

# Sampling Fish for the Water Framework Directive

*Lakes 2014*

**Lough Beagh**





## Water Framework Directive Fish Stock Survey of Lough Beagh, July 2014

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## 1.1 Introduction

Lough Beagh is situated in a remote valley in the Lackagh catchment, within the Glenveagh National Park, 24 kilometres north-west of Letterkenny, Co. Donegal. A visitor's centre is located near the northern shore of the lake and a castle is located on the eastern shore (Fig. 1.1). Lough Beagh is volcanic in origin. It is a long, narrow lake, approximately 6.5 kilometres in length and 0.8 kilometres wide. The lake is surrounded by mountains on three sides (including the Derryveagh and Glendowan Mountains on the south, east and west side respectively) (Plate 1.1).

The lake has a surface area of 261ha, a mean depth of 9.2m and a maximum depth of 46.5m. The altitude of the lake is 45.3m above sea level. The lake is classed as 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>). Lough Beagh has been characterised as 2b (i.e. expected to meet good status by 2015) in the WFD Characterization report (EPA, 2005). The geology of the area is predominantly granite, felsite and other intrusive rocks rich in silica.

The lake holds brown trout, and occasional salmon and sea trout arrive into the lake during August (O'Reilly, 1987). Arctic char are also present in the lake. The lake was surveyed jointly by Inland Fisheries Ireland (previously the Central Fisheries Board and Northern Regional Fisheries Board) in 1989, 1994 and 1995. In 2005, the lake was again surveyed using the current WFD lake sampling methodology as part of the cross border NS Share "Fish in Lakes" project by Inland Fisheries Ireland and the Agri-Food and Biosciences Institute Northern Ireland (AFBINI) (Kelly *et al.*, 2007). Subsequently Lough Beagh was surveyed in 2008 and 2011 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2009 and Kelly *et al.*, 2012a). During the 2011 survey, brown trout were found to be the dominant species present in the lake. Arctic char, sea trout, salmon, minnow and eels were also captured during the survey.

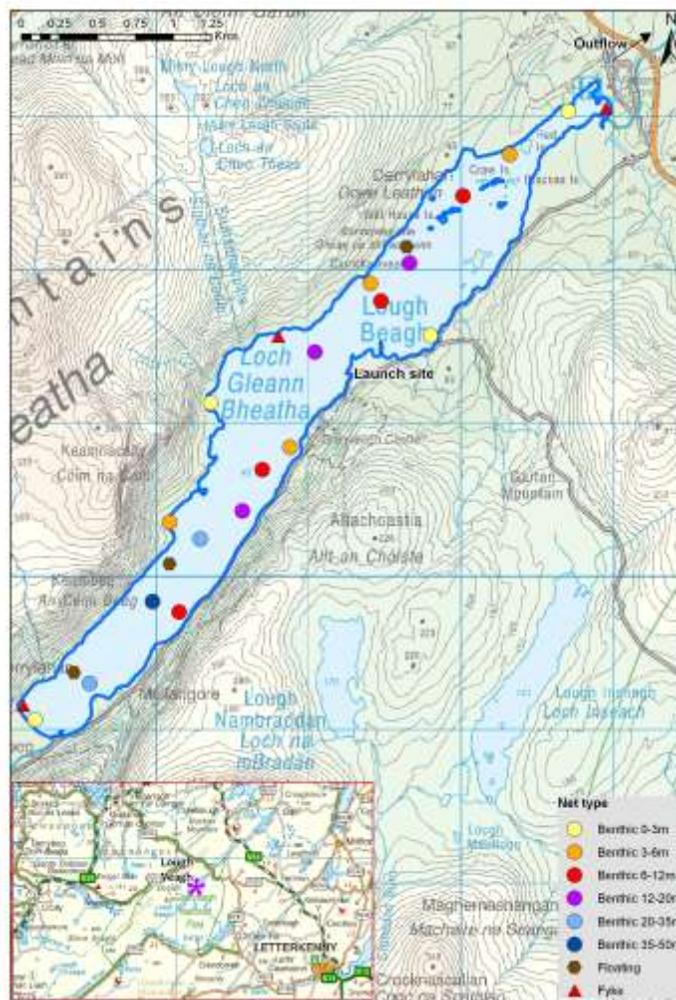
An additional experimental survey using hydroacoustic and pelagic gillnetting techniques was carried out on Lough Beagh on the night of the 28<sup>th</sup> of July 2014. This survey was carried out as part of a Ph.D. research project which aims to incorporate hydroacoustic technology into the existing standard sampling protocols used to assign ecological and conservation status for the Water Framework and Habitats Directive for conservation and endangered fish species. The experimental survey concentrated on the deeper sections of the lake (depth >12m) and covered *circa* 5km of hydroacoustic transects. A separate report will be available in due course.



This report summarises the results of the 2014 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme.



**Plate 1.1. View of Lough Beagh (Glenveagh)**



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

## 1.2 Methods

Lough Beagh was surveyed over two nights between the 29<sup>th</sup> and the 31<sup>st</sup> of July 2014. A total of three sets of Dutch fyke nets, 18 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 4 @ 6-11.9m, 3 @ 12-19.9m, 2 @ 20-34.9m and 1 @ 35-49.9m) and three floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (24 sites). Nets were deployed in the same locations as were randomly selected in the previous surveys in 2008 and 2011. 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 were measured and weighed on site and scales were removed from all brown trout, salmon and sea trout. 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 five fish species (sea trout are included as a separate ‘variety’ of trout) were recorded on Lough Beagh in July 2014, with 354 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most abundant fish species recorded, followed by minnow, Arctic char, sea trout, eels and salmon. During the previous surveys in 2008 and 2011 the same species composition was recorded with the exception of salmon and minnow, which were not captured during the 2008 survey but were recorded during the 2011 and the 2014 surveys.

**Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Beagh, July 2014**

Scientific name	Common name	Number of fish captured			Total
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Fyke nets	
<i>Salmo trutta</i>	Brown trout	214	13	4	231
<i>Phoxinus phoxinus</i>	Minnow	47	6	0	53
<i>Salvelinus alpinus</i>	Arctic char	44	3	0	47
	Sea trout	10	0	0	10
<i>Anguilla anguilla</i>	Eel	0	0	11	11
<i>Salmo salar</i>	Salmon	2	0	0	2

**Note:** Results from the experimental hydroacoustic and pelagic gillnetting survey will be presented in a separate report.

### 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 2008, 2011 and 2014 surveys are summarised in Table 1.2. Mean CPUE and BPUE for all species is illustrated in Figures 1.2 and 1.3.

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE). Although the mean brown trout CPUE and BPUE increased every year from 2008 to 2014, these differences were



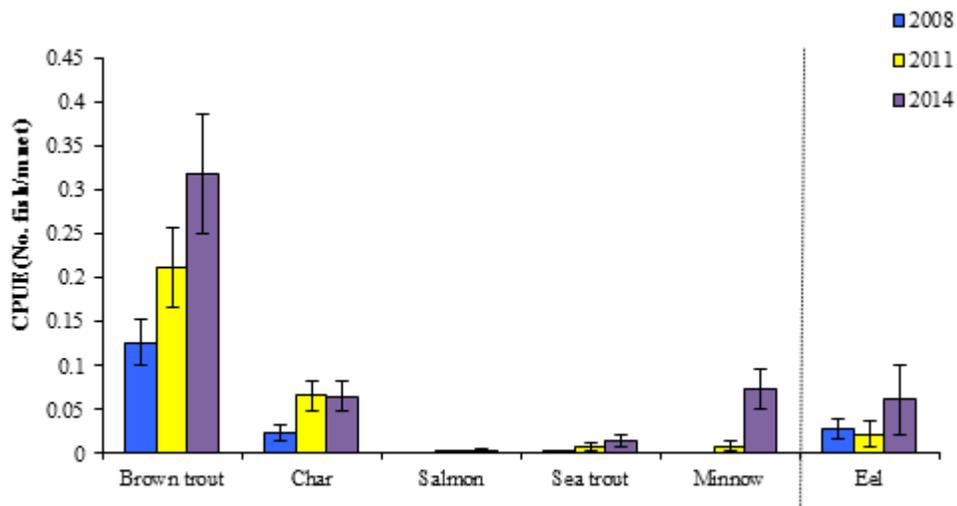
not statistically significant (Table 1.2; Fig 1.2 and 1.3). The mean Arctic char CPUE and BPUE was significantly higher in 2014 than in 2008 (Kruskal-Wallis  $H=5.8$ ,  $P<0.05$  and  $H=5.7$ ,  $P<0.05$  respectively) (Table 1.2; Fig 1.2 and 1.3).

**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on on Lough Beagh, 2008, 2011 and 2014**

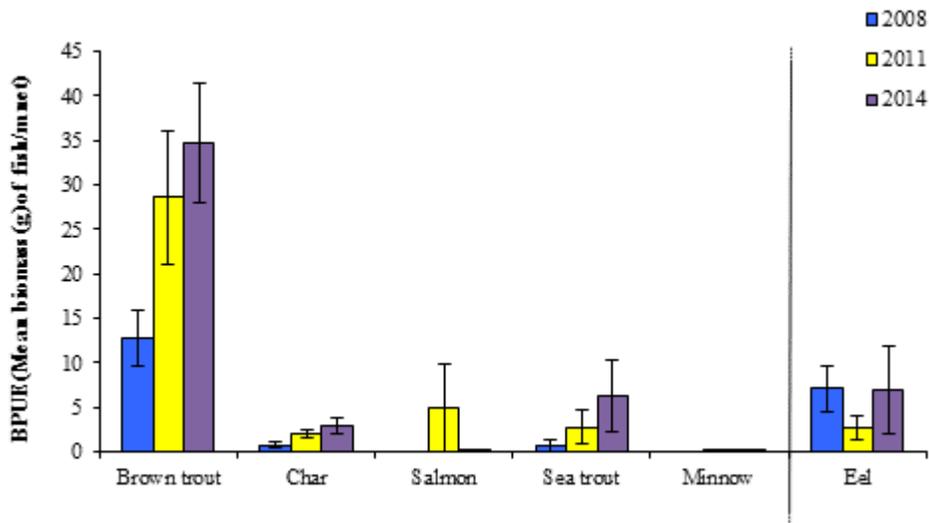
Scientific name	Common name	2008	2011	2014
<b>Mean CPUE</b>				
<i>Salmo trutta</i>	Brown trout	0.126 (0.026)	0.211 (0.044)	0.318 (0.680)
<i>Phoxinus phoxinus</i>	Minnow	-	0.008 (0.005)	0.074 (0.023)
<i>Salvelinus alpinus</i>	Arctic char	0.024 (0.008)	0.065 (0.017)	0.065 (0.017)
	Sea trout	0.002 (0.001)	0.007 (0.004)	0.0139 (0.007)
<i>Anguilla anguilla</i>	Eel	0.027 (0.011)	0.022 (0.014)	0.061 (0.039)
<i>Salmo salar</i>	Salmon	-	0.001 (0.001)	0.003 (0.002)
<b>Mean BPUE</b>				
<i>Salmo trutta</i>	Brown trout	12.794 (3.112)	28.553 (7.421)	34.651 (6.753)
<i>Phoxinus phoxinus</i>	Minnow	-	0.022 (0.013)	0.173 (0.052)
<i>Salvelinus alpinus</i>	Arctic char	0.669 (0.314)	1.958 (0.495)	2.891 (0.804)
	Sea trout	0.646 (0.589)	2.708 (1.926)	6.138 (4.037)
<i>Anguilla anguilla</i>	Eel	7.033 (2.666)	2.572 (1.317)	6.961 (4.968)
<i>Salmo salar</i>	Salmon	-	4.967 (4.967)	0.038 (0.027)

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.

\*Eel CPUE and BPUE based on fyke nets only



**Fig. 1.2.** Mean ( $\pm$ S.E.) CPUE for all fish species captured in Lough Beagh (Eel CPUE based on fyke nets only), 2008, 2011 and 2014



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

### 1.3.3 Length frequency distributions and growth

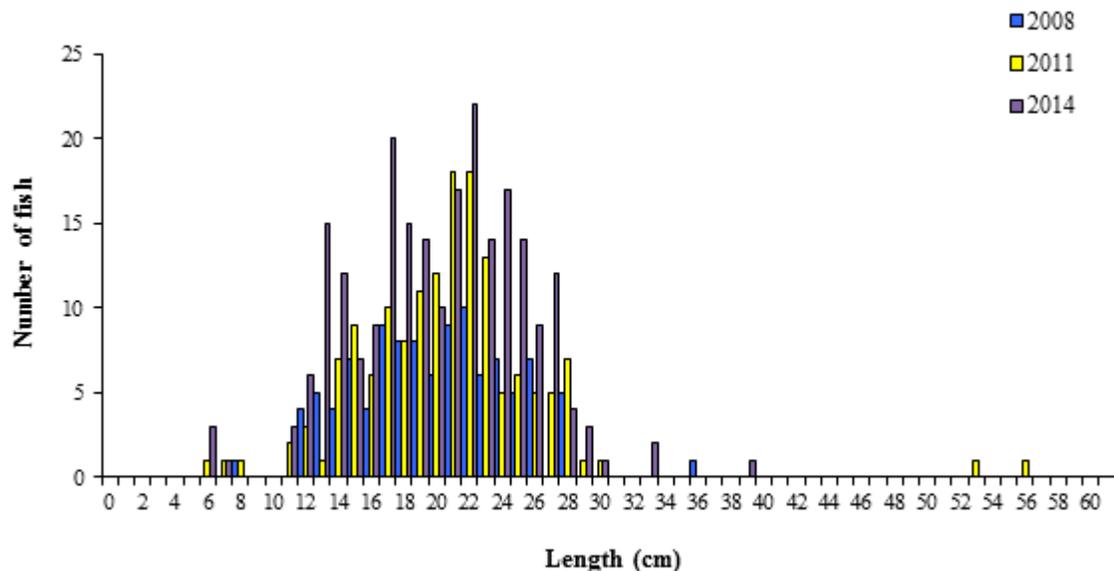
Brown trout captured during the 2014 survey ranged in length from 6.4cm to 39.0cm (mean = 20.4cm) (Fig. 1.4). Seven age classes present, ranging from 0+ to 6+, with a mean L1 of 7.7cm (Table 1.3). The dominant age class was 3+ (Fig. 1.4). Mean brown trout L4 in 2014 was 23.1cm indicating a very slow



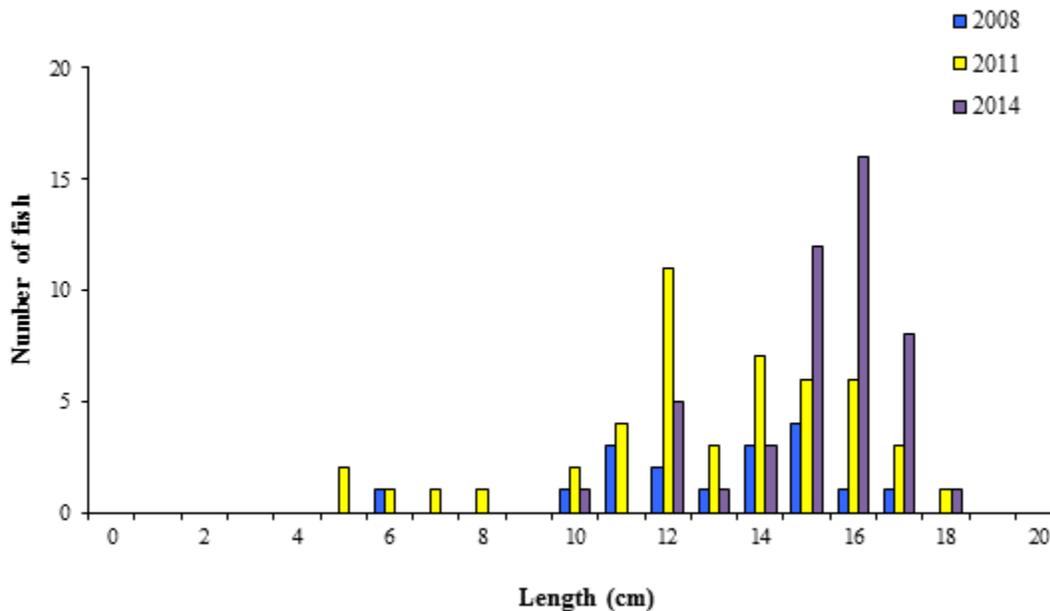
rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.3). Brown trout captured during the 2008 and 2011 surveys had a similar length range to the 2014 survey but a small number of larger fish were also present in 2011 (Fig. 1.4). The age ranges and growth rates were similar over the three sampling years (Fig. 1.4).

Arctic char captured during the 2014 survey ranged in length from 10.8cm to 18.0cm (mean = 15.5cm) (Fig.1.5) with five age classes present, ranging from 1+ to 6+. Arctic char captured during the 2008 and 2011 surveys had a similar age and length range but fish less than 10cm were not captured in the 2014 survey (Fig.1.5).

Minnow captured during the 2014 survey ranged in length from 4.5cm to 8.0cm and eels ranged from 35.0cm to 51.5cm. Two juvenile salmon captured were aged 1+ and ranged in length from 10.2cm to 10.5cm. Sea trout ranged in length from 26.5cm to 41.0cm and ranged in age from 2.0+ to 4.0+.



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



**Fig. 1.5. Length frequency of Arctic char captured on Lough Beagh, 2008, 2011 and 2014**

**Table 1.3. Mean ( $\pm$ SE) brown trout length (cm) at age for Lough Beagh, July 2014**

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	L <sub>6</sub>	Growth Category
Mean	7.7 (0.2)	15.2 (0.3)	21.0 (0.4)	24.9 (0.5)	26.7 (0.6)	30.7 (1.0)	Very slow
N	59	48	31	18	6	4	
Range	3.6-10.4	10.1-18.8	16.7-25.5	20.9-28.2	24.5-28.6	29.1-33.6	

#### 1.4 Summary

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2014 survey.

The mean brown trout CPUE and BPUE increased every year from 2008 to 2014; however, these differences were not statistically significant. Brown trout ranged in age from 0+ to 6+, indicating reproductive success in all of the previous seven years. The dominant age class was 3+. Length at age analyses revealed that brown trout in the lake exhibit a very slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

The mean Arctic char CPUE and BPUE was significantly higher in 2014 than in 2008. Arctic char ranged in age from 1+ to 6+, with no 0+ or 5+ fish being captured.



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.*, 2012b). Using the FIL2 classification tool, Lough Beagh has been assigned an ecological status of Good 2005, 2011 and 2014 and achieved a High status in 2008 based on the fish populations present.

In the 2010 to 2012 surveillance monitoring reporting period, the EPA assigned Lough Beagh an overall draft ecological status of Good, based on all monitored physico-chemical and biological elements, including fish.

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