National Research Survey Programme

Lakes 2022

Lough Lene

IFI/2023/1-4663

Iascach Intíre Éireann
Inland Fisheries Ireland

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Fish Stock Survey of Lough Lene, October 2023

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Cover photo: Lough Lene, Co. Westmeath © Inland Fisheries Ireland

ACKNOWLEDGEMENTS

1.   Introduction

Lough Lene is a limestone lake, situated in the Upper Boyne catchment in Co. Westmeath (Plate 1.1, Figure 1.1). It is located approximately 1km north of Collinstown and 4km north-east of Castlepollard. The lake has a surface area of 416.5ha, a mean depth >4m, a maximum depth of 20m and falls into typology class 8 (as designated by the EPA for the Water Framework Directive), i.e., deep (>4m), greater than 50ha and moderately alkaline (20-100mg/l $CaCO_3$).

Lough Lene is a clear, hard-water lake with areas of marl deposits. The lake supports a range of pondweed species (NPWS, 2013). A variety of stoneworts, indicators of marl or hard water lakes, are also present. Areas of woodland found along the shore include willows (*Salix* spp.), birch (*Betula* sp.) and alder (*Alnus glutinosa*) (NPWS, 2013). Bird species found along the shores of Lough Lene include mute swan (*Cygnus olor*), teal (*Anas crecca*), pochard (*Aythya ferina*), great-crested grebe (*Podiceps cristatus*), little grebe (*Tachybaptus ruficollis*), tufted duck (*Aythya fuligula*), grey heron (*Ardea cinerea*), water rail (*Rallus aquaticus*), mallard (*Anas platyrhynchos*), golden eye (*Bucephala clangula*), cormorant (*Phalacrocorax carbo*) and wigeon (*Anas penelope*) (NPWS, 2013).

The lake largely forms the Lough Lene SAC and qualifying interests include hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. and white clawed crayfish (*Austropotamobius pallipes*) (NPWS, 2021). In 1986 the white clawed crayfish was declared extinct from the lake due to an infestation of the fungal plague, *Aphanomyces astaci* (NPWS, 2013). Crayfish were reintroduced following their eradication; however, the plague reoccurred, leading to a second extinction (NPWS, 2013). While the current status is unclear (NPWS 2021) crayfish were observed during a fish stock survey of the lake in 2016 (IFI unpublished data)

The lake is stocked several times annually by the Lough Lene Anglers Association with both brown and rainbow trout of catchable size (*c*. 40cm and larger) and it is a popular boat angling fishery.

Lough Lene was previously surveyed in 2007, 2010, 2013 and 2016 as part of the WFD surveillance monitoring programme (Kelly and Connor, 2007 and Kelly *et al*., 2011, 2014 and 2017). Perch were found to be the dominant species present in the lake in all previous surveys.

This report summarises the results of the 2022 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.

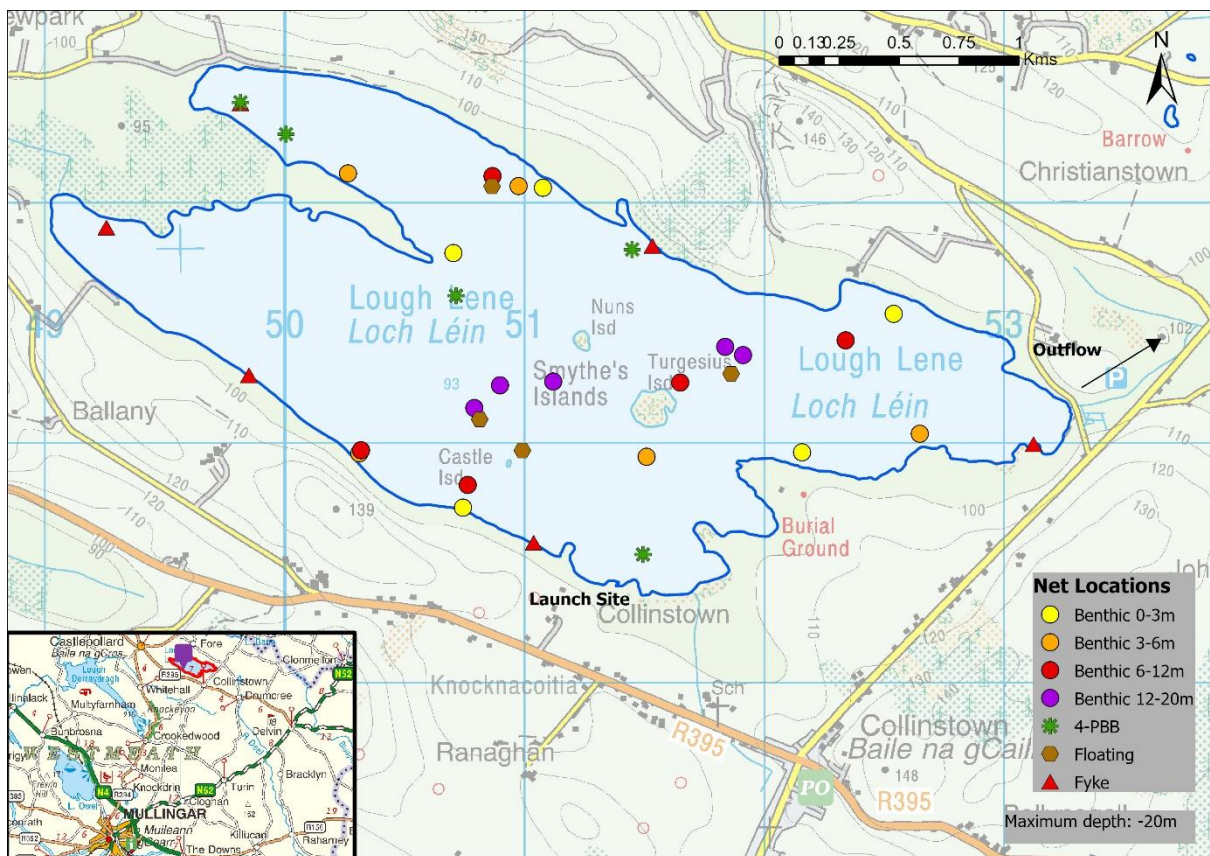**Plate 1.1. Lough Lene, October 2022.**

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

2. Methods

2.1. Netting methods

Lough Lene was surveyed over two nights from the 3rd to the 5th of October 2022. A total of six sets of Dutch fyke nets, 20 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (5 @ 0-2.9m, 5 @ 3-5.9m, 5 @ 6-11.9m and 5 @ 12-19.9m) and four floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (30 sites). The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at four additional sites. The four-panel survey gill nets are composed of four 27.5m long panels each a different mesh size (55mm, 60mm, 70mm and 90mm knot to knot). These survey nets were deployed in random locations throughout the lake. A handheld GPS was used to locate 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 except eels. 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).

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

Where:
 $\textbf{FO}_i$ is the percentage frequency of prey item i,
 N_i is the number of fish with prey i in their stomach,
 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

Seven fish species were recorded on Lough Lene in October 2022. A total of 1226 fish were captured (Table 3.1). Perch was the most common fish species recorded, representing 90% of all fish captured in the 2022 survey. Tench, rainbow trout, roach, three-spine stickleback, brown trout (stocked) and eels were also recorded (Table 3.1). A similar species composition was recorded in previous surveys with some exceptions; three-spined stickleback were not captured in the 2013 survey and eel were not recorded in 2007. Wild brown trout were recorded in 2013 and 2016. Roach were first recorded in the 2016 survey (Kelly and Connor, 2007 and Kelly *et al*., 2011, 2014 and 2017).

Table 3.1. Number of each fish species captured by each gear type during the survey on Lough Lene, 2022.

Scientific name	Common name	Number of fish captured				
		BM CEN	FM CEN	4-PBB	Fyke	Total
Perca fluviatilis	Perch	1102	0	0	3	1105
Tinca tinca	Tench	13	0	38	10	61
Oncorhynchus mykiss	Rainbow trout (stocked)	11	2	10	0	23
Rutilus rutilus	Roach	16	0	4	0	20
Gasterosteus aculeatus	Three-spined stickleback	11	0	0	1	12
Salmo trutta	Brown trout (stocked)	2	1	1	0	4
Anguilla anguilla	European eel	0	0	0	1	1

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. In 2022, perch was the dominant species captured in terms of both abundance (mean CPUE) and biomass (mean BPUE). Relatively high biomasses of tench and stocked rainbow trout were also captured (Table 3.2).

For comparison purposes box plots of CPUE and BPUE for each species captured in all surveys per net type between 2009 and 2021 are presented in Figures 3.1a to 3.2b and illustrates fish community change over time. Perch have been the most abundant species captured in all surveys of the lake conducted since 2007 and populations have remained relatively stable over that time. No obvious

trends are apparent in the less abundant species, although tench have become more prominent in the surveys in recent years and the median CPUE or roach has increased (Figure 3.2 a and b).

Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Lene, 2022

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Perca fluviatilis	Perch	1.051 (0.255)	32.051 (8.211)
Tinca tinca	Tench	0.027 (0.007)	28.293 (8.834)
Rutilus rutilus	Roach	0.016 (0.010)	3.134 (2.152)
Oncorhynchus mykiss	Rainbow trout (stocked)	0.015 (0.004)	16.729 (4.932)
Gasterosteus aculeatus	Three-spined stickleback	0.011 (0.008)	0.021 (0.015)
Salmo trutta	Brown trout (stocked)	0.003 (0.002)	2.948 (1.530)
Anguilla anguilla	European eel	0.003 (0.003)*	0.484 (0.484)*

*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*
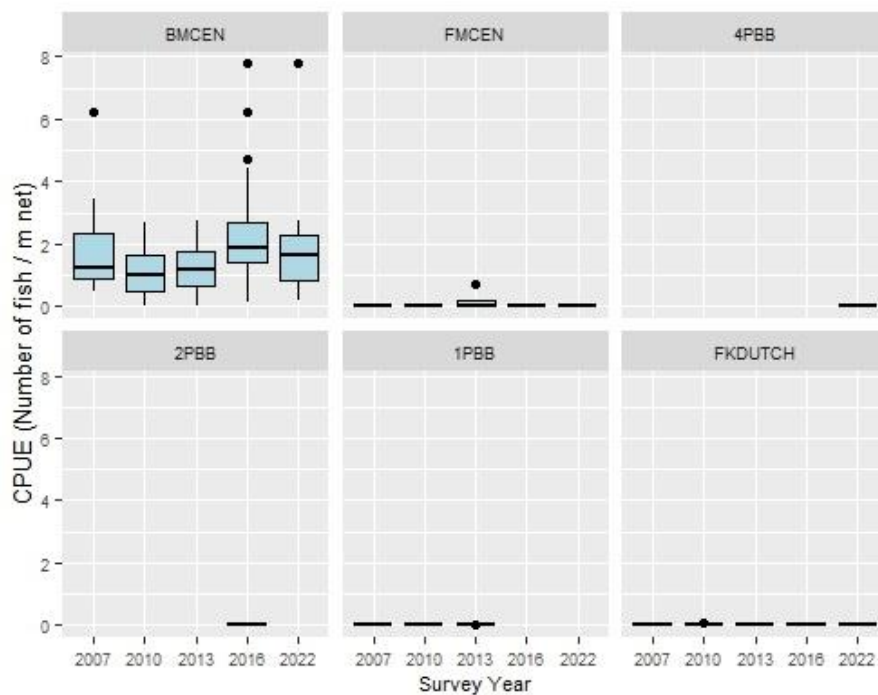

Figure 3.1a. CPUE of perch captured in each net type during surveys of Lough Lene between 2007 and 2022. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.
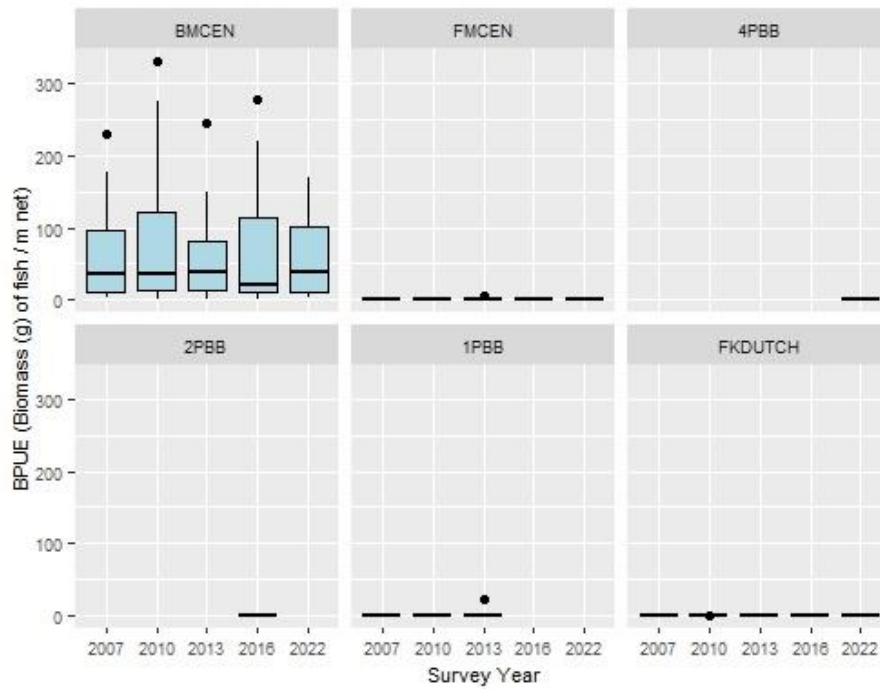
Figure 3.1b. BPUE of perch captured in each net type during surveys of Lough Lene between 2007 and 2022. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.
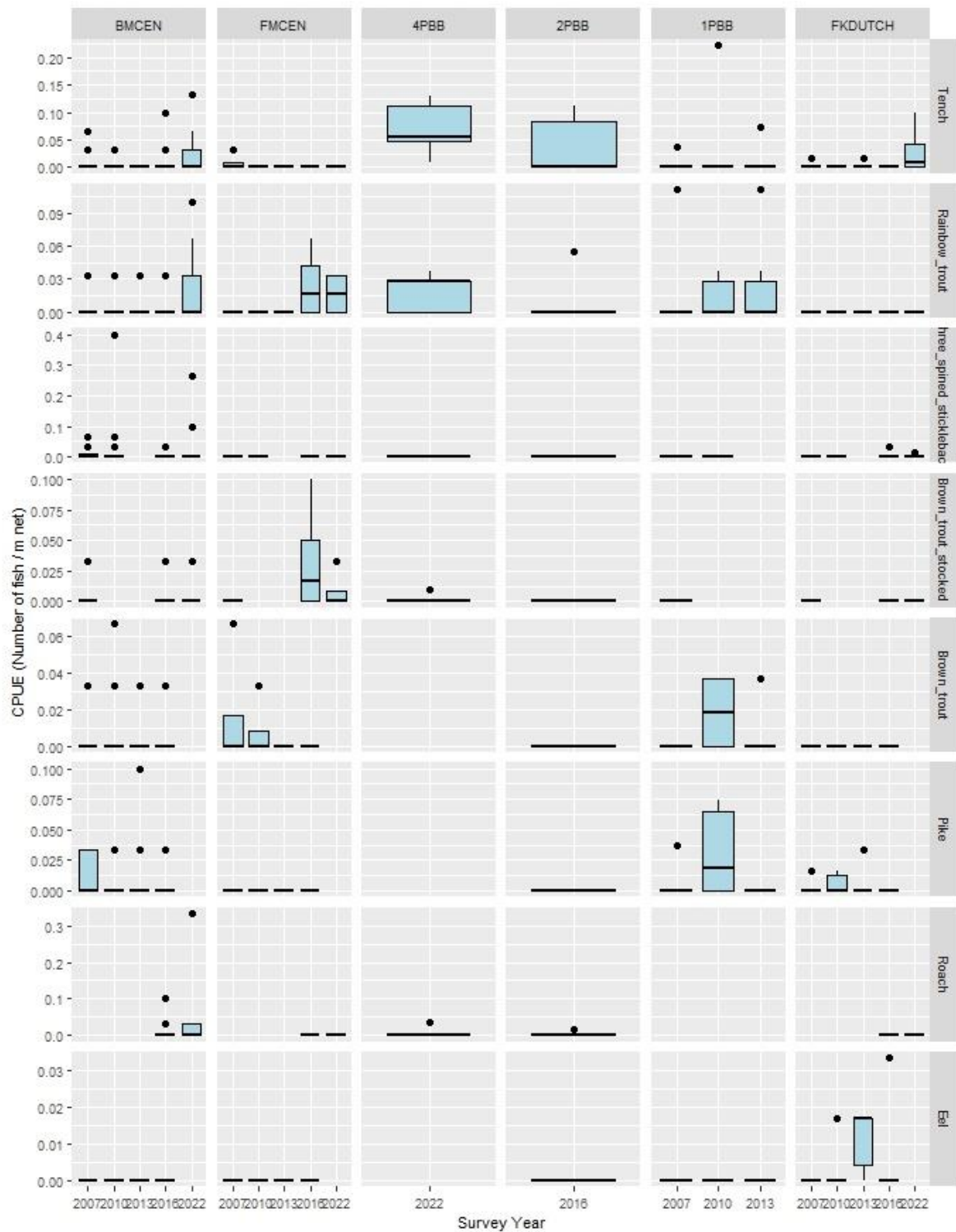
Figure 3.2a. CPUE of other fish species captured in each net type during surveys of Lough Lene between 2007 and 2022. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots. The y axis (CPUE) is unique for each species.

Figure 3.2b. BPUE of other fish species in each net type during surveys of Lough Lene between 2007 and 2022. Figures are expressed as biomass (g) 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. The y axis (BPUE) is unique for each species.

3.3. Length frequency distributions and growth

Perch

Perch captured during the 2022 survey ranged in length from 5.0cm to 30.3cm (mean 10.1cm). The length range was similar across all surveys. While the population was dominated by smaller fish in 2022 as it was in other previous surveys, the relative proportions of size classes has varied (Figure 3.3). Perch were aged between 0+ to 9+ and all year classes (with the exception of 8+) were represented. Approximately 88% of all fish aged were between 1+ and 5+ (*c.* 5cm – 27cm) (Figure 3.3). Six to 8cm fish were the most abundant size class, corresponding to 1 year old fish (Figure 3.3). Mean L1 (i.e. age at the end of the 1st year) was 6.6cm (Table 3.3).
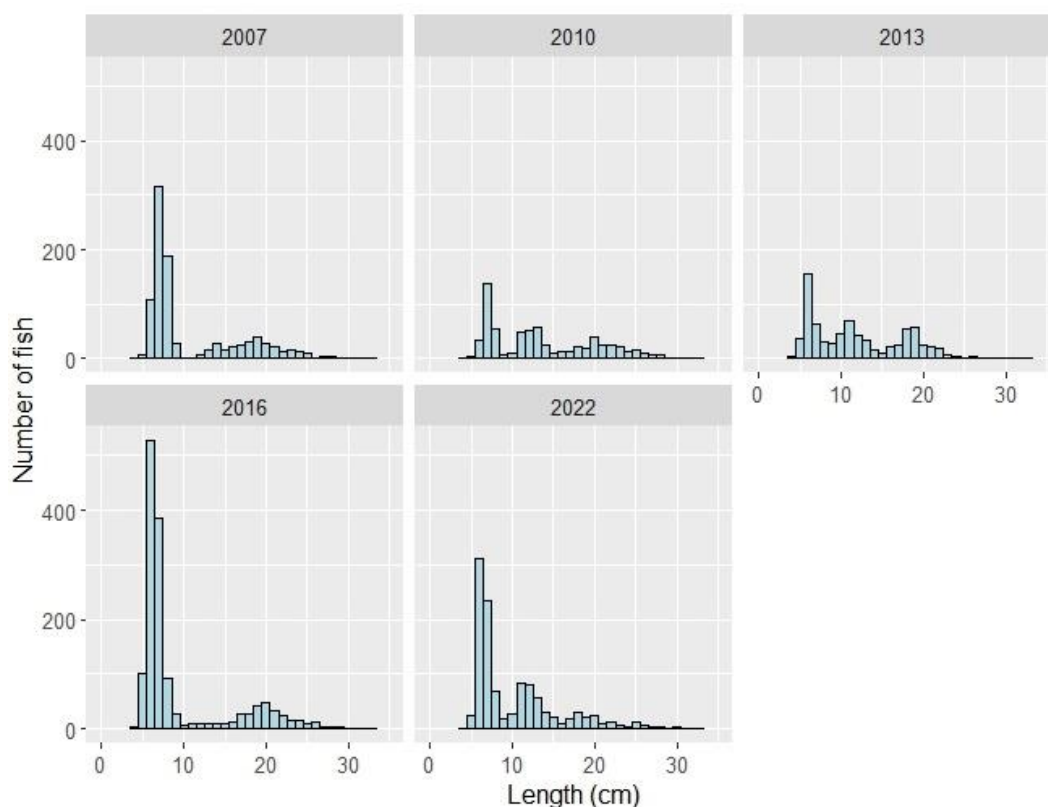

Figure 3.3. Length frequency of perch captured on Lough Lene, 2010, 2013, 2016 and 2022.

Table 3.3. Mean (±S.E.) perch length (cm) at age for Lough Lene, October 2022

Length (cm)	L$_1$	L$_2$	L$_3$	L$_4$	L$_5$	L$_6$	L$_7$	L$_8$	L$_9$
Mean	6.6	11.0	14.9	18.1	20.8	23.3	24.0	-	-
(±S.E.)	0.1	0.2	0.3	0.4	0.5	0.7	0.9	-	-
N	96	83	67	41	29	12	3	1	1
Min	4.6	7.0	9.7	11.4	12.8	19.9	22.4	23.5	24.7
Max	10.9	18.0	20.7	23.7	25.7	27.3	25.4	23.5	24.7

Tench

Tench ranged in length from 22.5cm to 54.4cm (mean 38.3cm) (Figure 3.4).
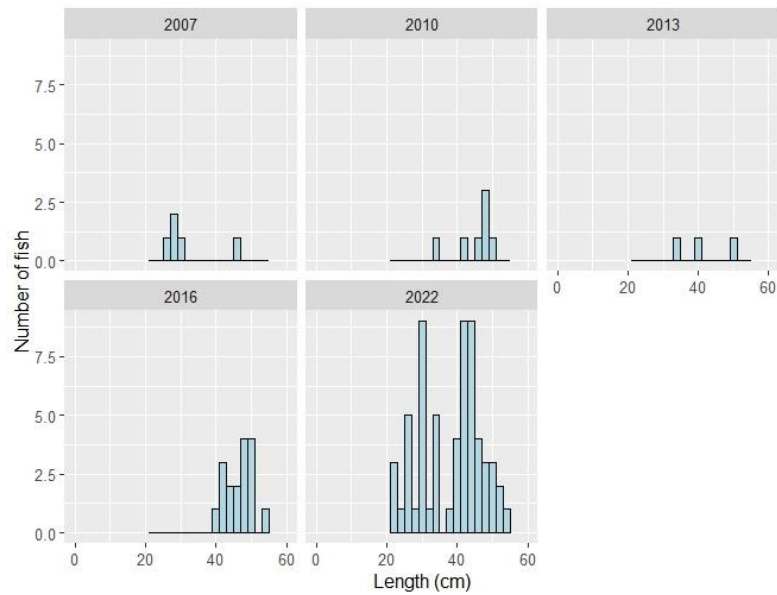

 Figure 3.4. Length frequency of tench captured on Lough Lene in 2007, 2010, 2013, 2016 and 2022.

Roach

Roach recorded in the 2022 survey ranged in length from 5.3cm to 32.6cm (mean 21.7cm) (Figure 3.5). Roach were aged between 1+ and 9+, with several missing year classes. The population was dominated by older (and larger fish) with 80% of the fish aged 5+ and older.
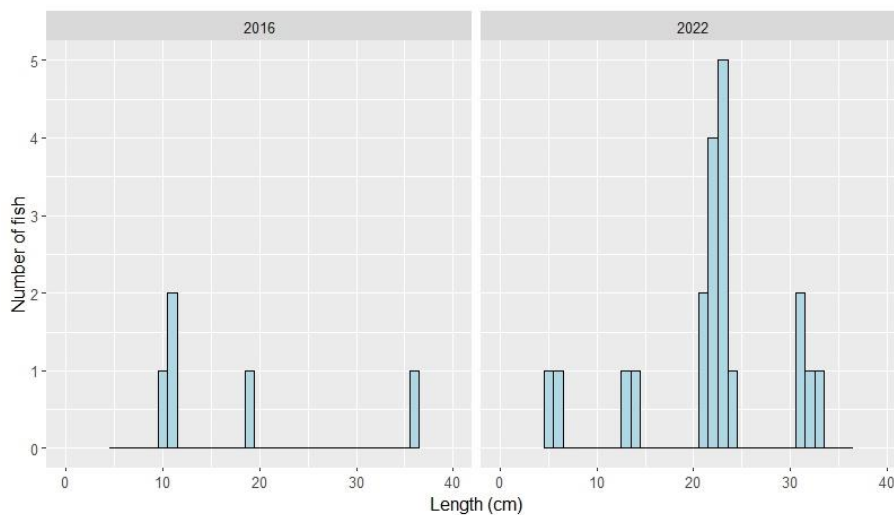

Figure 3.5. Length frequency of roach captured on Lough Lene in 2016 and 2022. Roach were first recorded in 2016.

Other species

Rainbow trout ranged in length from 38.8cm to 58.4cm (mean 46.2cm) and brown trout ranged in length from 41.2cm to 46.5cm (mean 43.6cm). One eel was captured and measured 48.0cm in length. Three-spined stickleback ranged in length from 3.3cm to 4.2cm (mean = 3.9cm).

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 perch, rainbow trout and brown trout captured during the survey were examined and are presented below.

Perch

A total of 80 perch stomachs were examined. Sixty one were empty. Ninetee perch stomachs contained food. Unidentified digested material was found in 15 (79%) stomachs. Three (16%) stomachs contained invertebrates. Fish remains was recorded in one (5%) stomach (Figure 3.6).
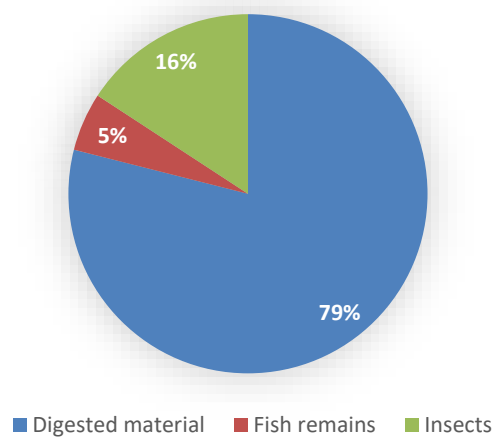

Figure 3.6. Diet of perch (N = 19) captured on Lough Lene, 2022 (% FO).

Other species

The stomach contents of two brown trout were examined. One sample was empty, and one contained fish and invertebrates. The stomach contents of five rainbow trout were also analysed. Two were empty and the remaining three stomachs contained invertebrates.

4. Summary and fish ecological status

Seven fish species were recorded on Lough Lene in October 2022.

Perch were the dominant species in terms of abundance and biomass in Lough Lene in 2022. This species has dominated fish stocks with respect to both abundance and biomass across all surveys of the lake since 2007. Recruitment appears to be strong and regular and the population is dominated by smaller and younger fish, but with several strong year classes apparent.

Tench was the second most abundant species in Lough Lene and biomass was comparable to that recorded for perch. Tench abundance has increased in Lough Lene, with numbers captured and associated CPUE and BPUE both increasing markedly since the 2007 survey.

Roach were first recorded in the lake in the 2016 survey, when five fish measuring between 10cm and 35.7cm were captured. This species is invasive in Ireland (Stoke *et al.*, 2004), is listed as a non-native species subject to restrictions under Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 [SI. 477] and populations can rapidly expand in newly colonised lakes. In the current survey, 20 roach were captured. They measured between 5.3cm and 32.6cm and were aged from 1+ to 9+. Several year classes were absent from the sample and the population was dominated by older fish. However, the presence of smaller juveniles indicates that some spawning, though possibly limited recruitment, is now occurring in the lake.

No wild brown trout were recorded in the Lough Lene survey in October 2022. Salmonid stocks are augmented regularly with introductions of non-native rainbow trout and stocked brown trout.

Classification and assigning lakes with an ecological status is a critical part of the WFD monitoring programme. It allows River Basin District managers to identify and prioritise 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 values for each lake and associated confidence in classification (Kelly *et al.*, 2012).

Using the FIL2 classification tool, Lough Lene has been assigned an ecological status of Poor for 2022 based on the fish populations present. In the most recent survey (2016) Lough Lene was assigned a status of Moderate. This deterioration is likely due to the absence of key water quality indicator

species, such as wild brown trout and an increase in total biomass (Corcoran *et al.*, 2023). In previous surveys Lough Lene was assigned Good status in 2007 and 2013, and Bad status in 2010 (Figure 4.1).

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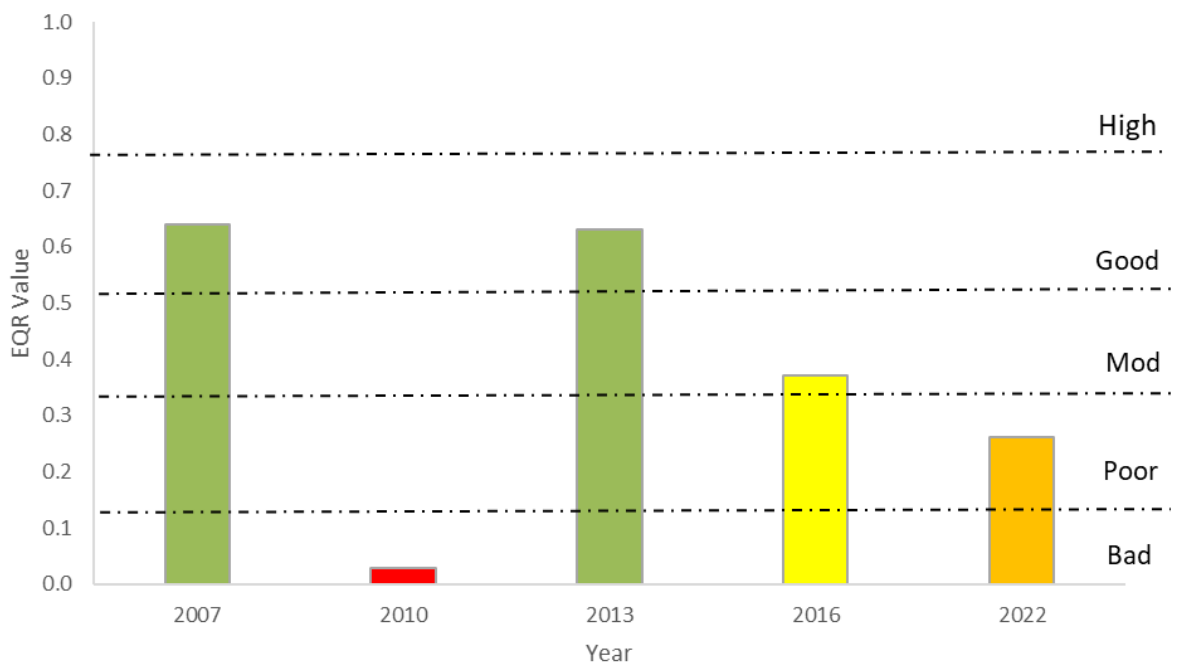

Figure 4.1. Fish ecological status, Lough Lene in 2007, 2010, 2013, 2016 and 2022 (dashed line indicates EQR status boundaries).

5.   References

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