

# National Research Survey Programme

## Lakes 2022

### Kylemore Lough

IFI/2023/1-4662



Iascach Intíre Éireann  
Inland Fisheries Ireland

## **Fish Stock Survey of Kylemore Lough, August 2022**



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Inland Fisheries Ireland**

National Research Survey Programme

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

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## 1. Introduction

Kylemore Lough is the largest of the three lakes, situated in the Dawros catchment in Co. Galway, approximately 5km north-east of Letterfrack, Co. Galway (Plate 1.1, Figure 1.1). It has a surface area of 134ha, a mean depth of >4m, a maximum depth of 30m and falls into typology class 4 (as designated by the EPA for the Water Framework Directive), *i.e.* deep (>4m), greater than 50ha and low alkalinity (<20mg/l CaCO<sub>3</sub>).

The lake has a stock of brown trout (*Salmo trutta*), Arctic char (*Salvelinus alpinus*) and gets a run of salmon (*Salmo salar*) and sea trout (*Salmo trutta*) from June to the end of the angling season (O' Reilly, 2007).

Kylemore Lough is situated within the Twelve Bens/Garraun Complex Special Area of Conservation (SAC). This is an extensive site located in the north-west of Connemara and is dominated by mountainous terrain. Geologically, the site can be divided into two distinct sections; the Twelve Bens which are composed of quartzite and schists in the valleys and the mountains to the north of Kylemore which are composed of gneiss, sandstones and mudstones (NPWS, 2015). The main soil type within the site is peat. Eight of the habitat types listed in the SAC are found in Annex I of the EU Habitats Directive. The SAC also contains the following species listed on Annex II of the Habitats Directive - freshwater pearl mussel (*Margaritifera margaritifera*), Atlantic salmon, otter (*Lutra lutra*) and the plant, slender naiad (*Najas flexilis*) (NPWS, 2015).

The lake has been surveyed on four occasions since 2007 (2007, 2010, 2013, 2016 and 2019) as part of the WFD surveillance monitoring programme (Kelly and Connor, 2007 and Kelly *et al.*, 2011, 2014 and 2017 and Corcoran *et al.* 2020). Brown trout were the dominant species present on the lake in all survey years. Sea trout, Arctic char, salmon, minnow (*Phoxinus phoxinus*) and eels (*Anguilla anguilla*) were also captured during all surveys. No salmon were recorded during the 2010 survey.

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. Kylemore Lough

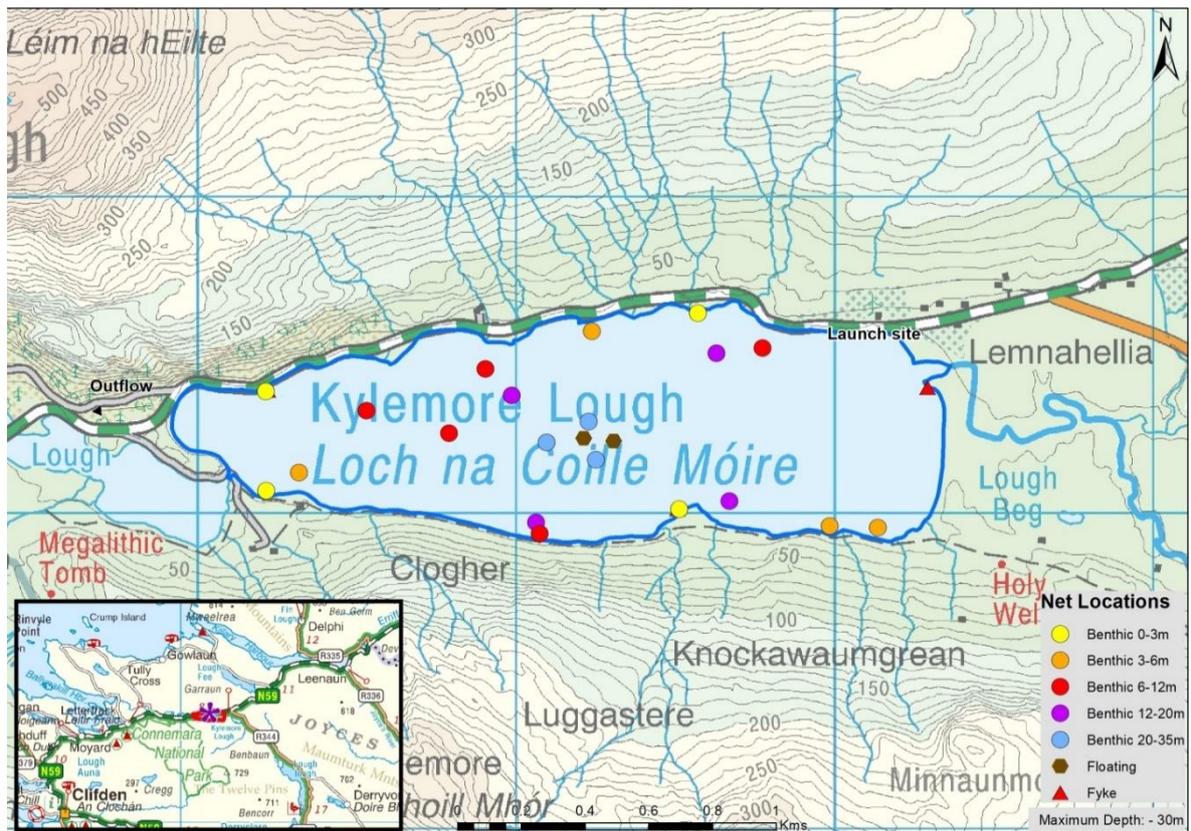


Figure 1.1. Location map of Kylemore Lough showing net locations and depths of each net (outflow is indicated on map).

## 2. Methods

### 2.1. Netting methods

Kylemore Lough was surveyed over one night from the 8<sup>th</sup> to the 9<sup>th</sup> of August 2022. 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 two floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed in the lake (25 sites). 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 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.

### 3. Results

#### 3.1. Species Richness

Five fish species, including two types of trout (brown trout and sea trout) were recorded in Kylemore Lough in August 2022. A total of 135 fish were captured (Table 3.1). Brown trout was the most common fish species recorded. Minnow, Arctic char, salmon and sea trout were also captured. The same species composition was recorded on previous surveys of the lake with the exception of salmon which were not recorded in 2010 (Kelly and Connor, 2007 and Kelly *et al.*, 2011, 2014 and 2017 and Corcoran *et al.* 2020).

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

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Salmo trutta</i>	Brown trout	81	0	4	85
<i>Phoxinus phoxinus</i>	Minnow	20	0	0	20
<i>Salvelinus alpinus</i>	Arctic char	17	0	0	17
<i>Salmo salar</i>	Salmon	8	0	0	8
<i>Salmo trutta</i>	Sea trout	5	0	0	5

#### 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 were the dominant species with respect to both abundance (CPUE) and biomass (BPUE) (Table 3.2).

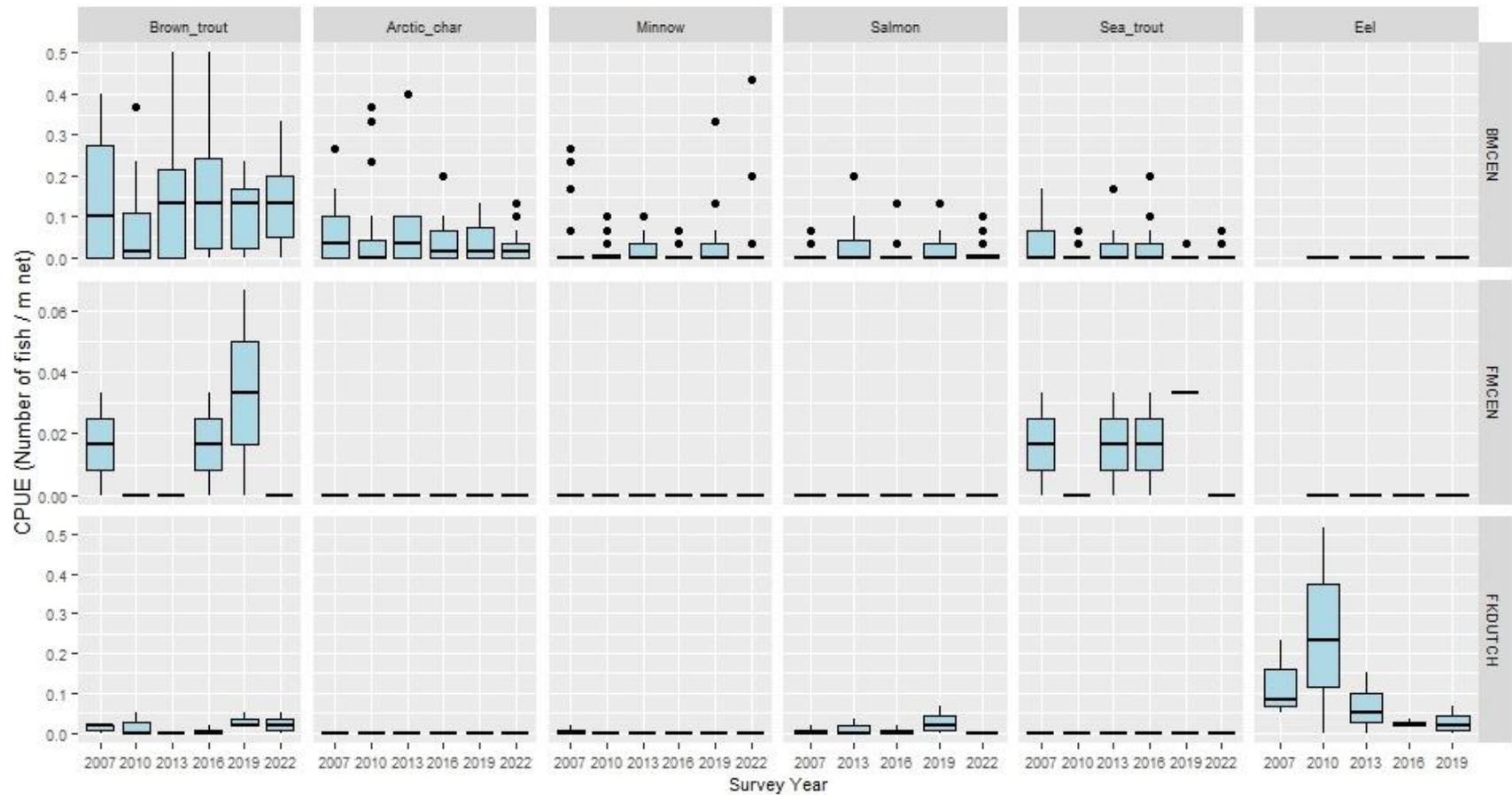
**Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Kylemore Lough**

Scientific name	Common name	Mean CPUE ( $\pm$ S.E)	Mean BPUE ( $\pm$ S.E)
<i>Salmo trutta</i>	Brown trout	0.111 (0.023)	21.825 (5.961)
<i>Phoxinus phoxinus</i>	Minnow	0.027 (0.019)	0.109 (0.074)
<i>Salvelinus alpinus</i>	Arctic char	0.023 (0.007)	1.130 (0.370)
<i>Salmo salar</i>	Salmon	0.011 (0.005)	2.344 (2.122)
<i>Salmo trutta</i>	Sea trout	0.007 (0.003)	3.275 (2.278)

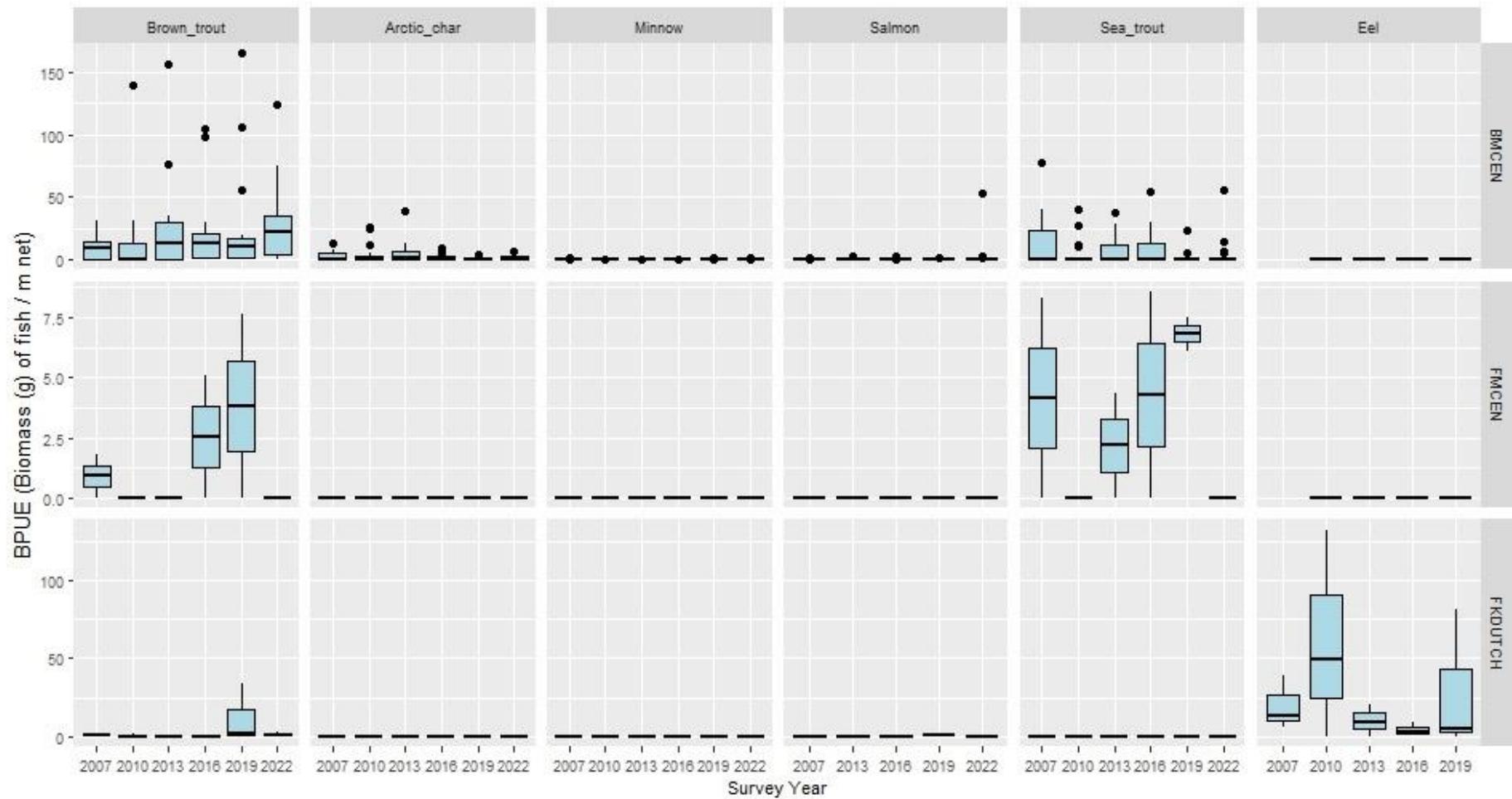
*Note: Where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species (Connor et al., 2017). \*Eel CPUE and BPUE based on fyke nets only.*

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. Populations of brown trout and Arctic char have remained relatively stable across all sampling occasions (Figures 3.1 and 3.2). Trends in less abundant species are more difficult to interpret, although there was an apparent decline in the abundance of eel recorded in fyke nets in 2019 and 2022 compared to the earlier surveys.



**Figure 3.1.** CPUE of all fish species captured in each net type during surveys of Kylemore Lough between 2007 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 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. The y axis (CPUE) is unique for each net type.

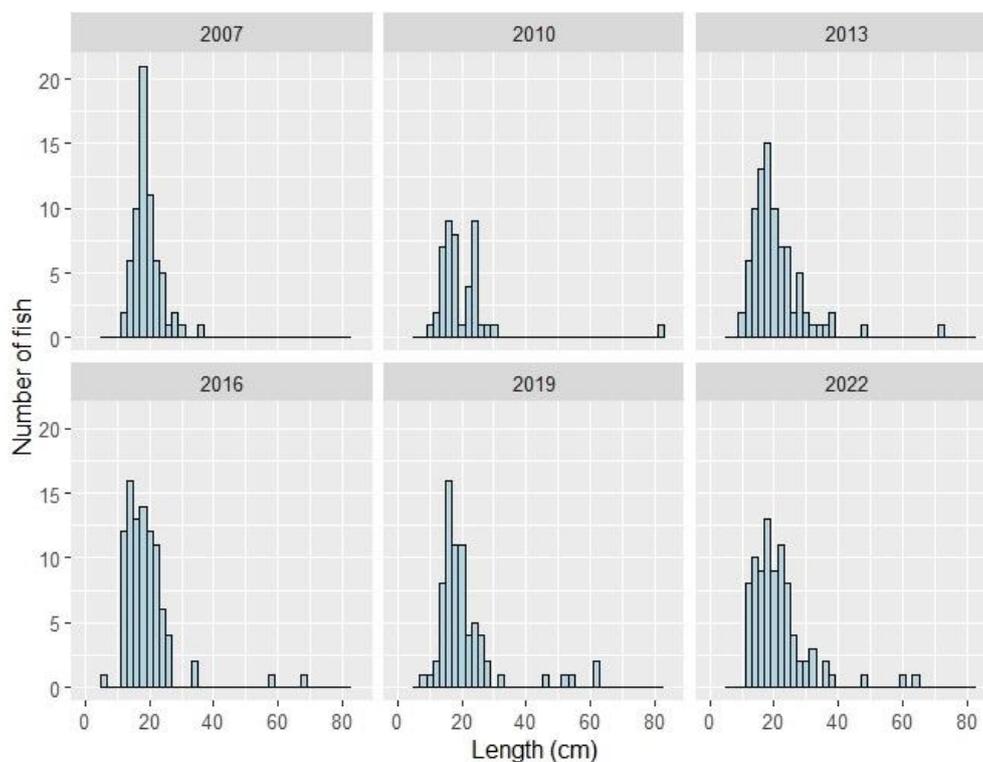


**Figure 3.2. BPUE of all fish species captured in each net type during surveys of Kylemore Lough from between 2007 and 2022. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75<sup>th</sup> 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. The y axis (BPUE) is unique for each net type.**

### 3.3. Length frequency distributions and growth

#### Brown trout

Brown trout captured during the 2022 survey ranged in length from 12.0cm to 64.2cm (mean 21.6cm). Brown trout captured in previous surveys had similar length and age ranges. While generally dominated by smaller fish, much larger fish (> 50cm) were captured regularly (Figure 3.3). Brown trout were aged between 1+ and 9+ and all intervening age classes were present in the sample aged. Mean L1 (i.e length at the end of the 1<sup>st</sup> year) was 6.4cm. The most abundant age class was 2+, with several much older fish captured (Table 3.3).



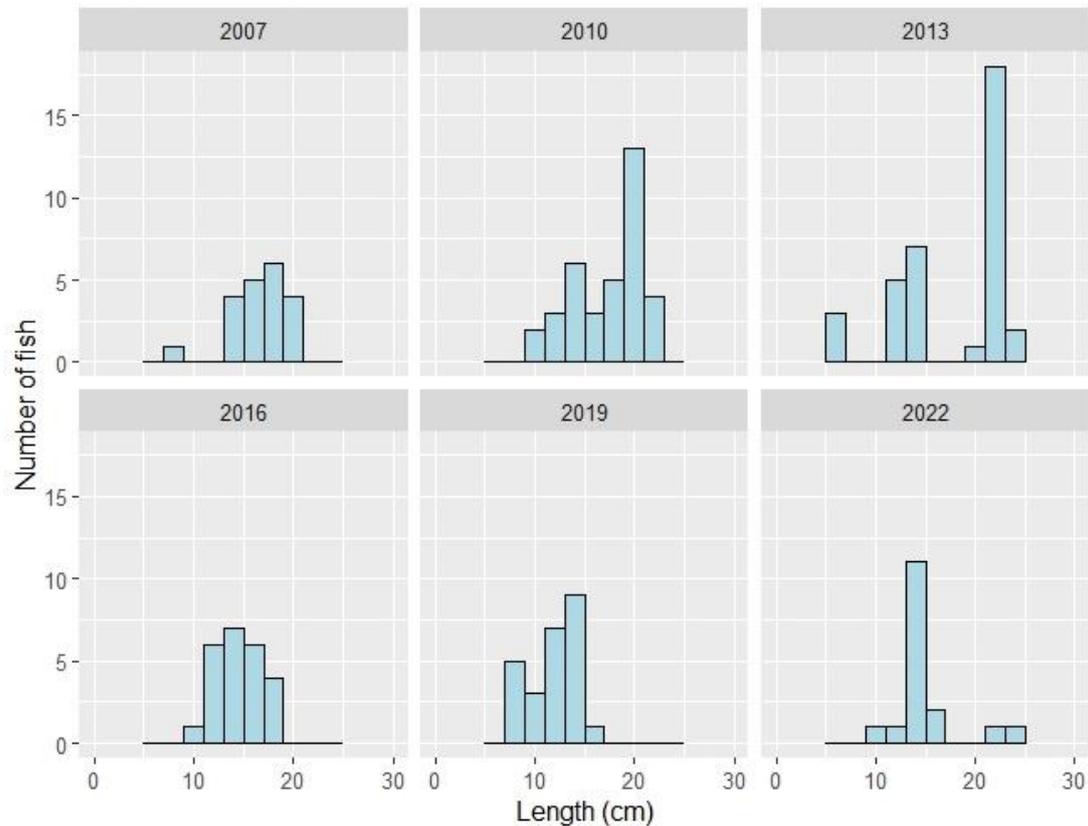
**Figure 3.3. Length frequency of brown trout captured on Kylemore Lough, 2007, 2010, 2013, 2016, 2019 and 2022.**

**Table 3.3. Mean ( $\pm$ S.E.) brown trout length (cm) at age for Kylemore Lough, August 2022**

Length (cm)	Age class						
	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	L <sub>6</sub>	L <sub>7</sub>
Mean ( $\pm$ S.E.)	6.4 (0.1)	14.1 (0.2)	20.5(0.4)	26.7 (0.8)	31.4 (1.4)	-	-
N	56	47	24	11	4	1	1
Range	4.3-7.9	11.9-16.4	15.7-25.8	23.4-32.2	29.2-35.4	39.4	42.7

### Arctic char

Arctic char captured during the 2022 survey ranged in length from 11.0cm to 23.2cm (mean 15.4cm) (Figure 3.4). Otoliths from 10 char were examined for age analysis. All fish were aged at 2+ (3 fish) and 3+ (7 fish).



**Figure 3.4. Length frequency of Arctic char captured on Kylemore Lough, 2007, 2010, 2013, 2016, 2019 and 2022.**

### Other fish species

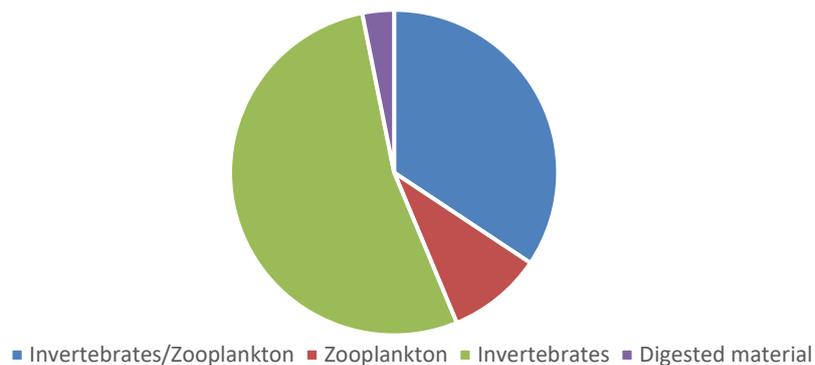
Eight salmon were captured ranging in length from 9.8cm to 53.2cm (mean 17.3cm). Six of the juvenile fish captured were aged as 1+. Five sea trout were captured during the 2022 survey. They ranged in length from 24.3cm to 50.2cm (mean 30.8cm) and were aged at 2.1+ to 2.2+. Minnow ranged in length from 5.0cm and 6.5cm (mean = 5.7cm).

### 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 and Arctic char captured during the survey were examined and are presented below.

#### **Brown trout**

A total of 42 stomachs were examined. Ten (23.8%) were empty. Thirty two stomachs contained food. Invertebrates were the sole prey type recorded in 17 (53%) stomachs and were found together with zooplankton in 11 stomachs (34%). Zooplankton was the sole prey type recorded in three (9%) stomachs. Unidentified digested material was recorded in one (3%) fish (Figure 3.5).



**Figure 3.5. Diet of brown trout (N = 32) captured on Kylemore Lough, 2022 (% FO).**

#### **Arctic char**

A total of eight Arctic char stomachs were examined. Of these, two were empty. Five (83%) stomachs contained zooplankton. Unidentified digested material was noted in one (17%) stomach.

#### **Salmon**

Seven juvenile salmon stomachs were examined. Of these, two were empty. Five juvenile salmon contained food. Invertebrates were found in four (80%) stomachs. Unidentified digested material was noted in one fish.

#### **Sea trout**

Five sea trout stomachs were examined, one of which empty. Three (75%) stomachs contained both invertebrates and zooplankton, while zooplankton was the sole prey type recorded in one stomach

#### **4. Summary and fish ecological status**

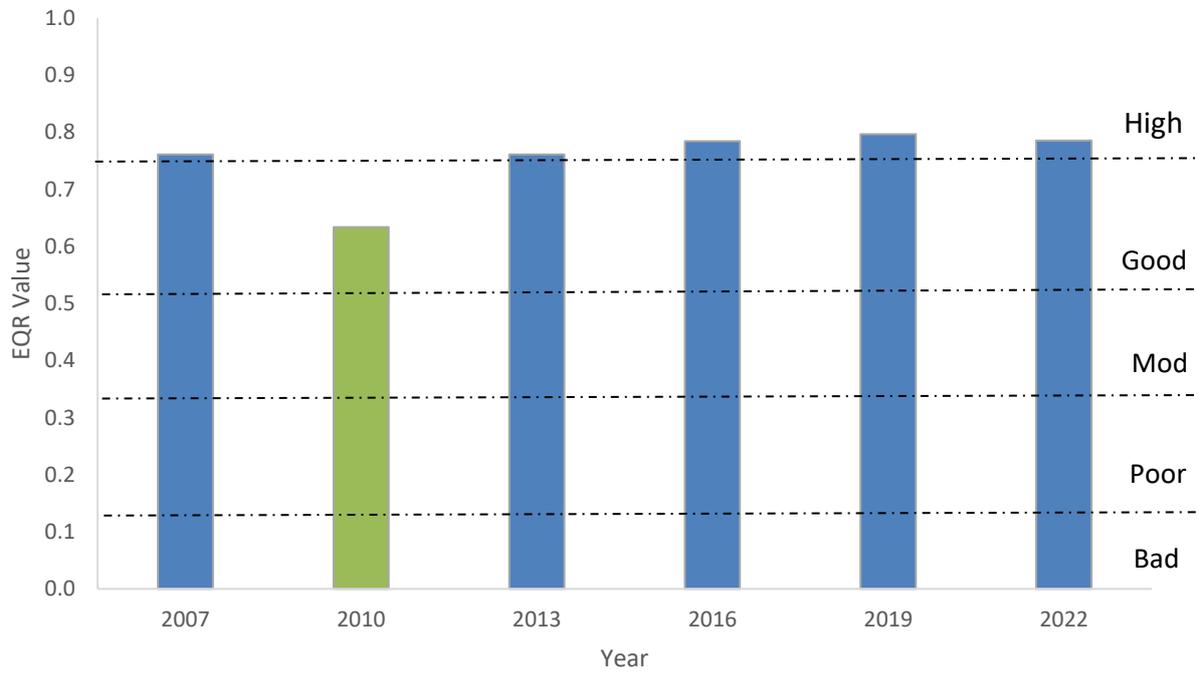
A total of four fish species, including two varieties of trout (brown and sea trout) were recorded in Kylemore Lough in August 2022. Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2022 survey. Recruitment appears to be 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.

Arctic char CPUE and BPUE fluctuated slightly between sampling occasions. They continue to be recorded and in relatively small numbers. While the length range of fish captured has remained relatively consistent here has been considerable variation in the relative proportions of age and size groups recorded in the surveys conducted since 2007. It is difficult to draw inferences on the overall health of the population in the lake.

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 Kylemore has been assigned an ecological status of High for 2022 based on the fish populations present. Lough Kylemore has also been assigned a status of High in 2019, 2016, 2013 and 2007. In 2010 the lake was assigned a status of Good (Figure 4.1).

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



**Figure 4.1. Fish ecological status, Lough Kylemore, 2007, 2010, 2013, 2016, 2019 and 2022 (dashed line indicates EQR status boundaries).**

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