

# National Research Survey Programme

## Lakes 2020

### Glen Lough

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Iascach Intíre Éireann  
Inland Fisheries Ireland



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National Research Survey Programme

**Fish Stock Survey of Glen Lough,  
August 2020**

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

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## 1.1 Introduction

Glen Lough is located in the Lackagh catchment, approximately 5km east of Creeslough, Co. Donegal, with Glen village at the northern end of the lake (Plate 1.1, Fig. 1.1). The lake is located approximately 1.5km upstream of the tidal limit of the Lackagh River and approximately 7km downstream of Lough Beagh (Glenveagh) on the Owencarrow River. The lake is situated at an altitude of 27m a.s.l., has a surface area of 168ha, a mean depth of 4.9m and a maximum depth of 21m. Glen Lough falls into typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (>4m), greater than 50ha and low alkalinity (<20mg/l CaCO<sub>3</sub>) (EPA, 2005). The geology of the area is predominantly granite, felsite and other intrusive rocks rich in silica.

Glen Lough is encompassed within the Cloghernagore Bog and Glenveagh National Park Special Area of Conservation (SAC). The site supports populations of Atlantic salmon and freshwater pearl-mussel (*Margaritifera margaritifera*); species that are both afforded protected status in Ireland and listed on Annex II of the EU Habitats Directive (NPWS, 2005). Several bird species listed on the Red Data Book and on Annex I of the EU Birds Directive breed within the SAC. Turf cutting and afforestation are the main threats to the SAC, with erosion, over-grazing by sheep and deer and burning also having an impact (NPWS, 2005).

Glen Lough used to be one of the great spring salmon lakes; however, it never really recovered from the effects of the salmon disease Ulcerative Dermal Necrosis (UDN) in the 1960s (O' Reilly, 2007). In 1970 an Inland Fisheries Trust survey revealed the presence of brown trout only in the lake (IFT, unpublished data). A conclusion of the survey was that there was limited spawning in the upper reaches of the tributaries and impassable waterfalls restricting spawning to the lower reaches of the system. The lake is now best known as a sea trout fishery, even though numbers have declined (O' Reilly, 2007).

Glen Lough was previously surveyed in 2006 as part of the NSSHARE Fish in Lakes Project (Kelly *et al.*, 2007). In 2010, 2013 and 2016 Glen Lough was surveyed as part of the WFD monitoring programme (Kelly *et al.*, 2011 and 2014 and 2017). During the 2016 survey brown trout were found to be the dominant species present in the lake. Arctic char, sea trout, eels, minnow and salmon were also captured.

This report summarises the results of the 2020 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme.



Plate 1.1. Glen Lough

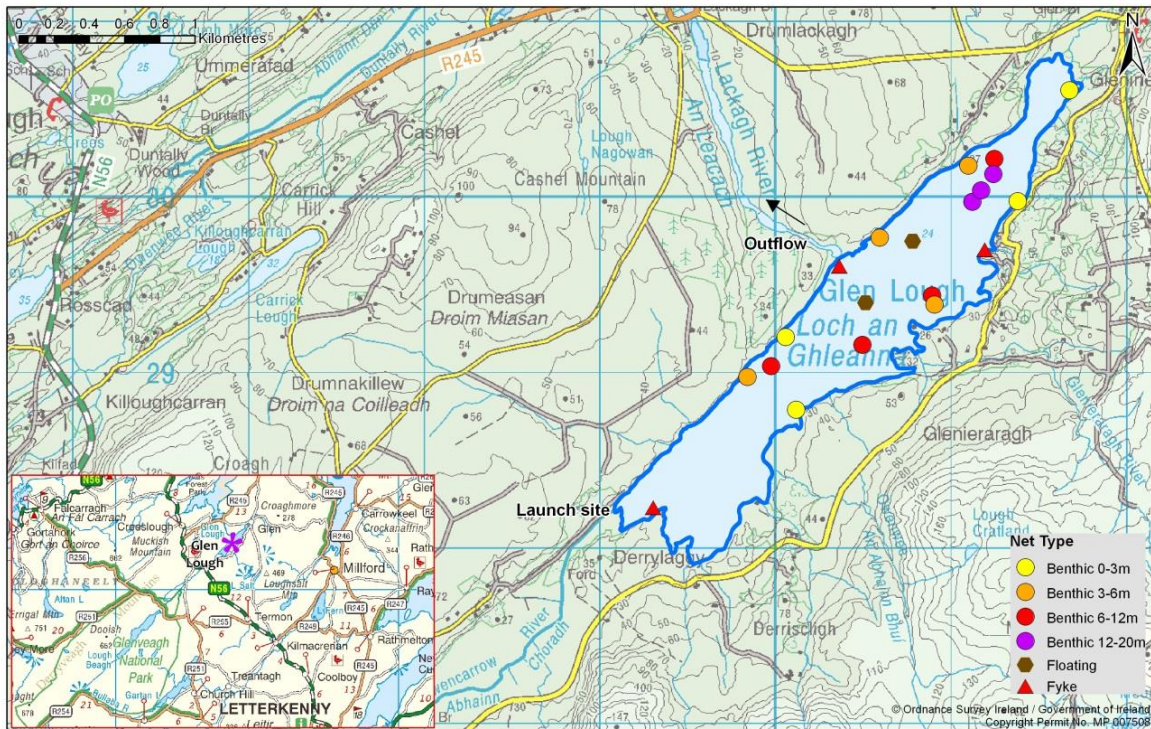


Fig. 1.1. Location map of Glen Lough showing net locations and depths of each net (outflow is indicated on map)

## 1.2 Methods

### 1.2.1 Netting methods

Glen Lough was surveyed over two nights from the 26<sup>th</sup> to the 28<sup>th</sup> of August 2020. A total of three sets of Dutch fyke nets, 15 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, 4 @ 6-11.9m and 3 @ 12-19.9m) and two floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (20 sites). 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 were measured and weighed on site and scales were removed from all brown trout, sea trout, Arctic char and salmon. 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 (%O) 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.

### 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 species were recorded on Glen Lough in August 2020, with 160 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most common fish species recorded. Arctic char, minnow and eels and were also recorded. During the previous surveys in 2006, 2010, 2013 and 2016 the same species composition was recorded except for sea trout which were recorded in 2006, 2013 and 2106 and salmon which were recorded in 2006, 2010, 2013 and 2016 (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 Glen Lough, August 2020**

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Salmo trutta</i>	Brown trout	68	3	4	75
<i>Salvelinus alpinus</i>	Arctic char	33	9	0	42
<i>Phoxinus phoxinus</i>	Minnow	34	0	0	34
<i>Anguilla anguilla</i>	European eel	0	0	9	9

### 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 2006, 2010, 2013 and 2016 surveys are summarised in Table 1.2. Mean CPUE and BPUE for all species is illustrated in Figure 1.2 and 1.3.

#### **Brown trout**

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE). Mean brown trout CPUE and BPUE remained relatively stable over the five sampling occasions, with a peak in 2013. (Table 1.2; Fig 1.2 and 1.3).



## Arctic char

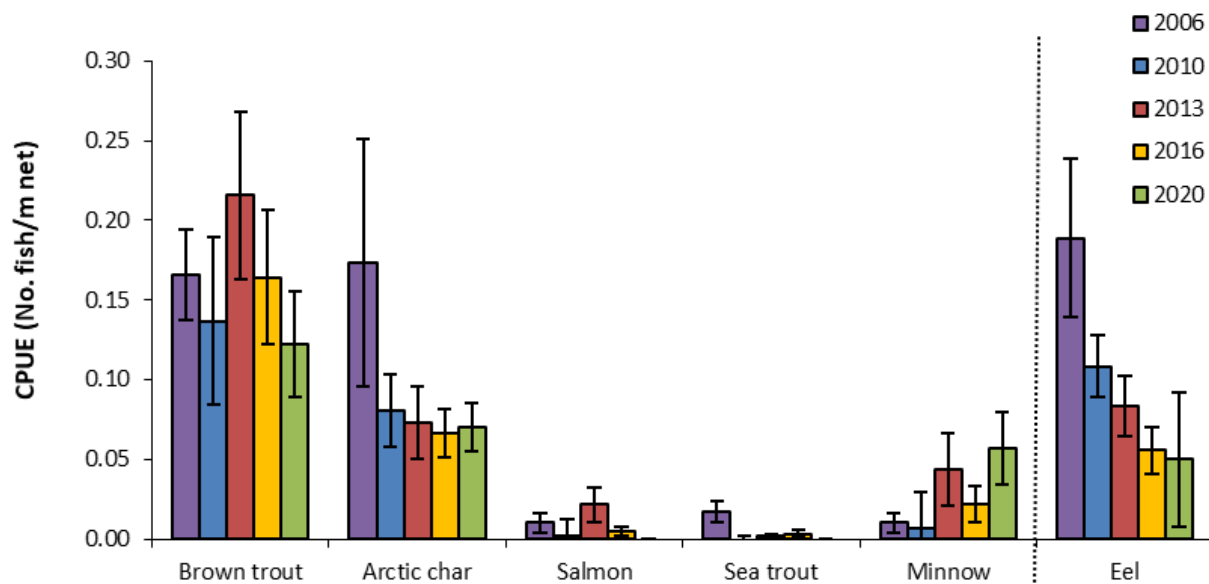
The mean Arctic char CPUE and BPUE has been relatively stable over the most recent surveys (2010-2020). Highest abundance and biomass figures for this species were recorded in the 2006 survey (Table 1.2; Fig 1.2 and 1.3).

**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Glen Lough, 2006 to 2020**

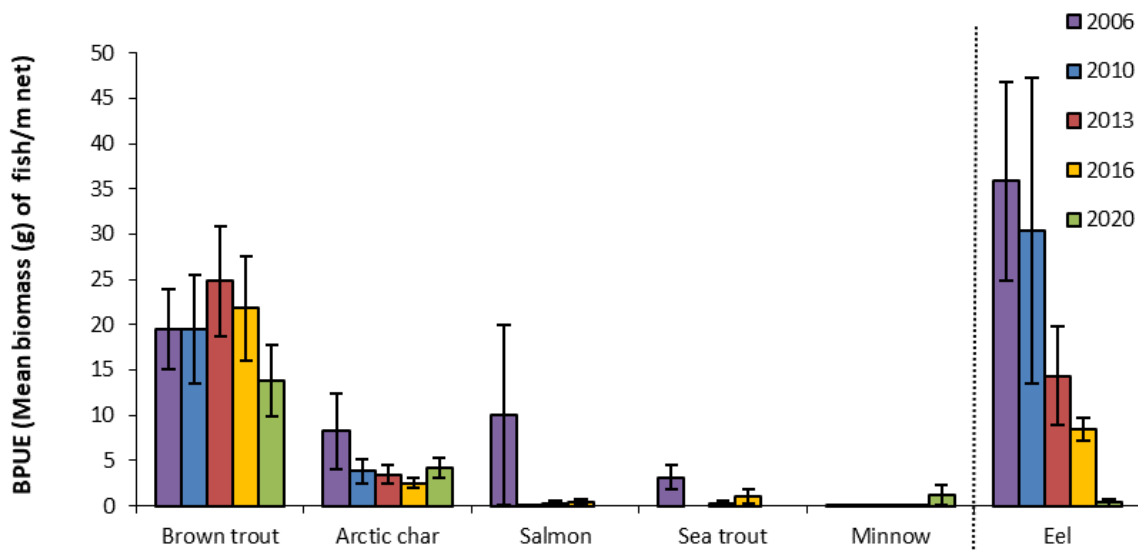
Scientific name	Common name	2006	2010	2013	2016	2020
<b>Mean CPUE</b>						
<i>Salmo trutta</i>	Brown trout	0.165 (0.288)	0.137 (0.033)	0.216 (0.053)	0.164 (0.042)	0.122 (0.033)
	Sea trout	0.017 (0.006)	-	0.002 (0.002)	0.003 (0.002)	-
<i>Salvelinus alpinus</i>	Arctic char	0.173 (0.078)	0.081 (0.027)	0.073 (0.023)	0.067 (0.015)	0.070 (0.015)
<i>Phoxinus phoxinus</i>	Minnow	0.010 (0.006)	0.007 (0.004)	0.043 (0.023)	0.022 (0.011)	0.057 (0.023)
<i>Salmo salar</i>	Salmon	0.016 (0.006)	0.002 (0.002)	0.022 (0.011)	0.005 (0.003)	-
<i>Anguilla anguilla</i>	European eel	0.189 (0.049)	0.108 (0.058)	0.083 (0.019)	0.056 (0.015)	0.050 (0.042)
<b>Mean BPUE</b>						
<i>Salmo trutta</i>	Brown trout	19.519 (4.372)	19.451 (6.020)	24.819 (6.069)	21.861 (5.754)	13.835 (3.976)
	Sea trout	3.122 (1.322)	-	0.307 (0.307)	1.041 (0.717)	-
<i>Salvelinus alpinus</i>	Arctic char	8.221 (4.248)	3.802 (1.334)	3.453 (1.057)	2.491 (0.545)	4.217 (1.080)
<i>Phoxinus phoxinus</i>	Minnow	0.017 (0.017)	0.019 (0.011)	0.113 (0.055)	0.069 (0.044)	1.260 (1.095)
<i>Salmo salar</i>	Salmon	10.053 (9.997)	0.013 (0.013)	0.321 (0.168)	0.384 (0.323)	-
<i>Anguilla anguilla</i>	European eel	35.887 (10.953)	30.383 (16.950)	14.317 (5.464)	8.418 (1.292)	0.362 (0.362)

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



**Fig. 1.2.** Mean ( $\pm$ S.E.) CPUE for all fish species captured in Glen Lough (Eel CPUE based on fyke nets only), 2006, 2010, 2013, 2016 and 2020



**Fig. 1.3.** Mean ( $\pm$ S.E.) BPUE for all fish species captured in Glen Lough (Eel BPUE based on fyke nets only), 2006, 2010, 2013, 2016 and 2020

### 1.3.3 Length frequency distributions and growth

#### Brown trout

Brown trout captured during the 2020 survey ranged in length from 10.0cm to 40cm (mean = 20.5cm) (Fig. 1.4). Six age classes were present, ranging from 0+ to 5+. The dominant age class was 3+ (Fig. 1.4). Mean length of trout after their first year (L1) was estimated at 6.6cm. Mean brown trout L4 in 2020 was 23.6cm 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 all surveys had broadly similar length and age ranges. Occasional larger and older fish have been recorded (Fig.1.4).

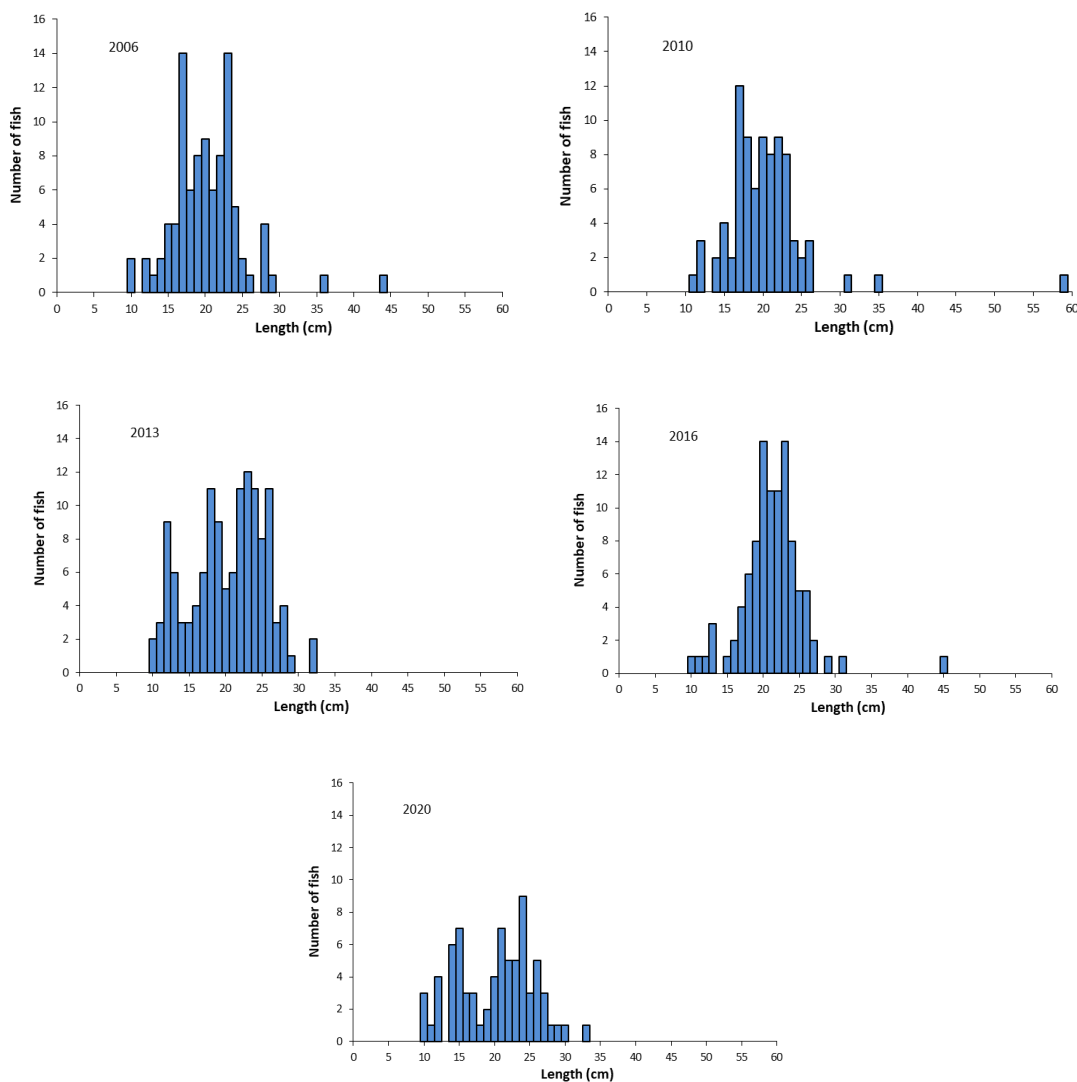


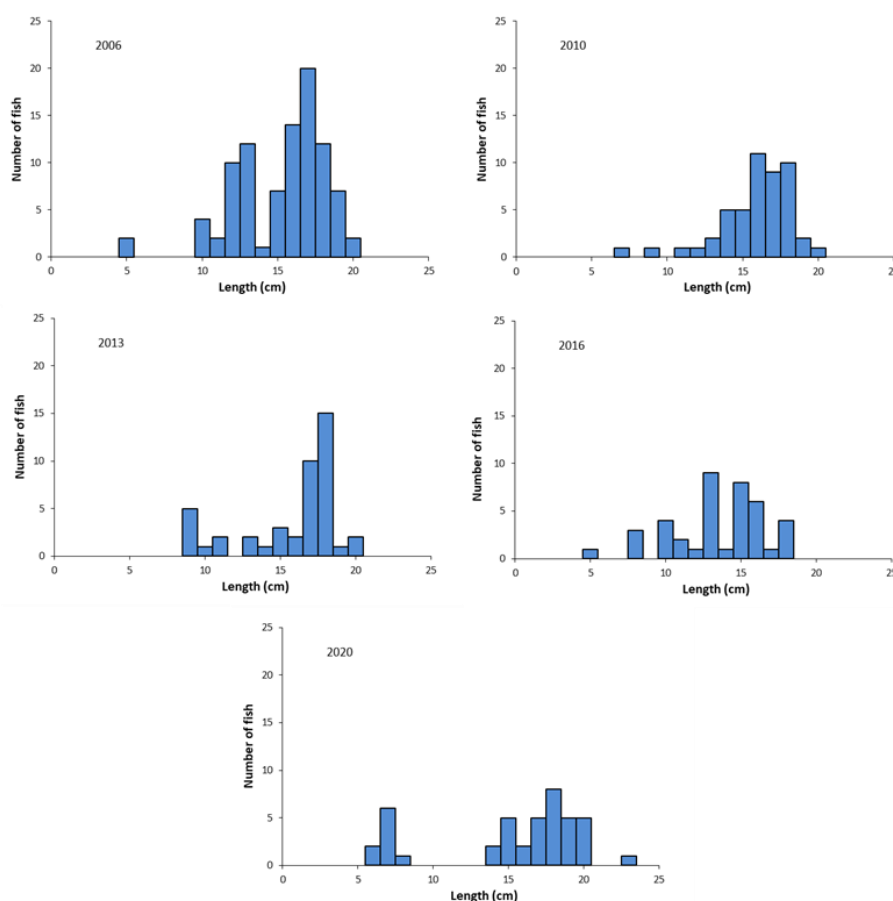
Fig. 1.4. Length frequency of brown trout captured on Glen Lough, 2006, 2010, 2013, 2016 and 2020

**Table 1.3. Mean ( $\pm$ S.E.) brown trout length (cm) at age for Glen Lough, August 2020**

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	Growth Category
Mean ( $\pm$ S.E.)	6.6 (0.2)	13.1 (0.4)	18.6 (0.3)	23.67 (0.4)	26.8 (0.8)	Slow
N	52	39	27	8	4	
Range	3.9-10.3	8.2-17.7	15.2-22.0	21.8-25.4	25.4-28.7	

### Arctic char

Arctic char captured during the 2020 survey ranged in length from 6.9cm to 23.2cm (mean = 15.7cm) (Fig.1.5). Six age classes were present, ranging from 0+ to 6+. No 1+ fish were recorded in the survey. The dominant age class in Glen Lough was 3+. Arctic char captured during the previous surveys had a similar length and age range. However, no fish between 9 and 13cm were captured during 2020. This size corresponds to the 1 year old cohort which were not captured in 2020. (Fig.1.5).



**Fig. 1.5. Length frequency of Arctic char captured on Glen Lough, 2006, 2010, 2013, 2016 and 2020**

### Other fish species

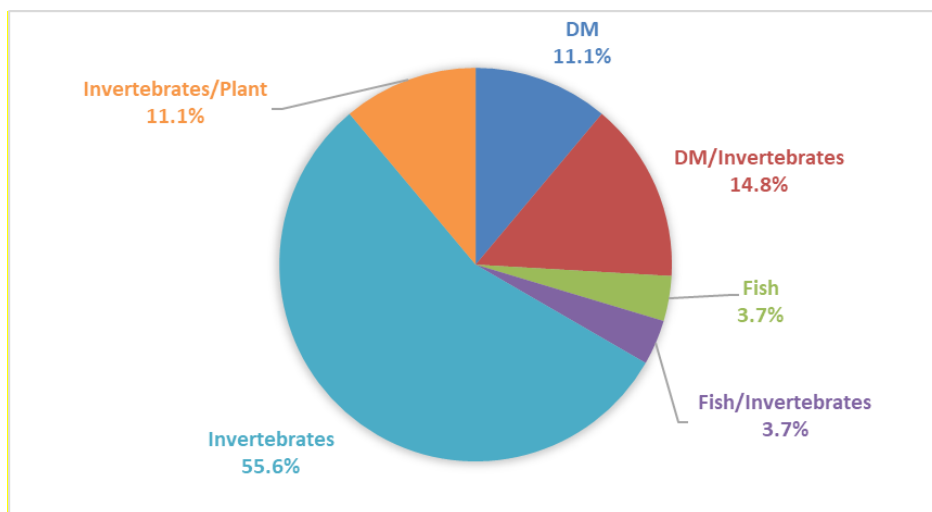
Eels captured during the 2020 survey ranged in length from 32.5cm to 58.0cm. Minnow ranged in length from 5.2cm to 9.0cm.

#### **1.3.4 Stomach and diet analysis**

Dietary analysis studies provide an indication of the availability of food items and the angling methods that are likely to be successful. The stomach contents of a subsample of brown trout captured during the survey were examined and are presented below.

### Brown trout

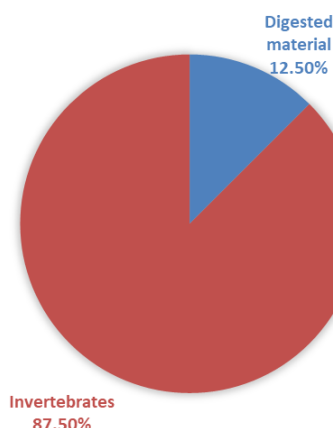
Adult trout usually feed principally on crustaceans (*Asellus* sp. and *Gammarus* sp.), insects (principally chironomid larvae and pupae) and molluscs (snails) (Kennedy and Fitzmaurice, 1971, O'Grady, 1981). A total of 41 stomachs were examined. Of these 14 were empty. Invertebrates were the sole dietary item consumed by 15 fish (55.6%). Invertebrates were recorded with unidentified digested material (DM), plant matter and fish in 4 (15%), 3 (11%) and 1 (4%) brown trout stomachs respectively. Fish were recorded in two (8%) brown trout stomachs, and were the sole dietary item found in one (4%) stomach (Fig. 1.6).



**Fig 1.6. Diet of brown trout (n=27) captured on Glen Lough, 2020 (% FO)**

### Arctic Char

A total of 28 Arctic char stomachs were examined. 20 of these stomachs were found to be empty. Of the eight stomachs found to contain food, 87.5% contained invertebrates and 12.5% contained unidentified digested material (Fig. 1.7).



**Fig 1.7. Diet of Arctic char (n=8) captured on Glen Lough, 2020 (% occurrence)**

### **1.4 Summary and ecological status**

A total of four fish species were recorded on Glen Lough in the August 2020 survey.

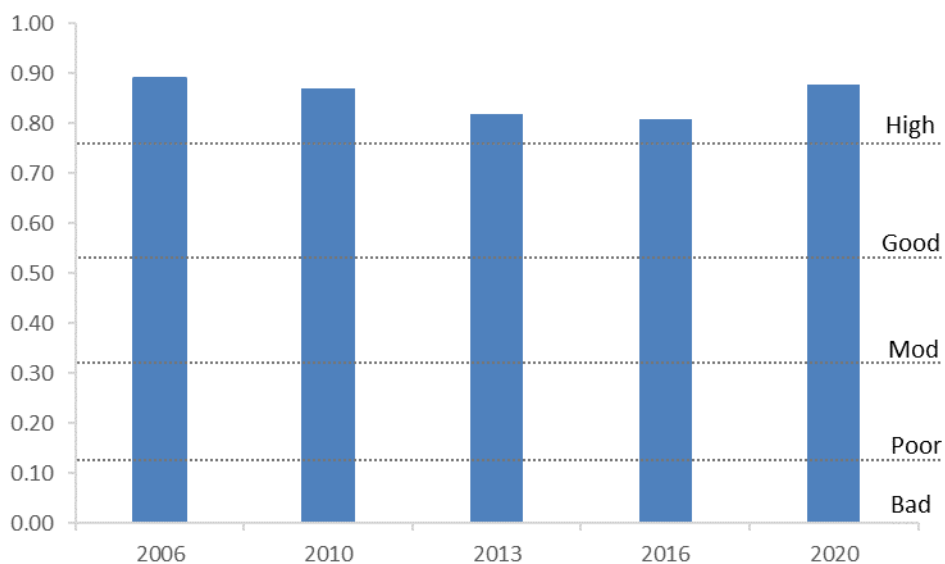
Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets. Both CPUE and BPUE have remained relatively stable across all surveys from 2006 to 2020. Six age classes were present, ranging from 0+ to 5+, indicating reproductive success in each of the previous six 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). Invertebrates were the main food item in stomachs of brown trout captured during the survey.

The mean Arctic char CPUE and BPUE has remained relatively stable in recent surveys, following an apparent (but statistically insignificant) decline compared to the 2006 survey. Arctic char ranged in age from 0+ to 6+. However, no 1+ fish (i.e. from the 2018/9 winter spawning) were recorded. This indicates Arctic char successfully spawned in five of the last six 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) 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, Glen Lough has been assigned an ecological status of High for 2020 based on the fish populations present. The lake was also assigned High status in 2006, 2010, 2013 and 2016 (Fig. 1.8).

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



**Fig. 1.8. Fish ecological status of Glen Lough, 2006, 2010, 2013, 2016 and 2020**



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