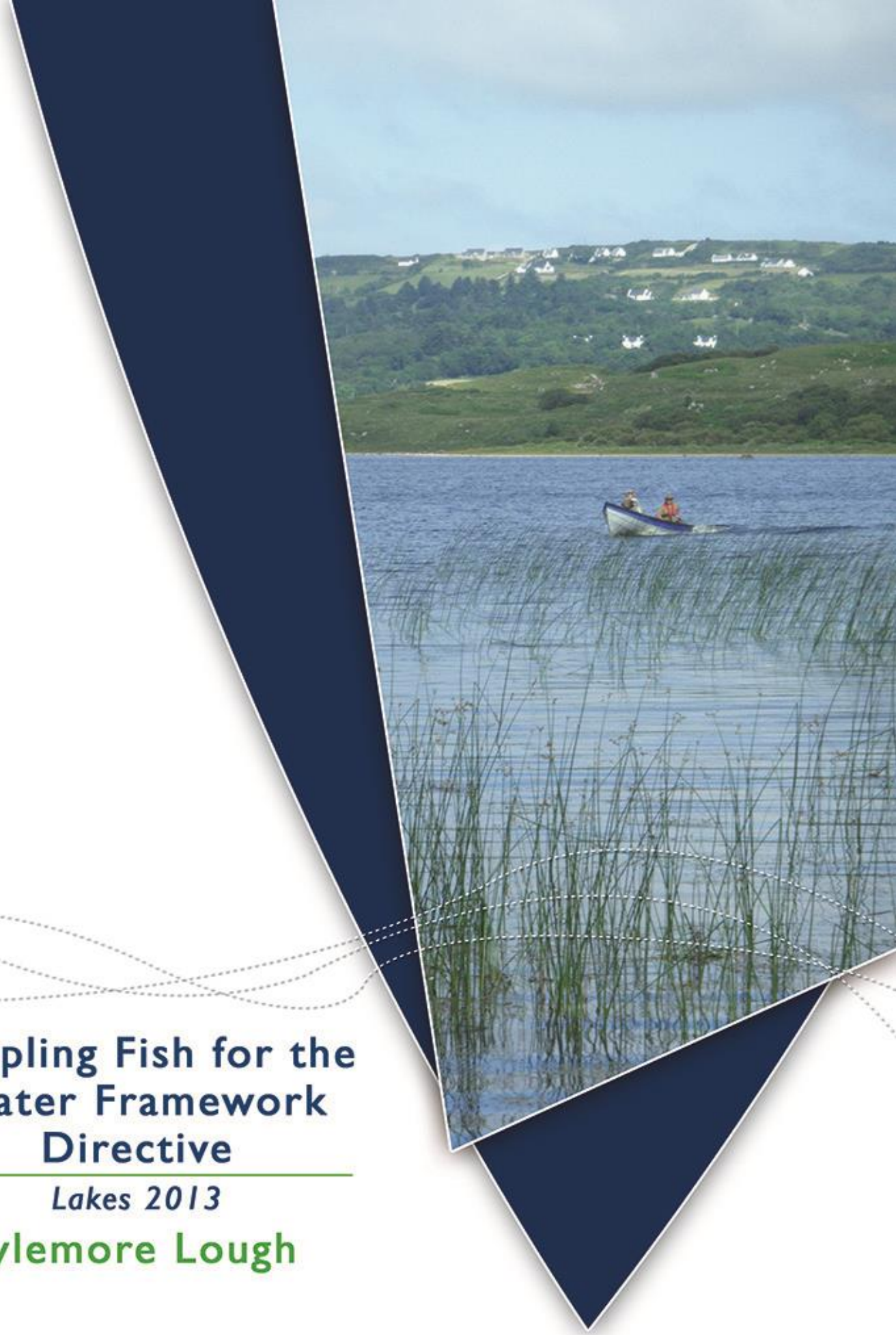
IFI/2014/1-4198



Sampling Fish for the Water Framework Directive

Lakes 2013

Kylemore Lough

Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Kylemore Lough, August 2013

Fiona L. Kelly, Lynda Connor, Emma Morrissey, John Coyne, Ronan Matson, Rory Feeney and Kieran Rocks

Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

CITATION: Kelly, F.L., Connor, L., Morrissey, E., Coyne, J., Matson, R., Feeney, R. and Rocks, K. (2014) Water Framework Directive Fish Stock Survey of Kylemore Lough, August 2013. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

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

ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of the regional director Dr. John Conneely and the staff from IFI, Galway. 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 thank the fishery owners for granting access during the survey.

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Energy and Natural Resources for 2013.

1.1 Introduction

Kylemore Lough is the largest of the three Kylemore loughs, situated in the Dawros catchment in Co. Galway, approximately 5km north-east of Letterfrack, Co. Galway (Plate 1.1, Fig. 1.1). It has a surface area of 134ha, a mean depth > 4m, a maximum depth of 30m and falls into typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (>4m), greater than 50ha and low alkalinity (<20mg/l $CaCO_3$). The lake has a stock of brown trout, Arctic char and gets a run of salmon and sea trout from June to the end of the angling season (O' Reilly, 2007).

Kylemore Lough is situated within the Twelve Bens/Garraun Complex Special Area of Conservation (SAC). This is an extensive site located in the north-west of Connemara and is dominated by mountainous terrain. Geologically, the site can be divided into two distinct sections; the Twelve Bens which are composed of quartzite and schists in the valleys and the mountains to the north of Kylemore which are composed of gneiss, sandstones and mudstones (NPWS, 2005). The main soil type within the site is peat. Eight of the habitat types listed in the SAC are found in Annex I of the EU Habitats Directive. The SAC also contains the following species listed on Annex II of the Habitats Directive - freshwater pearl mussel, Atlantic salmon, otter and the plant, slender naiad (NPWS, 2005).

Kylemore 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 this survey brown trout were found to be the dominant species present on the lake. Sea trout, Arctic char, salmon, minnow and eels were also captured during the survey.

An additional experimental survey using hydroacoustic and pelagic gillnetting techniques was carried out on Kylemore Lough in parallel to the WFD fish stock survey. 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* 12km of hydroacoustic transects. A separate report will be available in due course.

Plate 1.1. Kylemore Lough

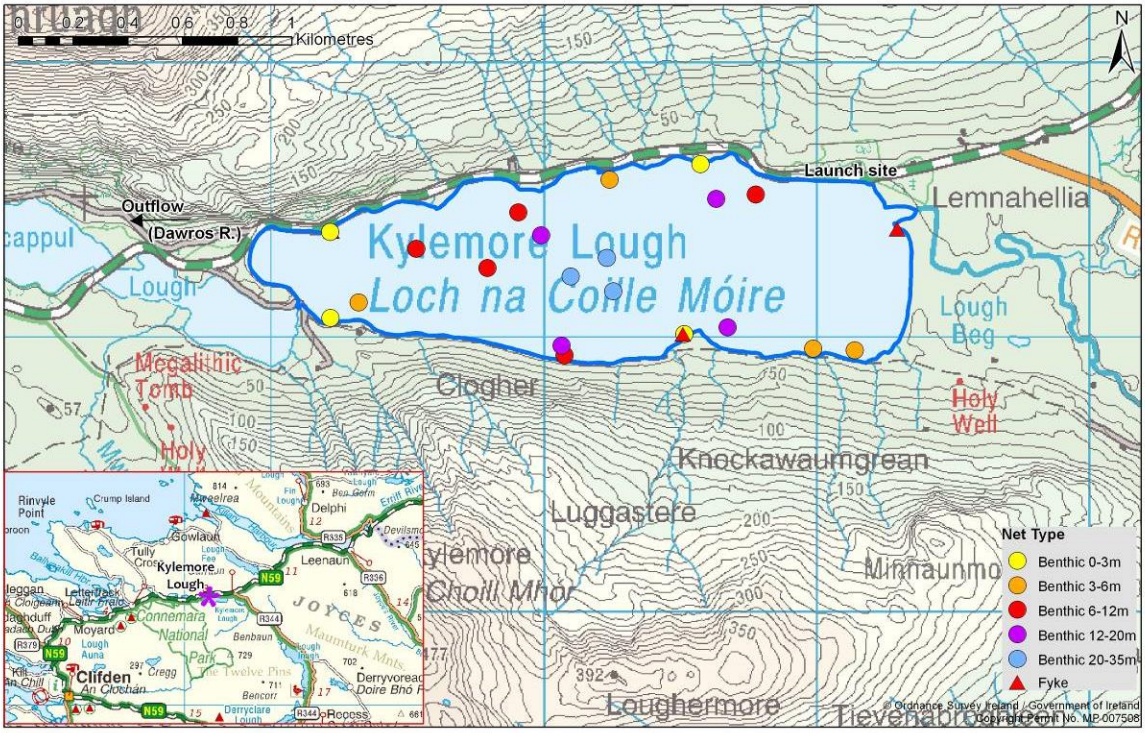


Fig. 1.1. Location map of Kylemore Lough showing net locations and depths of each net (outflow is indicated on map)

1.2 Methods

Kylemore Lough was surveyed over two nights from the 20th to the 22nd of August 2013. A total of three sets of Dutch fyke nets, 20 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 and 3 @ 20-34.9m) and two floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (25 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, salmon and sea trout. 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 five fish species (sea trout are included as a separate 'variety' of trout) were recorded in Kylemore Lough in August 2013, with 181 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout were the most abundant fish species recorded, followed by Arctic char. Salmon, sea trout, eels and minnow were also recorded. During the previous survey in 2010 and 2007 the same species composition was recorded, with the exception of salmon, which were present during the current survey and in the 2007 survey but were not captured in the 2010 survey.

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

Scientific name	Common name	Number of fish captured			
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Fyke nets	Total
Salmo trutta	Brown trout	90	1	0	91
Salvelinus alpinus	Arctic char	36	0	0	36
Salmo salar	Salmon	18	2	0	20
Salmo trutta	Sea trout	11	0	0	11
Phoxinus phoxinus	Minnow	11	0	0	11
Anguilla anguilla	European eel	0	0	12	12

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.

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

Although the mean brown trout CPUE fluctuated between the three years and the mean brown trout BPUE increased each year, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3).

The mean Arctic char CPUE and BPUE remained relatively stable between the three sampling occasions and 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 Kylemore Lough, 2010 and 2013

Scientific name	Common name	2007	2010	2013
			Mean CPUE	
Salmo trutta	Brown trout	0.120 (0.028)	0.058 (0.019)	0.115 (0.028)
Salvelinus alpinus	Arctic char	0.047 (0.014)	0.048 (0.020)	0.048 (0.017)
Salmo salar	Salmon	0.006 (0.003)	-	0.025 (0.009)
Salmo trutta	Sea trout	0.029 (0.009)	0.008 (0.004)	0.021 (0.007)
Phoxinus phoxinus	Minnow	0.030 (0.015)	0.010 (0.005)	0.015 (0.006)
Anguilla anguilla	European eel*	0.122 (0.056)	0.258 (0.258)	0.067 (0.044)
			Mean BPUE	
Salmo trutta	Brown trout	7.650 (1.857)	10.321 (5.635)	18.738 (6.809)
Salvelinus alpinus	Arctic char	1.598 (0.640)	3.129 (1.406)	4.020 (1.664)
Salmo salar	Salmon	0.105 (0.055)	-	0.339 (0.126)
Salmo trutta	Sea trout	9.942 (3.691)	3.575 (1.956)	6.243 (2.118)
Phoxinus phoxinus	Minnow	0.150 (0.075)	0.173 (0.008)	0.023 (0.010)
Anguilla anguilla	European eel*	19.361 (10.121)	66.341 (66.341)	9.822 (5.971)

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

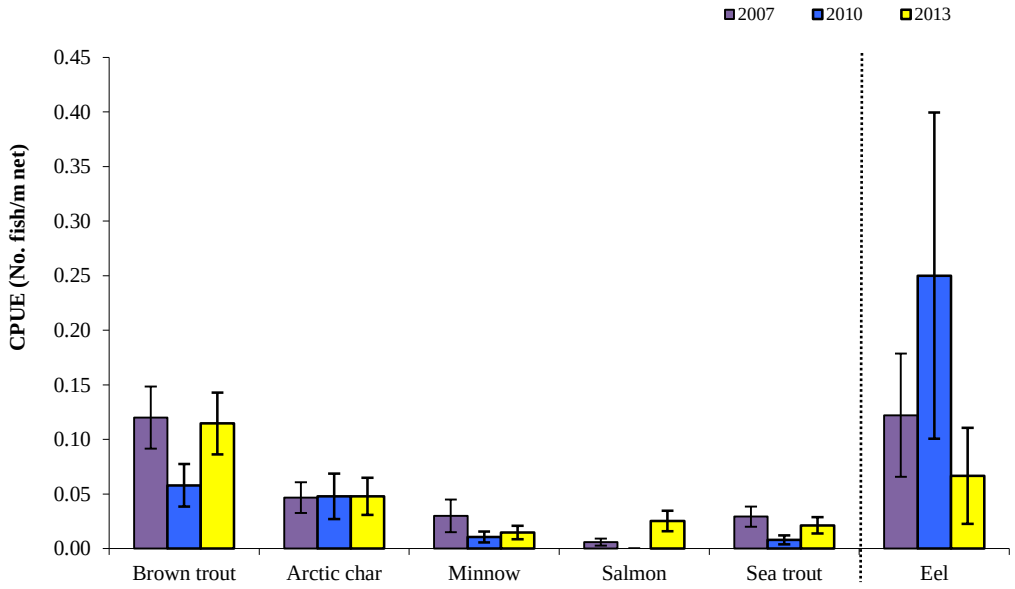


Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Kylemore Lough (Eel CPUE based on fyke nets only), 2007, 2010 and 2013

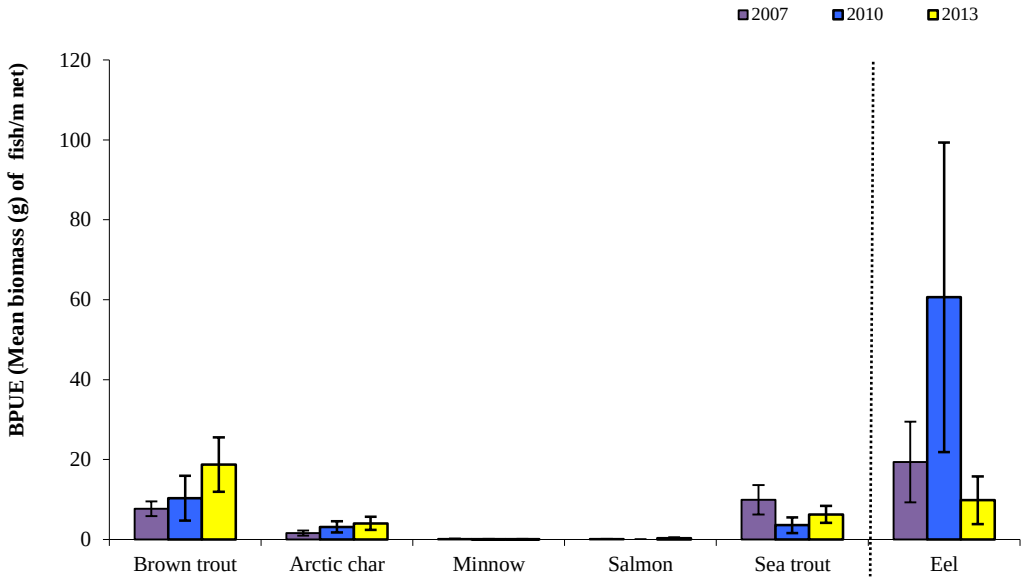


Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Kylemore Lough (Eel BPUE based on fyke nets only), 2007, 2010 and 2013

1.3.3 Length frequency distributions and growth

Brown trout captured during the 2013 survey ranged in length from 11.0cm to 72.0cm (mean = 20.9) (Fig. 1.4) with six age classes present, ranging from 1+ to 9+, with a mean L1 of 6.0cm (Table 1.3). The dominant age class was 2+ (Fig 1.4). Mean brown trout L4 was 25.5cm (Table 1.3) 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 2010 survey had a similar length range, age range and dominant age class (Fig. 1.4). With the exception of the ferox trout captured in 2013 and 2010, brown trout captured during the 2007 survey had a similar length range also and ranged in age from 1+ to 6+. Similar growth rates were observed in all years.

Arctic char captured during the 2013 survey ranged in length from 6.1cm to 23.1cm (mean = 17.9cm) (Fig.1.5) with four age classes present, ranging from 1+ to 4+. In the 2010 survey, Arctic char ranged in length from 10.0cm to 21.9cm (Fig.1.5) and ranged in age from 1+ to 6+. Arctic char captured during the 2007 survey had a similar length and age range.

Eels captured during the 2013 survey ranged in length from 35.2cm to 51.8cm, sea trout ranged in length from 23.1.0cm to 41.2cm (aged 2.1+ to 4.0+) and salmon ranged from 9.2cm to 12.0cm (aged 1+). Minnow captured during the 2013 survey ranged in length from 5.0cm to 6.1cm.

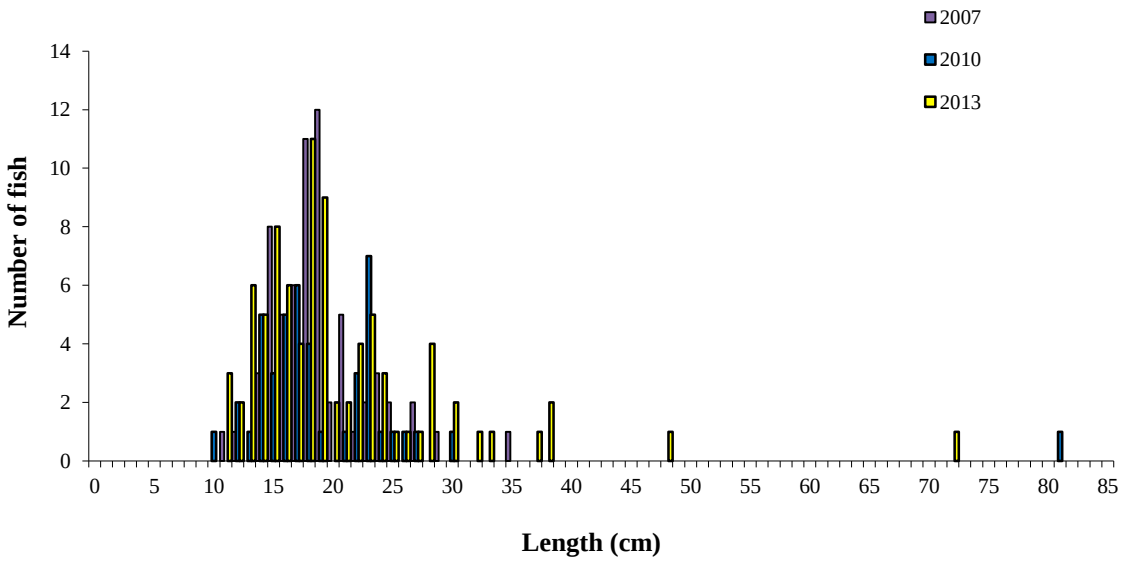


Fig. 1.4. Length frequency of brown trout captured on Kylemore Lough, 2007, 2010 and 2013

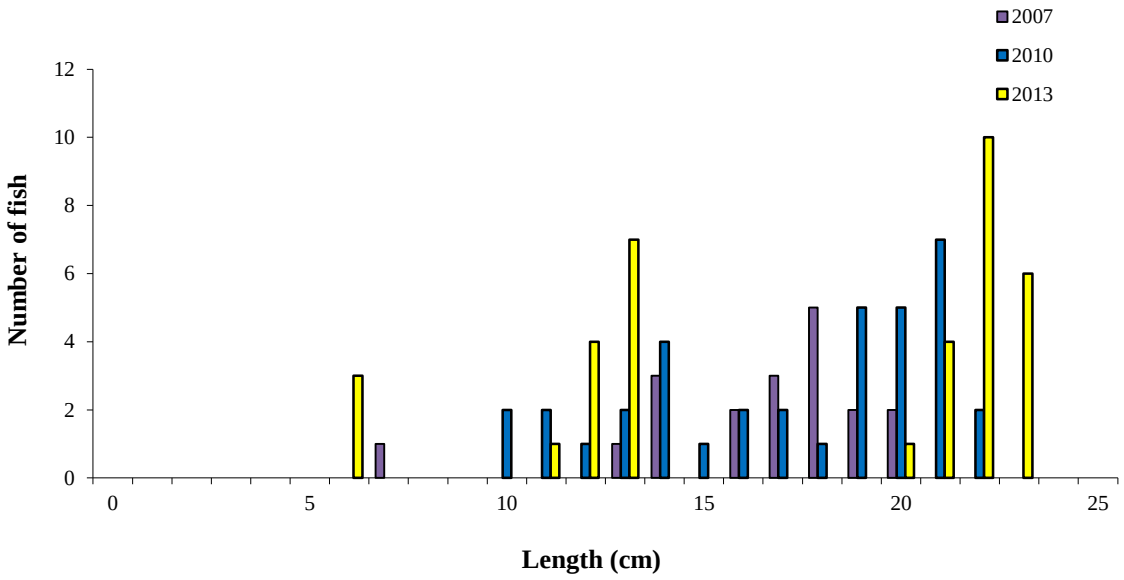


Fig. 1.5. Length frequency of Arctic char captured on Kylemore Lough, 2007, 2010 and 2013

Table 1.3. Mean (±SE) brown trout length (cm) at age for Kylemore Lough, August 2013

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9
Mean	6.0 (0.2)	12.9 (0.3)	19.7 (0.5)	25.5 (0.9)	31.6 (1.4)	34.8	39.2	43.7	46.5
N	62	54	32	15	4	1	1	1	1
Range	3.5-9.3	8.7-18.9	14.2-24.6	18.1-30.8	28.5-34.2	34.8-34.8	39.2-39.2	43.7-43.7	46.5-46.5

1.4 Summary

Brown trout was the dominant species in terms of both abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2013 survey.

Although the mean brown trout CPUE fluctuated between the three years and the mean brown trout BPUE was higher in every year, these differences were not statistically significant. Brown trout ranged in age from 1+ to 9+, indicating reproductive success in nine of the previous ten years. The dominant age class was 2+. 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). The survey also revealed that ferox trout are present in the lake.

There was no significant different in mean Arctic char CPUE and BPUE between sampling occasions. Arctic char ranged in age from 1+ to 4+, indicating reproductive success in four of the previous five years. However, no 0+ fish were captured.

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, Kylemore Lough has been assigned an ecological status of High based on the fish populations present in 2013. The ecological status assigned to the lake based on the 2010 survey fish data was Good and based on the 2007 survey fish data was High.

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

1.5 References

Kelly, F. and Connor, L. (2007) *WFD Surveillance Monitoring - Fish in Lakes 2007*. Central Fisheries Board report.

Kelly, F.L., Harrison, A., Connor, L., Allen, M., Rosell, R. and Champ, T. (2008) *FISH IN LAKES Task 6.9: Classification tool for Fish in Lakes. FINAL REPORT*. Central Fisheries Board, NSSHARE project.

Kelly, F., Harrison A., Connor, L., Matson, R., Morrissey, E., Wogerbauer, C., Feeney, R., O'Callaghan, R. and Rocks, K. (2011) *Sampling Fish for the Water Framework Directive – Summary Report 2010*. Inland Fisheries Ireland.

Kelly, F.L., Harrison A., Connor, L., Morrissey, E., Wogerbauer, C., Matson, R., Feeney, R., O'Callaghan, R. and Rocks, K. (2011) *Water Framework Directive Fish Stock Survey of Kylemore Lough, August 2010*. Inland Fisheries Ireland.

Kelly, F.L., Harrison, A.J., Allen, M., Connor, L. and Rosell, R. (2012) Development and application of an ecological classification tool for fish in lakes in Ireland. *Ecological Indicators*, **18**, 608-619.

Kennedy, M. and Fitzmaurice, P. (1971) Growth and food of brown trout *Salmo Trutta* (L.) in Irish waters. *Proceedings of the Royal Irish Academy*, **71 (B) (18),** 269-352.

King, J.J., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., Fitzpatrick, Ú., Gargan, P.G., Kelly, F.L., O' Grady, M.F., Poole, R., Roche, W.K. and Cassidy, D. (2011) *Ireland Red List No. 5: Amphibians, Reptiles and Freshwater Fish*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

NPWS (2005) Site *synopsis: The Twelve Bens, Garraun Complex. Site code: 002031*. Site Synopsis report, National Parks and Wildlife Service.

O' Reilly (2007) *Loughs of Ireland. A Flyfisher's Guide.* 4th Edition. Merlin Unwin Books.

IFI Dublin,
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland

www.fisheriesireland.ie
dublin@fisheriesireland.ie
+353 1 8842 600