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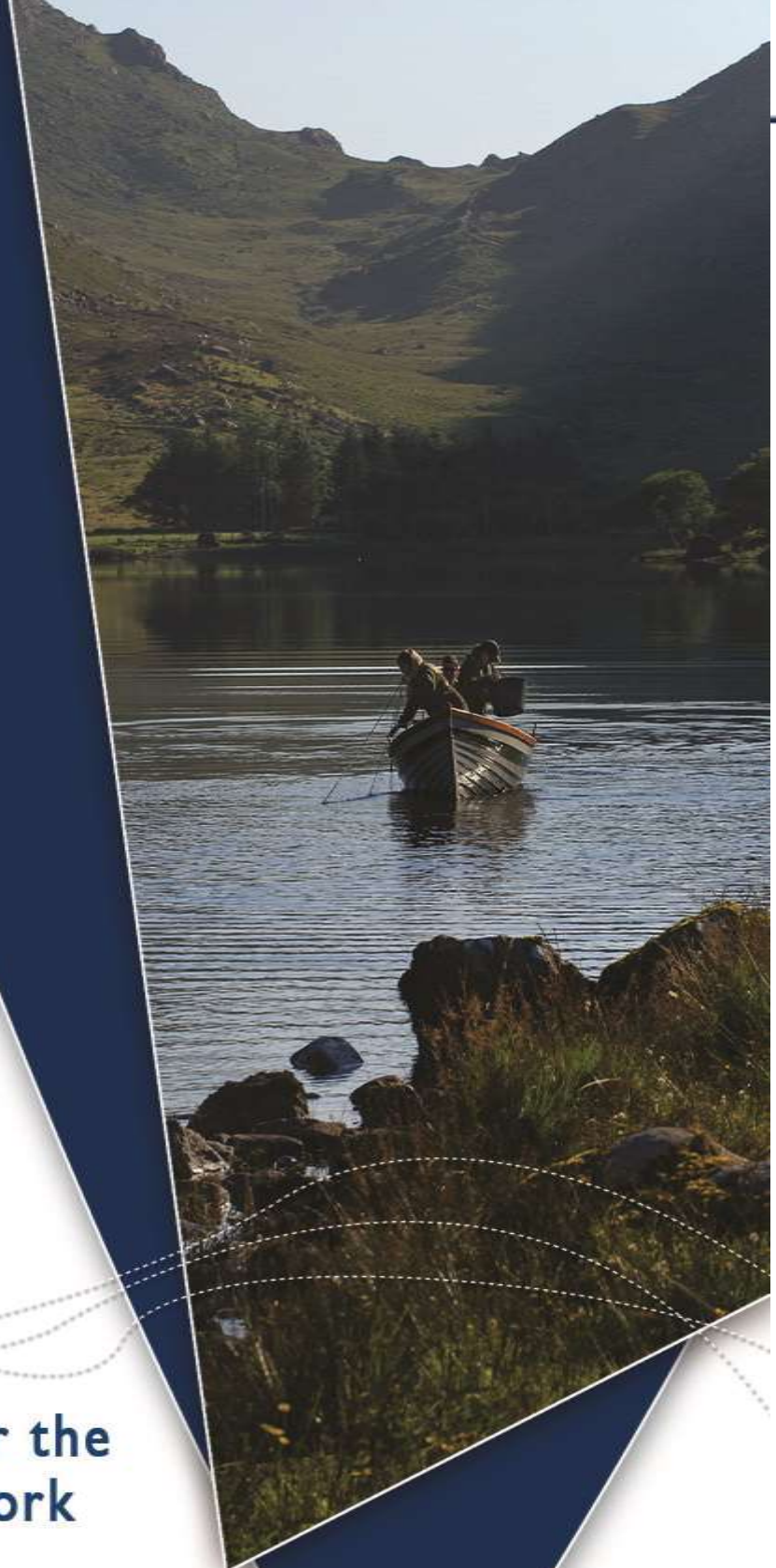

Sampling Fish for the Water Framework Directive

Lakes 2014

Lough Owel

IASCACH INTIRE EIREANN
INLAND FISHERIES IRELAND

Water Framework Directive Fish Stock Survey of Lough Owel, July 2014

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

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1.1 Introduction

Lough Owel is located approximately four kilometres north-west of Mullingar, Co. Westmeath in the Upper Shannon catchment (Plate 1.1, Fig. 1.1). The lake has a surface area of 102ha and a maximum depth of 21m. The underlying geology of the lake is limestone. The lake is categorised as typology class 8 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), greater than 50ha and moderate alkalinity (20-100 mg/l $CaCO_3$).

Lough Owel is a public water supply for Mullingar and is also the water supply for the Royal Canal. The lake is fed by four small streams (Ballyboy, Frewin, Kilpatrick and Portnashangan) and is also spring fed. With the exception of Lough Carra in county Mayo, this lake is the best example of a large spring fed calcareous lake in Ireland. The lake is of major conservation significance as it contains three habitats (alkaline fens, transition mires and hard water lakes) that are listed on Annex I of the EU Habitats Directive (NPWS, 1999). Water quality in the lake has been monitored regularly since the 1970s. Mean concentrations of total phosphorus, mean transparency and mean chlorophyll a placed Lough Owel in the mesotrophic category between 1998 and 2002 (Devins, M., 1998; McGarrigle *et al.,* 2002; OECD, 1982).

Lough Owel is one of the important trout lakes in the midlands and has a resident stock of wild brown trout. The lake also holds stocks of pike, perch and rudd. Spawning and nursery grounds for trout are limited; therefore trout stocks are maintained by stripping the ova from wild adult trout. These are then hatched out at the Inland Fisheries Ireland (IFI) fish farm and large numbers of the resulting fry and adult fish are later stocked back into the lake. The first triploid brown trout ever stocked into any water in Ireland were stocked into Lough Owel in March 2011. Triploid trout are infertile, and unable to breed with each other or cross breed with wild brown trout. IFI is monitoring the performance of these fish and have removed the adipose fin to help anglers identify the fish.

Fish stock surveys were undertaken regularly on Lough Owel by Inland Fisheries Ireland (previously the Central Fisheries Board and the Shannon Regional Fisheries Board) during the 1980s (CFB 1981; CFB1982; CFB1983; CFB 1984; CFB 1985; CFB, 1986 and CFB, 1987). These surveys revealed that there were excellent stocks of brown trout in the lake (wild and stocked F1 wild fish). At the time there was also a population of perch and a small pike population in the lake. Rudd were identified as being present in the lake during 1985 (CFB, unpublished data). Historically the lake held a population of Arctic char; however they have been extinct for some time, the last specimen being authenticated from the lake in 1886 (Went, 1945). There is an old unsubstantiated report that Arctic char from Lough Owel were as large as 1.4kg, but this can never be proven (Went, 1945). An attempt was made to reintroduce Arctic char to Lough Owel in 1995, however there is no evidence that they became established (Tierney *et al*., 2000).

More recently Lough Owel was 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, perch were found to be the dominant species present in the lake. Brown trout, roach, pike, three-spined stickleback, tench, roach x rudd hybrids, rudd 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.

Plate 1.1. Lough Owel

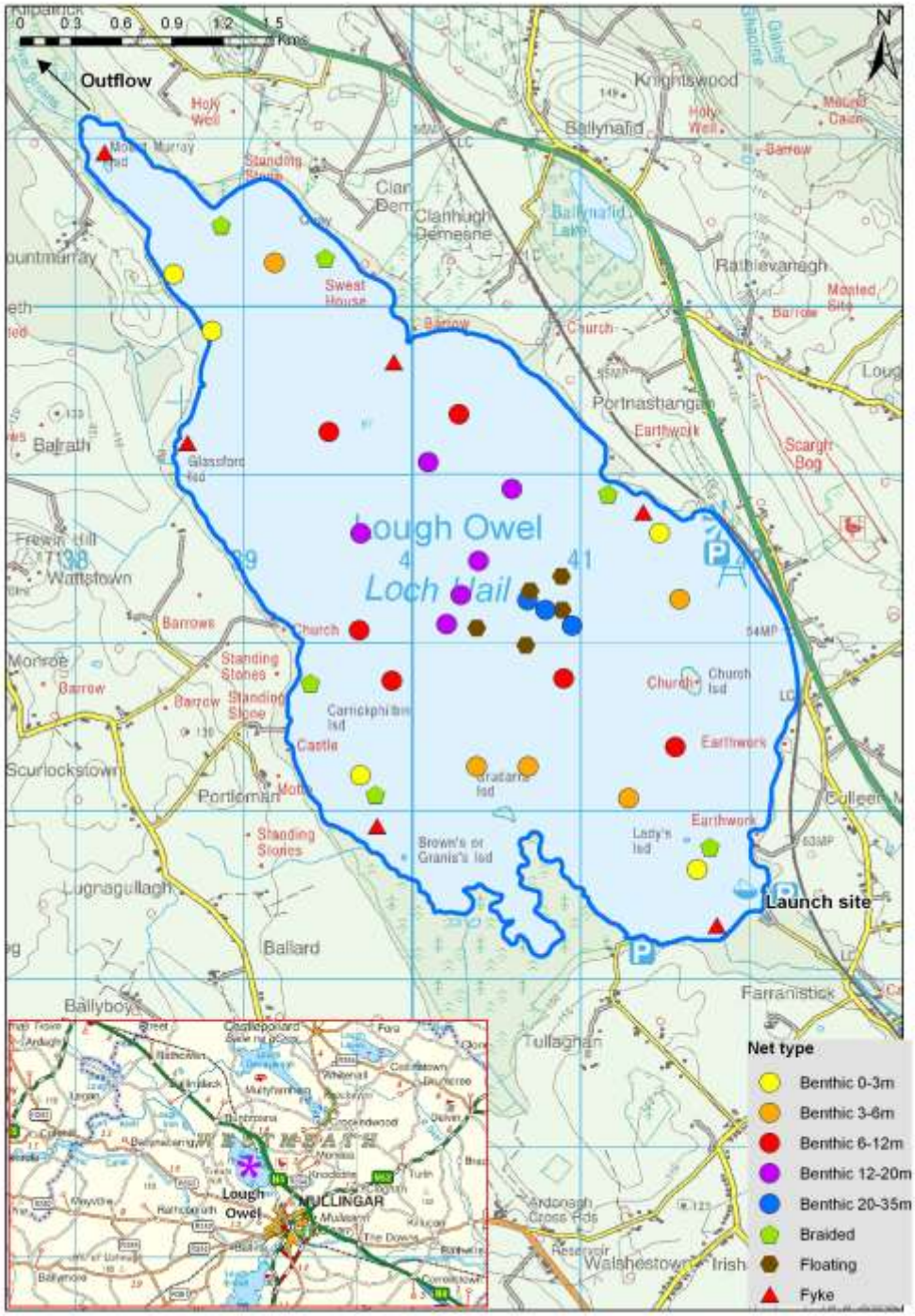

Fig. 1.1 Location map of Lough Owel indicating locations and depths of each net (outflow is indicated on map)

1.2 Methods

Lough Owel was surveyed over three nights between the 14th and the 17th of July 2014. A total of six sets of Dutch fyke nets, 25 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (5 @ 0-2.9m, 5 @ 3-5.9m, 6 @ 6-11.9m, 6 @ 12-19.9m and 3 @ 20-34.9m) and five floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (36 sites). The netting effort was supplemented using six benthic braided survey gill nets (62.5mm mesh knot to knot) at six additional 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, rainbow trout, roach, tench and 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 six fish species and one type of hybrid were recorded in Lough Owel in July 2014, with 712 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, brown trout, tench, hybrids, three-spined stickleback, rainbow trout and eels. During the previous surveys in 2008 and 2011 the same species composition was recorded with the exception of rainbow trout, which were only captured during the 2014 survey. Also pike, rudd and eels were not captured during the 2014 survey but were recorded during the 2008 and 2011 surveys.

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Owel, July 2014

Scientific name	Common name	Number of fish captured				
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Benthic braided gill nets	Fyke nets	Total
Perca fluviatilis	Perch	620	0	0	3	623
Rutilus rutilus	Roach	22	2	20	0	44
Salmo trutta	Brown trout (wild)	5	7	1	0	13
Salmo trutta	Brown trout (stocked)	1	0	0	0	1
Tinca tinca	Tench	2	0	10	1	13
Rutilus rutilus x Scardinius erythrophthalmus	Roach x Rudd hybrid	3	1	8	0	12
Gasterosteus aculeatus	3-spined stickleback	5	0	0	0	5
Oncorhynchus mykiss	Rainbow trout	0	1	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 2008, 2011 and 2014 surveys are summarised in Table 1.2. Mean CPUE and BPUE for all species is illustrated in Figure 1.2 and 1.3.

Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE). Although the mean brown trout CPUE and BPUE fluctuated slightly between 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 varied slightly from 2008 to 2014; however, these differences were also not statistically significant (Table 1.2; Fig 1.2 and 1.3).

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

Scientific name	Common name	2008	2011	2014
			Mean CPUE	
Salmo trutta	Brown trout (wild)	0.001 (0.001)	0.001 (0.001)	0.007 (0.003)
Salmo trutta	Brown trout (stocked)	0.006 (0.003)	0.003 (0.002)	0.003 (0.001)
Perca fluviatilis	Perch	0.677 (0.111)	0.381 (0.077)	0.493 (0.134)
Esox lucius	Pike	0.001 (0.001)	0.001 (0.001)	-
Rutilus rutilus	Roach	0.024 (0.013)	0.011 (0.004)	0.036 (0.017)
Scardinius erythrophthalmus	Rudd	0.004 (0.002)	0.021 (0.008)	-
Tinca tinca	Tench	0.001 (0.001)	0.005 (0.003)	0.011 (0.006)
Gasterosteus aculeatus	3-spined stickleback	0.026 (0.018)	0.025 (0.016)	0.004 (0.002)
Rutilus rutilus x Scardinius erythrophthalmus	Roach x Rudd hybrid	0.009 (0.004)	0.002 (0.001)	0.010 (0.005)
Oncorhynchus mykiss	Rainbow trout	-	-	0.001 (0.001)
Anguilla anguilla	Eel	0.002 (0.002)	0.011 (0.008)	-
			Mean BPUE	
Salmo trutta	Brown trout (wild)	0.056 (0.056)	0.087 (0.066)	2.046 (0.975)
Salmo trutta	Brown trout (stocked)	3.227 (2.308)	1.939 (1.207)	1.983 (0.941)
Perca fluviatilis	Perch	42.583 (7.202)	39.549 (8.191)	32.850 (7.908)
Esox lucius	Pike	6.871 (6.732)	0.231 (0.231)	-
Rutilus rutilus	Roach	1.200 (0.871)	0.966 (0.542)	17.551 (11.641)
Scardinius erythrophthalmus	Rudd	14.504 (9.233)	7.651 (3.334)	-
Tinca tinca	Tench	0.324 (0.273)	3.185 (2.392)	12.261 (7.703)
Gasterosteus aculeatus	3-spined stickleback	0.096 (0.07)	0.029 (0.017)	0.004 (0.002)
Rutilus rutilus x Scardinius erythrophthalmus	Roach x Rudd hybrid	6.410 (3.397)	0.580 (0.423)	8.684 (5.106)
Oncorhynchus mykiss	Rainbow trout	-	-	0.123 (0.123)
Anguilla anguilla	Eel	0.608 (0.394)	1.761 (1.325)	-

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

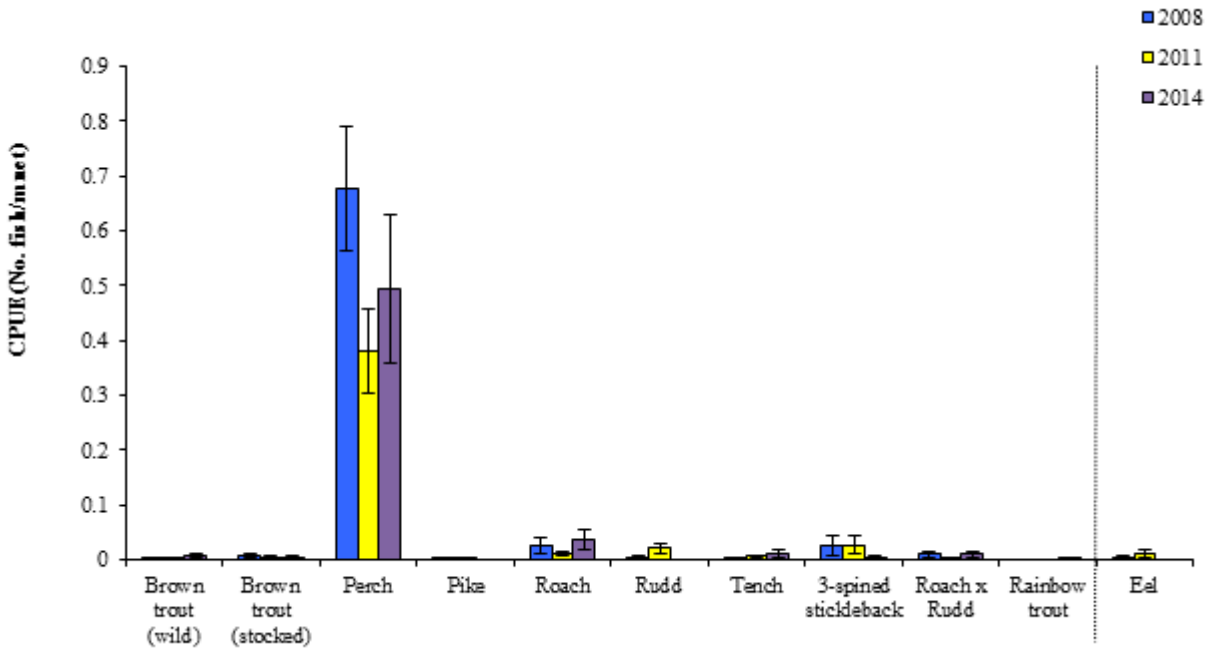

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Lough Owel (Eel CPUE based on fyke nets only), 2008, 2011 and 2014

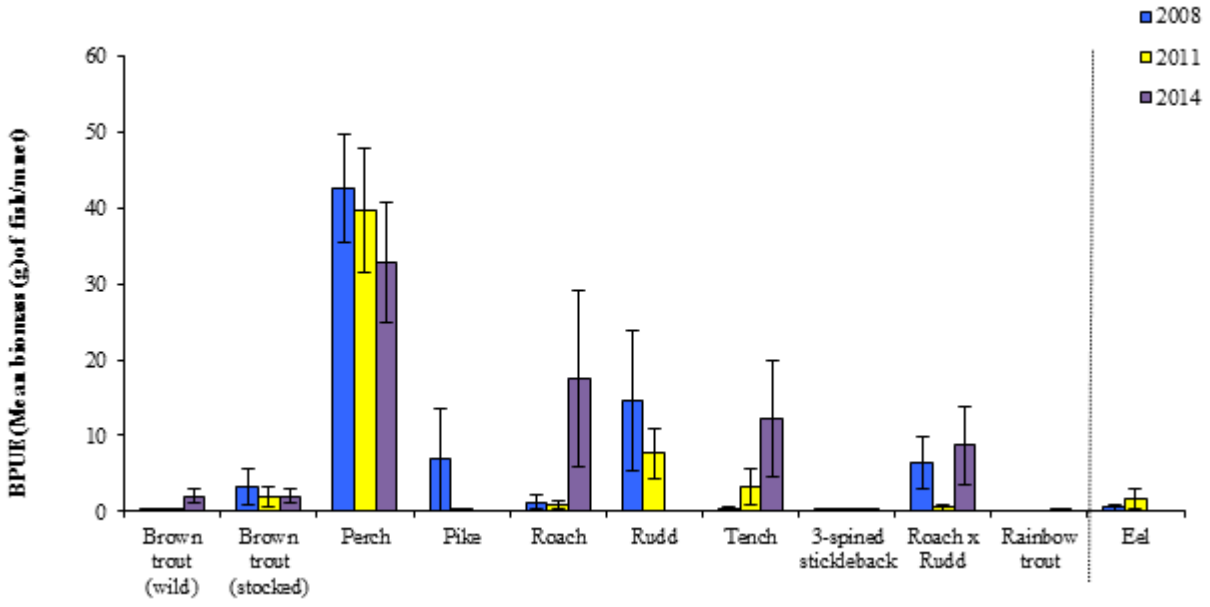

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lough Owel (Eel BPUE based on fyke nets only), 2008, 2011 and 2014

1.3.3 Length frequency distributions and growth

Perch captured during the 2014 survey ranged in length from 3.0cm to 35.0cm (mean = 13.1cm) (Fig. 1.4) with ten age classes present, ranging from 0+ to 9+, with a mean L1 of 6.3cm (Table 1.3). The dominant age class was 0+ (Fig. 1.4). Perch captured during the 2008 and 2011 surveys had a similar length range, age range and growth rate to the 2014 survey, with the widest age range recorded in the 2014 survey (Fig. 1.4). There was also a shift in the dominant age class over the three sampling years (Fig. 1.4).

Roach captured during the 2014 survey ranged in length from 13.0cm to 37.3cm (mean = 26.7cm) (Fig.1.5) with nine age classes present, ranging from 2+ to 11+, with a mean L1 of 2.2cm (Table 1.4). Roach captured during the 2008 and 2011 surveys had similar lengths with larger fish recorded in 2008 and 2014 and smaller fish captured in 2011 (Fig.1.5).

Wild brown trout captured during the 2014 survey ranged in length from 18.7cm to 44.0cm (mean = 27.4cm) with three age classes present (2+, 3+ 6+), with a mean L1 of 6.8cm. Stocked brown trout captured ranged in length from 28.2cm to 44.0cm (mean = 35.2cm) with two age classes present (2+ and 5+), with a mean L1 of 8.5cm (Table 1.5). Mean wild brown trout L4 in 2014 was 27.9cm indicating a slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971). Brown trout captured during the 2008 and 2011 surveys ranged in length from 16.3cm to 48.7cm and 14.0cm to 49.5cm respectively, and had a similar age range and growth rate to the 2014 survey.

Tench captured during the 2014 survey ranged in length from 12.0cm to 46.0cm and three-spined stickleback ranged from 4.0cm to 5.5cm. Roach x rudd hybrids ranged in length from 27.4cm to 40.0cm and one rainbow trout was measured at 23.9cm and aged 1+.

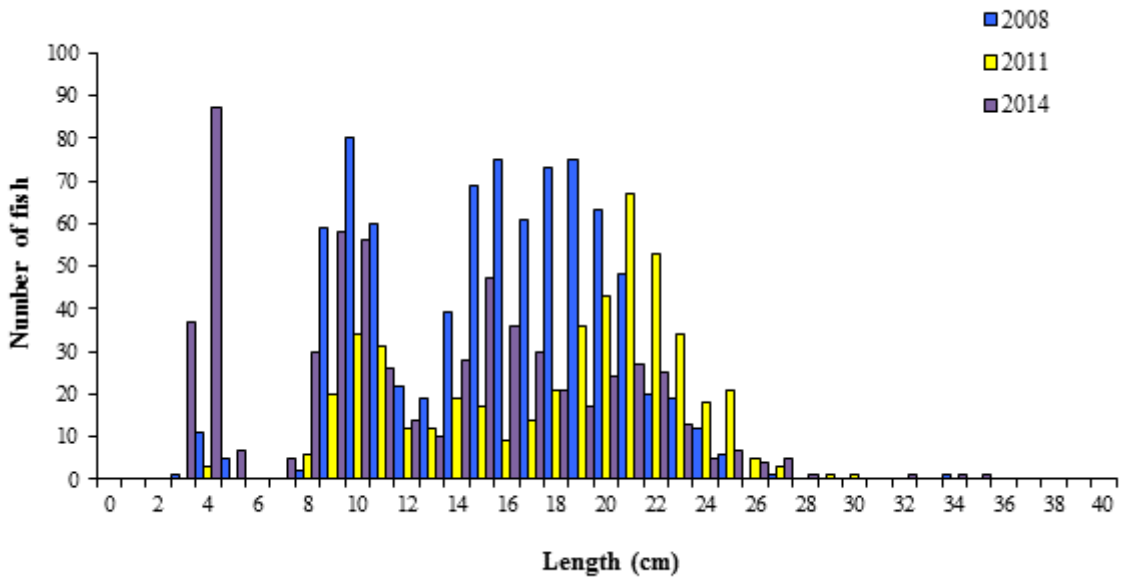

Fig. 1.4. Length frequency of perch captured on Owel Lough, 2008, 2011 and 2014

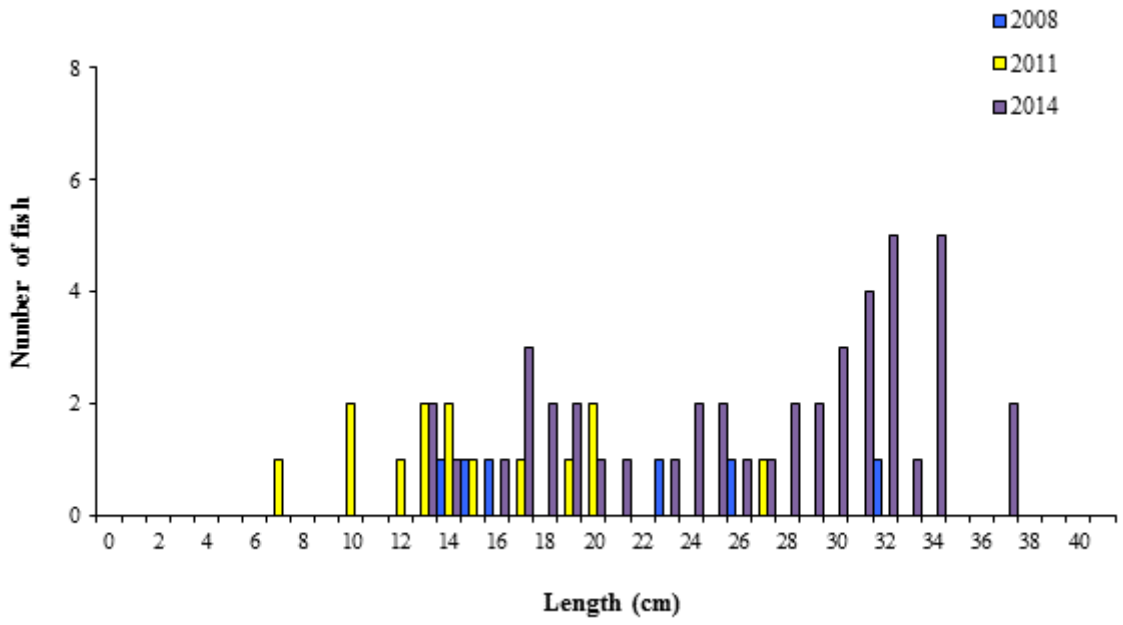

Fig. 1.5. Length frequency of roach captured on Owel Lough, 2008, 2011 and 2014

Table 1.3. Mean (±SE) perch length (cm) at age for Owel Lough, July 2014

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9
Mean	6.3 (0.1)	11.4 (0.3)	15.9 (0.3)	18.8 (0.4)	21.3 (0.6)	22.7 (0.5)	23.4 (0.7)	26.1 (1.1)	31.9
N	67	54	34	30	24	18	12	8	1
Range	4.7-10.2	8.6-16.5	13.2-22.6	16.2-27.1	17.3-32.6	19.5-26.2	21.1-27.7	22.4-31.0	31.9-31.9

Table 1.4. Mean (±SE) roach length (cm) at age for Owel Lough, July 2014

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}
Mean	2.2 (0.1)	5.4 (0.2)	9.8 (0.4)	14.1 (0.3)	18.9 (0.4)	23.0 (0.5)	26.6 (0.5)	29.0 (0.5)	31.4 (0.6)	33.0 (1.0)	32.9
N	36	36	34	28	26	24	17	10	10	5	1
Range	1.4-3.6	3.6-10.4	6.3-15.8	10.7-18.6	12.4-23.6	17.9-27.3	23.0-30.1	26.1-31.5	28.4-35.0	31.3-36.7	32.9-32.9

Table 1.5. Mean (±SE) brown trout length (cm) at age for Owel Lough, July 2014

	L_1	L_2	L_3	L_4	L_5	L_6	Growth Category
Mean	7.5 (0.3)	19.5 (2.0)	24.3 (1.7)	33.9 (5.9)	40.1 (2.1)	41.0	Fast
N	14	14	7	2	2	1	
Range	6.4-9.1	11.5-35.3	20.9-34.7	27.9-39.8	37.9-42.3	40.9-40.9	

1.4 Summary

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

The mean perch CPUE and BPUE varied slightly from 2008 to 2014; however, these differences were not statistically significant. Perch ranged in age from 0+ to 9+, indicating reproductive success in each of the previous ten years. The dominant age class was 0+.

Roach ranged in age from 2+ to 11+, with no 0+ or 1+ fish being captured. The dominant age class was 9+. No specimens of rudd were recorded in the 2014 survey.

Although the mean brown trout CPUE and BPUE fluctuated slightly between the three sampling years, these differences were not statistically significant. Wild brown trout ranged in age from 2+ to 6+ and stocked fish ranged from 2+ to 5+. Length at age analyses revealed that wild brown trout in the lake exhibit a slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

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, Owel Lough has been assigned an ecological status of Moderate for both 2008 and 2014 and Good for 2011 based on the fish populations present.

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

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