

National Research Survey Programme

Lakes 2017

Lough Fern

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Iascach Intíre Éireann
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National Research Survey Programme

**Fish Stock Survey of Lough Fern,
August 2017**

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

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Cover photo: Netting survey on Lough Derravaragh © 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 CaCO₃). The lake has been classed as 2a (i.e. expected to meet good status by 2015 pending further investigation) in the WFD Characterisation report (EPA, 2005). 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 and 2014 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2009, 2012a, 2015a and 2015b). During the 2014 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 2017 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)

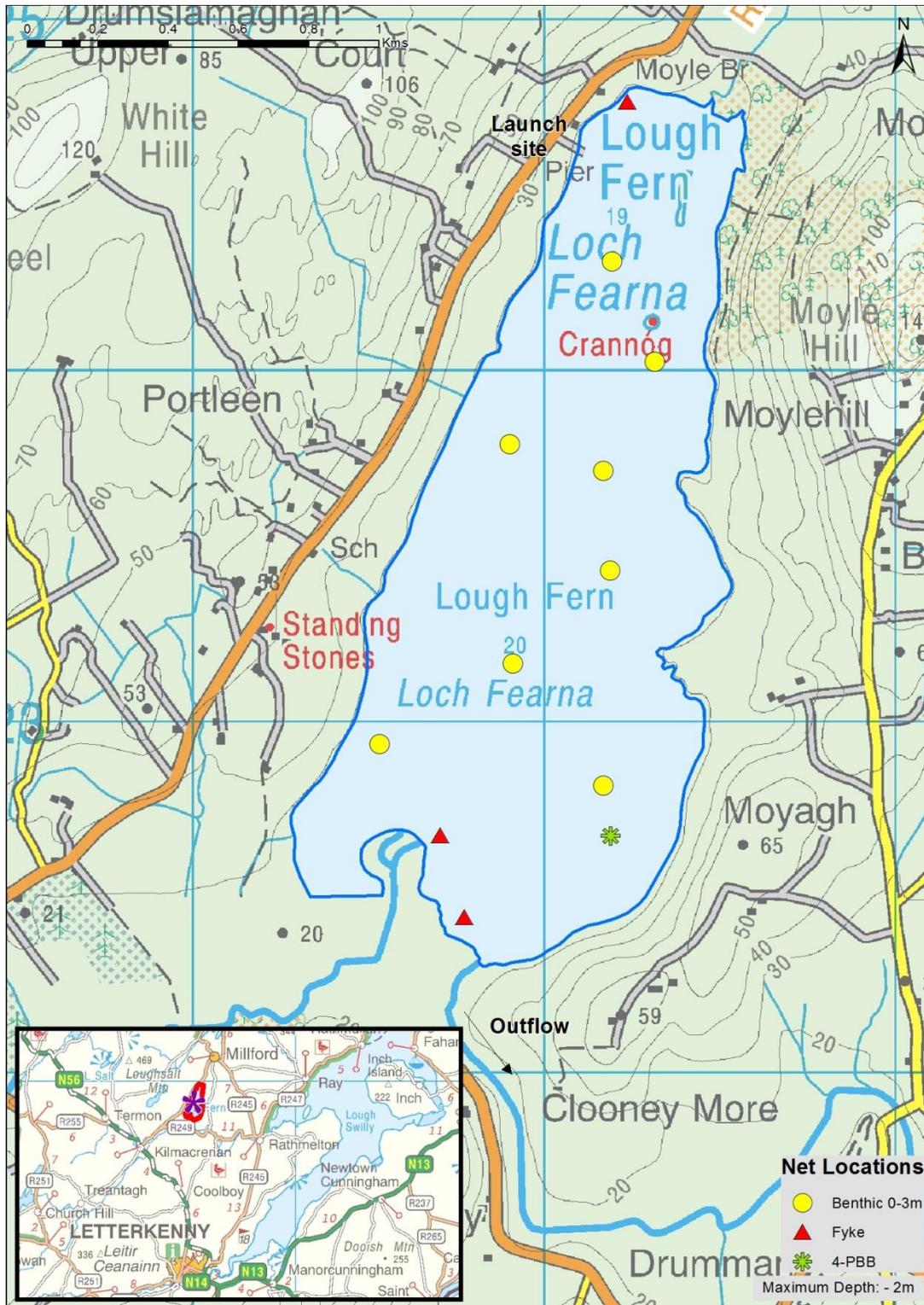


Fig. 1.1 Location map of Lough Fern showing locations and depths of each net (outflow is indicated on map)



1.2 Methods

1.2.1 Netting methods

Lough Fern was surveyed over two nights between the 28th to the 30th of August 2017. 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). The netting effort was supplemented using one four-panel benthic braided survey gill nets (4-PBB) at one additional site (Fig. 1.1). The 4-PBB nets are composed of four 27.5m long panels each a different mesh size (55mm, 60mm, 70mm and 90mm), tied together randomly. 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.

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).

$$\%FO_i = (N_i / N) \times 100$$

Where:

%FO_i is the percentage frequency of prey item i,
N_i is the number of a particular species with prey i in their stomach,
N is total number of a particular species 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

A total of five fish species were recorded on Lough Fern in August 2017, with 272 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most common fish species recorded, followed by perch, three-spined stickleback, eels and salmon. During the previous surveys in 2008, 2011 and 2014 the same species composition was recorded, with the exception of perch which were not recorded in the 2008 and 2011 surveys (Kelly *et al.*, 2009, 2012a, *al.*, 2015a and 2015b).

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Fern, August 2017

| Scientific name | Common name | Number of fish captured | | | |
|-------------------------------|----------------------|-------------------------|-------|------|-------|
| | | BM CEN | 4-PBB | Fyke | Total |
| <i>Salmo trutta</i> | Brown trout | 165 | 17 | 7 | 189 |
| <i>Perca fluviatilis</i> | Perch | 52 | 2 | 3 | 57 |
| <i>Gasterosteus aculeatus</i> | 3-spined stickleback | 10 | 0 | 0 | 10 |
| <i>Salmo salar</i> | Salmon | 0 | 3 | 0 | 3 |
| <i>Anguilla anguilla</i> | European eel | 0 | 0 | 13 | 13 |

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 2017 survey are summarised in Table 1.2. Brown trout was the dominant fish species in terms of abundance (CPUE) and biomass (BPUE) captured during the 2017 survey (Table 1.2).

The mean CPUE and BPUE (excluding the data recorded from the 55mm, 70mm and 90mm mesh panel of the 4-PBB) for all species captured in the 2008, 2011, 2014 and 2017 surveys are illustrated in Figures 1.2 and 1.3. Although the mean brown trout CPUE and BPUE fluctuated slightly over the four sampling occasions, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3). The mean perch CPUE and BPUE also fluctuated slightly over the four sampling occasions; however, the only difference was in the 2017 CPUE where it was significantly higher than 2008, 2011 and 2014 (Kruskal-Wallis $H=18.5$, $P<0.001$) (Table 1.2; Fig 1.2 and 1.3).



Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Fern, 2017

| Scientific name | Common name | Mean CPUE (\pm S.E) ** |
|-------------------------------|----------------------|--------------------------------------------|
| <i>Salmo trutta</i> | Brown trout | 0.481 (0.105) |
| <i>Perca fluviatilis</i> | Perch | 0.150 (0.042) |
| <i>Salmo salar</i> | Salmon | 0.002 (0.002) |
| <i>Gasterosteus aculeatus</i> | 3-spined stickleback | 0.028 (0.018) |
| <i>Anguilla anguilla</i> | European eel* | 0.072 (0.011) |
| | | Mean BPUE (\pm S.E) ** |
| <i>Salmo trutta</i> | Brown trout | 59.413 (13.181) |
| <i>Perca fluviatilis</i> | Perch | 16.449 (4.785) |
| <i>Salmo salar</i> | Salmon | 7.862 (7.862) |
| <i>Gasterosteus aculeatus</i> | 3-spined stickleback | 0.028 (0.018) |
| <i>Anguilla anguilla</i> | European eel* | 6.478 (1.750) |

Note: On the rare occasion 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

**CPUE and BPUE data above for all fish species except eels are not comparable to earlier surveys as extra panels were added to the 1-PBB to provide additional information on large fish.

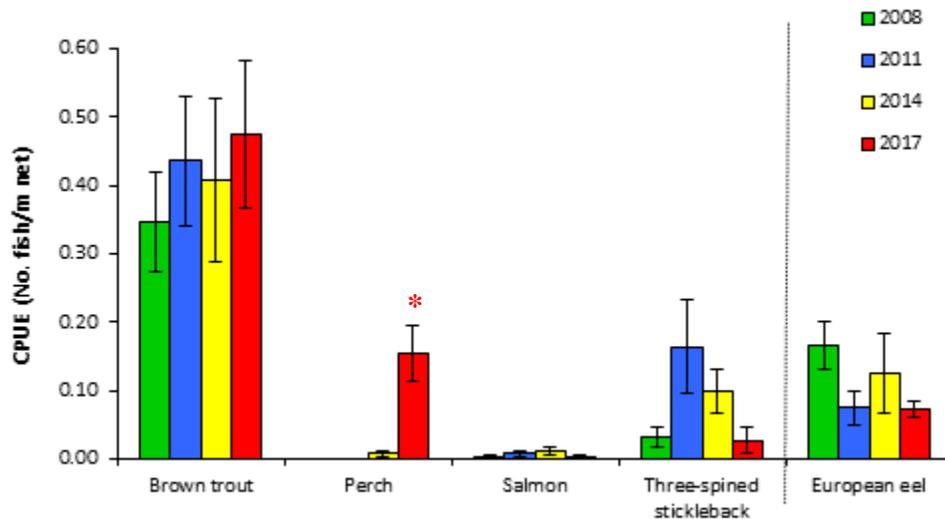


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Lough Fern (Eel CPUE based on fyke nets only), 2008, 2011, 2014 and 2017 (* indicates a significant difference)

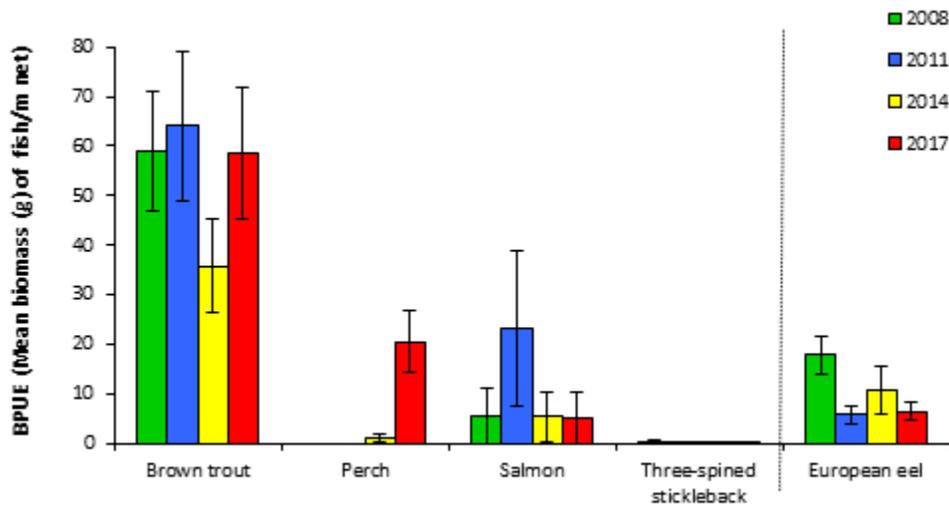


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Lough Fern (Eel BPUE based on fyke nets only), 2008, 2011, 2014 and 2017

1.3.3 Length frequency distributions and growth

Brown trout

Brown trout captured during the 2017 survey ranged in length from 8.8cm to 50.1cm (mean = 20.5cm) (Fig. 1.4). Six age classes were present, ranging from 0+ to 5+, with a mean L1 of 6.9cm (Table 1.3). The dominant age class was 2+ (Fig. 1.4). Mean brown trout L4 in 2017 was 26.3cm 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 and 2014 surveys had similar length and age ranges, with some larger and older fish recorded in the 2017 survey (Fig.1.4).

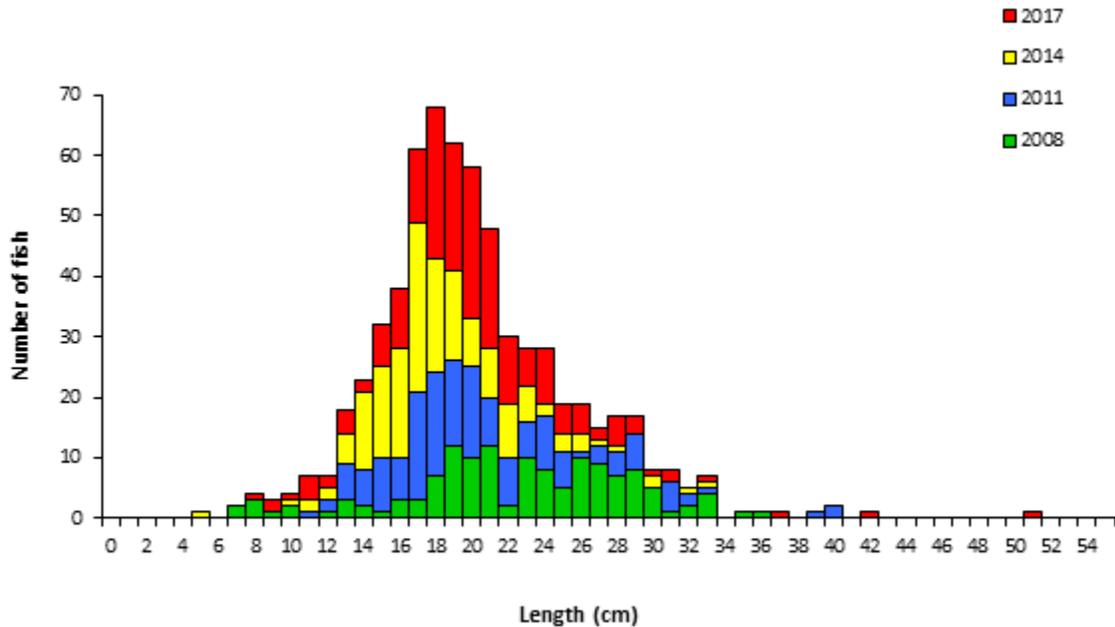


Fig. 1.4. Length frequency of brown trout captured on Lough Fern, 2008, 2011, 2014 and 2017

Table 1.3. Mean (\pm S.E.) brown trout length (cm) at age for Lough Fern, August 2017

| | L ₁ | L ₂ | L ₃ | L ₄ | L ₅ | Growth Category |
|--------------------|----------------|----------------|----------------|----------------|----------------|-----------------|
| Mean (\pm S.E.) | 6.9 (0.2) | 14.4 (0.6) | 21.7 (1.1) | 26.3 (2.0) | 32.1 | Slow |
| N | 56 | 31 | 9 | 3 | 1 | |
| Range | 4.4-10.6 | 8.2-23.1 | 17.3-27.5 | 23.9-30.3 | 32.1-32.1 | |

Perch

Perch captured during the 2017 survey ranged in length from 7.7cm to 34.5cm (mean = 17.2cm) (Fig.1.5, Table 1.4) with four age classes present, ranging from 1+ to 4+, with a mean L1 of 6.7cm. Perch captured during the 2017 survey had a much larger length and age range; no perch were recorded in the 2008 and 2011 surveys (Fig.1.5).

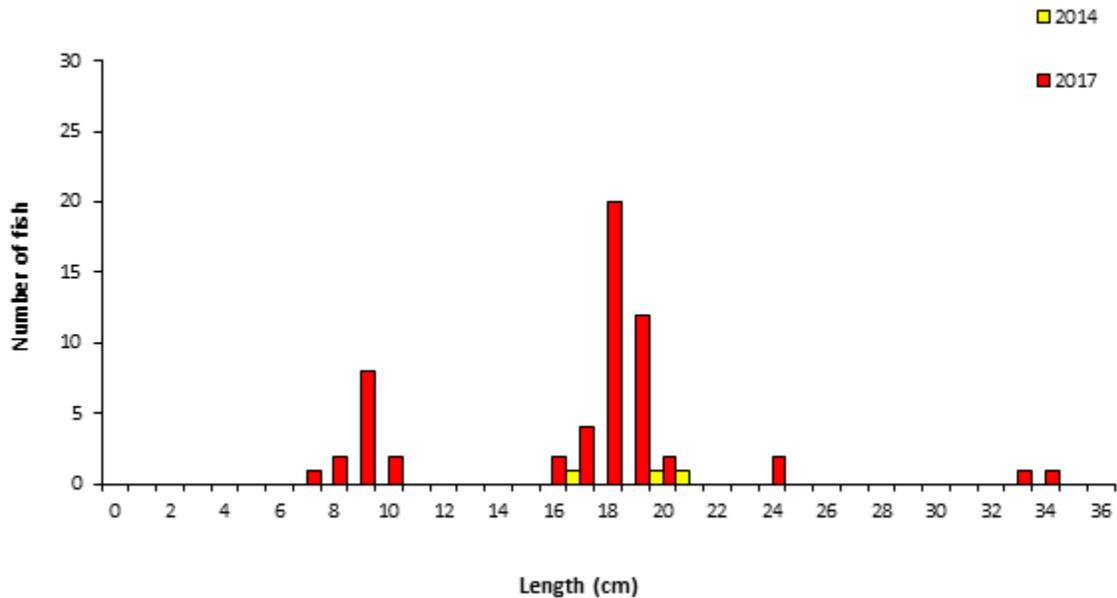


Fig. 1.5. Length frequency of perch captured on Lough Fern, 2014 and 2017

Table 1.4. Mean (\pm S.E.) perch length (cm) at age for Lough Fern, August 2017

| | L ₁ | L ₂ | L ₃ | L ₄ |
|--------------------|----------------|----------------|----------------|----------------|
| Mean (\pm S.E.) | 6.7 (0.3) | 12.8 (0.9) | 21.2 (2.9) | 30.9 (0.8) |
| N | 29 | 16 | 3 | 2 |
| Range | 4.8-10.7 | 9.7-19.8 | 15.5-24.6 | 30.1-31.8 |

Other fish species

Eels captured during the 2017 survey ranged in length from 30.0cm to 51.2cm. Salmon captured measured 54.5cm to 79.0cm and were aged at 2.1+. Three-spined stickleback ranged in length from 4.0cm to 4.7cm.

1.3.4 Stomach and diet analysis

Dietary analysis studies provide a good indication of the availability of food items and the angling methods that are likely to be successful. However, the value of stomach content analysis is limited unless undertaken over a long period as diet may change on a daily basis depending on the availability of food items. The stomach contents of a subsample of brown trout and perch captured during the survey were examined and are presented below.

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 43 stomachs were examined. Of these 18 were found to contain no prey items. Of the remaining 25 stomachs containing food, 48% contained invertebrates, 32% unidentified digested material, 8% zooplankton, 8% invertebrates/digested material and 4% invertebrates/zooplankton (Fig. 1.6).

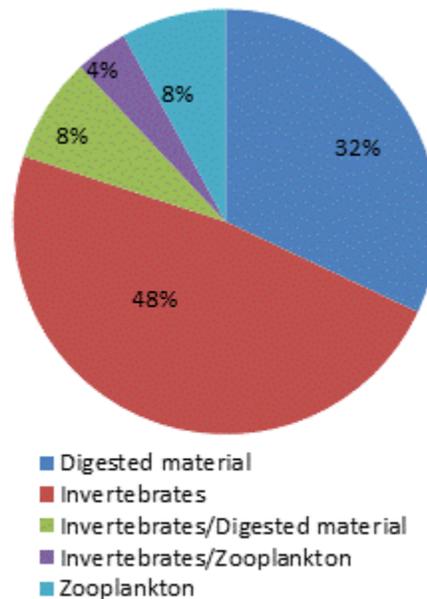


Fig 1.6. Diet of brown trout (n=25) captured on Lough Fern, 2017 (% FO)

Perch

Perch initially start to feed on pelagic zooplankton. Once they reach an intermediate size they start feeding on benthic resources eventually moving on to feed on fish once they are large enough (Hjelm *et al.*, 2000). A total of 27 stomachs were examined. Of these nine were found to contain no prey items. Of the remaining 18 stomachs containing food, 39% contained fish, 28% invertebrates, 17% zooplankton and 16% unidentified digested material (Fig. 1.7).

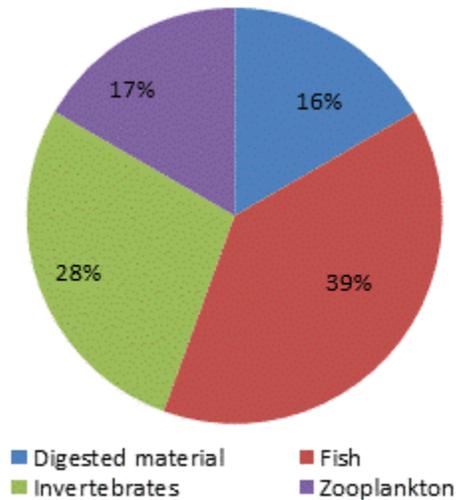


Fig 1.7. Diet of perch (n=18) captured on Lough Fern, 2017 (% FO)

1.4 Summary and ecological status

A total of five fish species were recorded in Lough Fern in August 2017. Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2017 survey.

Although the mean brown trout CPUE and BPUE fluctuated slightly over the four sampling occasions, these differences were not statistically significant. Brown trout ranged in age from 0+ to 5+, indicating reproductive success in each of the previous six years. The dominant age class was 2+. 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).

The mean perch CPUE and BPUE has increased since they were first recorded during the 2014 survey; the 2017 CPUE was significantly higher than 2014. Perch ranged in age from 1+ to 4+, with four age classes present.

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 Poor for 2017 based on the fish populations present. In previous years the lake was assigned a fish status of Moderate in 2008 and Good in 2011 and 2014.

In the 2010 to 2015 surveillance monitoring reporting period, the EPA assigned Lough Fern an overall ecological status of Poor.



1.5 References

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