National Research Survey Programme
Lakes 2017

Glasshouse Lake

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Iascach Intíre Éireann
Inland Fisheries Ireland

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National Research Survey Programme – Coarse Fish and Pike

Fish Stock Survey of Glasshouse Lake, September 2017

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ACKNOWLEDGEMENTS

1.1 Introduction

Glasshouse Lake is located approximately 7km north east of Carrigallen in Co. Cavan (Fig. 1.1). The area of the lake is 54 hectares, mean depth is <4m and maximum depth is 13m. It is located within the Erne Catchment, proximal to, but separate from the Lough Oughter lake complex to which it is linked *via* the Cullies River which enters and exits the lake at the western portion of the lake. The lake is categorised as 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 $CaCO_3$). The lake is largely reed fringed with the exception of the roadside shoreline and small sections of the eastern and western shores. The roadside shoreline is generally shallow but areas of deeper water occur off the eastern and western shores. The lake is reported to contain reasonable stocks of small to medium sized pike but larger fish are known to be present. There is bank fishing for bream, roach, hybrids, perch, pike and some tench and there is good access via a lakeside road to bank fishing from swims in a "Coillte" forest (IFI, 2017). Glasshouse Lake has an overall ecological status of Poor (EPA, 2013).

The lake was previously surveyed in 1969 (Inland Fisheries Trust Data). At that time, bream, perch, pike rudd and rainbow trout were recorded. Several roach and roach x bream hybrids were also captured at that time, which represent early records for roach and their hybrids in Irish lakes

This report summarises the results of the 2017 fish stock survey carried out on the lake as part of IFI's national coarse fish and pike research programme.

Plate 1.1. Glasshouse Lake
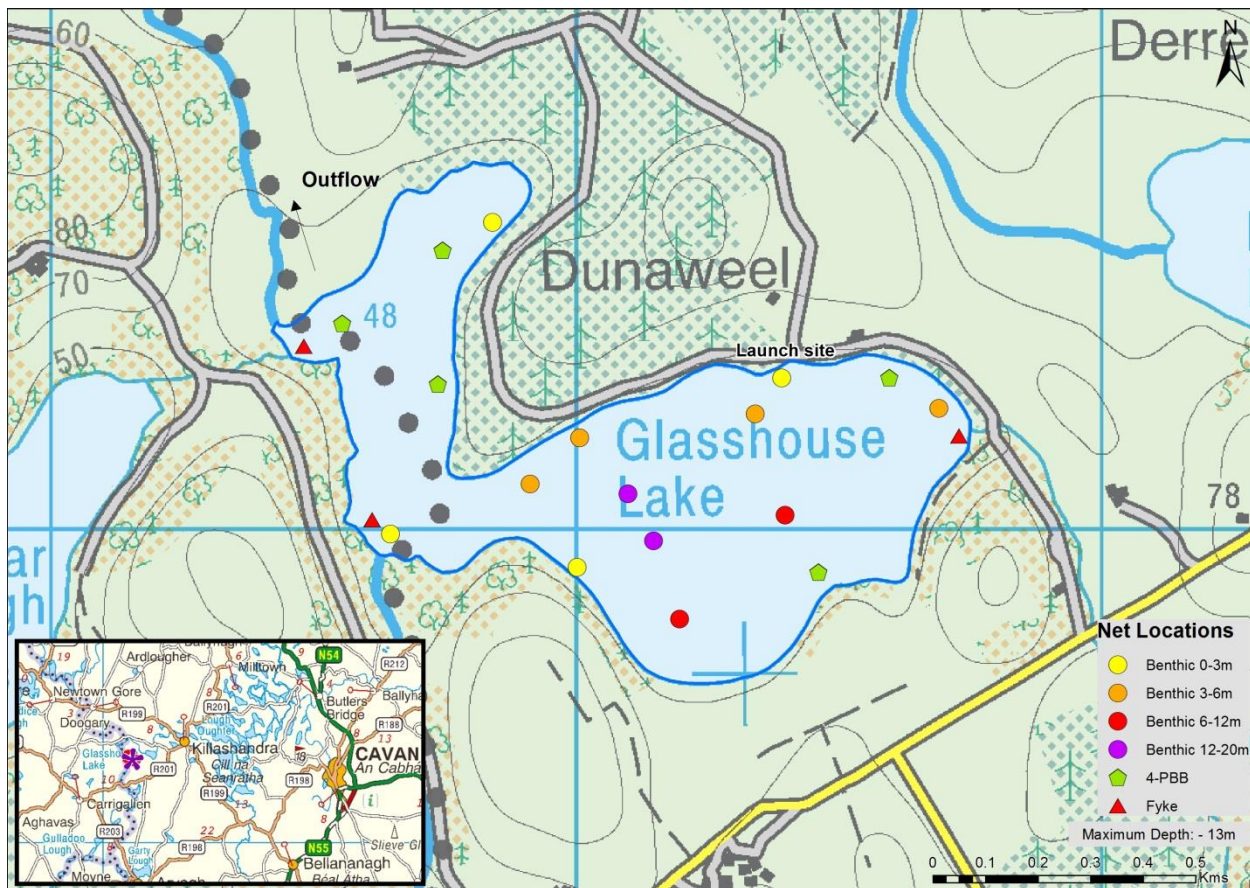
Fig. 1.1 Location map of Glasshouse Lake showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

1.2.1 Netting methods

Glasshouse Lake was surveyed over two nights between the 18th to the 20th of August 2017. A total of three sets of Dutch fyke nets (Fyke) and 12 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, 2 @ 6-11.9m and 2 @ 12-19.9m) were deployed in the lake (15 sites). The netting effort was supplemented using five four-panel benthic braided survey gill nets (4-PBB) at five 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 monofilament multi-mesh gill nets (BM 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 and 6-11.9m). 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 also 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 eels and gudgeon) 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 for later dissection in the IFI laboratory.

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).

$$\mathbf{FO}_i = \left(\frac{\mathbf{N}_i}{\mathbf{N}}\right) * \mathbf{100}$$

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 eight fish species and two hybrids were recorded on Glasshouse Lake in September 2017. A total of 1657 fish were captured. The number of each species captured by each gear type is shown in Table 1.1. Perch and roach were the most common fish species captured. Roach x bream hybrids and bream were the next most numerous fish captured in the nets. Other species captured were rudd, pike, gudgeon, tench, brown trout and rudd x roach hybrids.

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

Scientific name	Common name	Number of fish captured			
		BM CEN	4-PBB	Fyke	Total
Perca fluviatilis	Perch	1009	1	1	1011
Rutilus rutilus	Roach	547	0	5	552
Rutilus rutilus x Abramis brama	Roach x bream hybrid	24	8	0	32
Abramis brama	Bream	16	15	0	31
Scardinius erythrophthalmus	Rudd	11	0	0	11
Esox lucius	Pike	3	4	0	7
Gobio gobio	Gudgeon	5	0	0	5
Tinca tinca	Tench	0	4	1	5
Salmo trutta	Brown trout	1	1	0	2
Scardinius erythrophthalmus x Rutilus rutilus	Rudd x roach hybrid	1	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. Overall perch and roach were the dominant species in terms of CPUE, while roach was dominant in terms of biomass (expressed as BPUE).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Glasshouse Lake, September 2017

Scientific name	Common name	Mean CPUE (± S.E) **	Mean BPUE (± S.E) **
Perca fluviatilis	Perch	1.683 (0.507)	17.255 (5.917)
Rutilus rutilus	Roach	0.916 (0.307)	30.372 (9.358)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.044 (0.012)	18.894 (5.618)
Abramis brama	Bream	0.034 (0.008)	15.854 (4.265)
Scardinius erythrophthalmus	Rudd	0.018 (0.018)	2.968 (1.628)
Esox lucius	Pike	0.007 (0.003)	9.813 (3.902)
Tinca tinca	Tench	0.003(0.003)	3.153 (2.025)
Gobio gobio	Gudgeon	0.008 (0.003)	0.040 (0.017)
Salmo trutta	Brown trout	0.002 (0.002)	1.21 (0.923)
Scardinius erythrophthalmus x Rutilus rutilus	Rudd x roach hybrid	0.002 (0.002)	0.555 (0.555)

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 comparable to earlier surveys as an extra panels were added to the 2-PBB to provide additional information on large coarse fish.

1.3.3 Length frequency distributions and growth

Roach

Roach captured during the 2017 survey ranged in length from 4.4 cm to 26.2 cm (mean = 10.7 cm) (Fig.1.5). All age classes from 0 + to 7 + (8 age classes) were represented in the sample aged, indicating regular recruitment in recent years. The population captured was dominated by small fish and three year old fish (3+) dominated the sample of aged fish (Fig. 1.2). Mean length at age 1 was estimated as 3.5cm (Table 1.3).
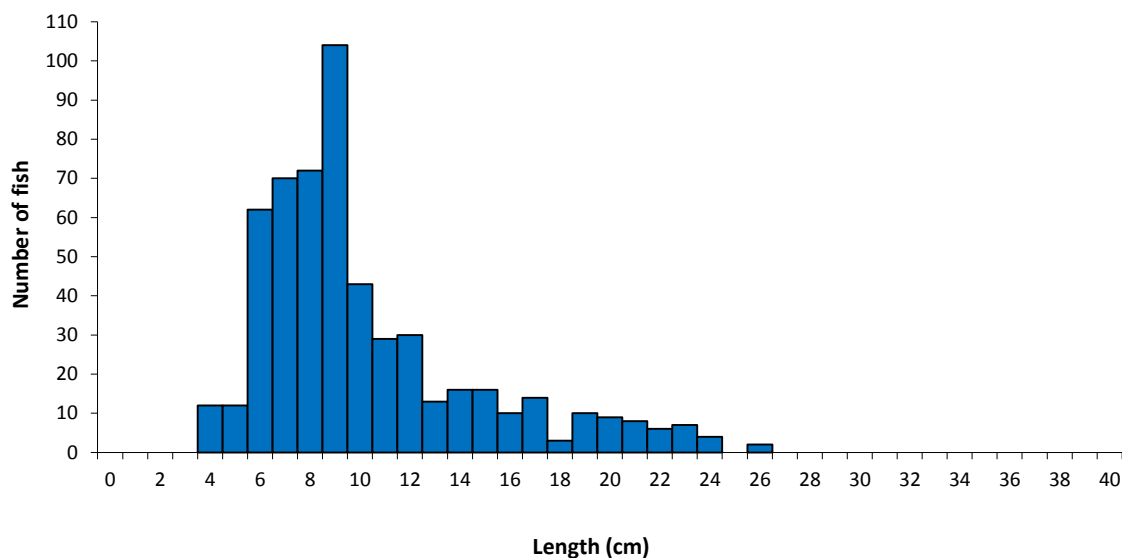
Fig. 1.2. Length frequency of roach captured on Glasshouse Lake in 2017

Table 1.3. Mean (±S.E.) roach length (cm) at age for Glasshouse Lake, September 2017

	L$_1$	L$_2$	L$_3$	L$_4$	L$_5$	L$_6$	L$_7$
Mean	3.5	7.3	10.5	12.9	15.5	17.6	18.8
(±S.E.)	0.1	0.1	0.2	0.4	0.6	0.9	1.2
N	37	28	20	9	5	4	3
Min	2.4	6.1	8.7	11.6	13.5	15.4	17.0
Max	4.7	8.5	12.2	14.8	17.0	19.6	21.0

Bream

Bream captured ranged in length from 7.5 to 45 cm (mean 29.5 cm) (Fig. 1.3). Eleven age classes were present. The oldest fish were aged at 14+, and most age classes between 1+ and 10+ (with the exception of 2+) were represented in the sample aged. This indicates that recruitment of bream in the lake remains relatively stable, with spawning successful in most years. Furthermore, no single year class dominated the population. Mean length at age 1 was estimated as 3.6cm (Table 1.4).

Fig. 1.3. Length frequency of bream captured on Glasshouse Lake in 2017

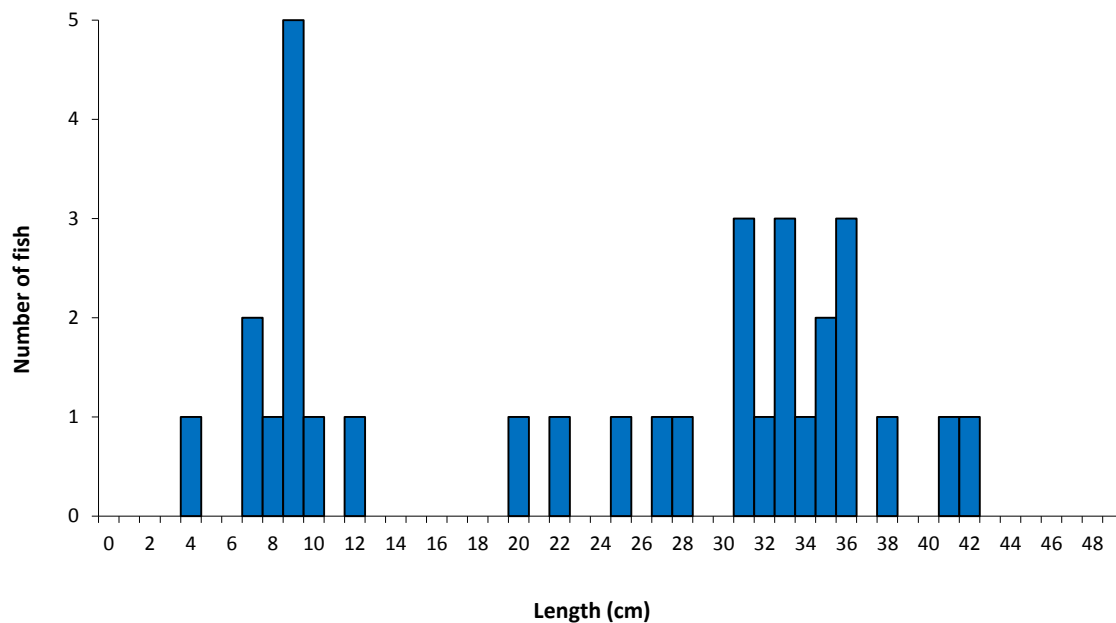**Table 1.4. Mean (±S.E.) bream length (cm) at age for Glasshouse Lake, September 2017**

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}
Mean	3.6	7.5	12.5	17.4	21.5	25.1	28.3	31.1	33.7	36.9	35.8
(±S.E.)	0.1	0.2	0.3	0.5	0.6	0.7	0.8	1.2	1.4	1.7	0.0
N	26	25	25	22	19	16	13	9	6	4	1
Min	2.6	5.7	9.2	11.8	15.4	17.8	21.3	23.9	28.4	32.7	-
Max	5.0	9.6	15.6	20.6	26.9	28.6	32.3	34.7	37.6	40.0	-

Roach x bream hybrids

Roach x bream hybrids captured ranged in length from 4.7 to 42.2 cm (mean 24.5 cm) (Fig. 1.4). Roach bream hybrids ranged in age from 1+ to 12+, with eight age classes observed in the aged sample. This indicates that there has been regular recruitment (i.e. hybridisation between the parent species), though not necessarily on an annual basis in the lake. The most abundant age class was 10+, made up of the larger specimens captured (Fig. 1.7). Mean length at age 1 was estimated as 3.5 cm (Table 1.5).

Fig. 1.4. Length frequency of roach x bream hybrids captured on Glasshouse Lake in 2017

Table 1.5. Mean (±S.E.) roach x bream hybrid length (cm) at age for Glasshouse Lake, September 2017

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}
Mean	3.5	7.0	11.0	15.2	18.6	21.9	25.2	27.5	30.6	34.3	36.3
(±S.E.)	0.1	0.2	0.3	0.5	0.5	0.7	0.7	0.8	0.8	1.3	1.4
N	21	17	17	17	17	16	16	14	12	5	5
Min	4.2	8.4	13.0	19.1	23.6	25.8	29.4	31.3	35.3	37.6	39.6
Max	4.2	8.4	13.0	19.1	23.6	25.8	29.4	31.3	35.3	37.6	39.6

Perch

Perch captured during the 2017 survey ranged in length from 3 to 25 cm (mean = 7.4 cm) (Fig.1.5). The population was dominated by younger fish. With the exception of one 5+ and one 8+ fish all others in the sample aged ranged in age from 1+ to 5+. Mean length at L1 was 5.6 cm (Table 1.9).
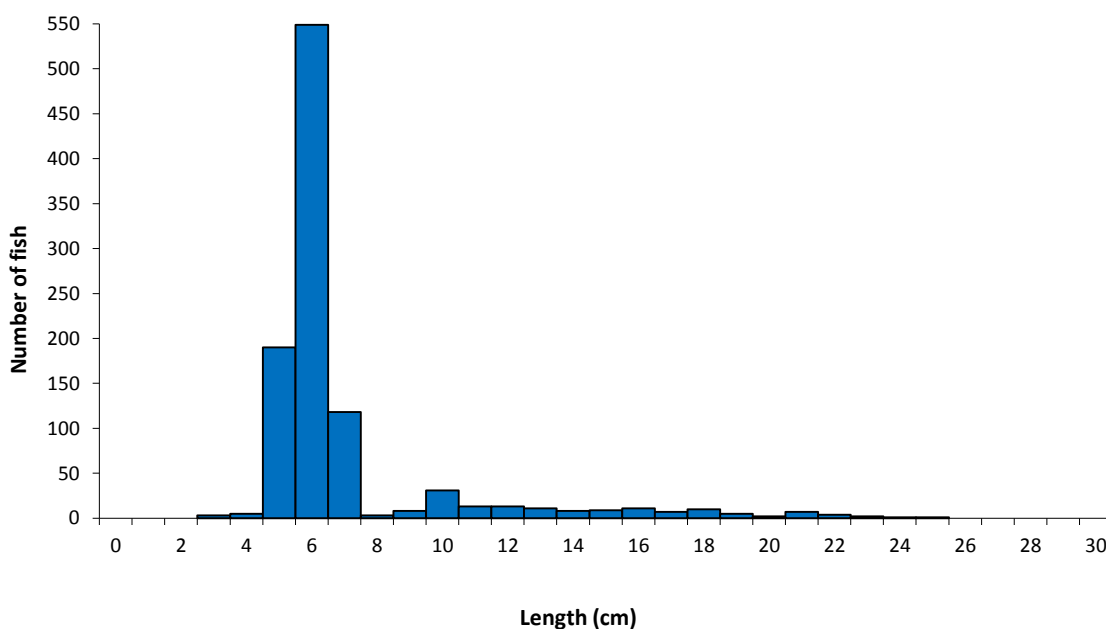

Fig. 1.5. Length frequency of perch captured on Glasshouse Lake in 2017

Table 1.9. Mean (±S.E.) perch length (cm) at age for at age for Glasshouse Lake, September 2017

|	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}
Mean	5.6	9.5	11.9	14.9	15.3	15.8	18.8	20.4	17.9	18.8	20.9
(±S.E.)	0.1	0.3	0.5	0.8	1.8	2.2	3.0	3.6	0.0	0.0	0.0
N	56	31	14	11	3	2	2	2	1	1	1
Min	4.3	6.5	8.3	9.8	12.0	13.6	15.7	16.8	17.9	18.8	20.9
Max	7.3	12.1	16.2	18.4	18.2	18.0	21.8	23.9	17.9	18.8	20.9

Other fish species

Eleven rudd were captured during the survey. These ranged in length from 7.3 to 26 cm (mean = 18.2 cm, with four year classes (1+ to 7+) represented in the sample. Pike (n = 7) ranged in length from 46.9 to 73.2 cm (mean = 61.7 cm). Tench (n = 5) ranged in length from 34.3 cm to 47.7 cm (mean = 40.5 cm). Gudgeon (n = 5) ranged in length from 6.3 cm to 9.1 cm (mean = 7.4 cm). Two brown trout (25.8 and 4+) and (49.3 cm and 6+) and one rudd x roach hybrid (25.2cm) were also captured

1.3.4 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 83 perch stomachs were examined. Of these 55 (62.5%) contained food (Fig, 1.10). Twenty five stomachs (45% FO) contained zooplankton and 23 (42% F0) contained unidentified digested material. Fish were recorded in six (11% FO) and zooplankton in 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.
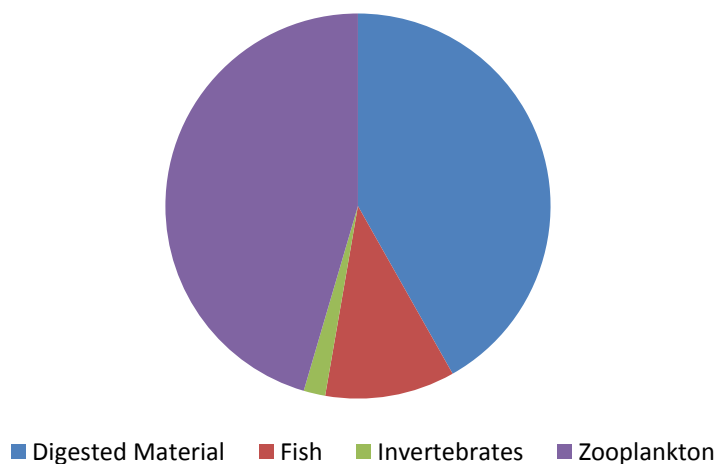
Fig 1.10. Diet of perch (n=55) captured on Glasshouse Lake in 2017 (% FO)
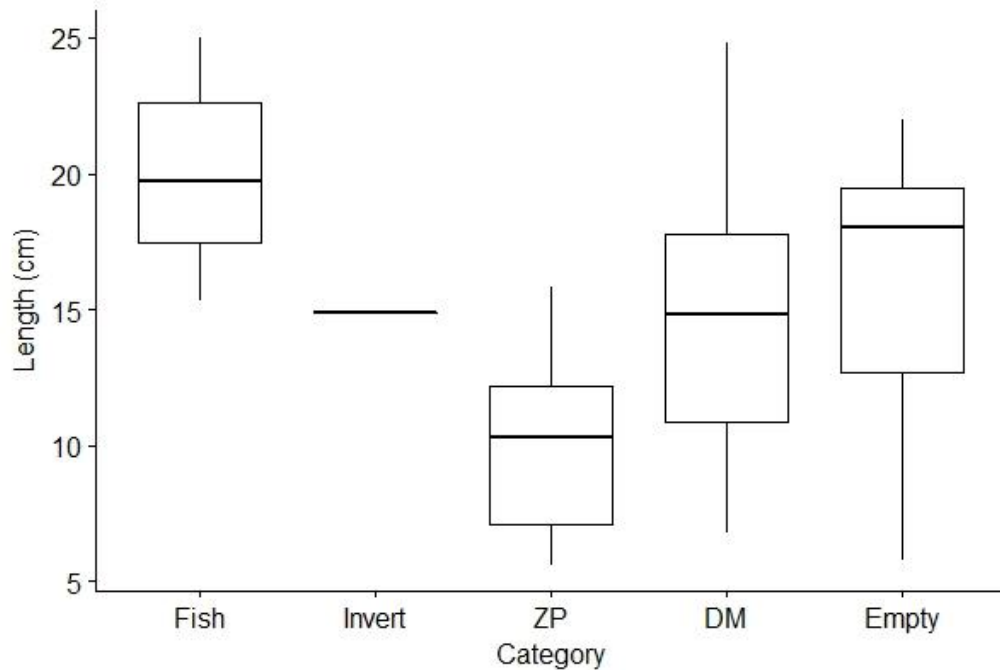
Figure 1.11 Boxplot illustrating ontogenetic differences in diet of perch captured in Glasshouse Lake in 2017. The horizontal bars represent the median value of the sample, while the 75% and 25% percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data 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.

1.4 Summary and ecological status

A total of eight fish species and two hybrids were recorded in the fish stock survey of Glasshouse Lake in 2017. Perch, predominantly YOY individuals, dominated fish stocks with respect to CPUE. Roach exhibited the highest BPUE. Populations of bream and particularly rudd can be threatened following the colonisation of roach, as has been demonstrated in the survey of Lough Allua in 2017 (McLoone *et al.*, 2018). However, while roach and roach x bream hybrids were recorded in the lake in 1969 (IFI data) both bream and rudd persist almost 50 years later following the first positive record of roach, highlighting the potential for long term coexistence (with roach) in Irish lakes.

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, Glasshouse Lake has been assigned an ecological status of Poor for 2017 based on the fish populations present.

In the 2010 to 2015 surveillance monitoring reporting period, the EPA assigned Glasshouse Lake an overall ecological status of Bad.

1.5 References

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