



Sampling Fish for the Water Framework Directive

Lakes 2014

Upper Lake Killarney





Water Framework Directive Fish Stock Survey of Upper Lake, Killarney, September 2014

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CITATION: Kelly, F.L., Connor, L., Morrissey, E., Coyne, J., Feeney, R., Matson, R. and Rocks, K. (2015z) Water Framework Directive Fish Stock Survey of Upper Lake, September 2014. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

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

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ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of the regional director Dr. Patrick Buck and the staff from IFI, Macroom. The authors would also like to gratefully acknowledge the help and cooperation of all their colleagues in IFI, Swords.

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Energy and Natural Resources for 2014.

The authors would also like to thank National Parks and Wildlife service (NPWS) and their staff in Killarney National Park for facilitating access and providing assistance during the survey.

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1.1 Introduction

Upper Lake, Killarney is situated at the bottom of Killarney's Black Valley in Killarney National Park, Co. Kerry (Plate 1.1, Fig. 1.1). Upper Lake has a surface area of 169ha, a mean depth of 14.5m and a maximum depth of 36m. The lake is categorised as typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), larger than 50ha and low alkalinity (<20mg/l CaCO₃).

Upper Lake forms part of the Killarney National Park, Macgillicuddy's Reeks and Caragh River catchment candidate Special Area of Conservation. 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). Upper Lake itself is a long and rocky lake holding both salmon (spring salmon and grilse) and brown trout. Brown trout in the lake average around 0.2kg (O' Reilly, 2007).

Upper Lake was previously 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, followed by brown trout. Salmon, rudd, minnow, tench 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. Upper Lake, Killarney

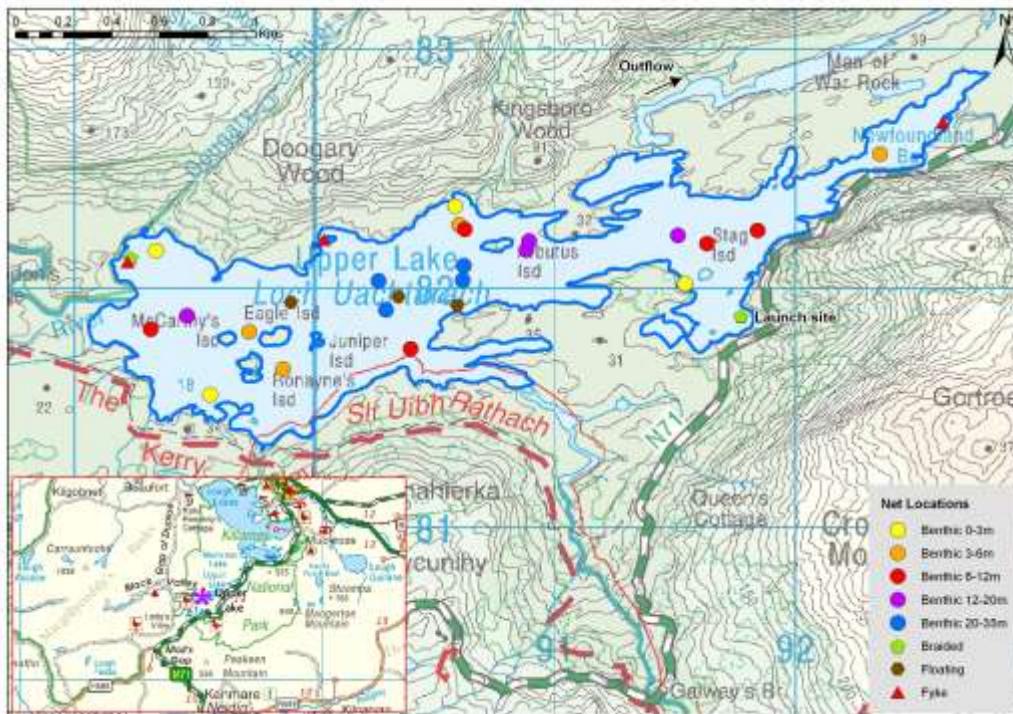


Fig: 1.1 Location map of Upper Lake showing locations and depths of each net (outflow is indicated on map)



1.2 Methods

Upper Lake was surveyed over one night on the 1st of September 2014. A total of three sets of Dutch fyke nets, 21 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 5 @ 6-11.9m, 4 @ 12-19.9m, 4 @ 20-34.9m and 3 @ 35-49.9m) and three floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (27 sites). The netting effort was supplemented using two benthic braided survey gill nets (62.5mm mesh knot to knot) at two 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, sea trout, salmon, 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 six fish species (sea trout are included as a separate ‘variety’ of trout) were recorded on Upper Lake in September 2014, with 260 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, sea trout, rudd, tench, eels and salmon. During the previous surveys in 2008 and 2011 the same species composition was recorded with the exception of sea trout, which were only recorded during the 2014 survey and minnow which 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 Upper Lake, September 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
<i>Perca fluviatilis</i>	Perch	126	0	0	26	152
<i>Salmo trutta</i>	Brown trout	72	11	0	6	89
<i>Salmo trutta</i>	Sea trout	1	0	0	0	1
<i>Scardinius erythrophthalmus</i>	Rudd	6	0	0	0	6
<i>Salmo salar</i>	Salmon	4	0	0	0	4
<i>Tinca tinca</i>	Tench	1	0	3	1	4
<i>Anguilla anguilla</i>	Eel	2	0	0	2	4

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 Figures 1.2 and 1.3.

Perch was the dominant species in terms of abundance (CPUE) and salmon was the dominant species in terms of biomass (BPUE). The mean brown trout CPUE and BPUE was significantly higher in 2014 than in 2008 (Kruskal-Wallis $H=6.8$, $P<0.05$ and $H=6.4$, $P<0.05$ respectively) (Table 1.2; Fig 1.2 and 1.3). The mean perch CPUE and BPUE increased each year from 2008 to 2014, however, 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 Upper Lake, 2008, 2011 and 2014

Scientific name	Common name	2008	2011	2014
Mean CPUE				
<i>Perca fluviatilis</i>	Perch	0.070 (0.022)	0.079 (0.031)	0.160 (0.050)
<i>Salmo trutta</i>	Brown trout	0.034 (0.011)	0.073 (0.021)	0.098 (0.022)
<i>Salmo trutta</i>	Sea trout	-	-	0.001 (0.001)
<i>Scardinius erythrophthalmus</i>	Rudd	0.018 (0.010)	0.006 (0.003)	0.007 (0.006)
<i>Salmo salar</i>	Salmon	0.002 (0.001)	0.005 (0.002)	0.005 (0.002)
<i>Tinca tinca</i>	Tench	0.001 (0.001)	0.001 (0.001)	0.005 (0.004)
<i>Phoxinus phoxinus</i>	Minnow	0.001 (0.001)	0.001 (0.001)	-
<i>Anguilla anguilla</i>	European eel	0.033 (0.033)	0.116 (0.048)	0.011 (0.005)
Mean BPUE				
<i>Perca fluviatilis</i>	Perch	3.78 (1.568)	3.928 (1.654)	8.342 (2.563)
<i>Salmo trutta</i>	Brown trout	3.892 (1.219)	9.393 (3.089)	12.145 (3.260)
<i>Salmo trutta</i>	Sea trout	-	-	0.981 (0.981)
<i>Scardinius erythrophthalmus</i>	Rudd	2.861 (1.617)	0.6251 (0.311)	1.017 (0.717)
<i>Salmo salar</i>	Salmon	6.082 (4.845)	21.917 (12.108)	14.692 (7.161)
<i>Tinca tinca</i>	Tench	0.944 (0.944)	1.354 (1.354)	5.476 (4.772)
<i>Phoxinus phoxinus</i>	Minnow	0.005 (0.005)	0.002 (0.002)	-
<i>Anguilla anguilla</i>	European eel	2.361 (2.361)	35.366 (26.541)	0.863 (0.526)

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

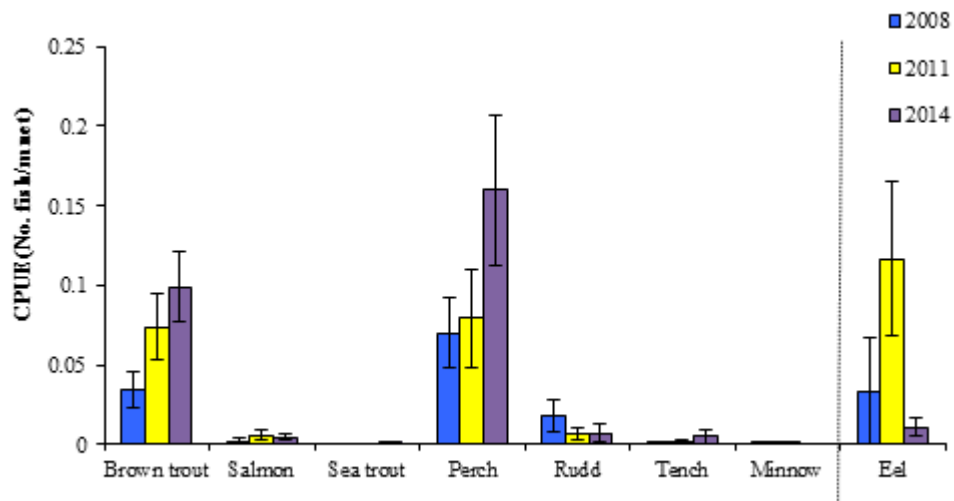


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Upper Lake (Eel CPUE based on fyke nets only), 2008, 2011 and 2014

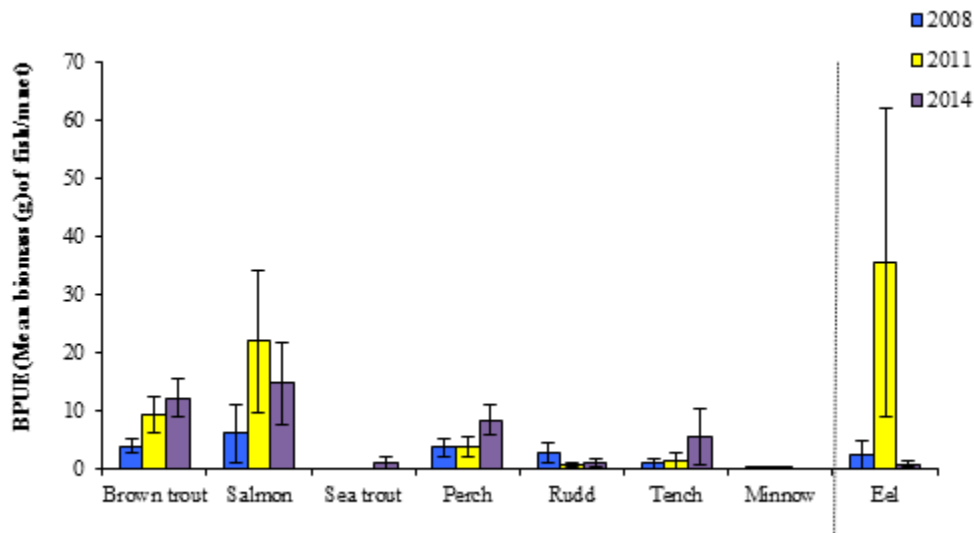


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Upper Lake (Eel BPUE based on fyke nets only), 2008, 2011 and 2014

1.3.3 Length frequency distributions and growth

Brown trout captured during the 2014 survey ranged in length from 13.4cm to 51.5cm (mean = 20.5cm) (Fig. 1.4). Five age classes were present, ranging from 1+ to 5+, with a mean L1 of 6.2cm (Table 1.3). The dominant age class was 2+ (Fig. 1.4). Mean brown trout L4 in 2013 was 24.1cm indicating a very 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 to the 2014 survey (Fig. 1.4). Age ranges and growth rates were similar over the three year sampling period (Fig. 1.4).

Perch captured during the 2014 survey ranged in length from 4.9cm to 32.5cm (mean = 14.7cm) (Fig.1.5) with eight age classes present, ranging from 0+ to 8+, with a mean L1 of 5.9cm (Table 1.4). The dominant age class was 1+ (Fig. 1.5). Perch captured during the 2014 survey had a wider length range and age range than the 2008 and 2011 surveys, the growth rate was similar for the three sampling years (Fig.1.5).

Rudd captured during the 2014 survey ranged in length from 17.5cm to 27.0cm, tench ranged in length from 38.0cm to 43.0cm and eels ranged from 31.5cm to 49.9cm. All adult salmon captured were aged



2.1+ and ranged in length from 58.1cm to 74.0cm. One sea trout measuring 42.0cm was aged at 2.1.1SM+.

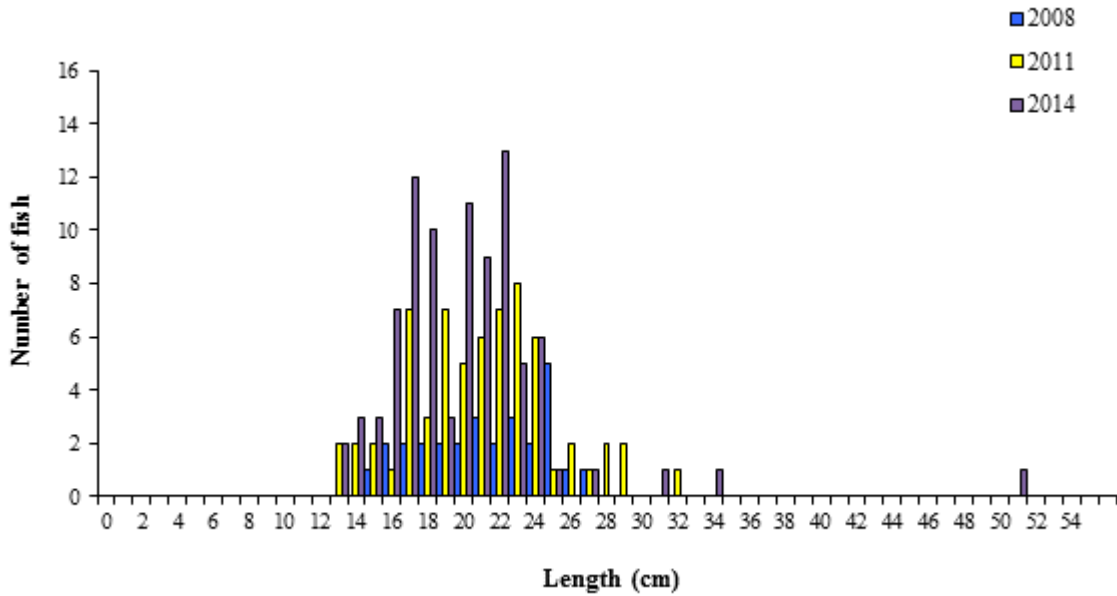


Fig. 1.4. Length frequency of brown trout captured on Upper Lake, 2008, 2011 and 2014

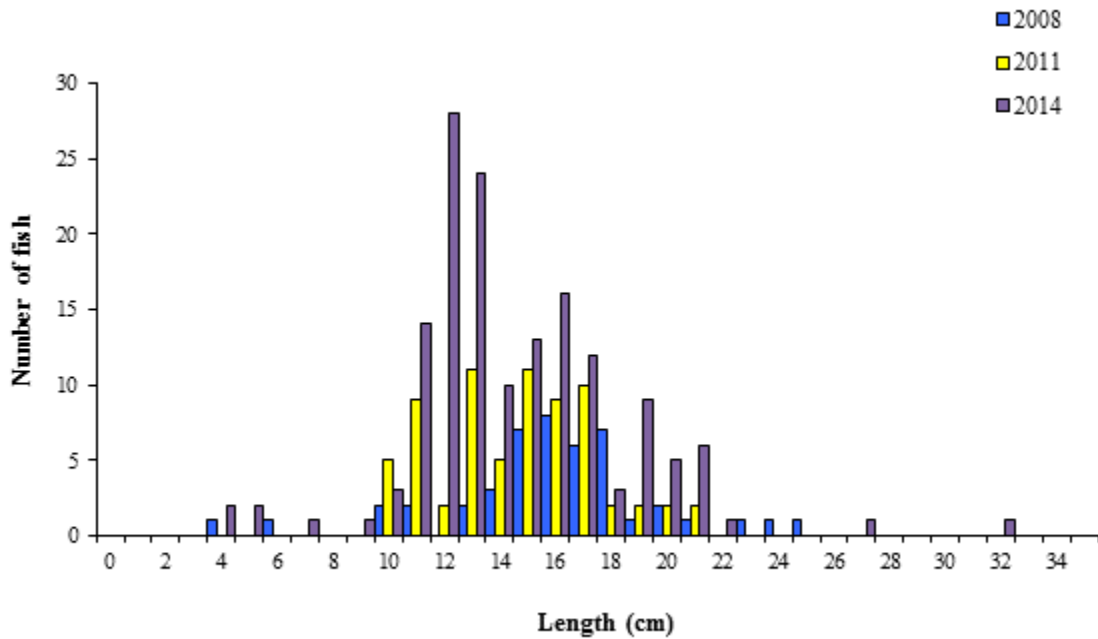


Fig. 1.5. Length frequency of perch captured on Upper Lake, 2008, 2011 and 2014



Table 1.3. Mean (\pm SE) brown trout length (cm) at age for Upper Lake, September 2014

	L ₁	L ₂	L ₃	L ₄	L ₅	Growth Category
Mean	6.2 (0.2)	13.7 (0.4)	19.2 (0.5)	24.1 (0.9)	33.0 (3.5)	Very slow
N	41	33	21	8	3	
Range	3.2-9.1	8.9-19.1	15.1-23.7	21.6-28.7	28.4-39.9	

Table 1.4. Mean (\pm SE) perch length (cm) at age for Upper Lake, September 2014

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈
Mean	5.9 (0.2)	11.5 (0.3)	14.8 (0.3)	17.9 (0.4)	20.2 (0.3)	21.9 (0.2)	23.7 (0.2)	27.5 (1.6)
N	38	24	17	15	7	3	2	2
Range	4.2-7.7	8.7-14.1	11.6-17.4	15.4-21.1	19.2-21.4	21.5-22.3	23.5-24.0	25.8-29.9

1.4 Summary

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

The mean brown trout CPUE and BPUE was significantly higher in 2014 than in 2008. Brown trout ranged in age from 1+ to 5+, indicating reproductive success in the previous five years. The dominant age class was 2+. Length at age analyses revealed that brown trout in the lake exhibit a very slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

The mean perch CPUE and BPUE increased each year from 2008 to 2014; however, these differences were not statistically significant. Perch ranged in age from 0+ to 8+, indicating reproductive success in eight of the previous nine years, with no 7+ fish 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, Upper Lake has been assigned an ecological status of Moderate for 2008, 2011 and 2014 based on the fish populations present.

In the 2010 to 2012 surveillance monitoring reporting period, the EPA assigned Upper Lake 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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