

National Research Survey Programme

Lakes 2021

Lough Dan

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Iascach Intíre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Lough Dan, September 2021



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Inland Fisheries Ireland**

National Research Survey Programme

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

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1. Introduction

Lough Dan is situated 5km west of Roundwood, Co. Wicklow (Plate 1.1, Figure 1.1). It is a moraine-dammed lake situated in a steep sided valley in the Wicklow Mountains. Lough Dan is fed by Lough Tay via the Cloghoge River from the north and is drained to the south by the Avonmore River (Figure 1.1).

Lough Dan has a surface area of 106ha, a mean depth of 13.5m, a maximum depth of 40m and is located at an altitude of 203m a.s.l. The lake is categorised as typology class 4 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. deep (>4m), greater than 50ha and low alkalinity (<20mg/l CaCO₃).

The surrounding geology of the lake is mostly granite. Most of the lake is surrounded by private lands, though the north-west corner is part of the Wicklow Mountains National Park. The lake forms part of the Wicklow Mountain Special Area of Conservation (NPWS, 2018). The Wicklow Mountain SAC has been designated as such for including 10 habitats which are listed on Annex I of the EU Habitats Directive. These include heath, blanket bog and upland grasslands. Due to the underlying rock strata in the SAC, the water of the rivers and streams tends to be acidic. The water is generally oligotrophic and free from nutrient enrichment. The deep lakes in the SAC, such as Lough Dan, are characteristically species poor (NPWS, 2018).

Lough Dan holds a good stock of small, slow growing brown trout. A population of Arctic char was historically present in the lake (Went, 1945 and 1971; Tierney *et al.*, 2000). However, the last authenticated record was validated in 1988 by the Natural History Museum of Ireland (Tierney *et al.*, 2000).

The lake was previously surveyed in 1985 and 1989 by Inland Fisheries Ireland (IFI) (previously the Central Fisheries Board) (IFI, unpublished data). IFI (previously the Eastern Regional Fisheries Board) also surveyed the lake in May and October 1994 and resurveyed it in association with University College Dublin in 1996. No Arctic char were recorded during any of these surveys (Bowman, 1991; Igoe and Kelly-Quinn, 2002) and it was concluded that the population was extinct, probably as a result of acidification.

The lake has been surveyed on three occasions since 2009 (2009, 2012 and 2015) (Kelly *et al.*, 2010, 2013 and 2016). During these surveys, brown trout were found to be the dominant species present in the lake. Other species recorded in the lake include minnow and eel.

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.

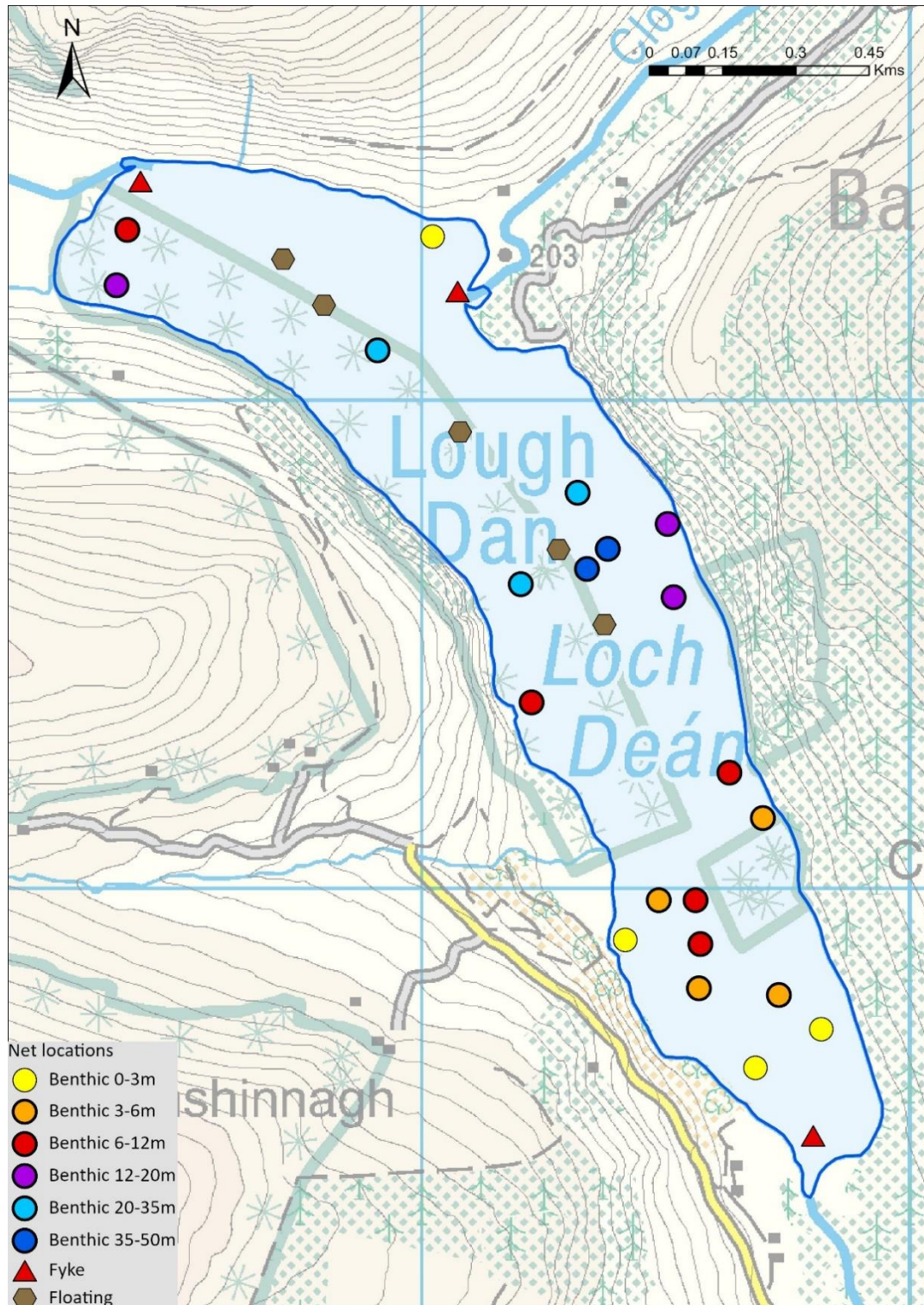


Figure 1.1. Location map of Lough Dan showing locations and depths of each net.

2. Methods

2.1. Netting methods

Lough Dan was surveyed over two nights from the 27th to the 29th of September 2022. A total of three sets of Dutch fyke nets (fyke), 21 benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 5 @ 6-11.9m, 3 @ 12-19.9m, 3 @ 20-34.9m and 2 @ 35-49.9m) and five 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 (29 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 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.

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.

3. Results

3.1 Species Richness

Three fish species were recorded on Lough Dan in September 2021. A total of 245 fish were captured. A total of 54 fish were captured. The number of each species captured by each gear type is shown in Table 3.1. Brown trout was the most abundant fish species recorded. Minnow and eels were also captured. The same species were captured on all previous surveys since 2009 (Kelly *et al.*, 2016)

Table 3.1 Number of each fish captured by each gear type during the survey on lough dan, September 2021

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Salmo trutta</i>	Brown trout	169	27	21	217
<i>Phoxinus phoxinus</i>	Minnow	25	0	0	25
<i>Anguilla anguilla</i> *	European eel	0	0	3	3



Plate 3.1. Lough Dan, September 2021

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 (WFD and WFD+). 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 brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) (Table 3.2; Figure 3.1 and Figure 3.2)

For comparison purposes CPUE and BPUE for each species captured in all surveys per net type between 2009 and 2021 are presented in Figures 3.2 and 3.3 respectively and illustrates fish community change over time. Similar results were recorded on previous sampling occasions, with brown trout numbers remaining relatively stable across all sampling occasions. No eels were recorded in the 2015 survey and numbers captured in 2021 remain low in comparison to the two earlier surveys conducted in 2009 and 2012.

Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Dan 2021

Scientific name	Common name	Mean CPUE (\pm S.E)	Mean BPUE (\pm S.E)
<i>Salmo trutta</i>	Brown trout	0.237 (0.041)	24.455 (4.435)
<i>Phoxinus phoxinus</i>	Minnow	0.029 (0.011)	0.143 (0.055)
<i>Anguilla anguilla</i> *	European eel	0.017 (0.000)	9.441 (1.697)

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.

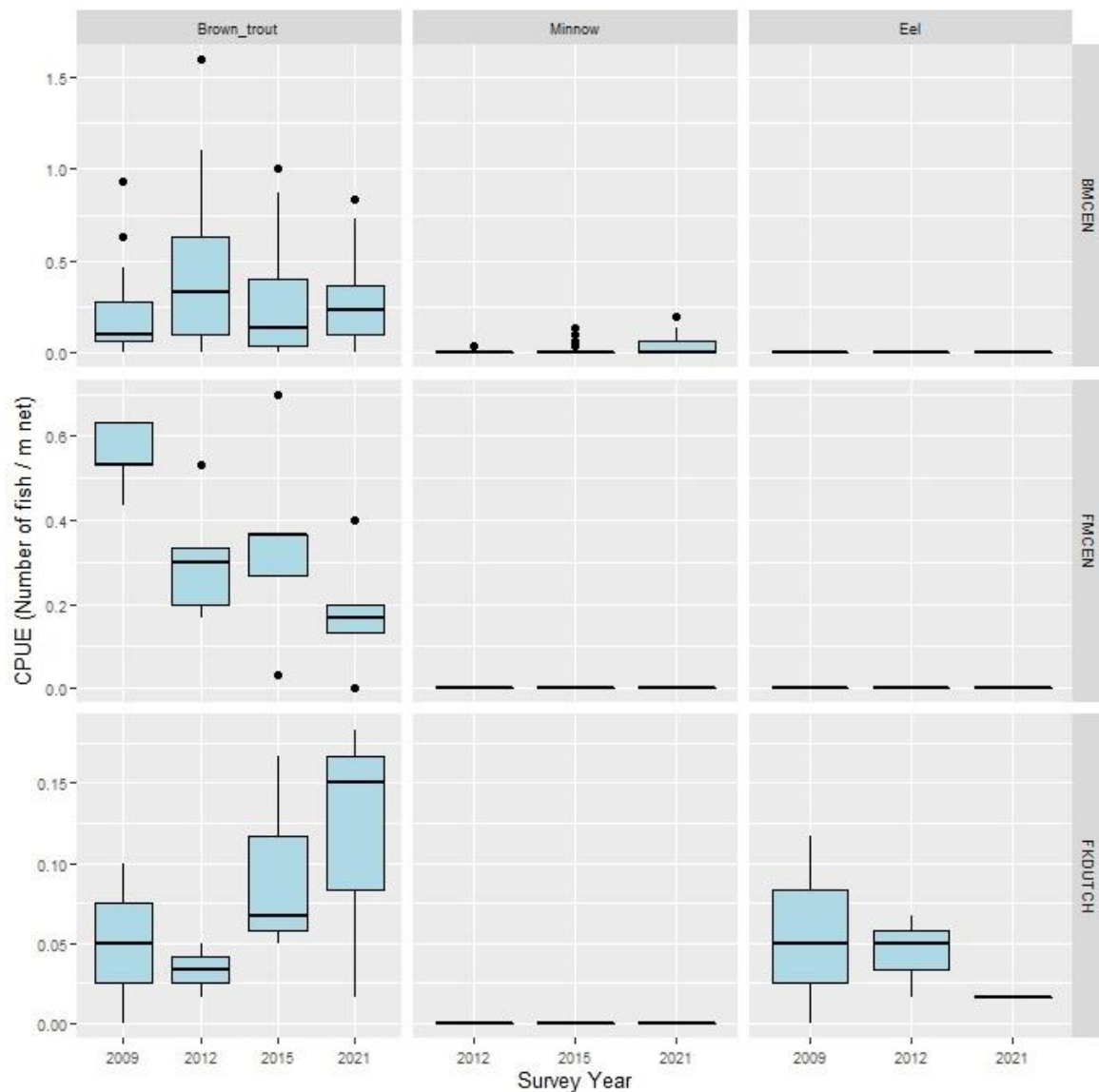


Figure 3.1. CPUE of all fish species captured in each net type during surveys of Lough Dan between 2009 and 2021. Figures are expressed as number of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked 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 net type.

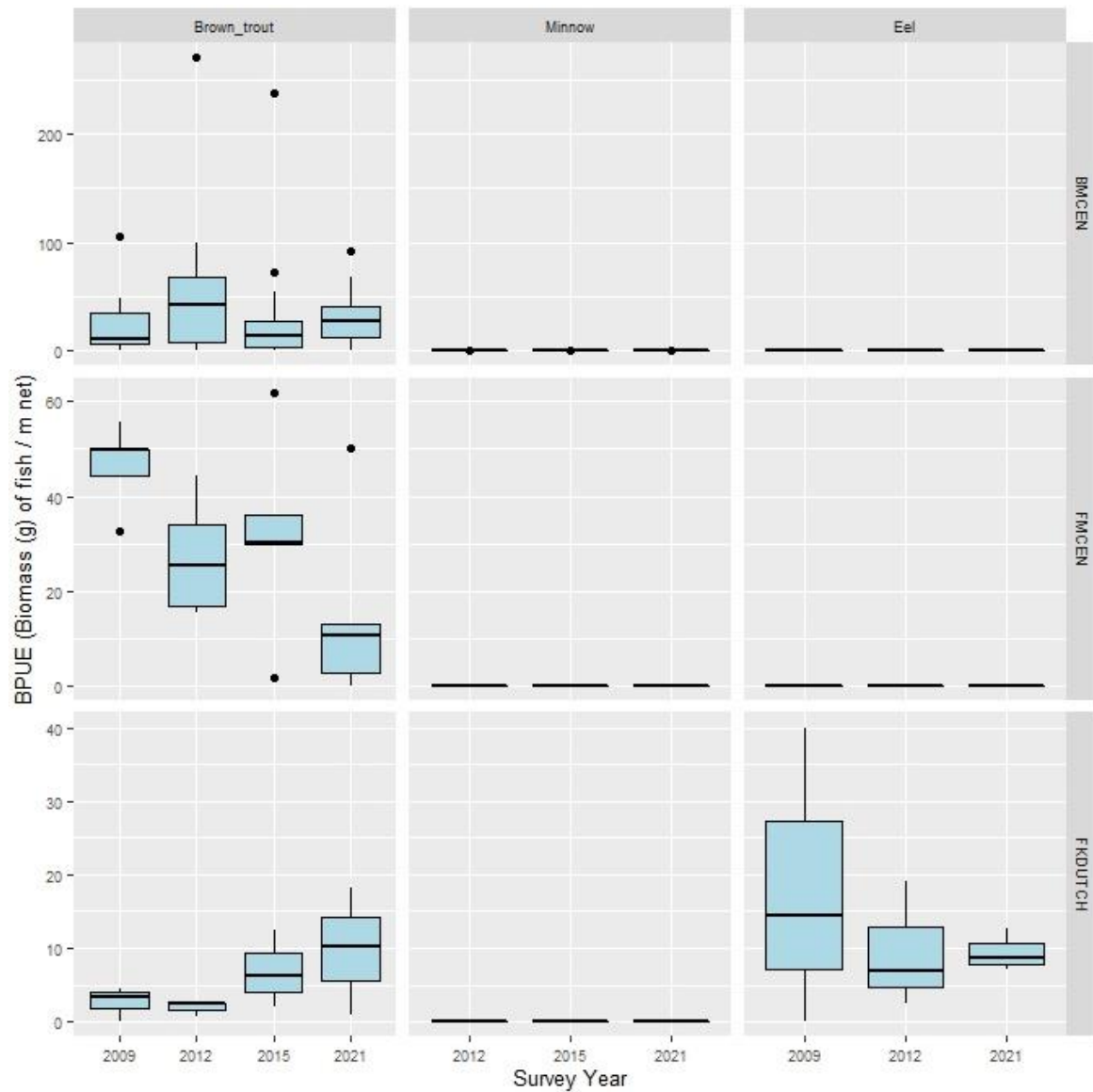


Figure 3.2. BPUE of all fish species captured in each net type during surveys of Lough Dan between 2009 and 2021. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are 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 net type.

3.3. Length frequency distributions and growth

Brown trout

Brown trout captured during the 2021 survey ranged in length from 11.0cm to 48.4cm (mean = 19.3cm) (Figure 3.3). Six age classes were present in the sample aged ranging from 1+ to 8+. The population was dominated by younger fish with 2+ and 3+ fish dominating the population (c.15.0cm - 25.0cm Figure 3.3). Mean L1 (i.e. length at the end of the 1st year) was 5.9cm (Table 3.3). Mean L3 was 19.4cm indicating a very slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971). Brown trout captured in 2021 had similar length and age ranges compared to previous surveys. The persistence of a small number of larger and older fish in the population is a common feature in the lake (Figure 3.3).

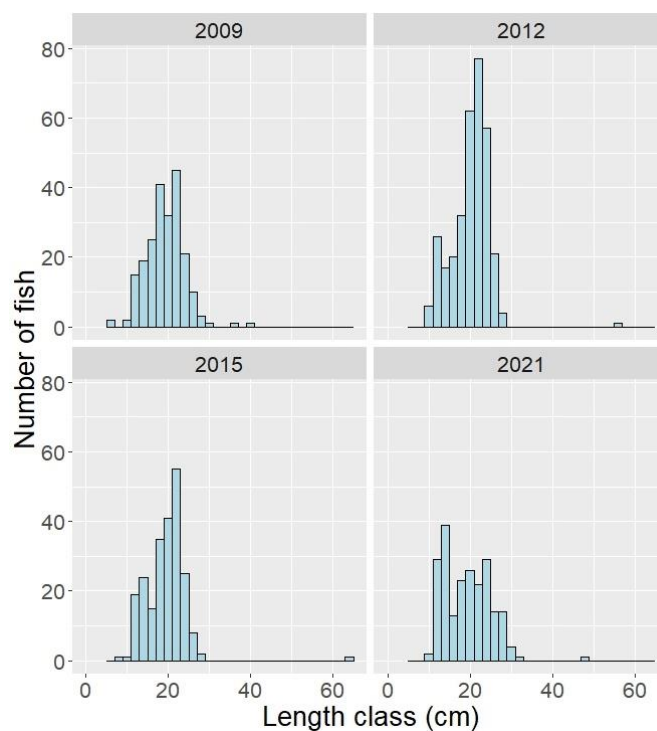


Figure 3.3. Length frequency of brown trout captured on Lough Dan, 2009, 2012, 2015 and 2021

Table 3.3. Mean (\pm S.E.) brown trout length (cm) at age for Lough Dan, August 2021

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈
Mean (\pm S.E.)	5.9 (0.1)	13.7 (0.2)	19.4 (0.3)	23.1 (0.3)	26.4 (0.2)	-	-	-
N	82	62	29	13	4	1	1	1
Range	4.2-7.7	11.0-16.8	16.6-22.2	21.5-24.8	25.8-27.0	33.3	38.7	42.4

Other Species

Twenty five minnow were captured during the 2021 survey. They ranged in length from 5.7cm to 8.0cm (mean = 6.2cm).

Three European eels were captured during the 2021 survey. They ranged in length from 64.1cm to 72.2cm.

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 food items recorded in a sub sample of brown trout captured are presented below (Figure 3.4). A total of 133 stomachs were examined. Of these 82 stomachs were empty. Of the 51 stomachs which contained food, invertebrates were the sole prey group in 36 (71%) stomachs. Invertebrates and fish were found in the stomach of one fish (2%). Unidentified digested material was recorded in 14 (27%) of the brown trout stomachs examined.

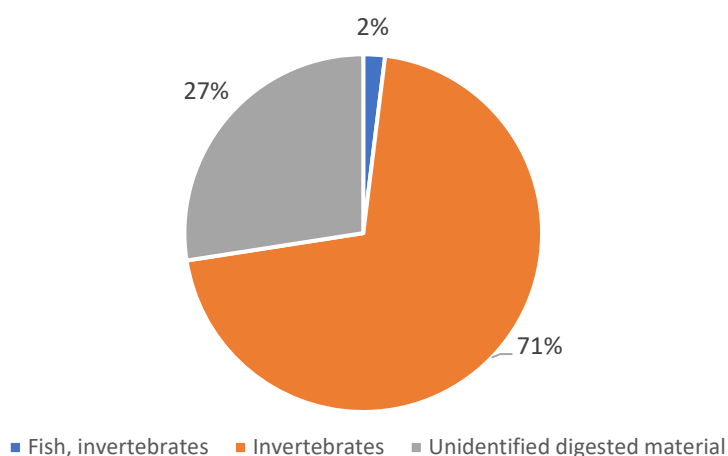


Figure 3.4. Diet of brown trout (n = 51) captured on Lough Dan 2021 (% frequency occurrence)

4. Summary and ecological status

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2021 survey.

Brown trout ranged in age from 1+ to 8+. The dominant age class was 2+. Length at age analyses revealed that brown trout in the lake exhibit a very 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, Lough Dan has been assigned an ecological status of High for 2021 based on the fish populations present. In previous years the lake was assigned High fish ecological status in 2015 and Good in 2009 and 2012 (Figure 4.1).

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

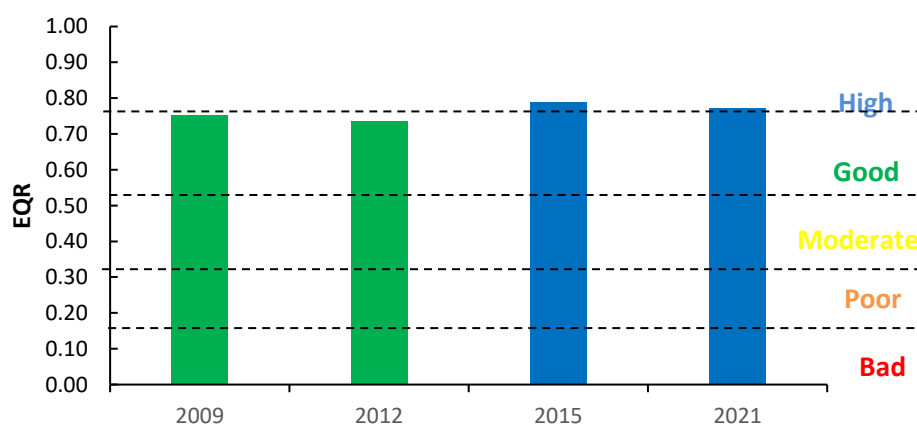


Figure 4.1 Fish ecological status of Lough Dan Lough, 2009, 2012, 2015 and 2021

5. References

- Amundsen, P.A., Gabler H.M., 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.
- Bowman, J. (1991) *Acid Sensitive Surface Waters in Ireland*. Environmental Research Unit, Dublin.
- Caffrey, J. (2010) *IFI Biosecurity Protocol for Field Survey Work*. Inland Fisheries Ireland.
- 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.
- Igoe, F. and Kelly-Quinn, M.K. (2002) The char (*Salvelinus alpinus* L.) of Lough Dan: extinct? *The Irish Naturalists' Journal* **27(1)**, 2–9
- 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., Harrison A., Connor, L., Matson, R., Morrissey, E., O'Callaghan, R., Wogerbauer, C., Feeney, R., Hanna, G. and Rocks, K. (2010) *Sampling Fish for the Water Framework Directive – Summary Report 2009*. The Central and Regional Fisheries Boards.
- 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., Connor, L., Matson, R., Feeney, R., Morrissey, E., Wogerbauer, C. and Rocks, K. (2013) *Sampling Fish for the Water Framework Directive – Summary Report 2012*. Inland Fisheries Ireland.
- Kelly, F.L., Connor, L., Delanty K., Coyne, J., Morrissey, E., Corcoran, W., Cierpial, D., Matson, R., Gordon, P., O' Briain, R., Rocks, K., Walsh, L., O' Reilly, S., O' Callaghan, R., Cooney, R. and Timbs, D. (2016) *National Research Survey Programme Fish Stock Survey of Lough Dan, September 2015*. 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 (2018) *Site synopsis: Wicklow Mountains. Site code 002122*. Site Synopsis report, National Parks and Wildlife Service.

<https://www.npws.ie/sites/default/files/protected-sites/natura2000/NF002122.pdf>.

Tierney, D.T., O'Grady, M.F. and Fitzmaurice, P. (2000) *The Irish Char Salvelinus alpinus L. Archival Project*. A report commissioned by the Environmental Protection Agency, Central Fisheries Board.

Went, A.E.J. (1945) The distribution of Irish char (*Salvelinus* spp.). *Biology and Environment: Proceedings of the Royal Irish Academy*, **50B**, 167-189.

**Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.
D24 CK66**

**www.fisheriesireland.ie
info@fisheriesireland.ie**

+353 1 8842 600

