



**Sampling Fish for the  
Water Framework  
Directive**

*Lakes 2013*

**Lough Ree**



Iascach Intíre Éireann  
Inland Fisheries Ireland

## Water Framework Directive Fish Stock Survey of Lough Ree, June 2013

Fiona L. Kelly, Lynda Connor, Emma Morrissey, John Coyne, Ronan Matson, Rory Feeney and  
Kieran Rocks

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

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

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## 1.1 Introduction

Lough Ree is the third largest lake in the Republic of Ireland, after Lough Corrib and Lough Derg (Plate 1.1, Fig. 1.1 and 1.2). It is the middle of the three large Shannon lakes; Loughs Allen, Ree and Derg. The lake is 26km long and 11km at its widest point, has an area of 10,500ha, a mean depth of 6.2m, a maximum depth of 36m and is categorised as typology class 12 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. deep (>4m), greater than 50ha and high alkalinity (>100mg/l CaCO<sub>3</sub>).

Lough Ree is situated in an ice deepened depression formed on Carboniferous limestone (Charlesworth, 1963). It has a highly irregular shoreline and hence has many sheltered bays. Glacial drift has resulted in the formation of many islands in the lake (NPWS, 2001). The main inflowing rivers are the Shannon, Inny and Hind, and the main outflowing river is the Shannon (NPWS, 2011).

Water levels in the lake are regulated by the Electricity Supply Board (ESB) and Waterways Ireland. The ESB control water levels on the Shannon system for the purpose of electricity generation at Ardnacrusha hydroelectric power station, which is located at the end of a purpose built channel (the head-race canal) connected to the River Shannon, approximately 8km below the southern end of Lough Derg. Waterways Ireland controls water levels for navigation purposes. The water level into Lough Ree and discharges from the lake are controlled by a navigational weir and sluice gates at Athlone. The sluices at Athlone weir are operated by Waterways Ireland on daily instruction from the ESB and at high flows the sluice gates are closed to hold water upstream of Lough Ree to minimize flooding along the Lower Shannon (RPS, 2008).

Lough Ree has been designated as a Special Area of Conservation (SAC) and a Special Protection Area (SPA). It has been selected as a SAC/SPA due to the presence of Annex I habitat types, bird species listed on Annex I of the Birds Directive (Council Directive 79/409/EEC) and the otter listed on Annex II of the EU Habitats Directive (Council Directive 92/43/EEC) (NPWS, 2011). The lake is also home to the endangered fish species, pollan (*Coregonus autumnalis*) listed on Annex V of the EU Habitats Directive. Pollan are classified as 'Endangered' in the Irish Red Data Book (King *et al.*, 2011) and the IUCN Red List of Threatened Species (Freyhof and Kottelat 2008). This species is endemic to Ireland and is found in five lakes throughout the country: Lough Neagh, Lower Lough Erne, Lough Allen, Lough Ree and Lough Derg (Harrison *et al.* 2010).

Lough Ree is classified as naturally eutrophic (NPWS, 2011b), however it is vulnerable to artificial enrichment due to agricultural run-off, domestic waste effluent and peat silt in suspension which limits light penetration, thus restricting aquatic flora in the shallow areas of the lake to depths of less than 2m (NPWS, 2001 and 2011). The lake is also being used for leisure activities, particularly

leisure boating, which can cause disturbance and some physical damage to marginal wetlands (NPWS, 2001).

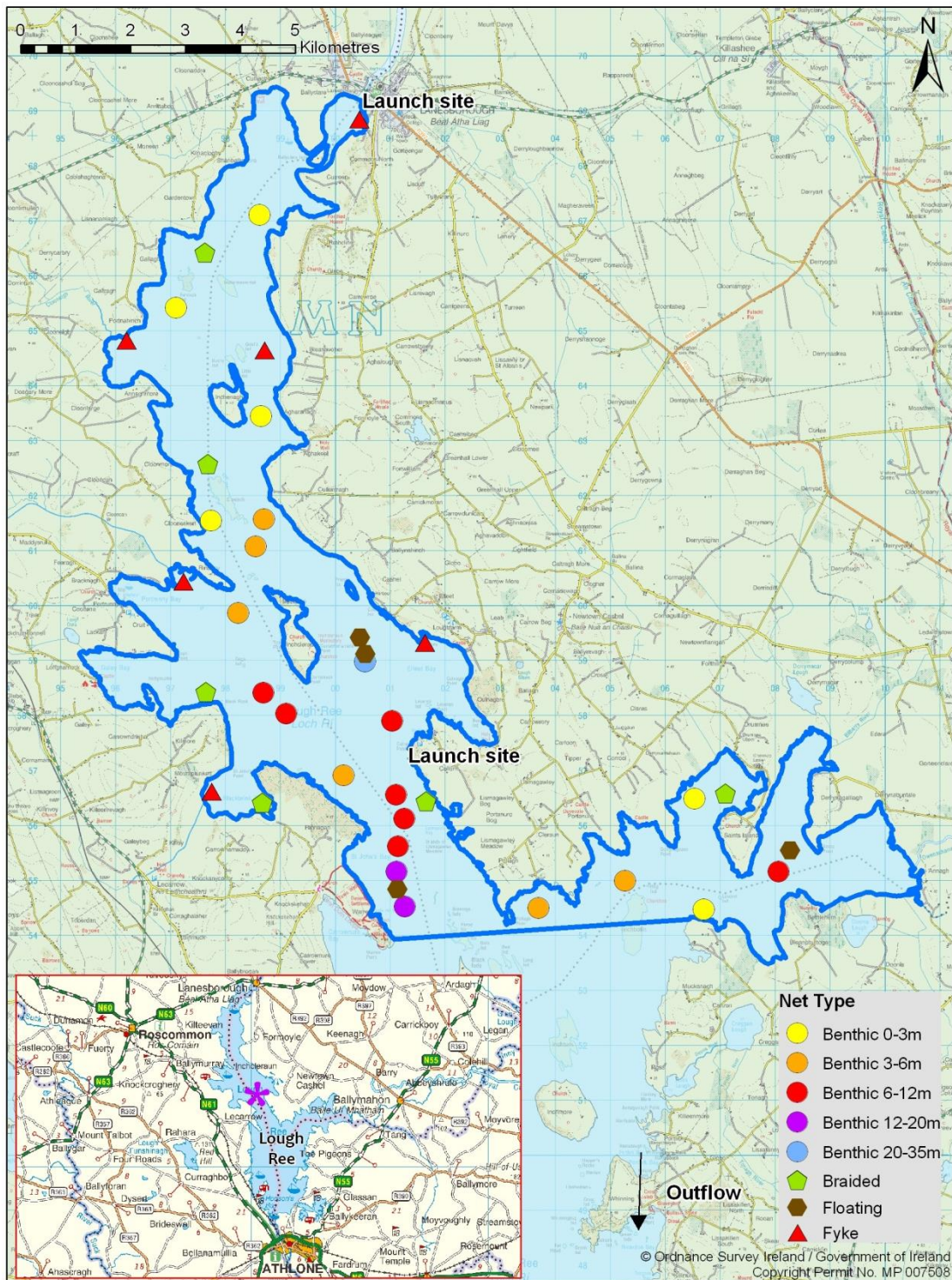
Lough Ree is classified as a mixed fishery with good stocks of trout, pike and coarse fish present (ShRFB, 2010). The local angling club is actively involved in fisheries programmes and operates a hatchery on the system (ShRFB, 2010). Local in-stream and bank rehabilitation development works have been carried out by Inland Fisheries Ireland (previously the Shannon Regional Fisheries Board) along the banks of the Hind River and the Inny system. The aim of this work was to enhance the wild brown trout stocks in the rivers and lake. These works and the implementation of pollution controls have led to an increase in the trout stocks in the lake (O' Reilly, 2007). Colonisation of Lough Ree by the zebra mussel has coincided with a reduction in phytoplankton and an increase in water clarity (NPWS, 2005). However, the long term effects of this invasive species are as yet unknown.

Lough Ree was previously surveyed in 2010 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2011). During this survey, perch were found to be the dominant species present in the lake followed by roach and roach x bream hybrids. Brown trout, pike, bream, tench and eels were also captured.



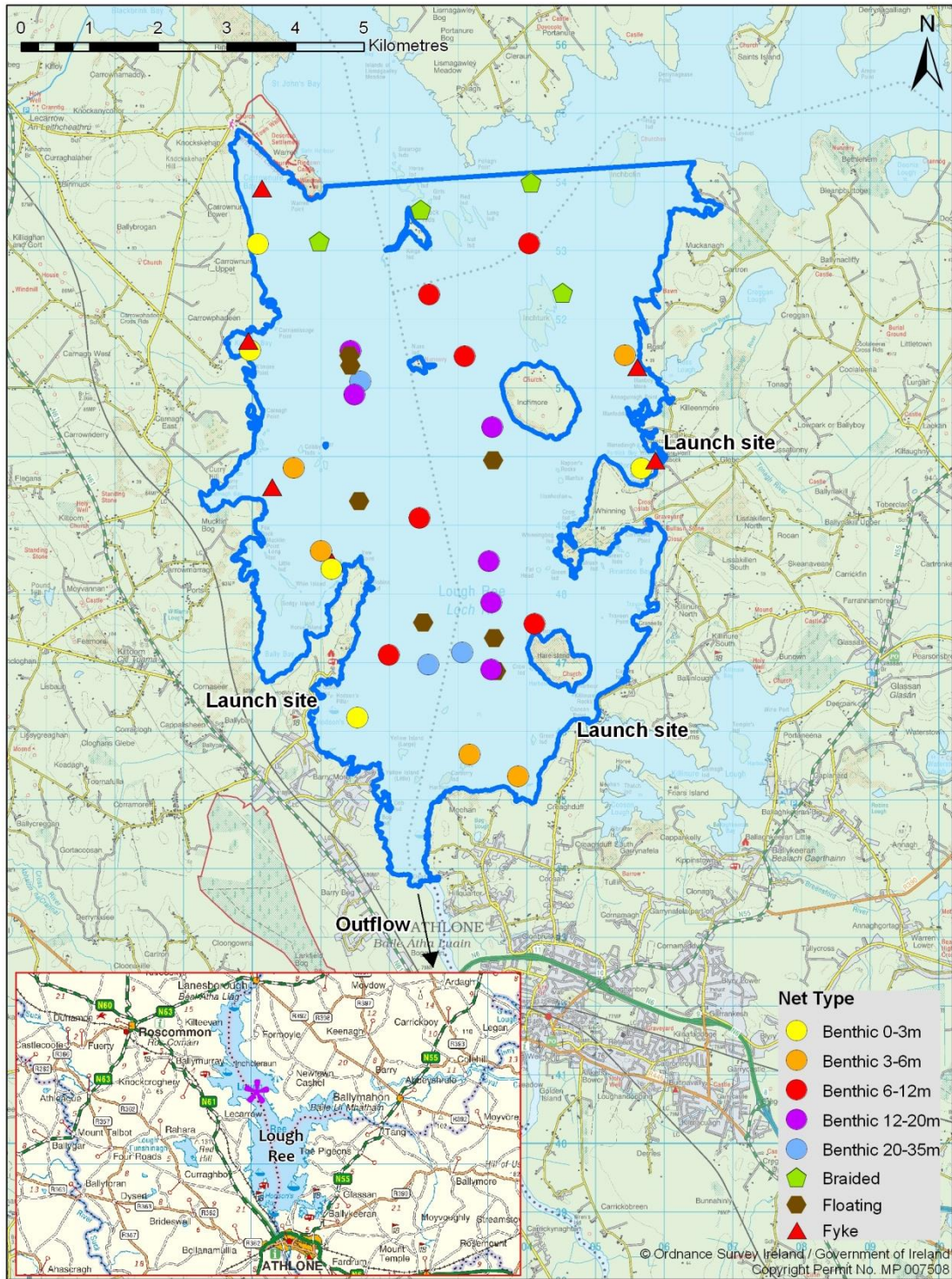
**Plate 1.1. Lough Ree (Portrunny)**





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





**Fig. 1.2. Location map of the South of Lough Ree showing net locations and depths of each net (outflow is indicated on map)**

## 1.2 Methods

Lough Ree was surveyed over seven nights from the 15<sup>th</sup> to the 25<sup>th</sup> of June 2013. A total of 12 sets of Dutch fyke nets, 47 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (11 @ 0-2.9m, 11 @ 3-5.9m, 13 @ 6-11.9m, 8 @ 12-19.9m and 4 @ 20-34.9m) and 11 floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed randomly in the lake (70 sites). The netting effort was supplemented using 10 benthic braided survey gill nets (62.5mm mesh knot to knot) at nine additional sites. 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 roach, brown trout, pike and roach x bream 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.

An additional experimental survey using hydroacoustic and pelagic gillnetting techniques was carried out on Lough Ree in parallel to the WFD fish stock survey. 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* 80km of hydroacoustic transects. A separate report will be available in due course.

## 1.3 Results

### 1.3.1 Species Richness

A total of six fish species and one type of hybrid were recorded in Lough Ree in June 2013, with 1,414 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 roach and roach x bream hybrids. Brown trout and eels were also captured, along with small numbers of pike and stone loach. The same species composition was recorded in 2010 with the exception of bream and tench which were not recorded in 2013 and stone loach which were only present in 2013.



**Table 1.1. Number of each fish captured by each gear type during the survey on Lough Ree, June 2013**

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	870	0	0	27	897
<i>Rutilus rutilus</i>	Roach	214	4	2	0	220
<i>Rutilus rutilus x Abramis brama</i>	Roach x Bream hybrid	90	0	59	0	149
<i>Anguilla anguilla</i>	European eel	0	0	0	116	116
<i>Salmo trutta</i>	Brown trout	21	1	0	1	23
<i>Esox lucius</i>	Pike	3	0	2	3	8
<i>Barbatulus barbatulus</i>	Stone loach	1	0	0	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 the 2010 and 2013 surveys are summarised in Table 1.2. Mean CPUE and BPUE for all species is illustrated in Figure 1.3 and 1.4.

Perch was the dominant species in terms of abundance (CPUE) and roach x bream hybrids were dominant in terms of biomass (BPUE).

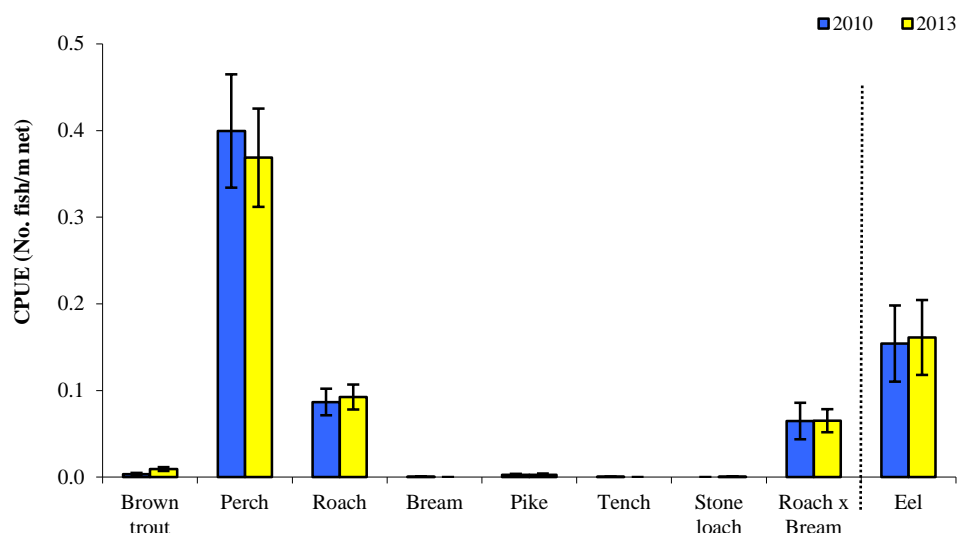
Although the mean perch CPUE and BPUE was lower in 2013 than in 2010, these differences were not statistically significant (Table 1.2; Fig 1.3 and 1.4). The mean roach CPUE was higher in 2013 than in 2010 and the mean roach BPUE was lower in 2013 than in 2010, however, these differences were also not statistically significant (Table 1.2; Fig 1.3 and 1.4). The mean brown trout CPUE and BPUE was significantly higher in 2013 than in 2010 (Mann-Whitney,  $P < 0.01$ ) (Table 1.2; Figs 1.3 and 1.4).

**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured in Lough Ree, June 2013**

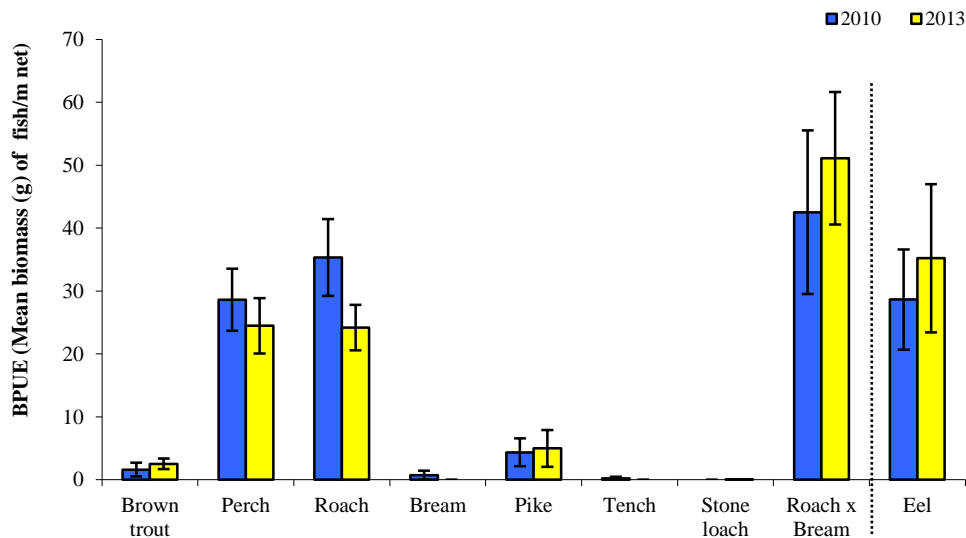
Scientific name	Common name	2010	2013
<b>Mean CPUE</b>			
<i>Perca fluviatilis</i>	Perch	0.399 (0.065)	0.369 (0.057)
<i>Rutilus rutilus</i>	Roach	0.086 (0.015)	0.092 (0.014)
<i>Rutilus rutilus x Abramis brama</i>	Roach x Bream hybrid	0.065 (0.021)	0.065 (0.013)
<i>Salmo trutta</i>	Brown trout	0.003 (0.001)	0.009 (0.002)
<i>Esox lucius</i>	Pike	0.003 (0.001)	0.003 (0.001)
<i>Abramis brama</i>	Bream	0.0004 (0.0004)	-
<i>Tinca tinca</i>	Tench	0.0002 (0.0002)	-
<i>Barbatula barbatula</i>	Stone loach	-	0.0004 (0.0004)
<i>Anguilla anguilla</i>	European eel*	0.154 (0.043)	0.161 (0.043)
<b>Mean BPUE</b>			
<i>Perca fluviatilis</i>	Perch	42.529 (13.014)	24.469 (4.402)
<i>Rutilus rutilus</i>	Roach	35.342 (6.094)	24.176 (3.620)
<i>Rutilus rutilus x Abramis brama</i>	Roach x Bream hybrid	28.610 (4.943)	51.106 (10.520)
<i>Salmo trutta</i>	Brown trout	1.611 (0.090)	2.525 (0.831)
<i>Esox lucius</i>	Pike	0.496 (0.203)	4.977 (2.907)
<i>Abramis brama</i>	Bream	0.726 (0.726)	-
<i>Tinca tinca</i>	Tench	0.241 (0.241)	-
<i>Barbatula barbatula</i>	Stone loach	-	0.002 (0.002)
<i>Anguilla anguilla</i>	European eel*	28.646 (7.976)	35.211 (11.789)

\* 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. 1.3. Mean ( $\pm$ S.E.) CPUE for all fish species captured in Lough Ree (Eel CPUE based on fyke nets only), 2010 and 2013**



**Fig. 1.4. Mean ( $\pm$ S.E.) BPUE for all fish species captured in Lough Ree (Eel BPUE based on fyke nets only), 2010 and 2013**

### 1.3.3 Length frequency distributions and growth

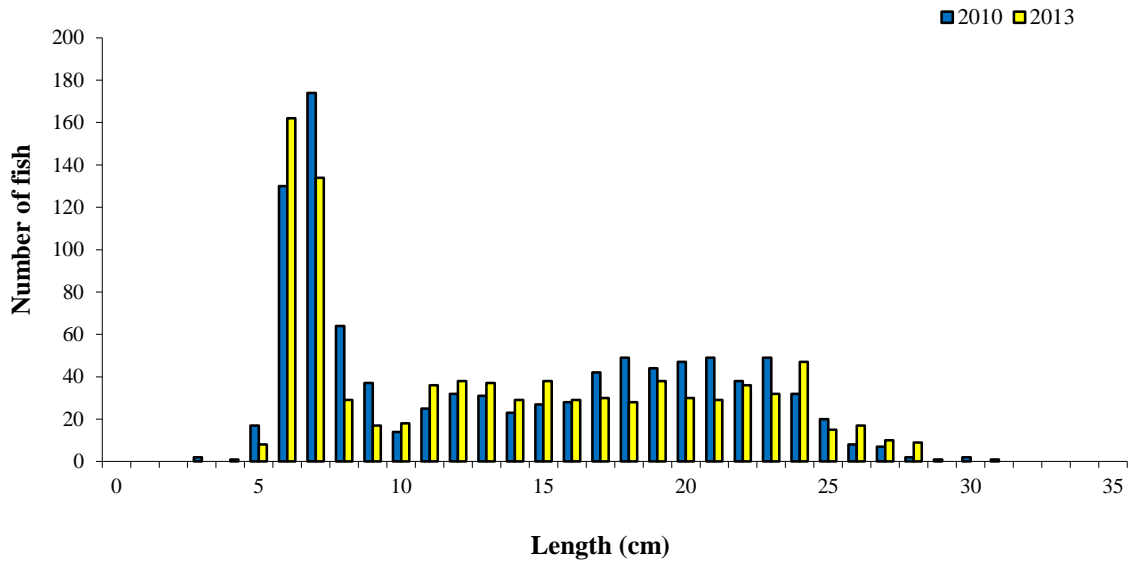
Perch captured in the 2013 survey ranged in length from 4.5cm to 28.8cm (mean = 14.0cm) (Fig. 1.5) with nine age classes present, ranging from 0+ to 8+, with a mean L1 of 5.9cm (Table 1.4). The dominant age class was 1+ (Fig. 1.5). Perch captured in the 2010 survey had a similar length range, age range and dominant age class (Fig. 1.5).

Roach captured in the 2013 survey ranged in length from 6.0cm to 35.4cm (mean = 22.86cm) (Fig. 1.6) with fifteen age classes present, ranging from 1+ to 15+ (Table 1.5). The dominant age class was 3+ (Fig. 1.6). Roach captured during the 2010 survey had a similar length range (Fig. 1.6) with twelve age classes present, ranging from 1+ to 14+. The dominant age class was 4+ (Fig. 1.6).

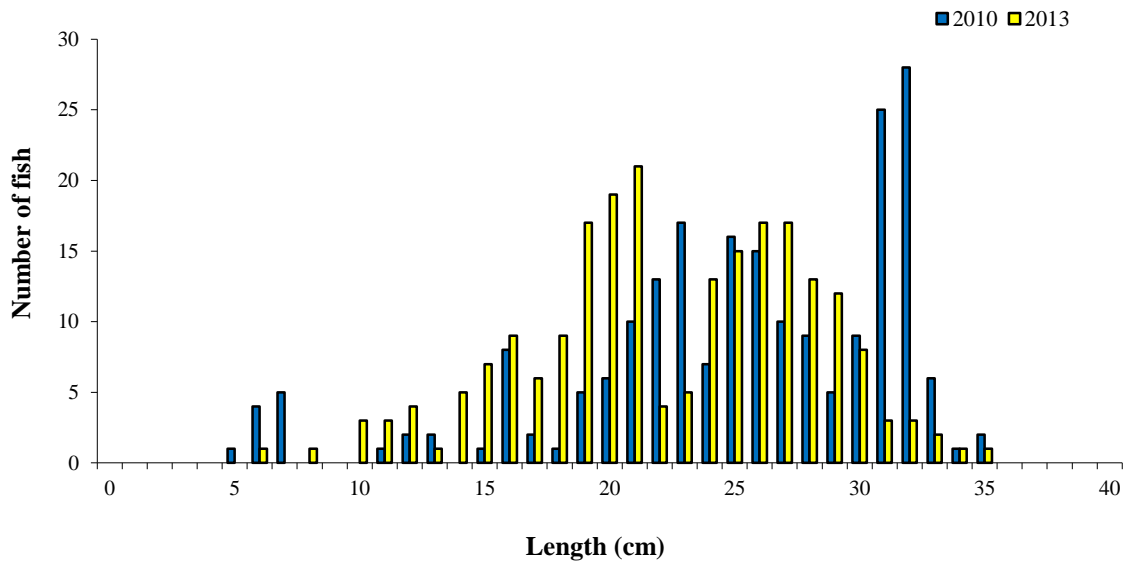
Brown trout captured in the 2013 survey ranged in length from 16.4cm to 49.5cm (mean = 25.2cm) (Fig. 1.7) with four age classes present, ranging from 1+ to 4+, with a mean L1 of 6.8cm (Table 1.3). The dominant age class was 2+ (Fig 1.7). Mean brown trout L4 was 37.5cm (Table 1.3) indicating a very fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971). Brown trout captured in the 2010 survey had a similar length range, age range, growth rate and dominant age class (Fig. 1.7).

Roach x bream hybrids ranged in length from 12.9cm to 42.5cm (age classes ranged from 6+ to 11+), pike ranged in length from 19.0cm to 91.5cm and eels ranged in length from 32.2cm to 68.5cm. One stone loach measuring 6.5cm was also captured.





**Fig. 1.5. Length frequency of perch captured on Lough Ree, 2010 and 2013**



**Fig. 1.6. Length frequency of roach captured on Lough Ree, 2010 and 2013**

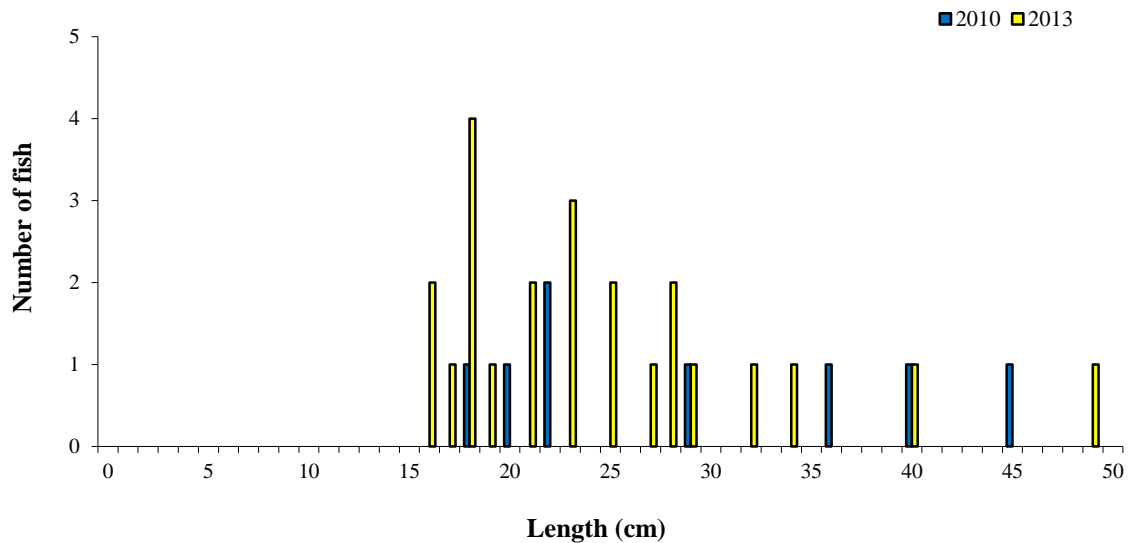


Fig. 1.7. Length frequency of brown trout captured on Lough Ree, 2010 and 2013

Table 1.3. Mean ( $\pm$ SE) brown trout length (cm) at age in Lough Ree, June 2013

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>
Mean	6.8 (0.3)	15.9 (0.7)	25.3 (1.7)	37.5
N	18	17	7	1
Range	4.5-9.3	10.4-20.0	20.0-31.2	37.5-37.5

Table 1.4. Mean ( $\pm$ SE) perch length (cm) at age for Lough Ree, June 2013

	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>
Mean	5.9 (0.1)	11.2 (0.2)	15.9 (0.2)	19.1 (0.3)	21.8 (0.3)	23.6 (0.3)	25.7 (0.4)	26.5 (0.6)
N	119	95	68	53	35	29	17	5
Range	3.9-8.3	7.2-15.2	11.0-20.0	13.7-23.7	17.3-25.6	18.9-26.5	22.4-28.5	24.7-28.1

Table 1.5 Mean ( $\pm$ SE) roach length (cm) at age for Lough Ree, June 2013

	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>
Mean	3.1 (0.1)	7.7 (0.2)	13.1 (0.3)	17.3 (0.3)	20.8 (0.3)	23.4 (0.3)	25.1 (0.4)	26.7 (0.6)
N	153	147	130	93	76	61	40	25
Range	1.5-6.9	4.4-13.5	8.1-19.8	10.3-22.9	13.5-25.2	18.8-26.9	20.9-28.2	22.6-30.1

Table 1.5 continued Mean ( $\pm$ SE) roach length (cm) at age for Lough Ree, June 2013

	L <sub>9</sub>	L <sub>10</sub>	L <sub>11</sub>	L <sub>12</sub>	L <sub>13</sub>	L <sub>14</sub>	L <sub>15</sub>
Mean	27.5 (0.3)	28.4 (0.3)	29.9 (0.7)	30.7 (0.4)	30.7 (0.8)	32.1	34.4
N	14	11	8	4	2	2	1
Range	24.1-32.9	26.9-29.6	28.4-30.8	29.4-32.3	30.3-31.1	31.3-32.9	34.4-34.4

## 1.4 Summary

Perch was the dominant species in terms of abundance (CPUE) and roach x bream hybrids were dominant in terms of biomass (BPUE) during the 2013 survey.

The mean brown trout CPUE and BPUE was significantly higher in 2013 than in 2010. Brown trout ranged in age from 1+ to 4+, indicating reproductive success in four of the previous five years, no 0+ fish were captured. The dominant age class was 2+. Length at age analyses revealed that brown trout in the lake exhibit a very fast rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

Although the mean perch CPUE and BPUE was lower in 2013 than in 2010, these differences were not statistically significant. The dominant age class of perch was 1+, with ages ranging from 0+ to 8+ indicating reproductive success in each of the previous nine years.

Although the mean roach CPUE was higher in 2013 than in 2010 and the mean roach BPUE was lower in 2013 than in 2010, these differences were not statistically significant. Roach ranged in age from 1+ to 15+, indicating reproductive success in 15 of the last 16 years. The dominant age class was 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, Lough Ree has been assigned an ecological status of Poor for both 2010 and 2013 based on the fish populations present.

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



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A dark blue geometric shape, resembling a stylized wave or a folded piece of paper, occupies the lower half of the page. It has a white dashed line pattern that flows across its surface. The shape is set against a white background.

**IFI Dublin,  
3044 Lake Drive,  
Citywest Business Campus,  
Dublin 24,  
Ireland**

**[www.fisheriesireland.ie](http://www.fisheriesireland.ie)  
[dublin@fisheriesireland.ie](mailto:dublin@fisheriesireland.ie)  
+353 1 8842 600**