Sampling Fish for the Water Framework Directive

Lakes 2012

Lough Cullin

Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Lough Cullin, July 2012

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1.1 Introduction

Lough Cullin is a large, shallow lake situated to the west of Foxford, which is connected to Lough Conn by a narrow inlet at Pontoon, Co. Mayo (Plate 1.1, Fig. 1.1). The outflow from the lake discharges directly into the River Moy south-west of Foxford (NPWS, 2004). Lough Cullin has a surface area of 1019.3ha with a maximum depth of approximately 3m (O' Reilly 2007). The underlying geology of the lake is mainly granite with some areas of limestone present in the southern region of the catchment (NPWS, 2004). The lake is categorised as typology class 10 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. shallow (<4m), greater than 50ha and high alkalinity (>100mg/l $CaCO_3$).

Lough Cullin is located within the River Moy Special Area of Conservation (NPWS, 2005). The underlying geology of the majority of the site is Carboniferous limestone, with areas of Carboniferous sandstone, Dalradian quartzites and schists also present. Some of the tributaries at the east and south of Lough Conn, and all in Lough Cullin are underlain by granite. The site has been selected as a candidate SAC for containing alluvial wet woodlands, raised bog, old oak woodlands (present on the shores of Lough Cullin), degraded raised bog and Rhynchosporion depressions (*Rhynchospora alba)*, all priority habitats on Annex I of the E.U. Habitats Directive. This SAC has also been selected due to the presence of the following species, listed on Annex II of the same Directive – Atlantic salmon, otter, sea and brook lamprey and white-clawed crayfish (NPWS, 2005). Lough Cullin is a moderately hard water lake with relatively low colour and good water clarity. The phytoplankton in the lake is dominated by diatoms and blue-green algae (NPWS, 2005). Lough Cullin also supports important concentrations of wintering waterfowl and is designated as a Special Protection Area, as one of the few breeding sites for Common Scoter in Ireland (NPWS, 2005).

Lough Cullin was once regarded as one of Ireland's premier brown trout fisheries, but was often considered to be the 'poor relation' of Lough Conn. Historically, in angling terms, Lough Cullin was noted for supporting a large population of relatively small (<0.5kg) brown trout (O' Grady and Delanty, 2001). Today brown trout averaging 0.3kg to 0.45kg are often caught, with some weighing up to 1.8kg (O' Reilly 2007). The lake was also regarded as a very important salmon fishery and receives a run of salmon during the spring and summer months (NPWS, 2004; O' Reilly 2007). In fact, all the salmon, of which there can be many, destined for Lough Conn and its inflowing rivers must pass through Lough Cullin.

Lough Cullin was previously surveyed by Inland Fisheries Ireland (IFI) (previously the Central Fisheries Board and the North Western Regional Fisheries Board) in 1994, 1998 and 2001 (O' Grady and Delanty,

2001). These surveys revealed that the brown trout population declined dramatically between 1995 and 2001. Eutrophication problems have been evident in the lake in recent years. There has been a population of rudd in the lake since the 1960s; however roach, a highly prolific non-native species, became established in the lake in the 1990s (O' Grady and Delanty, 2001).

The lake was also previously surveyed in July 2009 as part of IFIs Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2010). During this survey, roach were found to be the dominant species present in the lake. Perch, brown trout, tench, pike and eels were also captured during the survey.
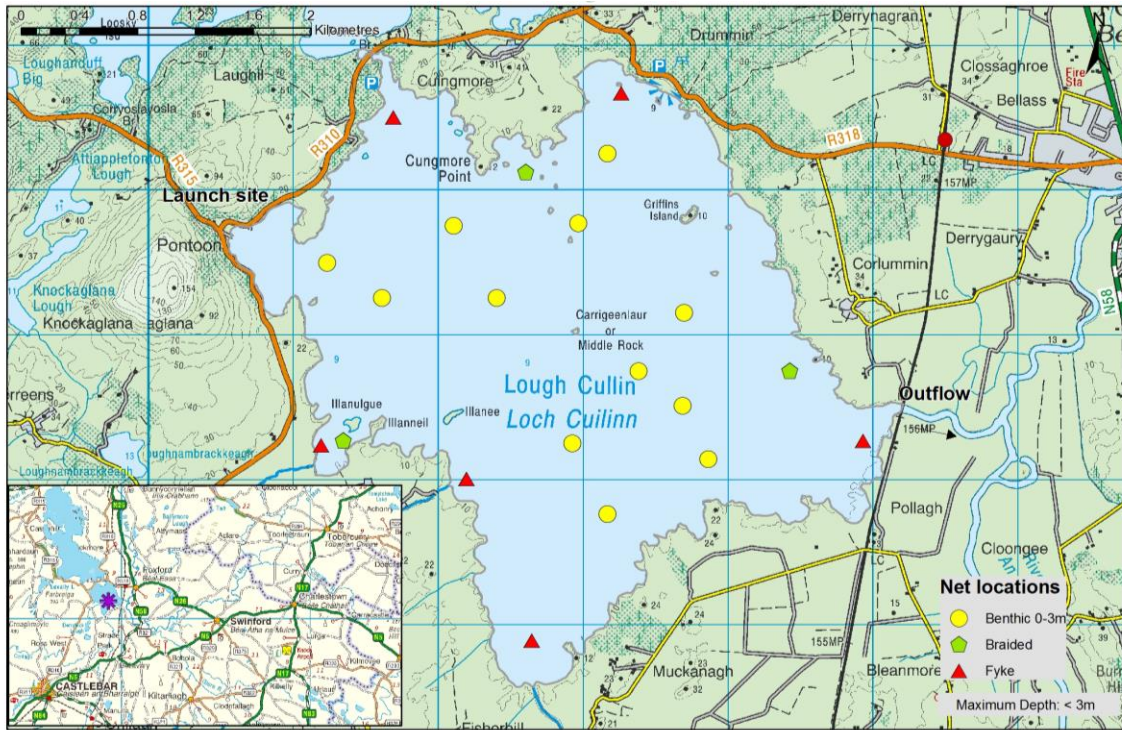

Plate 1.1. Lough Cullin

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

1.2 Methods

Lough Cullin was surveyed over two nights between the 16th and the 18th of July 2012. A total of six sets of Dutch fyke nets and 12 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (12 @ 0-2.9m) were deployed randomly in the lake (18 sites). The netting effort was supplemented using three benthic braided (62.5mm mesh knot to knot) survey gill nets at three additional sites. Nets were deployed in the same locations as were randomly selected in the previous survey in 2009. 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 trout and roach. 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 returned to the laboratory for further analysis.

1.3 Results

1.3.1 Species Richness

A total of six fish species were recorded on Lough Cullin in July 2012, with 587 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Roach was the most abundant fish species recorded, followed by perch, brown trout, eels, tench and three-spined stickleback. During the previous survey in 2009 the same species composition was recorded with the exception of three-spined stickleback, which were present during the 2012 survey but were not captured in 2009 and pike, which were present during the 2009 survey but were not captured in 2012 (Kelly *et al.*, 2010).

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Cullin, July 2012

Scientific name	Common name	Number of fish captured			
		Benthic mono multimesh gill nets	Benthic braided gill nets	Fyke nets	Total
Salmo trutta	Brown trout	10	0	0	10
Rutilus rutilus	Roach	413	0	7	420
Perca fluviatilis	Perch	85	1	0	86
Gasterosteus aculeatus	Three-spined stickleback	1	0	0	1
Tinca tinca	Tench	0	0	2	2
Anguilla anguilla	European eel	1	0	67	68

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 2009 and 2012 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 brown trout CPUE and BPUE were lower in 2012 than in 2009, these differences were not statistically significant (Fig. 1.2 and Fig. 1.3).

The differences in the mean brown trout CPUE and BPUE between Lough Cullin and six similar lakes was assessed, with overall significant differences being found (Kruskal-Wallis, P<0.05) (Fig. 1.4 and Fig. 1.5). However, Independent-Samples Mann-Whitney U tests between each lake showed that Lough Cullin was not significantly different from the other similar lakes surveyed (Fig. 1.4 and Fig. 1.5).

The mean roach CPUE was also higher in 2012 than in 2009, this difference was not statistically significant (Fig. 1.2).

The differences in the mean roach CPUE between Lough Cullin and three similar lakes was assessed, with an overall significant difference being found (Kruskal-Wallis, P<0.05) (Fig. 1.6). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Cullin had a significantly higher mean roach CPUE than Lough Arrow (z = 3.924, P<0.05), Lough Derg (z = 3.306, P<0.05) and Lough Mask (z = 3.906, P<0.05).

Although the mean roach BPUE appeared slightly lower in 2012 than in 2009, this difference was not statistically significant (Fig. 1.3).]

The differences in the mean roach BPUE between Lough Cullin and three similar lakes was assessed, with an overall significant differences being found (Kruskal-Wallis, P<0.05) (Fig. 1.7). Independent-Samples Mann-Whitney U tests between each lake also showed that Lough Cullin had a significantly higher mean roach BPUE Lough Arrow (z = 3.937, P<0.05), Lough Derg (z = 2.844 P<0.05) and Lough Mask (z = 3.619, P<0.05).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Cullin, 2009 and 2012

Scientific name	Common name	2009	2012
		Mean CPUE	
Salmo trutta	Brown trout	0.022 (0.011)	0.016 (0.009)
Rutilus rutilus	Roach	0.597 (0.130)	0.661 (0.142)
Perca fluviatilis	Perch	0.118 (0.031)	0.137 (0.047)
Gasterosteus aculeatus	Three-spined stickleback	-	0.002 (0.002)
Tinca tinca	Tench	0.002 (0.002)	0.002 (0.001)
Exos lucius	Pike	0.002 (0.002)	-
Anguilla anguilla	European eel	0.133 (0.076)	0.186 (0.086)
		Mean BPUE	
Salmo trutta	Brown trout	7.766 (3.940)	2.666 (1.302)
Rutilus rutilus	Roach	77.660 (17.373)	76.413 (16.530)
Perca fluviatilis	Perch	1.937 (0.751)	6.266 (2.030)
Gasterosteus aculeatus	Three-spined stickleback	-	0.004 (0.004)
Tinca tinca	Tench	-	0.505 (0.354)
Exos lucius	Pike	2.238 (2.238)	-
Anguilla anguilla	European eel	31.883 (19.451)	21.786 (10.209)

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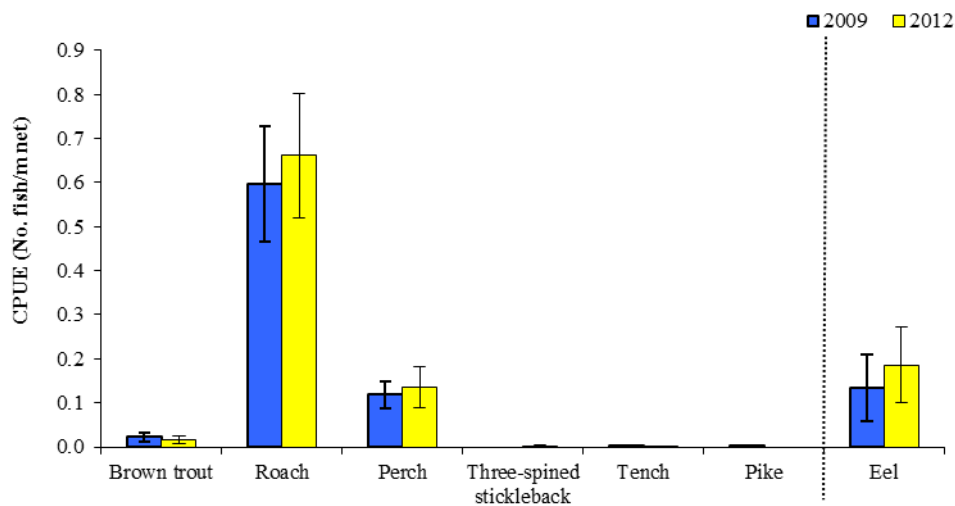

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Lough Cullin (Eel CPUE based on fyke nets only), 2009 and 2012
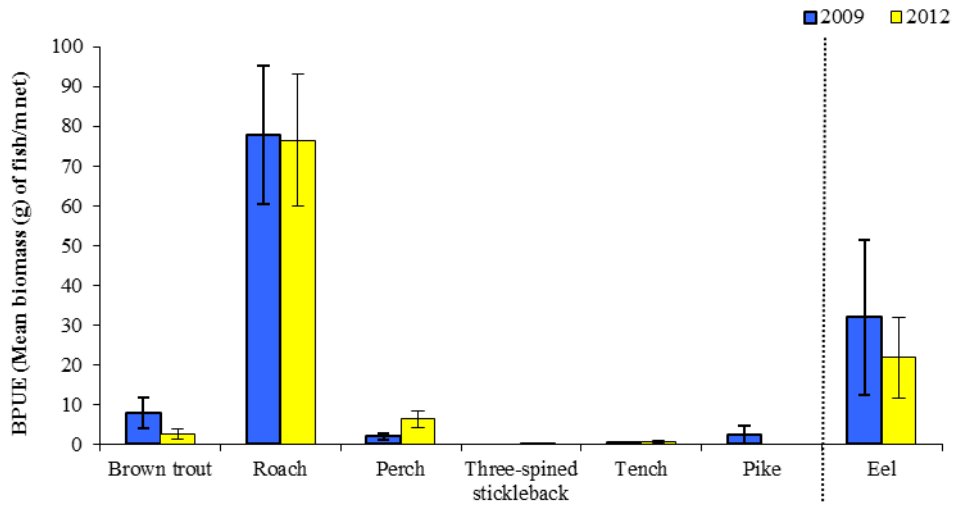
Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lough Cullin (Eel BPUE based on fyke nets only), 2009 and 2012
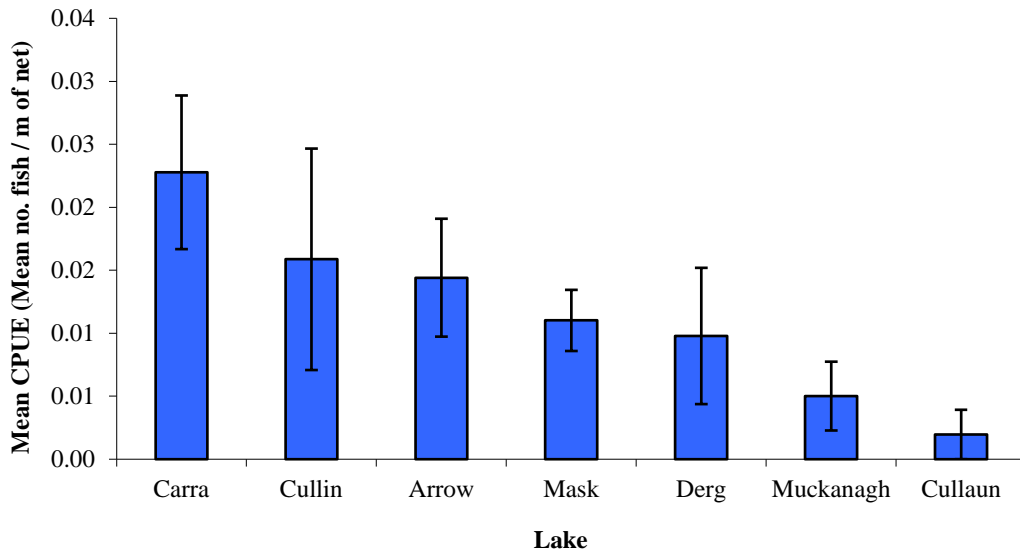

Fig. 1.4. Mean (±S.E.) brown trout CPUE in seven lakes surveyed during 2012
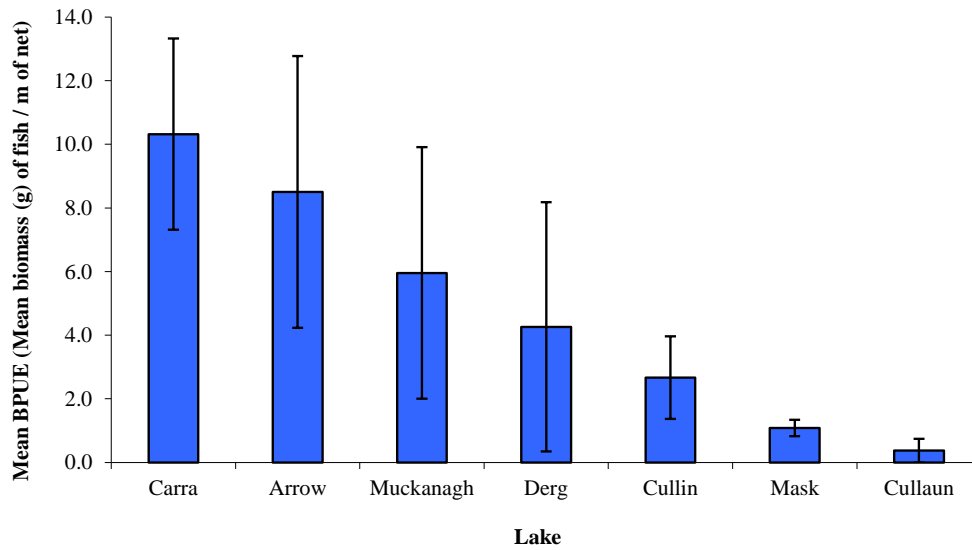
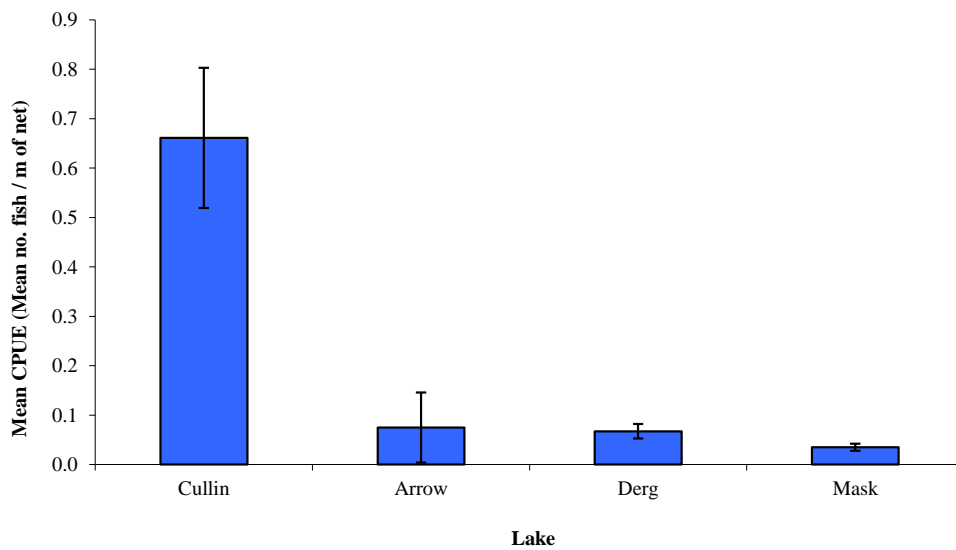**Fig. 1.5. Mean (±S.E.) brown trout BPUE in seven lakes surveyed during 2012**

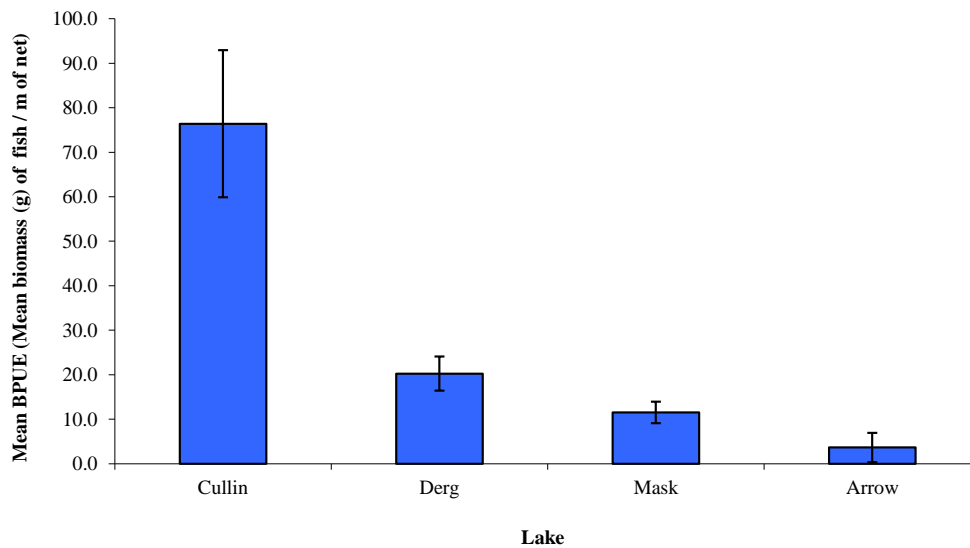**Fig. 1.6. Mean (±S.E.) roach CPUE in four lakes surveyed during 2012**

Fig. 1.7. Mean (±S.E.) roach BPUE in four lakes surveyed during 2012

1.3.3 Length frequency distributions

Brown trout captured during the 2012 survey ranged in length from 16.8cm to 29.9cm (mean = 23.0cm) (Fig. 1.6). Brown trout captured during the 2009 survey ranged in length from 17.5cm to 51.8cm (Fig. 1.6).

Roach captured during the 2012 survey ranged in length from 6.0cm to 26.5cm (mean = 17.4cm) (Fig. 1.7). Roach captured during the 2009 survey had lengths ranging from 7.0cm to 30.2cm (Fig. 1.7).

Perch captured during the 2012 survey ranged in length from 3.9cm to 34.0cm (mean = 9.8cm) (Fig. 1.8). Perch captured during the 2009 survey ranged in length from 4.9cm to 28.6cm (Fig. 1.8).

Eels captured during the 2012 survey ranged in length from 30.4cm to 62.5cm, one three-spined stickleback was recorded at 4.0cm and two tench were recorded at 24.7cm and 27.8cm.
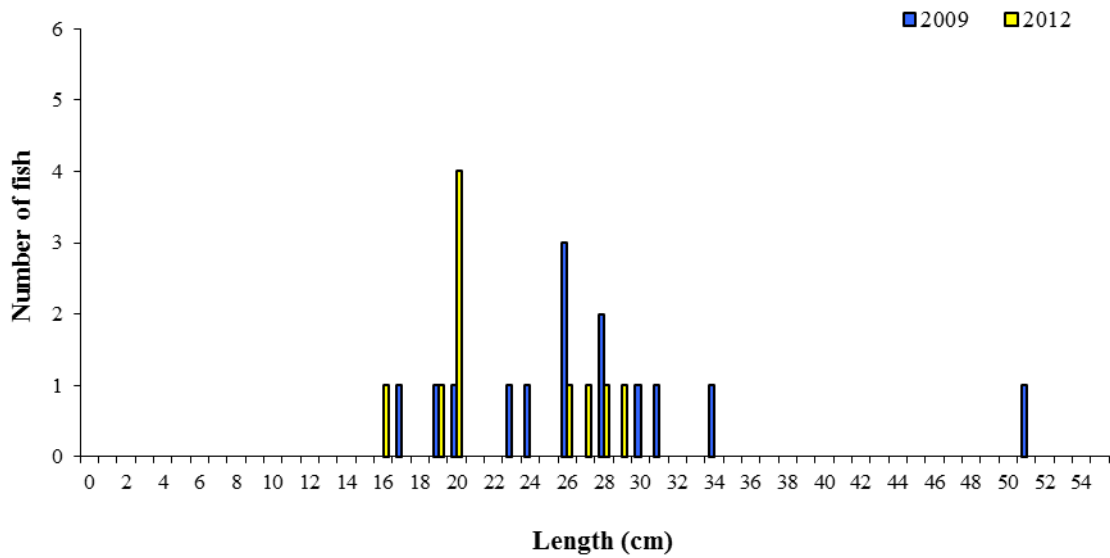
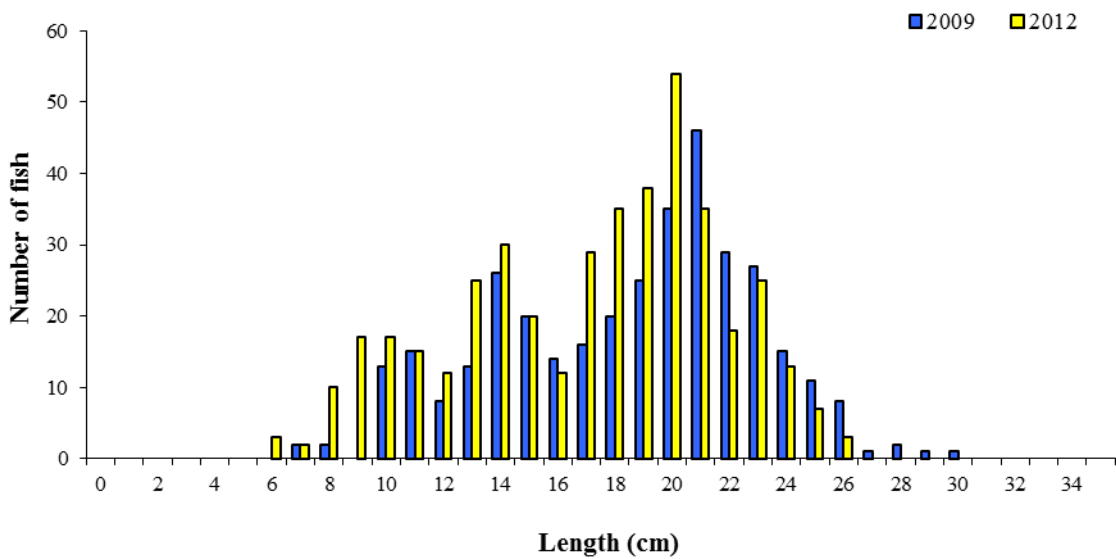**Fig. 1.6. Length frequency of brown trout captured on Lough Cullin, 2009 and 2012**

Fig. 1.7. Length frequency of roach captured on Lough Cullin, 2009 and 2012
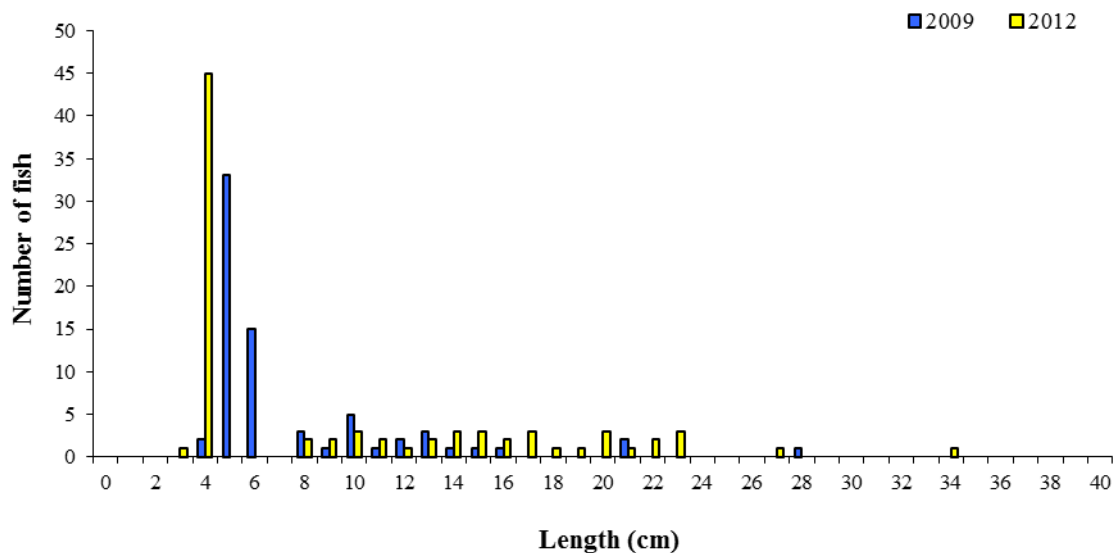
Fig. 1.8. Length frequency of perch captured on Lough Cullin, 2009 and 2012

1.3.4 Fish age and growth

Three age classes of brown trout were present, ranging from 1+ to 3+, with a mean L1 of 6.8cm (Table 1.3). In the 2009 survey, brown trout ranged from 1+ to 6+ with a mean L1 of 8.2cm.

Nine age classes of roach were present, ranging from 2+ to 10+, with a mean L1 of 2.2cm (Table 1.4). In the 2009 survey, roach ranged from 1+ to 9+ with a mean L1 of 3.4cm.

Seven age classes of perch were present, ranging from 0+ to 7+, with a mean L1 of 6.4cm (Table 1.5). The dominant age class was 0+ (Fig. 1.8). In the 2009 survey, perch ranged from 0+ to 9+ with a mean L1 of 6.4cm.

Table 1.3. Mean (±SE) brown trout length (cm) at age for Lough Cullin, July 2012

	L_1	L_2	L_3
Mean	6.8 (0.5)	16.1 (2.5)	22.7 (0)
N	7	6	1
Range	4.7-9.5	12.2-28.4	22.7-22.7

Table 1.4. Mean (±SE) roach length (cm) at age for Lough Cullin, July 2012

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}
Mean	2.2	5.7	10.4	14.5	17.5	19.5	21.9	23.2	24.0	25.3
	(0.0)	(0.1)	(0.2)	(0.2)	(0.2)	(0.2)	(0.3)	(0.3)	(0.5)	(0.4)
N	87	87	75	57	48	44	28	19	7	3
Range	1.4-3.2	3.5-8.8	7.0-13.6	10.9-17.6	14.2-20.1	15.3-22.8	19.0-25.8	20.9-25.3	21.4-25.5	24.6-26.1

Table 1.5. Mean (±SE) perch length (cm) at age for Lough Cullin, July 2012

	L_1	L_2	L_3	L_4	L_5	L_6	L_7
Mean	6.4 (0.1)	12.0 (0.2)	16.4 (0.4)	20.5 (0.8)	23.5 (1.3)	31.3	33.7
N	35	29	21	9	5	1	1
Range	5.0-9.6	9.9-14.7	13.7-20.2	17.3-24.7	21.6-28.5	31.3-31.3	33.7-33.7

1.4 Summary

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

Although the mean brown trout CPUE and BPUE in Lough Cullin appeared slightly lower in 2012 than in the 2009 survey, these differences were not statistically significant. The mean brown trout CPUE and BPUE in Lough Cullin was similar to the other lakes assessed during 2012, with no statistically significant differences being found between lakes. Brown trout ranged in age from 1+ to 3+, indicating reproductive success in three of the previous four years.

The mean roach CPUE and BPUE in Lough Cullin was slightly different in 2012 than in the 2009 survey, however these differences were not statistically significant. The mean roach CPUE and BPUE in Lough Cullin was significantly higher than Lough Arrow, Lough Derg and Lough Mask, other similar lakes surveyed. Roach ranged in age from 2+ to 10+, indicating reproductive success in nine of the previous eleven years.

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 Cullin has been assigned an ecological status of Poor based on the fish populations present in 2012. The ecological status assigned to the lake based on the 2009 survey data was also Poor.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Lough Cullin 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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