

National Research Survey Programme

Lakes 2022

Lough Conn

IFI/2023/1-4657



Iascach Iníre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Lough Conn, September 2022



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Inland Fisheries Ireland**

National Research Survey Programme

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CITATION: McLoone, P., Corcoran, W., Bateman, A., Cierpial, D., Gavin, A., Gordon, P., McCarthy, E., Heagney, B., Hyland, J., Robson, S., Kelly, K., and Kelly, F.L. (2023). Fish Stock Survey of Lough Conn, August & September 2022. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

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ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of all their colleagues in Inland Fisheries Ireland.

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Climate Action and Environment for 2022.

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1. Introduction

Lough Conn is located in the Moy catchment in north County Mayo (Plate 1.1, Figure 1.1). The lake is connected to its immediate neighbour to the south, Lough Cullin, by a narrow channel that passes under a regional road at Pontoon village (Figure 1.1). The River Deel flows into Lough Conn and exits Lough Cullin at its southern end near Foxford, just before joining the River Moy which discharges into the Atlantic at Killala Bay. The lake has a surface area of 4,704ha and a maximum depth of 37.9m. The lake is categorised as typology class 12 (as designated by the EPA for the Water Framework Directive), i.e., deep (mean depth >4m), greater than 50ha and high alkalinity (>100 mg/l CaCO₃).

Lough Conn is part of a Special Protection Area (SPA) (Site code: 004228) under the E.U. Birds Directive. The SPA is of special conservation interest for the following species: Greenland White-fronted Goose (*Anser albifrons*), Tufted Duck (*Aythya fuligula*), Common Scoter (*Melanitta nigra*) and Common Gull (*Larus canus*). The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA; the site, and its associated water birds, are of special conservation interest (NPWS, 2014).

Lough Conn's reputation as a fine brown trout (*Salmo trutta*) and salmon (*Salmo salar*) fishery goes back to the very beginning of angling in the west of Ireland (O' Reilly, 1998). The main run of spring salmon enters Lough Conn from the end of March and continues right through to April. The grilse run begins in May and continues into July (IFI, 2016).

The lake was surveyed by Inland Fisheries Ireland (IFI) on eight occasions between 1978 and 2013 (1978, 1984, 1990, 1994, 1998, 2001, 2005 and 2013) as part of a brown trout fish stock assessment programme (O' Grady and Delanty, 2001; Delanty and O'Grady, 2014). The lake was also surveyed in 2016 as part of the Water Framework Directive (WFD) surveillance programme (Kelly *et al.*, 2017). Brown trout, rudd (*Scardinius erythrophthalmus*), roach (*Rutilus rutilus*), perch (*Perca fluviatilis*), European eel (*Anguilla anguilla*) and pike (*Esox lucius*) were captured in the surveys. Historically the lake held a population of Arctic char (*Salvelinus alpinus*); however, they have been extinct for some time. Following the apparent collapse of the Arctic char population, IFI surveyed the spawning areas where Arctic char, if present, would be congregating to spawn during the Arctic char spawning seasons of 1991 to 1994. Three Arctic char were captured in the 1991 sampling, one fish in 1992 and none thereafter in 1993 or 1994. An examination of pike stomachs from fish captured in various parts of Lough Conn, throughout the 1990s, found no Arctic char (Igoe, *et al.*, 2000). It is therefore reasonable to assume that Arctic char had become extinct in Lough Conn by the mid-1990s.

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 Conn (photo taken from the launch site at Brackwansha, looking west towards Nepin.

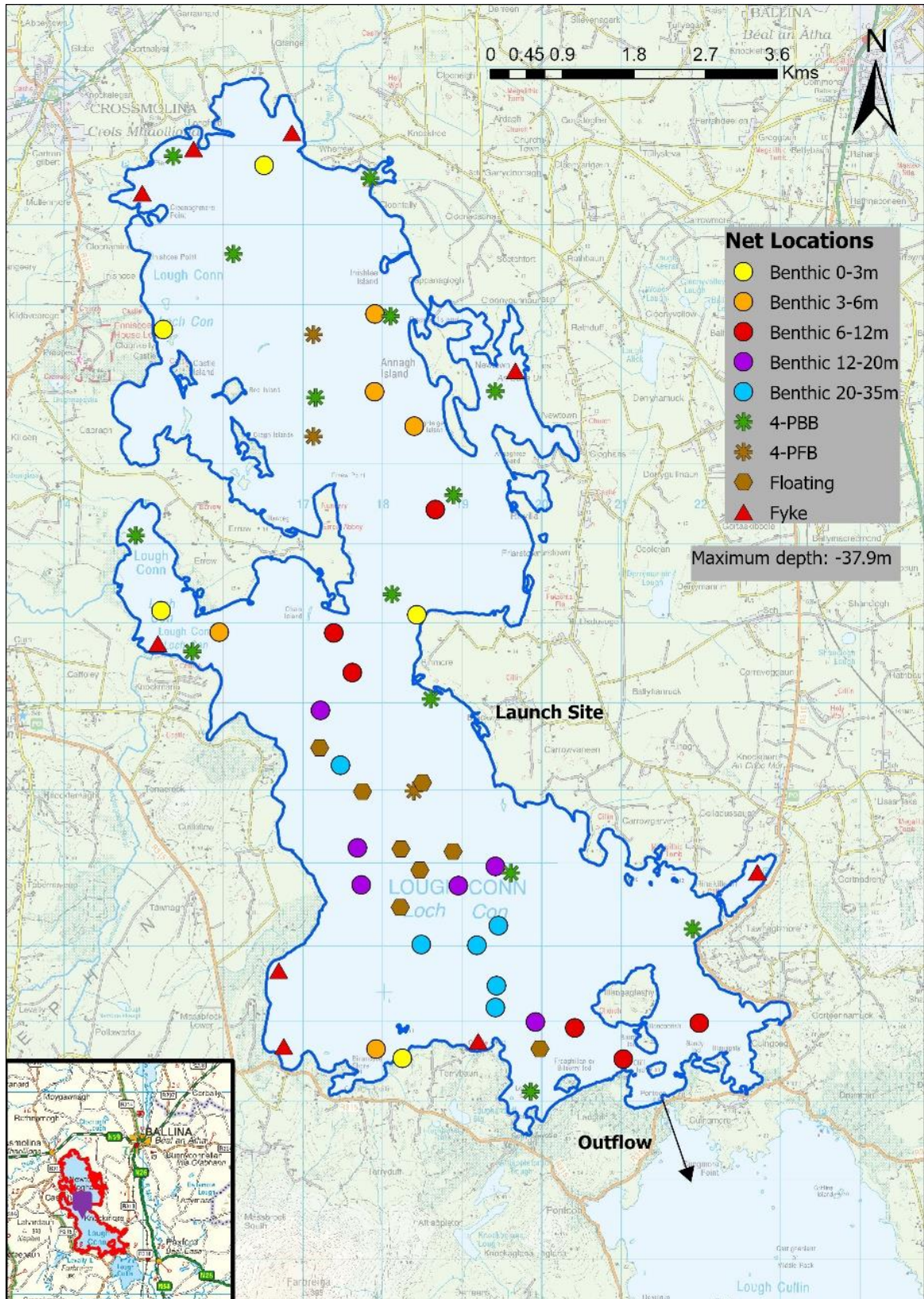


Figure 1.1. Location map of Lough Conn showing locations and depths of each net (outflow is indicated on map).

2. Methods

2.1. Netting methods

Lough Conn was surveyed over four nights between the 30th August to the 1st of September 2022. The survey comprised a total of nine Dutch fyke nets (Fyke), 28 benthic monofilament multi-mesh (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets (BM CEN) and eight surface floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets were deployed in the lake at the same locations as previous surveys.

The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) and four-panel floating braided survey gill nets (4-PFB) at 14 additional sites (12 benthic and 2 floating). The four-panel benthic braided 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 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).

$$FO_i = \left(\frac{N_i}{N} \right) * 100$$

Where:

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.



Plate 2.1. Retrieving a net on Lough Conn in August 2022

3. Results

3.1. Species Richness

Seven fish species were recorded on Lough Conn in August/September 2022. A total of 723 fish were captured (Table 3.1). Roach and perch were the two most common species captured in the lake, together representing 88% of all fish captured in the survey. Brown trout were also recorded in relatively large numbers. Salmon, tench, pike and eels, were also captured.

Table 3.1. Number of each fish species captured by each gear type during the survey on Lough Conn, August/September 2022.

Scientific name	Common name	Number of fish captured					
		BM CEN	FM CEN	4-PBB	4-PFB	Fyke	Total
<i>Rutilus rutilus</i>	Roach	313	2	1	0	4	320
<i>Perca fluviatilis</i>	Perch	302	1	8	1	3	315
<i>Salmo trutta</i>	Brown trout	9	38	4	0	0	51
<i>Salmo salar</i>	Salmon	1	0	7	0	0	8
<i>Tinca tinca</i>	Tench	0	0	3	0	2	5
<i>Esox lucius</i>	Pike	1	0	0	1	1	3
<i>Anguilla anguilla</i>	European eel	1	0	0	0	20	21

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. The CPUE and BPUE for each species captured in the 2022 survey is summarised in Table 3.2. In 2022 roach and perch dominated fish stocks with respect to both abundance and biomass.

For comparison purposes box plots of CPUE and BPUE for each species captured in all surveys per net type in 2019 and 2022 are presented in Figures 3.1(a and b) to 3.2 (a and b) respectively and illustrates fish community change over time. Abundance and biomass of the two most common fish species (i.e. roach and perch) was relatively similar in both 2016 and 2022; however the median CPUE and BPUE values of roach were higher in 2022 (Figure 3.1 and 3.2). The abundance and biomass of brown trout (an important angling species on the lake) also remained relatively stable.

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

Scientific name	Common name	Mean CPUE (\pm S.E)	Mean BPUE (\pm S.E)
<i>Rutilus rutilus</i>	Roach	0.171 (0.035)	27.496 (5.623)
<i>Perca fluviatilis</i>	Perch	0.165 (0.042)	14.737 (3.791)
<i>Salmo trutta</i>	Brown trout	0.026 (0.007)	5.040 (1.542)
<i>Salmo salar</i>	Salmon	0.002 (0.001)	5.659 (3.442)
<i>Tinca tinca</i>	Tench	0.001 (0.001)	0.537 (0.415)
<i>Esox lucius</i>	Pike	0.001 (0.001)	0.407 (0.374)
<i>Anguilla anguilla</i>	European eel	0.037 (0.010)*	7.836 (2.295)*

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.

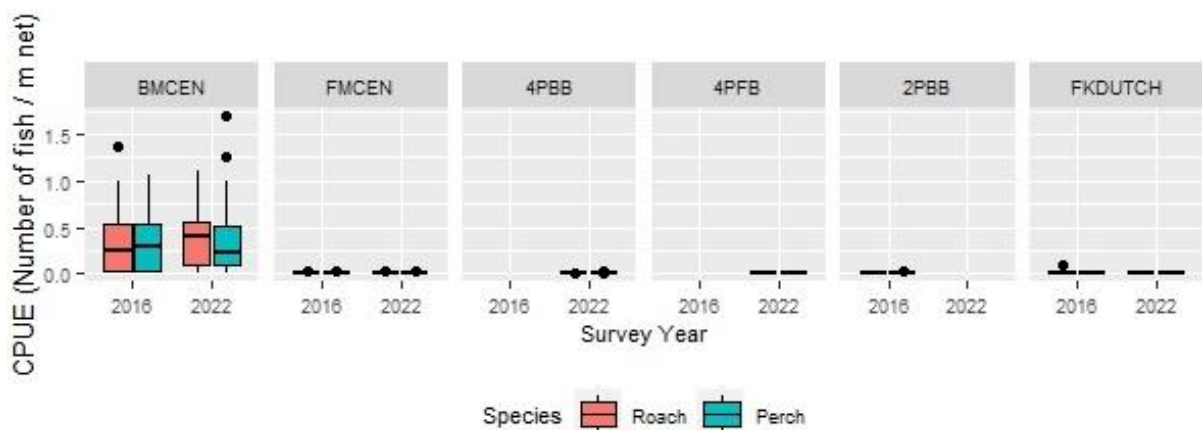


Figure 3.1a. CPUE of roach and perch captured in each net type during surveys of Lough Conn in 2016 and 2022. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical ‘whiskers’ show the data range. Outliers are marked by dots.

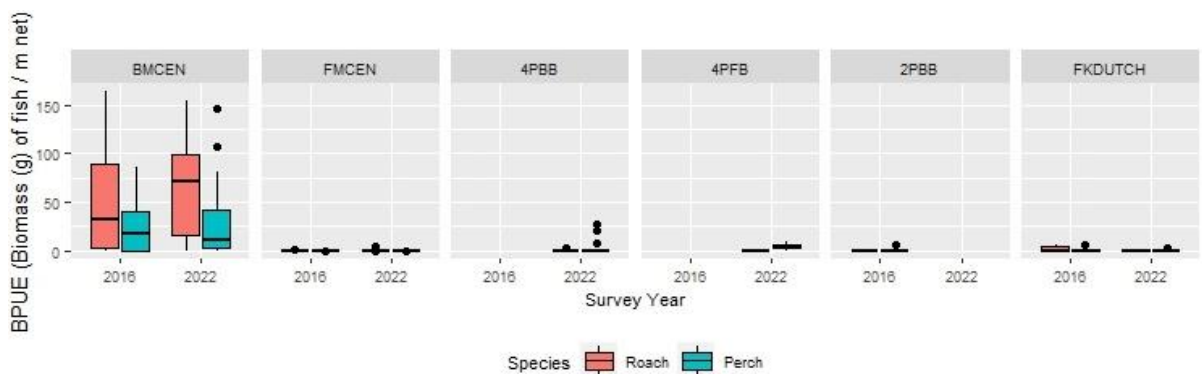


Figure 3.1b. BPUE of roach and perch captured in each net type during surveys of Lough Conn in 2016 and 2022. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical ‘whiskers’ show the data range. Outliers are marked by dots.

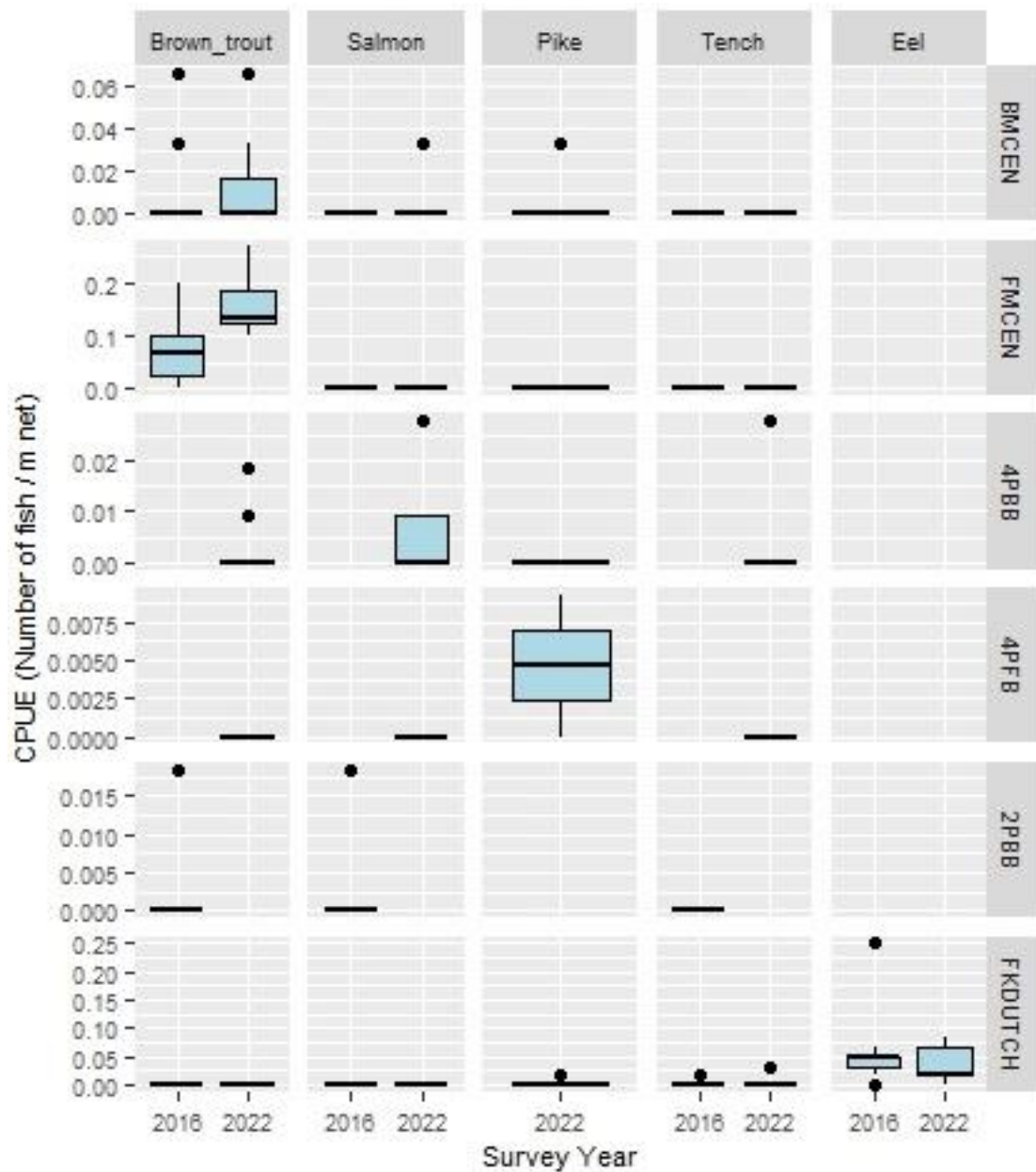


Figure 3.2a. CPUE (number of fish captured per linear meter of net) of brown trout and other fish species captured in each net type during surveys of Lough Conn in 2016 and 2022. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots. The y axis is unique for each net type.

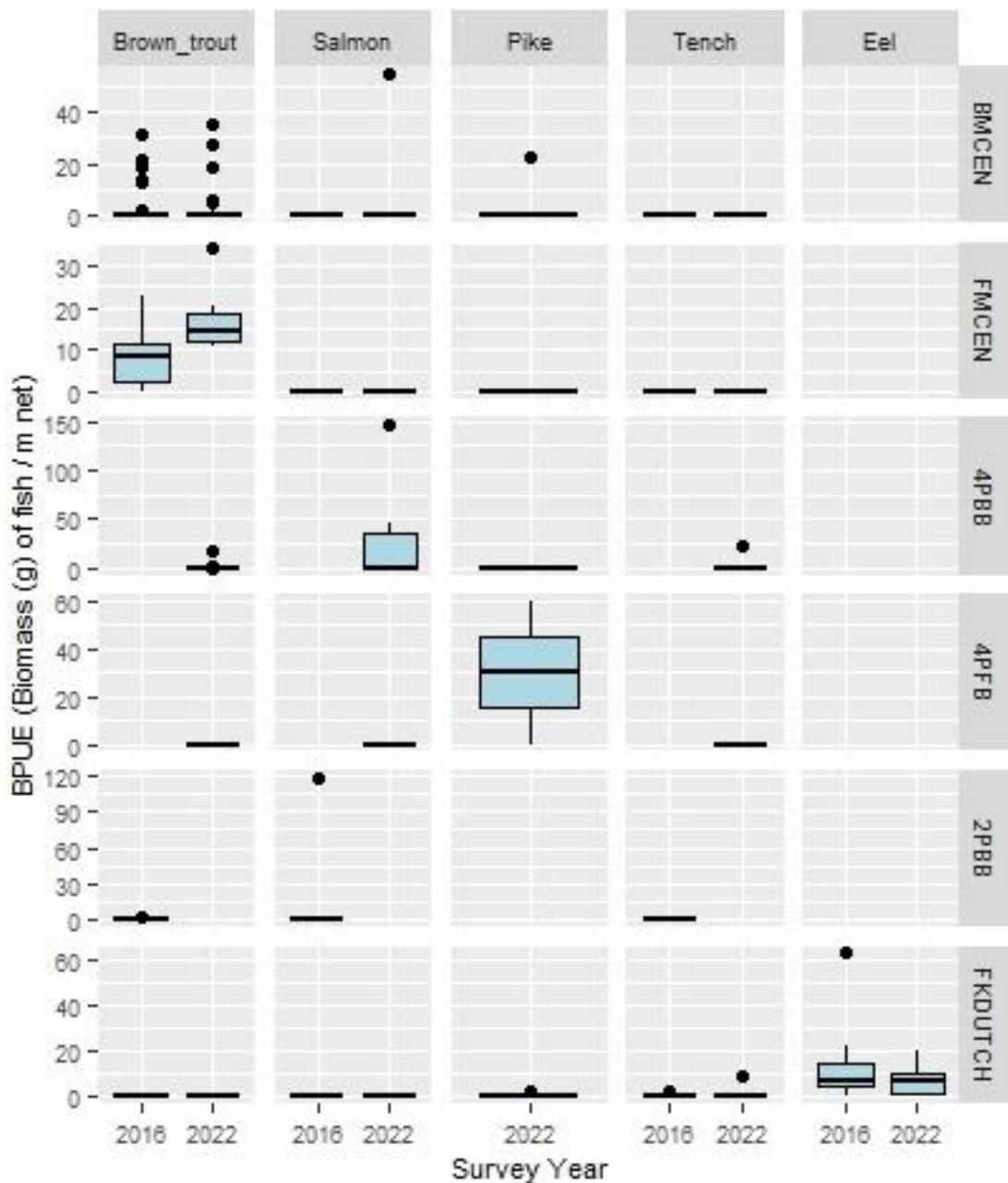


Figure 3.2b. BPUE (biomass of fish captured per linear meter of net) of of brown trout and other fish species captured in each net type during surveys of Lough Conn in 2016 and 2022. The horizontal bars represent the median value of the sample, while while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. The y axis is unique for each net type.

3.3. Length frequency distributions and growth

Roach

Roach captured during the 2022 survey ranged in length from 7.1cm to 29.9cm (mean 19.7cm) (Figure 3.3). Roach were aged between 1+ and 11+ and all intervening age classes were represented in the sample aged (Table 3.3). While 2+ fish were the largest cohort, no one year group dominated the population. However, the population was characterised by a large proportion of larger and older fish with many fish greater than 20cm captured (Figure 3.3 and Table 3.3)

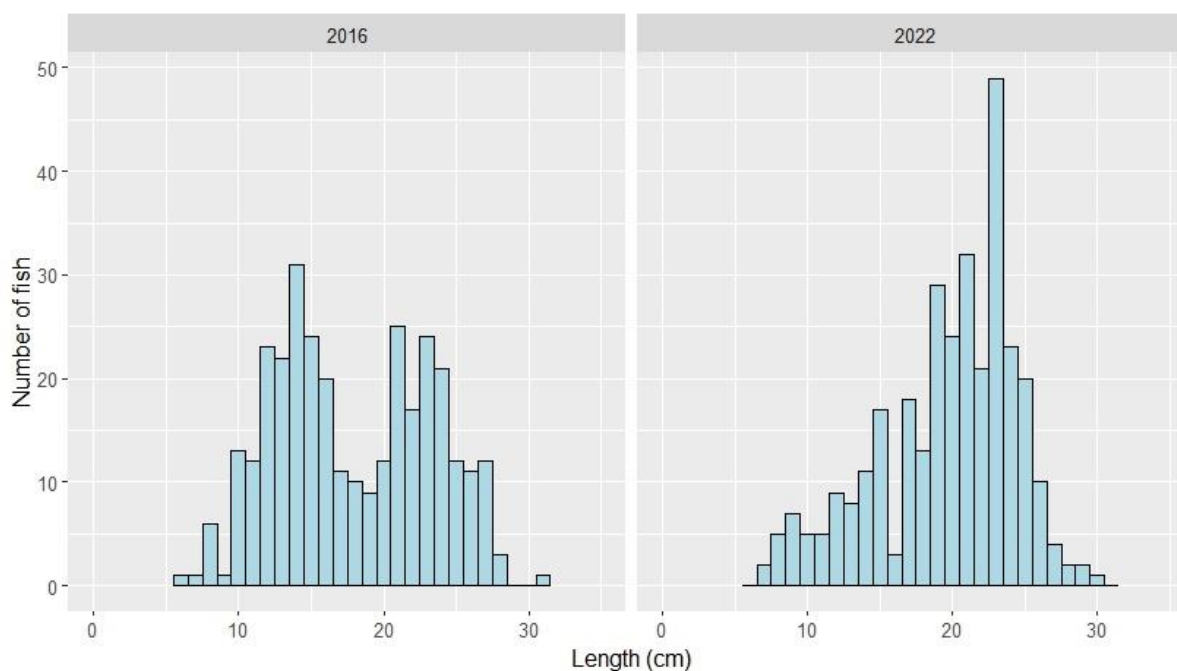


Figure 3.3. Length frequency of roach captured on Lough Conn, 2016 and 2022

Table 3.3. Summary age data from roach captured on Lough Conn, August/September 2021. Number of fish (N) and length ranges of all fish aged in the sample is presented.

Length (cm)	Age class											
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+
N	0	1	11	3	8	7	5	6	9	3	1	4
Mean L (cm)	-	-	11.3	14.2	16.3	19.0	21.2	23.1	25.4	27.1	-	28.8
Min L (cm)	-	7.5	9.0	14.2	15.0	18.2	20.3	22.7	24.2	27.0	28.6	28.0
Max L (cm)	-	7.5	14.0	14.2	17.7	20.4	21.8	23.7	26.3	27.3	28.6	29.9

Perch

Perch captured during the 2022 survey ranged in length from 5.0cm to 38.3cm (mean 14.8cm) (Figure 3.4). Perch were aged from 0+ to 12+ and all intervening age classes were represented. While the population was dominated by smaller and younger year classes, there was strong persistence of older and larger fish in the population (Figure 3.4). Mean L1 (i.e. age at the end of the 1st year) was 6.8cm (Table 3.4).

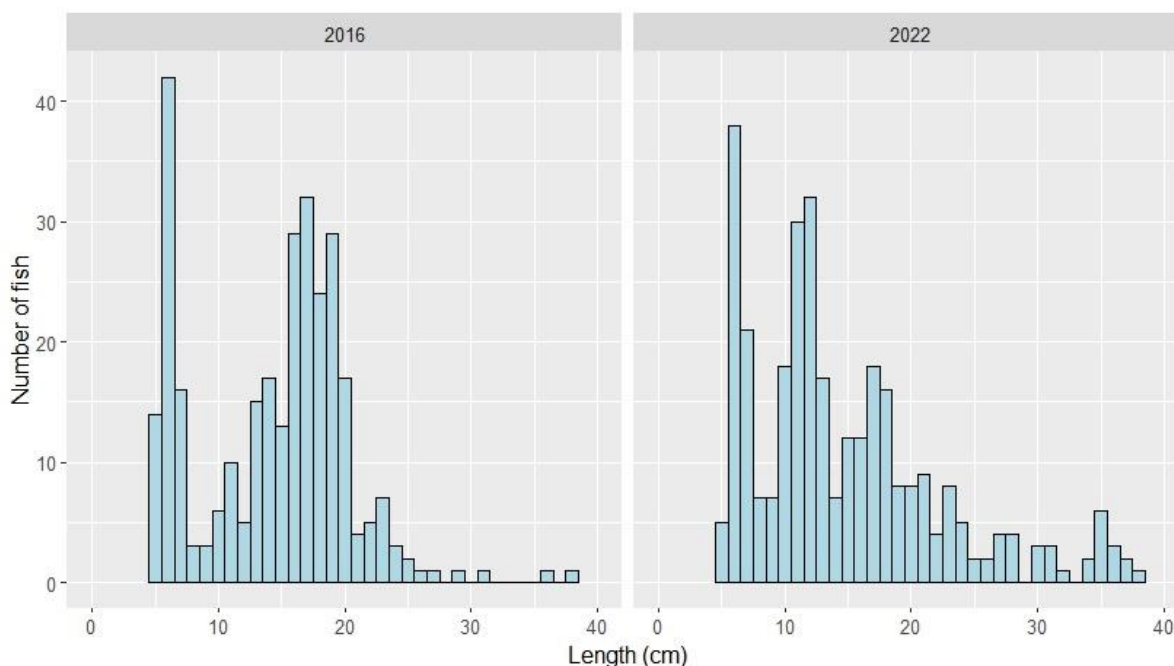


Figure 3.4. Length frequency of perch captured on Lough Conn, 2016 and 2022

Table 3.4. Mean (\pm S.E.) perch length (cm) at age for Lough Conn, August/September 2022

Length (cm)	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12
Mean	6.8	10.5	13.7	16.6	18.8	20.0	23.0	24.7	26.3	29.2	30.5	-
SE	0.1	0.29	0.3	0.4	0.4	0.5	0.7	0.8	1.2	1.5	2.2	-
N	102	92	74	57	40	29	22	17	9	7	4	1
Range	4.5-10	6.9-16	9.6-19.9	11.8-25.2	14.7-24.9	16.3-27.7	18-30.3	19.5-30.2	20.9-32.4	22.6-34.8	24.3-33.7	25

Brown trout

Brown trout captured during the 2022 survey ranged in length from 15.9cm to 56.7cm (mean 22.7cm) (Figure 3.5). Brown trout were aged from 1+ to 6+ and all intervening age groups were present. The most abundant age group was 2+ (Table 3.4). Mean L1 (i.e. age at the end of the 1st year) was 6.7cm (Table 3.5). While some larger and older fish were present in the population, it was characterised by a larger proportion of small fish (c. 20cm) (Figure 3.5).

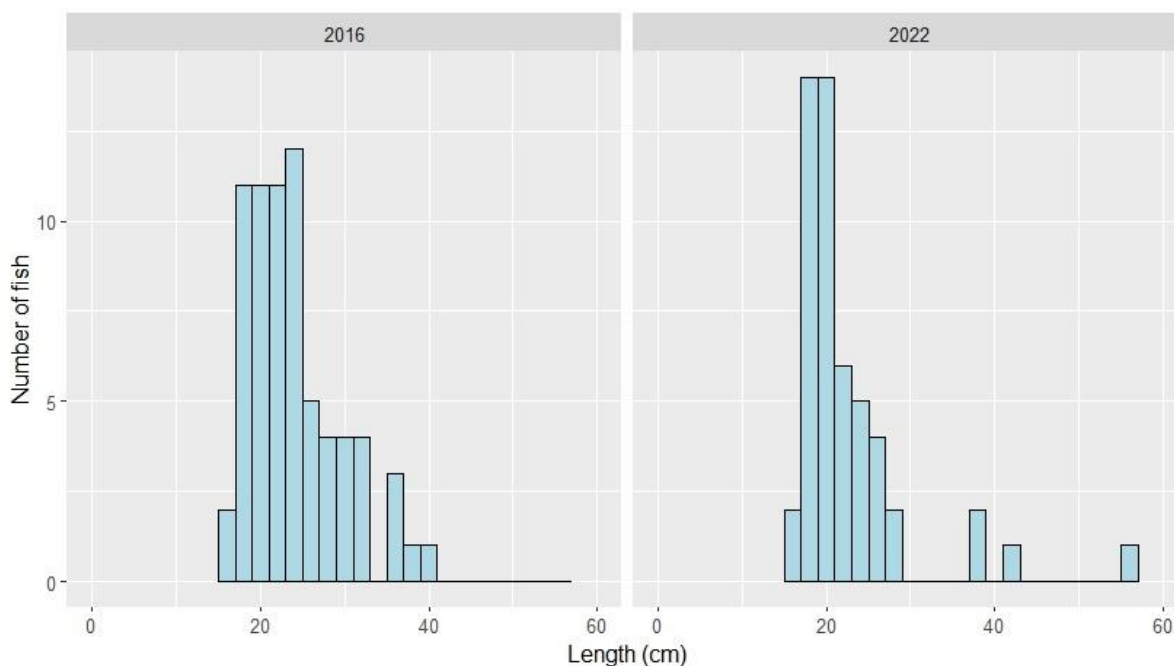


Figure 3.5. Length frequency of brown trout captured on Lough Conn, 2016 and 2022

Table 3.5. Mean (\pm S.E.) brown trout length (cm) at age for Lough Conn, August/September 2022

Length (cm)	L1	L2	L3	L4	L5	L6
Mean	6.7	15.3	22.5	30.7	38.3	50.4
S.E.	0.1	0.2	0.4	1.4	3.0	0
N	3	16	7	2	2	1
Range	5.3– 8.0	13.2- 16.9	19.7- 25.8	26.3- 33.6	34.3-44.1	50.4

Other fish

Eels recorded during the 2022 survey ranged in length from 32.9cm to 83.0cm (mean 46.7cm). Eight salmon were recorded ranging in length from 55.8.0 cm to 84.7cm (mean 74.3cm). Four salmon were aged at 2.2+ and one at 2.1+. Five tench were captured and ranged in length from 23.3cm to 40.2cm (mean 31.2cm). Three pike were captured measuring 26.1cm, 45.1cm (2+) and 94.3cm (5+).

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

Perch

A total of 112 perch stomachs were examined. Of these 91 (81.3%) were found to contain no prey items. Of the remaining 21 stomachs containing food, fish were found in five (24%) stomachs and zooplankton was recorded in one (5%) perch. Fifteen (71%) stomachs contained unidentified digested material (Figure 3.6).

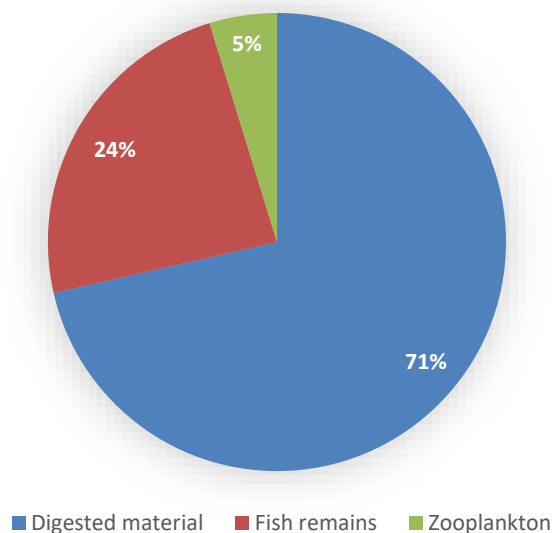


Figure 3.6. Diet of perch (N = 21) captured on Lough Conn, August/September 2022 (% FO).

Brown trout

A total of 38 brown trout stomachs were examined and 30 (79%) were empty. Of the remaining eight stomachs containing food, four (25%) contained both invertebrates and zooplankton. Zooplankton was the sole prey item in two (13%) stomachs, and two contained plant material and unidentified digested material (13%) respectively. Unidentified digested material was recorded in 3 (37%) stomachs (Figure 3.7).

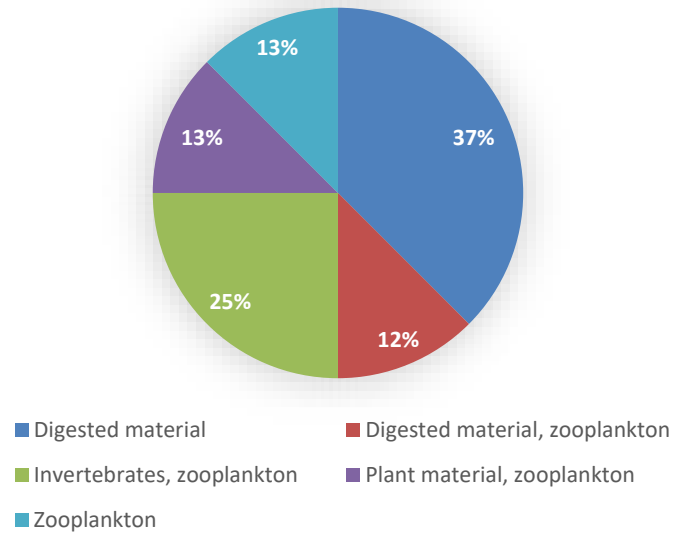


Figure 3.7. Diet of brown trout (N = 8) captured on Lough Conn, August/September 2022 (%FO).

4. Summary

A total of seven fish species were recorded on Lough Conn in August/September 2022.

Roach and perch were the two most abundant species captured on Lough Conn in the 2022 fish stock survey and they accounted for 88% of all fish captured in the survey. Abundance (mean CPUE) and biomass (mean BPUE) of roach and perch was relatively similar between 2016 and 2022; however the median CPUE and BPUE values of roach were higher in 2022. The roach population was characterised by a large proportion of larger and older fish while the perch population was dominated by younger year classes in 2022.

Lough Conn is an important brown trout fishery. Both the abundance and biomass of brown trout was relatively similar between the 2016 and 2022 surveys. Brown trout ranged in length from 15.9cm to 56.7cm and ranged in age from 1+ to 6+, indicating consistent recruitment with persistence of some larger and older individuals. An increase in the proportion of smaller fish (c. 20cm) was observed since 2016, indicating that recruitment may have increased in latter years. While no 0+ brown trout were captured as part of this survey, this cohort is likely present in the lake and particularly in streams and rivers connected to the lake. Similar trends in brown trout population structure were apparent on Lough Cullin, a lake connected to Lough Conn at Pontoon bridge (McLoone *et al.*, 2023).

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) 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 Conn has been assigned an ecological status of Good for 2022 based on the fish populations present. Lough Conn was also assigned a fish ecological status of Good in 2016 (Figure 4.1)

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

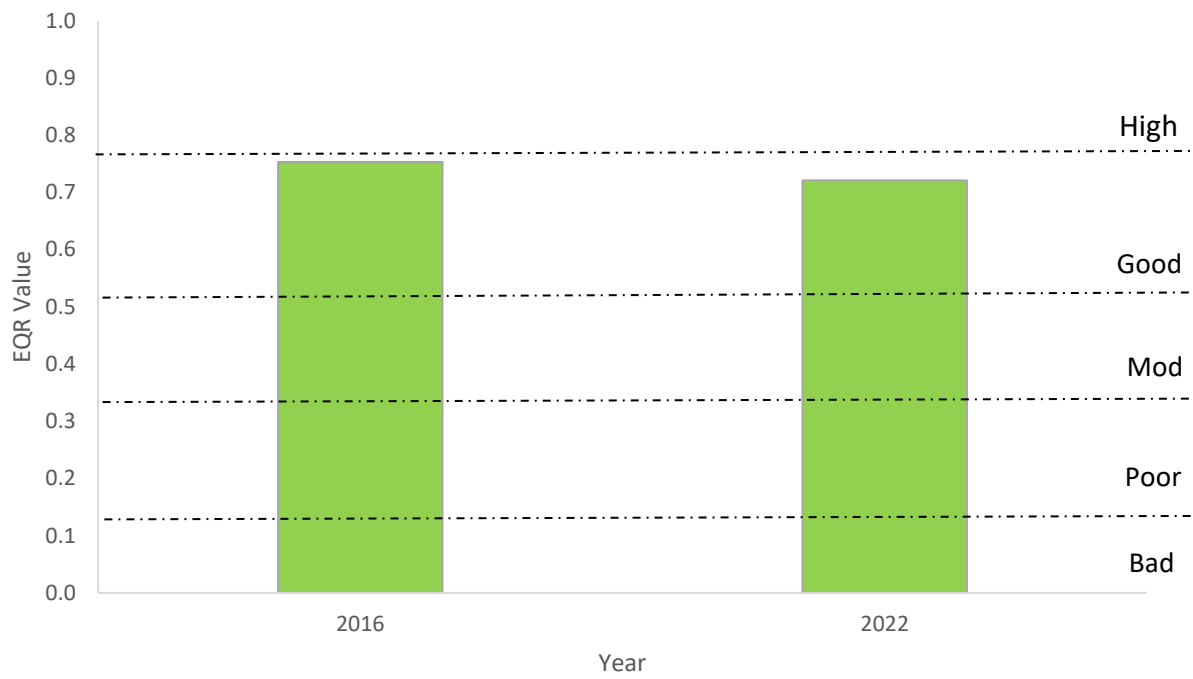


Figure 4.1. Fish ecological status, Lough Conn, 2016 and 2022 (dashed line indicates EQR status boundaries).

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