longitudinal connectivity for fish migration and sediment transport. The final outcome of the scoping workpackage will be a decision-making matrix with potential sites for intervention, possible remediation works and costs.

The CatchmentCARE project has also recruited three Catchment Project Officers to develop engagement, education and networking activities with landowners and other stakeholders in the catchment areas. Based in Corlismore, Lisa Doyle is IFI's Catchment Officer for the Arney, and she will be liaising with IFI regional staff and the CatchmentCARE research team. Lisa's focus will be liaising with stakeholders, securing access and overseeing sub-contractors implementing instream and riparian remediation within the Arney catchment.

A critical assessment of the enhancement of freshwater quality within the three complex catchments will allow best practice policies to be transferable to other catchments and will contribute to improved management of this precious resource on a wider scale. It is hoped that the harnessing of local goodwill and ecologically sound initiatives, supported by knowledge transfer and practical assistance with funding access, will empower catchment communities and will enable them to preserve high status resilient waterbodies. For more information, please visit www.catchmentcare.eu.

Boat electric fishing on the River Arney

River Hydromorphology Assessment Technique (RHAT) survey

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We Hope You Enjoyed the Newsletter

Feedback is always welcome, so please get in touch if you have any comments.

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