National Research Survey Programme

Lakes 2017

Lough Gill

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Fish Stock Survey of Lough Gill, July 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 Gill is mainly situated in Co. Sligo, with part of the north-eastern end of the lake extending into Co. Leitrim (Plate 1.1 and Fig. 1.1). It is located within the Garavogue catchment, between Dromahair in Co. Leitrim and Sligo town, and drains into the River Garavogue. Lough Gill is a large lake, with a surface area of 1,401ha and a maximum depth of 31m. It is approximately ten kilometres in length and four kilometres wide at its widest point. It is surrounded by wooded hills and contains around 20 small islands (Plate 1.1). The lake is categorised as typology class 8 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), greater than 50ha and moderate alkalinity (20-100mg/l $CaCO_3$). The site has been designated as a Special Area of Conservation for a number of reasons, including species listed on Annex II of the Habitats Directive, e.g. sea, river and brook lamprey, white-clawed crayfish, Atlantic salmon and otter (NPWS, 2005). The lake is the main domestic water supply for Sligo town.

Many environmental and ecological studies have been carried out on Lough Gill over the past sixty years (Cotton, 1994). In 1953 samples of planktonic algae were taken from 26 Irish lakes in order to assess their trophic status. A sample analysed from Lough Gill indicated that the lake was eutrophic (Round and Brook, 1959). The first water quality survey of Irish lakes in 1973 and 1974 included Lough Gill and the authors considered that the lake was naturally eutrophic at that time. They determined this from slightly raised orthophosphate levels, from the composition of the phytoplankton community and from reports that algal blooms had occurred in the lake for the two years prior to their study (Flanagan and Toner, 1975). Blooms of blue-green bacteria were a noticeable feature of the lake in the autumn months of the 1980s. Water quality in the lake deteriorated during the 1990's due to a number of reasons, one of these was the dumping of chicken slurry in the upstream Bonet catchment (Cotton, 1994).

Lough Gill is generally considered to be an important game fishery but is also utilized as a coarse fishery and historically it holds a mixture of fish species including lamprey, eel, salmon, sea trout, brown trout, pike, bream, gudgeon, stone loach, perch, rudd and flounder. The lake receives a large run of spring salmon and it is one of the few lakes in the country to have a reputation for being a predominantly salmon fishery (O' Reilly, 2007). Some stocking of brown trout fingerlings was carried out between 1968 and 1977 in an attempt to enhance the native fish population in the lake. The lake was previously surveyed to assess its fish stocks as part of a fish stock management programme in 1974, 1989 and in

the early 1990s by Inland Fisheries Ireland (IFI) (previously the North Western Regional Fisheries Board and the Central Fisheries Board) (Collins, P., *pers*. *comm*.; O'Grady, 1990). The 1974 survey revealed that there was a large stock of small perch and a good stock of pike present in the lake. Brown trout and bream were also recorded during the survey (O'Grady, *pers*. *comm*.). The 1989 survey indicated the presence of five fish species (i.e. salmon, trout, bream, perch and pike) and revealed that there were substantial populations of perch and pike, localized bream stocks and a relatively small trout population (O' Grady, 1990). Rudd were encountered in the lake in the early 1990s by IFI (Collins, P., *pers. comm*.). The lake was also previously 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, perch were found to be the dominant species present in the lake. Brown trout, roach, bream, pike, roach x bream hybrids and eels were also captured during the survey.

This report summarises the results of the 2017 fish stock survey carried out on the lake.

Plate 1.1. Lough Gill

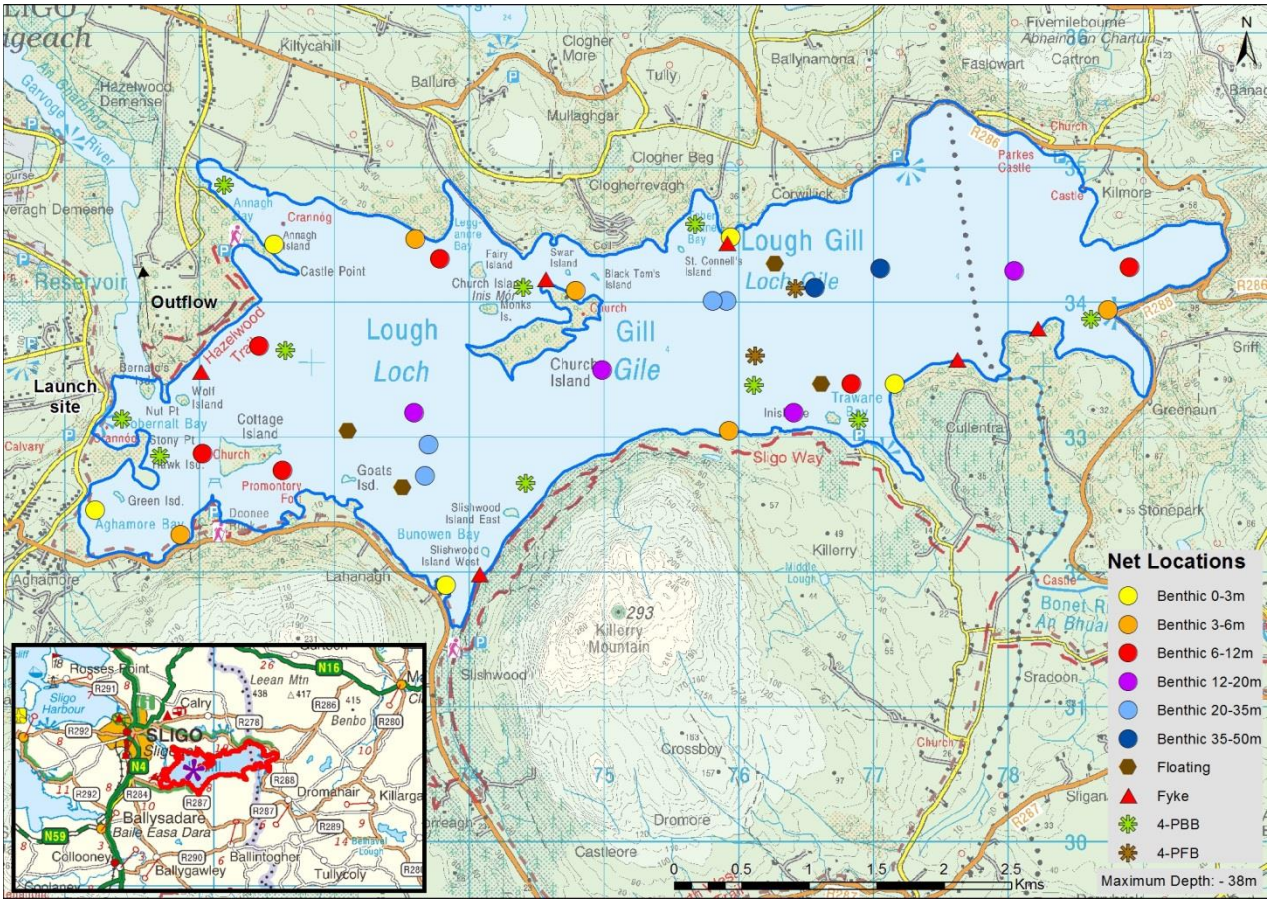

Fig. 1.1 Location map of Lough Gill showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

1.2.1 Netting methods

Lough Gill was surveyed over three nights between the 24th and the 27h of July 2017. A total of six sets of Dutch fyke nets (Fyke), 26 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, 6 @ 6-11.9m, 4 @ 12-19.9m, 4 @ 20-34.9m and 2 @ 35-49.9m) and four floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (36 sites). In addition ten four-panel benthic braided survey gill nets (4-PBB) and two four-panel floating braided survey gill nets (4-PFB) were deployed in the lake (Fig. 1.1). The 4-panel braided 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, roach, bream, pike and hybrids. 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 six fish species and one type of hybrid were recorded on Lough Gill in July 2017, with 444 fish being 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 roach, roach x bream hybrids, brown trout, bream, eels and pike. During the previous surveys in 2008, 2011 and 2014 the same species composition was recorded with the exception of salmon and flounder that were only recorded in 2011 and stone loach which were only recorded in 2008 (Kelly *et al*., 2009, 2012a, 2015a and 2015b).

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

Scientific name	Common name	Number of fish captured				
		BM CEN	FM CEN	4-Panel	Fyke	Total
Perca fluviatilis	Perch	248	1	7	2	258
Rutilus rutilus	Roach	79	0	0	2	81
Rutilus rutilus x Abramis brama	Roach x bream hybrid	23	3	20	0	46
Abramis brama	Bream	6	0	20	0	26
Salmo trutta	Brown trout	0	5	2	0	7
Esox lucius	Pike	2	0	2	0	4
Anguilla anguilla	European eel	0	0	0	22	22

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.

Perch was the dominant fish species in terms of abundance (CPUE) and roach x bream hybrids were the dominant fish species in terms of biomass (BPUE) captured during the 2017 survey (Table 1.2).

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

Scientific name	Common name	Mean CPUE (± S.E) **
Perca fluviatilis	Perch	0.174 (0.042)
Rutilus rutilus	Roach	0.056 (0.019)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.022 (0.006)
Abramis brama	Bream	0.008 (0.003)
Salmo trutta	Brown trout	0.004 (0.003)
Esox lucius	Pike	0.002 (0.001)
Anguilla anguilla	European eel*	0.061 (0.021)
		**Mean BPUE (± S.E) ** **
Perca fluviatilis	Perch	9.700 (2.212)
Rutilus rutilus	Roach	7.416 (2.705)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	9.185 (2.292)
Abramis brama	Bream	4.008 (1.892)
Salmo trutta	Brown trout	0.745 (0.422)
Esox lucius	Pike	1.928 (1.019)
Anguilla anguilla	European eel*	12.860 (4.420)

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.

The mean CPUE and BPUE (excluding three mesh panels - 55mm, 70mm and 90mm mesh panel of each 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, perch and roach 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).

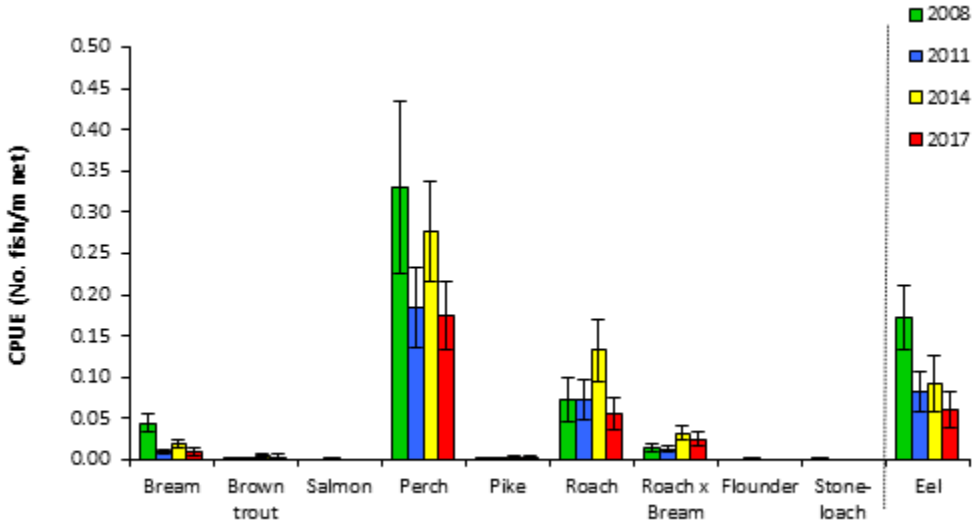

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Lough Gill (Eel CPUE based on fyke nets only), 2008, 2011, 2014 and 2017

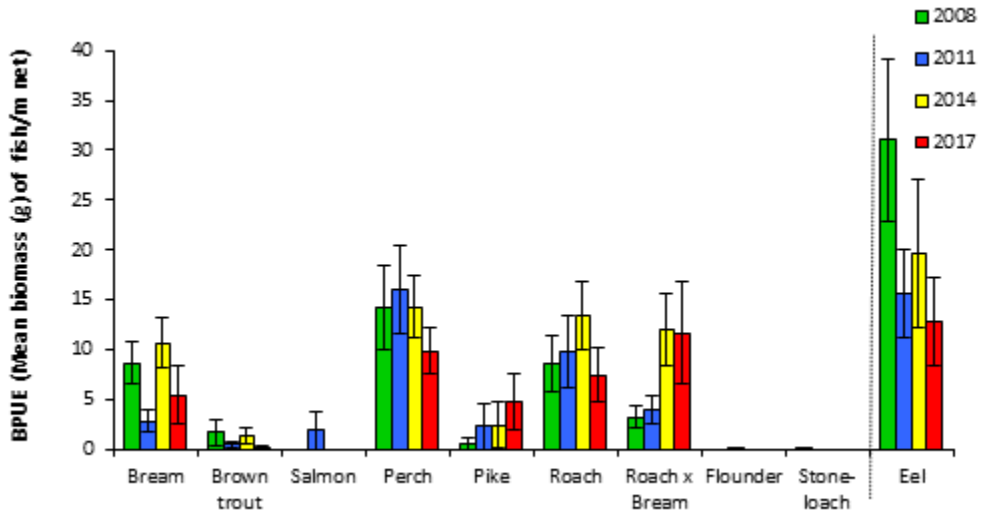

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lough Gill (Eel BPUE based on fyke nets only), 2008, 2011, 2014 and 2017

1.3.3 Length frequency distributions and growth

Perch

Perch captured during the 2017 survey ranged in length from 4.0cm to 36.0cm (mean = 13.2cm) (Fig.1.4) with eleven age classes present, ranging from 0+ to 10+, with a mean L1 of 6.4cm (Table 1.3). The dominant age class was 1+. Perch captured during the 2008, 2011 and 2014 surveys had a similar length and age range, with some larger fish recorded in 2017 (Fig.1.4).

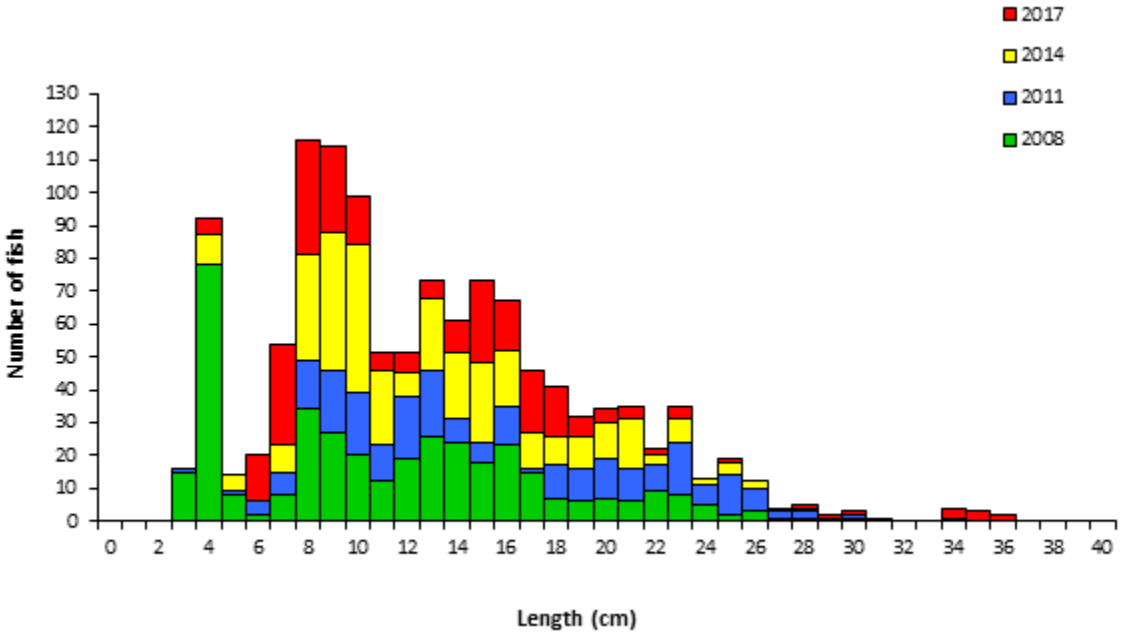

Fig. 1.4. Length frequency of perch captured on Lough Gill, 2008, 2011, 2014 and 2017

Table 1.3. Mean (±S.E.) perch length (cm) at age for Lough Gill, July 2017

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}
Mean (±S.E.)	6.4 (0.1)	10.8 (0.3)	14.1 (0.4)	18.1 (0.7)	20.9 (1.1)	24.4 (1.5)	25.2 (1.6)	26.9 (2.5)	24.9 (3.1)	22.2
N	62	50	48	31	14	11	8	4	2	1
Range	5.0-10.8	7.8-20.7	10.1-24.4	12.9-29.3	14.7-31.7	19.1-34.4	19.8-33.6	20.9-32.9	21.7-28.0	22.2-22.2

Roach

Roach captured during the 2017 survey ranged in length from 6.2cm to 29.0cm (mean = 18.7cm) (Fig.1.5) with nine age classes present, ranging from 1+ to 10+, with a mean L1 of 3.2cm (Table 1.4). The dominant age class was 4+. Roach captured during the 2008, 2011 and 2014 surveys had a similar length and age range (Fig.1.5), with the smallest length range recorded in 2008.

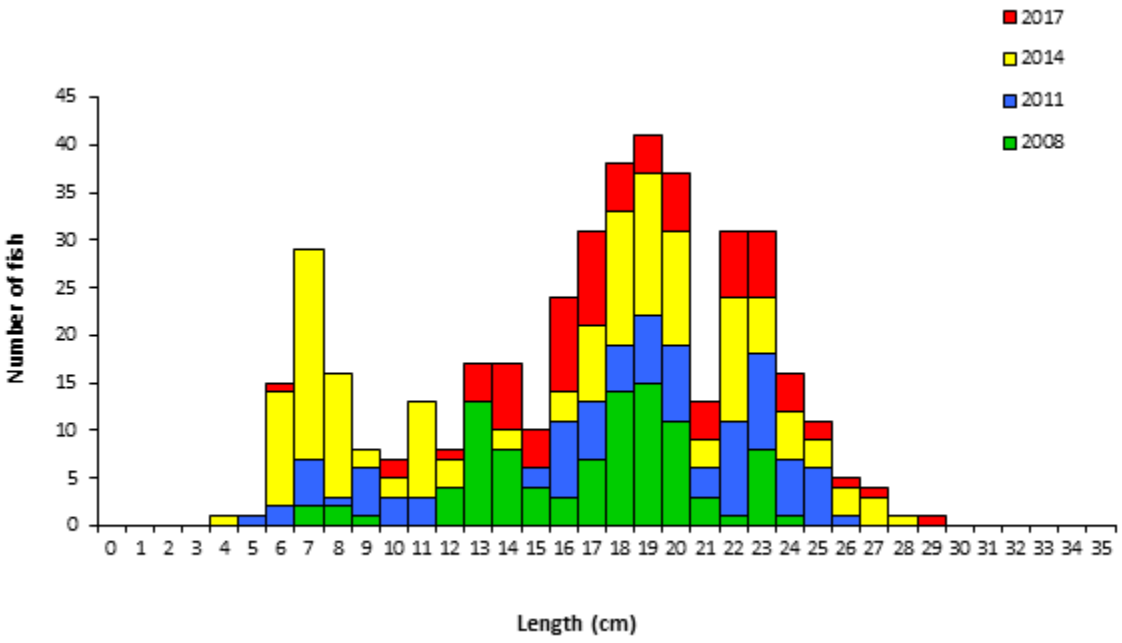

Fig. 1.5. Length frequency of roach captured on Lough Gill, 2008, 2011, 2014 and 2017

Table 1.4. Mean (±S.E.) roach length (cm) at age for Lough Gill, July 2017

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}
Mean (±S.E.)	3.3 (0.1)	7.0 (0.1)	11.1 (0.2)	15.1 (0.3)	18.9 (0.2)	21.4 (0.3)	23.1 (0.4)	24.8 (0.6)	24.7	25.8
N	41	40	39	36	23	15	11	6	1	1
Range	2.4-4.4	5.2-8.8	9.0-13.0	9.2-18.1	16.9-20.8	19.2-23.5	21.0-25.5	22.8-27.2	24.7-24.7	25.8-25.8

Brown trout

Brown trout captured during the 2017 survey ranged in length from 14.8cm to 49.5cm (mean = 25.3cm) (Table 1.5). Three age classes were present, ranging from 1+ to 7+, with a mean L1 of 7.2cm (Table 1.5). Mean brown trout L4 in 2017 was 31.2cm indicating a fast rate of growth for brown trout in this lake

according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.5). Brown trout captured during the 2008, 2011 and 2014 surveys had similar length and age ranges.

Other fish species

Eels captured during the 2017 survey ranged in length from 34.0cm to 62.5cm. Roach x bream hybrids captured measured 12.2cm to 37.1cm (aged 3+ to 12+). Bream ranged in length from 13.8cm to 35.5cm (aged 4+ to 12+) and pike ranged in length from 34.8cm to 70.9cm.

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.

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 71 stomachs were examined; 18 of these were empty. The remaining 53 stomachs contained unidentified digested material (72%), fish 21%, zooplankton (5%) and invertebrates (2%) (Fig. 1.6).

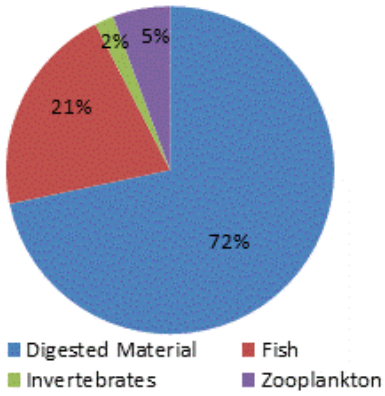

Fig 1.6. Diet of perch (n=53) captured on Lough Gill, 2017 (% FO)

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 seven stomachs were examined. Four were empty and the remaining three stomachs containing food, 67% contained fish and 33% unidentified digested material (Fig. 1.7).

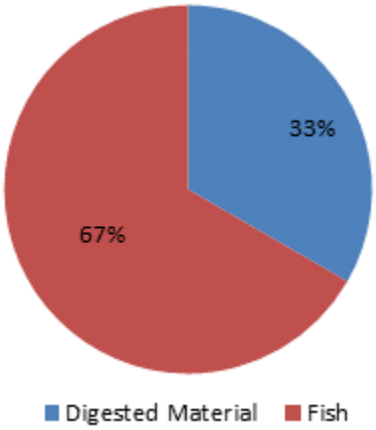

Fig 1.7. Diet of brown trout (n=3) captured on Lough Gill, 2017 (% FO)

1.4 Summary and ecological status

A total of six fish species and one type of hybrid were recorded on Lough Gill in July 2017. Perch was the dominant fish species in terms of abundance (CPUE) and roach x bream hybrids were the dominant fish species in terms of biomass (BPUE) captured during the 2017 survey.

Perch captured during the 2017 survey ranged in length from 4.0cm to 36.0cm (mean = 13.2cm) with eleven age classes present, ranging from 0+ to 10+, indicating reproductive success in each of the previous eleven years. The dominant age class was 1+. Perch captured during the 2011 and 2014 surveys had a similar length and age range, with some larger fish recorded in 2017.

Roach captured during the 2017 survey ranged in length from 6.2cm to 29.0cm (mean = 18.7cm) with nine age classes present, ranging from 1+ to 10+, indicating reproductive success in nine of the previous eleven years. The dominant age class was 4+. Roach captured during the 2011 and 2014 surveys had a similar length and age range.

Brown trout captured during the 2017 survey ranged in length from 14.8cm to 49.5cm (mean = 25.3cm). Three age classes were present, ranging from 1+ to 7+, with a mean L1 of 7.2cm, indicating reproductive success in three of the previous eight years. Mean brown trout L4 in 2017 was 31.2cm indicating a fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971). Brown trout captured during the 2011 and 2014 surveys had similar length and age ranges.

Although the mean brown trout, perch and roach CPUE and BPUE fluctuated slightly over the four sampling occasions, these differences were not statistically significant.

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

Gill has been assigned an ecological status of Good for 2017 based on the fish populations present. In previous years the lake was assigned a fish status of High in 2008/2011 and Good in 2014.

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

1.5 References

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Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.
D24 Y265

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600