National Research Survey Programme

Lakes 2023

Lough Fern

IFI/2024/1-4726

Iascach Intíre Éireann
Inland Fisheries Ireland

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Fish Stock Survey of Lough Fern, July 2023

National Research Survey Programme

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

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1. Introduction

Lough Fern is located in the Leannan (Lennon) catchment, two kilometres south of Milford and ten kilometres north of Letterkenny, in Co. Donegal (Figure 1.1). The lake is situated at an altitude of 18.7m above sea level. It has a surface area of 181ha, a mean depth of 2m and a maximum depth of 3m. The lake is categorised as typology class 6 (as designated by the EPA for the Water Framework Directive), i.e. shallow (<4m), greater than 50ha and moderately alkaline (20-100mg/l $CaCO_3$). The geology of the area is predominantly schist and gneiss. It is a soft water lake that has been classified as mesotrophic (NPWS, 2015).

Lough Fern is located within the Leannan River Special Area of Conservation (SAC). The river has been designated as a SAC as it is home to a number of species listed on Annex II of the EU Habitats Directive. These species include the freshwater pearl mussel (*Margaritifera margaritifera*) and Atlantic salmon (*Salmo salar*).

Lough Fern was one of the great spring salmon lakes until its stocks were hit by ulcerative dermal necrosis (UDN) in the 1970s. The lake holds a good stock of brown trout (O' Reilly, 2007). The catchment continues to support a salmon fishery, and in 2024, was open for catch and release angling. In 2024 the first Irish rod caught salmon of the year was caught on the River Leannan.

The lake has been surveyed on six occasions since 2005 (2005, 2008, 2011, 2014, 2017 and 2020) (Kelly *et al*., 2007, 2009, 2012a, 2015, Connor *et al.,* 2018 and Corcoran *et al.,* 2021). Perch were first reported by the Milford and District Fly Angling Club in 2013 and were captured for the first time by IFI staff in the 2014 fish stock survey (Kelly *et al*., 2014). By 2020 perch were the most abundant species captured and also recorded the highest biomass. Brown trout, salmon, three spined stickleback and eel are also regularly captured during surveys on the lake.

This report summarises the results of the 2023 fish stock survey carried out on the lake using Inland Fisheries Ireland's fish in lakes monitoring protocol. The protocol is WFD compliant and provides insight into fish stock status in the lake.

Plate 1.1. Lough Fern (looking North - South), July 2023.

Plate 1.2. Lough Fern, July 2023

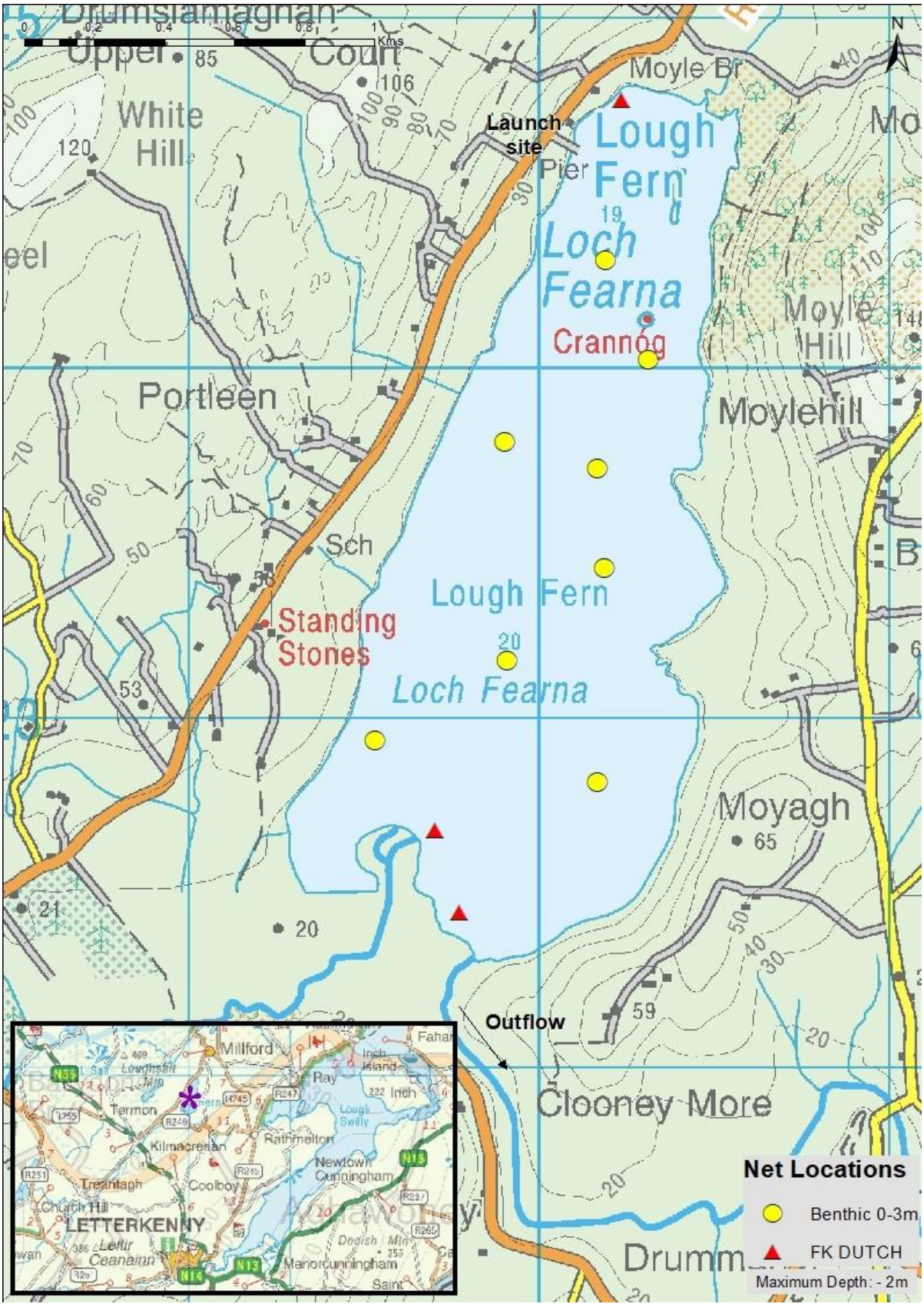

Figure 1.1. Location map of Lough Fern showing net locations and depths of each net (outflow is indicated on map).

2. Methods

2.1. Netting methods

Lough Fern was surveyed over one night from the 12th to the 13th of July 2023. A total of three sets of Dutch fyke nets and eight benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (8 @ 0-2.9m) were deployed in the lake (11 sites). Survey nets were deployed in the same locations as were randomly selected in the previous surveys. A handheld GPS was used to mark the precise location of each net. The angle of each gill net in relation to the shoreline was randomised.

All fish apart from perch were measured and weighed on site and scales were removed from a sub-sample of other species. Live fish were returned to the water whenever possible (i.e. when the likelihood of their survival was considered to be good). Samples of fish were retained for further analysis. Fish were frozen immediately after the survey and transported back to the IFI laboratory for later dissection.

2.2. Fish diet

Total stomach contents were inspected, and individual items were identified to the lowest taxonomic level possible. The percentage frequency occurrence (%FO) of prey items were then calculated to identify key prey items (Amundsen *et al.*, 1996).

$$\mathbf{FO}_i = \left(\frac{\boldsymbol{N_i}}{\boldsymbol{N}}\right) * \mathbf{100}$$

Where:
$\mathbf{FO}_i$ is the percentage frequency of prey item i,
$\boldsymbol{N_i}$ is the number of fish with prey i in their stomach,
$\boldsymbol{N}$ is total number of fish with stomach contents.

2.3. Biosecurity - disinfection and decontamination procedures

Procedures are required for disinfection of equipment to prevent dispersal of alien species and other organisms to uninfected waters. A standard operating procedure was compiled by Inland Fisheries Ireland for this purpose (Caffrey, 2010) and is followed by staff in IFI when moving between water bodies.

3. Results

3.1. Species Richness

Five fish species were recorded in Lough Fern in July 2023. A total of 394 fish were captured (Table 3.1). Perch was the most numerous fish species recorded, representing *c*. 81% of all fish captured. Brown trout were also captured in relatively large numbers, accounting for *c*. 17.5% of fish captured. Salmon (juvenile), three-spined stickleback and eels were recorded in smaller numbers. The same species composition has been recorded on the last three surveys of the lake in 2014, 2017 and 2020 (Kelly *et al.,* 2015, Connor *et al*., 2018 and Corcoran *et al.*, 2021).

Table 3.1. Number of each fish species captured by each gear type during the survey on Lough Fern July 2023.

Scientific name	Common name	Number of fish captured		
		BM CEN	Fyke	Total
Perca fluviatilis	Perch	311	7	318
Salmo trutta	Brown trout	64	5	69
Salmo salar	Salmon	2	0	2
Gasterosteus aculeatus	Three-spined stickleback	1	1	2
Anguilla anguilla	European eel	0	0	3

3.2. Fish abundance.

Fish abundance (mean CPUE) and biomass (mean BPUE) were calculated as the mean number/weight of fish caught per metre of net. For all fish species except eel, CPUE/BPUE is based on all nets, whereas eel CPUE/BPUE is based on fyke nets only. Perch was the dominant species with respect to both abundance (CPUE) and biomass in 2023 (BPUE) (Table 3.2).

Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Fern July 2023.

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Perca fluviatilis	Perch	0.953 (0.394)	43.341 (12.893)
Salmo trutta	Brown trout	0.202 (0.059)	19.712 (5.628)
Salmo salar	Salmon	0.006 (0.006)	0.129 (0.129)
Gasterosteus aculeatus	Three-spined stickleback	0.005 (0.003)	0.016 (0.012)
*Anguilla anguilla**	European eel	0.017 (0.017)	0.814 (0.814)

Note: Where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species (Connor et al., 2017). *Eel CPUE and BPUE based on fyke nets only.

3.3 Species Profiles

Perch

Perch captured during the 2023 survey ranged in length from 6.1cm to 27.1cm (mean = 12.1cm). The length range and proportions of various cohorts of perch has varied since they were first recorded in 2014. However, a common feature is the relative absence of fish between 10cm and 15cm, which may reflect length differences between juvenile and older perch. The proportion of juvenile, young of year (YOY) and fish larger than 20cm was smaller in 2023 compared to the 2020 survey (Figure 3.1). Perch were aged between 0+ and 4+. No one age class dominated, the sample aged although relative few 4+ (21cm – 26cm) fish were recorded (Figure 3.1). Mean L1 (i.e. length at the end of the 1st year) was 6.3cm (Table 3.3).

The perch population increased rapidly and dramatically between 2014 and 2020, but abundance (CPUE) and biomass (BPUE) now appear to have stabilised as indicated by the decline in 2023 (Figure 3.2).

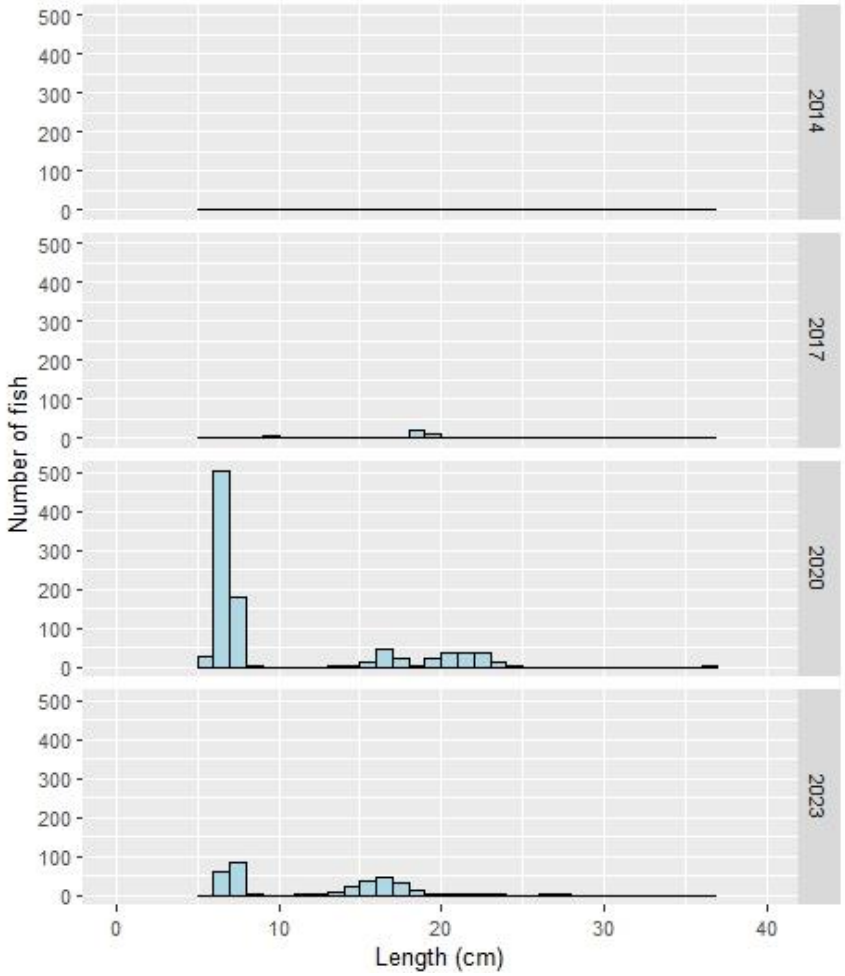

Figure 3.1. Length frequency of perch captured on Lough Fern between 2014 and 2023 (no perch captured in earlier surveys).

Table 3.3. Mean (±S.E.) perch length (cm) at age for Lough Fern, July 2023

	L_1	L_2	L_3	L_4
Mean (±S.E.)	6.3 (0.21)	12.0 (0.32)	17.5 (0.69)	21.5 (1.12)
N	43	31	15	4
Range	4.2-10.1	9.3-17.9	14.1-22.0	20.0-24.8

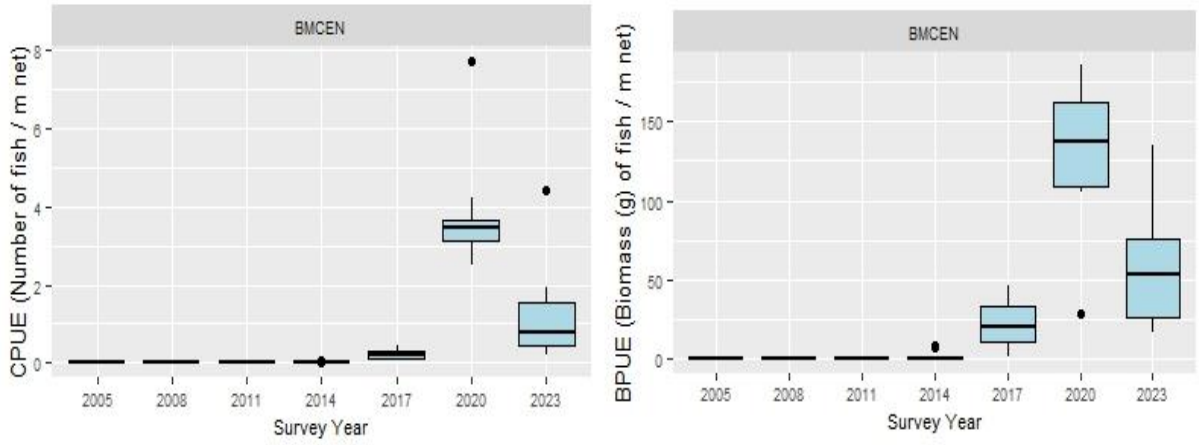

Figure 3.2. CPUE and BPUE of perch captured during surveys of Lough Fern between 2005 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

Plate 3.1 Fyke netting on Lough Fern, July 2023.

Brown trout

Brown trout captured during the 2023 survey ranged in length from 14.1cm to 29.3cm (mean 19.1cm). In 2023 brown trout captured had a more restricted length range compared to earlier surveys, with a lesser proportion of both smaller and larger fish recorded (Figure 3.3). Brown trout were aged between 1+ and 3+ in the sample aged. Two year old fish (16cm – 25cm) were the most abundant year class recorded (Figure 3.3). Mean L1 (i.e. length at the end of the 1st year) was 6.6cm (Table 3.4).

The abundance (CPUE) and biomass (BPUE) of brown trout was lower in 2020 and 2023 compared to previous surveys (Figure 3.4).

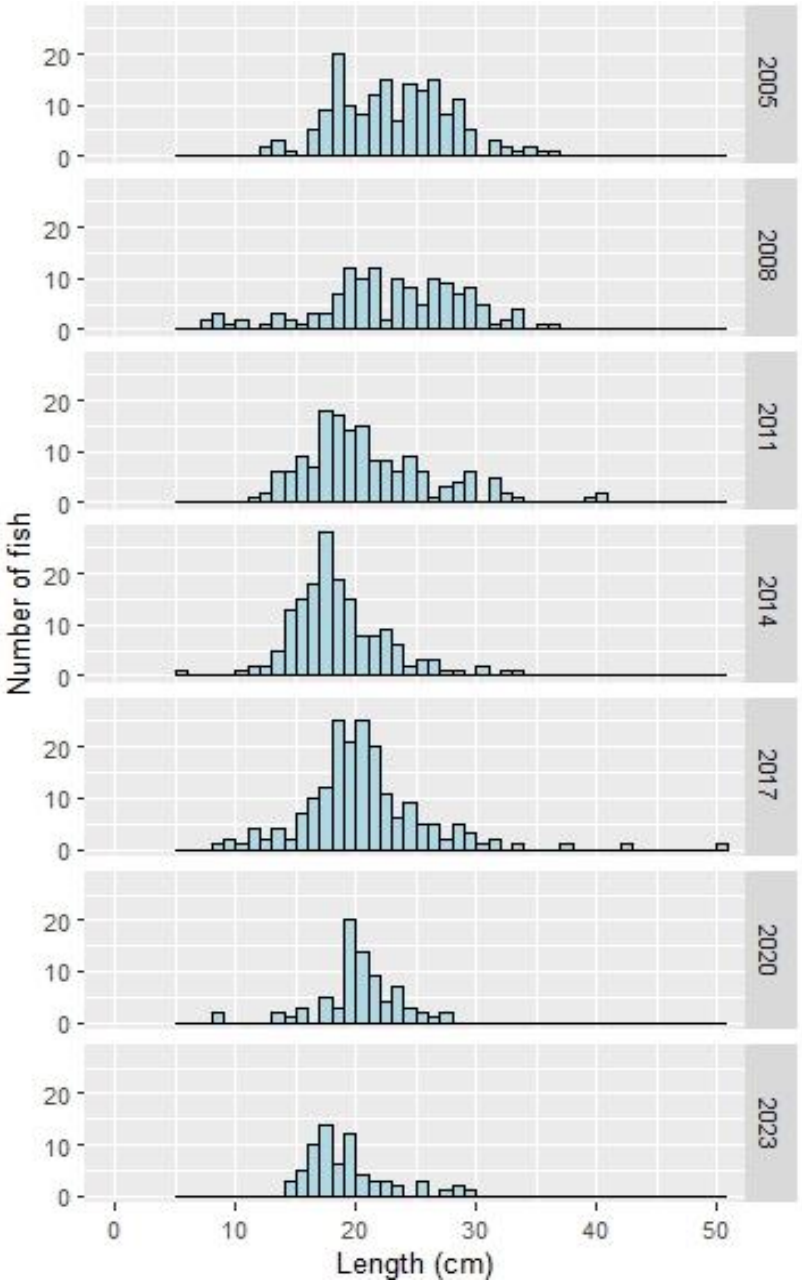

Figure 3.3. Length frequency of brown trout captured on Lough Fern between 2005 and 2023.

Table 3.4. Mean (±S.E.) brown trout length (cm) at age for Lough Fern, July 2023.

	L_1	L_2	L_3
Mean (±S.E.)	6.6 (0.07)	14.4 (0.10)	21.9 (0.39)
N	48	37	5
Range	5.5-7.6	13.1-16.8	20.8-23.2

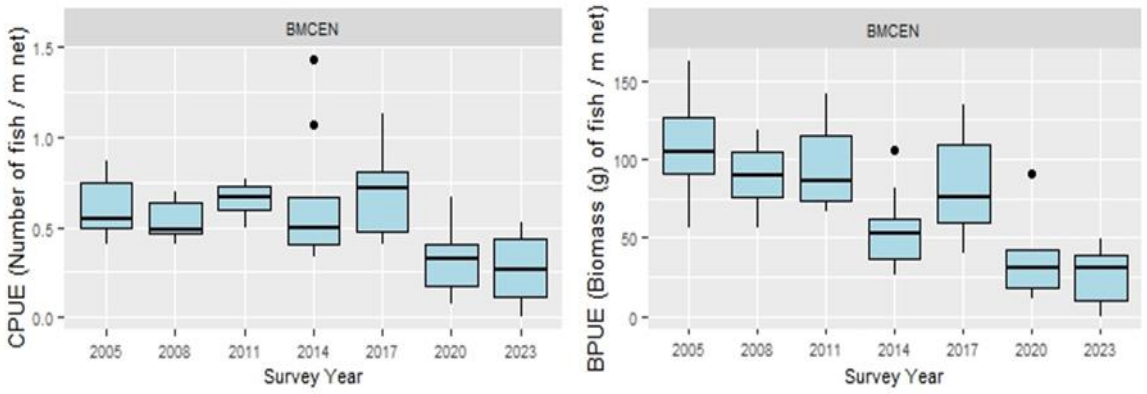

Figure 3.4. CPUE and BPUE of brown trout captured during surveys of Lough Fern between 2005 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

<u>European eel</u>

European eel captured in the 2023 survey ranged from 29.5cm to 37.8cm (mean = 32.8cm) (Figure 3.6). Eel CPUE and BPUE have fluctuated and were lower in 2023 than previous surveys (Figure 3.5).

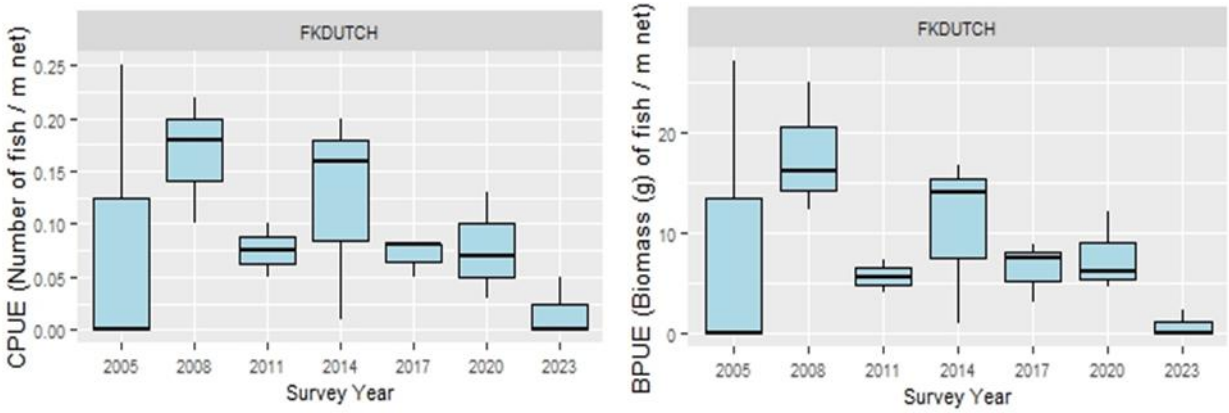

Figure 3.5. CPUE and BPUE of European eel captured during surveys of Lough Fern between 2005 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range.

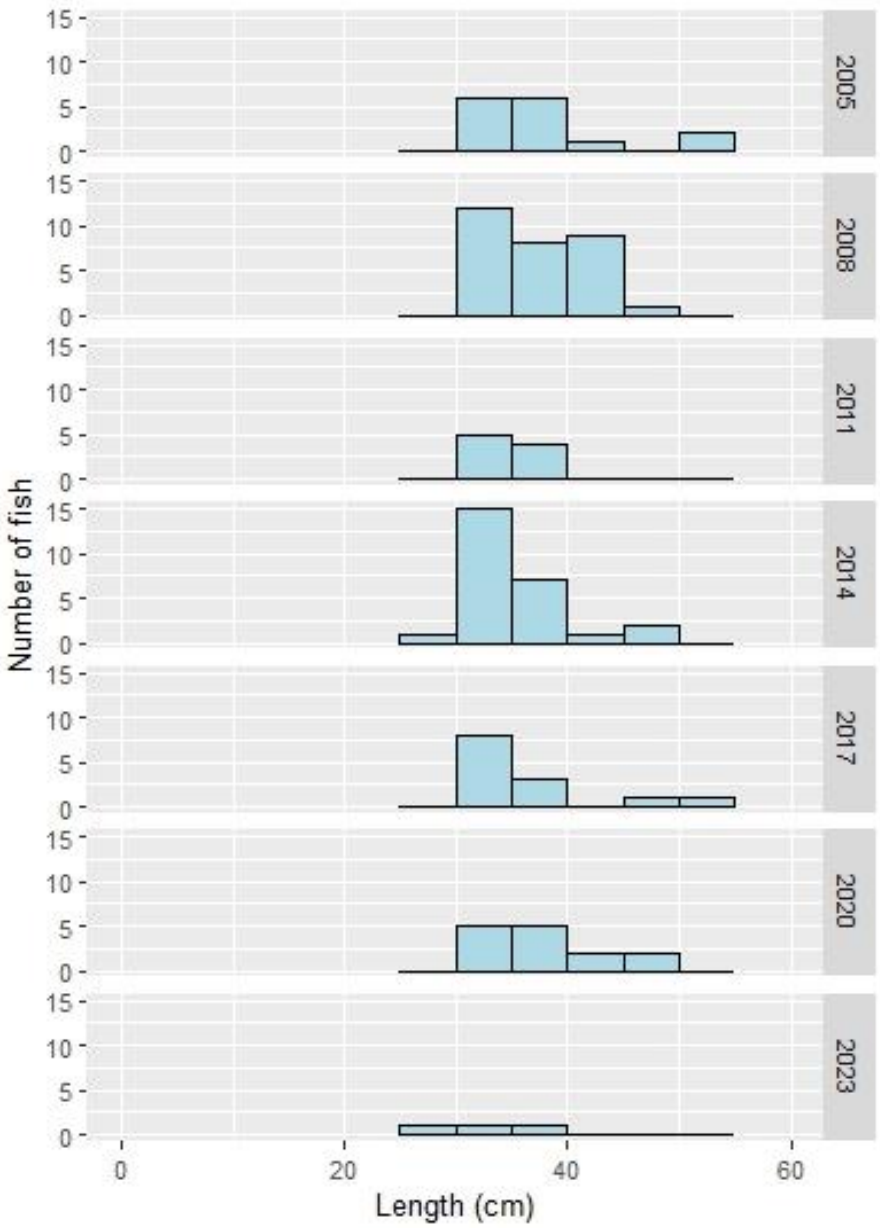

Figure 3.6. Length frequency of European eel captured on Lough Fern between 2005 and 2023

Other species

Two juvenile salmon were captured. They measured 11.0cm and 11.9cm and were age 1+. Two three-spined stickleback were also captured and measured 6.2cm and 6.7cm.

3.4. Stomach and diet analysis

The dietary analysis conducted provides insight to the prey of examined fish immediately prior to capture. Longer term and seasonal studies provide a more robust assessment of fish diet. The stomach contents of a subsample of brown trout and perch captured during the survey were examined and are presented below.

Perch

A total of 60 perch stomachs were examined. Twenty-five (41.7%) were empty. Thirty-five stomachs contained food. Zooplankton was the sole prey type recorded in 20 (57%) stomachs and was found together with invertebrates in one (3%) stomach. Invertebrates were the sole prey type recorded in 10 (29%) stomachs. Fish was found to be the sole prey item in four (11%) perch stomachs (Figure 3.7).

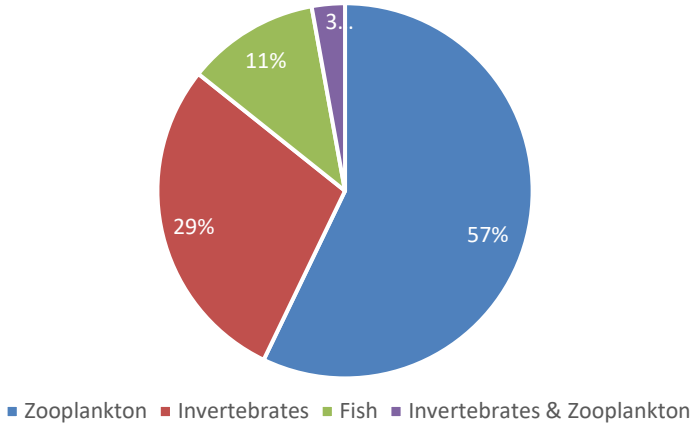

Figure 3.7. Diet of perch (N = 35) captured on Lough Fern, July 2023 (% FO).

Brown trout

A total of 53 brown trout stomachs were examined. Five (9.4%) were empty. Forty-eight stomachs contained food. Invertebrates were the sole prey type recorded in 33 (69%) fish. Zooplankton was the sole prey type recorded in six (12.5%) brown trout stomachs and was recorded with invertebrates in six (12.5%) stomachs. Plant matter (recorded together with other food types) was found in a total of three (6 %) stomachs (Figure 3.8).

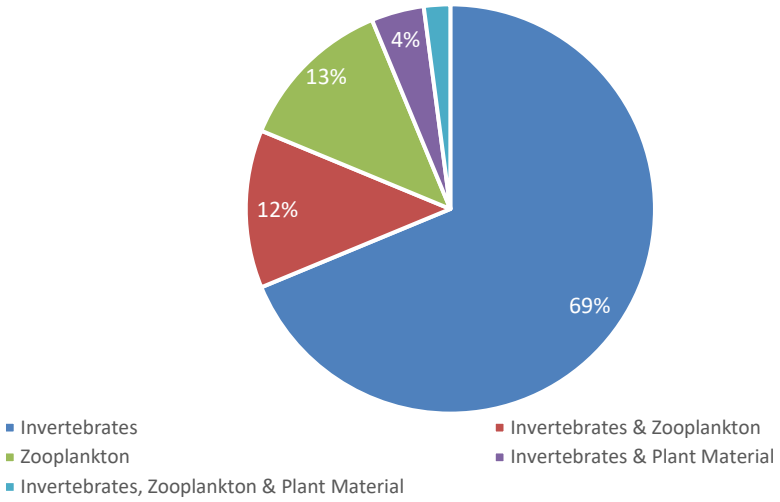

Figure 387. Diet of brown trout (N = 48) captured on Lough Fern, July 2023 (% FO).

4. Summary and fish ecological status

A total of five fish species were recorded in Lough Fern in July 2023. Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2023 survey. First reported in 2013 and recorded in IFI surveys in 2014, the perch population quickly expanded and has dominated fish stocks in both the 2020 and 2023 surveys. This initial population expansion may have stabilised and recruitment now appears to be regular. The population is dominated by younger and smaller individuals and few fish greater than 20cm were recorded in 2023.

Brown trout continue to recruit to the lake. However, both the abundance and biomass recorded in the latter two surveys in 2020 and 2023 are lower than those recorded between 2005 and 2017.

Classification and assigning lakes with an ecological status is a critical part of the WFD monitoring programme. It allows for the identification and prioritisation of lakes that currently fall short of the minimum "Good Ecological Status" that is required if Ireland is not to incur penalties. A multimetric fish ecological classification tool (Fish in Lakes – 'FIL') was developed for the island of Ireland (Ecoregion 17) using IFI and Agri-Food and Biosciences Institute Northern Ireland (AFBINI) data generated during the NSSHARE Fish in Lakes project (Kelly *et al.*, 2008). This tool was further developed during 2010 (FIL2) in order to make it fully WFD compliant, including producing EQR (Ecological Quality Ratio) values for each lake and associated confidence in classification (Kelly *et al.*, 2012b).

Using the FIL2 classification tool, Lough Fern has been assigned an ecological status of Poor for 2023 based on the fish populations present. Fish ecological classification for the lake between 2005 and 2023 is presented in Figure 4.1.

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Lough Fern an overall ecological status of Bad, based on all monitored physio-chemical and biological elements, including fish (EPA 2021).

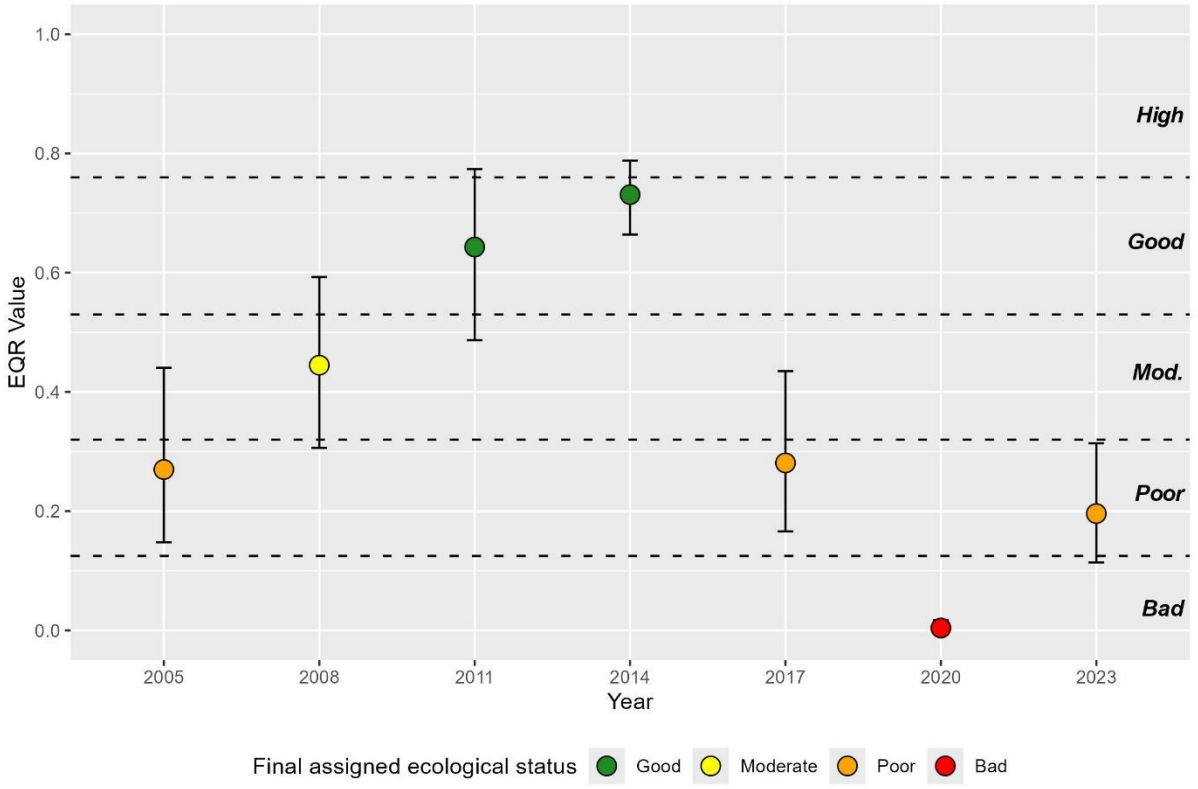

Figure 4.1. Fish ecological status, Lough Fern between 2005 and 2023 (dashed line indicates EQR status boundaries).

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Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.
D24 CK66

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600