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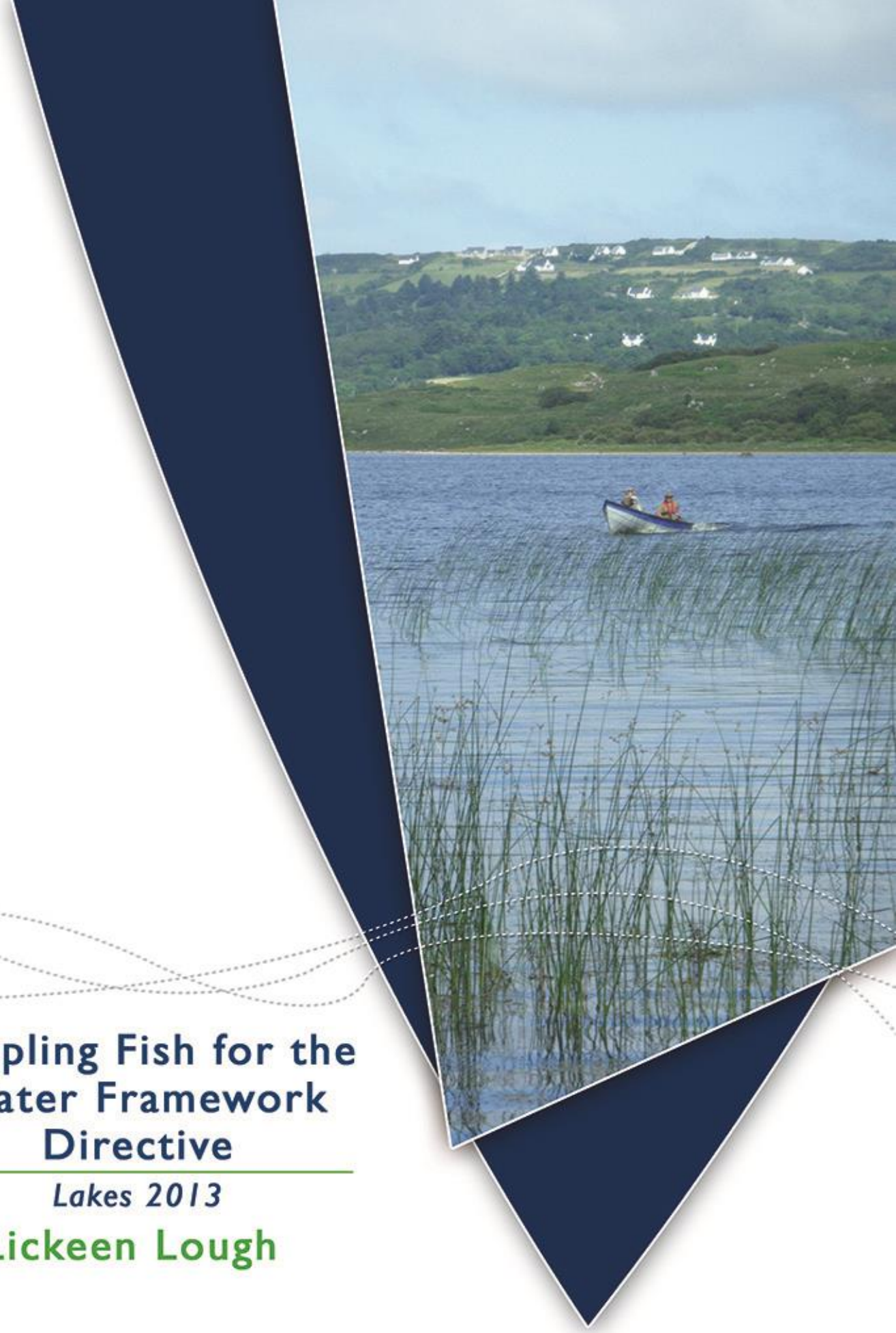

Sampling Fish for the Water Framework Directive

Lakes 2013

Lickeen Lough

Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Lickeen Lough, September 2013

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

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1.1 Introduction

Lickeen Lough is situated in the Inagh catchment in Co. Clare, approximately 3km north-east of Ennistymon (Plates 1.1 and 1.2, Fig. 1.1). It has a surface area of 84ha, a mean depth >4m, a maximum depth of 20m and is characterised as typology class 8 (as designated by the EPA for the Water Framework Directive), i.e. deep (>4m), greater than 50ha and moderately alkaline (20-100mg/l $CaCO_3$).

Historically, Lickeen Lough held a stock of Arctic char (O' Reilly, 2007). However the population is now extinct in the lake. A substantial fish kill (effecting brown trout, rainbow trout and perch) occurred in the lake in June 1998, which may have contributed to their demise. Wild brown trout up to 2.3kg are taken from the lake by anglers and it is stocked annually with rainbow trout by the Lickeen Lough Trout Anglers Co-operative. The lake is subject to water abstraction, supplying drinking water to North County Clare (Lickeen Lough Trout Anglers Co-operative, 2010).

Lickeen Lough was previously surveyed in 2007 and 2010 as part of the WFD surveillance monitoring programme (Kelly and Connor, 2007 and Kelly *et al.*, 2011). During the 2010 survey rudd were found to be the dominant species present in the lake. Brown trout, three spined stickleback and eels were also captured during the survey.

During the 2010 survey, an extensive algal bloom was visible on the lake (Plates 1.3 and 1.4), however this was not visible during the 2013 survey.

Plate 1.1 and 1.2 Lickeen Lough

Plate 1.3 and 1.4 Algal bloom on Lickeen Lough, September 2010

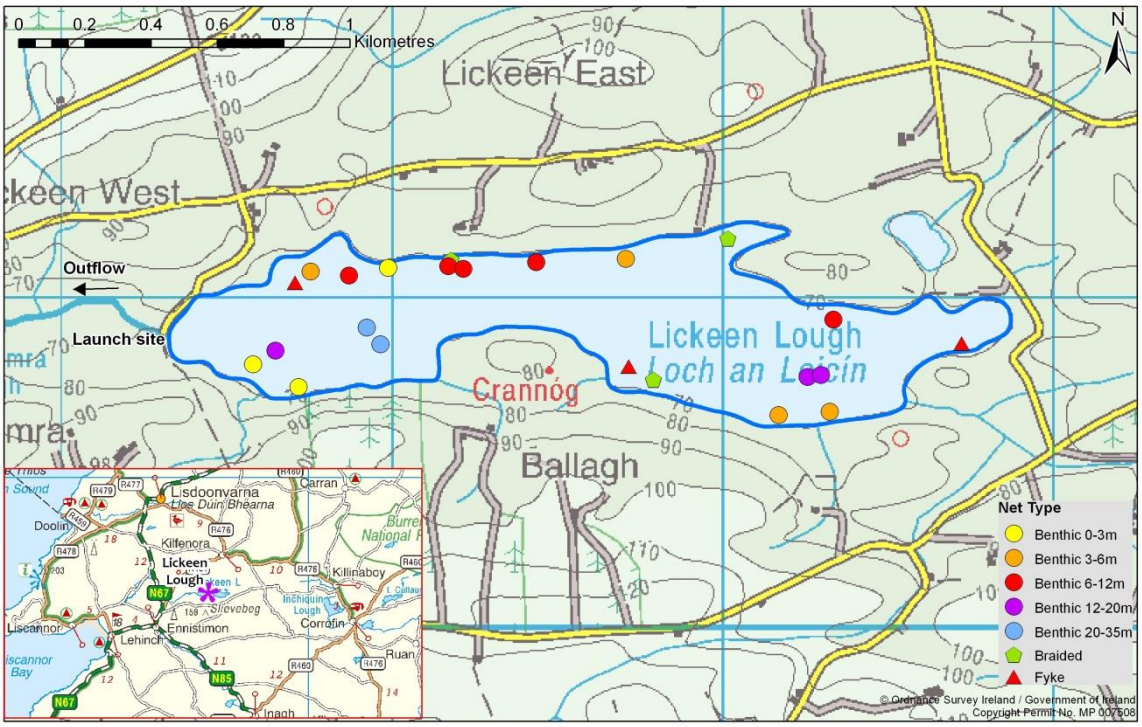

Fig. 1.1. Location map of Lickeen Lough showing net locations and depths of each net (outflow is indicated on map)

1.2 Methods

Lickeen Lough was surveyed over two nights from the 10th to the 12th of September 2013. A total of three sets of Dutch fyke nets and 17 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (3 @ 0-2.9m, 4 @ 3-5.9m, 5 @ 6-11.9m, 3 @ 12-19.9m and 2 @ 20-34.9m) were deployed in the lake (20 sites). The netting effort was supplemented using three benthic braided survey gill nets (62.5mm mesh knot to knot) at three 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 were measured and weighed on site and scales were removed from all brown trout and rudd. 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 four fish species were recorded in Lickeen Lough in September 2013, with 120 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Rudd was the most abundant fish species recorded, followed by brown trout, eels and three-spined stickleback. During the previous surveys in 2010 and 2007 the same species composition was recorded.

Table 1.1. Number of each fish species captured by each gear type during the survey on Lickeen Lough, September 2013

Scientific name	Common name	Number of fish captured			
		Benthic mono multimesh gill nets	Benthic braided gill nets	Fyke nets	Total
Scardinius erythrophthalmus	Rudd	68	0	1	69
Salmo trutta	Brown trout	34	0	3	37
Anguilla anguilla	European eel	0	0	9	9
Gasterosteus aculeatus	Three-spined stickleback	1	0	4	5

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 1.2 and 1.3.

Rudd was the dominant species in terms of abundance (CPUE) and biomass (BPUE).

Although the mean rudd CPUE and BPUE fluctuated over the three years, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3).

The mean brown trout CPUE was significantly lower in 2010 and 2013 than in 2007 (Mann Whitney U test, $z = -2.394$, $P<0.05$ and $z = -2.003$, $P<0.05$) and mean brown trout BPUE was also significantly lower in 2010 and 2013 than in 2007 (Mann Whitney U test, $z = -4.543$, $P<0.00$ and $z = -4.233$, $P<0.00$) (Table 1.2; Fig 1.2 and 1.3).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lickeen Lough, 2007, 2010 and 2013

Scientific name	Common name	2007	2010	2013
			Mean CPUE	
Scardinius erythrophthalmus	Rudd	0.226 (0.045)	0.269 (0.078)	0.099 (0.044)
Salmo trutta	Brown trout	0.112 (0.022)	0.052 (0.019)	0.051 (0.014)
Gasterosteus aculeatus	Three-spined stickleback	0.001 (0.001)	0.001 (0.001)	0.004 (0.003)
Anguilla anguilla	European eel*	0.072 (0.015)	0.128 (0.089)	0.050 (0.025)
			Mean BPUE	
Scardinius erythrophthalmus	Rudd	14.233 (3.684)	18.958 (5.579)	10.988 (4.554)
Salmo trutta	Brown trout	29.885 (5.605)	6.565 (2.468)	6.104 (1.808)
Gasterosteus aculeatus	Three-spined stickleback	0.002 (0.002)	0.001 (0.001)	0.008 (0.005)
Anguilla anguilla	European eel*	14.889 (0.360)	23.100 (16.026)	7.211 (3.222)

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

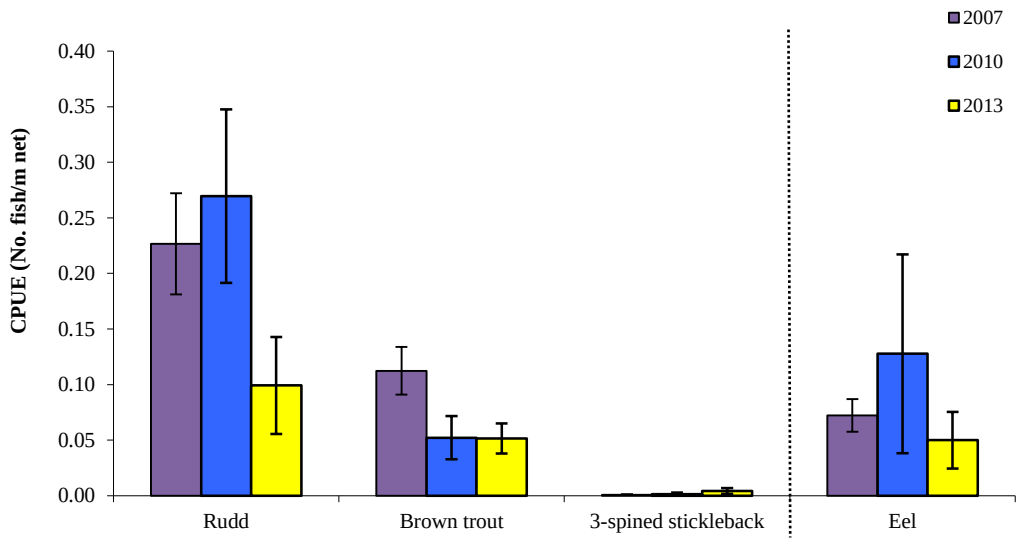

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured on Lickeen Lough (Eel CPUE based on fyke nets only), 2007, 2010 and 2013

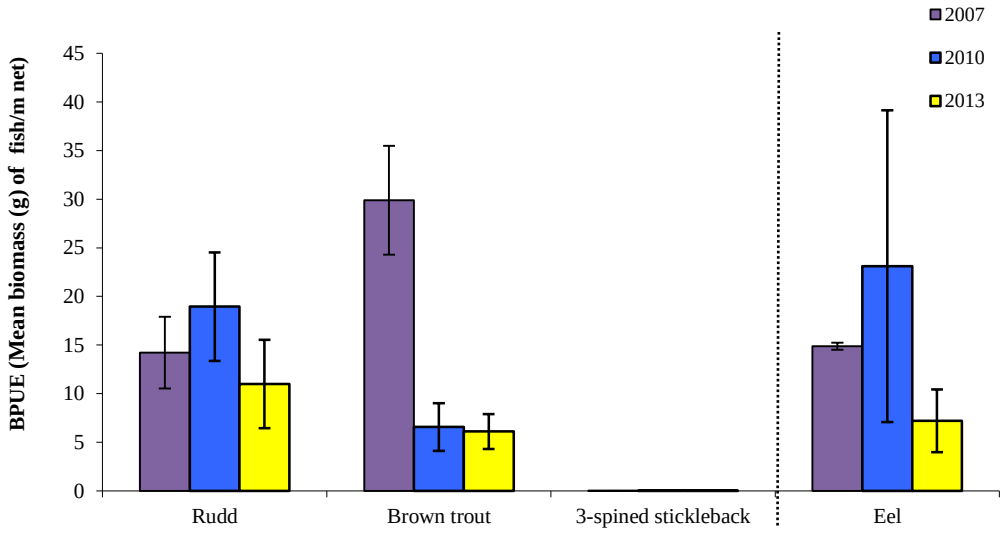

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lickeen Lough (Eel BPUE based on fyke nets only), 2007, 2010 and 2013

1.3.3 Length frequency distributions and growth

Rudd captured during the 2013 survey ranged in length from 12.4cm to 22.0cm (mean = 18.0cm) (Fig. 1.4) with seven age classes present, ranging from 2+ to 8+, with a mean L1 of 2.9cm (Table 1.3). The dominant age class was 6+ (Fig 1.4). Rudd captured during the 2010 survey ranged in length from 5.9cm to 20.9cm (Fig. 1.4) and ranged in age from 0+ to 5+. In the 2007 survey, rudd ranged in length from 6.5 cm to 22.0cm and had an age range of 1+ to 11+. The dominant age class in 2010 and 2007 was 3+ (Fig. 1.4).

Brown trout captured during the 2013 survey ranged in length from 12.6cm to 35.5cm (mean = 20.4cm) (Fig.1.5) with four age classes present, ranging from 1+ to 4+, with a mean L1 of 7.7cm (Table 1.4). The dominant age class was 1+ (Fig 1.5). Brown trout L4 was 34.6cm indicating a fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971). Brown trout captured during the 2010 survey had a similar length range (Fig.1.5) and ranged in age from 0+ to 3+. Brown trout captured during the 2007 survey were larger ranging in length from 16.0cm to 40.5cm (Fig.1.5) and had an age range of 1+ to 4+. The dominant age class in 2010 and 2007 was 2+ and the growth rate in these years was similar to 2013.

Eels captured during the 2013 survey ranged in length from 38.4cm to 50.2cm and three-spined stickleback ranged in length from 2.6cm to 5.2cm.

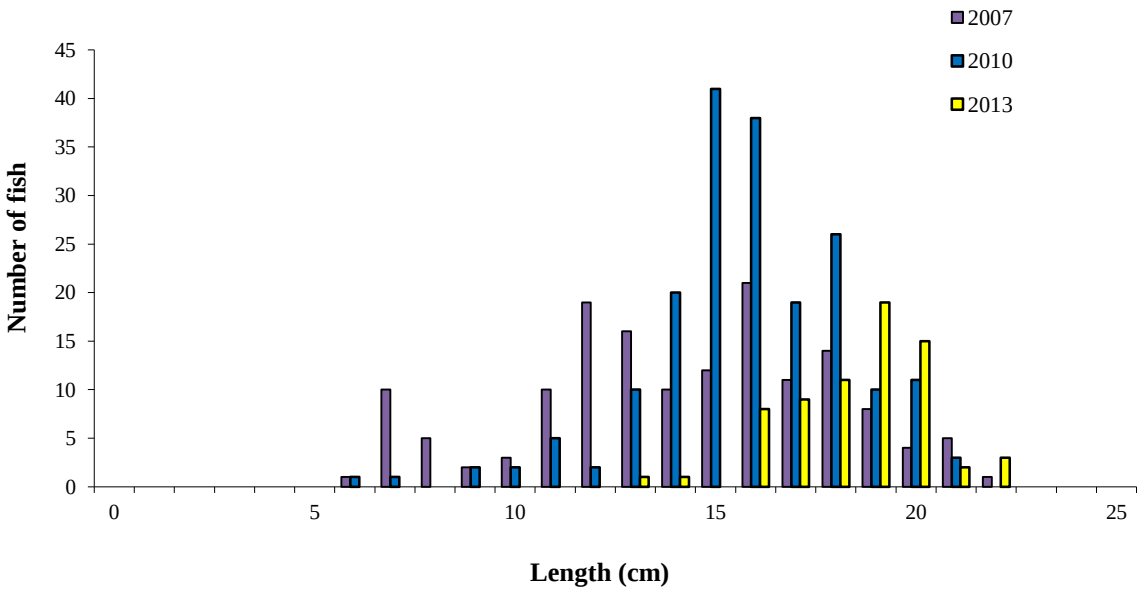

Fig. 1.4. Length frequency of rudd captured on Lickeen Lough, 2007, 2010 and 2013

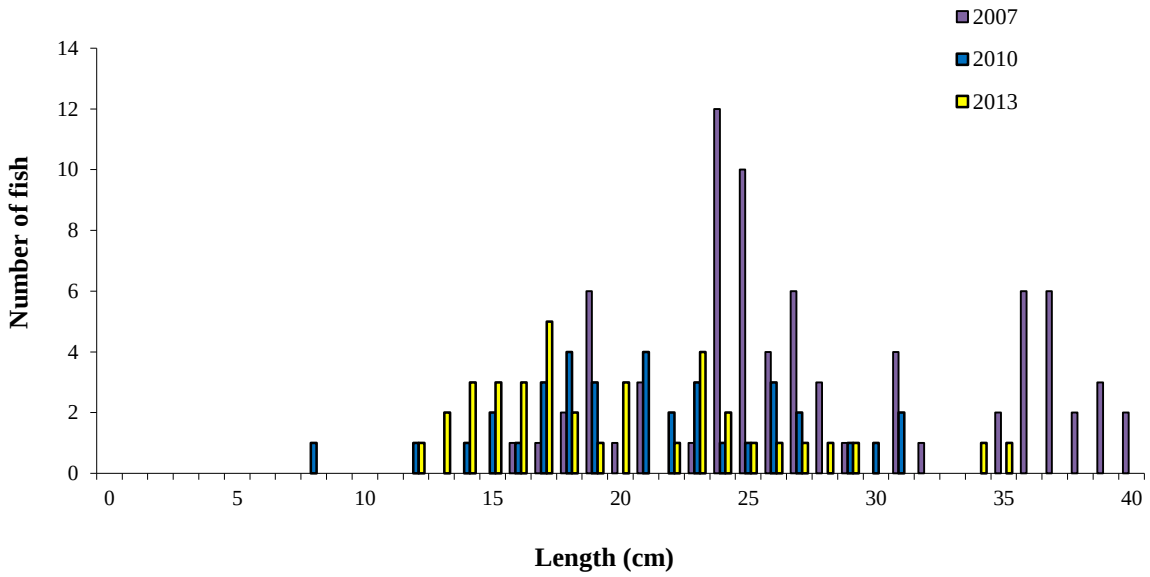

Fig. 1.5. Length frequency of brown trout captured on Lickeen Lough, 2007, 2010 and 2013

Table 1.3. Mean (±SE) rudd length (cm) at age for Lickeen Lough, September 2013

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8
Mean	2.9 (0.2)	5.9 (0.3)	9.6 (0.3)	12.8 (0.3)	15.3 (0.3)	17.1 (0.3)	18.6 (0.4)	20.6
N	52	52	50	37	32	26	12	1
Range	1.0-5.6	2.5-10.0	4.3-13.6	7.5-16.5	12.2-18.0	14.2-19.4	15.1-20.7	20.6-20.6

Table 1.4. Mean (±SE) brown trout length (cm) at age for Lickeen Lough, September 2013

	L_1	L_2	L_3	L_4
Mean	7.7 (0.2)	18.9 (0.7)	27.5 (2.9)	34.6
N	36	20	3	1
Range	5.1-10.8	12.5-25.0	22.7-32.7	34.6-34.6

1.4 Summary

Rudd was the dominant species in terms of abundance (CPUE) and biomass (BPUE) during the 2013 survey.

Although the mean rudd CPUE and BPUE fluctuated over the three sampling occasions, these differences were not statistically significant. Rudd ranged in age from 2+ to 8+, indicating reproductive success in seven of the previous nine years. The dominant age class was 6+.

The mean brown trout CPUE and BPUE was significantly lower in 2010 and 2013 than in 2007. Brown trout ranged in age from 1+ to 4+, indicating reproductive success in four of the previous five years. The dominant age class was 1+. 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).

There has been a substantial change in the fish populations in the lake since the 1990s; char and perch are absent from the lake, leading to the conclusion that the substantial fish kill in 1998 and the effects of continued eutrophication have contributed to their demise. The lake may also have been subject to the illegal stocking of rudd, a non-native fish species, over the last ten years as they have been captured in the current and previous WFD lake fish surveys but were not recorded in the lake in the 1990s. Lickeen Lough is stocked annually with rainbow trout (a non-native species). These hatchery reared fish have been released into the lake to create an angling amenity in the area, as the native brown trout stock have declined in recent years and cannot support large fishing pressures. No stocked rainbow trout were captured during the present survey.

A summary of the effects of stocking on the lake and recommendations for the future can be found in the previous survey report (Kelly *et al.,* 2011).

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, Lickeen Lough has been assigned an ecological status of Poor

based on the fish populations present in 2013. The ecological status assigned to the lake based on the 2010 survey data was Bad and it was assigned an ecological status of Poor in 2007.

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

1.5 References

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