National Research Survey Programme

Lakes 2023

Lough Meelagh

IFI/2024/1-4731

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Inland Fisheries Ireland

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Fish Stock Survey of Lough Meelagh, August 2023

National Research Survey Programme

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

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1. Introduction

Lough Meelagh is located west of Keadew, Co. Roscommon (Plate 1.1, Figure 1.1). The lake has a surface area of 116ha and a maximum depth of 14m. The lake outflows to the Feorish river in the Shannon Catchment The lake is categorised as 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 (<20mg/l $CaCO_3$).

Much of the lake is inaccessible due to the presence of extensive reed beds and heavy aquatic macrophyte growth. It is best fished from the shore near the amenity area, with good fishing for roach and roach x bream hybrids (Fishing in Ireland, 2020)

The lake was surveyed on several occasions between 1973 and 1981. At that time fish species captured included, perch, pike, rudd and brown trout, with roach recorded in small numbers in 1981 (IFI unpublished data). In a subsequent survey in 2000, roach were the most abundant species recorded. Other species captured at that time included perch, pike, rudd, tench and brown trout (IFI unpublished data).

More recently Lough Meelagh was surveyed in 2008, 2011, and 2014 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.,* 2009, 2012a, 2015). During the 2014 survey, perch and roach were found to be the dominant species present in the lake. Pike, roach x bream hybrids, bream and European eel were also captured.

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 Meelagh

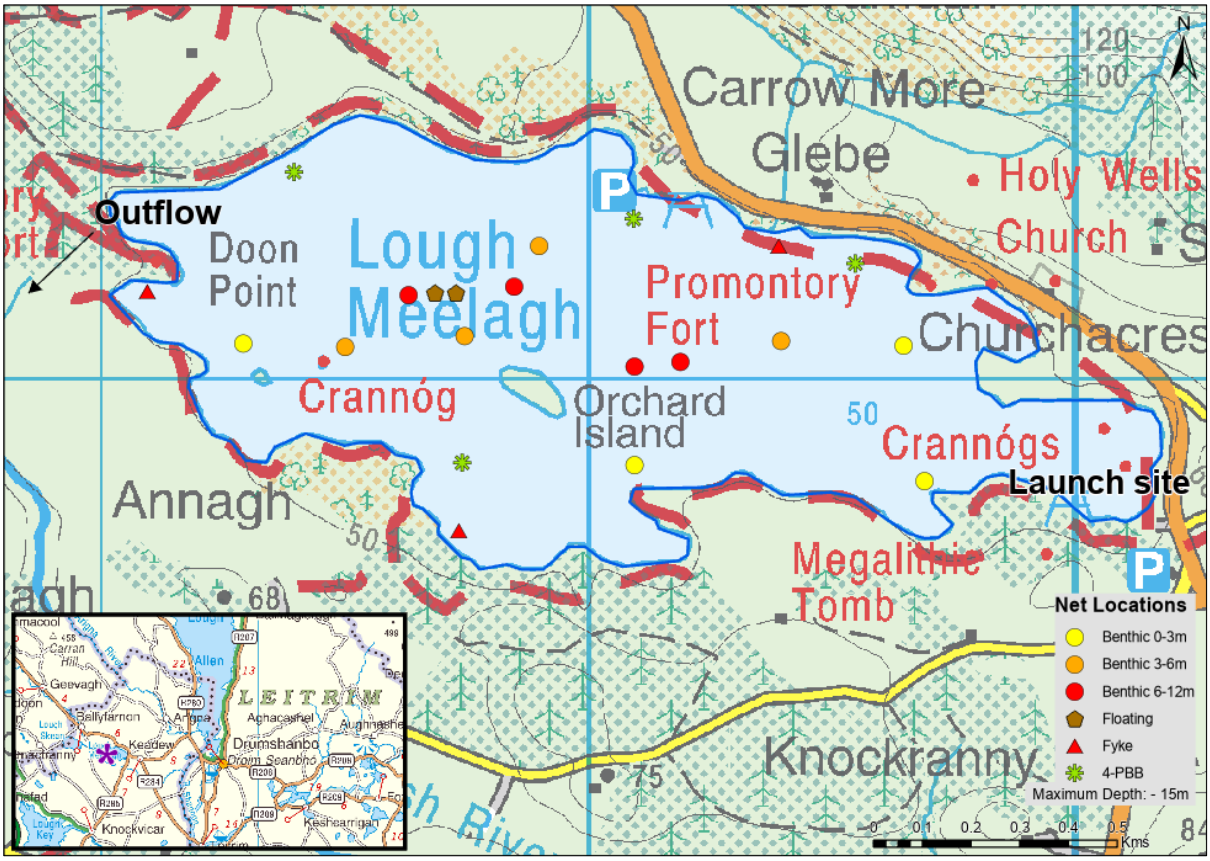

Figure 1.1. Location map of Lough Meelagh showing net locations and depths of each net (outflow is indicated on map).

2. Methods

2.1. Netting methods

Lough Meelagh was surveyed over two nights from the 8th to the 10th of August 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 4 @ 6-11.9m) and two floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed in the lake (17 sites). The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at four 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). 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

A total of six fish species and one type of cyprinid hybrid were recorded in Lough Meelagh in August 2023. A total of 667 fish were captured (Table 3.1). Perch and roach were the two most numerous species captured in the 2023 survey. Together they represented *c*. 85% of all fish recorded. Roach x bream hybrids, bream, pike, tench and European eel were also captured. The same species composition was recorded on previous surveys of the lake except tench, which were not recorded in 2014 (Kelly *et al.,* 2009, 2012a, 2015).

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

Scientific name	Common name	Number of fish captured				
		BM CEN	FM CEN	4-PBB	Fyke	Total
Perca fluviatilis	Perch	247	55	1	1	304
Rutilus rutilus	Roach	248	15	0	0	263
Rutilus rutilus x Abramis brama	Roach x bream hybrid	33	0	35	0	68
Abramis brama	Bream	2	0	19	0	21
Esox lucius	Pike	4	0	0	3	7
Tinca tinca	Tench	0	0	2	0	2
Anguilla anguilla	European eel	0	0	0	2	2

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 and roach were the dominant species with respect to abundance (CPUE). Roach was the dominant species in terms of biomass (BPUE), while roach x bream hybrids also recorded a high relative biomass (Table 3.2).

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

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Perca fluviatilis	Perch	0.482 (0.101)	9.683 (2.430)
Rutilus rutilus	Roach	0.417 (0.097)	52.752 (13.640)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.068 (0.014)	37.098 (8.153)
Abramis brama	Bream	0.012 (0.005)	11.235 (6.100)
Esox lucius	Pike	0.009 (0.003)	1.409 (0.904)
Tinca tinca	Tench	0.001 (0.001)	1.126 (0.802)
Anguilla anguilla *	European eel	0.011 (0.006)	6.650 (3.347)

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.

Crannog on L. Meelagh, August 2023

3.3 Species Profiles

Perch

Perch captured during the 2023 survey ranged in length from 3.8cm to 26.3cm (mean = 8.6cm) (Figure 3.1). The overall length range of perch captured was across all sampling occasions. In 2023, the population was characterised by a higher proportion of small, juvenile (i.e. <10cm) fish. Perch were aged between 0+ and 7+ and all intervening age classes were represented in the sampled aged. Perch aged between 0+ (4cm – 9cm) and 2+ (12cm – 18cm) dominated the population, representing *c*. 71% of all the fish aged (Figure 3.1). The modal peak at 5cm – 6cm is consistent with an abundance of 0+ perch fry. Mean L1 (i.e. length at the end of the 1st year) was 5.9cm (Table 3.3).

Perch abundance (CPUE) and biomass (BPUE) have remained relatively stable across all surveys and no obvious population trends are apparent (Figure 3.2).

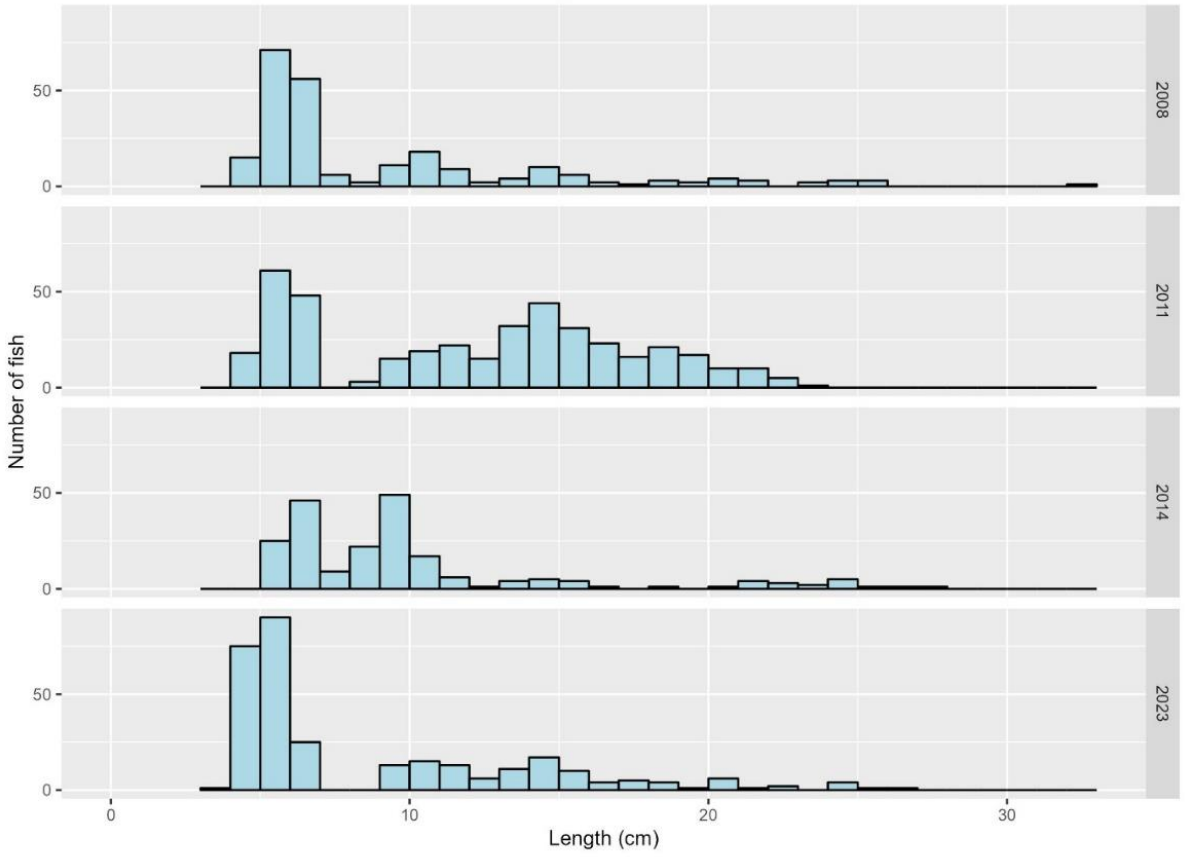

Figure 3.1. Length frequency of perch captured on Lough Meelagh between 2008 and 2023

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

	L_1	L_2	L_3	L_4	L_5	L_6	L_7
Mean (±S.E.)	5.9 (0.10)	10.0 (0.14)	14.5 (0.36)	17.9 (0.56)	20.0 (0.75)	21.7 (0.89)	-
N	64	45	21	15	11	4	1
Range	3.8-7.8	8.0-12.0	10.7-17.3	14.3-22.3	16.6-24.2	20.2-23.4	22.1

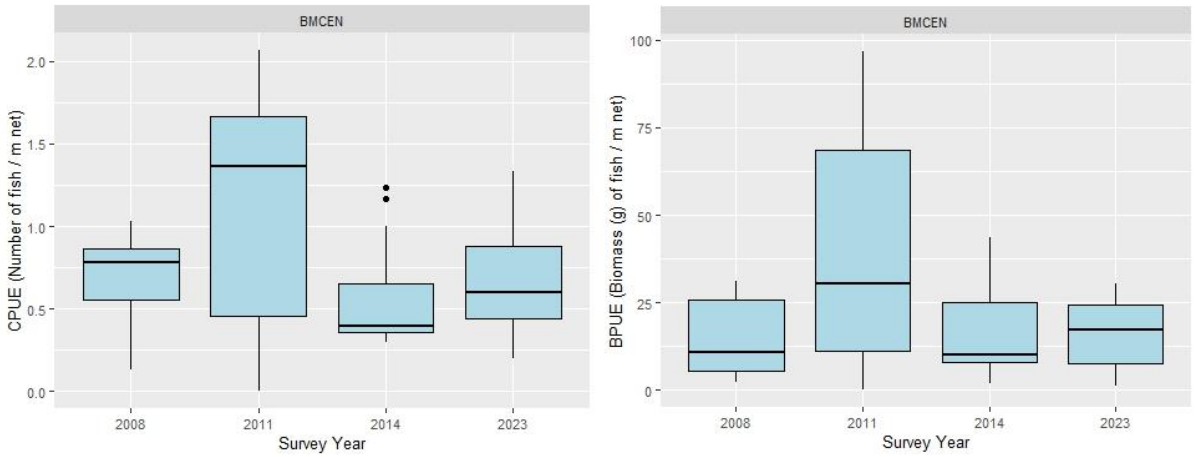

Figure 3.2. CPUE and BPUE of perch captured during surveys of Lough Meelagh between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper 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 4.6cm to 30.3cm (mean 17.8cm) (Figure 3.3). Length range of roach was broadly similar across all surveys of the lake. In 2023 roach were aged between 2+ and 10+ and all intervening age classes were present (Table 3.4). No one year class dominated the sample aged, but seven year old fish (22cm – 25cm) were prominent amongst the older cohorts (Figure 3.3, Table 3.4). The modal peak at 14cm – 15cm is consistent with four year old fish (Table 3.4).

Roach abundance (CPUE) has been increasing since 2011 and the median biomass (BPUE) was higher in 2023 than previous surveys (Figure 3.4).

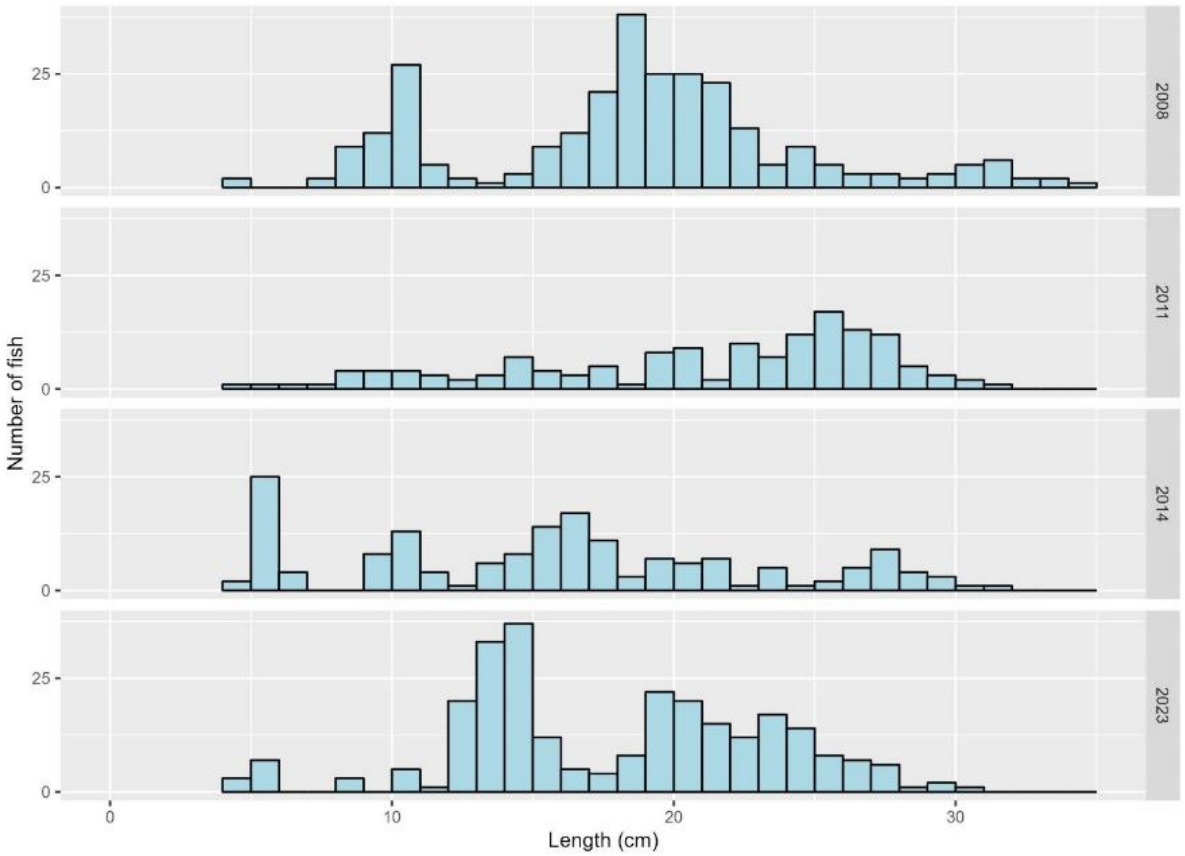

Figure 3.3. Length frequency of roach captured on Lough Meelagh between 2008 and 2023.

Table 3.4. Summary age data from roach captured on Lough Meelagh, September 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	-	-	4	12	11	12	12	18	10	4	2
Mean	-	-	9.6	13.4	15.4	18.6	21.0	23.8	26.5	27.4	30.0
Min	-	-	8.5	12.5	14	17.4	20	22.2	24.3	25.3	29.7
Max	-	-	10.9	14.1	16.9	19.9	22	25.9	27.3	28.5	30.3

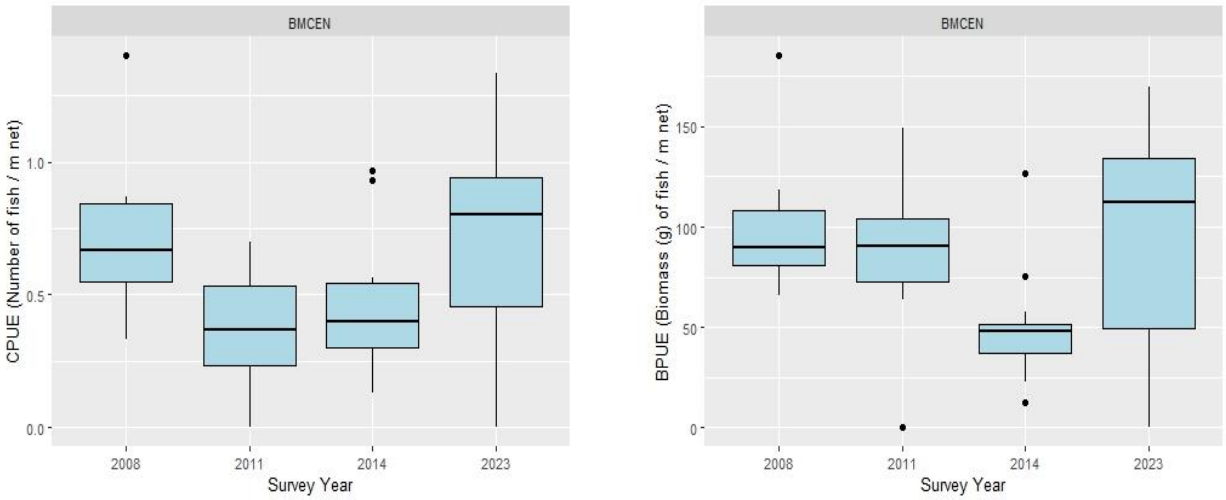

Figure 3.4. CPUE and BPUE of roach captured during surveys of Lough Meelagh between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper 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 14.0cm to 39.5cm (mean = 30.9cm) (Figure 3.5). In 2023 roach x bream hybrids were dominated by larger fish (i.e. >30cm). This represents a continued shift from earlier surveys which has seen an increase in the proportion (and overall numbers) of larger fish captured. In 2023 roach x bream hybrids were aged from 4+ to 14+ (Table 3.5). While no one age class dominated, the majority (c. 81%) of fish in the sample were aged 9+ and older. Nine year old fish (25cm – 31cm) were the largest cohort in the sample aged (Figure 3.4, Table3.5).

The abundance (CPUE) and biomass (BPUE) of roach x bream hybrids captured in benthic survey nets (BMCENS) (which catch fish of all size ranges) increased between 2008 and 2011 and has remained at a similar level since then. The preponderance of larger and older fish in latter years is evidenced by an increase in both abundance and biomass of roach x bream hybrids captured in benthic braided nets in 2014 and 2023 (Figure 3.6).

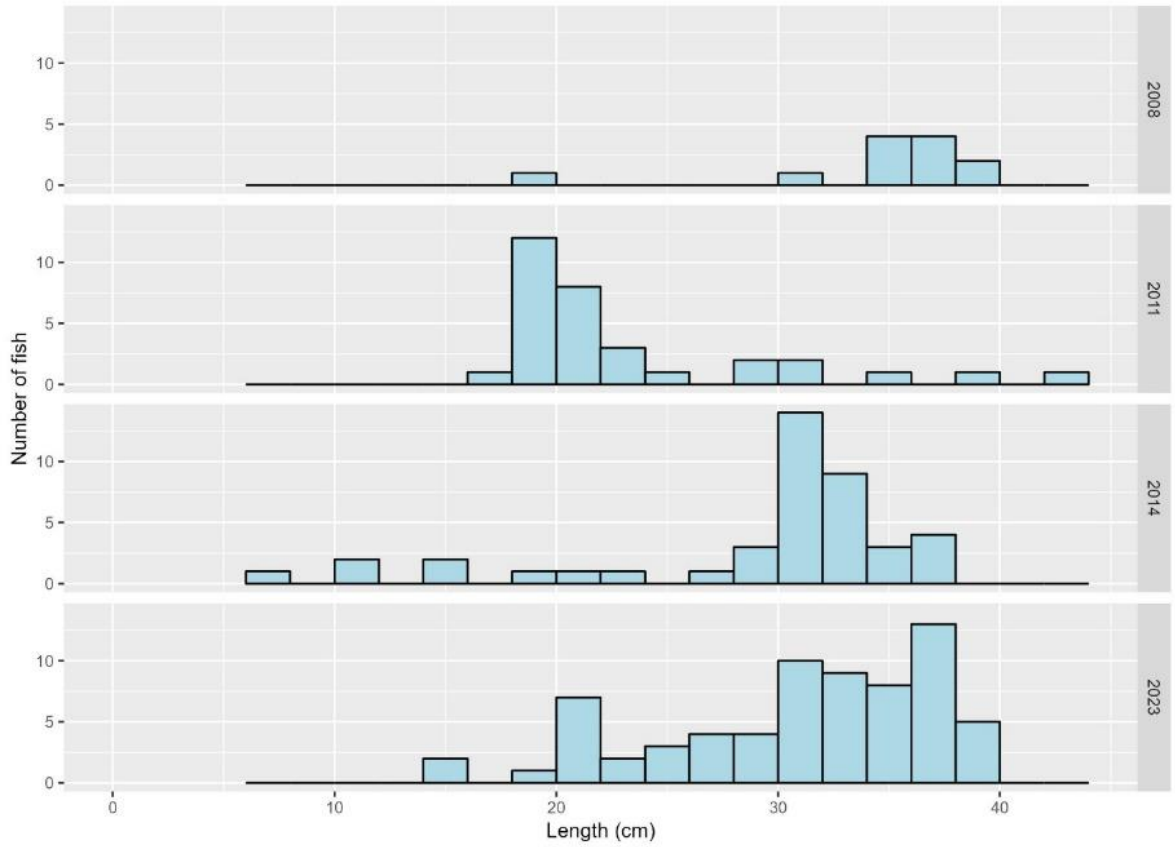

Figure 3.5. Length frequency of roach x bream hybrids captured on Lough Meelagh between 2008 and 2023.

Table 3.5. Summary age data from roach x bream hybrids captured on Lough Meelagh, September 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+	12+	13+	14+
N	-	-	-	-	2	4	3	1	1	13	5	10	7	10	1
Mean	-	-	-	-	14.5	20.6	21.5	22.3	24.3	30.0	30.8	33.8	36.1	38.1	38.0
Min	-	-	-	-	14	20.5	21.3	22.3	24.3	25.4	27.5	33.1	35	37.1	38
Max	-	-	-	-	15	20.7	21.8	22.3	24.3	31.9	32.8	34.4	37.1	39.8	38

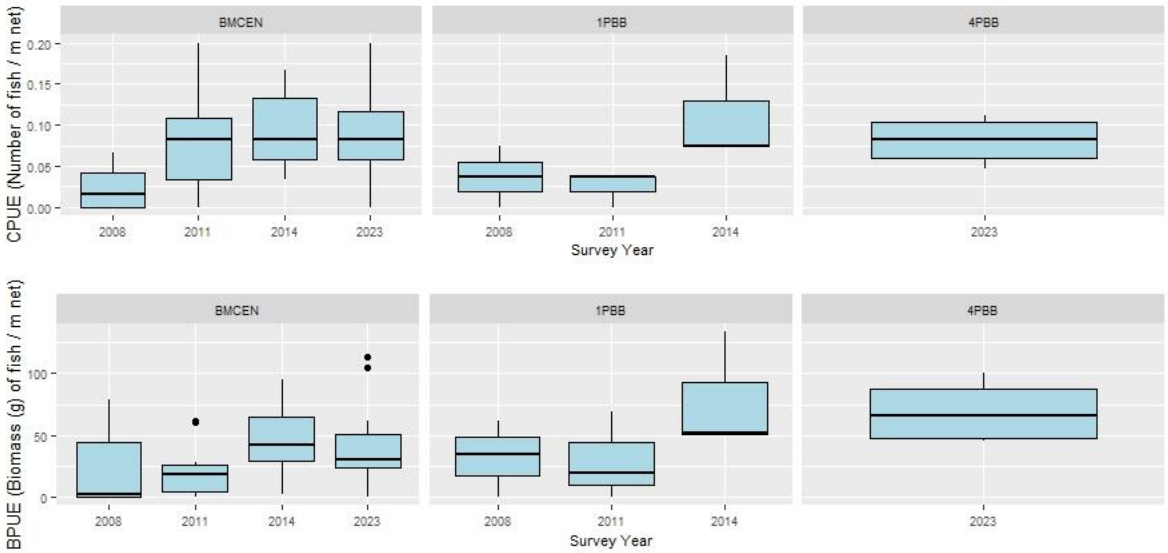

Figure 3.6. CPUE and BPUE of roach x bream hybrids captured during surveys of Lough Meelagh between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are 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 29.0cm to 44.8cm (mean 36.8cm) (Figure 3.7). Solitary juvenile bream were recorded in both 2008 and 2014. No smaller or juvenile bream were recorded on this occasion. In 2023 bream were aged from 7+ to 14+ (Table 3.6). While no one age class dominated 10+ fish (32cm – 39cm) were the largest cohort in the sample aged (Figure 3.7 and Table3.6).

The abundance and biomass of bream captured in 2023 were both much higher than in any previous survey of the lake. However, in 2023 all bream were recorded in the 4-PBB nets which were not set on the previous sampling occasions when 1-PBB nets were used (Figure 3.8). Future surveys will reveal more information on trends in CPUE and BPUE of bream in the lake.

European eel

Two European eel captured measured 69.4cm and 70.0cm (Figure 3.9). Abundance (CPUE) and biomass (BPUE) of eel were highest when the lake was first surveyed in 2008 (Figure 3.10).

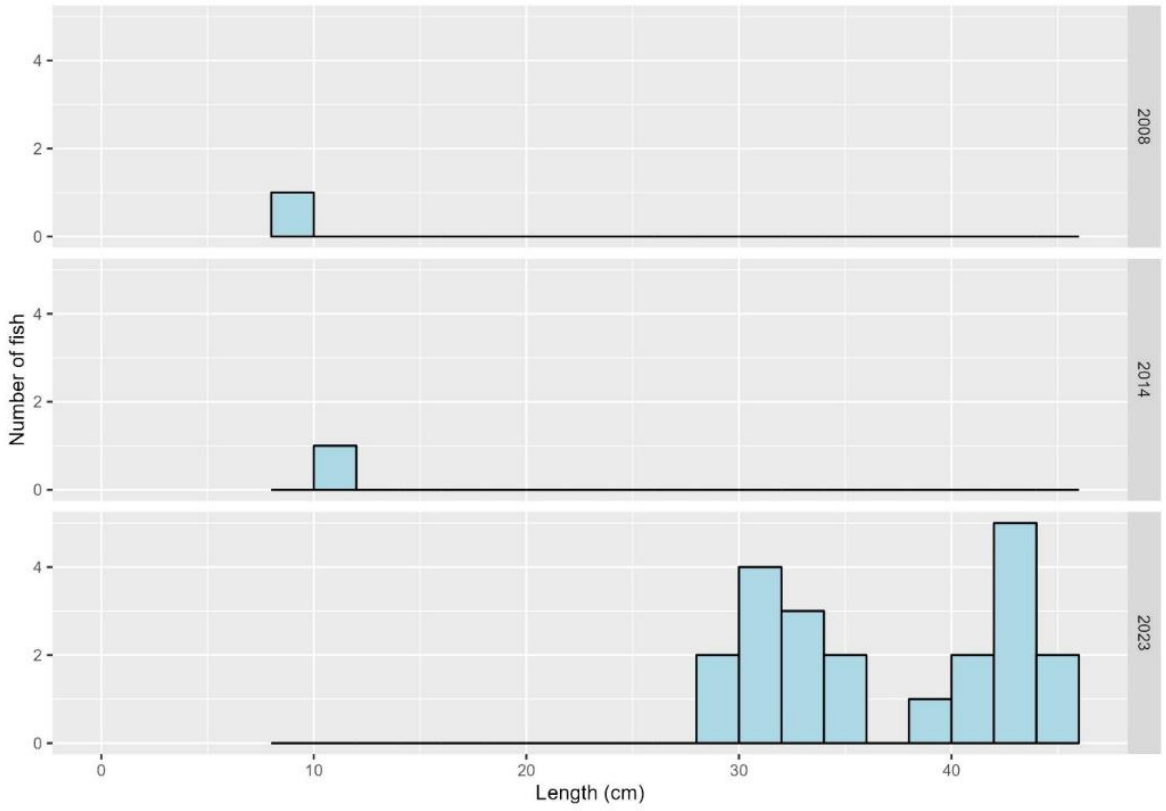

Figure 3.7. Length frequency of bream captured on Lough Meelagh between 2008 and 2023.

Table 3.6. Summary age data from bream captured on Lough Meelagh, September 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+	12+
N	-	-	-	-	-	-	-	3	6	1	3	3	2
Mean	-	-	-	-	-	-	-	30.0	31.9	34.3	41.0	42.4	44.5
Min	-	-	-	-	-	-	-	29	30.1	34.3	39.9	42.2	44.2
Max	-	-	-	-	-	-	-	31.8	33.9	34.3	41.8	42.6	44.8

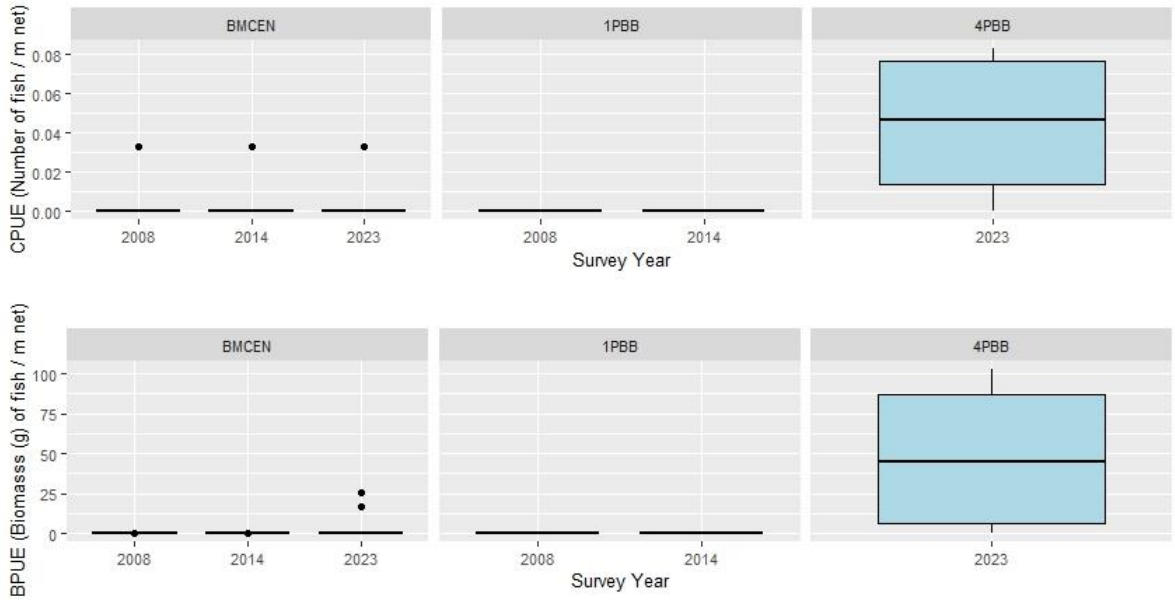

Figure 3.8. CPUE and BPUE of bream captured during surveys of Lough Meelagh between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

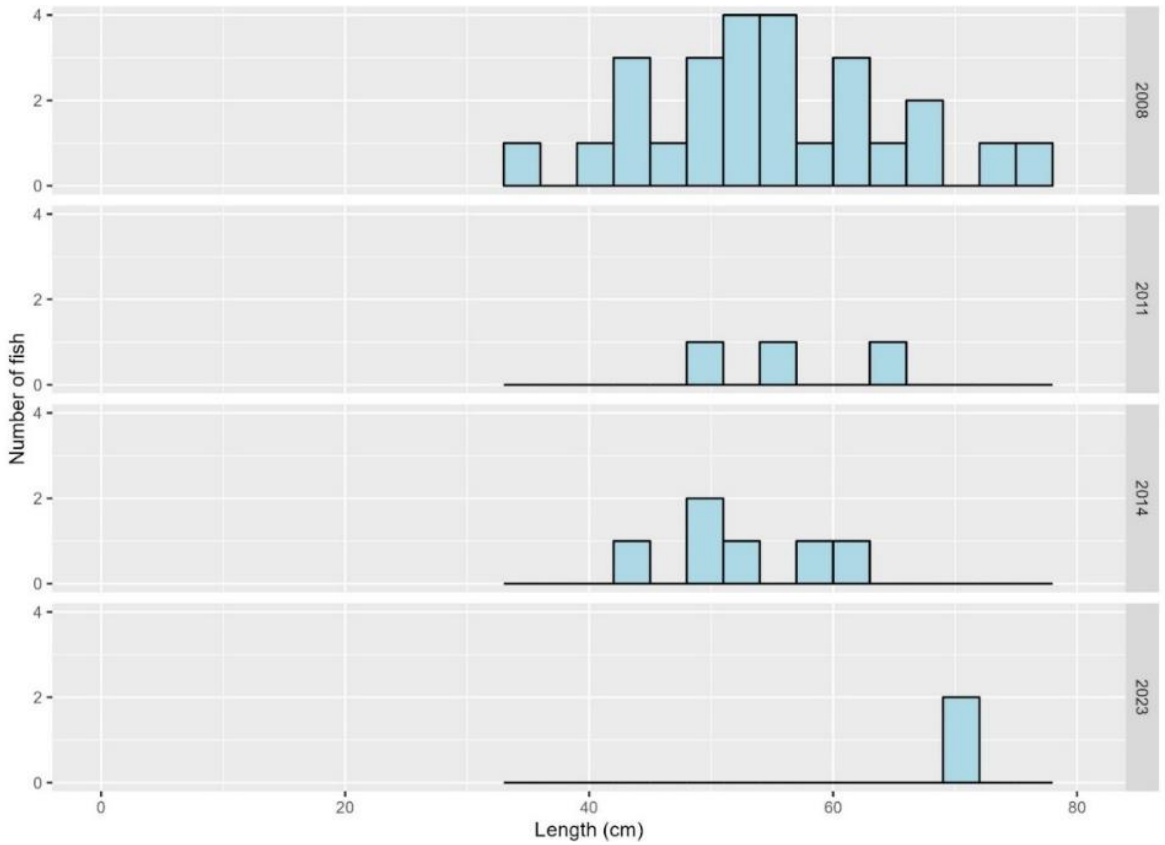

Figure 3.9. Length frequency of European eel captured on Lough Meelagh between 2008 and 2023

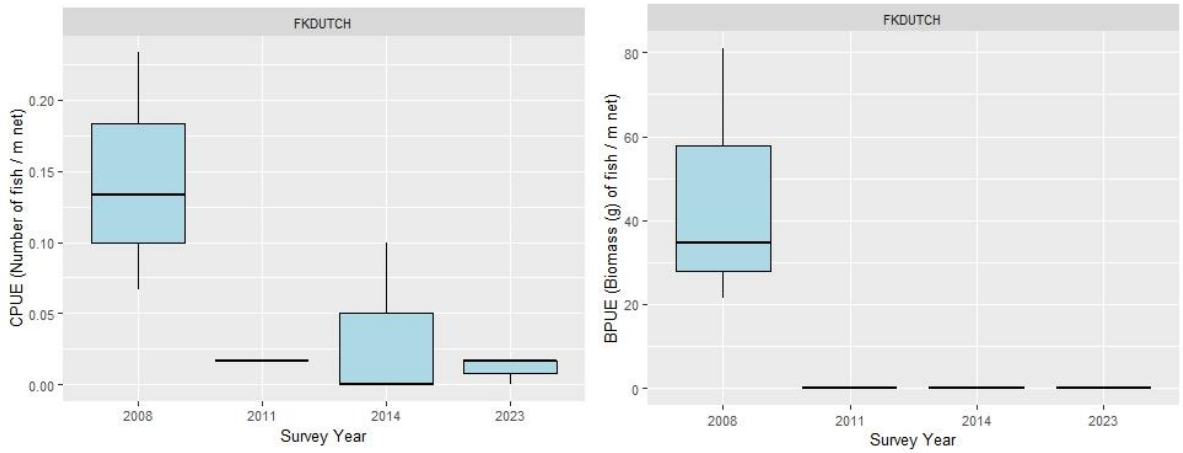

Figure 3.10. CPUE and BPUE of European eel captured during surveys of Lough Meelagh between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by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

Other Species

Pike captured during the 2023 survey ranged in length from 11.4cm to 40.6cm (mean 20.8cm). Pike were aged between 0+ and 2+. Two tench captured measured 38.2cm and 45.5 cm and were aged 6+ and 8+.

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 54 perch stomachs were examined. Twenty-seven (50%) were empty. Twenty-seven stomachs contained food. Invertebrates were the sole prey type recorded in 15 (56%) perch. The contents of eleven (41%) stomachs were made up of fish. Unidentified digested material was recorded in one (4%) perch stomach (Figure 3.11).

Pike

One pike stomach was available for analysis. It contained unidentified cyprinid remains.

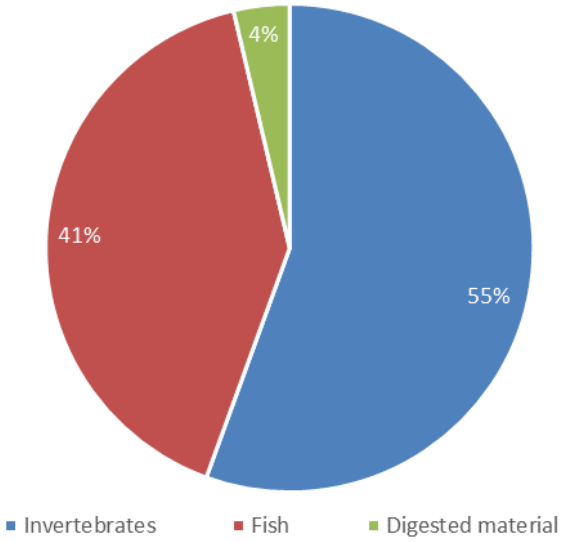

Figure 3.11. Diet of perch (N = 26) captured on Lough Meelagh, 2023 (% FO).

4. Summary and fish ecological status

A total of six fish species and one cyprinid hybrid were recorded in Lough Meelagh in August 2023. Perch and roach were the dominant species in terms of abundance (CPUE). Roach had the highest biomass (BPUE) while a relatively high biomass of roach x bream hybrids was also recorded.

Both the two most abundant species (i.e. perch and roach) are recruiting regularly in the lake. The perch population was dominated by younger and smaller cohorts. Younger cohorts were less prominent in the roach population.

Both bream and roach x bream hybrid (which requires spawning populations of both parent species (Hayden *et al*., 2010)) populations were dominated by larger and older individuals. The abundance and biomass of both species has increased since 2008. Prior to 2023 a total of two bream had been recorded when individual specimens were captured in 2008 (first recorded in the lake) and 2014. Together both species make up a considerable proportion of fish biomass in the lake.

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*., 2012b).

Using the FIL2 classification tool, Lough Meelagh has been assigned an ecological status of Bad for 2023 based on the fish populations present. Lough Meelagh was assigned a status of Poor following all other fish stock surveys on the lake (Figure 4.1).

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

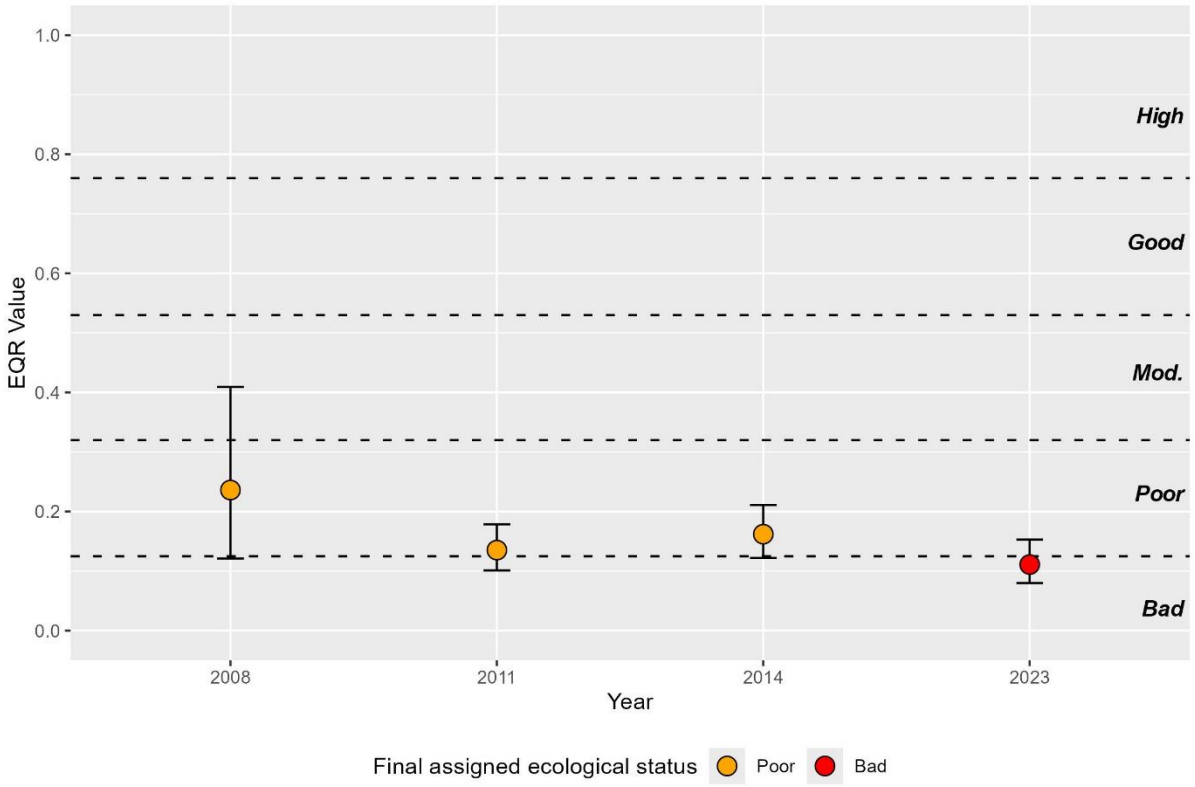

Figure 4.1. Fish ecological status, Lough Meelagh, between 2008 and 2023 (dashed line indicates EQR status boundaries).

5. References

Amundsen, P.A., Gabler, H.M. and Staldvik, F.J. (1996) A new approach to graphical analysis of feeding strategy from stomach contents data—modification of the Costello (1990) method. *Journal of Fish Biology,* **48,** 607–614.

Caffrey, J. (2010) *IFI Biosecurity Protocol for Field Survey Work*. Inland Fisheries Ireland.

Connor, L., Matson, R. and Kelly, F.L. (2017) Length-weight relationships for common freshwater fish species in Irish lakes and rivers. *Biology and Environment: Proceedings of the Royal Irish Academy*, **117** (2), 65-75.

EPA (2021) https://gis.epa.ie/EPAMaps/ Data - Catchments.ie - Catchments.ie. Accessed in May 2024

Hayden, B., Pulcini, D., Kelly-Quinn, M., O'Grady, M., Caffrey, J., McGrath, A., & Mariani, S. (2010). Hybridisation between two cyprinid fishes in a novel habitat: genetics, morphology and life-history traits. *BMC Evolutionary Biology*, **10 (1)**, 169.

Fishing in Ireland (2020). https://fishinginireland.info/wp-content/uploads/2020/11/Lough-Arrow-Guide-2019-Print-Final.pdf Accessed May 2024

Kelly, F.L., Harrison, A., Connor, L., Allen, M., Rosell, R. and Champ, T. (2008) *FISH IN LAKES Task 6.9: Classification tool for Fish in Lakes. FINAL REPORT*. Central Fisheries Board, NS Share project.

Kelly, F.L., Connor, L., Wightman, G., Matson, R. Morrissey, E., O'Callaghan, R., Feeney, R., Hanna, G. and Rocks, K. (2009) *Sampling fish for the Water Framework Directive – Summary report 2008*. Central and Regional Fisheries Boards. Internal report.

Kelly, F., Harrison A., Connor, L., Matson, R., Morrissey, E., Wogerbauer, C., Feeney, R., O'Callaghan, R. and Rocks, K. (2012a) *Sampling Fish for the Water Framework Directive – Summary Report 2011*. Inland Fisheries Ireland.

Kelly, F.L., Harrison, A.J., Allen, M., Connor, L. and Rosell, R. (2012b) Development and application of an ecological classification tool for fish in lakes in Ireland. *Ecological Indicators*, **18**, 608-619.

Kelly, F.L., Connor, L., Morrissey, E., Coyne, J., Feeney, R., Matson, R. and Rocks, K. (2015) Water Framework Directive *Fish Stock Survey of Lough Meelagh, August 2014.* Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

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