National Research Survey Programme

Lakes 2021

Lough Corrib

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Iascach Intíre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Lough Corrib,
June/July 2021

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ACKNOWLEDGEMENTS

1. Introduction

Lough Corrib the second largest lake in Ireland (after Lough Neagh), is situated in Co. Galway in the River Corrib catchment (Plates 1.1 and 1.2). The lake stretches from outside Galway city to within three kilometres of Maam Cross, a distance of over 50 kilometres (Figures 1.1 and 1.2). The main rivers draining into Lough Corrib include the Black, Clare, Dooghta, Cregg, Owenriff rivers and the Cong canal which joins Lough Corrib to Lough Mask. The lake can be divided into two parts; Lower Lough Corrib - a relatively shallow basin underlain by carboniferous limestone in the south (Figure 1.1), and Upper Lough Corrib - a larger, deeper basin underlain by more acidic granite, schists, shales and sandstones to the north (Figure 1.2) (NPWS, 2020). The lake has a surface area of 16,562Ha (5,042ha Lower Lough and 11,520ha Upper Lough), and has a maximum depth of 42m. The lower 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 (>100mg/l $CaCO_3$) and the upper lake fits into typology class 12, i.e. deep (mean depth >4m), greater than 50ha and high alkalinity (>100mg/l $CaCO_3$). The lake supports 14 protected habitats and six species, including salmon that are listed on Annex I and Annex II respectively of the EU Habitats Directive (NPWS, 2020). The lake is also recognised as a 'wetland of international importance' under the terms of the Ramsar Convention (Ramsar, 1971) to which Ireland is a signatory.

Lough Corrib is regarded as one of the best game fisheries in the world. The brown trout fishery which is of considerable economic and cultural importance is internationally renowned. The lake supports populations of brown trout, salmon, perch, roach, bream, roach x bream hybrids, tench, eels, 3-spined stickleback and pike.

Lough Corrib contains a number of aquatic invasive species. Roach, a non-native invasive fish species, was first identified in Lower Lough Corrib in the early 1980s and subsequently spread throughout the lake. High numbers of roach were observed in routine netting operations on the lake from the late 1980s until 1992 when a decline in the stock was observed (O' Grady, 1996).

The highly invasive plant species *Lagarosiphon major* (also known as "Curly Waterweed") was first identified in the lake in 2005. This rapidly colonizing plant has already excluded native plant species from bays in which it has become established and is subject to ongoing management. The zebra mussel (*Dreissena polymorpha*), was first recorded in Lough Corrib during 2007 and it is thought they were introduced to the lake in 2000/2001.

The lake was previously surveyed to assess its fish stocks by Inland Fisheries Ireland (formerly the Central Fisheries Board and the Western Regional Fisheries Board) in 1986 and 1996 (O'Grady, 1986;

O'Grady et al., 1996). The lake has been surveyed on four occasions since 2007 (Kelly *et al*., 2009, 2012a and 2015, Connor *et al*., 2018). During the most recent survey of the lake conducted in 2018, perch and roach x bream hybrids were the dominant species recorded with respect to numbers and biomass respectively. Brown trout, salmon, pike, three-spined stickleback, stone loach and eels were also captured during that survey.

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.
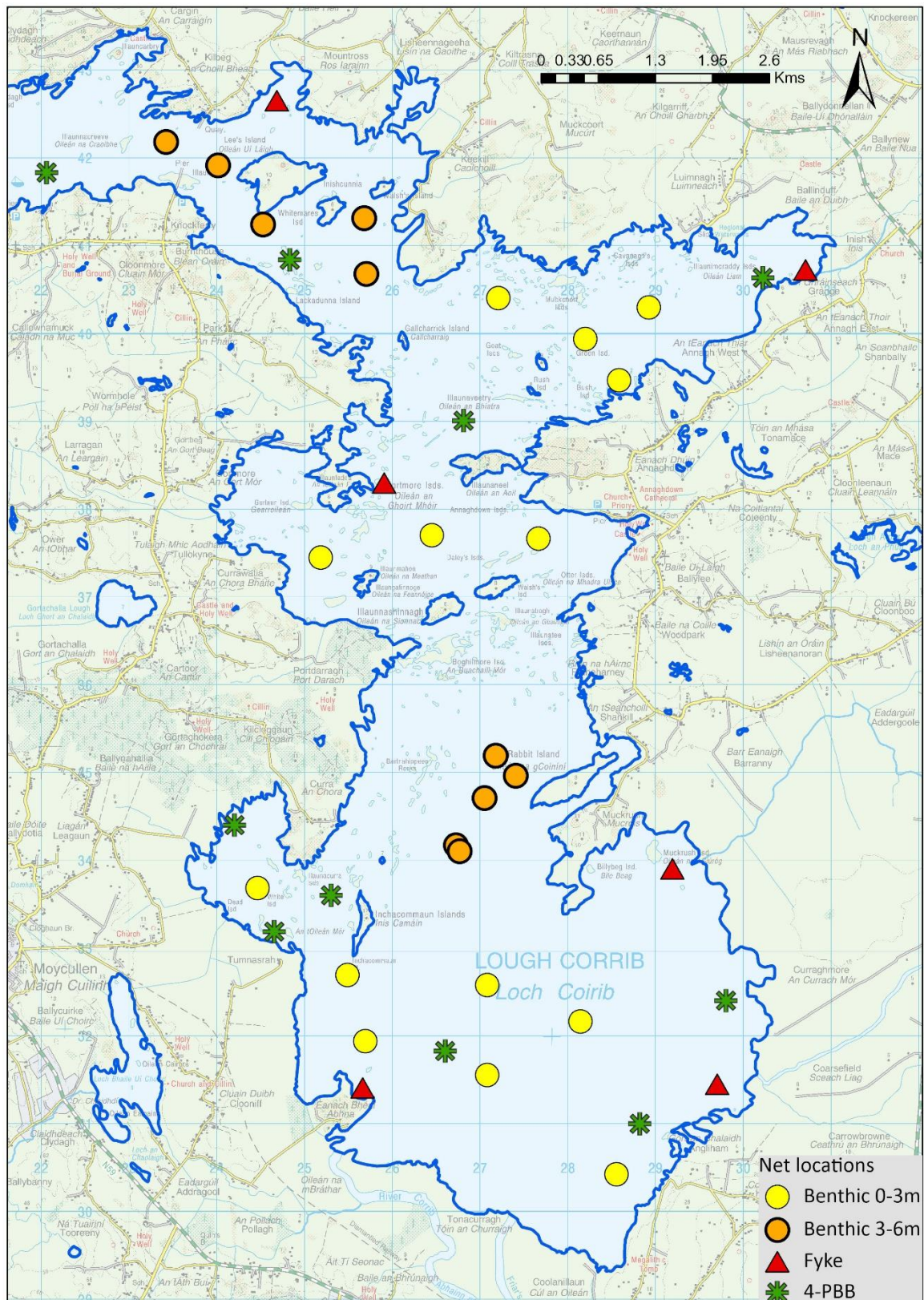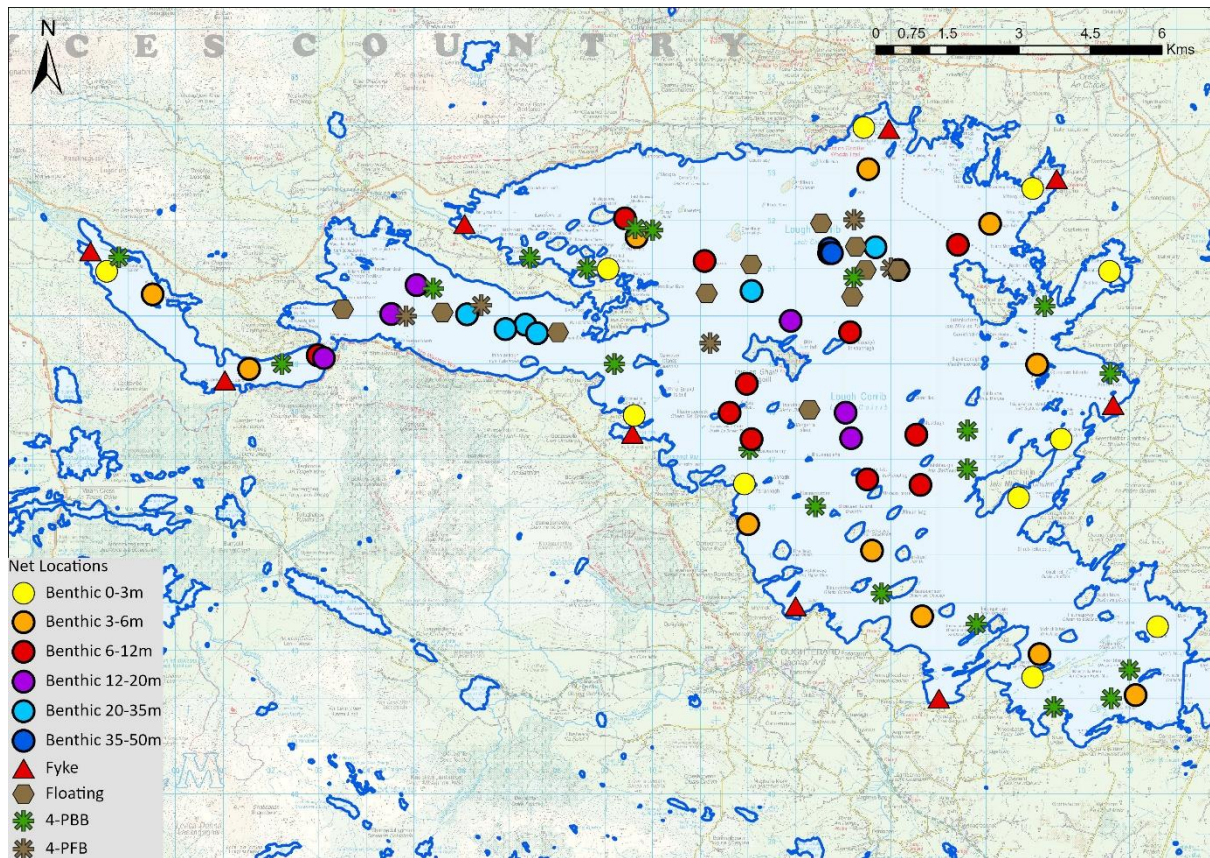

Plate 1.1. Upper Lough Corrib, Derrymoyle, June 2021

Figure 1.1. Location map of Lower Lough Corrib showing locations and depths of each net.

Figure 1.2. Location map of Upper Lough Corrib showing locations and depths of each net.

2.   Methods

2.1.   Netting methods

Lower Lough Corrib was surveyed over three nights between the 14th and the 18th of June 2021. A total of six sets of Dutch fyke nets (Fyke) and 24 benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets (14 @ 0-2.9m and 10 @ 3-5.9m) were deployed in the lake (30 sites). The netting effort was supplemented using 12 four-panel benthic braided survey gill nets (4-PBB) at 12 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).

Upper Lough Corrib was surveyed over six nights between the 21st June and the 1st of July 2021. A total of nine sets of Dutch fyke nets (Fyke), 49 benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets (11 @ 0-2.9m, 11 @ 3-5.9m, 11 @ 6-11.9m, 6 @ 12-19.9m, 7 @ 20-34.9m and 3 @ 35-49.9m) and 11 floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (69 sites). The netting effort was supplemented using four-panel benthic (4-PBB) and four-panel floating braided survey (4-PFB) gill nets at 25 additional sites.

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).

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

Where:

FO_i is the percentage frequency of prey item i,

N_i is the number of fish with prey i in their stomach,

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 . Lough Corrib, at Derrymoyle near Oughterard.

3. Results

3.1. Species Richness

<u>Lower Lough Corrib</u>

Nine fish species and one type of hybrid were recorded on Lower Lough Corrib in June 2021. A total of 373 fish were captured. The number of each species captured by each gear type is shown in Table 3.1. Roach and perch were the two most abundant fish species captured. Brown trout, roach x bream hybrids, pike, rudd, tench, three-spined stickleback, salmon and eels were also recorded (Table 3.1).

Table 3.1. Number of each fish species captured by each gear type during the survey on Lower Lough Corrib, June 2021 (Note: 4PBB netting effort in 2021 is different than previous surveys).

Scientific name	Common name	Number of fish captured			
		BM CEN	4-PBB	Fyke	Total
Rutilus rutilus	Roach	171	0	1	172
Perca fluviatilis	Perch	135	0	3	138
Salmo trutta	Brown trout	11	4	0	15
Rutilus rutilus x Abramis brama	Roach x bream hybrid	1	12	0	13
Esox lucius	Pike	7	1	0	8
Scardinius erythrophthalmus	Rudd	5	0	0	5
Tinca tinca	Tench	0	5	0	5
Gasterosteus aculeatus	Three-spined stickleback	3	0	0	3
Salmo salar	Salmon	0	1	0	1
Anguilla anguilla	European eel	0	0	13	13

<u>Upper Lough Corrib</u>

In Upper Lough Corrib seven fish species and one type of hybrid were recorded in June/July 2021. A total of 691 fish were captured. The number of each species captured by each gear type is shown in Table 3.2. Perch and roach were the two most abundant species captured. Roach x bream hybrids, brown trout, bream, pike, rudd and eels were also captured.

Table 3.2. Number of each fish species captured by each gear type during the survey on Upper Lough Corrib, June/July 2021 (Note: 4PBB netting effort in 2021 is different than previous surveys).

Scientific name	Common name	Number of fish captured				
		BM CEN	4-PBB	FM CEN	Fyke	Total
Perca fluviatilis	Perch	436	1	0	17	454
Rutilus rutilus	Roach	128	0	1	6	135
Rutilus rutilus x Abramis brama	Roach x bream hybrid	9	17	0	0	26
Salmo trutta	Brown trout	12	6	1	0	19
Abramis brama	Bream	6	13	0	0	19
Esox lucius	Pike	6	0	0	0	6
Scardinius erythrophthalmus	Rudd	1	0	0	0	1
Anguilla anguilla	European eel	0	0	0	31	31

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 (Tables 3.3 and 3.4). For all fish species except eel, CPUE/BPUE is based on all nets, whereas eel CPUE/BPUE is based on fyke nets only.

For comparison purposes CPUE and BPUE for each species captured in all surveys for each net type between 2006 and 2021 are presented in Figures 3.1 to 3.5 respectively and illustrates fish community change over time.

Lower Lough Corrib

In 2021 roach followed by perch were the dominant fish species in terms of abundance and biomass on Lower Lough Corrib (Table 3.3 and Figures 3.1a and 3.1b). These fish were the most abundant species across all surveys of Lower Lough Corrib and were caught predominantly in benthic monofilament survey nets (BMCEN).

Mean CPUE and BPUE of perch fluctuated over time with no clear trend evident (Figures 3.1a and 3.1b).

Roach CPUE and BPUE was highest in the 2008 survey. There was an apparent increase in both metrics since 2011 (Figures 3.1a and 3.1b).

Table 3.3. Mean (S.E.) CPUE and BPUE for all fish species captured on Lower Lough Corrib, 2021

Scientific name	Common name	Mean CPUE (± S.E)**	Mean BPUE (± S.E)**
Rutilus rutilus	Roach	0.143 (0.029)	10.998 (2.465)
Perca fluviatilis	Perch	0.114 (0.033)	10.350 (3.306)
Salmo trutta	Brown trout	0.010 (0.004)	5.847 (2.665)
Esox lucius	Pike	0.006 (0.002)	5.823 (3.580)
Scardinius erythrophthalmus	Rudd	0.004 (0.002)	0.301 (0.169)
Tinca tinca	Tench	0.001 (0.001)	1.355 (1.355)
Gasterosteus aculeatus	Three-spined stickleback	0.003 (0.001)	0.005 (0.003)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.004 (0.002)	6.761 (3.656)
Salmo salar	Salmon	0.0002 (0.0002)	0.694 (0.694)
Anguilla anguilla	European eel	0.036 (0.030)	6.535 (5.473)

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.

Other species were caught in lesser numbers across all net types (Figures 3.2a and 3.2b). Catches of these species have fluctuated across surveys and no clear trends are apparent. Brown trout population trends are described below (Figure 3.5).
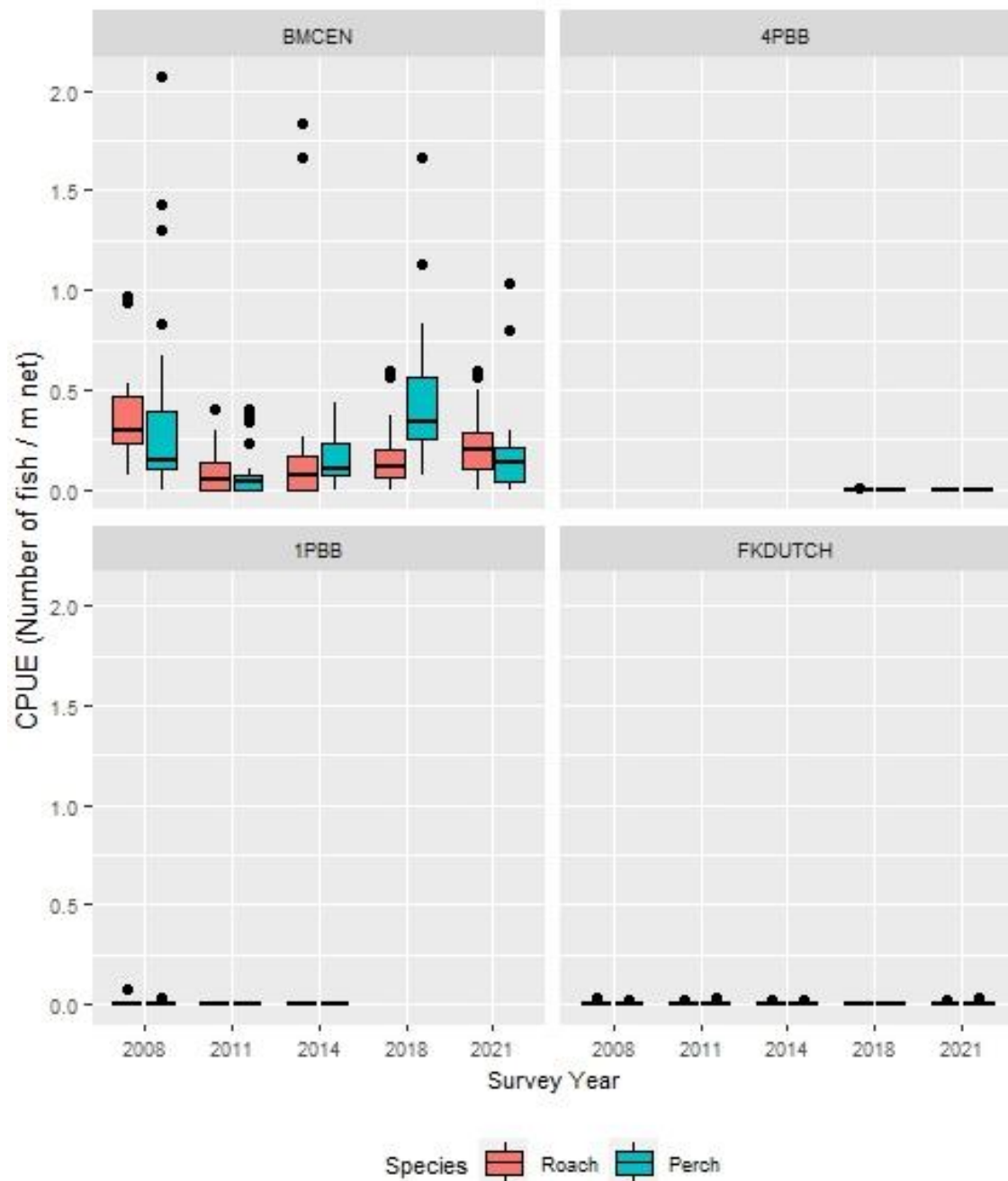
Figure 3.1a. CPUE (number of fish captured per linear meter of net deployed) of roach and perch in each net type during surveys of Lower Lough Corrib between 2008 and 2021. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.
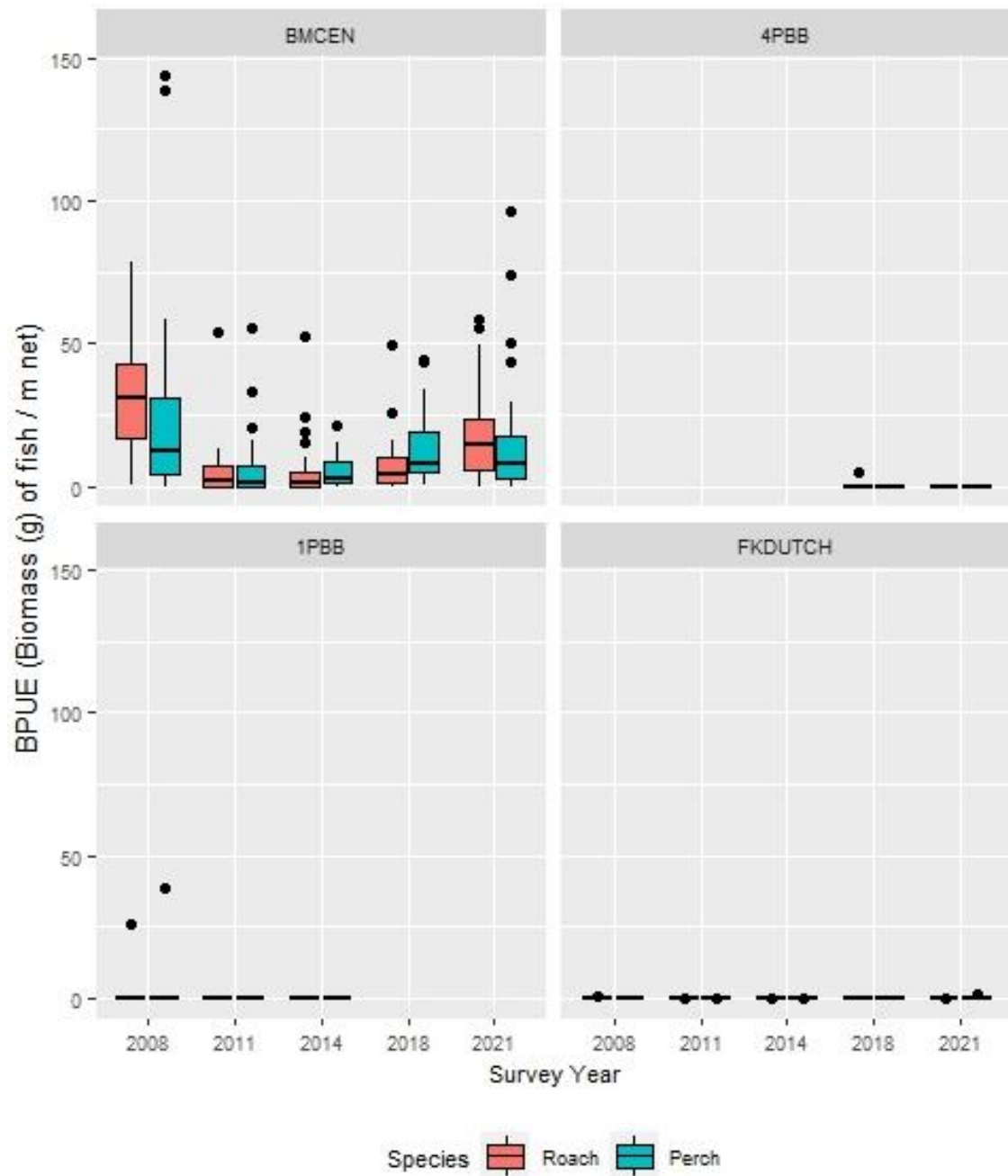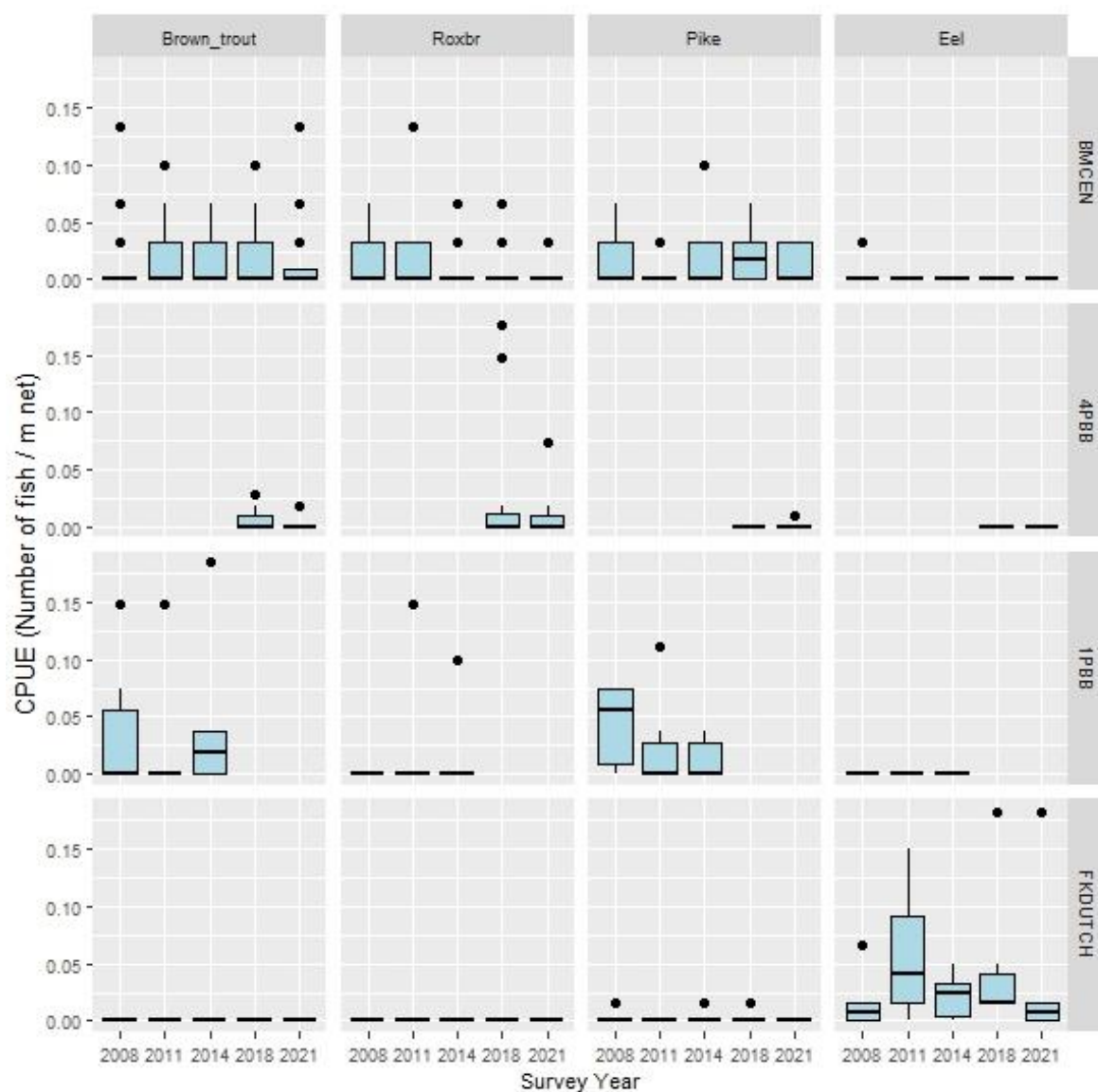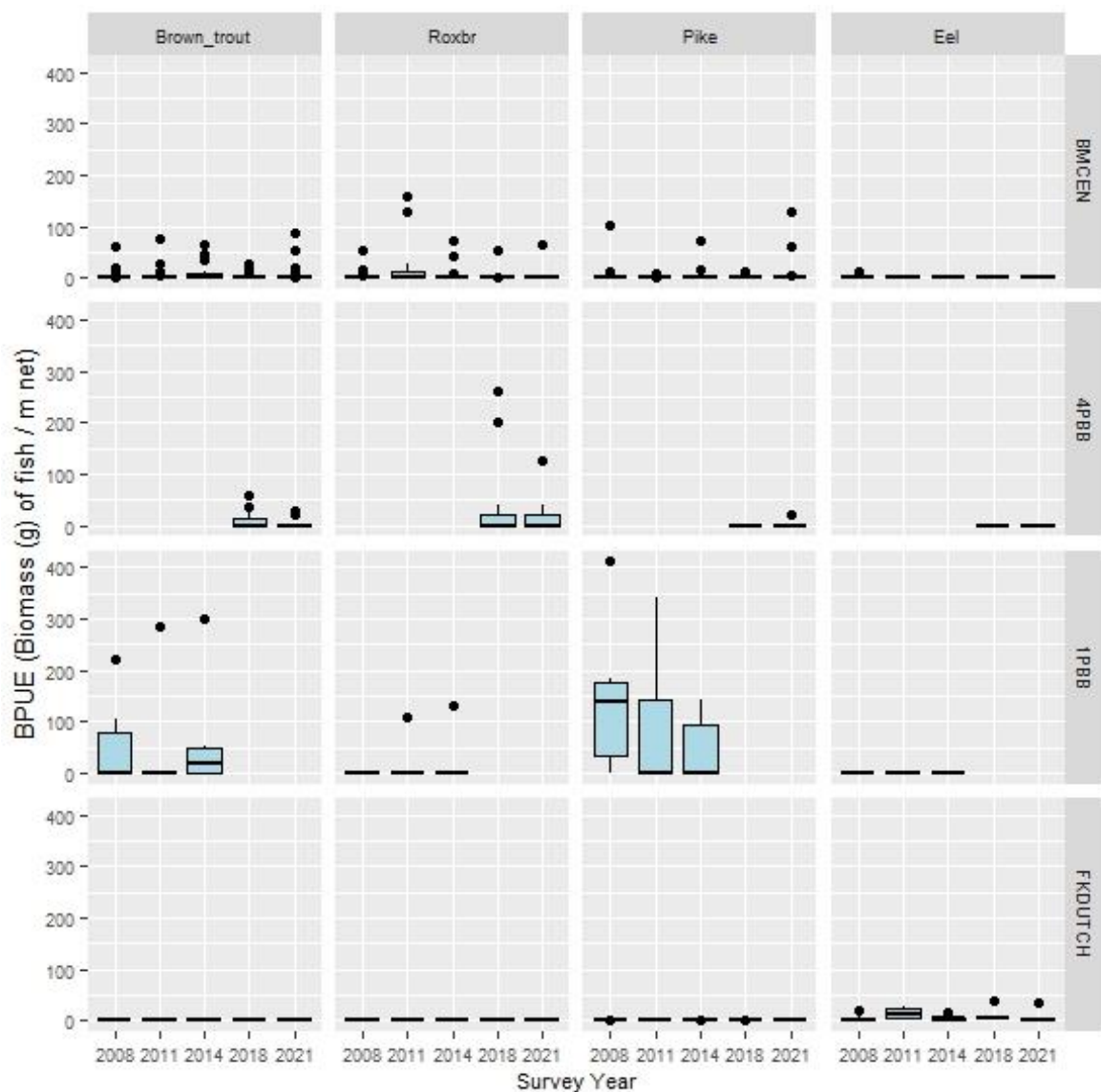
Figure 3.1b. BPUE (biomass (g) of fish captured per linear meter of net deployed) of roach and perch in each net type during surveys of Lower Lough Corrib between 2008 and 2021. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

Figure 3.2a. CPUE (number of fish captured per linear meter of net deployed) of brown trout and other regularly captured species in each net type during surveys of Lower Lough Corrib between 2008 and 2021. 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 brown trout and other fish species in each net type during surveys of Lower Lough Corrib between 2008 and 2021. Figures are expressed as mean 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.

Upper Lough Corrib

In 2021 perch followed by roach were the dominant fish species in terms of abundance and biomass on Upper Lough Corrib (Table 3.4 and Figures 3.3a and 3.3b). In common with the Lower Lough, perch and roach were the most abundant species captured across all surveys of Upper Lough Corrib since 2008. They were caught predominantly in benthic monofilament survey nets (BMCEN).

CPUE and BPUE of both species fluctuated over time. There was no clear trend in perch numbers or biomass (Figure 3.3a and 3.3b). While there was an apparent decline in numbers of roach across all surveys of the lake there was considerable variation in catch within each survey year, so data should be interpreted with caution.

Other species were captured in lesser numbers (compared to roach and perch) and across all net types (Figures 3.4a and 3.4b). Catches of these species have also fluctuated across surveys and no clear trends were apparent. Brown trout population trends are described below (Figure 3.5).

Table 3.4. Mean (S.E.) CPUE and BPUE for all fish species captured on Upper Lough Corrib, 2021

Scientific name	Common name	Mean CPUE (± S.E) **	Mean BPUE (± S.E) **
Perca fluviatilis	Perch	0.157 (0.028)	14.055 (2.827)
Rutilus rutilus	Roach	0.047 (0.014)	9.070 (2.487)
Salmo trutta	Brown trout	0.005 (0.001)	5.170 (1.634)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.005 (0.002)	4.277 (1.662)
Abramis brama	Bream	0.003 (0.002)	2.914 (1.861)
Esox lucius	Pike	0.002 (0.001)	1.738 (1.120)
Scardinius erythrophthalmus	Rudd	0.000 (0.000)	0.086 (0.858)
*Anguilla anguilla	European eel	0.057 (0.020)	19.093 (7.565)

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).
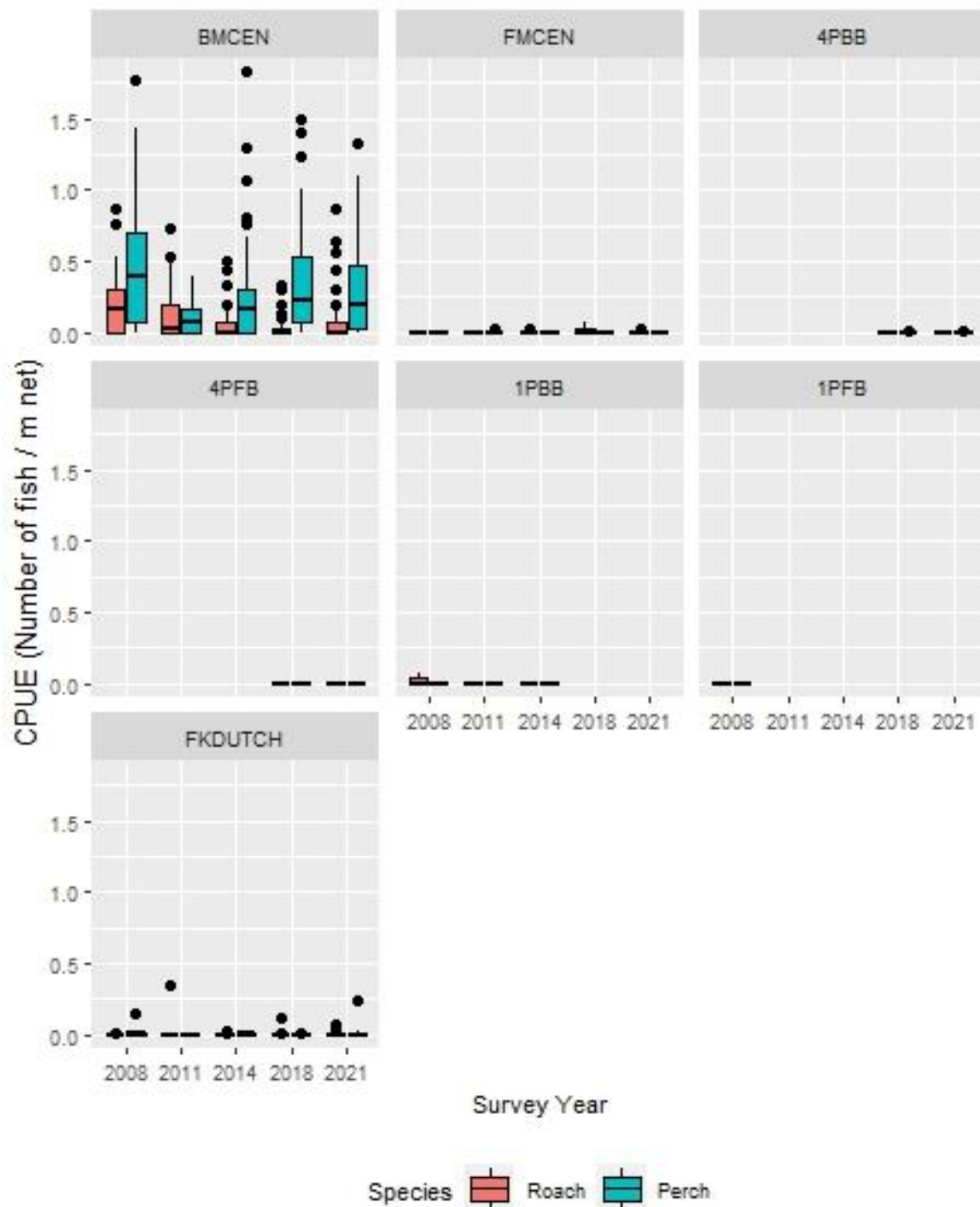
*Eel CPUE and BPUE based on fyke nets only.

Figure 3.3a. CPUE (number of fish captured per linear meter of net deployed) of roach and perch in each net type during surveys of Upper Lough Corrib between 2008 and 2021. 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 3.3b BPUE (biomass (g) of fish captured per linear meter of net deployed) of roach and perch in each net type during surveys of Upper Lough Corrib between 2008 and 2021. 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.

Fig. 3.4a. CPUE (number of fish captured per linear meter of net deployed) of brown trout and other species in each net type during surveys of Upper Lough Corrib between 2008 and 2021. 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. Note the scales are different for each net type.
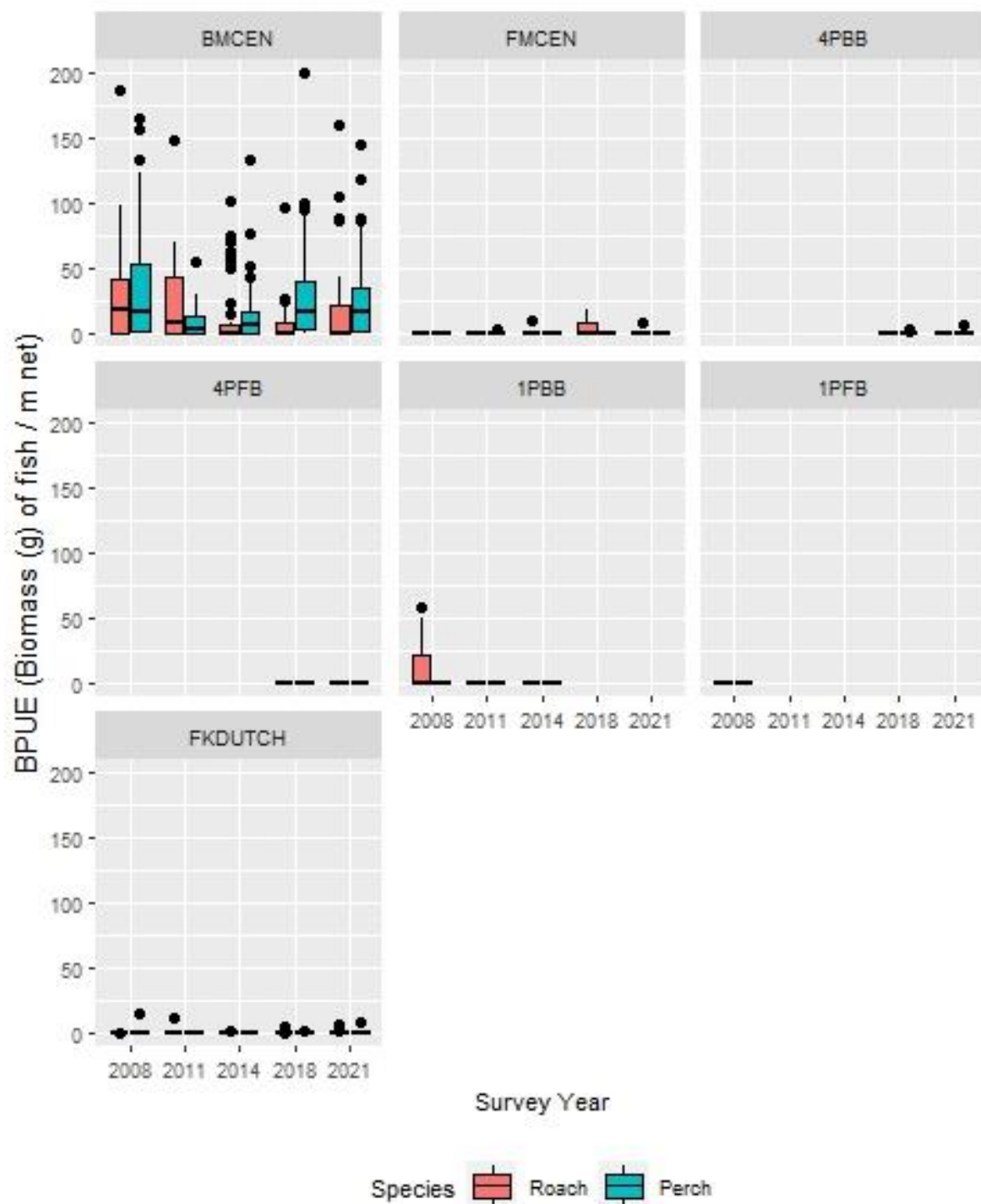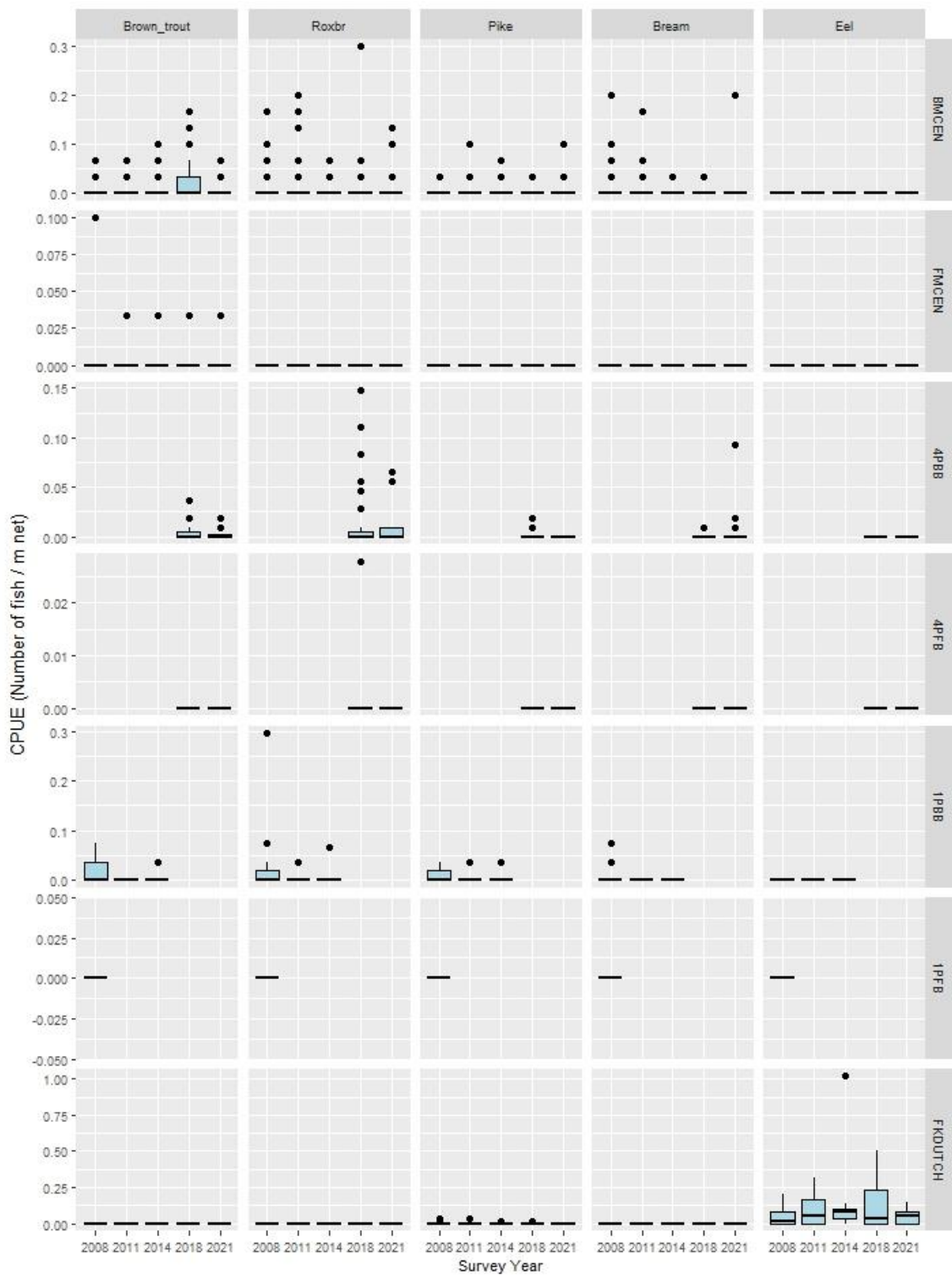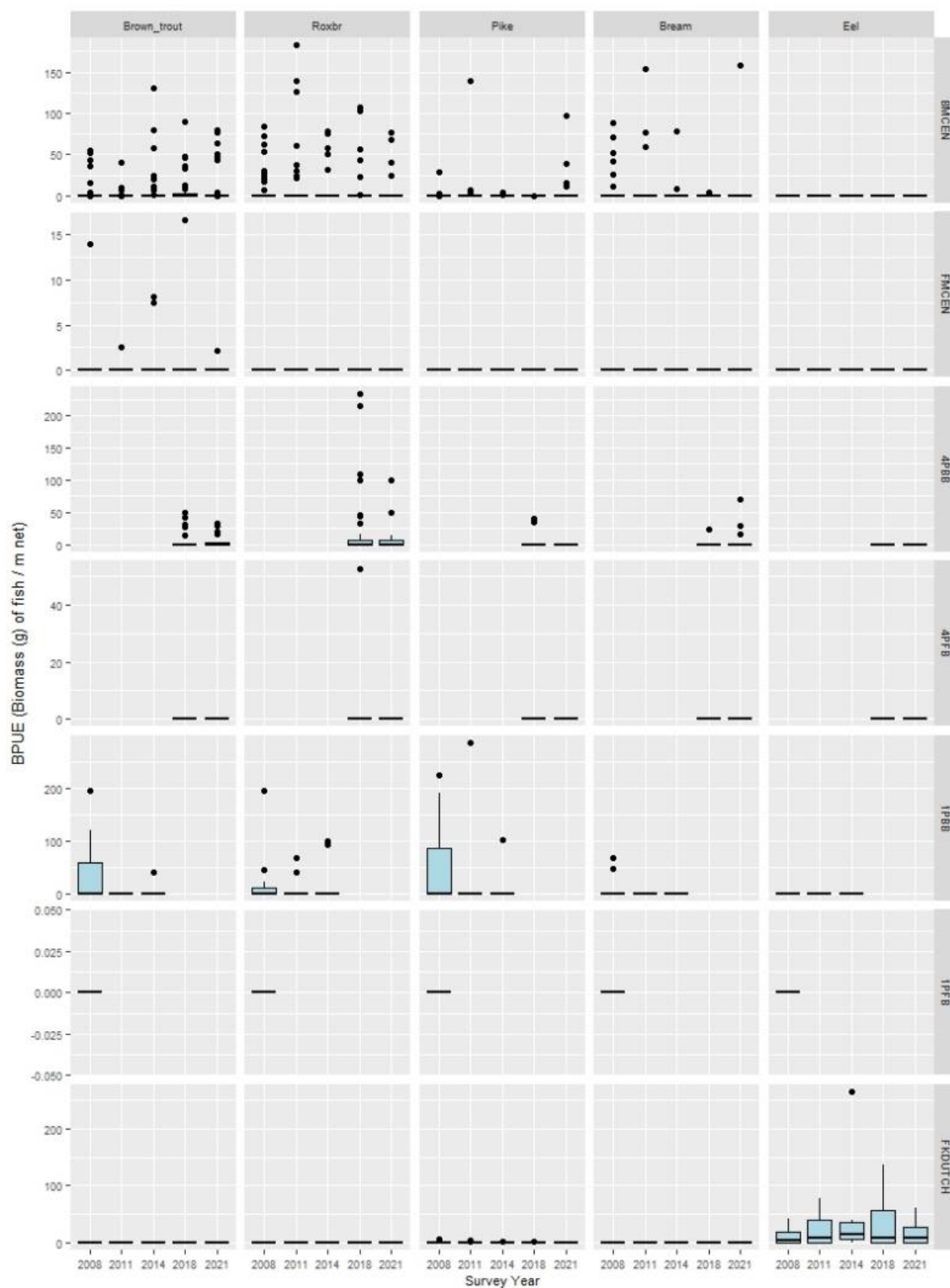
Figure 3.4b. BPUE (biomass (g) of fish captured per linear meter of net deployed) of brown trout and other species in each net type during surveys of Upper Lough Corrib between 2008 and 2021. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots. Note the scales are different for each net type.
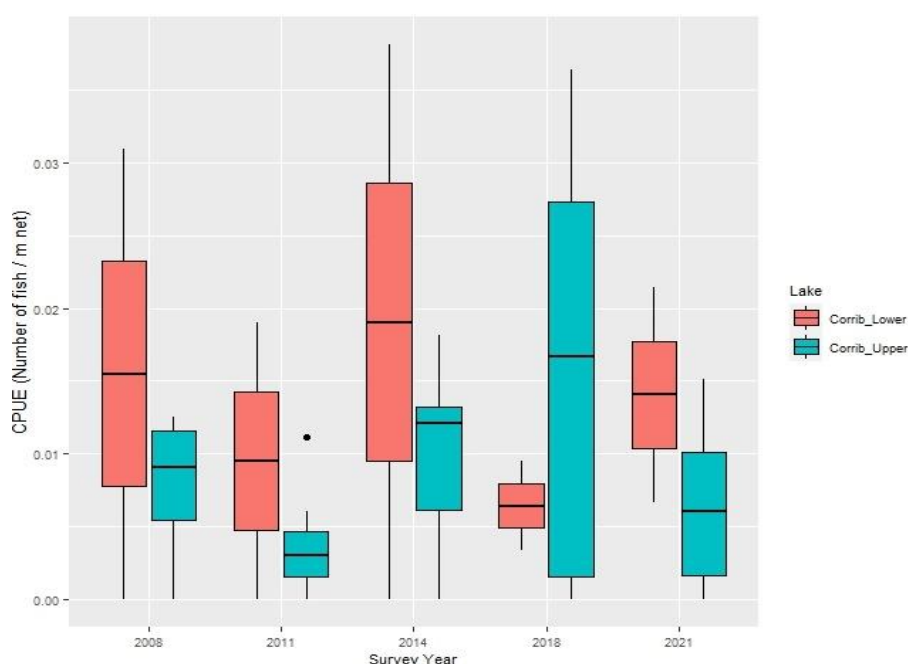
Brown trout CPUE in Upper and Lower Lough Corrib

Survey catch data is inherently subject to considerable variation. Larger bodied species (e.g. brown trout), which may be naturally less abundant than smaller species such as perch and roach are often captured in relatively low numbers and in a small proportion of the survey nets deployed. Changes in netting methodologies have also occurred since 2008 where the number and mesh size of supplementary braided survey gillnets has varied. This is apparent in the graphs above (Figures 3.1a to 3.4b) which can make visual interpretation of fish catches difficult.

For brown trout, fish catches and CPUEs from floating and benthic CEN nets have been pooled to reduce some of this variation. This has been achieved by aggregating catches within each depth zone for BMCEN nets on each sampling occasion. In this way all of the nets deployed within each depth zone were treated as one sampling unit for that survey occasion. Sampling effort, and netting locations across surveys were essentially identical. Braided nets which were set in varying quantities and with varying mesh sizes, and fyke nets (which captured no brown trout in any survey) have been excluded. Aggregate CPUEs for surveys on both lakes is presented in Figure 3.5. Stocks of brown trout appeared to fluctuate in both Lower and Upper Lough Corrib and no clear trend was apparent.

Figure 3.5. CPUE (number of fish captured per linear meter of net deployed) of brown trout captured in benthic and floating CEN nets during surveys of Lower and Upper Lough Corrib between 2008 and 2021. Data has been pooled within each depth zone. 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

Lower Lough Corrib:

Brown trout

Brown trout captured in Lower Lough Corrib in 2021 ranged in length from 12.9cm to 59.2cm (mean = 33.0cm) and was similar when compared to previous surveys of the lake (Figure 3.7). Brown trout in the sample were aged between 1+ and 7+. The most abundant age group in the sample was 1+. Older age groups were less abundant and no 4 year old fish were recorded. Mean brown trout L4 (i.e. length at end of year 4) was 35.5cm indicating a fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 3.7).
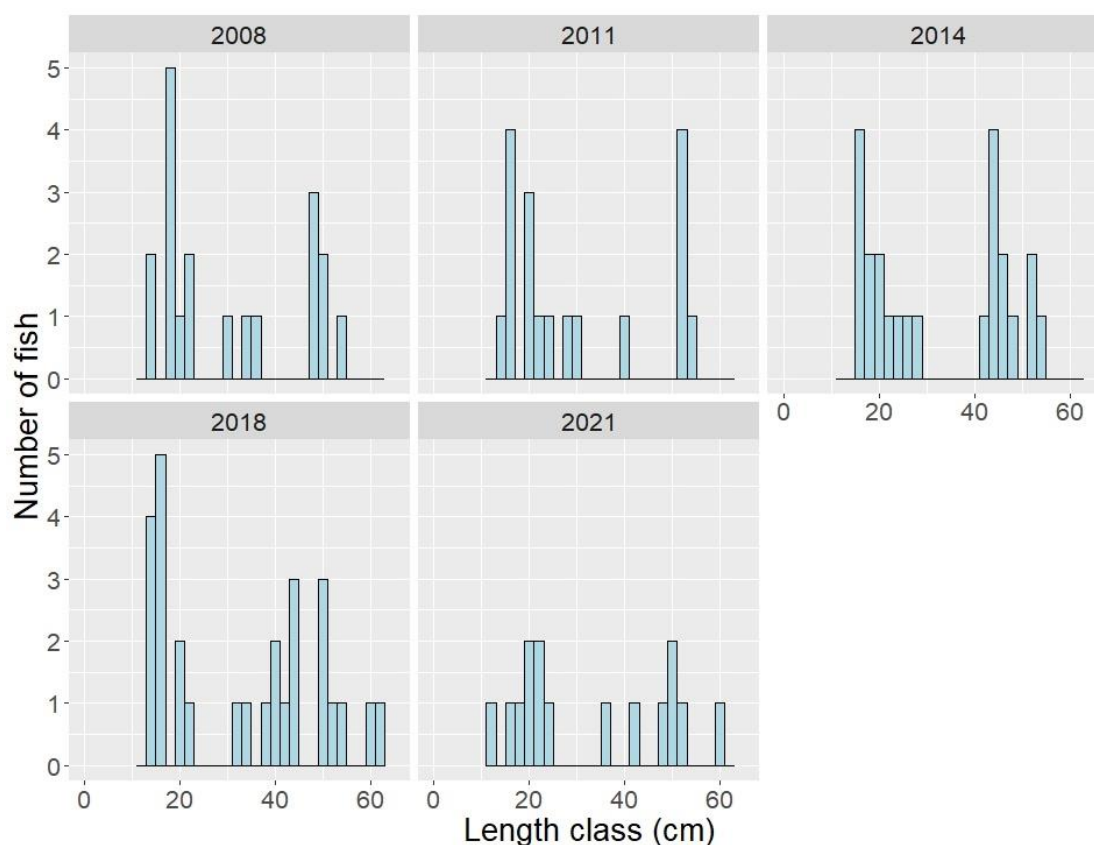
Figure 3.7. Length frequency of brown trout captured on Lower Lough Corrib, 2008, 2011, 2014, 2018 and 2021

Table 3.7. Mean (±S.E.) brown trout length (cm) at age for Lower Lough Corrib, June 2021

	L_1	L_2	L_3	L_4	L_5
Mean (±S.E.)	7.5 (0.2)	16.7 (0.8)	27.3 (1.4)	35.3 (1.1)	41.9 (0.9)
N	12	6	5	4	4
Range	6.8-8.3	13.8-19.1	25.1-30.8	33.0-38.1	39.8-44.0

Roach

Roach captured during the 2021 survey ranged in length from 5.2cm to 30.7cm (mean = 15.2cm) (Figure 3.5). Length range was similar to that recorded in 2018; however, the sample was dominated by larger fish in 2021 (Figure 3.5). Eight year classes (0+ to 8+) were recorded in the sample of roach aged. All intervening year classes with the exception of 7+ were represented (Table 3.5). The most abundant cohort recorded in the sample were 4+ fish, corresponding to the modal peak around 17.0-18.0cm. Older year groups were poorly represented, and fewer smaller and younger fish were recorded compared to previous years. (Figure 3.5).
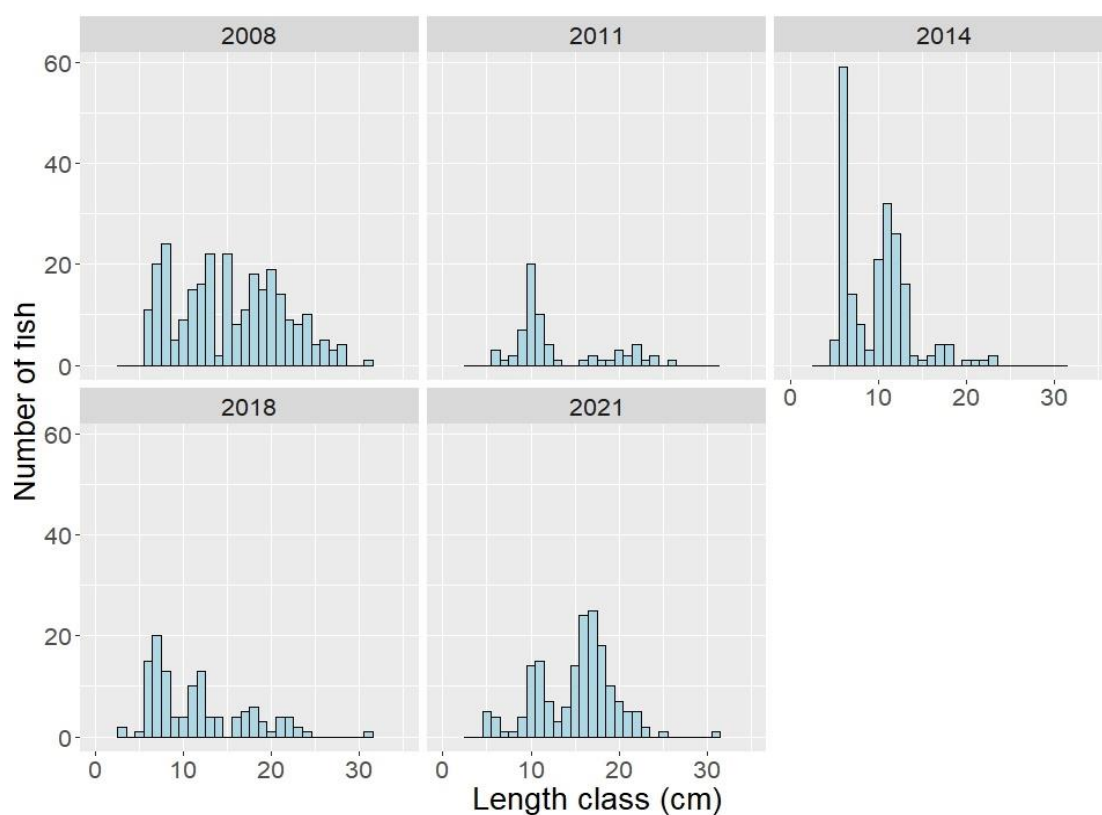

Figure 3.5. Length frequency of roach captured on Lower Lough Corrib, 2008, 2011, 2014, 2018 and 2021

Table 3.5. Summary age data from roach captured Lower Lough Corrib, June 2021. 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+
N	1	1	10	11	18	5	2	0	1
Mean L (cm)	5.2	8.6	11.1	14.5	18.1	21.5	21.7	-	-
Min L (cm)	-	-	9.2	11.3	14.4	20.4	21.3	-	30.7
Max L (cm)	-	-	12.6	17.2	22.5	22.7	22.1	-	30.7

Perch

Perch captured during the 2021 survey ranged in length from 7.0cm to 33.5cm (mean = 15.0cm) (Figure 3.6). Perch in the sample aged ranged from 2+ to 8+. Mean length at the end of the 1st year (L1) was 5.9cm (Table 3.6). No 0+ or young of year perch were recorded in the 2021 survey and no 1+ perch were recorded in the sample aged. In contrast to the previous survey, when young perch dominated the population, 4+ perch were the most abundant cohort in the sample aged. This group is *c.* 16.0cm - 17.0cm in length (Figure 3.6)
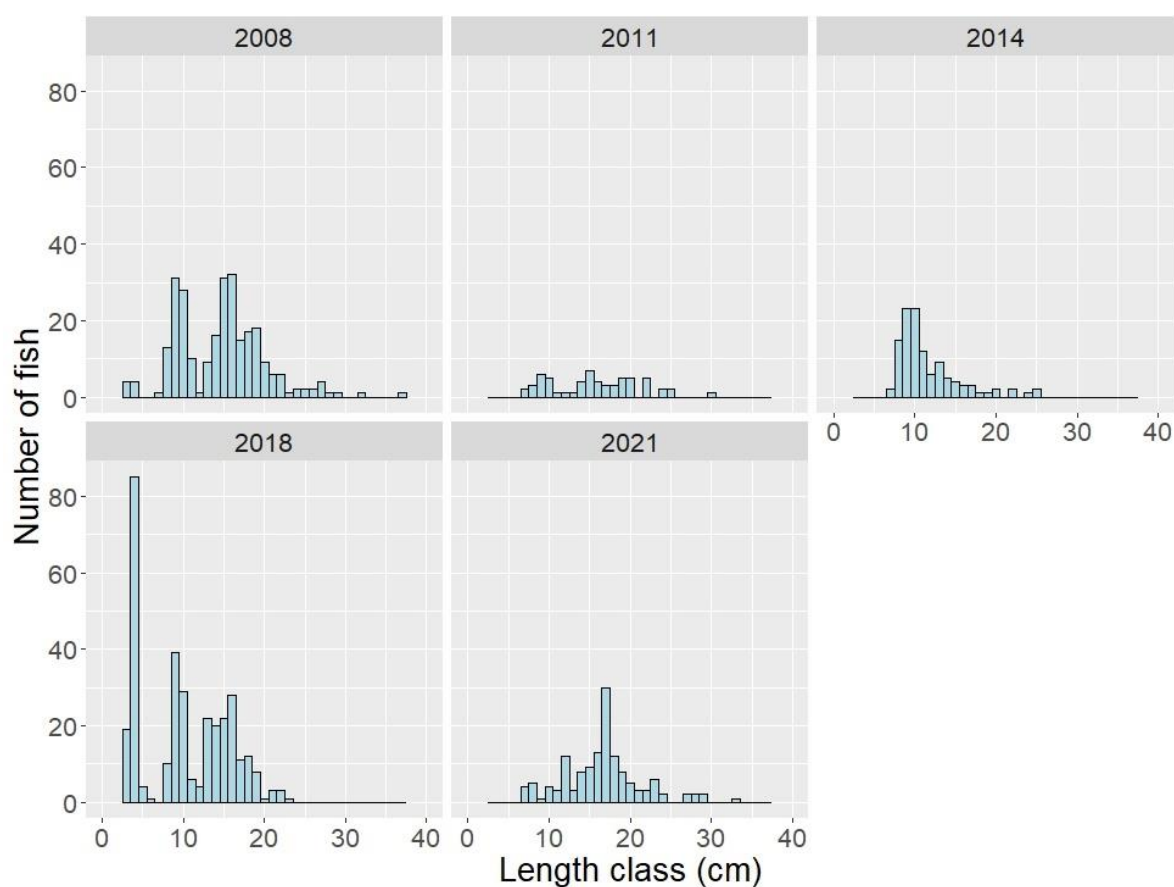

Figure 3.6. Length frequency of perch captured on Lower Lough Corrib, 2008, 2011, 2014 ,2018 and 2021

Table 3.6. Mean (±S.E.) perch length (cm) at age for Lower Lough Corrib, June 2021

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8
Mean (±S.E.)	5.9 (0.2)	10.2 (0.3)	14.3 (0.3)	17.8 (0.4)	20.3 (0.5)	23.9 (1.3)	26.95 (1.2)	-
N	50	50	25	35	17	6	2	1
Range	2.9-8.3	6.1-14.5	10.7-19.8	14.1-21.8	17-24.2	19.8-27.5	25.8-28.1	27.7

Roach x bream hybrids

Roach x bream hybrids captured during the 2021 survey ranged in length from 35.0cm to 49.3cm (mean = 28.6cm) (Figure 3.8). Five age class cohorts were present in the sample aged. These were 7+, 10+, 12+ 13+ and 14+ (Table 3.8). No smaller or younger fish were captured on this occasion.
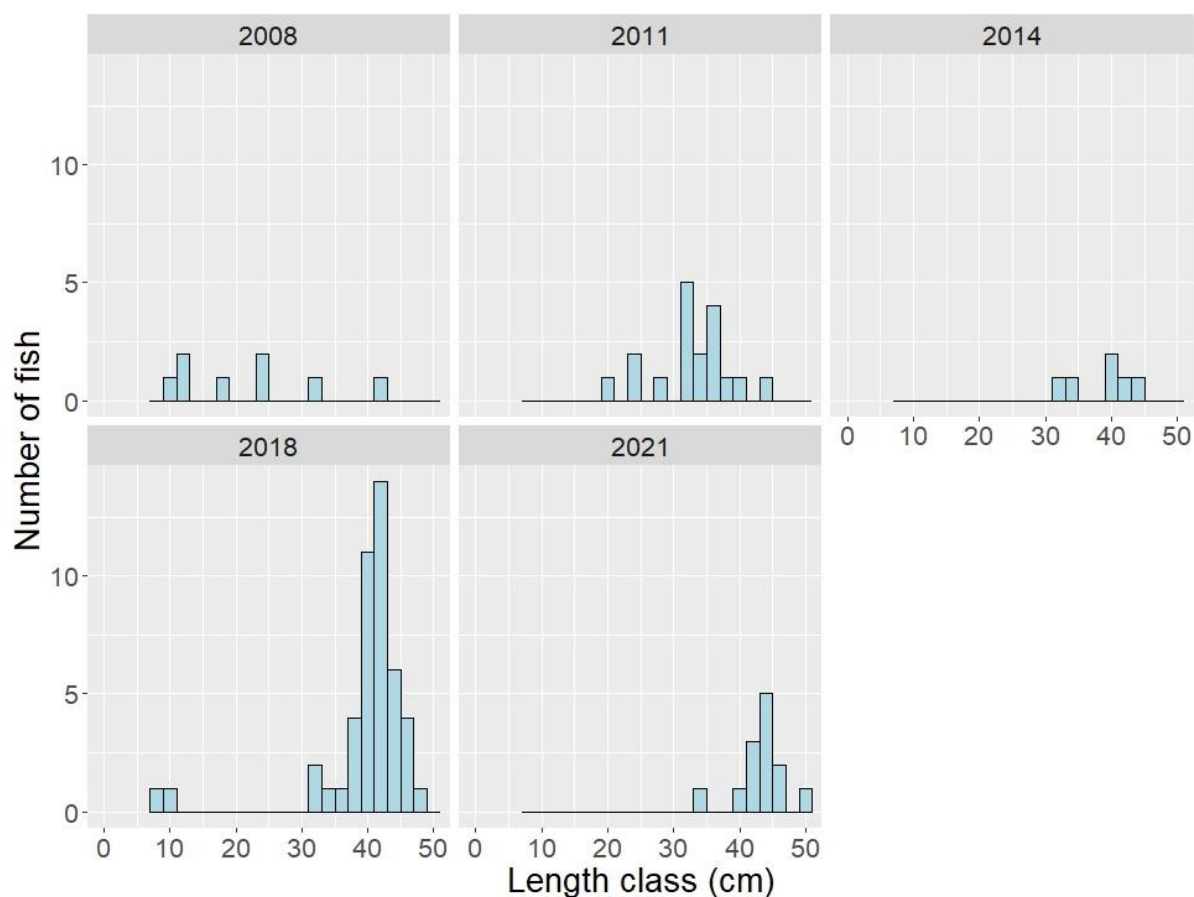
Figure 3.8 Length frequency of roach x bream hybrids captured on Lower Lough Corrib, 2008, 2011, 2014, 2018 and 2021. (Note that additional large panel nets were set in latter years)

Table 3.8 Summary age data from roach x bream hybrid captured Lower Lough Corrib, June 2021. Number of fish and length ranges of all fish aged in the sample is presented

	Age class								
	0+ - 6+	7+	8+	9+	10+	11+	12+	13+	14+
N	0	1	0	0	1	0	1	2	3
Mean L (cm)	-	-	-	-	-	-	-	46.9	45.2
Min L (cm)	-	35.0	-	-	40.6	-	43.0	44.5	45
Max L (cm)	-	35.0	-	-	40.6	-	-43.0	49.3	45.5

Other Species

Eight pike were captured in Lower Lough Corrib. Pike ranged in length from 18.0cm to 80.0cm (mean = 42.0cm). Five rudd were captured. They ranged in length from 13.4cm to 17.3cm (mean = 15.6cm). Five tench ranged in length from 39.0cm to 41.0 cm (mean = 40.2cm). One salmon measuring 68.2cm was recorded. Three-spined stickleback (n = 3) ranged in length from 3.5cm to 4.4cm.

Thirteen eels were also captured in Lower Lough Corrib. They ranged in length from 12.9cm to 59.2cm, mean length was 46.6cm.


Plate 3.1 Large brown trout captured and released on Lower Lough Corrib, June 2021

Upper Lough Corrib:

Brown trout

Brown trout captured in Upper Lough Corrib in 2021 ranged in length from 6.5cm to 40.8cm (mean = 40.8cm) and was similar when compared to previous surveys of the lake. However, the larger numbers of smaller fish (i.e. < 20.0cm) which were recorded in 2018 were not captured on this occasion (Figure 3.11). Brown trout in the sample were aged between 2+ and 9+. The largest age group in the sample was 5+. Mean brown trout L4 (i.e. length at end of year 4) was 35.5cm indicating a fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 3.11).
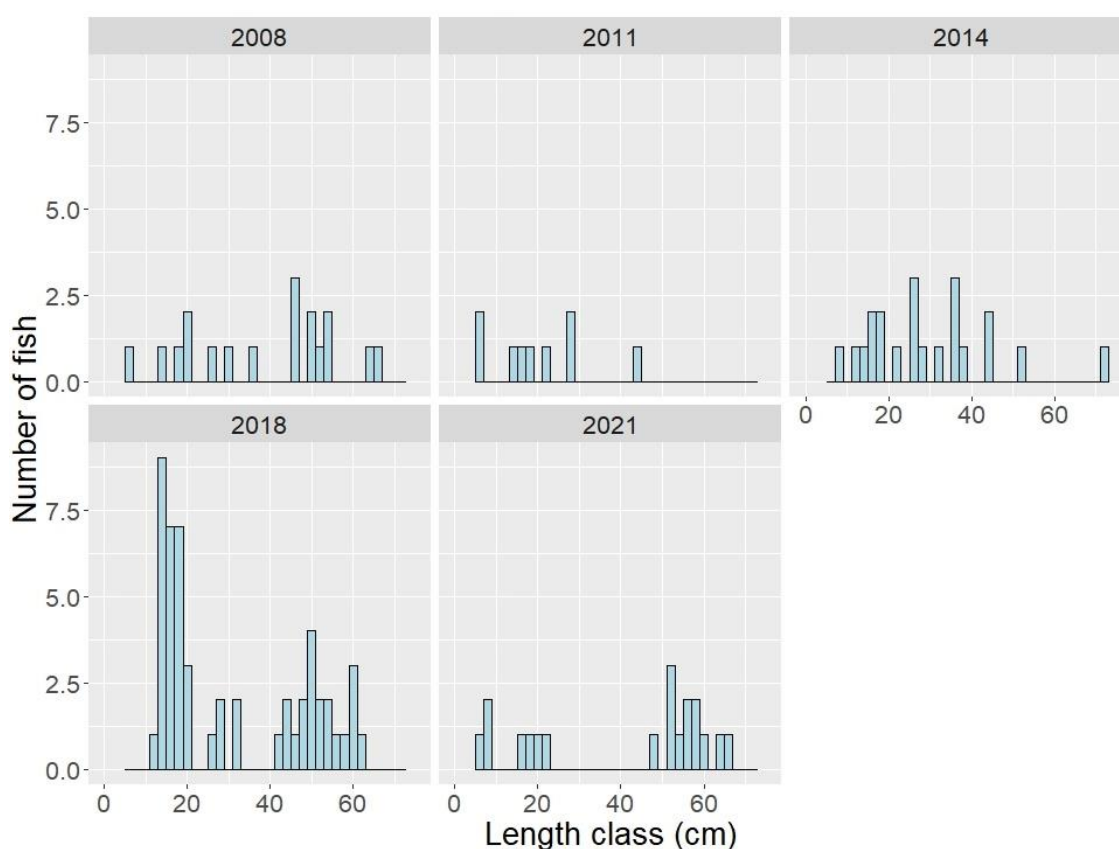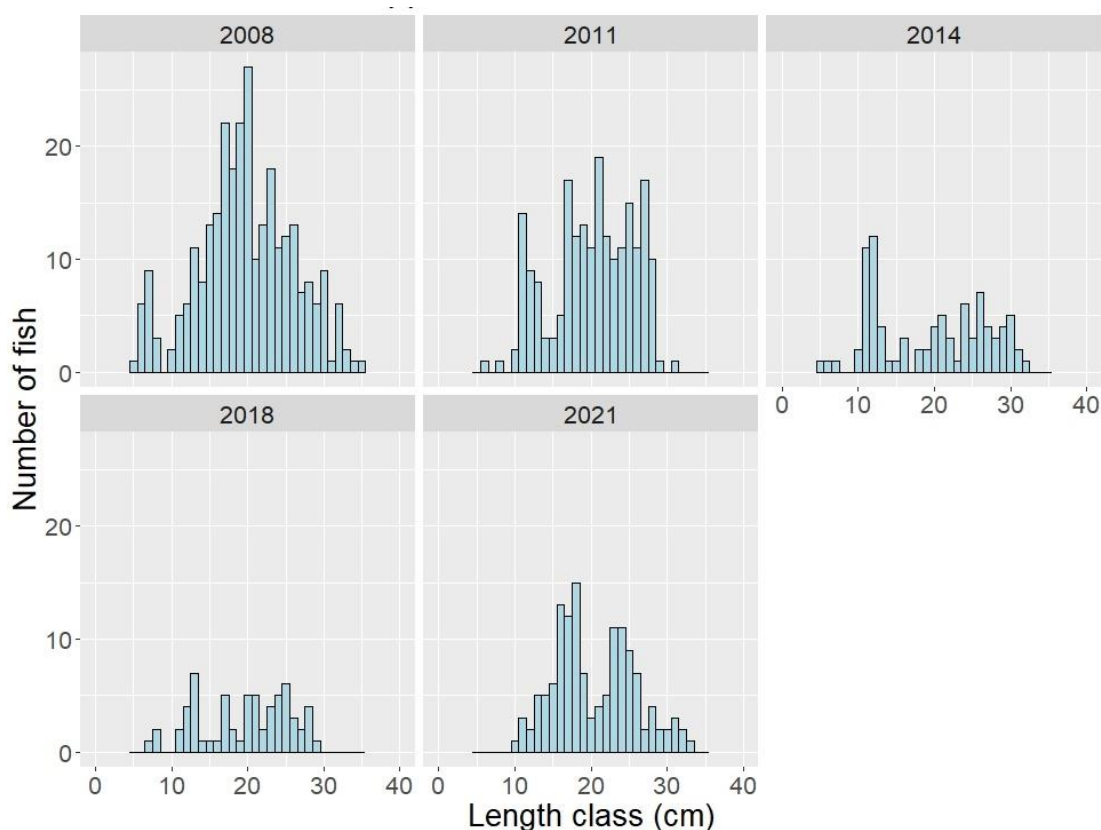

Figure 3.11. Length frequency of brown trout captured on Lower Lough Corrib, 2008, 2011, 2014, 2018 and 2021

Table 3.11. Mean (±S.E.) brown trout length (cm) at age for Upper Lough Corrib, June/July 2021

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9
Mean (±S.E.)	7.3 (0.3)	14.2 (0.5)	14.2 (0.5)	23.0 (0.6)	31.6 (0.7)	39.9 (0.1)	46.8 (1.1)	45.1 (1.3)	59.5
N	11	10	10	9	9	9	9	7	2
Range	6.3-8.7	12.1-17.9	12.1-17.9	20.3-26.2	26.9-33.9	36.1-45.7	42.1-52.4	46.3-56.2	58.9-60.0

Roach

Roach captured during the 2021 survey of Upper Lough Corrib ranged in length from 10.0cm to 33.3cm (mean = 20.5cm) (Figure 3.9). Length range was similar to that recorded in 2018; however, the sample was dominated by larger fish in 2021 (Figure 3.9). Nine year classes (1+ to 9+) were recorded in the sample of roach aged. All intervening year classes were represented and two year classes dominated the sample (i.e. 2+ and 4+) (Table 3.9). These groups are *c.* 15.0-18.0cm and 21.0-24.0cm in length respectively (Figure 3.9). Older year groups were poorly represented, and fewer smaller and younger fish were recorded compared to previous years. (Figure 3.9).
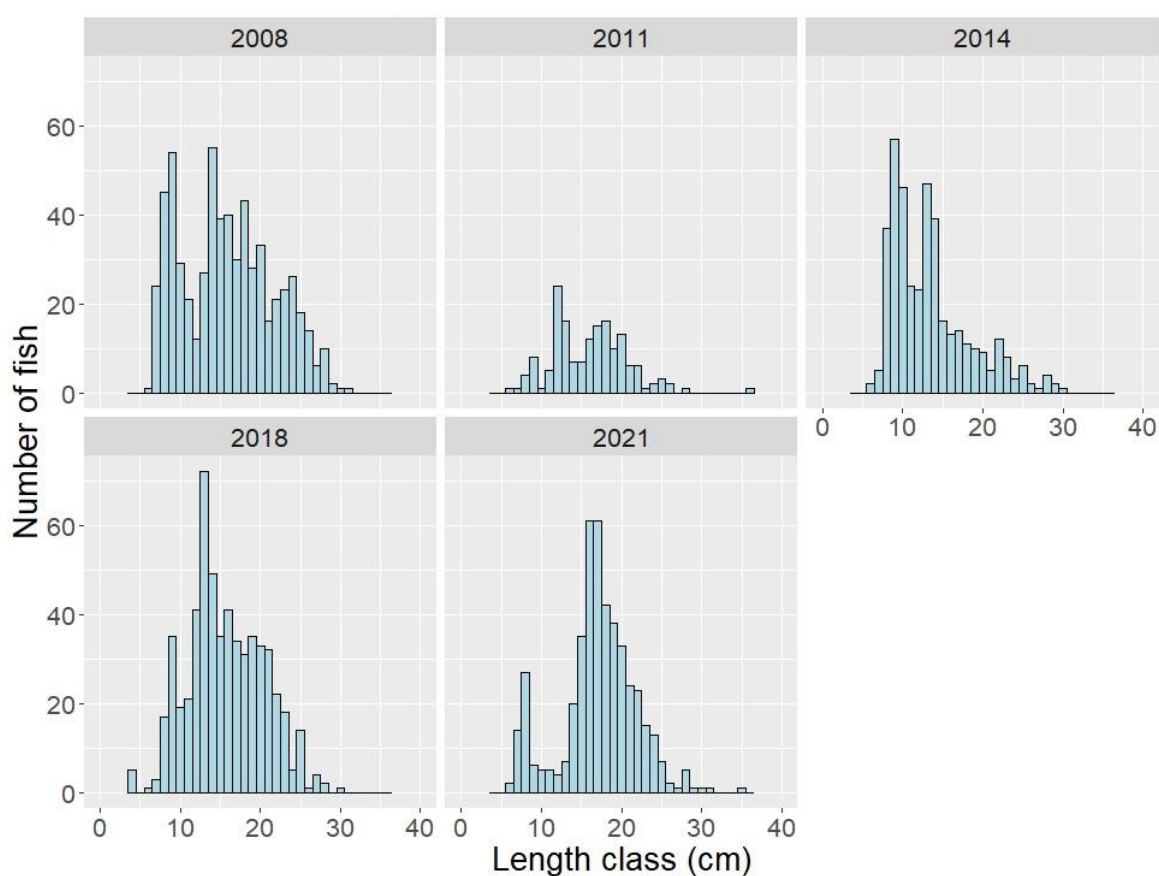

Figure 3.9. Length frequency of roach captured on Upper Lough Corrib, 2008, 2011, 2014 ,2018 and 2021

Table 3.9. Summary age data from roach captured on Lower Lough Corrib, June/July 2021. 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+
N	-	9	14	4	8	11	3	3	2	1
Mean L (cm)	-	13.6	16.9	18.9	22.3	24.4	26.8	29.4	31.2	-
Min L (cm)	-	11.3	15.2	18.3	21.5	23	25.5	27.9	30.8	33.3
Max L (cm)	-	15.2	18.8	19.3	23.9	26.5	28	30.5	31.6	33.3

Perch

Perch captured during the 2021 survey of Upper Lough Corrib ranged in length from 6.0cm to 32.0cm (mean = 17.2cm) (Figure 3.10). Mean length at the end of the 1st year (L1) was 7.0cm (Table 3.10). Perch in the sample ranged in age from 1+ to 9+. No 0+ or young of year perch were recorded in 2021 which may reflect the timing of the survey as that cohort would be unavailable to the nets deployed. 2+ and 3+ perch were the most abundant cohorts in the sample aged. These groups are *c.* 10.0cm to 20.0cm in length (Figure 3.10).
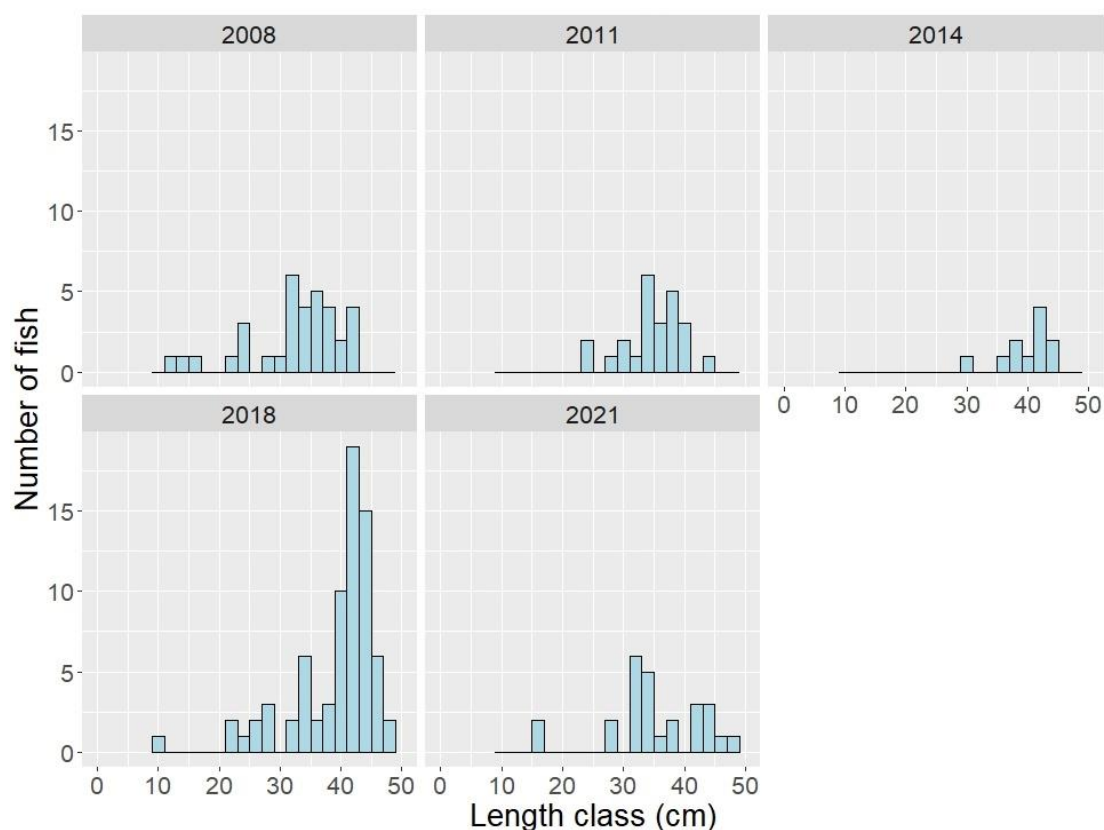

Figure 3.10. Length frequency of perch captured on Upper Lough Corrib, 2008, 2011, 2014 and 2018

Table 3.10. Mean (±S.E.) perch length (cm) at age for Upper Lough Corrib, June/July 2021

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9
Mean(±S.E.)	7.0 (0.2)	12.0 (0.2)	16.1 (0.3)	19.0 (0.4)	21.3 (0.3)	24.1 (0.4)	26.4 (0.8)	29.0	-
N	71	62	44	27	18	8	4	2	1
Range	5.0-10.5	9.3-15.9	13.0-20.3	16.6-22.8	18.9-23.5	22.3-25.8	24.1-27.5	27.9-30.0	28.7

Roach x bream hybrids

Roach x bream hybrids captured during the 2021 survey ranged in length from 16.3cm to 47.6cm (mean = 35.4cm) (Figure 3.12). Nine age groups (2+to 14+) were present in the sample aged. While some smaller and younger fish were captured, many year classes were missing from the sample captured in 2021 (Table 3.12).

Figure 3.12. Length frequency of roach x bream hybrids captured on Upper Lough Corrib, 2008, 2011, 2014, 2018 and 2021. (Note that additional large panel nets were set in latter years)

Table 3.12. Mean (±S.E.) roach x bream hybrids length (cm) at age for Upper Lough Corrib, June/July 2021

	Age Class													
	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+
N	0	2	0	1	2	4	3	2	0	0	0	3	3	1
Mean L (cm)	-	16.4	-	28.4	30.2	32.9	34.3	34.9	-	-	-	40.9	43.9	-
Min L (cm)	-	16.3	-	-	29.0	32.0	33.7	33.0	-	-	-	38.8	43.5	45.5
Max L (cm)	-	16.4	-	-	31.4	34.5	34.8	36.8	-	-	-	42.5	44.3	45.5

Other fish species

Nineteen bream were captured in Upper Lough Corrib in 2021. Bream ranged in length from 25.0cm to 44.5cm (mean = 35.9cm). Bream in the sample aged ranged from 4+ to 11+. Six pike, ranging in length from 16.4cm to 72.5cm (mean = 39.4cm) were captured. Pike were aged between 1+ and 5+. One rudd (5+) measuring 23.0cm was captured.

Thirty-one eels were also captured in Upper Lough Corrib. They ranged in length from 35.0cm to 79.0cm, mean length was 55.2cm.

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.

Brown trout

A total of ten brown trout stomachs were available for diet analysis on Lower Lough Corrib. Nine contained food. Invertebrates were the sole prey group recorded in three stomachs. Invertebrates and zooplankton occurred together in two stomachs. Zooplankton were the sole prey group recorded in two brown trout. It was not possible to identify the prey in two fish samples (Figure 3.13).

On Upper Lough Corrib, six brown stomachs were available for diet analysis. Five contained food. Invertebrates were the sole prey group recorded in three brown trout stomachs. Fish and zooplankton were each recorded in one brown trout stomach.


■ Invertebrate   ■ Mixed Invertebrate & Zooplankton
■ Zooplankton   ■ Unidentified Digested Material
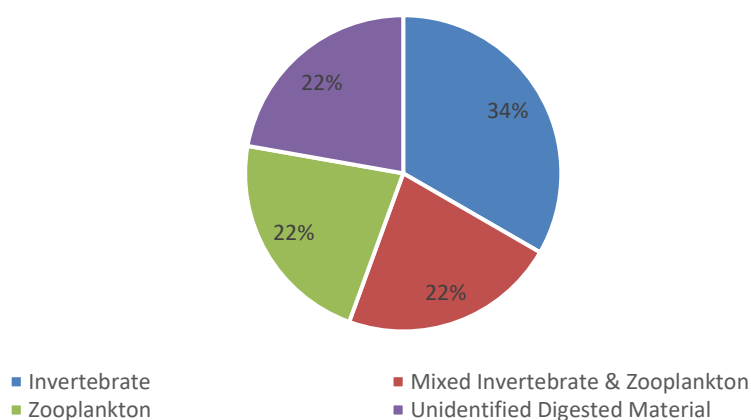
**Figure 3.13. Diet of brown trout (n = 10) captured on Lower Lough Corrib, 2021 (% occurrence)**

Perch

A total of 47 stomachs from perch captured on Lower Lough Corrib were examined. Of these 16 were found to contain no prey items. Of the remaining 31 stomachs containing food, five (16%) contained fish only. Invertebrates and zooplankton were found with fish in four (13%) and two (6%) stomachs respectively (Figure 3.13). Invertebrates were the sole prey item found in two (6%) stomachs while they were found with zooplankton in four stomachs (13%) respectively. Three stomachs (6%) contained zooplankton only. Prey in nine stomachs was unidentified.

A total of 71 stomachs from perch captured on Upper Lough Corrib were examined. Of these 17 were found to contain no prey items. Of the remaining 54 stomachs containing food, five (9%) contained fish (Figure 3.14). Invertebrates were the sole prey item found in four (7%) stomachs while they were found with fish (two stomachs) and zooplankton in one stomach (2%) respectively. Three stomachs (6%) contained zooplankton only. Prey in 39 stomachs was unidentified.
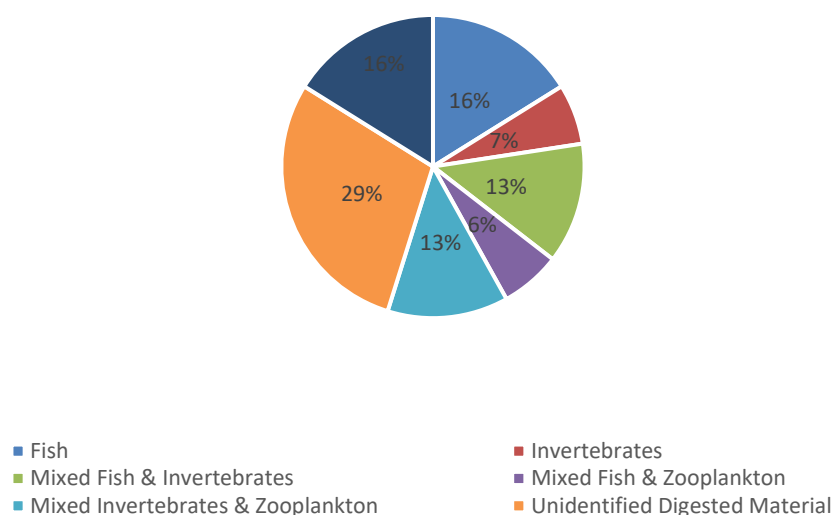
Figure 3.14. Diet of perch (n = 31) captured on Lower Lough Corrib, 2021 (% occurrence)
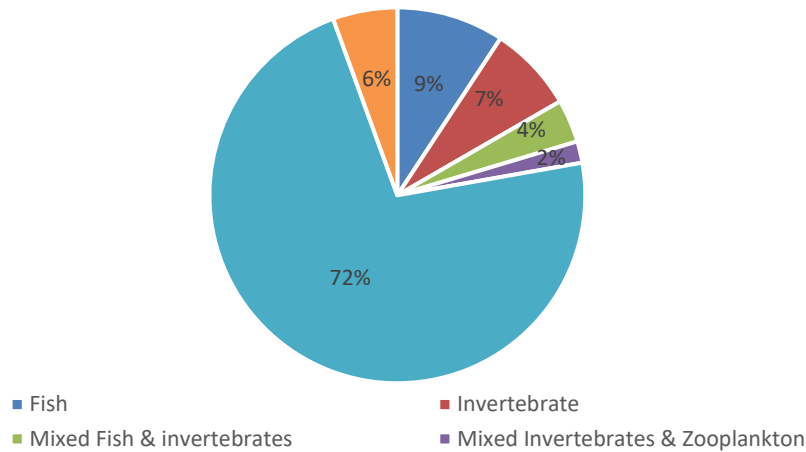
Figure 3.15. Diet of perch (n = 54) captured on Upper Lough Corrib, 2021 (% occurrence)

Pike

Four pike stomachs were available for diet analysis on Lower Lough Corrib. All stomachs contained fish prey. Three-spined stickleback were the sole prey item in three pike stomachs (24.0cm-32.3cm). Perch and invertebrates were found in the stomach of the remaining pike, which measured 24.4cm.

On Upper Lough Corrib, five pike stomachs were available for diet analysis. One stomach (38.7cm) was empty. Two pike stomachs (16.4cm and 72.0cm) contained cyprinid larva. Perch was found in the stomach of one pike (31.5cm) and invertebrates were recorded in the stomach of the remaining pike, which measured 23.4cm.

4.   Summary and ecological status

Lower Lough Corrib:

A total of nine fish species and one type of hybrid were recorded on Lower Lough Corrib in June 2021.

While the numbers (CPUE) of brown trout have fluctuated across the survey periods, no obvious trend in population status was apparent. Brown trout ranged in age from 1+ to 7+. One year old fish were the most abundant cohort in the sample. The length and age range of brown trout captured in 2021 was similar to that recorded in previous surveys conducted since 2008. Length at age analyses revealed that brown trout in the lake exhibit a fast rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

Roach and perch were the dominant fish species in terms of abundance biomass captured during the survey. These species have together been the most abundant species in the lake across all survey periods. While both species are recruiting regularly in the lower lake, some differences in stock structure were apparent in 2021 compared to earlier surveys. In particular, fewer younger and smaller roach were captured in 2021 when compared to previous surveys and 4 year old roach were the most abundant cohort. Similarly, fewer younger perch were captured in the survey nets in 2021. While the absence of 0+ perch (in common with previous surveys of the lake) can be attributed to the timing of the survey (i.e. when few 0+ group fish were available to the nets) no 1+ perch were recorded, and 4 year old perch were the most abundant cohort in the sample aged.

The roach x bream hybrid population, which requires both parent species to spawn (Hayden *et al.*, 2010), appears to be recruiting infrequently in the lower lake. Few smaller or younger roach x bream hybrids were recorded in Lower Lough Corrib in 2021 compared to previous surveys.

Upper Lough Corrib:

A total of seven fish species and one type of hybrid were recorded on Upper Lough Corrib in June/July 2021.

Numbers (CPUE) of brown trout have fluctuated across the survey periods and no obvious trend in population status was apparent. Brown trout ranged in age from 1+ to 9+. Five year old fish were the most abundant age group captured, and fewer smaller and younger fish were recorded in 2021 when compared to earlier surveys of the lake. Length at age analyses revealed that brown trout in the lake exhibit a fast rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

Perch and roach were the dominant fish species in terms of abundance and biomass captured during the survey. In contrast to Lower Lough Corrib, perch made up a greater proportion of overall fish abundance and biomass than roach. These species have together been the most abundant species in the lake across all survey periods and both species are recruiting regularly to the lake. No clear populations trends were apparent in perch populations, which were dominated by two and three year old fish in 2021. While caution should be exercised in interpreting an apparent declining trend in roach numbers, fewer smaller and younger cohorts were recorded in 2021 when compared to earlier surveys.

Roach x bream hybrids are also recruiting infrequently in the upper lake, where many year classes were missing from the population in 2021.
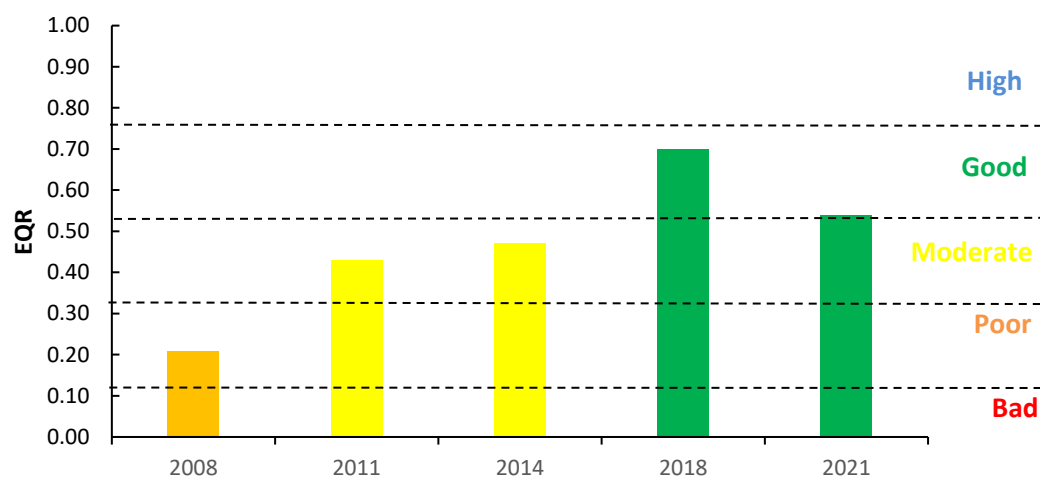
Ecological status

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, Lower Lough Corrib has been assigned an ecological status of Good for 2021. In previous years Lower Lough Corrib was assigned Poor fish ecological status in 2008, Moderate status in 2011 and 2014 and Good status in 2018 (Figure 4.1a).

Upper Lough Corrib has also been assigned an ecological status of Good based on the fish populations present. In previous years Upper Lough Corrib was assigned poor status in 2011 and Good fish ecological status in all other survey years (Figure 4.1b).

In the 2013 to 2018 surveillance monitoring reporting period, the EPA assigned Lower and Upper Lough Corrib an overall ecological status of Good.

Figure 4.1a. Fish ecological status of Lower Lough Corrib, 2008 to 2021.
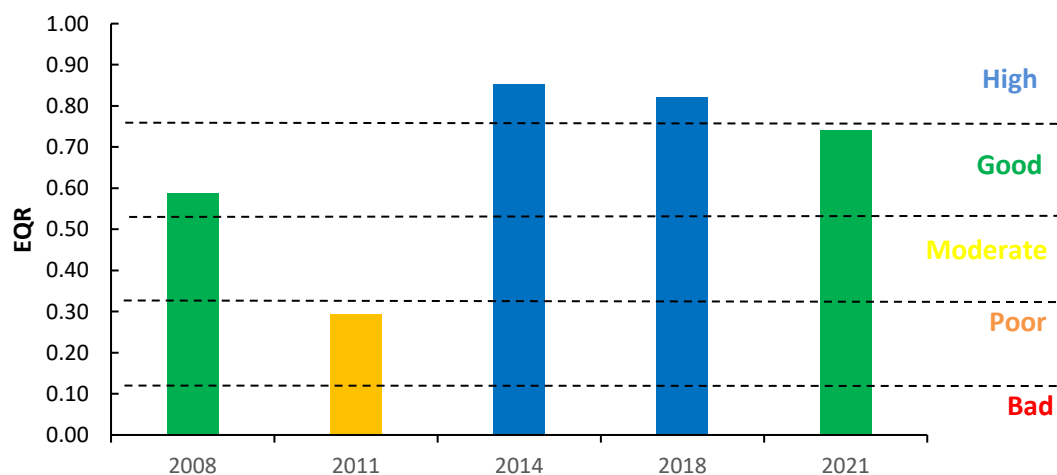
Figure 4.1b. Fish ecological status of Upper Lough Corrib, 2008 to 2021.

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