

# National Research Survey Programme

## Lakes 2023

### Lough Allua

IFI/2024/1-4711



Iascach Intíre Éireann  
Inland Fisheries Ireland

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## Fish Stock Survey of Lough Allua, September 2023



**Iascach Intíre Éireann  
Inland Fisheries Ireland**

National Research Survey Programme

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

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Cover photo: Lough Allua, Co. Cork © Inland Fisheries Ireland

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*CYAL50346939 © National Mapping Division of Tailte Éireann.*

## 1. Introduction

Lough Allua is a ten kilometer chain of lakes situated near Ballingearry, Co. Cork in the Lee catchment (Plate 1.1, Figure 1.1). The lake has a surface area of 138ha, a mean depth of 4m and a maximum depth of 28m. The lake is categorized as typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), larger than 50ha and low alkalinity (<20mg/l CaCO<sub>3</sub>).

Lough Allua is a proposed Natural Heritage Area (pNHA) indicating the presence of important semi-natural and natural habitats, landforms or geomorphological features, wild plant and animal species or a diversity of these natural attributes (Cork County Council, 2009).

The fish stock community in Lough Allua has undergone considerable change compared to its original composition. Historically Lough Allua was known for producing good trout, salmon and Arctic char. In the 1830s there was an accidental release of pike from a local privately owned pond and this event and human predation were attributed to the destruction of the Arctic char population in the lake (Went, 1945). The lake now supports an important pike fishery. In recent years, the introduction of roach has also had a considerable impact upon the fish stock structure of the lake.

Lough Allua has been surveyed on four occasions since 2008 (2008, 2011, 2014 and 2017) (Kelly *et al.*, 2009, Kelly *et al.*, 2012a, Kelly *et al.*, 2015 and McLoone *et al.*, 2018). Recorded in small numbers in 2008, roach dominated fish stocks in the 2014 and 2017 surveys.

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 also provides insight into fish stock status in the lake.



Plate 1.1. IFI survey boat on Lough Allua, looking North, September 2023.

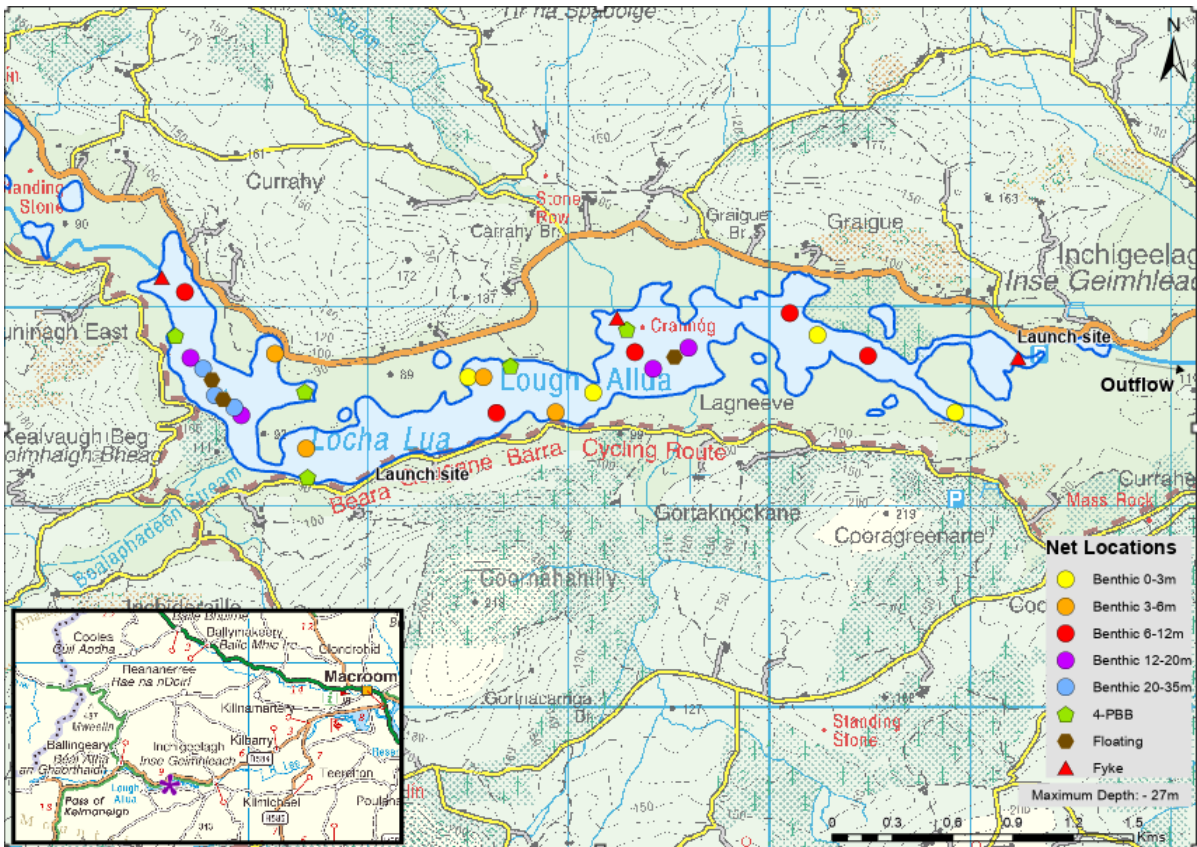


Figure 1.1. Location map of Lough Allua showing net locations and depths of each net (outflow is indicated on map).

## 2. Methods

### 2.1. Netting methods

Lough Allua was surveyed over three nights from the 25<sup>th</sup> to the 29<sup>th</sup> of September 2023. A total of three sets of Dutch fyke nets, 20 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, 5 @ 6-11.9m, 4 @ 12-19.9m and 3 @ 20-34.9m) and three floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed.

The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at five 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 (31 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).

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

Where:

$FO_i$  is the percentage frequency of prey item  $i$ ,

$N_i$  is the number of fish with prey  $i$  in their stomach,

$N$  is total number of fish with stomach contents.

### **2.3. Biosecurity - disinfection and decontamination procedures**

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



**Plate 2.1. High water level on Lough Allua, looking west, September 2023**

### 3. Results

#### 3.1. Species Richness

Seven fish species and one cyprinid hybrid variety were recorded in Lough Allua in September 2023. A total of 729 fish were captured (Table 3.1). Roach was the most prevalent fish species recorded representing almost 70% of all fish captured in the survey. Perch, roach x bream hybrids, bream, rudd, pike, gudgeon and European eel were also captured. The same species composition was recorded on previous surveys of the lake with the exception of rudd and rudd x bream hybrids which were recorded in 2017. No eels were caught during the 2017 survey (Kelly *et al.*, 2009, Kelly *et al.*, 2012a, Kelly *et al.*, 2015 and McLoone *et al.*, 2018).

**Table 3.1. Number of each fish species captured by each gear type during the survey on Lough Allua, September 2023**

Scientific name	Common name	Number of fish captured				
		BM CEN	FMCEN	4-PBB	Fyke	Total
<i>Rutilus rutilus</i>	Roach	274	227	0	4	505
<i>Perca fluviatilis</i>	Perch	78	0	2	1	81
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	75	1	1	0	77
<i>Abramis brama</i>	Bream	29	0	5	0	34
<i>Scardinius erythrophthalmus</i>	Rudd	0	19	0	0	19
<i>Esox lucius</i>	Pike	2	0	2	0	4
<i>Gobio gobio</i>	Gudgeon	4	0	0	0	4
<i>Anguilla anguilla</i>	European eel	0	0	0	5	5

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

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
<i>Rutilus rutilus</i>	Roach	0.540 (0.171)	8.725 (2.694)
<i>Perca fluviatilis</i>	Perch	0.085 (0.029)	3.953 (1.734)
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	0.082 (0.270)	8.067 (2.866)
<i>Abramis brama</i>	Bream	0.032 (0.009)	6.959 (1.947)
<i>Scardinius erythrophthalmus</i>	Rudd	0.020 (0.015)	0.248 (0.177)
<i>Esox lucius</i>	Pike	0.002 (0.001)	5.574 (3.641)
<i>Gobio gobio</i>	Gudgeon	0.004 (0.003)	0.032 (0.032)
<i>Anguilla anguilla</i> *	European eel	0.027 (0.014)	15.558 (9.737)

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

#### Roach

Roach captured in the 2023 survey ranged in length from 4.6cm to 17.3cm (mean = 10.0cm) (Figure 3.1). The length range of roach appears to have narrowed in recent years and no fish greater than 20cm were captured in 2023. Roach were aged between 2+ and 7+. All intervening age classes were present, and no one cohort dominated the population (Table 3.3).

The rapid expansion in the abundance (CPUE) and biomass (BPUE) of roach evident between 2008 and 2014 appears to have now stabilised. This is particularly evident for benthic nets which represent the bulk of the nets deployed in the survey (Figure 3.2).

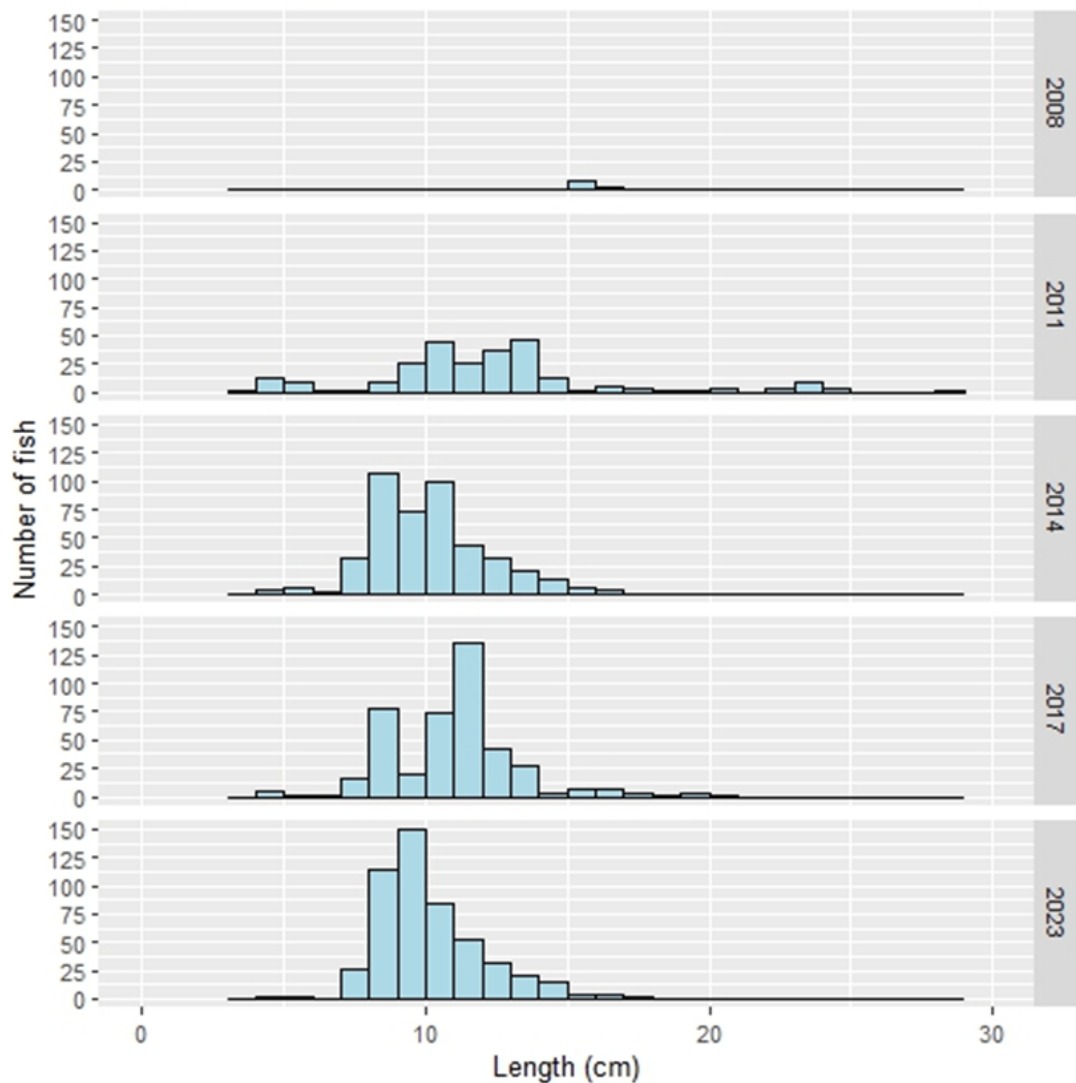
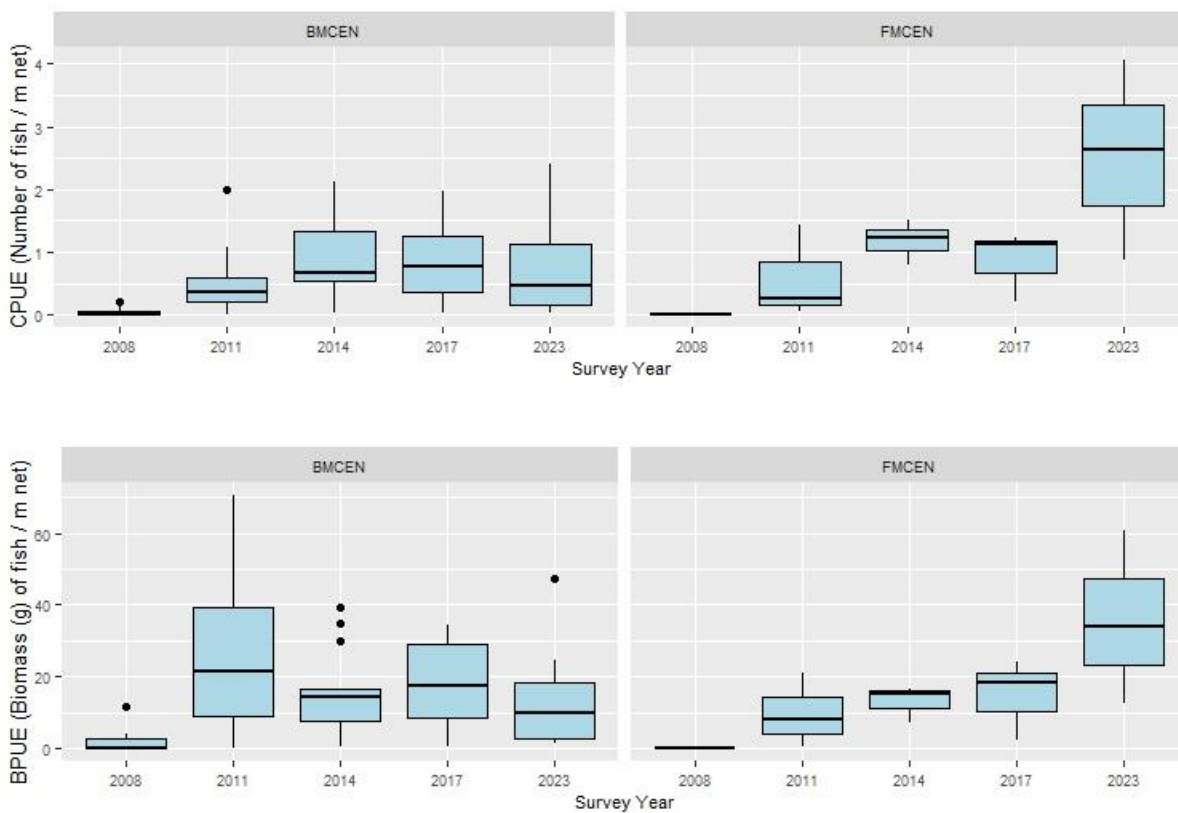


Figure 3.1. Length frequency of roach captured on Lough Allua between 2008 and 2023.

**Table 3.3. Summary age data from roach captured on Lough Allua, 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+
<b>N</b>	-	-	7	8	7	8	5	2
<b>Mean</b>	-	-	8.1	9.8	11.3	12.8	15.5	16.45
<b>Min</b>	-	-	7.6	9.2	10.4	11.8	14.1	16.2
<b>Max</b>	-	-	8.6	10.3	12.3	13.6	17.3	16.7

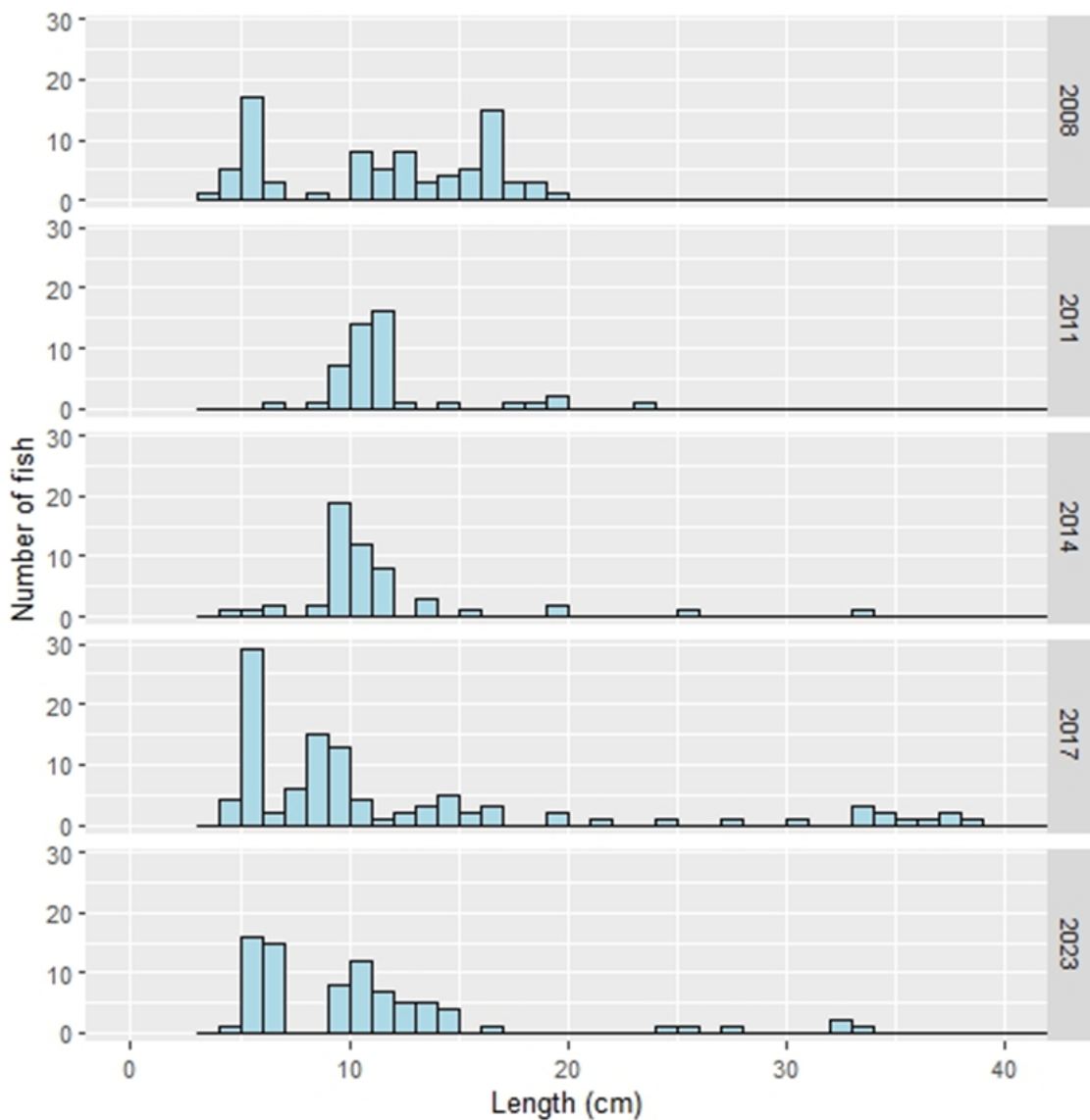


**Figure 3.2. CPUE and BPUE of roach captured during surveys of Lough Allua between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75<sup>th</sup> and 25<sup>th</sup> percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.**

## Perch

Perch captured in the 2023 survey ranged in length from 4.7cm to 42.5cm (mean = 11.0cm). While the population was largely dominated by fish smaller than 15cm, several much larger fish (>25.0 cm) (in common with previous surveys of the lake) were recorded in 2023. Perch in the sample were aged between 0+ and 6+. All age groups between 1+ and 3+ were present in the sample aged (5cm – 16cm, Figure 3.3). Small numbers of larger (and older) fish were captured and released and were not therefore available for aging. Mean L1 (i.e. length at the end of the 1<sup>st</sup> year) was 5.8cm (Table 3.4).

Perch populations have remained relatively stable across all surveys of the lake and no clear trends in abundance (CPUE) and biomass (BPUE) are apparent (Figure 3.4).



**Figure 3.3 Length frequency of perch captured on Lough Allua between 2008 and 2023.**

Table 3.4. Mean ( $\pm$ S.E.) perch length (cm) at age for Lough Allua, September 2023.

Length (cm)	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	L <sub>6</sub>
Mean ( $\pm$ S.E.)	5.8 (0.17)	10.0 (0.42)	13.9 (1.13)	-	-	-
N	27	14	4	1	1	1
Range	4.3-7.2	8.8-15.2	11.8-16.6	20.1	22.2	24.1

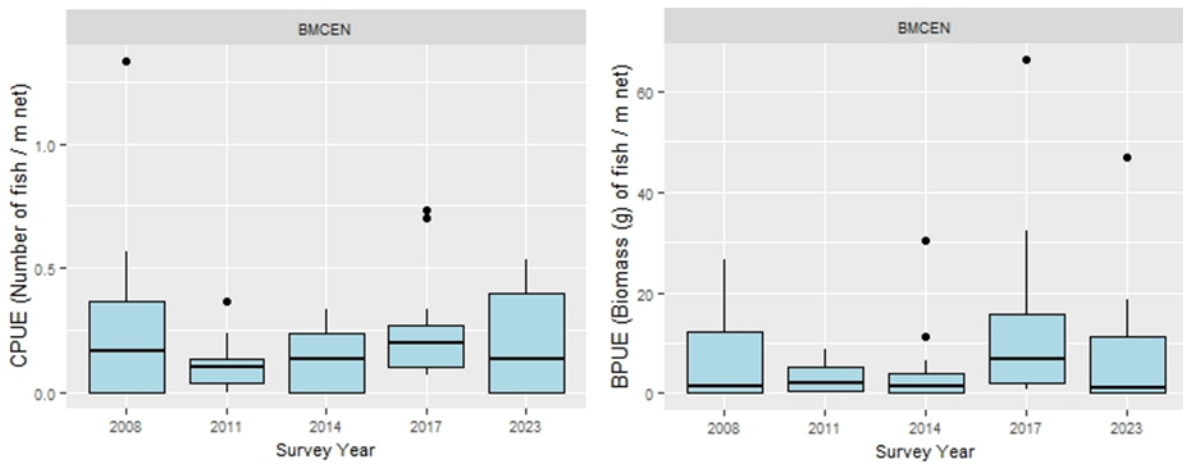
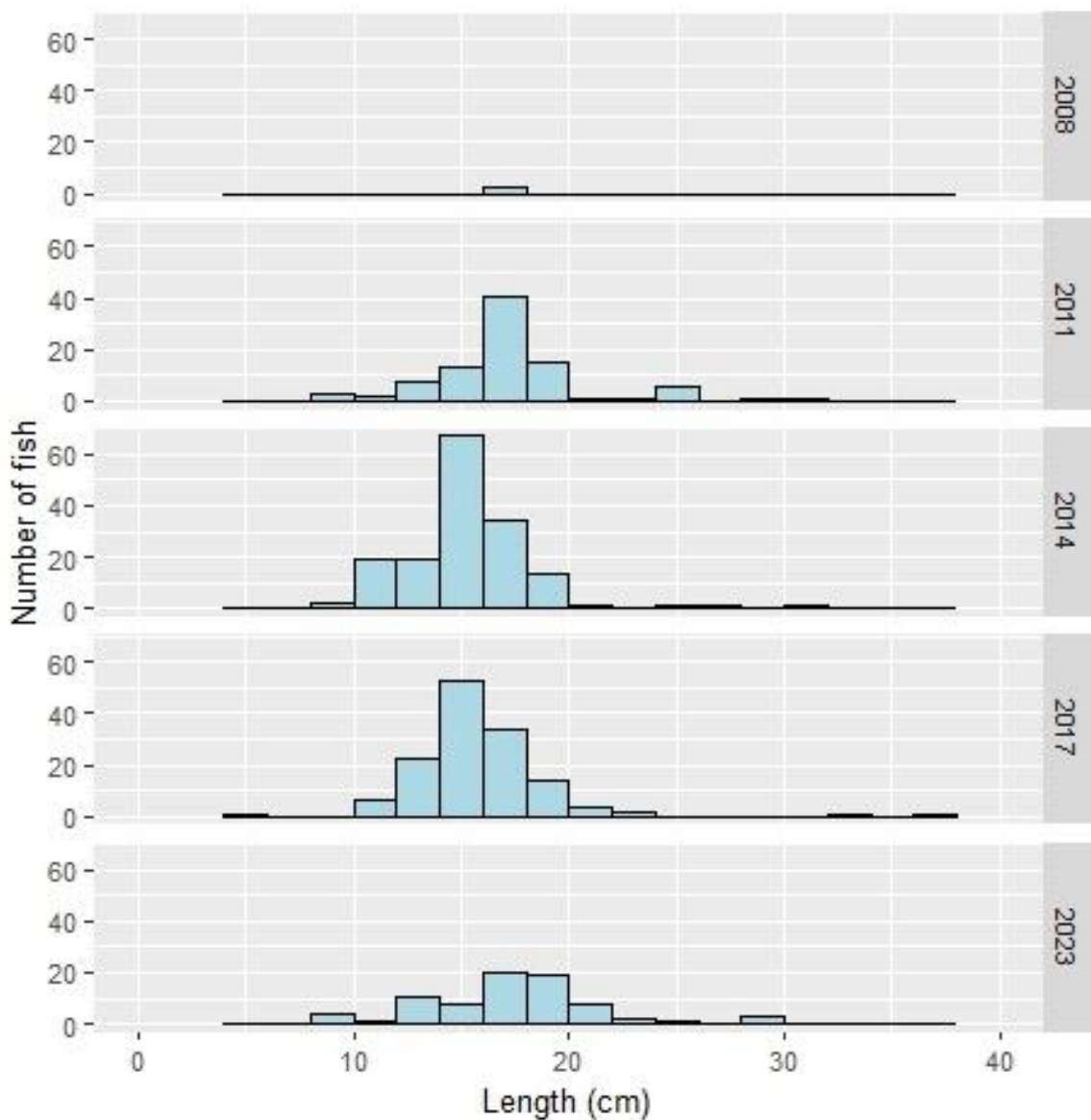


Figure 3.4. CPUE and BPUE of perch captured during surveys of Lough Allua between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75<sup>th</sup> and 25<sup>th</sup> percentiles 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 bream hybrids ranged in length from 8.4cm – 28.6cm (mean =17.4cm) in 2022 (Figure 3.5). Roach bream hybrids in the sample were aged between 2+ and 11+. All intervening age classes were present in the population aged. Four (15cm – 19cm, Figure 3.5) and six to seven (16cm – 28cm, Figure 3.5) year old hybrids were the most abundant year classes (Table 3.5).

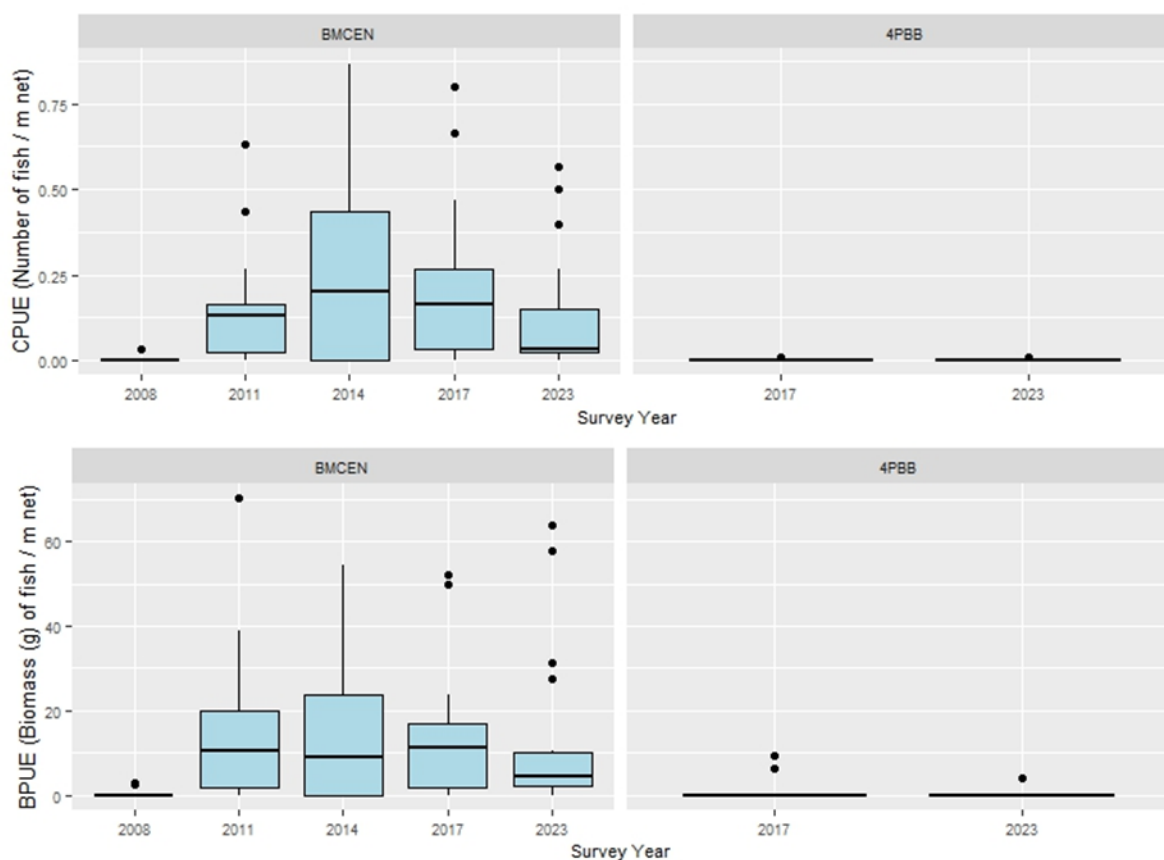
The rapid expansion in the abundance (CPUE) and biomass (BPUE) of roach x bream hybrids evident between 2008 and 2014 appears to have now stabilised (Figure 3.6)



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

**Table 3.5. Summary age data from roach x bream hybrids captured on Lough Allua, 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+
<b>N</b>	-	-	2	1	10	2	9	7	4	2	1	3
<b>Mean</b>	-	-	8.7	12.5	15.3	15.5	16.9	21.8	18.1	18.9	19.7	22.7
<b>Min</b>	-	-	8.9	12.5	19.8	15.7	20.2	28.6	18.7	19.5	19.7	28.6
<b>Max</b>	-	-	8.9	12.5	19.8	15.7	20.2	28.6	18.7	19.5	19.7	28.6

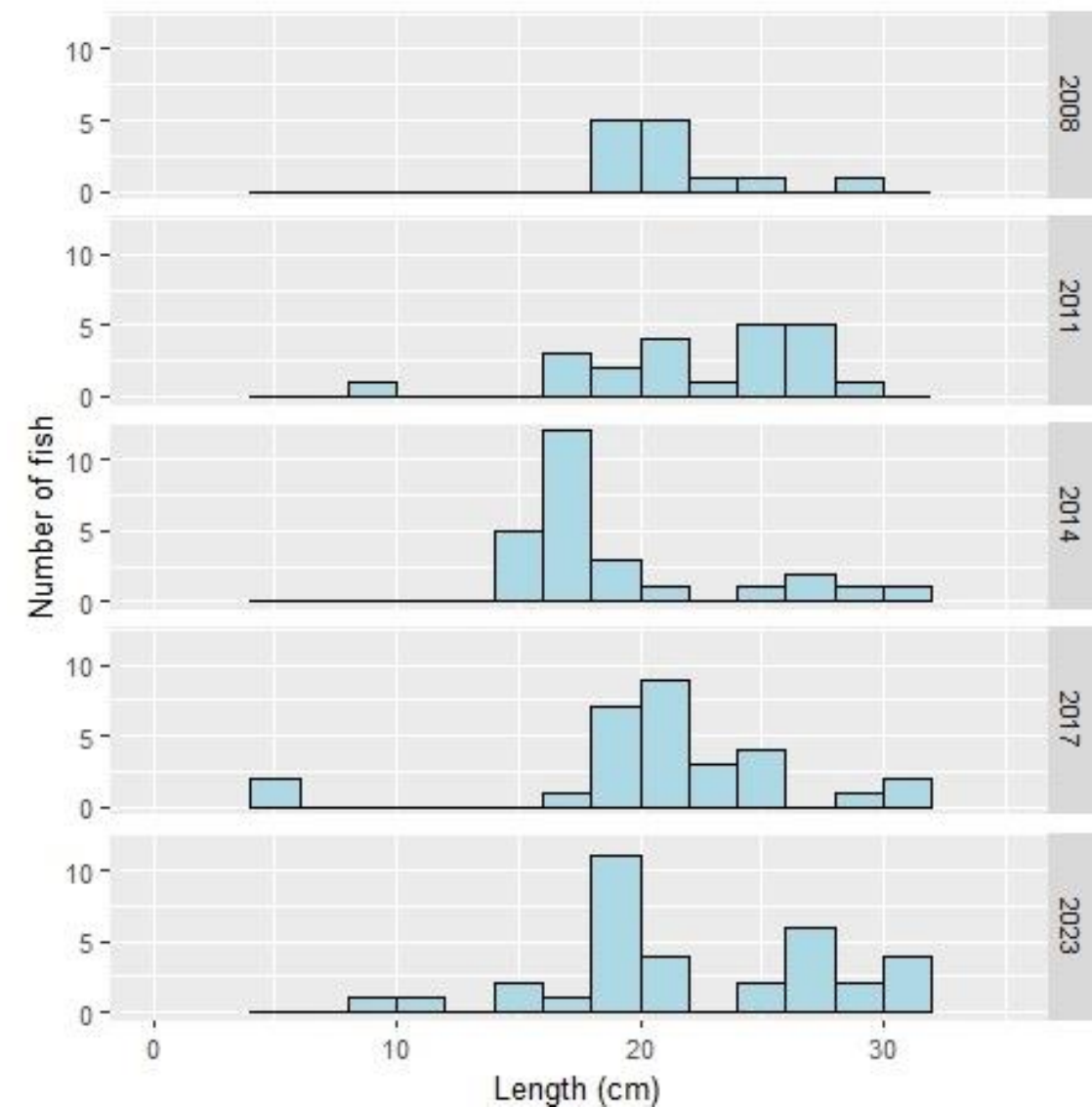


**Figure 3.6. CPUE and BPUE of roach x bream hybrids captured during surveys of Lough Allua between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75<sup>th</sup> and 25<sup>th</sup> 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 ranged in length from 8.0cm to 31.8cm (mean = 22.1cm) in 2023 (Figure 3.7). Bream were aged between 2+ and 12+ and all intervening age classes were present in the sample aged (Table 3.6). Four (18cm – 20cm) and six (24cm - 27cm)) year old fish were the most abundant year classes and together represent c. 52% of all the fish in the sample aged (Figure 3.7 and Table 3.6).

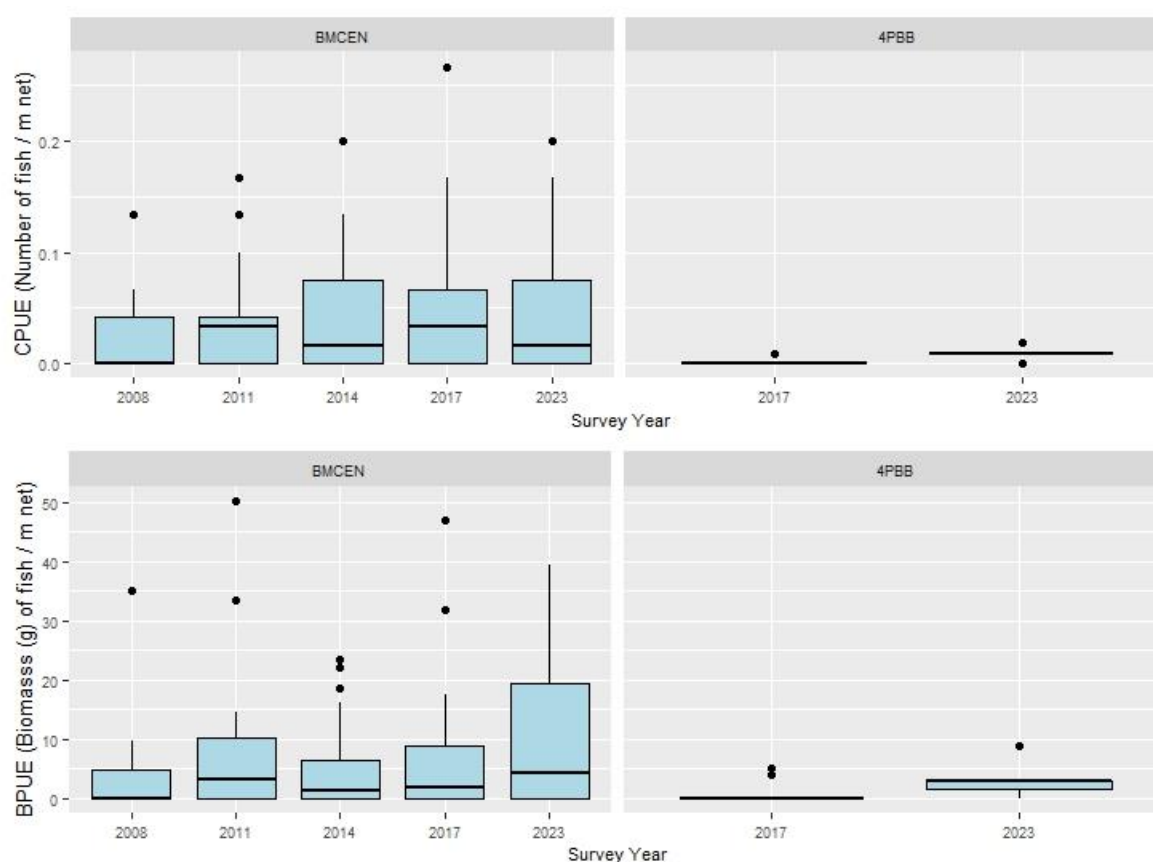
Bream populations have remained relatively stable across all surveys of the lake and no clear trends in abundance (CPUE) and biomass (BPUE) are apparent (Figure 3.8).



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

**Table 3.6. Summary age data from breem captured on Lough Allua, 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+
<b>N</b>	-	-	1	3	8	3	6	1	1	1	1	1	1
<b>Mean</b>	-	-	-	15.4	19.3	21.1	26.2	-	-	-	-	-	-
<b>Min</b>	-	-	11.4	16.3	20.1	21.6	27.2	27.3	29.2	31.8	30.9	30.9	30.3
<b>Max</b>	-	-	-	16.3	20.1	21.6	27.2	-	-	-	-	-	-



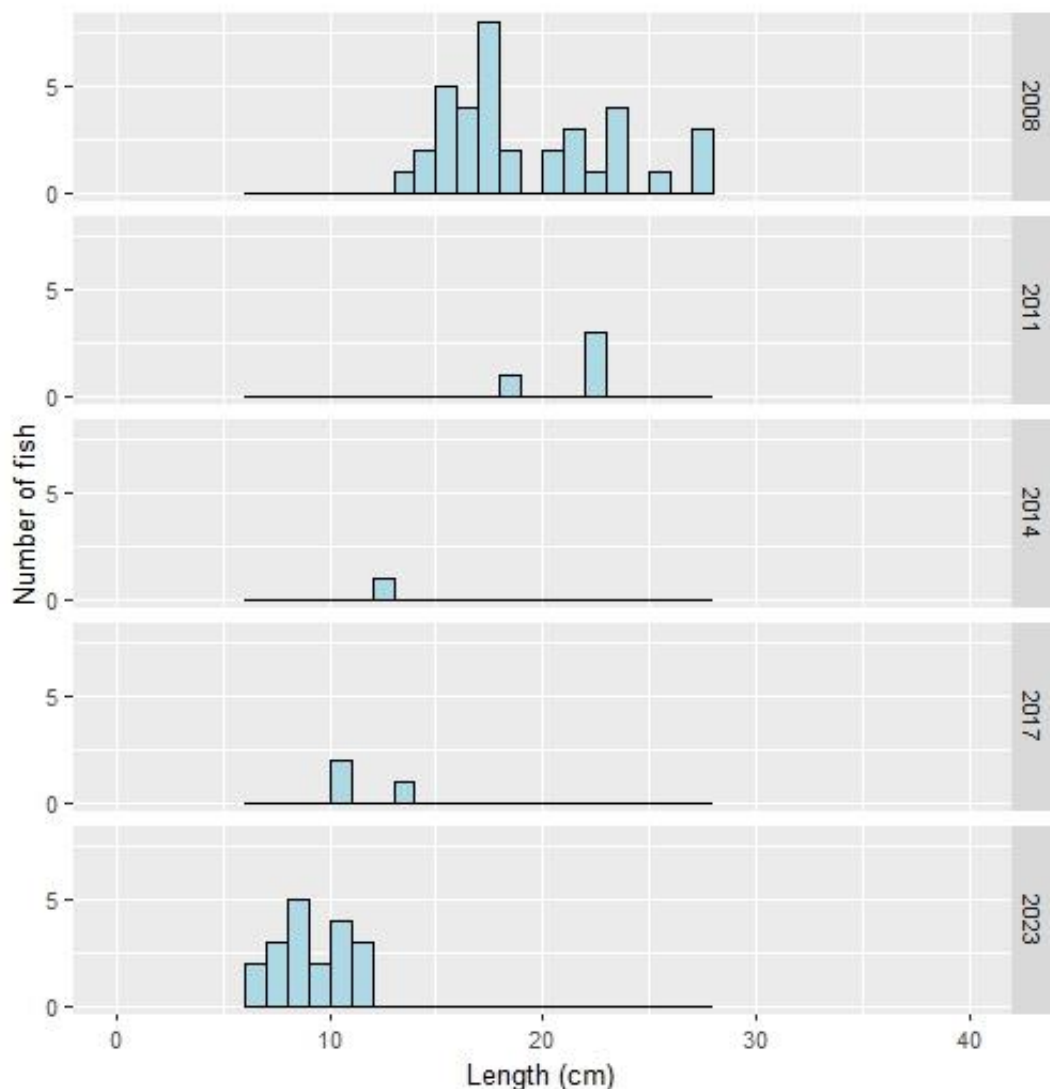
**Figure 3.8. CPUE and BPUE of breem captured during surveys of Lough Allua between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75<sup>th</sup> and 25<sup>th</sup> percentiles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



## **Rudd**

Rudd ranged in length from 6.0cm to 11.5cm (mean = 9.1cm) (Figure 3.9). Rudd were aged between 1+ and 4+ and all intervening age classes were present in the sample aged (Table 3.7). The dominant age class was 2+ (7cm to 11cm) (Figure 3.9 and Table 3.7)).

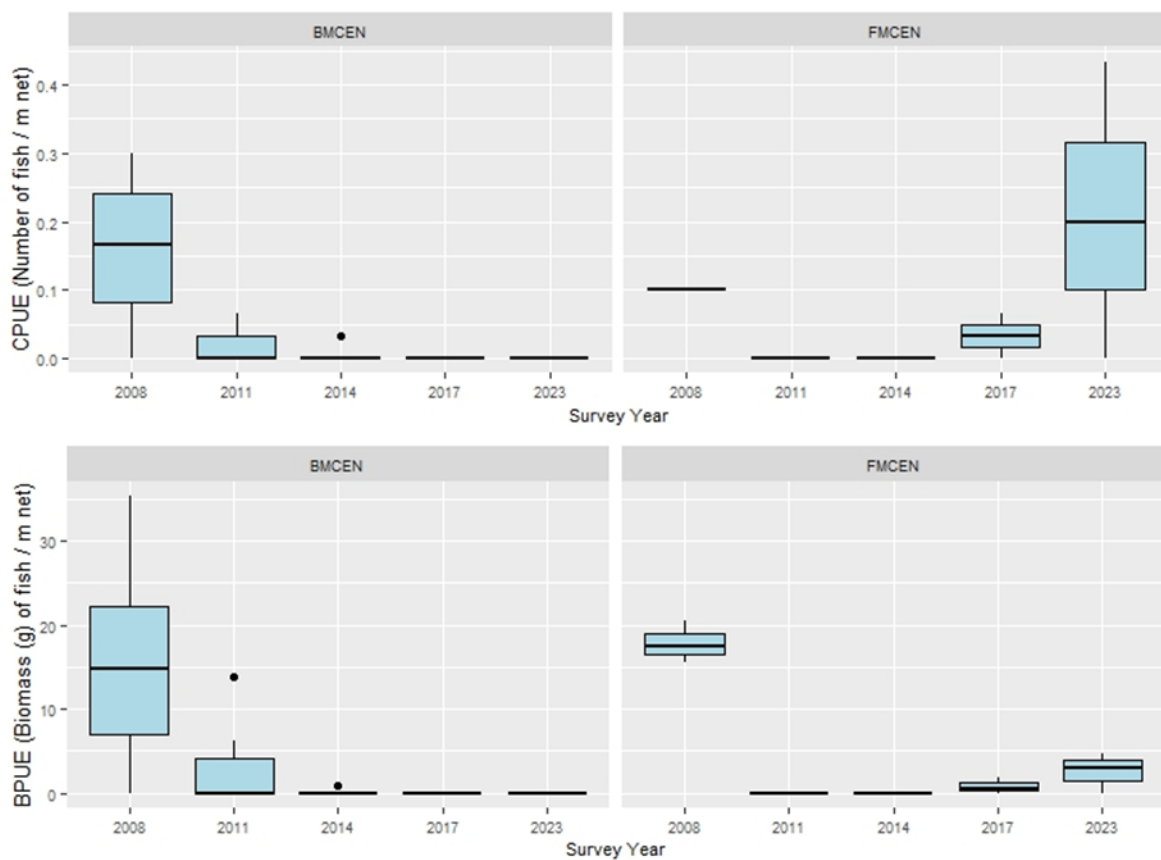
Abundance (CPUE) and biomass (BPUE) of rudd in benthic survey nets decreased substantially in all surveys between 2011 and 2017 when compared to previous levels in 2008. However there is some evidence that rudd CPUE has improved as indicated by fish captured in floating survey nets in the latter surveys (Figure 3.10).



**Figure 3.9. Length frequency of rudd captured on Lough Allua between 2008 and 2023.**

**Table 3.7. Summary age data from rudd captured on Lough Allua, September 2023. Number of fish and length ranges of all fish aged in the sample is presented.**

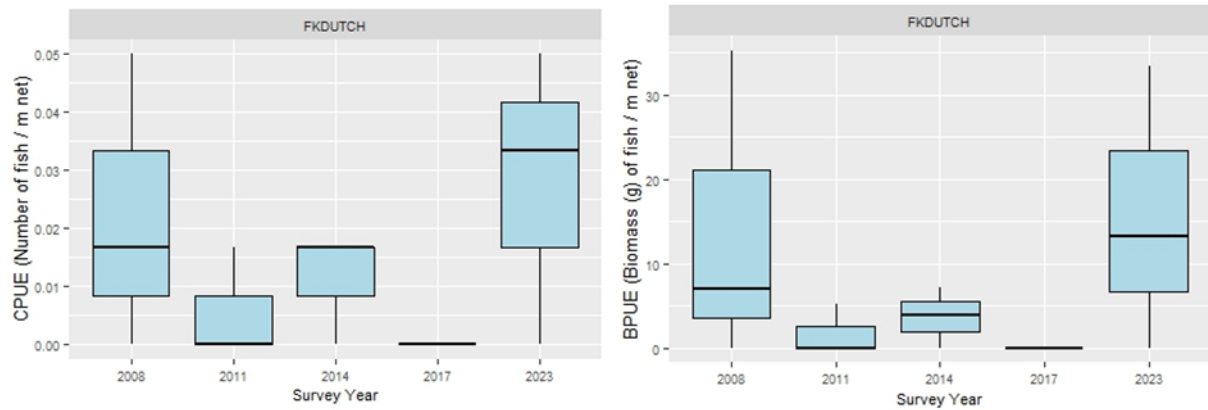
Length (cm)	Age class				
	0+	1+	2+	3+	4+
<b>N</b>	-	2	9	3	1
<b>Mean</b>	-	6.25	9.0	10.4	10.8
<b>Min</b>	-	6	7.8	9.6	10.8
<b>Max</b>	-	6.5	11.5	11.0	10.8



**Figure 3.10. CPUE and BPUE of rudd captured during surveys of Lough Allua 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 75<sup>th</sup> and 25<sup>th</sup> 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

Five eels ranging in length from 58.0cm to 78.5cm (mean = 63.9cm) were recorded. Both abundance (CPUE) and biomass (BPUE) of eel have fluctuated since 2008 (Figure 3.11). Pike ranged in length from 58cm to 73.2cm (mean =62.3cm). Gudgeon ranged in length from 9cm to 10cm (mean = 9.4cm)



**Figure 3.11. CPUE and BPUE of eel captured during surveys of Lough Allua 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 75<sup>th</sup> and 25<sup>th</sup> percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range.**



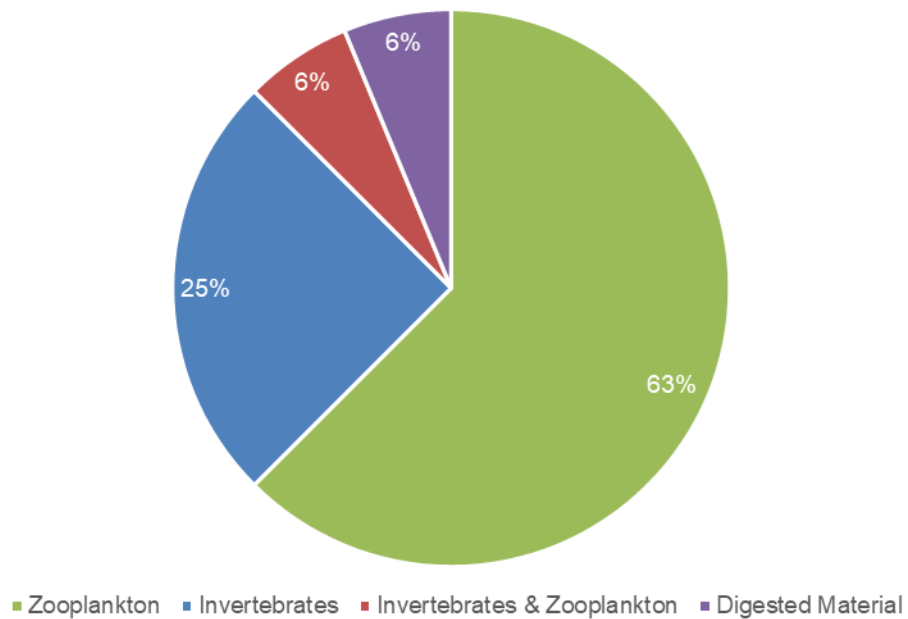
**Plate 3.2 Processing data at Lough Allua, September 2023**

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

#### Perch

A total of 32 perch stomachs were examined. Sixteen (50%) were empty. Zooplankton was the sole prey type recorded in 10 (36%) stomachs and was found together with invertebrates in one more stomach (6%). Invertebrates were the sole prey type found in four (25%) perch stomachs. Unidentified digested material was recorded in one (6%) fish (Figure 3.12).



**Figure 3.12. Diet of perch (N = 16) captured on Lough Allua, 2023 (% FO).**

#### Pike

One pike stomach was examined. This fish had consumed roach.

#### 4. Summary and fish ecological status

A total of seven fish species and one cyprinid hybrid variety were recorded in Lough Allua in September 2023. Roach was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2023 survey. This species was first recorded in the 2008 survey, and the initial rapid expansion in the population appears to have stabilised.

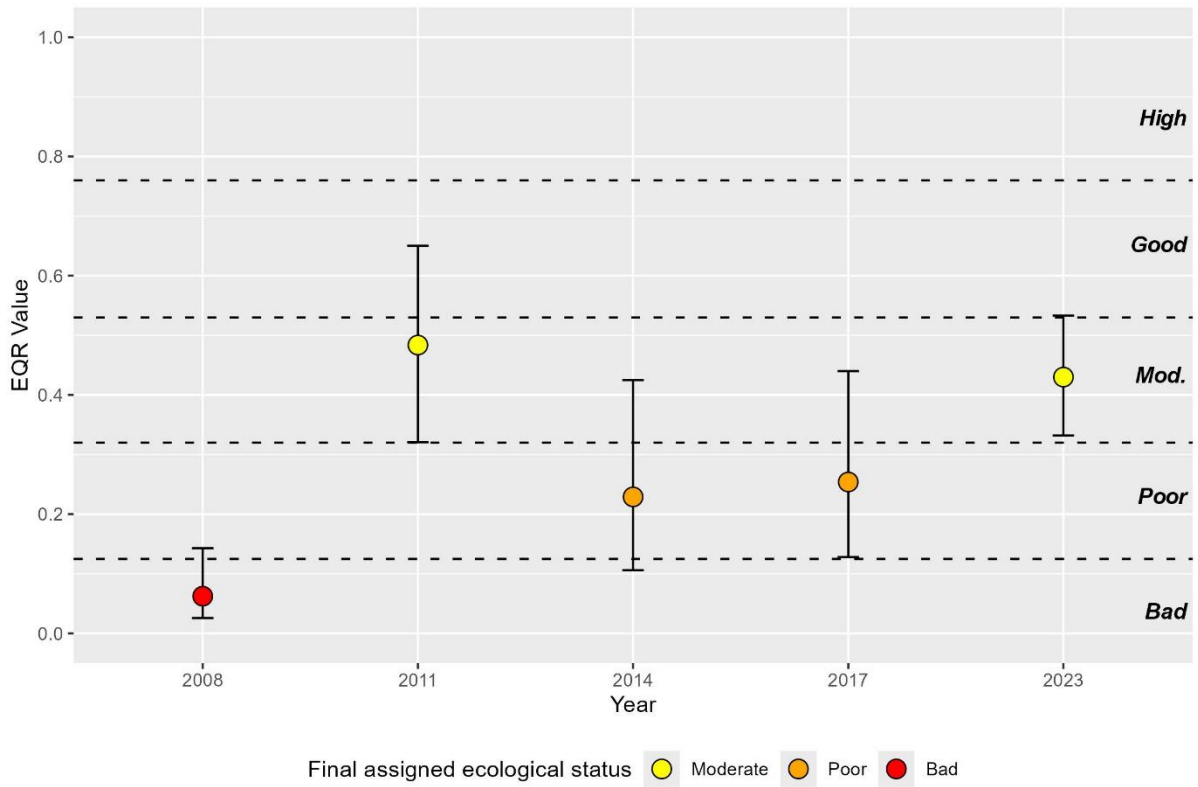
The roach x bream hybrid population (which requires both parent species to spawn (Hayden *et al.*, 2010) also exhibited consistent recruitment patterns, and the relative biomass was similar to that of roach. All the younger year groups were present, and there were several relatively strong older (i.e. > 10+) year classes apparent. The initial expansion of this species also appears to have stabilised.

Perch and bream populations have remained relatively stable in the lake, and there is evidence to suggest that the decline in the rudd population since 2008 may have ceased.

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, Lough Allua has been assigned an ecological status of Moderate for 2023 based on the fish populations present. The status of Lough Allua has fluctuated between Bad and Moderate following surveys of the lake since 2008 (Figure 4.1).

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Lough Allua 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 Allua between 2008 to 2023 (dashed line indicates EQR status boundaries).**

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