



# Sampling Fish for the Water Framework Directive

*Lakes 2014*

**Lough Caragh**





## Water Framework Directive Fish Stock Survey of Lough Caragh, August 2014

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

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## 1.1 Introduction

Lough Caragh is situated in Co. Kerry at the mouth of the Glencar Valley, approximately two kilometres north-east of Glenbeigh (Plate 1.1, Fig. 1.1). The lake has a surface area of 490ha, a mean depth of 11m and a maximum depth of 40m. The lake is categorised as typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), greater than 50ha and low alkalinity (<20mg/l CaCO<sub>3</sub>).

Lough Caragh forms part of the Killarney National Park, Macgillycuddy's Reeks and Caragh River catchment candidate Special Area of Conservation. This is a large area that encompasses a wide variety of habitats designated under Annex I of the EU Habitats Directive, including blanket bog, alluvial woodlands, alpine heath and both upland and lowland oligotrophic lakes. The site has also been selected for the following species, Killarney fern, slender naiad, freshwater pearl mussel, Kerry slug, marsh fritillary, Killarney shad, Atlantic salmon, brook lamprey, river lamprey, sea lamprey, lesser horseshoe bat and otter; all species listed on Annex II of the EU Habitats Directive (NPWS, 2005).

Lough Caragh is known for its spring salmon and grilse fishing, and to a lesser extent for brown trout and sea trout. The best salmon fishing is at the southern end of the lake along the west and east shores. Early in the season fish average 6.3kg and the record for the lake is 12.7kg. The sea trout arrive in the lake in July. The brown trout are to be found on all the shores and generally average 0.2-0.4kg (O' Reilly, 2007).

Lough Caragh was previously 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 and perch were found to be the dominant species present in the lake. Arctic char, sea trout, salmon and eels were also captured during the survey.

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.

An additional experimental survey using hydroacoustic and pelagic gillnetting techniques was carried out on Lough Caragh over two nights between the 18<sup>th</sup> and 20<sup>th</sup> of August 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* 30km of hydroacoustic transects. A separate report will be available in due course



**Plate 1.1. Lough Caragh**







## 1.2 Methods

Lough Caragh was surveyed over two nights between the 20<sup>th</sup> and the 22<sup>nd</sup> of August 2014. A total of three sets of Dutch fyke nets, 24 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (5 @ 0-2.9m, 5 @ 3-5.9m, 5 @ 6-11.9m, 4 @ 12-19.9m, 3 @ 20-34.9m and 2 @ 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 (30 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 apart from perch were measured and weighed on site and scales were removed from all brown trout, sea 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.

## 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 Caragh in August 2014, with 322 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, followed by brown trout, sea trout, Arctic char, eels and salmon. During the previous surveys in 2008 and 2011 the same species composition was recorded with the exception of sea trout and salmon, which were not captured during the 2008 survey but were recorded during the 2011 and 2014 surveys.

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

Scientific name	Common name	Number of fish captured			Total
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Fyke nets	
<i>Perca fluviatilis</i>	Perch	174	0	8	182
<i>Salmo trutta</i>	Brown trout	69	55	2	126
<i>Salmo salar</i>	Salmon	6	0	0	6
<i>Anguilla anguilla</i>	European eel	1	0	3	4
<i>Salvelinus alpinus</i>	Arctic char	3	0	0	3
<i>Salmo trutta</i>	Sea trout	1	0	0	1

**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.

Perch was the dominant species in terms of abundance (CPUE) and salmon was the dominant species in terms of biomass (BPUE). Although the mean brown trout CPUE and BPUE fluctuated slightly over the three sampling years, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3). The mean perch CPUE and BPUE was significantly higher in 2014 than in 2008 and 2011 (Kruskal-Wallis  $H=12.2$ ,  $P<0.01$  and  $H=9.7$ ,  $P<0.01$  respectively) (Table 1.2; Fig 1.2 and 1.3).

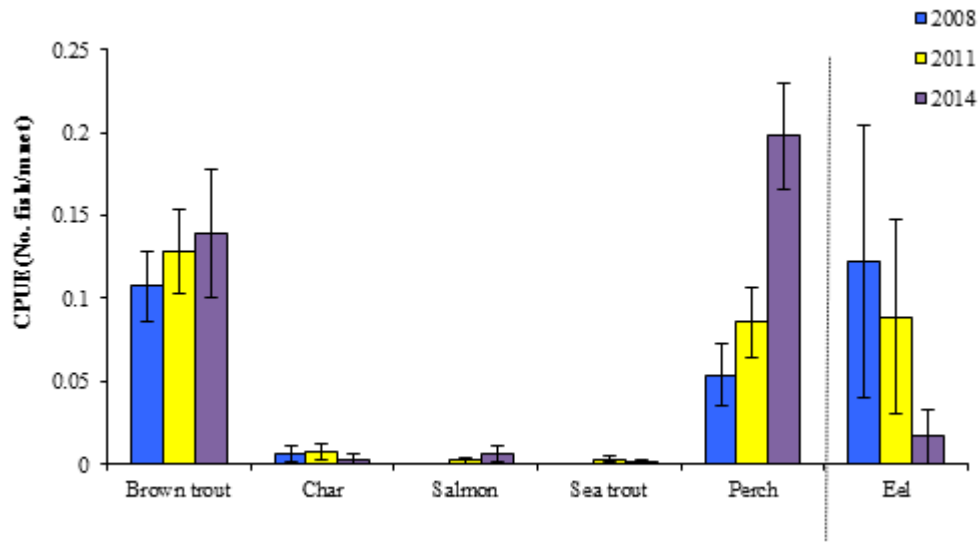
**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on on Lough Caragh, 2008, 2011 and 2014**

Scientific name	Common name	2008	2011	2014
<b>Mean CPUE</b>				
<i>Perca fluviatilis</i>	Perch	0.053 (0.018)	0.085 (0.021)	0.1977 (0.032)
<i>Salmo trutta</i>	Brown trout	0.107 (0.021)	0.128 (0.025)	0.138 (0.038)
<i>Salmo salar</i>	Salmon	-	0.002 (0.001)	0.006 (0.004)
<i>Salvelinus alpinus</i>	Arctic char	0.006 (0.004)	0.007 (0.004)	0.003 (0.002)
<i>Salmo trutta</i>	Sea trout	-	0.003 (0.001)	0.001 (0.001)
<i>Anguilla anguilla</i>	European eel	0.122 (0.081)	0.088 (0.058)	0.016 (0.016)
<b>Mean BPUE</b>				
<i>Perca fluviatilis</i>	Perch	3.636 (1.472)	7.032 (2.784)	10.581 (2.185)
<i>Salmo trutta</i>	Brown trout	12.287 (2.503)	15.261 (3.198)	12.405 (2.942)
<i>Salmo salar</i>	Salmon	-	4.655 (3.240)	14.239 (10.265)
<i>Salvelinus alpinus</i>	Arctic char	0.725 (0.504)	0.65 (0.416)	0.378 (0.350)
<i>Salmo trutta</i>	Sea trout	-	1.012 (0.634)	0.877 (0.877)
<i>Anguilla anguilla</i>	European eel	13.944 (9.959)	14.705 (11.467)	1.394 (1.394)

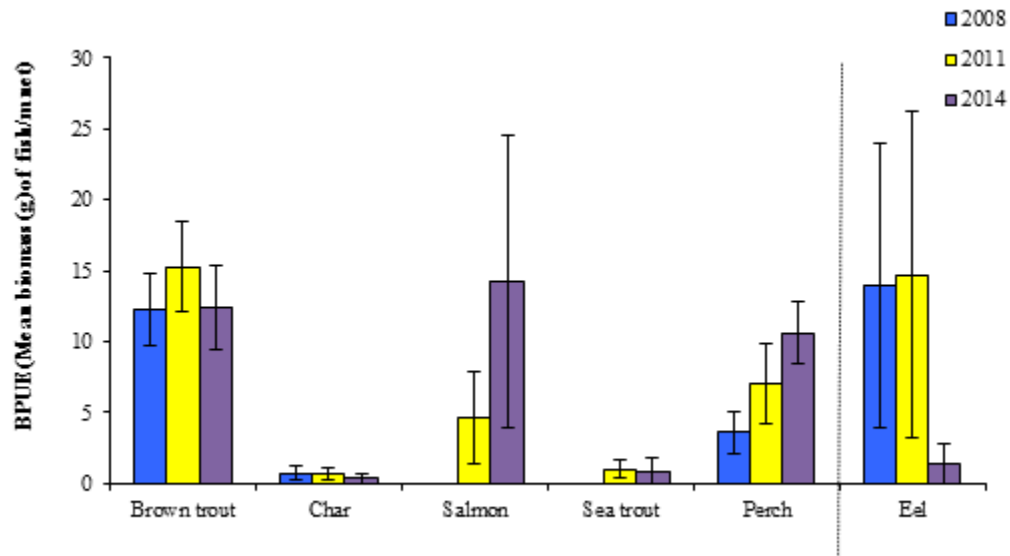
Note: On the rare occasion where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species.

\*Eel CPUE and BPUE based on fyke nets only





**Fig. 1.2. Mean ( $\pm$ S.E.) CPUE for all fish species captured in Lough Caragh (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 Caragh (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 12.3cm to 26.8cm (mean = 19.4cm) (Fig. 1.4). Five age classes were present, ranging from 1+ to 5+, with a mean L1 of 6.2cm (Table 1.3). The dominant age class was 2+ (Fig. 1.4). Mean brown trout L4 in 2014 was 23.2cm 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, age range and growth rate to the 2014 survey (Fig. 1.4).

Perch captured during the 2014 survey ranged in length from 4.2cm to 40.5cm (mean = 14.6cm) (Fig.1.5) with eight age classes present, ranging from 0+ to 9+, with a mean L1 of 6.6cm (Table 1.4). The dominant age class was 1+ (Fig. 1.5). Perch captured during the 2008 and 2011 surveys had similar length ranges to the 2014 survey. Age ranges and growth rates were similar in the 2011 and 2014 surveys, however, a narrower age range was recorded in 2008 (Fig.1.5).

Three Arctic char captured during the 2014 survey ranged in length from 14.4cm to 25.0cm and were aged from 2+ to 5+ and eels ranged from 30.5cm to 44.8cm. Salmon captured were aged 1.1+ to 2.1+ and ranged in length from 33.0cm to 78.1cm. One sea trout measuring 41.0cm was aged at 3.1+.

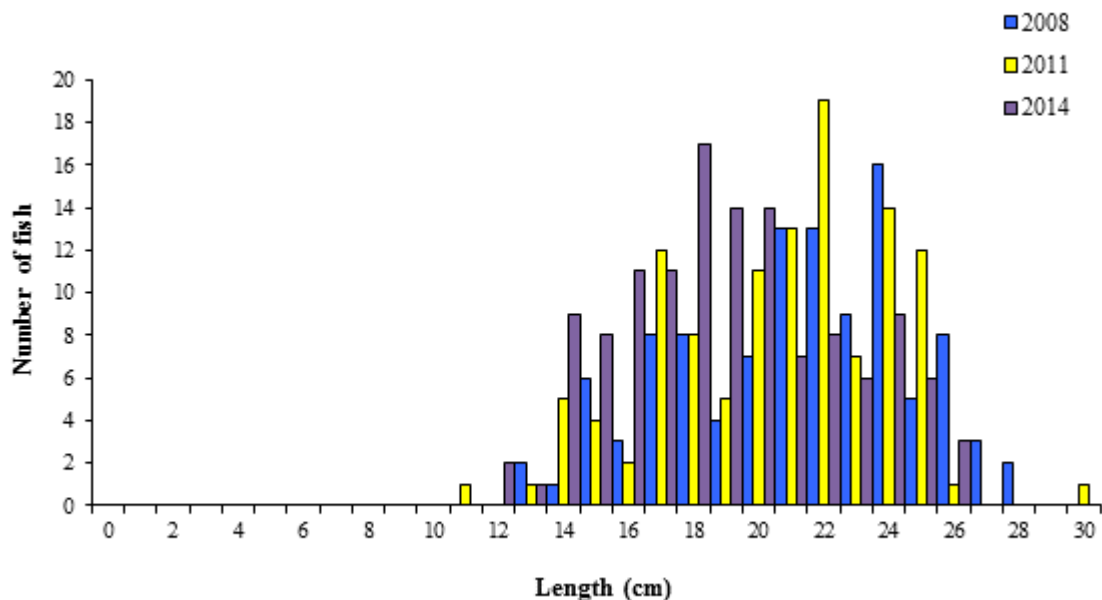
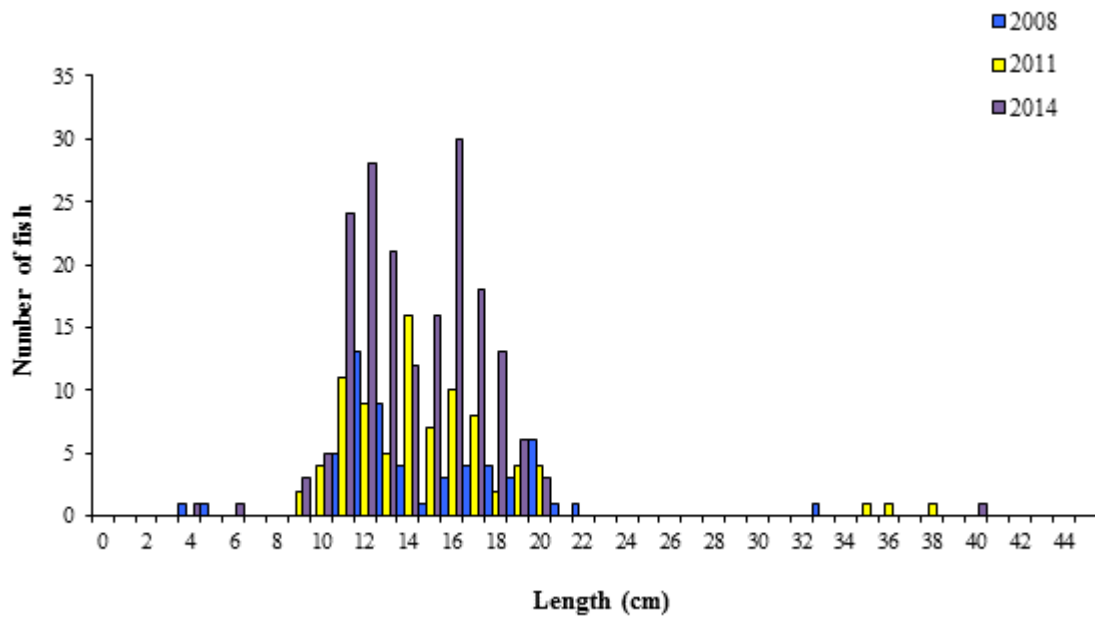


Fig. 1.4. Length frequency of brown trout captured on Lough Caragh, 2008, 2011 and 2014



**Fig. 1.5. Length frequency of perch captured on Lough Caragh, 2008, 2011 and 2014**



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

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	Growth Category
Mean	6.3 (0.2)	13.6 (0.5)	20.3 (0.5)	23.2 (0.6)	24.2	Very slow
N	43	36	14	7	1	
Range	3.6-8.7	8.3-18.6	16.9-24.7	20.1-25.0	24.2-24.2	

**Table 1.4. Mean ( $\pm$ SE) perch length (cm) at age for Lough Caragh, August 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>	L <sub>7</sub>	L <sub>8</sub>	L <sub>9</sub>
Mean	6.6 (0.2)	13.1 (0.4)	16.6 (0.6)	18.6 (0.7)	20.7 (1.8)	23.6 (3.7)	33.3	35.0	38.7
N	35	22	14	11	5	3	1	1	1
Range	5.0-8.5	10.8-20.1	14.3-22.7	16.0-24.7	17.7-27.8	19.6-31.1	33.3-33.3	35.0-35.0	38.7-38.7

#### 1.4 Summary

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

Although the mean brown trout CPUE and BPUE fluctuated slightly over the three sampling years, these differences were not statistically significant. Brown trout ranged in age from 1+ to 5+, indicating reproductive success in the previous five years. The dominant age class was 2+. 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 perch CPUE and BPUE was significantly higher in 2014 than in 2008 and 2011. Perch ranged in age from 0+ to 9+, indicating reproductive success in recent years. The dominant age class was 1+.

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 Caragh has been assigned an ecological status of High for 2008, 2011 and 2014 based on the fish populations present.

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

## 1.5 References

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A dark blue geometric shape, resembling a large triangle or trapezoid, is positioned on the left side of the page. It has a white dashed line that curves across its bottom edge and extends towards the right side of the page. The background is white.

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