

National Research Survey Programme

Lakes 2018

Garadice Lough

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National Research Survey Programme

**Fish Stock Survey of Garadice Lough,
August 2018**

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

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1.1 Introduction

Garadice Lough is situated in the Erne Catchment, in counties Leitrim and Cavan near the town of Ballinamore (Fig. 1.1). It forms part of the Shannon-Erne Waterway, a navigable watercourse which links the Shannon and Erne catchments at Leitrim Village and Belturbet respectively. The navigation enters the lake at its western end, via the Ballyconnell-Ballinamore Canal. The Woodford River exits at the eastern end of the lake. The lake is situated at an altitude of 48 m.a.s.l., has a surface area of 389ha, mean depth of 4.4m and maximum depth of 22.4m. The lake is categorised as typology class 8 for the purposes of WFD (as designated by the EPA), i.e. deep (>4m), greater than 50ha and medium alkalinity (20-100mg/l CaCO₃). In the 2010 to 2015 surveillance monitoring reporting period, the EPA assigned Garadice Lough an overall ecological status of Poor.

The lake is largely surrounded by agricultural pasture, and the geology of the area is predominantly limestone.

Garadice Lough is regarded as an excellent coarse fish and pike fishery and has been extensively developed as such. Access for cars to maintained angling pegs along the eastern portion of the lake (Houghton's and Church Shores), and at other locations is available. Several prestigious national and international angling competitions are held on the lake on an annual basis.

Inland Fisheries Ireland (previously the Central Fisheries Board) have undertaken relatively regular fish stock surveys on the lake, the most recent of which was conducted in 2012. Roach, perch, roach x bream hybrids, bream, brown trout, tench and pike were recorded at that time (IFI, 2013).

This report summarises the results of the 2018 fish stock survey (e.g. species composition, abundance and age structure) on the lake.



1.2 Methods

1.2.1 Netting methods

Garadice Lough was surveyed over three nights from the 3rd to the 6th of August 2018. A total of six sets of Dutch fyke nets (Fyke), 20 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (5 @ 0-2.9m, 5 @ 3-5.9m, 5 @ 6-11.9m, 5 @ 12-19.9m) and five floating monofilament multi-mesh (FM CEN) 12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (31 sites). The site locations for the benthic monofilament multi-mesh gill nets (BM CEN) were chosen randomly within fixed depth zones (0-2.9m, 3-5.9m, 6-11.9m, 12-19.9m), using lake bathymetry. Floating monofilament multi-mesh nets were set over the deepest area of the lake. The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at an additional 10 randomly selected sites. The 4-PBB nets are composed of four 27.5m long panels each a different mesh size (55mm, 60mm, 70mm and 90mm), tied together randomly. A handheld GPS was used to mark the precise location of each net. The angle of each survey gill net in relation to the shoreline was also randomised.

All fish were measured and weighed on site and scales were removed from all species except perch and eel. Live fish were returned to the water whenever practical or 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.

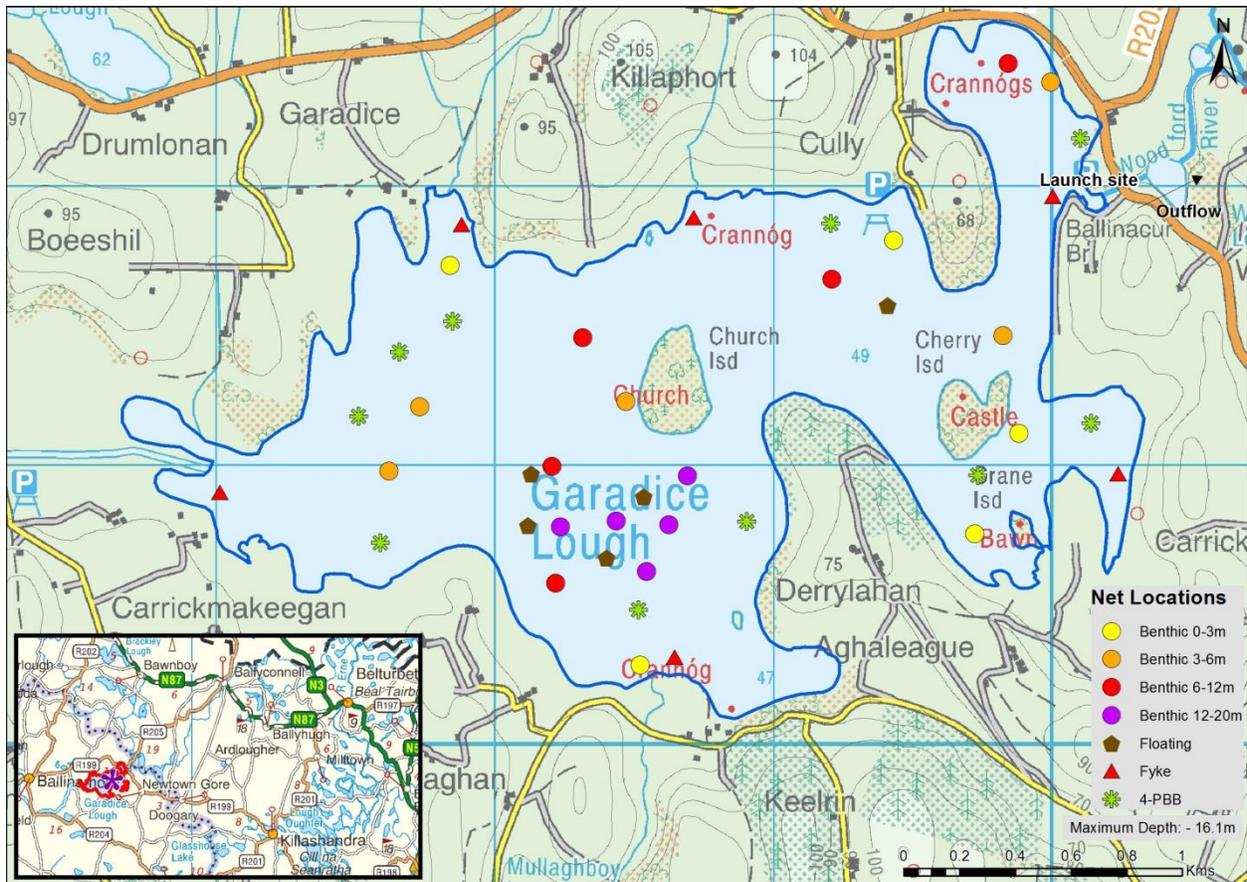


Fig. 1.1. Location map of Garadice Lough showing locations and depths of each net (outflow, to the Woodford River, is indicated on map)



Plate 1.1. Panoramic aerial photograph of Garadice Lough, looking east across the lake



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 one type of hybrid were recorded on Garadice Lough in August 2018. A total of 1648 fish were captured. The number of each species captured by each gear type is shown in Table 1.1. Perch was the most abundant fish species recorded, followed by roach. Bream, roach x bream hybrids, pike, tench, gudgeon, brown trout and eels were also recorded. A similar species composition was recorded in 2012 when the lake was last surveyed (IFI, 2013). Gudgeon were not recorded in the survey nets on that occasion (due to the mesh size used) but are known to be present in the lake.

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 2018 survey are summarised in Table 1.2 (Fig. 1.2 and 1.3).

Overall perch and roach were the dominant species in terms of CPUE. Roach x bream hybrids and roach were the dominant species in terms of biomass (BPUE) (Fig. 1.2 and 1.3).



Table 1.1. Number of each fish species captured by each method during the survey on Garadice Lough, August 2018

Scientific name	Common name	Number of fish captured				
		BM CEN	FM CEN	4-PBB	Fyke	Total
<i>Perca fluviatilis</i>	Perch	939	52	0	10	1001
<i>Rutilus rutilus</i>	Roach	360	88	0	7	455
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	54	0	67	0	121
<i>Abramis brama</i>	Bream	9	0	17	0	26
<i>Esox lucius</i>	Pike	3	1	2	0	6
<i>Tinca tinca</i>	Tench	0	0	4	0	4
<i>Gobio gobio</i>	Gudgeon	4	0	0	0	4
<i>Salmo trutta</i>	Brown trout	1	1	0	0	2
<i>Anguilla anguilla</i>	European eel	1	0	0	28	29

Table 1.2. Mean (S.E.) CPUE and BPUE (per metre of net) for all fish species captured on Garadice Lough, August 2018

Scientific name	Common name	Mean CPUE (\pm S.E)	Mean BPUE (\pm S.E)
<i>Perca fluviatilis</i>	Perch	0.810 (0.207)	19.758 (4.375)
<i>Rutilus rutilus</i>	Roach	0.367 (0.093)	25.033 (7.899)
<i>Rutilus rutilus x Abramis brama</i>	Roach x bream hybrid	0.061 (0.014)	27.862 (6.019)
<i>Abramis brama</i>	Bream	0.015 (0.008)	7.896 (3.703)
<i>Esox lucius</i>	Pike	0.004 (0.002)	6.789 (3.317)
<i>Tinca tinca</i>	Tench	0.001 (0.001)	1.252 (1.252)
<i>Gobio gobio</i>	Gudgeon	0.003 (0.002)	0.015 (0.009)
<i>Salmo trutta</i>	Brown trout	0.002 (0.001)	0.181 (0.127)
<i>Anguilla anguilla</i> *	European eel*	0.078 (0.025)*	18.168 (4.103)*

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).

*Eel CPUE and BPUE based on fyke nets only

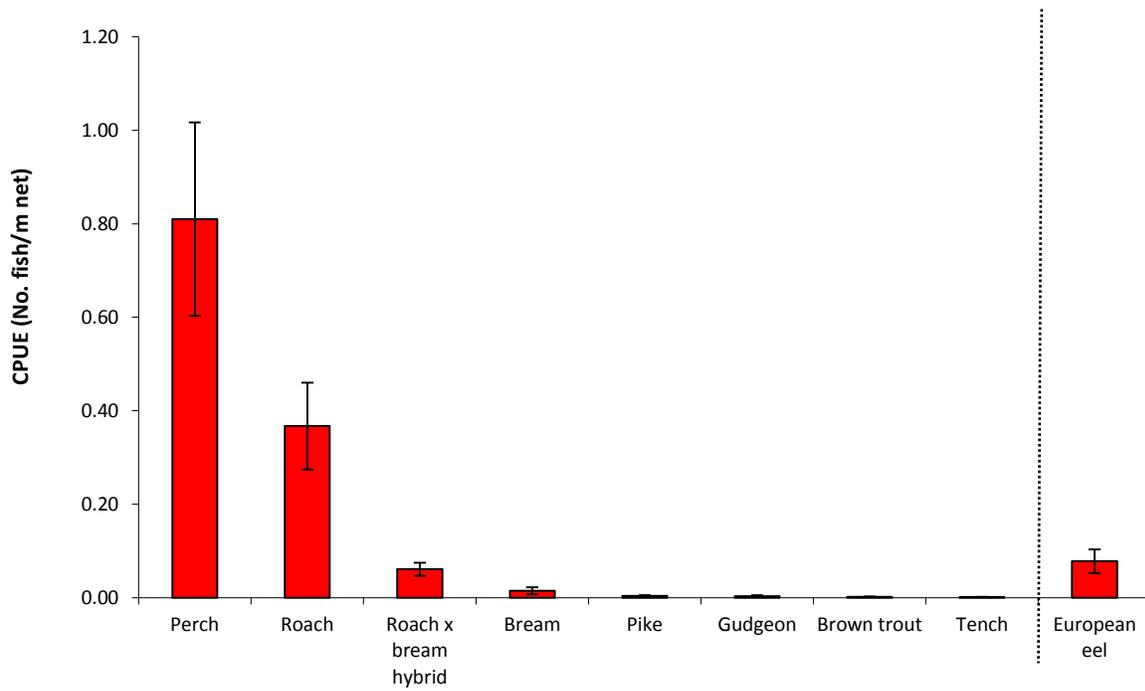


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Garadice Lough (Eel CPUE based on fyke nets only), 2018

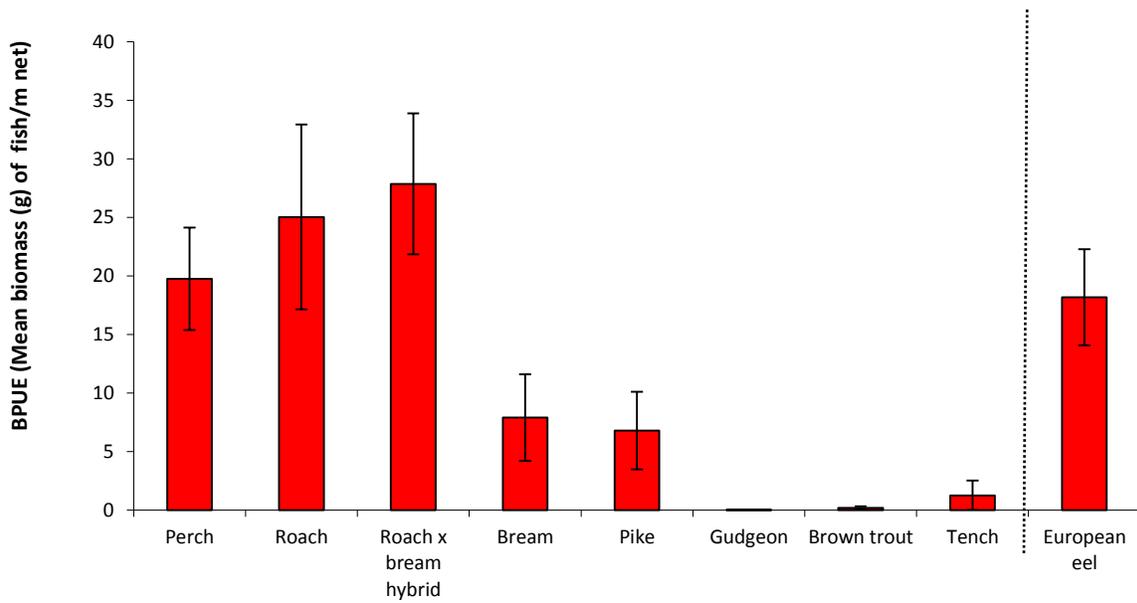


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Garadice Lough (Eel BPUE based on fyke nets only), 2018



1.3.3 Length frequency distributions and growth

Perch

Perch captured during the 2018 survey ranged in length from 4.3cm to 25.8cm (mean = 9.1cm) (Fig.1.4). Perch were aged from 0+ to 7+, with all intervening age classes recorded in the sample of perch that were aged. Mean L1 of 5.6cm (Table 1.3). Young fish dominated the population with c. 89% aged between 0+ and 5+. The dominant age class was 0+ (Fig. 1.4).

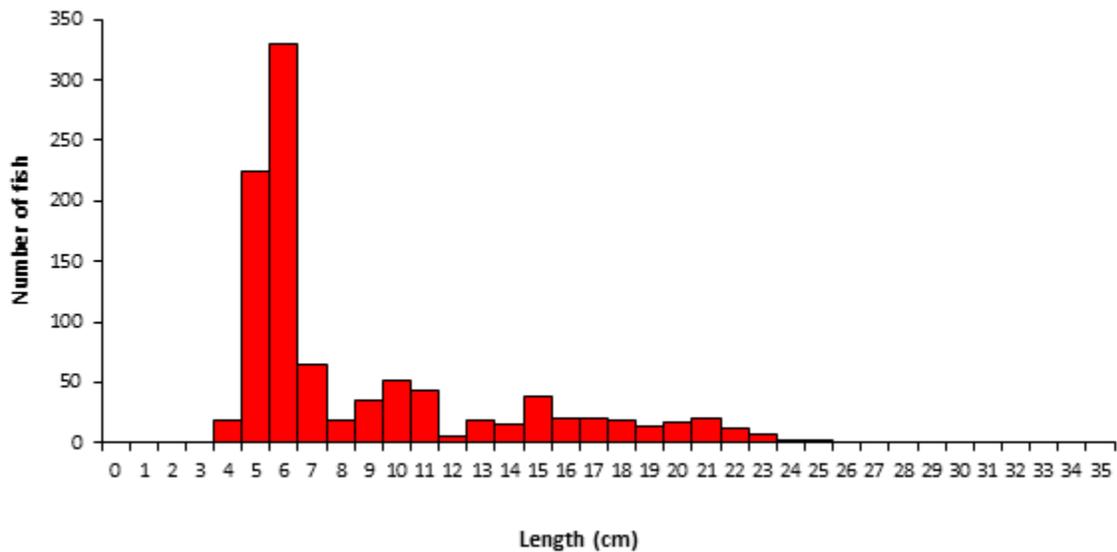


Fig. 1.4. Length frequency of perch captured on Garadice Lough, 2018

Table 1.3. Mean (\pm S.E.) perch length (cm) at age for Garadice Lough, August 2018

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇
Mean (cm) (\pm S.E.)	5.6 (0.1)	9.9 (0.2)	14.3 (0.2)	17.4 (0.3)	19.7 (0.3)	20.8 (0.5)	23.0 (0.6)
N	85	59	40	35	27	12	3
Range (cm)	3.9-8.5	7.7-12.7	11.0-17.5	13.5-21.1	15.7-23.3	16.9-23.1	22.2-24.2



Roach

Roach captured during the 2018 survey ranged in length from 4.6cm to 30.4cm (mean = 13.6cm) (Fig.1.5). Roach were aged between 1+ and 13+. All age classes, with the exception of 12+ were represented (Table 1.4). The dominant age class in the sample aged was 2+, although large numbers of mostly 1+ roach were recorded (Figure 1.5). Many of these fish were captured in the floating nets set over deep water.

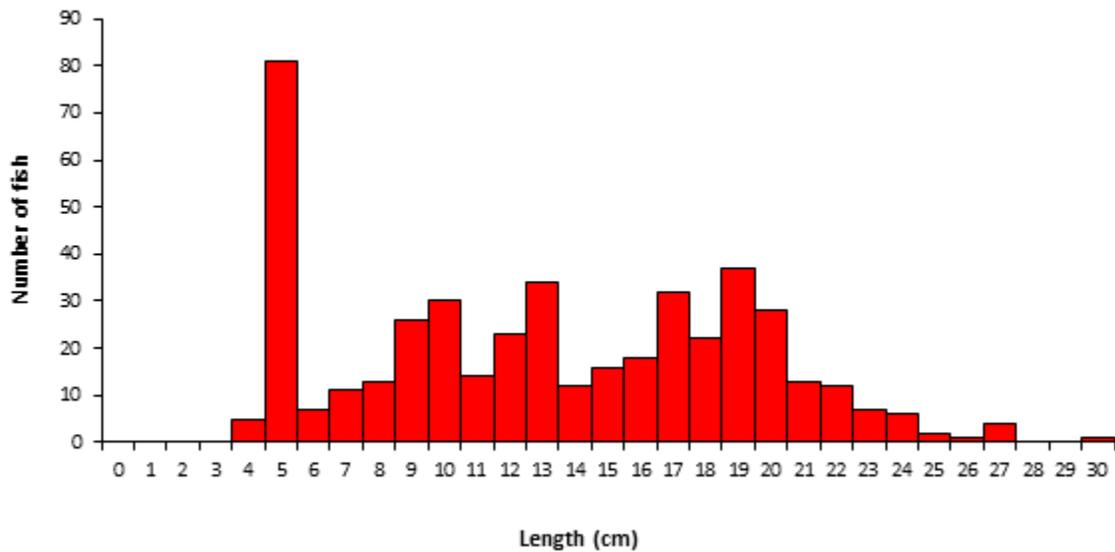


Fig. 1.5. Length frequency of roach captured on Garadice Lough, August 2018

Table 1.4. Summary age data from roach captured on Garadice Lough, August 2018. Number of fish and length ranges of all fish aged in the sample is presented

	Age class													
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+
Mean (cm)	-	6.2	9.5	12.7	14.5	16.6	19.7	21.1	21.9	23.7	24.3	26.1	-	30.4
N	-	9	19	10	12	12	7	7	7	7	5	6	-	1
Range (cm)	-	5.1- 9.8	7.5- 13.3	10.2- 15.5	11.2- 18.9	14.6- 18.0	18.7- 20.4	18.8- 22.5	19.8- 23.7	20.7- 27.3	23.7- 24.7	24- 27.2	-	30.4



Roach x bream hybrids

Roach x bream hybrids captured during the 2018 survey ranged in length from 12.6cm to 36.2cm (mean 29.1cm). The population was dominated by larger fish, with two smaller modal groups present. Approximately 83% of the population exceeded 25cm in length (Fig. 1.6). Fish were aged between 3+ and 14+. With the exception of 13+, all intervening age classes were present (Table 1.5) suggesting that recruitment to the hybrid population occurs regularly in the lake. However, older age cohorts dominated, with very strong 10, 11 and 12 year age groups present (Table 1.5). In contrast, relatively few smaller or younger fish were captured.

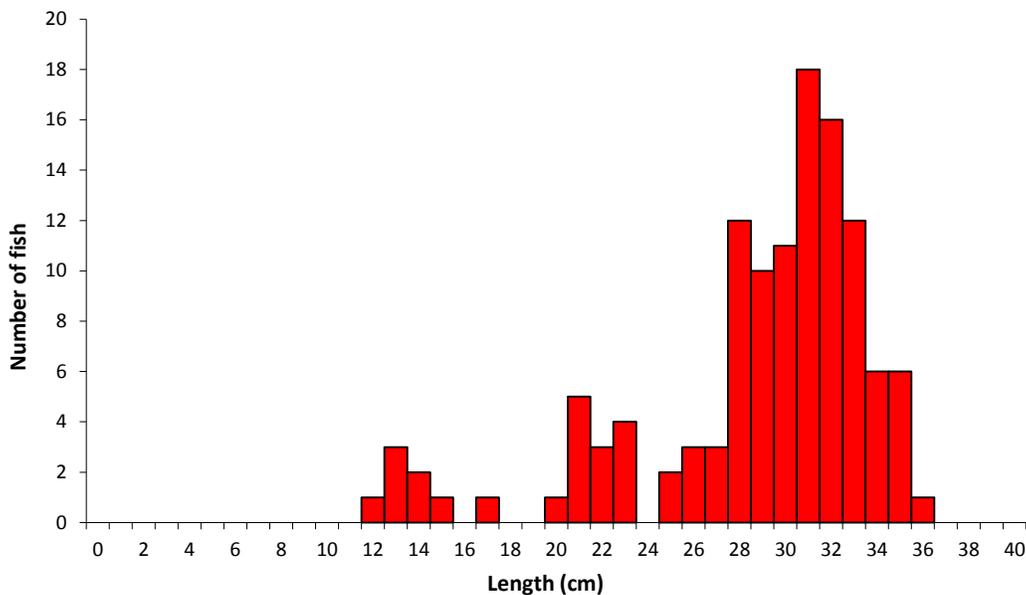


Fig. 1.6. Length frequency of roach x bream hybrids captured on Garadice Lough, August 2018

Table 1.5. Summary age data from roach x bream hybrids captured on Garadice Lough, August 2018. Number of fish and length ranges of all fish aged in the sample is presented

	Age class														
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+
Mean (cm)	-	-	-	13.8	13.8	22.4	22.8	23.4	27.0	28.5	30.8	31.4	33.2	-	33.9
N	-	-	-	3	4	6	3	4	4	8	17	24	17	-	2
Range (cm)	-	-	-	12.6- 15.5	13- 14.6	21- 23.3	17.8- 29	21.9- 26.3	22- 29.8	25.5- 31.5	27.6- 35.1	27.1- 35.5	30.5- 38.5	- ^A	32.2- 35.6



Bream

Bream captured during the 2018 survey ranged in length from 13.9cm to 47.3cm (mean 31.1cm). Length distributions are discontinuous (Fig. 1.7). Bream were aged between 2+ and 12+ and the population was dominated by the 5+ to 7+ cohorts. Other year classes, including younger groups, were poorly represented in the sample (Table 1.6).

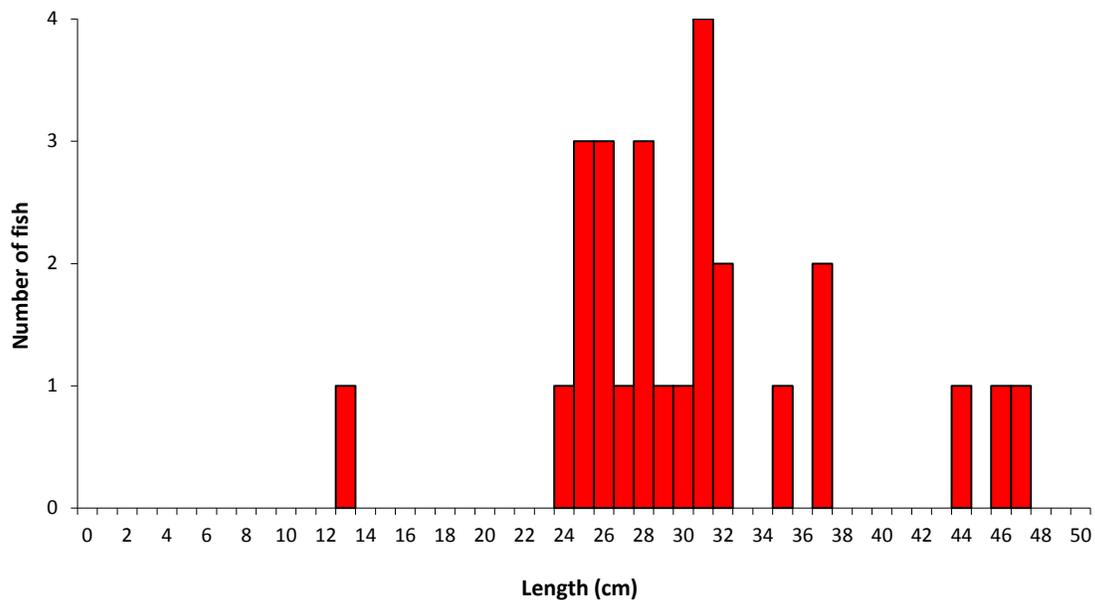


Fig. 1.7. Length frequency of bream captured on Garadice Lough, 2018

Table 1.6. Summary age data from bream captured on Garadice Lough, August 2018. Number of fish and length ranges of all fish aged in the sample is presented

	Age class												
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+
Mean (cm)	-	-	13.9	-	-	27.0	29.6	33.6	37.6	35.1	47.3	44.6	46.1
N	-	-	1	-	-	8	7	3	1	1	1	1	1
Range (cm)	-	-	13.9	-	-	24.5- 30.5	26.5- 32.9	31.5- 37.5	37.6	35.1	47.3	44.6	46.1



Other Species

Eels (n = 29) recorded during the 2018 survey ranged in length from 41.6cm to 69.4cm (mean = 51.5cm). Six pike, ranging in length from 24.1cm to 71.7cm (mean = 59cm) were captured. Four tench, ranging in length from 29 to 49cm (mean = 43.2cm) were also recorded. Four gudgeon were also captured during the survey. They ranged in length from 4.2cm to 9cm (mean = 6.4). Two brown trout were captured and measured 20.6 and 21.5cm respectively.

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 94 stomachs were examined. Of these 55 were empty. Of the remaining 39 stomachs containing food, 35 (90%) contained unidentified digested material. Four perch stomachs (10%) contained fish (Fig. 1.7).

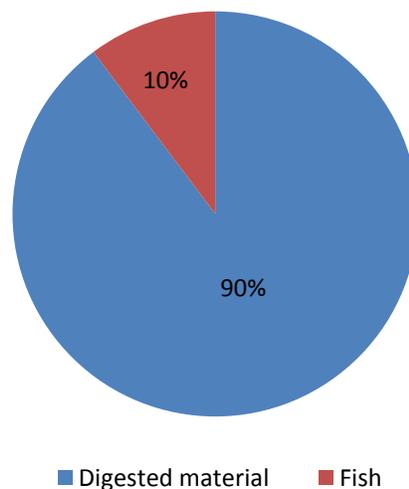


Fig 1.7. Diet of perch (n=39) captured on Garadice Lough, August 2018 (% FO)

Pike

Five pike were available for dietary analysis. Of these, three (60%) contained food. One fish was found to contain invertebrates. The remaining pike ($n = 2$) had preyed upon cyprinids, with bream recorded in one stomach.

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). Fish were recorded in the stomachs of both brown trout captured.



Plate 1.2. Angling on Haughton's Shore, Lough Garadice



1.4 Summary and ecological status

A total of seven fish species and one type of hybrid were recorded on Garadice Lough in the August 2018 survey. Overall perch and roach were the dominant species in terms of CPUE. Roach x bream hybrids and roach were the dominant species in terms of biomass captured.

With the exception of gudgeon, which could not be caught in the nets used at the time, a similar species composition was recorded when the lake was last surveyed in 2012 (IFI, 2013). The 2012 survey was conducted using standard 8 panel benthic braided survey gill nets (8-PBB) which capture different size ranges of fish species when compared to the CEN standard nets used in this survey. In particular, the 8-PBB survey gill nets fail to capture smaller fish (IFI unpublished data). The current suite of nets used combines standard CEN and the four largest panels of the 8-PBB survey gill nets to capture the full size range of fish species in the lake. This method has been adopted as the standard method for sampling all coarse and large trout and mixed fisheries.

The two most abundant species captured (i.e. perch and roach) have each been recruiting regularly in the lake. Both species were dominated by younger individuals and no poor or weakly represented year classes were apparent in recent years. The bream, population, however, was dominated by older (larger) individuals, with just 2 fish less than 25cm captured in the nets. The roach x bream hybrid population, which requires both parent species to spawn (Hayden *et al.*, 2010), was also dominated by larger and older fish, with relatively small and young fish captured. The paucity of smaller bream and hybrids may suggest that recruitment of the former species has been relatively limited in recent years.

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.*, 2012). Using the FIL2 classification tool, Garadice Lough has been assigned an ecological status of Moderate for 2018 based on the fish populations present.



1.5 References

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