

# National Research Survey Programme

## Lakes 2018

### Lough Cullin

IFI/2019/1-4453



Iascach Intíre Éireann  
Inland Fisheries Ireland



Inland Fisheries Ireland

National Research Survey Programme

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

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

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

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## 1.1 Introduction

Lough Cullin is a large, shallow lake situated to the west of Foxford, which is connected to Lough Conn by a narrow inlet at Pontoon, Co. Mayo (Plate 1.1, Fig. 1.1). The outflow from the lake discharges directly into the River Moy south-west of Foxford (NPWS, 2004). Lough Cullin has a surface area of 1019.3ha with a maximum depth of approximately 3m (O' Reilly, 2007). The underlying geology of the lake is mainly granite with some areas of limestone present in the southern region of the catchment (NPWS, 2004). The lake is categorised as typology class 10 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. shallow (<4m), greater than 50ha and high alkalinity (>100mg/l CaCO<sub>3</sub>).

Lough Cullin is located within the River Moy Special Area of Conservation (SAC) (NPWS, 2005). The underlying geology of the majority of the SAC is Carboniferous limestone, with areas of Carboniferous sandstone, Dalradian quartzites and schists also present. Some of the tributaries at the east and south of Lough Conn, and all inflowing to Lough Cullin are underlain by granite. The site has been selected as a candidate SAC for containing alluvial wet woodlands, raised bog, old oak woodlands (present on the shores of Lough Cullin), degraded raised bog and Rhynchosporion depressions (*Rhynchospora alba*), all priority habitats on Annex I of the E.U. Habitats Directive. This SAC has also been selected due to the presence of the following species, listed on Annex II of the same Directive – Atlantic salmon, otter, sea and brook lamprey and white-clawed crayfish (NPWS, 2005). Lough Cullin has relatively low colour and good water clarity. The phytoplankton in the lake is dominated by diatoms and blue-green algae (NPWS, 2005). Lough Cullin also supports important wintering waterfowl and is designated as a Special Protection Area, as its one of the few breeding sites for Common Scoter in Ireland (NPWS, 2005).

Lough Cullin was once regarded as one of Ireland's premier brown trout fisheries, but was often considered to be the 'poor relation' of Lough Conn. Historically, in angling terms, Lough Cullin was noted for supporting a large population of relatively small (<0.5kg) brown trout (O' Grady and Delanty, 2001). Today brown trout averaging 0.3kg to 0.45kg are often caught, with some weighing up to 1.8kg (O' Reilly 2007). The lake was also regarded as a very important salmon fishery and receives a run of salmon during the spring and summer months (NPWS, 2004; O' Reilly, 2007). In fact, all the salmon, of which there can be many, destined for Lough Conn and its inflowing rivers must pass through Lough Cullin.



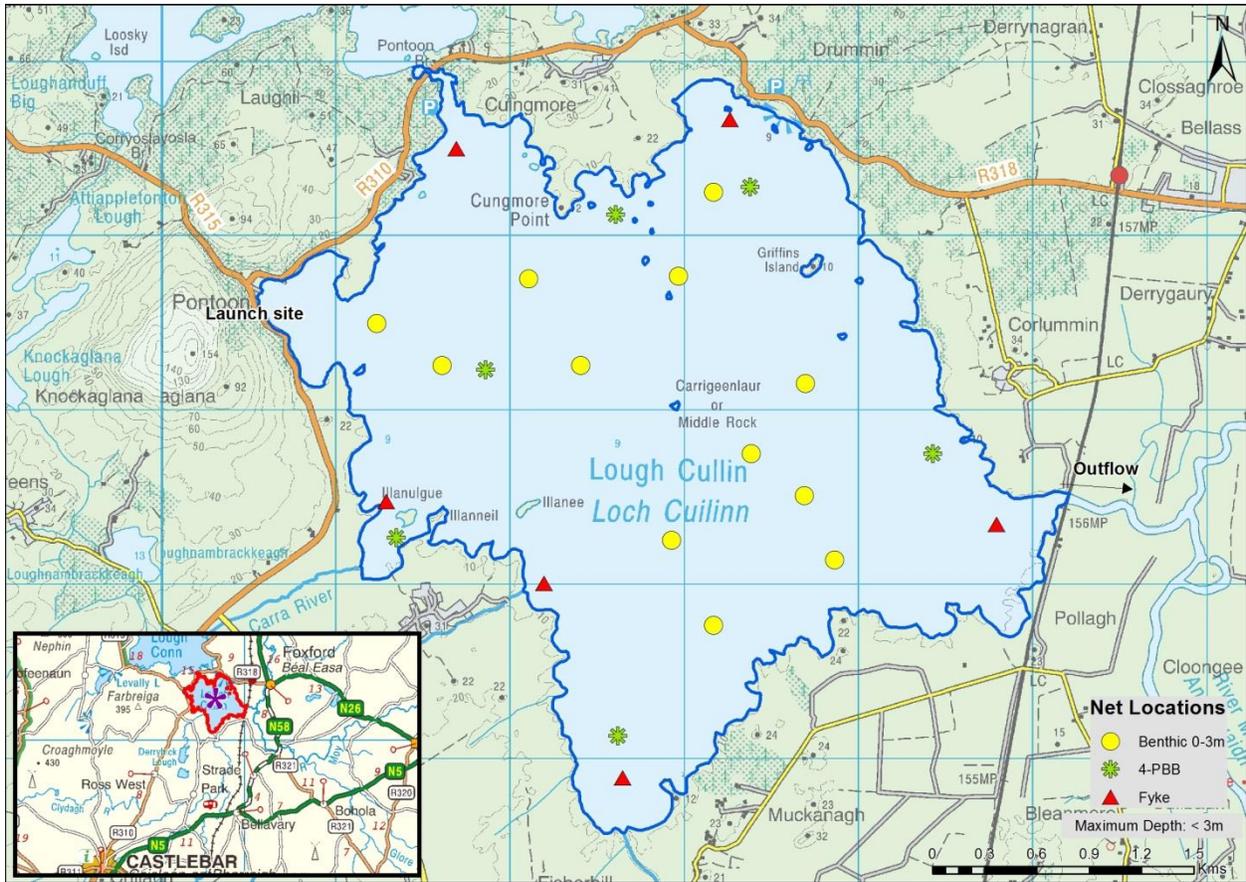
Lough Cullin was previously surveyed in 1994, 1998 and 2001 as part of a fish stock assessment by IFI's research section using seven-panel benthic braided survey gill nets (O' Grady and Delanty, 2001). These surveys revealed that the brown trout population declined between 1995 and 2001. Eutrophication problems have been evident in the lake in recent years. There was a population of rudd in the lake since the 1960s; however roach, a highly prolific non-native species, became established in the lake in the 1990s (O' Grady and Delanty, 2001).

The lake was also previously surveyed by IFI for the WFD fish monitoring programme in 2009, 2012 and 2015 (Kelly *et al.*, 2010, 2013 and 2016). During the 2015 survey, roach were found to be the dominant species present in the lake. Perch, brown trout, tench, eels and pike were also captured during the survey.

This report summarises the results of the 2018 fish stock survey carried out on the lake.



**Plate 1.1. Lough Cullin**



**Fig. 1.1. Location map of Lough Cullin showing locations and depths of each net (outflow is indicated on map)**



## 1.2 Methods

### 1.2.1 Netting methods

Lough Cullin was surveyed over three nights from the 28<sup>th</sup> to the 31<sup>st</sup> of August 2018. A total of six sets of Dutch fyke nets (Fyke), twelve benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets (12 @ 0-2.9m) were deployed in the lake (18 sites). The netting effort was supplemented using four-panel benthic braided survey gill nets (4-PBB) at six additional sites. The 4-PBB nets are composed of four 27.5m long panels each a different mesh size (55mm, 60mm, 70mm and 90mm knot to knot). Nets were deployed in the same locations as were randomly selected in the previous survey. 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 all brown trout, salmon, rudd, roach, hybrids, tench and pike. 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 then calculated to identify key prey items (Amundsen *et al.*, 1996).

$$\%FO_i = (N_i / N) \times 100$$

Where:

%FO<sub>i</sub> is the percentage frequency of prey item *i*,  
N<sub>i</sub> is the number of a particular species with prey *i* in their stomach,  
N is total number of a particular species with stomach contents.



### ***1.2.3 Biosecurity - disinfection and decontamination procedures***

Procedures are required for disinfection of equipment in order to prevent dispersal of alien species and other organisms to uninfected waters. A standard operating procedure was compiled by Inland Fisheries Ireland for this purpose (Caffrey, 2010) and is followed by staff in IFI when moving between water bodies.



## 1.3 Results

### 1.3.1 Species Richness

A total of nine fish species and one type of hybrid were recorded on Lough Cullin in August 2018, with 921 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Roach was the most abundant fish species recorded, followed by perch. Brown trout, tench, three-spined stickleback, rudd, pike, salmon, roach x bream hybrids and eels were also recorded. During the previous surveys in 2009, 2012 and 2015 the same species composition was recorded, with the exception of three-spined stickleback, which were present during the 2012 and 2018 survey but were not captured in 2009 or 2015 and pike, which were present during the 2009, 2015 and 2018 surveys but were not captured in 2012. Salmon, rudd and roach x rudd hybrids were recorded in the 2018 survey only (Kelly *et al.*, 2010, 2013 and 2016). The IFI surveys conducted in 1994, 1998 and 2001 captured salmon, sea trout, rudd and roach x rudd hybrids in previous surveys (O' Grady and Delanty, 2001).

**Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Cullin, August 2018**

Scientific name	Common name	Number of fish captured			
		BM CEN	4-PBB	Fyke	Total
<i>Rutilus rutilus</i>	Roach	580	3	19	602
<i>Perca fluviatilis</i>	Perch	243	0	8	251
<i>Salmo trutta</i>	Brown trout	20	2	0	23
<i>Tinca tinca</i>	Tench	5	3	8	16
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	2	0	9	11
<i>Scardinius erythrophthalmus</i>	Rudd	10	0	0	10
<i>Exos lucius</i>	Pike	0	1	1	2
<i>Rutilus rutilus x Scardinius erythrophthalmus</i>	Roach x rudd hybrid	2	0	0	2
<i>Salmo salar</i>	Salmon	0	2	0	1
<i>Anguilla anguilla</i>	European eel	1	0	2	3

### 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.

Roach was the dominant fish species in terms of abundance (CPUE) and biomass (BPUE) captured during the 2018 survey (Table 1.2). The mean CPUE and BPUE (excluding the 55mm, 70mm and 90mm mesh



panels of 4-PBB) for all species captured in the 2009, 2012, 2015 and 2018 surveys are illustrated in Figures 1.2 and 1.3.

The mean perch, roach and brown trout CPUE and BPUE fluctuated over the four sampling occasions. Mean perch CPUE and BPUE increased over the sampling years, while mean roach CPUE increased, but BPUE decreased (Table 1.2; Fig 1.2 and 1.3).

**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Cullin, 2018**

Scientific name	Common name	Mean CPUE ( $\pm$ S.E.) **
<i>Rutilus rutilus</i>	Roach	0.821 (0.186)
<i>Perca fluviatilis</i>	Perch	0.343 (0.098)
<i>Salmo trutta</i>	Brown trout	0.310 (0.009)
<i>Scardinius erythrophthalmus</i>	Rudd	0.014 (0.007)
<i>Tinca tinca</i>	Tench	0.014 (0.016)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.009 (0.005)
<i>Rutilus rutilus x Scardinius erythrophthalmus</i>	Roach x rudd hybrid	0.003 (0.0030)
<i>Exos lucius</i>	Pike	0.001 (0.001)
<i>Salmo salar</i>	Salmon	0.001 (0.001)
<i>Anguilla anguilla</i> *	European eel*	0.006 (0.004)*
		<b>Mean BPUE (<math>\pm</math> S.E.) **</b>
<i>Rutilus rutilus</i>	Roach	21.982 (4.938)
<i>Perca fluviatilis</i>	Perch	7.400 (2.565)
<i>Salmo trutta</i>	Brown trout	5.056 (1.793)
<i>Scardinius erythrophthalmus</i>	Rudd	0.321 (0.229)
<i>Tinca tinca</i>	Tench	4.177 (2.393)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.010 (0.006)
<i>Rutilus rutilus x Scardinius erythrophthalmus</i>	Roach x rudd hybrid	0.062 (0.062)
<i>Exos lucius</i>	Pike	3.585 (2.922)
<i>Salmo salar</i>	Salmon	2.542 (2.542)
<i>Anguilla anguilla</i> *	European eel*	0.381 (0.241)*

Note: On the rare occasion 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

\*\*CPUE and BPUE data above for all fish species except eels are not comparable to earlier surveys as extra panels were added to the 1-PBB to provide additional information on large fish.

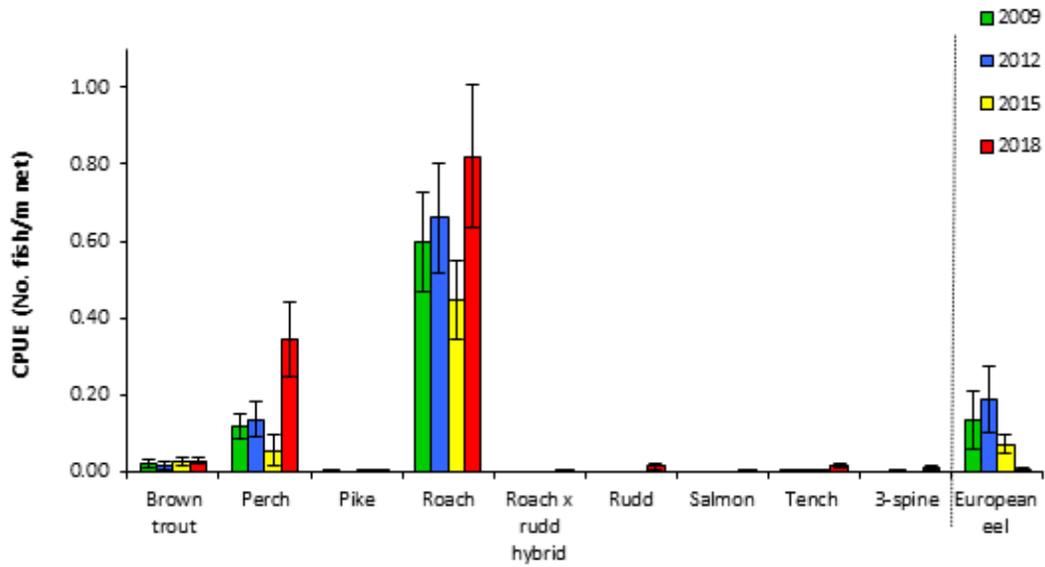


Fig. 1.2. Mean ( $\pm$ S.E.) CPUE for all fish species captured in Lough Cullin (Eel CPUE based on fyke nets only), 2009, 2012, 2015 and 2018

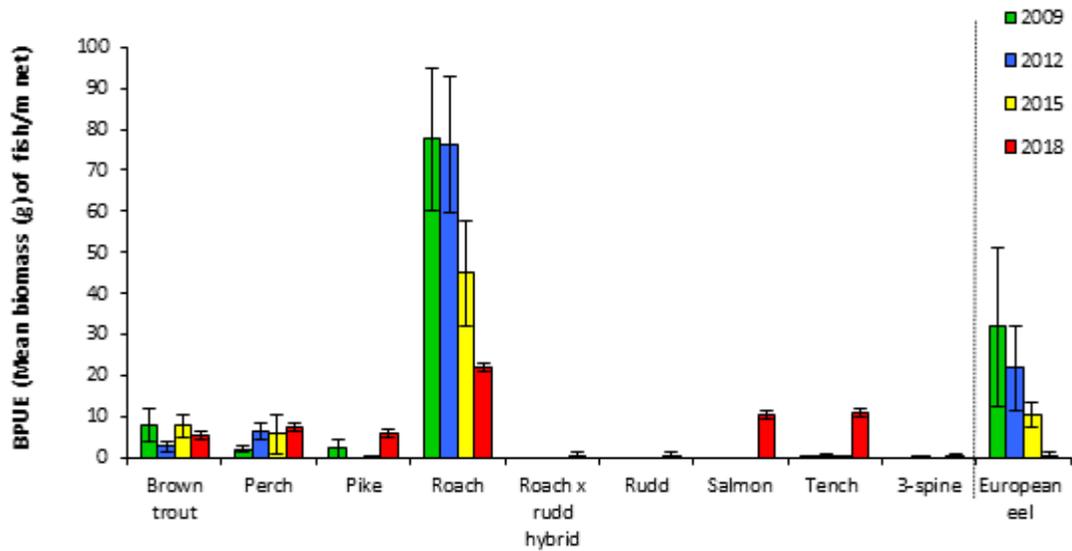


Fig. 1.3. Mean ( $\pm$ S.E.) BPUE for all fish species captured in Lough Cullin (Eel BPUE based on fyke nets only), 2009, 2012, 2015 and 2018

### 1.3.3 Length frequency distributions and growth

#### Perch

Perch captured during the 2018 survey ranged in length from 5.0cm to 24.1cm (mean = 9.1cm) (Fig.1.4) with five age classes present, ranging from 0+ to 4+ with a mean L1 of 5.9cm (Table 1.3). The dominant age class was 0+ (Fig. 1.4). Perch captured during the 2009, 2012 and 2015 surveys had a similar length and age range (Fig.1.4).

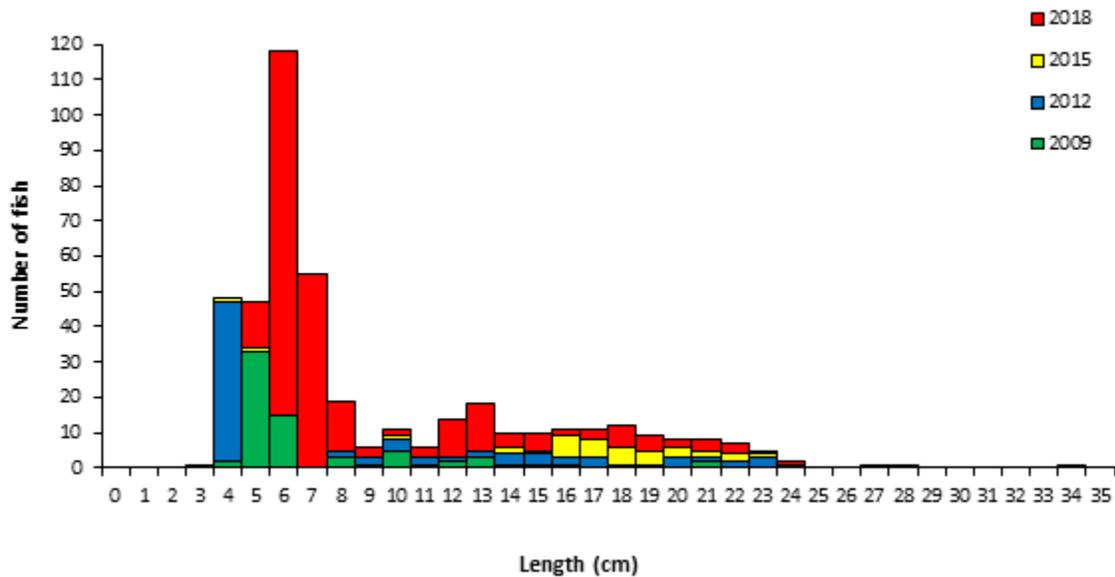


Fig. 1.4. Length frequency of perch captured on Lough Cullin, 2009, 2012, 2015 and 2018

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

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>
Mean ( $\pm$ S.E.)	5.9 (0.1)	11.0 (0.2)	16.1 (0.4)	19.0 (0.7)
N	53	31	12	6
Range	4.3-8.4	9.4-14.7	12.9-18.1	15.7-21.0



## Roach

Roach captured during the 2018 survey ranged in length from 3.3cm to 27.1cm (mean = 11.1cm) (Fig.1.5) with five age classes present, ranging from 1+ to 5+ (Table 1.4). Roach captured during the 2009, 2012 and 2015 surveys had a similar length and age range (Fig.1.5).

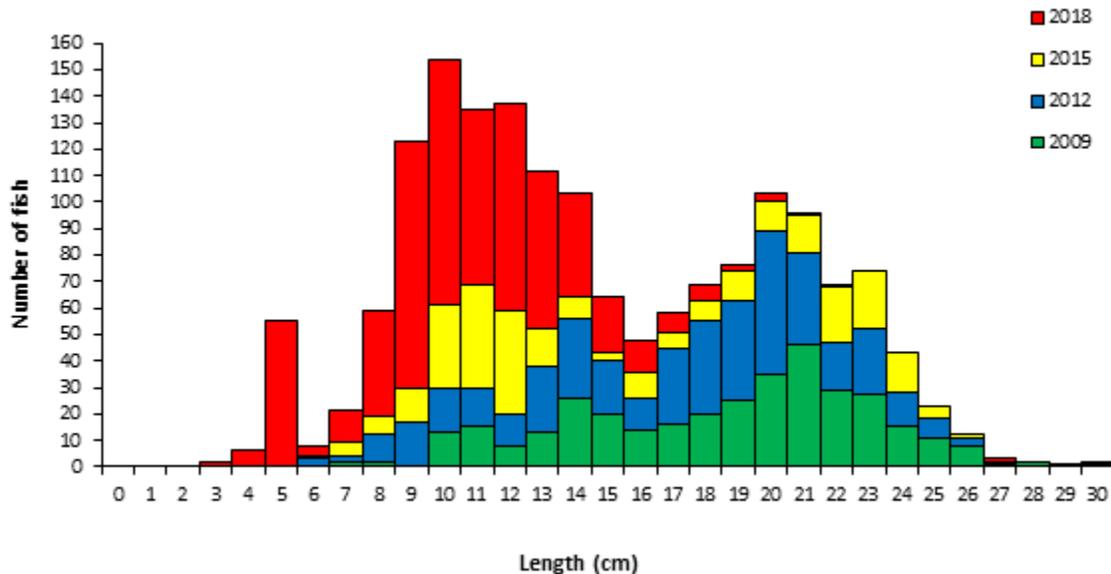


Fig. 1.5. Length frequency of roach captured on Lough Cullin, 2009, 2012, 2015 and 2018

Table 1.4. Summary age data for a sub-sample of roach captured on Lough Cullin, 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+
Mean (cm)	-	6.4	10.5	13.4	16.4	18.7
N	-	7	23	14	11	7
Range (cm)	-	5.0-8.6	7.0-14.0	10.2-16.4	15.1-18.6	16.9-20.2

## Brown trout

Brown trout captured during the 2018 survey ranged in length from 15.5cm to 36.9cm (mean = 23.1cm) (Fig.1.5) with four age classes present, ranging from 1+ to 4+ (Table 1.5). Brown trout captured during the 2009, 2012 and 2015 surveys had a similar length and age range (Fig.1.5).

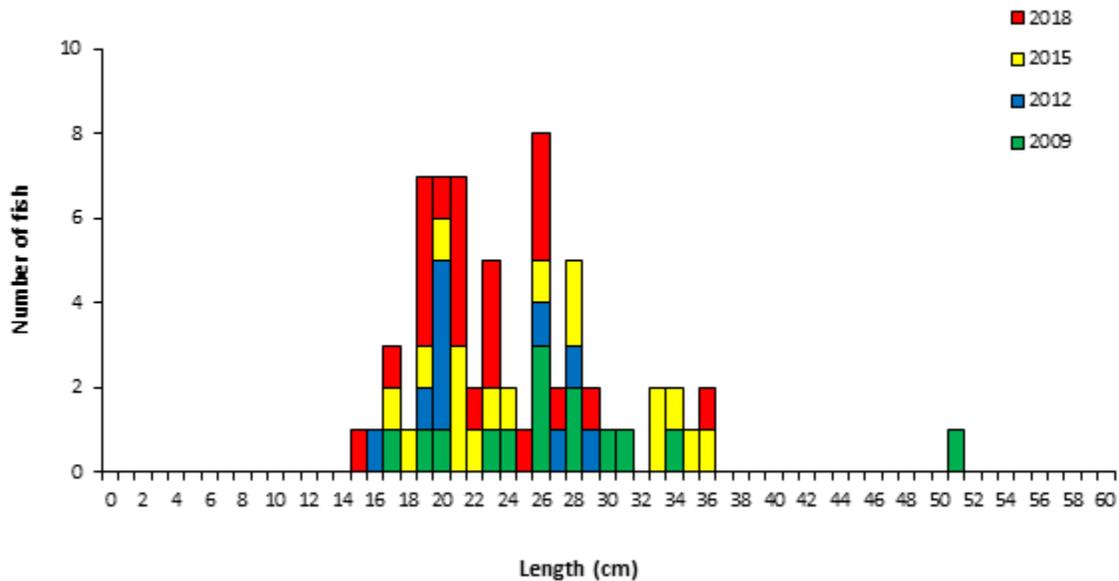


Fig. 1.5. Length frequency of brown trout captured on Lough Cullin, 2009, 2012, 2015 and 2018

Table 1.5. Summary age data for a sub-sample of brown trout captured on Lough Cullin, 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+
Mean (cm)	-	18.6	23.1	25.4	36.9	-
N	-	5	12	3	1	-
Range (cm)	-	15.5-21.4	19.6-29.9	22.9-27.1	36.9	-

### Other fish species

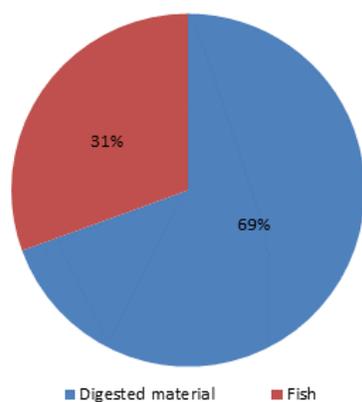
Three eels were captured during the 2018 survey and ranged in length from 33.0cm and 47.4cm. Two salmon at 58.4cm and 75.7cm were recorded, aged 2.1+ and 2.2+; three-spined stickleback ranged in length from 1.9cm to 29.cm; tench captured ranged in length from 13.1cm to 66.7cm. Two roach x rudd hybrids ranged in length from 8.4cm to 12.8cm and two pike captured were measured at 62.6cm to 81.3cm. Rudd ranged in length from 6.5cm to 20.3cm with three age classes present ranging from 0+ to 5+.

### 1.3.4 Stomach and diet analysis

Dietary analysis studies provide a good indication of the availability of food items and the angling methods that are likely to be successful. However, the value of stomach content analysis is limited unless undertaken over a long period as diet may change on a daily basis depending on the availability of food items. The stomach contents of a subsample of perch captured during the survey were examined and are presented below.

#### Perch

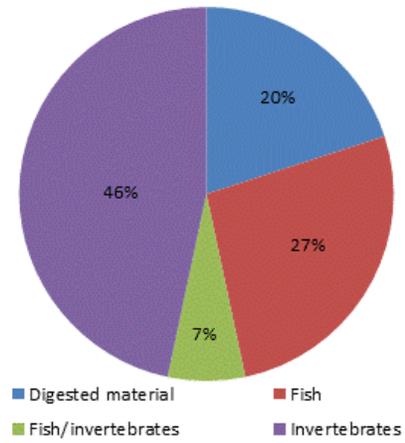
Perch initially start to feed on pelagic zooplankton. Once they reach an intermediate size they start feeding on benthic resources eventually moving on to feed on fish once they are large enough (Hjelm *et al.*, 2000). A total of 61 stomachs were examined. Of these 25 were empty. Of the remaining 36 stomachs containing food, 69% contained unidentified digested material and 31% fish (Fig. 1.6).



**Fig 1.6. Diet of perch (n=36) captured on Lough Cullin, 2018 (% FO)**

#### 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). Lough Cullin had total of 18 stomachs were examined. Of these three were found to contain no prey items. Of the remaining 15 stomachs containing food, 46% contained invertebrates, 27% fish, 20% unidentified digested material and 7% fish/invertebrates (Fig. 1.7).



**Fig 1.7. Diet of brown trout (n=15) captured on Lough Cullin, 2018 (% FO)**



#### 1.4 Summary and ecological status

A total of nine fish species and one type of hybrid were recorded on Lough Cullin in August 2018. Roach was the dominant fish species in terms of abundance and in terms of biomass captured during the 2018 survey.

Perch captured during the 2018 survey ranged in length from 5.0cm to 24.1cm, with five age classes present, ranging from 0+ to 4+, indicating reproductive success in each of the previous five years. The dominant age class was 0+.

Roach captured during the 2018 survey ranged in length from 3.3cm to 27.1cm, with five age classes present, ranging from 1+ to 5+, indicating reproductive success in five of the previous six years.

Brown trout ranged in length from 15.5cm to 58.4cm and ranged in age from 1+ to 4+, indicating reproductive success in four of the previous five 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, Lough Cullin has been assigned an ecological status of Moderate for 2018 based on the fish populations present. In previous years the lake was also assigned a fish status of Moderate in 2015 and Poor in 2009 and 2012 based on the fish populations present.

In the 2010 to 2015 surveillance monitoring reporting period, the EPA assigned Lough Cullin an overall ecological status of Poor.



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**Inland Fisheries Ireland  
3044 Lake Drive,  
Citywest Business Campus,  
Dublin 24,  
Ireland.  
D24 Y265**

**[www.fisheriesireland.ie](http://www.fisheriesireland.ie)  
[info@fisheriesireland.ie](mailto:info@fisheriesireland.ie)**

**+353 1 8842 600**