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Sampling Fish for the Water Framework Directive

Lakes 2014

Lough Leane

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INLAND FISHERIES IRELAND

Water Framework Directive Fish Stock Survey of Lough Leane, September 2014

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

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1.1 Introduction

Lough Leane forms part of the Killarney National Park, Macgillycuddy's Reeks and Caragh river catchment candidate Special Area of Conservation (Plate 1.1a, Plate 1.1b and Fig. 1.1). This is a large area that encompasses a wide variety of habitats designated under Annex I of the EU Habitats Directive, including blanket bog, alluvial woodlands, alpine heath and both upland and lowland oligotrophic lakes. The site has also been selected for the following species, Killarney fern, slender naiad, freshwater pearl mussel, Kerry slug, marsh fritillary, Killarney shad, Atlantic salmon, brook lamprey, river lamprey, sea lamprey, lesser horseshoe bat and otter; all species listed on Annex II of the EU Habitats Directive (NPWS, 2005).

Lough Leane itself is the largest of the Killarney lakes, with a surface area of 1,978ha, a mean depth of 13m and a maximum depth of 60m. 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 (20-100mg/l $CaCO_3$).

A decline in water quality in the Lough Leane catchment has been evident throughout the past 40 years and in 1997 Lough Leane was classified as hypertrophic (Coillte 2010; Killarney National Park, 2010). This decline in water quality was principally attributed to increased levels of nutrients, most significantly phosphorus, being transported via the rivers to the lakes, which has led to eutrophication in the past. (Coillte, 2010; Killarney National Park, 2010). A number of algal blooms were noticed in Lough Leane during the summer of 1997 and this event resulted from excessive phosphorus levels within the lake and had the potential to cause significant damage to the ecology of the lake (Anon, 2009). In response to this, Kerry County Council set up the Lough Leane Working Group to co-ordinate efforts to monitor and manage water quality within the catchment between 1998 and 2001 (Coillte, 2010). This monitoring and management programme was a catchment wide initiative, aimed at stopping the eutrophication process and restoring the rivers and lakes to a satisfactory state by reducing phosphorus inputs from all sources. The project also aimed to identify and quantify all significant point and diffuse sources of pollution input, in particular those inputs from local authority activities, agriculture, forestry and septic tanks.

Lough Leane contains a variety of fish species, including brown trout, sea trout, ferox trout, salmon, perch, flounder, eel, tench and Arctic char. A landlocked subspecies of the twaite shad known as the Killarney shad (*Alosa fallax killarnensis*) is also present and is unique to this lake. The Killarney shad are listed as one of the Annex II fish species in the EU Habitats Directive. Lough Leane is famous for its free rising trout and good salmon fishing (O' Reilly 2007), with hundreds of spring salmon and grilse being

caught on the troll every year. Brown trout in the lake average 0.23kg; however, a specimen ferox trout was caught in 2005 weighing nearly 8kg (O' Reilly 2007).

Inland Fisheries Ireland (previously the Central Fisheries Board) has undertaken a number of fish stock surveys on Lough Leane. The two most recent (prior to 2008) were in 2001 and 2003 to assess the status of the Killarney shad population (Roche and Rosell, 2003). The Killarney shad population size at the time was estimated to be in excess of 20,000 individuals of 1+ and older fish (Roche and Rosell, 2003). A small number of char were also recorded during the 2003 survey. In 2002, the Irish Char Conservation Group carried out fish surveys on all three Killarney Lakes and brown trout were recorded in all. Muckross (Middle) lake was the only lake in which Arctic char were captured, with the population in Lough Leane believed to be extinct due to the eutrophication of the lake (Igoe, *pers. comm.*). Arctic char were not recorded in Upper Lake, however there are reports from anglers that char have been caught and released there.

Lough Leane was more recently 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. Salmon, sea trout, brown trout, Arctic char, Killarney shad, flounder, rudd, tench and eels were also captured during the survey.

An additional experimental survey using hydroacoustic, pelagic gillnetting and trawling techniques was carried out on Lough Leane between the 26th to the 30th May 2014 and between the 1st to the 4th of September 2014. 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* 24km of hydroacoustic transects. A separate report will be available in due course.

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 1.1a. Lough Leane

Plate 1.1b. Lough Leane

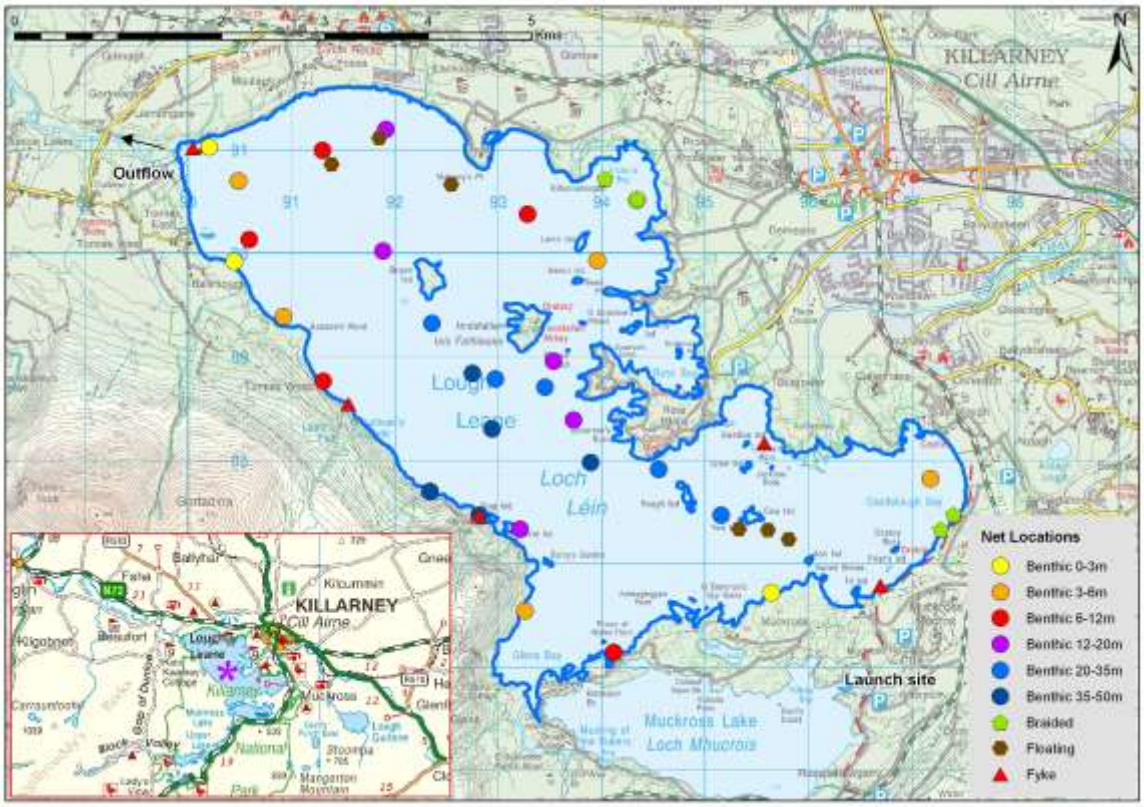

Fig. 1.1 Location map of Lough Leane showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

Lough Leane was surveyed over three nights from the 2nd to the 5th of September 2014. A total of six sets of Dutch fyke nets, 30 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (5 @ 0-2.9m, 5 @ 3-5.9m, 5 @ 6-11.9m, 5 @ 12-19.9m, 5 @ 20-34.9m and 5 @ 35-49.9m) and six floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed randomly in the lake (42 sites). The netting effort was supplemented using four benthic braided survey gill nets (62.5mm mesh knot to knot) at four 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, shad, salmon, char, rudd and tench. 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 nine fish species were recorded in Lough Leane in September 2014, with 653 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 brown trout, rudd, eels, Killarney shad, flounder, tench, salmon and Arctic char. During the previous surveys in 2008 and 2011 the same species composition was recorded with the exception of Arctic char, which were not recorded in the 2008 survey but were present in 2011 and 2014 and sea trout which were only recorded in 2011.

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Leane, Septemeber 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	277	0	2	52	331
Salmo trutta	Brown trout	129	23	1	26	179
Scardinius erythrophthalmus	Rudd	45	1	0	4	50
Anguilla anguilla	Eel	2	0	0	25	27
Alosa fallax killarnensis	Killarney shad	27	9	0	0	36
Platichthys flesus	Flounder	8	0	7	4	19
Tinca tinca	Tench	4	0	1	1	6
Salmo salar	Salmon	2	0	2	0	4
Salvelinus alpinus	Arctic char	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 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 brown trout was the dominant species in terms of biomass (BPUE). Although the mean brown trout and perch CPUE and BPUE fluctuated slightly over the three sampling years, these differences were 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 on Lough Leane, 2008, 2011 and 2014

Scientific name	Common name	2008	2011	2014
			Mean CPUE	
Salmo trutta	Brown trout	0.098 (0.025)	0.131 (0.033)	0.120 (0.030)
	Sea trout	-	0.003 (0.002)	-
Salmo salar	Salmon	0.005 (0.002)	0.002 (0.001)	0.003 (0.001)
Salvelinus alpinus	Arctic char	-	0.003 (0.001)	0.001 (0.001)
Alosa fallax killarnensis	Killarney shad	0.007 (0.004)	0.006 (0.004)	0.026 (0.011)
Perca fluviatilis	Perch	0.121 (0.037)	0.187 (0.054)	0.221 (0.043)
Scardinius erythrophthalmus	Rudd	0.002 (0.001)	0.034 (0.015)	0.034 (0.013)
Tinca tinca	Tench	0.001 (0.001)	0.001 (0.001)	0.004 (0.001)
Platichthys flesus	Flounder	0.005 (0.002)	0.018 (0.005)	0.012 (0.004)
Anguilla anguilla	Eel	0.083 (0.021)	0.088 (0.055)	0.069 (0.031)
			Mean BPUE	
Salmo trutta	Brown trout	14.02 (4.494)	19.267 (5.264)	15.497 (4.121)
	Sea trout	-	0.611 (0.433)	-
Salmo salar	Salmon	12.662 (5.679)	4.7647 (2.941)	12.664 (7.491)
Salvelinus alpinus	Arctic char	-	0.234 (0.178)	0.128 (0.128)
Alosa fallax killarnensis	Killarney shad	0.368 (0.257)	0.484 (0.34)	2.065 (1.011)
Perca fluviatilis	Perch	5.848 (1.629)	12.516 (3.503)	11.537 (2.332)
Scardinius erythrophthalmus	Rudd	0.379 (0.242)	5.014 (2.547)	4.969 (2.005)
Tinca tinca	Tench	0.655 (0.602)	1.241 (1.1931)	3.761 (2.835)
Platichthys flesus	Flounder	0.952 (0.400)	4.696 (1.638)	3.163 (1.352)
Anguilla anguilla	Eel	13.936 (3.861)	12.172 (5.916)	10.958 (5.223)

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

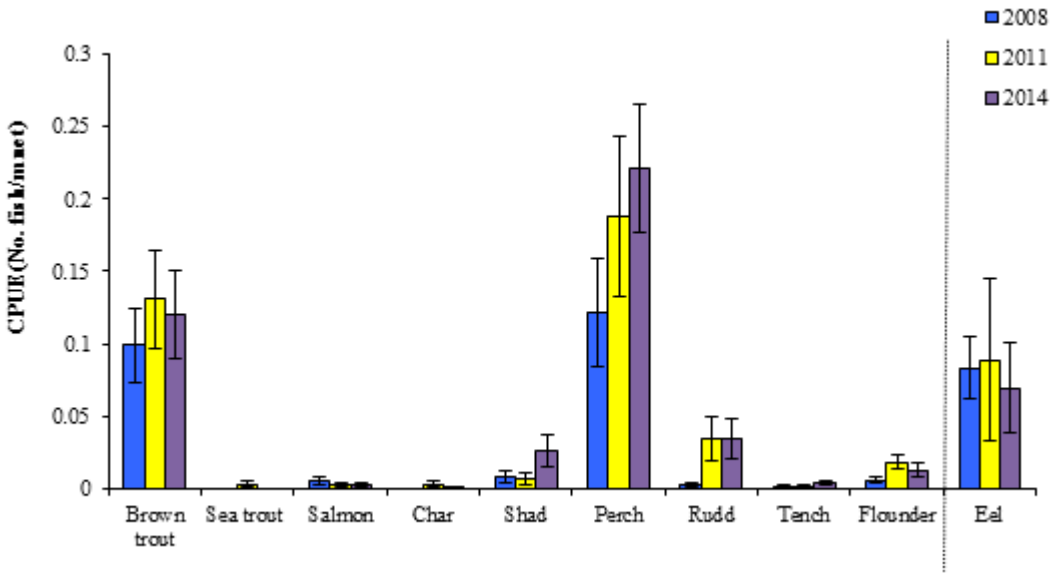

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Lough Leane (Eel CPUE based on fyke nets only), 2008, 2011 and 2014

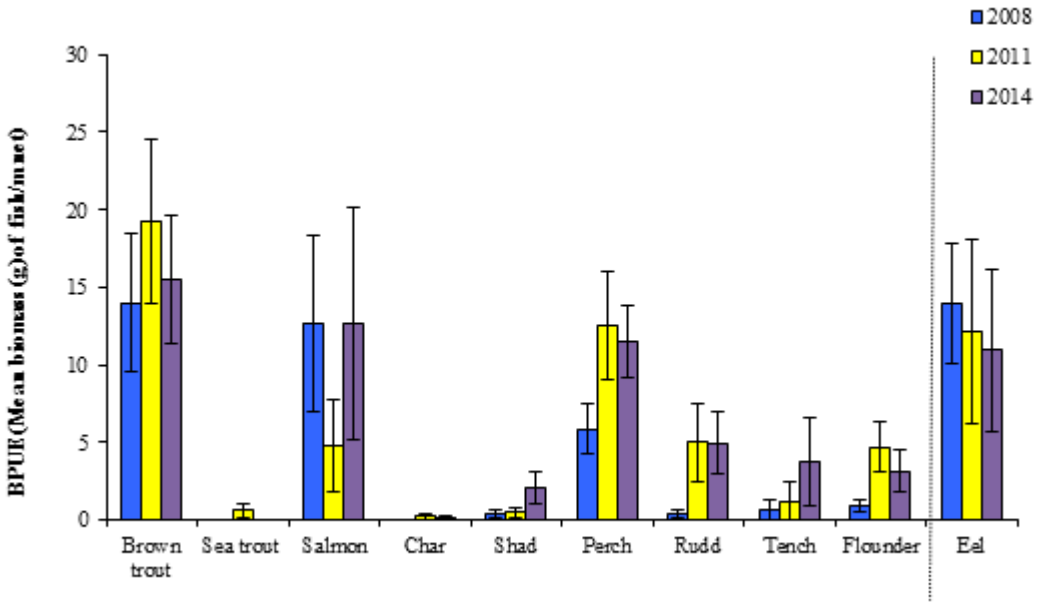

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lough Leane (Eel BPUE based on fyke nets only), 2008, 2011 and 2014

1.3.3 Length frequency distributions and growth

Brown trout captured during the 2014 survey ranged in length from 13.1cm to 38.5cm (mean = 21.0cm) (Fig. 1.4) with five age classes present, ranging from 1+ to 5+, with a mean L1 of 6.7cm (Table 1.3). The dominant age class was 3+ (Fig. 1.4). Mean brown trout L4 in 2014 was 25.5cm indicating a slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.3). Brown trout captured during the 2008 and 2011 surveys had a similar length range, age range and growth rate to the 2014 survey (Fig. 1.4

Perch captured during the 2014 survey ranged in length from 6.5cm to 36.6cm (mean = 14.0cm) (Fig.1.5) with eight age classes present, ranging from 0+ to 8+, with a mean L1 of 7.0cm (Table 1.4). The dominant age class was 1+ (Fig. 1.5). Perch captured during the 2008 and 2014 surveys had similar lengths; however, perch captured during the 2011 survey exhibited a much narrower length range. Age ranges and growth rates were similar for the three sampling years (Fig.1.5).

Flounder captured during the 2014 survey ranged in length from 11.7cm to 30.2cm, tench ranged in length from 15.2cm to 50.1cm, rudd had lengths ranging from 9.2cm to 27.2cm, Killarney shad ranged in length from 10.5cm to 22.0cm and eels ranged from 28.7cm to 56.7cm. Three salmon captured were aged between 2.1+ and 2.2+ and ranged in length from 53.1cm to 90.4cm. One Arctic char measuring 25.5cm was captured and was aged at 3+.

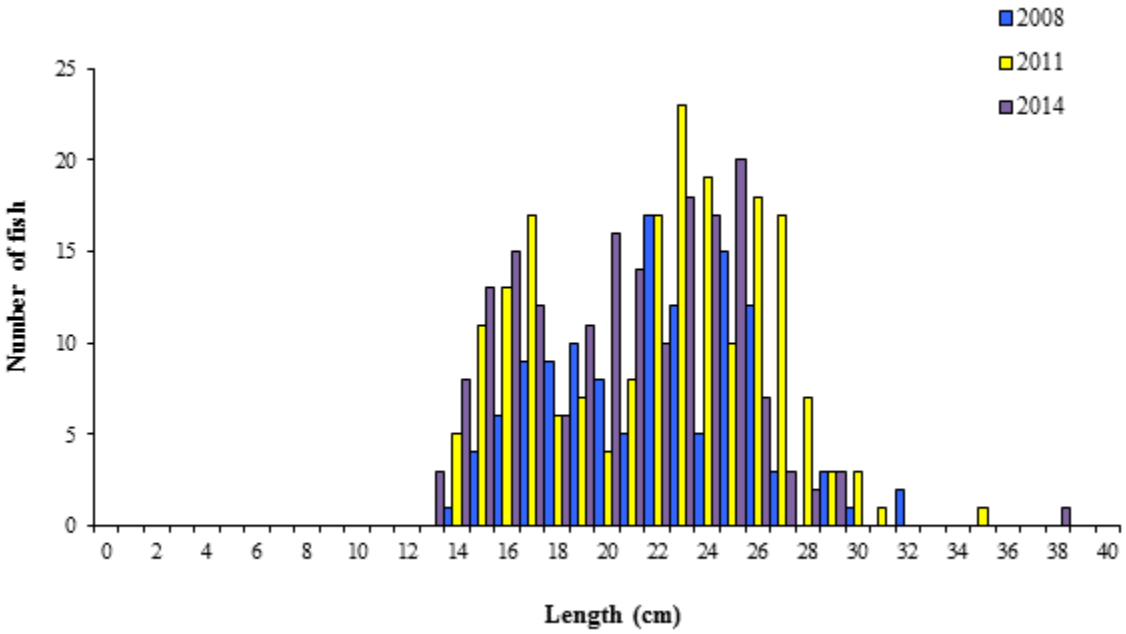

Fig. 1.4. Length frequency of brown trout captured on Lough Leane, 2008, 2011 and 2014

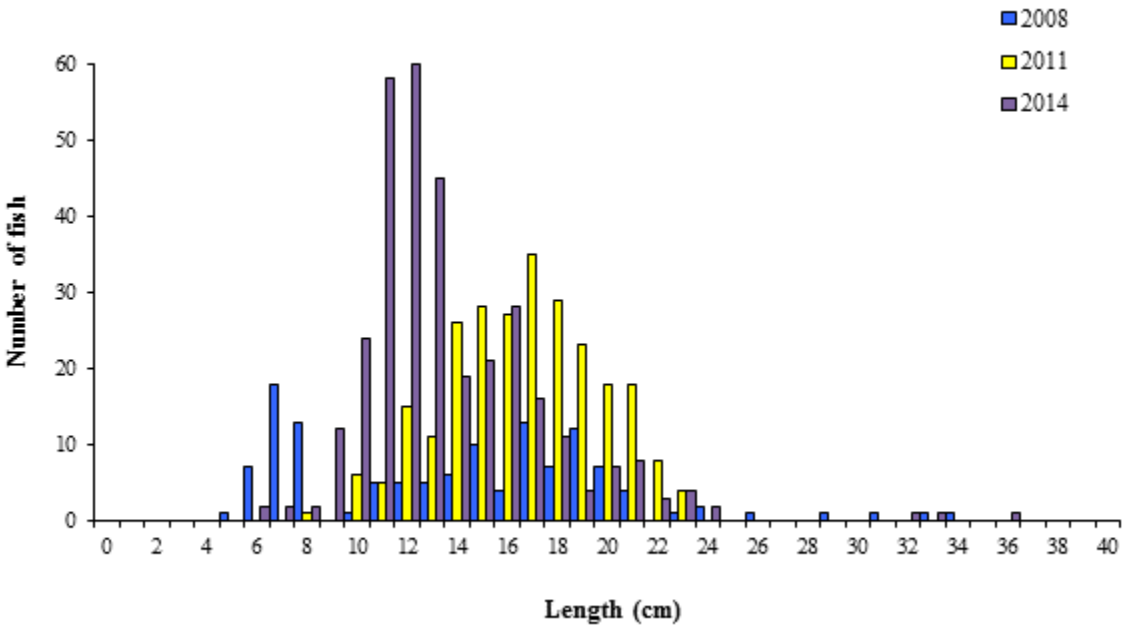

Fig. 1.5. Length frequency of perch captured on Lough Leane, 2008, 2011 and 2014

Table 1.3. Mean (±SE) brown trout length (cm) at age for Lough Leane, September 2014

	L_1	L_2	L_3	L_4	L_5	Growth Category
Mean	6.7 (0.2)	15.8 (0.5)	22.5 (0.7)	25.5 (2.4)	28.6 (3.7)	Slow
N	45	31	17	3	2	
Range	3.8-9.9	9.9-19.9	16.9-27.2	22.7-30.3	24.8-32.4	

Table 1.4. Mean (±SE) perch length (cm) at age for Lough Leane, September 2014

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8
Mean	7.0 (0.2)	12.2 (0.3)	15.7 (0.3)	18.0 (0.3)	19.9 (0.4)	22.3 (0.7)	23.3 (1.7)	27.3 (6.0)
N	52	32	23	23	18	13	4	2
Range	5.1-10.5	9.1-15.4	12.0-18.2	15.1-19.9	17.7-22.5	19.0-27.8	20.5-27.7	21.3-33.3

1.4 Summary

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

Although the mean brown trout CPUE and BPUE fluctuated slightly over the three sampling years, these differences were not statistically significant. Brown trout ranged in age from 1+ to 5+, indicating reproductive success in the previous five years. The dominant age class was 3+. Length at age analyses revealed that brown trout in the lake exhibit a slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

Although the mean perch CPUE and BPUE fluctuated slightly over the three sampling years, these differences were not statistically significant. Perch ranged in age from 0+ to 8+, indicating reproductive success in eight of the previous nine years, as no 3+ fish were recorded. The dominant age class was 1+.

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

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

1.5 References

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