



Brown Trout Population Structure & Genetic Stock identification of the River Tolka, Liffey & Dodder

2016





Inland Fisheries Ireland
National Research Survey Programme

**Population Structure and Genetic Stock Identification of Trout (*Salmo trutta*)
from three Dublin Rivers: Dodder, Liffey and Tolka**

INTERIM REPORT

Karen Delanty, Martin F. O' Grady and Fiona L. Kelly

Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

&

Rosaleen Hynes and Paulo Prodöhl

Beaufort Fish Genetics Group,

School of Biological Sciences, Queen's University Belfast

CITATION: Delanty, K., O'Grady, M.F., Kelly, F.L., Hynes, R. and Prodöhl, P. (2016) Population Structure and Genetic Stock Identification of Trout (*Salmo trutta*) from three Dublin Rivers: Dodder, Liffey and Tolka. Interim Report. National Research Survey Programme. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

Cover photo: Brown trout in the River Suir at Cahir, Co. Tipperary © Inland Fisheries Ireland

© Inland Fisheries Ireland 2016



ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of all their colleagues in IFI Citywest.

The authors would also like to thank all the anglers from the many fishing clubs who collected fish scale samples for the project.

The authors would also like to acknowledge the funding provided for the project from each of the following;

- Dublin City Council
- Intel
- Ballymore Eustace Trout & Salmon Anglers Association
- Dodder Anglers Association
- Leixlip and District Angling Association
- Dublin Trout Anglers
- Kilbride Anglers Club
- North Kildare Trout & Salmon Anglers Association
- Clane Trout and Salmon Anglers Association
- Peter Brown

Inland Fisheries Ireland in partnership with Queen's University Belfast are co-project leaders for this study.

The report includes Ordnance Survey Ireland data reproduced under OSi Copyright Permit No. MP 007508.

Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright.

© Ordnance Survey Ireland, 2015.



1. Introduction

The wild brown trout (*Salmo trutta*) displays a remarkable level of variation in its external appearance, behaviour, ecology, biology and many other aspects of its life-history. The realisation that much of this variation has a genetic basis, has led scientists to also study the genetic make-up of brown trout in the recognition that there is enormous genetic diversity within and among brown trout populations, which is of great importance for both management and conservation of the species.

Since 2006 Inland Fisheries Ireland (IFI) have commissioned a number of genetic based studies of brown trout, in selected catchments across Ireland (e.g. Mask, Corrib, Sheelin, Ennell, Suir, Boyne) to understand more about how genetic diversity is distributed among populations in order to assist in making the correct and most cost effective management decisions (e.g. is a particular tributary stream contributing more fish to a lake or river main channel than any other stream, or is there one genetic strain in a catchment completely different and unique than all others, if so how can IFI manage this) (EREP, 2014; O'Grady and Delanty, 2014). This ongoing work is providing IFI with valuable information for fisheries management purposes.

In 2014, IFI in collaboration with Queen's University Belfast began a three-year research programme to examine the genetic diversity of brown trout in selected Dublin Rivers in tandem with two other catchments. This study included three of the main Dublin rivers; Dodder, Liffey and Tolka. The main objectives of the study were:

- To investigate if there are a number of discrete genetic stocks in each catchment.
- To understand how important each genetic group is to the fishery.
- Examine the behaviour and other processes occurring within individual populations and between populations over their life span.
- The project also aims to investigate the impact of barriers (natural and manmade) to fish migration on the brown trout populations.



Dodder

- Have manmade and natural barriers divided trout stocks in the Dodder into discrete genetic trout populations?

Liffey

- What proportion of the adult trout stock in the Liffey is recruiting from the 10 known spawning streams?
- Are other small streams making a contribution to the Liffey stock?
- Are there one or more trout stocks that spawn and spend their entire life cycle in the Liffey main channel?
- Are fish of tributary origin widely distributed in the main channel?

Tolka

- There have been two major problems for trout stocks in this river, i.e. man-made barriers and water quality. What effect have these had on brown trout stocks within the catchment?

Preliminary results from the genetic analysis are presented in this report. A final report will be available mid 2017.

2. Methods

Fish samples

Where possible 50 one year-old trout were captured by electrofishing in each tributary sub catchment from each of the three rivers (Fig. 1). A small sample, comprising of non-destructively collected scales, was retained from each individual fish for genetic analysis. To ensure that samples provided a proper representation of brown trout inhabiting those catchments, sampling was carried out as extensively as possible covering both main channel and associated tributary rivers. This extensive sampling also minimised possible family bias which are known to take place when large number of samples are taken from few locations. Location details of all sample sites were recorded by taking a GPS reading. The number of scale samples taken from each catchment is shown in Table 1. In addition, anglers from

various fishing clubs kindly agreed to forward scale samples and relevant location details to IFI as part of this study. Prior to the fish scales being processed, all sampling information was collated and transferred to IFI's electronic database.

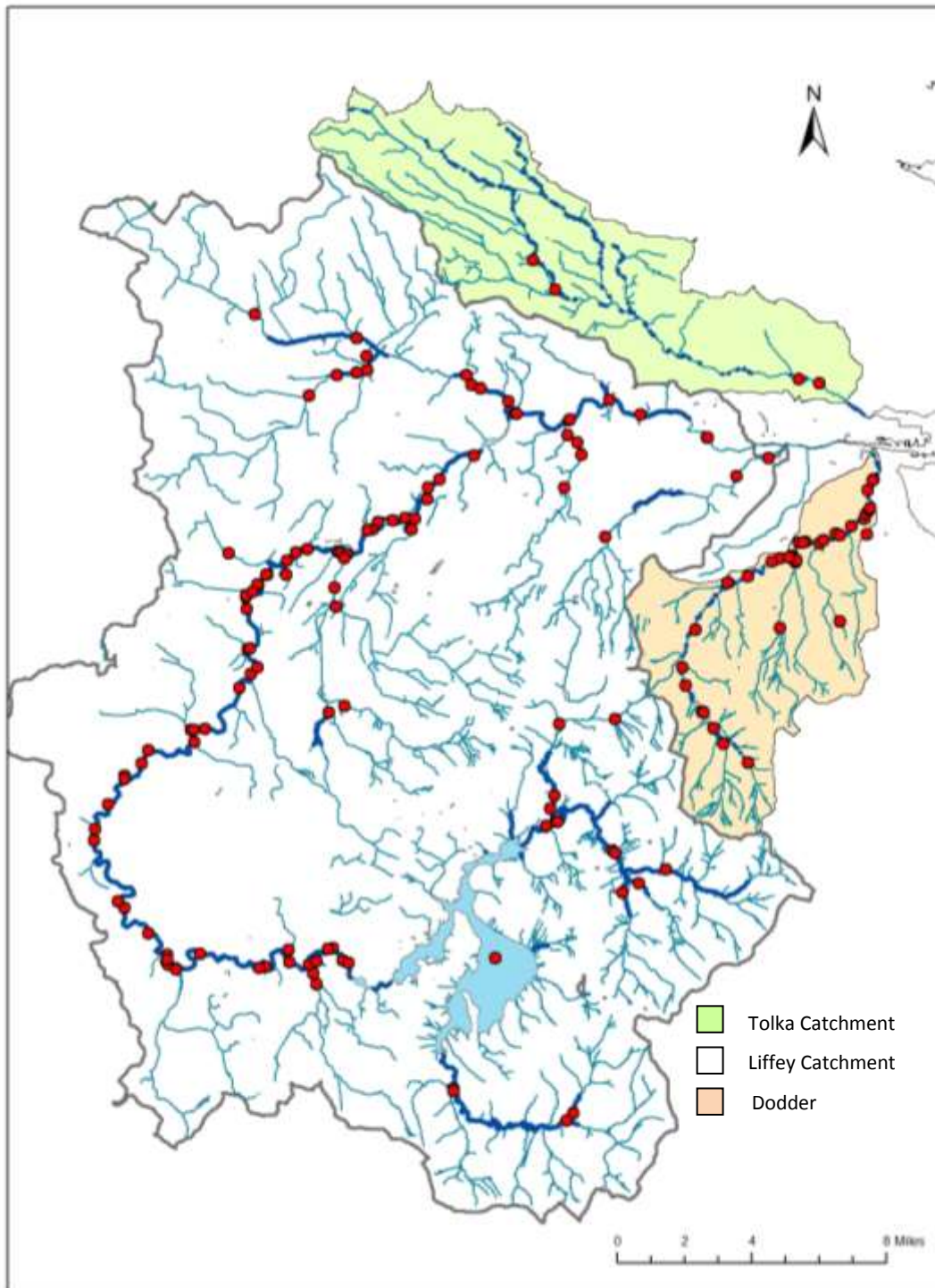


Fig. 1. Location of sampling sites within the Tolka, Liffey and Dodder systems (not all additional sites included here).



Table 1: Number of fish samples collected in each river catchment

Catchment	Number of samples collected
Tolka	102
Liffey	1266
Dodder	431

Genetics – DNA profiling

DNA was extracted from each fish sample and DNA profiling (genetic testing or DNA fingerprinting) carried out. Genomic DNA was extracted using the Promega Wizard SV 96 genomic DNA purification system and subsequently transferred to 96 well microtitre plates for storage at -20°C and subsequent genetic analysis. Genetic analysis (i.e. DNA profiling) was carried out using a panel consisting of 22 microsatellite marker loci developed at QUB. This DNA fingerprinting based technique has been routinely used for parentage analysis (i.e. identification of individuals to families), identification of population genetic sub structuring and also to identify the source population to particular individuals (e.g. genetic stock identification and/or individual assignment). The data obtained was then analysed using specific computer software for genetic analysis.

3. Progress to date and preliminary results

- a. Statistical analysis of genetic data is under way by Queen's University Belfast.
- b. Early difficulty with Liffey samples has been overcome; thus additional samples have been collected from relevant tributaries and the main channel where insufficient number of samples and/or sampling sites were identified. Additional sampling also involved securing a larger sample of sea-trout scale samples. Additional scale samples have also been provided from the IFI archival collection of scale samples.

- c. Preliminary STRUCTURE analysis of the genetic data indicates that there are two main distinct genetic groups in the Liffey catchment (represented by yellow and dark purple colour) (Fig. 2).
- d. Preliminary analysis involving samples from the Liffey, Dodder and Tolka indicate clear differences between each river system (Fig. 3). It also indicates that there is further genetic substructuring within the Liffey catchment.
- e. Within the Dodder, there is also clear evidence for further population substructuring (Fig.3).

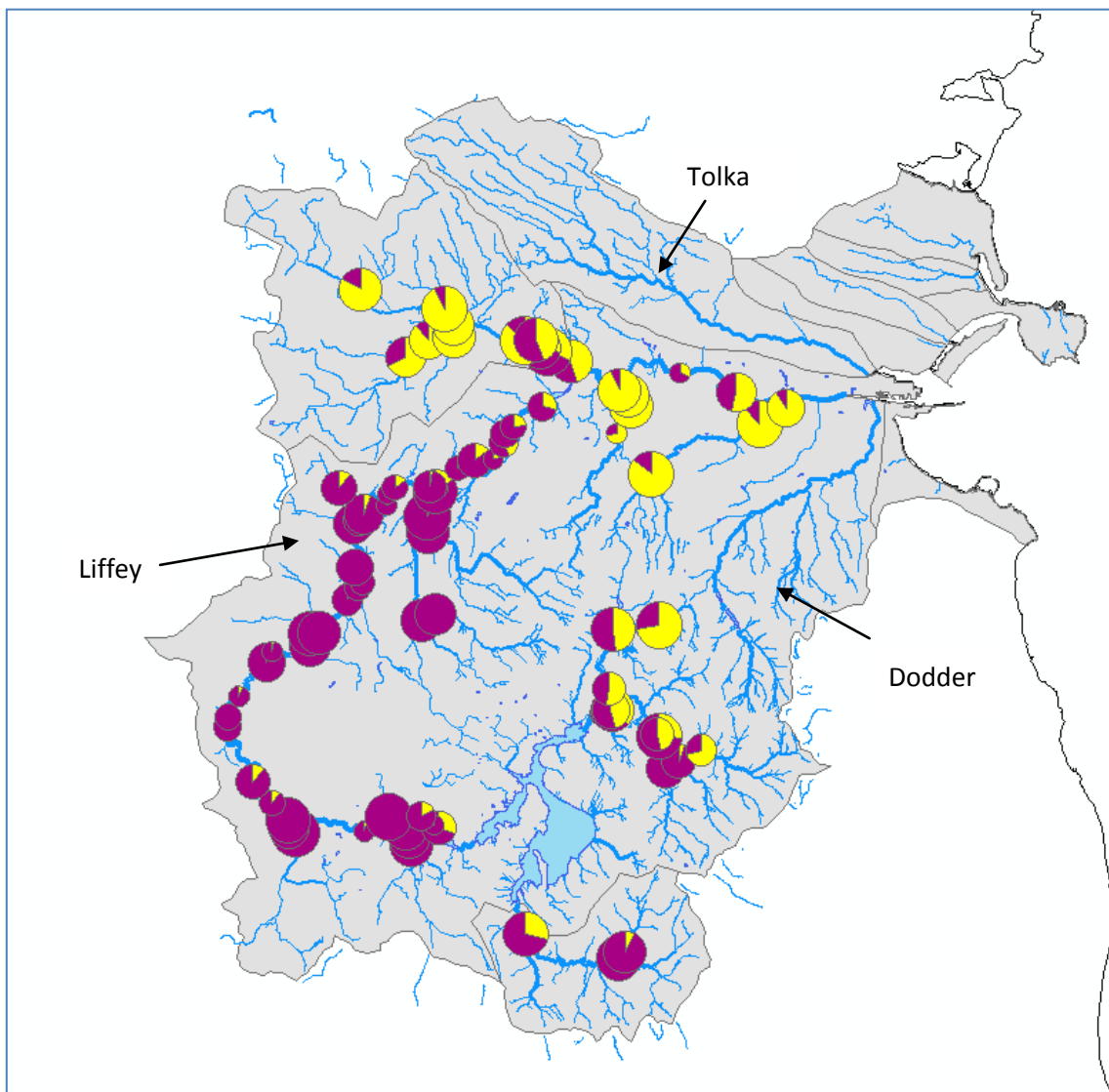


Fig. 2. Preliminary STRUCTURE genetic analysis of trout samples for the Liffey catchment. Difference colours represent distinct genetic profiles.

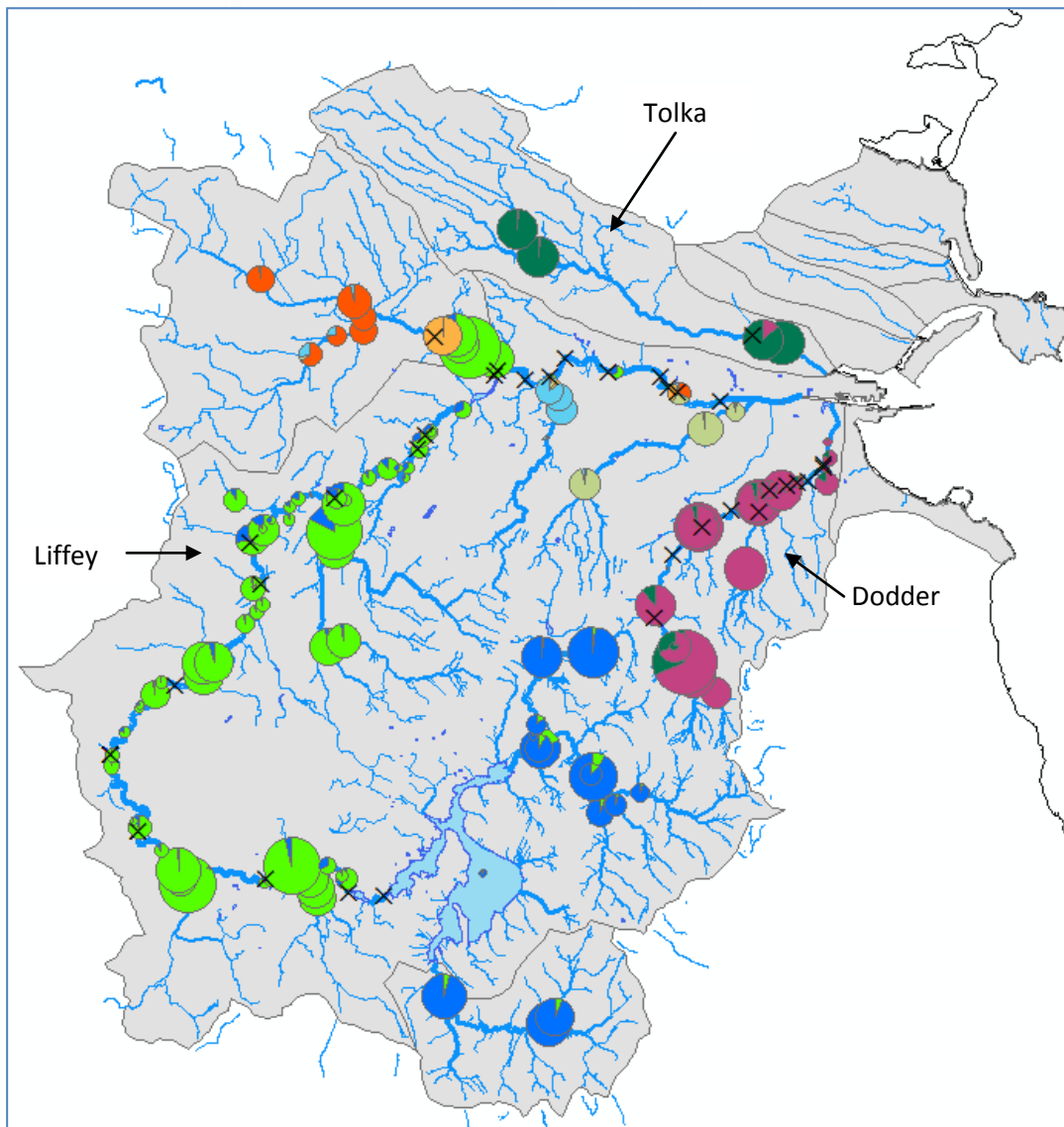


Fig. 3. Preliminary STRUCTURE summary of genetic analysis of trout for the three Dublin Rivers. Different colours represent distinct genetic profiles. The crosses "X" represent possible barriers to dispersal



4. Next Phase (January 2016 to June 2017)

Additional fish scale samples were collected from a number of sites within all of the three Dublin rivers in 2015, these samples will be sent to Queen's University Belfast for genetic analyses and included in the over-all results. It is expected that all samples will have been processed and all lab work completed by mid-2016. Statistical analysis of the data along with interpretation of such analysis will be reported in the Final Report expected in June 2017.

5. References

EREP (2014) <http://www.fisheriesireland.ie/EREP/brown-trout-genetics-and-fisheries-management-in-ireland.html>).

O'Grady, M.F. and Delanty, K. (2014)

<http://www.fisheriesireland.ie/images/dmdocuments/IFI%20Corrib%202012%20survey%20report%20final.pdf>



Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.

Web: www.fisheriesireland.ie
Email: info@fisheriesireland.ie

Tel: +353 1 8842 600