National Research Survey Programme
Lakes 2017

Lough Acoose

IFI/2018/1-4404

Iascach Intíre Éireann
Inland Fisheries Ireland

Inland Fisheries Ireland

National Research Survey Programme

Fish Stock Survey of Lough Acoose,
August 2017

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

ACKNOWLEDGEMENTS

1.1 Introduction

Lough Acoose is situated in Co. Kerry in the upper Caragh catchment (Plates 1.1 and 1.2; 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 is categorised as 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 known to hold a stock of brown trout and gets a run of salmon grilse from July onwards. A review paper on the distribution and status of Arctic Char in Ireland (Igoe *et al.*, 2003) a rare and threatened species listed in the Irish Red Data Book for fish as vulnerable (King, 2011), reported that Arctic 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 Arctic char eggs to environmental change found a population present in the lake (E. Morrissey, *pers*. *com*.). Recent IFI surveys also confirmed the presence of a population of Arctic char (Kelly *et al*., 2009, 2012 and 2015)

Lough Acoose was previously surveyed in 2008, 2011 and 2014 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al*., 2009a, 2012a, 2015a and 2015b). During the 2014 survey, brown trout and Arctic char were found to be the dominant species present in the lake. Eels and salmon were also captured during the surveys.

This report summarises the results of the 2017 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme and IFI's Arctic char research programme.

Plate 1.1. Lough Acoose
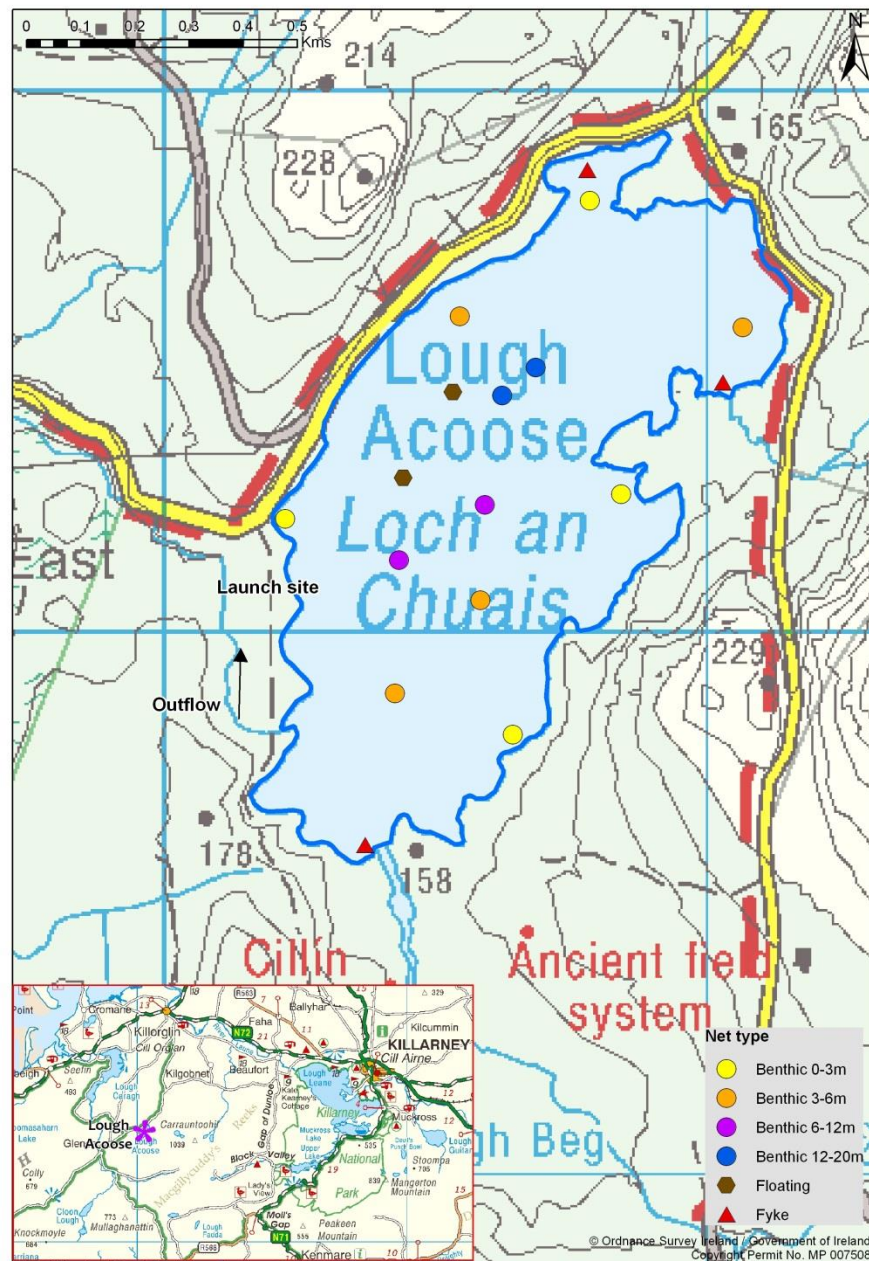

Plate 1.2. Lough Acoose

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

1.2 Methods

1.2.1 Netting methods

Lough Acoose was surveyed over two nights between the 23rd and 25th of August 2017. A total of three sets of Dutch fyke nets (Fyke), 12 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (4 @ 0-2.9m, 4 @ 3-5.9m, 2 @ 6-11.9m and 2 @ 12-19.9m) and two floating monofilament multi-mesh (FM CEN) (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 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. Fish were frozen immediately after the survey and transported back to the IFI laboratory for later dissection

1.2.2 Fish diet

Total stomach contents were inspected and individual items were counted and identified to the lowest taxonomic level possible. The percentage frequency occurrence (%FO) of prey items were then calculated to identify key prey items (Amundsen *et al.*, 1996).

$$\%FO_i = (N_i/ N)\times100$$

Where:

%FO$_i$ is the percentage frequency of prey item i,
N$_i$ is the number of a particular species with prey i in their stomach,
N is total number of a particular species with stomach contents.

1.2.3 Biosecurity - disinfection and decontamination procedures

Procedures are required for disinfection of equipment in order to prevent dispersal of alien species and other organisms to uninfected waters. A standard operating procedure was compiled by Inland Fisheries Ireland for this purpose (Caffrey, 2010) and is followed by staff in IFI when moving between water bodies.

1.3 Results

1.3.1 Species Richness

A total of four fish species were recorded on Lough Acoose in August 2017, with 364 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most common fish species recorded, followed by Arctic char, eels and salmon. During the previous surveys in 2008, 2011 and 2014 the same species composition was recorded, with the exception of salmon which were not recorded in 2008 (Kelly *et al*., 2009a, 2012a, 2015a and 2015b).

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Acoose, August 2017

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
Salmo trutta	Brown trout	230	15	20	265
Salvelinus alpinus	Arctic char	88	6	0	94
Salmo salar	Salmon	2	0	0	2
Anguilla anguilla	European eel	0	0	3	3

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 and illustrated in Figures 1.2 and 1.3.

Brown trout

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE). Although the mean brown trout CPUE increased over the four sampling occasions, these differences were not statistically significant (Table 1.2; Figs. 1.2 and 1.3). There were also no significant differences in mean BPUE across the four sampling years, although the BPUE fluctuated slightly.

Arctic char

The mean Arctic char CPUE and BPUE also fluctuated slightly over the four sampling occasions; however, these differences were not statistically significant (Table 1.2; Figs. 1.2 and 1.3).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Acoose, 2008, 2011, 2014 and 2017

Scientific name	Common name	2008	2011	2014	2017
			Mean CPUE (±S.E.)		
Salmo trutta	Brown trout	0.363 (0.084)	0.405 (0.069)	0.431 (0.077)	0.500 (0.092)
Salvelinus alpinus	Arctic char	0.066 (0.022)	0.122 (0.031)	0.084 (0.021)	0.184 (0.060)
Salmo salar	Salmon	-	0.012 (0.008)	0.003 (0.002)	0.004 (0.004)
Anguilla anguilla	European eel	0.117 (0.053)	0.033 (0.016)	0.022 (0.014)	0.033 (0.010)
			Mean BPUE (±S.E.)		
Salmo trutta	Brown trout	31.634 (7.127)	37.091 (6.957)	33.379 (6.210)	46.059 (7.942)
Salvelinus alpinus	Arctic char	2.866 (0.969)	7.147 (1.825)	3.621 (0.958)	8.262 (2.943)
Salmo salar	Salmon	-	5.349 (5.085)	0.093 (0.053)	6.800 (6.800)
Anguilla anguilla	European eel	23.766 (13.302)	5.437 (1.867)	6.731 (4.141)	4.600 (2.736)

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 (Connor *et al.,* 2017).

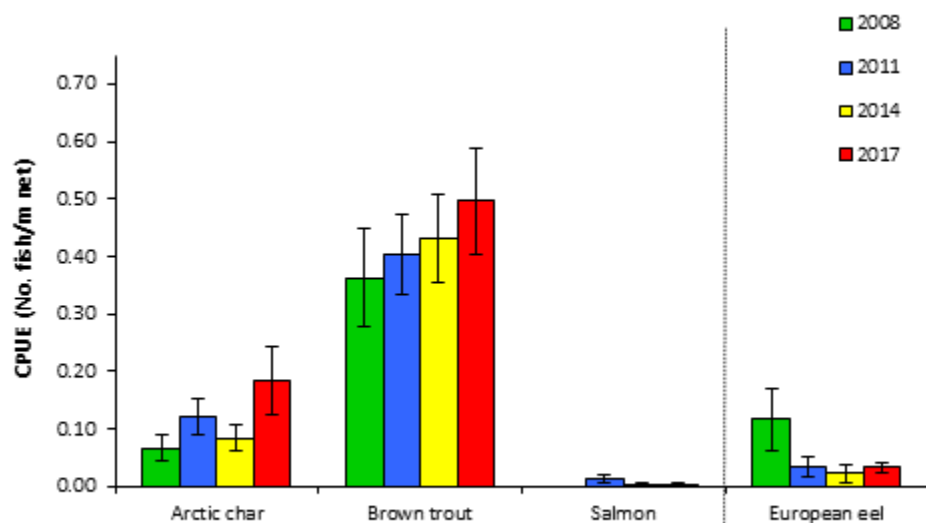*Eel CPUE and BPUE based on fyke nets only

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Lough Acoose (Eel CPUE based on fyke nets only), 2008, 2011, 2014 and 2017
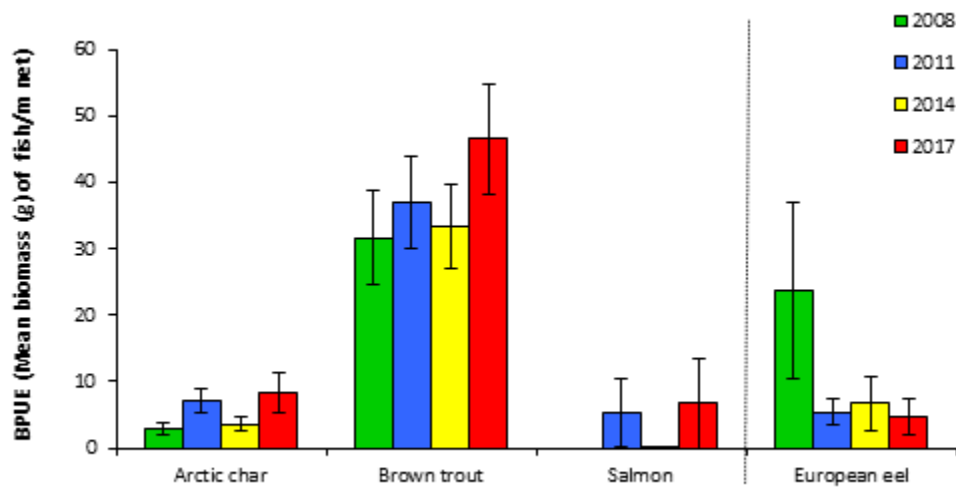

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lough Acoose (Eel BPUE based on fyke nets only), 2008, 2011, 2014 and 2017

1.3.3 Length frequency distributions and growth

Brown trout

Brown trout captured during the 2017 survey ranged in length from 8.5cm to 36.0cm (mean = 19.65cm) (Fig. 1.4). Six age classes were present, ranging from 0+ 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 2017 was 26.2cm 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, 2011 and 2014 surveys had similar length and age ranges (Fig.1.4).
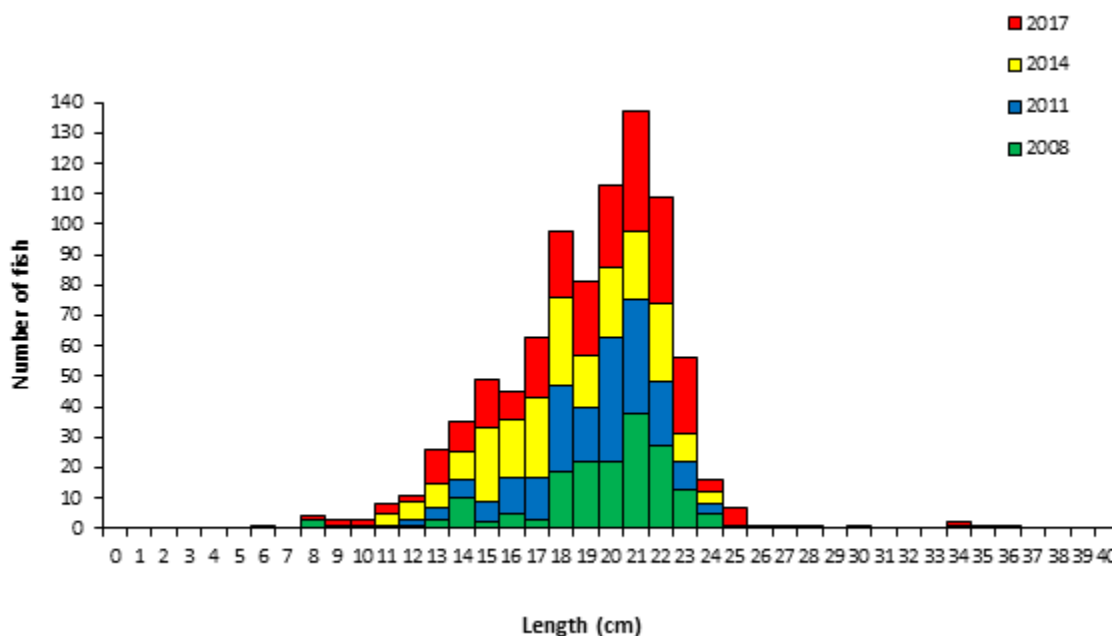

Fig. 1.4. Length frequency of brown trout captured on Lough Acoose, 2008, 2011, 2014 and 2017

Table 1.3. Mean (±S.E.) brown trout length (cm) at age for Lough Acoose, August 2017

	L_1	L_2	L_3	L_4	L_5	Growth Category
Mean (±S.E.)	6.2 (0.2)	13.5 (0.4)	20.4 (0.5)	26.2 (0.5)	31.1 (1.0)	Slow
N	49	41	20	5	2	
Range	3.6-8.6	9.5-17.9	16.3-25.0	24.5-27.1	30.1-32.1	

Arctic char

Arctic char captured during the 2017 survey ranged in length from 6.8cm to 19.8cm (mean = 15.4cm) (Fig.1.5) with five age classes present, ranging from 0+ to 4+. Arctic char captured during the 2008, 2011 and 2014 surveys had a similar length and age range (Fig.1.5).
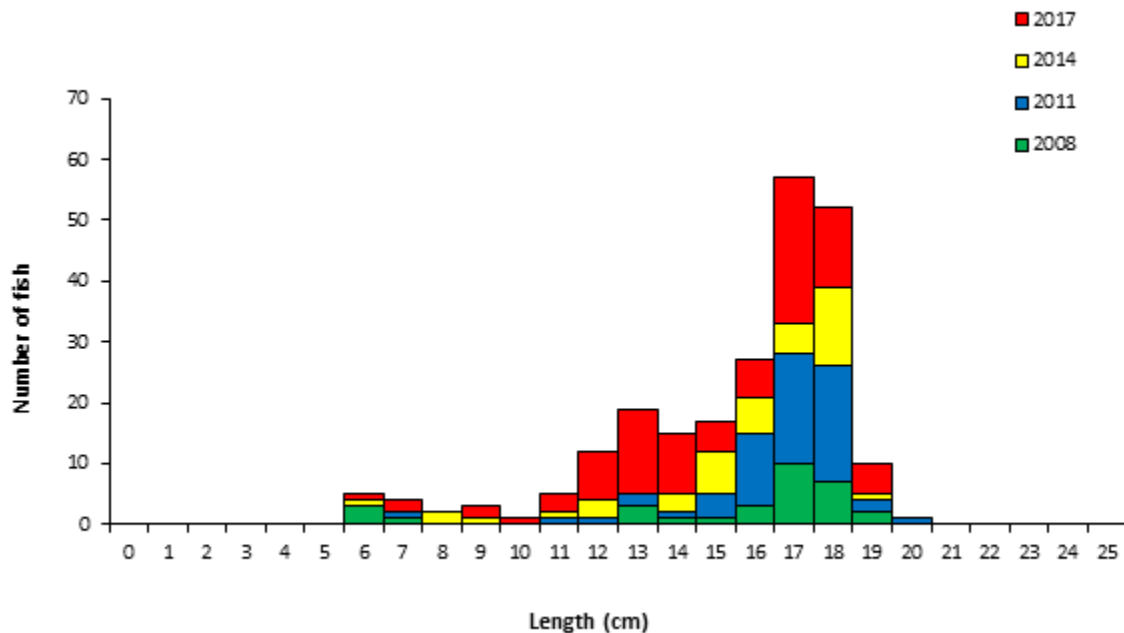

Fig. 1.5. Length frequency of Arctic char captured on Lough Acoose, 2008, 2011, 2014 and 2017

Other fish species

Eels captured during the 2017 survey ranged in length from 37.9cm to 51.4cm. Two adult salmon captured measured 54.0cm and 56.8cm and were aged at 2.1+.

1.3.4 Stomach and diet analysis

Dietary analysis studies provide a good indication of the availability of food items and the angling methods that are likely to be successful. However, the value of stomach content analysis is limited unless undertaken over a long period as diet may change on a daily basis depending on the availability of food items. The stomach contents of a subsample of brown trout and Arctic char captured during the survey were examined and are presented below.

Brown trout

Adult trout usually feed principally on crustaceans (*Asellus* sp. and *Gammarus* sp.), insects (principally chironomid larvae and pupae) and molluscs (snails) (Kennedy and Fitzmaurice, 1971, O'Grady, 1981). A total of 60 stomachs were examined. Of these 20 were found to contain no prey items. Of the remaining 40 stomachs containing food, 75% contained invertebrates, 15% zooplankton, 7% unidentified digested material and 3% unidentified digested material/invertebrates (Fig. 1.6).
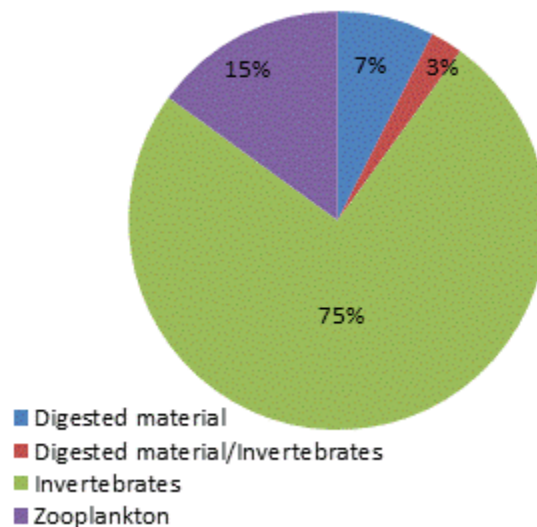

Fig 1.6. Diet of brown trout (n=40) captured on Lough Acoose, 2017 (% FO)

Arctic char

A total of 63 Arctic char stomachs were examined. Of these 28 were found to contain no prey items. Of the remaining 34 stomachs containing food, 74% contained zooplankton and 26% unidentified digested material (Fig. 1.7).
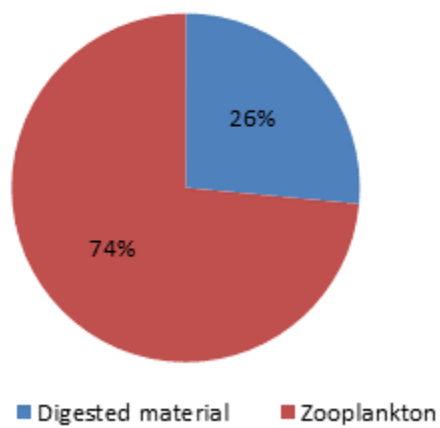
Fig 1.7. Diet of Arctic char (n=34) captured on Lough Acoose, 2017 (% FO)

1.4 Summary and ecological status

A total of four fish species were recorded in Lough Acoose in August 2017. Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2017 survey.

Although the mean brown trout CPUE increased slightly over the four sampling occasions, these differences were not statistically significant. There were also no significant differences in mean BPUE across the four sampling years, although the BPUE fluctuated slightly. Brown trout ranged in age from 0+ to 5+, indicating reproductive success in each of the previous six 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 mean Arctic char CPUE and BPUE fluctuated slightly over the four sampling occasions; however, these differences were not statistically significant. Arctic char ranged in age from 0+ to 4+, with five age classes present.

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 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 Acoose has been assigned an ecological status of Good for 2017 based on the fish populations present. In previous years the lake was also assigned a fish status of Good in 2008, 2011 and 2014.

In the 2010 to 2015 surveillance monitoring reporting period, the EPA assigned Lough Acoose an overall ecological status of Good.

1.5 References

Amundsen, P.A., Gabler H.M. and Staldvik F.J. (1996) A new approach to graphical analysis of feeding strategy from stomach contents data—modification of the Costello (1990) method. *Journal of Fish Biology,* **48,** 607–614.

Caffrey, J. (2010) *IFI Biosecurity Protocol for Field Survey Work*. Inland Fisheries Ireland.

Connor, L., Matson R. and Kelly F.L. (2017) Length-weight relationships for common freshwater fish species in Irish lakes and rivers. *Biology and Environment: Proceedings of the Royal Irish Academy*. Vol. **117**, No. 2, 65-75.

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. (2009a) Water Framework Directive Fish Stock Survey of Lough Acoose, 2008. Central and Regional Fisheries Boards report.

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

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

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

Kelly, F.L., Connor, L., Morrissey, E., Coyne, J., Feeney, R., Matson, R. and Rocks, K. (2015a) Water Framework Directive Fish Stock Survey of Lough Acoose, August 2014. Inland Fisheries Ireland.

Kelly, F.L., Connor, L., Morrissey, E., Coyne, J., Feeney, R., Matson, R. and Rocks, K. (2015b) *Sampling Fish for the Water Framework Directive – Summary Report 2014*. Inland Fisheries Ireland.

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.

O' Grady, M.F. (1981) *A Study of Brown Trout (Salmo trutta L.) Populations in Selected Irish Lakes*. Ph.D. Thesis, National University of Ireland.

Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.
D24 Y265

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600