

# Population Structure, Genetic Stock Identification and Potential Impact of Farm Stocking

## Lough Sheelin Brown trout

IFI/2021/1-4537



Iascach Intíre Éireann  
Inland Fisheries Ireland

## Table of Contents

1. Introduction .....	3
2. Brown Trout Stocking Programme.....	3
3. Summary of Results .....	4

## 1. Introduction

In 2012, IFI, in partnership with Queens University Belfast (QUB), carried out a genetic study, based on microsatellite DNA profiling, to describe the L. Sheelin brown trout genetic population structure. The study also revealed which subcatchments the lake adults were coming from and the % contribution each makes to the lake. A final objective was to explore the potential impact(s) of the considerable stocking history of the lake and inflowing tributaries on the wild brown trout populations.

Lough Sheelin is a medium to large-sized productive lake, located on the border of Counties Cavan, Westmeath, and Meath within the mid Shannon Region, Upper Inny River. It is a relatively shallow alkaline lake with a maximum depth of 15 m and has a capacity to produce and maintain a large stock of large wild trout. The lake currently supports populations of brown trout (*Salmo trutta*), pike (*Esox lucius*) and roach (*Rutilus rutilus*), as well as perch (*Perca fluviatilis*), bream (*Abramis brama*), tench (*Tinca tinca*), eels (*Anguilla anguilla*), and hybrids of bream and roach.

Brown trout (*Salmo trutta*) populations are sensitive to alterations of the physical and natural environment (Elliott 1994). Over the past century the L. Sheelin catchment has experienced farming activities and agricultural run-off, arterial drainage, introduction of alien species (roach and zebra mussel), stocking of farmed fishes, urban growth and associated discharges all of which have contributed to the alteration of the natural aquatic environment and the loss of suitable spawning, nursery and feeding areas for brown trout.

The Environmental Protection Agency (EPA) has assigned Lough Sheelin with an ecological status of Good for the purpose of the Water Framework Directive (WFD) reporting 2013 – 2018 (EPA, 2019). Similarly, in 2017, IFI has also assigned the fish status as Good (Connor *et al.*, 2018). Nevertheless, given past water quality issues, as well as ongoing channelisation pressures, L. Sheelin, and much of its river network, has been identified as ‘at risk’ (EPA webmaps 2019).

This project was part funded by the Lough Sheelin Trout Protection Association LSTPA who also provided adult scale samples.

## 2. Brown Trout Stocking Programme

During the 1960s and early 1970s L. Sheelin was considered as one of the premier brown trout angling lakes in Ireland. However over the period late 1970’s to early 2000’s, the lake saw a substantial decline in trout numbers. Mitigation measures to counteract declining wild brown trout stocks mainly focused on an intensive brown trout stocking programme and in later years a stream



enhancement programme. The stocking programme, which ran for over four decades, involved the annual stocking of unfed fry, yearlings, and adult brown trout of farm origin across the catchment. While stocking with hatchery reared fish has been extensively used in Ireland and elsewhere as a mitigation strategy to rebuild depleted populations, there is now increasing scientific evidence arguing both against its usefulness, and its potential negative impact(s) on genetic diversity and fitness of wild populations (Ferguson 2007).

At the time of this study (2012) the trout stocking programme had been discontinued since 2011. Brown trout lake fish populations were beginning to improve along with angling.

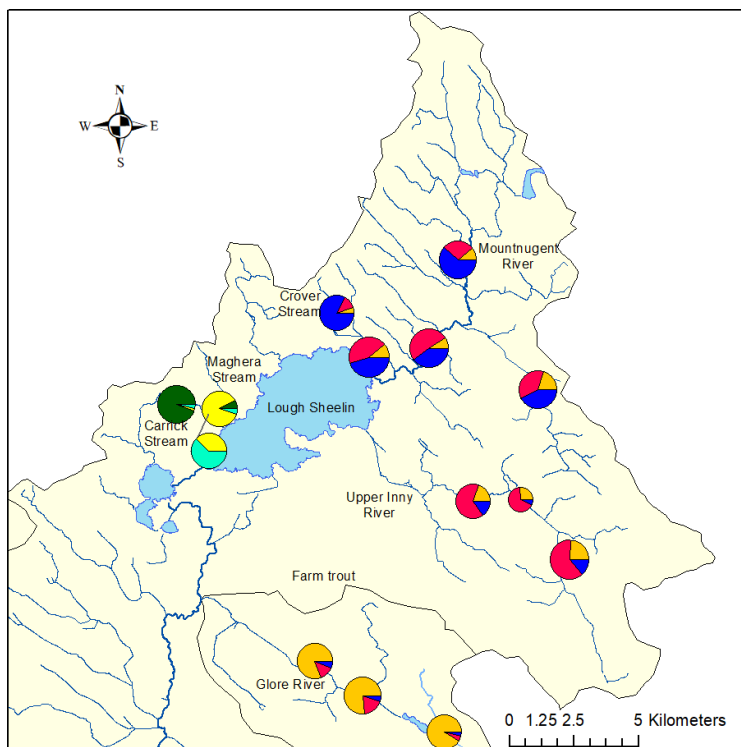
### 3. Summary of Results

River and lake fish scales were used to extract the DNA from brown trout juveniles and adults, including historical samples. In total 1078 brown trout were available for analyses in this study.



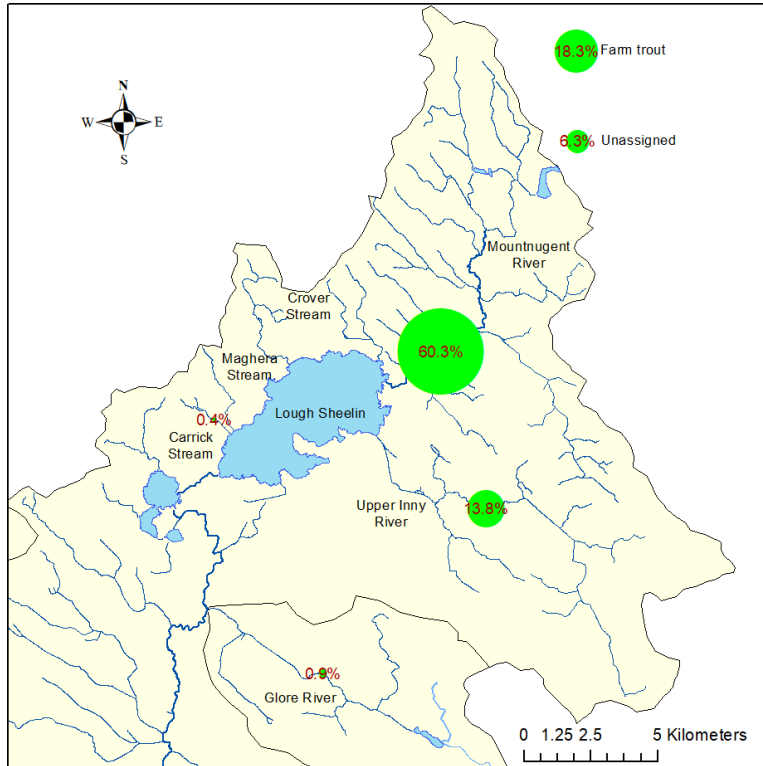
- The results from this genetic study indicates a remarkable level of natural resilience from the wild brown trout community of the system notwithstanding the many known environmental pressures.
- The resilience of Lough Sheelin brown trout stock is further supported by the absence of evidence indicating any long-lasting impact(s) resulting from the extensive brown trout stocking history within the system. Thus, the evidence indicates that, when stocked as fry or juveniles, farm derived fish have extremely poor survival in comparison to the wild fry and/or juveniles, and when stocked as adults, they are either not fit to reproduce or their offspring have again poor survival in comparison to that of wild fish.
- It is worth noting that comparisons involving the study samples (2011-2012) and historical samples (1990's) indicates a remarkable degree of genetic stability over time. Thus, in the absence of any major environmental disturbance in the L. Sheelin catchment over the past few years, it is reasonable to assume that the results (patterns of population structuring and the relative contribution of the identified populations to the lake mixed brown trout fishery) are also temporally stable.
- The brown trout inhabiting Lough Sheelin and its river catchment are partitioned into seven distinct populations (Figure 1).

- The Mounnugent River, the largest L. Sheelin subcatchment was identified as the most significant and important contributor to the adult lake population with 60% of all adults assigning to this river catchment (Figure 2).
- Routine genetic monitoring in the future will prove useful in guiding the management and conservation efforts of L. Sheelin brown trout. The most significant finding of this study is that despite the well documented high level of stocking within L. Sheelin, brown trout population recovery was based on wild fish assisted by improved water quality and habitat restoration measures.



**Figure 1.** STRUCTURE plot – Second level population structuring – of Lough Sheelin baseline river samples involving contemporary samples only. Different colours represent distinctly genetic lineages/groups.





**Figure 2.** Graphical summary assignment results (%) for adult lake trout caught between 2011 and 2012 to the river baseline populations identified in this study.

