

National Research Survey Programme

Lakes 2017

Lough Beagh

IFI/2018/1-4414



Iascach Intíre Éireann
Inland Fisheries Ireland



Inland Fisheries Ireland

National Research Survey Programme

**Fish Stock Survey of Lough Beagh,
July/August 2017**

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

CITATION: Connor, L., Coyne, J., Corcoran, W., Cierpial, D., Ni Dhonnaibhain L., Delanty, K., McLoone, P., Morrissey, E., Gordon, P., O' Briain, R., Matson, R., Rocks, K., O' Reilly, S., Brett A., Garland D. and Kelly, F.L. (2018) Fish Stock Survey of Lough Beagh, July/August 2017. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

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

© Inland Fisheries Ireland 2017



ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of all their colleagues in Inland Fisheries Ireland.

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Climate Action and Environment for 2017.

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

The report includes Ordnance Survey Ireland data reproduced under OSi Copyright Permit No. MP 007508.

*Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright.
© Ordnance Survey Ireland, 2017.*



1.1 Introduction

Lough Beagh is situated in a remote valley in the Lackagh catchment, within the Glenveagh National Park, 24 kilometres north-west of Letterkenny, Co. Donegal (Fig. 1.1). A visitor's centre is located near the northern shore of the lake and a castle is located on the eastern shore. Lough Beagh is volcanic in origin. It is a long, narrow lake, approximately 6.5 kilometres in length and 0.8 kilometres wide. The lake is surrounded by mountains on three sides (including the Derryveagh and Glendowan Mountains on the south, east and west side respectively) (Plate 1.1).

The lake has a surface area of 261ha, a mean depth of 9.2m and a maximum depth of 46.5m. The altitude of the lake is 45.3m above sea level. The lake is classed as 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 CaCO₃). Lough Beagh has been characterised as 2b (i.e. expected to meet good status by 2015) in the WFD Characterization report (EPA, 2005). The geology of the area is predominantly granite, felsite and other intrusive rocks rich in silica.

The lake holds brown trout, and occasional salmon and sea trout arrive into the lake during August (O'Reilly, 1987). Arctic char are also present in the lake. The lake was surveyed by Inland Fisheries Ireland (previously the Central Fisheries Board and Northern Regional Fisheries Board) in 1989, 1994 and 1995. In 2005, the lake was again surveyed using the current WFD lake sampling methodology as part of the cross border Interreg IIIA funded NS Share "Fish in Lakes" project by Inland Fisheries Ireland and the Agri-Food and Biosciences Institute Northern Ireland (AFBINI) (Kelly *et al.*, 2007). Subsequently Lough Beagh was surveyed in 2008, 2011 and 2014 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2009, 2012a, 2015a and 2015b). During the 2014 survey, brown trout were found to be the dominant species present in the lake. Arctic char, sea trout, salmon, minnow and eels were also captured during the survey.

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 and brown trout research programmes.



Plate 1.1. View of Lough Beagh (Glenveagh)

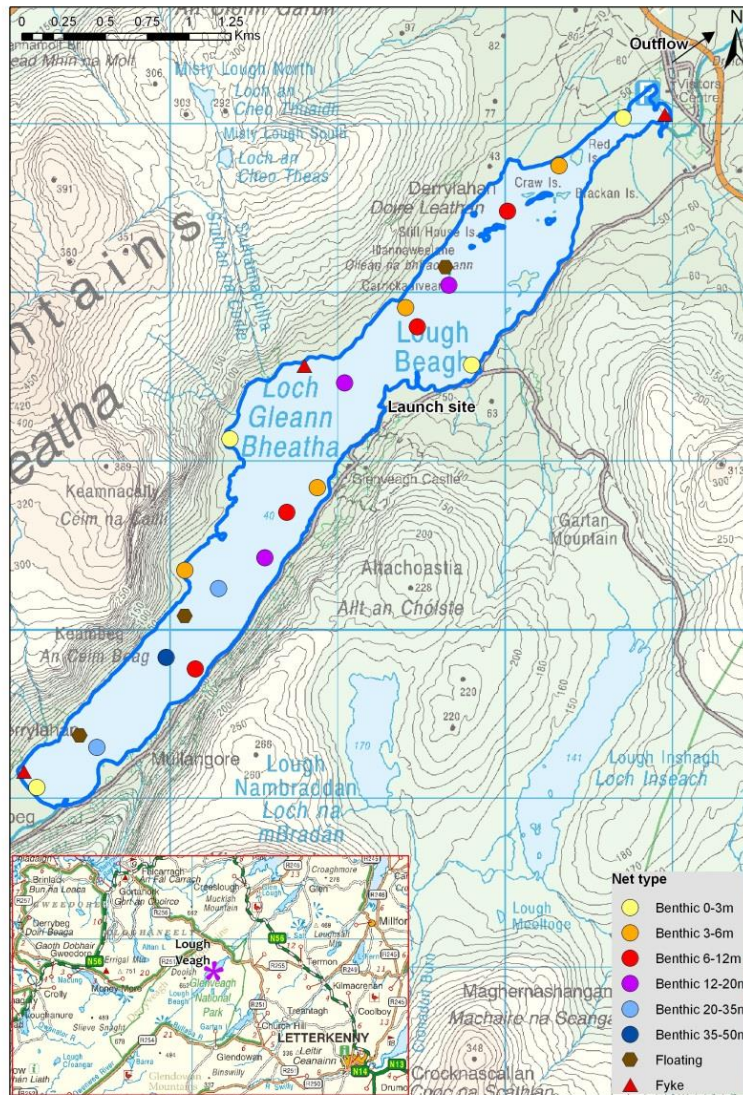


Fig. 1.1 Location map of Lough Beagh showing locations and depths of each net (outflow is indicated on map)



1.2 Methods

1.2.1 Netting methods

Lough Beagh was surveyed over two nights between the 31st July and the 2nd August 2017. A total of three sets of Dutch fyke nets, 18 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, 4 @ 6-11.9m, 3 @ 12-19.9m, 2 @ 20-34.9m and 1 @ 35-49.9m) and three floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (24 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, Arctic char, 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. 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).

$$\%FO_i = (N_i / N) \times 100$$

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 five fish species (sea trout are included as a separate 'variety' of trout) were recorded on Lough Beagh in July/August 2017, with 180 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, salmon, minnow, eels and sea trout. During the previous surveys in 2008, 2011 and 2014 the same species composition was recorded, with the exception of minnow and salmon which were not recorded during the 2008 survey (Kelly *et al.*, 2009, 2012a, 2015a and 2015b).

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

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Salmo trutta</i>	Brown trout	108	10	0	118
	Sea trout	5	0	0	5
<i>Salvelinus alpinus</i>	Arctic char	28	4	0	32
<i>Phoxinus phoxinus</i>	Minnow	12	0	0	12
<i>Anguilla anguilla</i>	Eel	0	0	11	11
<i>Salmo salar</i>	Salmon	1	0	1	2

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 fluctuated slightly over the four sampling occasions, these differences were not statistically significant (Table 1.2; Fig 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; Fig 1.2 and 1.3).

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

Scientific name	Common name	2008	2011	2014	2017
Mean CPUE (\pmS.E.)					
<i>Salmo trutta</i>	Brown trout	0.126 (0.026)	0.211 (0.044)	0.318 (0.680)	0.164 (0.039)
	Sea trout	0.002 (0.001)	0.007 (0.004)	0.0139 (0.007)	0.007 (0.004)
<i>Salvelinus alpinus</i>	Arctic char	0.024 (0.008)	0.065 (0.017)	0.065 (0.017)	0.044 (0.013)
<i>Phoxinus phoxinus</i>	Minnow	-	0.008 (0.005)	0.074 (0.023)	0.017 (0.011)
<i>Salmo salar</i>	Salmon	-	0.001 (0.001)	0.003 (0.002)	0.002 (0.002)
<i>Anguilla anguilla</i> *	Eel*	0.027 (0.011)*	0.022 (0.014)*	0.061 (0.039)*	0.061 (0.006)*
Mean BPUE (\pmS.E.)					
<i>Salmo trutta</i>	Brown trout	12.794 (3.112)	28.553 (7.421)	34.651 (6.753)	19.960 (4.984)
	Sea trout	0.646 (0.589)	2.708 (1.926)	6.138 (4.037)	2.999 (2.105)
<i>Salvelinus alpinus</i>	Arctic char	0.669 (0.314)	1.958 (0.495)	2.891 (0.804)	2.141 (0.654)
<i>Phoxinus phoxinus</i>	Minnow	-	0.022 (0.013)	0.173 (0.052)	0.038 (0.024)
<i>Salmo salar</i>	Salmon	-	4.967 (4.967)	0.038 (0.027)	0.042 (0.035)
<i>Anguilla Anguilla</i> *	Eel*	7.033 (2.666)*	2.572 (1.317)*	6.961 (4.968)*	7.658 (1.175)*

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

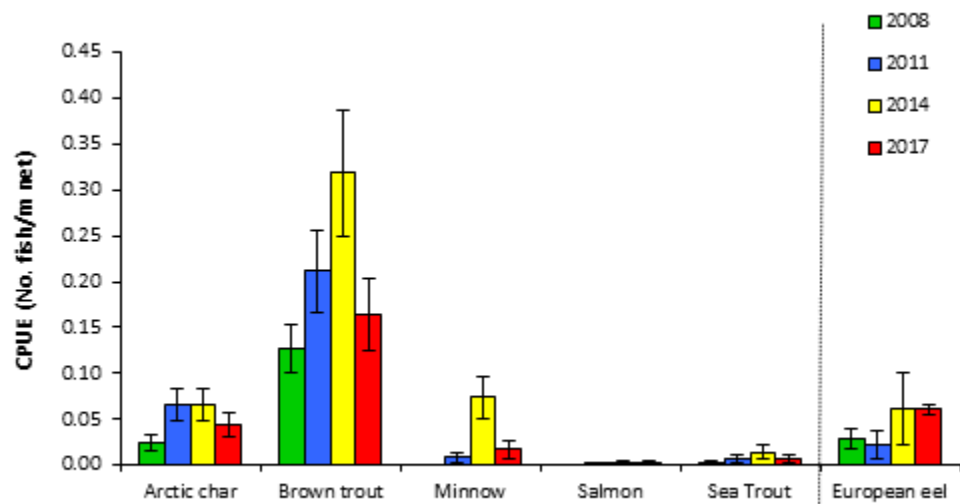


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Lough Beagh (Eel CPUE based on fyke nets only), 2008, 2011, 2014 and 2017

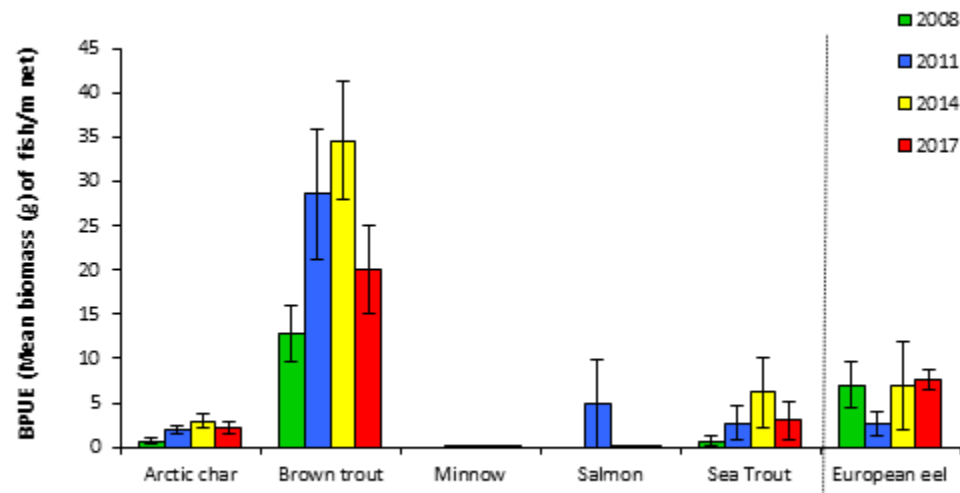


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Lough Beagh (Eel BPUE based on fyke nets only), 2008, 2011, 2014 and 2017



1.3.3 Length frequency distributions and growth

Brown trout

Brown trout captured during the 2017 survey ranged in length from 5.2cm to 32.4cm (mean = 21.1cm) (Fig. 1.4). Six age classes were present, ranging from 0+ to 5+, with a mean L1 of 7.5cm (Table 1.3). The dominant age class was 2+ (Fig. 1.4). Mean brown trout L4 in 2017 was 25.1cm 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, with some larger and older fish recorded in the 2011 and 2014 surveys (Fig.1.4).

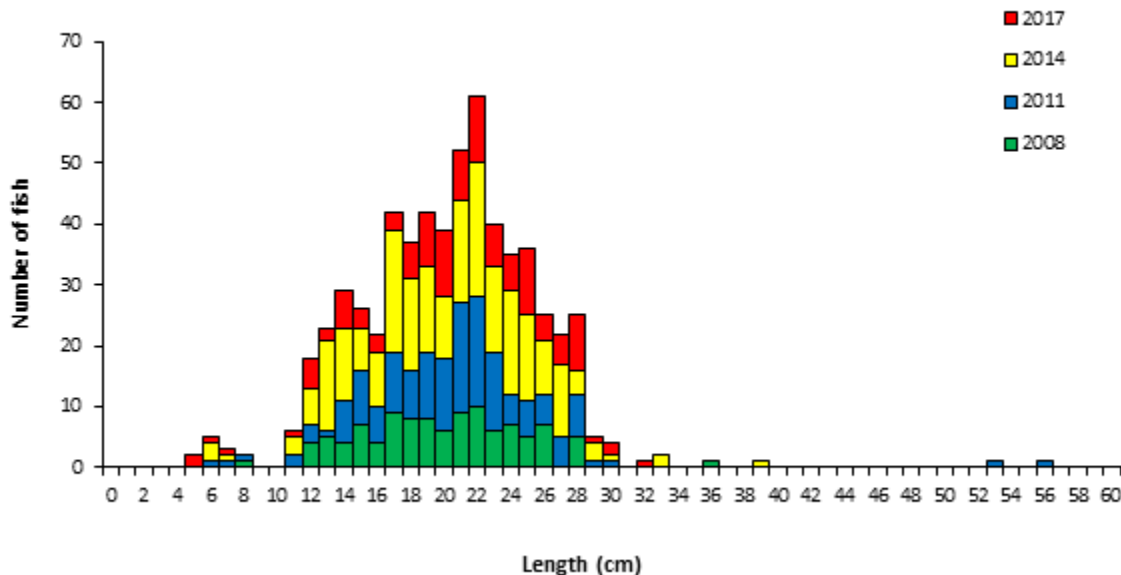


Fig. 1.4. Length frequency of brown trout captured on Lough Beagh, 2008, 2011, 2014 and 2017

Table 1.3. Mean (\pm S.E.) brown trout length (cm) at age for Lough Beagh, July/August 2017

	L ₁	L ₂	L ₃	L ₄	L ₅	Growth Category
Mean (\pm S.E.)	7.5 (0.2)	14.9 (0.3)	20.5 (0.4)	25.1 (0.5)	29.3	Slow
N	67	56	33	11	1	
Range	4.4-10.0	9.8-18.5	13.3-23.5	22.6-28.1	29.3-29.3	

Arctic char

Arctic char captured during the 2017 survey ranged in length from 9.9cm to 19.0cm (mean = 15.7cm) (Fig.1.5) with five age classes present, ranging from 1+ to 5+. Arctic char captured during the 2014 survey had a similar length and age range; however, the 2008 and 2011 surveys recorded smaller younger Arctic char (Fig.1.5).

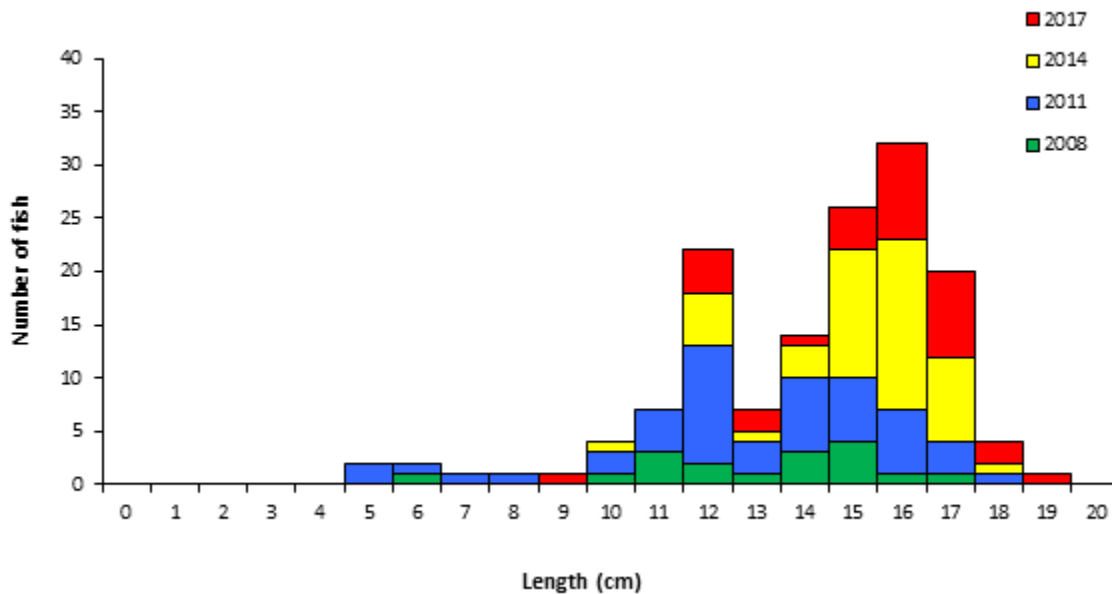


Fig. 1.5. Length frequency of Arctic char captured on Lough Beagh, 2008, 2011, 2014 and 2017

Other fish species

Eels captured during the 2017 survey ranged in length from 33.0cm to 49.3cm. Two juvenile salmon captured were measured at 9.6cm and 12.8cm and aged 1+. Sea trout ranged in length from 26.6cm to 41.6cm and ages ranged from 2.0+ to 3.1+. Minnow ranged in length from 4.5cm to 6.5cm.

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 49 stomachs were examined. Of these 21 were found to contain no prey items. Of the remaining 28 stomachs containing food, 61% contained invertebrates, 36% unidentified digested material and 3% fish (Fig. 1.6).

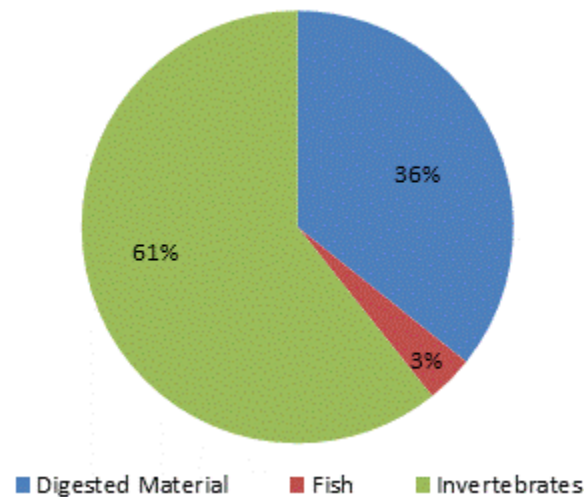


Fig 1.6. Diet of brown trout (n=28) captured on Lough Beagh, 2017 (% FO)

Arctic char

A total of 22 Arctic char stomachs were examined. Of these, three were empty and the remaining 19 contained 79% zooplankton, 16% unidentified digested material and 5% invertebrates (Fig. 1.7).

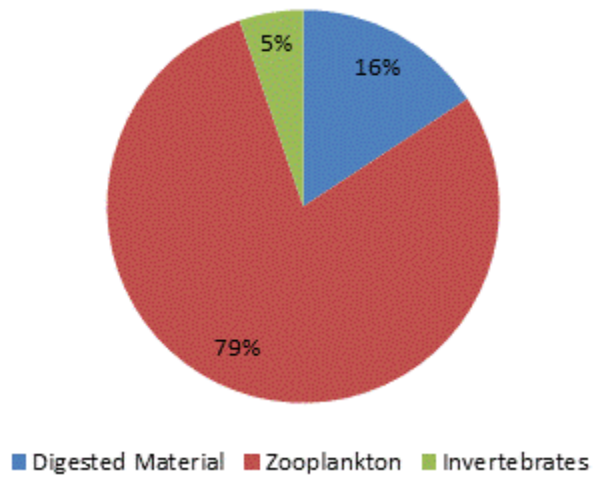


Fig 1.7. Diet of Arctic char (n=19) captured on Lough Neagh, 2017 (% FO)



1.4 Summary and ecological status

A total of five fish species (sea trout are included as a separate 'variety' of trout) were recorded on Lough Beagh in July/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 fluctuated 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 1+ to 5+, 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 (AFBNI) 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 Beagh has been assigned an ecological status of High for 2017 based on the fish populations present. In previous years the lake was assigned a fish status of High in 2008 and Good in 2011 and 2014.

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



1.5 References

- Amundsen, P.A., Gabler H.M., 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*, **117** (2), 65-75.
- EPA (2005) *The Characterisation and Analysis of Ireland's River Basin Districts in accordance with section 7 (2&3) of the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003)*. National Summary Report (Ireland). 166pp.
- Kelly, F., Connor, L. and Champ T. (2007) *A Survey of the Fish Populations in 46 lakes in the Northern Regional Fisheries Board, June to September 2005 and 2006*. (Central Fisheries Board, unpublished 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, 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., Connor, L., Morrissey, E., Wogerbauer, C., Matson, R., Feeney, R. and Rocks, K. (2012a) *Water Framework Directive Fish Stock Survey of Lough Beagh, 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. and Rocks, K. (2015a) *Sampling Fish for the Water Framework Directive – Summary Report 2014*. Inland Fisheries Ireland.
- Kelly, F.L., Connor, L., Morrissey, E., Coyne, J., Feeney, R., Matson, R. and Rocks, K. (2015b) *Water Framework Directive Fish Stock Survey of Lough Beagh, July 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.

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.

O' Reilly, P. (1987) *Trout and Salmon Loughs of Ireland, A Fisherman's Guide*. UK. Unwin Hyman.

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

**www.fisheriesireland.ie
info@fisheriesireland.ie**

+353 1 8842 600

