Sampling Fish for the Water Framework Directive

Lakes 2010

Lough Ree

Iascach Intíre Éireann
Inland Fisheries Ireland

ACKNOWLEDGEMENTS

1.1 Introduction

Lough Ree (Plate 1.1, Fig. 1.1 and 1.2) is the third largest lake in the Republic of Ireland, after Lough Corrib and Lough Derg. 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 CaCO3).

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 lead 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.

Plate 1.1. Lough Ree

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

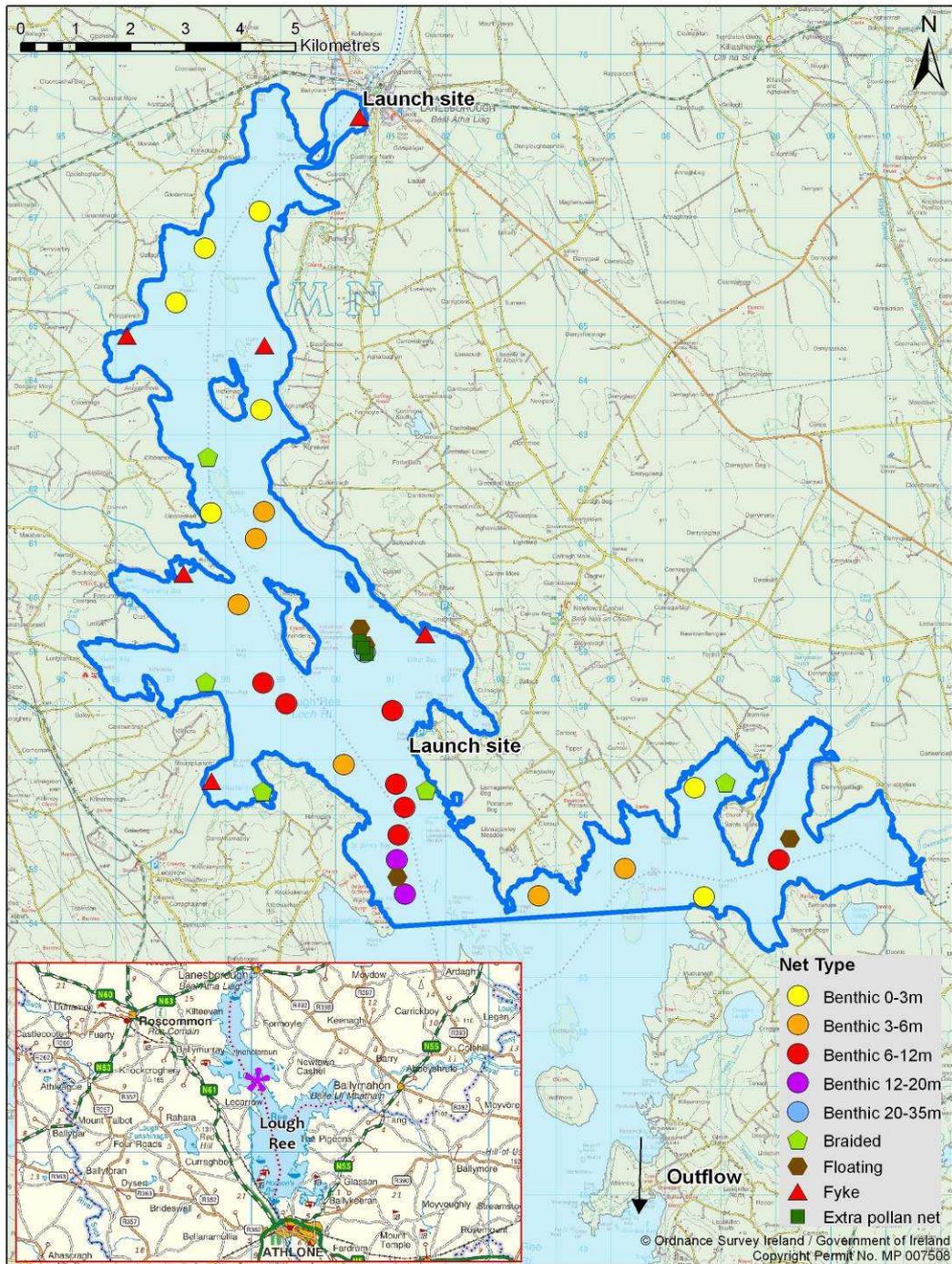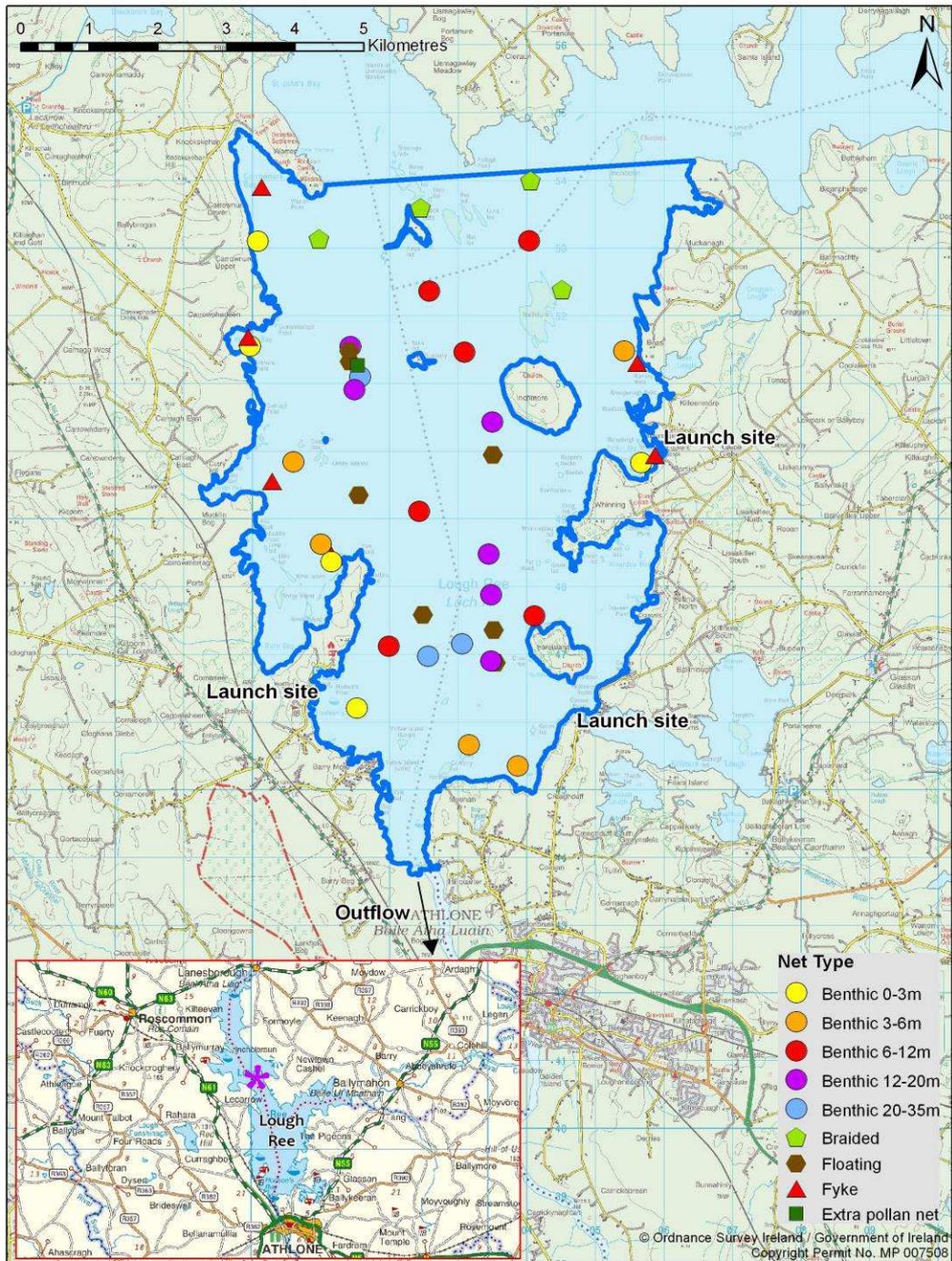**Fig. 1.2. Location map of the South of Lough Ree showing net locations and depths of each net (outflow is indicated on map)**

1.2 Methods

Lough Ree was surveyed over seven nights from the 15th to the 25th of June 2010. A total of 12 sets of Dutch fyke nets, 48 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (12 @ 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 (71 sites). The netting effort was supplemented using nine benthic braided survey gill nets (62.5mm mesh knot to knot) at nine additional sites and four pelagic monofilament multi-mesh (12 panel, 5-55mm mesh size) survey gill nets at four additional sites. Survey locations were randomly selected within each depth zone using a grid placed over a map of the lake. 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, bream, brown trout, pike, pollan, tench 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.

1.3 Results

1.3.1 Species Richness

A total of eight fish species and one type of hybrid were recorded in Lough Ree in June 2010, with 1,499 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, pollan and eels were also captured, along with small numbers of pike, bream and tench.

Table 1.1. Number of each fish captured by each gear type during the survey on Lough Ree, June 2010

Scientific name	Common name	Number of fish captured					
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Pelagic mono multimesh gill nets	Benthic braided gill nets	Fyke nets	Total
Perca fluviatilis	Perch	990	0	0	4	1	995
Rutilus rutilus	Roach	166	3	0	42	0	211
Rutilus rutilus x Abramis brama	Roach x Bream hybrid	48	0	0	102	0	150
Anguilla anguilla	European eel	0	0	0	0	111	111
Coregonus autumnalis	Pollan	6	4	5	0	0	15
Salmo trutta	Brown trout	4	2	0	2	0	8
Esox lucius	Pike	6	0	0	1	0	7
Abramis brama	Bream	1	0	0	0	0	1
Tinca tinca	Tench	0	0	0	0	1	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 are summarised in Table 1.2.

The differences in the mean brown trout CPUE between Lough Ree and four other similar lakes were assessed and found to be statistically significant (Kruskal-Wallis, $P<0.01$) (Fig. 1.2). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Ree had a significantly lower mean brown trout CPUE than Lough Derg ($z = -3.116$, $P<0.01$).

The differences in the mean perch CPUE between Lough Ree and four other similar lakes were assessed and found to be statistically significant (Kruskal-Wallis, $P<0.001$) (Fig. 1.3). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Ree had a significantly higher mean perch CPUE than Lough Derg ($z = -2.200$, $P<0.05$) and a significantly lower mean p erch CPUE than Lough Owel ($z = -2.014$, $P<0.05$).

The differences in the mean roach CPUE between Lough Ree and four other similar lakes were assessed and found to be statistically significant (Kruskal-Wallis, $P<0.001$) (Fig. 1.4). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Ree had a significantly higher mean roach CPUE than Lough Owel ($z = -4.259$, $P<0.001$).

Although pollan are known to be present in Lough Derg, none were captured during the most recent survey in 2009. Therefore, the difference in the mean pollan CPUE between Lough Ree and Lough

Allen (2005 survey) was assessed, with no significant difference being found. However, it should be noted that this analysis is based on limited data from a small number of pollan captured in each lake.

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured in Lough Ree, June 2010

Scientific name	Common name	
		Mean CPUE
Perca fluviatilis	Perch	0.399 (0.065)
Rutilus rutilus	Roach	0.086 (0.015)
Rutilus rutilus x Abramis brama	Roach x Bream hybrid	0.065 (0.021)
Coregonus autumnalis	Pollan	0.005 (0.002)
Salmo trutta	Brown trout	0.003 (0.001)
Esox lucius	Pike	0.003 (0.001)
Abramis brama	Bream	0.0004 (0.0004)
Tinca tinca	Tench	0.0002 (0.0002)
Anguilla anguilla	European eel	0.154 (0.043)
		Mean BPUE
Rutilus rutilus x Abramis brama	Roach x Bream hybrid	42.529 (13.014)
Rutilus rutilus	Roach	35.342 (6.094)
Perca fluviatilis	Perch	28.610 (4.943)
Esox lucius	Pike	4.342 (2.214)
Salmo trutta	Brown trout	1.611 (0.090)
Coregonus autumnalis	Pollan	0.496 (0.203)
Abramis brama	Bream	0.726 (0.726)
Tinca tinca	Tench	0.241 (0.241)
Anguilla anguilla	European eel	28.646 (7.976)

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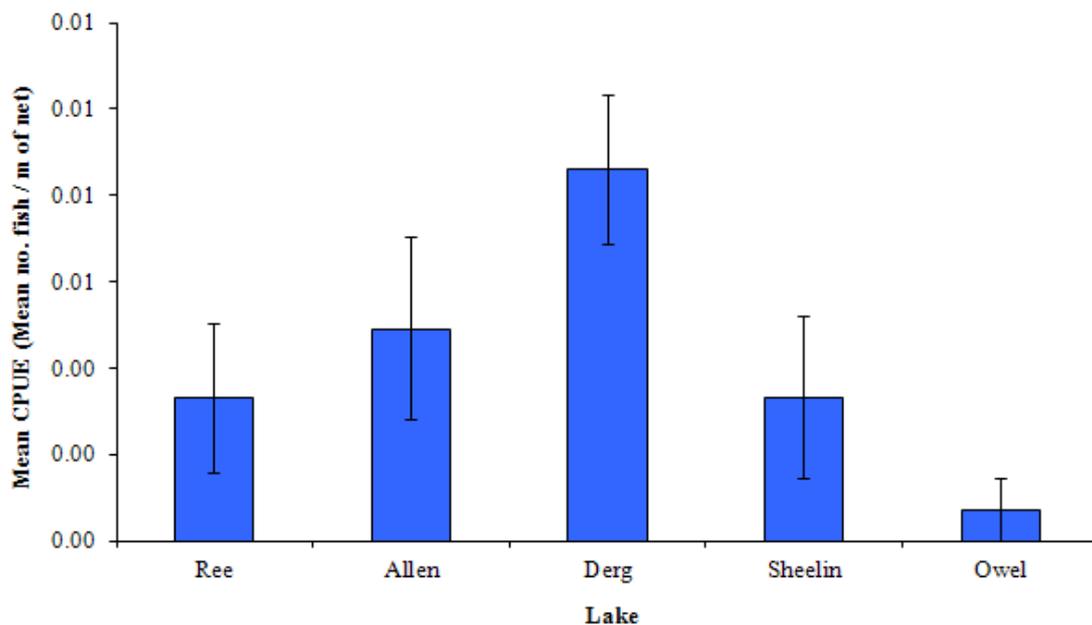

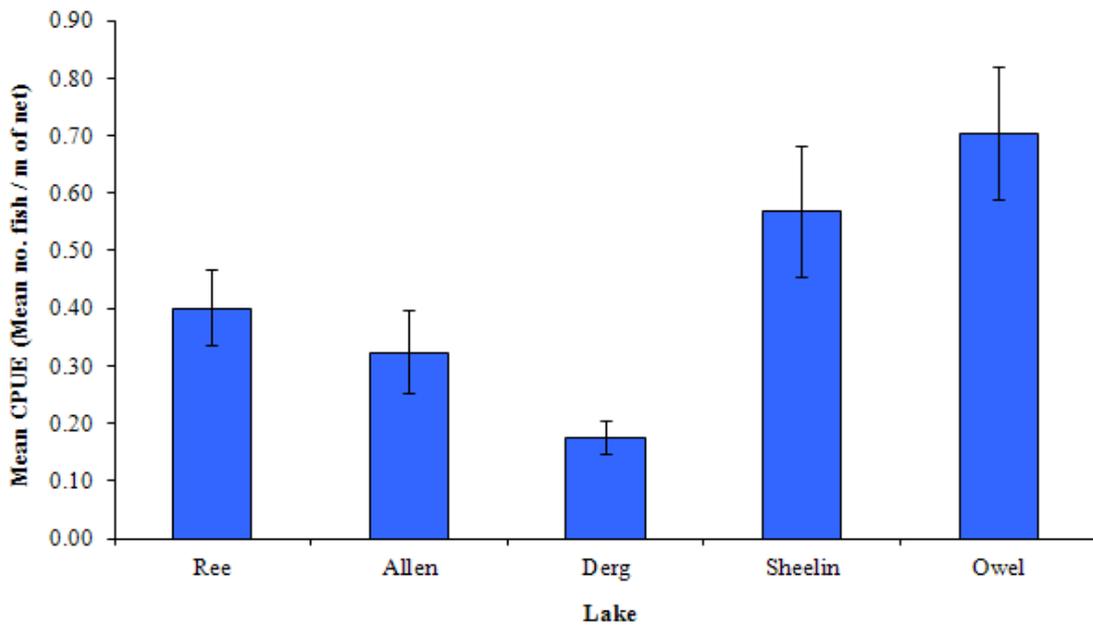**Fig. 1.2. Mean (±S.E.) brown trout CPUE in five lakes surveyed during 2010**

Fig. 1.3. Mean (±S.E.) perch CPUE in five lakes surveyed during 2010
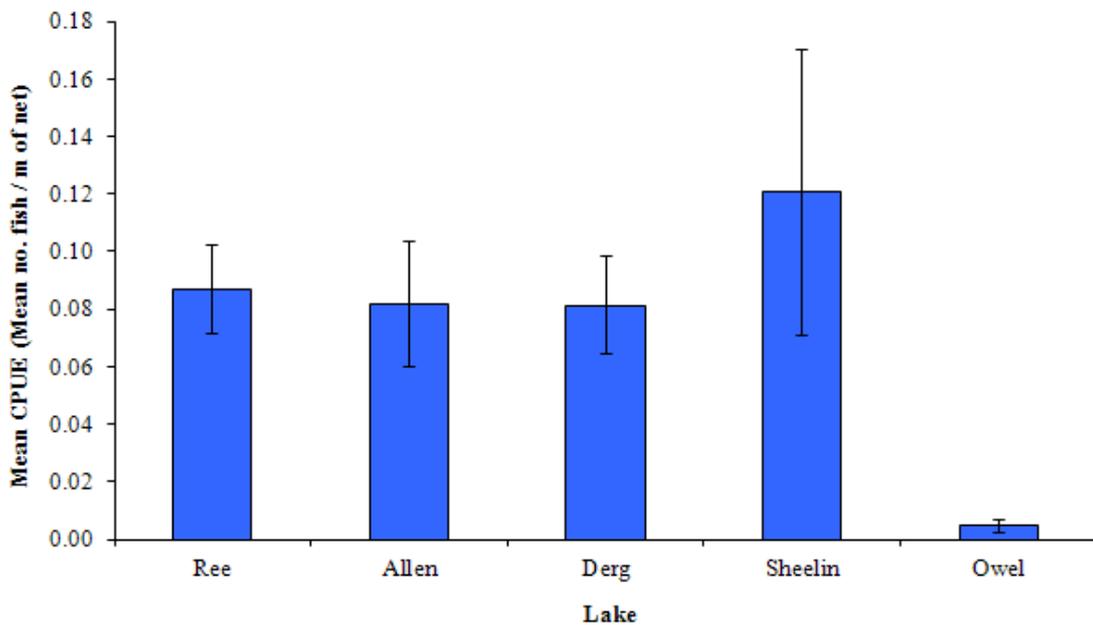

Fig. 1.4. Mean (±S.E.) roach CPUE in five lakes surveyed during 2010

1.3.3 Length frequency distributions

Perch ranged in length from 3.2cm to 31.0cm (mean = 13.9cm) (Fig. 1.4). Roach ranged in length from 5.2cm to 35.1cm (mean = 25.4cm) (Fig. 1.5). Roach x bream hybrids ranged in length from

20.8cm to 41.9cm. Pollan ranged in length from 13.8 cm to 26cm (Fig. 1.6). Brown trout ranged in length from 18.8cm to 45.2cm, pike ranged in length from 29.5cm to 73.3cm and eels ranged in length from 34.5cm to 59.5cm. One bream measuring 42.0cm and one tench measuring 40.2cm were also captured.
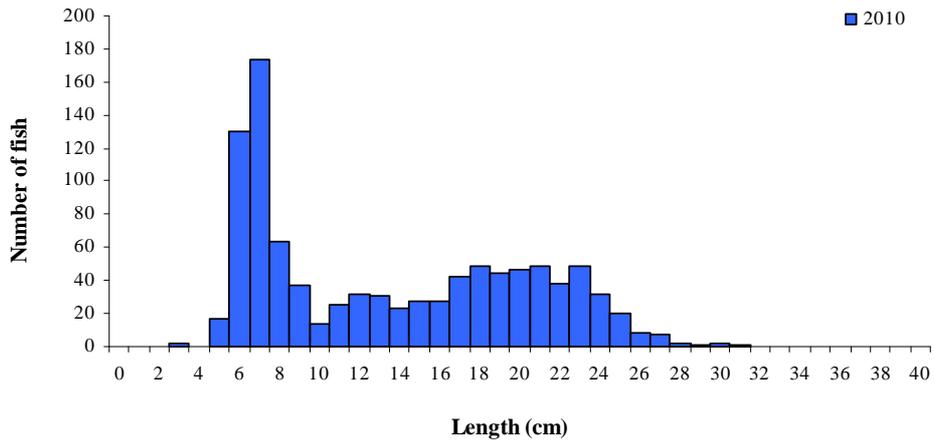
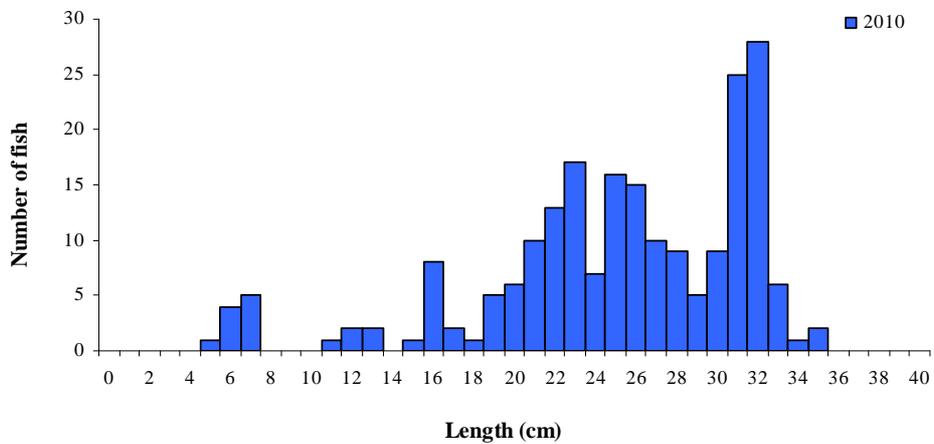**Fig. 1.4. Length frequency of perch captured on Lough Ree**
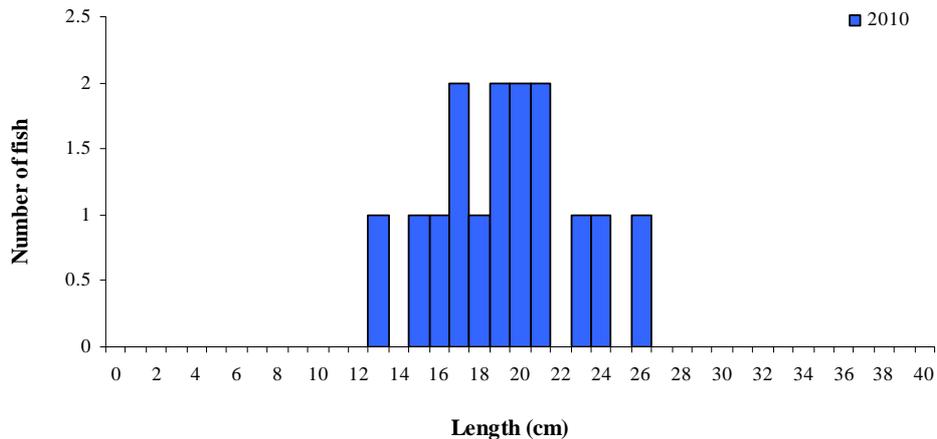
Fig. 1.5. Length frequency of roach captured on Lough Ree

Fig. 1.6. Length frequency of pollan captured on Lough Ree

1.3.4 Fish age and growth

Five age classes of brown trout were present, ranging from 1+ to 5+, with a mean L1 of 6.5cm (Table 1.3). Mean brown trout L4 was 31.0cm (Table 1.3) indicating a fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971).

Nine age classes of perch were present, ranging from 0+ to 8+, with a mean L1 of 5.6cm (Table 1.4). The dominant age class was 1+ corresponding to the 5cm to 10cm length class (Fig. 1.4).

Twelve age classes of roach were present, ranging from 1+ to 14+. Nine age classes of roach x bream hybrids were present, ranging from 4+ to 13+, four age classes of pike were present, ranging from 2+ to 6+ and the single bream captured was aged 11+. All pollan captured were aged 1+ or 2+.

Table 1.3. Mean (±SE) brown trout length (cm) at age in Lough Ree, July 2010

	L_1	L_2	L_3	L_4	L_5
Mean	6.5 (0.7)	13.5 (1.3)	22.2 (2.6)	31.0 (1.8)	42.5
N	8	7	5	2	1
Range	4.6-11.2	9.8-18.3	17.2-31.5	29.2-32.8	42.5-42.5

Table 1.4. Mean (±SE) perch length (cm) at age for Lough Ree, July 2010

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8
Mean	5.6 (0.1)	10.7 (0.2)	15.8 (0.3)	19.7 (0.3)	22.4 (0.4)	24.1 (0.5)	26.1 (0.9)	27.9 (1.7)
N	122	94	72	56	40	27	8	2
Range	3.4-7.8	6.7-17.3	11.0-22.1	15.6-25.6	17.0-26.3	19.2-29.3	21.2-29.3	26.1-29.5

1.4 Summary

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

The mean brown trout CPUE was significantly lower in Lough Ree than in Lough Derg, but was not significantly different to the other three lakes assessed. Length at age analyses revealed that brown trout in the lake exhibit a fast rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

The mean perch CPUE in Lough Ree was significantly higher than in Lough Derg, but significantly lower than in Lough Owel.. 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.

The mean roach CPUE in Lough Ree was comparable to three of the other lakes assessed, however it was significantly higher than the mean roach CPUE in Lough Owel. Roach ranged in age from 1+ to 14+, indicating reproductive success in 12 of the last 14 years, however, no 2+ or 8+ fish were captured.

The capture of pollan during the current netting survey is encouraging, with several age classes demonstrating reproductive success over the past number of years. A concurrent hydroacoustic survey was conducted to assess the current status of the pollan population in Lough Ree and this work will be published separately (Harrison *et al.*, In Press). Although the mean pollan CPUE was higher in Lough Ree than in Lough Allen, this was not statistically significant, with CPUE figures being based on limited data from a small number of fish captured during the netting surveys. Nevertheless, results from the hydroacoustic survey suggest that the pollan population in Lough Ree might be larger than previously thought.

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. Using the FIL2 classification tool, Lough Ree has been assigned an ecological status of Poor/Bad based on the fish populations present.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Lough Ree an overall ecological status of Moderate, based on all monitored physic0-chemical and biological elements, including fish. This status classification will be revised at the end of 2012.

1.5 References

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