

National Research Survey Programme

Lakes 2017

Lough Allua

IFI/2018/1-4420



Iascach Intíre Éireann
Inland Fisheries Ireland



Inland Fisheries Ireland

National Research Survey Programme – Coarse Fish and Pike

Fish Stock Survey of Lough Allua, September 2017

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

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

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1.1 Introduction

Lough Allua is a ten kilometre chain of lakes situated near Ballingeary, Co. Cork in the Lee catchment (Plate 1.1, Fig. 1.1). The lake has a surface area of 138ha, a mean depth of 4m and a maximum depth of 28m. The lake is categorized as typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), larger than 50ha and low alkalinity (<20mg/l CaCO_3).

Under the 2009 Cork Development plan, Lough Allua has been proposed as a Natural Heritage Area, indicating the presence of important semi-natural and natural habitats, landforms or geomorphological features, wild plant and animal species or a diversity of these natural attributes (Cork County Council, 2009).

Historically Lough Allua was known for producing good trout, salmon and Arctic char. In the 1830s there was an accidental release of pike from a local privately owned pond and this event and human predation were attributed to the destruction of the Arctic char population in the lake (Went, 1945). The lake is now well known for its pike angling, with pike of between 10kg and 14kg regularly being caught.

In the past rainbow trout were held within floating pens on the lake, where they were on-grown before stocking into local put and take trout fisheries by Inland Fisheries Ireland (IFI). However, this practice has been discontinued since September 2018. Water quality monitoring is carried out on the lake on a monthly basis by IFI Macroom.

Lough Allua was previously surveyed in 2008, 2011 and 2014 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2009, Kelly *et al.*, 2012a and Kelly *et al.*, 2015). During the 2014 survey, roach were the dominant species present in the lake, followed by roach x bream hybrids. Perch, brown trout, bream, pike, gudgeon, rudd 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 national coarse fish and pike research programme.



Plate 1.1. Lough Allua, September 2017

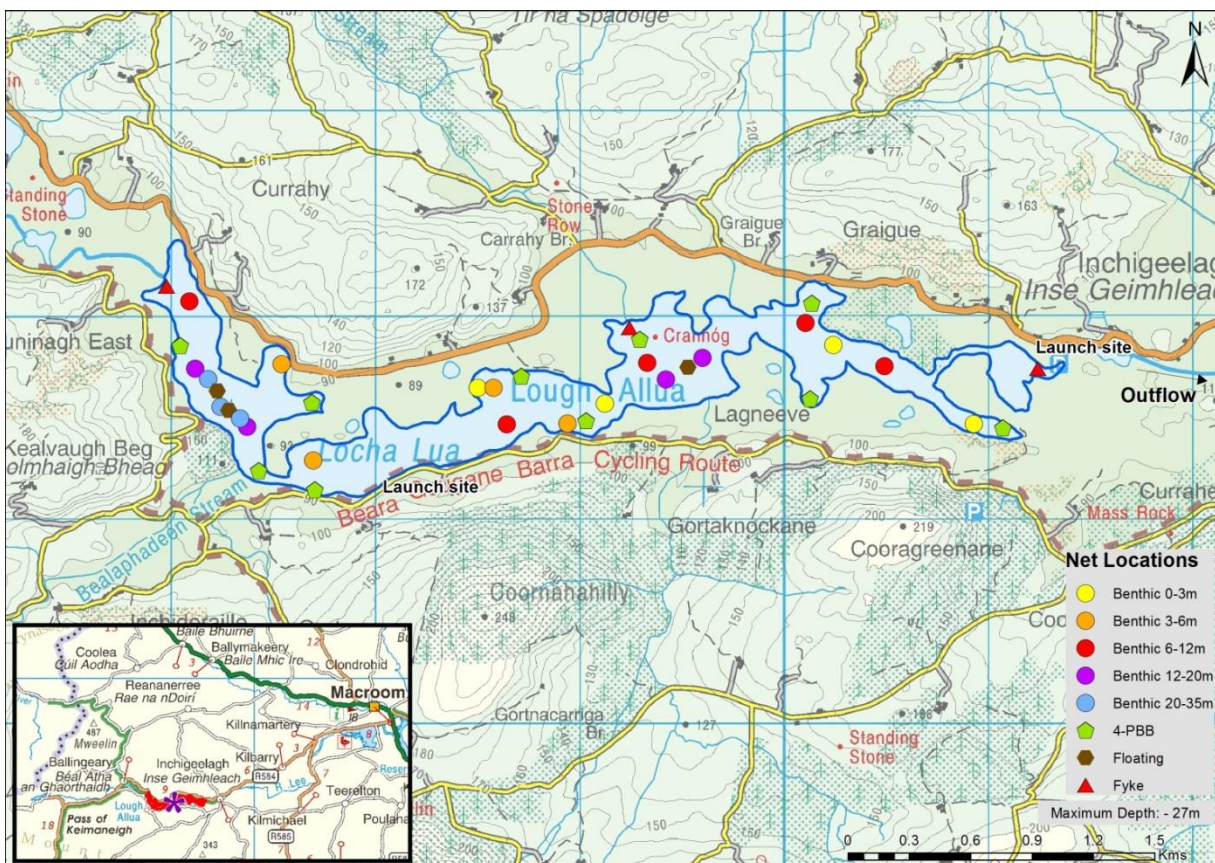


Fig. 1.1 Location map of Lough Allua showing locations and depths of each net (outflow is indicated on map)



1.2 Methods

1.2.1 Netting methods

Lough Allua was surveyed over three nights between the 25th to the 28th of September 2017. A total of three sets of Dutch fyke nets (Fyke), 20 benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 5 @ 6-11.9m, 4 @ 12-19.9m and 3 @ 20-34.9m) and three floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (26 sites). The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at ten additional sites. The 4-PBB nets are composed of four 27.5m long panels each a different mesh size (55mm, 60mm, 70mm and 90mm knot to knot). The site locations for the benthic and floating monofilament multi-mesh survey gill nets (BM CEN and FM CEN) and the four-panel benthic braided survey gill nets (4-PBB) were chosen randomly within fixed depth zones (0-2.9m, 3-5.9m, 6-11.9m, 12-19.9m and 20-34.9m). 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 a representative sample of all other fish species (excluding gudgeon and eel) captured. 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 calculated to identify key prey items (Amundsen *et al.*, 1996).

$$FO_i = \left(\frac{N_i}{N} \right) * 100$$

Where:

FO_i is the percentage frequency of prey item i ,
 N_i is the number of pike with prey i in their stomach,
 N is total number of pike 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 seven fish species and two hybrid varieties were recorded on Lough Allua in September 2017. A total of 715 fish were captured. The number of each species captured by each gear type is shown in Table 1.1. Roach, roach x bream hybrids and perch were the most common species captured during the survey. Bream, pike, gudgeon, rudd, brown trout and rudd x bream hybrids were also recorded. During the previous surveys in 2008, 2011 and 2014 a similar species composition was recorded (Kelly *et al.*, 2009, Kelly *et al.*, 2012a and Kelly *et al.*, 2015). No eel were captured on this occasion.

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

Scientific name	Common name	Number of fish captured				
		BM CEN	FM CEN	4-PBB	Fyke	Total
<i>Rutilus rutilus</i>	Roach	333	77	0	9	419
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	125	4	2	7	138
<i>Perca fluviatilis</i>	Perch	100	0	4	1	105
<i>Abramis brama</i>	Bream	27	0	2	0	29
<i>Esox lucius</i>	Pike	3	0	6	0	9
<i>Gobio gobio</i>	Gudgeon	9	0	0	0	9
<i>Scardinius erythrophthalmus</i>	Rudd	0	3	0	0	3
<i>Salmo trutta</i>	Brown trout	1	1	0	0	2
<i>Scardinius erythrophthalmus x Abramis brama</i>	Rudd x bream hybrid	1	0	0	0	1



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 2017 survey are summarised in Table 1.2.

Roach and pike were the dominant fish species in terms of abundance (CPUE) and biomass (BPUE) respectively captured during the 2017 survey (Table 1.2).

Mean CPUE and BPUE (excluding the 55mm, 70mm and 90mm of 4-PBB) for all species captured in the 2008, 2011, 2014 and 2017 surveys are illustrated in Figures 1.2 and 1.3. CPUE and BPUE of roach and roach x bream hybrids were much greater on all sampling occasions subsequent to the first survey in 2008. Concomitantly, the CPUE and BPUE of rudd captured has been decreasing since 2008.

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

Scientific name	Common name	Mean CPUE ($\pm$ S.E) **	Mean BPUE ($\pm$ S.E) **
<i>Rutilus rutilus</i>	Roach	0.384 (0.100)	7.988 (1.939)
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	0.123 (0.032)	8.225 (2.084)
<i>Perca fluviatilis</i>	Perch	0.094 (0.030)	7.424 (2.459)
<i>Abramis brama</i>	Bream	0.026 (0.009)	4.443 (1.641)
<i>Esox lucius</i>	Pike	0.004 (0.002)	13.962 (5.751)
<i>Gobio gobio</i>	Gudgeon	0.008 (0.008)	0.088 (0.040)
<i>Scardinius erythrophthalmus</i>	Rudd	0.003 (0.002)	0.067 (0.053)
<i>Salmo trutta</i>	Brown trout	0.002 (0.001)	0.044 (0.031)
<i>Scardinius erythrophthalmus x Abramis brama</i>	Rudd x bream hybrid	0.001 (0.001)	0.014 (0.014)

Note: Where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species (Connor *et al.*, 2017).

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

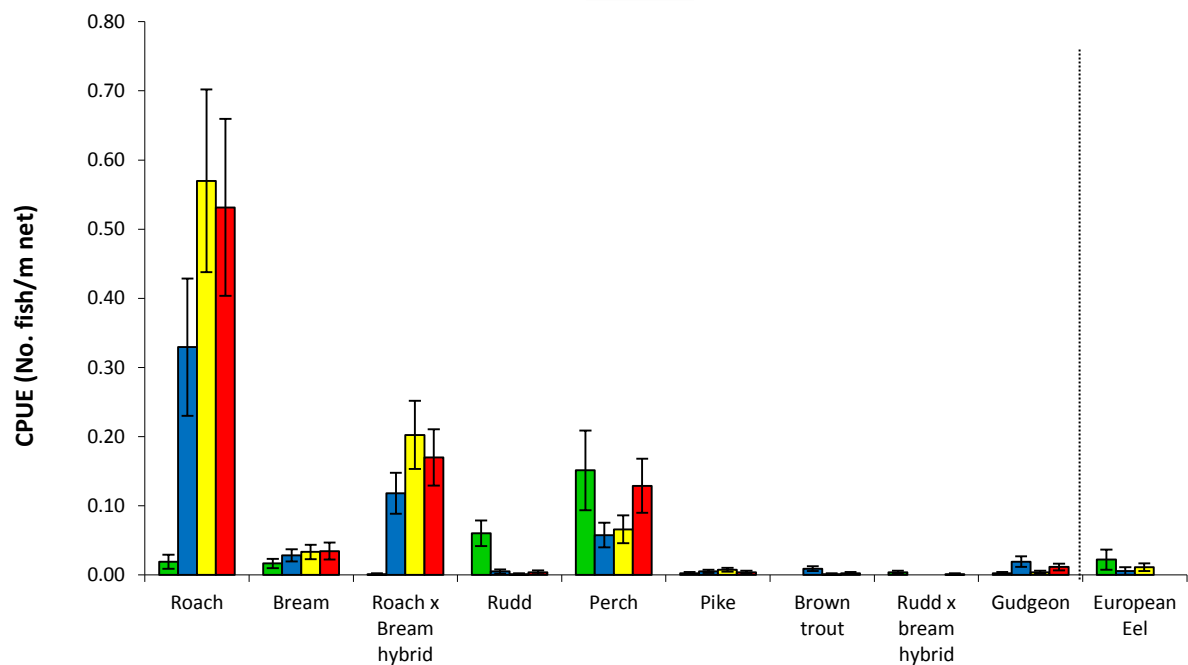


Fig. 1.2. Mean ($\pm$ S.E.) CPUE for all fish species captured in Lough Allua (Eel CPUE based on fyke nets only), 2008, 2011, 2014 and 2017 (For comparison purposes the CPUE figures exclude the 55mm, 70mm and 90mm mesh panel of 4-PBB)

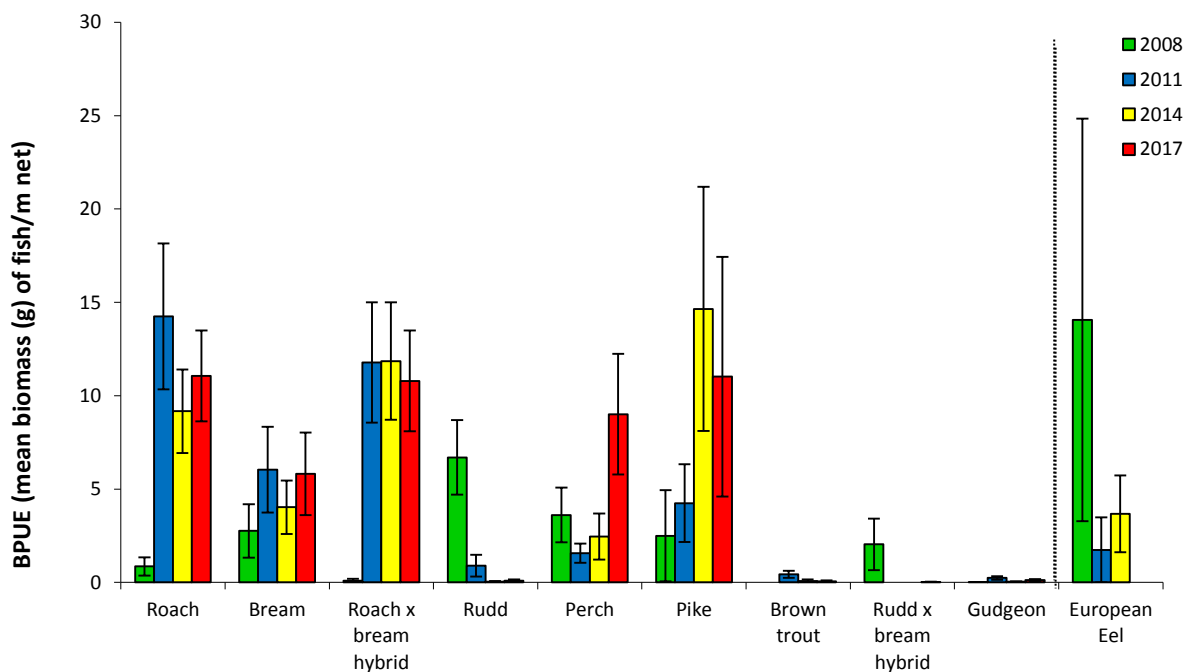


Fig. 1.3. Mean ($\pm$ S.E.) BPUE for all fish species captured in Lough Allua (Eel BPUE based on fyke nets only), 2008, 2011, 2014 and 2017. (For comparison purposes the BPUE figures exclude the 55mm, 70mm and 90mm mesh panel of 4-PBB)



1.3.3 Length frequency distributions and growth

Roach

Roach captured during the 2017 survey ranged in length from 4.4cm to 20.1cm (mean = 10.8) (Fig.1.5). Roach captured during the 2011 and 2014 surveys had a similar length range (Fig.1.4). In 2008, however, the small number of roach captured had a restricted length range (Fig.1.5). All seven age classes from 1+ to 7+ were represented in the sample aged, indicating regular recruitment in recent years. The dominant age class was 4+. Mean length at age 1 was estimated as 3.6cm (Table 1.3).

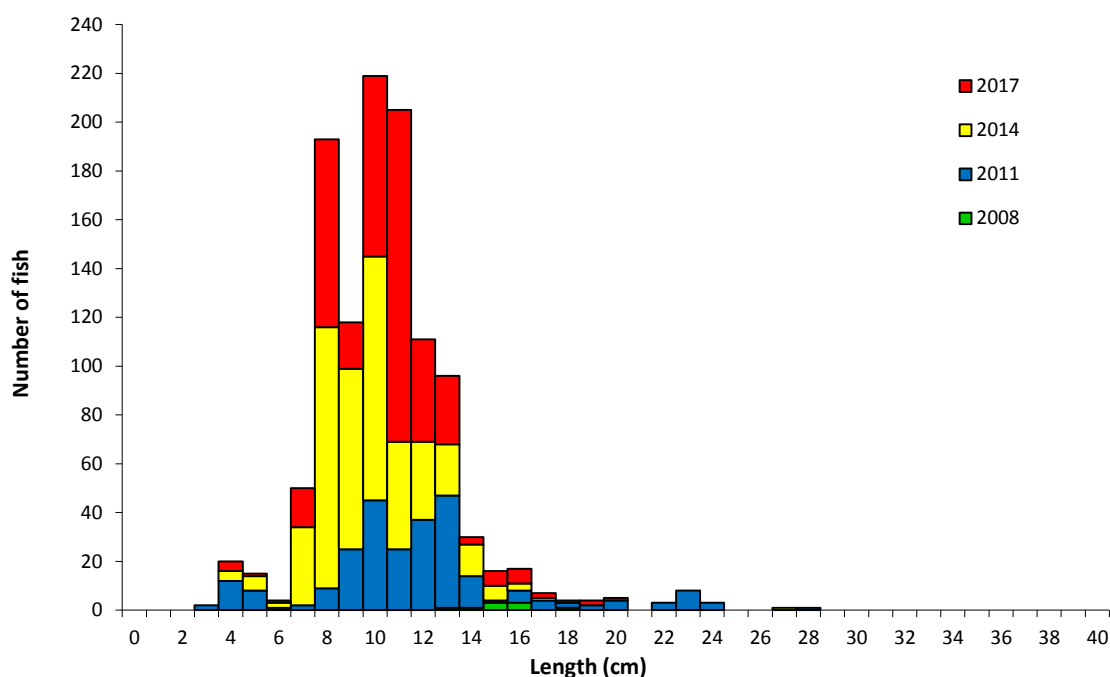


Fig. 1.4. Length frequency of roach captured on Lough Allua, 2008, 2011, 2014 and 2017

Table 1.3. Mean ($\pm$ S.E.) roach length (cm) at age for Lough Allua, September 2017

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇
Mean	3.6	6.9	10.3	12.6	15.2	17.7	19.0
($\pm$ S.E.)	0.1	0.1	0.3	0.3	0.4	0.6	-
N	32	29	23	20	11	3	1
Min	2.8	5.3	8.3	10.3	12.5	16.5	19.0
Max	5.0	8.8	13.0	14.8	17.0	18.5	



Bream

Bream captured ranged in length from 4.7 to 30.7 cm (mean 20.9 cm) (Fig. 1.5). Bream captured during the 2008, 2011 and 2014 surveys had a similar length range (Fig.1.6). Seven age classes were present. All ages between 4+ and 10+ (except 9+) were represented in the sample aged. The most abundant age class was 7+. Several young of year fish (0+) were also recorded, indicating that while recruitment may have been limited in recent years, bream had spawned during 2017. Mean length at age 1 was estimated as 3.6 cm (Table 1.4).

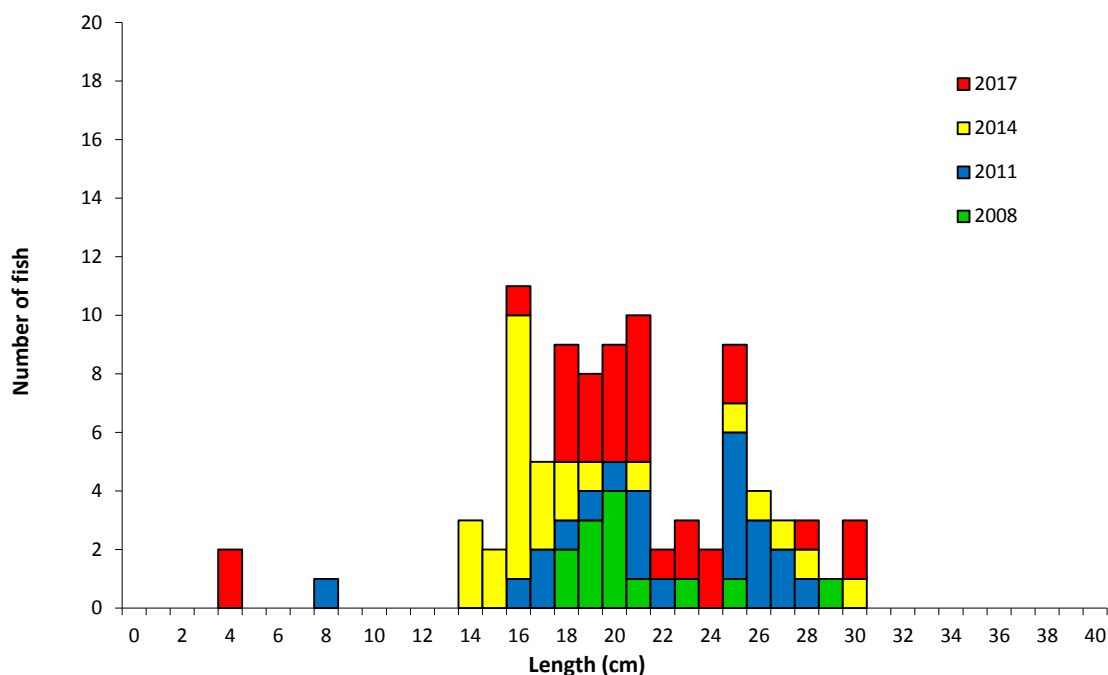


Fig. 1.5. Length frequency of bream captured on Lough Allua, 2008, 2011, 2014 and 2017

Table 1.4. Mean ($\pm$ S.E.) bream length (cm) at age for Lough Allua, September 2017

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈	L ₉	L ₁₀
Mean	3.6	7.4	11.0	13.9	16.8	19.3	21.6	24.4	27.1	29.4
($\pm$ S.E.)	0.09	0.14	0.15	0.19	0.23	0.20	0.27	0.58	0.00	0.00
N	20	20	20	20	18	13	9	3	1	1
Min	2.9	6.2	9.8	12.1	15.5	18.0	20.6	23.2	27.1	29.4
Max	4.9	8.6	12.4	15.3	19.1	20.4	22.8	25.1		

Roach x bream hybrids

Rudd

With the exception of the initial survey conducted in 2008, only a small number of rudd, with restricted size distributions, have been captured in Lough Allua (Fig. 1.7). Only three rudd were captured during the 2017 survey. The fish measured 10.7, 10.9 and 13.2 cm (Fig. 1.8). The ages of the two fish aged were 3+ and 4+ respectively.

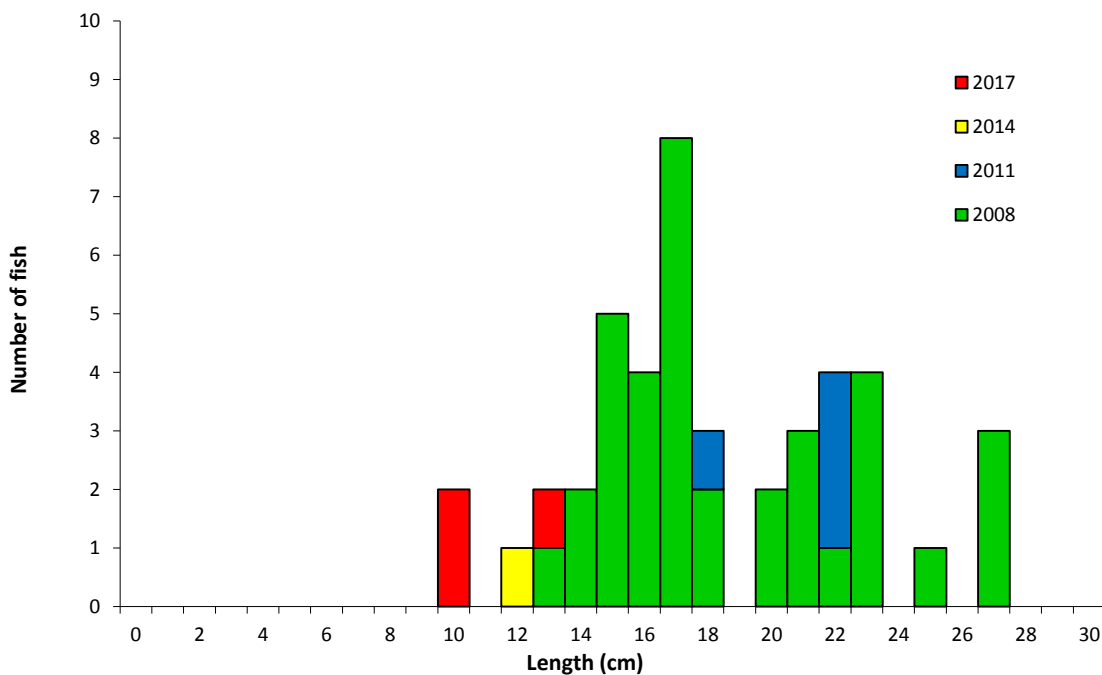


Fig. 1.7. Length frequency of rudd captured on Lough Allua, 2008, 2011, 2014 and 2017

Perch

Perch captured during the 2017 survey ranged in length from 4.2 cm to 38.1 cm (mean = 11.9 cm) (Fig.1.8). Perch captured during the 2008, 2011 and 2014 surveys had a similar length and age range, with some larger fish (>30cm) recorded in 2017 (Fig.1.8). None of these were caught in the larger meshed 4-panel benthic braided survey gill nets which were not set on previous sampling occasions, suggesting a shift in the size structure of this species in Lough Allua. A total of eight age classes (0+ to 7+ with all intervening years) were present in the sample. Mean length at L1 was 6.2cm (Table 1.6). The dominant age class was 1+.

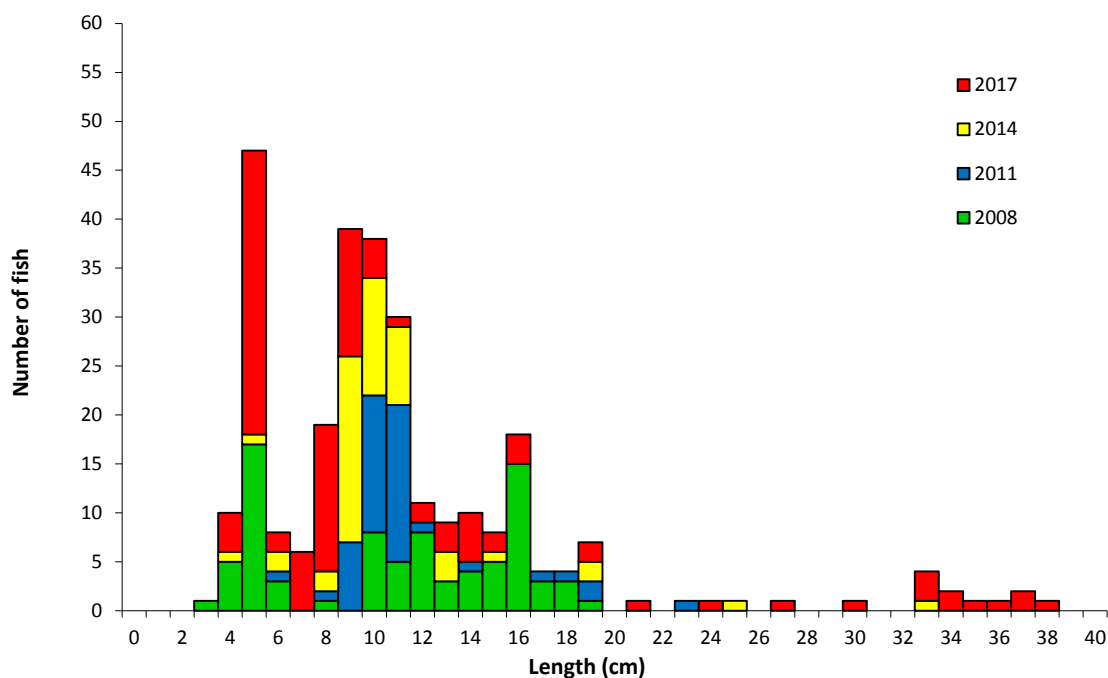


Fig. 1.8. Length frequency of perch captured on Lough Allua, 2008, 2011, 2014 and 2017

Table 1.6. Mean ($\pm$ S.E.) perch length (cm) at age for Lough Allua, September 2017

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆
Mean	6.2	10.3	13.5	15.7	22.1	27.8
($\pm$ S.E.)	0.2	0.4	0.7	1.3	3.7	5.5
N	34	20	19	14	5	3
Min	4.1	8.2	10.9	11.6	14.6	16.9
Max	10.0	14.2	19.7	28.2	31.9	33.6

Other fish species

Nine pike were captured during the survey. They ranged in length from 63.5 to 96.5 cm (Mean 74.7 cm). All fish were aged between 6+ and 8+. Gudgeon (n = 9) captured during the survey ranged in length from 7.9 cm to 11.4 cm (mean 9.3 cm). Two 1+ brown trout (11.8 and 13.8 cm) and one rudd x bream hybrid (11.4 cm and 3 +) were also captured.

1.3.3 Stomach and diet analysis

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 45 perch stomachs were examined. Of these 22 (48.9 %) contained food (Fig. 1.10). Nine stomachs (41% FO) contained zooplankton and nine (41% FO) contained unidentified digested material. Fish were recorded in three (14% FO) and zooplankton and one (5% FO) stomachs respectively. Ontogenetic differences in perch diet, showing differences in the size of zooplankton and fish eaters respectively, are illustrated in Fig 1.11.

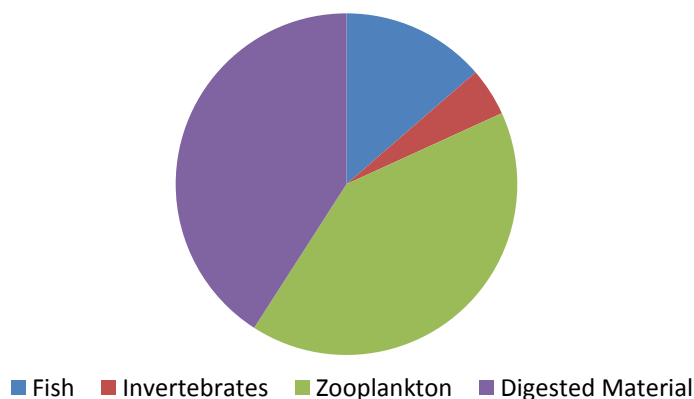


Fig 1.10. Diet of perch (n=23) captured on Lough Allua, 2017 (% FO)

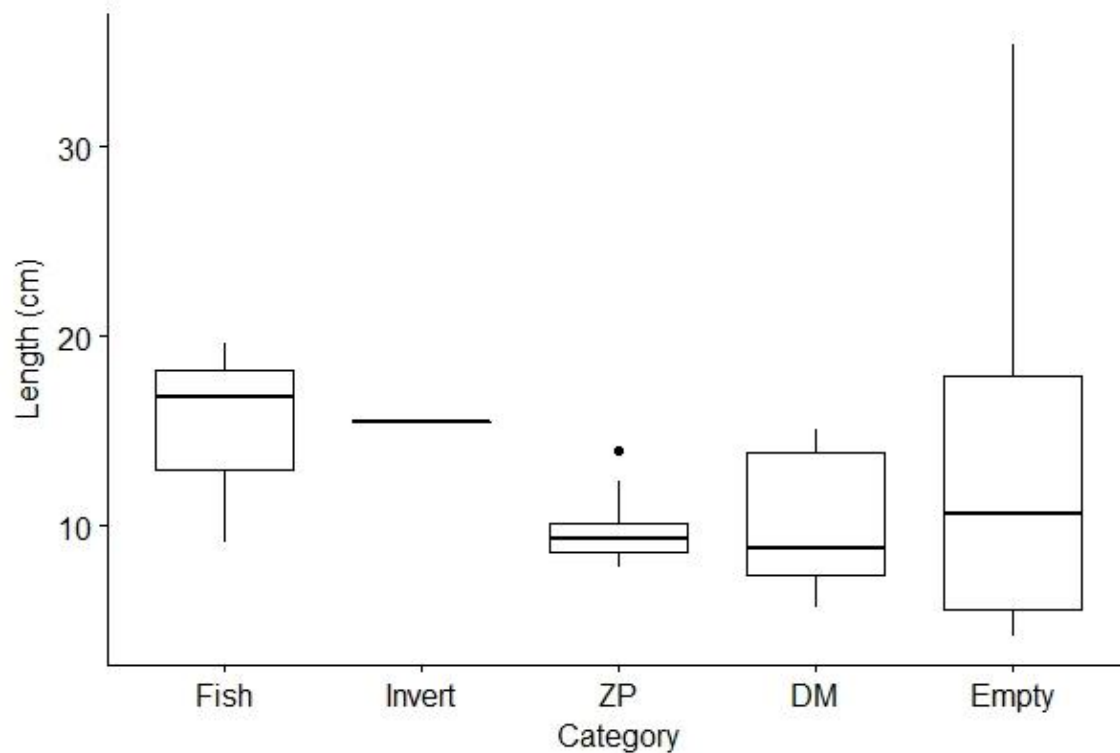


Figure 1.11. Boxplot illustrating ontogenetic differences in diet of perch captured in Lough Allua in 2017. The horizontal bars represent the median value of the sample, while the 75% and 25% percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots. (Fish = Fish; Invert = Invertebrates; ZP = Zooplankton; DM = unidentified digested material; Empty = no food)

Pike

Two pike were available for analysis. Neither stomach contained food. All other pike were returned alive to the lake.



1.4 Summary and ecological status

A total of seven fish species and two hybrid varieties were recorded on Lough Allua in September 2017. Roach was the dominant species in respect of abundance (CPUE). While a total of nine pike were recorded, this species recorded the highest biomass (BPUE) in the survey.

Roach were first recorded in the lake during the 2008 survey (Kelly *et al.*, 2009). At that time, a total of 15 individual fish were recorded. The fish exhibited a restricted length (13 to 18.1 cm) range at that time. It is possible that the initial survey was conducted shortly after the initial colonisation of the species in the lake. The rapid and pronounced expansion of roach was accompanied by a similar increase in the numbers of roach x bream hybrids captured during subsequent surveys. Furthermore, numbers of rudd were much reduced in 2011 and subsequent years compared to those recorded in 2008.

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

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



1.5 References

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