National Research Survey Programme
Lakes 2022

Lough Ree

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Iascach Intíre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Lough Ree, June 2022

National Research Survey Programme

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ACKNOWLEDGEMENTS

1.   Introduction

Lough Ree is the third largest lake in the Republic of Ireland, after Lough Corrib and Lough Derg (Plates 1.1 and 1.2, Figure 1.1). It is the middle of the three large Shannon lakes; Loughs Allen, Ree and Derg. The lake is 26km long and 11km at its widest point, has an area of 10,500ha, a mean depth of 6.2m, a maximum depth of 36m and is categorised as typology class 12 (as designated by the EPA for the purposes of the Water Framework Directive), i.e., deep (>4m), greater than 50ha and high alkalinity (>100mg/l CaCO3).

Lough Ree is situated in an ice deepened depression formed on Carboniferous limestone (Charlesworth, 1963). It has a highly irregular shoreline and has many sheltered bays. Glacial drift has resulted in the formation of many islands in the lake (NPWS, 2019). The main inflowing rivers are the Shannon, Inny and Hind, and the main outflowing river is the Shannon (NPWS, 2011).

Water levels in the lake are regulated by the Electricity Supply Board (ESB) and Waterways Ireland. The ESB control water levels on the Shannon system for the purpose of electricity generation at Ardnacrusha hydroelectric power station, which is located at the end of a purpose-built channel (the head-race canal) connected to the River Shannon, approximately 8km below the southern end of Lough Derg. Waterways Ireland controls water levels for navigation purposes. The water level into Lough Ree and discharges from the lake are controlled by a navigational weir and sluice gates at Athlone. The sluices at Athlone weir are operated by Waterways Ireland on daily instruction from the ESB and at high flows the sluice gates are closed to hold water upstream of Lough Ree to minimize flooding along the Lower Shannon (RPS, 2008).

Lough Ree has been designated as a Special Area of Conservation (SAC) and a Special Protection Area (SPA). It has been selected as a SAC/SPA due to the presence of Annex I habitat types, bird species listed on Annex I of the Birds Directive (Council Directive 79/409/EEC) and the otter listed on Annex II of the EU Habitats Directive (Council Directive 92/43/EEC) (NPWS, 2011). The lake is also home to the endangered fish species, pollan (*Coregonus pollan*) listed on Annex V of the EU Habitats Directive. Pollan are classified as 'Endangered' in the Irish Red Data Book (King *et al.*, 2011) and the IUCN Red List of Threatened Species (Freyhof and Kottelat, 2008). This species is endemic to Ireland and is only found in five lakes on the island: Lough Neagh, Lower Lough Erne, Lough Allen, Lough Ree and Lough Derg (Harrison *et al.*, 2010).

Lough Ree is classified as naturally eutrophic (NPWS, 2011b); however, it is vulnerable to artificial enrichment due to agricultural run-off, domestic waste effluent and peat silt in suspension which limits light penetration, thus restricting aquatic flora in the shallow areas of the lake to depths of less

than 2m (NPWS, 2019 and 2011). The lake is also being used for leisure activities, particularly leisure boating, which can cause disturbance and some physical damage to marginal wetlands (NPWS, 2019).

Lough Ree is classified as a mixed fishery with good stocks of trout, pike, and coarse fish present (ShRFB, 2010). Local angling clubs are actively involved in fisheries enhancement programmes. An independently operated brown trout hatchery (ShRFB, 2010) ceased operation in 2018. In-stream and bank rehabilitation development works have been carried out by Inland Fisheries Ireland (previously the Shannon Regional Fisheries Board) along the banks of the Hind River and the Inny system. The aim of this work was to enhance the wild brown trout stocks in the rivers and lake. These works and the implementation of pollution controls led to an increase in the trout stocks in the lake (O' Reilly, 2007).

Colonisation of Lough Ree by the zebra mussel coincided with a reduction in phytoplankton and an increase in water clarity (Minchin *et al*., 2002). A second dreissenid mussel (Quagga mussel, (*Dreissena rostriformis bugensis)* has subsequently colonised the lake and has the potential to further influence the ecology of the Lake (Baars, 2022). Asian clam (*Corbicula fluminea*) was first recorded in the River Shannon in 2013 (Hayden *et al*., 2013) and was subsequently found in Lough Ree (Minchin 2014)

Lough Ree was previously surveyed in 2010 and 2013 as part of the Water Framework Directive monitoring programme (Kelly *et al*., 2011 and 2014). In 2013 a pelagic and hydroacoustic survey was conducted as part of a PhD study (Morrissey 2019). A survey of the adult fish stocks in Lough Ree was undertaken in 2014 (Delanty *et al*., 2016). During these surveys, perch, roach, roach x bream hybrids, brown trout, pike, bream, tench, pollan and eels were recorded.

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 also provides insight into fish stock status in the lake.

Plate 1.1. Lough Ree, looking towards Portrunny Harbour, June 2022.

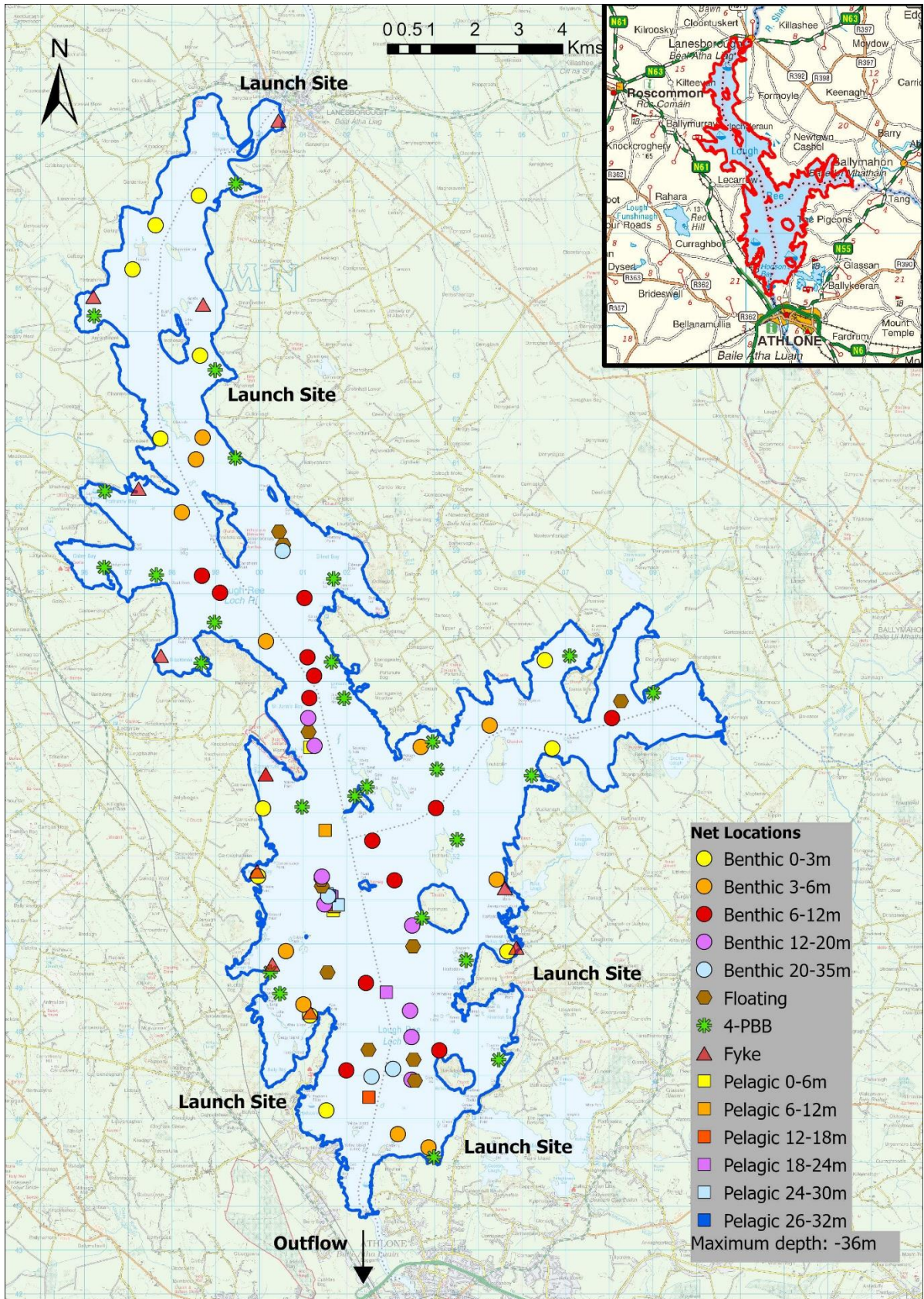**Plate 1.2. Quagga mussel from Lough Ree, June 2022.**

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

## 2.	Methods

### 2.1.	Netting methods

Lough Ree was surveyed over nine nights from the 7th to the 17th of June 2022. A total of 12 sets of Dutch fyke nets, 48 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (12 @ 0-2.9m, 11 @ 3-5.9m, 13 @ 6-11.9m, 8 @ 12-19.9m, and 4 @ 20-34.9m) and 11 floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed in the lake (71 sites). These survey nets were deployed in the same locations as were randomly selected in previous surveys.

The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at 27 additional sites (Figure 1.1). 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 nets were deployed in random locations throughout the lake.

An additional 11 pelagic monofilament multi-mesh (12 panel, 6.25-55mm mesh size) CEN standard (PMCEN) survey gill nets were also set in the lake over two nights from 13th to the 15th of June 2022 (Figure 1.1). Each PMCEN survey gill net is 30m long and 6m deep. They are typically deployed at specific depths within the water column in the deeper portions of a lake. Six PMCEN survey gill nets were set at varying depths at one location, creating a net 'curtain' that covered the entire water column (0-32m). Five PMCEN survey gill nets (1 @ 0-6m, 1 @6-12m, 1 @ 12-18m, 1 @ 18-24m and 1@ 24-30m) were set at five random locations within the deeper sections of the lake (Figure 1.1).

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 counted and 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).

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

Where:

$\mathbf{FO}_i$ 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 in order 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

Nine fish species and one cyprinid hybrid variety were recorded in Lough Ree in June 2022. A total of 1166 fish were captured (Table 3.1). Roach and perch were the most common species recorded in the survey and together represented *c.* 81% of all fish captured. Roach x bream hybrids, bream, pike, pollan, brown trout, tench, gudgeon and European eel, were also captured in the survey nets. During the previous surveys in 2010 and 2013, a similar species composition was recorded with the exception of bream and tench which were not recorded in 2013 and stone loach which were recorded in 2013 (Kelly *et al.*, 2011 and 2014). Four fish species were recorded in the PMCEN survey gill nets. Pollan was the most common fish species recorded in those nets.

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

Scientific name	Common name	Number of fish captured					
		BM CEN	FM CEN	PM CEN	4-PBB	Fyke	Total
Rutilus rutilus	Roach	456	3	5	22	7	484
Perca fluviatilis	Perch	441	0	7	4	4	465
Rutilus rutilus x Abramis brama	Roach x bream hybrid	32	0	0	86	0	118
Abramis brama	Bream	0	0	0	26	0	26
Esox lucius	Pike	12	0	0	7	0	19
Coregonus pollan	Pollan	0	0	15	0	0	15
Salmo trutta	Brown trout	5	1	5	3	0	14
Tinca tinca	Tench	0	0	0	8	0	8
Gobio gobio	Gudgeon	1	0	0	0	0	1
Anguilla anguilla	European eel	1	0	0	0	15	16

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 BM CEN, FM CEN, 4-PBB and fyke survey nets. Eel CPUE/BPUE is based on fyke nets only. Catches in PMCEN nets are calculated separately. Roach and perch dominated fish stocks with respect to abundance (CPUE)

while roach was the dominant species with respect to biomass (BPUE) (Table 3.2). The same species (i.e. roach and perch) have dominated fish stocks on all surveys of the lake.

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

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Rutilus rutilus	Roach	0.156 (0.026)	31.283 (4.381)
Perca fluviatilis	Perch	0.154 (0.027)	14.816 (2.597)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.019 (0.004)	13.487 (2.951)
Abramis brama	Bream	0.002 (0.002)	2.069 (1.505)
Esox lucius	Pike	0.005 (0.001)	13.389 (4.055)
Salmo trutta	Brown trout	0.002 (0.001)	2.704 (1.173)
Tinca tinca	Tench	0.001 (0.000)	1.297 (0.893)
Gobio gobio	Gudgeon	0.000 (0.000)	0.001 (0.001)
Anguilla anguilla	European eel	0.031 (0.014)	12.015 (5.327)

*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.*

Pollan were the dominant species with respect to abundance (CPUE) while brown trout was the dominant species with respect to biomass (BPUE) in the PM CEN survey gill nets (Table 3.3).

Table 3.3. Mean (S.E.) CPUE and BPUE for all fish species captured in pelagic CEN survey nets on Lough Ree, June 2022.

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Coregonus pollan	Pollan	0.011 (0.003)	1.809 (0.675)
Perca fluviatilis	Perch	0.005 (0.002)	0.039 (0.017)
Salmo trutta	Brown trout	0.004 (0.002)	2.509 (1.979)
Rutilus rutilus	Roach	0.004 (0.002)	0.949 (0.407)

For comparison purposes box plots of CPUE and BPUE for each species captured in surveys on the lake per net type in 2010, 2013 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. While BPUE and CPUE of roach has shown an increase since 2010, the median CPUE of perch has decreased. However, biomass of the latter species has remained relatively stable (Figures 3.1a and b).

Other fish species were recorded in lower abundances across all net types (Figures 3.2a and 3.2b). CPUE and BPUE of the European eel was lower in 2022 than previous surveys.

Pollan were captured in the PMCEN survey gill nets only. Comparison with PMCEN survey gill nets deployed throughout the water column in both 2010 and 2013 indicates that CPUE and BPUE have fluctuated over that time period. Median CPUE and BPUE in 2022 was similar to 2010 but lower than 2013 (Figures 3.3a and b).

Abundance and biomass of the remaining fish species have fluctuated across surveys and no clear trends were apparent. Brown trout population trends are described below (Figures 3.4a and b).
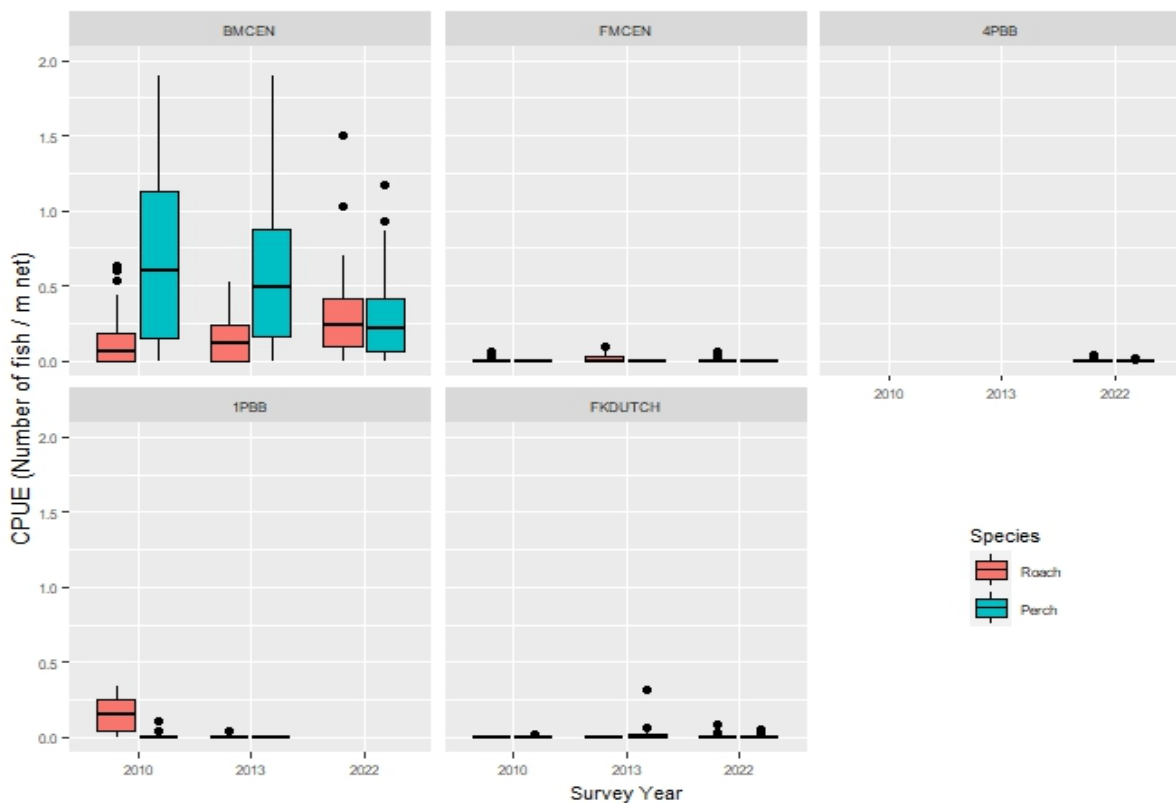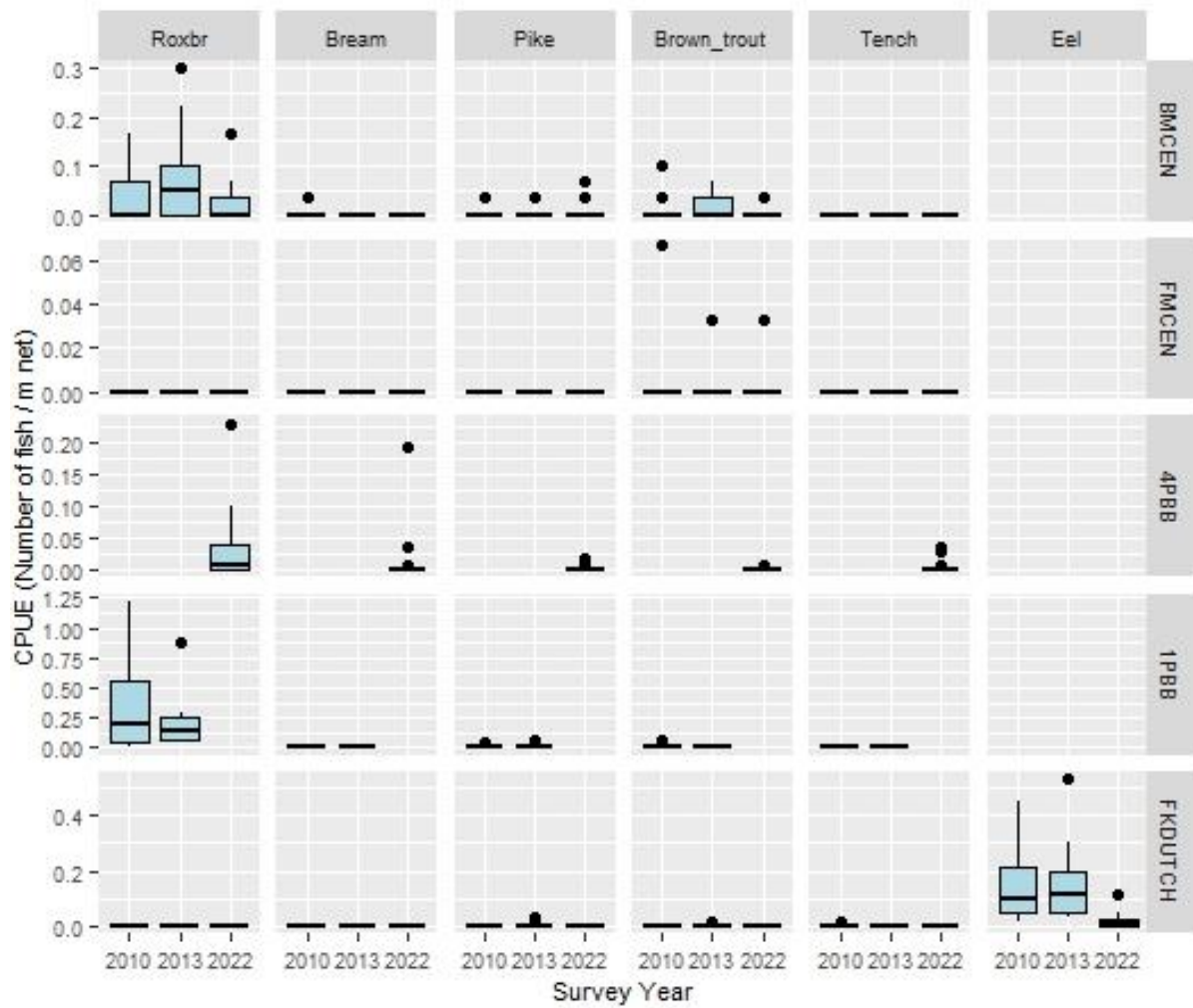

Figure 3.1a. CPUE of roach and perch captured in each net type during surveys of Lough Ree between 2010 and 2022. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.
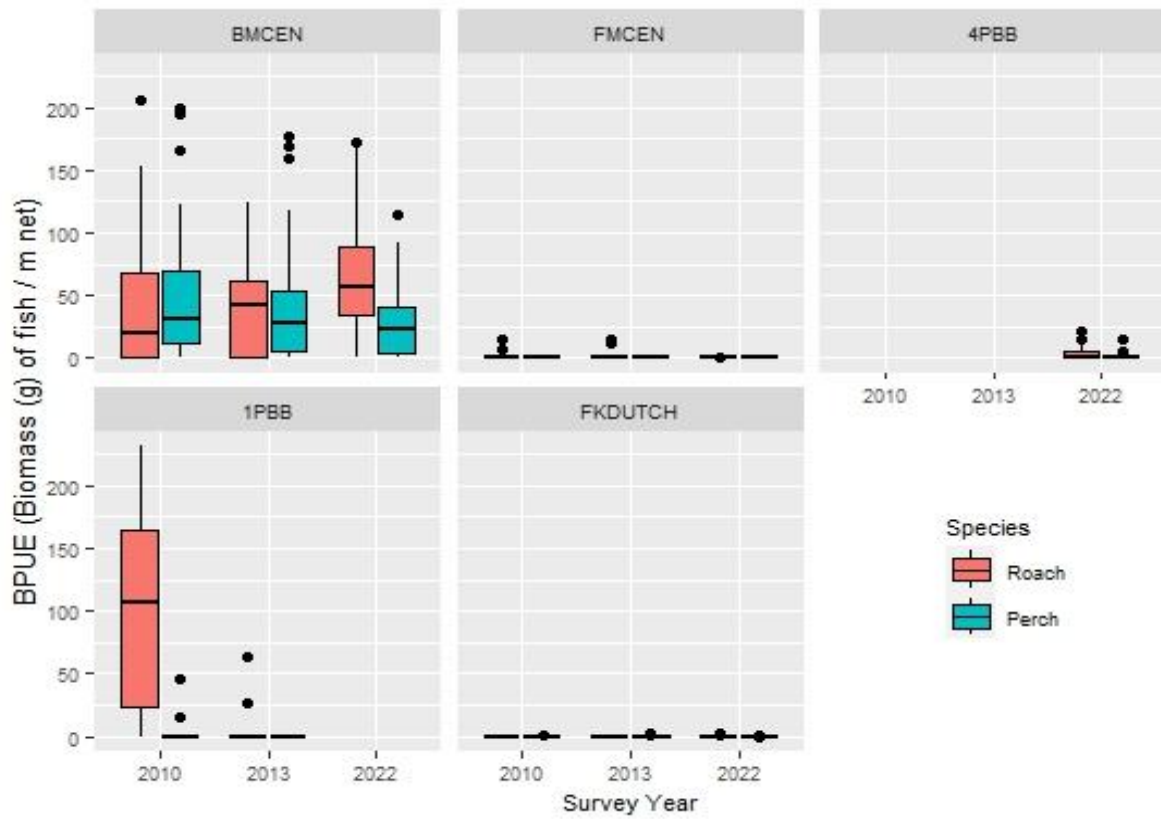
Figure 3.1b. BPUE of roach and perch captured in each net type during surveys of Lough Ree from between 2010 and 2022. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles 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 Ree between 2010 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 net type.
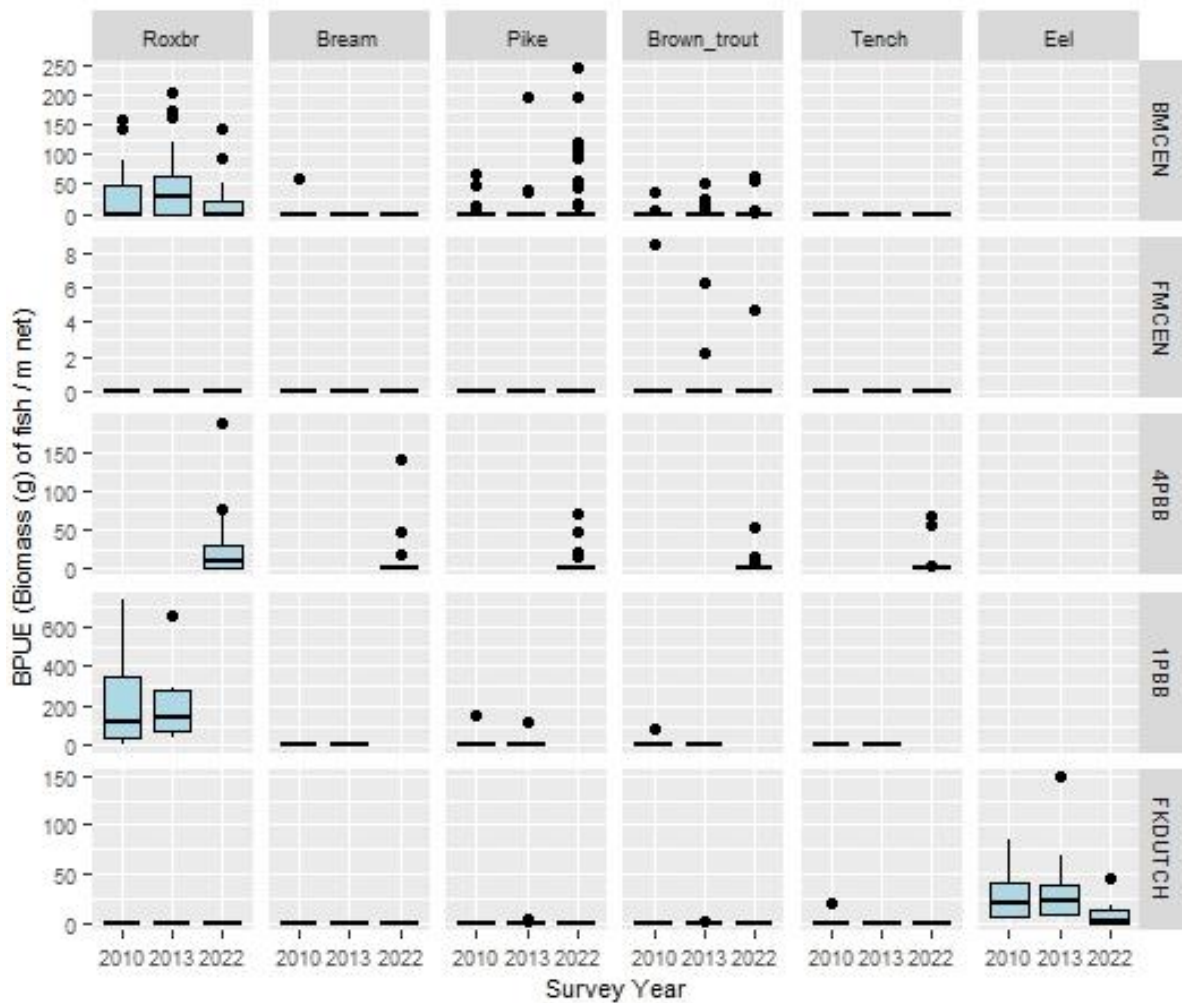
Figure 3.2b. BPUE of other fish species captured in each net type during surveys of Lough Ree from between 2010 and 2022. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles 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 (CPUE) is unique for each net type.
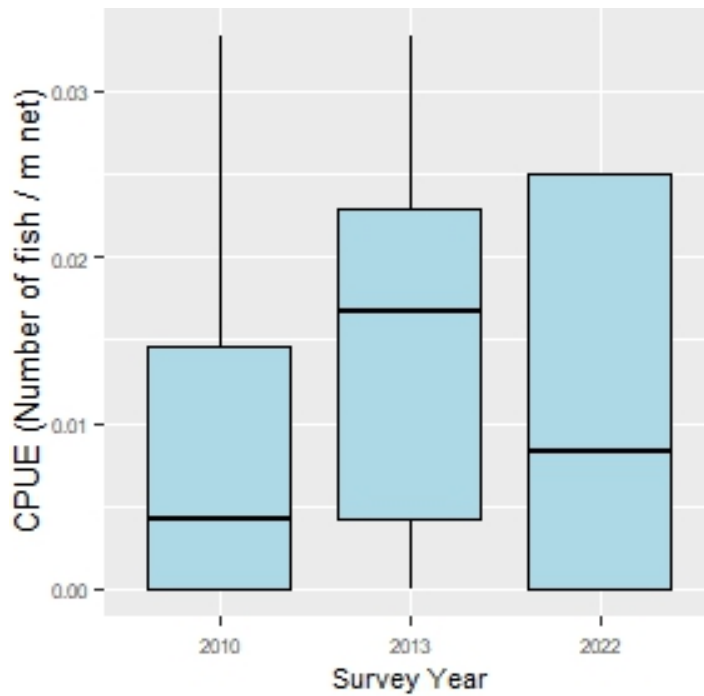
Figure 3.3a. CPUE of pollan captured in pelagic nets during surveys of Lough Ree between 2010 and 2022. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range.
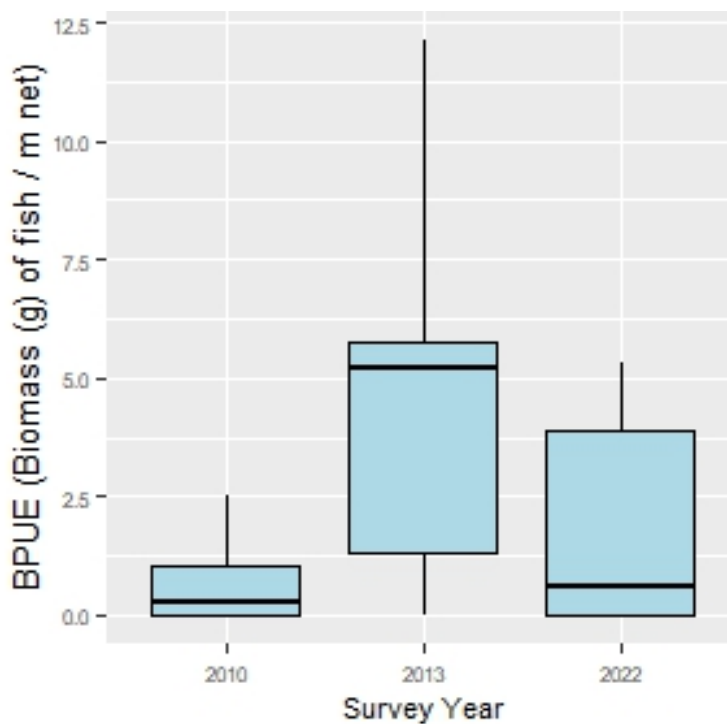

Figure 3.3b. BPUE of pollan captured in pelagic nets during surveys of Lough Ree from between 2010 and 2022. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range.
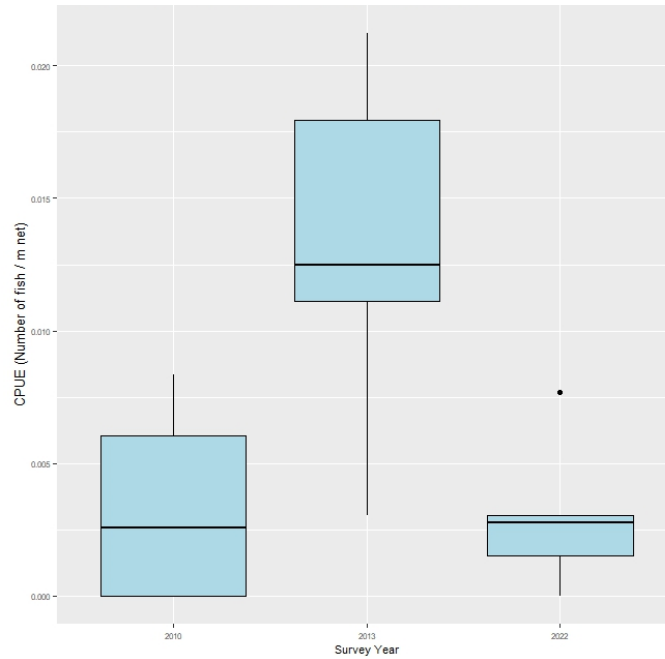
Brown trout CPUE in Lough Ree

Survey catch data is inherently subject to considerable variation. Larger bodied species (e.g. brown trout), which may be naturally less abundant in certain lakes than smaller species such as perch are often captured in relatively low numbers and in a small proportion of the survey nets deployed. Changes in netting methodologies have occurred since 2009 where the number and mesh size of supplementary braided survey gillnets has varied. This is apparent in the graphs above (Figures 3.1 to 3.2) which can make visual interpretation of fish catches difficult.

For brown trout, fish catches and CPUEs from BMCEN and FMCEN survey gill nets have been pooled to reduce some of this variation. This has been achieved by aggregating catches within each depth zone on each sampling occasion. In this way, all the nets deployed within each depth zone were treated as one sampling unit for that survey occasion. Sampling effort, and netting locations across surveys were essentially identical. Supplementary braided survey gill nets which were set in varying quantities and with varying mesh sizes in 2022, and fyke nets (which captured no brown trout in any survey) have been excluded. No brown trout were recorded in survey gill nets deployed in the 20-35m depth zone therefore these have also been excluded from the analysis. Aggregate CPUEs and BPUEs for Lough Ree are presented in Figure 3.4a and 3.4b. Stocks of brown trout appeared to fluctuate in the lake, with more fish captured in 2013 than in 2010 and 2022 (note median CPUE was higher in 2013 than 2010 and 2022). Brown trout biomass (BPUE) in 2022, however, was relatively similar to that recorded in the 2013 survey and higher than 2010 (Figure 3.4 a and b).

Plate 3.1 Preparing survey nets for deployment on Lough Ree, June 2022.

Figure 3.4a. CPUE (number of fish captured per linear meter of net deployed) of brown trout captured in benthic and floating CEN survey nets during fish stock surveys of Lough Ree between 2010 and 2022. Data has been pooled within each depth zone. 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.
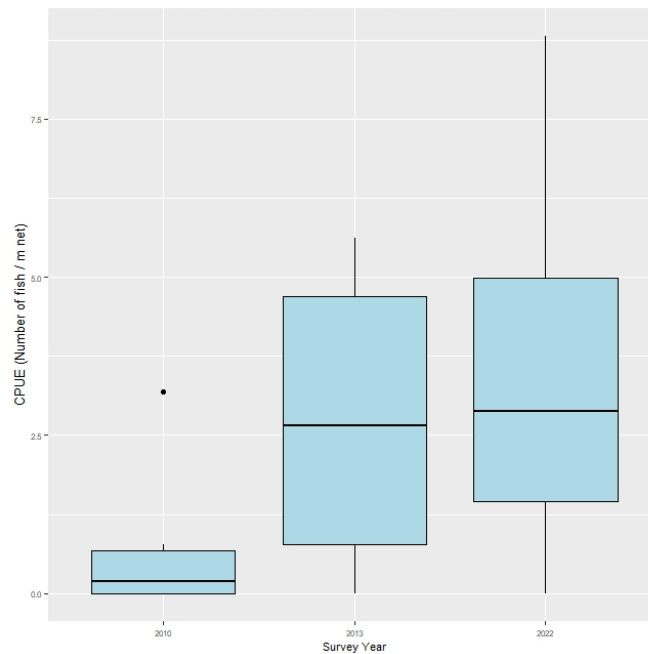
Figure 3.4b. BPUE (biomass of fish captured per linear meter of net deployed) of brown trout captured in benthic and floating CEN survey nets during fish stock surveys of Lough Ree between 2010 and 2022. Data has been pooled within each depth zone. The horizontal bars represent the median value of the 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.

3.3.   Length frequency distributions and growth

Roach

Roach captured in the 2022 survey ranged in length from 5.0cm to 37.4cm (mean = 20.6cm) (Figure 3.5). A large proportion of the fish captured in 2022 were larger than 20cm. Larger fish were also prominent in the earlier surveys (Figure 3.5). Roach were aged between 1+ and 9+ (Table 3.4). The most abundant age class was 3+ and many other year classes up to 10+ were well represented (Table 3.4).
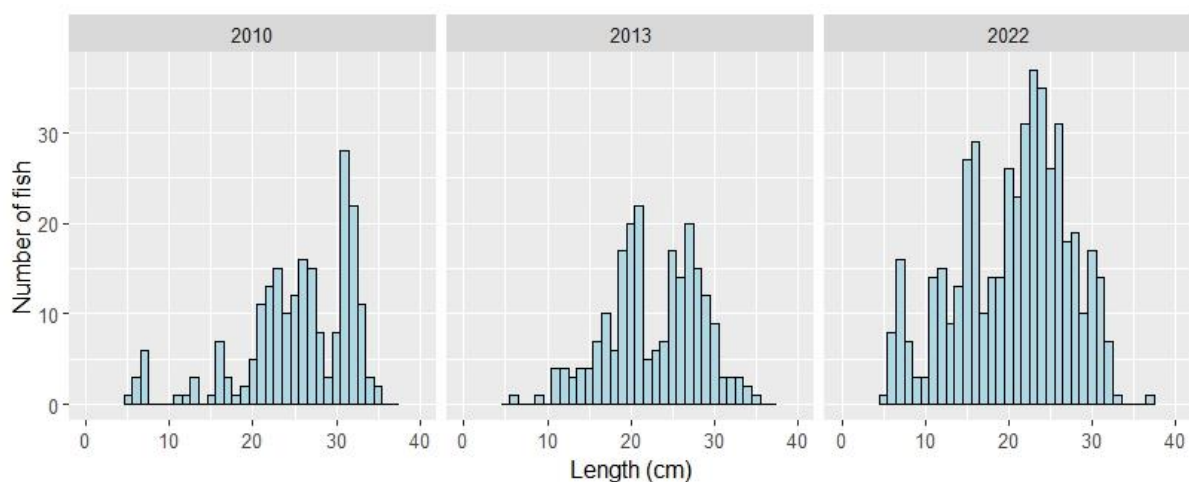

Figure 3.5. Length frequency of roach captured on Lough Ree, 2010, 2013 and 2022.

Table 3.4. Summary age data from roach captured on Lough Ree, June 2022. Number of fish 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+
N	-	10	21	28	19	17	15	10	3	3
Mean	-	7.1	12.3	17.4	22.1	24.8	29.2	21.1	29.9	32
Min	-	6.2	9.5	11.3	18.5	22.9	26.1	27.7	29.1	31.1
Max	-	8	16.3	21.3	25.5	27	32.3	37.4	30.5	32.8

Perch

Perch captured in the 2022 survey ranged in length from 5.5cm to 36.4cm (mean = 17.7cm) (Figure 3.6). Perch in the sample were aged between 1+ to 10+ and all intervening age classes (with the exception of 9+) were recorded. Mean L1 (i.e. age at the end of the 1st year) was 6.9cm (Table 3.5). The population was dominated by 2 to 4 year old fish (*c.* 11cm – 24cm; Figure 3.4). Compared to previous surveys fewer younger (and smaller) perch < 10.0cm were captured (Figure 3.5).
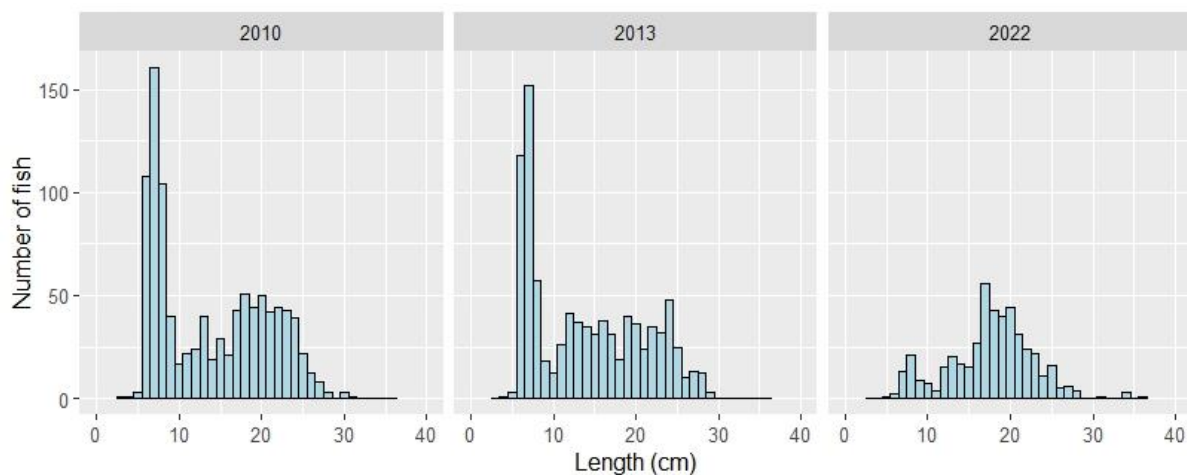

Figure 3.6. Length frequency of perch captured on Lough Ree, 2010, 2013 and 2022.

Table 3.5. Mean (±S.E.) perch length (cm) at age for Lough Ree, June 2022.

Length (cm)	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}
Mean	6.9	11.4	15.4	18.6	20.9	23.0	25.0	29.6	28.9	30.2
(±S.E.)	0.1	0.2	0.3	0.3	0.3	0.4	0.7	2.2	2.3	2.9
N	100	88	66	43	24	13	9	3	2	2
Min	4.8	8.0	10.8	13.1	18.8	20.5	21.8	25.8	26.6	27.3
Max	10.3	15.4	22.8	22.1	24.6	25.3	28.9	33.3	31.2	33.1

Roach x bream hybrids

Roach x bream hybrids ranged in length from 8.5cm to 42.2cm (mean = 32.8cm) (Figure 3.7). Roach x bream hybrids were aged between 1+ and 11+. While all intervening age classes were present, fish aged between 6+ and 8+ (*c*. 29cm - 36cm, Figure 3.6) dominated (Table 3.6). Larger specimens, > 30.0cm dominated the roach x bream hybrid population on all surveys (Figure 3.7).
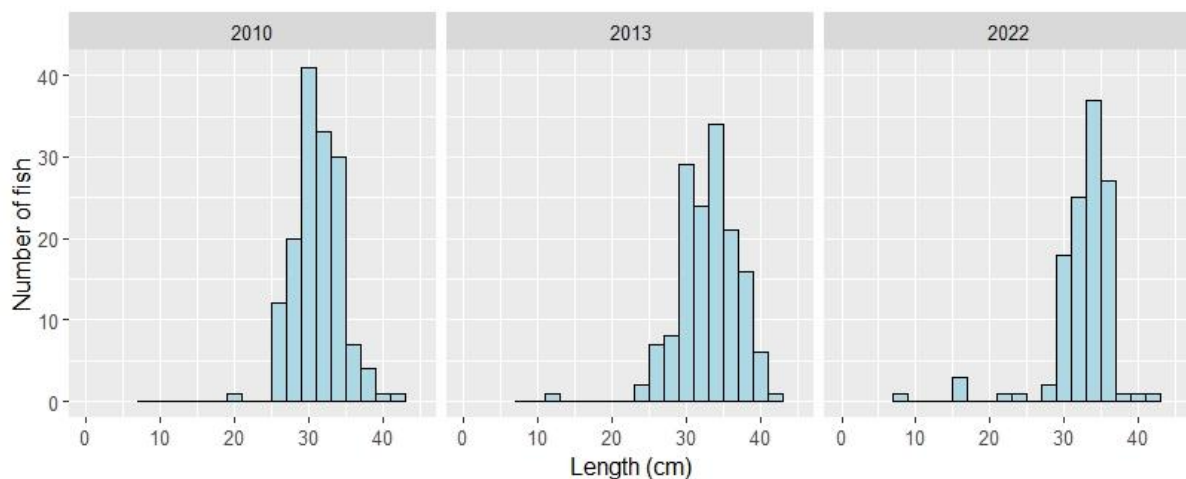

Figure 3.7. Length frequency of roach x bream hybrids captured on Lough Ree, 2010, 2013 and 2022.

Table 3.6. Summary age data from roach x bream hybrids captured Lough Ree, June 2022. Number of fish 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	2	1	1	3	12	17	13	1	2	1
Mean	-	-	15.5	-	-	28.7	32.2	34.9	35	-	36.8	-
Min	-	8.5	15.5	16.8	21.3	24.2	29.3	32.5	33.3	37	36.5	42.2
Max	-	8.5	15.5	16.8	21.3	31.9	34.8	39.4	36.7	37	37	42.2

Bream

Bream ranged in length from 29.6cm to 44.8cm (mean = 34.9cm) (Figure 3.8). Bream were aged between 6+ and 9+ and no younger fish were present in the sample. No bream were captured in the 2013 survey and just one fish was captured in 2010. In 2022 all fish were captured in the supplementary 4PBB survey nets. Netting effort for braided survey nets was greater in 2022 compared to the earlier surveys when nine 1PBB survey nets were used. Bream were aged from 6+ to 9+ (Table 3.7).
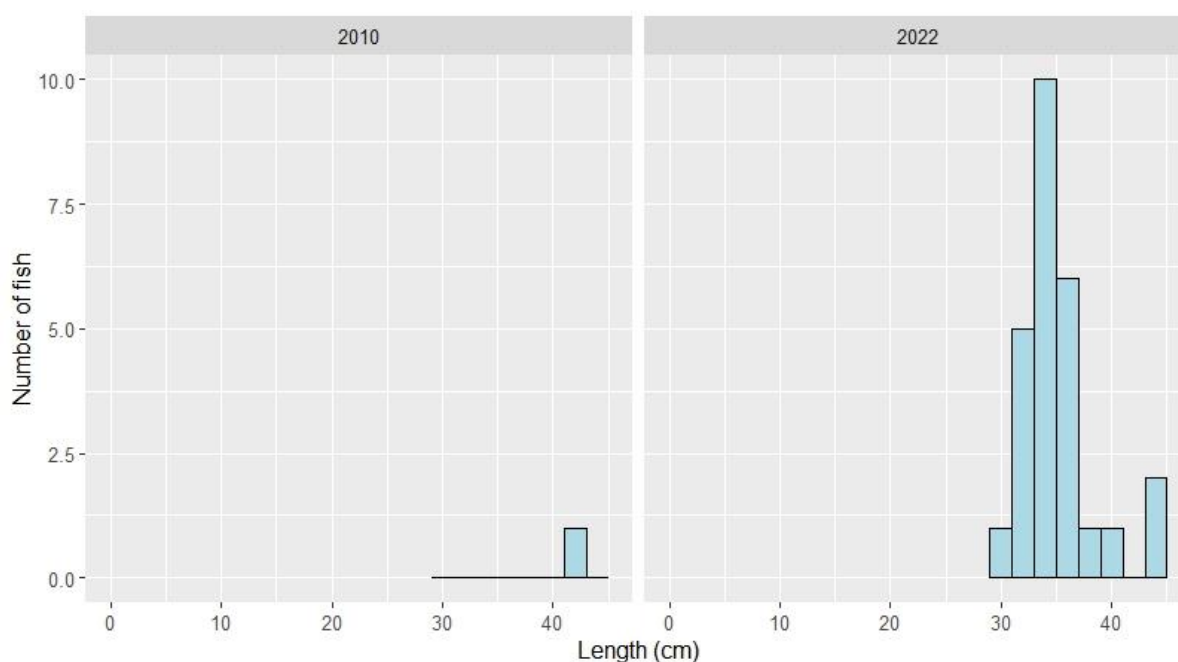
Figure 3.8. Length frequency of bream captured on Lough Ree, 2010 and 2022.

Table 3.7. Summary age data from bream captured Lough Ree, June 2022. Number of fish 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+
N							1	2	2	1
Mean							-	36.2	39.5	-
Min							33.2	35.4	38.5	44.5
Max							33.2	36.9	40.5	44.5

Brown trout

Brown trout captured in the 2022 survey ranged in length from 18.2cm to 76.7cm (mean = 43.1cm) (Figure 3.9). While relatively few fish in any size class were captured, the greatest length range of brown trout was recorded in 2022 (Figure 3.9). This was influenced by the capture of one large (76.7cm) trout in 2022. However, there were fewer fish between 18-30cm captured in 2022 compared to the previous survey in 2013.

Brown trout in the sample were aged between 1+ and 6+ and all intervening age classes were present. Mean L1 (i.e. age at the end of the 1st year) was 8.1cm. No one age group was dominant, although sample size was small (Table 3.8).
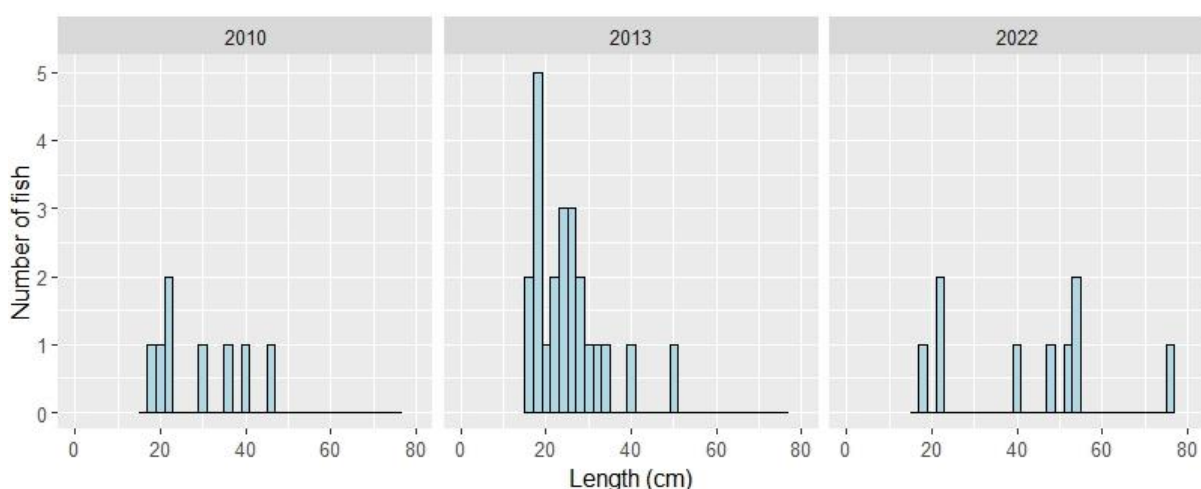
**Figure 3.9. Length frequency of brown trout captured on Lough Ree, 2010, 2013 and 2022.**

Table 3.8. Mean (±S.E.) brown trout length (cm) at age for Lough Ree, June 2022.

Length (cm)	Age class					
	L_1	L_2	L_3	L_4	L_5	L_6
Mean (±S.E.)	8.1 (1.1)	16.3 (2.0)	25.4 (2.5)	37.6 (2.5)	47.6 (2.5)	57.0 (8.6)
N	8	8	7	5	4	2
Range	5.3 - 14.8	11.7 - 28.3	18.6 - 36.3	32.5 - 45.1	43.1 - 53.8	48.4 - 65.6

Pollan

Pollan ranged in length from 14cm to 27.5cm during the 2022 survey (mean 21.2cm). While the length range was wider in 2013 compared to the other surveys, this may have been influenced by a greater number of survey gill nets used in that year. However, in 2013 there was a smaller proportion of fish less than 20cm in length compared to both the earlier surveys.
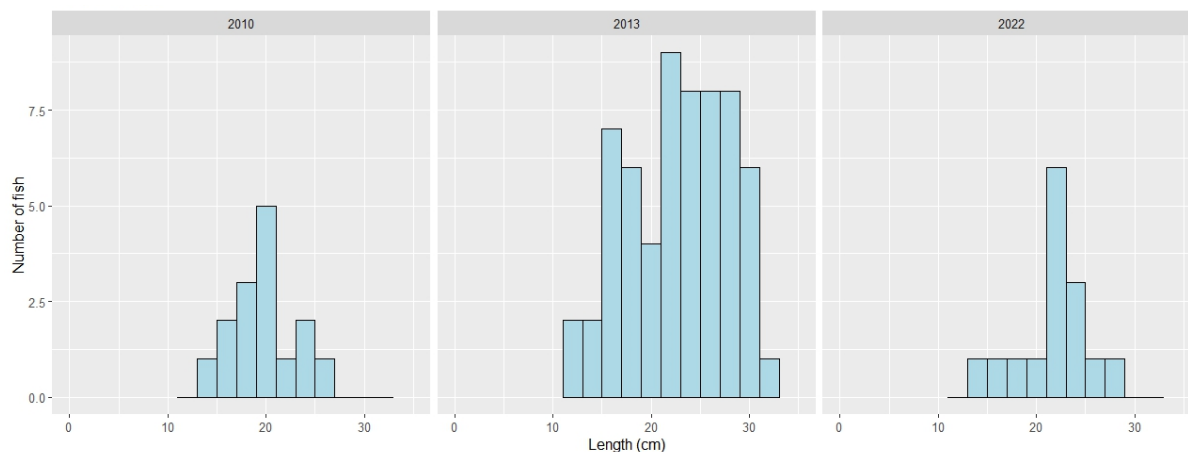
Figure 3.10. Length frequency of pollan captured on Lough Ree, 2010, 2013 and 2022.

Other species

Pike captured ranged in length from 27.8cm to 99.0cm (mean = 66.3cm). Pike were aged from 1+ to 7+. Eels ranged in length from 51.5cm to 78.5cm (mean = 60.8cm). Tench ranged in length from 27.0cm to 51.3cm (mean = 44.6cm) and were aged between 4+ and 7+. One gudgeon measuring 6.8cm in length was also captured

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

Perch

A total of 28 perch stomachs were examined. Of these 17 (60.7%) were empty. Of the 11 stomachs that contained prey items, fish were the sole prey type recorded in five (46%) stomachs and with zooplankton in one (8%) stomach. Zooplankton and unidentified digested material were each

recorded in two (18%) stomachs. Invertebrates were recorded in one (9%) perch stomach (Figure 3.11).

■ Fish remains/Zooplankton ■ Fish remains ■ Invertebrates ■ Zooplankton ■ Digested material
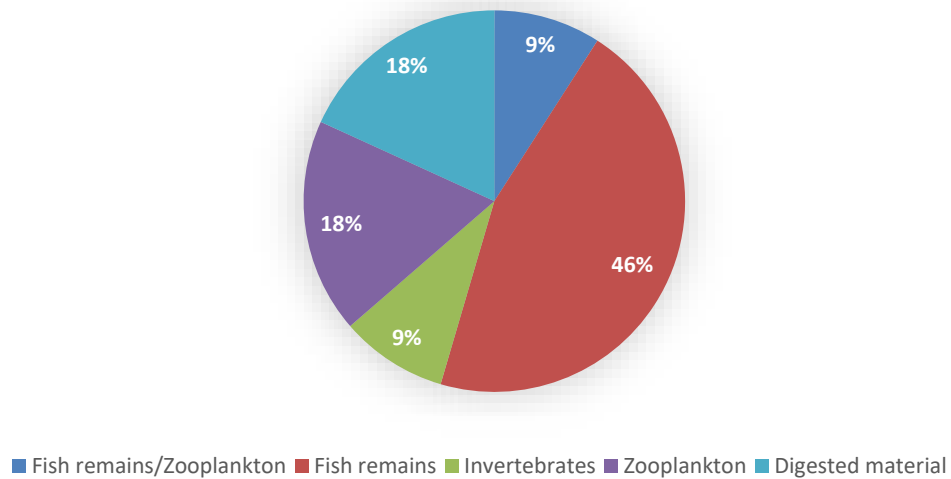
Figure 3.11. Diet of perch (N = 11) captured on Lough Ree, 2022 (% FO).

Brown trout

A total of three brown trout stomachs were examined. One stomach was empty. Invertebrates were the sole prey type recorded in one trout stomach, while they were found together with zooplankton in the remaining stomach.

Pike

A total of three pike stomach contents were analysed. One stomach was empty. Fish were the sole prey item in one pike (66.2cm) and were recorded together with invertebrates in one pike (27.8cm).

4.   Summary and fish ecological status

Nine fish species and one cyprinid hybrid variety were recorded in Lough Ree in June 2022.

Roach was the dominant species in terms of both abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2022 survey. An increase in both metrics was noted since the lake was first surveyed in 2010. Perch was the second most common and abundant (CPUE) species recorded during the 2022 survey. Median CPUE of perch was lower in 2022 than previous years but biomass was relatively similar. While both species continue to recruit regularly there was a smaller proportion of younger (*c*. 1 year old) perch recorded in 2022 compared to previous surveys.

A higher abundance of bream was recorded in 2022 compared to previous surveys. While this may be attributed to the deployment of larger numbers of benthic braided nets in 2022 compared to previous years (i.e. 4PBB v 1PBB), it indicates that an extant population of this important angling species is present in the lake.

Bream and roach x bream hybrid populations were both dominated by older individuals. Hybridization between roach and bream requires spawning between both parent species (Hayden *et al*., 2010). The absence of younger cohorts may suggest that recruitment to both bream and hybrid populations may have been limited in recent years. However, roach x bream hybrids were similarly dominated by older individuals in previous surveys and it is possible that recruitment to the lake is supplemented from elsewhere in the catchment.

Pollan are restricted to five lakes on the island of Ireland and Lough Ree is one of three lakes on the Shannon which supports a population of this species (Harrison *et al*., 2012). CPUE and BPUE have fluctuated across the three surveys on Lough Ree conducted since 2013. While recruitment continues (evidenced by the continued presence of some smaller individuals) the relative lack of fish smaller than 20cm compared to earlier surveys of the lake may suggest that recruitment has decreased in recent years.

Lough Ree continues to support an active brown trout fishery (recreation and commercial). While abundance and biomass have fluctuated across all three sampling periods and more fish were captured in the 2013 survey than in 2010 and 2022, this species continues to recruit to the lake. However there were less small fish captured in 2022 (i.e. 18-30cm). Brown trout biomass (BPUE) in 2022 was similar to that recorded in the 2013 survey and higher than 2010.

CPUE and BPUE of the European eel was lower in 2022 than previous surveys.

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 values for each lake and associated confidence in classification (Kelly *et al.*, 2012).

Using the FIL2 classification tool, Lough Ree has been assigned an ecological status of Moderate for 2022 based on the fish populations present. Lough Ree had previously been assigned Poor status in 2010 and 2013 (Figure 4.1). This increase in status is likely driven by a reduction in the biomass of tolerant fish species (in this instance roach x bream hybrids) (Corcoran *et al*., 2023).

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Lough Ree an overall ecological status of Good, based on all monitored physico-chemical and biological elements, excluding fish (EPA 2021).
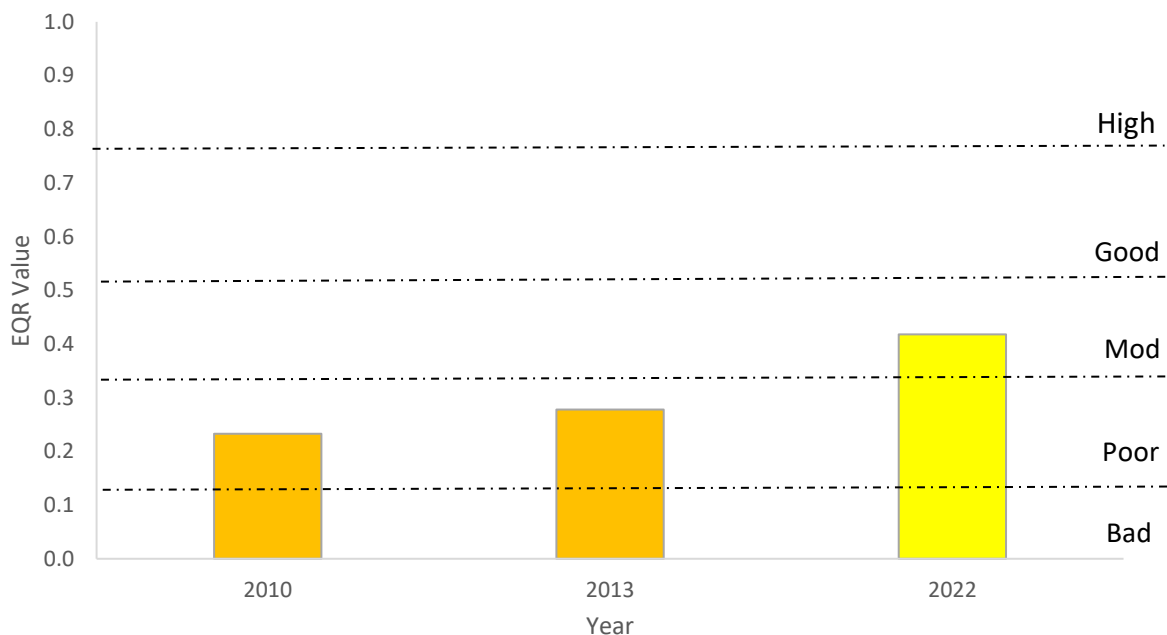
Figure. 4.1. Fish ecological status, Lough Ree, 2010, 2013 and 2022 (dashed line indicates EQR status boundaries).

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