Lough Melvin Catchment Electrofishing Survey

2022 – 2023

IFI/2024/1-4694

Iascach Intíre Éireann
Inland Fisheries Ireland

fisheriesireland.ie

Lough Melvin Catchment Electrofishing Survey 2022-2023

ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of their colleagues in Inland Fisheries Ireland along with our colleagues in Northern Ireland working in the Inland Fisheries Division of the Department of Agriculture, Environment and Rural Affairs (DAERA) and Agri-Food and Biosciences Institute (AFBI) under the direction of Dr. Richard Kennedy. We also acknowledge the support provided by Dr. Milton Matthews, Northwestern River Basin District Director, Ballyshannon.

We would like to thank all angling clubs and landowners who granted access to their land and respective fisheries.

PROJECT STAFF

Research Officer:	Dr. Karen Delanty
Technician:	Rory Feeney
NWRBD Fisheries Inspector:	Gerry McCafferty
NWRBD Assistant Inspector:	Alan Mahon
NWRBD Fisheries Officer:	Paul Doherty
NWRBD Fisheries Officer:	Derek Hemphill
Acting Senior Research Officer:	Dr. Colm Fitgerald

CITATION: Delanty, K., Feeney, R. Fitzgerald, C. (2024). Lough Melvin Catchment Electrofishing Survey 2022. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

Table of Contents

1 Introduction 5

1.1 General Introduction 5

1.2 Study Area - Drowes / Lough Melvin Catchment 5

1.3 Fish Communities of Lough Melvin 12

1.4 Special Area of Conservation 12

1.5 Barriers and Hydromorphology 13

1.6 Water Quality 14

1.7 Recreational Angling 17

1.8 Other issues 17

2. Methodology 19

2.1 Ethical statement 19

2.2 Site Selection 19

2.3 Electrofishing survey methods 22

2.4 Habitat assessment 23

2.5 Age and growth of fish 23

2.6 Data analysis 24

2.7 Fish Ecological Status 24

3. Results 25

3.1 Riverine Fish Stock Assessment – repeat monitoring sites 25

3.2 Comparisons with previous electrofishing surveys 35

3.3. Fish data from Genetic Sampling 44

4 Habitat Assessment 46

4.1 Identification of Salmonid spawning & nursery waters 48

5 Summary 55

1 Introduction

1.1 General Introduction

Over the course of the 2022 and 2023 survey seasons Inland Fisheries Ireland (IFI) undertook an electrofishing survey of the Drowes/Lough Melvin catchment.

The main objectives of this study were:

1. To undertake a survey of riverine fish stocks across the Lough Melvin catchment, to provide information and data necessary to determine the status of stocks present.
2. To review archival data on salmonid populations within the Lough Melvin main inflowing tributaries and to assess changes in salmonid populations over the period 1990 to 2022.
3. Collection of baseline juvenile genetic samples to further the determination of the status of the unique trout assemblages of Lough Melvin comprising, Gillaroo, Ferox and Sonaghan trout.

This report presents the results of the 2022/2023 surveys.

1.2 Study Area - Drowes / Lough Melvin Catchment

Lough Melvin is situated in the north-west of Ireland and lies between counties Leitrim and Fermanagh (53% of the catchment is in Co. Leitrim and 47% in Co. Fermanagh). It extends 12km in length with a maximum width of just under 3km and an average depth of 10.9m. The deepest part of the lake (45m) is found at the centre of a basin near its southeastern edge (towards Rossinver) (Appendix I). A large proportion of the lake (46%) is less than 5m deep with extensive shallow areas around the lake's islands and shores (Girvan & Foy, 2003). The lough lies within a glaciated valley, has a water surface area of approximately 21.25km^2 and drains a catchment area of 224.63km^2. The outflowing River Drowes at Lareen Bay in the north-west of the lake drains a small part of County Donegal meandering for approximately 7km, before discharging into Donegal Bay north of Tullaghan in County Leitrim (Fig. 1).

Lough Melvin is a mesotrophic (low to medium nutrient status) lake that is characterised by diverse plant and animal communities. The lake is considered to be in a relatively pristine state, despite previous evidence of nutrient enrichment (Campbell & Foy, 2008), and is fringed by emergent swamp and fen habitat.

The geology of the Lough Melvin catchment is dominated by Middle Carboniferous Limestone, with portions of Upper Avonian Shales & Sandstones and Lower Carboniferous Limestone. The Dartry Limestone formation underlies over 26% of the catchment area, predominately in the south and eastern parts of the catchment (Appendix II). The Glenade Sandstone formation in the upper eastern reaches of the catchment underlies 23% of the catchment and the Mullaghmore sandstone formation dominates the northern and western shores (Campbell & Foy, 2008).

The soils within the Lough Melvin catchment are dominated by gleys, peats and peaty gleys. Gleys and peats account for almost 90% of the soils within the catchment. Soil types are typically poorly draining and infertile (Campbell & Foy, 2008).

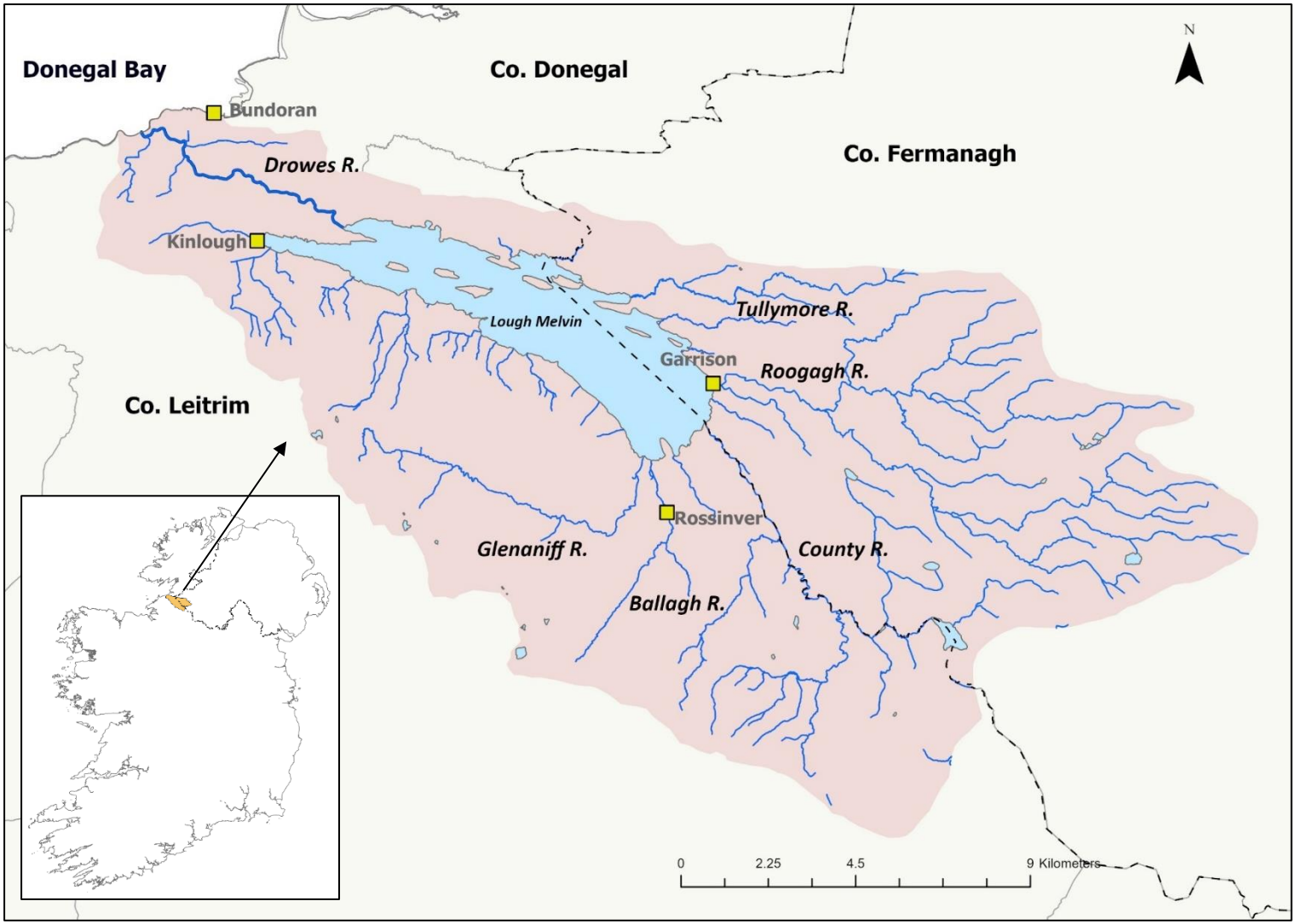


Figure 1. Drowes and L. Melvin catchment

The shoreline areas of Lough Melvin comprise sandy materials (medium to coarse grained sediments), muddy (common in eastern end of lake), rocky (loose rock and bedrock) (Plate 1) and peaty substrates primarily at the eastern end of the lake (NPWS, 2024).

Plate 1. Lough Melvin shoreline

The predominant land cover type in the catchment is pasture, followed by agricultural land, peat bogs and natural grassland. Peat bogs are common in upland areas; with pasture and woodland scrub dominating areas of the lakeshore (Appendix III). The three primary land uses that are most relevant in terms of the possible eutrophication of Lough Melvin are agriculture, forestry and housing (Campbell & Foy, 2008).

Drainage programmes have been undertaken within the County and Roogagh river systems (Fig. 2). The Office of Public Works (OPW) is responsible for maintenance of the drainage network in the Republic of Ireland. The County River and its tributaries within Co. Leitrim are part of the Kilcoo Arterial Drainage scheme. The construction of the scheme started in 1969 and was completed in 1971 under the 1945 Arterial Drainage Act. Maintenance works have been ongoing since completion of the scheme (Ryan Hanley, 2019). Under the NI Drainage Scheme the Roogagh River was drained between 1966 and 1971 (https://arcg.is/1DODWy). The Department for Infrastructure (DFI) has delegated powers derived from the Drainage (NI) Order 1973 to DFI Rivers. DFI Rivers is effectively the statutory Drainage and Flood Defence authority with responsibility for carrying out drainage maintenance operations and flood defence schemes. The Lower Roogagh near Garrison is maintained annually (Campbell & Foy, 2008).

Initial drainage works will often lead to changes in channel morphology due to over deepening and over widening of the river, a disconnect from its floodplain and removal of instream channel features (Plate 2). Maintenance can involve removal of bed material, bridge/culvert maintenance, in-channel, bank and riparian vegetation management (Brew & Gilligan, 2019).

Plate 2. OPW drained section of the County River

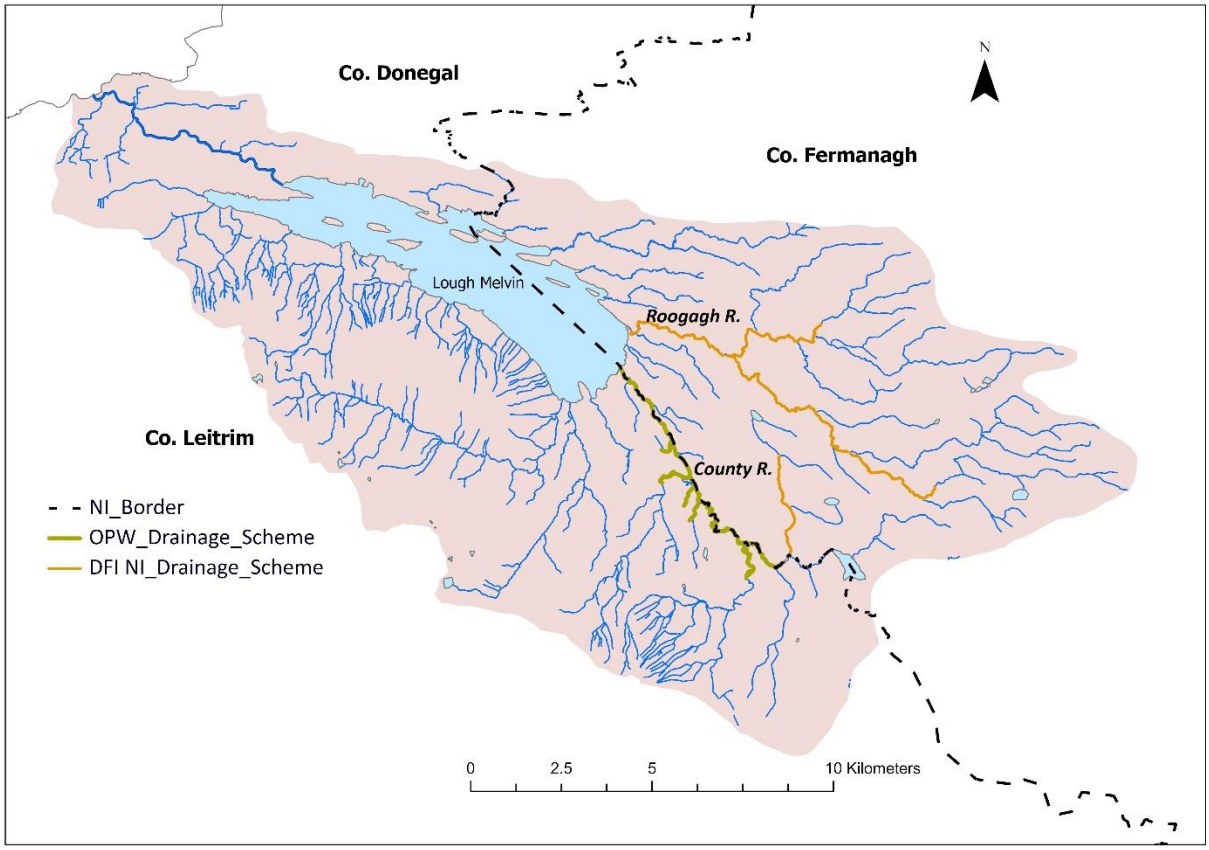


Figure 2. Drainage schemes across the L. Melvin catchment. (*source OPW https://www.floodinfo.ie/map/drainage_map/ and DFI - Drainage Council Northern Ireland https://dfi-ni.maps.arcgis.com/apps/webappviewer/index.html?id=28b901c557054dd488953180d2309903*)

There are over 30 rivers and streams that enter Lough Melvin from the surrounding catchment. Details of the main tributaries flowing into Lough Melvin are presented in Table 1. The four largest rivers (Roogagh, County, Glenaniff and Ballagh Rivers) drain 70% of the total catchment area. The remaining 30% of the catchment consists of smaller rivers and streams.

Table 1. L. Melvin sub catchments and areas

Sub-Catchment	Area (km2)	% of total L. Melvin catchment area *(excluding outflowing Drowes)*
Roogagh River	60.16	27
County River	55.23	25
Glenaniff River	27.24	12
Ballagh River	13.8	6
Tullymore River	9.05	4
Clancy's	7.73	3.44
Mill	4.91	2.2
Kinlough River	4	1.78
Rosclogher	3.05	1.36
Bomahas / Breffni	2.13	1
Others	37.35	16.6

The southern part of the catchment drains a section of the Darty Mountain range (Arroo and Dough/Thur mountains) and is characterised by steep slopes with many small flashy streams draining small sub-catchments (Plate 3 & Fig. 3). The two main tributaries in this area of the catchment are the Ballagh River and the Glenaniff River. Fowley's Falls, a series of cascades on the Glenaniff River are a well-known feature. The southeastern and northeastern parts of the Lough Melvin catchment are less steep and dotted with small lakes that feed into large river systems. The two main tributaries in this area are the County River, which forms the Leitrim/Fermanagh border, and the Roogagh River within Co. Fermanagh (Fig. 1).

There are an additional 48 lakes within the Lough Melvin catchment ranging in size from over 30 hectares (ha) (Lattone Lough) to 0.02 ha. The total combined area of lakes (excluding Lough Melvin) equates to 121 ha. or less than 1% of the catchment.

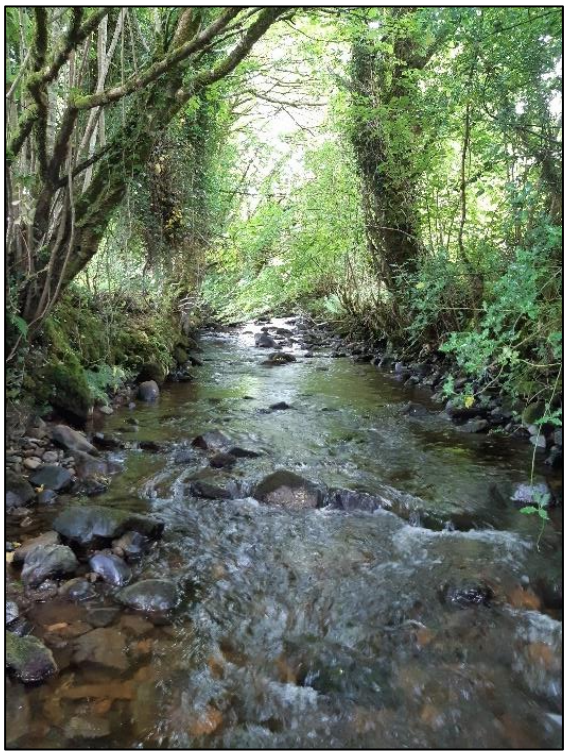


Plate 3. Example of a L. Melvin high gradient channel

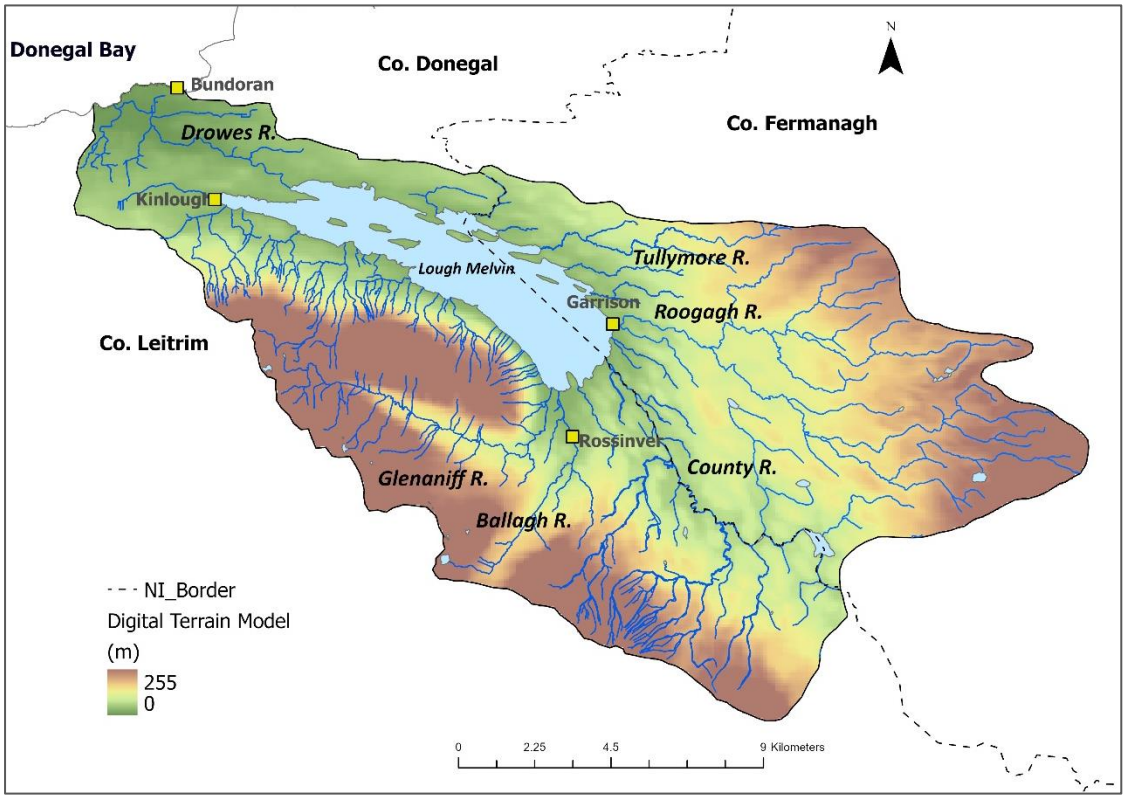


Figure 3. Drowes / L. Melvin elevation map. (*DTM derived from SRTM data V4, http://srtm.csi.cgiar.org)*

1.3 Fish Communities of Lough Melvin

Lough Melvin is best known for its unique and internationally important assemblage of fish species, most of which are indigenous to the lake. Some of these species represent the only remaining populations of their type. The salmonid fish community in Lough Melvin originates from the end of the last Ice Age and its continuation is an indication of the lake's relatively pristine and undisturbed state (Ferguson, 2004; Ferguson, 1986). The lough supports a high diversity of fish species including Arctic char (*Salvelinus alpinus*), Atlantic salmon (*Salmo salar*) and three distinct species of trout (here on in referred to as 'trout'): gillaroo (*Salmo stomachius*), sonaghan (*Salmo nigripinnis*), and ferox (*Salmo ferox*). In addition, perch (*Perca fluviatilis*), rudd (*Scardinius erythropthalmus*), European eel (*Anguilla anguilla*), tench (*Tinca tinca*) and minnow (*Phoxinus phoxinus*) also occur along with three-spined stickleback (*Gasterosteus aculeatus*) and nine-spined stickleback (*Pungitius pungitius*). Roach (*Rutilus rutilus*) and hybrids of roach x rudd and roach x bream have been recorded in recent years within the lake (Ferguson & Taggart, 1991, O'Grady & Delanty, 2001; NRSP, 2021).

1.4 Special Area of Conservation

Lough Melvin is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive;

- Oligotrophic to Mesotrophic Standing Waters
- Molinia Meadows
- Atlantic Salmon (*Salmo salar*)
- Otter (*Lutra lutra*)

The lake has a good diversity of aquatic plants, four of which are listed in the Irish Red Data Book, Globeflower (*Trollius europaeus*), Marsh Helleborine (*Epipactis palustris*), Blue-eyed-grass (*Sisyrinchium bermudiana*) and Tea-leaved Willow (*Salix phylicifolia*). Globeflower is also protected under the Flora (Protection) Order, 2015.

National Parks and Wildlife Service note that "the main interest of the site is the unique fish community which the lake supports. Lough Melvin is an excellent example of a natural, post-glacial salmonid lake. A relict population of the Arctic Char, which constitutes an arctic-alpine element of the Irish fauna, occur there, as does the Atlantic Salmon" (NPWS, 2024). Both species are listed in the Irish Red List (O'Leary *et al*., in prep.), and Salmon is listed on Annex II of the E.U. Habitats Directive. Lough Melvin has three species of tout - ferox, sonaghan and gillaroo - which have distinctive characteristics and separate spawning grounds. All three species have an Irish Status of Vulnerable under the most recent Irish Red List (O'Leary *et al*., in prep). The lake's inflowing and outflowing streams which are used for spawning by these trout species are included in the site.

All SACs and Areas of Special Scientific Interest (ASSIs) within the Drowes / Lough Melvin catchment are identified in Appendix IV.

1.5 Barriers and Hydromorphology

IFI's Barrier Assessment Programme completed a survey of the Drowes/Lough Melvin catchment in 2020 (Coghlan *et al*., 2020 and https://opendata-ifigis.hub.arcgis.com/datasets/IFIgis::national-barriers-programme-dataset/explore), with a total of 252 potential barriers identified and assessed (Fig. 4). Culvert structures were the most common barrier type recorded (231). Thirty-one structures were classified as barriers to fish passage after field visits, 18 culverts, 4 weirs and 9 natural bedrock outcrops/ waterfalls (Coghlan *et al*., 2020) (Fig. 4). The report identifies a small group of these barriers as potential areas for futher assessment and consideration for mitigation measures (Fig. 4).

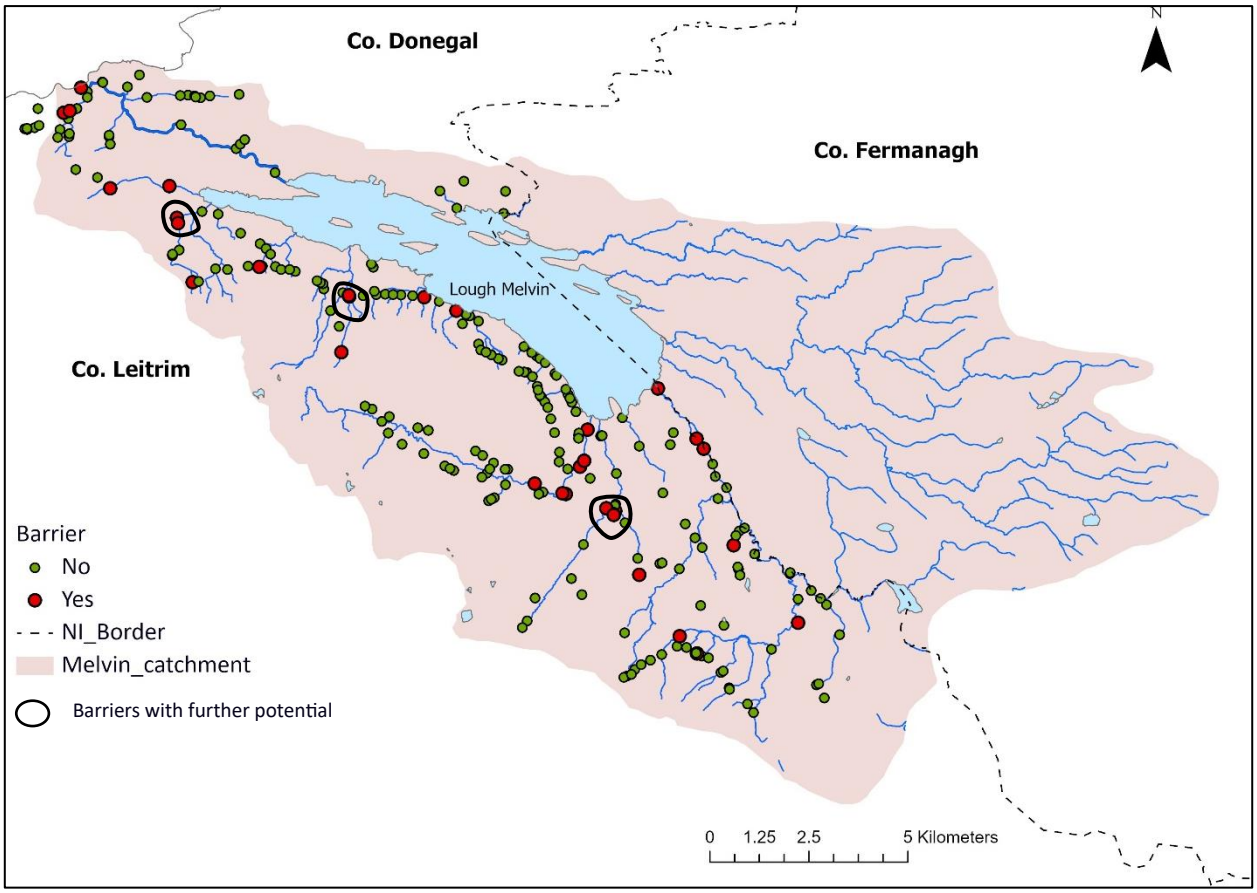


Figure 4. Barriers assessed L. Melvin catchment Co. Leitrim and three areas identified for potential work by Coghlan *et al*. (2020) circled in black.

Plate 4. Barriers to fish migration (natural (a) and man-made (b to d)

During the 2022/2023 catchment wide survey, river & stream walk-over assessments were carried out by IFI (Ballyshannon & Research) noting features of interest, such as river & stream blockages, tunnelling, bank disturbance & erosion and other instream barriers (Plate 4). This information has been stored as GIS datasets and will assist with identifying areas for remedial works and enhancement works.

1.6 Water Quality

Water quality (biological and chemical) of the Drowes/Lough Melvin catchment has been monitored by the Environmental Protection Agency (EPA) and its predecessors since 1971 within Co. Leitrim and by Northern Ireland Environment Agency (NIEA) in Co. Fermanagh. The EPA & NIEA have a small network of monitoring sites on selected tributaries and within the lake (Figure 5). The most recent EPA

WFD reporting period of 2016-2012 reports that Lough Melvin has an Ecological Status of Moderate (Table 2). This Moderate status relates to 'Aquatic Flora Macrophyte Status' (Moderate) along with failing to achieve good 'Chemical Surface Water Status' (EPA, 2024) (https://www.catchments.ie/data/#/waterbody/IE_NW_35_160?_k=sqh3e0).

Table 2. Lake Status 2005-2021 (data source EPA & IFI)

Reporting Yr. / Reporting Period	Fish Status	Over-all WFD Ecological Status
2005	Moderate	
2008	Moderate	
2007-2009		Moderate
2011	High	
2010-2012		Moderate
2014	Good	
2010-2015		Moderate
2017		
2013-2018	Good	Moderate
2021		
2016-2021	Good	Moderate

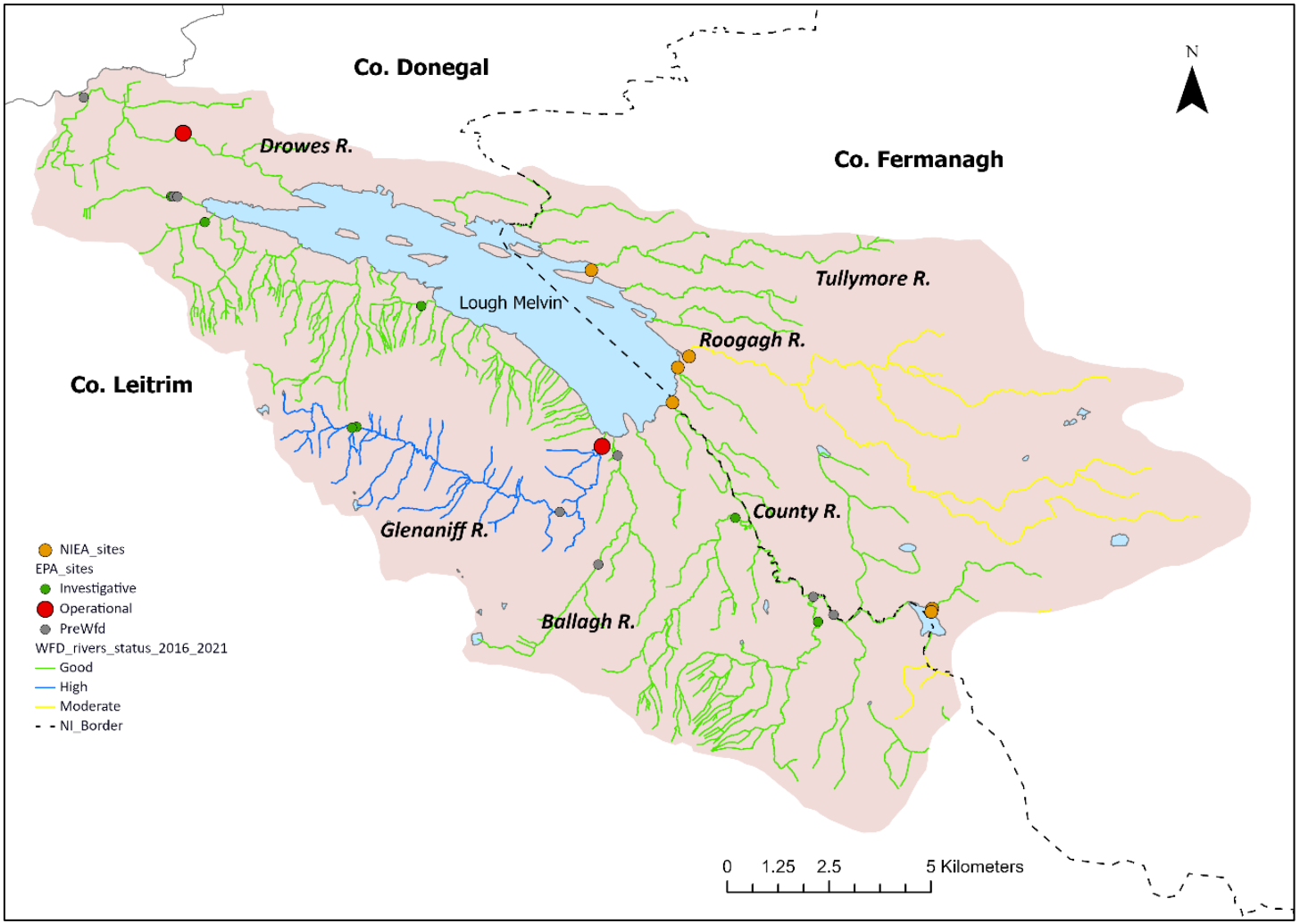


Figure 5. River WFD Status and monitoring sites (*Data source: https://gis.epa.ie/EPAMaps and https://gis.daera-ni.gov.uk/arcgis/apps/webappviewer/index.html?id=16fddc459bd04d64b9e8f084f3a8e14a* ©NIEA, 2019)

1.7 Recreational Angling

There are several angling clubs associated with fishing Lough Melvin and the Drowes River for trout and salmon including, Garrison Lough Melvin Anglers Association, Kinlough and District Angler Association, Rossinver and District Angling Club, Rossinver Fishery and the Drowes Fishery.

The Drowes Fishery and the Rossinver Fishery are both established salmon fisheries. The Drowes Fishery covers the outflowing Drowes River. While the Rossinver Fishery has an established salmon fishery within the southeastern quarter of the lake, covering Rossinver Bay and the Roosky shore (Appendix V). Most of the salmon that run up the River Drowes congregate in this area of the lough, prior to running up the spawning rivers in December.

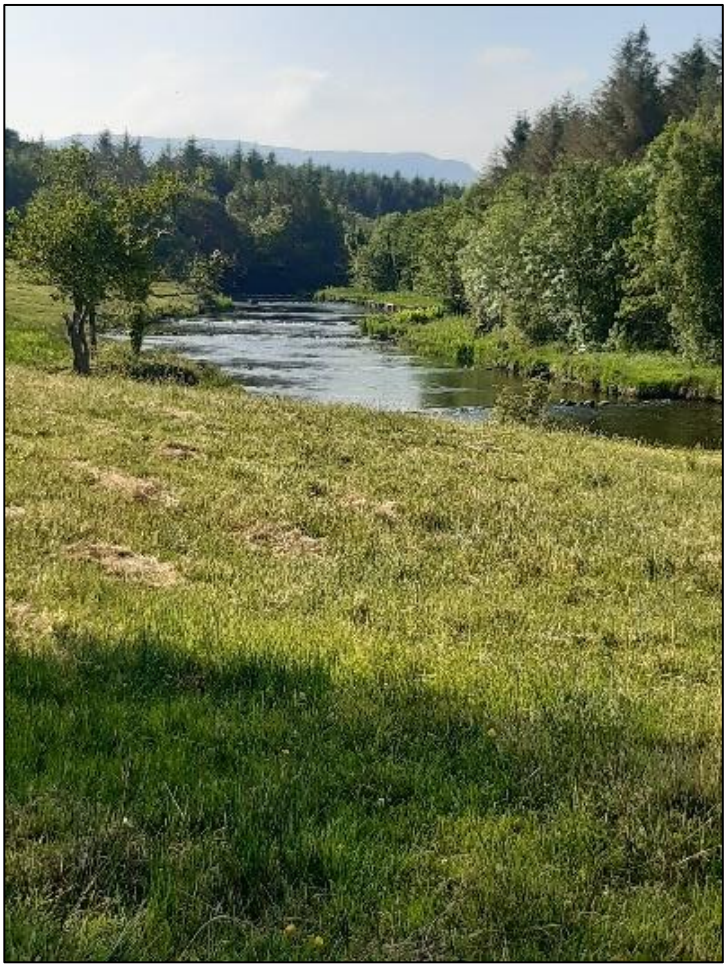


Plate 5. Drowes River Fishery

1.8 Other issues

Issues within the lake environment have identified the presence of non-native fish species including roach, roach/rudd hybrids and roach/bream hybrids. Widespread distribution of invasive plant species

such as Japanese knotweed and Himalayan Balsam (Indian Balsam) have been recorded around the catchment and in particular along the banks of many rivers and streams (NBDC, 2024 & Appendix VI).

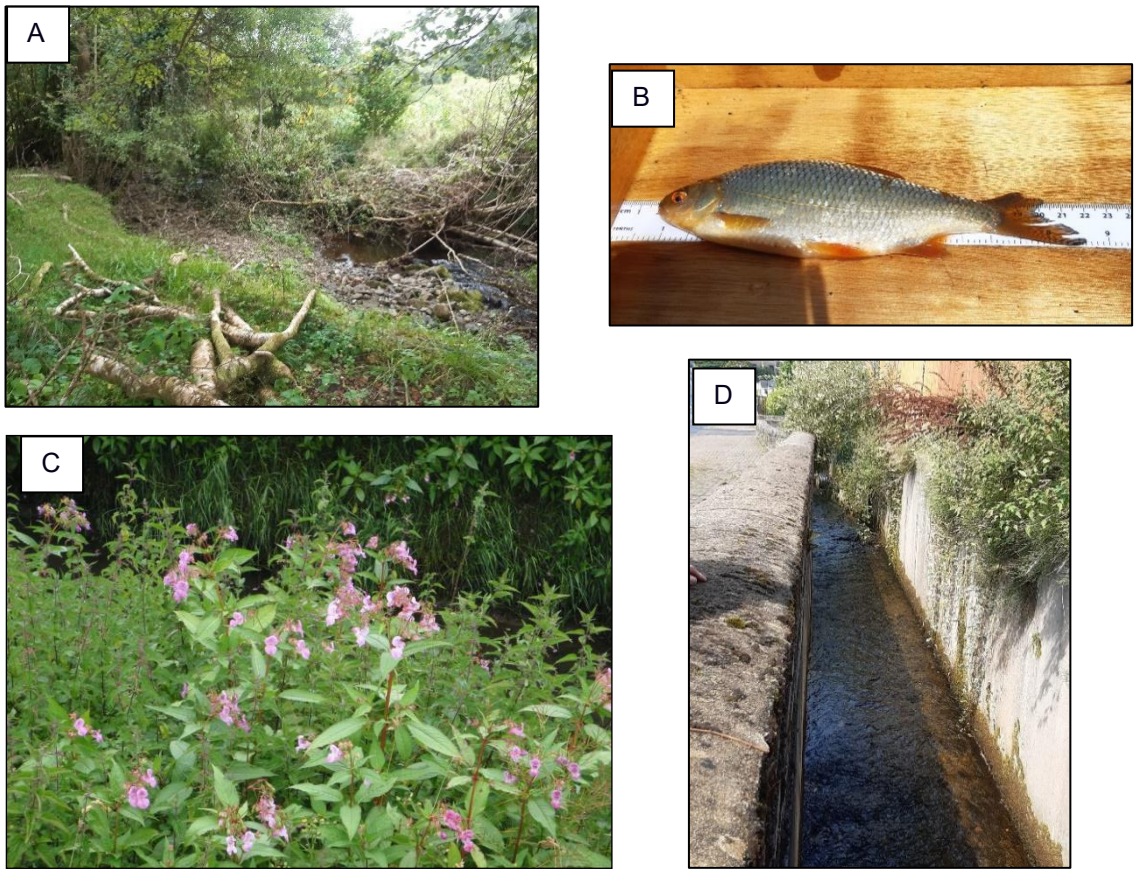


Plate 6. Examples of other issues within the L. Melvin catchment, a) instream blockage, b) roach, c) Himalayan Balsam & d) concreted stream bed and banks

2. Methodology

2.1 Ethical statement

Fish welfare is always at the highest priority when conducting electrofishing operations. Electric-fishing surveys are carried out using the most appropriate electrical settings to effectively and safely catch fish but cause no fatalities or permanent harm (IFI Electrofishing SOP, unpublished & CEN, 2003). For all electrofishing operations, reported here, at least one member of the survey team had completed the IFI Fish Health and Welfare course. One member of the L. Melvin survey team had also completed the Laboratory Animal Science and Training (LAST).

2.2 Site Selection

Site selection for the purpose of the repeat monitoring survey (study objectives 1 and 2) used the same sites as sampled in the 1992 and 2000/2001 surveys (CFB, 1993 & 2002), where possible. This survey included 19 sites sampled in 2022 (Fig. 6).

Site selection for the purpose of genetic sampling (study objective 3) included as many L. Melvin inflowing tributaries as feasible and the outflowing Drowes River (Fig. 6). Where possible several sites were sampled across the larger sub-catchments to ensure good representation of juvenile trout populations. With the smaller tributary sub-catchments this was not always possible. A number of natural barriers are located within the L. Melvin catchments and efforts were made to collect genetic samples from above these barriers as well as downstream of them. Sites within Co. Fermanagh were surveyed by both DAERA/AFBI and IFI (under a S14 license issued by DAERA). In total 98 individual sites were sampled over the two survey seasons of 2022 & 2023.

Five main sub-catchments and 16 smaller systems that drain directly into L. Melvin were chosen to provide an overall assessment of distribution and status of the fish stocks in the catchment (Table 3 & Fig. 6). The sites chosen represented a range of habitat types present throughout the system.

Table 3. Drowes/L. Melvin sub-catchments and tributaries included in current study.

Map ID #	River/Stream Name	Local name
1	Drowes	
2	Kinlough	Laghta
3	Mill	Moneen/Eco Park
4	Ballymore	
5	Rosclogher	Gorteendarragh
6	Clancy's	Stracummer/Aghavoghill
7	Bomahas	Breffni/Buckode
8	Breffni Pier	
9	Un named tributary	*(Barra climb)*
10	Ballindrehid	Cloghan
11	Glenaniff	
12	Ballagh	
13	Mogue	
14	County	
15	Garrison/Gorteen	
16	Roogagh	
17	John Elliotts	
18	Aughamuldoney	
19	Tullymore	
20	Ruskit	
21	Derrynaseer (west)	

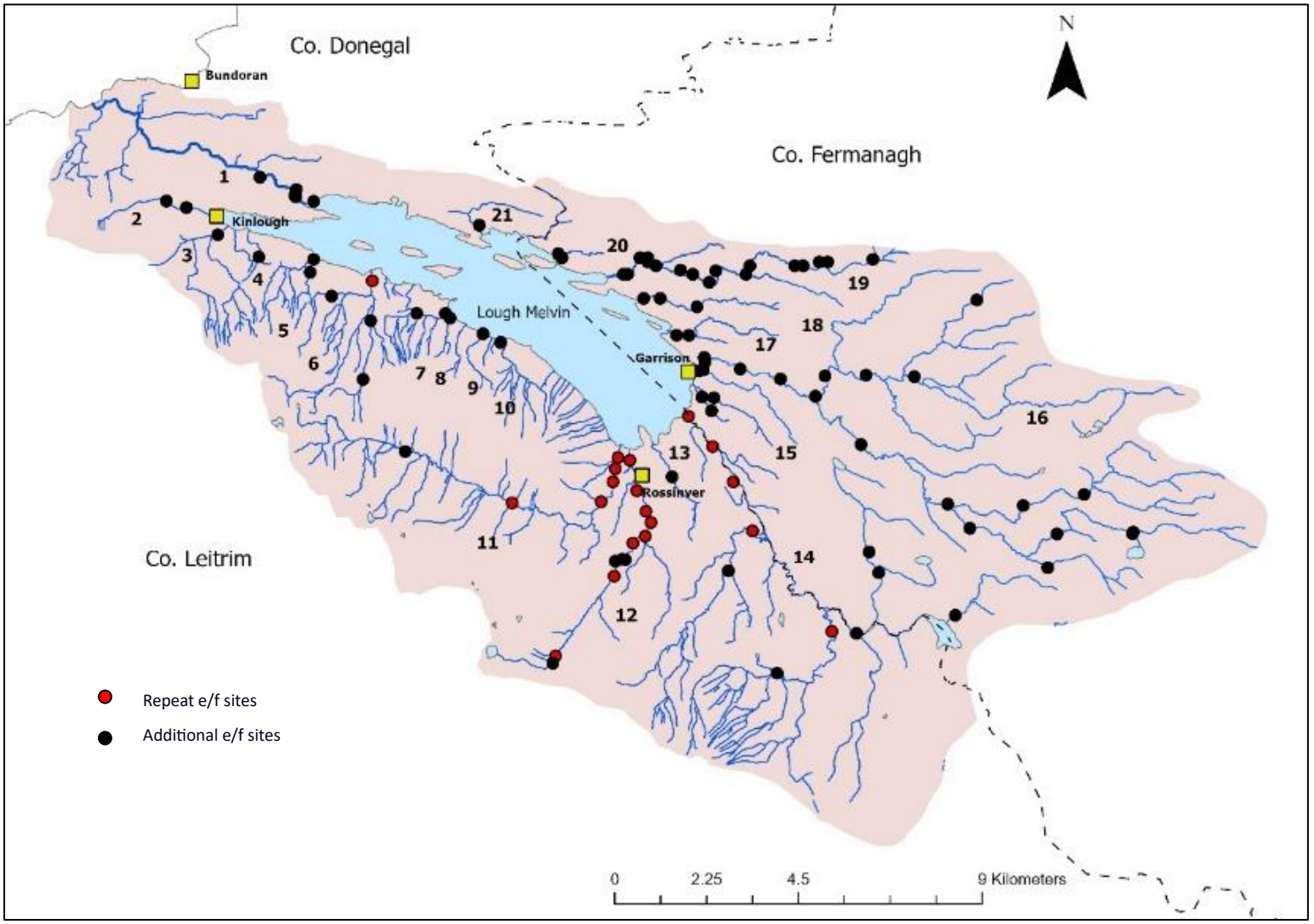


Figure 6. Location of repeat electrofishing sites and additional sites sampled for genetics.

2.3 Electrofishing survey methods

Electric fishing is the method of choice to obtain a representative sample of the fish assemblage in rivers. It is a well-established technique used by fishery biologists all over the world for sampling fish in freshwaters and is generally the most non-destructive, effective and cost-efficient means of sampling freshwater fish, particularly in rivers. Standard methods have been developed by IFI in compliance with the European standards for fish stock assessment in rivers (CEN, 2003 and 2005).

2.3.1 Repeat Monitoring Sites

Semi-quantitative electrofishing was employed on this occasion using area delineated single pass electrofishing. This method would allow for comparison with previous electrofishing surveys (CFB 1993 & 2002). All sites surveyed as part of the repeat monitoring exercise were undertaken in July 2022.

In the L. Melvin wadable waters (generally spawning and nursery waters) fish sampling was carried out using bank-based electrofishing equipment consisted of one or more portable generators (220/240 v) with an appropriate control unit (DC converter), a cathode and anode, for each unit (Plate 7). No stop-nets were used to isolate the survey stretch. In general, sites sampled in this manner were between 30 and 40m in length. At each site, all fish species present were identified and recorded along with individual fish length measurements. A set of scale samples were taken from trout and salmon, a fin clip sample was also taken from trout. General physical characteristics of the site were also noted (e.g. land use, riparian vegetation and instream features – flow, width, depth, length of survey site, temperature and substrate type).

Plate 7. Electrofishing and processing, Melvin tributaries 2022.

2.3.2 Additional trout genetic sampling sites

All other sites, which were fished as part of the trout genetic study, were surveyed using a backpack unit operated by a two-person crew. Again, no stop nets were used. Using backpack units allowed sites with accessibility issues to be sampled. This ensured a representative range of sites were included in the genetic study. The collection of genetic material from trout for the purpose of DNA extraction required as many sites as possible to be sampled and therefore neither the timed nor area delineated approach was used, for those sites within Co. Leitrim. The approach was to collect, if possible, up to 30 trout 1+ samples from each site and then move on. Even so, during all electrofishing operations, all fish species encountered were collected and processed. This provided information on the distribution of all other fish species, total counts and fish lengths. Habitat information from each site was also recorded and photographed. Sites surveyed by AFBI, within Co. Fermanagh, followed the 5-minute electrofishing method (timed sampling) (Crozier & Kennedy, 1994).

The collection of trout genetic material consisted of a mixture of adipose fin clips and or a set of fish scales. Adipose fin clips were stored in 99.9% ethanol in labelled tubes. Scales were stored dry in fish scale envelopes. Details of fish length, date of collection and location were recorded for each sample retained.

These additional sites were sampled during the field seasons of 2022 and 2023.

2.4 Habitat assessment

An evaluation of habitat and water quality is critical to any assessment of ecological integrity and should be performed at each site at the time of fish sampling. General physical characteristics of the site were also recorded with particular reference being made to river typology, land use, riparian and instream vegetation along with other instream features such as flow type and substrate composition. Chemical parameters recorded included water temperature and conductivity.

Wetted width and water depths were also measured throughout each stretch at three transects, with five depth intervals along each transect. The percentage of riffle, glide and pool was also estimated in each reach surveyed.

2.5 Age and growth of fish

A subsample of the dominant fish species was aged. Fish scales were read using a microfiche reader. Growth was determined by back-calculating lengths at the end of each winter using the following formula:

$$Ln=(Sn/S)l$$

Where: Ln= length of fish when annulus “n” was formed
l= length of fish when scale sample was taken
Sn = radius of annulus “n” (at fish length Ln)
S = total scale radius

2.6 Data analysis

Repeat monitoring sites

Semi quantitative electrofishing using single pass fishing was carried out at the repeat sites and therefore fish density estimates were calculated as minimum density estimates (Crisp and McCormack, 1974) (total number of fish/m^2). Electrofishing survey data at repeat sampling sites were pairwise compared across years using non-parametric Wilcoxon signed-rank tests to identify any changes in juvenile abundance. Minimum density estimates from repeat electrofishing survey sites on the Ballagh and Glenaniff for (1992, 2022), (2000, 2022) and (1992, 2000) surveys were pairwise compared across years to detect any changes in juvenile abundance. County electrofishing sites from the 2000 and 2022 did not appear to coincide and were not considered suitable for pairwise comparison of abundances. These "non-parametric" tests do not assume normality of the observed sampling distributions and are considered more suitable for small sample sizes; however, they have low statistical power meaning the threshold for detecting real differences between samples is relatively high (Guy and Brown, 2007).

Additional Genetic sites

Fish sampling at these additional genetic sites was to collect trout genetic material for DNA extraction. Data collected on fish species present and fish counts was used to produce presence/absence tables and distribution maps. No data analyses, such as density estimates, were calculated.

2.7 Fish Ecological Status

An essential step in the EU Water Framework Directive 2000/60/EC (European Parliament and Council, 2000) process is the classification of the ecological status of lakes, rivers and transitional waters, which in turn will assist in identifying objectives that must be set in the individual River Basin District Management Plans. An ecological classification tool for fish in rivers (Fisheries Classification Scheme 2, FCS2-Ireland) was developed in 2011 to assign ecological status to fish in rivers for the Republic of Ireland and Northern Ireland along with a separate version for Scotland (SNIFFER, 2011). The resulting output is an Ecological Quality Rating (EQR) between 1 and 0 for each site, corresponding to the five different ecological status classes of High, Good, Moderate, Poor and Bad (SNIFFER, 2011). Using this tool and expert opinion, each repeat electrofishing site surveyed was assigned a draft fish classification status.

3. Results

For the purpose of this report the electrofishing repeat survey sites will be presented first and the additional fish information collected as part of the genetic sampling programme will be presented separately.

3.1 Riverine Fish Stock Assessment – repeat monitoring sites

A total of nineteen sites were fished as part of the repeat fish stock assessment programme (Fig. 6 and Table 4). Lough Melvin inflowing rivers included were the Ballagh (7 sites), County (6 sites), Glenaniff (5 sites) and Clancy's (1 site).

3.1.1 Species Richness

A total of five fish species were recorded across sites surveyed within the L. Melvin catchment, July 2022, with a total of 2,256 fish being captured. Fish species encountered (in order of abundance) during the sampling programme were, Atlantic salmon, trout, minnow, European eel and roach (Table 4).

All sites fished recorded trout, while 17 sites recorded salmon. A single roach specimen was recorded within the County River main channel.

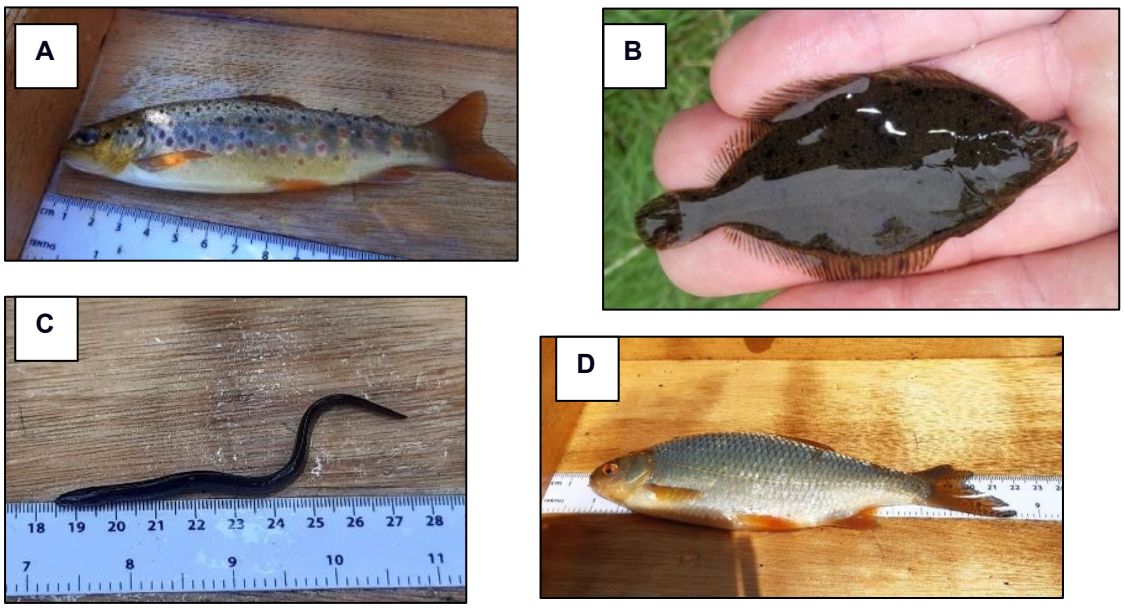


Plate 8. Examples of fish species recorded - a) juvenile gillaroo trout, b) flounder, c) European eel and d) roach.

Table 4. Repeat electrofishing sites, locations and fish species present.

Survey Year	River subcatchment	River/Stream	Site ID	Easting	Northing	Salmon	Brown Trout	Minnow	Eel	Roach
2022	Glenaniff	Glenaniff	site 1 d/s falls	192063	349702	P	P	P		
2022	Glenaniff	Glenaniff	site 2 d/s falls	191999	349430	P	P		P	
2022	Glenaniff	Glenaniff	site 4 u/s McSharry's house	191948	349111	P	P		P	
2022	Glenaniff	Glenaniff	site 5 d/s falls	191649	348624	P	P		P	
2022	Glenaniff	Glenaniff	site 7 top site	189471	348597		P			
2022	Ballagh	Ballagh	site 1	192355	349639	P	P	P		
2022	Ballagh	Ballagh	site 2	192525	348901	P	P	P		
2022	Ballagh	Ballagh	site 3	192753	348393	P	P	P		
2022	Ballagh	Ballagh	site 4	192875	348123	P	P	P	P	
2022	Ballagh	Ballagh	site 5	192732	347778	P	P		P	
2022	Ballagh	Ballagh	site 6	192431	347610	P	P			
2022	Ballagh	Ballagh	site 7	191977	346807		P			
2022	County	County	site 1	193798	350725	P	P	P	P	P
2022	County	County	site 2	194387	349977	P	P	P	P	
2022	County	County	u/s of Kiltyclogher	197909	345404	P	P	P	P	
2022	County	County	d/s metal footbridge	194894	349116	P	P	P	P	
2022	County	Sraduffy	d/s br. in Kiltyclogher	197349	345382	P	P			
2022	County	Lattone	Lattone site 1	195360	347910	P	P			
2022	Clancy's	Clancy's	site 1	186050	354040	P	P	P	P	

3.1.2 Fish Species Abundance and distribution

Glenaniff River

Five sites were surveyed along the Glenaniff main channel (Fig. 7), as part of the repeat monitoring survey. All sites recorded trout while only those downstream of Fowley's Falls (natural waterfall and complete barrier) had salmon present (4 sites). European eel and minnow were also noted. Trout lengths ranged from 3cm to 24cm (Fig. 8a). Salmon lengths ranged from 3cm to 15cm (Fig. 8b). Salmon were more abundant than trout at all sites downstream of Fowley's Falls.

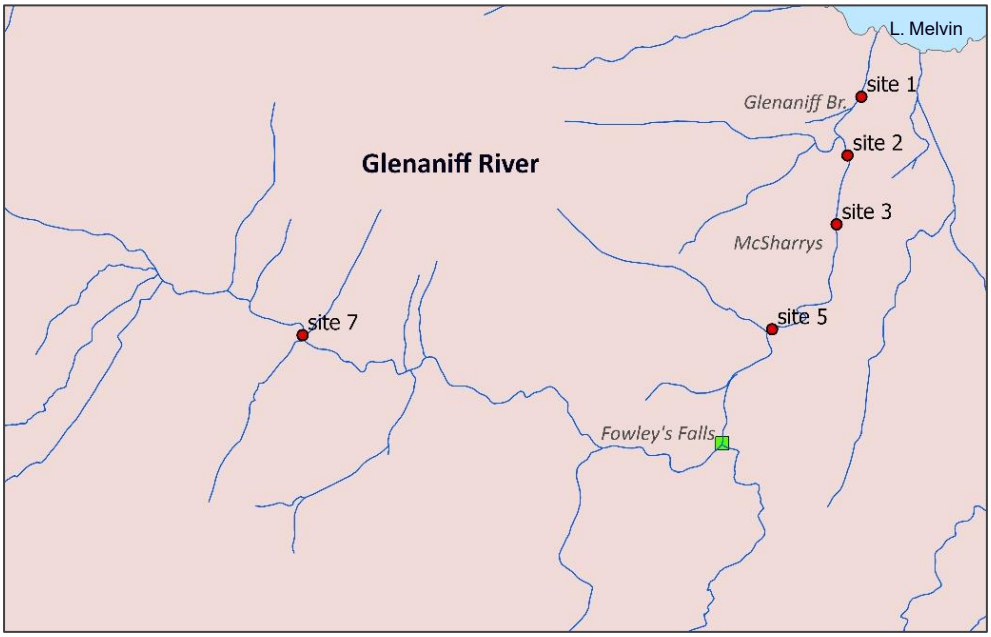
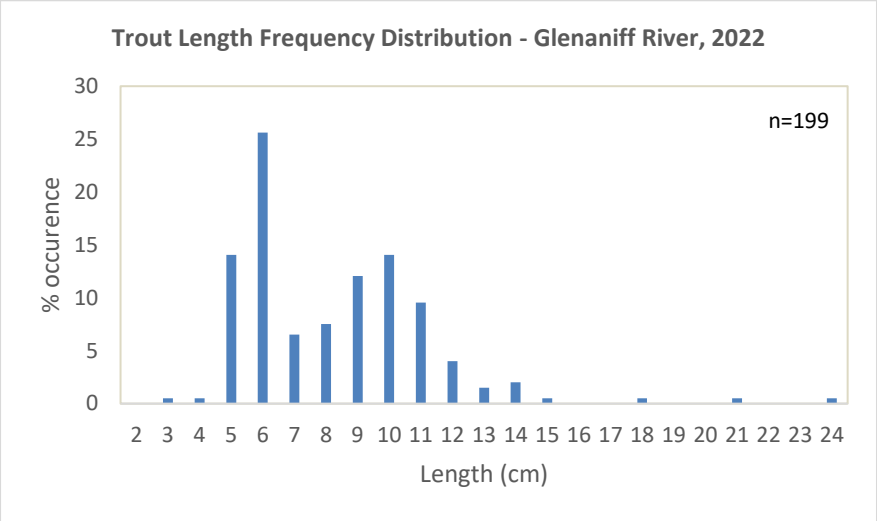


Figure 7. Glenaniff River and location of 5 sites electrofished, 2022.

Minimum density estimates are presented in Table 5. Trout estimates varied from 0 to 0.123m^2 for 0+ trout and from 0.009 to 0.155m^2 for 1+ & older trout, while salmon minimum density estimates ranged from 0 to 0.262m^2 for 0+ fish and between 0 and 0.238m^2 for 1+ salmon.

Overall salmon were more prevalent than trout and present in greater numbers, where both species occurred downstream of Fowley's Falls.

A



B

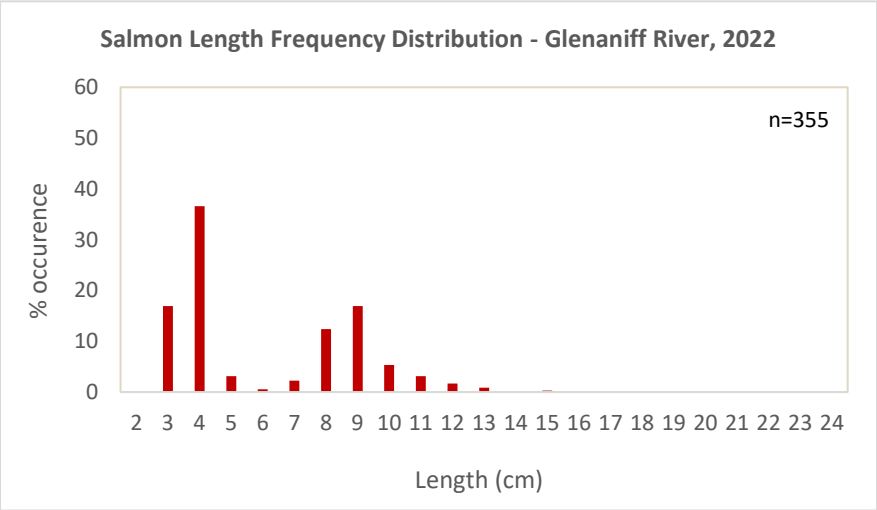


Figure 8. Length Frequency Distributions for trout (a) and salmon (b).

A set of 41 trout scales were examined and aged, of those 83% were aged 1+, 12% were 2+ and 5% were 3+. Of the 199 trout recorded and measured across all sites within the Glenaniff River, 47% were 0+, 49.5% 1+, 2.5% 2+ and 1% were 3+.

Length at age data, from back-calculated scale readings, were determined for trout and mean lengths for L_1, L_2 and L_3 were 5.92cm, 12.34cm and 17.45cm respectively (Appendix VIII & Fig. 9). Only three trout were greater than 16cm.

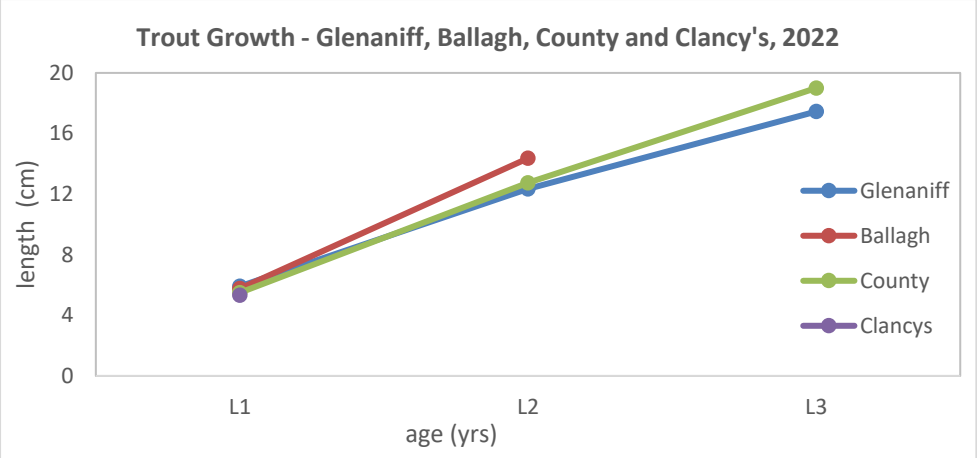


Figure 9. Glenaniff, Ballagh, County and Clancy's trout length at age data, 2022.

No salmon scales were aged; however, of the 355 fish measured, 57% were 0+ fish and 43% were 1++ as determined from length frequency data (Fig. 8b).

Ballagh River

Seven sites were surveyed along the Ballagh main channel (Fig. 10), as part of the repeat monitoring survey. All sites recorded trout while salmon were present at sites 1 to 6. Trout lengths ranged from 4cm to 18cm (Fig. 11a). Salmon lengths were in the range of 3cm to 15cm (Fig. 11b).

Minimum fish density estimates varied from site to site (Table 5). Those for 0+ trout ranged from 0.026 to 0.346m^2 and for 1+ & older trout values were between 0.052 and 0.241m^2. Those for salmon were between 0 and 1.235m^2 for 0+ fish and for 1+ salmon values ranged from 0 and 0.261m^2. In general salmon were more prevalent than trout.

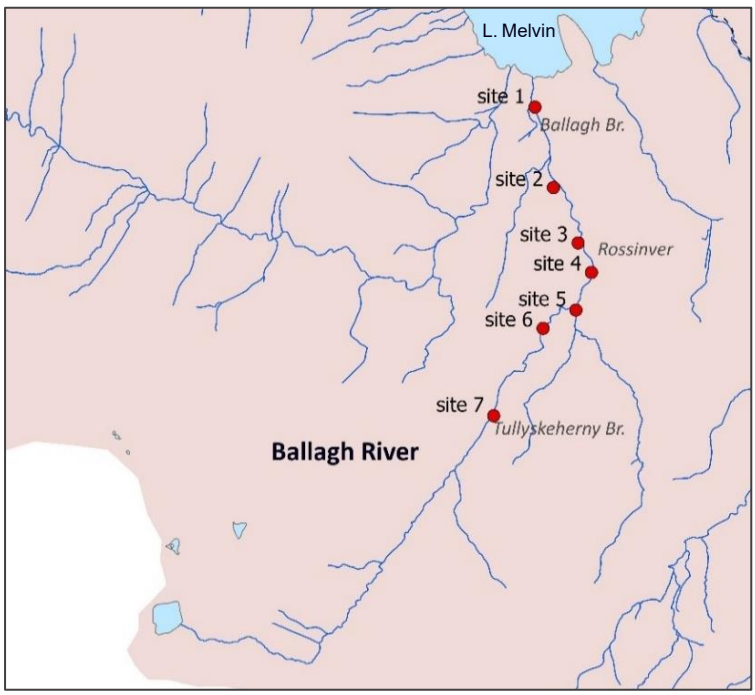
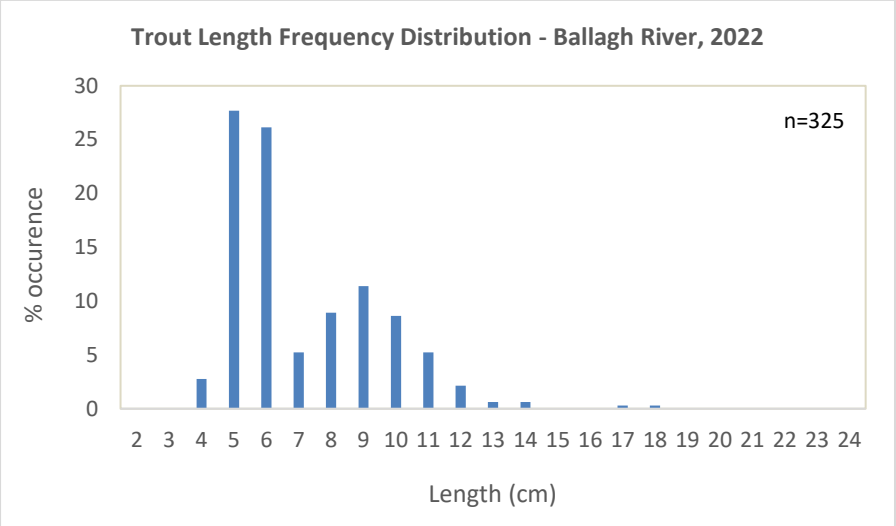


Figure 10. Ballagh River and location of 7 sites electrofished, 2022.

A



B

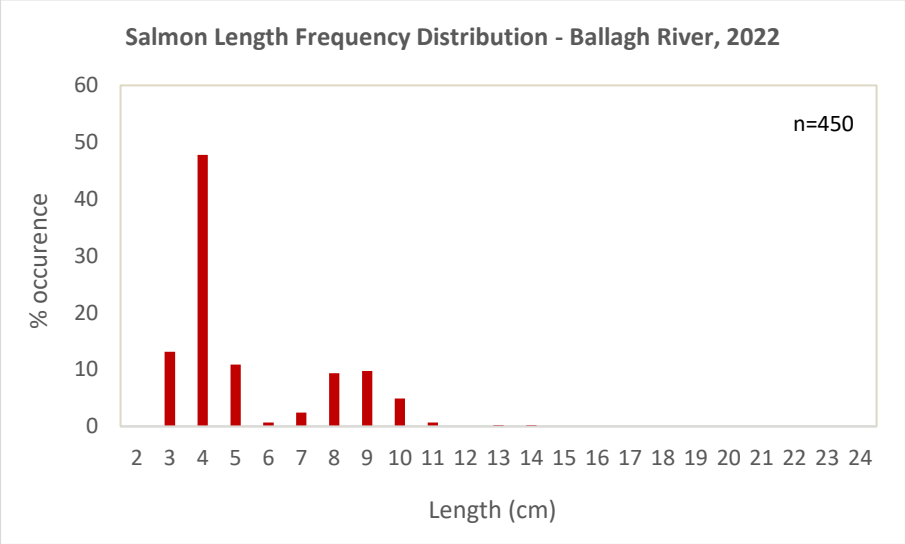


Figure 11. Length Frequency Distributions for trout (A) and salmon (B).

A set of 56 trout scales were examined and aged, of those 95% were aged 1+ and 5% were 2+. Of the 335 trout recorded and measured across all sites within the Ballagh River, 62% were 0+, 37% 1+ and 1% were 2+.

Length at age back-calculations were also calculated for trout and mean length for L_1 and L_2 were 5.77cm and 14.37cm respectively (Appendix VIII & Fig. 8). Only two trout recorded were greater than 16cm.

No salmon scales were aged; however, of the 460 fish measured, 72% were 0+ fish and 28% were 1++ as determined from length frequency data (Fig. 11b).

County River

Six sites were surveyed within the County River system, as part of the repeat monitoring survey (Fig. 12). Trout and salmon were recorded at all sites. Trout lengths ranged from 3cm to 21cm. Salmon lengths ranged from 3cm to 13cm (Fig. 13a). Salmon dominated the salmonid populations at all sites (Fig. 13b).

Trout minimum density estimates, for 0+ fish, were between 0 and 0.109m^2 and for 1+ & older fish ranged from 0.015 and 0.057m^2 (Table 5). While density estimates for salmon varied from 0 to 0.437m^2 for 0+ fish and between 0.041 and 0.314m^2 for 1+ fish. In general salmon were more prevalent than trout.

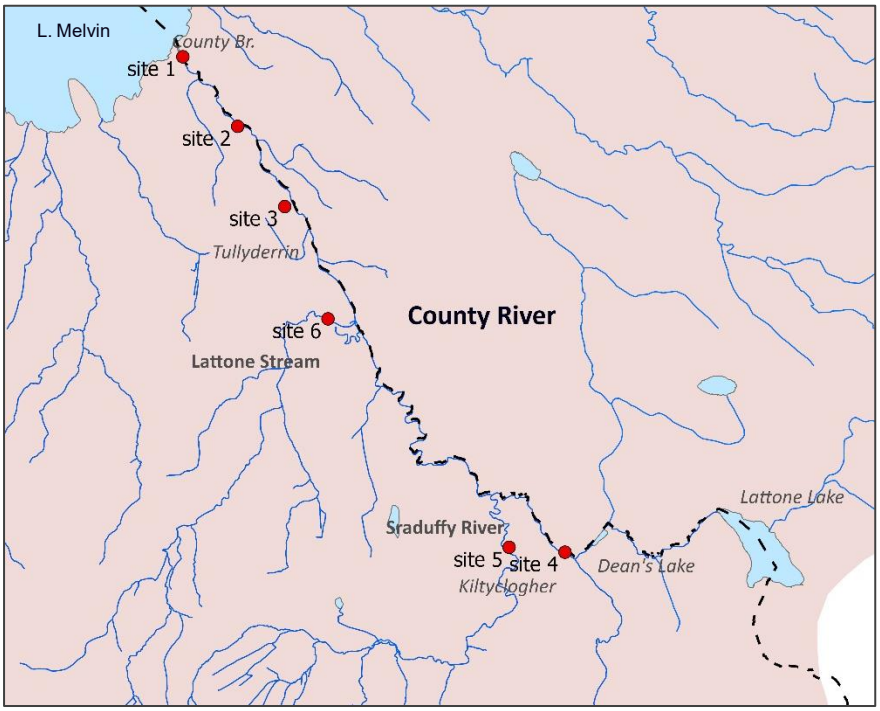
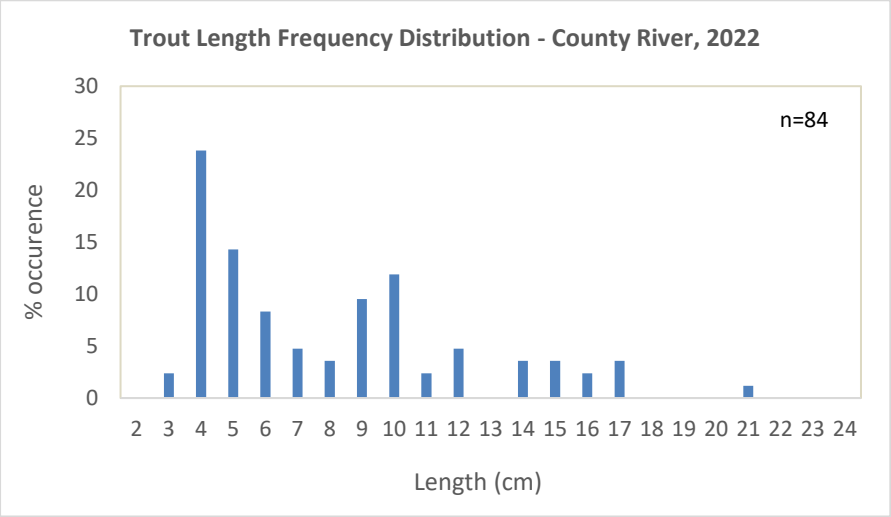


Figure 12. County River and location of six sites electrofished, 2022.

A



B

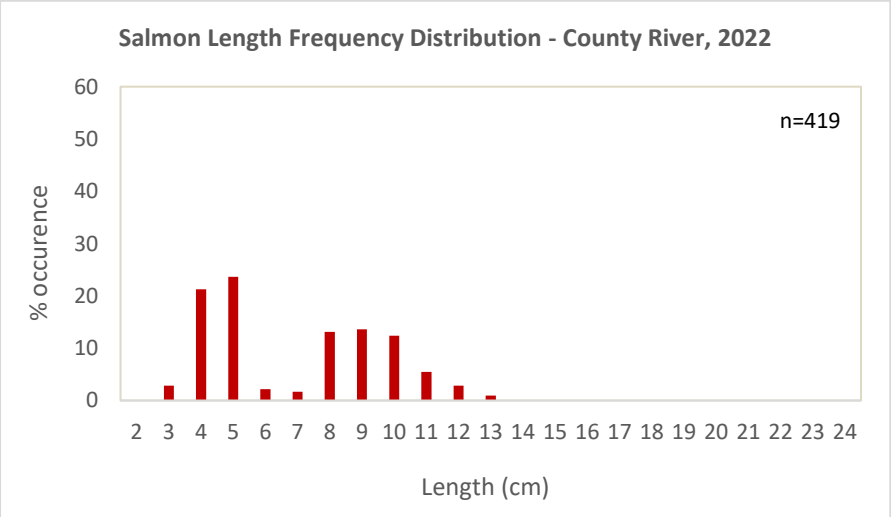


Figure 13. Length Frequency Distributions for trout (A) and salmon (B).

A set of 34 trout scales were examined and aged, of those 66% were aged 1+, 31% were 2+ and 3% were aged 3+. Of the 84 trout recorded and measured across all sites within the County system, 51% were 0+, 49% 1++.

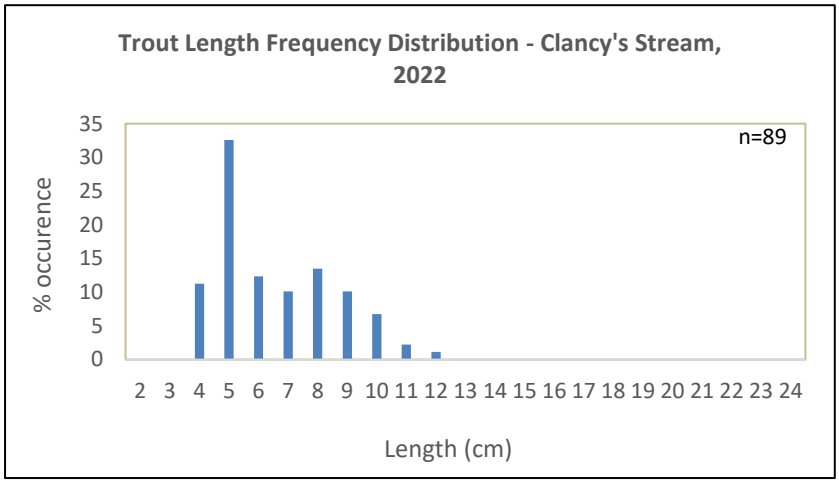
Length at age back-calculations were also calculated for the trout and mean length for L_1, L_2 and L_3 were 5.49cm, 12.74cm and 19cm respectively (Appendix VII & Fig. 8). Only four trout recorded were greater than 16cm.

No salmon scales were aged; however, of the 419 fish measured, 50% were 0+ fish and 50% were 1++ as determined from length frequency data (Fig. 13b).

Clancy's Stream

One site was surveyed here as part of the repeat monitoring survey (Fig. 6). Trout and salmon were present. Juvenile salmon dominated the population with a minimum density estimate of 1.185m^2 fish being recorded (see Table 5). This was the second highest density value recorded for 0+ salmon across all repeat monitoring sites (July 2022). Trout lengths ranged from 4cm to 12cm (Fig. 14a), while salmon lengths ranged from 2cm to 12cm (Fig. 14b).

A



B

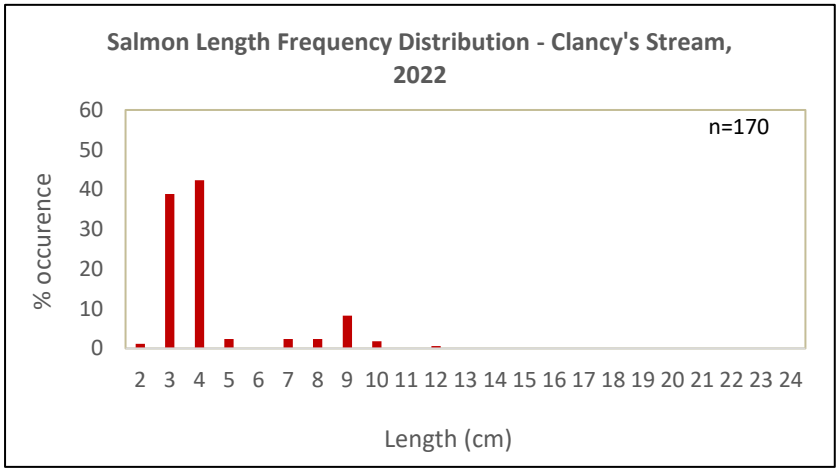


Figure 14. Length Frequency Distributions for trout (A) and salmon (B).

No trout or salmon scales were aged. Of the 89 trout recorded and measured within Clancy's Stream, 56% were 0+ and 44% 1++ (Fig. 13a). Of the 170 salmon measured, 85% were 0+ fish and 15% were 1++ as determined from length frequency data (Fig. 14b).

Table 5. Salmonid Minimum Density Estimates, L. Mevin catchment 2022.

				2022			
River	**Site**	**Location**	**area (m2)**	**Trout 0+**	**Trout ≥1+**	**Salmon 0+**	**Salmon 1+**
Glenaniff	1	d/s Glenaniff Br.	325	0.123	0.049	0.200	0.138
	2	250m u/s Glenaniff Br.	252	0.103	0.143	0.262	0.238
	3	200m d/s McSharrys	**ns**	**ns**	**ns**	**ns**	**ns**
	4	200m u/s McSharrys	212	0.085	0.009	0.108	0.132
	5	at riverside walk	241.5	0.058	0.062	0.203	0.161
	6	300m d/s impassable falls	**ns**	**ns**	**ns**	**ns**	**ns**
	7	Br. on Glenaniff link road	193.7	0	0.155	0	0
Ballagh	1	d/s Ballagh Br.	170.8	0.299	0.064	0.211	0.111
	2	Edmonds	136	0.346	0.125	1.235	0.103
	3	d/s Rossinver Br.	191.3	0.094	0.125	0.345	0.261
	4	400m u/s Rossinver	133	0.241	0.241	0.158	0.173
	5	at R.C. church	187.6	0.053	0.101	0.144	0.043
	6	450m d/s waterfall	117.5	0.340	0.128	0.111	0.094
	7	d/s Tullyskeherny Br.	154	0.026	0.052	0	0
County	1	u/s Rossinver to Garrison road br.	274	0.007	0.015	0	0.102
	2	south Carran West	254.45	0.008	0.028	0.086	0.314
	3	d/s metal footbridge	357	0	0.017	0.078	0.134
	4	u/s of Kiltyclogher forestry br	193.43	0.109	0.047	0.295	0.041
	5	Sraduffy tributary in Kiltyclogher	153.18	0.039	0.052	0.437	0.287
	6	Lattone Tributary- lower site	139.5	0.079	0.057	0.244	0.029
Clancys	1	Lower site	121.5	0.412	0.321	1.185	0.214

3.1.3 Water Framework Directive Fish Status

Fish status for the Glenaniff River would suggest the lower reaches are productive, but as one moves upstream fish status declines to Moderate (Table 6). Numbers and life stages of trout were not as expected.

Overall, the Ballagh river recorded High fish status for all but one sampling site (Table 6). The upper most site recorded a status of Good in 1992 but then in 2022 was Moderate. Again, this Moderate value is due to lower than expected trout numbers and life stages being present.

The data for the County Rivers is more varied. The system was not surveyed in 1992. For the most part the lower reaches of this river achieved a status of Moderate (Table 6), while upper sections improved in fish status to Good, in both survey years. Hydromorphological pressures are more evident on this river, mainly as a consequence historical OPW drainage operations and continued maintenance.

Table 6. WFD Fish Status for each individual site sampled over the periods 1992, 2000/2001 and 2022.

River	Site ID	Status 1992	Status 2000 / 2001	Status 2022
Glenaniff	1	High	High	High
Glenaniff	2	High	High	High
Glenaniff	3	High	*ns*	*ns*
Glenaniff	4	Good	Good	Good
Glenaniff	5	Good	Moderate	High
Glenaniff	6	Moderate	*ns*	*ns*
Glenaniff	7	Moderate	*ns*	Moderate
Ballagh	8	High	High	High
Ballagh	9	High	*ns*	High
Ballagh	10	High	High	High
Ballagh	11	High	*ns*	High
Ballagh	12	High	High	*ns*
Ballagh	13	High	High	High
Ballagh	14	Good	*ns*	Moderate
County	1	*ns*	Good	*ns*
County	2	*ns*	Moderate	Moderate
County	3	*ns*	Moderate	*ns*
County	4	*ns*	Moderate	*ns*
County	5	*ns*	Good	Good
County	6	*ns*	Good	Good
Clancy's	1	*ns*	High	High

(ns = not surveyed)
(used 1st pass EQR values for 1992, 2000/2001 & 2022)

3.2 Comparisons with previous electrofishing surveys

The Glenaniff and Ballagh Rivers were both surveyed on two previous occasions, in 1992 and then again in 2000 (CFB, 1993 & 2002). The County River and Clancy's stream were surveyed only once previously, in 2001 (CFB, 2002). Salmonid minimum density estimates for sites are presented in Appendix VIII.

Salmonid density estimate plots are presented in Figure 15. These plots do indicate some change in fish populations over the survey periods. A decline in trout and salmon numbers has been observed in the Ballagh River. The Glenaniff River suggests a slight decline in trout numbers, but salmon fluctuated over the three sampling periods and is currently similar to the 1992 survey. The County River shows a decline in trout but an increase in salmon numbers between the two survey periods - 2001 and 2022.

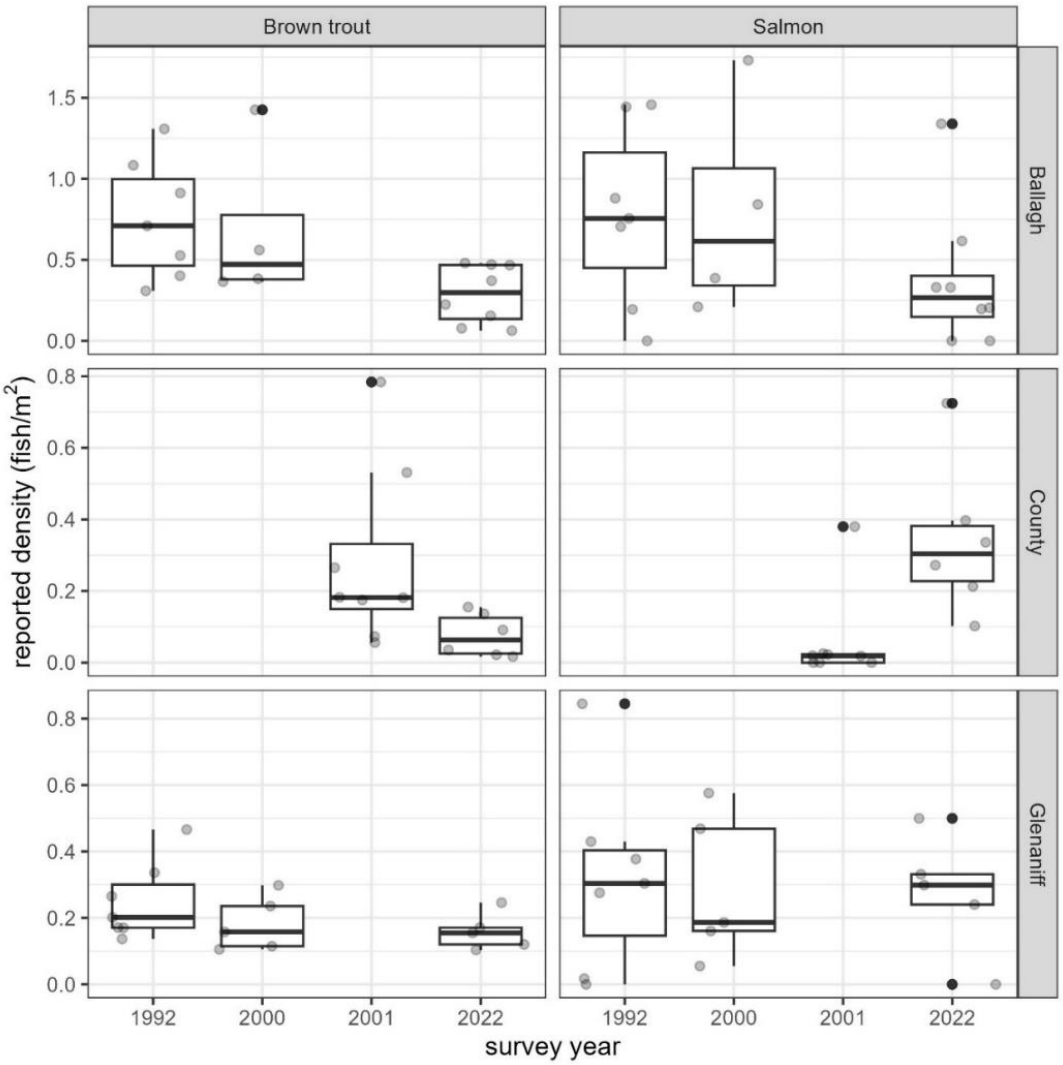


Figure 15. Reported trout and salmon density estimates, from each river and across each survey period.

The proportion of trout numbers to those of salmon is presented in Figure 16. Both the Ballagh and Glenaniff Rivers appear to have remained relatively stable over the three survey periods with salmon dominating each river during each survey period. However, the County River data indicates that trout dominated the earlier survey of 2001 while in 2022 salmon were dominant.

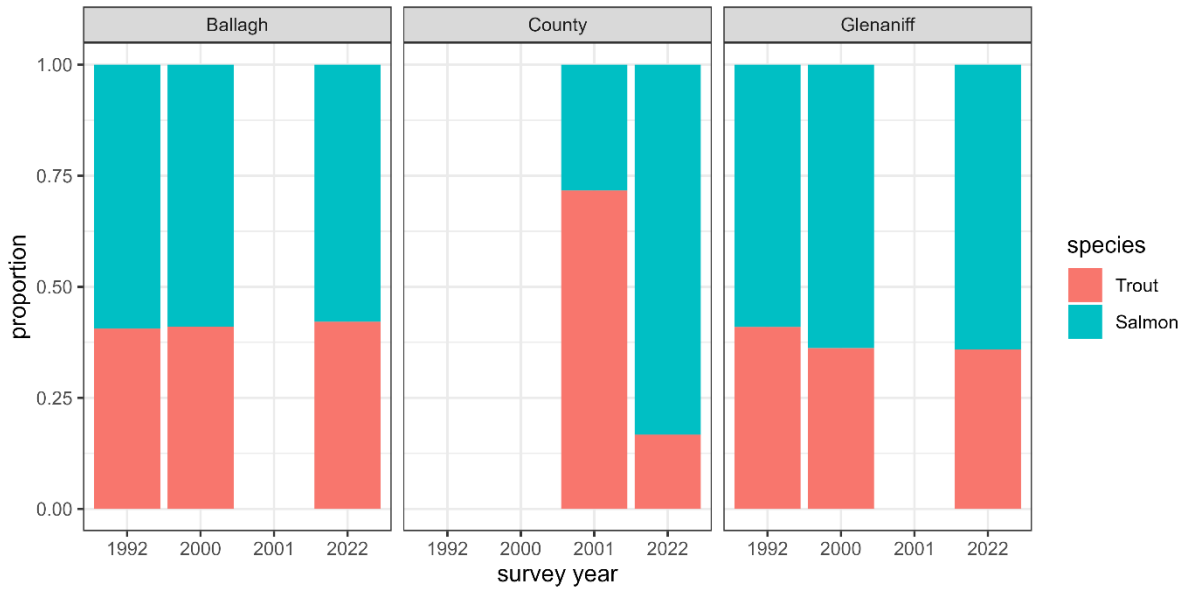


Figure 16. The proportion of trout to salmon within each river and for each survey period.

The data was further explored to consider the different salmonid life stages and possible changes over the three survey periods (1992 – 2000/2001 – 2022). Life stages can reflect spawning effort and nursery potential of individual rivers/streams of a system. Some changes in abundance have occurred — the most noticeable changes appear to be within the Ballagh River with both 0+ and 1+ & older trout in decline (Fig. 17). Salmon life stages (0+ and 1+ fish) show similar results (Fig. 18). This decline would suggest issues with spawning effort and/or success and possibly the river's capacity to support adequate nursery waters.

On the County River a decline in both life stages for trout has been recorded. However, a considerable increase in numbers of salmon life stages is now evident (Fig. 16). These changes are mostly likely attributed to the modifications carried out on an old fish pass in 2005 which has aided the migration of salmon upstream since the earlier survey of 2001.

Life stages of both trout and salmon have altered the least on the Glenaniff River. The densities of 0+ trout and salmon have remained relatively stable (Fig. 17), suggesting spawning effort and success is also stable. Only a slight decline in 1+ & older trout has been observed, but the decline in salmon 1+ is more noticeable. As this life stage would be a reflection on the capacity of the river to accommodate 1+ & older fish there may be some issues with the nursery potential of the Glenaniff River.

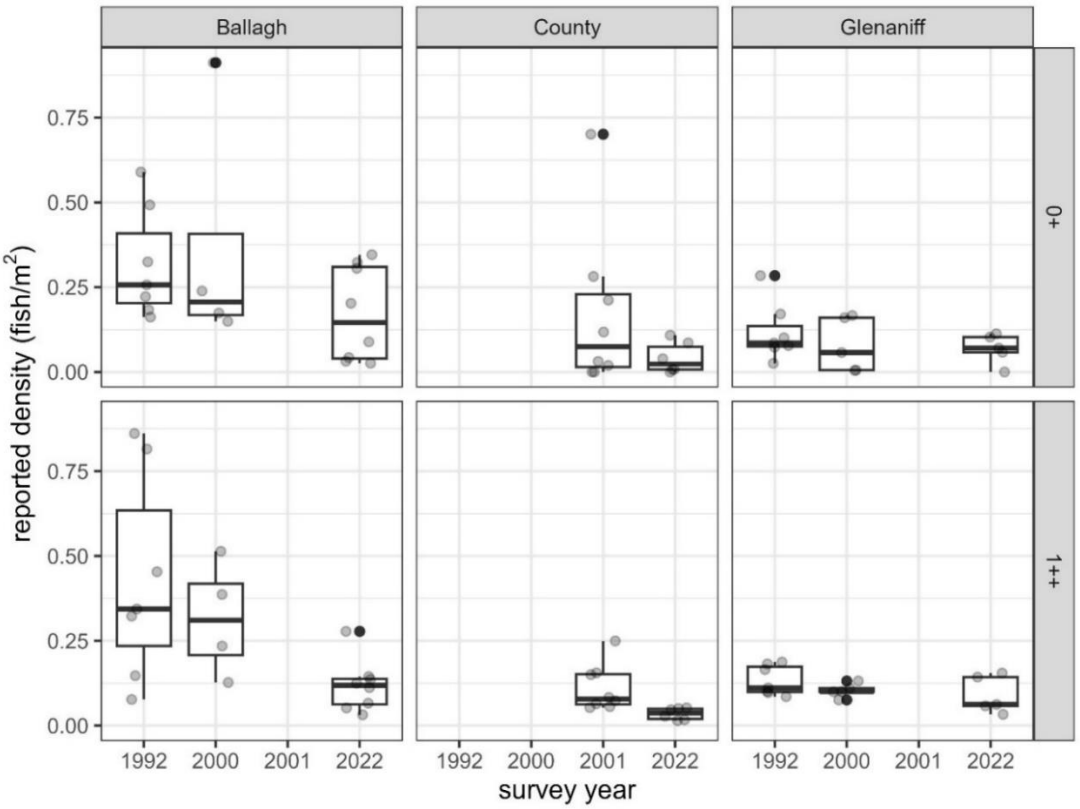


Figure 17. Reported density estimates for fry (0+) and parr (1++) trout life stages.

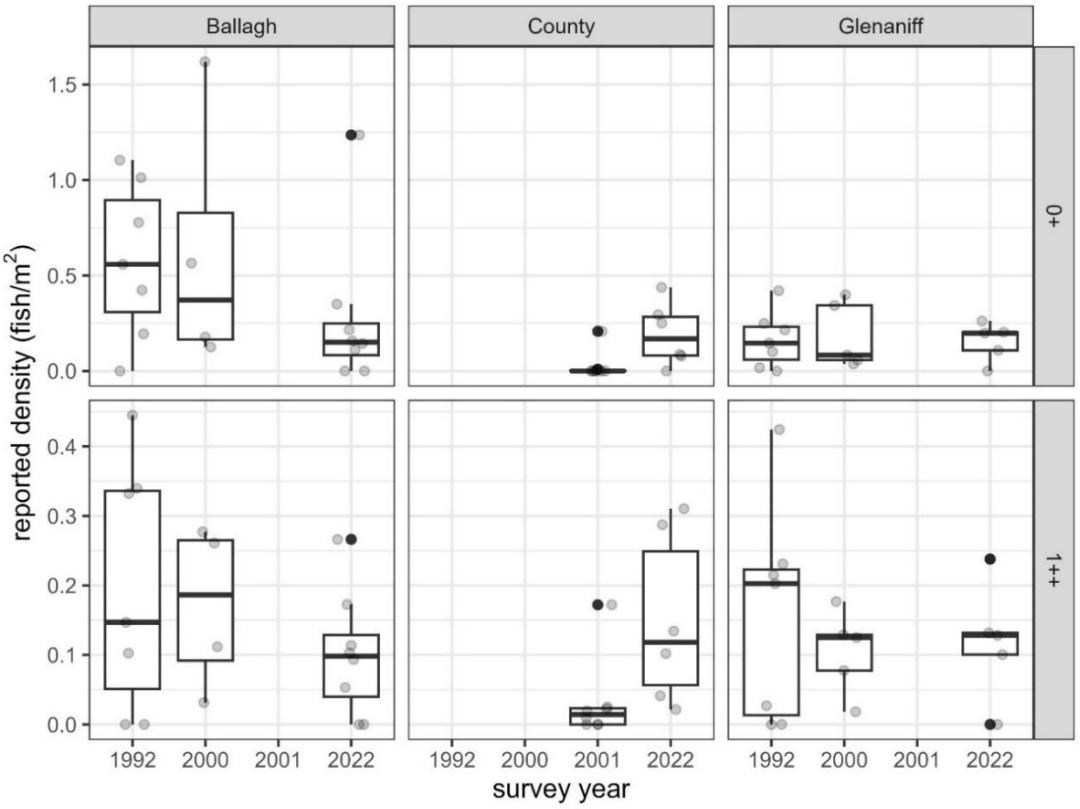
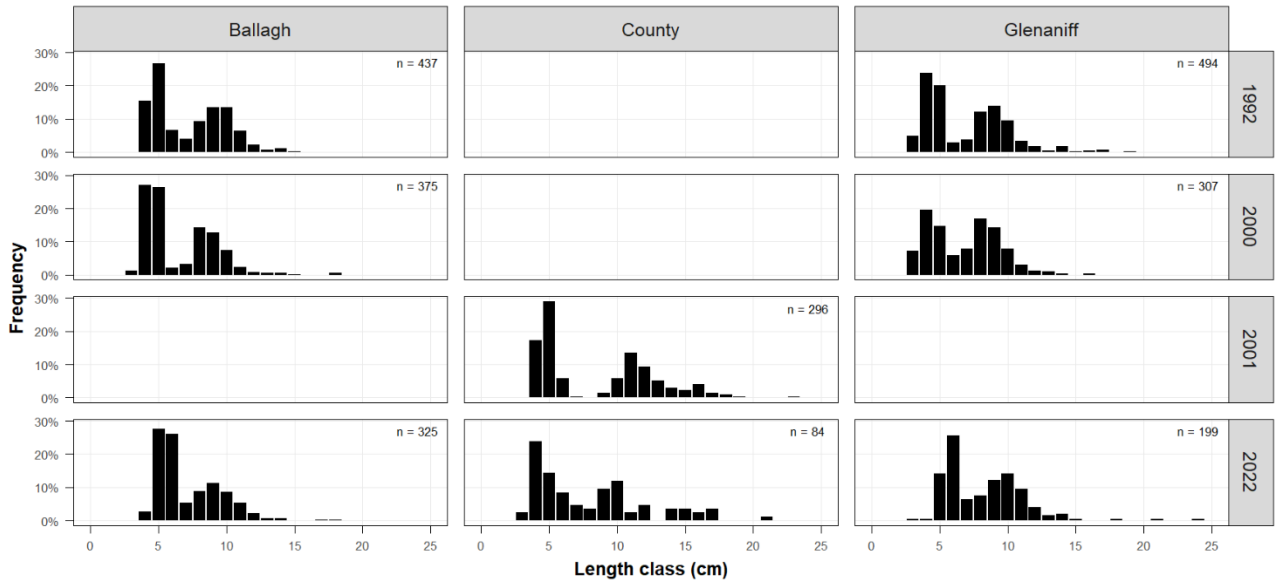
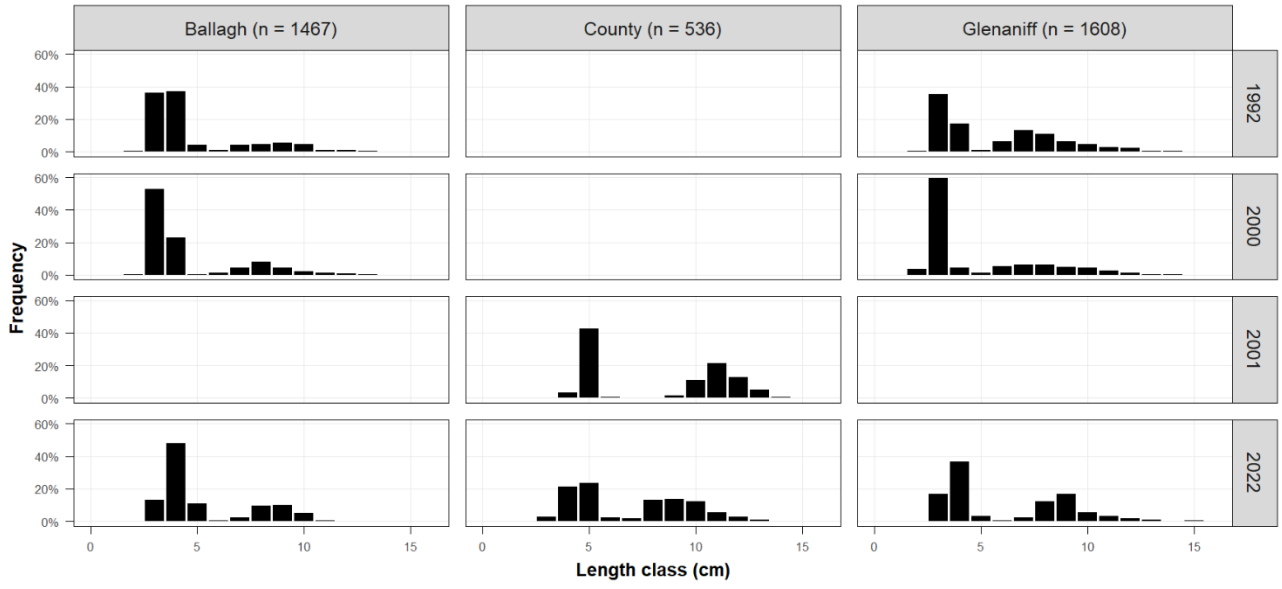


Figure 18. Reported density estimates for fry (0+) and parr (1++) salmon life stages.

Length frequency distribution patterns for trout (A) and salmon (B) were also considered (Fig. 19). Both the Ballagh and Glenaniff Rivers exhibited similar length distributions. However, some change is noted in the length frequencies of both trout and salmon recorded within the County River (Fig. 19).



A) Brown Trout



B) Salmon

Figure 19. Comparative length frequency distributions, Ballagh, Glenaniff and County Rivers – 1992, 2000/2001 and 2022.

Over the three survey periods the Ballagh River recorded greater abundances of trout and salmon than the Glenaniff River (Fig. 20), both in terms of spawning and nursery with only one exception to this noted in 2022 where the Glenaniff recorded slighter higher abundances of salmon 1++ (parr).

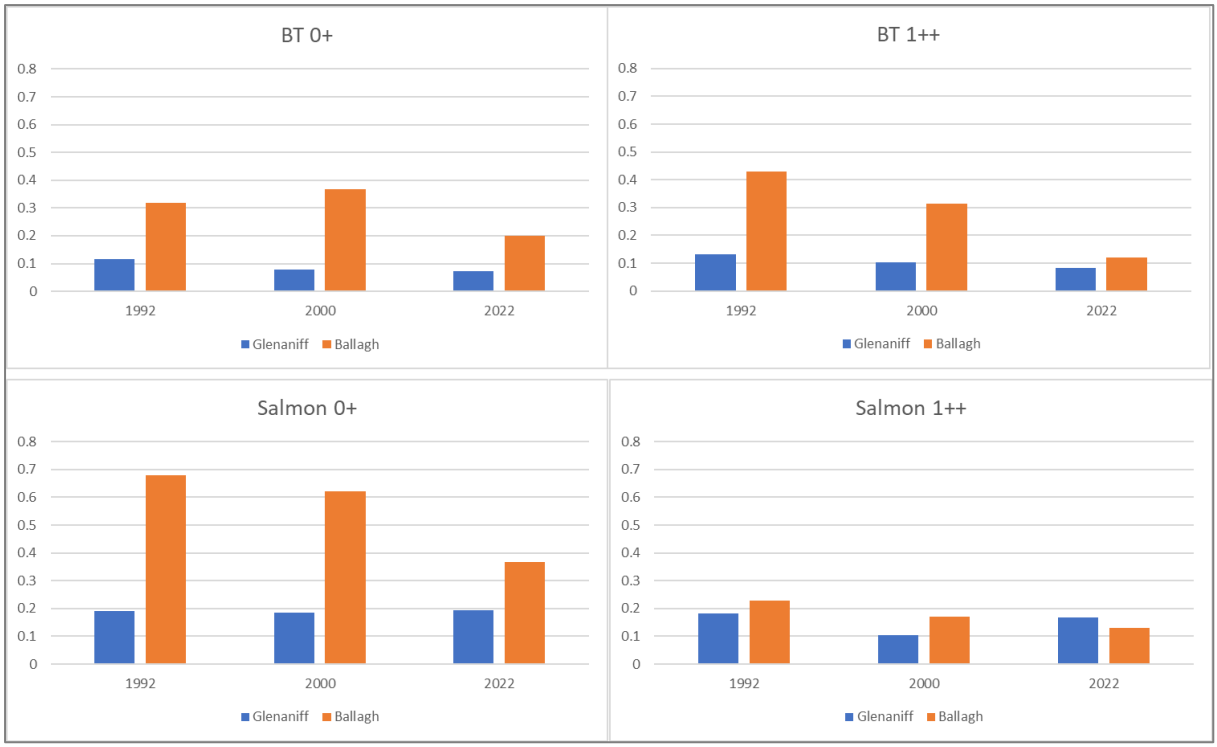


Figure 20. Ratio of salmonid life stages over the three survey periods, Ballagh and Glenaniff Rivers.

3.2.1. Statistical analysis of minimum density estimates across years

A non-parametric Wilcoxon signed rank statistical test was used to pairwise compare density estimates for all trout life stages at all seven repeat sampling sites from the Ballagh sub-catchment surveys as depicted in Fig. 21. A significant difference (decrease) in densities was detected between the 1992 and 2022 survey periods (p value = 0.047).

Differences in juvenile trout density distributions from the five repeat Glenaniff sites sampled in 1992 and 2000 were not found to be significant – based on a p-value of 0.063 slightly above the significance threshold – using the same statistical test. No other paired annual density distributions for trout within the Ballagh and Glenaniff sub-catchments were found to significantly differ.

Pairwise differences in trout densities at repeat sites were also examined for both fry (0+) and parr and older (1++) juvenile life stages. Trout parr but not trout fry densities were found to significantly differ (decrease) between 1992 and 2022 at repeat Ballagh electrofishing sites with a p value of 0.047. No significant changes were detected for either trout life stage at Glenaniff sub-catchment sites. A visual examination of Ballagh juvenile trout densities confirms a marked decrease in reported parr (1++) densities between 1992 and 2022. Although declines in trout fry (0+) densities are also evident for most Ballagh sites, the threshold for significance was not met (Fig. 21). Trout electrofishing densities decreased slightly at most repeat Glenaniff sites from 1992 to 2000 and from 2000 to 2022 for both trout fry and parr (Fig. 21) but the declines were much smaller than at Ballagh river sites and the threshold for significance was not crossed in the associated statistical tests (minimum p-values of 0.0625).

The same pairwise statistical tests were applied to salmon densities to detect changes in salmon abundance within sub-catchments between years. No statistically significant differences were detected at sampling sites in the Ballagh or Glenaniff sub-catchments for any pairwise comparison of site densities for the survey years 1992, 2000 and 2022. Salmon electrofishing densities at repeat electrofishing sub-catchment sites were not found to change significantly at either fry or parr life stages (Fig. 22).

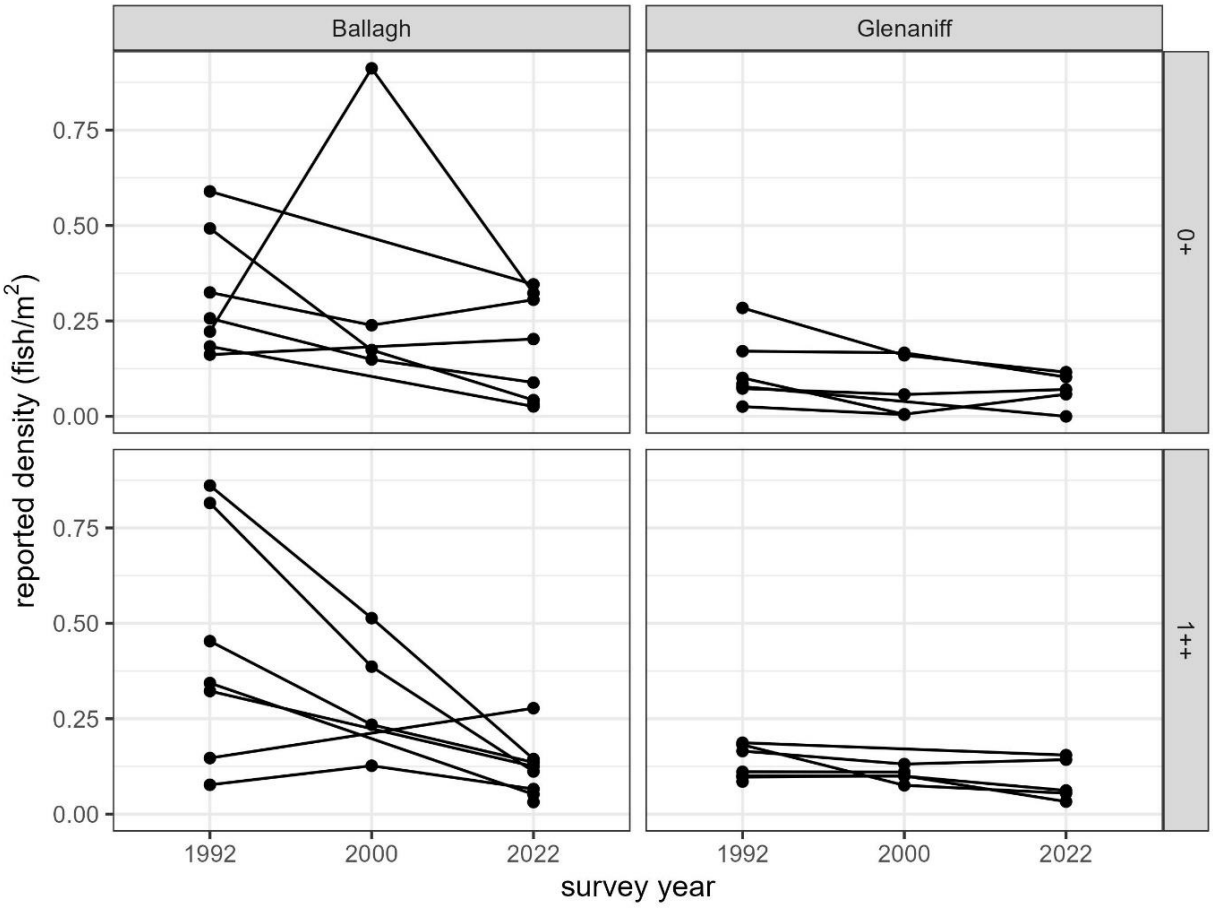


Figure 21: Reported trout 0+ and 1++ density estimates over the three survey periods, 1992, 2000 and 2022.

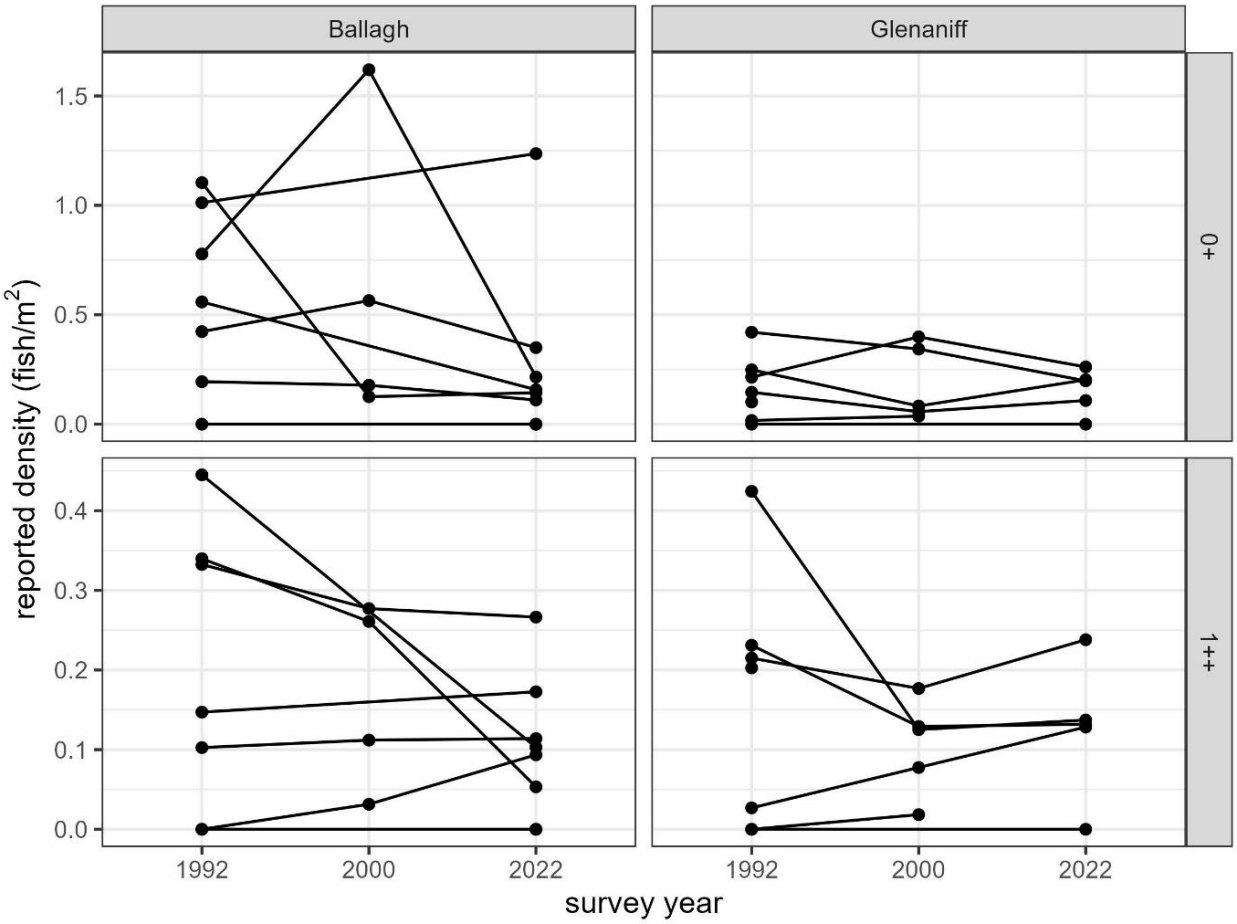


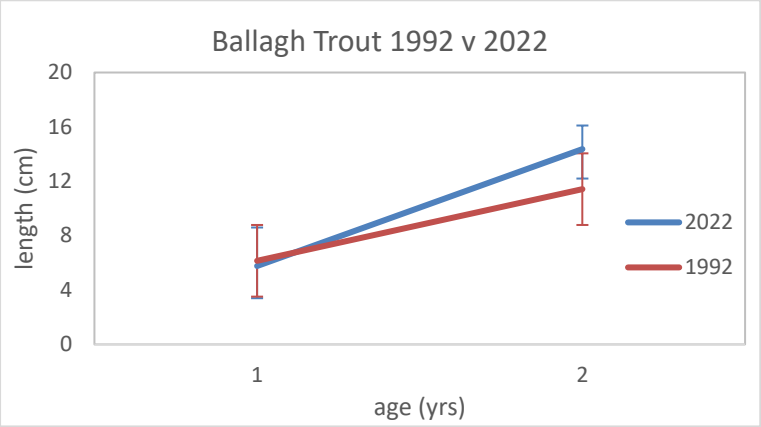
Figure 22: Reported salmon 0+ and 1++ density estimates over the three survey periods, 1992, 2000 and 2022.

3.2.2. Trout Growth Comparisons

Trout growth comparisons are only available for the Ballagh and Glenaniff Rivers between the 1992 and 2022 survey periods. In general trout growth rates amongst these rivers are relatively slow (Kennedy & Fitzmaurice, 1971, Appendix VIII). Data from the Ballagh River might suggest that there has been some change in growth rate, with faster growth noted for L_2 (length at age 2) within the 2022 sample (Fig. 22a). However, it should be noted that the mean L_2, for both survey years, is based on a very small number of samples (Appendix VII). Growth patterns for Glenaniff trout show no change between the two survey periods (Fig. 23b).

When compared to a number of other Irish catchments the L. Melvin trout can be seen to exhibit a relatively slow growth rate, only slightly faster than noted for the Cornamona River, L. Corrib catchment (Table 7).

A)



B)

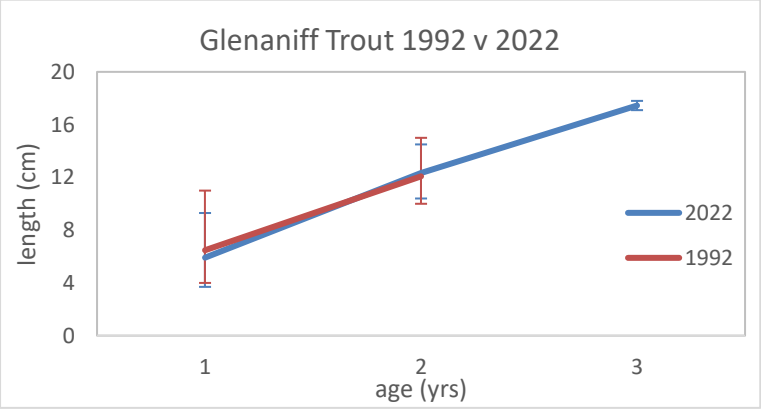


Figure 23. Growth rate of trout sampled, Ballagh and Glenaniff Rivers *(error bars based on minimum and maximum growth for the back-calculated length at age data*).

Table 7. Comparison of trout length at age data across selected Irish River

		Back-calculated length at age (cm)		
Catchment	River	L_1	L_2	L_3
Suir	Aherlow	7.05	15.35	
Corrib	Cornamona	5.34	10.73	
Bandon	Bandon	9	16.22	
Drowes/L.Melvin	mixed tributaries	5.63	13.15	18.23

3.3. Fish data from Genetic Sampling

The distribution of sites sampled to collect genetic material from trout was more widespread than for repeat monitoring electrofishing sites. The entire catchment was included, both within Northern Ireland and Republic of Ireland, thus, providing additional information on the distribution of salmonids around the catchment and in the identification of salmonid spawning and nursery waters.

However, as the sampling methodology differed between the two programmes the data collected are not directly comparable. It does still provide invaluable fish information in relation to the presence and distribution of salmonids, along with other fish species, across the entire catchment.

In order to include the entire L. Melvin catchment, fishery colleagues in AFBI & DAERA carried out electrofishing surveys at river sites within Co. Fermanagh (Northern Ireland), providing fish data and genetic samples to the project. A small number of samples were collected by IFI directly under a Section 14 Authorisation issued by DAERA both in 2022 and 2023.

3.3.2 Results

A total of 96 sites were electrofished across the L. Melvin catchment (Fig. 24) between 2022 and 2023 and included 21 individual river/stream sub-catchments. Riverine trout genetic samples (1,155) were collected at 75 of these sites (Fig. 24). At each site the presence of all fish species encountered was recorded (Appendix X). A total of eight species were noted. In addition to the five species already mentioned, three spined stickleback, perch and flounder (*Platichthys flesus*) were also recorded during the genetic electrofishing surveys. However, the distribution of these species was more restricted. Distribution maps of each species are provided in Appendix XI.

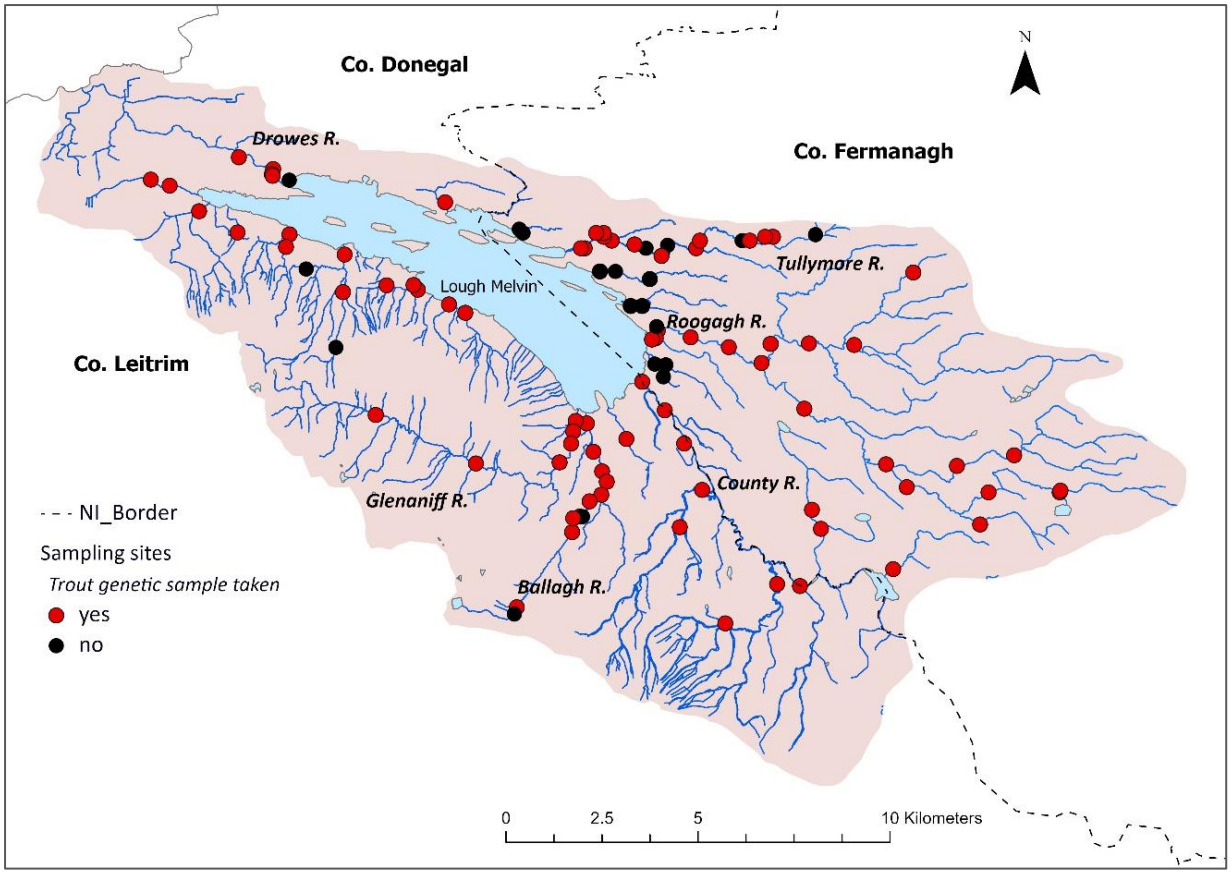


Figure 24. Location of all electrofishing sites and those where trout genetic samples were taken (●) .

Trout were the most common species and displayed a widespread distribution, followed by salmon. Eels were recorded mostly on the larger rivers, or lower reaches of smaller streams close to the lake. Other species displayed a more restricted distribution, in particular roach which were a single specimen was recorded from two rivers and flounder recorded only at one site on one river.

4 Habitat Assessment

Habitat assessments have been carried out across the Lough Melvin (Leitrim) riverine catchments, by both IFI staff of the NWRBD office (Ballyshannon) and those of the Research Section. Data collected included information on potential barriers to fish migration and flow, bank erosion, debris blockages, tunnelling, stock poaching, bed material, spawning and nursery habitat and hydromorphology (RHAT).

Given the constraints of both the Habitats Directive and the WFD there is a need to ensure any development works (enhancement and restoration) are considered carefully in line with both Directives before being undertaken. An understanding of the hydromorphology of each system is required and identifying anthropogenic changes that may have occurred will assist in determining whether a river, or river section requires enhancement/restoration works.

Drainage programmes have been undertaken within the County and Roogagh river systems previously along with routine maintenance programmes since (see Section 1.2). Instream development works were undertaken on the County River (main channel middle reaches, Plate 9) in 2022 by the OPW, while enhanced maintenance works have occasionally also been carried out (IFI unpublished, 2014).

Plate 9. Examples of OPW drainage maintenance works, County River 2022.

Habitat pressures mapped during walk-over surveys (by local IFI officers within Co. Leitrim only) identified a number of different issues, most notably tunnelling, debris blockages and bank erosion (Fig. 25). Access along the majority of the smaller tributaries was difficult and therefore issues identified along these channels were restricted to sections that could be walked. The larger rivers (in Co. Leitrim only) were more accessible and thus enabled greater sections to be mapped. Fewer problems areas identified within the smaller tributaries is a reflection of channel inaccessibility.

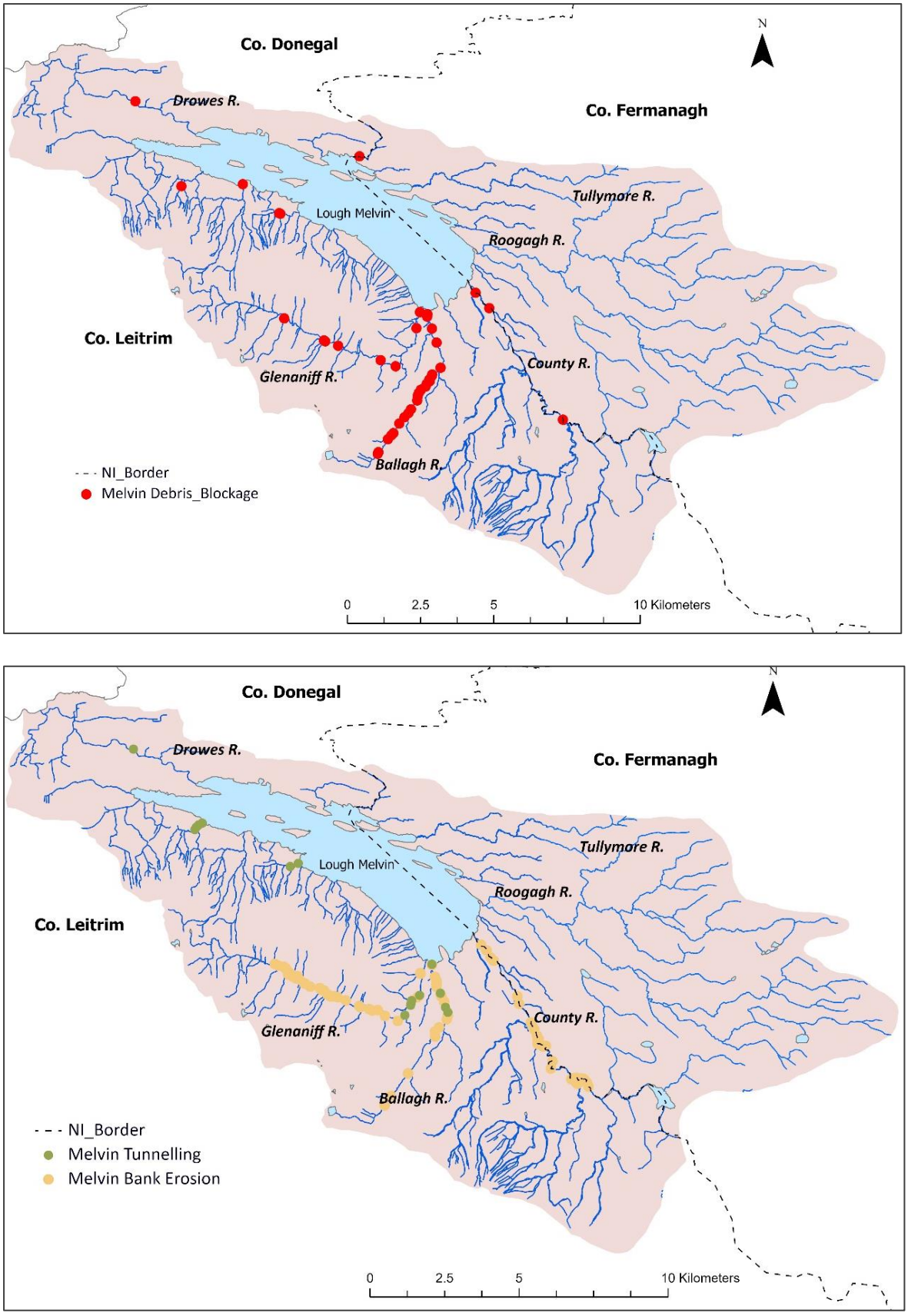


Figure 25. Examples of issues identified during walk-over surveys, Melvin catchment Co. Leitrim.

4.1 Identification of Salmonid spawning & nursery waters

Due to the electrofishing survey type used when sampling the additional sites for genetic purposes, fish density estimates cannot be presented. However, it was possible to use the fish data collected during all surveys to identify important spawning and nursery waters around the L. Melvin catchment. It is clear that all inflowing tributaries are actively used by trout, with only the larger rivers being occupied by salmon (Appendix XI trout). Utilisation of the tributaries varies greatly, depending most often on the tributary habitat resources and their physical characteristics (channel base width, gradient, bed material, riffle/glide/pool habitat), barriers to migration, along with water quality and food resources. L. Melvin tributaries with adequate availability of these resources are the most successful in terms of salmonid abundance. For the most part the L. Melvin inflowing rivers/streams support spawning and nursery opportunities but few of the inflowing tributaries hold large trout outside of the spawning season.

Smaller inflowing Tributaries

Tributaries flowing into the lake between Kinlough and Rossinver (southern shore), apart from the Glenaniff and Ballagh Rivers, are short systems many draining high ground with steep gradients in the upper and middle reaches and often with bedrock outcrops and heavy vegetation cover. Survey data collected indicate that all these rivers/streams support salmonids, and for the most part trout only (Appendix XI). However, due to the high gradients and bedrock outcrops/waterfalls, fish access is restricted mainly to the lower reaches on many of these tributaries. The smaller of these streams (usually with a base width of < 2.5m) support trout spawning opportunities, but nursery potential can be limited. Larger tributaries with adequate juvenile habitat (i.e. pool and glide areas with sufficient water depth) were found to support both ages groups of juveniles (0+ and 1+ fish).

Good salmonid spawning opportunities were noted in the lower reaches of tributaries like the Rosclogher and Clancy's (Stracummer). Here the presence of gravel beds and mixed habitat of riffle/glide/pool were evident and electrofishing data identify these streams as important spawning and nursery locations. Other streams such as the Ballymore and Cloghans (Fig. 6) would be considered important for trout spawning, though with limited nursery potential.

In general, all tributaries (large and small) supported trout spawning when gravels were present, and fish had unobstructed (free) access up through the system. If these streams also had suitable nursery waters (i.e. pool and glide areas) then the stream was also capable of supporting older juveniles (1+ fish). Salmon were only recorded in three of these smaller tributaries, namely Clancy's Co. Leitrim and Aughamuldoney and John Elliotts Co. Fermanagh.

Rivers and streams like Kinlough, Derrynasser, Mogue and middle to lower reaches of Mill drain less steep land (more commonly used for agricultural purposes) with lower gradients. Bed material within these rivers contain more silt and finer material and are less suitable for salmonid spawning, though some provide a potential nursery function if sufficient depth of water is present. Good numbers of 1+ trout juveniles were recorded within the lower reaches of the Mill River.

The Glenaniff, Ballagh and County Rivers are more substantial systems and are thus described in more detail. It is worth noting though that the habitat descriptions and the physical nature of the Glenaniff and Ballagh Rivers presented in the 1992 baseline survey report (CFB, 1993) remain valid today.

Glenaniff River

In summary, the Glenaniff River has three discrete ecological zones. From the headwaters to the major impassable waterfall (Fowley's Falls) the channel provides ideal salmonid spawning and nursery habitat because of the gradient, riffle/glide/pool sequences and suitable gravels present (Fig. 7). From this falls to McSharry's (site 3), bedrock dominates the riverbed. Gravels are limited and spawning opportunities are restricted as a consequence. The river section from McSharry's to the lake again provides suitable salmonid spawning and nursery habitat: riffle/glide/pool sequences are present along with spawning gravels and a favourable channel gradient.

In general, the river between Glenaniff bridge and Fowley's Falls provides good salmonid habitat for spawning and nursery. Both salmon and trout actively utilize this area. Upstream of the Falls, the river still provides suitable salmonid spawning and nursery waters however fish migrating up from the lake cannot access this section of river. A small population of trout are resident in this section completing their full life cycle upstream of the Falls. The length of main channel river available to migrating fish is approx. 2.42km representing 28% of the total main channel length (approx. 8.6km). The accessible main channel wetted area is 13.8km^2 and is 30% of the total available wetted area.

Heavy tree cover is evident along the lower to middle reaches, bedrock substrate is common place and lacks suitable quantities of spawning gravels. These sections of the river would benefit from the addition of gravels and selective vegetation management.

The river upstream of the impassable waterfalls to the headwaters has an almost continuous riffle/glide/pool sequence over a bed of gravels, cobbles and boulders. This type of habitat is ideal salmonid spawning and nursery water, probably more suited to salmon than trout, however salmon do not have access to this section of the river.

Spawning

Survey data identify the best of the trout spawning is within the lower reaches of this river (site 1 & 2) and spawning effort declined as one moved upstream towards Fowley's Falls (Table 5). Suitable spawning gravels are present in good quantities in the area around Glenaniff bridge both upstream and downstream. There is a noted change in bed material upstream of an area locally referred to as McSharrys (site 3). This section is not as suitable for trout spawning due to the presence of sheet bedrock and limited trout spawning gravels. Salmon spawning also occurs along the same section of river but extends further upstream than the trout spawning grounds, with reasonable numbers of 0+ salmon recorded at all sites fished downstream of the Falls. The best salmon spawning habitat is again around Glenaniff bridge.

Nursery

A similar pattern was noted for salmonid nursery waters. The lower reaches of the Glenaniff again function well as nursery waters with good habitat available. Data collected in relation to trout indicates the area around Glenaniff bridge provides good nursery habitat (Table 5). Upstream of Fowley's Falls suitable nursery habitat is also available and electrofishing results suggest 1++ trout are using this area. Salmon data identify the section of river downstream of the Falls to below Glenaniff bridge as productive salmon nursery waters, with reasonable numbers of salmon 1++ utilizing the section between the Falls and McSharrys but particularly around Glenaniff bridge area.

Ballagh River

The Ballagh River has a good gradient throughout its length with riffle, shallow glide and occasional pools sequences noted throughout its length from the lake inflow to almost site 7 at Tullyskeherny bridge (site 7). The substratum is comprised primarily of gravels and cobble with occasional protrusions of bedrock. Gradient and habitat changes occur in the area of Tullyskeherny bridge with less suitable spawning and nursery conditions available.

Survey data would suggest that lake migrating salmonids do not have access to the upper and middle reaches of the Ballagh River (Appendix X). A series of low bedrock falls with sections of sheet bedrock linking them can be found downstream of Tullyskeherny bridge (Fig. 10). No salmon have been recorded upstream of here during either survey periods of 1992 and 2022/2023.

The length of main channel river available to migrating fish is approx. 3.65km (total length of main channel is approx. 6.7km). This represents 54% of the total main channel length. The accessible main channel wetted area is 13.5km^2 and is 65% of the total available wetted area.

Spawning

Survey data indicated trout used the entire length of river for spawning. However, spawning effort varied and sections with good quality spawning gravels present were most productive, as indicated by fry (0+) numbers captured. Such suitable habitat was recorded at sites 2, 6, 1 and 4. Salmon spawning activity was restricted to the river downstream of the low bedrock falls located downstream of Tullyskeherny bridge. Electrofishing results identify the section of river between Ballagh bridge and Rossinver village as an extremely active salmon spawning area (sites 2 and 3). Suitable salmon spawning habitat is available further upstream though is less extensively utilised currently.

Nursery

Survey results from the Ballagh river suggest that this river offers more suitable trout nursery waters than the Glenaniff due to the suitable gradient and riffle, shallow glide and occasional pools sequences noted throughout its length. Survey results identify the areas around sites 4, 6, 2 and 3 as being particularly good with high 1++ trout numbers present (Table 5). Even so, fish data comparisons with previous survey years would suggest that it is currently functioning below potential. Indeed, statistical analysis performed identify a significant difference between trout 1++ density estimates of 1992 and

2022 (see Section 3.2.1). Salmon nursery habitat is most suitable between Ballagh bridge and Rossinver school (sites 3 and 4).

County River

The County River system is the second largest sub-catchment of L. Melvin, the Roogagh River system being the largest (Co. Fermanagh). The main channel forms the county border between Co's. Leitrim and Fermanagh (RoI and NI). Under the Kilcoo Arterial Drainage Scheme approx. 14km of channel were subjected to drainage operations. For the most part this included the County main channel from L. Melvin up to Deans Lough (north of Kiltyclogher, Fig. 12), and the lower reaches of five smaller tributaries (see Fig. 2 Section 1.2). Sections of the upper system (upstream of Deans Lake) were drained via the NI Drainage Council.

Drainage schemes aim to enhance land drainage and agricultural productivity within a catchment and reduce flooding. However, such schemes, for the most part, will negatively impact on the catchment's hydrology, ecology, and fisheries. Drainage schemes typically involved a lowering of the natural riverbed, over-widening and straightening of the river, and removal of instream features, e.g. pools, bank vegetation, spawning gravels, natural channel sinuosity (Gargan *et al*., 2002; O'Grady *et al*., 2017) thereby reducing the rivers overall diversity. The OPW maintain a working bank along the left hand side of the main channel.

Overall, the main channel could be described as having 2 discrete zones, deep slow flowing section interspersed with short riffle like areas, mainly from Kiltyclogher downstream to Tullyderrin (approx. 4km downstream, Fig. 12) draining a more agricultural landscape and is typical of a lowland meandering river. The second zone from Tullyderrin to County Bridge features heavy bankside tree cover, with moderate to high gradient and faster flows, bedrock with boulder/cobble/gravel type substrate. This section also has a number of bedrock outcrops which have formed natural waterfalls. One of which was reported as being impassable to salmon but during the late 1970s early 1980s was modified to give access to fish migrating upstream from L. Melvin with a denil fish pass being incorporated into the falls. Repair works were carried out on this fish pass in 2005 (Plate 9).

Plate 9. Denil fish pass on the County River

Both the Lattone and Sraduffy Rivers drain large areas of forestry (Fig. 26). Again, these rivers are high gradient channels with bedrock/ boulder/cobble/gravel type substrate.

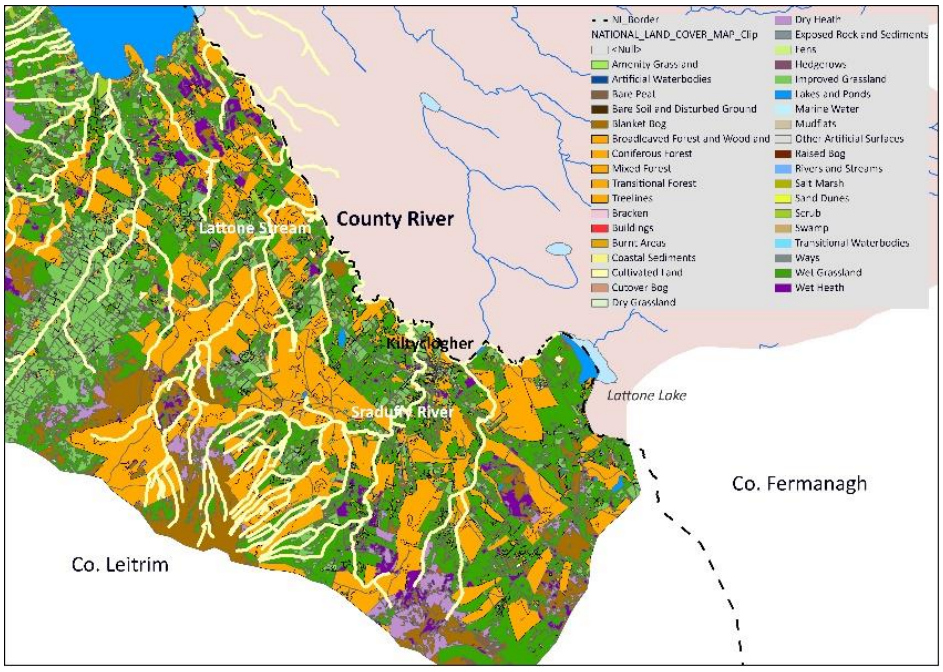


Figure 26. National Land Cover Mapping, County River Co. Leitrim. (https://www.tailte.ie/en/surveying/products/professional-mapping/national-land-cover-map/)

Spawning

In general, salmonid spawning is limited within the main channel due to unsuitable spawning bed material of bedrock & boulder or deep slow flowing glide like river sections (Plate 10). Occasionally pockets of spawning areas are present, however, in selected areas where adequate gravels are available. The area upstream of Kiltyclogher presents more opportunities for spawning. The main tributaries of note include Lattone Stream, Sraduffy River and the inflowing Lattone lake stream, these also contribute to the salmonid spawning function of this system. For the most part, salmon spawning effort has improved since the last electrofishing undertaken within this catchment (2001). Survey data indicates that the most productive areas for salmonid spawning were the tributaries and the river upstream of Kiltyclogher.

Nursery

The main channel provides suitable nursery habitat, such as deeper water and pool areas, good bankside vegetation cover (Plate 10), and salmonid 1++ productivity was best observed within areas like those noted at sites 2 and 3 and the Sraduffy tributary and Lattone Stream (Fig. 12), as suggested by the current electrofishing survey results (Appendix VIII).

Plate 10. Examples of bed material within the County River catchment, A) bedrock, B) deep slow flowing section, C) boulder and cobble strewn and D) spawning gravels

Fermanagh Tributary Systems

Trout are widespread across the Roogagh River system, however due to a series of natural waterfalls within the lower reaches of the river, upstream of Garrison, migrating salmon and trout from L. Melvin do not have access to much of this sub catchment (Appendix XI, trout and salmon). Trout above the waterfalls are resident fish. Much of the upper Roogagh catchment is forested.

Habitat assessment and identification of salmonid spawning and nursery areas within the Fermanagh rivers were not identified as part of this survey.

5 Summary

It is clear from the 2022 and 2023 electrofishing surveys that all inflowing lake tributaries are contributing to the adult salmonid populations of the lough. Trout were present in every tributary surveyed whereas salmon were only recorded in the larger rivers. Access to many of the southern shore tributaries was limited to the lower reaches due to high gradients and waterfalls present within their lower reaches. Access within even the larger rivers, Glenaniff, Ballagh and Roogagh, is also restricted due to the presence of several natural waterfalls located within each. In the case of the Glenaniff and Ballagh rivers the waterfalls are located several kilometers upstream of the lake and thus provides greater available wetted area than the smaller tributaries, whereas the impassable waterfalls located on the Roogagh are closer to the lake. The County River, which is known to have had an impassable natural waterfall present but now has an improved stepped fish pass, does provide access to migrating lake fish up through the main channel to areas upstream of Kiltyclogher.

Survey results suggest there is moderate to good salmon and trout spawning and nursey within the Glenaniff and Ballagh rivers. Moderate spawning and nursery occurs within the County river, mainly for salmon downstream of Kiltyclogher and for trout upstream of Kiltyclogher. Good to high spawning was noted for trout within many of the smaller tributaries to L. Melvin, with some also providing a nursery function.

The Glenaniff and Ballagh rivers have been surveyed on three occasions, 1992, 2000 and 2022. Fish data collected during this survey (2022) provides some evidence that there has been a decline in salmonid numbers in both rivers. This decline, however, is more apparent in the Ballagh River and is more apparent amongst trout stocks. Declines in salmon numbers though are evident. However, only the trout 1++ reported density estimates were statistically significantly different between the 1992 and 2022 periods. A similar pattern is observed in the Glenaniff albeit with smaller declines in densities, however fish density estimates were not found to be significantly different.

However, the population structure of riverine salmonids from the Ballagh and Glenaniff has remained similar across the three survey periods. Salmon were more abundant than trout in both rivers during each survey period. Salmonid length frequencies and age composition have also remained relatively stable. In general, salmonids >16cm were not common in either river.

Since the 2001 survey of the County River remedial works on a denil fish pass, that was in disrepair, has been completed (in 2005). This work has eased passage through the fish pass for fishes migrating upstream from Lough Melvin. Since then, a notable increase in the numbers of salmon moving further upstream of the fish pass has been recorded (Appendix VIII). While salmon numbers and distribution have increased within the County River there has been a marked decline in trout numbers compared to the 2001 survey (Appendix VIII).

Trout numbers in the lake, as reported by IFI fish stock survey CPUE's (1986, 2001, 2008-2021) (Delanty & O'Grady, 2002 and McLoone *et al*., 2021), suggest the trout populations have remained relatively stable over the years. Comprehensive identification of the three trout species taken during these lake surveys was not possible and therefore status and possible population changes amongst the three trout species cannot be confirmed. One of the survey objectives was to collect juvenile baseline trout genetic samples from across the entire catchment and these, together with already archived adult lake

trout genetic material, will provide for identification of the three trout species and thus allow for a more comprehensive review of the status of each species both within the rivers and the lake itself.

Habitat walkovers, mapping and assessments carried out across the L. Melvin catchment (Co. Leitrim) suggest the physical characteristics of many of the rivers and streams are reasonably similar to those report in 1992 and 2000/2001 and with similar issues identified on all three occasions also (CFB 1993 & 2002). These issues included;

- tunnelling due to shrub/bush/tree and requiring selective vegetation management
- limited spawning gravels and opportunities and requiring the need to maximise the availability of spawning gravels which occurs in large accumulation in places (Plate 11)
- debris blockages and requiring management or modification

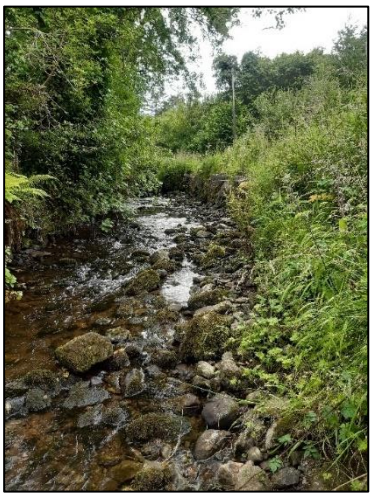
and were common to almost all of the inflowing tributaries, not just the Glenaniff, Ballagh and County. Overall, the fishery would benefit if spawning and nursery tributaries were managed in terms of selective vegetation management and spawning gravel management – re-using and re-distributing gravel accumulations across locations within that river or as done previously creating measures to hold onto gravels. Sufficient quantities of spawning gravels are limited along many sections of several rivers/streams, including the Glenaniff, Ballagh and County. Some planting in upland areas where bank vegetation is limited could also be considered.

Plate 11. Example of gravel accumulations on the Glenaniff River

Agricultural issues are not extensive but more localized (such as drinking points and bank poaching) and programmes to address this would be useful along with environmental management of forestry felling that is likely to occur over the next decade. Fish data results from the Kinlough river were poor, possibly reflecting issues related to an urban environment.

In general, the larger river systems are the most productive in salmonid terms (Glenaniff, Ballagh, County, Roogagh and Tullymore) but most smaller tributaries are contributing to the lake salmonid

populations albeit mostly in terms of trout. The bigger rivers and streams which can accommodate salmon do so and those which are too small for adult salmon are providing spawning and some nursery habitat for trout. The majority of rivers and streams inflowing to the lough along the southern shore are spatey in nature with a bedrock, boulder and cobble mixed substratum. Spawning gravels are randomly distributed and limited; vegetation cover is moderate to high with only some upland areas devoid of bankside vegetation. Bank erosion varies from small scale to moderate across the entire catchment area. Opportunities exist amongst some of these rivers and streams for localised instream and riparian enhancement works employing soft engineering techniques and nature-based solution measures.


References

Brew, T. & Gilligan, N. (2019). Environmental Guidance: Drainage Maintenance and Construction. Series of Ecological Assessments on Arterial Drainage Maintenance No 13. Environment Section, Office of Public Works, Trim, Co. Meath, Ireland.

Campbell, E. and Foy, B. (Eds.) (2008). Lough Melvin Catchment Management Plan. Northern Regional Fisheries Board.

CEN (2003). Water Quality Sampling of Fish with Electricity. CEN EN 14011:2000. Brussels. European Committee for Standardization.

CEN (2005). Water Quality - Guidance on the scope and selection of fish sampling methods. CEN EN 14962.

Central Fisheries Board (1993). A Baseline Survey of the Glenaniff and Ballagh Rivers, Lough Melvin Catchment and Recommendations for Fisheries Development. Central Fisheries Board, Glasnevin, Dublin.

Central Fisheries Board (2002). Electrofishing Survey of Selected Tributaries in the Lough Melvin Catchment, 2000 and 2001. Unpublished internal report. Central Fisheries Board, Glasnevin, Dublin.

Coghlan, B., Timpson, D., and O'Leary, C. (2020). Opportunities to Enhance Fish Migration and Ecological Connectivity in the Drowes Catchment. National Barriers Programme. Inland Fisheries Ireland. Citywest, Dublin.

Cole, B.; De la Barreda, B.; Hamer, A.; Codd, T.; Payne, M.; Chan, L.; Smith, G.; Balzter, H. (2021). Corine land cover 2018 for the UK, Isle of Man, Jersey and Guernsey. NERC EDS Environmental Information Data Centre. (Dataset). https://doi.org/10.5285/084e0bc6-e67f-4dad-9de6-0c698f60e34d

Crisp and McCormack, (1974). The populations of fish at Cow Green, Upper Teesdale, before impoundment. *Journal of Applied Ecology*, **11**, 969-996.

Crozier, W. & Kennedy, G. (1994). Application of semi-quantitative electrofishing to juvenile salmonid stocks. Journal of Fish Biology. 45 (1). 159 - 164. 10.1111/j.1095-8649.1994.tb01293.x.

Delanty, K. and O' Grady, M. (2001). Lough Melvin Fish Stock Report. Central Fisheries Board, Glasnevin, Dublin. Internal report.

Department for Infrastructure (DFI) (2024). Drainage Council of NI. Available at: https://dfi-ni.maps.arcgis.com/apps/webappviewer/index.html?id=28b901c557054dd488953180d2309903 (Accessed January 2024).

Environmental Protection Agency (2024). EPA Maps - CORINE. Available at: https://gis.epa.ie/EPAMaps/Water (Accessed January 2024).

Environmental Protection Agency (2024). WFD Status. Available at: https://www.catchments.ie/data/?_gl=1*peb96f*_ga*OTYwODcyOTcuMTY5ODgzNTc1OA..*_ga_TPK

2CK9KEX*MTcwODY4MjA3Ny41Mi4wLjE3MDg2ODIwNzcuMC4wLjA.#/waterbody/IE_NW_35_160?_k=bny6p5). (Accessed January 2024).

European Parliament and Council (2000). Water Framework Directive 20000/60/EC establishing a framework for community action in the field of water policy. Official Journal of the European Communities, L327, 1-73

Ferguson, A. (1986). Lough Melvin –A unique fish community. Occasional papers in Irish Science and Technology, 1. Royal Dublin Society.

Ferguson, A. (2004). The importance of identifying conservation units: brown trout and pollan biodiversity in Ireland. Biology and Environment. Proceedings of the Royal Irish Academy, 104, 33–41. https://doi.org/10.3318/BIOE.2004.104.3.33

Ferguson, A., & Taggart, J. (1991). Genetic differentiation among the sympatric brown trout (Salmo trutta) populations of Lough Melvin, Ireland. Biological Journal of the Linnean Society, 43, 221–237.https://doi.org/10.1111/j.1095-8312.1991.tb00595.x

Gargan, P.G., O'Grady, M.F., Delanty, K., Igoe, F. and Byrne, C. (2002). The effectiveness of habitat enhancement on salmon and trout stocks in streams in the Corrib Catchment. In O'Grady, M.F. (ed): Proceedings of the 13th International Salmonid Riverine Enhancement Workshop, Westport, Ireland, September 2002. pp. 220-233.

Girvan, J. and Foy, R. (2003). Water Quality and Limnology of Lough Melvin (SAC) – 1990 and 2001/02 (EHS CON 4/4/42). Report prepared for Environment and Heritage Service by Queens University Belfast and Department of Agriculture and Rural Development Northern Ireland.

Guy, C.S. and Brown, M.L. (2007). Science and Statistics in Fisheries Research. Pages 1-30 in C.S. Guy and M.L. Brown (eds) - Analysis and interpretation of freshwater fisheries data. American Fisheries Society, Bethesda, Maryland.

Inland Fisheries Ireland (2014). EREP Kilcoo (Kiltyclogher River) Enhanced Maintenance Plan, 2014. Unpublished internal report to OPW.

JBA (2014). Office of Public Works Arterial Drainage Maintenance Works – Kilcoo Arterial Drainage Scheme Stage 1: Appropriate Assessment Screening November 2014.

Kennedy, M. and Fitzmaurice, P. (1971). Growth and food of brown trout Salmo trutta (L.) in Irish waters. Proceedings of the Royal Irish Academy, 71 (B) (18), 269-352.

McKeown, N., Prodöhl, P. & Ferguson, A. (2003). Conclusions on Lough Melvin brown trout community. Unpublished. Queens University Belfast.

McLoone, P., Corcoran, W., Bateman, A., Cierpial, D., Gavin, A., Gordon, P., McCarthy, E., Twomey, C., Burke, E., Matson, R., Robson, S., Duffy, P., Donovan, R. and Kelly, F.L. (2022). Fish Stock Survey of Lough Melvin, July 2021. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

O'Grady, MF., Delanty, K., Coghlan, B., O'Briain, R. and Gilligan, N. (2017). River Enhancement Programmes in Ireland. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

O'Leary, C., Kelly, F.; Gargan, P, McLoone, P., Rosell, R., Roche, W., Gallagher, T., Delanty, K., Prodöhl, P., McLean, R. Poole, S., Looney, D. and Marnell, F. (in prep.). Ireland Red List No. x: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Dublin, Ireland.

National Biological Data Centre (NBDC) (2024). Species maps available at: https://maps.biodiversityireland.ie/Dataset (Accessed January 2024)

NPWS (2024). SAC Maps. Available at: https://www.npws.ie/maps-and-data (accessed January 2024).

NPWS (2024). Lough Melvin SAC Site Synopsis. Available at: https://www.npws.ie/protected-sites/sac/000428. (Accessed January 2024)

Ryan Hanley (2019). Arterial Drainage Maintenance Works: Kilcoo Arterial Drainage Scheme 2020 - 2024 Natura Impact Statement November 2019

SNIFFER, (2010). WFD111 Phase 2a Course resolution rapid-assessment methodology to assess obstacles to fish migration. Edinburgh. Scotland and Northern Ireland Forum for Environmental Research

SNIFFER (2011) River Fish Classification Tool: Science Work. WFD68c, Phase 2. Final Report. Version 6. Edinburgh. Scotland and Northern Ireland Forum for Environmental Research.

Additional GIS Datasets

https://www.daera-ni.gov.uk/articles/digital-datasets

https://www.opendatani.gov.uk/

Appendices I - XI

Appendix I. Bathymetry of Lough Melvin

Appendix II. Geology of Lough Melvin Catchment

Appendix III. CORINE Landcover 2018 & OSi aerial imagery 2011-2013

Appendix IV. SACs within the Lough Melvin Catchment

Appendix V. Rossinver Salmon Fishery, Lough Melvin

Appendix VI. Invasive plant species, Lough Melvin catchment

Appendix VII. Back-calculated length at age data for trout, 1992 & 2002

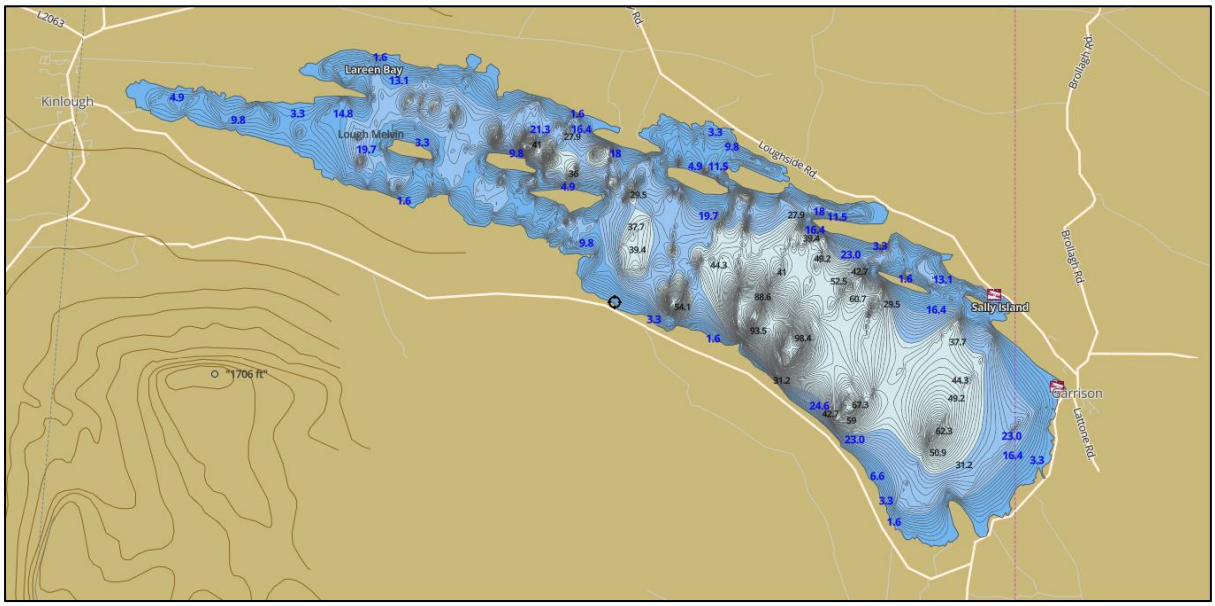
Appendix VIII. Salmonid Density Estimates, Lough Melvin tributaries, 1992, 2000/2001 and 2022

Appendix IX. Categories of Growth of Irish Streams and Riverine Brown Trout

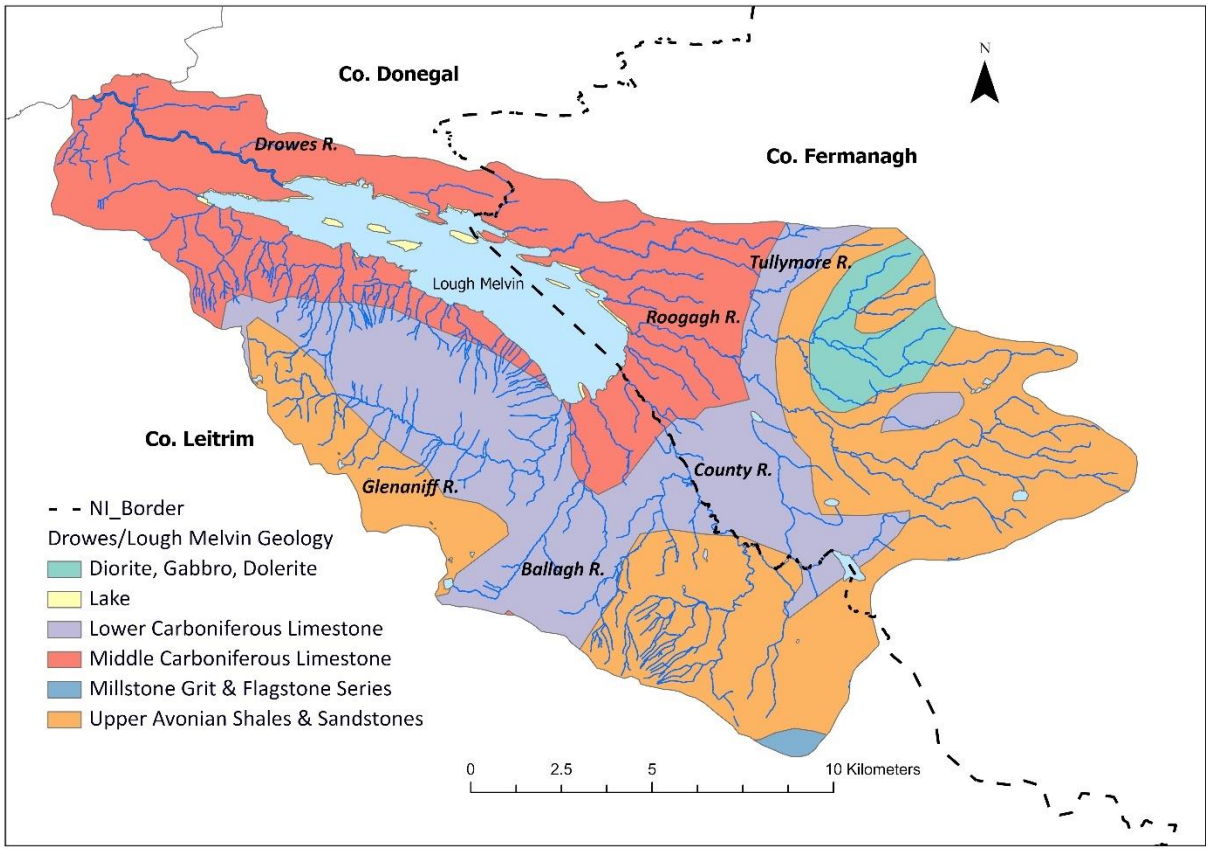
Appendix X. Fish Species Presence / Absence Tables

Appendix XI. Fish Species Distribution Maps

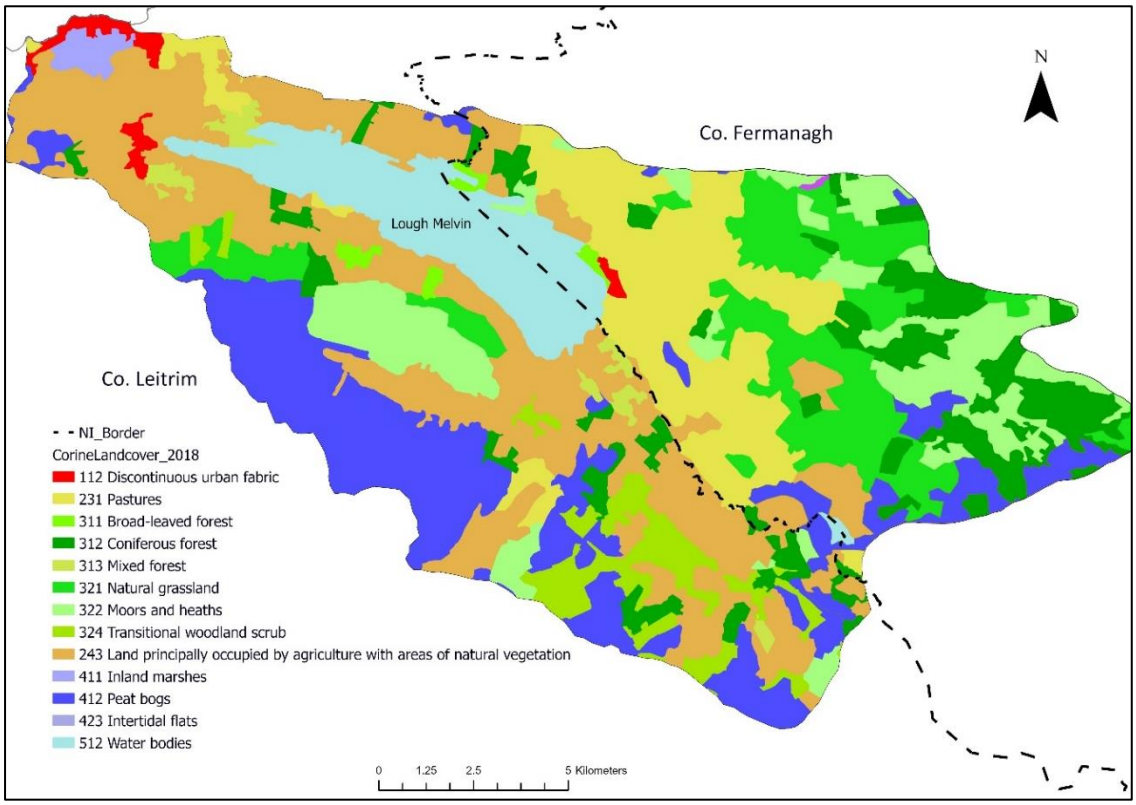
Appendix I. Bathymetry of Lough Melvin (source https://fishing-app.gpsnauticalcharts.com/)



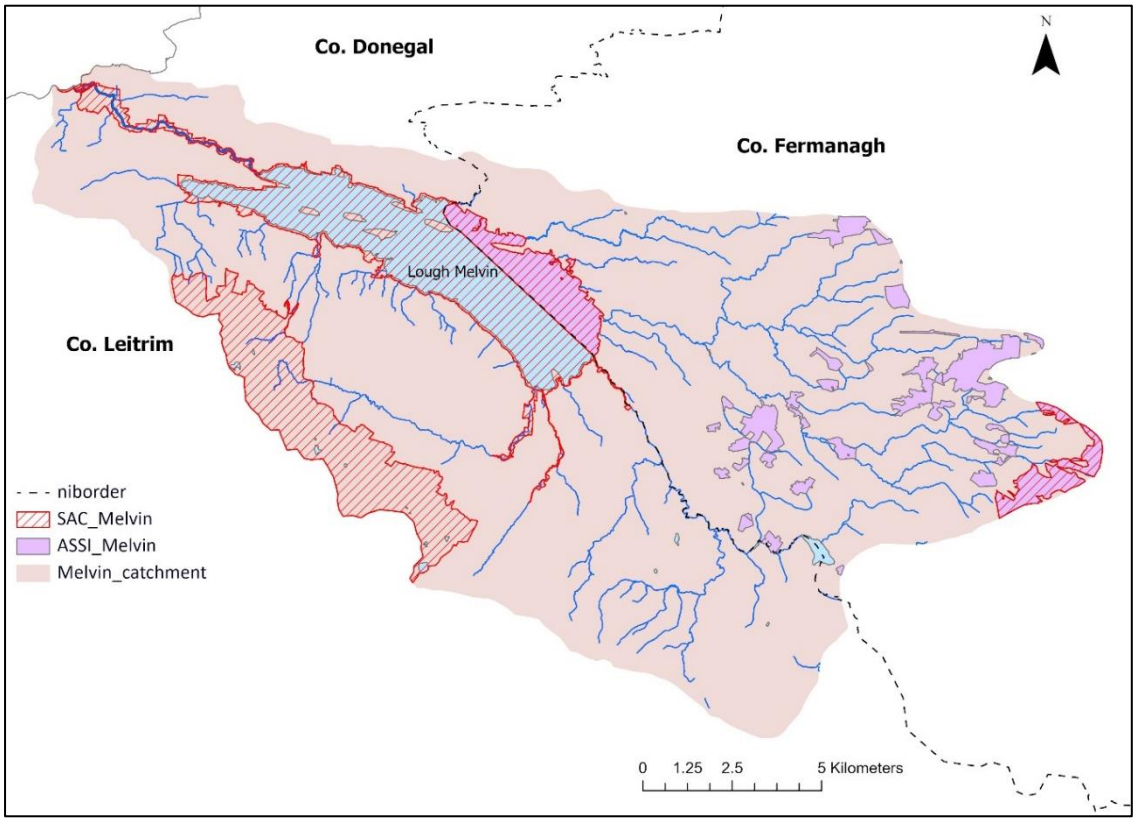
Appendix II. Geology of Lough Melvin Catchment



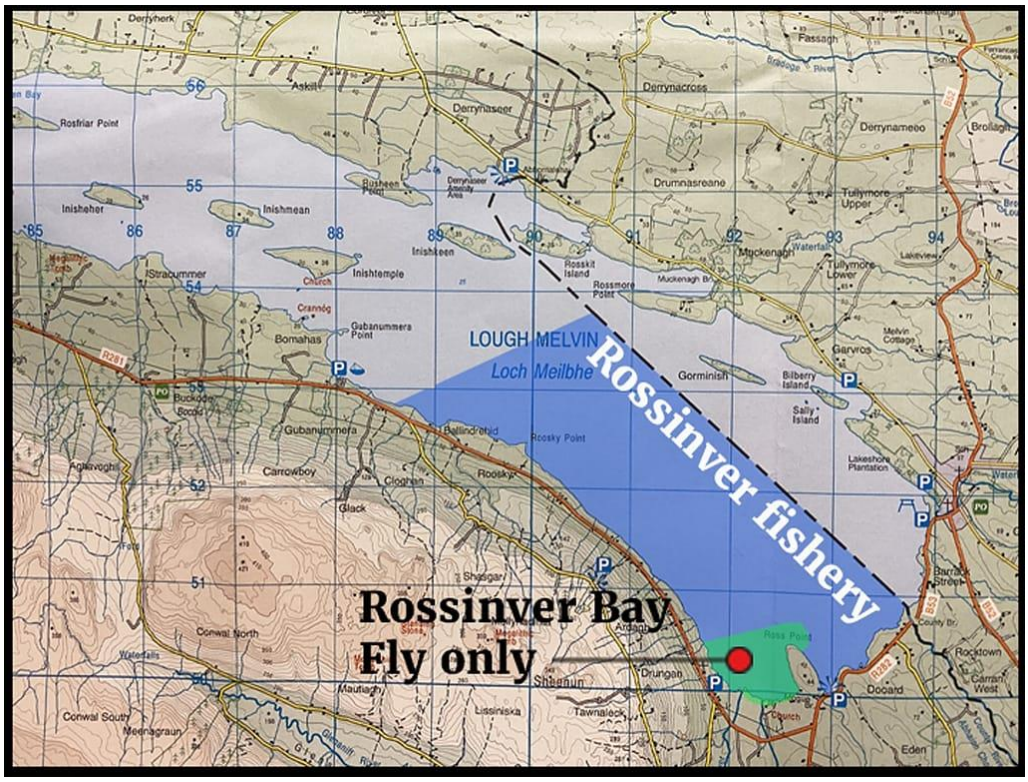
Appendix III. CORINE Landcover 2018 & OSi aerial imagery 2011-2013 *(Tailte Éireann)*



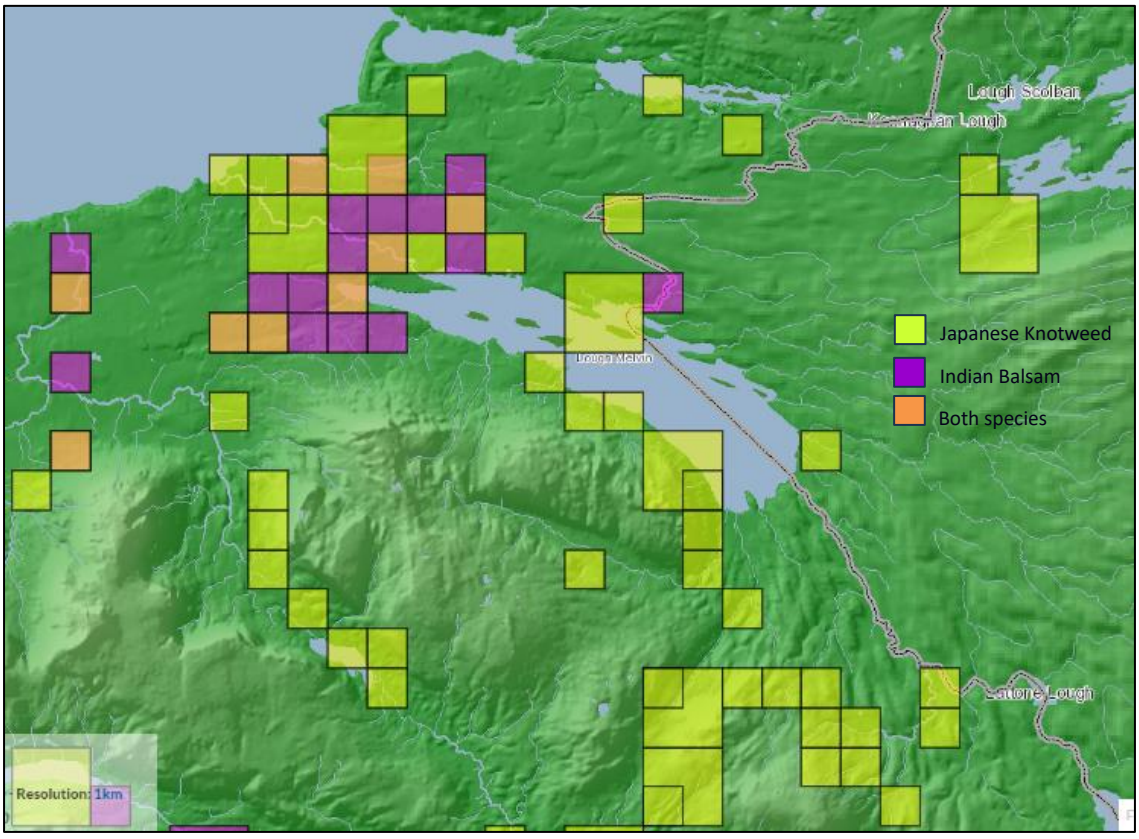
Appendix IV. SACs within the Lough Melvin Catchment (source NPWS https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=8f7060450de3485fa1c1085536d477ba and NIEA https://gis.daera-ni.gov.uk/arcgis/apps/webappviewer/index.html?id=bb721449cb8949e7a4f90c722bd2d80b#



Appendix V. Rossinver Salmon Fishery, Lough Melvin



Appendix VI. Invasive plant species, Lough Melvin catchment (source https://maps.biodiversityireland.ie/Map/Terrestrial/Species/28772)



Appendix VII. Back-calculated length at age data for trout, 1992 & 2002

		2022			1992	
River		**L1**	**L2**	**L3**	**L1**	**L2**
Glenaniff	min	3.7	10.4	17.1	4	10
	max	9.3	14.5	17.8	11	15
	mean	5.92	12.34	17.45	6.48	12.08
	n	*41*	*7*	*2*	*39*	*12*
Ballagh	min	3.4	12.2		4.5	10
	max	8.6	16.1		8	14
	mean	5.77	14.37		6.15	11.42
	n	*56*	*3*		*37*	*5*
County	min	3.6	8.8	19	*ns*	*ns*
(including tribs)	max	8.6	15.5	19		
	mean	5.49	12.74	19		
	n	*35*	*12*	*1*		
Clancys	min	4.6			*ns*	*ns*
	max	5.9				
	mean	5.32				
	n	*5*				

Appendix VIII. Salmonid Density Estimates, Lough Melvin tributaries, 1992, 2000/2001 and 2022

			1992				2000				2022			
River	**Site**	**Location**	**Trout 0+**	**Trout ≥1+**	**Salmon 0+**	**Salmon 1+**	**Trout 0+**	**Trout ≥1+**	**Salmon 0+**	**Salmon 1+**	**Trout 0+**	**Trout ≥1+**	**Salmon 0+**	**Salmon 1+**
Glenaniff	1	d/s Glenaniff Br.	0.284	0.182	0.420	0.424	0.160	0.076	0.343	0.125	0.123	0.049	0.200	0.138
	2	250m u/s Glenaniff Br.	0.171	0.165	0.215	0.215	0.167	0.131	0.399	0.177	0.103	0.143	0.262	0.238
	3	200m d/s McSharrys	0.085	0.085	0.101	0.203	ns	ns	ns	ns	**ns**	**ns**	**ns**	**ns**
	4	200m u/s McSharrys	0.073	0.097	0.146	0.231	0.057	0.100	0.057	0.129	0.085	0.009	0.108	0.132
	5	at riverside walk	0.101	0.101	0.249	0.027	0.006	0.100	0.083	0.078	0.058	0.062	0.203	0.161
	6	300m d/s impassable falls	0.026	0.111	0.017	0	0.005	0.110	0.037	0.018	**ns**	**ns**	**ns**	**ns**
	7	Br. on Glenaniff link road	0.078	0.187	0	0	ns	ns	ns	ns	0	0.155	0	0
Ballagh	1	d/s Ballagh Br.	0.325	0.077	0.778	0.103	0.239	0.127	1.620	0.112	0.299	0.064	0.211	0.111
	2	Edmonds	0.590	0.323	1.012	0.445	ns	ns	ns	ns	0.346	0.125	1.235	0.103
	3	d/s Rossinver Br.	0.257	0.453	0.423	0.332	0.149	0.234	0.565	0.277	0.094	0.125	0.345	0.261
	4	400m u/s Rossinver	0.162	0.147	0.559	0.147	ns	ns	ns	ns	0.241	0.241	0.158	0.173
	5	at R.C. church	0.493	0.815	1.104	0.340	0.174	0.387	0.126	0.261	0.053	0.101	0.144	0.043
	6	450m d/s waterfall	0.222	0.861	0.194	0	0.912	0.514	0.178	0.031	0.340	0.128	0.111	0.094
	7	d/s Tullyskeherny Br.	0.183	0.344	0	0	ns	ns	ns	ns	0.026	0.052	0	0
							2001							
County	1	u/s Rossinver to Garrison road br.	ns	ns	ns	ns	ns	ns	ns	ns	0.007	0.015	0	0.102
	2	south Carran West	ns	ns	ns	ns	ns	ns	ns	ns	0.008	0.028	0.086	0.314
	3	d/s metal footbridge	ns	ns	ns	ns	0	0.073	0	0.023	0	0.017	0.078	0.134
	4	u/s of Kiltyclogher forestry br	ns	ns	ns	ns	0.701	0.083	0.009	0.009	0.109	0.047	0.295	0.041
	5	Sraduffy tributary in Kiltyclogher	ns	ns	ns	ns	0.282	0.249	0	0	0.039	0.052	0.437	0.287
	6	Lattone Tributary- lower site	ns	ns	ns	ns	ns	ns	ns	ns	0.079	0.057	0.251	0.029
Clancys	1	Lower site	ns	ns	ns	ns	0.302	0.174	0.279	0.232	0.412	0.321	1.185	0.214

Appendix IX. Categories of Growth of Irish Streams and Riverine Brown Trout *(taken from Kenndy & Fitzmaurice, 1971)*

Growth					Examples	
Category	***mean lengths (cm)***			***average weight (g) of 3+ trout***	***Geology***	***Bicarbonate alkalinity (mEq/l)***
	L2	**L3**	**L4**			
very slow	12	15-16	17-18	50-60	Granite or Ordovician or Silurian, draining granite or sandstone hills	0.2-0.4
slow	13-14	18-19	20-21	80-100	Streams on sandstone with some glacial drift small rivers on granite with limestone drift	1.5-2
fast	18-20	24-25	29-30	200-300	Limestone with granite headwaters, mixed bed	0.5 1.4-2.8
very fast	20	30	35-40	400-500	Limestone	3-6.5

Appendix X. Fish Species Presence / Absence Tables (all sites)

Catchment	River/Stream	Site	County	Survey Year	Easting	Northing	Trout	BT 0+	BT ≥1+	Salmon	Sal 0+	Sal ≥1+	Eels	3 Spined Stickleback	Roach	Minnow	Perch	Flounder
Drowes/Melvin	Drowes mc	Site 1	Leitrim	2022	184172	356091	P	P	P	P	P	P	P	P			P	
Drowes/Melvin	Drowes mc	Site 2	Leitrim	2022	184151	356133	P	P	P	P	P		P				P	
Drowes/Melvin	Drowes mc	Site 3	Leitrim	2022	184190	356269	P	P	P	P	P		P	P			P	
Drowes/Melvin	Drowes mc	Site 4	Leitrim	2022	183298	356574	P	P	P	P	P	P	P				P	P
Drowes/Melvin	Derrynaseer (west)	Site 1	Leitrim	2023	188669	355399	P	P						P				
Drowes/Melvin	Ruskit	Site 1	Fermanagh	2023			P	P	P				P			P	P	
Drowes/Melvin	Ruskit	Site 2	Fermanagh	2023			P	P								P		
Drowes/Melvin	Tullymore	Site 1	Fermanagh	2022			P		P							P		
Drowes/Melvin	Tullymore	Site 2	Fermanagh	2022						P	P	P						
Drowes/Melvin	Tullymore	Site 3 (15)	Fermanagh	2022			P	P	P	P		P						
Drowes/Melvin	Tullymore	Site 4	Fermanagh	2022						P	P	P						
Drowes/Melvin	Tullymore	Site 5	Fermanagh	2022						P	P	P						
Drowes/Melvin	Tullymore	Site 6	Fermanagh	2022						P	P	P						
Drowes/Melvin	Tullymore	Site 7	Fermanagh	2022			P	P	P							P		
Drowes/Melvin	Tullymore	Site 8	Fermanagh	2022			P	P		P	P		P			P		
Drowes/Melvin	Tullymore	Site 9	Fermanagh	2022						P	P	P				P		
Drowes/Melvin	Tullymore	Site 10	Fermanagh	2022			P	P	P	P		P				P		
Drowes/Melvin	Tullymore	Site 11	Fermanagh	2022			P	P	P	P		P				P		
Drowes/Melvin	Tullymore	Site 3a	Fermanagh	2022			P	P		P		P						
Drowes/Melvin	Tullymore	Site 1a	Fermanagh	2022			P	P										
Drowes/Melvin	Tullymore	Site 1	Fermanagh	2023			P		P									
Drowes/Melvin	Tullymore	Site 2	Fermanagh	2023			P	P										
Drowes/Melvin	Tullymore	Site 3	Fermanagh	2023			P	P										
Drowes/Melvin	Tullymore	Site 4	Fermanagh	2023			P	P										
Drowes/Melvin	Tullymore	Site 5	Fermanagh	2023			P	P	P									
Drowes/Melvin	Tullymore	Site 6	Fermanagh	2023			P	P	P									
Drowes/Melvin	Tullymore	Site 7	Fermanagh	2023			P	P	P									
Drowes/Melvin	Tullymore	Site 8	Fermanagh	2023			P	P	P	P		P						
Drowes/Melvin	Tullymore	Site 9	Fermanagh	2023			P	P					P					

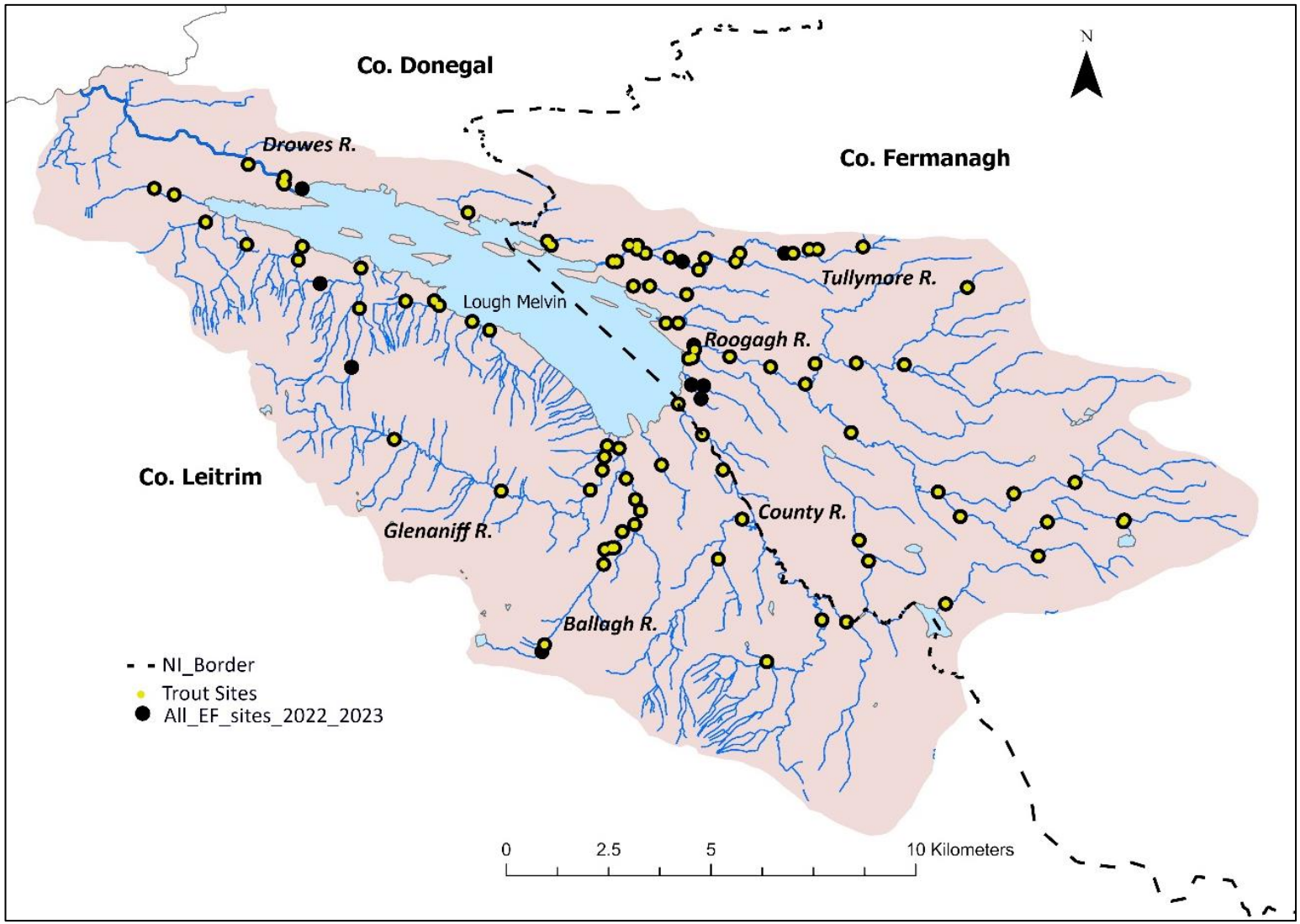
Catchment	River/Stream	Site	County	Survey Year	Easting	Northing	Trout	BT 0+	BT ≥1+	Salmon	Sal 0+	Sal ≥1+	Eels	3 Spined Stickleback	Roach	Minnow	Perch	Flounder
Drowes/Melvin	Tullymore	Site 10	Fermanagh	2023			P	P	P	P		P				P		
Drowes/Melvin	Tullymore	Site 11	Fermanagh	2023			P	P	P	P		P				P		
Drowes/Melvin	Aughamuldoney	Site 1	Fermanagh	2022			P		P	P	P	P		P		P		
Drowes/Melvin	Aughamuldoney	Site 2	Fermanagh	2022			P	P		P	P	P		P		P		
Drowes/Melvin	Aughamuldoney	Site 3	Fermanagh	2022			P	P	P	P	P	P				P		
Drowes/Melvin	Aughamuldoney	Site 1	Fermanagh	2023			P	P	P							P		
Drowes/Melvin	Aughamuldoney	Site 2	Fermanagh	2023			P	P					P			P		
Drowes/Melvin	Aughamuldoney	Site 3	Fermanagh	2023			P	P	P									
Drowes/Melvin	John Elliotts	Site 1	Fermanagh	2022			P	P	P	P	P	P		P				
Drowes/Melvin	John Elliotts	Site 2	Fermanagh	2022			P	P	P	P	P							
Drowes/Melvin	John Elliotts	Site 1	Fermanagh	2023			P	P	P				P		P	P		
Drowes/Melvin	John Elliotts	Site 2	Fermanagh	2023			P	P										
Drowes/Melvin	Roogagh	Site 1	Fermanagh	2022			P		P	P	P	P	P			P		
Drowes/Melvin	Roogagh	Site 2	Fermanagh	2022			P	P	P	P	P	P	P			P		
Drowes/Melvin	Roogagh	Site 3	Fermanagh	2022			P	P	P	P	P	P	P					
Drowes/Melvin	Roogagh	Site 4	Fermanagh	2022						P		P	P					
Drowes/Melvin	Roogagh	Site 5	Fermanagh	2022			P		P									
Drowes/Melvin	Roogagh	Site 6	Fermanagh	2022			P	P	P									
Drowes/Melvin	Roogagh	Site 7	Fermanagh	2022			P		P									
Drowes/Melvin	Roogagh	Site 8	Fermanagh	2022			P	P	P									
Drowes/Melvin	Roogagh	Site 9	Fermanagh	2022			P	P	P							P		
Drowes/Melvin	Roogagh	site 10	Fermanagh	2022			P		P									
Drowes/Melvin	Roogagh	Site 11	Fermanagh	2022			P	P	P							P		
Drowes/Melvin	Roogagh	Site 12	Fermanagh	2022			P	P	P									
Drowes/Melvin	Roogagh	Site 13	Fermanagh	2022			P	P	P									
Drowes/Melvin	Roogagh	Site 14	Fermanagh	2022			P	P										
Drowes/Melvin	Roogagh	Site 15	Fermanagh	2022			P	P	P									
Drowes/Melvin	Roogagh-Glen	Site 16	Fermanagh	2022			P	P	P									
Drowes/Melvin	Roogagh-Glen	Site 17	Fermanagh	2022			P		P									
Drowes/Melvin	Roogagh-Glen	Site 18	Fermanagh	2022			P		P				P	P		P		

Catchment	River/Stream	Site	County	Survey Year	Easting	Northing	Trout	BT 0+	BT ≥1+	Salmon	Sal 0+	Sal ≥1+	Eels	3 Spined Stickleback	Roach	Minnow	Perch	Flounder
Drowes/Melvin	Roogagh-Glen	Site 19	Fermanagh	2022			P		P									
Drowes/Melvin	Roogagh-Glen	Site 20	Fermanagh	2022			P	P	P									
Drowes/Melvin	Garrison south trib	Site 1	Fermanagh	2022														
Drowes/Melvin	Garrison south trib	Site 1	Fermanagh	2022														
Drowes/Melvin	Garrison south trib	Site 2	Fermanagh	2022														
Drowes/Melvin	O'Briens	Site 1	Fermanagh	2023			P	P	P							P	P	
Drowes/Melvin	O'Briens	Site 2	Fermanagh	2023			P	P	P									
Drowes/Melvin	County	Site 1	Leitrim	2022	193798	350725	P	P	P	P		P	P			P		
Drowes/Melvin	County	Site 2	Leitrim	2022	194387	349977	P	P	P	P	P	P	P			P		
Drowes/Melvin	County	Site 3	Leitrim	2022	194894	349116	P		P	P	P	P	P		P	P		
Drowes/Melvin	County	Site 4	Leitrim	2022	197909	345404	P	P	P	P	P	P	P			P		
Drowes/Melvin	County	Site 5	Fermanagh	2022	198451	346893	P	P	P									
Drowes/Melvin	County	Site 6	Fermanagh	2022	198216	347392	P	P	P					P		P		
Drowes/Melvin	County	Site 7	Fermanagh	2022	200331	345843	P		P				P					
Drowes/Melvin	County	Site 8	Leitrim	2022	197310	345455	P	P	P	P	P	P						
Drowes/Melvin	County	Site 9	Leitrim	2022	195961	344429	P	P	P									
Drowes/Melvin	County	Site 10	Leitrim	2022	195360	347910	P	P	P	P	P	P	P					
Drowes/Melvin	County	Site 11	Leitrim	2022	194776	346937	P	P	P	P	P	P						
Drowes/Melvin	Mogue stream	Site 1	Leitrim	2022	193388	349234	P	P	P									
Drowes/Melvin	Ballagh	site 1	Leitrim	2022	192355	349639	P	P	P	P	P	P				P		
Drowes/Melvin	Ballagh	site 2	Leitrim	2022	192525	348901	P	P	P	P	P	P				P		
Drowes/Melvin	Ballagh	site 3	Leitrim	2022	192753	348393	P	P	P	P	P	P				P		
Drowes/Melvin	Ballagh	site 4	Leitrim	2022	192875	348123	P	P	P	P	P	P	P			P		
Drowes/Melvin	Ballagh	site 5	Leitrim	2022	192732	347778	P	P	P	P	P	P	P					
Drowes/Melvin	Ballagh	site 6	Leitrim	2022	192431	347610	P	P	P	P	P	P						
Drowes/Melvin	Ballagh	Site 6a	Leitrim	2023	192242	347212	P	P	P									
Drowes/Melvin	Ballagh	Site 6b	Leitrim	2023	192174	347214	P	P	P									
Drowes/Melvin	Ballagh	Site 6c	Leitrim	2023	192000	347168	P	P	P									
Drowes/Melvin	Ballagh	site 7	Leitrim	2022	191977	346807	P	P	P									
Drowes/Melvin	Ballagh	site 8	Leitrim	2022	190532	344847	P	P	P									

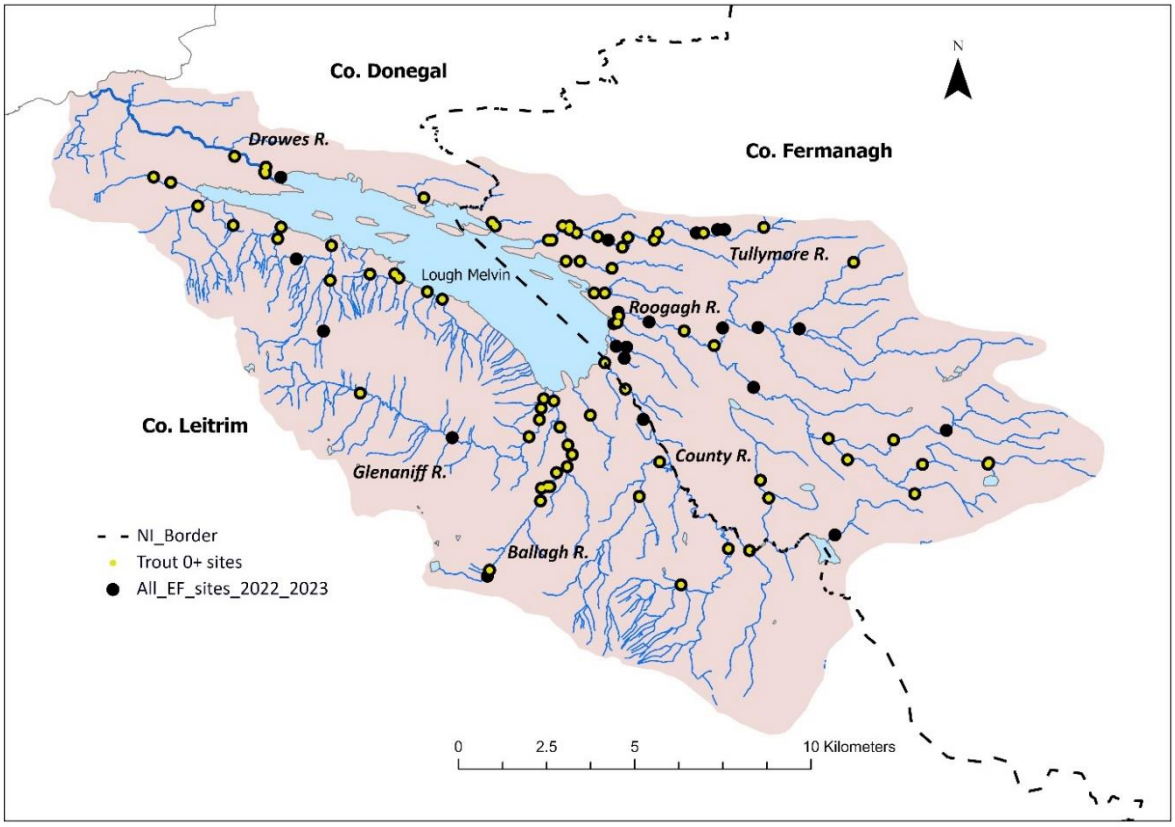
Catchment	River/Stream	Site	County	Survey Year	Easting	Northing	Trout	BT 0+	BT ≥1+	Salmon	Sal 0+	Sal ≥1+	Eels	3 Spined Stickleback	Roach	Minnow	Perch	Flounder
Drowes/Melvin	Ballagh	site 9	Leitrim	2022	190467	344675												
Drowes/Melvin	Glenaniff	site 1 d/s fal	Leitrim	2022	192063	349702	P	P	P	P	P	P				P		
Drowes/Melvin	Glenaniff	site 2 d/s fal	Leitrim	2022	191999	349430	P	P	P	P	P	P	P					
Drowes/Melvin	Glenaniff	site 3 d/s fal	Leitrim	2022	191948	349111	P	P	P	P	P	P	P					
Drowes/Melvin	Glenaniff	site 5 d/s fal	Leitrim	2022	191649	348624	P	P	P	P	P	P	P					
Drowes/Melvin	Glenaniff	site 7 u/s fal	Leitrim	2022	189471	348597	P		P									
Drowes/Melvin	Glenaniff	upper u/s fal	Leitrim	2022	186859	349860	P	P	P									
Drowes/Melvin	Ballinadrehid	Site 1	Leitrim	2023	189190	352523	P	P	P									
Drowes/Melvin	Un named trib	Site 1	Leitrim	2022	188764	352738	P	P	P									
Drowes/Melvin	Breffni Pier	Site 1	Leitrim	2022	187957	353126	P	P	P									
Drowes/Melvin	Bomahas Stream	Site 1	Leitrim	2022	187842	353242	P	P	P							P	P	
Drowes/Melvin	Bomahas Stream	Site 2	Leitrim	2023	187139	353238	P	P	P									
Drowes/Melvin	Clancys/Stracummer	Site 1	Leitrim	2022	185050	353664												
Drowes/Melvin	Clancys/Stracummer	Site 2	Leitrim	2023	186008	353059	P	P	P									
Drowes/Melvin	Clancys/Stracummer	Site 3	Leitrim	2022	185819	351619												
Drowes/Melvin	Clancys/Stracummer	Site 4	Leitrim	2022	186050	354040	P	P	P	P	P	P	P			P		
Drowes/Melvin	Rosclogher	Site 1	Leitrim	2022	184614	354566	P	P	P									
Drowes/Melvin	Rosclogher	Site 2	Leitrim	2022	184522	354240	P	P	P									
Drowes/Melvin	Ballymore	Site 1	Leitrim	2022	183263	354617	P	P	P									
Drowes/Melvin	Mill Stream	Site 1	Leitrim	2023	182260	355166	P	P	P				P	P			P	
Drowes/Melvin	Kinlough Stream	Site 1	Leitrim	2023	181490	355833	P	P	P				P	P			P	
Drowes/Melvin	Kinlough Stream	Site 2	Leitrim	2023	181005	355987	P	P						P				
Drowes/Melvin	Lake shore	Site 1	Leitrim	2022	184611	355978												

Appendix XI. Fish Species Distribution Maps *(based on all electrofishing survey sites, repeat and genetic sampling sites and incorporating IFI and DAERA/AFBI fish data, 2022 & 2023).*

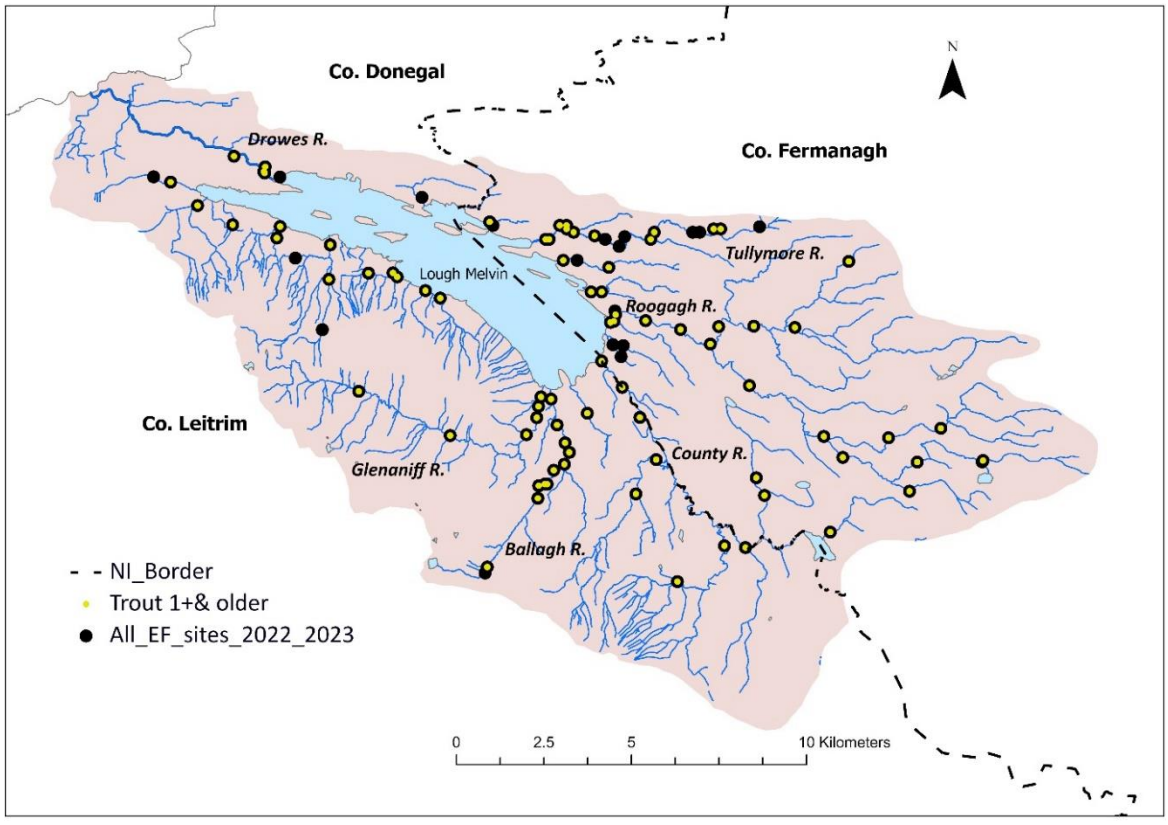
Trout



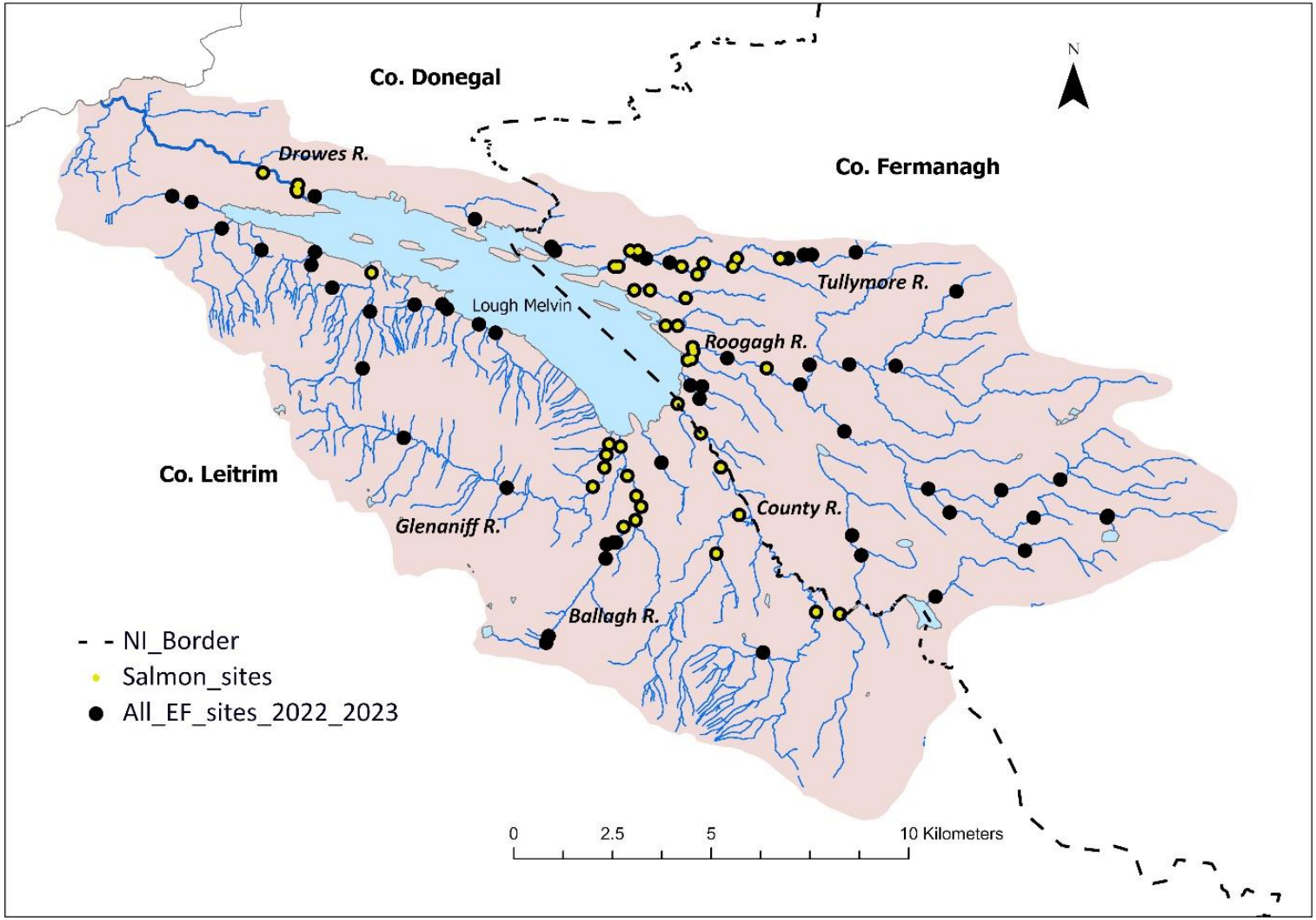
Trout 0+



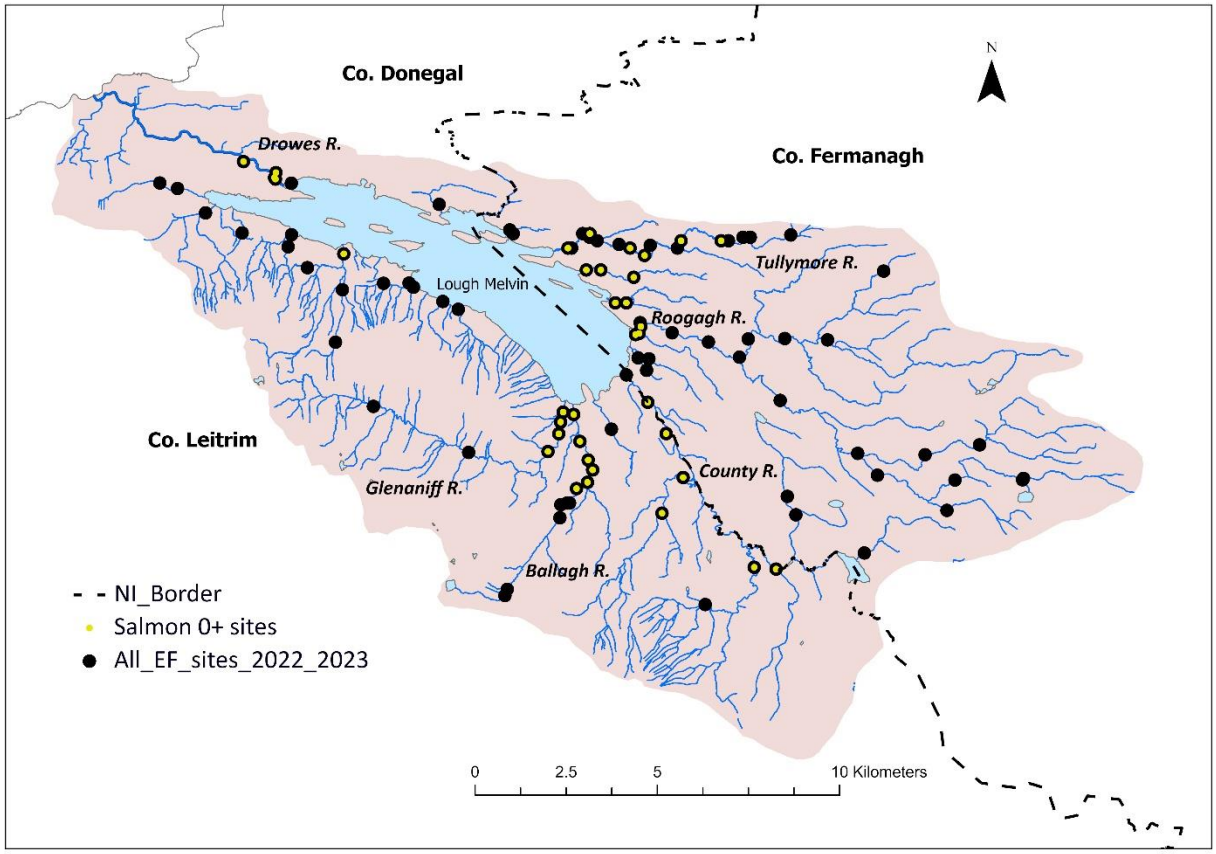
Trout 1++



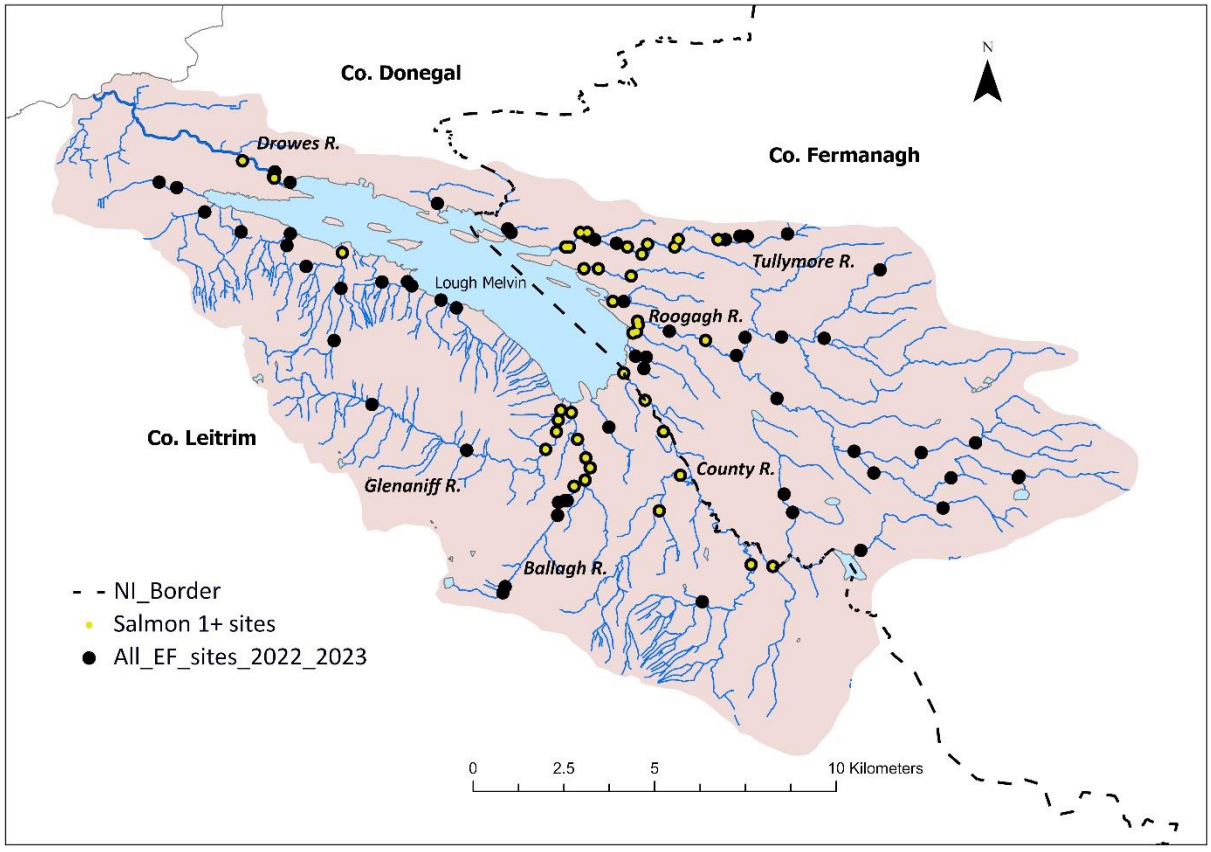
Salmon


Co. Donegal
Co. Fermanagh
Co. Leitrim
N
Drowes R.
Lough Melvin
Tullymore R.
Roogagh R.
County R.
Glenaniff R.
Ballagh R.
NI_Border
Salmon_sites
All_EF_sites_2022_2023
0
2.5
5
10 Kilometers

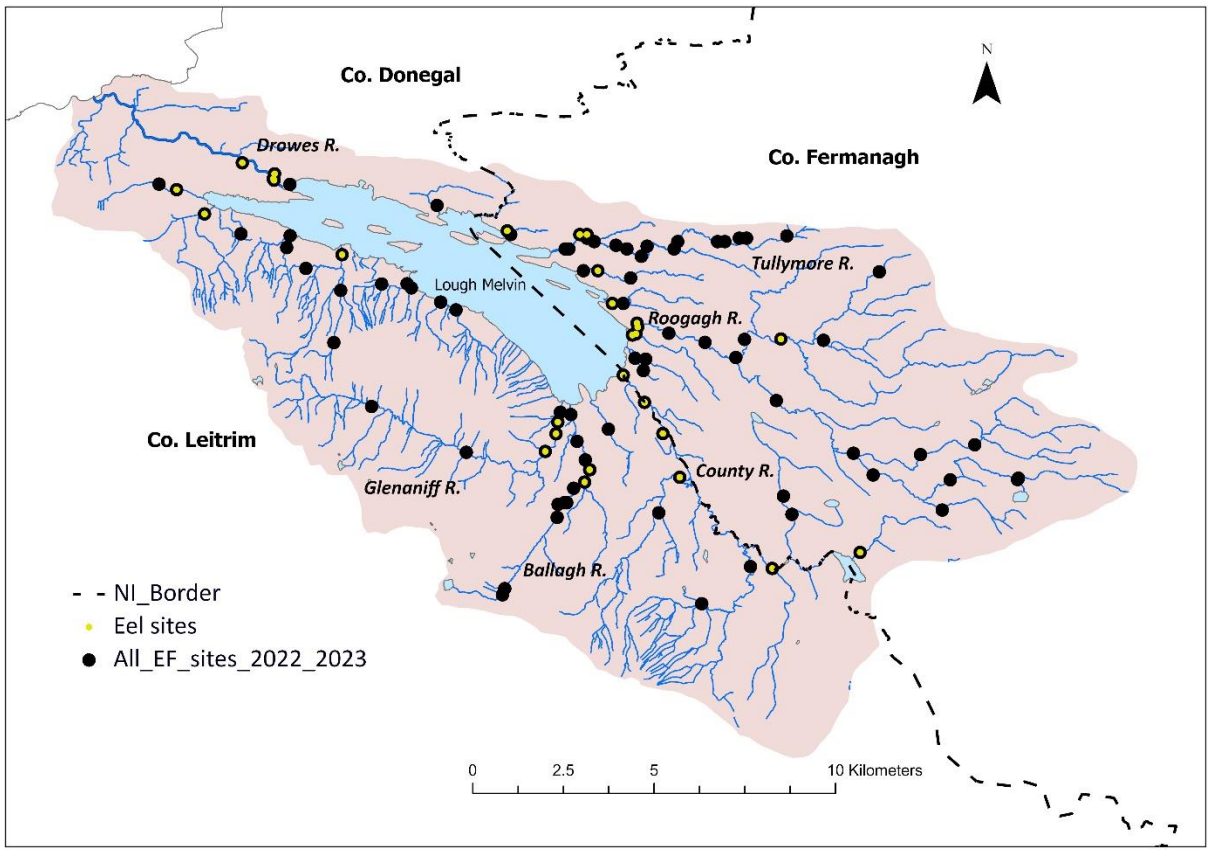
Salmon 0+



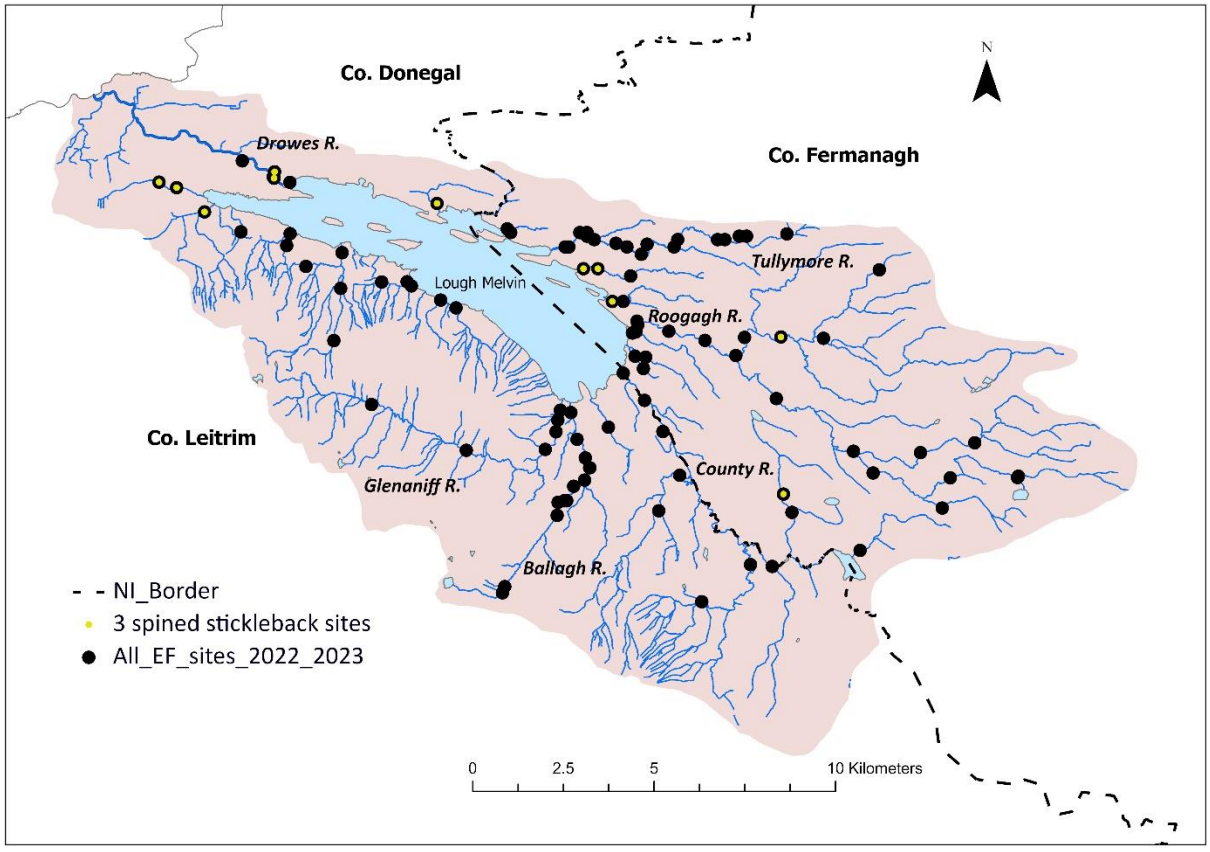
Salmon 1++



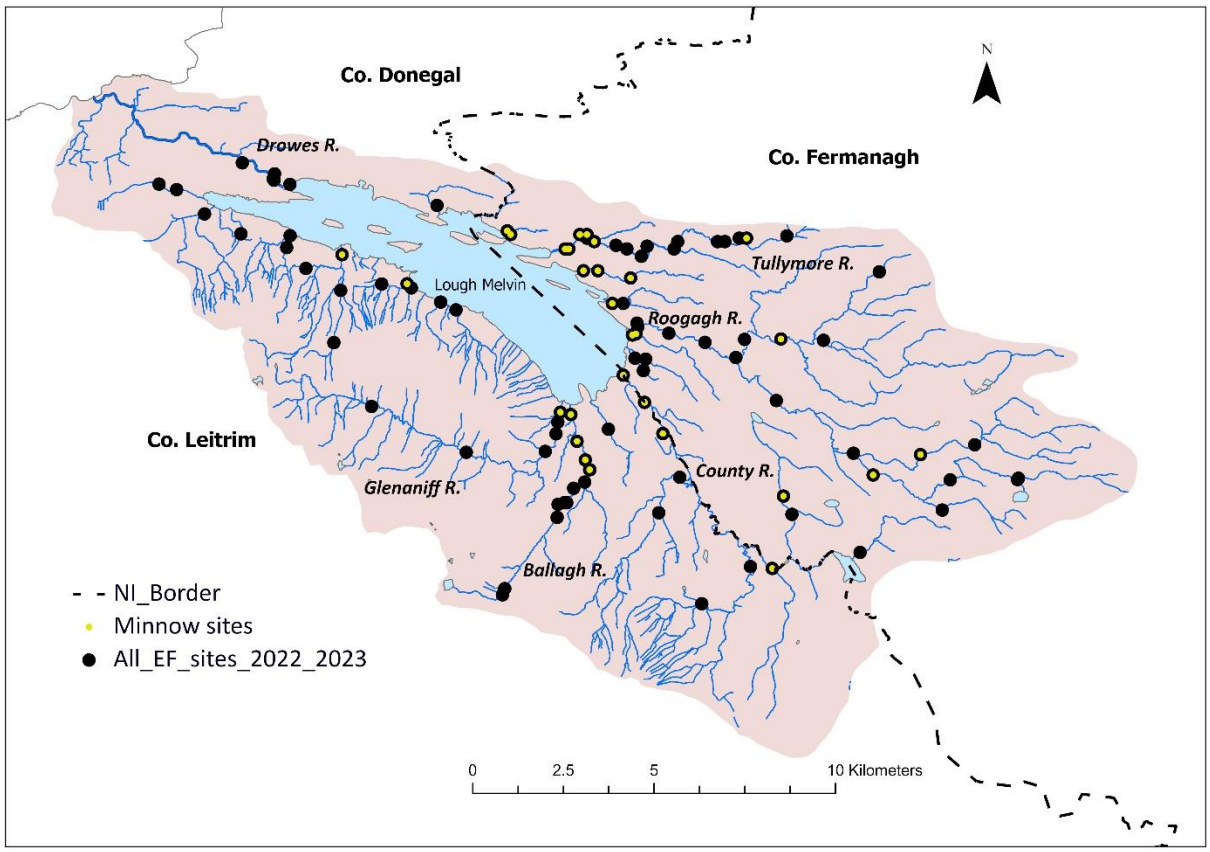
Eels



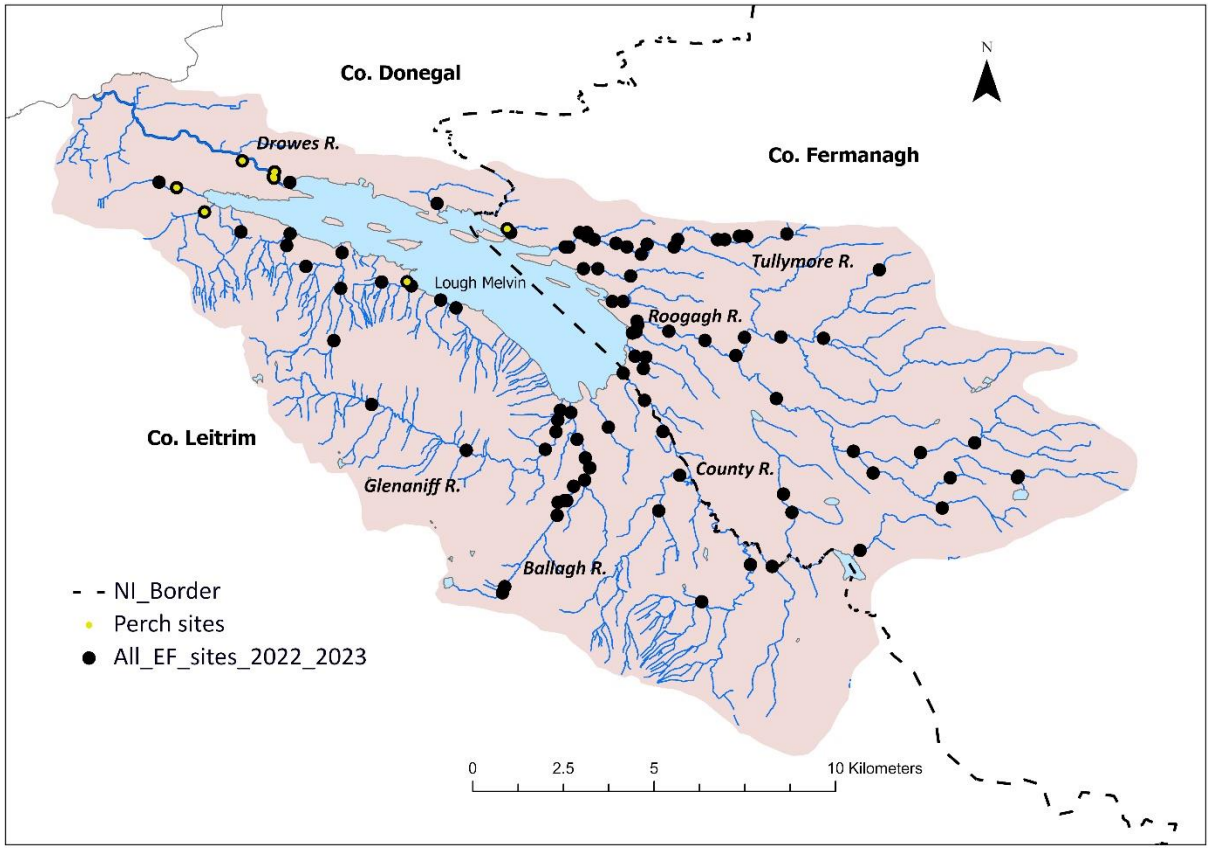
3 Spined Stickleback



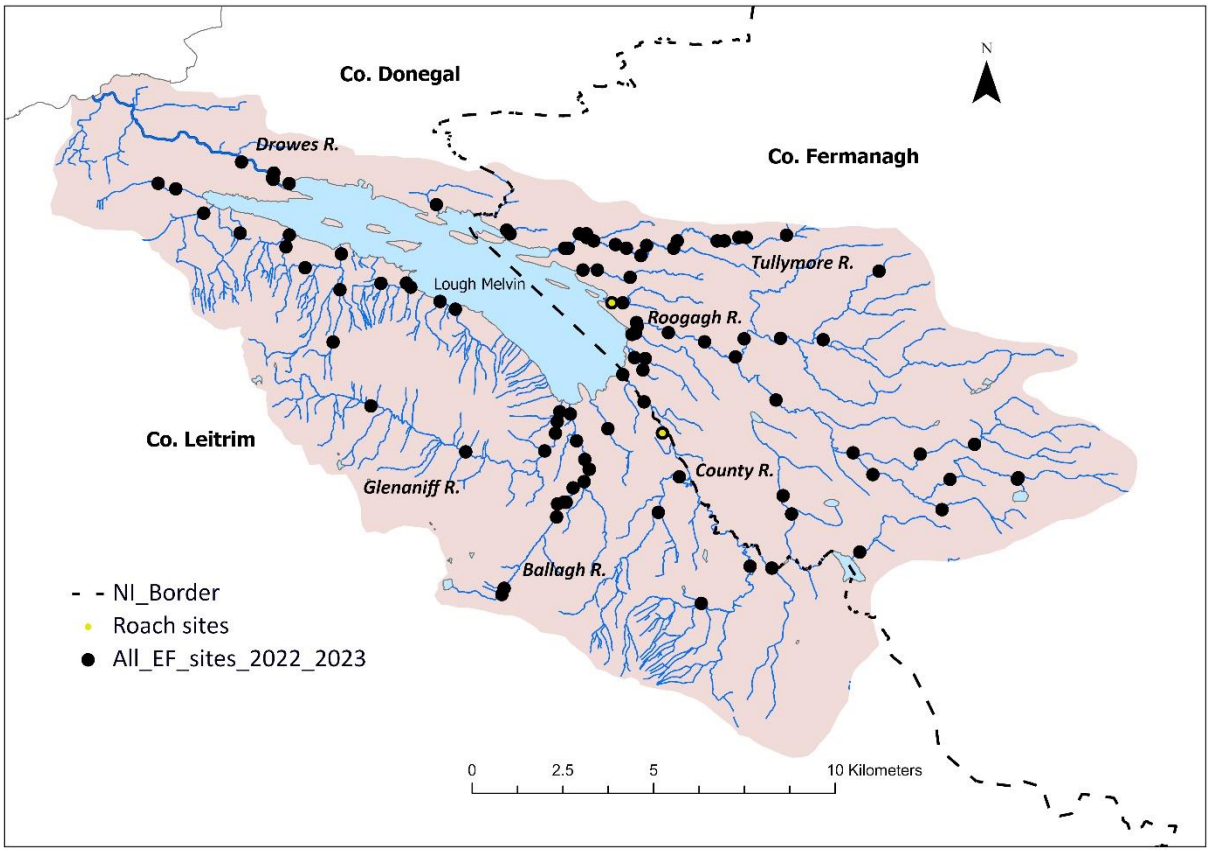
Minnow



Perch



Roach


Co. Donegal
Co. Fermanagh
Co. Leitrim
Drowes R.
Lough Melvin
Tullymore R.
Roogagh R.
County R.
Glenaniff R.
Ballagh R.
N
NI_Border
Roach sites
All_EF_sites_2022_2023
0
2.5
5
10 Kilometers

Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.
D24 Y265

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600