National Research Survey Programme
Lakes 2022

Lough Beltra

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Iascach Intíre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Lough Beltra, July 2022

National Research Survey Programme

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ACKNOWLEDGEMENTS

1.   Introduction

Lough Beltra is a picturesque lake located 8km north-east of Newport and 11km north-west of Castlebar, Co. Mayo (Plate 1.1, Figure 1.1). The lake is 2.4km in length and 1.6km wide, has a surface area of 403ha, a mean depth of > 4m and a maximum depth of 26.0m. The lake is categorised as typology class 4 (as designated by the EPA for the purposes of the Water Framework Directive), i.e., deep (>4m), greater than 50ha and high alkalinity (<20mg/l CaCO3).

Lough Beltra forms part of the Newport River Special Area of Conservation (SAC). The site consists of the Newport River, its tributaries and Lough Beltra (NPWS, 2013). The site is selected as a SAC for Atlantic salmon (*Salmo salar*) and freshwater pearl mussel (*Margaritifera margaritifera*), both species listed on Annex II of the E.U. Habitats Directive. The Newport River and Lough Beltra are important for spring salmon and grilse and contain important spawning areas.   Broad-leaved deciduous woodland is also found within the site, which is comprised of ash (*Fraxinus excelsior*), hawthorn (*Crataegus monogyna*), downy birch (*Betula pubescens*), alder (*Alnus glutinosa*), willow (*Salix* spp.). The kingfisher (*Alcedo atthis*), a species listed on Annex I of the E.U. Birds Directive, has also been recorded along the Newport River.

Water quality in the lake is considered to be good; however, there are potential threats to water quality through nutrient enrichment, particularly from agricultural run-off. Afforestation within the catchment could also pose a threat to water quality (NPWS, 2013).

Lough Beltra gets an excellent run of spring salmon and, from June onwards, a run of grilse and sea trout (*Salmo trutta*). The sea trout average approximately 0.34kg, but fish of between 1.8kg and 2.3kg are taken annually (O' Reilly, 2007).

The lake has been surveyed on three occasions since 2010 (2010, 2013 and 2016) (Kelly *et al*., 2011, 2014 and 2017). During these surveys perch (*Perca fluviatilis*) were found to be the dominant species present in the lake. Brown trout (*Salmo trutta*), sea trout, eels (*Anguilla anguilla*) and salmon were also captured during previous surveys.

This report summarises the results of the 2022 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.
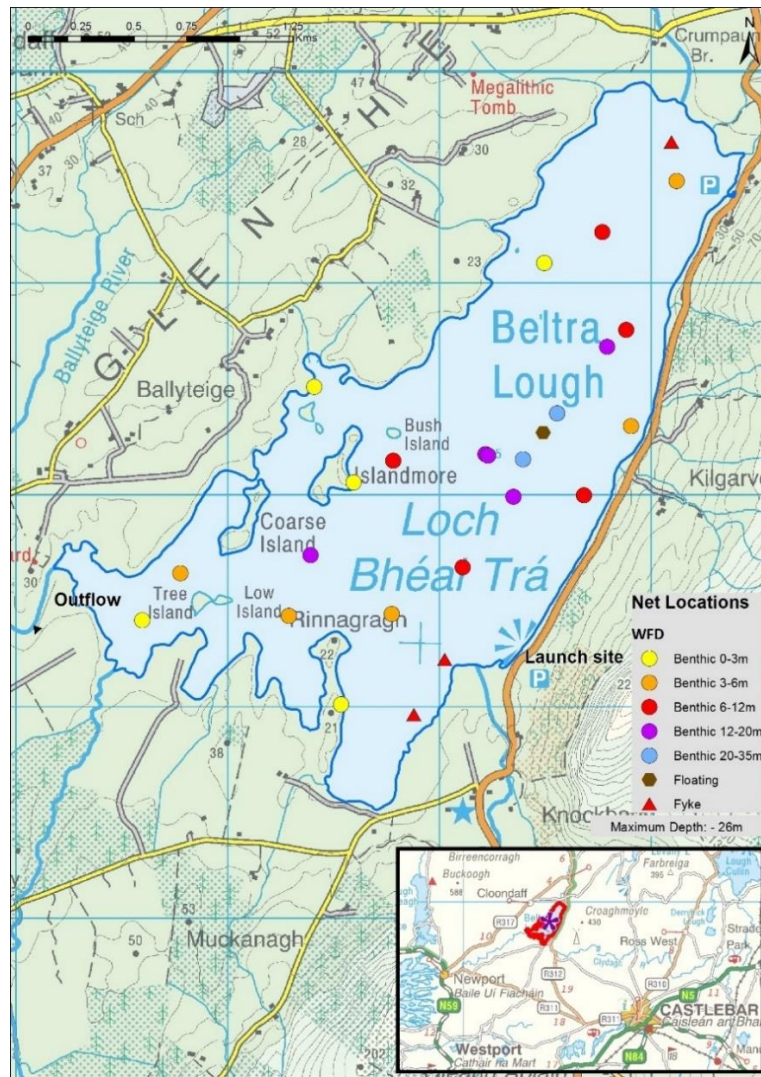
Plate 1.1. Lough Beltra, July 2022.

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

2. Methods

2.1. Netting methods

Lough Beltra was surveyed over two nights from the 12th to 14th of July 2022. A total of three sets of Dutch fyke nets, 22 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (5 @ 0-2.9m, 5 @ 3-5.9m, 5 @ 6-11.9m, 5 @ 12-19.9m and 2 @ 20-34.9m) and one floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill net was deployed in the lake at the same locations as were randomly selected in previous surveys (26 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 except eels. 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).

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

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

Five fish species (sea trout are included as a separate 'variety' of trout) were recorded in Lough Beltra in July 2022. A total of 396 fish were captured (Table 3.1). Perch was the most abundant fish species recorded, representing *c*. 91% of all fish captured. Brown trout, sea trout, eels and one salmon were also captured. During the previous surveys in 2010, 2013 and 2016 the same species composition was recorded with the exception of salmon which were not recorded in 2016 (Kelly *et al*., 2011, 2014 and 2017).

Table 3.1. Number of each fish species captured by each gear type during the survey on Lough Beltra, July 2022.

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
Perca fluviatilis	Perch	355	0	6	361
Salmo trutta	Brown trout	19	3	5	27
	Sea trout	5	0	0	5
Salmo salar	Salmon	1	0	0	1
Anguilla anguilla	European eel	1	0	1	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. Perch were the dominant species with respect to both CPUE and BPUE captured in 2022 (Table 3.2).

For comparison purposes box plots of CPUE and BPUE for each species captured in all surveys per net type between 2009 and 2021 are presented in Figures 3.1 and 3.2 respectively and illustrates fish community change over time. There was an apparent increase in both median CPUE and BPUE of perch captured across all surveys of the lake. Eel catches (both CPUE and BPUE) declined over the sampling period (Figs. 3.1 and 3.2).

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

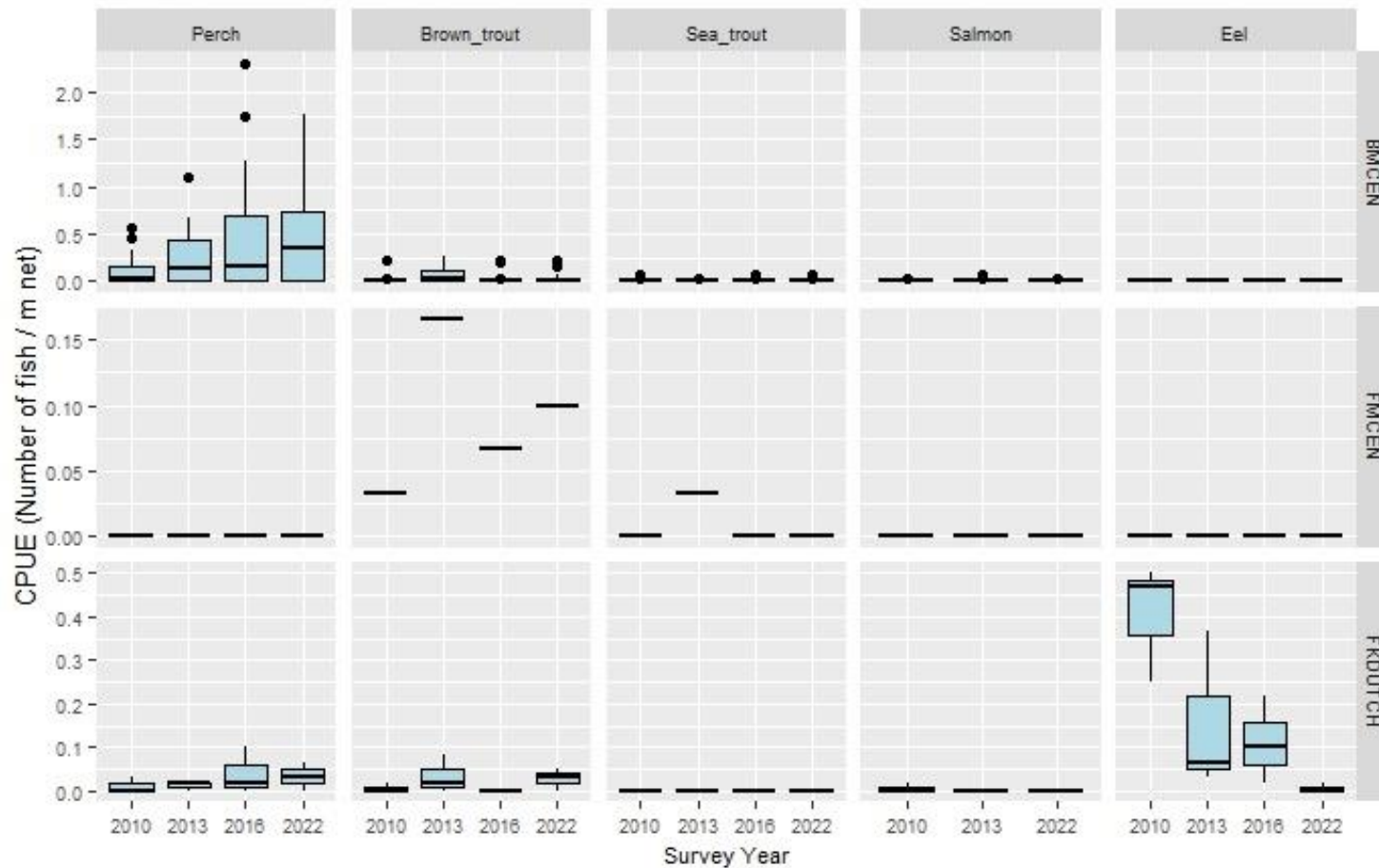| Scientific name	Common name	Mean CPUE (± S.E.)	Mean BPUE (± S.E.)
Perca fluviatilis	Perch	0.459 (0.112)	16.599 (3.820)
Salmo trutta	Brown trout	0.031 (0.011)	2.712 (1.108)
	Sea trout	0.006 (0.006)	2.300 (1.381)
Salmo salar	Salmon	0.006 (0.006)	2.878 (2.878)
Anguilla anguilla	European eel	0.001 (0.001)	4.962 (4.962)

Figure 3.1. CPUE of fish species captured in each net type during surveys of Lough Beltra between 2010 and 2022. 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. The y axis (CPUE) is unique for each net type.
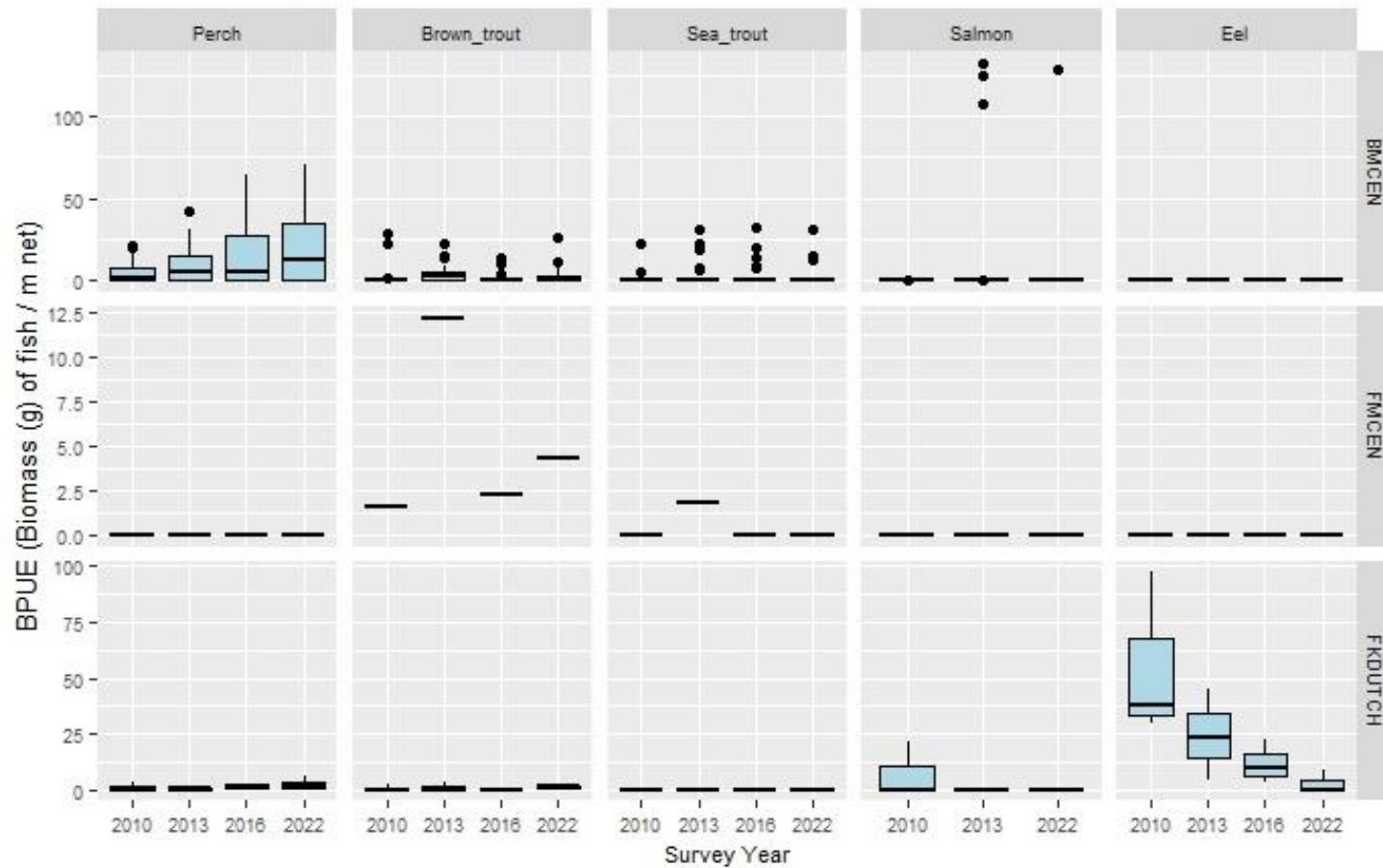
Figure 3.2. BPUE of fish species captured in each net type during surveys of Lough Beltra between 2010 and 2022. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots. The y axis (BPUE) is unique for each net type.

3.3. Length frequency distributions and growth

Perch

Perch captured during the 2022 survey ranged in length from 5.0cm to 31.5cm (mean 13.6cm) (Figure 3.3). Seven age classes were present, ranging from 1+ to 8+. All age classes with the exception of 7+ were present in the sample aged. Mean L1 (i.e., length at the end of the first year) was 6.4cm (Table 3.3). The population was typically dominated by smaller and younger fish. While very few fish greater than a length of 20.0cm have been captured in any of the survey occasions, the persistence of a small number of larger (and older) fish was apparent in several years including 2022 (Figure 3.3 and Table 3.3).
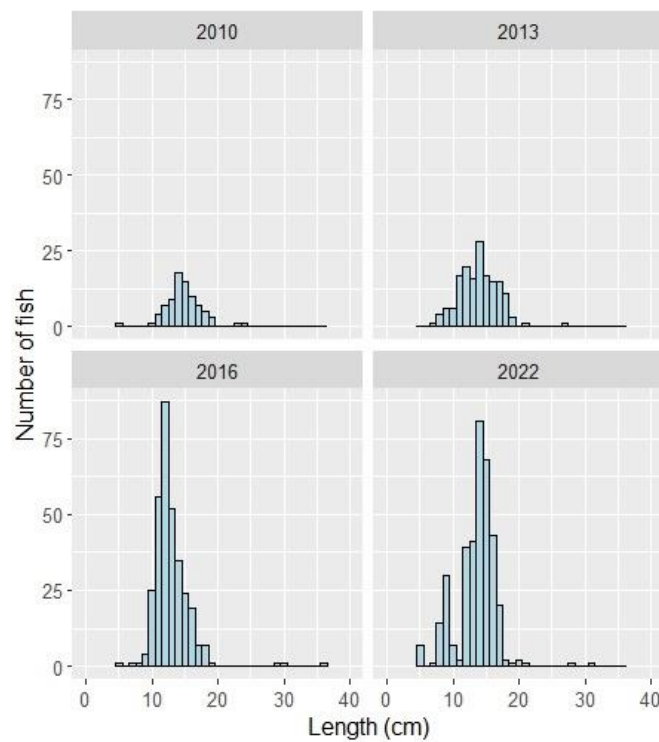

Figure 3.3. Length frequency of perch captured on Lough Beltra, 2010, 2013, 2016 and 2022.

Table 3.3. Mean (±S.E.) perch length (cm) at age for Lough Beltra, July 2022.

Length (cm)	L1	L2	L3	L4	L5	L6	L7	L8
Mean	6.4	10.9	13.9	16.2	19.9	25.7	-	-
±S.E.	0.2	0.2	0.2	0.4	1.7	0.4	-	-
N	52	42	31	15	3	2	1	1
Min	4.3	7.6	11.4	13.1	16.6	25.3	28.0	30.5
Max	9.4	13.2	17.0	19.0	21.7	26.0	28.0	30.5

Brown trout

Brown trout captured during the 2022 survey ranged in length from 13.4cm to 26.3cm (mean 18.4cm) (Figure 3.4). Three age classes were present, with brown trout aged from 1+ to 3+. Mean L1 (i.e., length at the end of the first year) was 6.7cm (Table 3.4). The most abundant age class in the sample aged was 2+ (i.e., *c*. 12.0-20.0cm). Relatively few larger or older fish were captured in 2022 (Figure 3.4). Brown trout captured during the previous surveys had a similar age range and length. (Figure 3.4).
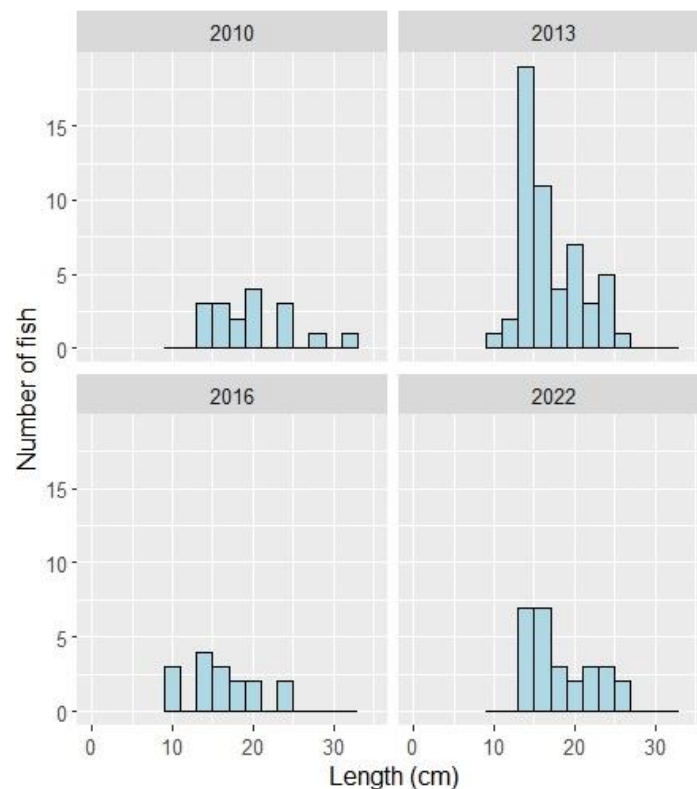

Figure 3.4. Length frequency of brown trout captured on Lough Beltra, 2010, 2013, 2016 and 2022.

Table 3.4. Mean (±S.E.) brown trout length (cm) at age for Lough Beltra, July 2022.

Length (cm)	L_1	L_2	L_3
Mean (±S.E.)	6.7 (0.2)	13.3 (0.5)	16.1 (0.6)
N	25	19	5
Range	4.2 – 7.9	11.9 - 19.1	20.1 - 23.7

Other Species

Five sea trout were captured during the 2022 survey. They ranged in length from 24.7cm to 36.5cm (mean 30.9cm). One female salmon measuring 70.5cm was also captured. Two eels measuring 63.0cm and 29.2cm were captured and released.

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

Perch

A total of 47 perch stomachs were examined. Of these, 26 (55%) were found to contain no prey items. A total of 21 stomachs contained food. Of these, 12 (57%) contained zooplankton, three (14%) contained both zooplankton and invertebrate remains. Invertebrates were the sole prey type found in two (9.5%) stomachs. Two stomachs (9.5%) contained both invertebrates and fish, while fish and zooplankton were found together in one stomach (5%). Fish were also found as the sole prey type in one stomach (Figure 3.5).
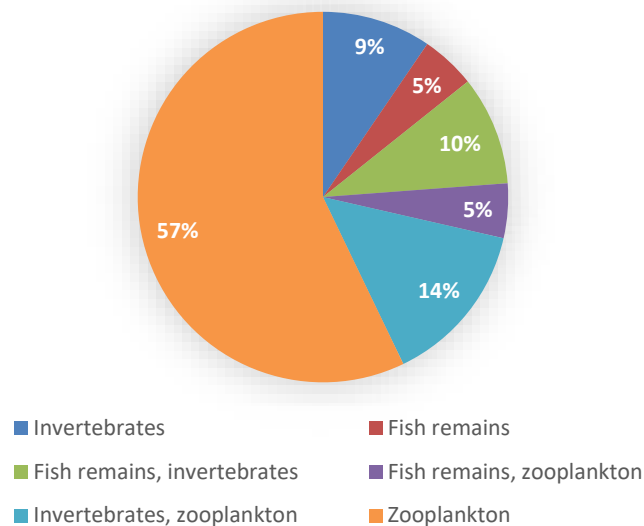

Figure 3.5. Diet of perch (N = 21) captured on Lough Beltra, July 2022 (% FO)

Brown trout

A total of 16 brown trout stomachs were examined; of these, four were found to contain no prey items and the remaining 12 stomachs contained invertebrates.

Sea trout

The stomach contents of four sea trout were examined; two were empty and two contained invertebrate remains.

4. Summary

A total of five fish species (sea trout are included as a separate 'variety' of trout) were recorded in Beltra Lough in July 2022.

Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2022 survey. There was an apparent increase in both median CPUE and BPUE of perch captured across all surveys of the lake. This species recruits regularly to the lake and the population was dominated by younger individuals (<3+).

There was a noticeable decline in eel (both CPUE and BPUE) since 2010.

Brown trout are also recruiting regularly, and the numbers and biomass recorded have remained relatively stable across all sampling occasions. This species was also dominated by younger year class groups.

Classification and assigning lakes with an ecological status is a critical part of the WFD monitoring programme. It allows River Basin District managers to identify and prioritise 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) to make it fully WFD compliant, including producing EQR values for each lake and associated confidence in classification (Kelly *et al*., 2012).

Using the FIL2 classification tool, Lough Beltra has been assigned an ecological status of High for 2022 based on the fish populations present. Lough Beltra was previously assigned a status of High in 2016 and 2013 and was assigned a status of Good in 2010 (Figure 4.1).

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Lough Beltra an overall ecological status of Good, based on all monitored physico-chemical and biological elements, including fish (EPA 2021).
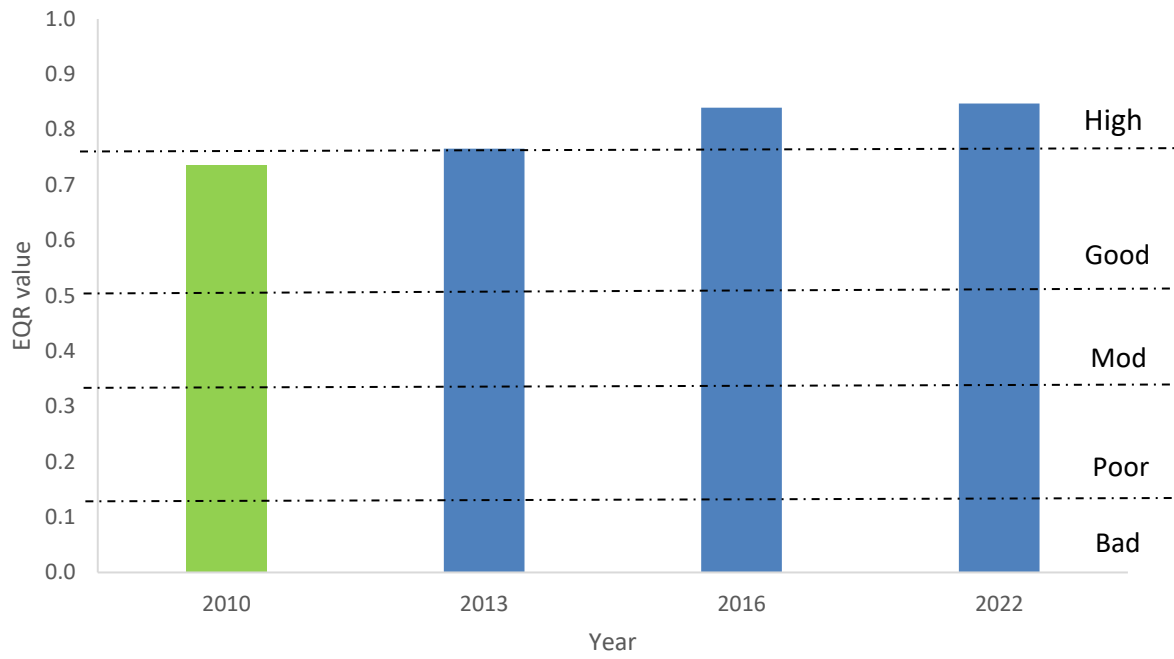
Figure 4.1. Fish ecological status, Lough Beltra, 2010, 2013, 2016 and 2022 (dashed line indicates EQR status boundaries).

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