National Research Survey Programme

Lakes 2021

Lough Sessiagh

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Iascach Intíre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Lough Sessiagh, July 2021

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1. Introduction

Lough Sessiagh is a small lowland lake situated 3.5km south-east of Dunfanaghy, on the outskirts of Port na Blagh in Co. Donegal (Plate 1.1, Fig. 1.1). The geology of the area is predominantly quartzite; however on the western side of the lake, the bedrock contains more base-rich units, including units of dolomitic marble (NPWS, 2015 and 2021). The lake is bordered on its northern, western and eastern edge by houses and agricultural lands, with steep cliffs bordering the southern shore (NPWS, 2015). The lake has a stony bottom comprised of metamorphic bedrock and has a barren appearance.

Lough Sessiagh has an area of 20.9ha, a mean depth of 4m and a maximum depth of 22m. The lake is categorised as typology class 7 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. deep (>4m), less than 50ha and moderately alkaline (20-100mg/l CaCO3).

Lough Sessiagh has been designated as a Special Area of Conservation (NPWS, 2015). It comprises a habitat listed under Annex I of the EU Habitats Directive, i.e. lowland oligotrophic lake, and also provides suitable habitat for a rare plant species, the slender naiad (*Najas flexilis*), which is a legally protected aquatic plant listed under Annex II of the Habitats Directive (NPWS, 2015).

Brown trout is the dominant fish species in Lough Sessiagh. Brown trout spawning is limited to a single narrow inflowing stream on the south-west shore (Fig. 1.1). Arctic char, a rare freshwater fish species listed in the Irish Red Data book of threatened vertebrates as vulnerable (King *et al*., 2011), is also present. The water is alkaline and has excellent clarity (O' Reilly, 2007).

The lake has been surveyed on four occasions since 2006 (2006, 2009, 2012, 2011 and 2015) (Kelly *et al*., 2007,2010, 2013 and 2016). Brown trout have dominated fish stocks on all recent survey occasions. Arctic char, three-spined stickleback and eel have also been recorded.

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. Lough Sessiagh, July 2021

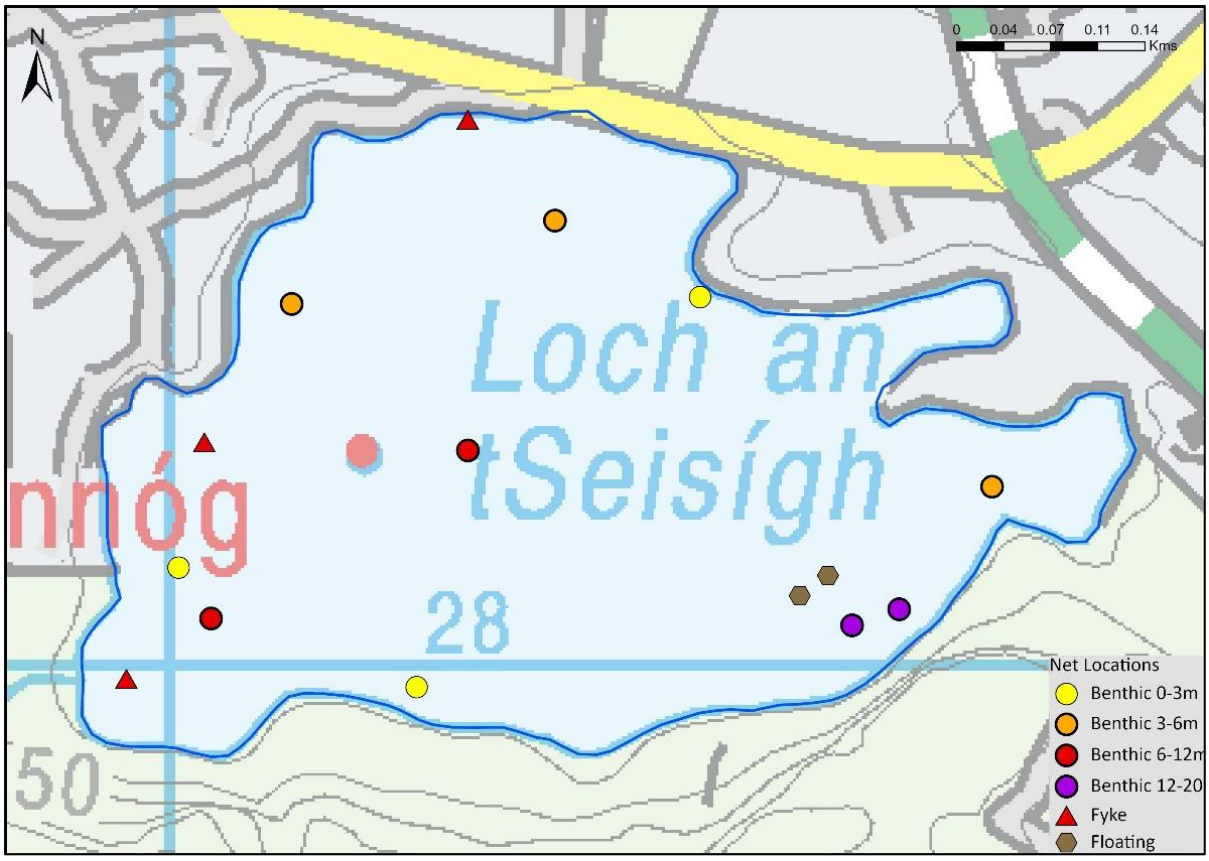

Fig. 1.1. Location map of Lough Sessiagh showing locations and depths of each net

2. Methods

2.1 Netting methods

Lough Sessiagh was surveyed over one night on the 5th of July 2021. A total of three sets of Dutch fyke nets (fyke), 10 benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets (3 @ 0-2.9m, 3 @ 3-5.9m, 2 @ 6-11.9m and 2 @ 12-19.9m) and two surface monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets were deployed randomly in the lake (15 sites). Nets were deployed in the same locations as were randomly selected in the previous surveys. A handheld GPS was used to mark the precise location of each net. The angle of each gill net in relation to the shoreline was randomised.

All fish were measured and weighed on site and scales were removed from a sample of all fish captured 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).

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

Where:
$\mathbf{FO}_{\boldsymbol{i}}$ is the percentage frequency of prey item i,
$\boldsymbol{N_i}$ is the number of fish with prey i in their stomach,
$\boldsymbol{N}$ is total number of fish with stomach contents.

2.3 Biosecurity - disinfection and decontamination procedures

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

3. Results

3.1 Species Richness

Four fish species were recorded on Lough Sessiagh in July 2021. A total of 305 fish were captured (Table 1.1). Three-spined stickleback was the most abundant fish species recorded, accounting for 91% of all fish captured. Brown trout, Arctic char and eels were also recorded. The same species composition was recorded on all previous sampling surveys conducted since 2006 (Kelly *et al*., 2007,2010, 2013 and 2016).

Table 3.1. Number of each fish species captured by each gear type during the survey on Lough Sessiagh, July 2021

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
Gasterosteus aculeatus	Three-spined stickleback	213	9	0	222
Salmo trutta	Brown trout	70	7	0	77
Salvelinus alpinus	Arctic char	1	0	0	1
*Anguilla anguilla**	European eel	1	0	4	5

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. In 2021, three-spined stickleback was the dominant species in terms of abundance (CPUE) while brown trout was the dominant species in terms of biomass (BPUE) (Table 3.2)

Table 3.1. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Sessiagh, 2009, 2012 and 2015

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Gasterosteus aculeatus	Three-spined stickleback	0.507 (0.257)	1.700 (0.859)
Salmo trutta	Brown trout	0.167 (0.050)	26.902 (8.167)
Salvelinus alpinus	Arctic char	0.002 (0.002)	0.139 (0.139)
*Anguilla anguilla**	European eel*	0.033 (0.033)	4.213 (4.213)

Note: Where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species.

*Eel CPUE and BPUE based on fyke nets only

For comparison purposes CPUE and BPUE for each species captured, per net type, in all surveys between 2009 and 2021 are presented in Figures 3.1 and 3.2 respectively and illustrates fish community change over time. Brown trout populations (CPUE and BPUE) have remained relatively stable across sampling occasions. There is an apparent decline in Arctic char numbers, with just one captured in the 2021 survey (Figure 3.1 and 3.2).

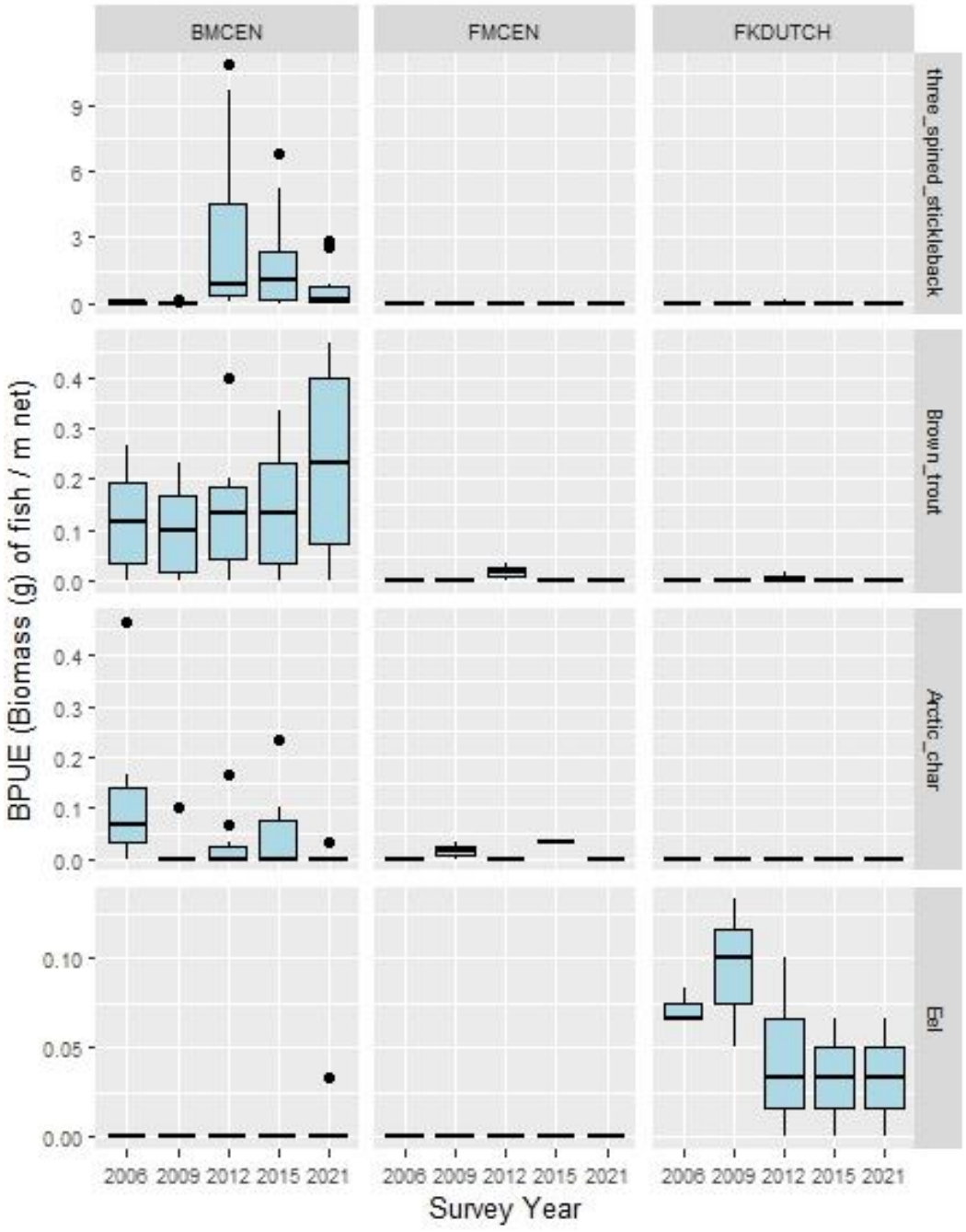

Figure 3.1. CPUE of all fish species captured in each net type during surveys of Lough Sessiagh between 2006 and 2021. Figures are expressed as number of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots. The y axis (CPUE) is unique for each species.

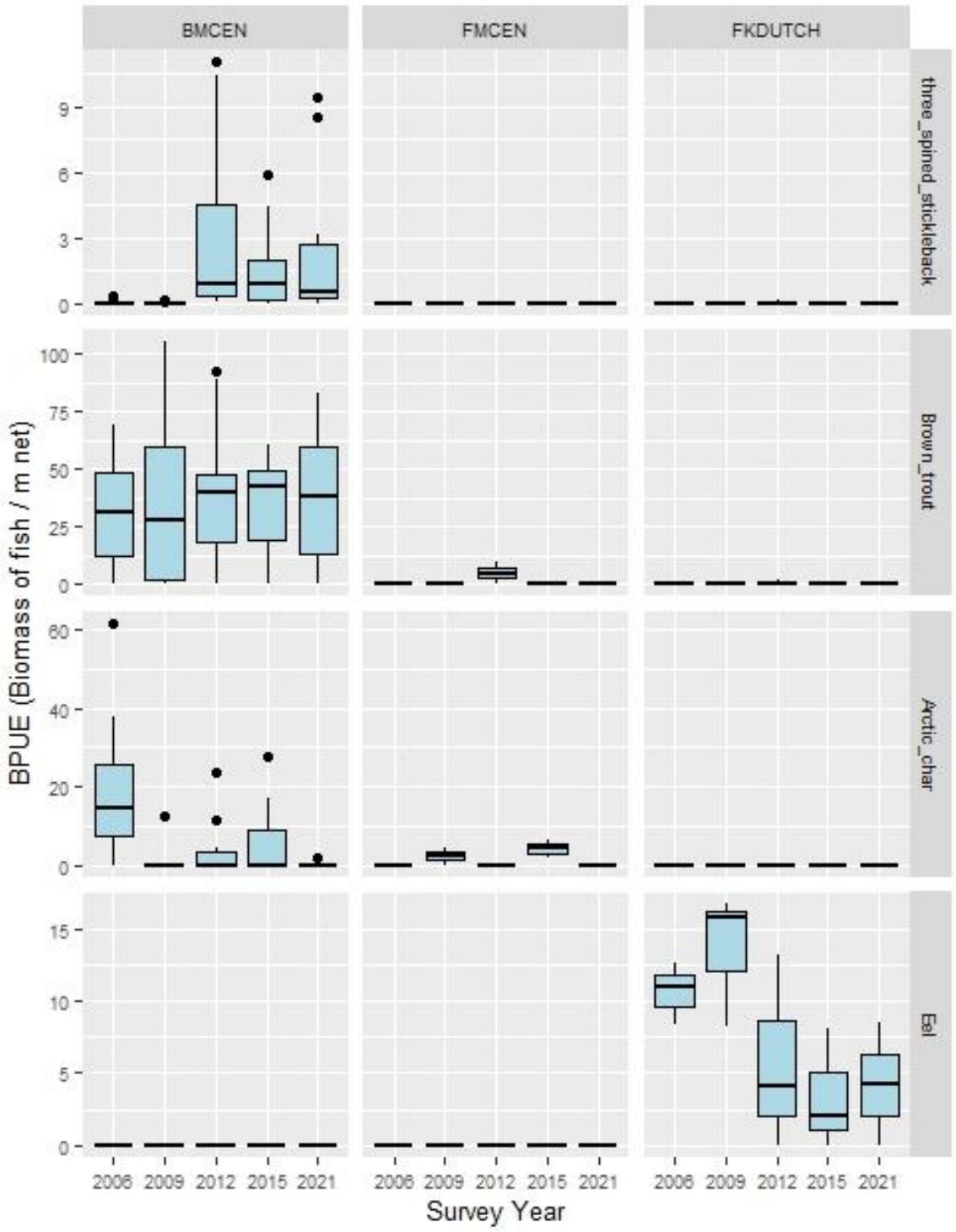

Figure 3.2. BPUE of all fish species captured in each net type during surveys of Lough Sessiagh between 2006 and 2021. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots. The y axis (BPUE) is unique for each species.

3.3 Length frequency distributions and growth

Brown trout:

Brown trout captured during the 2021 survey ranged in length from 11.9cm to33.4cm (mean =22.9cm) Fewer larger (i.e. 30cm) or older fish were recorded in the sample in 2021 compared to earlier surveys (Figure 3.3). Four age classes (1+ to 4+) were recorded. The largest age group was 2+. However 4+ fish accounted for c. 13% of fish in the sample. Mean L1 (i.e. length at the end of the first year) was 8.4cm (Table 1.3). Mean L4 was 27.0cm indicating a slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 3.3).

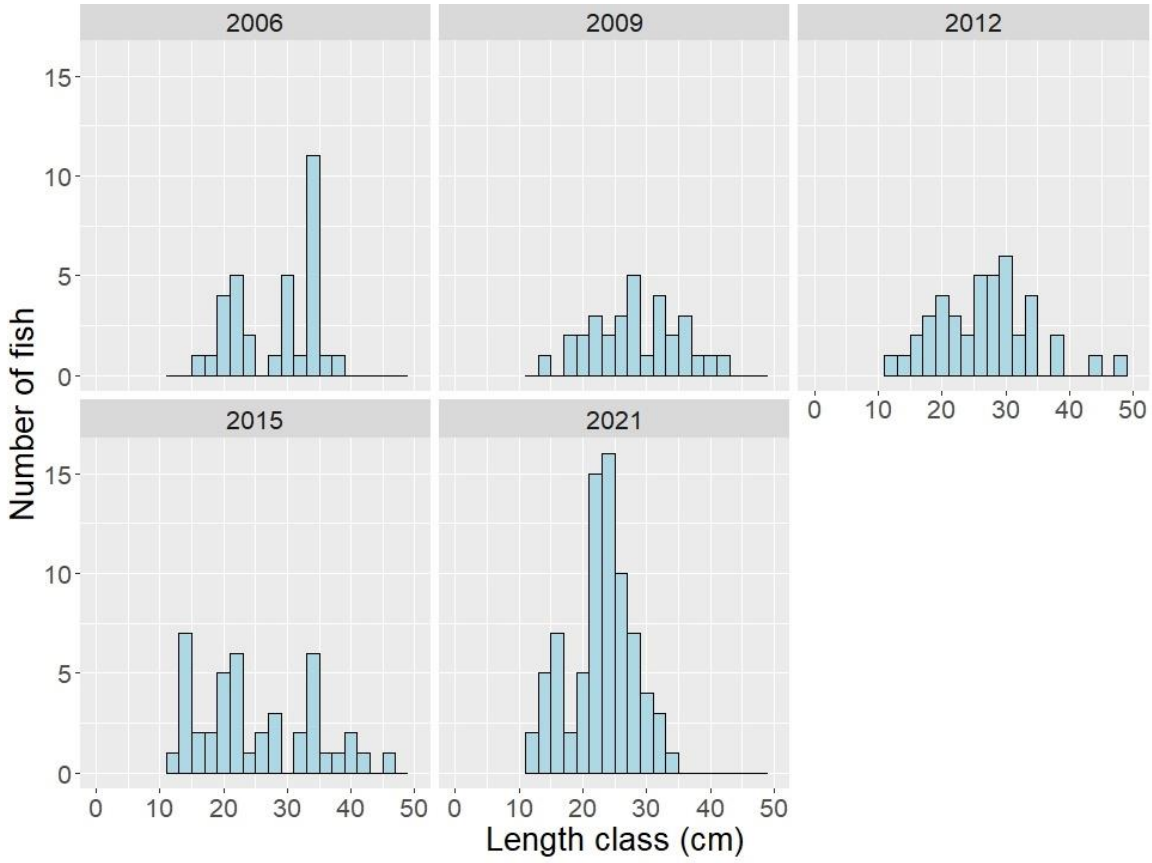

Figure 3.3. Length frequency of brown trout captured on Lough Sessiagh, 2006, 2009, 2012, 2015 and 2021

Table 3.3. Mean (±S.E.) brown trout length (cm) at age for Lough Sessiagh, July 2021

	L_1	L_2	L_3	L_4
Mean (±S.E.)	8.4 (0.2)	17.2 (0.3)	22.9 0.4)	27.0 (0.6)
N	77	62	31	10
Range	4.5-12.1	11.4-21.1	18.1-26.2	23.9-30.0

Arctic char:

One Arctic char was captured during the 2021 survey measuring 17.9cm in length (Fig.3.4) and was aged 1+. A reduction in the numbers of Arctic char captured since 2006 is evident (Figure 3.4)

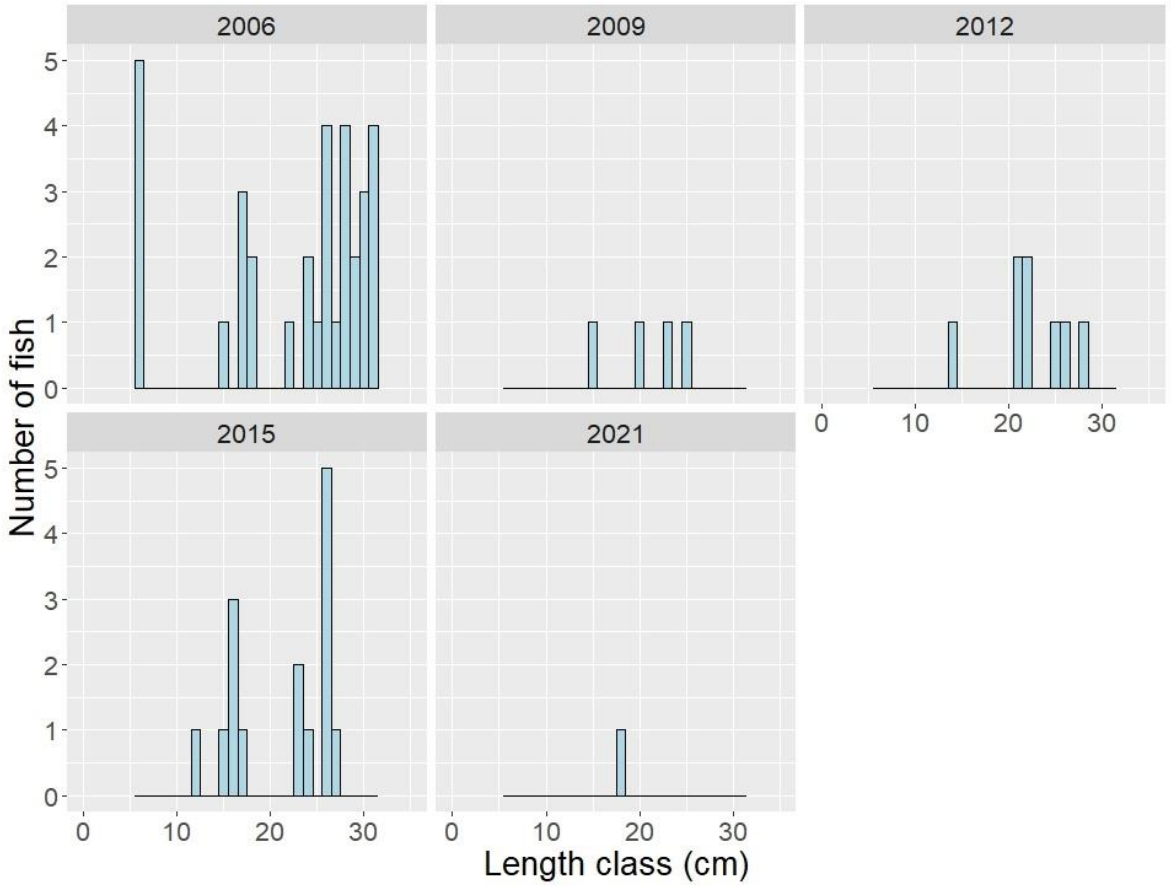

Figure. 3.4. Length frequency of Arctic char captured on Lough Sessiagh, 2006, 2009, 2012, 2015 and 2021

Other fish:

Five eels captured during the 2021 survey ranged in length from 37.5cm to 48.5cm (mean = 43.5cm). Three-spined stickleback (n = 222) captured, ranged in length from 3.5cm to 6.5cm (mean = 4.8cm).

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

Brown trout:

A total of 53 brown trout stomach contents were examined. Of these, 34 contained food items. Invertebrates were recorded in 23 (68%) stomachs. Fish and invertebrates were recorded together in two stomachs (6%) while fish were the sole dietary item recorded in one (3%) brown trout stomach. It was not possible to categorise the stomachs of eight (23%) fish (Figure 3.5).

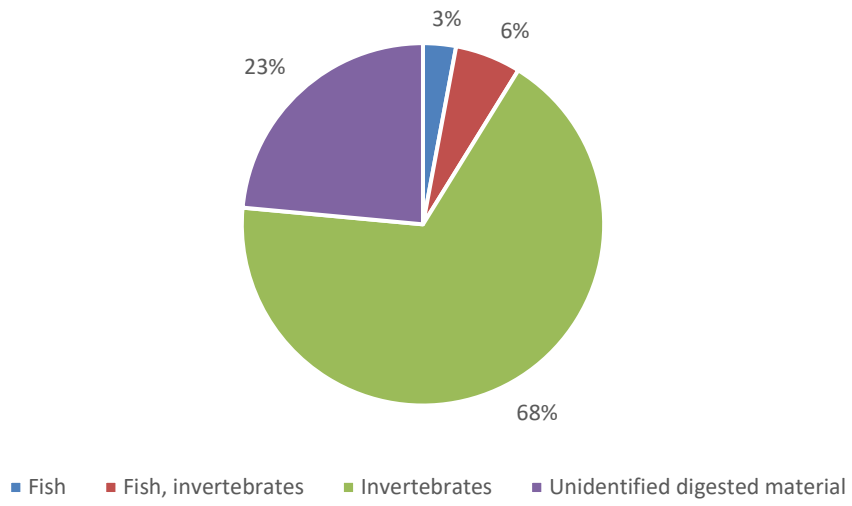

Fig. 3.5. Diet of brown trout captured on Lough Sessiagh 2021 (% occurrence), n=34

4. Summary and ecological status

Three-spined stickleback was the dominant fish species in terms of abundance (CPUE) and brown trout was the dominant species in terms of biomass (BPUE) in the survey gill nets during the 2021 survey. Similar results were observed on previous sampling occasions. While the size of the brown trout population has remained relatively stable, fewer larger or older fish were recorded in 2021 compared to previous surveys although there was a relatively large proportion of 4 year old fish in the sample.

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).

Just one Arctic char was recorded in the 2021 survey. While numbers have fluctuated between surveys, there is a declining trend in the CPUE (population size) of this threatened species.

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, Lough Sessiagh has been assigned an ecological status of High based on the fish populations present. In previous years the lake was assigned Good fish ecological status in 2006 and 2009 and High in 2012 and 2015 (Figure 4.1).

In the 2013 to 2018 surveillance monitoring reporting period, the EPA assigned Lough Sessiagh an overall draft ecological status of Good, based on all monitored physico-chemical and biological elements, including fish. This status classification will be revised during 2022.

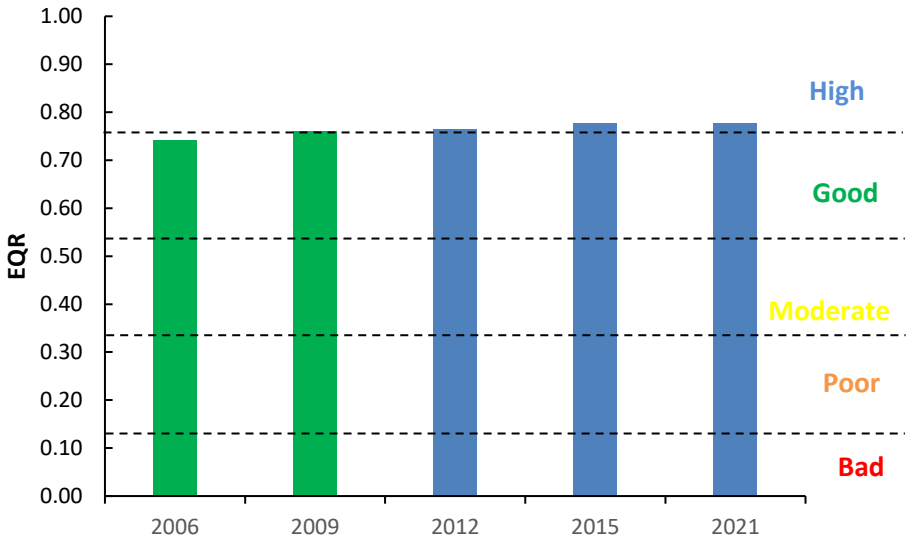

Figure 4.1. Fish ecological status, Templehouse Lake, 2008 to 2021.

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