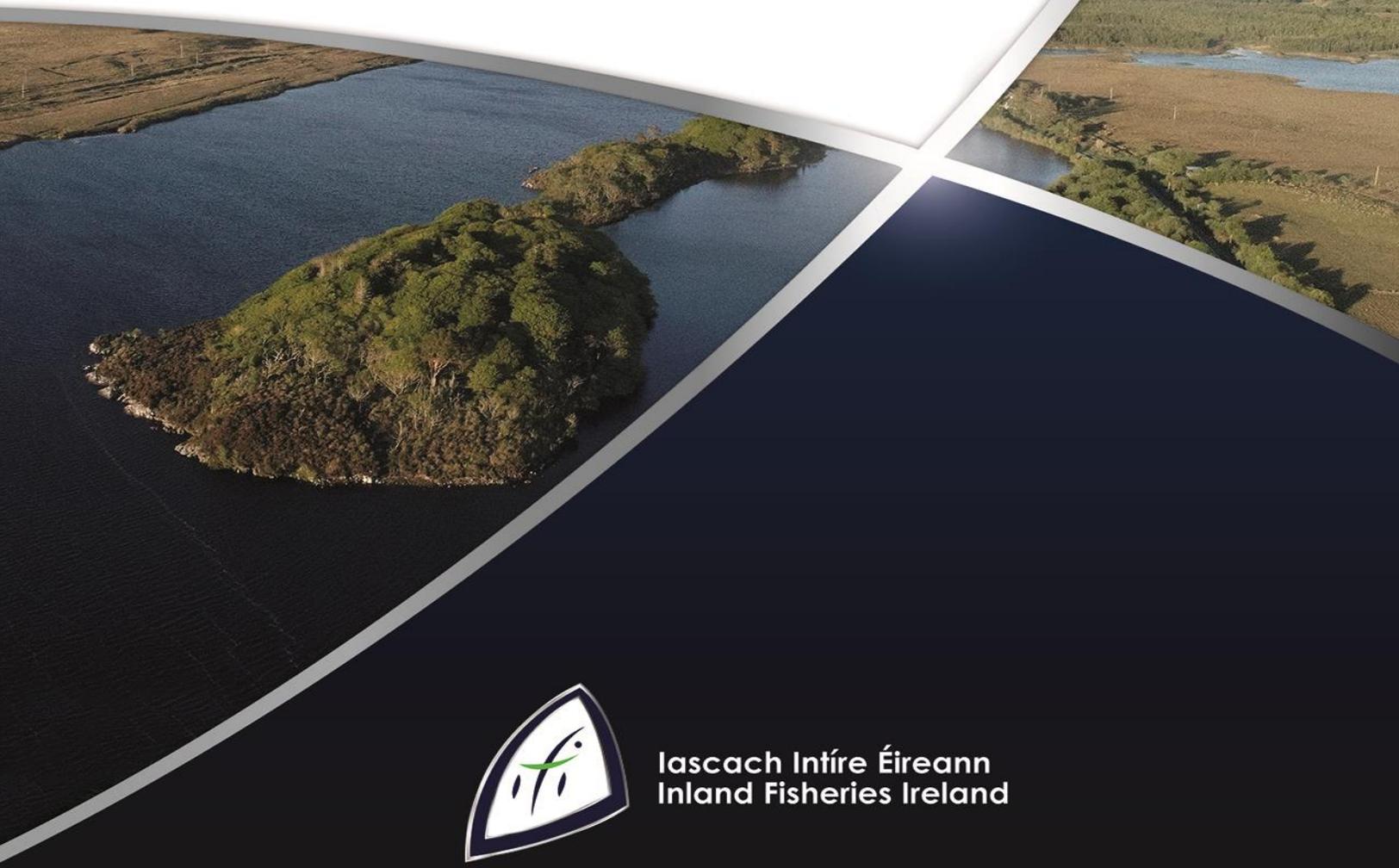


# National Research Survey Programme

## Lakes 2019

### Lettercraffroe Lough

IFI/2020/1-4498



Iascach Intíre Éireann  
Inland Fisheries Ireland



Inland Fisheries Ireland

National Research Survey Programme

**Fish Stock Survey of Lettercraffroe Lough,  
August 2019**

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

CITATION: Corcoran, W., Connor, L., Bateman, A., Cierpial, D., Coyne, J., McLoone, P., Twomey, C., Rocks, K., Gordon, P., Lopez, S., Matson, R., O' Briain, R., and Kelly, F.L. (2020) Fish Stock Survey of Lettercraffroe Lough, August 2019. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

Cover photo: Aerial view of Lough Shindilla, Co. Galway © Inland Fisheries Ireland

© Inland Fisheries Ireland 2020



## **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 project from the Department of Communications, Climate Action and Environment for 2019.

*The report includes Ordnance Survey Ireland data reproduced under OSi Copyright Permit No. MP 007508.*

*Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright.  
© Ordnance Survey Ireland, 2019.*



## 1.1 Introduction

Lettercraffroe Lough is located 6km south-west of Oughterard, Co. Galway on a tributary of the Owenriff River which flows through the town and into Lough Corrib (Plate 1.1, Fig. 1.1). It has a surface area of 82ha, a mean depth of 2.86m and a maximum depth of 17.9m (WRFB, 2006). The lake is categorised as typology class 2 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. shallow (<4m), greater than 50ha and low alkalinity (<20mg/l CaCO<sub>3</sub>). Lettercraffroe Lough is an excellent example of a lowland oligotrophic lake, an Annex 1 habitat. It holds a large stock of brown trout, ranging in size from 0.23kg to 0.34kg (O' Reilly, 2007).

Lettercraffroe Lough is situated within the Connemara Bog Complex, a large Special Area of Conservation (SAC) site that encompasses a wide range of habitats, including extensive tracts of blanket bog, heath, woodland, lakes, rivers and streams. The Connemara Bog Complex is underlain by various Galway granites, with small areas along the northern boundary made up of schist and gneiss (NPWS, 2005). The main perceived threats within the SAC are peat cutting, overgrazing and afforestation. Forestry affects habitat uniformity, lake and river catchments, nesting and feeding habitats for animals, and landscape integrity (NPWS, 2005).

The western and southern shores of the lake are heavily forested and there have previously been problems with phosphorus loading in the lake, which reached critical levels in the summer of 2004 (FIE, 2010). Water samples have since indicated that phosphorus levels are decreasing in the lake (Coillte, *pers. comm.*). A revised forestry management plan was devised for the Owenriff catchment in 2010 (Coillte, 2010) and more recently a draft plan was compiled specifically for freshwater pearl mussel *Margaritifera margaritifera* catchments, including the Owenriff, to reduce the impact of forestry operations on the species (DAFM, 2018).

Lettercraffroe Lough was previously surveyed in 2007, 2010, 2013 and 2016 as part of the WFD fish in lakes surveillance monitoring programme (Kelly and Connor, 2007 and Kelly *et al.*, 2011, 2014 and 2017). During the 2016 survey roach were found to be the dominant species present in the lake. Brown trout, European eel and three-spined stickleback were also recorded.

This report summarises the results of the 2019 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme.



Plate 1.1. Lettercraffroe Lough

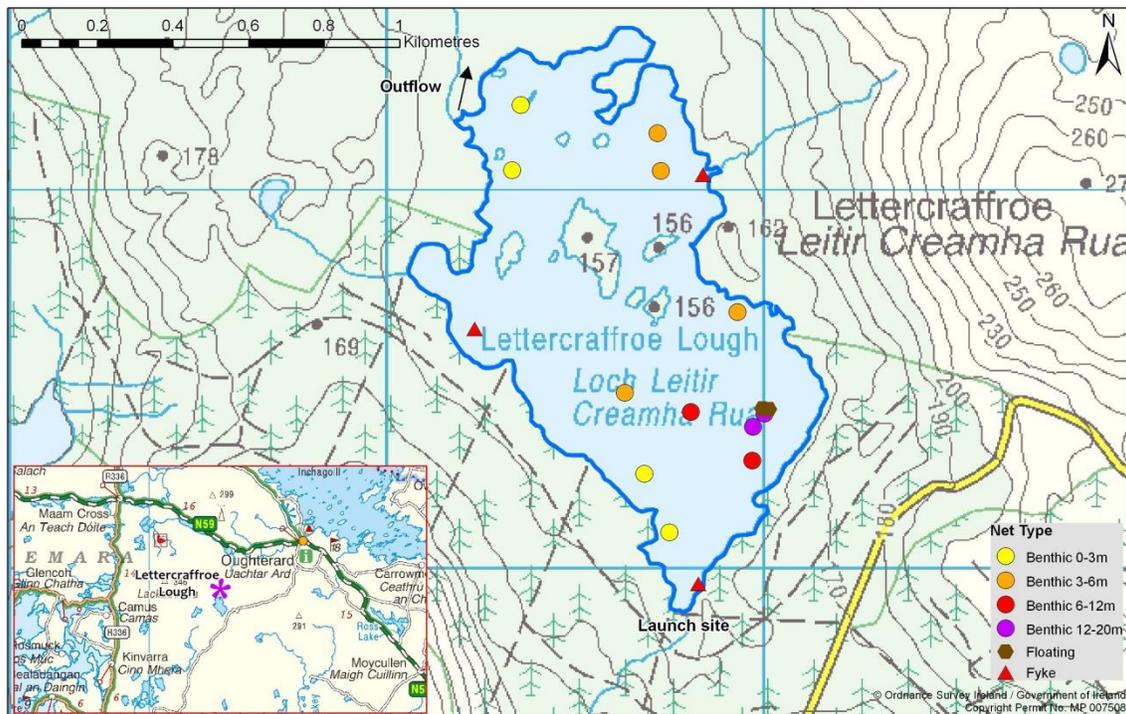


Fig. 1.1. Location map of Lettercraffroe Lough showing net locations and depths of each net (outflow is indicated on map)



## 1.2 Methods

### 1.2.1 Netting methods

Lettercraffroe Lough was surveyed over one night on the 14<sup>th</sup> of August 2019. A total of three sets of Dutch fyke nets, 12 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (4 @ 0-2.9m, 4 @ 3-5.9m, 2 @ 6-11.9m and 2 @ 12-19.9m) and two floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed randomly in the lake (17 sites). Nets were deployed in the same locations as were randomly selected in previous surveys. 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 were measured and weighed on site and scales were removed from all roach and brown trout. 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

### 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 four fish species were recorded in Lettercraffroe Lough in August 2019, with 196 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Roach was the most common fish species recorded, followed by brown trout. Three-spined stickleback and eels were also recorded. During the previous surveys in 2007, 2010, 2013 and 2016 the same species composition was recorded with the exception of eels which were not recorded in 2013 (Kelly and Connor, 2007 and Kelly *et al.*, 2011, 2014 and 2017).

**Table 1.1. Number of each fish species captured by each gear type during the survey on Lettercraffroe Lough, August 2019**

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Rutilus rutilus</i>	Roach	137	11	0	148
<i>Salmo trutta</i>	Brown trout	40	0	3	43
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0	0	4	4
<i>Anguilla anguilla</i>	European eel	0	0	1	1

### 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 2010, 2013, 2016 and 2019 surveys are summarised in Table 1.2 and illustrated in Figures 1.2 and 1.3.

#### Roach

Roach was the dominant species in terms of abundance (CPUE) and biomass (BPUE). The mean CPUE and BPUE showed a steady increase over the course of the five surveys (Table 1.2; Fig 1.2 and 1.3). Both figures did decrease in 2016 before increasing again in 2019. The highest recorded figure for both CPUE and BPUE was observed in 2019.



## **Brown trout**

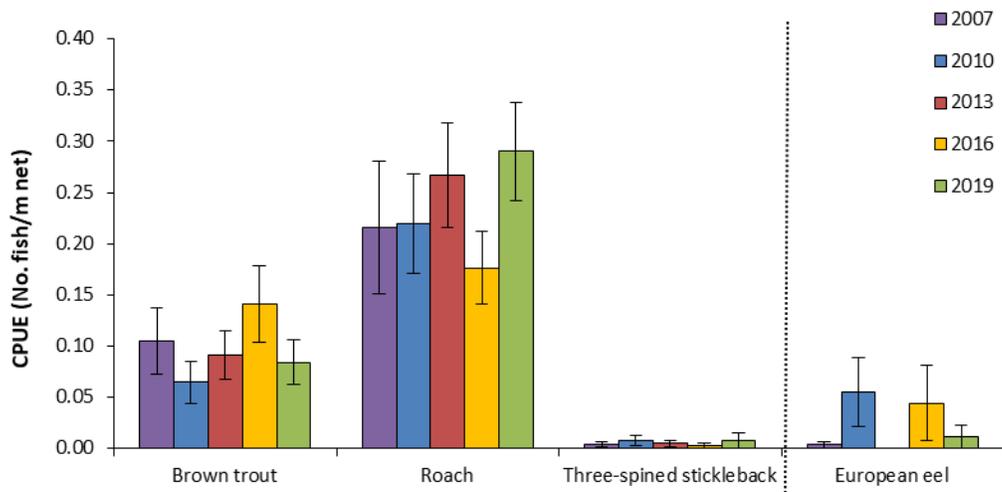
The mean brown trout CPUE and BPUE fluctuated between the five surveys (Table 1.2; Fig 1.2 and 1.3). The CPUE and BPUE have decreased slightly between 2007 and 2019. The highest CPUE was recorded in 2016 and the highest BPUE recorded in 2007.

**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lettercraffroe Lough, 2007, 2010, 2013, 2016 and 2019**

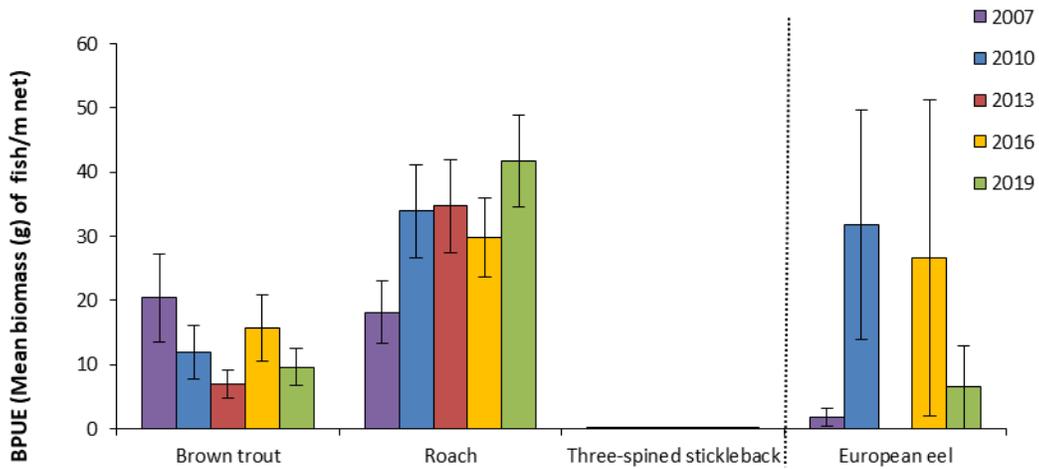
Scientific name	Common name	2007	2010	2013	2016	2019
<b>Mean CPUE</b>						
<i>Rutilus rutilus</i>	Roach	0.215 (0.064)	0.220 (0.049)	0.267 (0.051)	0.176 (0.035)	0.290 (0.048)
<i>Salmo trutta</i>	Brown trout	0.104 (0.032)	0.065 (0.020)	0.091 (0.024)	0.141 (0.038)	0.084 (0.022)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.004 (0.002)	0.008 (0.005)	0.005 (0.003)	0.003 (0.003)	0.008 (0.008)
<i>Anguilla anguilla</i> *	European eel*	0.004 (0.003)	0.056 (0.034)	-	0.044 (0.036)	0.011 (0.011)
<b>Mean BPUE</b>						
<i>Rutilus rutilus</i>	Roach	18.100 (4.846)	33.925 (7.243)	34.687 (7.193)	29.766 (6.110)	41.706 (7.135)
<i>Salmo trutta</i>	Brown trout	20.383 (6.838)	11.833 (4.192)	6.888 (2.192)	15.633 (5.180)	9.607 (2.823)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.016 (0.010)	0.010 (0.006)	0.013 (0.007)	0.004 (0.004)	0.008 (0.008)
<i>Anguilla anguilla</i> *	European eel*	1.730 (1.356)	31.861 (17.870)	-	26.600 (24.659)	6.478 (6.478)

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



**Fig. 1.2. Mean ( $\pm$ S.E.) CPUE for all fish species captured in Lettercraffroe Lough (Eel CPUE based on fyke nets only), 2007, 2010, 2013, 2016 and 2019**



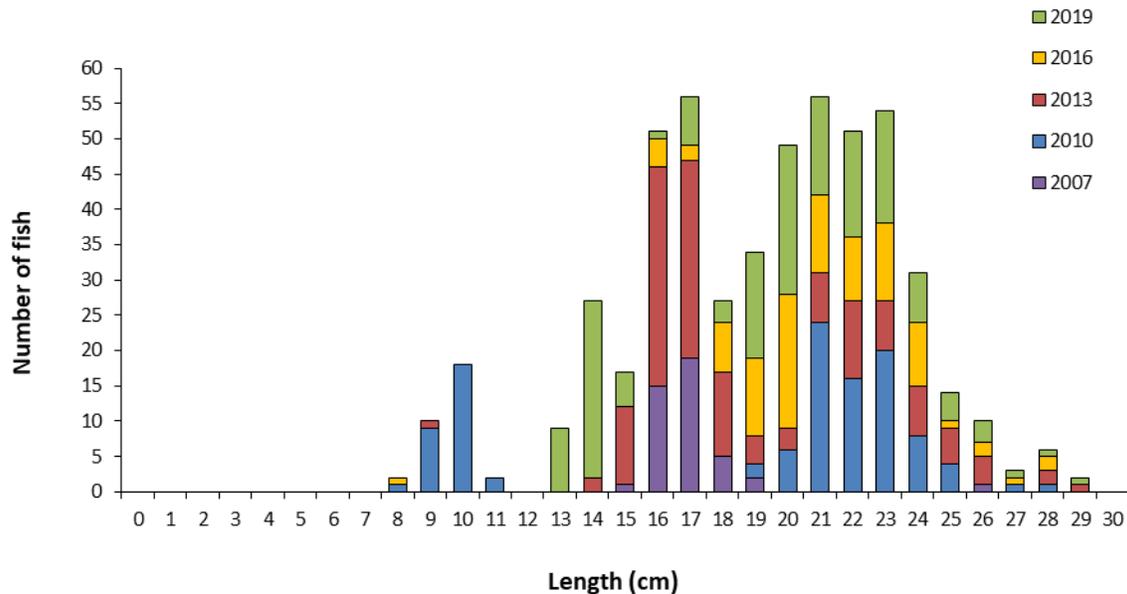
**Fig. 1.3. Mean ( $\pm$ S.E.) BPUE for all fish species captured in Lettercraffroe Lough (Eel CPUE based on fyke nets only), 2007, 2010, 2013, 2016 and 2019**



### 1.3.3 Length frequency distributions and growth

#### Roach

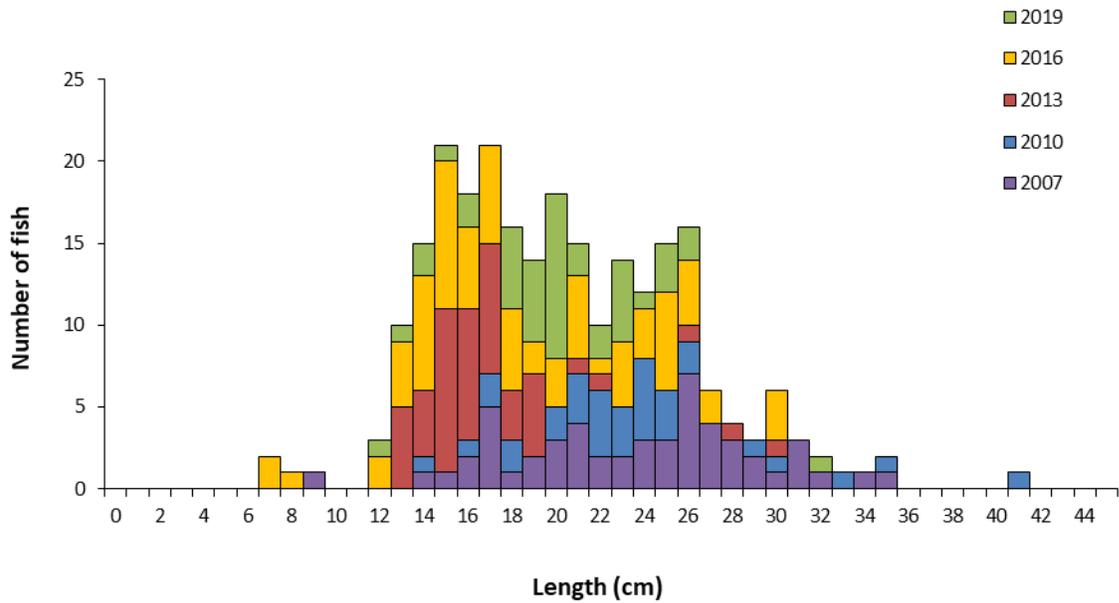
Roach captured during the 2019 survey ranged in length from 13.9cm to 29.8cm (mean = 19.8cm) (Fig. 1.4). Ten age classes were present, ranging from 2+ to 12+. The dominant age class was 7+. Roach captured during previous surveys had similar length ranges to the 2019 survey apart from 2010 when some smaller fish were captured compared to other surveys



**Fig. 1.4. Length frequency of roach captured on Lettercraffroe Lough, 2007, 2010, 2013, 2016 and 2019**

#### Brown trout

Brown trout captured during the 2019 survey ranged in length from 12.6cm to 32.1 (mean = 20.7cm) (Fig. 1.5). Four age classes were present, ranging from 1+ to 4+, with a mean L1 of 7.1cm (Table 1.3). The dominant age class was 2+ (Fig. 1.5). Mean brown trout L4 in 2019 was 27.7cm indicating a slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.3). Brown trout captured during 2019 had a narrower length and age range to previous surveys. Smaller fish were captured in 2016 and the largest trout captured was in 2010 (Fig.1.5).



**Fig. 1.5. Mean ( $\pm$ S.E.) brown trout length (cm) at age for Lettercraffroe Lough, August 2019**

	<b>L<sub>1</sub></b>	<b>L<sub>2</sub></b>	<b>L<sub>3</sub></b>	<b>L<sub>4</sub></b>	<b>Growth Category</b>
Mean ( $\pm$ S.E.)	7.1 (0.1)	15.4 (0.2)	21.7 (0.3)	27.7	Slow
N	40	33	4	1	
Range	6.0-8.4	13.4-18.3	21.1-22.4	-	

### **Other fish species**

One European eel was captured during the 2019 survey measuring 71.1cm. Four three-spined stickleback were recorded ranging in length from 4.2cm to 5.0cm.

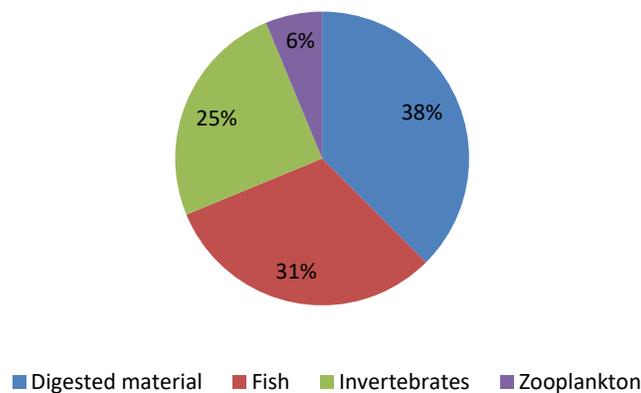


### 1.3.4 Stomach and diet analysis

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 sub-sample of brown trout captured during the survey were examined and are presented below.

#### **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). A total of 24 stomachs were examined. Of these eight were found to contain no prey items. Of the remaining 16 stomachs containing food, 38% contained unidentified digested material, 6% zooplankton, 25% invertebrates and 31% fish (Fig. 1.6).



**Fig 1.6. Diet of brown trout (n=16) captured on Lettercraffroe Lough, 2019 (% FO)**



#### 1.4 Summary and ecological status

A total of four fish species were recorded in Lettercraffroe Lough in August 2019. Roach was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2019 survey.

The mean roach CPUE and BPUE recorded in the 2019 survey was higher than that recorded in 2016. Ten age classes were present, ranging from 2+ to 12+. The dominant age class was 7+.

The mean brown trout CPUE and BPUE fluctuated over the course of the five surveys undertaken since 2018, but was higher in 2019 than 2013 and 2016. Brown trout ranged in age from 0+ to 4+, indicating reproductive success in the previous five years. The dominant age class was 3+. Length at age analyses revealed that brown trout in the lake exhibit a slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

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, Lettercraffroe Lough has been assigned an ecological status of Good for 2019 based on the fish populations present. In previous years the lake was also assigned a fish status of Good in 2007, 2010, 2013 and 2016.

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



## 1.5 References

- Amundsen, P.A., Gabler H.M. and 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.
- Coillte (2010) [http://www.coillte.ie/fileadmin/user\\_upload/FMPs/fmp\\_pdf/gy22\\_derrada.pdf](http://www.coillte.ie/fileadmin/user_upload/FMPs/fmp_pdf/gy22_derrada.pdf) [accessed on April 20th 2010].
- 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.
- DAFM (2018) *Draft Plan for Forests and Freshwater Pearl Mussel in Ireland: Consultation Document. Appendix F, Priority 8 FPM Catchments*. Department of Agriculture, Forestry and Marine.
- FIE (2010) Friends of the Irish Environment  
<http://www.friendsoftheirishenvironment.net/fnn/index.php?action=view&id=200> [accessed on April 20<sup>th</sup> 2010]. Kelly, F. and Connor, L. (2007) *WFD Surveillance Monitoring - Fish in Lakes 2007*. Central Fisheries Board Report.
- 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.
- Kelly, F.L., Harrison A., Connor, L., Morrissey, E., Wogerbauer, C., Matson, R., Feeney, R., O'Callaghan, R. and Rocks, K. (2011) *Water Framework Directive Fish Stock Survey of Lettercraffroe Lough, September 2010*. Inland Fisheries Ireland.
- Kelly, F.L., Harrison, A.J., Allen, M., Connor, L. and Rosell, R. (2012) 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., Matson, R., Feeney, R. and Rocks, K. (2014) *Water Framework Directive Fish Stock Survey of Lettercraffroe Lough, September 2013*. Inland Fisheries Ireland.
- Kelly, F.L., Connor, L., Coyne, J., Morrissey, E., Corcoran, W., Cierpial, D., Delanty, K., McLoone, P., Matson, R., Gordon, P., O' Briain, R., Rocks, K., O' Reilly, S., Kelly K., Puttharee, D., McWeeney, D.,



Robson S. and Buckley, S. (2017) *Fish Stock Survey of Lettercraffroe Lough, September 2016*. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

Kennedy, M. and Fitzmaurice, P. (1971) Growth and Food of Brown Trout *Salmo trutta* (L.) in Irish Waters. *Proceedings of the Royal Irish Academy*, **71 (B) (18)**, 269-352.

NPWS (2005) *Site synopsis: Connemara Bog Complex. Site code: 2034* Site Synopsis report, National Parks and Wildlife Service.

O' Grady, M.F. (1981) *A Study of Brown Trout (Salmo trutta L.) Populations in Selected Irish Lakes*. Ph.D. Thesis, National University of Ireland.

O' Reilly, P (2007) *Loughs of Ireland. A Flyfisher's Guide*. 4th edition. Merlin Unwin Books.

WRFB (2006) *Bathymetric survey of lakes in the Western Regional Fisheries Board Area. A Water Framework Directive Project, 2006*.

**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**