

National Research Survey Programme

Lakes 2016

Lough Macnean Upper

IFI/2017/1-4358



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**Fish Stock Survey of Lough Macnean Upper,
July 2016**

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

CITATION: Kelly, F.L., Connor, L., Coyne, J., Morrissey, E., Corcoran, W., Cierpial, D., Delanty, K., McLoone, P., Matson, R., Gordon, P., O' Briain, R., Rocks, K., O' Reilly, S., Puttharee, D., McWeeney, D., Robson S. and Buckley, S. (2017) Fish Stock Survey of Lough Macnean Upper, July 2016. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

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

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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 2016.

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1.1 Introduction

Lough Macnean Upper is the larger of the two Macnean lakes, situated on the border of Counties Fermanagh, Leitrim and Cavan at an altitude of 47m a.s.l. (Plate 1.1, Fig. 1.1). It is a mesotrophic lake with a surface area of 644ha, mean depth of 5.2m and maximum depth of 22.7m. The lake falls into typology class 8 (as designated by the EPA for the Water Framework Directive), i.e. deep (>4m), greater than 50ha and moderately alkaline (20-100mg/l CaCO₃).

Lough Macnean Upper is fed by several rivers (Lurgan, Esky and Black Rivers) and flows into the lake via the Belcoo River. Both Lough Macnean Upper and Lough Macnean Lower were formed by a process of glaciation. Glaciers excavated deep basins in the carboniferous rocks, creating steep valley sides and rocky cliffs (NIEA, 2009a). The shores of the lake have good examples of wet woodland and extensive fen and reed bed communities (NIEA, 2009b). The islands on the lake are important breeding sites for lapwing, snipe and curlew (NIEA, 2009b). The white-clawed crayfish, a species listed on Annex II of the EU Habitats Directive, has been recorded in the lake (NIEA, 2009b).

Lough Macnean Upper is a mixed coarse fishery and is particularly noted for its pike angling. The shoreline is broken up by areas of woodland and sheltered bays fringed with reed swamps and fen (NIEA, 2009a). Agricultural usage along the shorelines of the lake is not very developed when compared to the lower lake. Surrounding fields tend to be rush-infested with overgrown hedges (NIEA, 2009a).

A survey carried out in 1969 revealed perch, pike, roach, roach x bream hybrids and brown trout to be present in Lough Macnean Upper (IFT, unpublished data). The lake was again surveyed in 2006, 2010 and 2013 as part of the NSSHARE Fish in Lakes Project and the WFD lakes monitoring programme respectively (Kelly *et al.*, 2007, 2011 and 2014). During the 2013 survey perch were found to be the dominant species present in the lake. Roach, pike, bream, roach x bream hybrids, eels, rudd and brown trout were also recorded.



Plate 1.1. Lough Macnean Upper

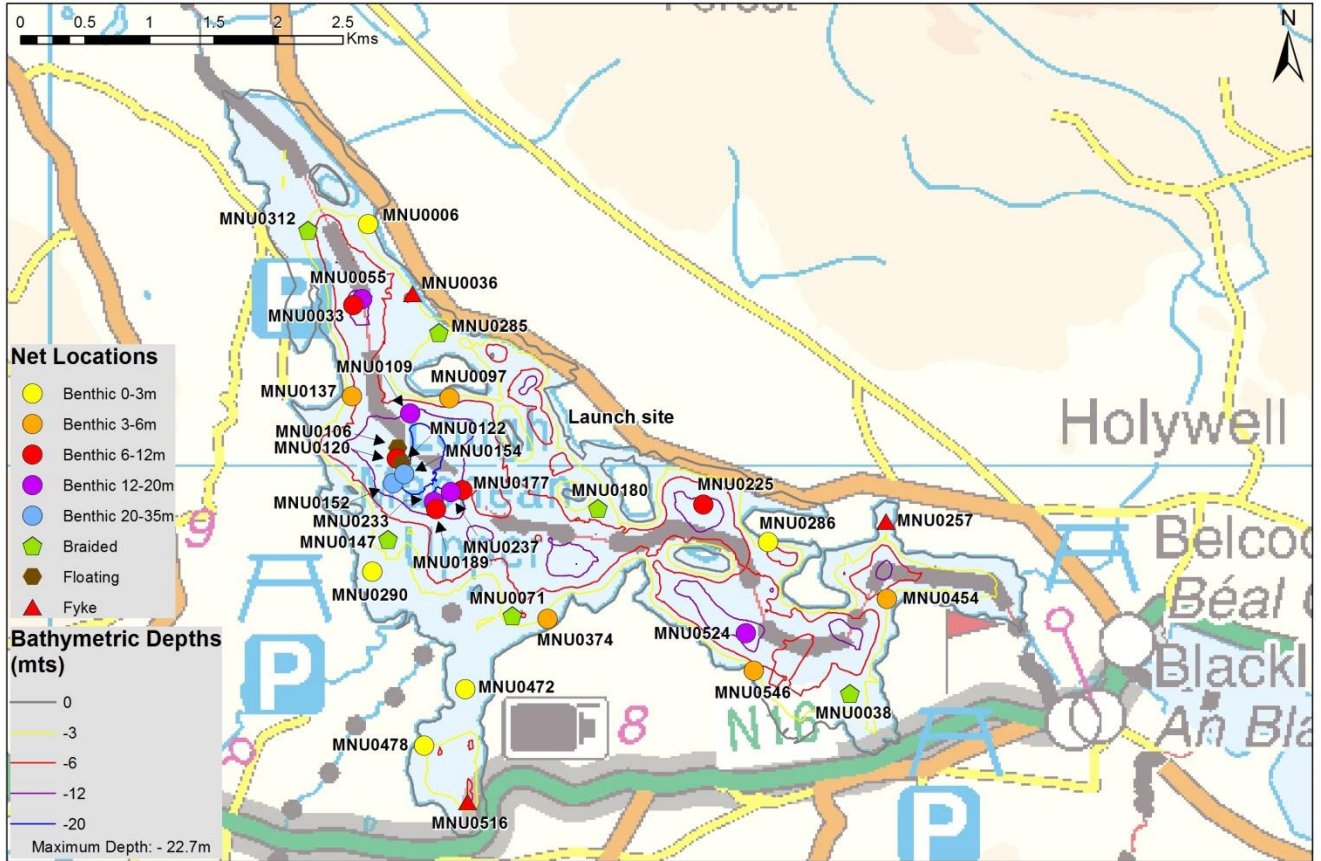


Fig. 1.1. Location map of Lough Macnean Upper showing net locations and depths of each net (outflow is indicated on map)



1.2 Methods

1.2.1 Netting methods

Lough Macnean Upper was surveyed over two nights from the 18th to the 20th of July 2016. A total of three sets of Dutch fyke nets, 22 benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets (5 @ 0-2.9m, 5 @ 3-5.9m, 5 @ 6-11.9m, 5 @ 12-19.9m and 2 @ 20-34.9m) and two floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake. The netting effort was supplemented using six two-panel benthic braided (63.5mm and 88.9mm mesh knot to knot) survey gill nets (2-PBB).

The nets were deployed in the same locations as were randomly selected in the previous survey. The site locations for additional two-panel benthic braided survey gill net sites (2-PBB) locations were chosen randomly within fixed depth zones. 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 roach, tench, bream, trout, pike and roach x bream hybrids. 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.

1.2.2 Fish diet

Fish were frozen before being dissected for stomach content analysis in the IFI laboratory. Total stomach contents were inspected and individual items were counted and identified to the lowest taxonomic level possible. The percentage frequency occurrence (%O) of prey items were then calculated to identify key prey items (Amundsen *et al.*, 1996).

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

Where:

%O_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 on the IFI NRSP team when moving between water bodies.



1.3 Results

1.3.1 Species Richness

A total of six fish species and one type of hybrid were recorded on Lough Macnean Upper in July 2016, with 778 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Perch was the most common fish species recorded, followed by roach. Roach x bream hybrids, bream, brown trout, eels and pike. During the previous surveys in 2006, 2010 and 2013 the same species composition was recorded with the exception of rudd; this species was not captured during the 2006 and 2016 surveys, but was recorded during the 2010 and 2013 surveys (Kelly *et al.*, 2007, 2011 and 2014).

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Macnean Upper, July 2016

Scientific name	Common name	Number of fish captured				
		2-PBB	BM CEN	FM CEN	Fyke	Total
<i>Perca fluviatilis</i>	Perch	0	438	17	3	458
<i>Rutilus rutilus</i>	Roach	0	223	12	1	236
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	0	37	0	0	37
<i>Anguilla anguilla</i>	European eel	0	0	0	33	33
<i>Abramis brama</i>	Bream	0	8	0	0	8
<i>Salmo trutta</i>	Brown trout	0	1	3	0	4
<i>Esox lucius</i>	Pike	0	2	0	0	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 2016 survey are summarised in Table 1.2.

Perch was the dominant fish species in terms of abundance (CPUE) and eel was the dominant fish species in terms of biomass (BPUE) captured during the 2016 survey (Table 1.2).

The mean CPUE and BPUE (excluding the larger 88.9mm mesh panel) for all species captured in the 2006, 2010, 2013 and 2016 surveys are illustrated in Figure 1.2 and 1.3.



Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Macnean Upper, 2016

Scientific name	Common name	Mean CPUE (\pm S.E) **
<i>Perca fluviatilis</i>	Perch	0.460 (0.123)
<i>Rutilus rutilus</i>	Roach	0.236 (0.107)
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	0.037 (0.018)
<i>Abramis brama</i>	Bream	0.006 (0.002)
<i>Salmo trutta</i>	Brown trout	0.004 (0.003)
<i>Esox lucius</i>	Pike	0.002 (0.001)
<i>Anguilla anguilla</i> *	European eel*	0.183 (0.033)*
		Mean BPUE (\pm S.E) **
<i>Perca fluviatilis</i>	Perch	14.690 (4.230)
<i>Rutilus rutilus</i>	Roach	10.366 (4.604)
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	7.893 (3.854)
<i>Abramis brama</i>	Bream	4.893 (2.234)
<i>Salmo trutta</i>	Brown trout	0.765 (0.533)
<i>Esox lucius</i>	Pike	2.217 (1.623)
<i>Anguilla anguilla</i> *	European eel*	48.341 (15.482) *

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

**CPUE and BPUE data above for all fish species except eels are not comparable to earlier surveys as an extra panel was added to the 2-PBB to provide additional information on large coarse fish.

Perch

Mean perch CPUE increased and mean BPUE fluctuated over the four sampling occasions with the highest CPUE in 2016; however these differences were not statistically significant (Fig 1.2 and 1.3).

Roach

The mean roach CPUE and BPUE fluctuated over the four sampling occasions with the highest CPUE and BPUE in 2016; however these differences were also not statistically significant (Fig 1.2 and 1.3).

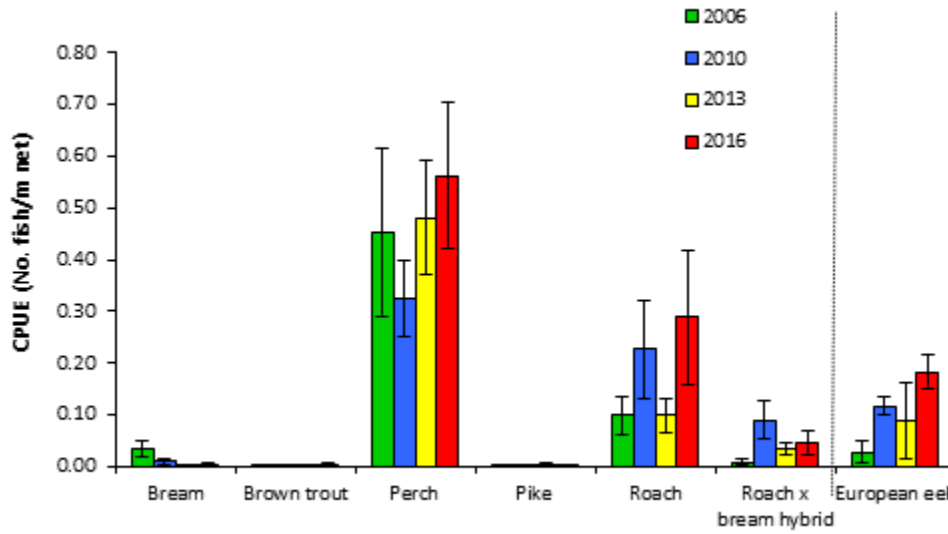


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Lough Macnean Upper (Eel CPUE based on fyke nets only), 2006, 2010, 2013 and 2016

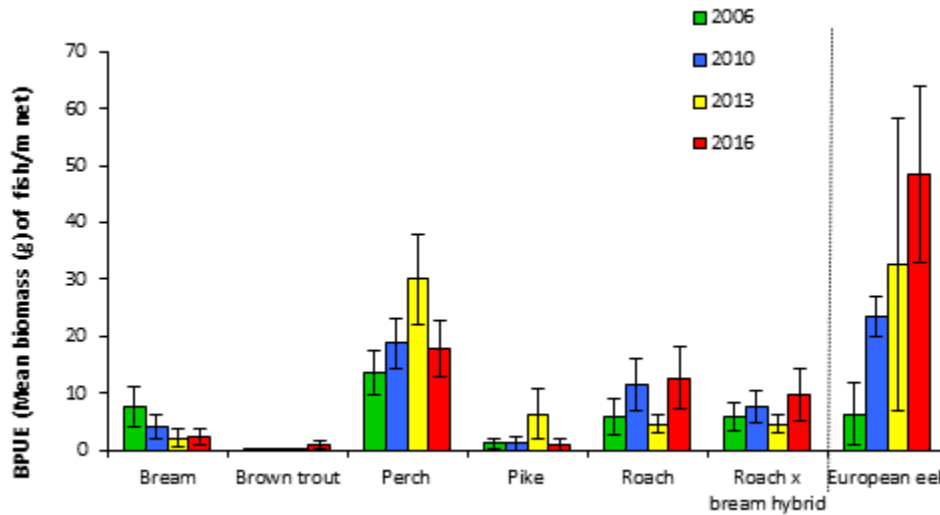


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Lough Macnean Upper (Eel BPUE based on fyke nets only), 2006, 2010, 2013 and 2016



1.3.3 Length frequency distributions and growth

Perch

Perch captured during the 2016 survey ranged in length from 3.0cm to 24.5cm (mean = 12.1cm) (Fig.1.4) with seven age classes present, ranging from 1+ to 7+ with a mean L1 of 5.5cm (Table 1.3). The dominant age class was 1+ (Fig. 1.4). Perch captured during the 2010 and 2013 survey had a similar length and age range (Fig.1.4), with some larger and older fish recorded in the 2010 and 2013 surveys (Fig 1.4).

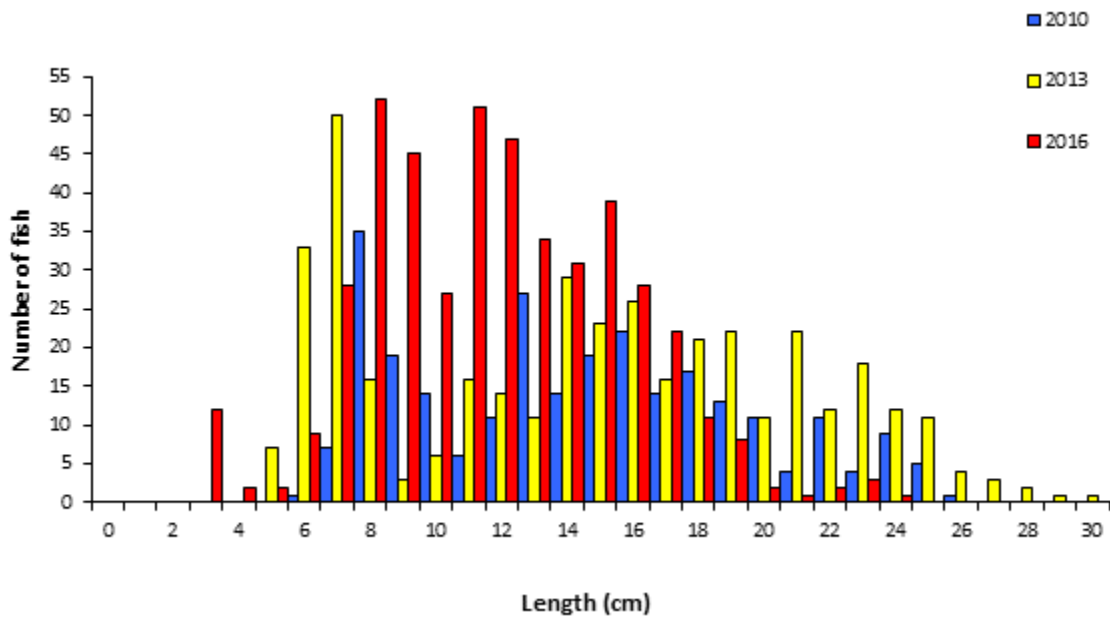


Fig. 1.4. Length frequency of perch captured on Lough Macnean Upper, 2010, 2013 and 2016

Table 1.3. Mean (\pm S.E.) perch length (cm) at age for Lough Macnean Upper, July 2016

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇
Mean (\pm S.E.)	5.5 (0.1)	9.5 (0.2)	13.5 (0.3)	17.0 (0.4)	19.3 (0.9)	20.7(0.9)	20.0
N	49	35	29	18	8	5	1
Range	4.0-8.8	8.1-11.7	10.2-1.0	15.0-21.8	16.4-24.1	18.4-22.6	20.0-20.0



Roach

Roach captured during the 2016 survey ranged in length from 5.7cm to 23.1cm (mean = 13.3cm) (Fig.1.5) with nine age classes present, ranging from 1+ to 9+ with a mean L1 of 3.3cm (Table 1.4). The dominant age class was 3+ (Fig.1.5). Roach captured during the 2010 and 2013 surveys had a similar length and age range (Fig 1.5).

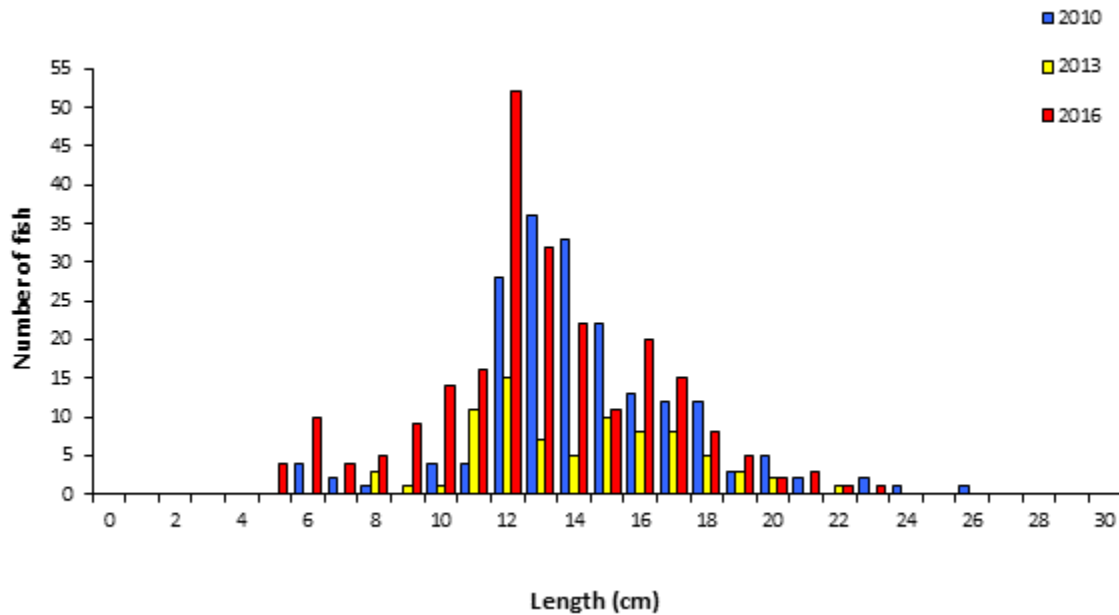


Fig. 1.5. Length frequency of roach captured on Lough Macnean Upper, 2010, 2013 and 2016

Table 1.4. Mean (\pm S.E.) roach length (cm) at age for Lough Macnean Upper, July 2016

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈	L ₉
Mean (\pm S.E.)	3.3 (0.1)	6.7 (0.1)	10.4 (0.2)	13.0 (0.2)	15.0 (0.3)	17.0 (0.5)	17.7 (0.4)	18.9 (0.5)	20.3 (1.1)
N	44	43	34	23	19	13	7	5	2
Range	2.5-4.4	5.2-9.3	8.2-13.3	10.7-15.0	12.8-17.2	14.6-21.7	16.5-19.7	17.5-20.1	19.2-21.3

Other fish

Eels captured during the 2016 survey ranged in length from 33.5cm to 76.5cm, pike ranged from 46.0cm to 72.8cm, bream ranged from 24.5cm to 40.5cm and roach x bream hybrids ranged in length from 14.5cm to 32.3cm. The four brown trout ranged in length from 20.3cm to 30.4cm.

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 perch captured during the survey were examined and are presented below.

Perch

Perch initially start to feed on pelagic zooplankton. Once they reach an intermediate size they start feeding on benthic resources eventually moving on to feed on fish once they are large enough (Hjelm *et al.*, 2000). A total of 81 stomachs were examined and 35 of these were contained no prey items. Of the remaining 46 stomachs containing food, 46% contained unidentified digested material, 39% fish and 15% zooplankton (Fig. 1.6).

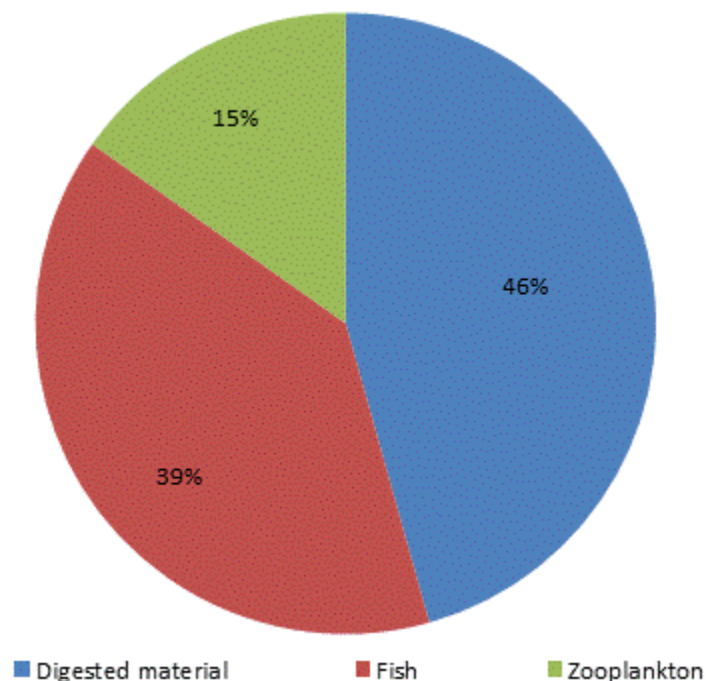


Fig 1.6. Diet of perch (n=46) captured on Lough Macnean Upper, 2016 (% occurrence)



1.4 Summary and ecological status

A total of six fish species and one type of hybrid were recorded on Lough Macnean Upper in the July 2016 survey. Perch was the dominant species in terms of abundance (CPUE) and eel was the dominant species in terms of biomass (BPUE) captured in the survey gill nets during the survey.

Perch CPUE increased and BPUE fluctuated over the four sampling occasions with the highest CPUE in 2016; however these differences were not statistically significant. Perch ranged in length from 3.0cm to 24.5cm and ranged in age from 1+ to 7+, indicating reproductive success in seven of the previous eight years. The dominant age class was 1+.

The mean roach CPUE and BPUE fluctuated over the four sampling occasions with the highest CPUE and BPUE in 2016; however these differences were not statistically significant. Roach ranged in length from 5.7cm to 23.1cm and ranged in age from 1+ to 9+, indicating reproductive success in nine of the previous ten years. The dominant age class was 3+.

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 Macnean Upper has been assigned an ecological status of Good for 2016 based on the fish populations present. The lake was also assigned a fish status of Good in 2006, 2010 and 2013.

In the 2010 to 2015 surveillance monitoring reporting period, the EPA assigned Lough Macnean Upper an overall ecological status of Moderate.



1.5 References

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