National Research Survey Programme

Lakes 2023

Glencullin Lough

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Fish Stock Survey of Glencullin Lough, July 2023

National Research Survey Programme

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

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1. Introduction

Glencullin Lough is situated in Co. Mayo in the Bundorragha catchment (Plate 1.1, Figure 1.1). The lake is one of four situated in the Delphi Fishery and is located just north-west of Doo Lough, south of Louisburgh, Co. Mayo. The lake has a surface area of 34ha, a mean depth of 2.6m and a maximum depth of 13m. The lake is categorised as typology class 1 (as designated by the EPA for the Water Framework Directive), i.e. shallow (mean depth <4m), less than 50ha and low alkalinity (<20mg/l $CaCO_3$).

Glencullin Lough is situated in the Mweelrea/Sheeffry/Erriff Complex Special Area of Conservation and supports a number of priority habitats on Annex I of the EU Habitats Directive including active blanket bog, lagoons, machair, decalcified dunes and petrifying springs. The site is also selected for the following species listed on Annex II of the EU Habitats Directive - freshwater pearl mussel, Atlantic salmon, otter, the snails *Vertigo angustior* and *Vertigo geyeri,* the plant Slender Naiad and the liverwort Petalwort (NPWS, 2021).

Glencullin Lough was historically a sea trout fishery and is now fished primarily for brown trout and occasionally salmon (O' Reilly, 2007).

Glencullin Lough has been surveyed on four occasions since 2008 (2008, 2011, 2014 and 2017) as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al*., 2009, 2012a, 2015, Connor *et al.,* 2018). In all previous surveys, brown trout was found to be the dominant species present in the lake. Sea trout, three-spined stickleback, salmon and European eel were also found to be present in all previous surveys, with the exception of salmon, which was not captured in 2008.

This report summarises the results of the 2023 fish stock survey carried out on the lake using Inland Fisheries Ireland's fish in lakes monitoring protocol. The protocol is WFD compliant and provides insight into fish stock status in the lake.

Plate 1.1. Glencullin Lough, July 2023.

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

2. Methods

2.1. Netting methods

Glencullin Lough was surveyed over one night from the 3rd to the 4th of July 2023. A total of two sets of Dutch fyke nets, 6 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (BM CEN) (2 @ 0-2.9m, 2 @ 3-5.9m, and 2 @ 6-11.9m) and two floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed in the lake (10 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 sub-sample of other species. 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 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).

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

Where:
$\mathbf{FO}_i$ 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, including two types of trout (brown trout and sea trout) were recorded in Glencullin Lough in July 2023. A total of 61 fish were captured (Table 3.1). Brown trout was the most numerous fish species recorded, in common with previous surveys of the lake. Three-spined stickleback, sea trout, salmon and European eel were also captured. The same species composition was recorded on all previous surveys of the lake with the exception of salmon which was not recorded in 2008 (Kelly *et al*., 2009, 2012a, 2015, Connor *et al.,* 2018).

Table 3.1. Number of each fish species captured by each gear type during the survey on Glencullin Lough, July 2023.

Scientific name	Common name	Number of fish captured			
		BM CEN	FMCEN	Fyke	Total
Salmo trutta	Brown trout	37	7	0	44
	Sea trout	3	2	0	5
Gasterosteus aculeatus	Three-spined stickleback	7	0	0	7
Salmo salar	Salmon	1	0	0	1
Anguilla anguilla	European eel	1	0	3	4

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. Brown trout were the dominant species with respect to both abundance (CPUE) and biomass (BPUE) (Table 3.2).

Table 3.2. Mean (S.E) CPUE and BPUE for all fish species captured on Glencullin Lough, July 2023.

Scientific name	Common name	Mean CPUE (± S.E)	Mean BPUE (± S.E)
Salmo trutta	Brown trout	0.147 (0.039)	18.556 (5.452)
	Sea trout	0.017 (0.009)	7.115 (3.856)
Gasterosteus aculeatus	Three-spined stickleback	0.023 (0.013)	0.023 (0.013)
Salmo salar	Salmon	0.003 (0.003)	0.062 (0.062)
*Anguilla anguilla**	European eel	0.250 (0.008)	2.509 (1.163)

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.

3.3 Species Profiles

Brown trout

Brown trout captured during the 2023 survey ranged in length from 11.0cm to 44.2cm (mean 18.7cm). Brown trout captured in previous surveys had broadly similar ranges. While generally dominated by smaller fish (i.e. < 20cm), larger trout (i.e. > 30cm) have been captured on several survey occasions (Figure 3.1). Brown trout were aged between 1+ and 6+ and all intervening age classes were present in the sample aged. One- and two-year-old fish (11cm – 19cm) dominated the population, although older age groups were also prominent, with several 4+ to 6+ fish recorded (26cm to 40cm) (Figure 3.1). Mean L1 (i.e. length at the end of the 1st year) was 6.8cm (Table 3.3).

Brown trout abundance (CPUE) and biomass (BPUE) have remained relatively stable since the 2011 survey of the lake (Figure 3.2).

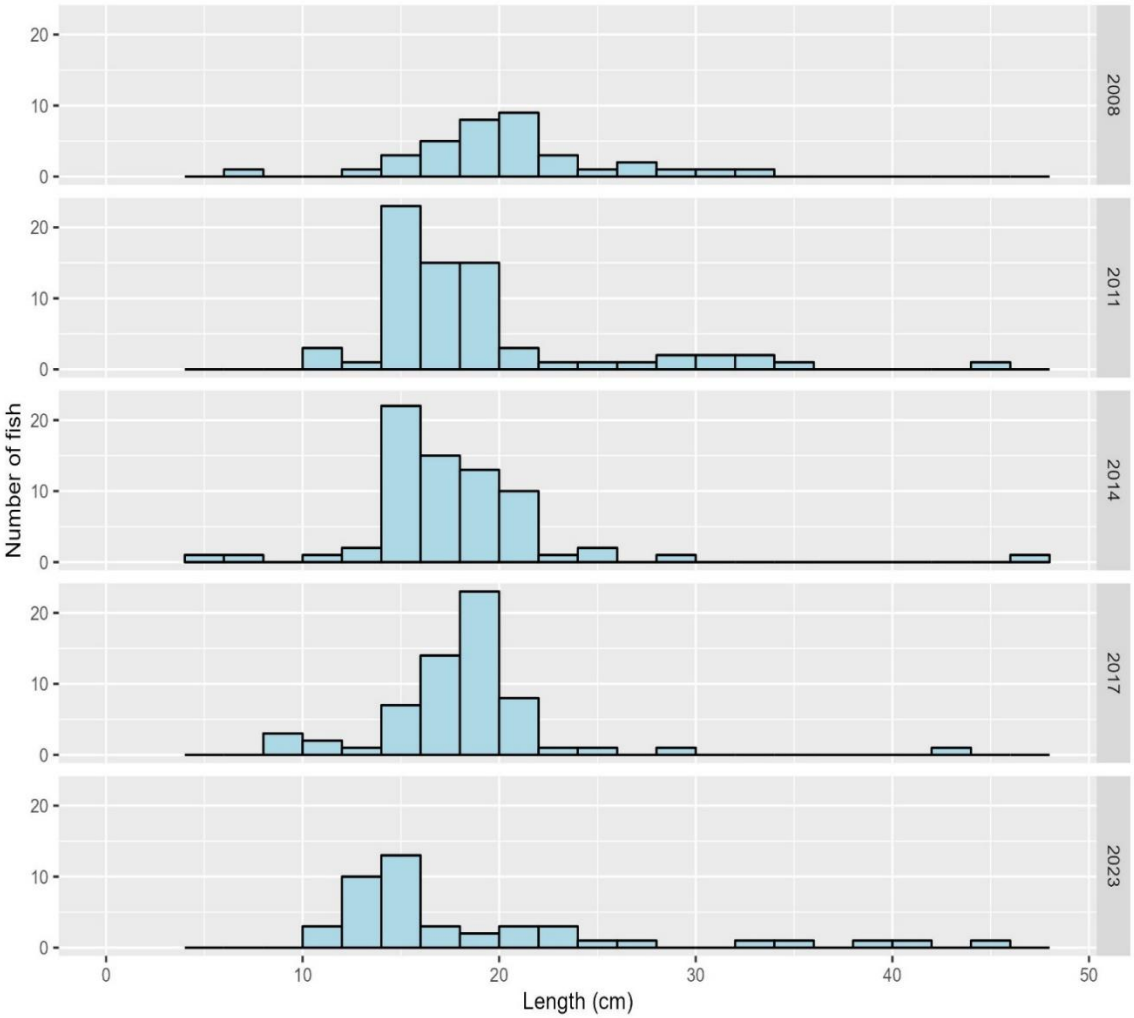

Figure 3.1. Length frequency of brown trout captured on Glencullin Lough between 2008 and 2023

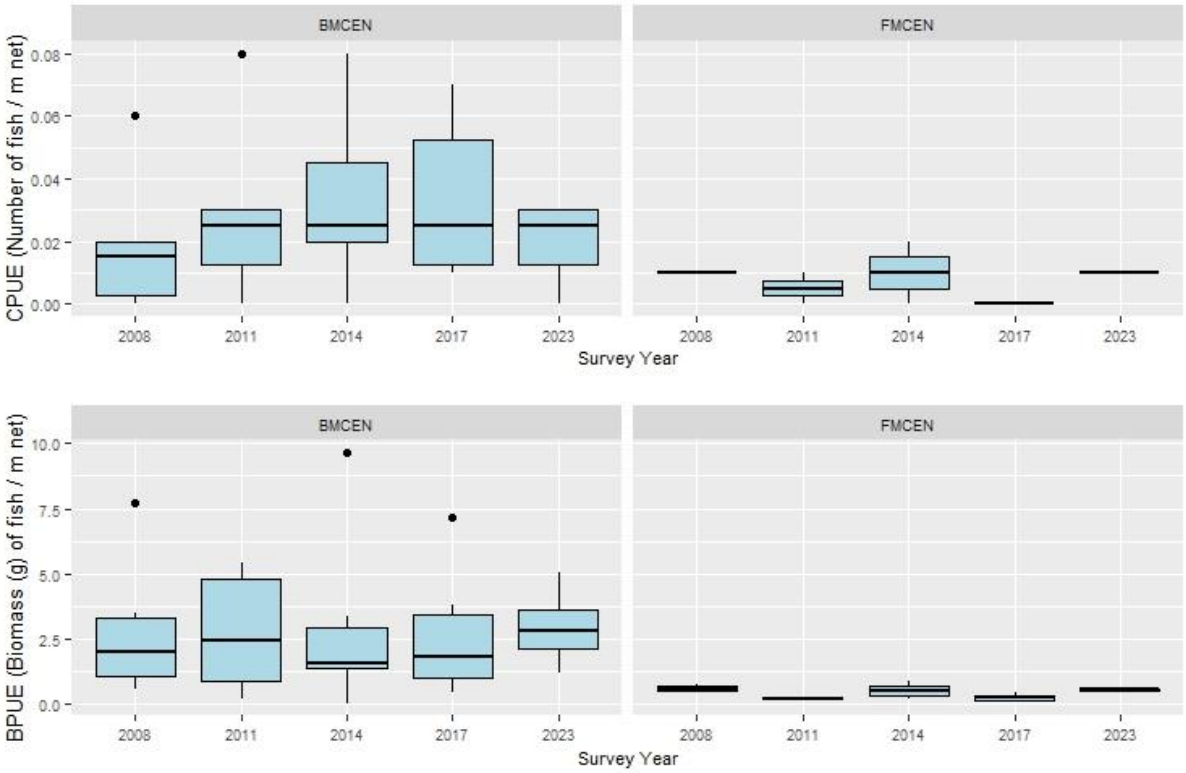

Figure 3.2. CPUE and BPUE of brown trout captured during surveys of Glencullin Lough between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

Table 3.3. Mean (±S.E) brown trout length (cm) at age for Glencullin Lough, July 2023

	L_1	L_2	L_3	L_4	L_5	L_6
Mean (±S.E.)	6.8 (0.11)	13.3 (0.18)	19.6 (0.33)	25.6 (0.83)	32.0 (0.68)	35.1 (0.98)
N	32	22	12	6	4	2
Range	5.8-8.8	12.0-15.0	18.1-21.7	23.3-29.0	30.5-33.3	34.1-36.1

European eel

European eel captured during the 2023 survey ranged in length from 35.0cm to 56.8cm (mean = 42.5cm) (Figure 3.3). Abundance (CPUE) and biomass (BPUE) of eel recorded in fyke nets have declined since the lake was initially surveyed in 2008 (Figure 3.4).

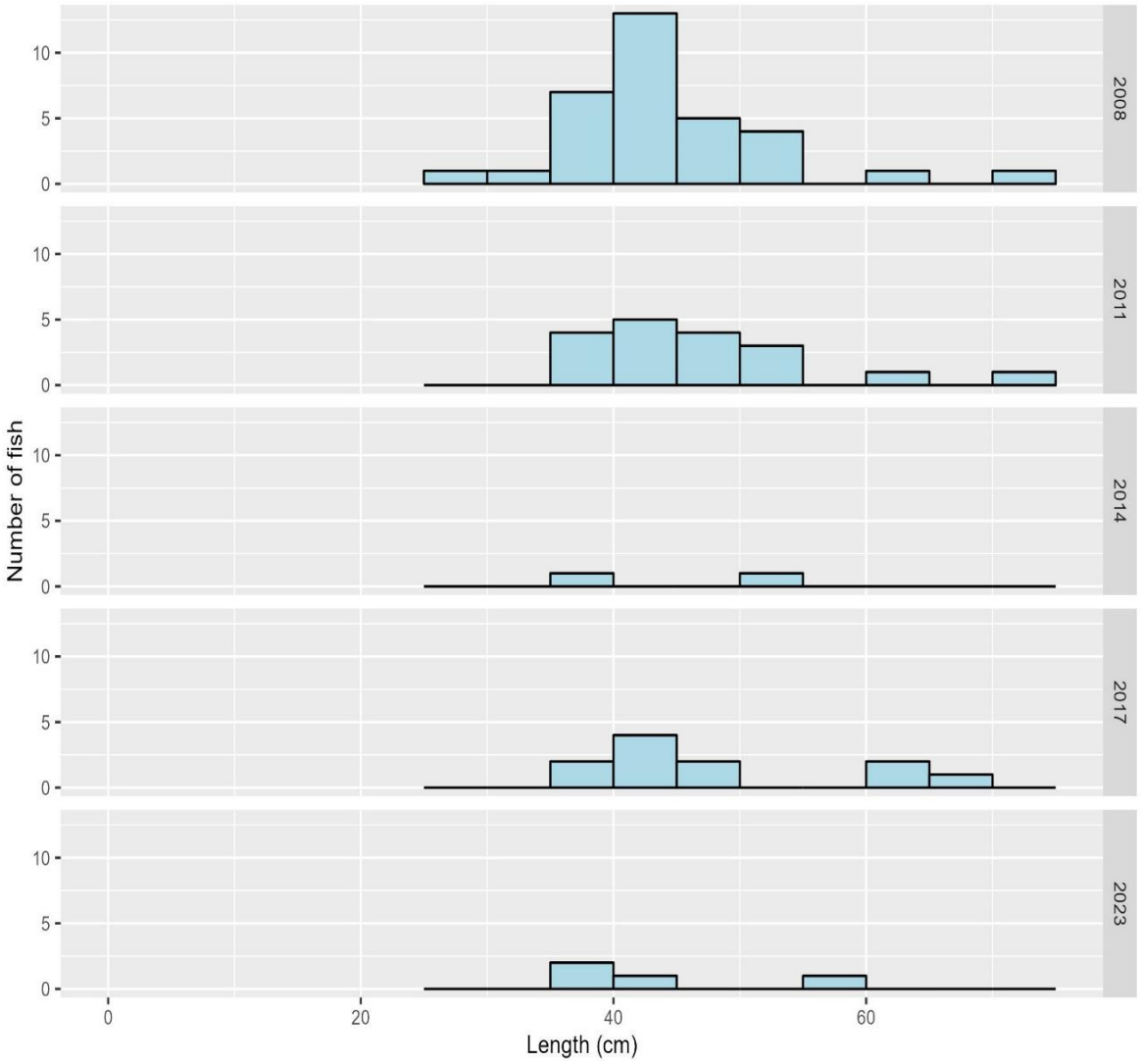

Figure 3.3. Length frequency of European eel captured on Glencullin Lough between 2008 and 2023.

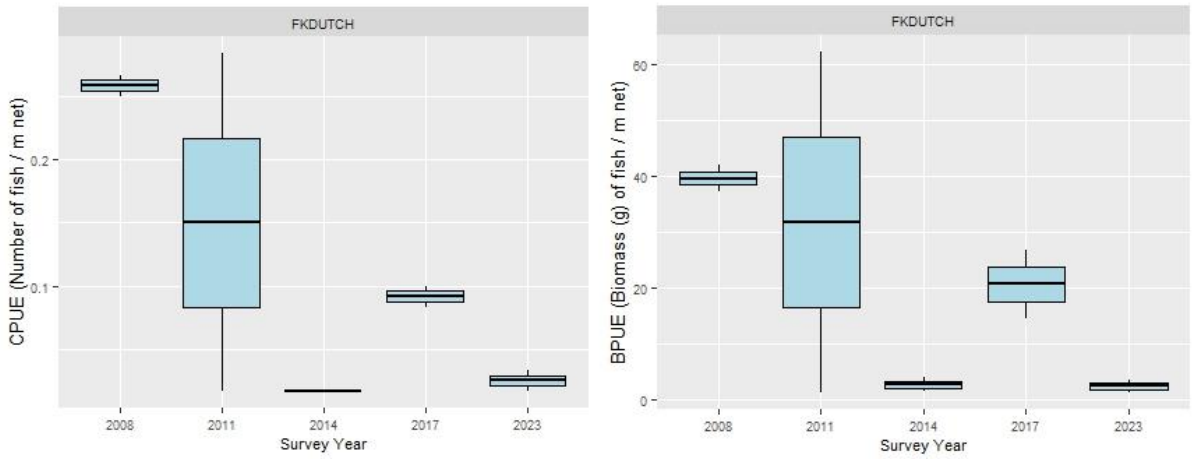

Figure 3.4. CPUE and BPUE of European eel captured during surveys of Glencullin Lough between 2008 and 2023. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots.

Other fish species

Sea trout captured during the 2023 survey ranged in length from 24.5cm to 41.4cm (mean = 33.3cm). One salmon was captured and measured 11.6cm. Three-spined stickleback ranged in length from 4.1cm - 4.8cm (mean = 4.5cm).

Plate 3.1 Surveying Glencullin Lough, September 2023

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

Brown trout

A total of 33 brown trout stomachs were examined. Nine (27.3%) were empty. Twenty-four stomachs contained food. Invertebrates were recorded in a total of 18 (75%) stomachs. They were the sole prey type recorded in ten (42%) stomachs and were found with plant matter in five (21%) trout. Zooplankton was the sole prey type recorded in two (8%) stomachs and found together with invertebrates in two more. Other prey and mixed groups were recorded in several individual stomachs (Figure 3.5).

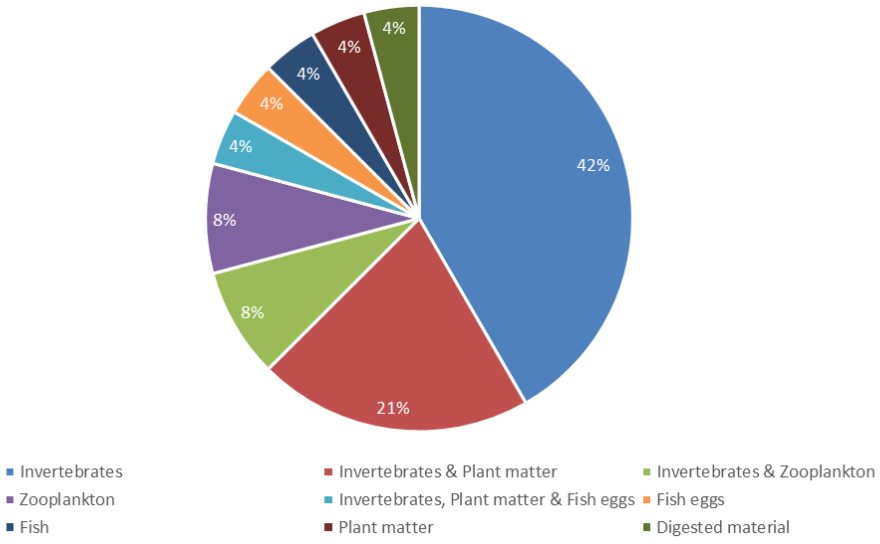

Figure 3.5. Diet of brown trout (N = 24) captured on Glencullin Lough, 2023 (% FO).

Sea trout

Four sea trout stomachs were examined, two (50%) of which empty. One (25%) stomach contained invertebrates and the other contained fish eggs.

4. Summary and fish ecological status

A total of four fish species, including two varieties of trout (brown and sea trout) were recorded in Glencullin Lough in July 2023. Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2023 survey. Recruitment appears to be regular, and the population has remained stable across all surveys of the lake conducted since 2008.

The relative abundance and biomass of eel appears to have declined since 2008.

Classification and assigning lakes with an ecological status is a critical part of the WFD monitoring programme. It allows for the identification and prioritisation of 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 (Ecological Quality Ratio) values for each lake and associated confidence in classification (Kelly *et al*., 2012b). Using the FIL2 classification tool, Glencullin Lough has been assigned an ecological status of High for 2023 based on the fish populations present. Glencullin Lough was also assigned a status of High following all previous surveys of the lake (Figure 4.1).

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Glencullin Lough an overall ecological status of Moderate, based on all monitored physio-chemical and biological elements, including fish (EPA 2021).

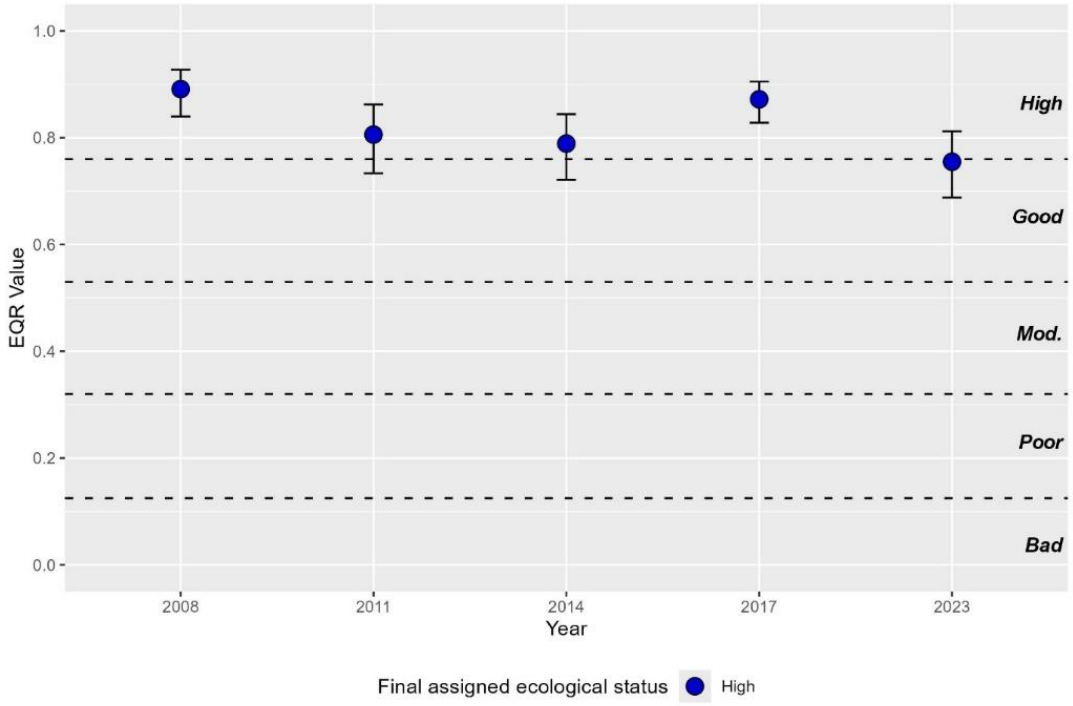

Figure 4.1. Fish ecological status, Glencullin Lough, between 2008 and 2023 (dashed lines indicates EQR status boundaries).

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

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600