National Research Survey Programme
Lakes 2023

Bawn Lough

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Iascach Intíre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Bawn Lough, August 2023

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1.   Introduction

Bawn Lough is situated in the Erne catchment, Co. Cavan in the town of Killashandra. It is associated with the Lough Oughter Complex and is connected to Disert Lough and the Cullies River via a stream at its northern shore (Plate 1.1, Figure 1.1). The lake is situated at an altitude of 50 m.a.s.l., has a surface area of 17ha, mean depth of 2.1m and maximum depth of 6.6m. The lake is categorised as typology class 9 for the purposes of WFD (as designated by the EPA), i.e. shallow (<4m), less than 50ha and high alkalinity (>100mg/l $CaCO_3$). The geology of the area is predominantly Lower Carboniferous limestone.

This lake is known to hold a good stock of coarse fish species, with angling for roach, perch, bream, pike, bream and hybrids (IFI, 2019). The lake was previously surveyed in 2005 and 2017 (Kelly *et al*., 2007, McLoone *et al*., 2018). During the latter survey, perch and roach were the most abundant species 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. Bawn Lough, August 2023. Connection to Disert Lough is visible in the top right
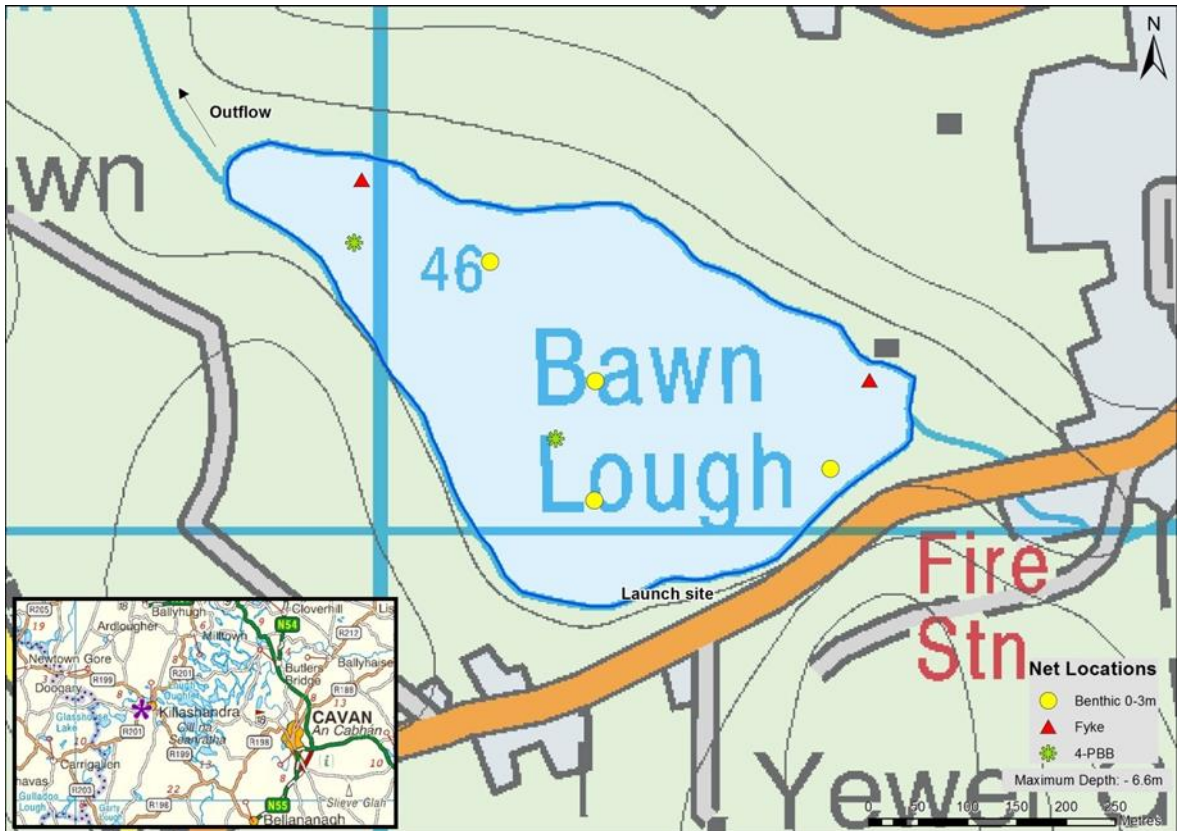
Figure 1.1. Location map of Bawn Lough showing net locations and depths of each net (outflow is indicated on map).

Plate 1.2. Surveying on Bawn Lough, August 2023.

2.   Methods

2.1.   Netting methods

Bawn Lough was surveyed over one night from the 21st to the 22nd of August 2023. A total of two sets of Dutch fyke nets and 4 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (4 @ 0-2.9m). The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at two additional sites. The four-panel survey gill nets are composed of four 27.5m long panels each a different mesh size (55mm, 60mm, 70mm and 90mm knot to knot). Nets were deployed in the same locations as were randomly selected in the previous surveys (eight sites). 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).

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

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

2.3.   Biosecurity - disinfection and decontamination procedures

Procedures are required for disinfection of equipment to prevent dispersal of alien species and other organisms to uninfected waters. A standard operating procedure was compiled by Inland Fisheries Ireland for this purpose (Caffrey, 2010) and is followed by staff in IFI when moving between water bodies.

3. Results

3.1. Species Richness

Six fish species and one cyprinid hybrid variety were recorded in Bawn Lough in August 2023. A total of 648 fish were captured. Perch was the most numerous fish species recorded, representing *c*. 59% of all fish captured in the survey. Roach were also recorded in high numbers (35% of all fish captured). Roach x bream hybrids, tench, pike, bream and European eels were also captured (Table 3.1).

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

Scientific name	Common name	Number of fish captured			
		BM CEN	4-PBB	Fyke	Total
Perca fluviatilis	Perch	378	0	5	383
Rutilus rutilus	Roach	229	0	0	229
Rutilus rutilus x Abramis brama	Roach x bream hybrid	14	5	0	19
Tinca tinca	Tench	2	10	0	12
Esox lucius	Pike	0	2	0	2
Abramis brama	Bream	0	1	0	1
Anguilla anguilla	European eel	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 were the dominant species with respect to abundance (CPUE), while roach had the highest biomass (BPUE) in the 2023 survey. The biomass of perch, roach x bream hybrids and tench was also relatively high (Table 3.2).

Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Bawn Lough, August 2023.

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Perca fluviatilis	Perch	1.585 (0.717)	21.329 (9.438)
Rutilus rutilus	Roach	0.954 (0.390)	59.992 (26.296)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.064 (0.024)	20.864 (8.824)
Tinca tinca	Tench	0.019 (0.011)	20.209 (20.152)
Esox lucius	Pike	0.002 (0.002)	4.808 (4.808)
Abramis brama	Bream	0.001 (0.001)	0.959 (0.959)
Anguilla anguilla*	European eel	0.016 (0.016)	8.983 (8.983)

*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 5.0cm to 27.0cm (mean = 7.9cm) (Figure 3.1). Perch length was similar across all three surveys, and the population in 2023 was dominated by small fish (< 10cm), but with smaller numbers of much larger fish (i.e. > 20cm) persisting in the population. Perch were aged between 0+ and 6+. While all intervening age classes were present in the sample aged, the population was dominated by younger fish. The most abundant age class was 1+ (8cm – 12cm, Figure 3.1). Mean L1 (i.e. length at the end of the 1st year) was 5.8cm (Table 3.3). Population abundance (CPUE) and biomass (BPUE) have remained relatively stable in the two most recent surveys and are higher than those recorded in 2005 (Figure 3.2).
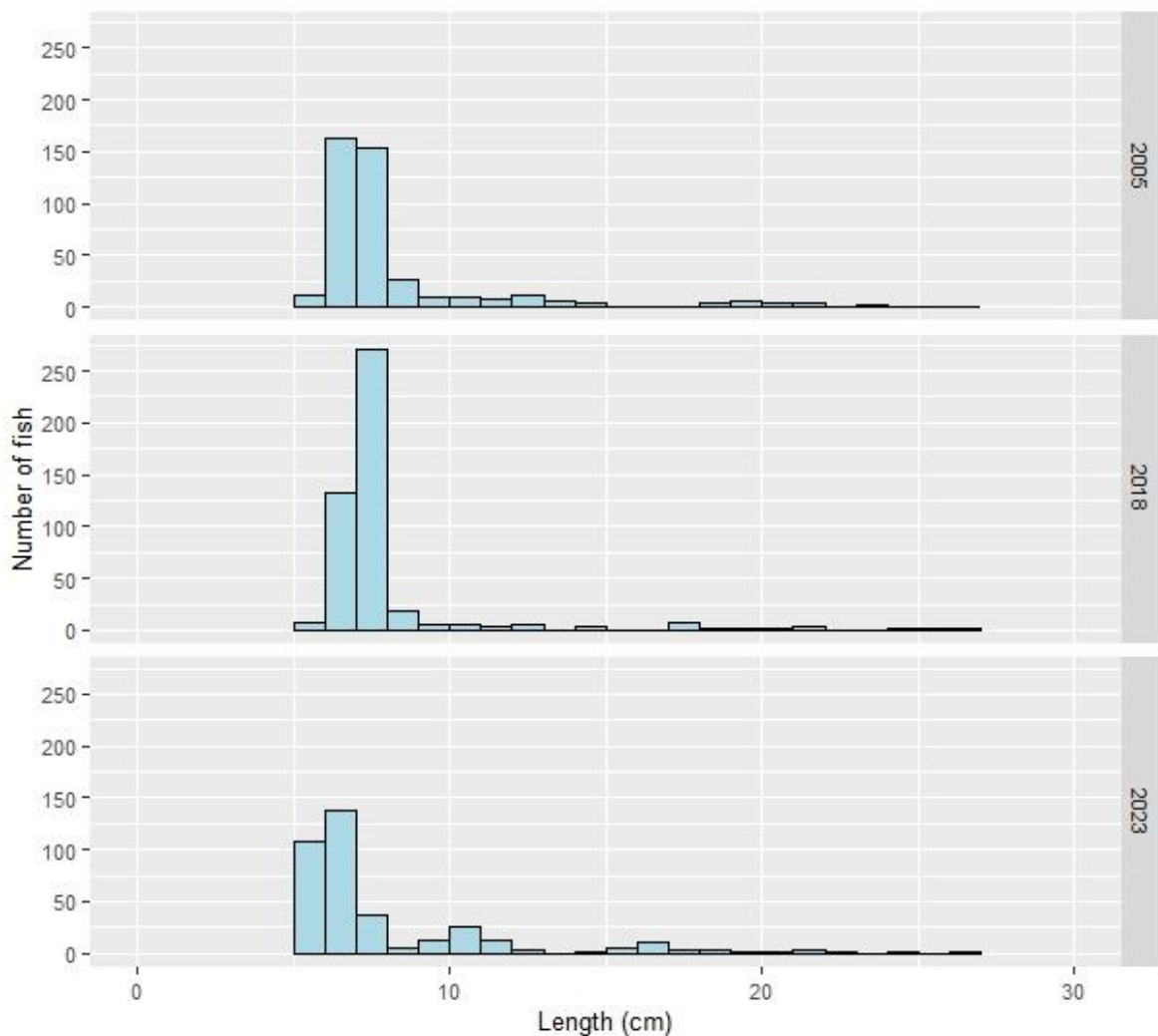

Figure 3.1. Length frequency of perch captured on Bawn Lough between 2005 and 2023.

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

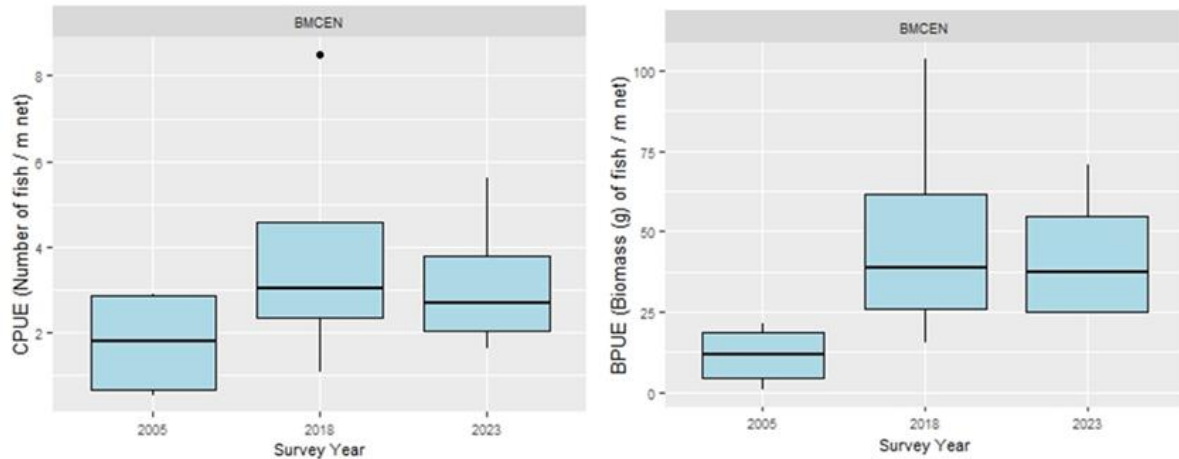| Length (cm)	L_1	L_2	L_3	L_4	L_5	L_6
Mean (±S.E)	5.8 (0.08)	10.4 (0.23)	15.8 (0.41)	19.8 (0.63)	22.8 (1.18)	-
N	51	34	23	9	4	1
Range	4.4-7.5	8.2-13.5	12.6-19.8	15.9-22.6	20.8-26.0	26.6

Figure 3.2. CPUE and BPUE of perch captured during surveys of bawn lough between 2005 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 7th 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 7.2cm to 30.1cm (mean = 13.2cm)
(Figure 3.3). Roach length was relatively similar across all three surveys. Roach were aged between 2+
and 9+ and all intervening age classes (except 8+) were represented in the sample aged (Table 3.4).
No one age class dominated in the aged sample with all cohorts between 2+ (7cm – 9cm) and 7+
(22cm-26cm) well represented in the sample aged (Table 3.4).

The population (CPUE) and biomass (BPUE) of roach were both higher in the later surveys compared
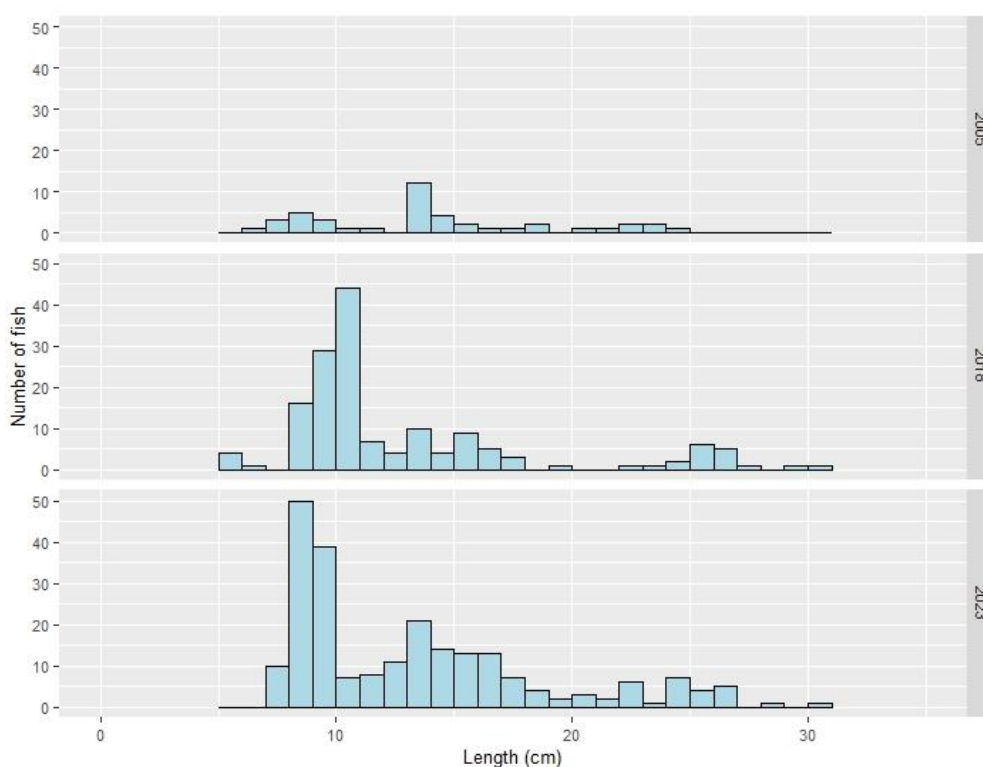to 2005 (Figure 3.4).

Figure 3.3. Length frequency of roach captured on Bawn Lough between 2005 and 2023.

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

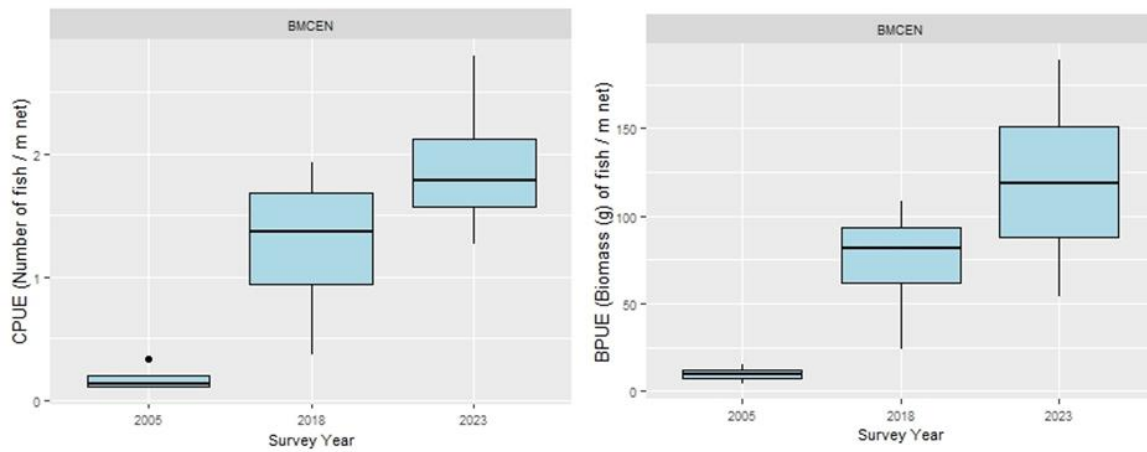| Length (cm)	Age class									
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+
N	-	-	13	15	16	12	10	7	-	1
Mean	-	-	8.3	11.5	14.6	18.1	22.5	24.9	-	30.1
Min	-	-	7.2	9.6	13.2	16	20.5	22.7	-	30.1
Max	-	-	9.3	12.9	16.9	20	24.8	26.3	-	30.1

Figure 3.4. CPUE and BPUE of roach captured during surveys of Bawn Lough between 2005 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 9.2cm to 45.6cm (mean = 23.8cm) (Figure 3.5). Roach x bream hybrids were aged between 2+ and 20+ (Table 3.5). Many age classes were missing, and most year classes were generally represented by one fish only. Two (9cm) and six (19cm – 20cm) year old age classes were better represented (Figure 3.5 and Table 3.5).

The population abundance (CPUE) and biomass (BPUE) of roach x bream hybrids were both higher in the later surveys compared to 2005 (Figure 3.6).
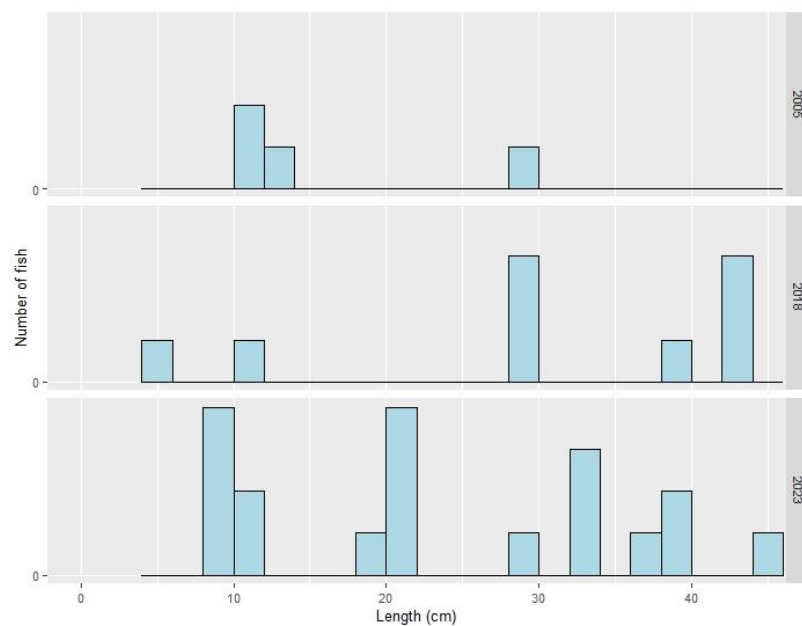

Figure 3.5. Length frequency of roach x bream hybrids captured on Bawn Lough between 2005 and 2023.

Table 3.5. Summary age data from roach x bream hybrids captured on Bawn Lough, August 2023. Number of fish and length ranges of all fish aged in the sample is presented.

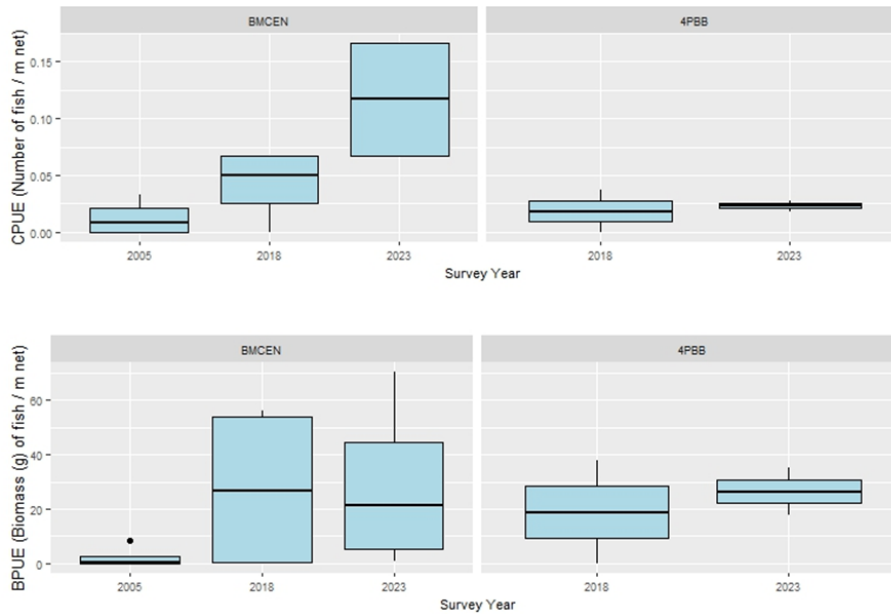| Length (cm)	Age class										
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+
N	-	-	4	-	-	-	4	-	-	1	-
Mean	-	-	9.5	-	-	-	20.8	-	-	28.6	-
Min	-	-	9.2	-	-	-	19	-	-	28.6	-
Max	-	-	9.9	-	-	-	21.8	-	-	28.6	-
Length (cm)	**Age class**									
	11+	12+	13+	14+	15+	16+	17+	18+	19+	20+
N	2	1	1	-	1	-	1	-	-	1
Mean	32.2	33.8	36.5	-	39.0	-	39.7	-	-	45.6
Min	32.1	33.8	36.5	-	39	-	39.7	-	-	45.6
Max	32.3	33.8	36.5	-	39	-	39.7	-	-	45.6

Figure 3.6. CPUE and BPUE of roach x bream hybrids captured during surveys of Bawn Lough between 2005 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 fish species

Nineteen tench captured ranged in length from 6.9cm to 53.6cm (mean = 39.8cm). This is the first record of small or juvenile tench (<10cm) captured in surveys of the lake. Tench were aged between 1+ and 7+. One bream caught measured 35.0cm. Two pike captured measured 59.8cm and 69.1cm.

Two eels captured in 2023 measured 51.7cm and 76.2cm. Abundance (CPUE) and biomass (BPUE) of eel have fluctuated and no clear population trends are apparent (Figure 3.7).
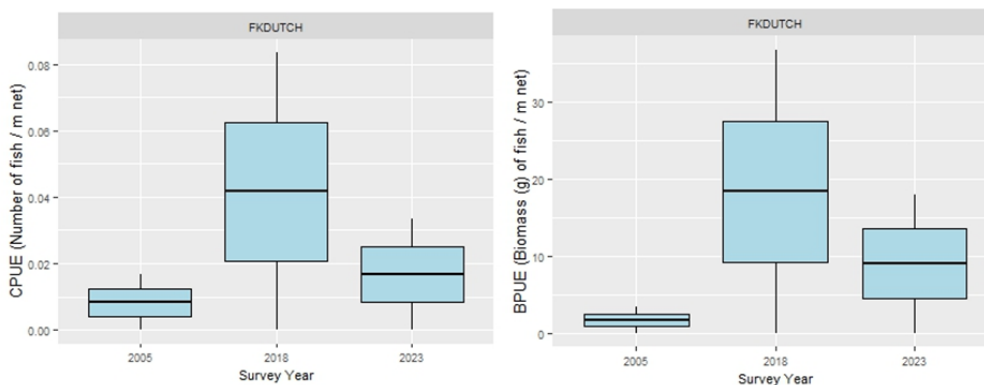

Figure 3.7. CPUE and BPUE of eel captured during surveys of Bawn Lough between 2005 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and 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 captured during the survey were examined and are presented below.

Perch

A total of 65 perch stomachs were examined. Forty-eight (74%) were empty. Seventeen stomachs contained food. Zooplankton was the sole prey type recorded in nine (53%) stomachs. Four stomachs (23.5%) contained invertebrates. Fish were found in four (23.5%) perch stomachs (Figure 3.8).
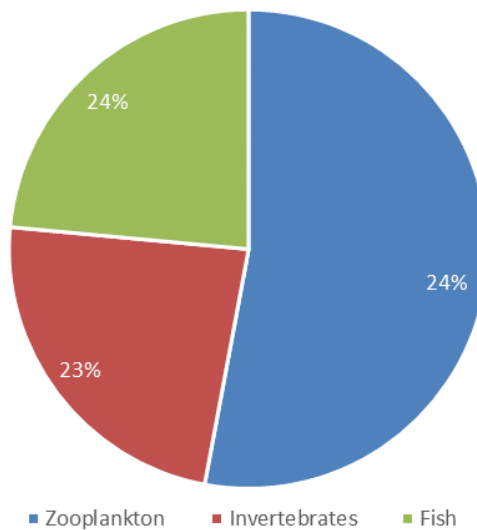

Figure 3.8. Diet of perch (N = 17) captured on Bawn Lough, 2023 (% FO).

4.   Summary and fish ecological status

A total of six fish species and one hybrid variety were recorded in Bawn Lough in August 2023. Perch was the dominant species in terms of abundance (CPUE) while roach had the highest biomass (BPUE) captured in the survey gill nets during the 2023 survey. Recruitment of both species appears to be regular and the populations of both species have increased in recent years when compared to the 2005 survey of the lake. While just one bream was captured in 2023, there is continued recruitment, albeit at relatively low levels compared to the roach x bream hybrid population. This hybrid variety requires both parent species to spawn (Hayden *et al.*, 2010) suggesting also that a small spawning population of bream is present. Hybrids are long lived in the lake with fish aged up to 20 years recorded.

While captured in relatively low numbers compared to other species in the lake, there was some evidence to suggest that the population of tench may be increasing. Small juvenile tench were recorded for the first time in 2023 which indicated that this species is spawning successfully 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 (Ecological Quality Ratio) values for each lake and associated confidence in classification (Kelly *et al*., 2012).

Using the FIL2 classification tool, Bawn Lough has been assigned an ecological status of Bad for 2023 based on the fish populations present. Bawn Lough was assigned a status of Bad in 2005, and moderate in 2018 (Figure 4.1).

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Bawn Lough an overall ecological status of Moderate, based on all monitored physio-chemical and biological elements, including fish (EPA 2021).
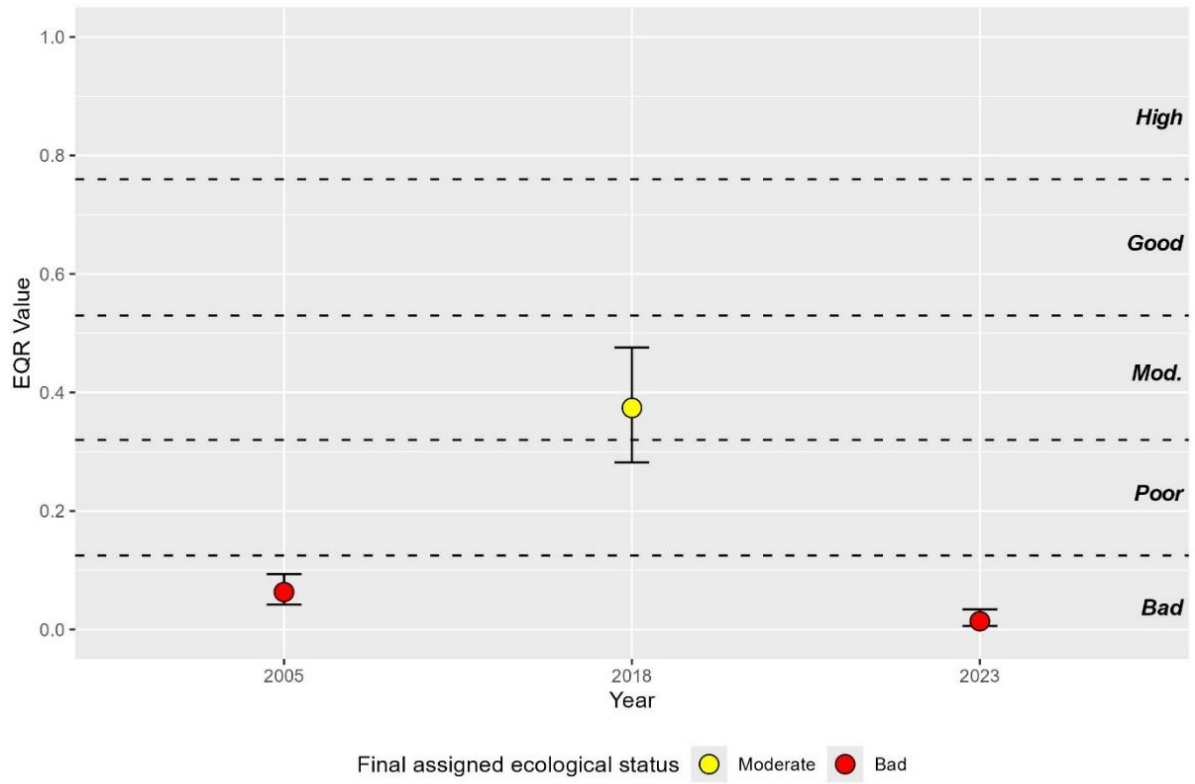
Figure 4.1. Fish ecological status, Bawn Lough, between 2005 and 2023 (dashed line indicates EQR status boundaries).

5.   References

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