National Research Survey Programme

Lakes 2023

Lough Anure

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Iascach Intíre Éireann
Inland Fisheries Ireland

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Fish Stock Survey of Lough Anure, July 2023

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National Research Survey Programme

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

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1. Introduction

Lough Anure is situated adjacent to the village of Loch Anure, approximately 8km north-east of Dungloe, Co. Donegal (Plate 1.1, Figure 1.1). The lake is the largest in the Rosses system and drains into the sea through the River Crolly (Gweedore River). Lough Anure is very rocky, with a surface area of 156ha, a mean depth of only 2m and maximum depth of 12m. The lake is categorised as typology class 2 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. shallow (<4m), greater than 50ha and low alkalinity (<20mg/l $CaCO_3$). The lake was classed as 1a (i.e. at risk of failing to meet good status by 2015) in the WFD Characterization report (EPA, 2005) and has failed for chemical water status in the most recent monitoring assessment (2016-2021) (EPA, 2024). The geology of the area is predominantly granite, felsite and other intrusive rocks rich in silica.

Both the Lough Anure and Rosses Angling clubs fish on the lake, which is viewed as one of the better trout fisheries in the area (O' Reilly, 2007) with brown trout averaging approximately 0.25kg (1/2lb) and numerous fish weighing up to 0.5kg (1lb). The lake also gets a good run of sea trout and occasional salmon from July (O' Reilly, 2007).

This lake was surveyed in 2006 as part of the NSSHARE Fish in Lakes Project (Kelly *et al*., 2007) and in 2009, 2012, 2015 and 2020 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al*., 2010, 2013 and 2016, Corcoran *et al.,* 2021). Brown trout was the dominant species captured in each survey. Eel, salmon and minnow were also regularly 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. Lough Anure

Plate 1.2. Preparing nets at Lough Anure, July 2023

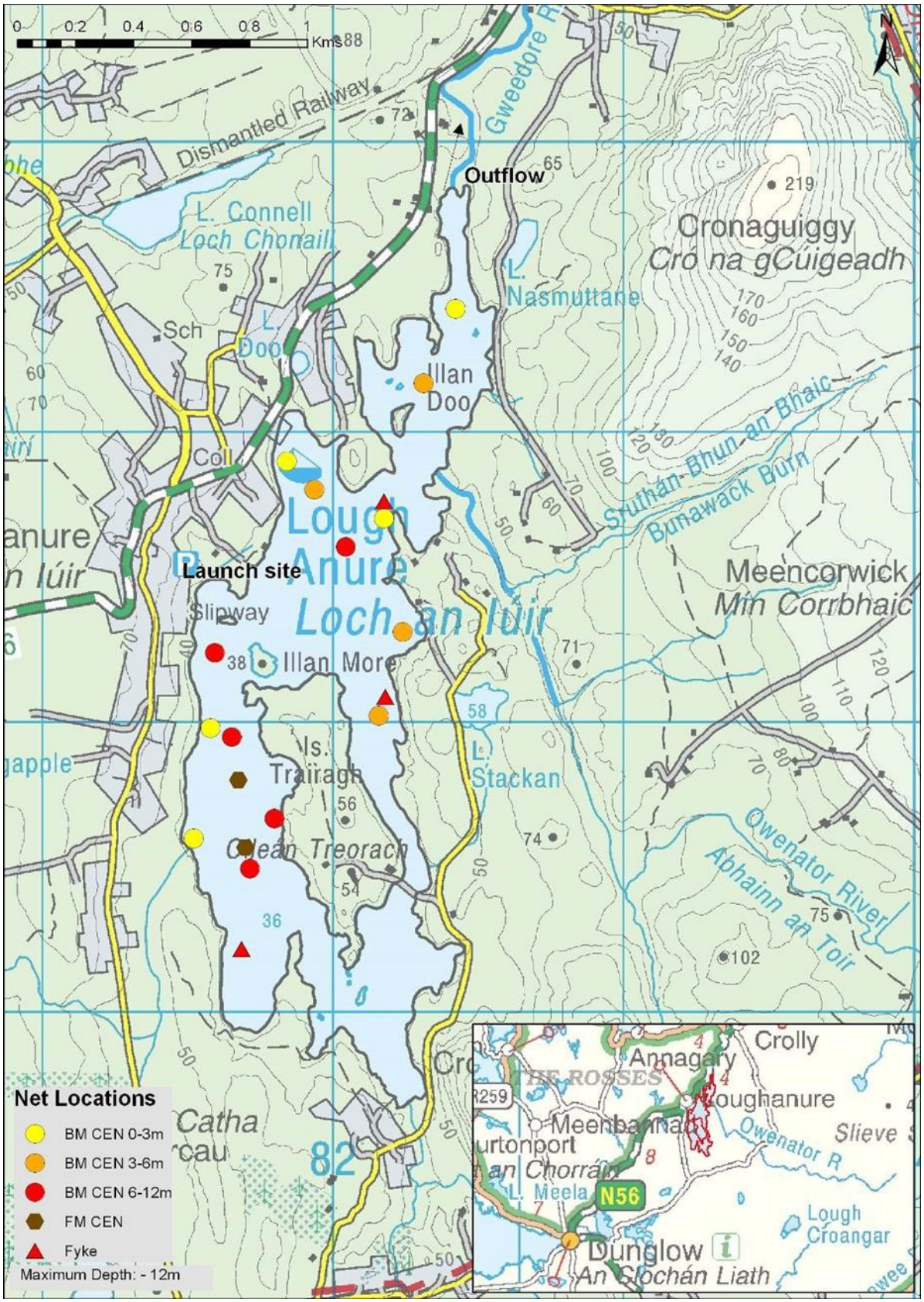

Figure 1.1. Location map of Lough Anure showing net locations and depths of each net (outflow is indicated on map).

2. Methods

2.1. Netting methods

Lough Anure was surveyed over two nights from the 10th to the 12th of July 2023. A total of three sets of Dutch fyke nets, 14 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (5 @ 0-2.9m, 4 @ 3-5.9m, and 5 @ 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 (19 sites). Nets were deployed in the same randomly selected locations as in 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 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

Four fish species were recorded in Lough Anure in July 2023. A total of 185 fish were captured (Table 3.1). Brown trout was the most numerous fish species recorded, representing *c.* 94% of all fish recorded. Salmon, minnow and European eels were also captured. A similar species composition was recorded during previous surveys of the lake, except salmon which were not captured in 2009 (Kelly *et al.*, 2010, 2013 and 2016, Corcoran *et al.,* 2021).

Table 3.1. Number of each fish species captured by each gear type during the survey on Lough Anure

Scientific name	Common name	Number of fish captured			
		BM CEN	FMCEN	Fyke	Total
Salmo trutta	Brown trout	135	27	11	173
Salmo salar	Salmon	2	0	0	2
Phoxinus phoxinus	Minnow	2	0	0	2
Anguilla anguilla	European eel	0	0	8	8

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. Brown trout was the dominant species with respect to both abundance (CPUE) and biomass (BPUE) (Table 3.2).

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

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Salmo trutta	Brown trout	0.293 (0.044)	30.620 (5.055)
Salmo salar	Salmon	0.003 (0.003)	0.055 (0.055)
Phoxinus phoxinus	Minnow	0.003 (0.002)	0.010 (0.007)
*Anguilla anguilla**	European eel	0.044 (0.005)	5.730 (0.347)

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.

3.3. Species Profiles

Brown trout

Brown trout captured during the 2023 survey ranged in length from 11.8cm to 33.2cm (mean 20.2cm) (Figure 3.1). Brown trout captured in previous surveys had similar length and age ranges. While generally dominated by smaller fish, several larger trout (> 30cm) have been captured during surveys (Figure 3.1). Brown trout were aged between 1+ and 6+ and all intervening age classes were represented. The most abundant year class was 2+ (14cm-21cm; Figure 3.1) and older cohorts (≥ 4+) were recorded in smaller numbers. Mean L1 (i.e. length at the end of the 1st year) was 6.2cm (Table 3.3).

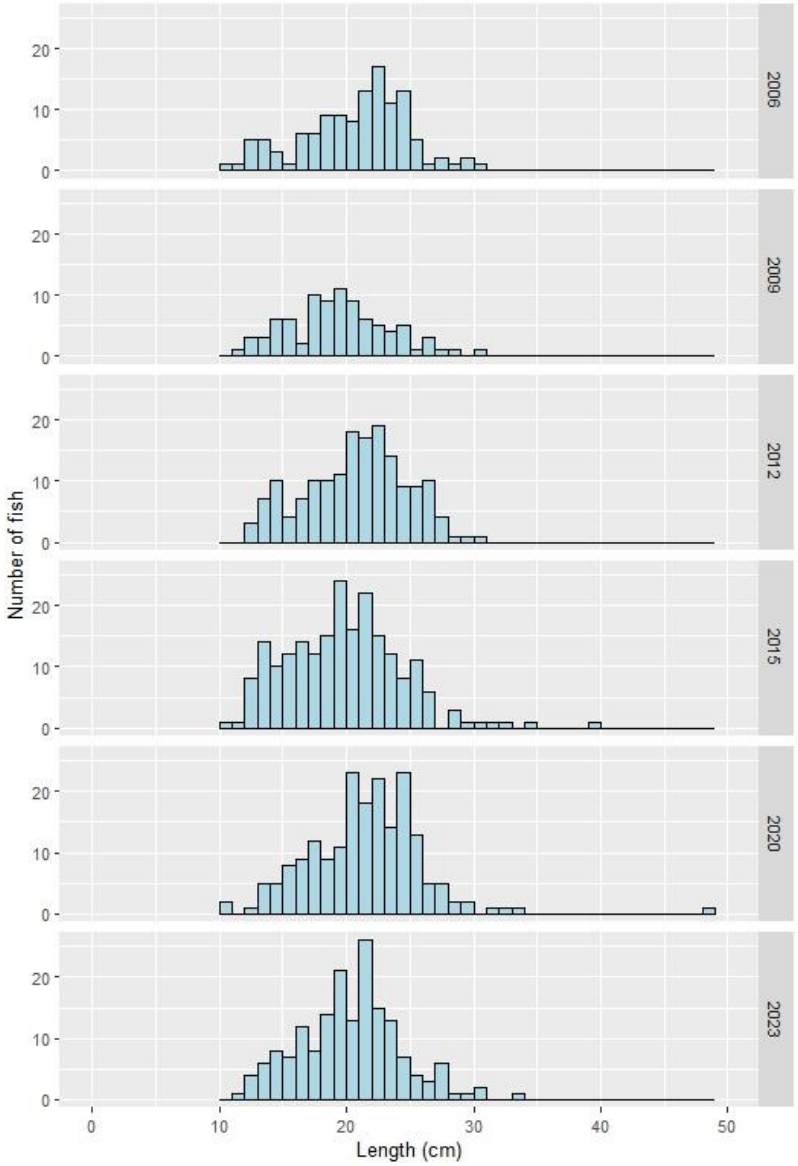

Figure 3.1. Length frequency of brown trout captured on Lough Anure, between 2006 and 2023.

Table 3.3. Mean (±S.E.) brown trout length (cm) at age for Lough Anure, July 2023.-

Length (cm)	L1	L2	L3	L4	L5	L6
Mean (±S.E)	6.2 (0.07)	13.0 (0.15)	19.2 (0.27)	23.4 (0.54)	27.3 (0.62)	-
N	73	61	29	11	4	1
Range	4.5-7.8	10.4-16.8	14.7-21.8	19.5-26.4	25.5-28.4	31

Brown trout abundance (CPUE) and biomass (BPUE) have fluctuated across all sampling periods, an increasing trend was observed from 2009 to 2020 (Figure 3.2).

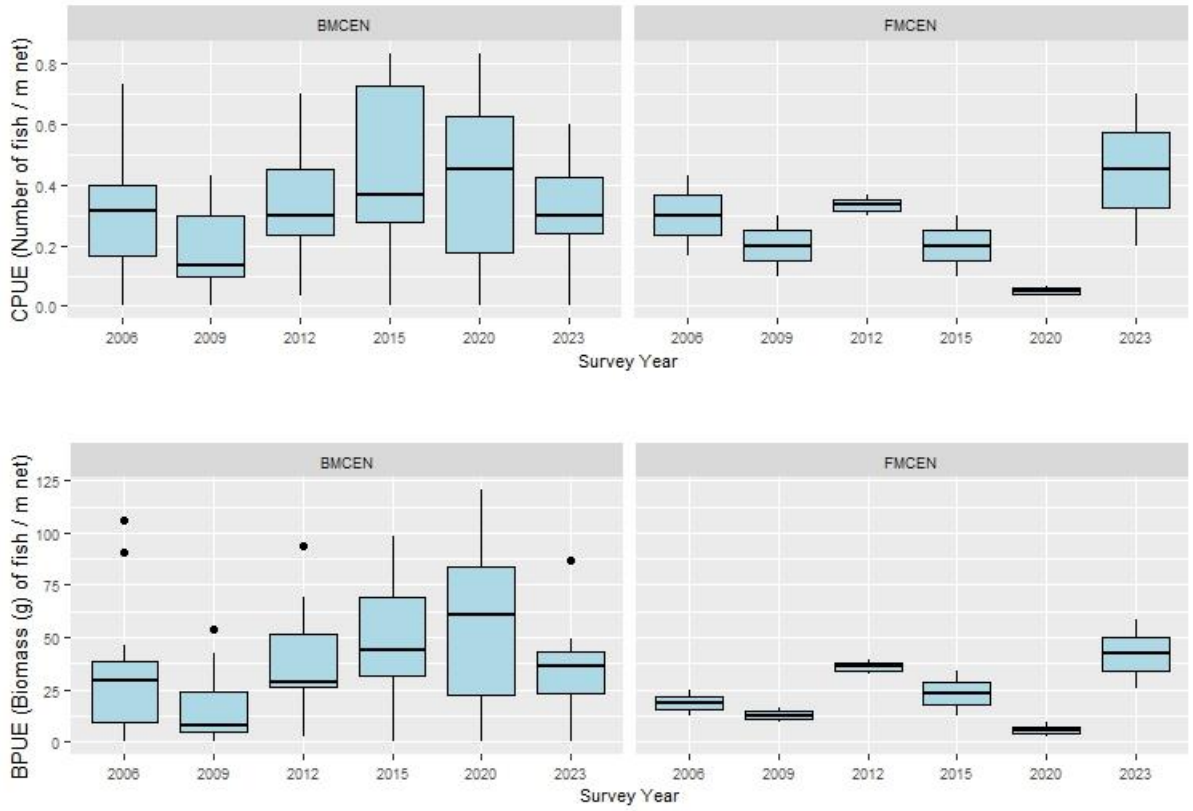

Figure 3.2. CPUE and BPUE of brown trout captured during surveys of Lough Anure between 2006 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

European eel

Eight European eels captured in 2023 ranged in length from 34.2cm to 52.5cm (mean = 42.9cm) (Figure 3.3). Eel abundance (CPUE) and biomass (BPUE) declined in 2015 compared to the earlier surveys and has remained low on all subsequent surveys of the lake (Figure 3.4).

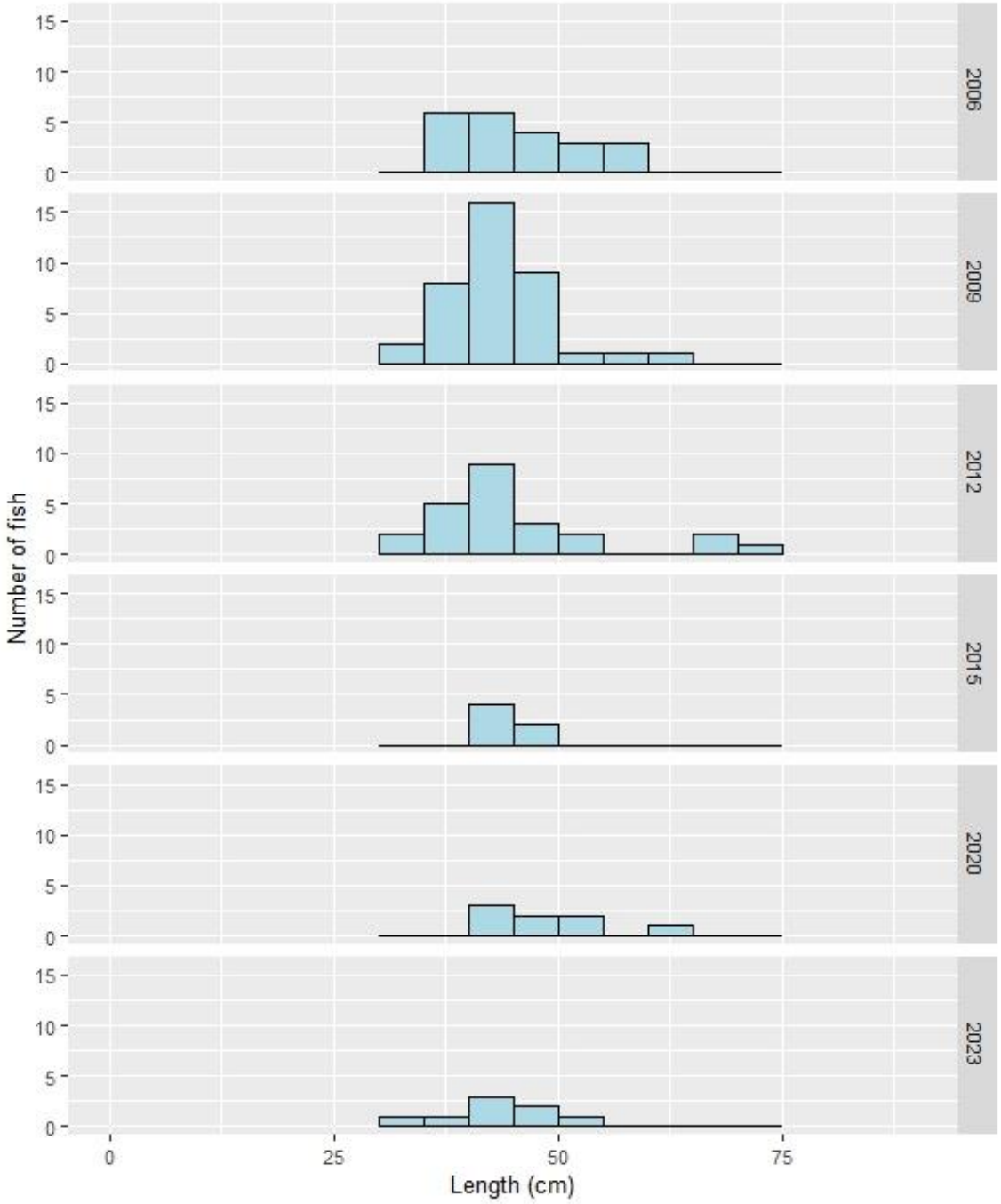

Figure 3.3. Length frequency of eel captured on Lough Anure, between 2009 and 2023.

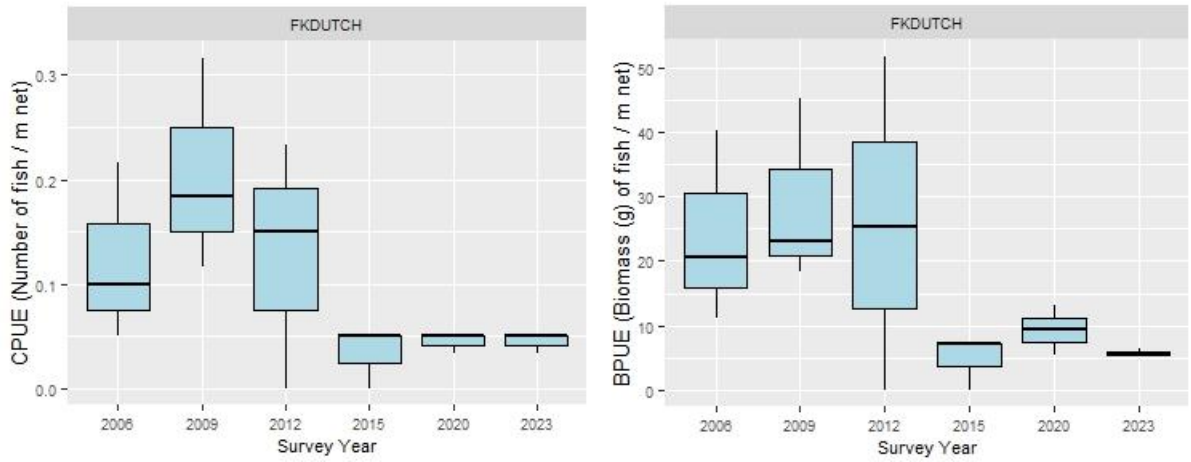

Figure 3.4. CPUE and BPUE of eel captured during surveys of Lough Anure between 2006 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

<u>Other fish species</u>

Two juvenile salmon (11cm) were recorded. Two minnow captured measured 5.2cm and 5.5cm.

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.

Brown trout

A total of 61 stomachs were examined. Twenty-two (36%) were empty. Thirty-nine stomachs contained food. Invertebrates were the sole prey type recorded in 21 (54%) stomachs and were found together with zooplankton in eight stomachs (21%). Zooplankton was the sole prey type recorded in seven (18%) stomachs. Fish was recorded in one (3%) brown trout stomach. Unidentified digested material was recorded in two (5%) fish (Figure 3.5).

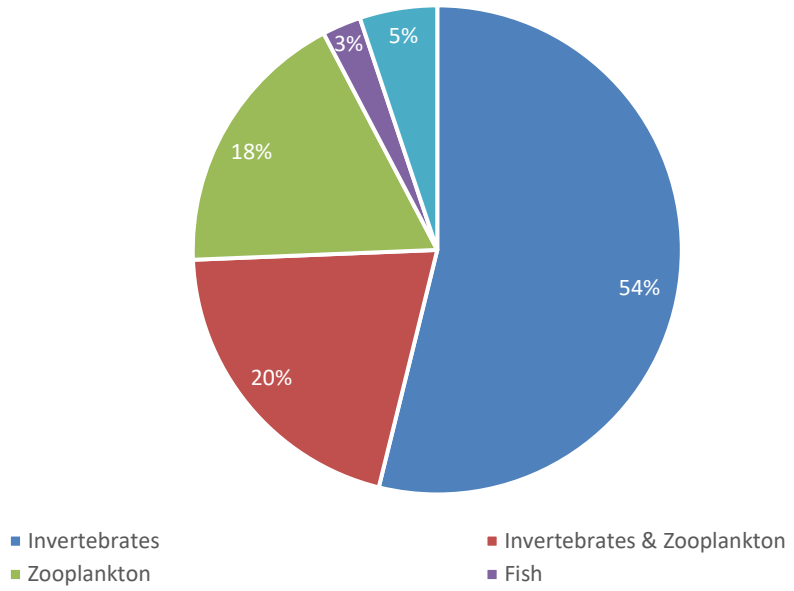

Figure 3.5. Diet of brown trout (N = 39) captured on Lough Anure, 2023 (% FO).

4. Summary and fish ecological status

Four fish species were recorded in Lough Anure in July 2023. Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2023 survey. Recruitment appears to be regular and the population, in common with previous surveys was dominated by younger and smaller individuals but with older and larger cohorts persisting in the population.

Catches of European eel, which initially declined in 2015, have remained at similar levels in all three surveys conducted since that time.

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, Lough Anure has been assigned an ecological status of Good for 2023 based on the fish populations present. Lough Anure has also been assigned a status of Good in 2020 and 2015. The lake was assigned High fish ecological status in 2012, 2009 and 2006 (Figure 4.1).

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

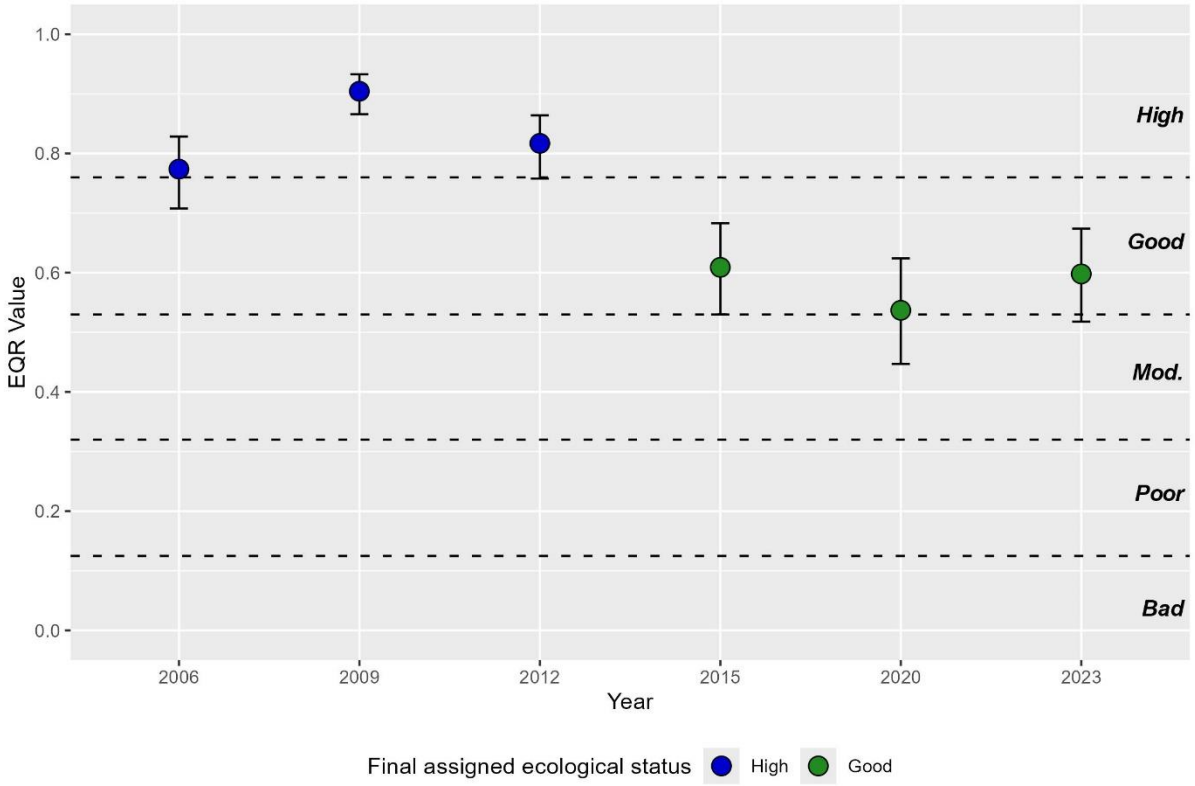

Figure 4.1. Fish ecological status, Lough Anure between 2006 and 2023 (dashed line indicates EQR status boundaries).

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