National Research Survey Programme

Lakes 2016

Lough Macnean Lower

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Iascach Intíre Éireann
Inland Fisheries Ireland

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

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

ACKNOWLEDGEMENTS

1.1 Introduction

Lough Macnean Lower is a large freshwater lake located in County Fermanagh, at an altitude of 51m a.s.l. (Plate 1.1, Fig. 1.1). It is a mesotrophic lake, with a surface area of 456ha, mean depth of 1.5m and maximum depth of 12.7m. The lake is categorised as typology class 6 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. shallow (<4m), greater than 50ha and moderately alkaline (20-100mg/l $CaCO_3$).

Lough Macnean Lower is fed by the Belcoo River which flows from Lough Macnean Upper into the lake near the village of Belcoo (Fig. 1.1). Lough Macnean Lower contains two islands, Cushrush Island which is the larger of the two and Inishee or Jinny's Island, which is smaller and is completely forested. A causeway was built onto Cushrush Island in the 1960's to allow animals to be moved on to the island. The shores of both the lower and upper loughs have good examples of wet woodland and of extensive fen and reed bed communities (NIEA, 2009b). The islands in both loughs are important breeding sites for lapwing, snipe and curlew (NIEA, 2009b).

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 lower lough is enclosed by a steep limestone escarpment. Agricultural usage along the shorelines of Lough Macnean Lower is more developed when compared to the upper lough. The underlying limestone soils produce good quality grassland and the southern shores and lower slopes are farmed intensively (NIEA, 2009a).

The shape of Lough Macnean Lower was changed dramatically during the 1960's when a major dredging operation took place. The level of the lake was dropped by approximately 1m resulting in wide areas of shallows as well as exposure of a lot of soft and barren shoreline (IFT, unpublished data).

In a survey carried out in 1969, perch, pike, rudd, roach, bream, rudd x bream and roach x bream hybrids were all recorded in Lough Macnean Lower (IFT, unpublished data).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 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, followed by roach. Roach x bream hybrids, rudd, pike, eels and bream were also recorded.
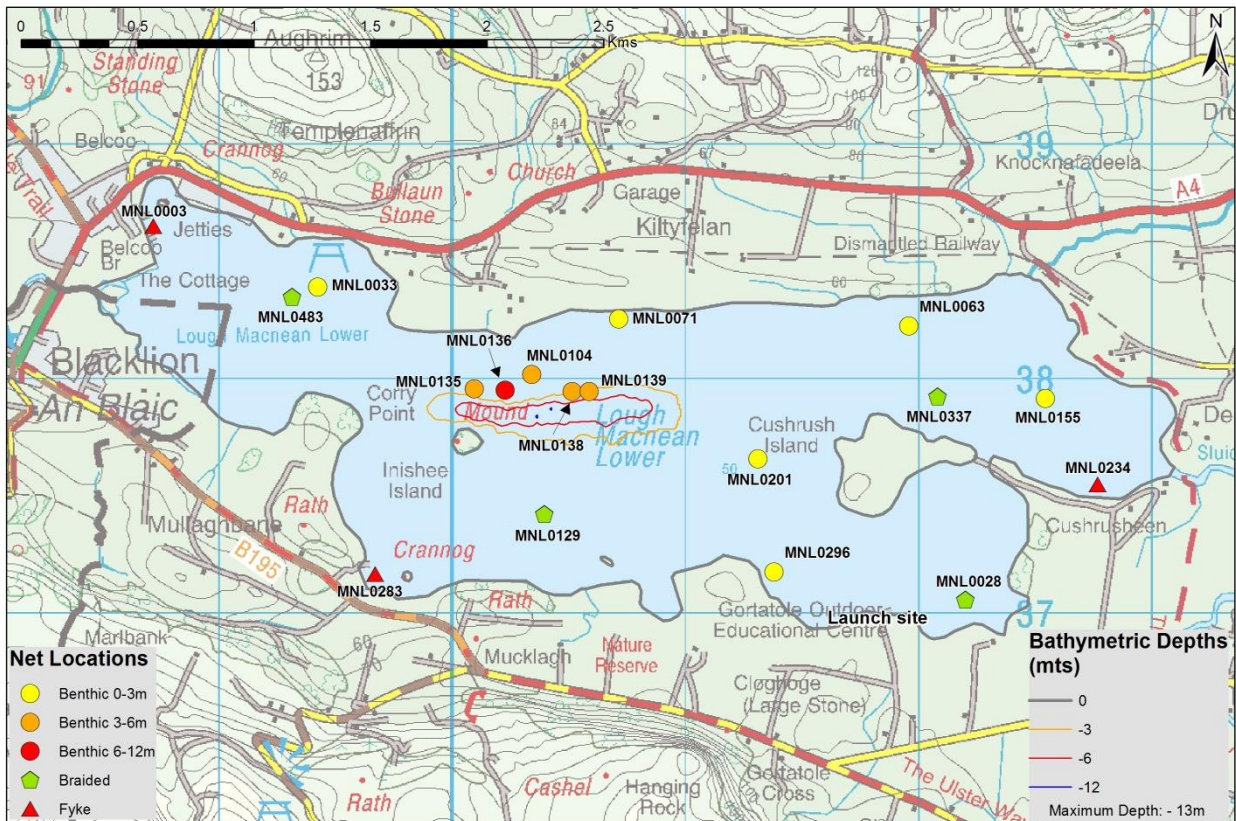

Plate 1.1. Lough Macnean Lower

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

1.2 Methods

1.2.1 Netting methods

Lough Macnean Lower was surveyed over two nights from the 20th to the 22nd of July 2016. A total of three sets of Dutch fyke nets and eleven benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets (6 @ 0-2.9m, 4 @ 3-5.9m and 1 @ 6-11.9m) were deployed in the lake (14 sites). The netting effort was supplemented using four 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 randomly chosen in the previous surveys. 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 also randomised.

All fish apart from perch were measured and weighed on site and scales were removed from all roach, rudd, pike, bream 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 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.

1.2.3 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).

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

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.

1.3 Results

1.3.1 Species Richness

A total of seven fish species and one type of hybrid were recorded on Lough Macnean Lower in July 2016, with 742 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 and roach x bream hybrids. Bream, rudd, pike, tench and eels were also recorded in smaller numbers. During the previous surveys in 2010 and 2013 the same species composition was recorded with the exception of pike, which were not captured during the 2010 survey, rudd which were not captured during the 2006 survey and tench which were only recorded in the 2016 survey (Kelly *et al.*, 2011 and 2014).

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

Scientific name	Common name	Number of fish captured			
		2-PBB	BM CEN	Fyke	Total
Perca fluviatilis	Perch	0	372	0	372
Rutilus rutilus	Roach	0	268	1	269
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0	79	0	79
Abramis brama	Bream	0	11	0	11
Scardinius erythrophthalmus	Rudd	0	3	0	3
Esox lucius	Pike	0	2	0	2
Tinca tinca	Tench	0	1	0	1
Anguilla anguilla	European eel	0	0	5	5

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 roach 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 Figures 1.2 and 1.3.

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

Scientific name	Common name	Mean CPUE (± S.E) **
Perca fluviatilis	Perch	0.689 (0.186)
Rutilus rutilus	Roach	0.497 (0.136)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.145 (0.036)
Abramis brama	Bream	0.018 (0.006)
Scardinius erythrophthalmus	Rudd	0.006 (0.004)
Esox lucius	Pike	0.004 (0.003)
Tinca tinca	Tench	0.001 (0.001)
Anguilla Anguilla*	European eel*	0.028 (0.028)*
		Mean BPUE (± S.E)**
Perca fluviatilis	Perch	13.779 (3.067)
Rutilus rutilus	Roach	34.553 (8.387)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	33.792 (8.448)
Abramis brama	Bream	7.422 (3.306)
Scardinius erythrophthalmus	Rudd	1.069 (0.774)
Esox lucius	Pike	12.037 (8.258)
Tinca tinca	Tench	1.749 (1.749)
Anguilla anguilla*	European eel*	10.431 (10.431)*

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, only the perch CPUE showed a significant result with a significantly higher CPUE in 2013 and 2016 than in 2010 (Kruskal-Wallis H=8.24, P<0.05) (Fig 1.2 and 1.3).

Roach

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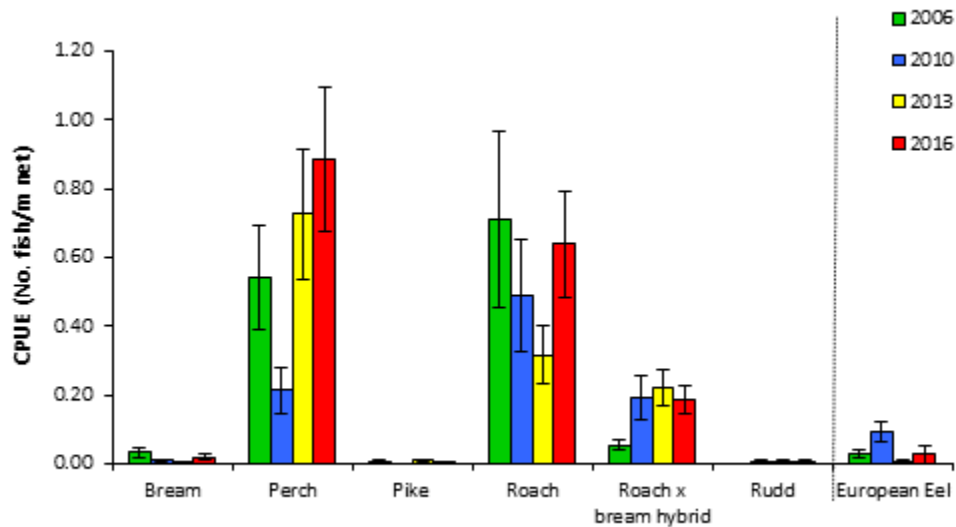

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Lough Macnean Lower (Eel CPUE based on fyke nets only), 2006, 2010, 2013 and 2016
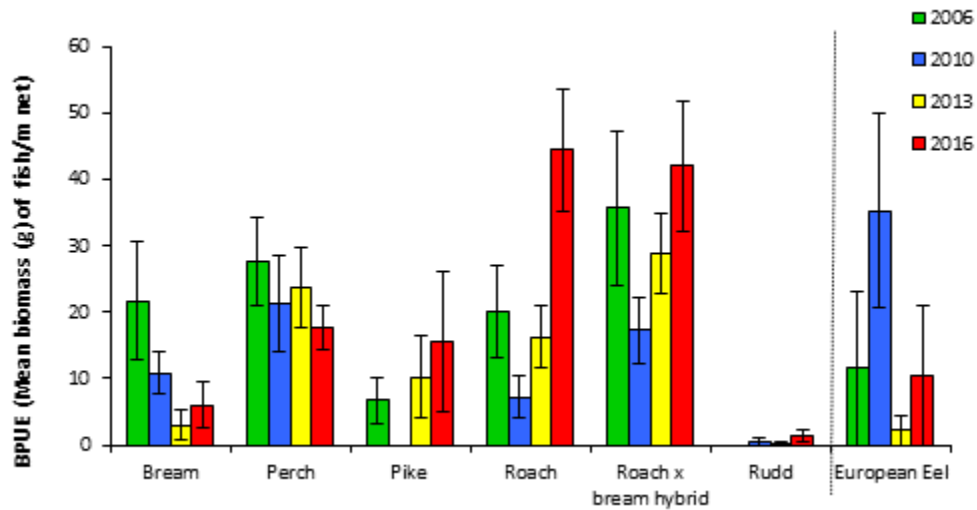
Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lough Macnean Lower (Eel BPUE based on fyke nets only), 2006, 2010, 2013 and 2016

1.3.3 Length frequency distributions and growth

Perch

Perch captured during the 2016 survey ranged in length from 3.0cm to 26.0cm (mean = 10.9cm) (Fig.1.4) with six age classes present, ranging from 0+ to 5+ with a mean L1 of 5.6cm (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).
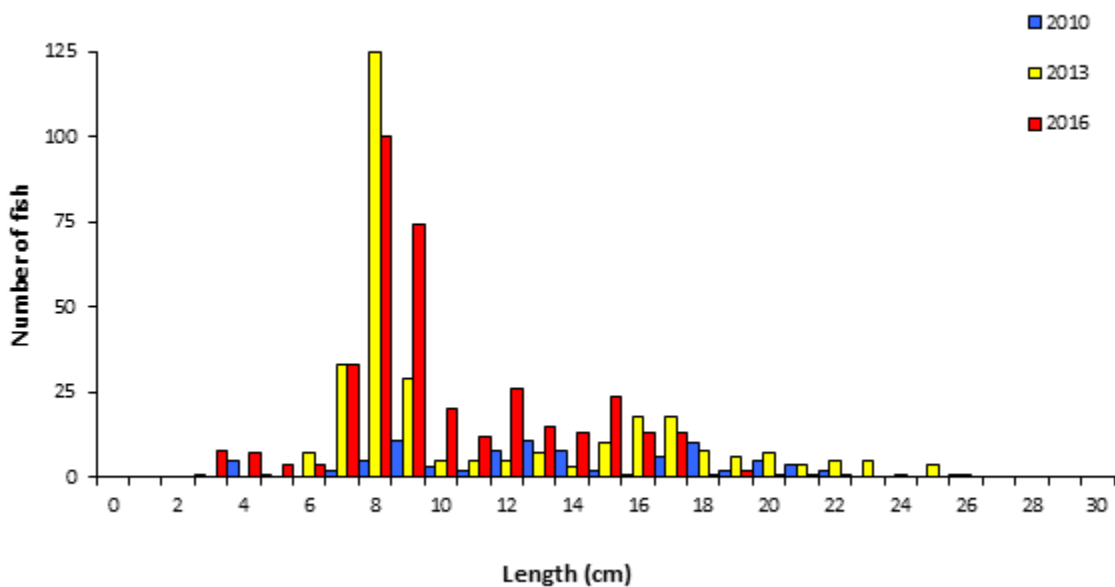
Fig. 1.4. Length frequency of perch captured on Lough Macnean Lower, 2010, 2013 and 2016

Table 1.3. Mean (±S.E.) perch length (cm) at age for Lough Macnean Lower, July 2016

	L_1	L_2	L_3	L_4	L_5
Mean (±S.E.)	5.6 (0.1)	10.3 (0.2)	14.7 (0.2)	19.9 (0.7)	22.2
N	53	41	29	3	1
Range	2.7-7.4	8.9-13.7	12.4-17.5	18.5-21.0	22.2-22.2

Roach

Roach captured during the 2016 survey ranged in length from 6.1cm to 29.4cm (mean = 14.7cm) (Fig.1.5) with eleven age classes present, ranging from 1+ to 11+ 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, with some larger and older fish captured in 2016 survey (Fig 1.5).
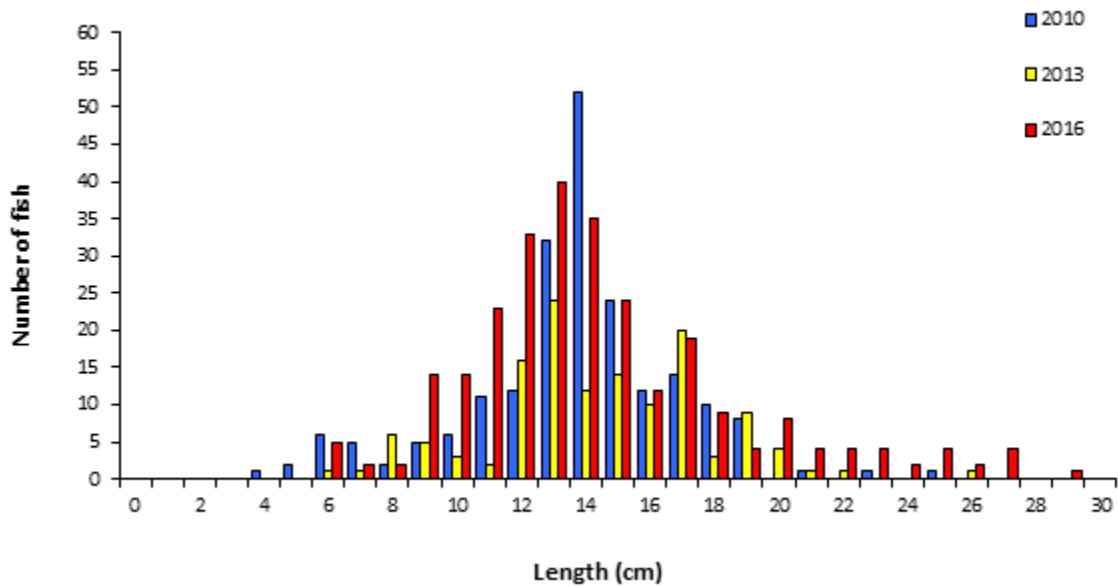
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Fig. 1.5. Length frequency of roach captured on Lough Macnean Lower, 2010, 2013 and 2016

Table 1.4. Mean (±S.E.) roach length (cm) at age for Lough Macnean Lower, July 2016

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}
Mean	3.3	6.9	10.3	12.7	15.2	17.5	19.2	21.4	23.9	26.4	28.2
(±S.E.)	(0.1)	(0.1)	(0.2)	(0.3)	(0.3)	(0.4)	(0.4)	(0.6)	(0.4)	(0.2)	
N	64	61	54	37	33	29	23	18	13	3	1
Range	2.3-4.6	5.0-9.4	7.5-14.7	9.5-15.9	11.3-19.5	13.1-21.9	14.6-22.8	16.0-25.5	22.0-26.8	26.1-26.8	28.2-28.2

Other fish

Eels captured during the 2016 survey ranged in length from 57.8cm to 60.5cm, pike ranged from 70.9cm to 76.9cm, rudd ranged from 13.2cm to 26.6cm, bream ranged from 13.4cm to 38.6cm and roach x bream hybrids ranged in length from 9.7cm to 37.0cm. One 49.0cm tench was also recorded.

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 65 stomachs were examined. Of these 22 were found to contain no prey items. Of the 43 stomachs containing food, 46% contained unidentified digested material invertebrates, 28% invertebrates, 19% zooplankton and 7% fish (Fig. 1.6).
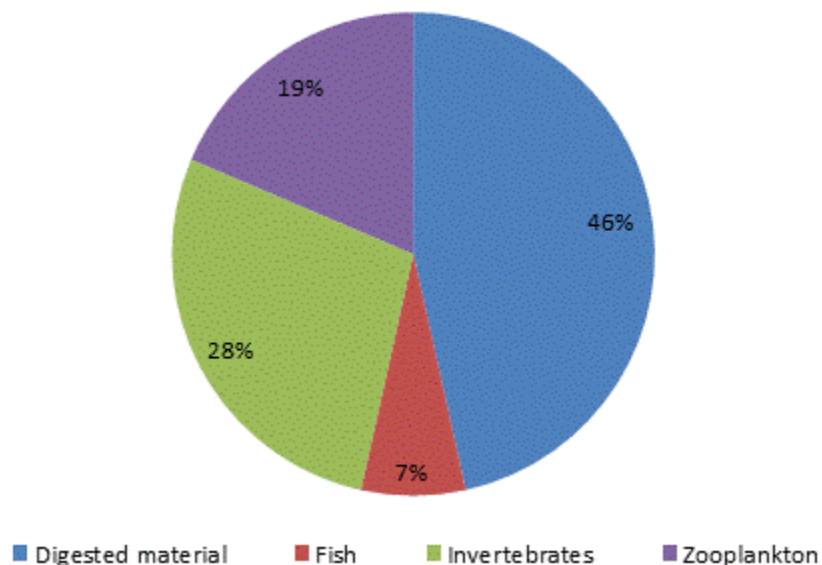

Fig 1.6. Diet of perch (n=43) captured on Lough Macnean Lower, 2016 (% occurrence)

1.4 Summary and ecological status

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

Perch CPUE increased and BPUE fluctuated over the four sampling occasions with the highest CPUE in 2016, however, only the perch CPUE showed a significant result with a significantly higher CPUE in 2013 and 2016 than in 2010. Perch ranged in length from 3.4cm to 22.8cm and ranged in age from 0+ to 5+, indicating reproductive success in each of the previous six years. The dominant age class was 1+.

The mean roach CPUE fluctuated and BPUE increased over the four sampling occasions with the highest BPUE in 2016, however, these differences were not statistically significant. Roach ranged in length from 6.1cm to 29.4cm and ranged in age from 1+ to 11+, indicating reproductive success in eleven of the previous twelve 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 Lower has been assigned an ecological status of Bad for 2016 and based on the fish populations present. In previous years the lake was assigned a fish status of Poor for 2006, 2010 and 2013.

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

1.5 References

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