National Research Survey Programme
Lakes 2023

Upper Lough Skeagh

Iascach Intíre Éireann
Inland Fisheries Ireland

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Fish Stock Survey of Upper Lough Skeagh, August/September 2023

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National Research Survey Programme

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ACKNOWLEDGEMENTS

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1.   Introduction

Upper Lough Skeagh is located seven kilometres north-west of Bailieborough, Co. Cavan, in the Boyne catchment (Plate 1.1 and Figure 1.1). The lake has a surface area of 61ha and a maximum depth of 4.9m. The lake falls into typology class 6 (as designated by the EPA for the Water Framework Directive), i.e. shallow (mean depth <4m), greater than 50ha and moderate alkalinity (20-100mg/l $CaCO_3$).

Upper Lough Skeagh historically held stocks of bream, pike, roach and perch. A private water supply is taken from the lake and a pump house is present on the shores of the lake. The lake supports an important coarse fishery with shore-based angling predominantly occurring on the eastern (roadside) shore of the lake. Significant pressures affecting the ecological status of Upper Lough Skeagh include agricultural enrichment and domestic wastewater discharges (EPA, 2021).

Upper Lough Skeagh has been surveyed on three occasions since 2008 (Kelly *et al.*, 2009, 2012a, McLoone *et al.*, 2017). During the 2017 survey, perch and roach were found to be the dominant species present in the lake. Pike, bream, roach x bream hybrids and eel were also recorded.

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.
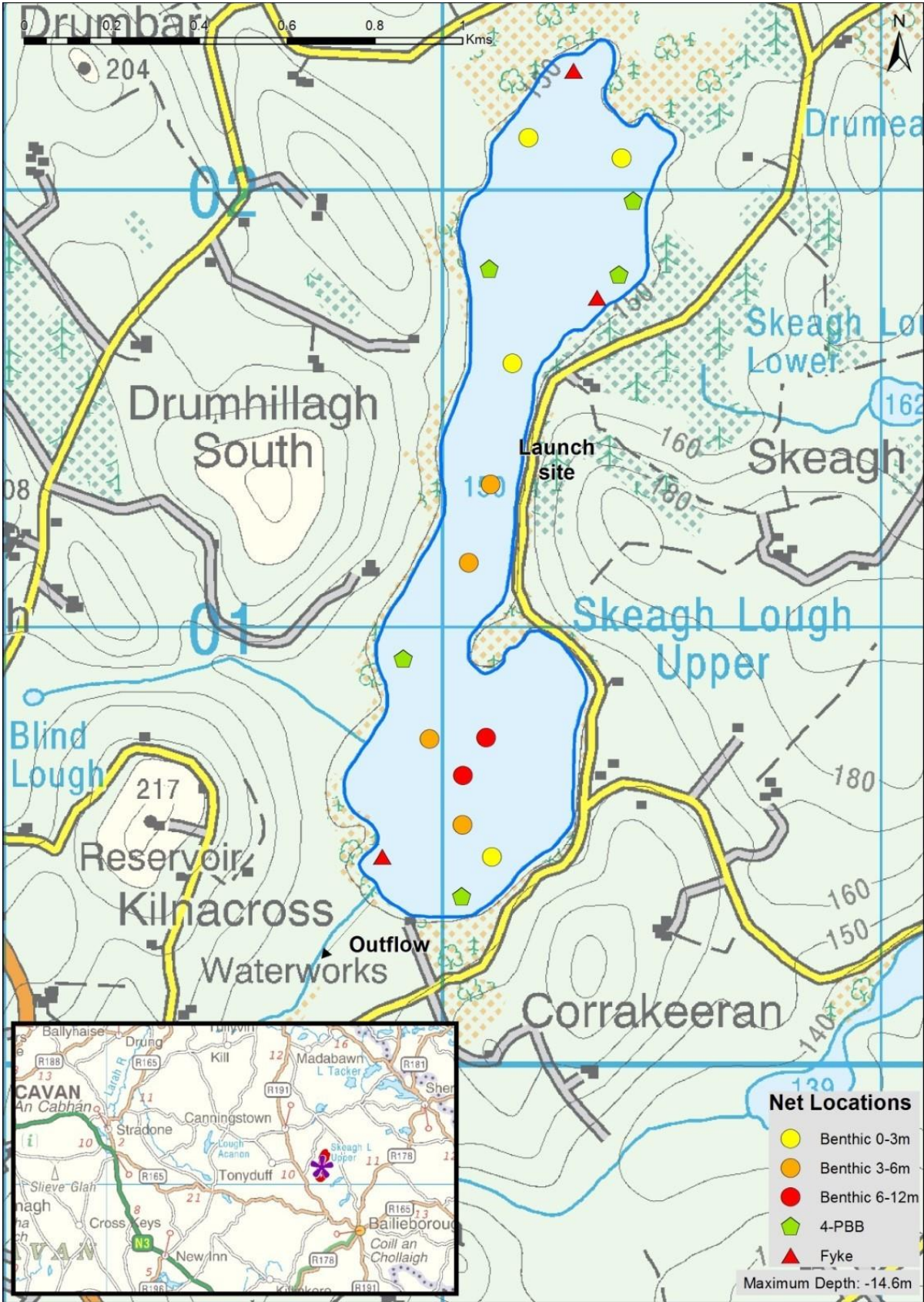

Plate 1.1. Upper Lough Skeagh, August 2023

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

2. Methods

2.1. Netting methods

Upper Lough Skeagh was surveyed over two nights from the 30th of August to the 1st of September 2023. A total of three sets of Dutch fyke nets, 12 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (4 @ 0-2.9m, 4 @ 3-5.9m and 2 @ 6-11.9m) were deployed in the lake (15 sites). The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at five additional sites. The 4-PBB nets are composed of four 27.5m long panels each a different mesh size (55mm, 60mm, 70mm and 90mm knot to knot). 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).

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

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 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

A total of five fish species and one cyprinid hybrid were recorded on Upper Lough Skeagh in 2023. A total of 815 fish were captured (Table 3.1). Perch was the most numerous fish species recorded, accounting for *c.* 59% of all fish captured in the survey. Roach, bream, roach x bream hybrids, pike and European eel were also captured. The same species composition was recorded on previous surveys of the lake in 2008, 2011 and 2017 (Kelly *et al.,* 2009*,* 2012a and McLoone *et al.,* 2017*)*.

Table 3.1. Number of each fish species captured by each gear type during the survey on Upper Lough Skeagh, August/September 2023.

Scientific name	Common name	Number of fish captured			
		BM CEN	4-PBB	Fyke	Total
Perca fluviatilis	Perch	478	2	2	482
Rutilus rutilus	Roach	210	0	4	214
Abramis brama	Bream	47	13	0	60
Rutilus rutilus x Abramis brama	Roach x bream hybrid	51	0	0	51
Esox lucius	Pike	3	2	0	5
Anguilla anguilla	European eel	0	0	3	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 (BPUE). Biomass of roach and bream were also relatively high in comparison to perch (Table 3.2).

Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Upper Lough Skeagh

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Perca fluviatilis	Perch	0.888 (0.369)	19.297 (6.532)
Rutilus rutilus	Roach	0.393 (0.154)	12.299 (4.767)
Abramis brama	Bream	0.094 (0.025)	15.619 (4.090)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.094 (0.032)	8.000 (2.836)
Esox lucius	Pike	0.007 (0.003)	9.621 (4.708)
*Anguilla anguilla**	European eel	0.017 (0.010)	10.376 (7.591)

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 5.1cm to 30.0cm (mean 10.0cm) (Figure 3.1). Length range of perch was broadly similar in all surveys. In 2023, two prominent size classes were dominant, with some persistence of larger fish evident. Perch were aged between 0+ and 7+ and all intervening age classes were present in the sample aged (Table 3.3). Fish aged from 0+ (5cm – 7cm) to 2+ (10cm – 14cm) together represented *c*. 61% of all fish in the sample aged (Figure 3.1). A large cohort of five year old fish (15cm - 27cm) was also recorded (Figure 3.1 and Table 3.3).

Abundance (CPUE) and biomass (BPUE) of perch have remained relatively stable across all surveys of the lake, and no clear trends in either metric are apparent (Figure 3.2).
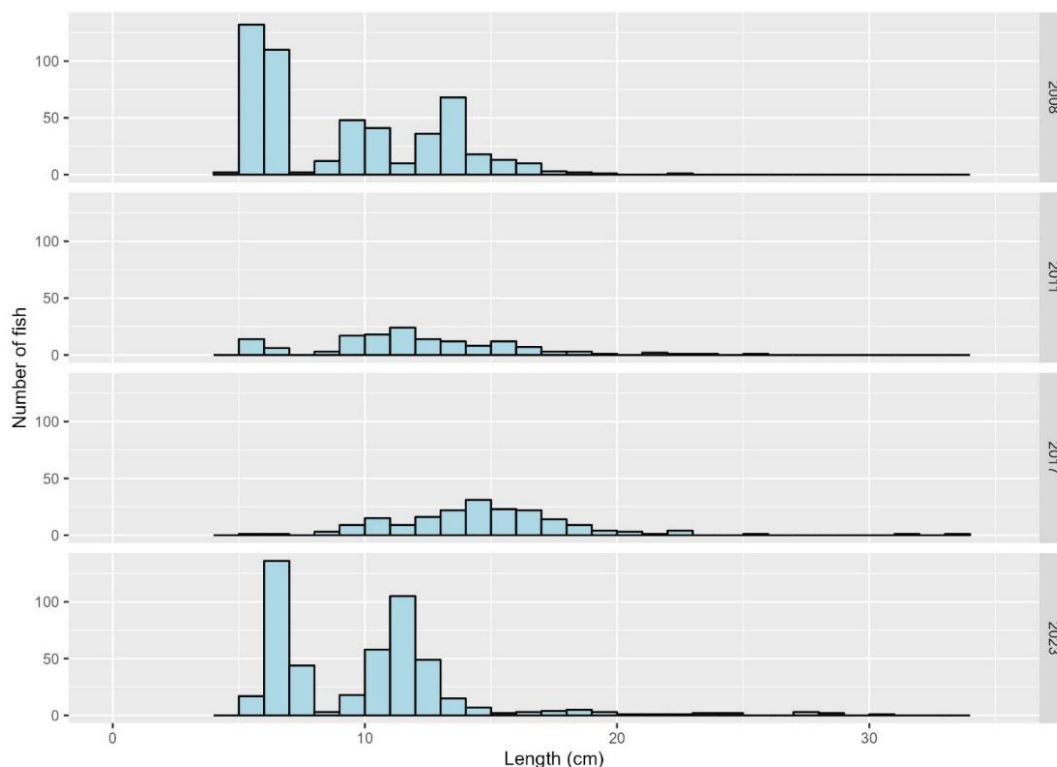

Figure 3.1. Length frequency of perch captured on Upper Lough Skeagh between 2008 and 2023

Table 3.3. Mean (±S.E.) perch length (cm) at age for Upper Lough Skeagh, August/September 2023

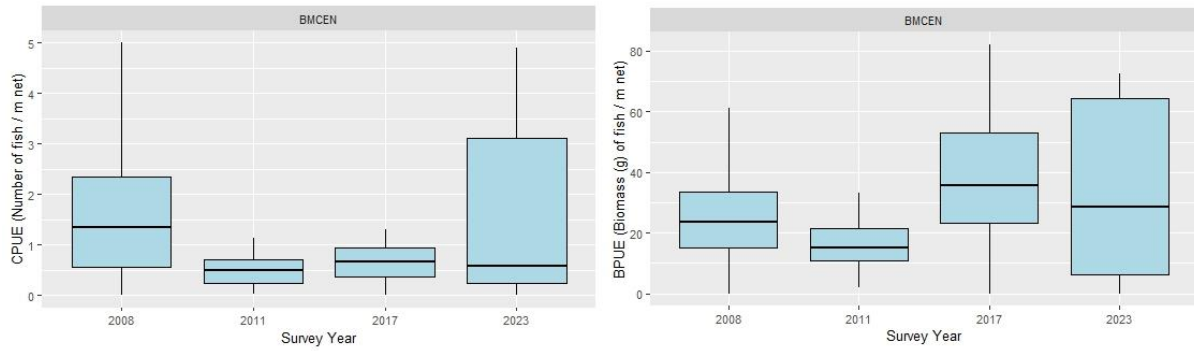| Length (cm)	L_1	L_2	L_3	L_4	L_5	L_6	L_7
Mean (±S.E.)	5.4 (0.13)	9.4 (0.17)	12.5 (0.28)	15.6 (0.37)	18.6 (0.68)	-	-
N	57	45	28	22	15	1	1
Range	3.8-7.8	7.8-12.0	10.1-17.2	12.3-18.7	14.5-23.7	24.9	27.9

Figure 3.2. CPUE and BPUE of perch captured during surveys of Upper Lough Skeagh between 2008 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.

Roach

Roach captured during the 2023 survey ranged in length from 7.5cm to 19.1cm (mean 12.3cm) (Figure 3.3). The size range of roach captured was narrower (with both fewer small and large fish) in 2023 compared to earlier surveys (Figure 3.3). Roach were aged between 1+ and 7+and all intervening age classes were present in the sample aged (Table 3.4). Two to four year old year old fish (9cm – 13cm) dominated the population and accounted for *c.* 73% of all fish in the sample aged (Figure 3.3 and Table 3.4).

An apparent decreasing trend in roach biomass (BPUE) was more marked than the change in abundance (CPUE) between 2008 and 2023 (Figure 3.4).
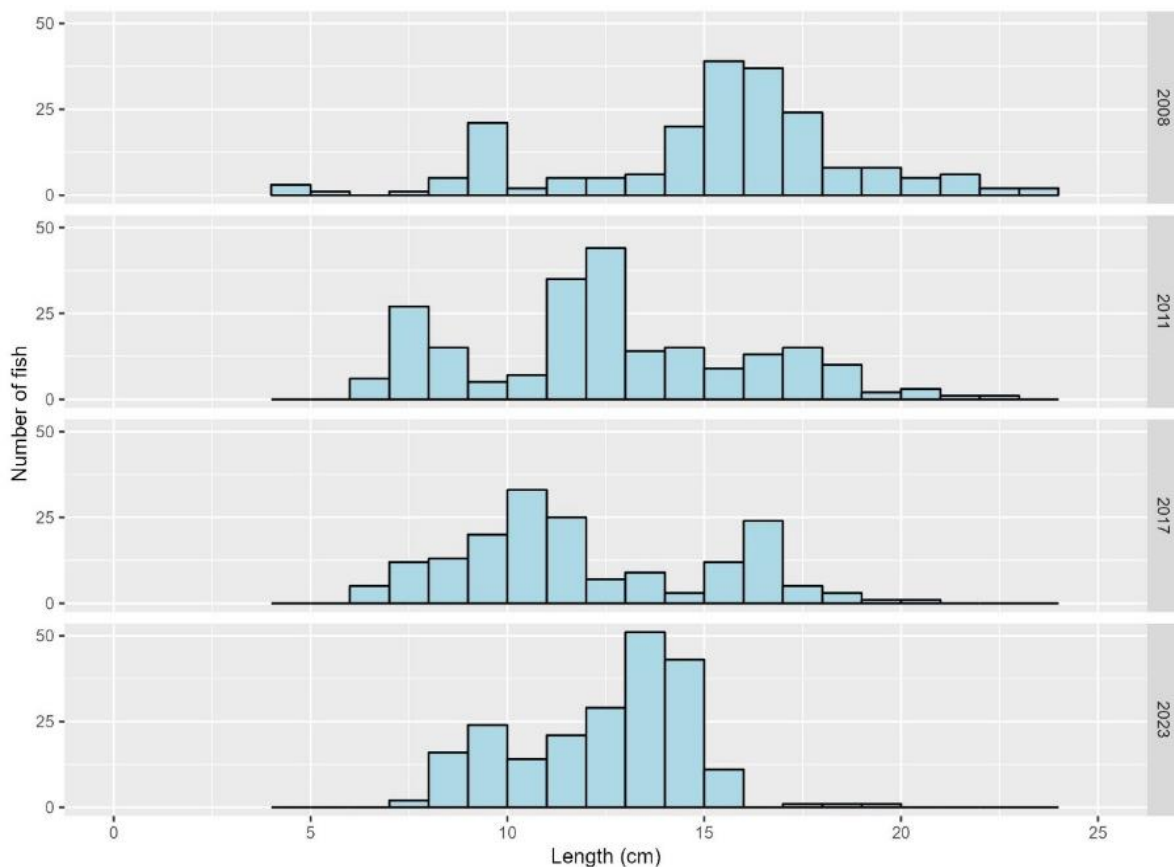

Figure 3.3. Length frequency of roach captured on Upper Lough Skeagh between 2008 and 2023

Table 3.4. Summary age data from roach captured on Upper Lough Skeagh, July / August 2023. Number of fish and length ranges of all fish aged in the sample is presented

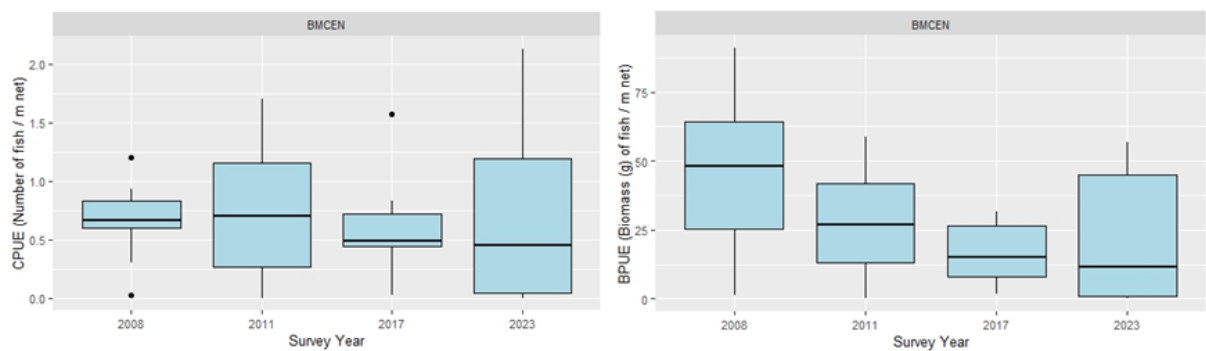| Length (cm)	Age class								
	0+	1+	2+	3+	4+	5+	6+	7+	8+
N	-	1	11	10	8	6	1	2	1
Mean	-	7.7	9.6	12.1	13.7	15.0	14.4	18.0	19.1
Min	-	7.7	8.7	11	12.6	14.3	14.4	17.2	19.1
Max	-	7.7	10.6	13.3	14.4	15.7	14.4	18.7	19.1

Figure 3.4. CPUE and BPUE of roach captured during surveys of Upper Lough Skeagh between 2008 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.

Bream

Bream captured during the 2023 survey ranged in length from 9.3cm to 41.5cm (mean 21.0cm) (Figure 3.5). Bream in excess of 40cm in length were captured for the first time in 2023. Bream were long lived and were aged between 2+ and 17+ (Table 3.5). However, the population was dominated by younger fish aged between 3+ (11cm - 13cm) and 7+ (20cm - 21cm) with more limited persistence of fish older than 10+ (27cm) in the population(Figure 3.5).

There was a slight upwards trend in bream abundance (CPUE) between 2008 and 2023. This trend was less pronounced for biomass (BPUE) (Figure 3.6).
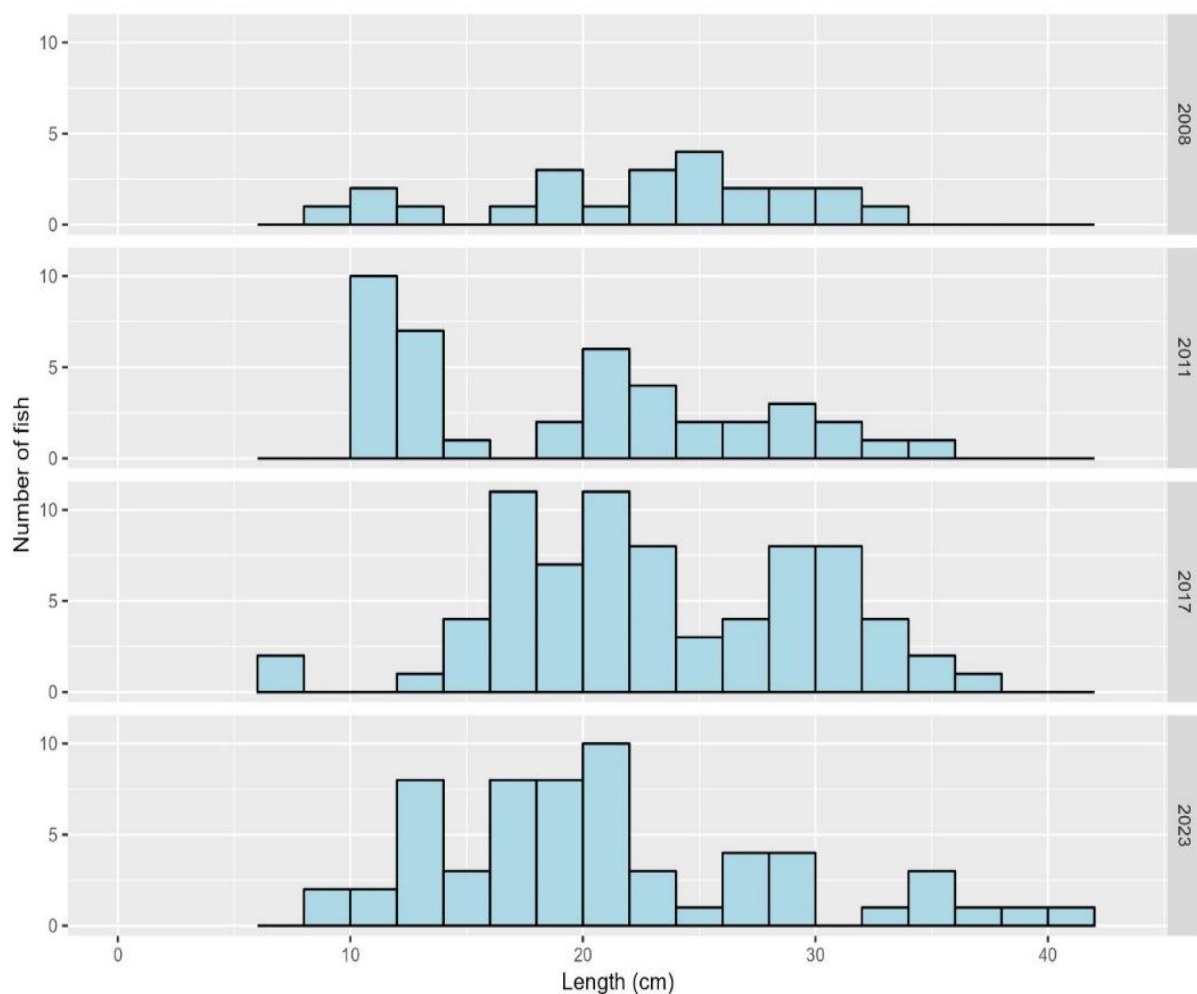

Figure 3.5. Length frequency of bream captured on Upper Lough Skeagh between 2008 and 2023.

Table 3.5. Summary age data from bream captured on Upper Lough Skeagh, July / August 2023. 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+
N	-	-	2	8	3	7	8	10	2	-	2
Mean	-	-	9.3	12.9	13.7	17.1	18.6	20.8	24.5	-	27.2
Min	-	-	9.3	11.6	11.3	15.8	16	20	23.8	-	27
Max	-	-	9.3	13.6	15.5	17.5	19.9	21.5	25.2	-	27.3

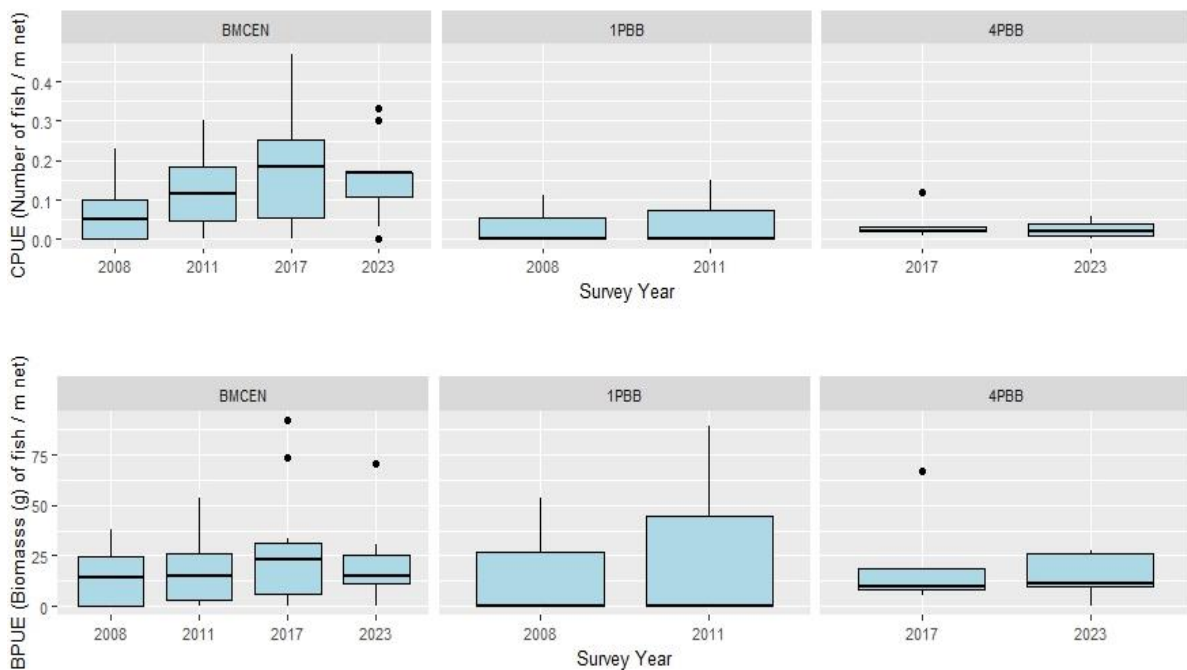| Length (cm)	Age class						
	11+	12+	13+	14+	15+	16+	17+
N	5	1	1	2	-	-	1
Mean	29.8	35.8	32.7	37	-	-	41.5
Min	27.9	35.8	32.7	36	-	-	41.5
Max	35.2	35.8	32.7	38	-	-	41.5

Figure 3.6. CPUE and BPUE of bream captured during surveys of Upper Lough Skeagh between 2008 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.

Roach x bream hybrids

Roach x bream hybrids captured during the 2023 survey ranged in length from 8.7cm to 28.3cm (mean 16.7cm) (Figure 3.7). Smaller fish dominated the population in 2023, when fish less than 20cm in length were particularly dominant and all fish captured measured less than 30cm. Roach x bream hybrids were aged between 2+ and 11+ (Table 3.6). Five and six year old fish (15cm – 18cm) were the most abundant cohorts and accounted for *c*. 53% of all fish in the sample aged (Figure 3.7).

Roach x bream hybrid abundance and biomass have increased since 2008 (Figure 3.8).
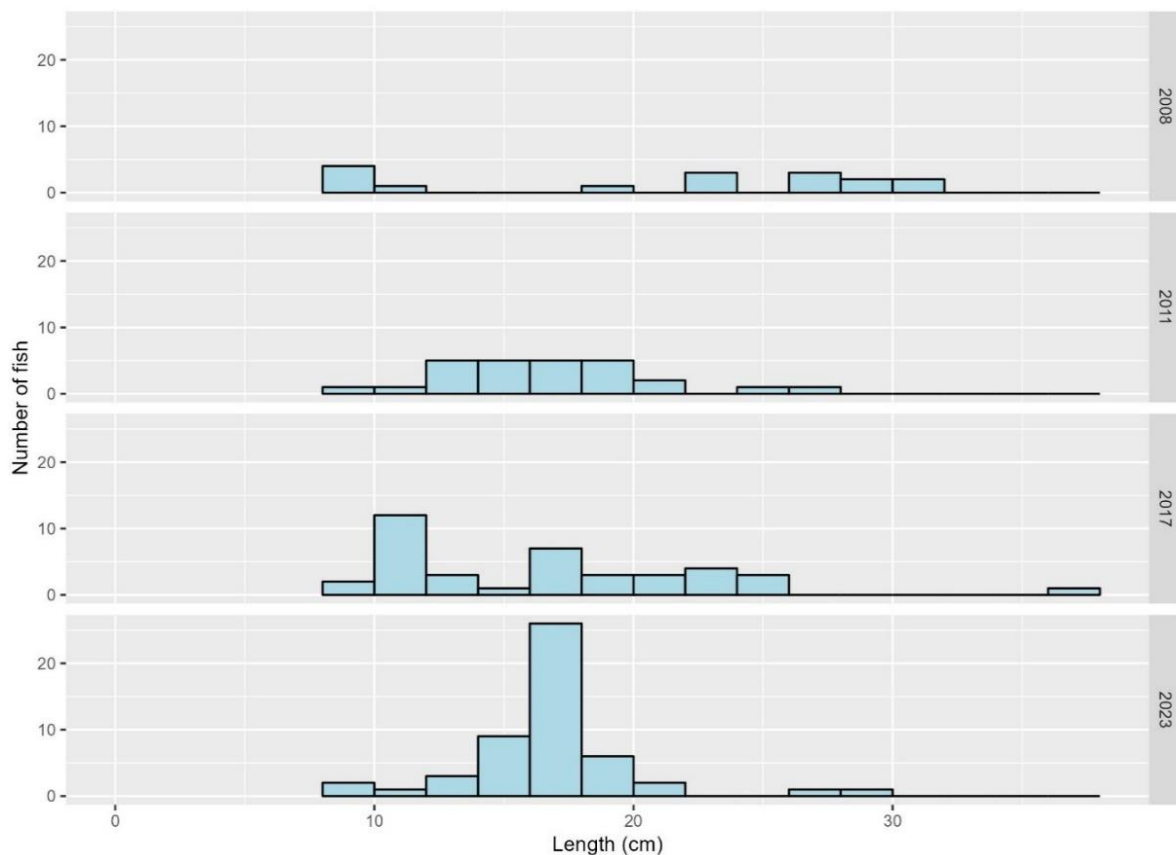

Figure 3.7. Length frequency of roach x bream hybrids captured on Upper Lough Skeagh between 2008 and 2023.

Table 3.6. Summary age data from roach x bream hybrids captured on Upper Lough Skeagh, July / August 2023. Number of fish and length ranges of all fish aged in the sample is presented

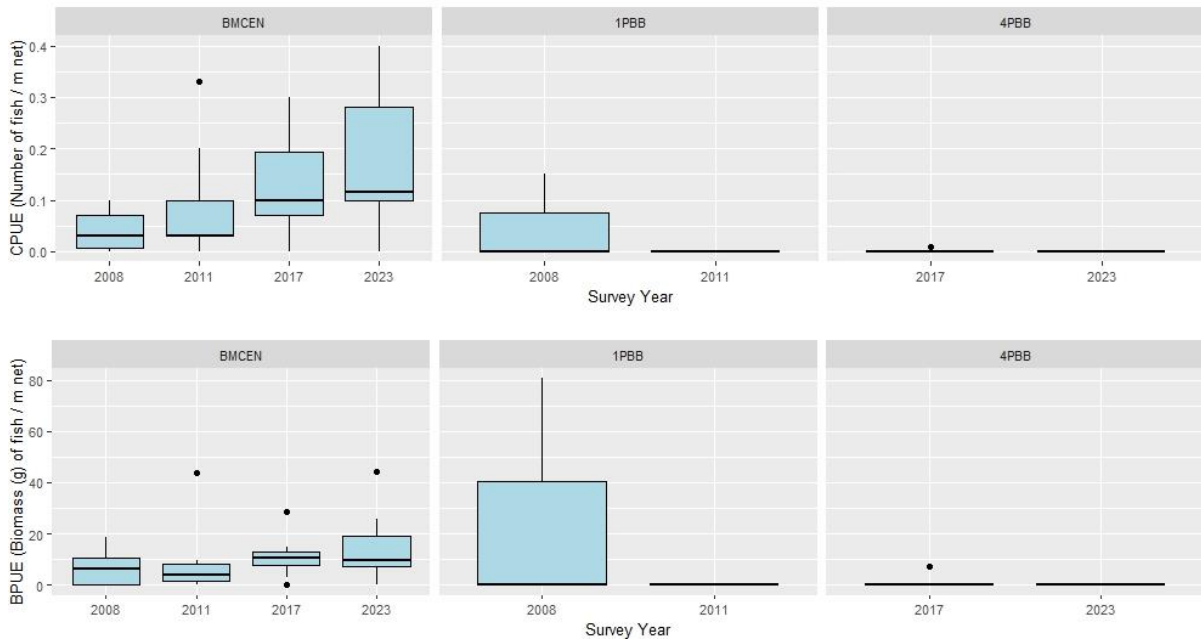| Length (cm)	Age class											
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+
N	-	-	2	3	2	6	10	4	1	1	-	1
Mean	-	-	8.95	12.8	14.7	15.9	17.2	20.0	19.7	19.9	-	28.3
Min	-	-	8.7	12.5	14.2	15.5	16.2	18	19.7	19.9	-	28.3
Max	-	-	9.2	13.1	15.1	16.3	18.2	21.7	19.7	19.9	-	28.3

Figure 3.8. CPUE and BPUE of roach x bream hybrids captured during surveys of Upper Lough Skeagh between 2008 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.

Other Species

European eel captured during the 2023 survey ranged in length from 59.0cm to 80.0cm (mean 70.7cm) (Figure 3.9). Eel abundance (CPUE) and biomass (BPUE) have fluctuated widely on the lake (Figure 3.10).

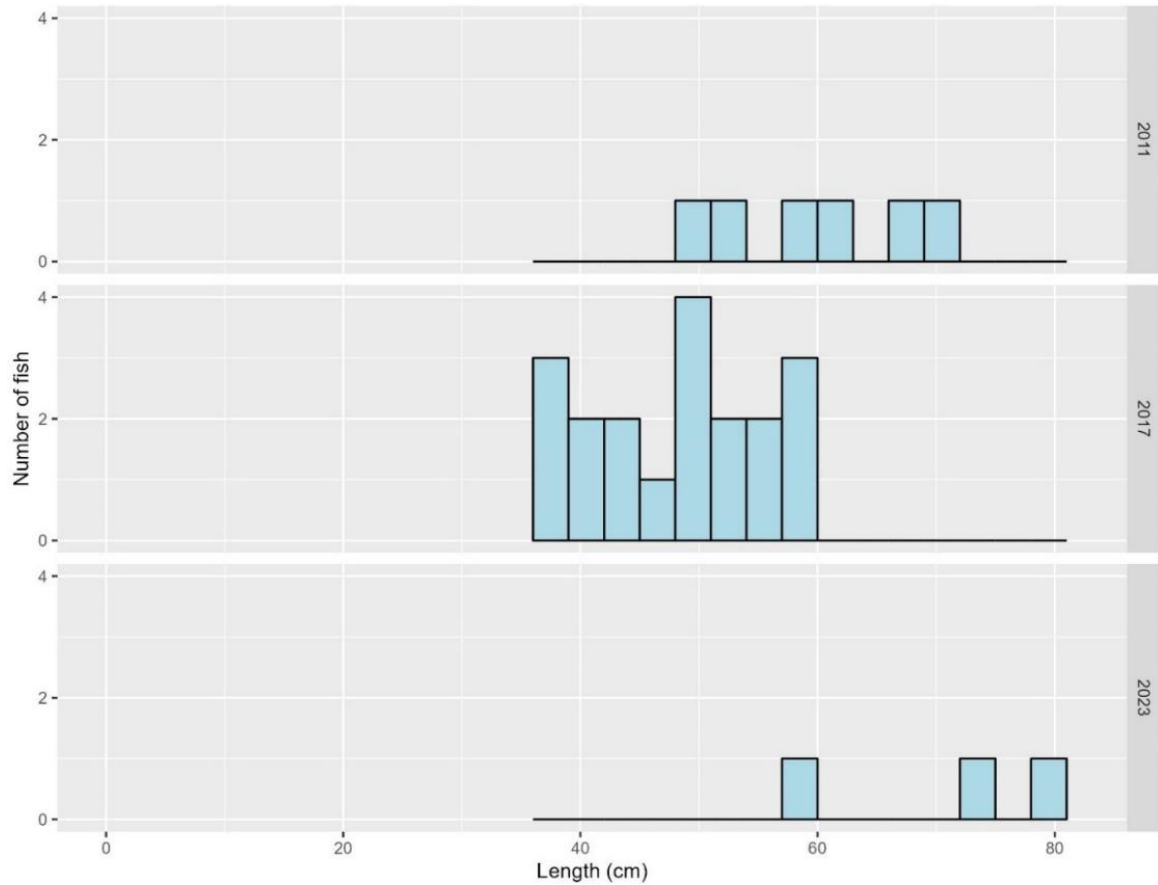Pike captured in the 2023 survey ranged from 47.2cm to 66.6cm (mean = 57.6cm).

Figure 3.9. Length frequency of European eel captured on Upper Lough Skeagh between 2008 and 2023.
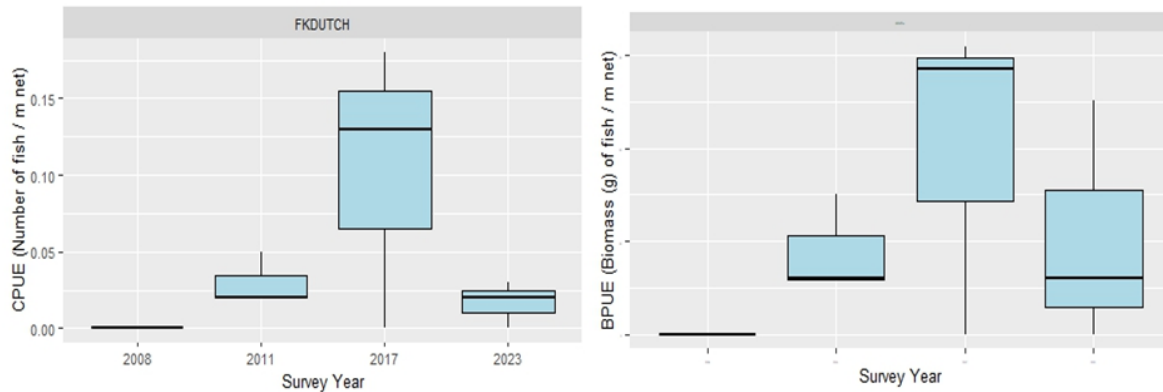

Figure 3.10. CPUE and BPUE of European eel captured during surveys of Upper Lough Skeagh between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

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 pike captured during the survey were examined and are presented below.

Perch

A total of 55 perch stomachs were examined. Fifty (91%) were empty. Five stomachs contained food. Invertebrates were the sole prey type recorded in three (60%) stomachs. Fish and unidentified digested material were each recorded in one (20%) fish (Figure 3.5).
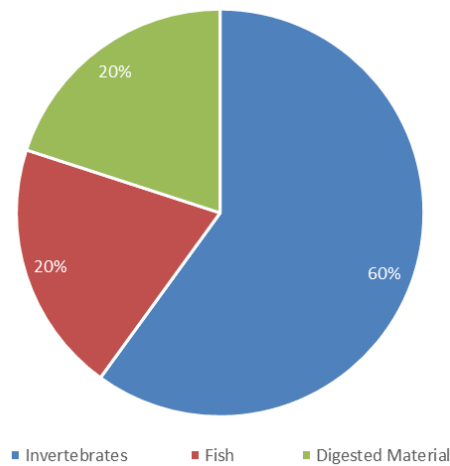

Figure 3.5. Diet of perch (N = 5) captured on Upper Lough Skeagh, 2023 (% FO).

Pike

Two pike stomachs were available for analysis. Both stomachs contained fish. One stomach contained a roach x bream hybrid, while the second stomach contained a bream.

4.   Summary and fish ecological status

A total of five fish species and one hybrid were recorded on Upper Lough Skeagh in 2023. Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2023 survey.

Populations of the two most abundant species in the lake (i.e. perch and roach) appear to be relatively stable. Spawning and recruitment was regular in both species which were dominated by smaller and younger individuals. The size range of roach appears to have contracted in recent years, and no fish greater than 20cm in length were recorded in the survey in 2023.

While the bream population was also dominated by a larger proportion of younger and smaller fish, there was some persistence of larger and older fish in the population. Bream CPUE appear to be relatively stable. The roach x bream hybrid population, which require spawning populations of both parent species to successfully recruit (Hayden *et al*., 2010) appears to have increased since 2008.

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, Upper Lough Skeagh has been assigned an ecological status of Bad for 2023 based on the fish populations present. The ecological status of Upper Lough Skeagh following fish stock surveys of the lake between 2008 and 2023 is presented in Figure 4.1

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Upper Lough Skeagh an overall ecological status of Poor, based on all monitored physico-chemical and biological elements, including fish (EPA 2021).
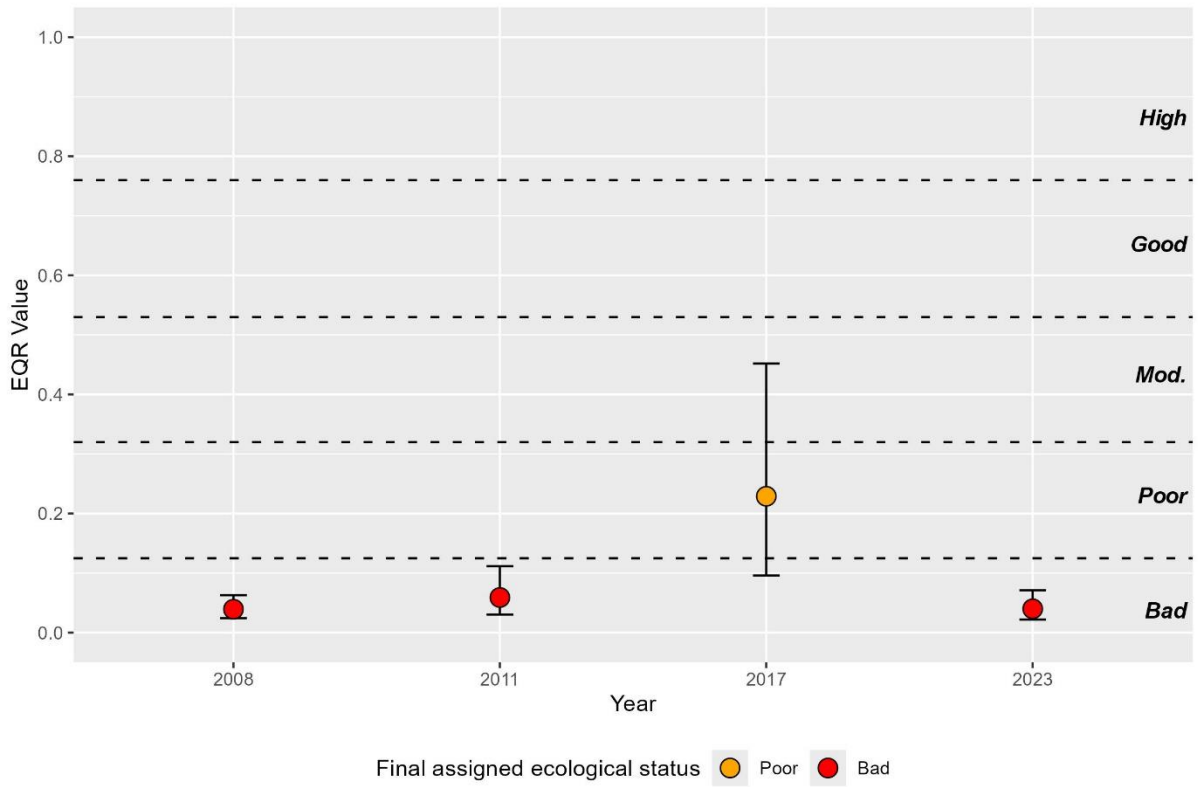
Figure 4.1. Fish ecological status, Upper Lough Skeagh, between 2008 and 2023 (dashed line indicates EQR status boundaries).

Plate 4.1. Retrieving a survey net on Upper Lough Skeagh, September 2024

5. References

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