National Research Survey Programme

Lakes 2020

Lough Fern

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Fish Stock Survey of Lough Fern,
August 2020

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Cover photo: Netting survey on Lough Talt © Inland Fisheries Ireland

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1.1 Introduction

Lough Fern is located in the Leannan (Lennon) catchment, two kilometres south of Milford and ten kilometres north of Letterkenny, in Co. Donegal (Fig. 1.1). The lake is situated at an altitude of 18.7m above sea level. It has a surface area of 181ha, a mean depth of 2m and a maximum depth of 3m. The lake is categorised as typology class 6 (as designated by the EPA for the Water Framework Directive), i.e. shallow (<4m), greater than 50ha and moderately alkaline (20-100mg/l $CaCO_3$). The geology of the area is predominantly schist and gneiss. It is a soft water lake that has been classified as mesotrophic (NPWS, 2005).

Lough Fern is located within the Leannan River Special Area of Conservation. The river has been designated as a SAC as it is home to a number of species listed on Annex II of the EU Habitats Directive. These species include the freshwater pearl mussel and Atlantic salmon.

Lough Fern was one of the great spring salmon lakes until its stocks were hit by ulcerative dermal necrosis (UDN) in the 1970s (O' Reilly, 2007). Since then, however, signs of recovery are slowly emerging and salmon from the River Leannan have been reported to average 4kg, with the largest weighing in at 15kg. The lake holds a good stock of brown trout (O' Reilly, 2007). The lake was previously surveyed in September 2005 by Inland Fisheries Ireland (previously the Central Fisheries Board and the Northern Regional Fisheries Board) as part of the NS Share "Fish in Lakes" project (Kelly *et al*., 2007). Brown trout, salmon and eels were recorded in this survey. The lake was also surveyed in 2008, 2011, 2014 and 2017 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al*., 2009, 2012a, 2015a, 2015b and Connor *et al* 2018). Having first been reported by Milford and District Angling Club in 2013, perch were captured by IFI staff for the first time in the 2014 survey.

During the 2017 survey, brown trout were found to be the dominant species present in the lake. Perch, three-spined stickleback, salmon and eels were also captured during the survey.

This report summarises the results of the 2020 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme and IFI's brown trout research programme.

Plate 1.1. Lough Fern (photo taken near launch site)
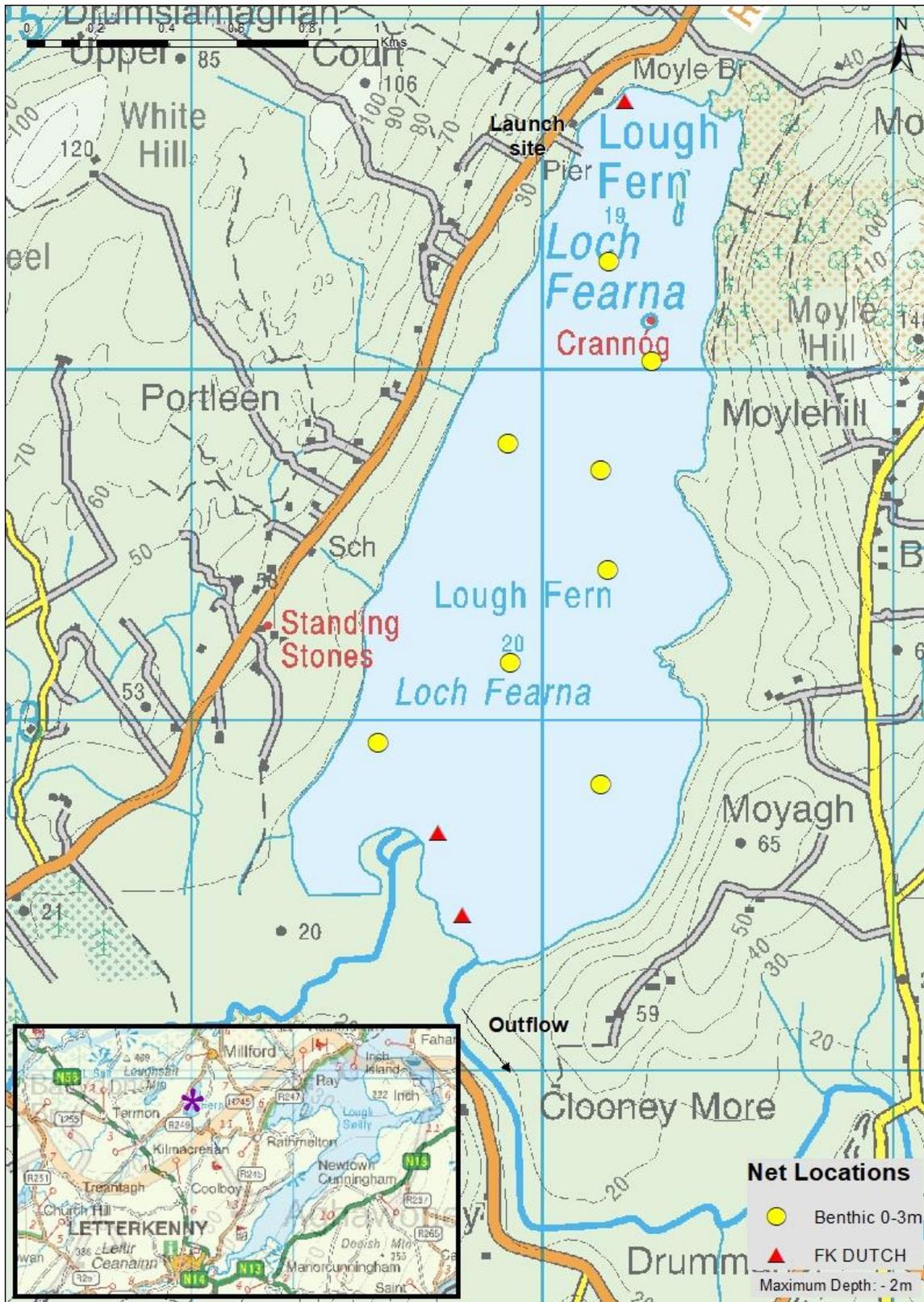
Fig. 1.1 Location map of Lough Fern showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

1.2.1 Netting methods

Lough Fern was surveyed over one night on the 24th of August 2020. A total of three sets of Dutch fyke nets and eight benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets (8 @ 0-2.9m) were deployed in the lake (11 sites) (Fig. 1.1). Nets were deployed in the same locations as were randomly selected in the previous survey. 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. Due to Covid 19 restrictions, the single four-panel benthic braided survey gill net (4-PBB), set on previous surveys was not set at this time.

All fish apart from perch were measured and weighed on site and scales were removed from all brown trout and salmon. 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.

1.2.2 Fish diet

Total stomach contents were inspected and individual items were counted and 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).

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

Where:

$\textbf{FO}_i$ is the percentage frequency of prey item i,

$\textbf{\textit{N}}_i$ is the number of fish with prey i in their stomach,

$\textbf{\textit{N}}$ is total number of fish with stomach contents.

1.2.3 Biosecurity - disinfection and decontamination procedures

Procedures are required for disinfection of equipment in order 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.

1.3 Results

1.3.1 Species Richness

Four fish species were recorded on Lough Fern in August 2020. A total of 1045 fish were captured. The number of each species captured by each gear type is shown in Table 1.1. Perch was the most common fish species recorded, followed by brown trout, eels and salmon. During the previous surveys in the similar fish species composition were recorded. However, perch were not recorded in the 2008 and 2011 surveys (Kelly *et al*., 2009, 2012a, *al*., 2015, 2015b and 2018) and three-spined stickleback which were recorded in all previous surveys were not recorded in 2020 (Kelly *et al*., 2009, 2012a, 2015a, 2015b and Connor *et al* 2018).

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Fern, August 2020

Scientific name	Common name	Number of fish captured		
		BM CEN	Fyke	Total
Salmo trutta	Brown trout	74	4	78
Perca fluviatilis	Perch	921	30	951
Salmo salar	Salmon	2	0	2
Anguilla anguilla	European eel	0	14	14

1.3.2 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. Mean CPUE and BPUE for all fish species captured in the 2020 survey are summarised in Table 1.2. The mean CPUE and BPUE for all species captured in the 2008, 2011, 2014, 2017 and 2020 surveys are illustrated in Figures 1.2 and 1.3. For comparison purposes only CEN nets and fyke nets are displayed.

Perch

Perch was the dominant fish species in terms of abundance (CPUE) and biomass (BPUE) captured during the 2020 survey (Table 1.2). Perch first appeared in IFI surveys in 2014 and have steadily increased in number in subsequent surveys (Figs. 1.2. and Fig 1.3.)

Brown trout

The mean brown trout CPUE and BPUE was stable over the first four sampling occasions from 2008 to 2017 (Figs. 1.2 and 1.3).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Fern, 2020

Scientific name	Common name	Mean CPUE (± S.E) **
Salmo trutta	Brown trout	0.230 (0.063)
Perca fluviatilis	Perch	2.836 (0.667)
Salmo salar	Salmon	0.006 (0.004)
Gasterosteus aculeatus	Three-spined stickleback	-
Anguilla anguilla	European eel*	0.078 (0.029)
		Mean BPUE (± S.E) **
Salmo trutta	Brown trout	26.399 (7.879)
Perca fluviatilis	Perch	99.580 (19.964)
Salmo salar	Salmon	0.209 (0.140)
Gasterosteus aculeatus	Three-spined stickleback	-
Anguilla anguilla	European eel*	7.595 (2.282)

NoteWhere 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
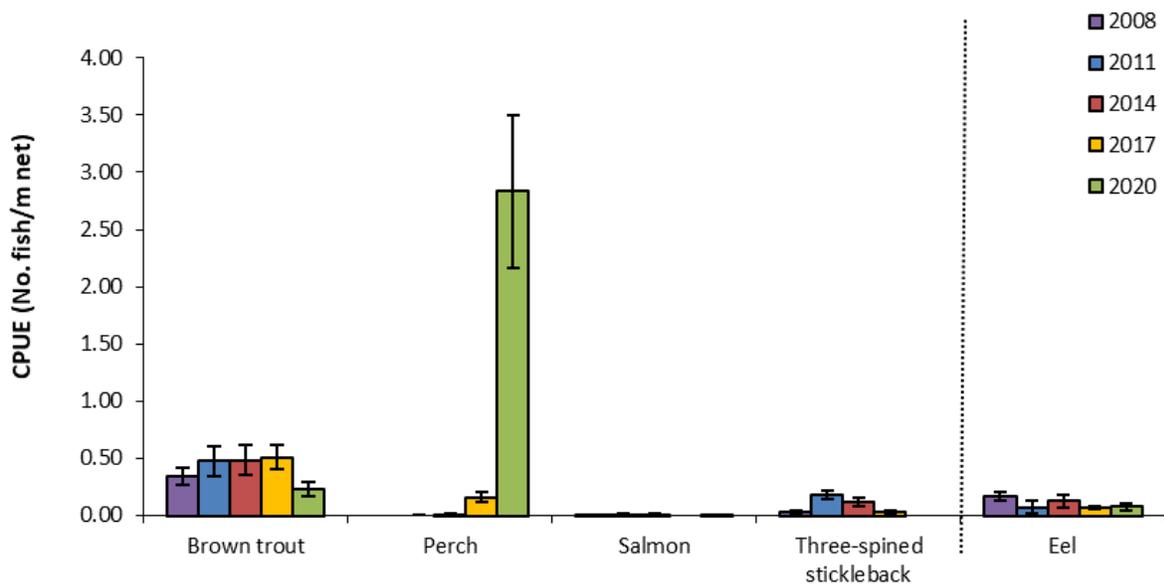
Fig. 1.2. Mean (±S.E.) CPUE (CEN and fyke nets only) for all fish species captured in Lough Fern (Eel CPUE based on fyke nets only), 2008, 2011, 2014, 2017 and 2020
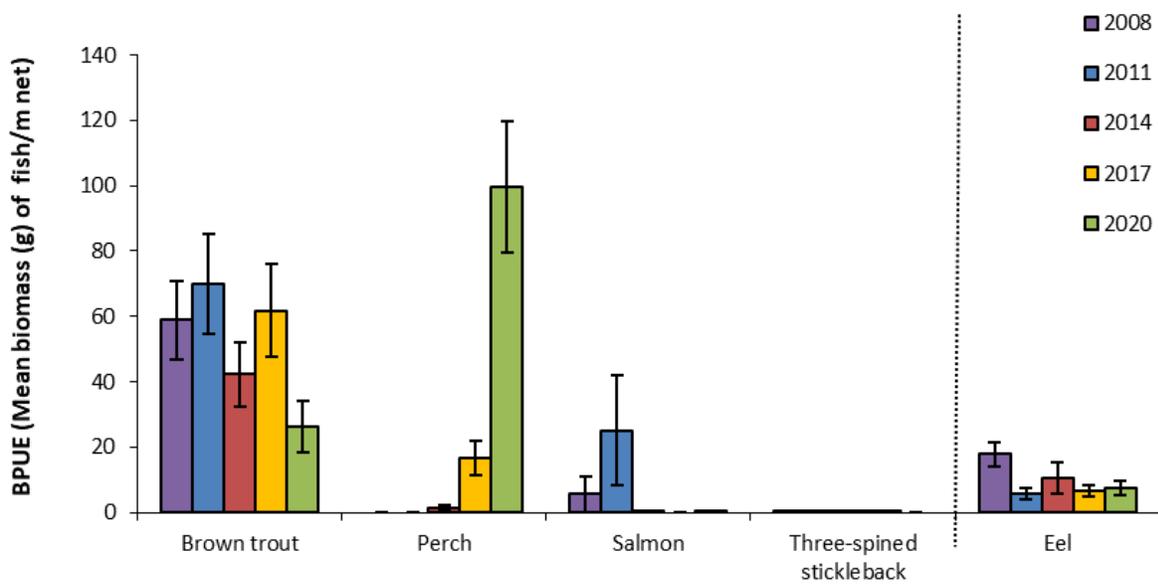
Fig. 1.3. Mean (±S.E.) BPUE (CEN and fyke nets only) for all fish species captured in Lough Fern (Eel BPUE based on fyke nets only), 2008, 2011, 2014, 2017 and 2020

1.3.3 Length frequency distributions and growth

Brown trout

Brown trout captured during the 2020 survey ranged in length from 8.2cm to 27.2cm (mean = 20.2cm) (Fig. 1.4). Five age classes were present, ranging from 0+ to 4+. The dominant age class was 1+. Mean length of one year old brown trout (L1) was estimated at 7.9cm (Table 1.3). Mean brown trout L4 in 2020 was 25.1cm indicating a slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.3). Brown trout captured during the 2008, 2011, 2014 and 2017 surveys had similar length and age ranges, although fewer larger brown trout were captured in 2020 (Fig.1.4).
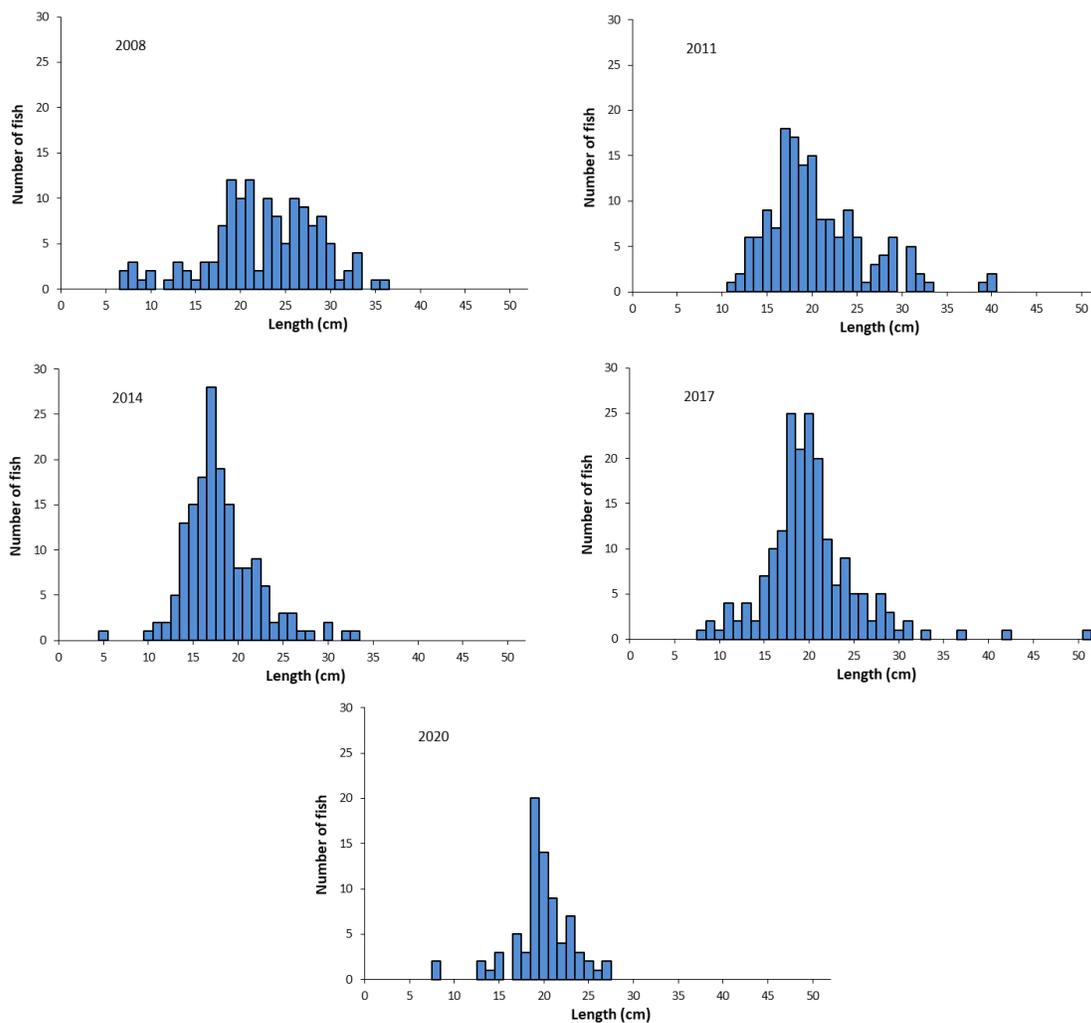
Fig. 1.4. Length frequency of brown trout captured on Lough Fern, 2008, 2011, 2014, 2017 and 2020

Perch

Perch captured during the 2020 survey ranged in length from 5.0cm to 36.5cm (mean = 9.8cm) (Fig.1.5, Table 1.4). Perch were aged between 0+ and 6+. However, no 4 or 5 year old perch were recorded in the sample aged. Young of year fish (YOY 4-7cm) were the most abundant cohort captured in the survey nets. Mean length of one year old perch (L1) was estimated at 8.0cm. Perch captured during the 2020 survey had a broader length and age range compared to the 2014 and 2017 surveys, with YOY perch captured in large numbers. No perch were recorded in the 2008 and 2011 surveys (Fig.1.5).
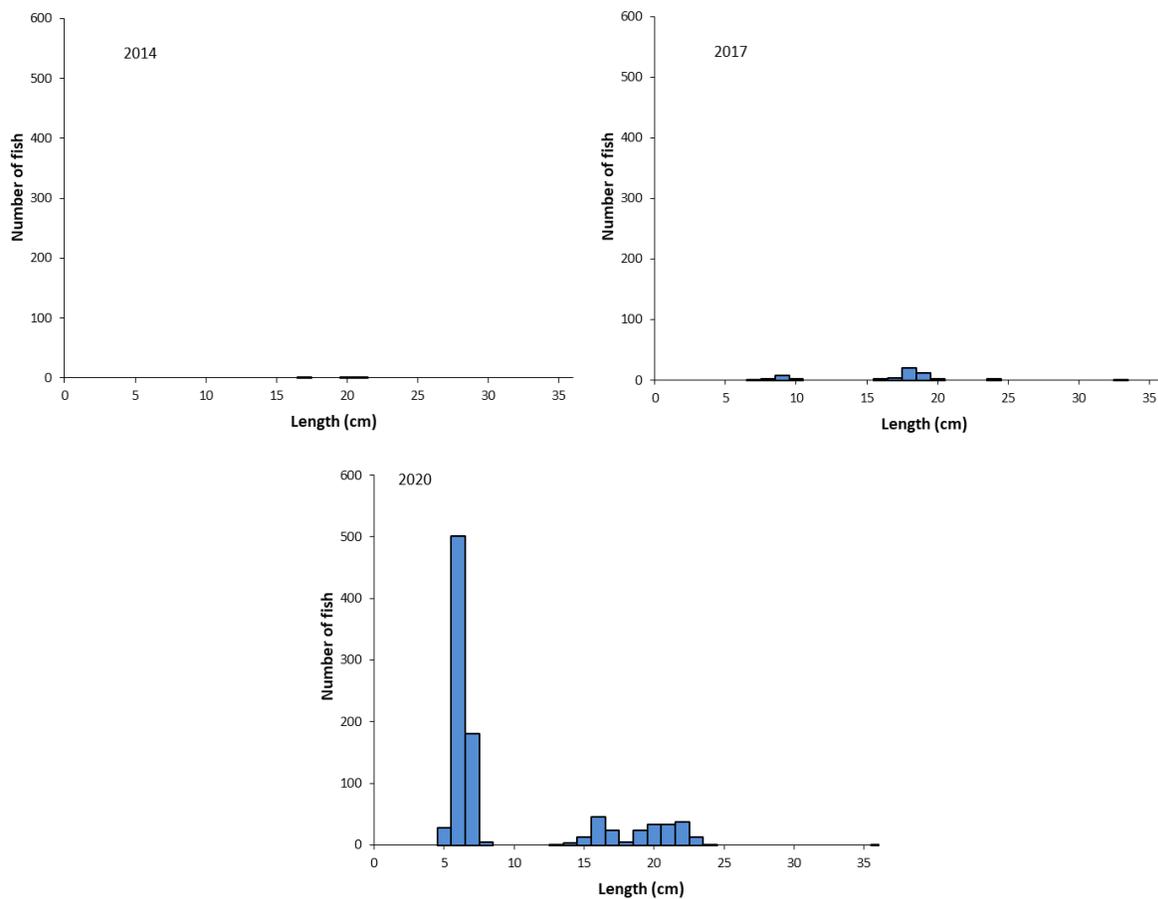
Fig. 1.5. Length frequency of perch captured on Lough Fern, 2014, 2017 and 2020

Table 1.3. Mean (±S.E.) brown trout length (cm) at age for Lough Fern, August 2020

	L_1	L_2	L_3	L_4	Growth Category
Mean (±S.E.)	7.9 (0.2)	13.5 (0.7)	18.6 (0.9)	25.1	Slow
N	73	28	5	1	
Range	4.6-10.4	9.3-19.8	16.1-23.3	25.1	

Table 1.4. Mean (±S.E.) perch length (cm) at age for Lough Fern, August 2020

	L_1	L_2	L_3	L_4	L_5	L_6
Mean (±S.E.)	8.0 (0.3)	14.4 (0.9)	18.7 (2.9)	23.9 (0.8)	34.1	35.7
N	62	30	8	1	1	1
Range	5.2-9.9	11.6-16.8	15.5-21.9	30.1	34.1	35.7

Other fish species

Eels captured during the 2020 survey ranged in length from 30.0cm to 48.5cm. Salmon captured measured 12.9cm to 13.6cm and were aged at 1+.

1.3.4 Stomach and diet analysis

Dietary analysis can provide insight into potential prey resource use and competition use within and between species. It can also give an indication of the availability of food items and the angling methods that are likely to be successful. The stomach contents of two species captured is presented below (Figs. 1.6 and 1.7).

Brown trout

Adult trout usually feed principally on crustaceans (*Asellus* sp*.* and *Gammarus* sp.), insects (principally chironomid larvae and pupae) and molluscs (snails) (Kennedy and Fitzmaurice, 1971, O'Grady, 1981). A total of 75 stomachs were examined. Of these three were found to contain no prey items. Of the remaining 72 stomachs containing food, 67 (93%) contained invertebrates only, 3 (4%) contained invertebrates and plant material. Fish was recorded in one brown trout stomach where it was found with invertebrates. One stomach contained unidentified material (Fig. 1.6).
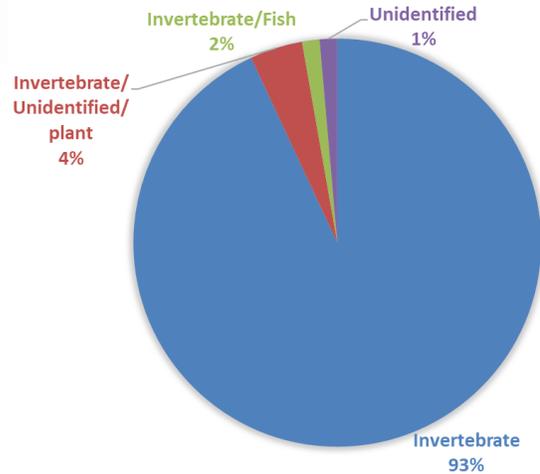
Fig 1.6. Diet of brown trout (n=72) captured on Lough Fern, August 2020 (% FO)

Perch

A total of 112 perch stomach were available for analysis. 18 of these contained no prey items. Of the remaining 94 stomachs containing food, 75 (80%) contained invertebrates. Fish were recorded in 12 stomachs. Fish which were the sole prey item recorded in five (5%) perch stomachs were found together with invertebrates in seven (8%) of the stomachs examined. Three spined stickleback which had been recorded in nets in previous surveys of the lake were recorded in several of the perch stomachs examined Zooplankton were recorded in three (3%) of the stomachs examined (Figure 1.7)
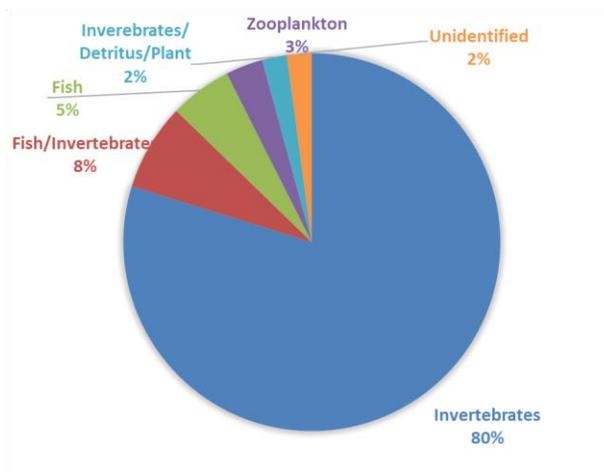
Fig 1.7. Diet of perch (n=94) captured on Lough Fern, August 2020 (% FO)

1.4 Summary and fish ecological status

A total of four fish species were recorded in Lough Fern in August 2020. Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2020 survey. This represents a shift from previous surveys, where brown trout were the dominant species with respect to both abundance and biomass.

The mean perch CPUE and BPUE has increased since they were first recorded during the 2014 survey. Both metrics showed a large increase on the figures recorded in 2017. The length range of perch captured in the survey continues to expand, with YOY perch captured in large numbers on this occasion. The population was dominated by younger fish. Perch were from 0+ to 6+ in age with no 3 or 4 year old fish in the population sampled.

There has been an apparent decline in mean brown trout CPUE and BPUE since the previous surveys on Lough Fern. Brown trout ranged in age from 0+ to 4+, indicating reproductive success in each of the previous five years. The dominant age class was 1+. Length at age analyses revealed that brown trout in the lake exhibit a slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

No three-spined stickleback were captured in the 2020 survey. However, dietary analysis recorded this species in several perch stomachs examined.

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) in order to make it fully WFD compliant, including producing EQR values for each lake and associated confidence in classification (Kelly *et al*., 2012b).

Using the FIL2 classification tool, Lough Fern has been assigned an ecological status of Bad for 2020 based on the fish populations present. In 2017 Lough Fern was assigned a status of Poor. In previous years the lake was assigned a fish status of Moderate in 2008 and Good in 2011 and 2014 (Fig. 1.8).

In the 2013 to 2018 surveillance monitoring reporting period, the EPA assigned Lough Fern an overall ecological status of Poor.
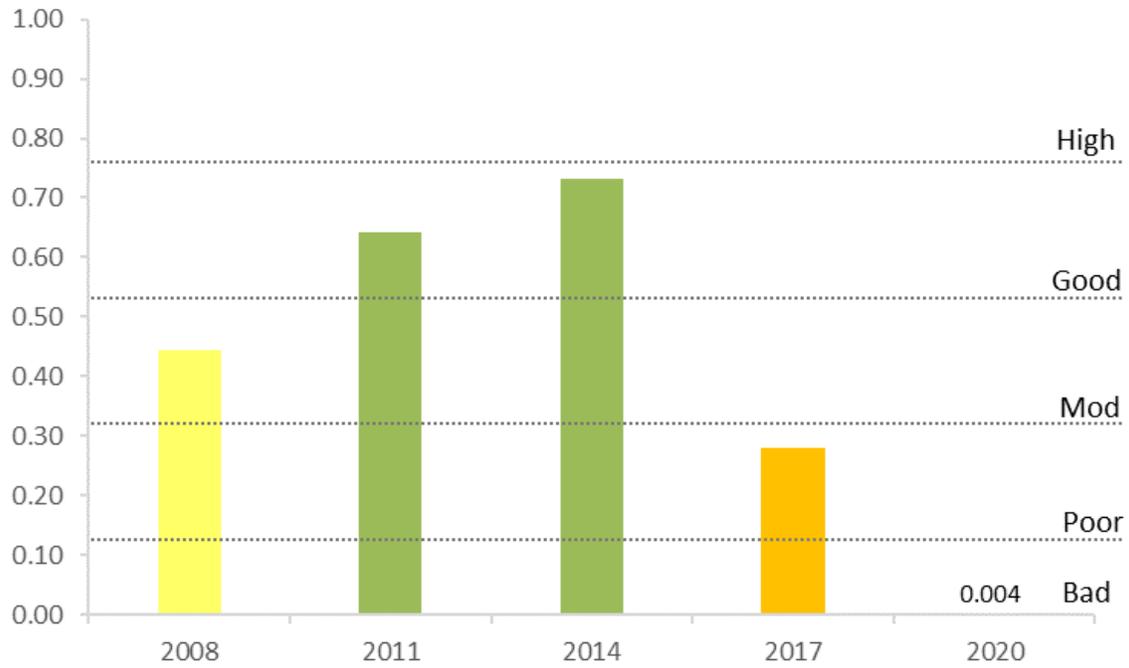
Fig. 1.8. Fish ecological status of Lough Fern, 2008, 2011, 2014, 2017 and 2020

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