Brown Trout Fry Index Surveys in the Lough Ennell Catchment

2021–2024

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Iascach Intíre Éireann
Inland Fisheries Ireland

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Project Staff:

- Research Officer: Dr. Karen Delanty
- Technician: Rory Feeney
- Fisheries Inspector: Oisín Naughton
- Assistant Fisheries Inspector: Martin Moffatt
- Fisheries Officer: Joe Cheevers
- Fisheries Officer: Hugh Gilsenan
- Fisheries Officer: Padraig Carroll
- Fisheries Officer: Nigel Gallagher
- Senior Research Officer: Dr. Colm Fitzgerald
- Senior Research Officer: Dr. James Barry

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1. Executive Summary

- The National Brown Trout Programme (NBTP) researches the population dynamics of brown trout to better understand their life cycle as they develop from juveniles into adulthood, providing insight into recruitment of trout stocks.
- The Brown Trout Juvenile Index Monitoring work aims to develop an index for brown trout fry (juveniles aged 0+ years) to measure abundance, spatial distribution within subcatchments and habitat requirements. This index will also provide insights into the recruitment success of juvenile trout to adult stocks. A five-minute timed electrofishing (TEF) protocol was used to monitor abundance and spatial distribution of trout fry in three fry index catchments: Lough Carra, Lough Ennell and the Clodiagh River (a subcatchment the River Suir[i]). This report summarises 3 years of fry data from electrofishing surveys in the Lough Ennell catchment.
- Fifty surveys were carried out at 23 sites on 9 streams in July in 2021, 2023 and 2024, recording a total of 1,024 fish. Of the total of 976 brown trout recorded, 778 were designated 0+ fry and 198 trout were designated aged 1+ & older.
- The mean brown trout 0+ fry/5-min over the entire catchment was 19.2 in 2021, 11.5 in 2023 and 18.5 in 2024. The Castletown Geoghan and the Dysart had the highest mean fry counts across all years, with 23.3 fry/5-min.
- A decrease in fry count from 2021 to 2023 and subsequent increase in 2024 was recorded in the Tudenham, Dysart, Hanstown and Kilpatrick, whereas the opposite trend was recorded in the Carrick.
- Brown trout assigned as 0+ fry spanned the 3–7 cm length classes, whereas brown trout assigned as aged 1+ and older spanned the 8–19 cm length classes.
- The fry index counts and length frequency analysis show that the Dysart, Castletown Geoghan and Monaghanstown streams generally produced relatively higher numbers of trout, with relatively higher proportions of trout fry aged 0+.
- The other species recorded comprised, in order of decreasing abundance, three-spined stickleback, lamprey, gudgeon, nine-spined stickleback and pike. The Tudenham, the Dysart and the Hanstown streams had the greatest species richness, with 4 species each.
- Habitat surveys indicated that calcification of spawning gravels and access of livestock to streams are environmental issues with the potential to have impacts on trout populations in the catchment.
- The NBTP aims to continue surveying the Lough Ennell catchment annually as part of the brown trout juvenile index programme, these data will be used to inform modelling of fry habitat and factors effecting recruitment to adult stocks.
- Ultimately, monitoring trout fry index catchments and modelling data on fry abundance annually as part of the brown trout juvenile index programme, these data will be used to inform modelling of fry habitat and factors effecting recruitment to adult stocks

[i] *The Clodiagh River referred to in this report is the Clodiagh River (Tipperary), a subcatchment in the upper reaches of the River Suir west of Thurles, County Tipperary; not to be confused with the Clodiagh River (Portlaw), a subcatchment that joins the lower River Suir in County Waterford.*

2. Introduction

The brown trout (*Salmo trutta*) is a native salmonid fish species that is widespread in river systems and lakes throughout Ireland. Brown trout are important, and often predominant, in fish communities in Ireland's freshwater ecosystems. The species is highly variable in appearance and behaviour, and their adaptability means that they can pursue alternative feeding and life-history strategies to survive and thrive in the ecological niches available in rivers. Life-history strategies include remaining resident for their entire life in smaller streams close to where they were born, or migrating from these streams to larger rivers, lakes or even estuaries to exploit richer feeding opportunities elsewhere.

Inland Fisheries Ireland (IFI) and its institutional predecessors (i.e., the Central & Regional Fisheries Boards and the Inland Fisheries Trust) have a long history of scientific research on brown trout, including some foundational research on early life and growth of brown trout (Kennedy & Fitzmaurice, 1968, 1971) . This endeavour continues today with the Brown Trout Research Strategy 2021–2025 implemented by the National Brown Trout Programme (NBTP), which outlines areas of research to improve our understanding of the ecology of brown trout and to support trout conservation and management. This includes collecting information on population dynamics to better understand the life cycle of brown trout as they develop from juveniles into adulthood, providing insight into recruitment of trout stocks (National Brown Trout Programme, 2021).

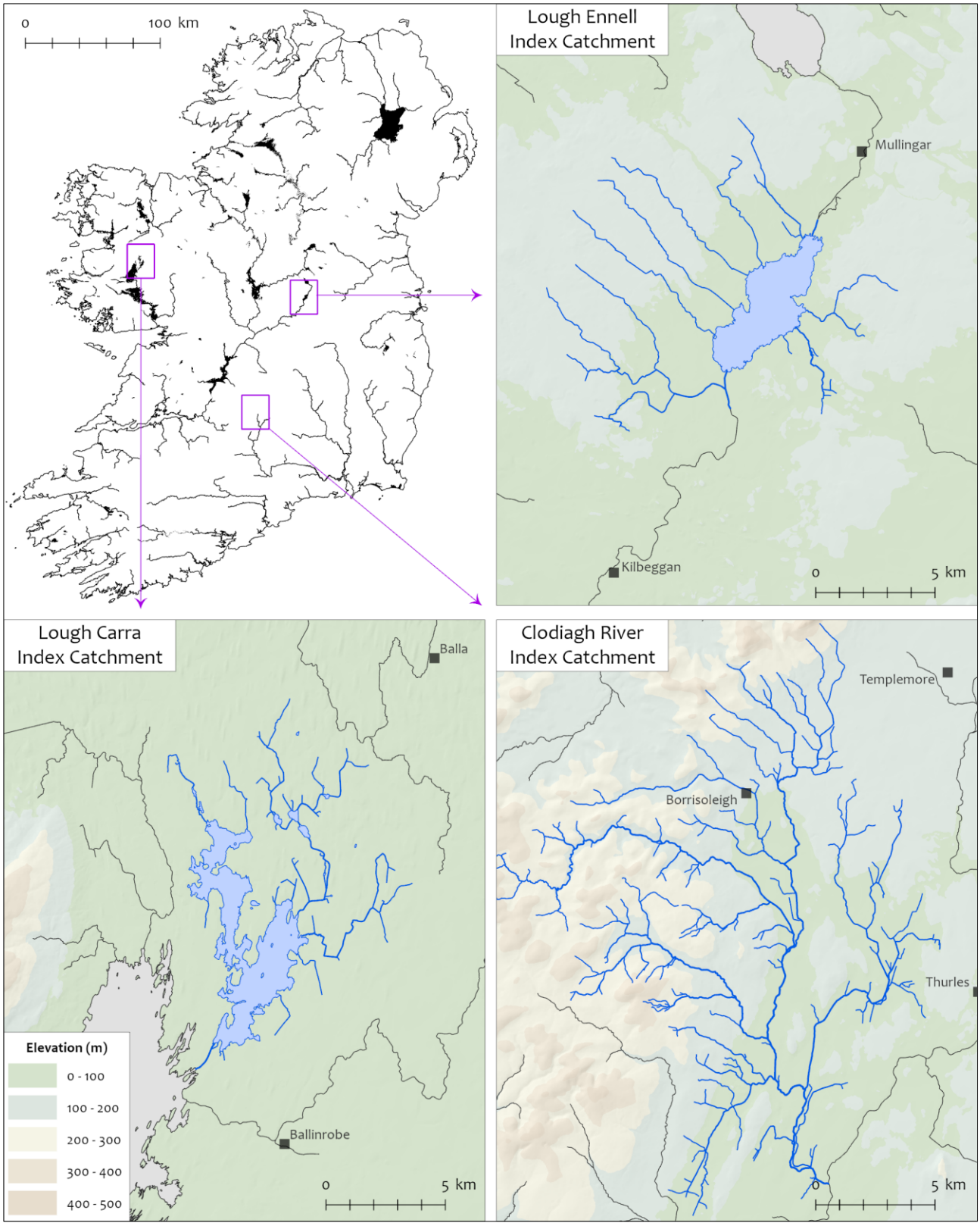
This report summarises the 2021, 2023 and 2024 electrofishing surveys targeting brown trout juveniles, known as trout 0+ fry, in the Lough Ennell Catchment as part of the Brown Trout Juvenile Index Monitoring.

2.1 Brown Trout Index Catchments

Index catchments are river catchments that are monitored over time by research programmes as model systems to scientifically investigate specific topics. The NBTP currently surveys three brown trout index catchments, which are all subcatchments of larger systems: Lough Ennell, Lough Carra and the River Clodiagh (Map 2.1).

This report specifically deals with the inflowing streams and rivers of Lough Ennell, which were surveyed in 2021, 2023 and 2024. This catchment was selected for the following reasons:

- It is a relatively closed system, with little population movement to or from the rest of the Brosna River system.
- It has a relatively simple fish community that is dominated by trout in its rivers and streams, which provide breeding habitat for the adult trout stock in the lake.
- It has a limited number of tributaries consisting primarily of 1st or 2nd order streams feeding a single lake, thereby allowing tracking of juvenile recruitment into the adult fishery.
- It has an associated lake fishery where data on adults may be collected.



Map 2.1: Geographic location of brown trout index catchments surveyed by the NBTP (scale 1:240,000); rivers ≥1st order and lakes in the index catchments in blue; all other rivers ≥3rd order and lakes outside index catchments in grey.

2.2 Study Area: The Ennell Catchment

Lough Ennell is a relatively large limestone lake on the River Brosna located about 4 kilometres southwest of Mullingar, County Westmeath. Approximately 7 kilometres in length along its longest axis running from southwest to northeast, Lough Ennell is about 2 kilometres across at its widest. The lake has an area of approximately 1,156 hectares, and it is mostly quite shallow, with about two thirds under 8 metres deep and almost half under 3 metres deep. Lough Ennell is a Special Area of Conservation (SAC), which is designated for its hard-water lake habitat and alkaline fen around its shorelines (National Parks & Wildlife Service, 2021).

The streams flowing into Lough Ennell drain a catchment primarily covered with well drained, loamy mineral soils overlying glacial till, which is interspersed with areas of lacustrine sediments, alluvium and gravels (Environmental Protection Agency & Teagasc, 2024; Geological Survey Ireland, 2024b). The underlying bedrock consists of limestone formations from the Carboniferous period (Geological Survey Ireland, 2024a). The land use in the catchment is dominated by agricultural pasture, with some areas of arable land and forestry, and with natural vegetation found in areas of transitional woodland scrub, marshland and cut-over bog (Environmental Protection Agency, 2024a).

Lough Ennell is highly productive and supports a huge abundance of aquatic flora and invertebrate life that provide cover and prey for brown trout, respectively. Lough Ennell has had a long history as a renowned brown trout fishery and is among the finest in Ireland (O'Reilly, 2007). Stocking with hatchery-reared trout was also carried out in the past, but trout genetic studies have shown that these fish did not ultimately breed successfully to become part of the river populations or lake fishery (Massa-Gallucci & Mariani, 2011).

Inland Fisheries Ireland and its predecessor (CFB) surveyed fish stocks in Lough Ennell on seven occasions between 1983 and 2004 (O'Grady & Delanty, 2004). Lough Ennell was surveyed by the National Research Survey Programme in 2017[ii], and the lake's fish community was assigned an ecological status of Moderate (Connor *et al*., 2018). The survey recorded, in order of decreasing abundance, perch (*Perca fluviatilis*), roach (*Rutilis rutilis*), roach × bream hybrid (*Rutilis rutilis* × *Abramis brama*), brown trout, rudd (*Scardinius erythrophthalmus*), tench (*Tinca tinca*), pike (*Esox lucius*), three-spined stickleback (*Gasterosteus aculeatus*) and European eel (*Anguilla anguilla*).

The streams flowing into Lough Ennell are part of the Brosna Arterial Drainage Scheme under the Arterial Drainage Act (1945), which mandated the Office of Public Works (OPW) to improve drainage and prevent flooding in designated districts, typically by deepening, widening and straightening river channels and by removing instream hydromorphological features. These drainage schemes can have negative impacts on trout habitat (O'Grady, 2006), and works by the OPW to maintain drainage and

[ii] *The latest NRSP survey of Lough Ennell was in 2024, report pending.*

flood relief in these channels are now carried out in accordance with guidelines on stream enhancement and river restoration to protect fish habitat.

In the late 1990s, the Central and Shannon Regional Fisheries Boards carried out a stream enhancement programme under the Tourism Angling Measure (TAM) 1994–1999, which involved restoring hydromorphological features, such as pools, gravel beds and thalweg, to drained channels to increase the catchment's carrying capacity, post drainage works, for juvenile trout (O'Grady *et al*., 2002). This contributed an increase in Lough Ennell's adult trout stocks as 1+ year-old juvenile trout emigrated from the streams to the lake (O'Grady & Delanty, 2004).

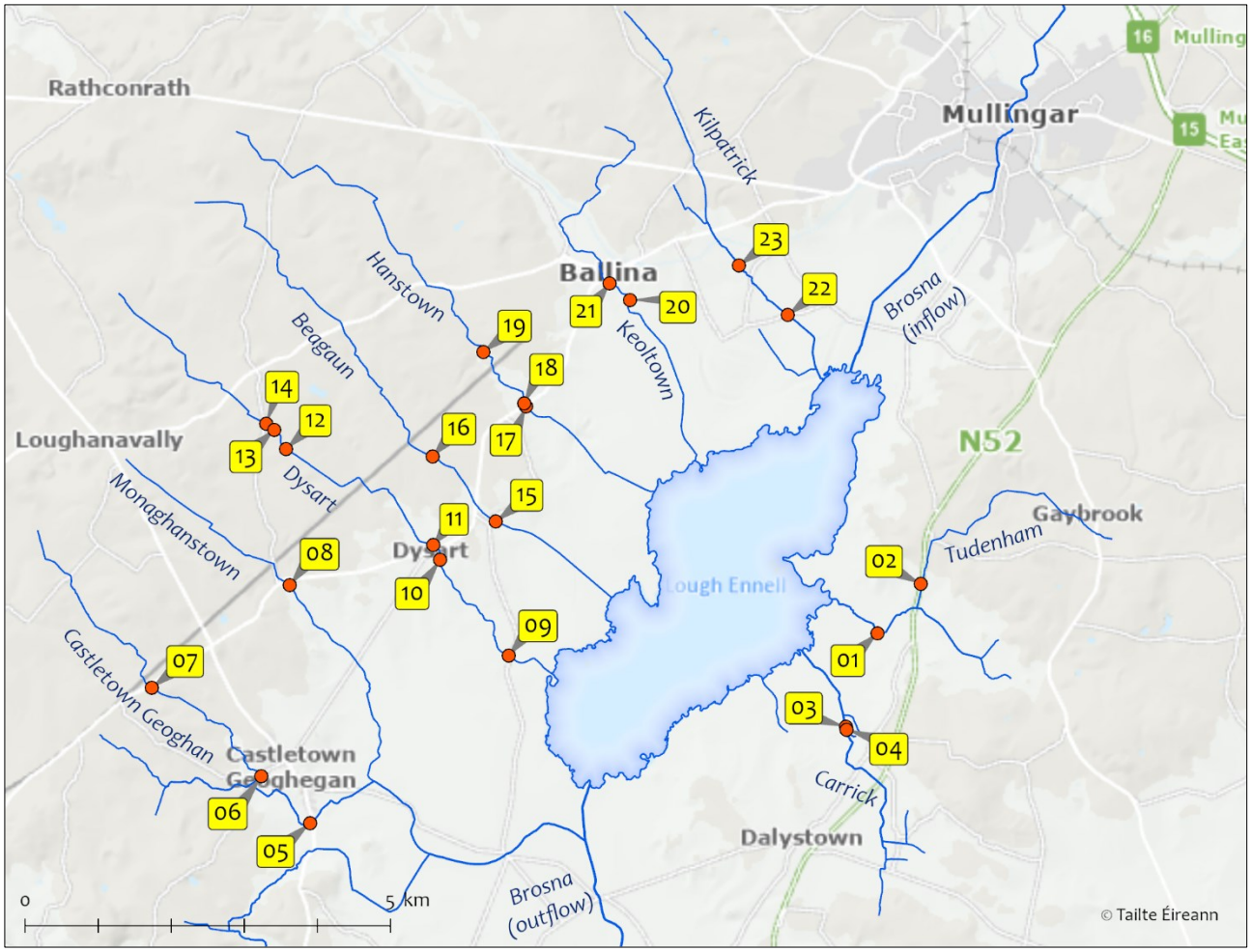
Nutrient enrichment is also an anthropogenic pressure of concern in the catchment. Lough Ennell went through a period of eutrophication in the 1970s and 1980s, partly due to pollution by municipal sewage from Mullingar, which caused algal blooms. The trophic status of Lough Ennell has been recovering slowly but steadily since improvement of wastewater treatment infrastructure, and ecological status is rated Good overall (Tierney, 2024). The WFD risk assessment for the catchment has identified significant pressures on water quality and hydromorphology, including agriculture, forestry, urban run-off and channelisation (Environmental Protection Agency, 2022, 2024b), and the Monaghanstown, Dysart and Tudenham[iii] streams, along with Lough Ennell itself, have been identified as high priority targets for improvement measures due to their value as fish habitat.

Nine streams that flow into Lough Ennell were sampled by the NBTP, comprising a network with a total channel length of 85.23 km and draining a catchment of 122.42 km^2 (Map 2.2, Table 2.1):

- The Tudenham and the Carrick on the southeastern shore
- The Monaghanstown and its tributary the Castletown Geoghan, which join the River Brosna just south of its outflow from Lough Ennell
- The Dysart, the Beagaun, the Hanstown, the Keoltown and the Kilpatrick on the western shore

Lough Ennell lies on the River Brosna, but the inflowing main channel provides relatively little spawning or nursery habitat for brown trout. Two sites were surveyed experimentally to investigate potential trout spawning habitat on the River Brosna near Mullingar north of Lough Ennell during the site assessment phase, but were not included as Lough Ennell index sites.

[iii] *The Tudenham stream is also known as Dunboden Park Stream in WFD reporting.*



Map 2.2: Sites surveyed in the Lough Ennell fry index catchment, 2021–2024.

Table 2.1: Key to Map 2.2 of sites surveyed in the Lough Ennell fry index catchment 2021–2024.

Map Key	River Name	Site	Latitude	Longitude	Segment Code	WFD RWB Code
01	Tudenham	beside N52 in Tallyho	53.46812	-7.35743	25_13105	IE_SH_25D160150
02	Tudenham	d/s of footbridge two fields from N52	53.4621	-7.36647	25_3122	IE_SH_25B090200
03	Carrick	u/s from cattle drink near Knockroe	53.45061	-7.37316	25_3100	IE_SH_25B090200
04	Carrick	d/s landbridge near Knockroe	53.45026	-7.37299	25_3100	IE_SH_25B090200
05	Castletown Geoghan	u/s road bridge near walkway	53.43929	-7.48365	25_2940	IE_SH_25M010500
06	Castletown Geoghan	u/s 2nd road bridge west of village	53.44512	-7.49358	25_2940	IE_SH_25M010500
07	Castletown Geoghan	d/s of Golcorra Bridge	53.4561	-7.51602	25_3106	IE_SH_25M010500
08	Monaghanstown	d/s upper road bridge	53.46857	-7.48746	25_3111	IE_SH_25M010500
09	Dysart	lowest road bridge near lake	53.45973	-7.44248	25_13122	IE_SH_25D050400
10	Dysart	d/s of Dysart village	53.47155	-7.45644	25_13122	IE_SH_25D050400
11	Dysart	u/s of Dysart village	53.47343	-7.45782	25_13122	IE_SH_25D050400
12	Dysart	two fields d/s upper site in Milltown	53.48535	-7.48802	25_13122	IE_SH_25D050400
13	Dysart	one field d/s upper site in Milltown	53.4877	-7.49048	25_13122	IE_SH_25D050400
14	Dysart	upper site in Milltown	53.48848	-7.49213	25_13122	IE_SH_25D050400
15	Beagaun	lower site d/s of road bridge	53.47624	-7.44488	25_3816	IE_SH_25B090200
16	Beagaun	upper site beside beech avenue	53.4843	-7.45783	25_3816	IE_SH_25B090200
17	Hanstown	d/s R391 road bridge	53.49033	-7.43852	25_1173	IE_SH_25B090200
18	Hanstown	u/s R391 road bridge	53.49072	-7.43891	25_1173	IE_SH_25B090200
19	Hanstown	upper site in farm in Strokestown	53.49707	-7.44728	25_1173	IE_SH_25B090200
20	Keoltown	lower site two fields from road	53.50334	-7.41694	25_1178	IE_SH_25B090200
21	Keoltown	d/s railway br, and R391 road br.	53.50543	-7.42102	25_1178	IE_SH_25B090200
22	Kilpatrick	lowest road bridge in forestry	53.50131	-7.3844	25_1152	IE_SH_25B090200
23	Kilpatrick	behind farmyard near Kilpatrick Br.	53.50746	-7.39436	25_1152	IE_SH_25B090200

3. Methods

3.1 Semi-Quantitative Electrofishing

Electrofishing is a well-established tool for monitoring freshwater fish communities in streams and rivers (Bohlin *et al*., 1989). Electrofishing equipment passes an electric field through the water from a cathode to an anode, causing the muscles of fish caught in the field to spasm, which prevents them from swimming effectively, turns them towards the anode and allows them to be captured with a hand-net. Electrofishing allows non-lethal sampling and monitoring of fish communities and provides information on abundance, distribution, length frequency and age structure of fish populations in rivers.

The IFI R&D Division designs its electrofishing protocols in compliance with European standards for fisheries assessment (European Committee for Standardization, 2003, 2006), and fish welfare is always the highest priority when conducting electrofishing operations, which are carried out using the most appropriate electrical settings to effectively and safely catch fish without causing fatalities or harm. One protocol used by IFI is timed electrofishing (TEF), which involves electrofishing a stretch of river without stop nets in a single pass for a timed interval. TEF requires relatively less investment of time and effort per site, allowing more sites across a catchment to be sampled. The use of a standard time interval in TEF allows a minimum estimate of the fish population based on only one pass that can be compared across sites fished with the same method.

Semi-quantitative TEF methodologies have been developed to allow rapid assessments of fish populations over catchments. A semi-quantitative five-minute electrofishing technique targeting 0+ juvenile Atlantic salmon (*Salmo salar*) (Crozier & Kennedy, 1994; Gargan *et al*., 2008) is currently used across Ireland to support assessment of salmon stocks (Holmes *et al*., 2023).

3.2 NBTP Five-Minute TEF Protocol

The five-minute TEF protocol adopted by the NBTP for assessing juvenile trout abundance and developing a trout fry index in brown trout index catchments is similar to the Catchment Wide Electrofishing (CWEF) protocol (Holmes *et al*., 2023). Key criteria of its design include the following:

- In advance of sampling, potential sites are mapped and inspected to assess their suitability as trout habitat, their accessibility for survey work and their spatial distribution around the catchment to ensure adequate sampling of all significant tributaries where possible.
- Sites that were surveyed by IFI in the past were targeted initially, with additional sites included where suitable trout spawning habitat was identified.
- Sites in streams and rivers are selected to include typical juvenile trout habitat, generally stretches of stream that included riffles and areas with gravelly substrate suitable for trout spawning.
- Yearly repeat visits to a site aim to replicate the original survey by fishing the same type of habitat at the same location, and as close as possible to the same date.

- Two operatives fish continuously in an upstream direction using a single anode electrofishing apparatus (either backpack or bankside generator) for five minutes in the absence of stop nets, catching all fish "turned" by the electric current where possible (Figure 3.1).
- In addition to fish captured, fish that are seen but not captured are counted and added to the total, with an estimation of life stage (0+ fry or 1+ & older) for any trout or salmon not captured.
- Fish processing involves identifying species caught, enumerating number of individuals captured and measuring their length to establish age classes present at the site. Fork length is measured in length classes, e.g., fish measuring ≥5.0 cm and <6.0 cm are in the 5 cm length class, etc.
- Fish caught were usually identified to species level, except for lamprey; these comprise brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*), juveniles of which are difficult to distinguish in the field.
- Scales samples may be taken for investigating age and growth if required and for potential future genetic studies.
- Fish species present other than trout are also recorded and enumerated. The presence/absence of the protected invertebrates white-clawed crayfish (*Austropotamobius pallipes*) and freshwater pearl mussel (*Margaritifera margaritifera*) is also recorded.
- Following processing all fish caught are then monitored for a short period to ensure their recovery and released back into the site.

Sites with good juvenile trout habitat were selected, with a particular focus on riffle sections, which provide good nursery waters for trout fry (Armstrong *et al*., 2003). The protocol aims to sample enough sites across a catchment to gain a representative picture of the trout fry distribution and abundance in each catchment.

3.3 Habitat Survey

Immediately after each electrofishing survey at a site, a habitat survey was carried out to record the site's physical characteristics, riparian & instream habitat, water quality, etc. This information is vital to allow ecological integrity of sites to be evaluated and will be used in modelling of juvenile trout habitat. Parameters recorded include the following:

- GPS co-ordinates to record site location and confirm accurate surveys on repeat visits.
- Physical features, such as wetted width, depths, channel widths, flow conditions, etc.
- Water quality, such as temperature, conductivity, algae levels, water clarity, etc.
- Habitat characteristics, such as substrate, type of habitat, instream vegetation, fish cover, etc.
- Riparian features, such as bank characteristics, land-use, bank vegetation, erosion, etc.
- Channel pressures, such as straightening, widening, sediment, livestock access, etc.
- Habitat suitability for trout life stages (fry, juveniles & adults)
- Hydromorphological channel features, such as gravel bars, berms, etc.

Figure 3.1: Electrofishing on the Tudenham, 2021.

4. Results

The NBTP implemented its five-minute TEF protocol targeting trout 0+ fry in 50 surveys at 23 sites on 9 tributary streams across the Lough Ennell catchment across July in 2021, 2023 and 2024. The surveys recorded a total of 1,024 fish, comprised of 976 brown trout and 48 other fish from 5 other species. The brown trout comprised 778 brown trout fry aged 0+ and 198 trout aged 1+ & older.

4.1 Trout Fry/5-Min

The primary result of the surveys is expressed as **fry/5-min**, which is the number of individual brown trout fry aged 0+ caught in 5 minutes of electrofishing[iv]. The number of sites sampled increased from 8 in 2021 to 21 in 2023 and 21 in 2024 (Table 2.1), and the catchment wide- average fry count was highest in 2021 with 19.2 fry/5-min and lowest in 2023 with 11.5 fry/5-min. Boxplots of the annual fry counts illustrate how the range of values at sites varies across years, with the median value at its lowest for 2023 and with some outlying high count values in 2024; however, there is overlap across the years despite variation around the catchment, with counts of between 9 to 20 fry/5-min recorded at half of sites overall (Figure 4.1).

Table 4.1: Summary of trout 0+ fry/5-min counts across years from the Lough Ennell catchment, 2021–2024.

Year surveyed	Sites sampled	Trout 0+ fry: total	Trout 0+ fry: site minimum	Trout 0+ fry: site maximum	Trout 0+ fry: mean per site
2021	8	154	8	34	19.2
2023	21	242	0	33	11.5
2024	21	389	1	50	18.5

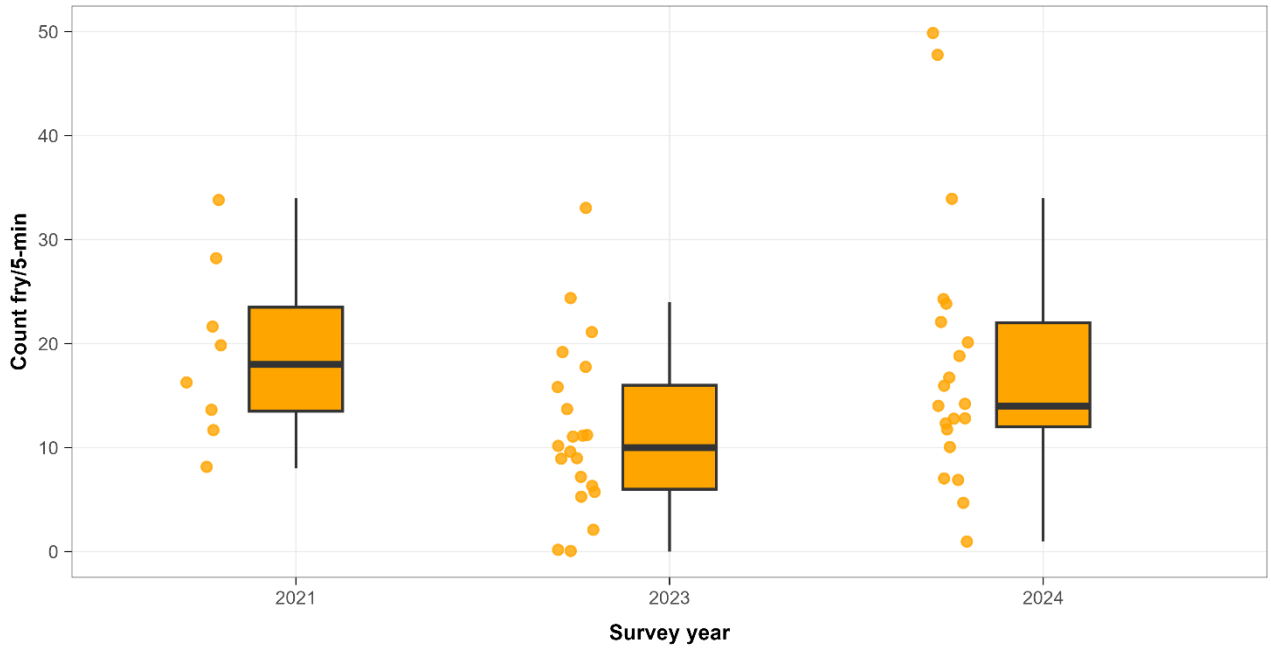


Figure 4.1: Boxplot of trout fry/5-min counts from Lough Ennell surveys, 2021–2024: thick horizontal line is the median; top and bottom of the box representing the interquartile range (IQR) are the 75th and 25th percentiles; vertical 'whiskers' are 1.5×IQR; orange points are fry counts per survey with random jitter added to aid visibility.

[iv] *For fish other than 0+ fry, the unit is **trout/5-min** for 1+ & older brown trout and **fish/5-min** for other species.*

Comparison of the results across the catchment shows that some streams, such as the Carrick, the Beagaun and the Keoltown, had fairly consistent mean trout 0+ fry/5-min numbers in sites surveyed across years, whereas there were noticeably lower numbers in 2023 compared with 2024 in other rivers, such as the Tudenham, the Dysart and the Hanstown (Table 4.2; Figure 4.2).

For rivers where data are available for all years, the recovery in mean fry/5-min counts after 2023 is similar across all rivers, except for the Kilpatrick, where mean trout 0+ fry/5-min remained lower. The Castletown Geoghan and the Dysart had the highest mean trout fry counts across all years surveyed, with 23.3 fry/5-min, whereas the Monaghanstown had the highest individual annual mean, with 34 fry/5-min in 2024 (Figure 4.2). The spatial patterns of trout 0+ fry/5-min and 1+ & older trout/5-min counts in surveys across the catchment over the period 2021–2024 are shown in Map 4.1.

Table 4.2: Mean brown trout 0+ fry/5-min counts across rivers in the Lough Ennell catchment, 2021–2024.

River	Number of sites			Mean 0+ fry/5-min			All years	
	2021	2023	2024	2021	2023	2024	Mean	SD[v]
Tudenham	2	2	2	18	6.5	21.5	15.3	7.6
Carrick	2	2	2	10	11.5	9.5	10.3	2.7
Castletown Geoghan	0	3	3	-	22.3	24.3	23.3	15.9
Monaghanstown	0	1	1	-	11.0	34.0	22.5	16.3
Dysart	2	4	4	31	15.8	27.0	23.3	11.7
Beagaun	0	2	2	-	5.5	7.5	6.5	6.1
Hanstown	1	3	3	16	3.7[vi]	16.0	10.7	7.9
Keoltown	0	2	2	-	11.0	9.0	10.0	5.4
Kilpatrick	1	2	2	20	10.5	12.0	13.0	5.3

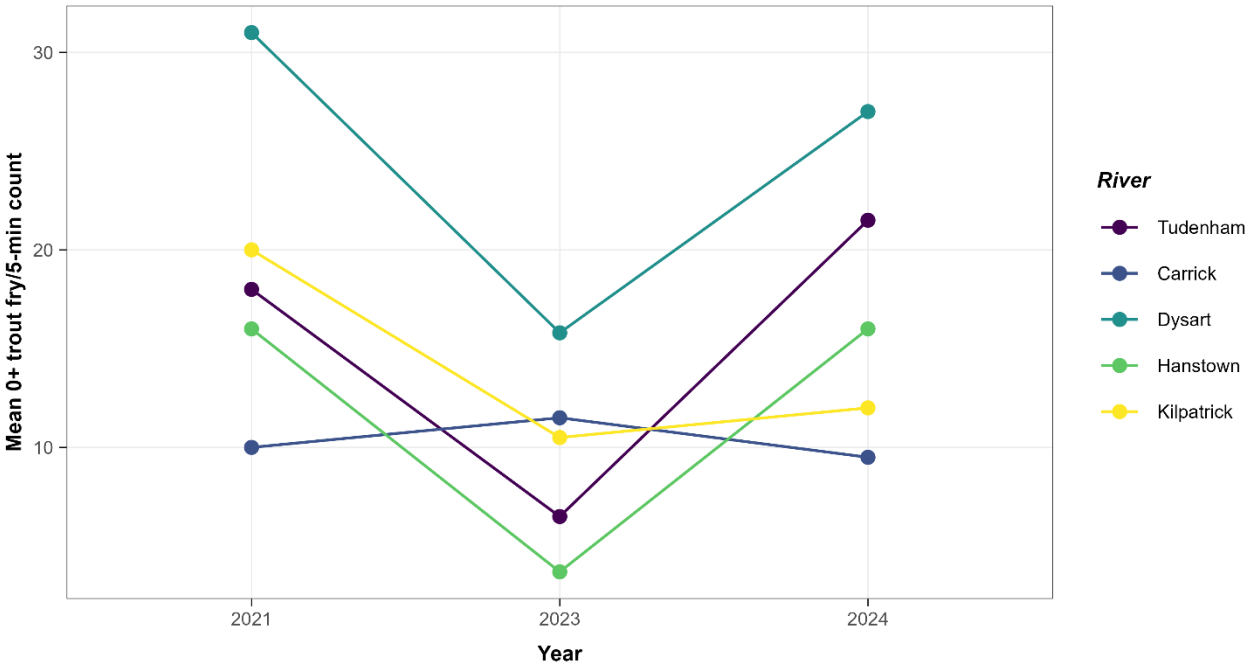
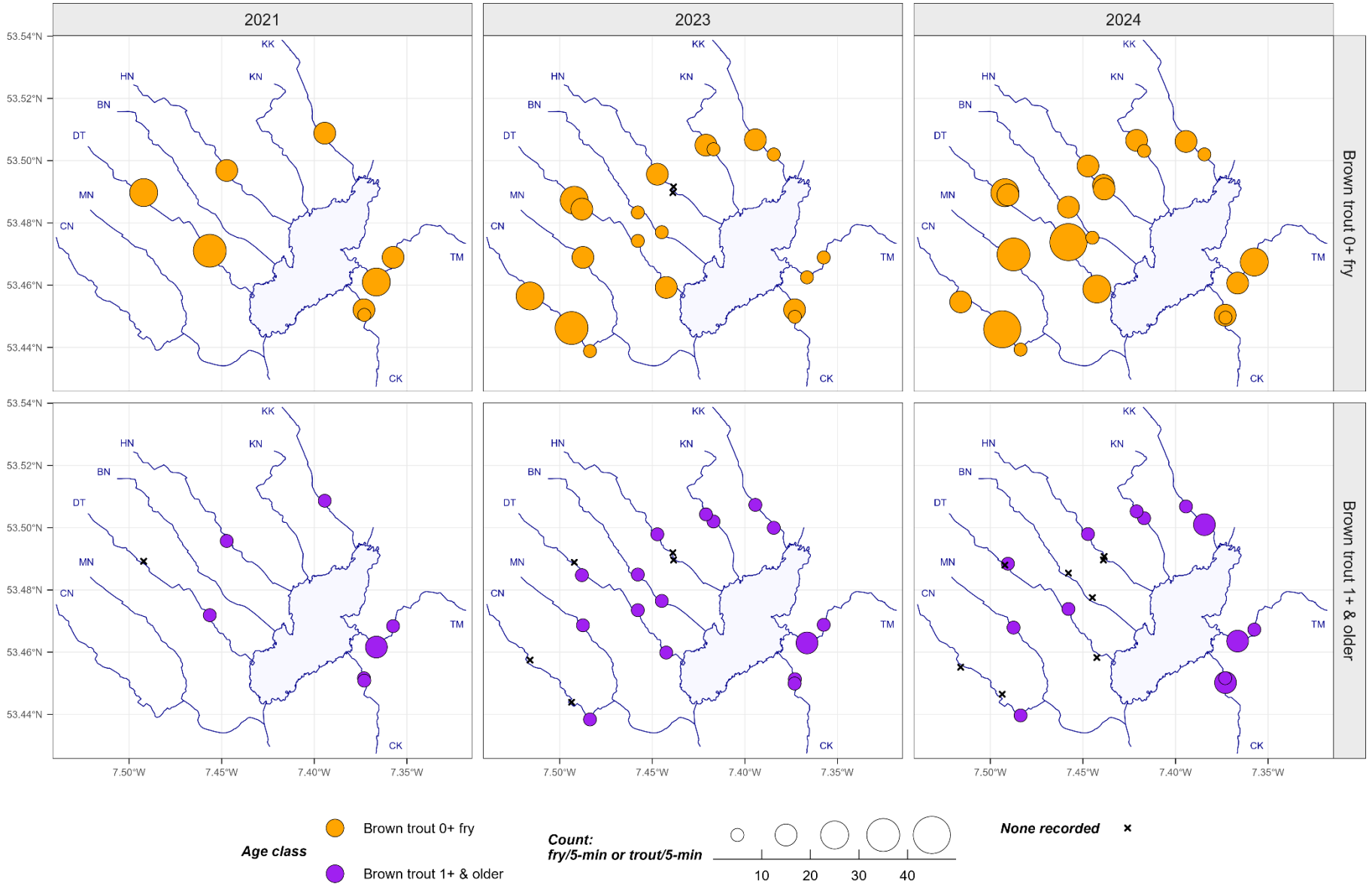


Figure 4.2: Changes in mean trout 0+ fry/5-min counts among surveyed Lough Ennell streams, 2021–2023.

[v] *SD = standard deviation.*

[vi] *In 2023, there were 3 surveys on the Hanstown, with no fish caught in 2 of the surveys; if these two surveys are omitted, the mean count per site is 11 fry/5-min, which maintains the same general trend.*



Map 4.1: Spatial distribution of counts of trout 0+ fry/5-min and 1+ & older trout/5-min at survey sites on Lough Ennell streams, 2021–2024.
Map key: Tudenham (TM), Carrick (CK), Castletown Geoghan (CN), Monaghanstown (MN), Dysart (DT), Beagaun (BN), Hanstown (HN), Keoltown (KN), Kilpatrick (KK)

4.2 Trout Length Frequency & Assigned Age

Fish were measured in length classes: for example, fish measuring ≥5.0 cm and <6.0 cm are in the 5 cm length class. All brown trout captured or observed and counted for each five-minute fishing were assigned one of two age classes based on length frequency distribution:

- 0+ are juvenile fry aged less than one year old, which were born the previous winter.
- 1+ & older (1++) fish are aged at least one year old; these fish may be juvenile fish aged 1+ after one year's growth, or they may be older adult fish.

Overall, the length of 869 brown trout were measured in 2021–2024, comprising 696 0+ fry and 173 1+ & older trout. The median length of trout 0+ fry was similar across years, with a median length of 5 cm overall (Figure 4.3).

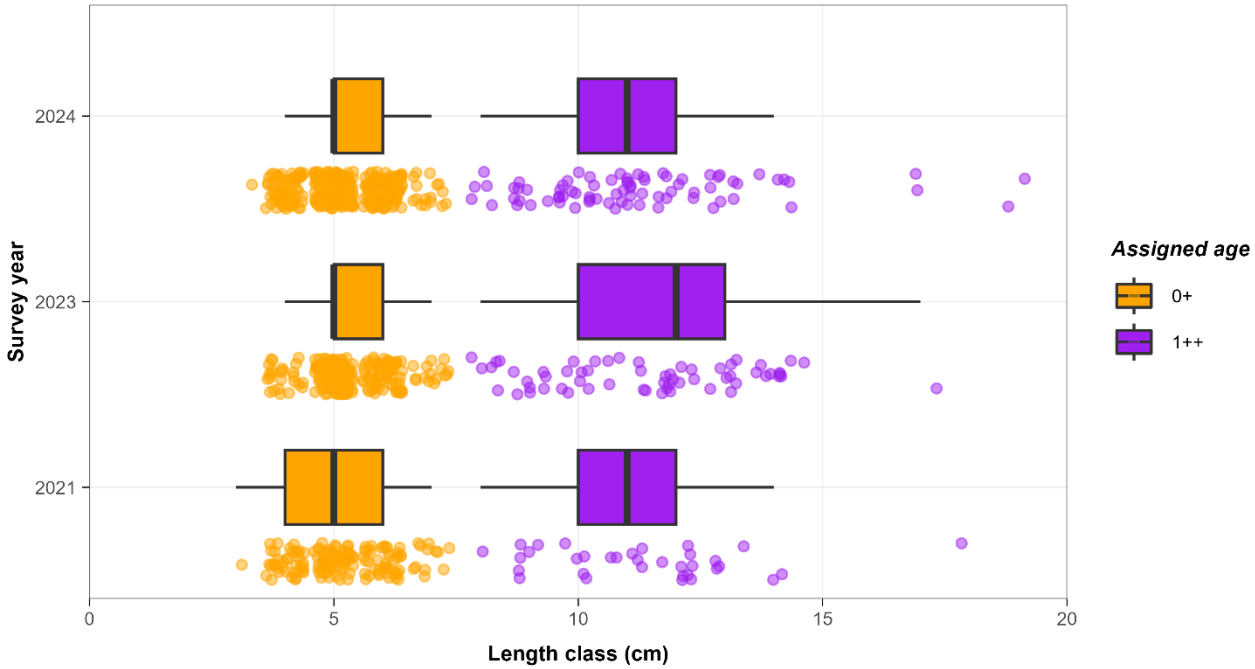


Figure 4.3: Boxplot of brown trout length classes from Lough Ennell surveys, 2021–2024. Each point represents an individual 0+ fry (orange) or 1+ & older trout (violet); random jitter added to aid visibility.

The lengths of trout fry aged 0+ spanned the 3–7 cm length classes, whereas the lengths of trout aged 1+ and older spanned the 8–19 cm length classes (Figure 4.3). Individual fish were assigned to the 0+ or 1++ age classes based on their length with reference to the length frequency distribution for the river each survey year (Figure 4.4). As would be expected in juvenile habitat, the trout recorded were generally quite small, and the largest recorded trout were in the 19 cm length class and were captured in the Carrick and the Castletown Geoghan in 2024. In general, the median length of trout in the Tudenham was at least equal to and mostly greater that other streams each year, and the Tudenham had the greatest mean length overall at 7.73 cm (Table 4.3; Figure 4.4).

Table 4.3: Summary of length class (cm) data for brown trout in the Lough Ennell catchment, 2021–2024.

River	Median	Mean	SD	Minimum length	Maximum length
Tudenham	6	7.73	3.23	4	18
Carrick	5	7.06	3.32	3	19
Castletown Geoghan	5	5.58	2.21	3	19
Monaghanstown	6	6.31	2.29	4	13
Dysart	5	5.60	1.90	4	14
Beagaun	6	6.28	2.41	4	14
Hanstown	6	6.77	2.42	4	14
Keoltown	5	6.40	2.57	4	13
Kilpatrick	6	7.45	3.26	4	14

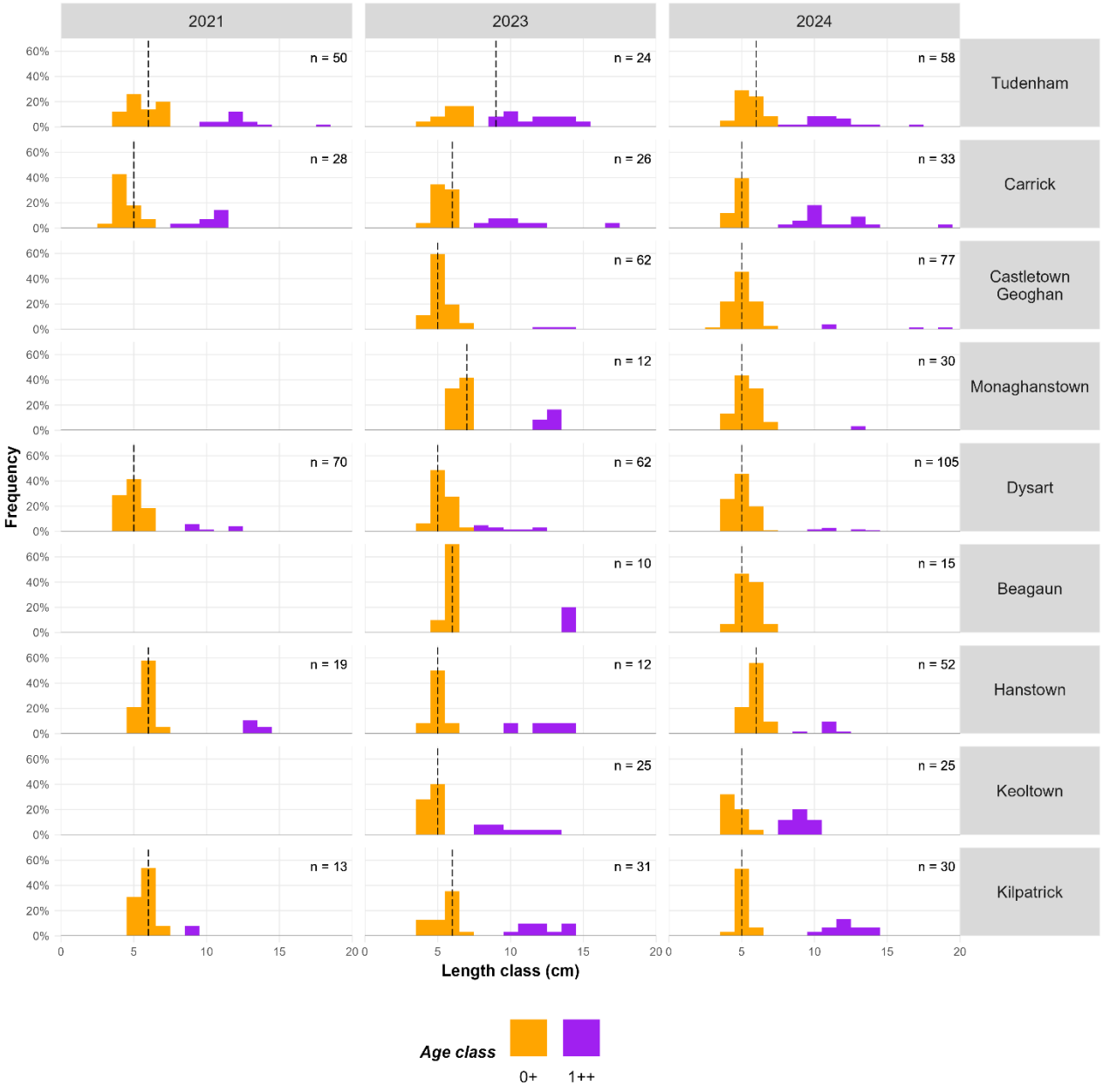


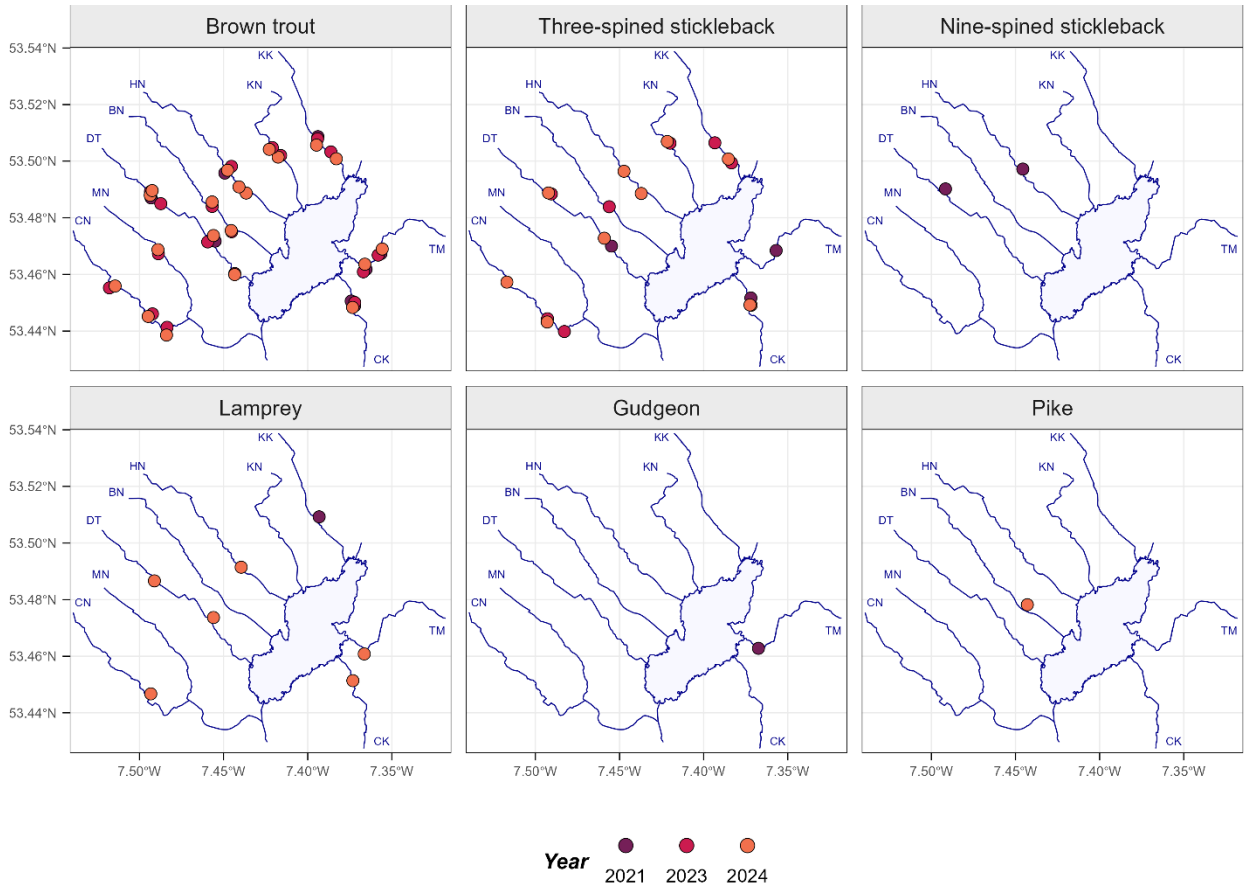
Figure 4.4: Length frequency distribution of brown trout captured in the Lough Ennell catchment, 2021–2024; orange bars are trout 0+ fry; violet bars are trout aged 1+ & older; vertical black dashed line is the median value for trout length class (cm) for the stream each year.

4.3 Fish Community

Brown trout (Figure 4.5) dominated the fish community of the Lough Ennell catchment. The other species recorded comprised, in order of decreasing abundance, three-spined stickleback, lamprey, gudgeon (*Gobio gobio*), nine-spined stickleback (*Pungitius pungitius*) and pike (Table 4.4). The Tudenham, the Dysart and the Hanstown were the rivers with the greatest species richness, with 4 species each, whereas the Monaghanstown had the least diverse fish community, with just brown trout present (Map 4.2).

Table 4.4: Summary of fish species counts across years from Lough Ennell catchment, 2021–2024

Species	2021	2023	2024	Total
Brown trout	190	319	467	976
Three-spined stickleback	3	10	17	30
Lamprey	1	0	7	8
Gudgeon	5	0	0	5
Nine-spined stickleback	3	0	0	3
Pike	0	0	2	2



Map 4.2: Distribution of fish species recorded at sites surveyed in the Lough Ennell catchment, 2021–2024. Map key: Tudenham (TM), Carrick (CK), Castletown Geoghan (CN),Monaghanstown (MN), Dysart (DT), Beagaun (BN), Hanstown (HN), Keoltown (KN), Kilpatrick (KK)

Figure 4.5: A brown trout fry aged 0+ from the Tudenham, 2021.

5. Summary

The results for fry index counts indicate that the Castletown Geoghan (23.3 fry/5-min ± 15.9 SD), the Dysart (23.3 fry/5-min ± 11.7 SD) and the Monaghanstown (22.5 fry/5-min ± 16.3 SD) generally had relatively higher numbers of trout compared with other streams across the catchment. The length frequency distribution showed that these rivers also tended to have with a relatively high proportion of trout fry aged 0+ but that older trout were also present each year.

The Tudenham and the Carrick had relatively moderate fry index counts, with relatively higher proportions of 1+ & older trout each year compared with other streams across the catchment. It must be noted, however, that survey sites were selected on the basis that they contain stream habitat likely to provide spawning and to shelter fry. Therefore, the results are expected to show some variation in the counts for 1+ & older trout because the surveys did not target their preferred river habitat.

Overall, the length frequency distributions of streams in the Lough Ennell catchment were not observed to change greatly over the survey period from 2021 to 2024, with each stream maintaining broadly similar proportions of 0+ fry and of 1+ & older trout from year to year. This indicates that the trout populations in the catchment are stable.

An issue that was evident in habitat surveys of sites was calcification of the riverbed, which was frequently observed each year, especially in the streams to the west of Lough Ennell. This may limit the availability of spawning gravels to trout if they become too compacted for them to dig redds. Another issue frequently observed was that many stretches of Lough Ennell's tributary streams are not fenced from surrounding pasture, which means that livestock have access to the streams and may have an impact on water quality, erosion and sedimentation.

The NBTP aims to continue surveying the Lough Ennell catchment, together with the Lough Carra catchment and the Clodiagh River catchment, annually over the next few years until sufficient data are available for modelling. The fry index data will enable modelling of juvenile habitat availability and expected fry densities in catchment streams, which will be very informative for assessing the potential for river restoration and the enhancement of trout fry recruitment to adult fisheries.

The Brown Trout Juvenile Index Monitoring data will be important for the development of IFI's management strategy evaluation (MSE) for inland fisheries, which integrates scientific information on the biology of target fish species and ecological interactions within fish communities with real world data on catch statistics to estimate the status of fishery stocks. Ultimately, applying this framework for assessing management options to inland fisheries will help IFI to develop best practice and to use informed decision-making for the conservation of brown trout fisheries.

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7. Appendix: Site Photos

Figure 7.1: Tudenham: beside N52 in Tallyho (see Map 2.2, site 1).

Figure 7.2: Tudenham: d/s of footbridge two fields from N52 (see Map 2.2, site 2).

Figure 7.3: Carrick: u/s from cattle drink near Knockroe (see Map 2.2, site 3).

Figure 7.4: Carrick: d/s landbridge near Knockroe (see Map 2.2, site 4).

Figure 7.5: Castletown Geoghan: u/s road bridge near walkway (see Map 2.2, site 5).

Figure 7.6: Castletown Geoghan: u/s 2nd road bridge west of village (see Map 2.2, site 6).

Figure 7.8: Castletown Geoghan: d/s of Golcorra Bridge (see Map 2.2, site 7).

Figure 7.8: Monaghanstown: d/s upper road bridge (see Map 2.2, site 8).

Figure 7.9: Dysart: lowest road bridge near lake (see Map 2.2, site 9).

Figure 7.10: Dysart: d/s of Dysart village (see Map 2.2, site 10).

Figure 7.11: Dysart: u/s of Dysart village (see Map 2.2, site 11).

Figure 7.12: Dysart: two fields d/s upper site in Milltown LHB (see Map 2.2, site 12).

Figure 7.13: Dysart: one field d/s upper site in Milltown LHB (see Map 2.2, site 13).

Figure 7.14: Dysart: upper site in Milltown (see Map 2.2, site 14).

Figure 7.15: Beagaun: lower site d/s of road bridge (see Map 2.2, site 15).

Figure 7.16: Beagaun: upper site beside beech avenue (see Map 2.2, site 16).

Figure 7.17: Hanstown: d/s R391 road bridge (see Map 2.2, site 17).

Figure 7.18: Hanstown: u/s R391 road bridge (see Map 2.2, site 18).

Figure 7.19: Hanstown: upper site in farm in Strokestown (see Map 2.2, site 19).

Figure 7.20: Keoltown: lower site two fields from road in Keoltown (see Map 2.2, site 20).

Figure 7.21: Keoltown: d/s railway bridge and R391 road bridge (see Map 2.2, site 21).

Figure 7.22: Kilpatrick: lowest road bridge in forestry (see Map 2.2, site 22).

Figure 7.23: Kilpatrick: behind farmyard near Kilpatrick Bridge (see Map 2.2, site 23).

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

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600