# Brown Trout Fry Index Surveys in the Lough Carra Catchment



IFI/2025/1-4744



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**Citation:** Feeney, R., Delanty, K., Fitzgerald, C. & Barry, J. (2025). Brown Trout Fry Index Surveys in the Lough Carra Catchment 2021–2024. National Brown Trout Programme. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, D24 CK66, Ireland.

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#### Acknowledgements

The authors wish to gratefully acknowledge the help and co-operation of their colleagues in Inland Fisheries Ireland, especially the IFI Galway Operational staff.

We would like to thank all landowners who granted us access across their land to visit sites.

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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<sup>i</sup>). This report summarises 3 years of fry data from electrofishing surveys in the Lough Carra catchment.
- Thirty-six surveys were carried out at 17 sites on 7 tributary streams in July & August in 2021, 2023 and 2024, recording a total of 880 fish. Of the total of 844 brown trout recorded, 660 were designated 0+ fry and 184 trout were designated aged 1+ & older.
- The mean brown trout 0+ fry/5-min over the entire catchment was 16.7 in 2021, 15 in 2023 and 21.7 in 2024.
- The Ballintober stream had the highest mean brown trout fry counts across all years surveyed, with 35 fry/5 min.
- There were variable and contrasting trends between streams across the catchment from year to year, with relatively large increases and decreases in fry/5min counts recorded in the Partry and the Ballintober streams.
- Brown trout assigned as 0+ fry spanned the 3–9 cm length classes, whereas brown trout assigned as aged 1+ and older spanned the 9–21 cm length classes.
- The fry index counts and length frequency analysis show that the Ballintober stream generally produced relatively higher numbers of trout, with a relatively high proportion of trout fry aged 0+.
- The other species recorded comprised, in order of decreasing abundance, three-spined stickleback, perch, lamprey, pike and European eel. The Annies River had the greatest species richness, with 6 species recorded.
- The NBTP aims to continue surveying the Lough Carra 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 in 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.

<sup>&</sup>lt;sup>†</sup> 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 Carra 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 Carra, 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 Corrib River system, which it is connected to via the Keel River flowing to Lough Mask.
- 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 1<sup>st</sup> or 2<sup>nd</sup> 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  $\geq 1^{st}$  order and lakes in the index catchments in blue; all other rivers  $\geq 3^{rd}$  order and lakes outside index catchments in grey.

#### 2.2 Study Area: The Carra Catchment

Lough Carra is a large limestone lake located just northeast of Lough Mask and about 4 kilometres north of Ballinrobe, County Mayo. Approximately 9 kilometres in length along its longest axis running from south to north, Lough Carra has an area of about 1,564 hectares. The lake is very shallow, mostly less than about 2 metres, with a maximum depth of about 20 metres. Lough Carra is predominately a spring-fed lake with few inflowing streams, and it is connected to Lough Mask by the Keel River, forming part of the River Corrib system. Lough Carra is a marl lake known for its charophyte vegetation and its clear, turquoise, water, with euphotic depths of greater than 9 metres recorded (Roden & O'Connor, 2024). The lake is part of the Lough Carra/Mask Complex Special Area of Conservation (SAC) and is designated for its hard-water lake habitat, as well as areas of sedge marsh, limestone pavement, alkaline fen and calcareous grassland along the lakeshore (National Parks & Wildlife Service, 2015).

The streams flowing into Lough Carra drain a catchment covered with well drained, loamy mineral soils, interspersed with some areas of peaty soils; there is an area of shallow, well-drained soils with a high lime content to the north of the lake. These soils overlie glacial till derived from limestones, which is interspersed with areas cut-over peat (Environmental Protection Agency & Teagasc, 2024; Geological Survey Ireland, 2024b). The underlying bedrock consists of limestone and shale from the Carboniferous period (Geological Survey Ireland, 2024a). The land use in the catchment is dominated by agricultural pasture, with some areas of forestry, and with natural vegetation found in areas of scrub, marshland and cut-over bog (Environmental Protection Agency, 2024a).

Lough Carra is considered one of the Great Western Lakes, which are large lakes in Ireland that are renowned as wild brown trout fisheries. Trout from Lough Carra are noted for their relatively large size compared with other western lakes (O'Reilly, 2007) and for their distinctive silvery, heavily spotted colouration (Huxley, 2011). Annual stocking of Lough Carra with farmed reared trout took place in the 1970s but ceased in 1981 (O'Grady & Wögerbauer, 2009).

Inland Fisheries Ireland and its institutional predecessors surveyed fish stocks in Lough Carra on eight occasions between 1978 and 2009, and trout stocks were considered to be excellent in 2009 (O'Grady & Wögerbauer, 2009). Since 2009, Lough Carra has been surveyed on five occasions for Water Framework Directive (WFD) reporting by the National Research Survey Programme. There is some evidence of a declining trend in overall abundance of trout, but considerable variation make these results difficult to interpret with confidence; trout biomass has remained relatively stable (McLoone *et al.*, 2023). The lake's fish community was assigned an ecological status of Good in the most recent survey in 2022 (McLoone *et al.*, 2023). A change to the fish community in recent years has been the appearance of roach (*Rutilis rutilis*), with single specimens caught in the 2015 and 2022 surveys (Kelly *et al.*, 2016; McLoone *et al.*, 2023). The latest survey recorded, in order of decreasing abundance, perch (*Perca fluviatilis*), brown trout, pike (*Esox lucius*), European eel (*Anguilla anguilla*) and roach.

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Electrofishing surveys of the streams feeding Lough Carra by the National Research Survey Programme in July 2019 (O'Briain *et al.*, 2019) recorded brown trout in seven out of eight sites surveyed, with 0+ fry present in seven sites and 1+ and older fish present in four sites. Perch, three-spined stickleback (*Gasterosteus aculeatus*) and pike were also present in lower numbers. Based on the survey results, the fish ecological status was designated as Poor at two sites, Good at four sites and High at two sites using the WFD FCS2 fish classification tool.

The streams flowing into Lough Carra are part of the Corrib-Mask-Robe 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 flood relief in these channels are now carried out in accordance with guidelines on stream enhancement and river restoration to protect fish habitat (Brew & Gilligan, 2019).

In the 1990s, the Central and Western Regional Fisheries Board carried out a programme of stream enhancement 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 for juvenile trout in the Corrib catchment, including around Lough Carra (Gargan *et al.*, 2002). This work is considered to have contributed to an increase in Lough Carra's adult trout stocks recorded in surveys in the 2000s compared with the 1980s (O'Grady & Wögerbauer, 2009).

WFD risk assessment has identified significant pressures on water quality and hydromorphology, including agriculture and channelisation (Environmental Protection Agency, 2022), with sediments, morphology and nutrients identified as among the significant issues in the Annies and Carrowkilleen<sup>ii</sup> streams (Environmental Protection Agency, 2024b). There are also concerns that changes in the charophyte flora and marl crusts may signal habitat degradation in Lough Carra (DeEyto *et al.*, 2024). The Lough Carra LIFE project (https://www.loughcarralife.ie/) is an EU funded project that is currently working with landowners and local community groups to improve water quality, to restore protected habitats and to raise awareness about protected species.

Six inflowing tributaries of Lough Carra were sampled by the NBTP, comprising a network with a total channel length of 64.32 km and draining a catchment of 91.53 km<sup>2</sup> (Map 2.2; Table 2.1):

- The Annies, the Carrowkilleen, the Brownstown and the Rocksborough to the east of the lake
- The Partry to the west of the lake
- The Ballintober and the Clogher to the northwest of the lake

<sup>&</sup>lt;sup>ii</sup> The Carrowkilleen comprises river waterbodies known as Aghinish and Cloondaver Stream (North) in WFD reporting.



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

Map Key	River Name	Site	Latitude	Longitude	Segment Code	WFD RWB Code
01	Annies	d/s in forestry in Towerhill Desmesne	53.72737	-9.19902	30_3362	WE_30A340980
02	Annies	u/s of Towerhill Desmesne road bridge	53.73264	-9.20723	30_3250	WE_30A340980
03	Annies	Mountpleasant	53.74786	-9.20362	30_69	WE_30A340980
04	Annies	d/s road bridge beside school	53.76055	-9.22626	30_2255	WE_30A340980
05	Annies	d/s of old mill in Clogher	53.76522	-9.22943	30_2255	WE_30A340980
06	Annies	d/s of landbridge/solar pump site	53.76726	-9.23108	30_2255	WE_30A340980
07	Carrowkilleen	u/s Carrowkilleen bridge	53.69434	-9.19652	30_3119	WE_30A030100
08	Carrowkilleen	u/s Mullingar Bridge	53.70403	-9.17502	30_3412	WE_30C090100
09	Carrowkilleen	O'Donnell's (u/s of landbridge)	53.70878	-9.16858	30_3412	WE_30C090100
10	Brownstown	u/s of Carr's Bridge	53.68687	-9.20311	30_3120	WE_30A030100
11	Rocksborough	midway to lake from school	53.67102	-9.22099	30_2302	WE_30A030100
12	Rocksborough	at road bridge beside national school	53.66404	-9.22388	30_2302	WE_30A030100
13	Partry	d/s road bridge & u/s of landbridge	53.70513	-9.27308	30_8888	WE_30A030100
14	Ballintober	u/s road bridge near Ballintober Abbey	53.75663	-9.28731	30_1994	WE_30A030100
15	Ballintober	d/s of bridge on main road in Ballintober	53.76168	-9.29151	30_1994	WE_30A030100
16	Ballintober	at landbridge just off main road in Ballintober	53.76259	-9.29158	30_8891	WE_30A030100
17	Clogher	d/s of landbridge	53.74009	-9.24795	30_8894	WE_30A030100

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

#### 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, which 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 a river site.

#### 4. Results

The NBTP implemented its five-minute TEF protocol targeting brown trout 0+ fry in 36 surveys at 17 sites on 7 tributary streams across the Lough Carra catchment across July & August in 2021, 2023 and 2024. The surveys recorded a total of 880 fish, comprised of 844 brown trout and 36 other fish from 5 other species. The brown trout comprised 660 fry aged 0+ and 184 trout aged 1+ & older.

#### 4.1 Trout Fry/5-Min

2023

2024

10

15

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<sup>iii</sup>. The number of sites sampled during the annual surveys decreased from 11 in 2021 to 10 in 2023 but increased to 15 in 2024 (Table 4.1), and the catchment-wide average fry count was highest in 2024 with 21.7 fry/5-min and lowest in 2023 with 14.9 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 a very high outlying value from a site on the Ballintober in 2024; however, there is overlap across the years despite variation around the catchment, with counts of between 4 to 23 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 Lough Carra catchment, 2021–2024.								
	Year	Sites	Trout 0+ fry:	Trout 0+ fry:	Trout 0+ fry:	Trout 0+ fry:		
	surveyed	sampled	total	site minimum	site maximum	mean per site		
	2021	11	184	1	57	16.7		

150

326

0

0

64

121

15

21.7



Figure 4.1: Boxplot of trout fry/5-min counts from Lough Carra surveys, 2021–2024: thick horizontal line is the median; top and bottom of the box representing the interquartile range (IQR) are 75<sup>th</sup> and 25<sup>th</sup> percentiles; vertical 'whiskers' are 1.5×IQR; jittered orange points show fry counts per survey.

<sup>&</sup>lt;sup>iii</sup> For fish other than 0+ fry, the unit is trout/5-min for 1+ & older brown trout and fish/5-min for other species.

The results show that mean trout 0+ fry/5-min numbers in each river varies considerably across years, with no apparent trends across the catchment from year to year. (Table 4.2; Figure 4.2). Mean fry/5-min counts decreased in 2023 compared with 2021 for the Annies, the Brownstown and the Ballintober, whereas they increased in the Carrowkilleen, the Rocksborough and the Partry. The fry counts in the Partry and the Ballintober were particularly variable with relatively large changes in fry/5-min counts from year to year.

The spatial pattern of trout 0+ fry (fry/5-min) and 1+ & older trout (fish/5-min) in surveys across the catchment over the period 2021–2024 is shown in Map 4.1.

Pivor	Sites			Mean 0+ fry/5-min			All years	
NIVEI	2021	2023	2024	2021	2023	2024	Mean	SD <sup>iv</sup>
Annies	3	2	5	18	3	16.2	14.1	13.3
Carrowkilleen	3	3	3	7.3	15.3	23.7	15.4	9.7
Brownstown	1	1	1	29	4	4	12.3	14.4
Rocksborough	1	1	2	8	12	0	5	6
Partry	1	1	1	1	64	17	27.3	32.7
Ballintober	2	2	2	35	9	61	35	46.9
Clogher	0	0	1	-	-	31	31	-

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



Figure 4.2: Changes in mean trout fry/5-min counts among Lough Carra streams, 2021–2024.

<sup>&</sup>lt;sup>iv</sup> SD = standard deviation.



Map 4.1: Spatial distribution of counts of trout 0+ fry/5-min and 1+ & older trout/5-min at survey sites on Lough Carra streams, 2021–2024. Map key: Annies (AS), Carrowkilleen (CN), Brownstown (BN), Rocksborough (RH), Partry (PY), Ballintober (BR), Clogher (CR).

#### 4.2 Trout Length Frequency

Fish were measured in length classes: for example, fish measuring  $\geq$ 5.0 cm and <6.0 cm are in the 5 cm length class. All brown trout and salmon 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 600 brown trout were measured in 2021–2024, comprising 467 0+ fry and 133 1+ & older trout. The median length of trout 0+ fry was similar across all years, with a median length of 6 cm overall (Figure 4.3).



Figure 4.3: Boxplot of brown trout length classes from Lough Carra 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 3–9 cm length classes, whereas the lengths of trout aged 1+ and older spanned the 9–21 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 trout recorded were in the 21 cm length class and were captured in the Annies and the Ballintober in 2024. Overall, trout from the Partry stream had a relatively low average length at 6.96 cm, as well as a maximum recorded length class of 9 cm (Table 4.3; Figure 4.4).

Table 4.3: Summary of length class (cm) data for brown trout in the Lough Carra catchment, 2021–2024.							
River	Median	Mean	SD	Minimum length	Maximum length		
Annies	7	7.97	3.61	4	21		
Carrowkilleen	7	8.39	3.15	4	19		
Brownstown	6	7.41	3.62	4	16		
Rocksborough	5	6.82	3.43	4	15		
Partry	7	6.96	0.91	4	9		
Ballintober	6	6.65	2.77	3	16		
Clogher	6	7.35	2.94	5	16		



Figure 4.4: Length frequency distribution of brown trout captured in the Lough Carra 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 dominated the fish community of the Lough Carra catchment streams. The other species recorded comprised, in order of decreasing abundance, three-spined stickleback, perch, lamprey, pike and European eel (Table 4.4). The Annies was the river with the greatest species richness, with 6 species recorded, whereas the Partry and the Clogher streams were the least diverse, with just brown trout present (Map 4.2).

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

Species	2021	2023	2024	Total
Brown trout	222	170	452	844
European eel	1	0	0	1
Lamprey	3	0	0	3
Perch	2	2	1	5
Pike	0	1	1	2
Three-spined stickleback	14	5	6	25



Map 4.2: Distribution of fish species recorded in the Lough Carra catchment, 2021–2024. Map key: Annies (AS), Carrowkilleen (CN), Brownstown (BN), Rocksborough (RH), Partry (PY), Ballintober (BR), Clogher (CR).

#### 5. Summary

The results for fry index counts indicate that the Ballintober (35 fry/5-min  $\pm$  46.9 SD) generally had higher numbers of trout, compared with other streams across the catchment, with a relatively high proportion of trout fry aged 0+ but with 1+ & older trout also present each year. The Partry (27.3 fry/5-min  $\pm$  32.7 SD) and the Clogher (31 fry/5-min) also had relatively higher fry index counts, but the Partry exhibited highly variable trout abundance from year to year, and only one year's data are available for the Clogher.

The Carrowkilleen 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 to target 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.

Fry index counts and length frequency distributions in other streams across the catchment were observed to change over the survey period from 2021 to 2024, with changing proportions of 0+ fry and of 1+ & older trout from year to year. This may indicate that there is a degree of instability in the trout population over time at these sites which may be linked to spawning success in a given or year or survivability of fry due to environmental factors.

The NBTP aims to continue surveying the Lough Carra catchment, together with the Lough Ennell catchment and the Clodiagh River catchment, annually building a robust time series for fry modelling at the catchment scale. The fry index data will enable modelling of juvenile habitat availability and expected fry densities in catchment streams, which will be 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: Annies: d/s in forestry in Towerhill Desmesne (see Map 2.2, site 01).



Figure 7.2: Annies: u/s of Towerhill Desmesne road bridge (see Map 2.2, site 02).



Figure 7.3: Annies: d/s road bridge beside school (see Map 2.2, site 03).



Figure 7.4: Annies: d/s of old mill in Clogher (see Map 2.2, site 04).



Figure 7.5: Annies: d/s of landbridge/solar pump site (see Map 2.2, site 05).



Figure 7.6: Annies: Mountpleasant (see Map 2.2, site 06).



Figure 7.7: Carrowkilleen: u/s Carrowkilleen bridge (see Map 2.2, site 07).



Figure 7.8: Carrowkilleen: u/s Mullingar Bridge (see Map 2.2, site 08).



Figure 7.9: Carrowkilleen: O'Donnell's (u/s of landbridge) (see Map 2.2, site 09).



Figure 7.10: Brownstown: u/s of Carr's Bridge (see Map 2.2, site 10).



Figure 7.11: Rocksborough: at road bridge beside national school (see Map 2.2, site 12).



Figure 7.12: Partry: d/s road bridge & u/s of landbridge (see Map 2.2, site 13).



Figure 7.13: Ballintober: u/s road bridge near Ballintober Abbey (see Map 2.2, site 14).



Figure 7.14: Ballintober: d/s of bridge on main road in Ballintober (see Map 2.2, site 15).



Figure 7.15: Ballintober: at landbridge just off main road in Ballintober (see Map 2.2, site 16).



Figure 7.16: Clogher: d/s of landbridge (see Map 2.2, site 17).

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