

National Research Survey Programme

Lakes 2022

Ardderry Lough

IFI/2023/1-4650



Iascach Intíre Éireann
Inland Fisheries Ireland

Fish Stock Survey of Ardderry Lough, August 2022



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National Research Survey Programme

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1. Introduction

Ardderry Lough is the second lake on the Screebe system in Co. Galway (Plate 1.1, Figure 1.1). The lake is located adjacent to Maam Cross and to the south of the N59 Galway to Clifden road at an altitude of 37m a.s.l. (Figure 1.1). The underlying geology is categorised as siliceous. The lake has a surface area of 81.1ha, a mean depth of >4m and a maximum depth of 12m. The lake is classified as 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 CaCO₃).

The lake has been surveyed on five occasions since 2007 (2007, 2010, 2013, 2016 and 2019) (Kelly and Connor, 2007 and Kelly *et al.*, 2011, 2014, and 2017, Corcoran *et al.*, 2020). These surveys have revealed a change in the fish community in the lake. While perch have been the dominant species across all surveys Arctic char, a rare endemic species, has been not been recorded since 2010.

This report summarises the results of the 2022 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 Ardderry Lough showing net locations and depths of each net (outflow is indicated on map).



Plate 1.1. Aerial view of Ardderry Lough.

2. Methods

2.1. Netting methods

Ardderry Lough was surveyed over one night, from the 17th to the 18th of August 2022. 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 and 4 @ 6-11.9m) and two floating benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed in the lake (17 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 apart from perch were measured and weighed on site and scales were removed from all 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.

2.2. Fish diet

Total stomach contents were inspected, and prey 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).

$$FO_i = \left(\frac{N_i}{N} \right) * 100$$

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 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.

3. Results

3.1. Species Richness

Three fish species were recorded in Ardderry Lough in August 2022. A total of 207 fish were captured. The number of each species captured by each gear type is shown in Table 3.1. Perch was the most abundant fish species recorded. Brown trout and European eel were also captured in 2022. No Arctic char were recorded in 2022. The latter species was last captured in the 2010 survey.

Table 3.1. Number of each fish species captured by each gear type during the survey on Ardderry Lough, August 2022.

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Perca fluviatilis</i>	Perch	183	13	1	197
<i>Salmo trutta</i>	Brown trout	8	1	0	9
<i>Anguilla anguilla</i>	European eel	0	0	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. The CPUE and BPUE for each species captured in the 2022 survey is summarised in Table 3.2. For comparison purposes box plots of CPUE and BPUE for each species captured in all surveys per net type between 2007 and 2022 are presented in Figures 3.1a and 3.2b and illustrates fish community change over time. Perch have been recorded in all surveys conducted since 2007. Both abundance and biomass have remained relatively stable, with evidence of an increasing trend evident between 2007 and 2016. While brown trout populations appear to be stable, no Arctic char have been recorded since 2010.

Table 3.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Ardderry Lough, 2022

Scientific name	Common name	Mean CPUE (\pm S.E)	Mean BPUE (\pm S.E)
<i>Perca fluviatilis</i>	Perch	0.385 (0.108)	25.445 (7.008)
<i>Salmo trutta</i>	Brown trout	0.018 (0.010)	1.944 (0.937)
<i>Anguilla anguilla</i>	European eel	0.006 (0.006)*	0.978 (0.978)*

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.

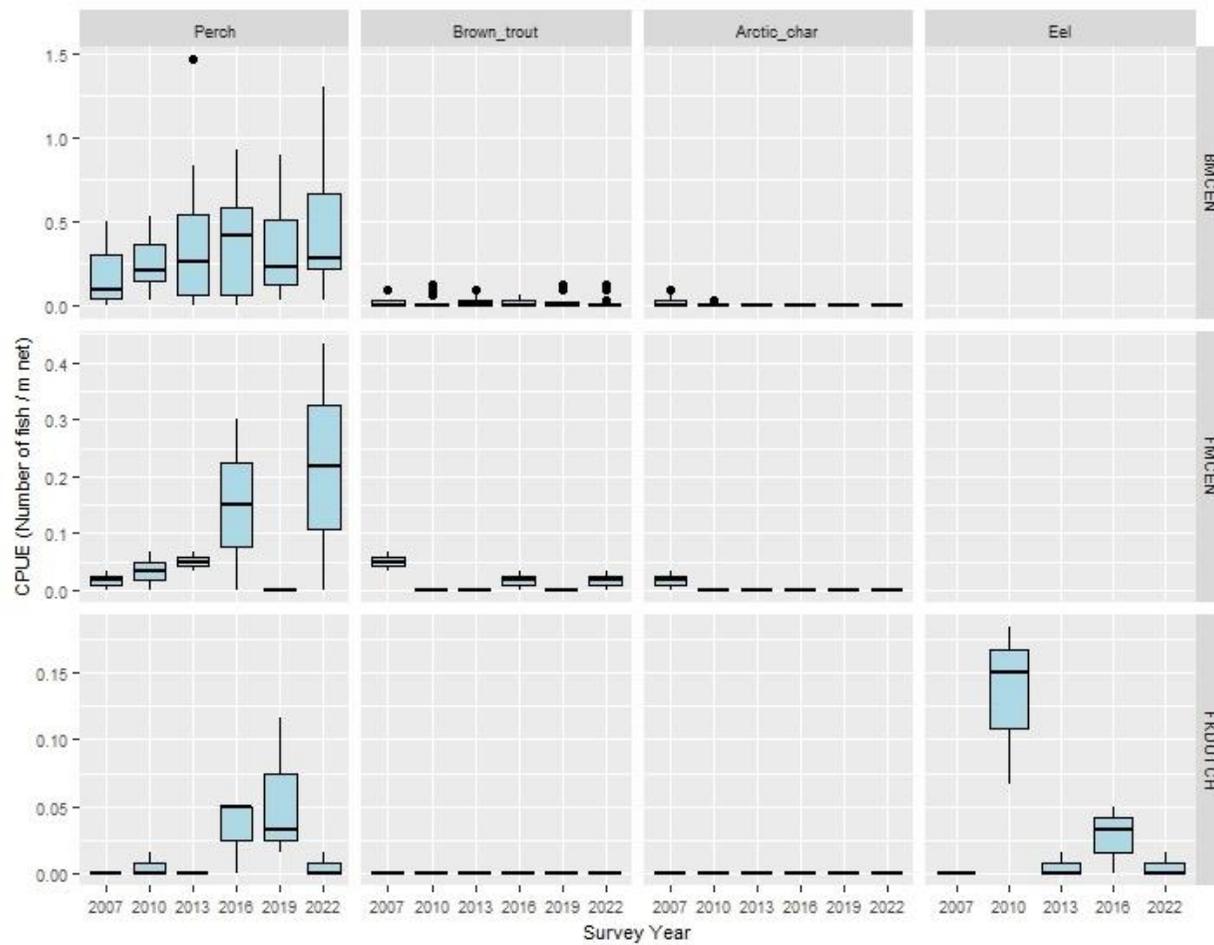


Figure 3.1. CPUE of fish species captured in each net type during surveys of Ardderry Lough between 2007 and 2022. Figures are expressed as numbers of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles are marked by the upper and lower boundary of each box. The vertical 'whiskers' show the data range. Outliers are marked by dots. The y-axis (CPUE) is unique for each net type

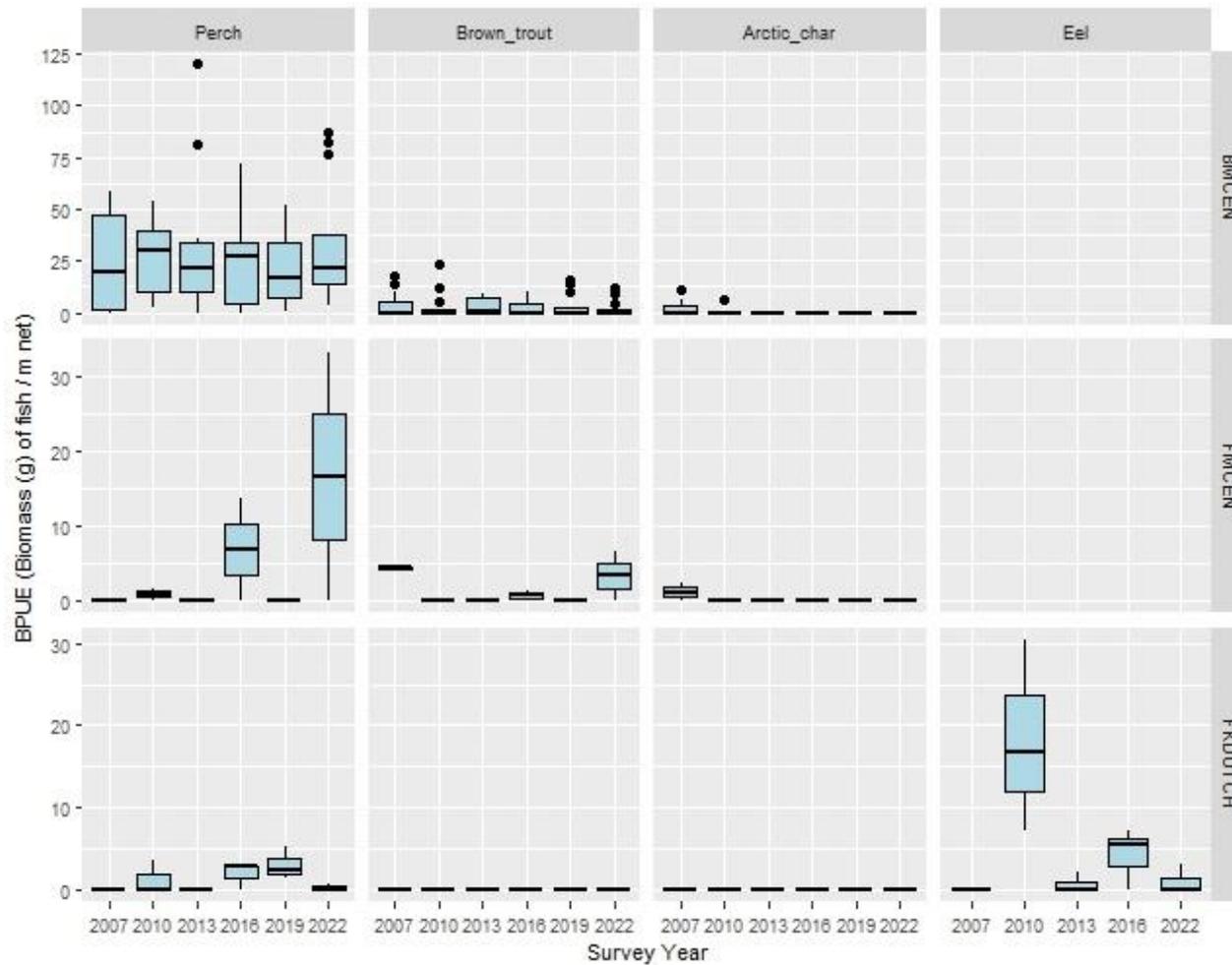


Figure 3.2. BPUE of fish species captured in each net type during surveys of Ardderry Lough between 2007 and 2022. Figures are expressed as biomass (g) of fish captured per linear meter of net deployed. The horizontal bars represent the median value of the sample, while the 75th and 25th percentiles 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

Perch

Perch captured during the 2022 survey ranged in length from 5.4cm to 20.9cm (mean 16.6cm). Length range was similar across all surveys conducted since 2007, although fewer larger fish (i.e. > 20-25cm) were captured in 2019 and 2022 compared to earlier surveys (Figure 3.3). Seven age classes were present. Perch were aged from 0+ to 6 and all intervening year classes were present in the sample aged. The dominant age class was 2+. Mean L1 (i.e., age at the end of the first year) was 7.1cm, (Table 3.3).

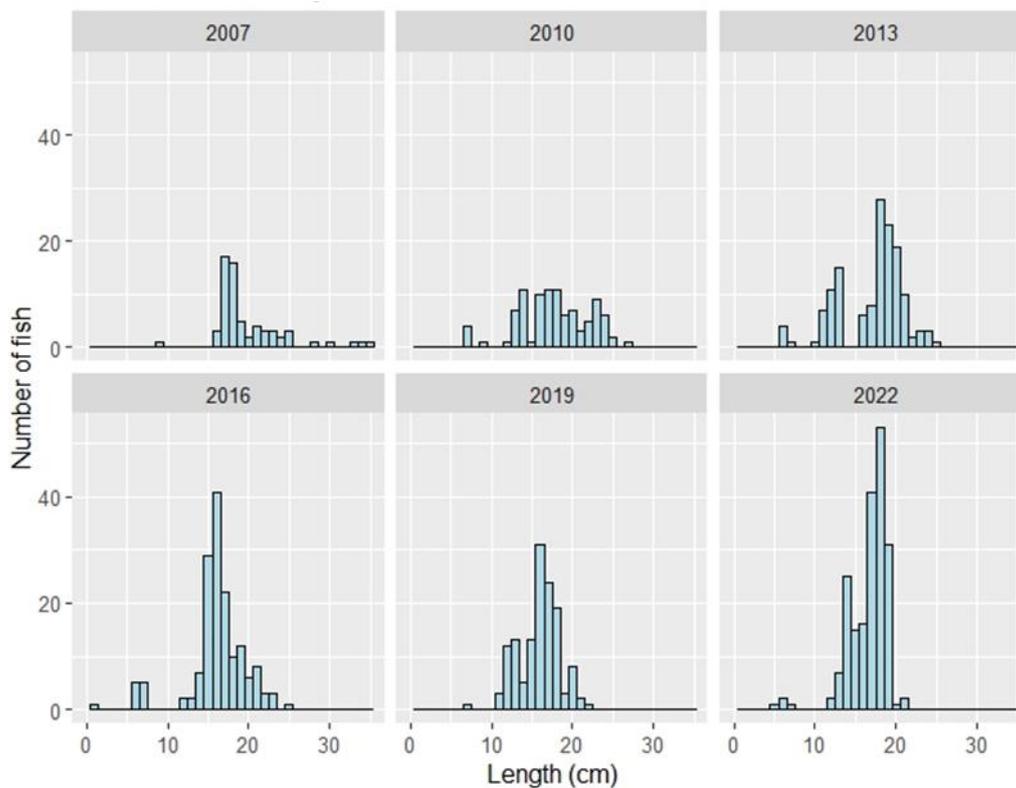


Figure 3.3. Length frequency of perch captured on Ardderry Lough, 2007, 2010, 2013, 2016, 2019 and 2022.

Table 3.3. Mean (\pm S.E.) perch length (cm) at age for Ardderry Lough, August 2022.

Length (cm)	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆
Mean (\pm S.E.)	7.1 (0.2)	12.8 (0.2)	15.3 (0.2)	17.2 (0.2)	18.3 (0.5)	19.5 (0.7)
N	50	44	26	16	4	2
Range	4.9 - 9.7	10.2 - 14.5	13.3 - 16.8	15.7 - 18.3	17.5 - 19.5	18.8 - 20.2

Brown trout

Brown trout captured during the 2022 survey ranged in length from 11.7cm to 25.9cm (mean 20.1cm) (Figure 3.4). Brown trout captured during previous surveys had similar length ranges, with some larger and older fish recorded in the 2007 survey (Figure 3.4). Three age classes were recorded ranging from 1+ to 3+. The most abundant age class sampled was 3+. Mean L1 (i.e., age at the end of the first year) was 7.5cm (Table 3.4).

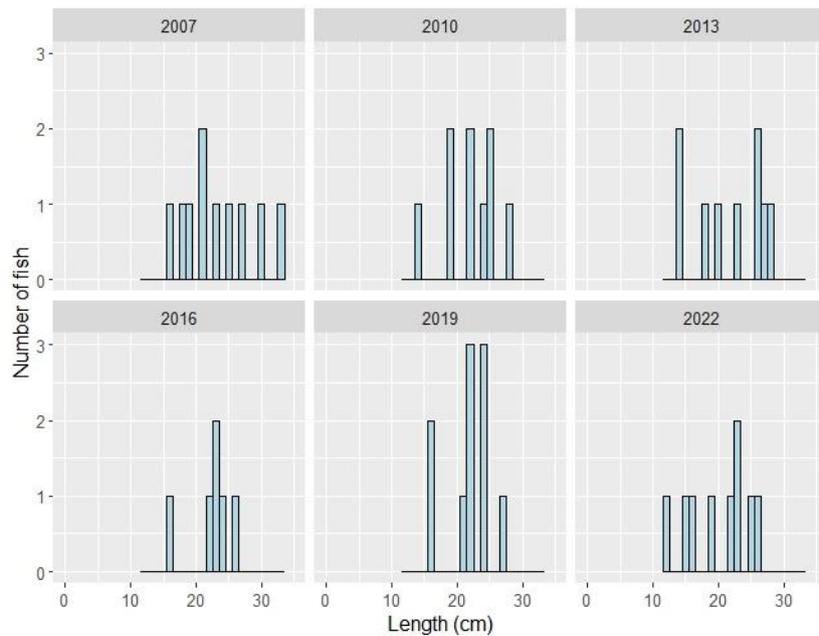


Figure. 3.4. Length frequency of brown trout captured on Ardderry Lough, 2007, 2010, 2013, 2016, 2019 and 2022.

Table 1.4. Mean (\pm S.E.) brown trout length (cm) at age for Ardderry Lough, August 2022.

Length (cm)	L ₁	L ₂	L ₃
Mean (\pm S.E.)	15.1 (0.5)	37.8 (1.9)	54.0 (1.0)
N	9	6	2
Range	13.0 - 18.0	32.0 - 46.0	53.0 - 55.0

Eels

One eel was captured during the survey, measuring 46.0cm in length and weighing 176.0g.

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 perch captured during the survey were examined and are presented below.

Perch

A total of 34 stomachs were examined. Eleven (32%) were found to contain no prey items. Of the remaining 23 stomachs containing food, 22 (96%) contained zooplankton and invertebrates were found in one stomach (4 %) (Figure 3.5).

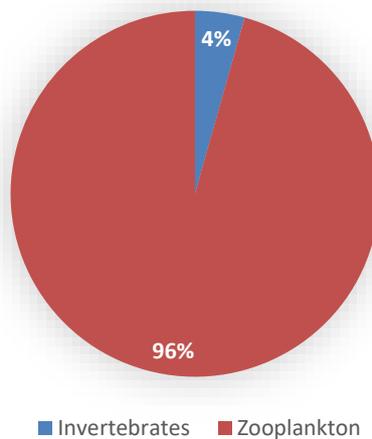


Fig 3.5. Diet of perch (N=23) captured on Ardderry Lough, 2022 (% FO).

Brown trout

Nine brown trout stomachs captured during the 2022 study were examined. Seven were found to contain no prey items. Identifiable prey (invertebrates) was recorded in one stomach and it was not possible to identify prey in the remaining stomach

4. Summary and fish ecological status

A total of three fish species were recorded in Ardderry Lough in August 2022. Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the survey. This species has dominated fish communities across all survey occasions since 2007 when they were first recorded in the lake. Perch were aged between 0+ and 6+ and all intervening age groups were present, indicating regular recruitment to the adult population.

Brown trout abundance and biomass have remained relatively stable across all survey periods. Fish were aged between 1+ and 3+ indicating regular recruitment of brown trout in Lough Ardderry.

No Arctic char have been recorded in surveys of the lake since 2010, when a single specimen was captured. In Ireland, Arctic char populations are threatened by several pressures including the combined impact of climate change and competition from non-native species (Connor *et al.*, 2019). Surveys of the adjacent Shindilla Lough have indicated a similar decrease and subsequent disappearance of Arctic char from that lake at a time that coincided with the first record of perch, and a subsequent population expansion in abundance and biomass of that population since 2010 (McLoone *et al.*, 2023).

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.*, 2012).

Using the FIL2 classification tool, Ardderry Lough has been assigned an ecological status of Good for 2022 based on the fish populations present. In previous years the lake was also assigned a fish status of Good in 2007, 2010, 2013, 2016 and 2019 (Figure 4.1). The EQR value calculated in 2022 is the lowest value recorded in Lough Ardderry (Figure 4.1). The decline in the EQR value is likely due to a decrease in native species, particularly European eel, when compared to previous surveys.

In the 2016 to 2021 surveillance monitoring reporting period, the EPA assigned Lough Ardderry an overall ecological status of Good, based on all monitored physico-chemical and biological elements, including fish.

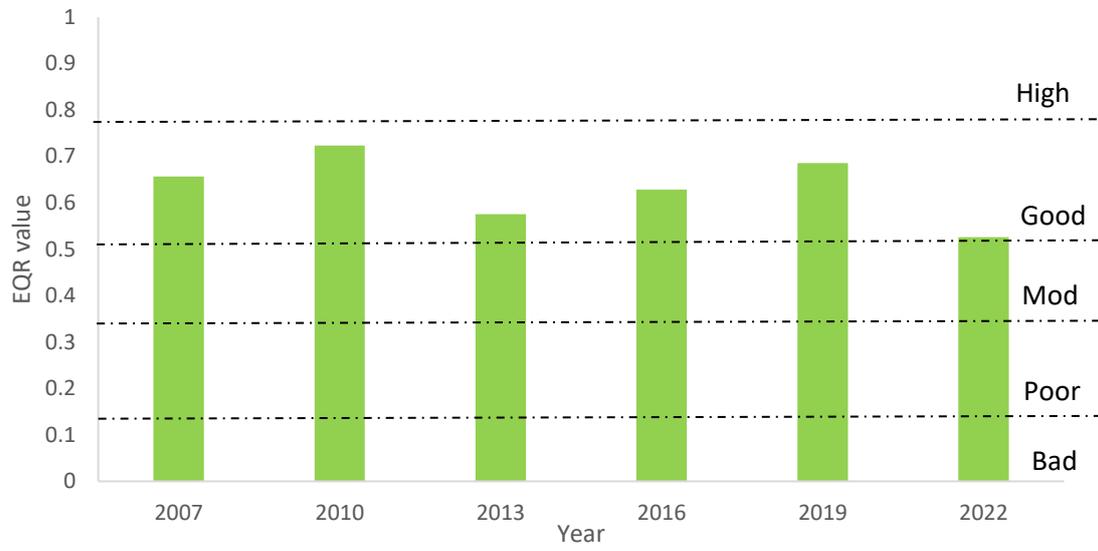


Figure 4.1. Fish ecological status, Lough Ardderry, 2007, 2010, 2013, 2016, 2019 and 2022 (dashed line indicates EQR status boundaries).

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