National Research Survey Programme

Lakes 2024

Inniscarra Reservoir

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Iascach Intíre Éireann
Inland Fisheries Ireland

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Fish Stock Survey of Inniscarra Reservoir, September 2024

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National Research Survey Programme

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1. Introduction

Inniscarra Reservoir is located 11 kilometres to the west of Cork City on the River Lee system (Figure 1.1). The reservoir was created by the Electricity Supply Board (ESB) in 1956, with the construction of two dams on the River Lee at Carrigadrohid (21m high) and Inniscarra (44m high) (Fitzpatrick and Bree, 2001). It is one of the largest waterbodies in the south-west region of Ireland, with its linear shape providing *circa* 40km of shoreline. Inniscarra Reservoir has a surface area of 488ha and a maximum depth of 34.7m. The lake is categorised as typology class 8 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), greater than 50ha and moderate alkalinity (20-100mg/l $CaCO_3$).

The reservoir is situated in a primarily agricultural area, with some industrial activity in the form of quarrying on its southern and northern shores. The reservoir supports several water-based activities including boating and sailing. A designated site for water-skiing is located at the mouth of the Dripsey Arm on the northeastern shore where the Dripsey River joins the reservoir (Figure 1.1). The reservoir is also the site of the National Rowing Centre. Swimming is also very popular on the north-western shoreline.

With its diverse fish stocks and its close proximity to Cork City, Inniscarra Reservoir is a popular coarse angling destination with both domestic and international anglers. The shoreline has been developed to enhance access for anglers at several locations. Several prestigious national and international angling competitions are held on the lake on an annual basis. The fish stocks present in the reservoir have altered significantly since it was created. The River Lee (a predominantly salmonid river) provided some of the initial stocks of brown trout, which were enhanced with fingerling stocking by the Inland Fisheries Trust (IFT) in the 1960s. A pike control program which was operated by the Inland Fisheries Trust during the 1960's, ceased in the 1970's when the reservoir was designated as a mixed coarse fishery. A population of adult bream was introduced into Carrigadrohid Reservoir in 1974. In the 1980's this stock of bream had spread downstream and was discovered at Inniscarra Reservoir by the angling community.

The reservoir has been surveyed on three occasions since 2005 (i.e. 2005, 2008 and 2015) by Inland Fisheries Ireland using a variety of survey netting techniques. In 2005 a survey using eight-panel benthic braided survey gill nets (8-PBB), supplemented with a number of 60m monofilament survey gill nets found that stocks were dominated by a large population of small to medium sized bream, with healthy stocks of perch, rudd and pike also present. Roach x bream hybrids were also captured, despite no roach being recorded (CFB, 2005). In 2008, the reservoir was surveyed using the netting

protocol developed for IFIs Water Framework Directive (WFD) fish surveillance monitoring programme in lakes. While perch was the most abundant fish species, more bream were captured than both roach x bream hybrids and roach. The latter species was recorded for the first time during that survey (CFB, 2008). In 2015, Inniscarra Reservoir was surveyed as part of IFI's national coarse fish and pike research programme and as part of a method intercalibration exercise using both the WFD and the 8-PBB methods (Kelly *et al.,* 2016).

The lake was also surveyed in 2019 using IFI's fish in lakes monitoring protocol (Corcoran *et al.,* 2020). During the 2019 survey, perch were found to be the most abundant species present in the lake. Roach, roach x bream hybrids, bream, gudgeon, brown trout, pike, rudd and carp were also captured during the survey.

This report summarises the results of the 2024 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.

Plate 1.1. Setting a fyke net on Inniscarra Reservoir (Dripsey Arm), September 2024.

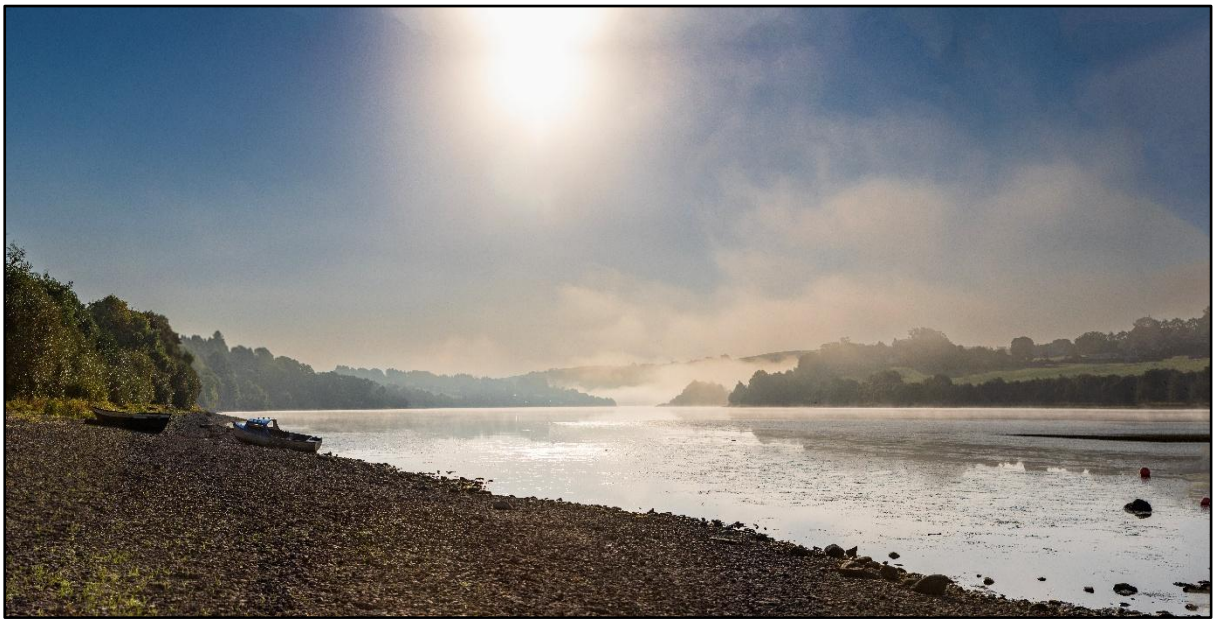

Plate 1.2. Early morning on Inniscarra Reservoir at Inishleena, September 2024.

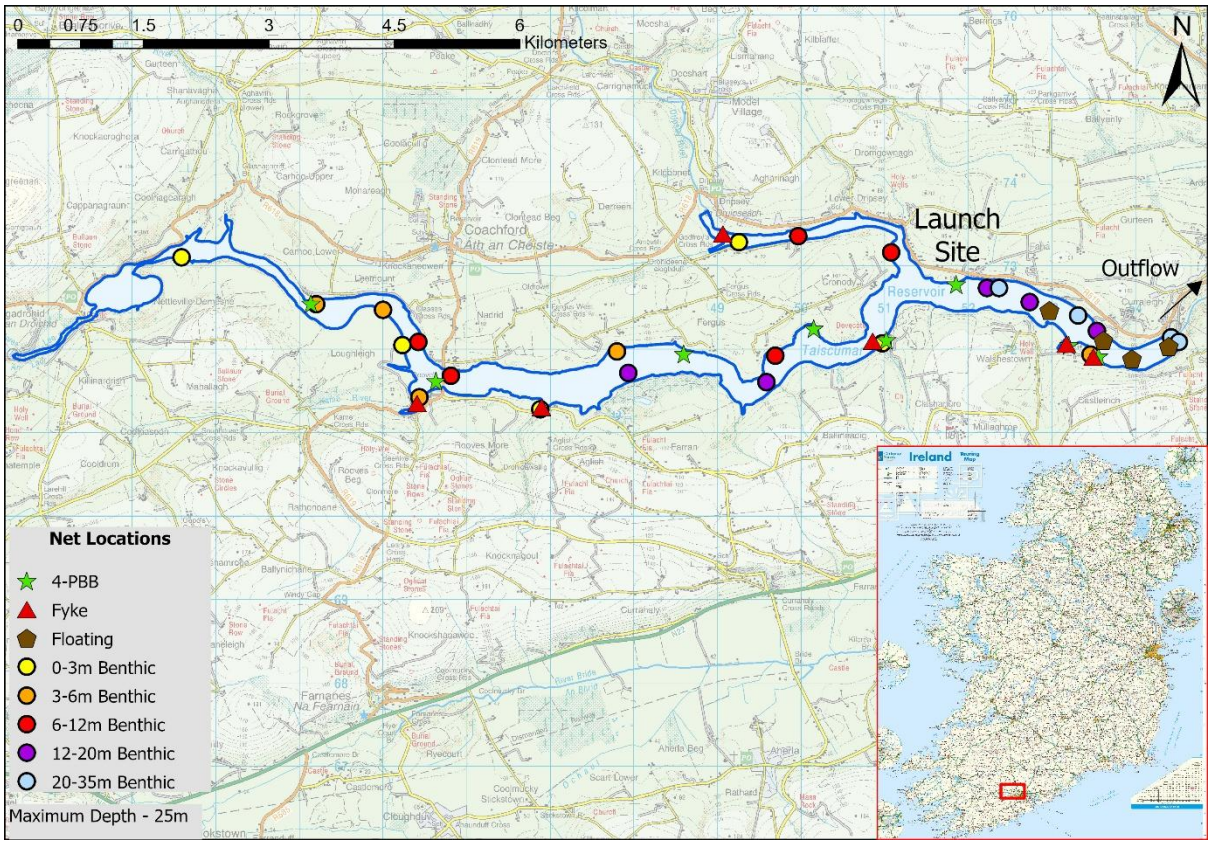

Figure 1.1. Location map of Inniscarra Reservoir showing net locations and depths of each net, September 2024.

2. Methods

2.1. Netting methods

Inniscarra Reservoir was surveyed over four nights from the 16th to the 20th of September 2024. A total of six sets of Dutch fyke nets, 24 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 4 @ 20-34.9m) and four floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed in the lake (34 sites). The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at eight 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). Nets were deployed in the same locations as were randomly selected in the previous surveys. 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 sub-sample of other species. 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 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).

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

Where:
$\mathbf{FO}_i$ 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.

Plate 2.1. Processing fish on Inniscarra reservoir, September 2024.

3. Results

3.1. Species Richness

Nine fish species and one type of cyprinid hybrid were recorded in Inniscarra Reservoir in September 2024. A total of 1458 fish were captured. The number of each species captured by each gear type during the survey is shown in Table 3.1. Perch and roach were the most numerous fish species recorded. Together they represented *c*. 80% of all fish captured in the survey. Roach x bream hybrids, bream, gudgeon, brown trout, pike, minnow and European eels were also captured. A similar species mix was recorded on all previous sampling occasions. Minnow were recorded for the first time in 2024.

Table 3.1. Number of each fish species captured by each gear type during the survey on Inniscarra Reservoir, August 2024.

Scientific name	Common name	Number of fish captured				
		BM CEN	FMCEN	4-PBB	Fyke	Total
Rutilus rutilus	Roach	462	124	0	1	587
Perca fluviatilis	Perch	556	2	0	22	580
Rutilus rutilus x Abramis brama	Roach x bream	161	5	3	13	182
Abramis brama	Bream	30	2	15	0	47
Gobio gobio	Gudgeon	41	0	0	0	41
Salmo trutta	Brown trout	7	0	1	0	8
Esox lucius	Pike	2	0	1	1	4
Tinca tinca	Tench	2	0	1	1	4
Phoxinus phoxinus	Minnow	1	0	0	0	1
Anguilla anguilla	European eel	0	0	0	4	4

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. Roach and perch were the dominant species with respect to abundance (CPUE). Roach x bream hybrids were the dominant fish in terms of biomass (BPUE) (Table 3.2)

Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Inniscarra Reservoir, August 2024.

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Rutilus rutilus	Roach	0.465 (0.106)	14.647 (3.106)
Perca fluviatilis	Perch	0.452 (0.123)	7.889 (1.897)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.138 (0.024)	25.107 (5.056)
Abramis brama	Bream	0.029 (0.006)	8.536 (1.849)
Gobio gobio	Gudgeon	0.033 (0.011)	0.318 (0.108)i
Salmo trutta	Brown trout	0.006 (0.004)	1.481 (0.756)
Esox lucius	Pike	0.002 (0.001)	1.772 (0.876)
Tinca tinca	Tench	0.002 (0.001)	2.894 (1.668)
Phoxinus phoxinus	Minnow	0.001 (0.001)	0.003 (0.003)
*Anguilla anguilla**	European eel	0.011 (0.008)	3.272 (2.651)

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.

3.3. Species Profiles

Roach

Roach captured during the 2024 survey ranged in length from 4.5cm to 23.9cm (mean =10.7cm) (Figure 3.1). The overall length range has remained relatively stable across recent surveys and larger fish (i.e. >20cm) were generally recorded in small numbers. Roach were aged from 2+ to 9+. All intervening age groups, except 6+ roach were present in the sample aged (Table 3.3). Roach aged 3+ and 4+ (8cm - 18cm) were the most abundant cohorts (Table 3.3 and Figure 3.1). Larger and older cohorts (i.e. >7+ and c. 20cm) were largely absent from the population.

There was an increasing trend in both abundance (CPUE) and biomass (BPUE) of roach since 2008 in both benthic and floating survey gill nets (Figure 3.2).

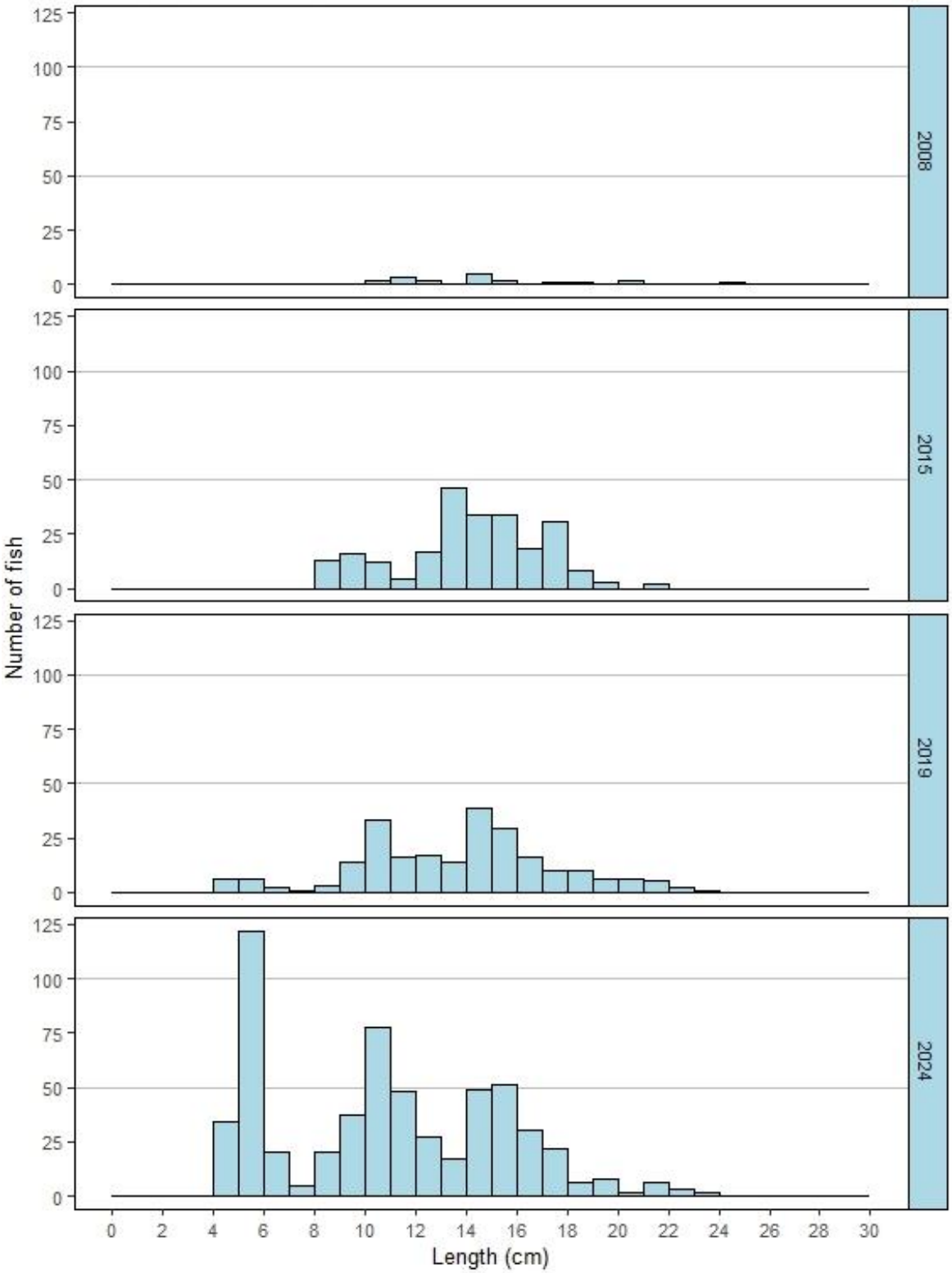

Figure 3.1. Length frequency of roach captured on Inniscarra Reservoir between 2008 and 2024.

Table 3.3. Summary age data from roach captured Inniscarra Reservoir, August 2024. Number of fish and length ranges of all fish aged in the sample is presented.

Length (cm)	Age class									
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+
N	-	-	7	18	20	15	-	7	3	1
Mean	-	-	7.9	10.7	14.3	17.5	-	21.8	21.9	23.9
Min	-	-	5.7	8.9	10.7	15.0	-	20.9	20.0	23.9
Max	-	-	11.4	13.4	18.5	19.6	-	23.3	22.9	23.9

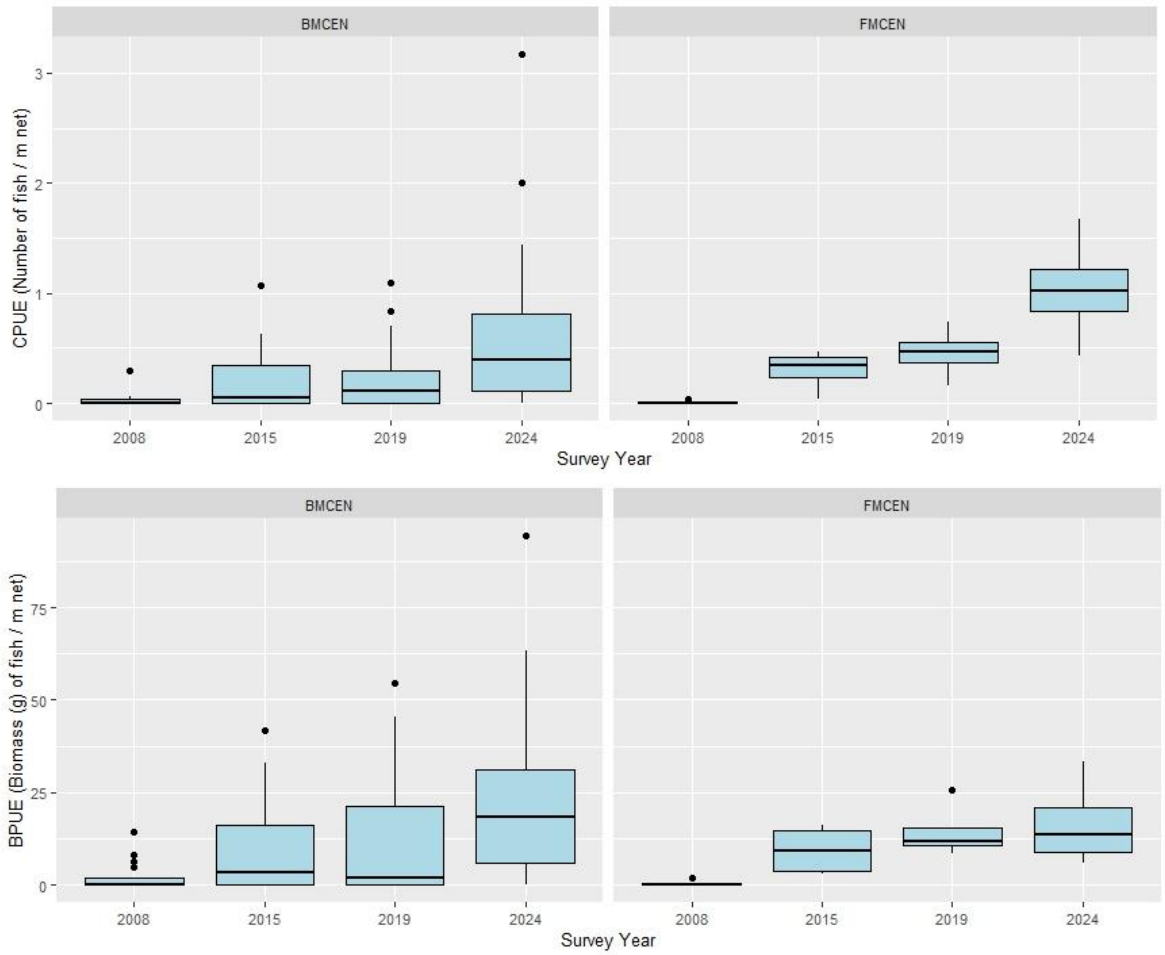

Figure 3.2. CPUE and BPUE of roach captured during surveys of Inniscarra Reservoir between 2008 and 2024. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

Perch

Perch captured during the 2024 survey ranged in length from 4.9cm to 26.8cm (mean = 8.9cm) (Fig.3.3). In previous surveys of the reservoir, larger perch (i.e. > 30cm) were regularly captured. No fish of this size were recorded in 2024 and few perch >14cm in length were captured. In 2024 perch were aged from 0+ to 6+ and all intervening age classes were present. 1+ perch (6cm - 15cm) was the most abundant age class and the population was dominated by 0+ and 1+ perch (5cm-15cm) (Figure 3.3). Mean L1 (i.e. length at the end of the first year) was 6.0cm (Table 3.4).

Perch abundance (CPUE) and biomass (BPUE) has fluctuated across all surveys of the lake, and no clear population trends were apparent.

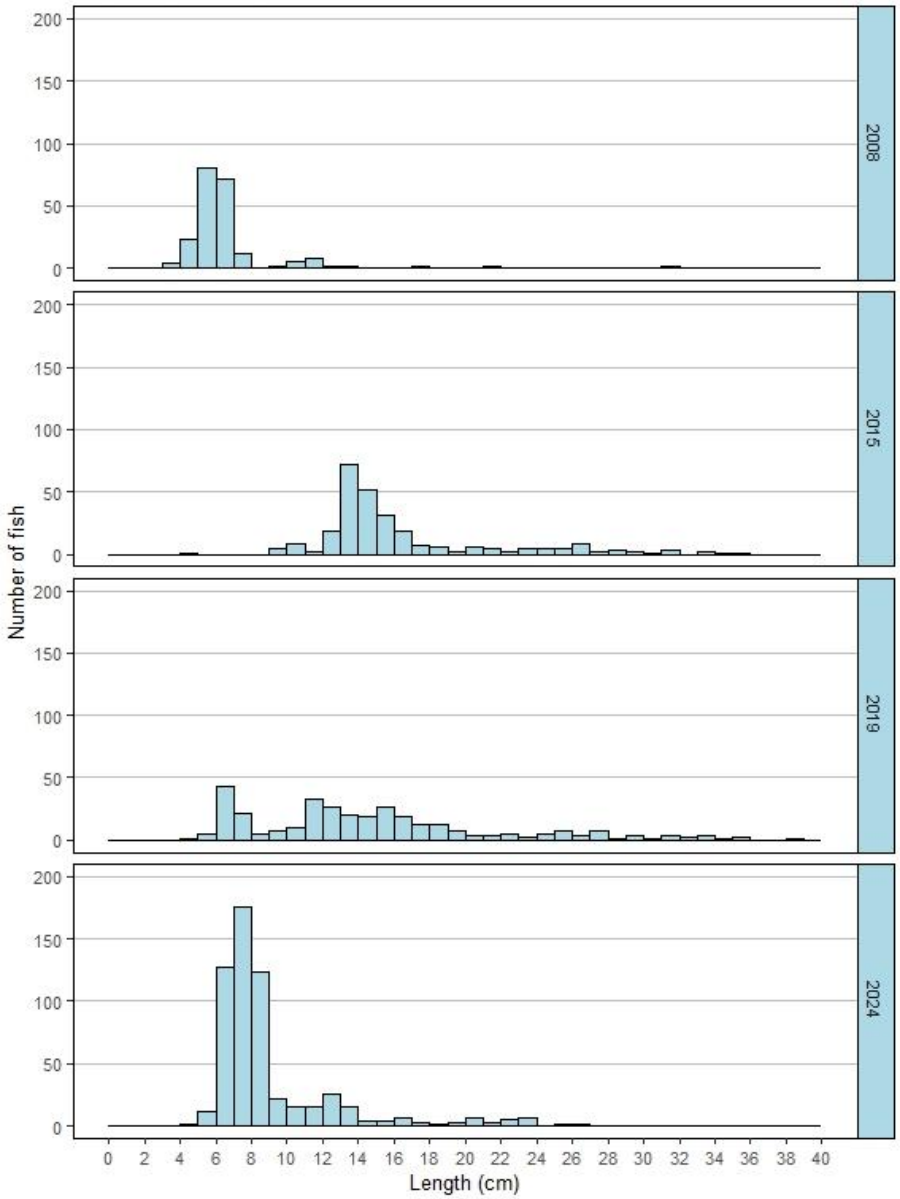

Figure 3.3. Length frequency of perch captured on Inniscarra Reservoir between 2015 and 2024.

Table 3.4. Mean (±S.E.) perch length (cm) at age for Inniscarra Reservoir, August 2024.

	L_1	L_2	L_3	L_4	L_5	L_6
Mean (±S.E.)	6.0 (±0.13)	10.8 (±0.24)	14.2 (±0.32)	17.6 (±0.51)	19.5 (±0.47)	20.7
N	65	41	34	20	9	1
Range	3.8–7.9	6.9–14.5	10.9–19.1	14.4–22.3	16.8–21.5	20.7–20.7

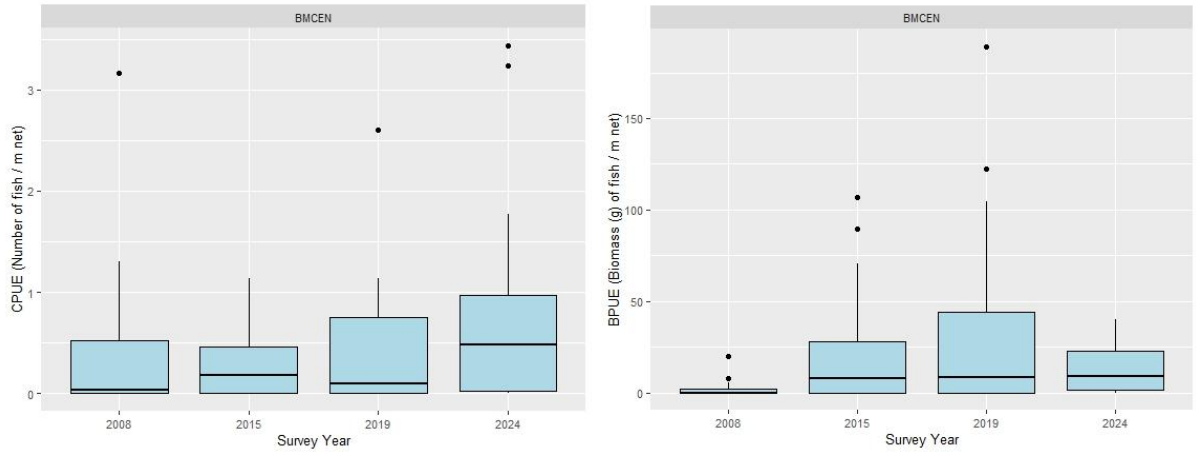

Figure 3.4. CPUE and BPUE of perch captured during surveys of Inniscarra Reservoir between 2015 and 2024. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

Roach x bream hybrids

Roach x bream hybrids captured during the 2024 survey ranged in length from 4.0cm to 38.1cm (mean = 20.4cm) (Figure 3.5). A relatively narrow length range of roach x bream hybrids have been captured in most surveys of the reservoir. Fish less than 20cm in length were generally prominent in the roach x bream hybrid population. Roach x bream hybrids were aged between 1+ and 12+ (Table 3.5). All intervening age classes, except 11+ were represented in the sample aged. Fish aged 4+ to 6+ (17cm – 26cm) dominated the population (Figure 3.5 and Table 3.4). Together these cohorts accounted for *c.* 63% of all fish aged.

There was an increasing trend in both abundance and biomass (BPUE) of roach x bream hybrids since the reservoir was first surveyed in 2005. This was particularly pronounced in the benthic (BM CEN) and floating (FM CEN) survey gill nets which target fish of all size classes (Figure 3.6)

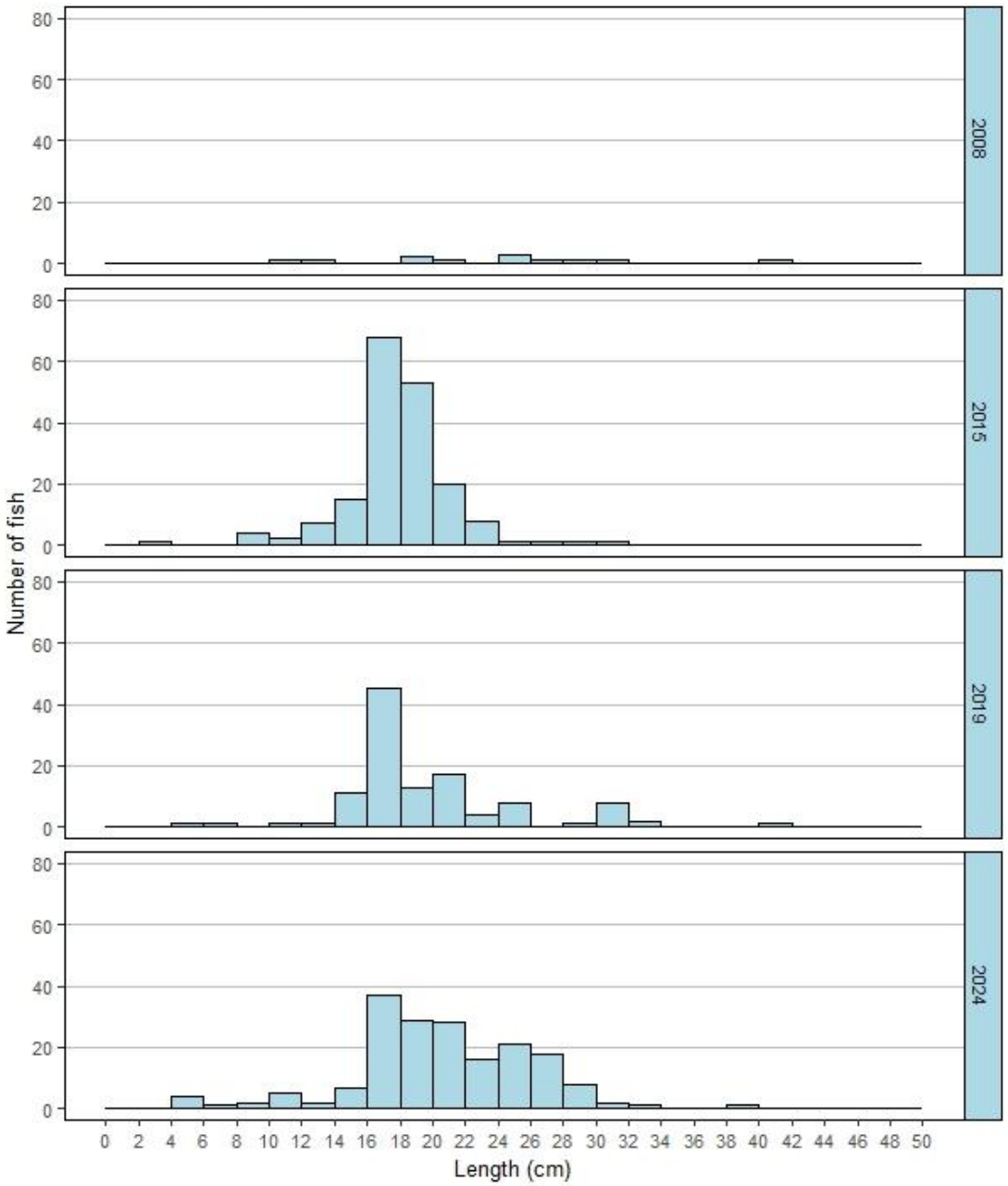

Figure 3.5. Length frequency of roach x bream hybrids captured on Inniscarra Reservoir between 2015 and 2024.

Table 3.5. Summary age data from roach x bream hybrids captured Inniscarra Reservoir, August 2024. Number of fish and length ranges of all fish aged in the sample is presented.

Length (cm)	Age class												
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+
N	-	2	4	6	15	22	22	8	9	2	2		1
Mean	-	8.3	11.4	15.4	17.5	20.7	24.1	26.8	27.9	30.9	30.7		38.1
Min	-	6.1	10.0	14.6	15.9	15.9	21.8	26.2	26	29.0	30		38.1
Max	-	10.6	13.0	16.3	18.8	24.3	26	28.3	29.1	32.8	31.5		38.1

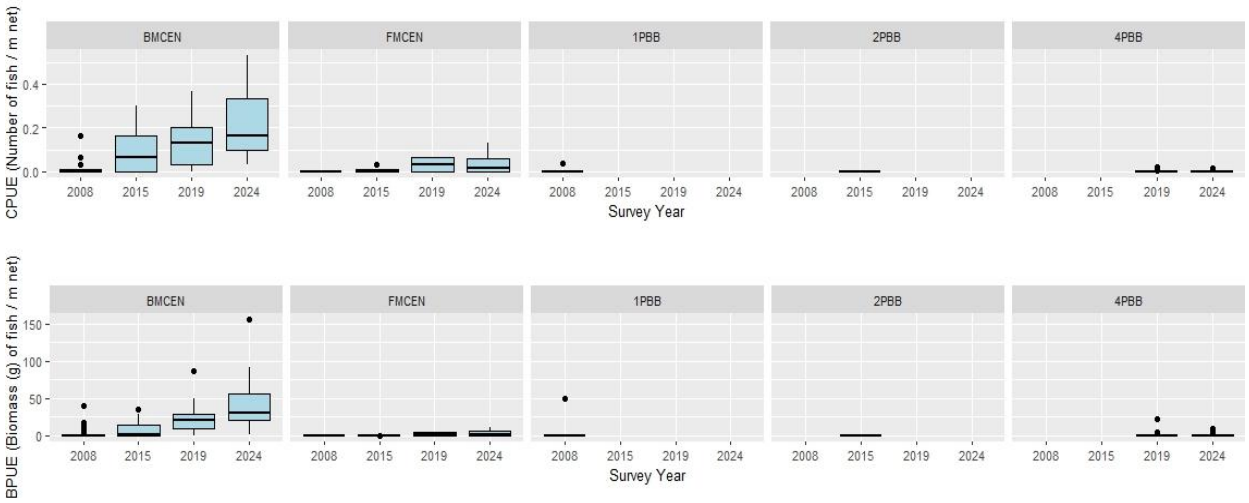

Figure 3.6. CPUE and BPUE of roach x bream hybrids captured during surveys of Inniscarra Reservoir between 2015 and 2024. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

Bream

Bream ranged in length from 4.0cm to 42.0cm (mean = 25.2cm) in 2024 (Figure 3.7). Bream were aged between 1+ and 10+. All intervening age classes, except 3+ bream were present in the sample aged (Table 3.6). 5+ to 7+fish (14cm - 22cm) were the most abundant year classes and together represent *c*. 67% of all the fish in the sample aged (Figure3.7 and Table 3.6). Fish younger than these cohorts were relatively poorly represented (Figure 3.7 and Table 3.6).

An apparent decreasing trend in both abundance (CPUE) and biomass (BPUE) was evident across all surveys of the lake, in both BM CEN survey nets and the various braided gill nets deployed (Figure 3.8).

Table 3.6. Summary age data from bream captured Inniscarra Reservoir, August 2024. Number of fish and length ranges of all fish aged in the sample is presented.

Length (cm)	Age class										
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+
N	-	2	1	-	3	10	9	10	4	3	1
Mean	-	5.2	11.3	-	20.7	22.0	24.4	30.8	35.1	39.4	42.0
Min	-	4.6	11.3	-	17.1	18.6	23.0	24.6	32.7	38.9	42.0
Max	-	5.8	11.3	-	25.1	26.7	26.1	37.1	38.7	39.8	42.0

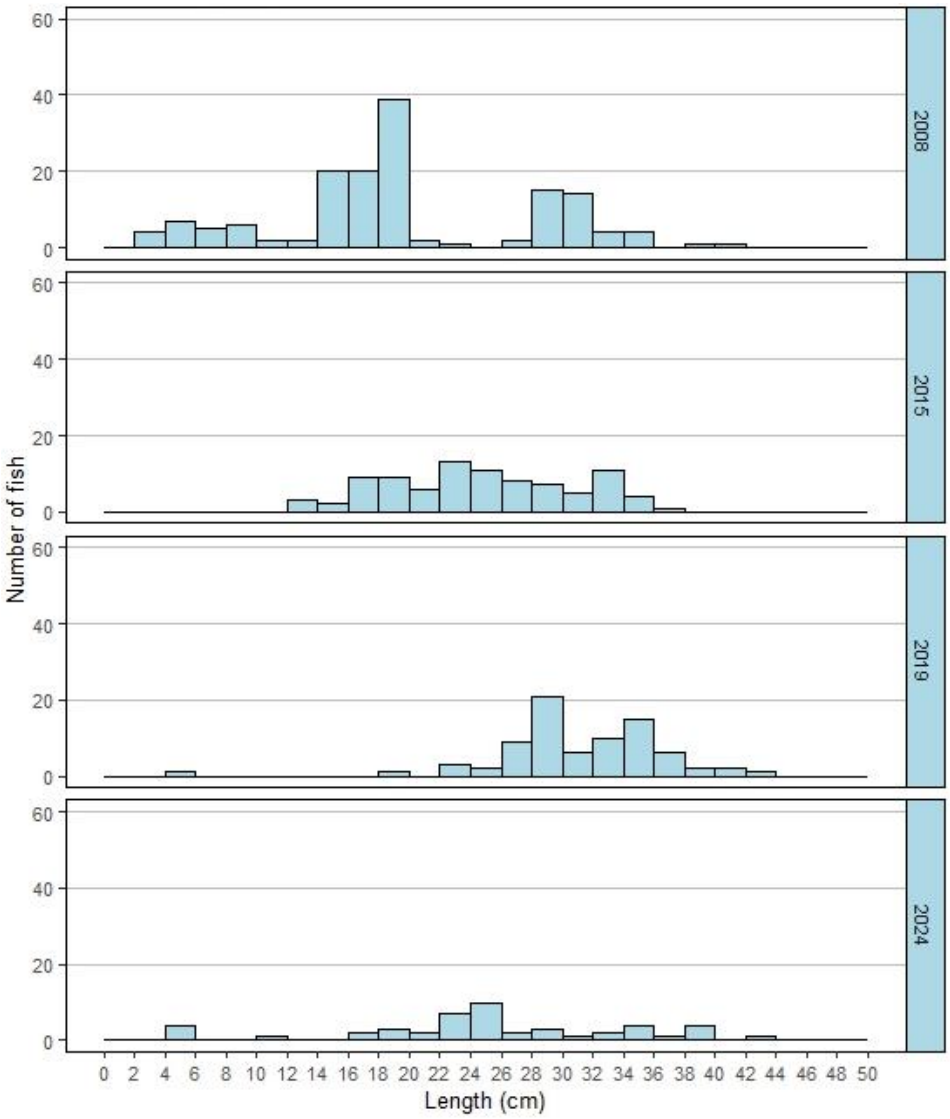

Figure 3.7. Length frequency of bream captured on Inniscarra Reservoir between 2015 and 2024.

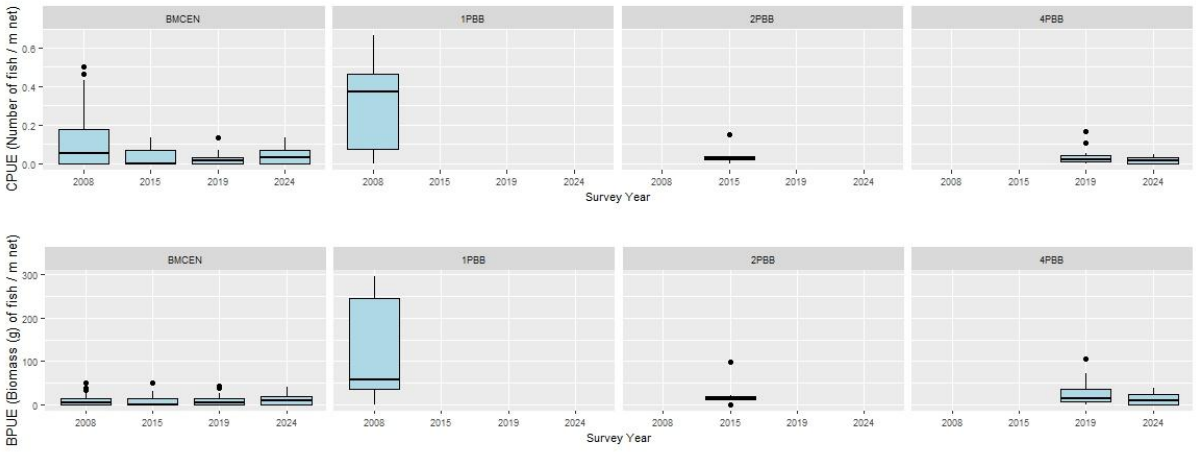

Figure 3.8. CPUE and BPUE of bream captured during surveys of Inniscarra Reservoir between 2015 and 2024. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

Other fish species

Eight brown trout captured in 2024 ranged in length from 21.1cm to 50.6cm (mean = 27.4cm). Brown trout were aged from 2+ to 7+. The dominant age class was 3+ (62% of all brown trout captured). No 5+ or 6+ fish were recorded. Mean L1 (i.e. length at the end of the first year) was 6.7cm (Table 3.7).

Table 3.7. Mean (±S.E.) brown trout length (cm) at age for Inniscarra Reservoir, August 2024.

Length (cm)	L_1	L_2	L_3	L_4	L_5	L_6	L_7
Mean (±S.E.)	6.7 (0.14)	13.1 (0.44)	18.9 (0.69)	25.3 (0.94)	31.5	39.8	45.7
N	8	8	7	2	1	1	1
Range	6.2-7.3	11.5-15.1	17.1-21.8	24.4-26.3	31.5	39.8	45.7

Four pike captured ranged in length from 40.4cm to 68.5cm (mean = 50.6cm). Pike were aged between 3+ and 6+.

Four tench captured ranged in length from 30.3cm to 44.5cm (mean = 50.6cm). It was possible to determine age for one tench (44.0cm). This fish was aged 6+.

One minnow was captured. It measured 5.5cm.

Four European eel captured in 2024 ranged in length from 49.0cm to 66.2cm (mean = 56cm). The highest abundance (CPUE) and biomass (BPUE) of eel was recorded in 2008 (Figure 3.9).

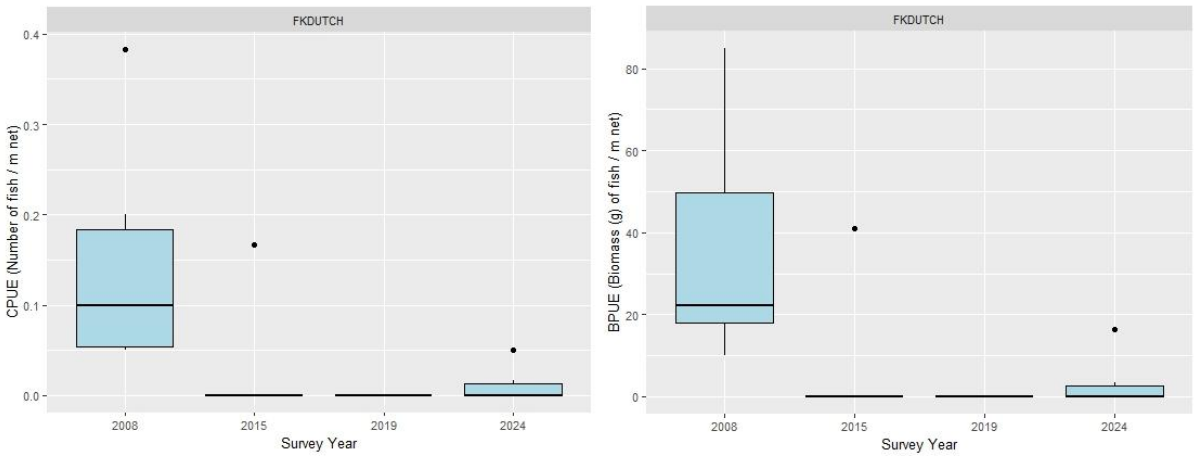

Figure 3.9. CPUE and BPUE of European eel captured during surveys of Inniscarra Reservoir between 2015 and 2024. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

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, brown trout and pike captured during the survey were examined and are presented below.

Perch

A total of 72 perch stomachs were examined. Thirty-nine stomachs contained food (54%). Zooplankton was the sole prey type recorded in 16 (41%) perch stomachs and was found together with invertebrates in one (3%) stomach. Fish was the sole prey type recorded in nine (23%) perch stomachs. Invertebrates were the sole prey type recorded in seven (18%) perch stomachs, while fish and invertebrates were recorded together in the stomachs of six perch (Figure 3.10).

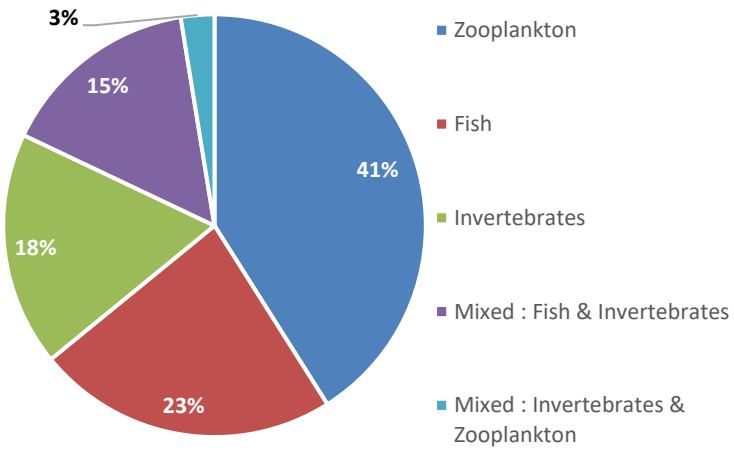

Figure 3.10. Diet of perch (N =39) captured on Inniscarra Reservoir, 2024 (% FO).

Brown trout

A total of five brown trout stomachs were examined. One stomach was empty. In the four stomachs which contained food, fish were the sole prey type recorded in three stomachs. Fish was found together with invertebrates in the remaining trout stomach.

Pike

One pike stomach was available for analysis. This fish, which measured 40.4cm had eaten roach.

4. Summary and fish ecological status

Nine fish species and one type of cyprinid hybrid were recorded in Inniscarra Reservoir in September 2024.

In 2024, roach and perch were the dominant species with respect to abundance (CPUE) while roach x bream hybrids had the highest relative biomass (BPUE).

The two most abundant species (i.e. perch and roach) are both recruiting regularly in the lake. Both populations were dominated by smaller and younger individuals. While no discernible trends in population abundance (CPUE) or biomass (BPUE) were apparent in perch this is not the case for roach. This species was first recorded in the 2008 survey, and both CPUE and BPUE have consistently increased since that time in both benthic and floating CEN nets.

The abundance and biomass of roach x bream hybrids also increased between 2008 and in 2024 this hybrid variety recorded the highest biomass of all fish captured in 2024. This was particularly evident in the benthic and floating CEN survey gill nets but was less apparent in the benthic braided survey gill nets, which target larger bodied fish. This hybrid variety (which requires spawning populations of both parent species (Hayden *et al*., 2010) was characterised by a relatively large proportion of 4+ to 6+ fish. While younger and smaller fish were not captured, fish of that size are not routinely captured in surveys of the lake.

In contrast with roach and roach x bream hybrids, the bream population has declined since 2008. There is some evidence that this decline may have stabilised between 2019 and 2024 (as indicated by the BM CEN survey nets). The capture of 1+ fish is evidence that this important angling species is continuing to recruit to the lake fishery.

One single Asian clam (*Corbicula fluminea*) was recorded in a fyke net during the survey. This is the first record of this species from the reservoir.

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) to make it fully WFD compliant, including producing EQR values for each lake and associated confidence in classification (Kelly *et al*., 2012).

Plate 4.1 Asian clam (*Corbicula fluminea*) recorded in a fyke net during a survey of Inniscarra Reservoir in 2024.

Using the FIL2 classification tool, Inniscarra Reservoir has been assigned an ecological status of Good for 2024 based on the fish populations present. The ecological status of Inniscarra Reservoir has improved since the first WFD compliant fish stock survey on the lake was carried out in 2008 (Figure 4.1).

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Inniscarra Reservoir an overall ecological status of Good, based on all monitored physio-chemical and biological elements, including fish (EPA, 2021).

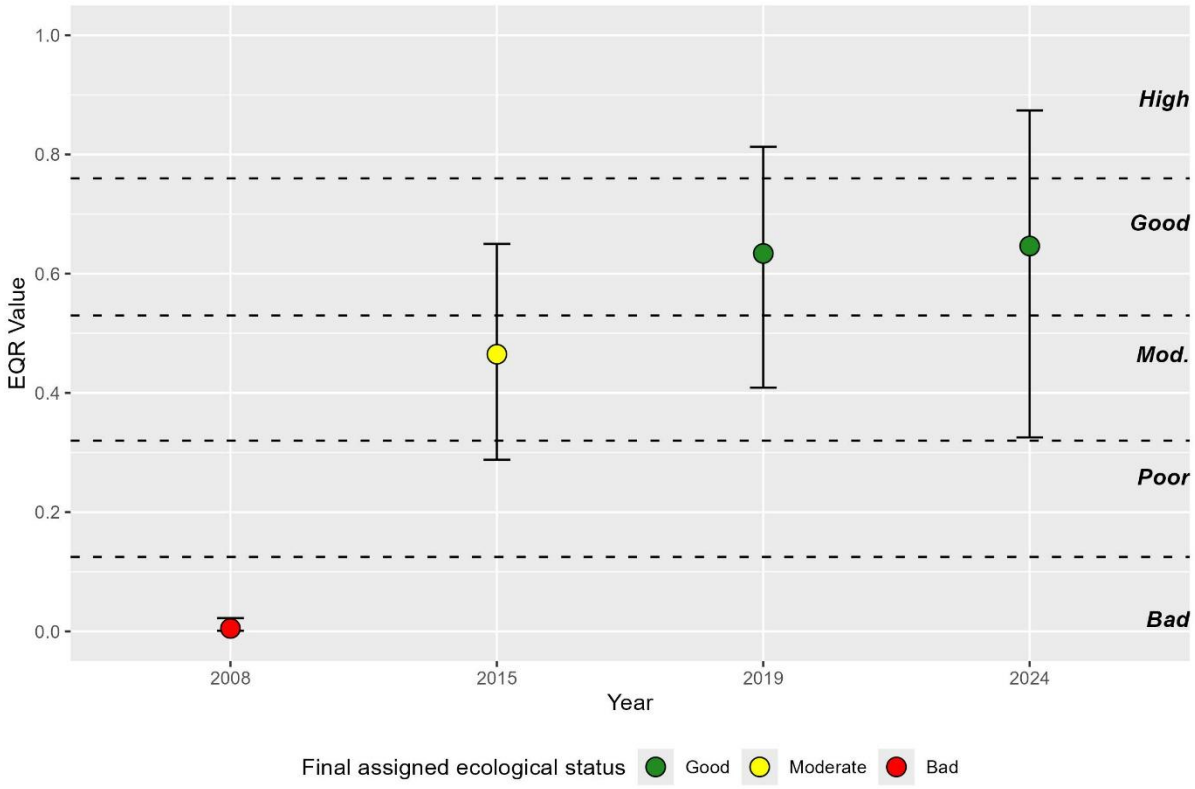

Figure 4.1. Fish ecological status Inniscarra Reservoir, between 2008 and 2024 (dashed line indicates EQR status boundaries).

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