National Research Survey Programme

Lakes 2021

Templehouse Lake

IFI/2022/1-4614

Iascach Intíre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Templehouse Lake,

August 2021

Iascach Intíre Éireann
Inland Fisheries Ireland

National Research Survey Programme

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

CITATION: McLoone, P., Corcoran, W., Bateman, A., Cierpial, D., Gavin, A., Gordon, P., McCarthy, E., Twomey, C., Burke, E., Matson, R., Robson, S., Duffy, P., Donovan, R. and Kelly, F.L. (2022) Fish Stock Survey of Lough Sheelin, July 2021. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

Cover photo: Upper Lake, Killarney, Co. Kerry © Inland Fisheries Ireland

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 programme from the Department of Housing, Local Government and Heritage and Department of Communications, Climate Action and Environment for 2022.

The authors would also like to thank Templehouse Estate for providing access to the lake

1. Introduction

Templehouse Lake is situated approximately six kilometres south of Ballymote, Co. Sligo in the Owenmore catchment (Plate 1.1, Figure 1.1). The lake is located on the private 405ha Templehouse Estate. The lake has a surface area of 118.6ha, a mean depth of 2.6m and a maximum depth of 5.3m. The underlying geology is carboniferous limestone. The lake is categorised as typology class 10 (as designated by the EPA for the Water Framework Directive), i.e. shallow (mean depth <4m), greater than 50ha and high alkalinity (>100 mg/l $CaCO_3$).

Templehouse Lake forms part of the Templehouse and Cloonacleigha Loughs Special Area of Conservation. It has been designated as a SAC under the EU Habitats Directive due to the diversity of habitats present; namely hard oligo-mesotrophic waters containing benthic vegetation made up of *Chara* spp. (stoneworts) and water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho- Batrachion* vegetation (submerged or floating river vegetation). Templehouse Lake supports typical aquatic vegetation for hard water lakes, with well-developed and diverse marginal vegetation (NPWS, 2021).

The lake is well known for its pike and coarse fishing and supports populations of pike, roach, roach x bream hybrids, bream, perch and eels. Templehouse Estate promotes angling and regularly plays host to fishing competitions. Densities of pike have been described by Inland Fisheries Ireland (IFI Ballina) as good, with individuals of up to 13.6kg present.

The lake was surveyed in 1980 by the Inland Fisheries Trust and was found to have good stocks of bream, rudd and pike (IFT, unpublished data). More recently Templehouse Lake was surveyed in 2008, 2011 and 2014 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al*., 2009, 2012a and 2015). Roach and perch dominated fish stocks on the latter survey occasion with roach x bream hybrids, pike and eels also captured. Brown trout and gudgeon were recorded on earlier sampling surveys.

This report summarises the results of the 2021 fish stock survey carried out on the lake using Inland Fisheries Ireland's fish in lakes monitoring protocol. The protocol is WFD compliant and also provides insight into fish stock status in the lake.

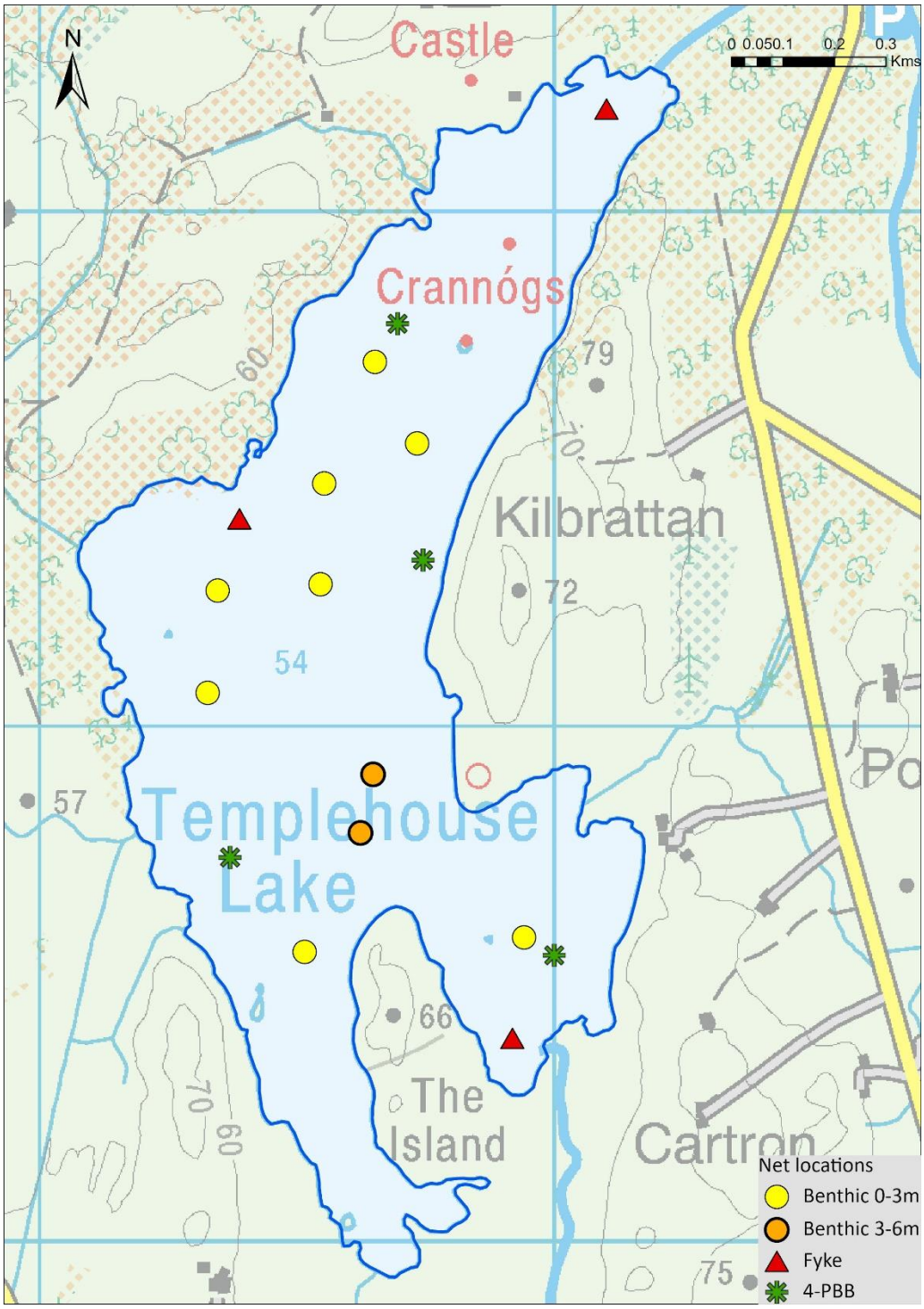

Figure 1.1 Location map of Templehouse Lake showing locations and depths of each net

Plate 1.1. Templehouse Lake, August 2021

Plate 1.2 Hauling a survey net on Templehouse Lake, August 2021

2. Methods

2.1. Netting methods

Templehouse Lake was surveyed over two nights between the 23rd and the 25th of August 2021. A total of three sets of Dutch fyke nets and 10 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (8 @ 0-2.9m and 2 @ 3-5.9m) were deployed in the lake (13 sites). The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at four additional sites. The four-panel survey gill nets are composed of four 27.5m long panels each a different mesh size (55mm, 60mm, 70mm and 90mm knot to knot). These nets were deployed in random locations throughout the lake. A handheld GPS was used to locate 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 sub-sample of other species except eels. 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.

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 then calculated to identify key prey items (Amundsen *et al.*, 1996).

$$\mathbf{FO}_{\boldsymbol{i}} = \left(\frac{\boldsymbol{N_i}}{\boldsymbol{N}}\right) * \mathbf{100}$$

Where:

$\mathbf{FO}_{\boldsymbol{i}}$ is the percentage frequency of prey item i,

$\boldsymbol{N_i}$ is the number of fish with prey i in their stomach,

$\boldsymbol{N}$ is total number of fish with stomach contents.

2.3. Biosecurity - disinfection and decontamination procedures

Procedures are required for disinfection of equipment 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.

3. Results

3.1. Species Richness

Five fish species and one type of hybrid were recorded in Templehouse Lake in August 2021. A total of 236 fish were captured. The number of each species captured by each gear type is shown in Table 3.1. Perch and roach were the most abundant species recorded in the survey nets. Smaller numbers of roach x bream hybrids, pike, bream and eels were also captured. Rudd hybrids, brown trout and gudgeon have been recorded in previous surveys but were not captured during the 2021 survey.

Table 3.1. Number of each fish species captured by each gear type during the survey on Templehouse Lake, August 2021

Scientific name	Common name	Number of fish captured			
		BM CEN	4-PBB	Fyke	Total
Perca fluviatilis	Perch	106	1	0	107
Rutilus rutilus	Roach	101	0	2	103
Esox lucius	Pike	3	1	2	6
Rutilus rutilus x Abramis brama	Roach x bream hybrid	6	1	0	7
Abramis brama	Bream	0	5	0	5
**Anguilla anguilla*	European eel	0	0	8	8

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 2021 survey are summarised in Table 3.2. In 2021, perch and roach were the dominant species in terms of abundance (CPUE) and biomass (BPUE) of species captured in all net types. Eels, which were captured in fyke nets only, also had a high biomass (Table 3.2).

For comparison purposes, the CPUE and BPUE for each species captured in all surveys between 2008 and 2021, per net type, are presented in Figures 3.1 (a and b) to 3.2 (a and b) respectively and illustrates fish community change over time. There was an apparent trend towards increasing abundance (CPUE) of perch and a decreasing abundance and biomass (BPUE) of roach and roach x bream hybrids in 2021 compared to earlier surveys (Figures 3.1 (a and b) and 3.2 (a and b)).

Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Templehouse Lake, August 2021

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Perca fluviatilis	Perch	0.208 (0.063)	12.961 (5.904)
Rutilus rutilus	Roach	0.200 (0.071)	15.306 (5.261)
Esox lucius	Pike	0.008 (0.004)	1.661 (1.317)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.005 (0.003)	5.763 (3.464)
Abramis brama	Bream	0.003 (0.002)	3.698 (2.679)
**Anguilla anguilla*	European eel	0.044 (0.015)	24.233 (4.682)

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.

Plate 3.1. Bream captured on Templehouse Lake, August 2021.

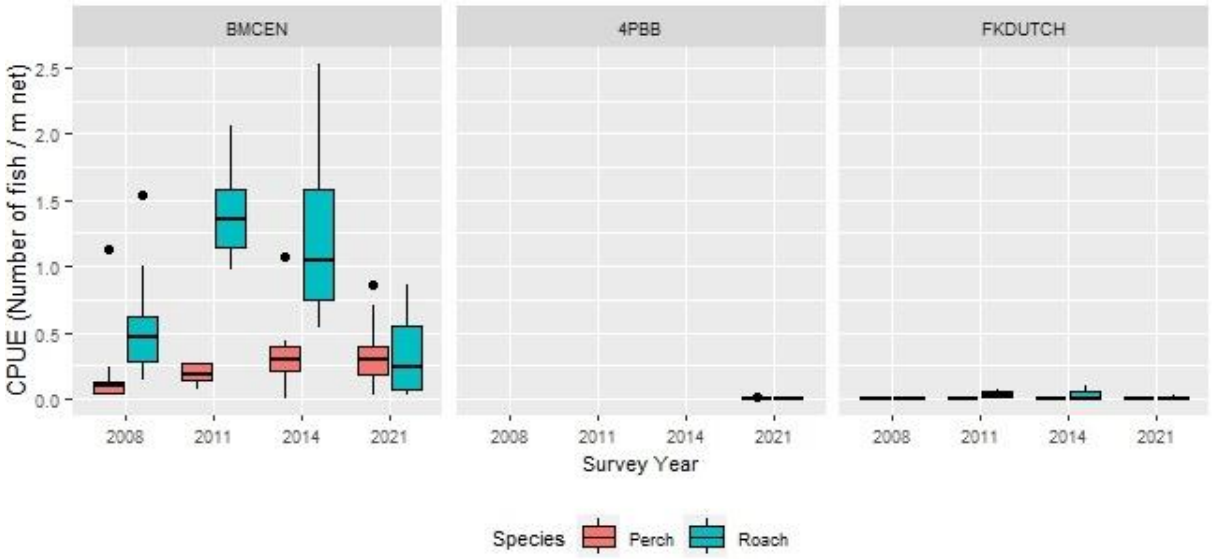

Figure 3.1a. CPUE of roach and perch captured in each net type during surveys of Templehouse Lake between 2008 and 2021. Figures are expressed as number of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range.

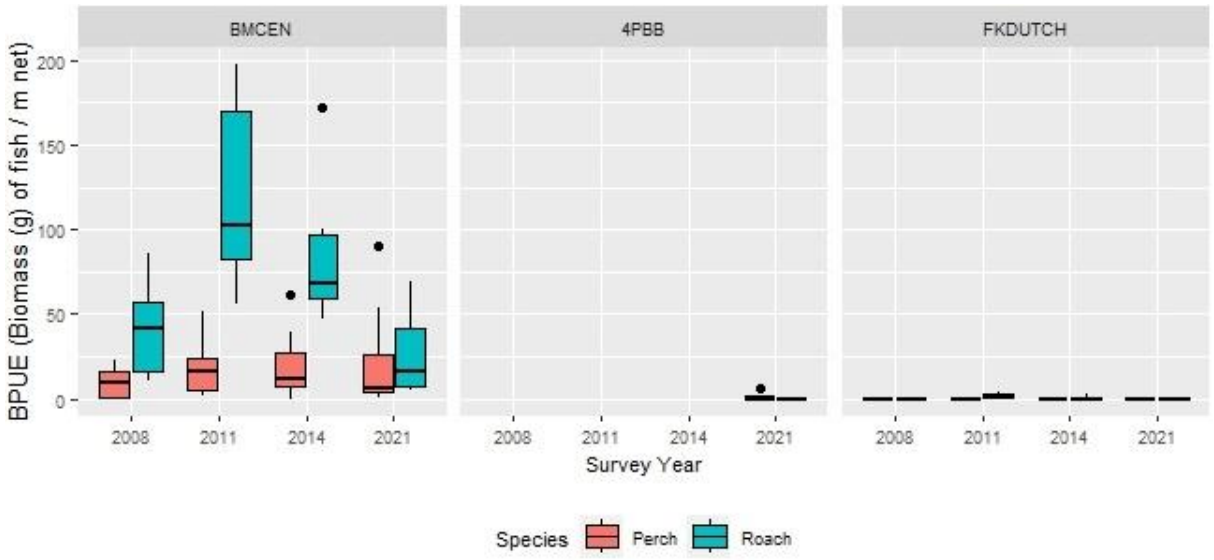

Figure 3.1b. BPUE of roach and perch captured in each net type during surveys of Templehouse Lake between 2008 and 2021. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

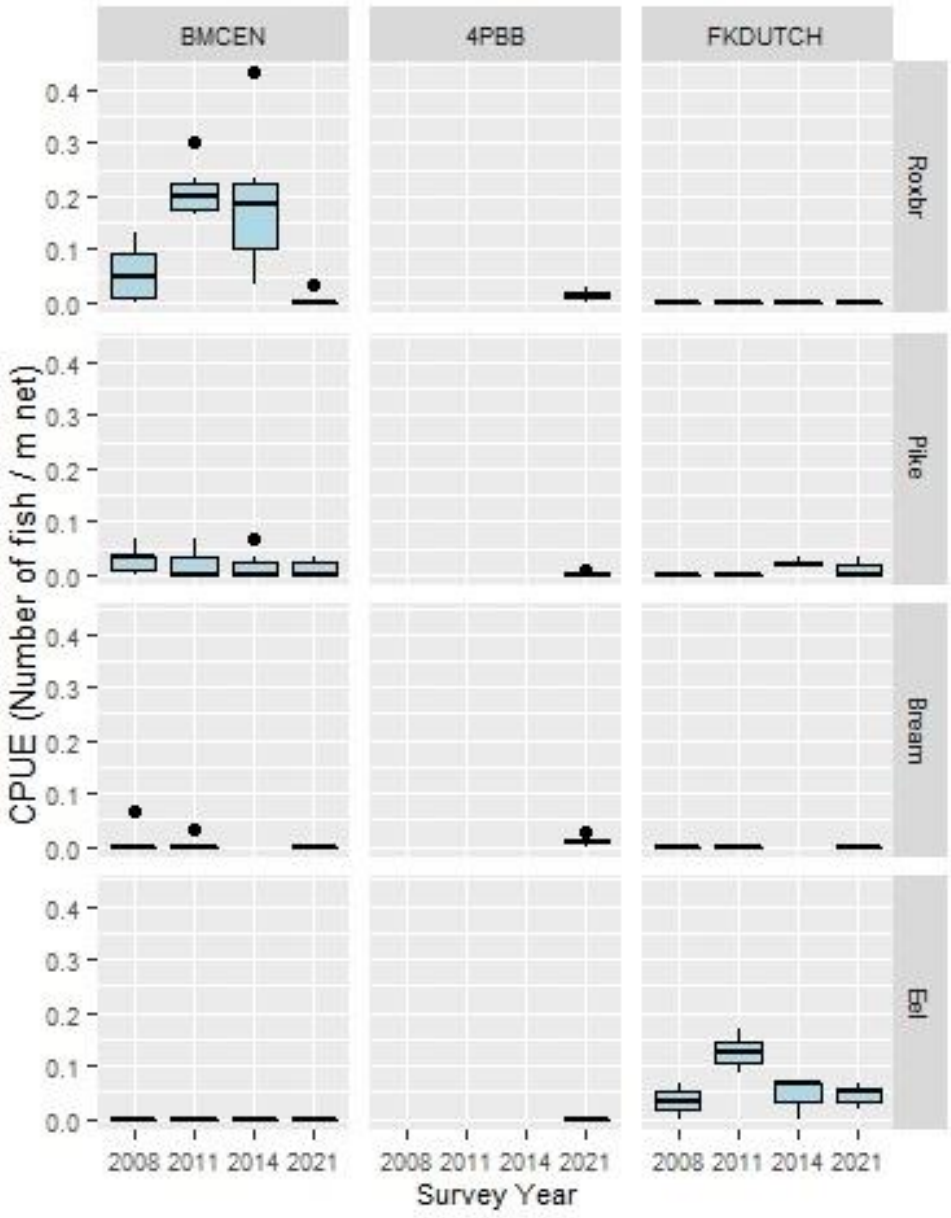

Figure 3.2a. CPUE of other species captured in each net type during surveys of Templehouse Lake between 2008 and 2021. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

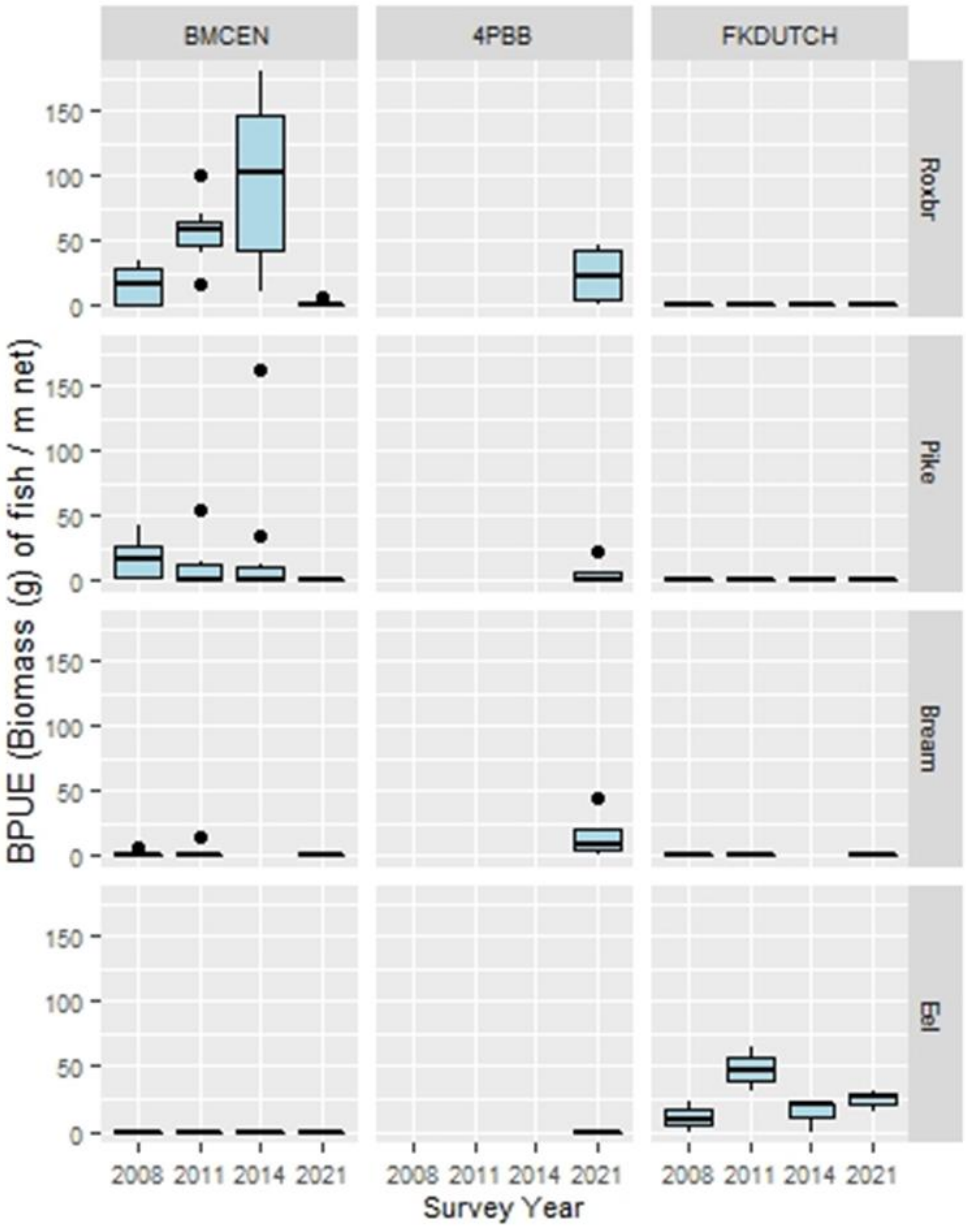

Figure 3.2b BPUE of other fish species captured in each net type during surveys of Templehouse Lake between 2008 and 2021. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

3.3. Length frequency distributions and growth

Perch

Perch captured during the 2021 survey ranged in length from 5.0cm to 35.0cm (mean = 12.2cm) (Figure 3.3). Mean L1 (length at the end of the first year) was 7.0cm (Table 3.3). Perch ranged in aged from 0+ to 8+. All intervening age classes with the exception of 5+ and 6+ were recorded in the sample. The dominant age class was 0+ corresponding with fish in the 6.0cm to 7.0cm length range (Figure 3.3).

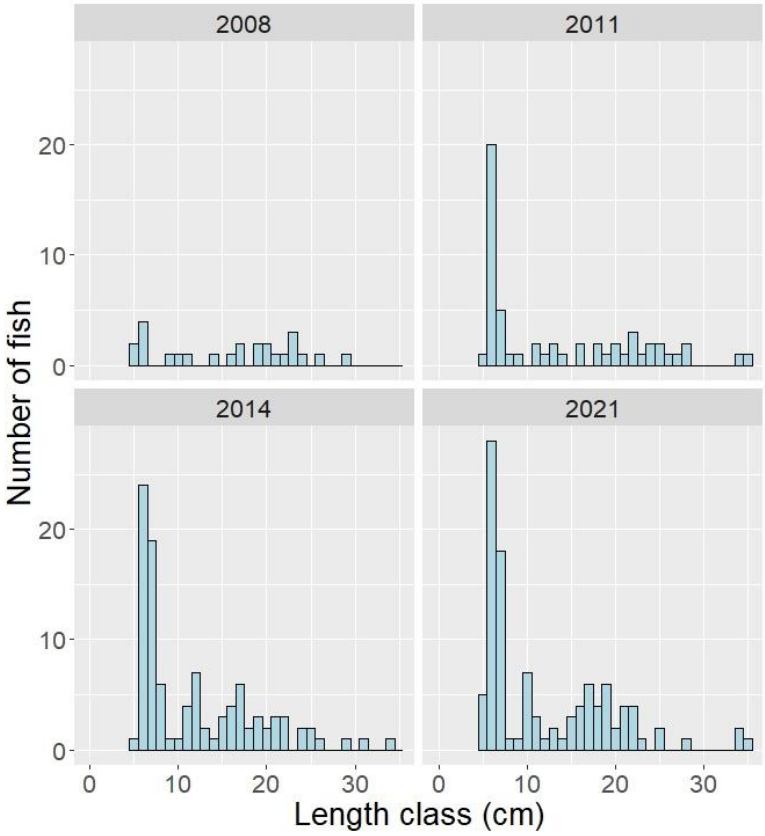

Figure 3.3. Length frequency of perch captured on Templehouse Lake, 2008, 2011, 2014 and 2021

Table 3.3. Mean (±S.E.) perch length (cm) at age for Templehouse Lake, September 2021

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8
Mean (±S.E.)	7.0 (0.2)	11.8 (0.3)	16.2 (0.3)	19.7 (0.6)	23.5 (1.8)	27.0 (2.3)	29.3 (2.6)	33.0 (0.8)
N	58	42	28	11	3	3	3	2
Range	4.6-11.0	8.5-15.8	13.7-19.5	16.5-22.6	19.9-25.5	22.4-29.8	24.1-32.5	32.1-33.8

Roach

Roach captured during the 2021 survey ranged in length from 6.6cm to 25.5cm (mean = 14.4cm) (Figure 3.4). Roach were aged between 1+ to 8+ and all intervening year groups were present (Table 3.4). No one year class dominated the population. Strong year groups apparent in earlier surveys, which tended to be dominated by younger and smaller fish, were not evident in 2021 (Figure 3.4).

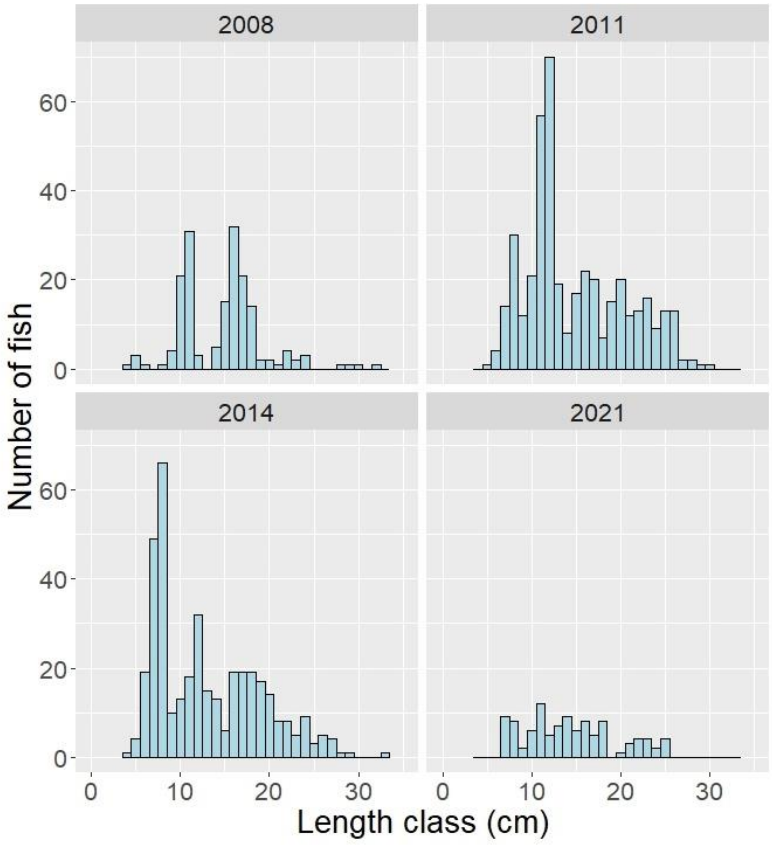

Figure 3.4. Length frequency of roach captured on Templehouse Lake, 2008, 2011, 2014 and 2021.

Table 3.4. Summary age data from roach captured on Templehouse Lake, August 2021. Number of fish and length ranges of all fish aged in the sample is presented.

	Age class							
	1+	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**
N	8	15	11	12	3	5	7	5
Mean L (cm)	7.2	11.0	14.3	16.5	18.2	21.2	23.0	24.9
Min L (cm)	6.6	8.8	13.0	14.5	18.0	20.5	22.1	23.7
Max L (cm)	7.8	12.7	16.0	18.4	18.3	21.6	23.7	25.5

Other species

Seven roach x bream hybrids were captured during the 2021 survey and measured in length from 21.1cm to 50.2cm (mean = 38.8cm) (Figure 3.5). Roach x bream hybrids ranged in age from 5+ to 12+.

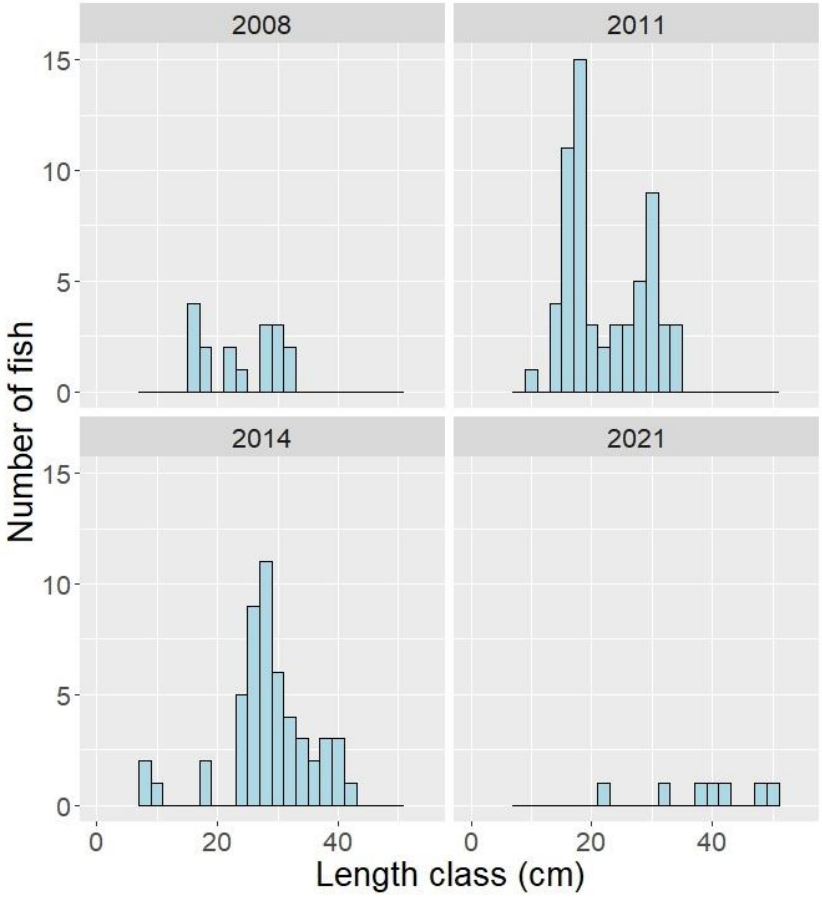

Figure 3.5. Length frequency of roach x bream hybrid captured on Templehouse Lake, 2008, 2011, 2014 and 2021.

Five bream were captured and measured from 29.4cm to 48.4cm (mean = 39.6cm) in length. Bream ranged in age from 5+ to 12+.

Six pike were captured and measured 13.1cm to 68.4cm (mean = 25.8cm) in length. Five of the sampled pike were aged at 1+ and one pike was aged at 6+. Eight European eels were captured and measured 52.5cm to 78.0cm (mean = 65.1cm).

3.4. Stomach and diet analysis

The dietary analysis conducted provides insight to the prey of examined fish immediately prior to capture. Longer term and seasonal studies provide a more robust assessment of fish diet.

The stomach contents of a subsample of perch and pike captured during the survey were examined and are presented below.

Perch

A total of 47 stomachs were examined. Of these 19 (40%) were found to contain no prey items. Of the remaining 28 stomachs, 11 (39%) contained fish prey exclusively. Fish and invertebrates were recorded in one perch stomach, zooplankton was recorded in two (7%). Unidentified digested material was recorded in 13 (46%) stomachs (Figure 3.6).

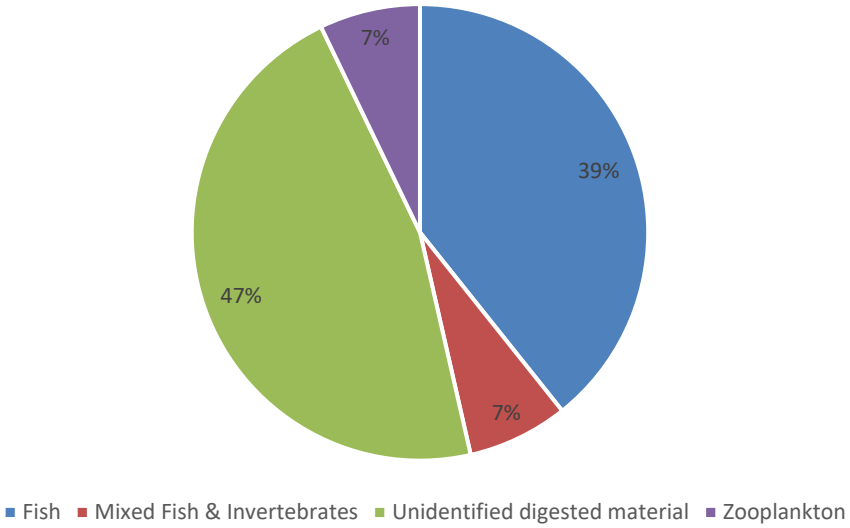

Figure 3.6. Diet of perch (n = 30) captured on Templehouse Lake, August 2021.

Pike

Three pike stomachs were available for analysis. One stomach (fish length = 19.0cm) was empty. Both remaining pike (L = 17.7cm and 68.4cm) contained fish. Prey items included perch and unidentified cyprinid remains.

4. Summary and ecological status

Roach and perch were the dominant fish species in terms of both abundance (CPUE) and biomass (BPUE). Both species have been recruiting regularly in the lake with all recent year groups represented in populations of both species. While perch were dominated by younger individuals, there is evidence of the persistence of longer-lived individuals within the population. Eels, which were captured in fyke nets only, also had a relatively high biomass.

While no one year class dominated the roach population and recruitment continues on a regular basis, there is some evidence to suggest that stocks have declined in recent years, with reduction in the numbers and biomass captured since 2011.

Roach x bream hybrids were also recorded in relatively small numbers when compared to earlier surveys. While some large individual fish were captured, roach x bream hybrids which require both parent species to spawn (Hayden *et al.*, 2010) appear to be recruiting infrequently in the lake.

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, Templehouse Lake has been assigned an ecological status of Good in 2021 based on the fish populations present (Figure 4.1).

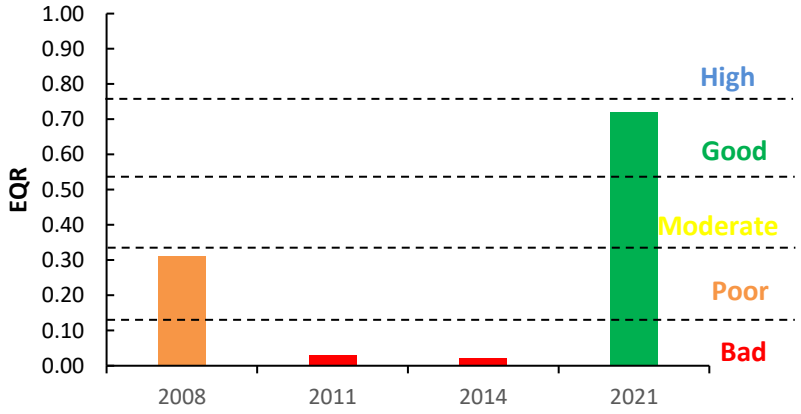

Figure 4.1. Fish ecological status, Templehouse Lake, 2008 to 2021.

In the 2013 to 2018 surveillance monitoring reporting period, the EPA assigned Templehouse Lake an overall draft ecological status of Bad, based on all monitored physico-chemical and biological elements, including fish.

5. References

Amundsen, P.A., Gabler H.M., Staldvik F.J. (1996) A new approach to graphical analysis of feeding strategy from stomach contents data—modification of the Costello (1990) method. *Journal of Fish Biology,* **48,** 607–614.

Caffrey, J. (2010) *IFI Biosecurity Protocol for Field Survey Work*. Inland Fisheries Ireland.

Connor, L., Matson, R. and Kelly, F.L. (2017) Length-weight relationships for common freshwater fish species in Irish lakes and rivers. *Biology and Environment: Proceedings of the Royal Irish Academy*, **117 (2)**, 65-75.

Hayden, B., Pulcini, D., Kelly-Quinn, M., O'Grady, M., Caffrey, J., McGrath, A., & Mariani, S. (2010). Hybridisation between two cyprinid fishes in a novel habitat: genetics, morphology and life-history traits. *BMC Evolutionary Biology*, **10(1)**, 1-11.

Kelly, F.L., Harrison, A., Connor, L., Allen, M., Rosell, R. and Champ, T. (2008) *FISH IN LAKES Task 6.9: Classification tool for Fish in Lakes. FINAL REPORT*. Central Fisheries Board. NS Share project report.

Kelly, F.L., Connor, L., Wightman, G., Matson, R. Morrissey, E., O'Callaghan, R., Feeney, R., Hanna, G. and Rocks, K. (2009) *Sampling fish for the Water Framework Directive – Summary report 2008*. Central and Regional Fisheries Boards. Internal report.

Kelly, F., Harrison A., Connor, L., Matson, R., Morrissey, E., Wogerbauer, C., Feeney, R., O'Callaghan, R. and Rocks, K. (2012a) *Sampling Fish for the Water Framework Directive – Summary Report 2011*. Inland Fisheries Ireland.

Kelly, F.L., Harrison, A.J., Allen, M., Connor, L. and Rosell, R. (2012b) Development and application of an ecological classification tool for fish in lakes in Ireland. *Ecological Indicators*, **18**, 608-619.

Kelly, F.L., Connor, L., Morrissey, E., Coyne, J., Feeney, R., Matson, R. and Rocks, K. (2015y) *Water Framework Directive Fish Stock Survey of Templehouse Lake, September/October 2014*. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

NPWS (2021) Site synopsis*: Templehouse and Cloonacleigha Loughs SAC. Site code: 000636*. Site Synopsis report, National Parks and Wildlife Service. Available at https://www.npws.ie/sites/default/files/protected-sites/natura2000/NF000636.pdf

Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.
D24 CK66

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600