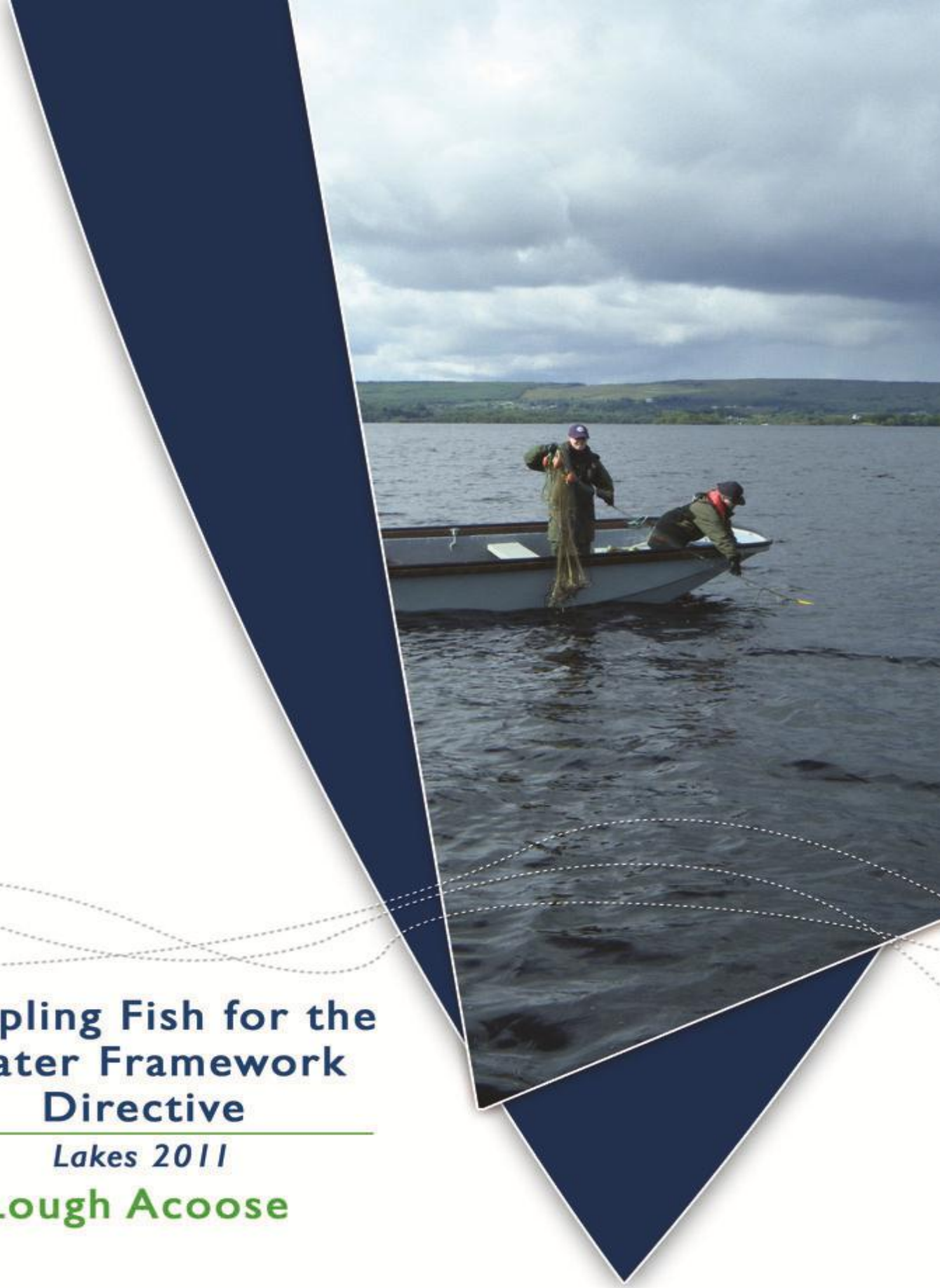
IFI/2012/1-4059



Sampling Fish for the Water Framework Directive

Lakes 2011

Lough Acoose

Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Lough Acoose, August 2011

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

Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin

CITATION: Kelly, F.L., Connor, L., Morrissey, E., Wogerbauer, C., Matson, R., Feeney, R. and Rocks, K. (2012) Water Framework Directive Fish Stock Survey of Lough Acoose, August 2011. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin, Ireland.

Cover photo: Lynda and Fiona gill netting © Inland Fisheries Ireland

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 2011.

1.1 Introduction

Lough Acoose is situated in Co. Kerry in the upper Caragh catchment (Plate 1.1a and 1.1b, Fig 1.1). The lake is located approximately seven kilometres south of Killorglin, between Glencar and Kilorglin (Fig. 1.1). The lake has a surface area of 66ha and a maximum depth of 19m. Lough Acoose falls into typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), greater than 50ha and low alkalinity (<20mg/l $CaCO_3$).

Lough Acoose forms part of the Killarney National Park, Macgillycuddy'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).

Lough Acoose is historically known to hold a stock of brown trout and gets a run of grilse from July onwards. The lake also historically held a population of Arctic char (Went, 1945) a rare and threatened species listed in the Irish Red Data Book for fish as vulnerable (King, 2011). A review paper on the distribution and status of Arctic Char in Ireland (Igoe *et al.*, 2003) reported that char were not present in the lake following a 1983 survey. In 2006 however, an EPA funded PhD studentship at University College Cork investigating the vulnerability of char eggs to environmental change found a char population present in the lake (E. Morrissey, *pers. com.*).

Lough Acoose was previously surveyed in 2008 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al*., 2009). During this survey, brown trout and Arctic char were found to be the dominant species present in the lake. Eels were also captured during the survey.

Plate 1.1a. Lough Acoose

Plate 1.1b. Lough Acoose

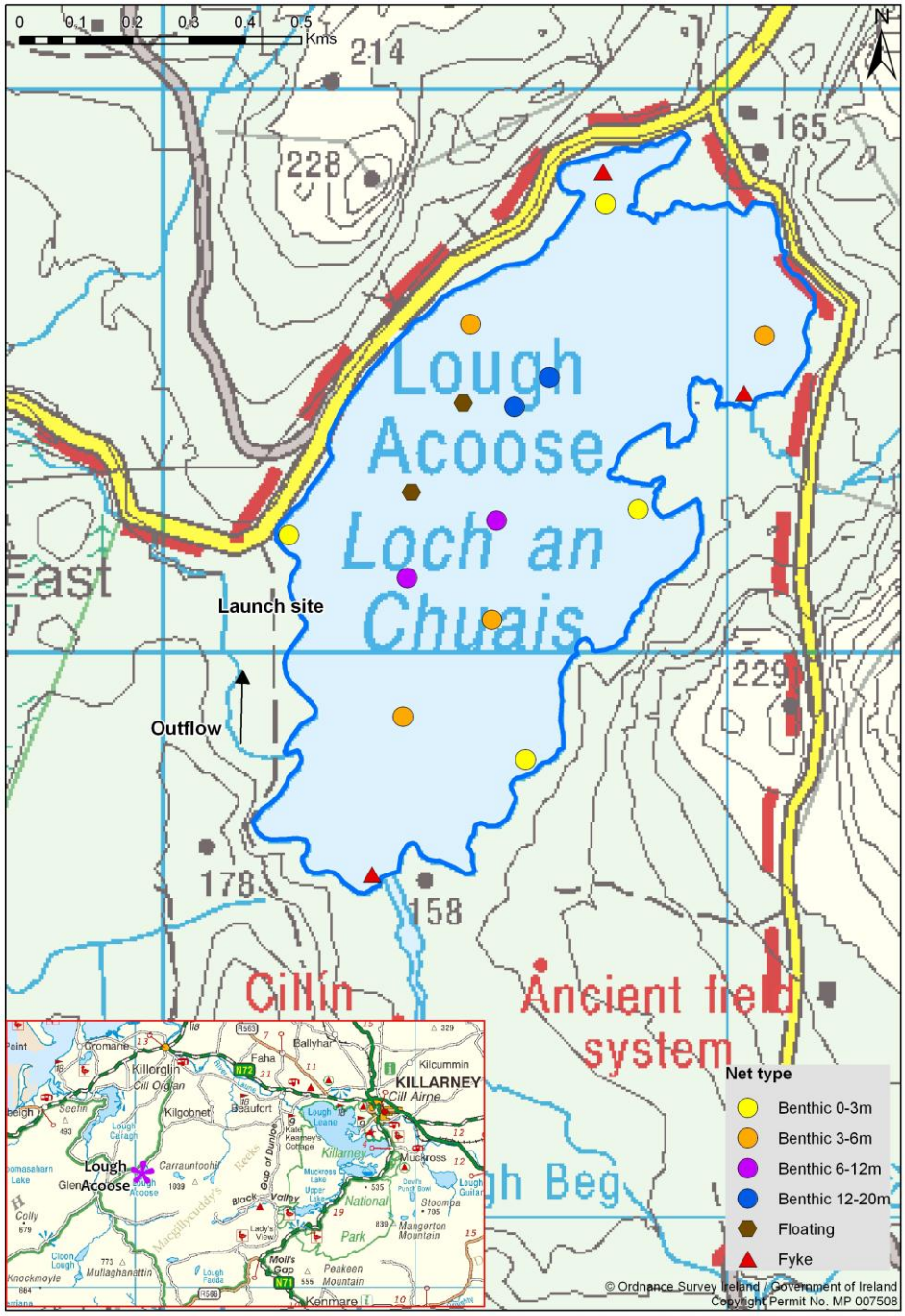


Fig. 1.1. Location map of Lough Acoose showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

Lough Acoose was surveyed over two nights from the 22nd to the 24th of August 2011. A total of three sets of Dutch fyke nets, 12 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 2 @ 6-11.9m and 2 @ 12-19.9m) and two floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (17 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 Arctic char. 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 three fish species were recorded on Lough Acoose in August 2011, with 282 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most abundant fish species recorded, followed by Arctic char (Plate 1.2), salmon and eels. During the previous survey in 2008 the same species composition was recorded with the exception of salmon, which were present during the 2011 survey but were not captured in 2008.

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Acoose, August 2011

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	182	24	1	207
Salvelinus alpinus	Arctic char	61	1	0	62
Salmo salar	Salmon	6	0	1	7
Anguilla anguilla	European eel	0	0	6	6

Plate 1.2. Arctic char from Lough Acoose

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 2008 and 2011 are summarised in Table 1.2. Mean CPUE and BPUE for all fish species is illustrated in Figures 1.2 and 1.3.

Although the mean brown trout and Arctic char CPUE was higher in 2011 than in 2008, these differences were not statistically significant.

The differences in the mean brown trout CPUE between Lough Acoose and four similar lakes was assessed, with no overall significant differences being found (Fig. 1.4).

The differences in the mean Arctic char CPUE between Lough Acoose and four other similar lakes were also assessed and found to be statistically significant (Kruskal-Wallis, $P<0.05$) (Fig. 1.5). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Acoose had a significantly higher mean Arctic char CPUE than Lough Talt, Lough Leane and Lough Melvin ($z = -3.386$ $P<0.05$, $z = -5.410$ $P<0.05$ and $z = -6.456$ $P<0.05$).

Although the mean brown trout BPUE was higher in 2011 than in 2008, these differences were also not statistically significant. However, in contrast the mean Arctic char BPUE was significantly higher in 2011 than in 2008 (t-test, t_{-24}=2.071, P<0.05).

The differences in the mean brown trout BPUE between Lough Acoose and four similar lakes was assessed, with no overall significant differences being found (Fig. 1.6). However, Independent-Samples Mann-Whitney U tests between each lake showed that Lough Acoose had a significantly higher mean brown trout BPUE than Lough Barra (z = -2.205, P<0.05).

The differences in the mean Arctic char BPUE between Lough Acoose and four other similar lakes were also assessed and found to be statistically significant (Kruskal-Wallis, P<0.05) (Fig. 1.7). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Acoose had a significantly higher mean Arctic char BPUE than Lough Talt, Lough Beagh, Lough Leane and Lough Melvin (z = -3.213 P<0.05, z = -2.084 P<0.05, z = -5.408 P<0.05 and z = -6.475 P<0.05).

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

Scientific name	Common name	2008	2011
		Mean CPUE	
Salmo trutta	Brown trout	0.363 (0.084)	0.405 (0.069)
Salvelinus alpinus	Arctic char	0.066 (0.022)	0.122 (0.031)
Salmo salar	Salmon	-	0.012 (0.008)
Anguilla anguilla	European eel	0.117 (0.053)	0.033 (0.016)
		Mean BPUE	
Salmo trutta	Brown trout	31.634 (7.127)	37.0912 (6.957)
Salvelinus alpinus	Arctic char	2.866 (0.969)	7.147 (1.825)
Salmo salar	Salmon	-	5.349 (5.085)
Anguilla anguilla	European eel	23.766 (13.302)	5.437 (1.867)

* On the rare occasion where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species.

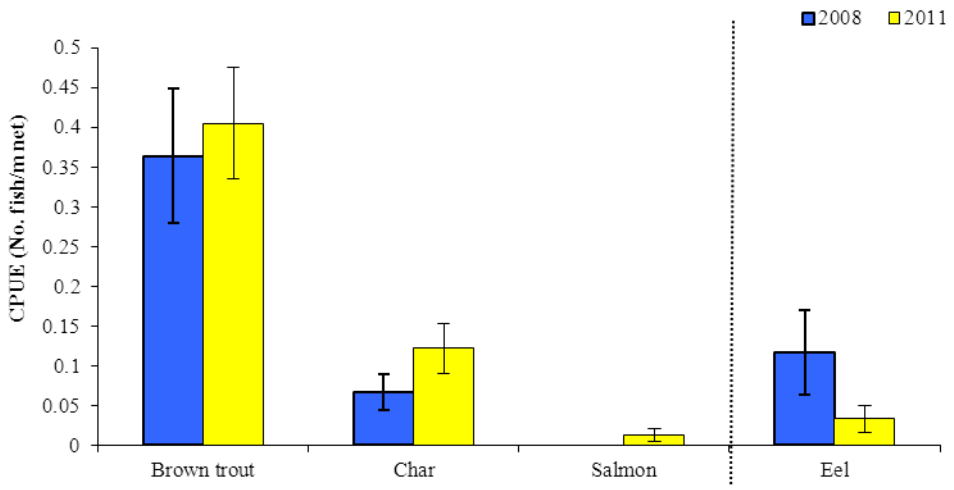


Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Lough Acoose (Eel CPUE based on fyke nets only), 2008 and 2011

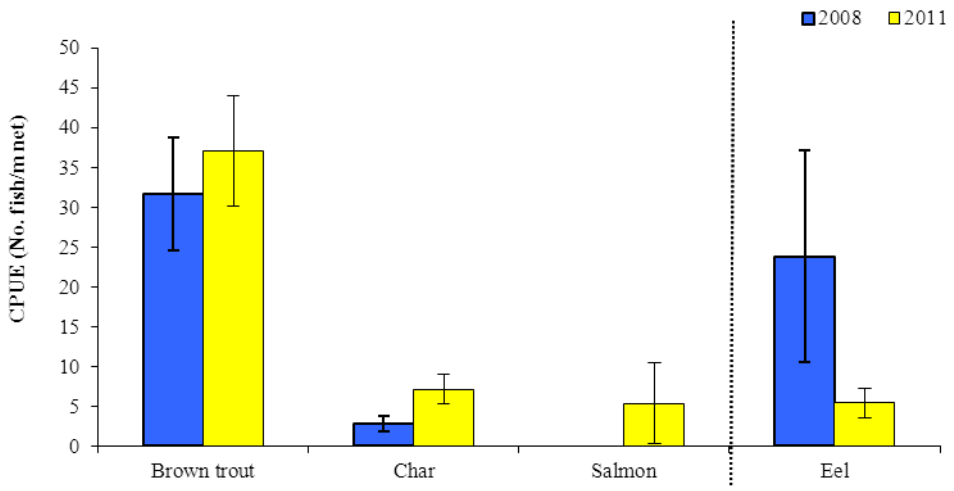


Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lough Acoose (Eel CPUE based on fyke nets only), 2008 and 2011

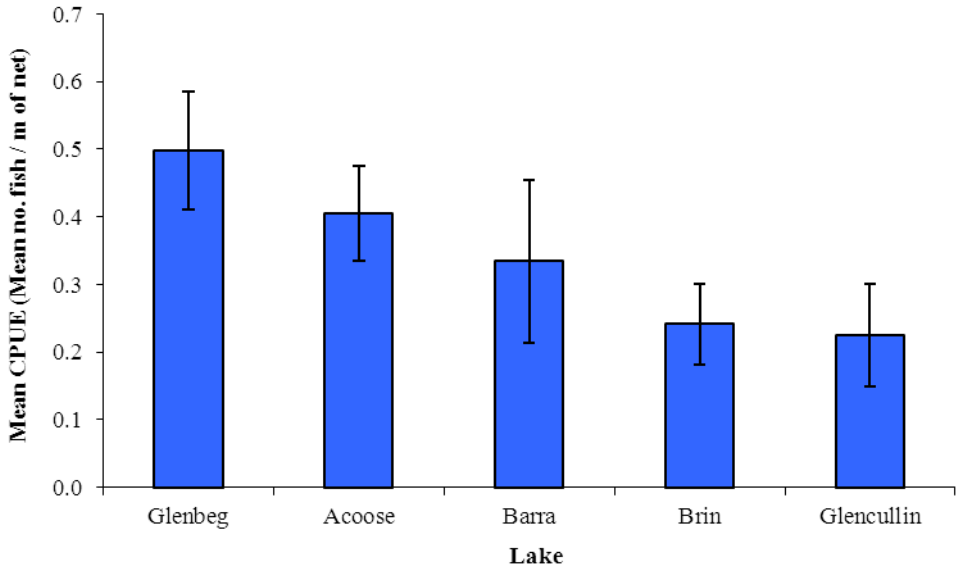


Fig. 1.4. Mean (±S.E.) brown trout CPUE in five lakes surveyed during 2011

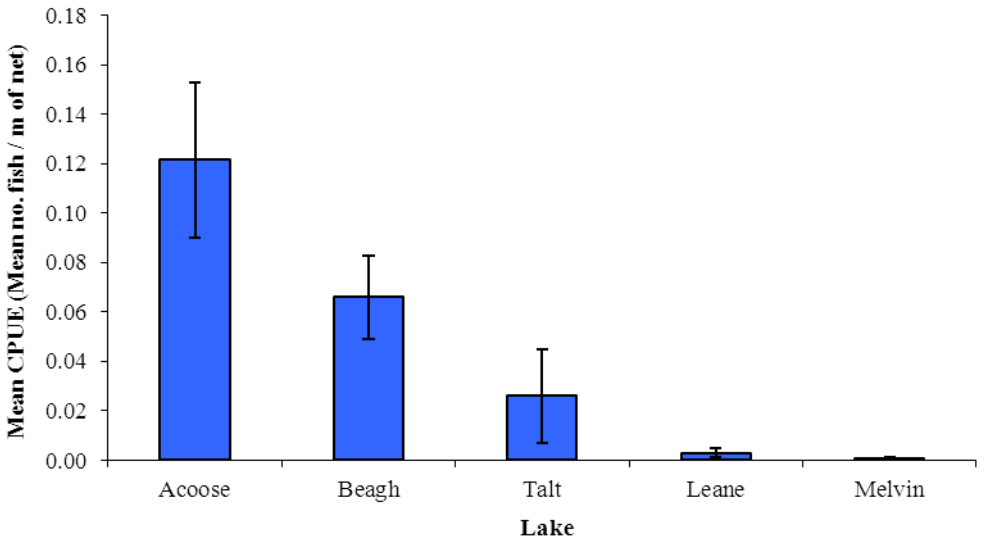


Fig. 1.5. Mean (±S.E.) Arctic char CPUE in five lakes surveyed during 2011

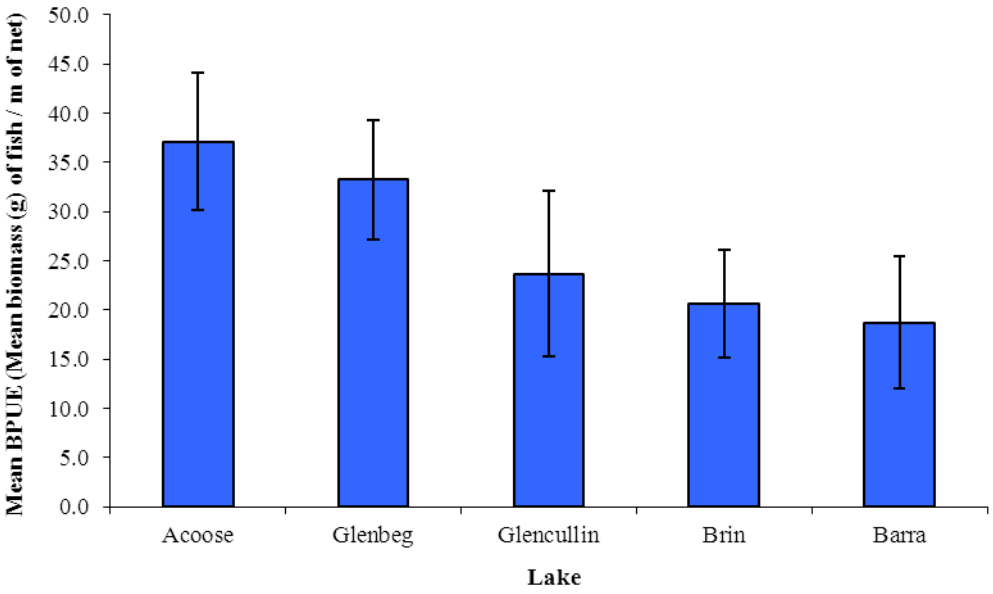


Fig. 1.6. Mean (±S.E.) brown trout BPUE in five lakes surveyed during 2011

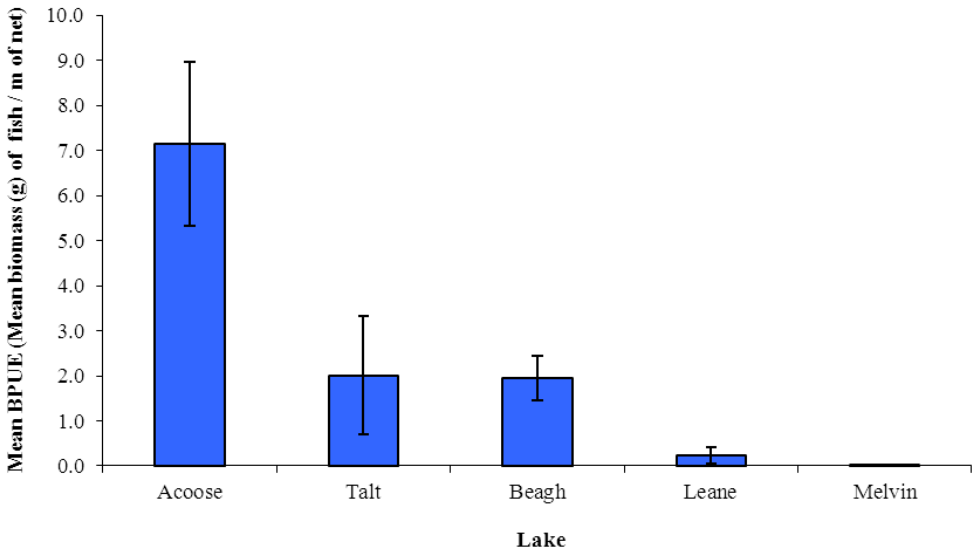


Fig. 1.7. Mean (±S.E.) Arctic char BPUE in five lakes surveyed during 2011

1.3.3 Length frequency distributions

Brown trout captured during the 2011 survey ranged in length from 6.8cm to 34.8cm (mean = 19.5cm) (Fig. 1.8). Brown trout captured during the 2008 survey ranged in length from 8.0cm to 26.2cm (Fig. 1.8).

Arctic char captured during the 2011 survey ranged in length from 7.0cm to 20.2cm (mean = 16.9cm) (Fig.1.9). Arctic char captured during the 2008 survey had lengths ranging from 6.0cm to 19.2cm (Fig.1.9).

Salmon captured during the 2011 survey ranged in length from 10.0cm to 65.2cm and eels ranged in length from 39.0cm to 52.5cm.

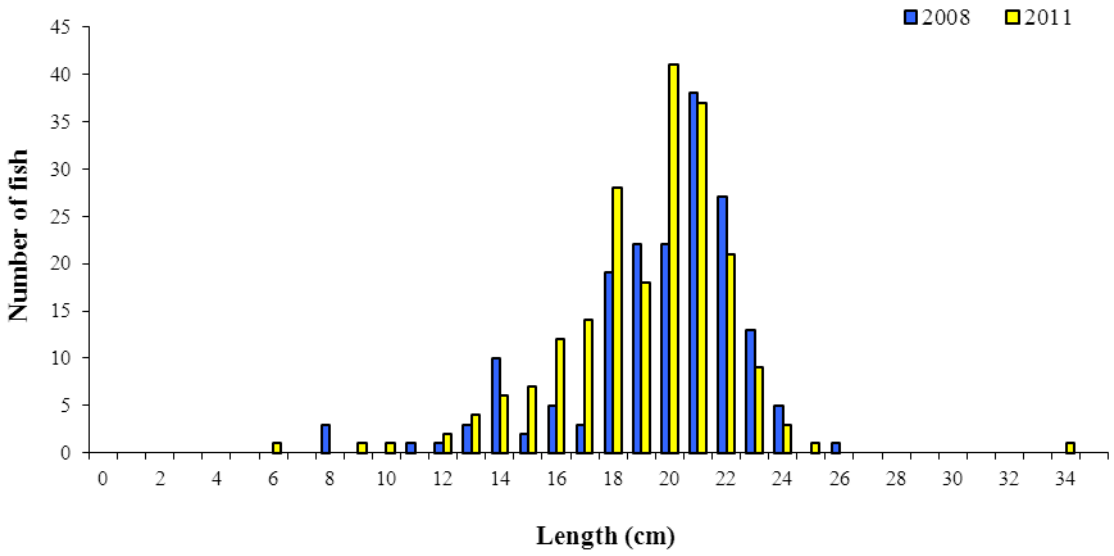


Fig. 1.8. Length frequency of brown trout captured on Lough Acoose

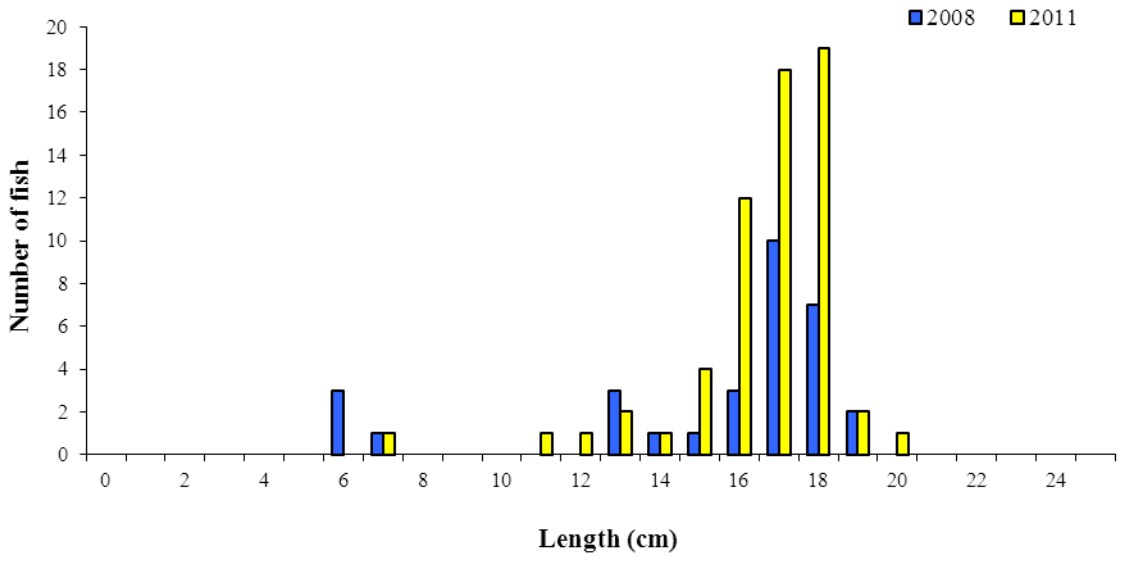


Fig. 1.9. Length frequency of Arctic char captured on Lough Acoose

1.3.4 Fish age and growth

Six age classes of brown trout were present, ranging from 0+ to 5+, with a mean L1 of 6.2cm (Table 1.3). In the 2008 survey, brown trout ranged from 0+ to 3+ with a mean L1 of 6.9cm. Mean brown trout L4 in 2011 was 22.5cm indicating a very slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971). The dominant age class of brown trout was 2+, with ages ranging from 0+ to 5+ indicating reproductive success in each of the previous six years.

Six age classes of Arctic char were present, ranging from 0+ to 5+. Juvenile salmon captured were aged at 1+ and one adult was aged at 2.1+.

Table 1.3. Mean (±SE) brown trout length (cm) at age for Lough Acoose, August 2011

	L_1	L_2	L_3	L_4	L_5
Mean	6.2 (0.2)	14.8 (0.5)	18.9 (0.4)	22.5 (0.7)	31.4
N	50	42	9	3	1
Range	3.3-12.3	6.8-22.2	16.6-20.7	21.5-24.0	31.4-31.4

1.4 Summary

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

The mean brown trout CPUE in Lough Acoose was similar to the other lakes assessed, with no statistically significant differences being found between lakes. The mean brown trout BPUE in Lough Acoose was significantly higher than Lough Barra, another similar lake surveyed. Brown trout ranged in age from 0+ to 5+, indicating reproductive success in each of the previous six years. 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 Arctic char BPUE was significantly higher in 2011 than in 2008. The mean Arctic char CPUE in Lough Acoose was significantly higher than Lough Talt, Lough Leane and Lough Melvin, other similar lakes surveyed. The mean Arctic char BPUE in Lough Acoose was significantly higher than Lough Talt, Lough Beagh, Lough Leane and Lough Melvin, other similar lakes surveyed. Arctic char ranged in age from 0+ to 5+, with 0+ and 1+ fish being captured indicating reproductive success in recent years.

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, Lough Acoose has been assigned an ecological status of Good based on the fish populations present. The ecological status assigned to the lake based on the 2008 survey data was also Good.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Lough Acoose an overall ecological status of Moderate, based on all monitored physico-chemical and biological elements, including fish. This status classification will be revised at the end of 2012.

1.5 References

Igoe F., O'Grady M.F., Tierney D. and Fitzmaurice P. (2003) Arctic Char *Salvelinus alpinus* (L.) in Ireland-A millennium review of its distribution and status with conservation recommendations. Biology and Environment: Proceedings of the Royal Irish Academy **103B** (1) 9-22.

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, NS Share project.

Kelly, F.L., Connor, L., Wightman, G., Matson, R. Morrissey, E., O'Callaghan, R., Feeney, R., Hanna, G. and Rocks, K. (2009) *Sampling fish for the Water Framework Directive – Summary report 2008.* Central and Regional Fisheries Boards report.

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.F., 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*: Killarney National Park, MacGillycuddy's Reeks and Caragh River Catchment. Site code: 000365*. Site Synopsis report, National Parks and Wildlife Service.

Went A. E. J. (1945) "The distribution of Irish Char (Salvelinus spp.)." Proc. Roy. Irish Acad. **50B** (8) 167-189.

Whilde, A (1993) Threatened Mammals, Birds, Amphibians and Fish in Ireland. *Irish Red Data Book 2: Vertebrates*. HMSO Belfast.

Inland Fisheries Ireland
Swords Business Campus,
Swords,
Co. Dublin,
Ireland.

Web: www.fisheriesireland.ie
Email: info@fisheriesireland.ie
Tel: +353 1 8842 600
Fax: +353 1 8360 060