



# Sampling Fish for the Water Framework Directive

*Lakes 2011*

**Lough Gill**



Iascach Intíre Éireann  
Inland Fisheries Ireland

## Water Framework Directive Fish Stock Survey of Lough Gill, July 2011

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Cover photo: Lynda and Fiona gill netting © 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 falls into 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<sub>3</sub>). 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). Water quality in the lake has deteriorated due to a number of reasons, one of these was the dumping of chicken slurry in the upstream Bonet catchment (Cotton, 1994). Blooms of blue-green bacteria were a noticeable feature of the lake in the autumn months of the 1980s.

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, *pers. comm.*; O'Grady, *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, *pers. comm.*). The lake was also previously surveyed in 2008 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2009). During this survey, perch were found to be the dominant species present in the lake. Brown trout, roach, bream, pike, roach x bream hybrids, stoneloach and eels were also captured during the survey.

This report summarises the results of the 2011 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme.



**Plate 1.1. Lough Gill ((Photo courtesy of IFI and No. 3 Operational Wing, Irish Air Corps [Aer Chór na hÉireann])**

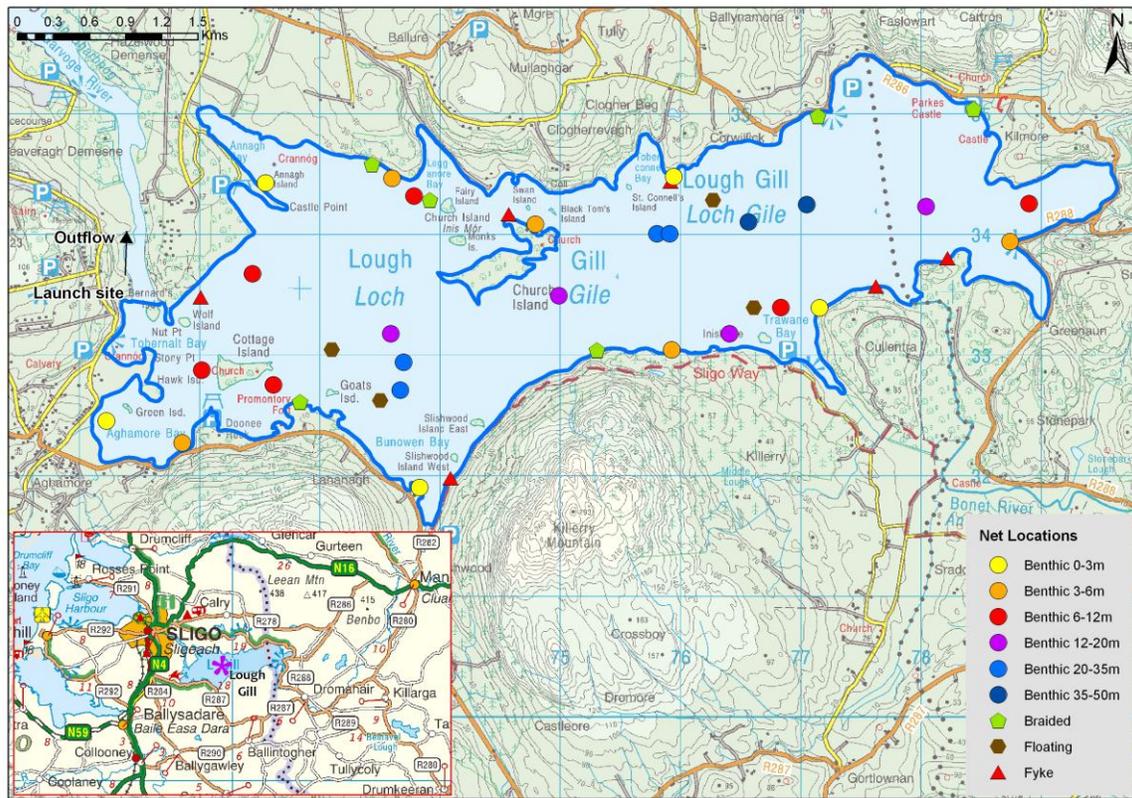


Fig. 1.1. Location map of Lough Gill showing locations and depths of each net (outflow is indicated on map)

## **1.2 Methods**

Lough Gill was surveyed over three nights between the 25<sup>th</sup> and the 28<sup>th</sup> of July 2011. A total of six sets of Dutch fyke nets, 26 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (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 (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (36 sites). The netting effort was supplemented using six benthic braided survey gill nets (62.5mm mesh knot to knot) at six additional sites. Nets were deployed in the same locations as were randomly selected in the previous survey in 2008. 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, salmon, 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.

## **1.3 Results**

### ***1.3.1 Species Richness***

A total of eight fish species and one type of hybrid were recorded on Lough Gill in July 2011, with 400 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Perch was the most abundant fish species recorded. Roach, brown trout, salmon, flounder, roach x bream hybrids, pike, bream and eels were also recorded. During the previous survey in 2008 the same species composition was recorded with the exception of stoneloach, which were present during the 2008 survey but were not captured in the current survey and salmon and flounder which were present during the current survey but were not captured in the 2008 survey.

**Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Gill, July 2011**

Scientific name	Common name	Number of fish captured				Total
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Benthic braided gill nets	Fyke nets	
<i>Perca fluviatilis</i>	Perch	225	0	0	14	239
<i>Rutilus rutilus</i>	Roach	81	10	0	1	92
<i>Anguilla anguilla</i>	Eel	0	0	0	31	31
<i>Rutilus rutilus x</i>	Roach x bream	15	0	0	4	19
<i>Abramis brama</i>	hybrid					
<i>Abramis brama</i>	Bream	12	0	1	0	13
<i>Salmo trutta</i>	Brown trout	1	2	0	0	3
<i>Salmo salar</i>	Salmon	1	0	0	0	1
<i>Platichthys flesus</i>	Flounder	0	0	0	1	1
<i>Esox lucius</i>	Pike	0	0	1	0	1

### 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 2008 and 2011 are summarised in Table 1.2. Mean CPUE and BPUE for all fish species is illustrated in Figures 1.2 and 1.3.

Although the mean perch CPUE was lower in 2011 than in 2008, this difference was not statistically significant (Fig. 1.2). The mean perch BPUE was slightly higher in 2011 than in 2008 this was also not significantly different (Fig. 1.3)

The differences in the mean perch CPUE between Lough Gill and four other similar lakes was assessed, with no overall significant differences being found (Fig. 1.4). However, Independent-Samples Mann-Whitney U tests between each lake showed that Lough Gill had a significantly lower mean perch CPUE than Lough Meelagh ( $z = -2.043$ ,  $P < 0.05$ ). The differences in the mean perch BPUE between Lough Gill and four other similar lakes was also assessed, with no overall significant differences being found (Fig. 1.5).

There was no significant difference in the mean brown trout CPUE or BPUE between 2008 and 2011. The differences in the mean brown trout CPUE between Lough Gill and four other similar lakes was assessed, and found to be statistically significant (Kruskal-Wallis,  $P < 0.05$ ) (Fig. 1.6). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Gill had a significantly lower

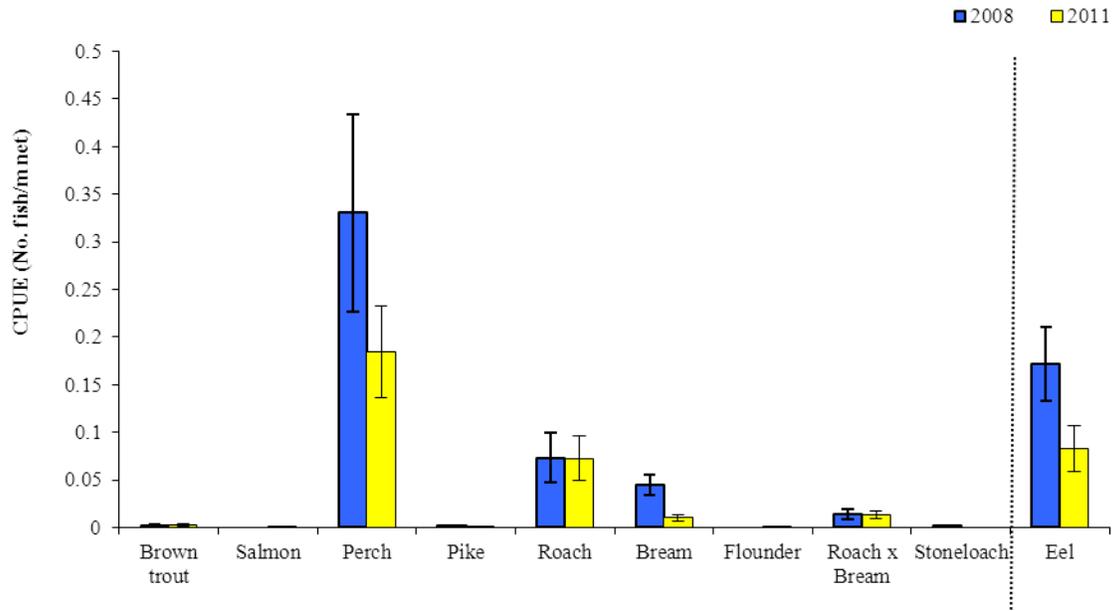
mean brown trout CPUE than Lough Fern, Carrowmore Lake and Lough Leane ( $z = -4.791$   $P < 0.05$ ,  $z = -6.751$   $P < 0.05$  and  $z = -5.294$   $P < 0.05$ ).

The differences in the mean brown trout BPUE between Lough Gill and four other similar lakes was also assessed, and found to be statistically significant (Kruskal-Wallis,  $P < 0.05$ ) (Fig. 1.7). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Gill also had a significantly lower mean brown trout BPUE than Lough Fern, Carrowmore Lake and Lough Leane ( $z = -4.790$   $P < 0.05$ ,  $z = -6.643$   $P < 0.05$  and  $z = -5.230$   $P < 0.05$ ).

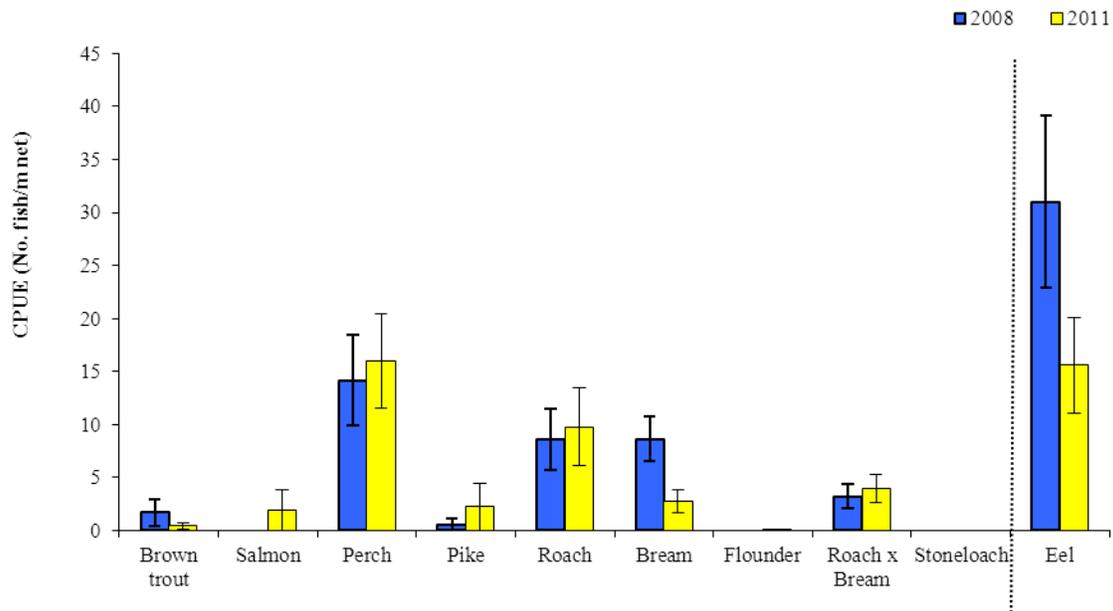
**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Gill, 2008 and 2011**

Scientific name	Common name	2008	2011
<b>Mean CPUE</b>			
<i>Salmo trutta</i>	Brown trout	0.002 (0.001)	0.002 (0.001)
<i>Salmon salar</i>	Salmon	-	0.001 (0.001)
<i>Perca fluviatilis</i>	Perch	0.330 (0.103)	0.184 (0.048)
<i>Esox lucius</i>	Pike	0.001 (0.001)	0.001 (0.001)
<i>Rutilus rutilus</i>	Roach	0.073 (0.025)	0.072 (0.023)
<i>Abramis brama</i>	Bream	0.044 (0.010)	0.010 (0.003)
<i>Platichthys flesus</i>	Flounder	-	0.0004 (0.004)
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	0.014 (0.005)	0.013 (0.004)
<i>Barbatula barbatula</i>	Stone loach	0.001 (0.001)	-
<i>Anguilla anguilla</i>	European eel	0.172 (0.038)	0.083 (0.24)
<b>Mean BPUE</b>			
<i>Salmo trutta</i>	Brown trout	1.690 (1.274)	0.436 (0.273)
<i>Salmon salar</i>	Salmon	-	1.904 (1.904)
<i>Perca fluviatilis</i>	Perch	14.172 (4.261)	16.022 (4.436)
<i>Esox lucius</i>	Pike	0.588 (0.588)	2.238 (2.238)
<i>Rutilus rutilus</i>	Roach	8.609 (2.873)	9.788 (3.671)
<i>Abramis brama</i>	Bream	8.620 (2.095)	2.776 (1.130)
<i>Platichthys flesus</i>	Flounder	-	0.0341 (0.341)
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	3.218 (1.140)	3.967 (1.353)
<i>Barbatula barbatula</i>	Stone loach	-	-
<i>Anguilla anguilla</i>	European eel	31.025 (8.112)	15.577 (4.471)

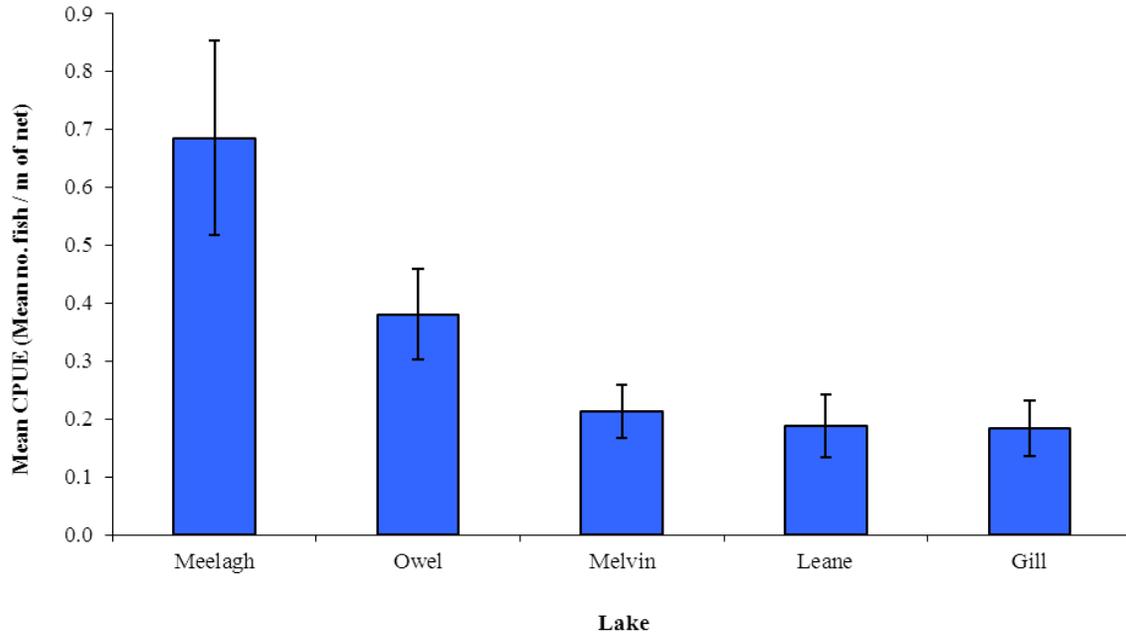
\* On the rare occasion where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species.



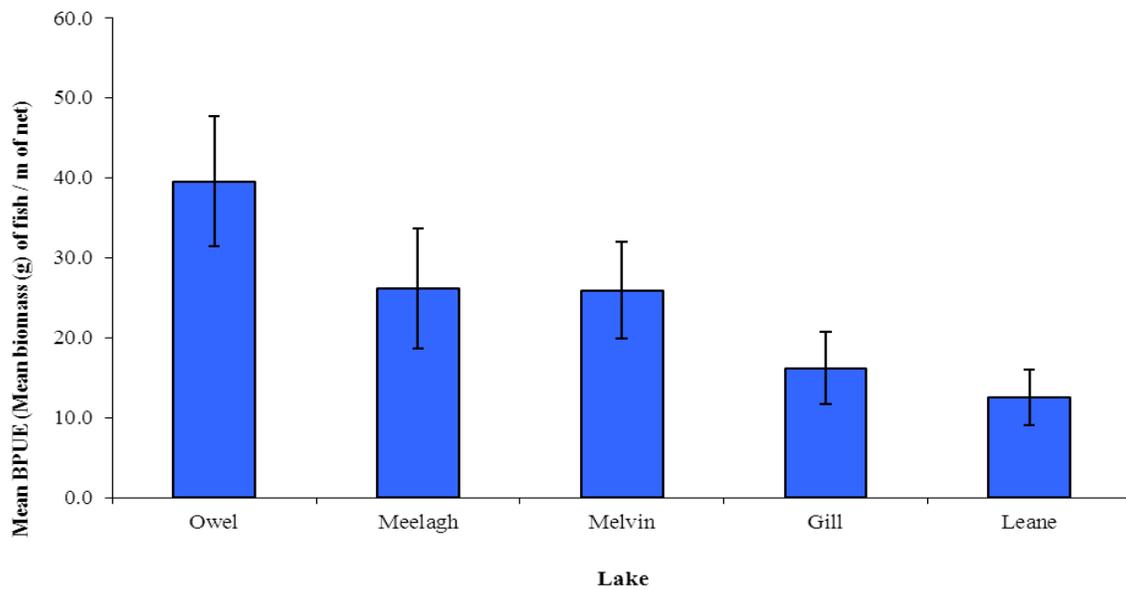
**Fig. 1.2. Mean ( $\pm$ S.E.) CPUE for all fish species captured in Lough Gill (Eel CPUE based on fyke nets only), 2008 and 2011**



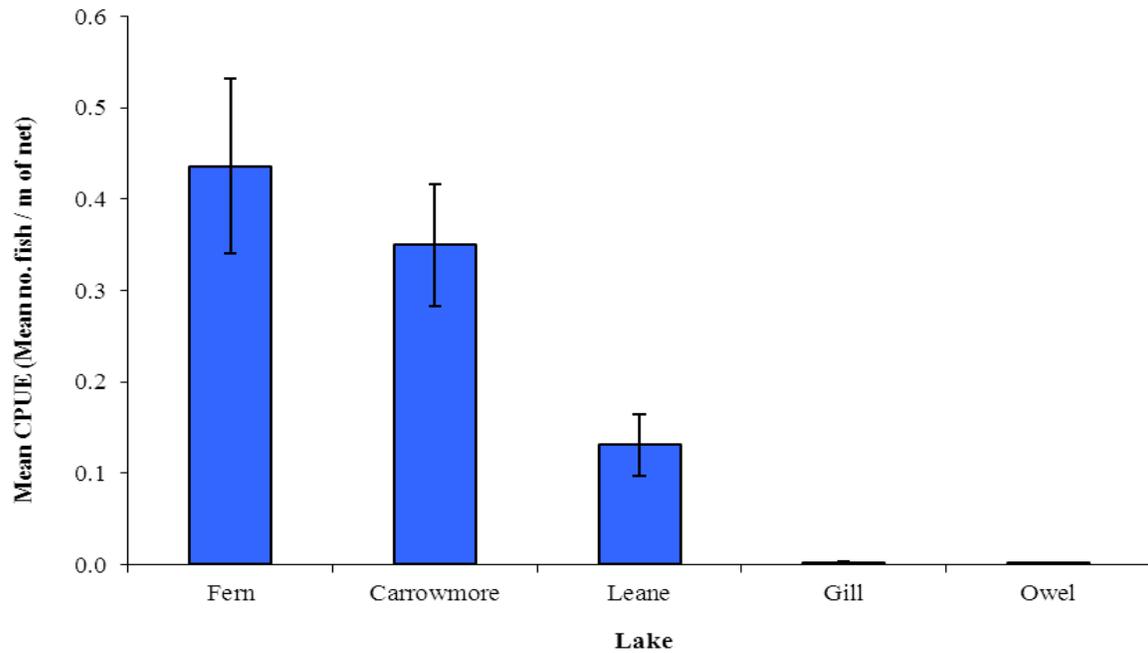
**Fig. 1.3. Mean ( $\pm$ S.E.) BPUE for all fish species captured in Lough Gill (Eel CPUE based on fyke nets only), 2008 and 2011**



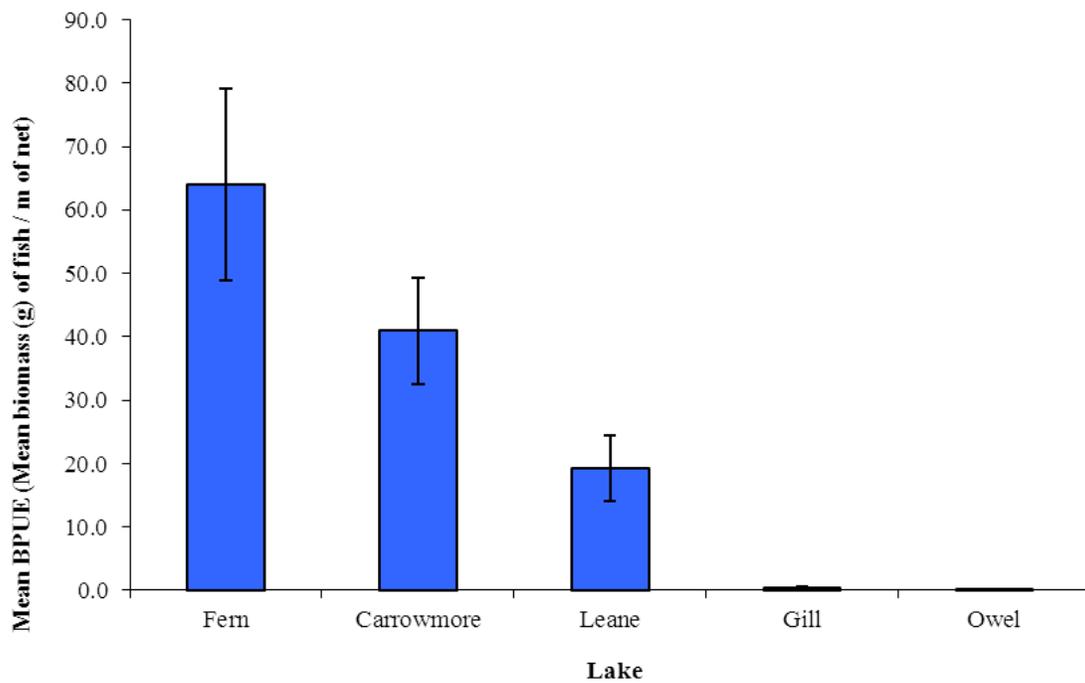
**Fig. 1.4. Mean ( $\pm$ S.E.) perch CPUE in five lakes surveyed during 2011**



**Fig. 1.5. Mean ( $\pm$ S.E.) perch BPUE in five lakes surveyed during 2011**



**Fig. 1.6. Mean ( $\pm$ S.E.) brown trout CPUE in five lakes surveyed during 2011**



**Fig. 1.7. Mean ( $\pm$ S.E.) brown trout BPUE in five lakes surveyed during 2011**

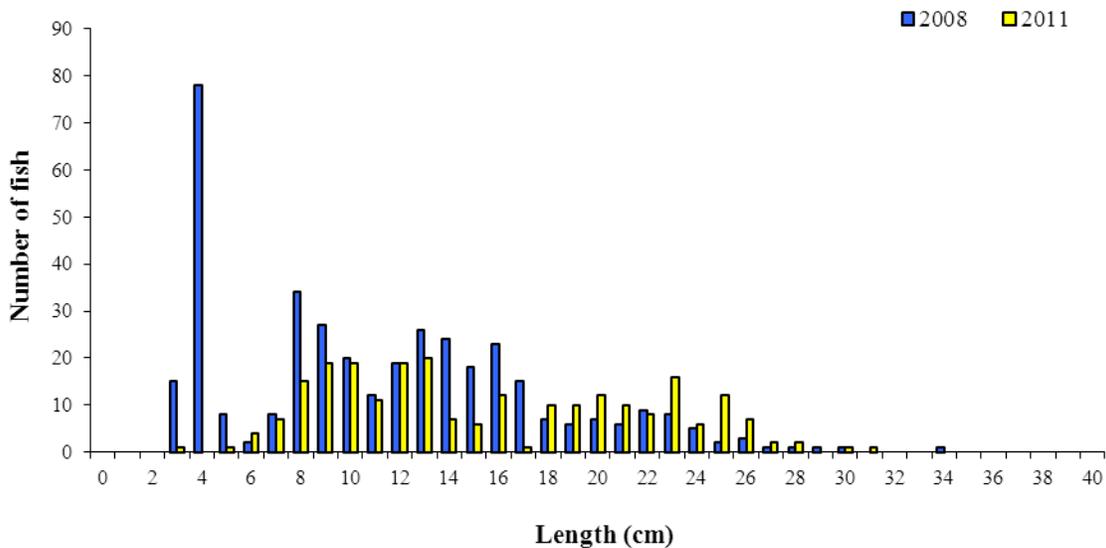
### 1.3.3 Length frequency distributions

Perch captured during the 2011 survey ranged in length from 3.5cm to 31.2cm (mean = 16.0cm) (Fig.1.8).

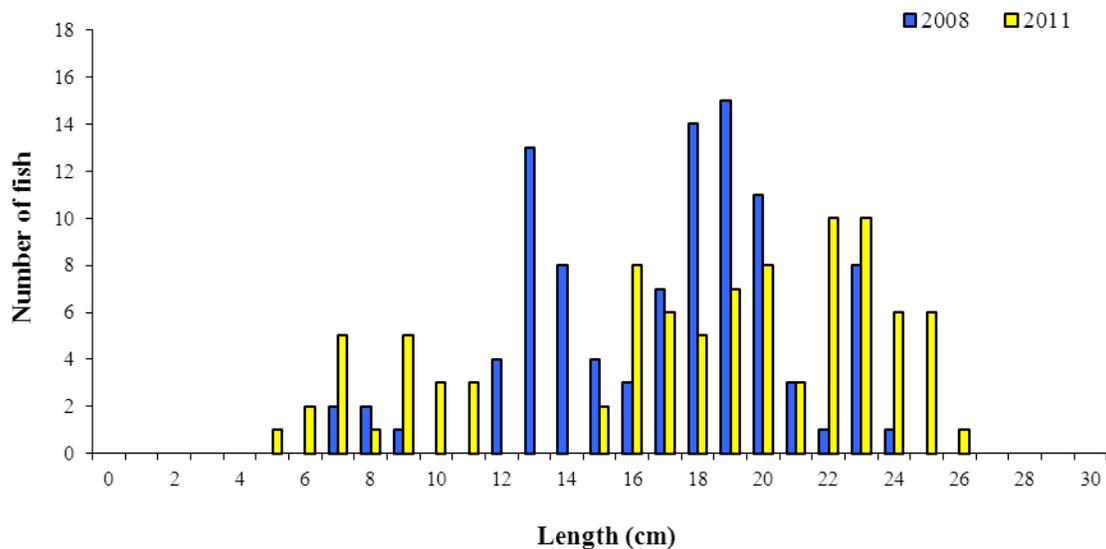
Perch captured during the 2008 survey had lengths ranging from 3.0cm to 34.0cm (Fig.1.8).

Roach captured during the 2011 survey ranged in length from 5.7cm to 26.8cm (mean = 18.2cm) (Fig. 1.9). Roach captured during the 2008 survey ranged in length from 7.4cm to 24.3cm (Fig. 1.9).

Roach x bream hybrids captured during the 2011 survey ranged in length from 16.8cm to 31.5cm, brown trout ranged in length from 21.0cm to 27.6cm, bream ranged in length from 18.4cm to 32.3cm and eels ranged in length from 33.0cm to 65.0cm. One salmon was recorded at 69.1cm, one pike was recorded at 72.5cm and one flounder was recorded at 18.8cm.



**Fig. 1.8. Length frequency of perch captured on Lough Gill**



**Fig. 1.9. Length frequency of roach captured on Lough Gill**

### 1.3.4 Fish age and growth

Ten age classes of perch were present, ranging from 1+ to 10+, with a mean L1 of 5.5cm (Table 1.3). In the 2008 survey, perch ranged from 0+ to 10+ with a mean L1 of 6.0cm. The dominant age class of perch was 2+, with ages ranging from 1+ to 10+ indicating reproductive success in ten of the previous eleven years.

Six age classes of roach were present, ranging from 1+ to 6+, with a mean L1 of 2.4cm. In the 2008 survey, roach ranged from 1+ to 4+ with a mean L1 of 4.8cm. One age class (3+) of brown trout was present, with a mean L1 of 5.3cm (Table 1.4).

**Table 1.3. Mean ( $\pm$ SE) perch length (cm) at age for Lough Gill, July 2011**

	<b>L<sub>1</sub></b>	<b>L<sub>2</sub></b>	<b>L<sub>3</sub></b>	<b>L<sub>4</sub></b>	<b>L<sub>5</sub></b>	<b>L<sub>6</sub></b>	<b>L<sub>7</sub></b>	<b>L<sub>8</sub></b>	<b>L<sub>9</sub></b>	<b>L<sub>10</sub></b>
Mean	5.5 (0.1)	10.3 (0.1)	14.4 (0.2)	18.3 (0.3)	20.8 (0.3)	22.8 (0.4)	24.4 (0.8)	24.2 (2.4)	27.3 (2.8)	24.9
N	112	92	62	52	40	24	12	3	2	1
Range	2.9-7.3	6.7- 13.1	10.8- 17.9	13.7- 24.5	17.8- 25.8	19.1- 28.4	20.6- 29.9	21.0- 29.0	24.5- 30.1	24.9-

**Table 1.4. Mean ( $\pm$ SE) brown trout length (cm) at age for Lough Gill, July 2011**

	<b>L<sub>1</sub></b>	<b>L<sub>2</sub></b>	<b>L<sub>3</sub></b>
Mean	5.3 (0.6)	13.3 (0.6)	20.3 (2.1)
N	3	3	3
Range	4.2-6.3	12.4-14.6	18.1-24.6

#### 1.4 Summary

Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets.

The mean perch CPUE in Lough Gill was significantly lower than Lough Meelagh, another similar lake surveyed during 2011 and no significant differences were detected in the mean perch CPUE between Lough Gill and Lough Owel, Co. Westmeath, Lough Melvin, Co. Leitrim and Lough Leane, Co. Kerry. The mean perch BPUE in Lough Gill was similar to the four other similar lakes assessed, with no statistically significant differences being found between lakes. Perch ranged in age from 1+ to 10+, indicating reproductive success in recent years. The dominant age class of perch was 2+.

The mean brown trout CPUE and BPUE in Lough Gill was significantly lower than three other lakes surveyed in 2011, i.e. Lough Fern, Co. Donegal, Carrowmore Lake, Co. Mayo and Lough Leane and was similar to the CPUE and BPUE from Lough Owel. All brown trout were aged at 3+.

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 by 2015 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.*, 2012). Using the FIL2 classification tool, combined with expert opinion on non-native/alien species, Lough Gill has been assigned an ecological status of Good based on the fish populations present. The ecological status assigned to the lake based on the 2008 survey data was also Good.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Lough Gill an overall ecological status of Moderate, based on all monitored physico-chemical and biological elements, including fish. This status classification will be revised at the end of 2012.

## 1.5 References

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A dark blue abstract shape, resembling a stylized wave or a folded piece of paper, occupies the lower-left and bottom portions of the page. It features several white dashed lines that flow across its surface and extend into the white background on the right. The lines are composed of small dashes and create a sense of movement and depth.

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