

National Research Survey Programme

Lakes 2019

Derryclare Lough

IFI/2020/1-4508



Iascach Iníre Éireann
Inland Fisheries Ireland



Inland Fisheries Ireland

National Research Survey Programme

**Fish Stock Survey of Derryclare Lough,
September 2019**

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

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Cover photo: Aerial view of Lough Shindilla © Inland Fisheries Ireland

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1.1 Introduction

Derryclare Lough is situated in the Ballynahinch system approximately 4.5km north-west of Recess, Co. Galway. The lake is located in the Inagh valley with the Twelve Pins Mountains rising to the west and the Maumturk mountain range to the east. Derryclare Lough is fed from the Tooreenacoona River, which flows into the lake from Lough Inagh (Plate 1.1, Fig. 1.1).

The lake has a surface area of 223ha and a maximum depth of 20m and has been characterised 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).

Derryclare Lough is situated within the Twelve Bens/Garraun Complex Special Area of Conservation (SAC). This is an extensive site located in the north-west of Connemara and is dominated by mountainous terrain. Geologically, the SAC can be divided into two distinct sections; the Twelve Bens which are composed of quartzite and schists in the valleys and the mountains to the north of Kylemore which are composed of gneiss, sandstones and mudstones (NPWS, 2005). The main soil type within the SAC is peat. Eight of the habitat types listed in the SAC are found in Annex I of the EU Habitats Directive. The SAC also contains the following species listed on Annex II of the Habitats Directive: freshwater pearl mussel, Atlantic salmon, otter and the plant, slender naiad (NPWS, 2005).

Derryclare Lough is part of the Lough Inagh and Derryclare Fishery. The lake holds a stock of brown trout, has a spring and grilse salmon fishery and a run of sea trout (O' Reilly, 2007).

Derryclare Lough was previously surveyed in 2014, as part of Inland Fisheries Ireland's (IFI) Habitats Directive and Red Data Book monitoring programme (O' Gorman *et al.*, 2015). Brown trout were found to be the dominant species. Minnow, three spined stickleback and European eels were also captured in the survey (O' Gorman *et al.*, 2015). No Arctic char were recorded during the 2014 survey although they had been recorded in the lake previously (Igoe *et al.*, 2003).

This report summarises the results of the 2019 fish stock survey. This survey was a joint survey, carried out by IFI's National Research Survey Programme and Habitats Directive and Red Data Book teams. The aim of the survey was to assess the current status of fish stocks in Derryclare Lough, after the introduction of perch to the lake, and determine the current status of Arctic char in the lake.



Plate 1.1. Derryclare Lough, photo taken from the “Butts” or long fishing piers at the northern end of the lake.

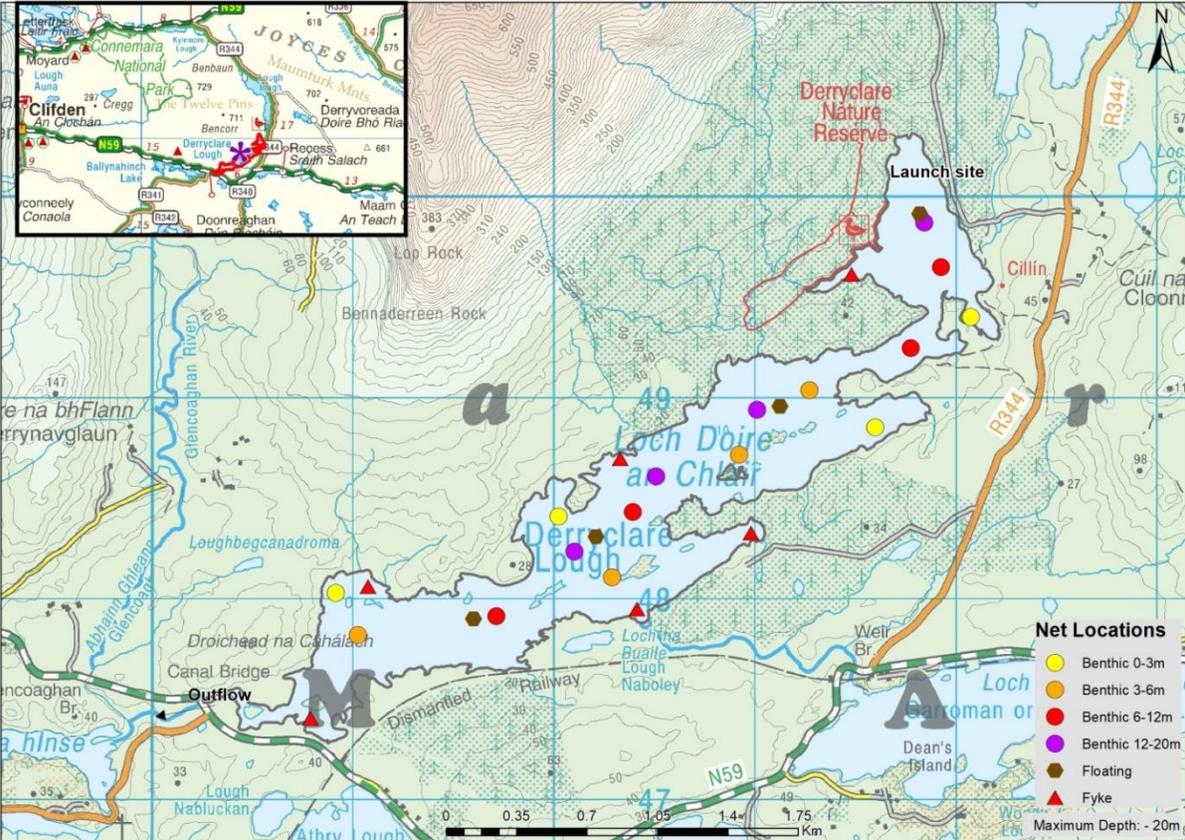


Fig. 1.1. Location map of Derryclare Lough showing net locations and depths of each net (outflow is indicated on map)



1.2 Methods

1.2.1 Netting methods

Derryclare Lough was surveyed over two nights from the 25th to the 27th of September 2019. A total of six sets of Dutch fyke nets, 16 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 4 @ 12-19.9m) and four floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (FM CEN) were deployed in the lake (26 sites). 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 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 (%FO) of prey items were then calculated to identify key prey items (Amundsen *et al.*, 1996).

$$\%FO_i = (N_i / N) \times 100$$

Where:

%FO_i is the percentage frequency of prey item i,
N_i is the number of a particular species with prey i in their stomach,
N is total number of a particular species 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 fish species were recorded in Derryclare Lough in September 2019, with 171 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Perch was the most common fish species recorded, followed by European eel, brown trout and Arctic char. Perch and Arctic char were not recorded in the previous survey carried out in 2014. Minnow and three-spined stickleback were recorded in 2014 but not in the 2019 survey.

Table 1.1. Number of each fish species captured by each gear type during the survey on Derryclare Lough, September 2019

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Perca fluviatilis</i>	Perch	141	0	1	142
<i>Salmo trutta</i>	Brown trout	10	0	2	12
<i>Salvelinus alpinus</i>	Arctic char	1	0	0	1
<i>Anguilla anguilla</i>	European eel	0	0	16	16

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 2019 survey are summarised in Table 1.2 and illustrated in Figures 1.2 and 1.3. The mean CPUE recorded in 2014 survey are included for comparison purposes. There was no BPUE data available for comparison.

Perch were the dominant species in terms of CPUE and BPUE in the 2019 survey, despite not being recorded in the 2014 survey. The mean CPUE of brown trout has declined since the 2014 survey. Arctic char were not recorded in the 2014 survey; however a single specimen was captured in 2019. The mean CPUE of European eels decreased between 2014 and 2019. Minnow and three-spined stickleback were recorded in 2014 but were absent in 2019 (Table 1.2 and Fig. 1.2).



Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Derryclare Lough, 2014 and 2019

Scientific name	Common name	Mean CPUE (\pm S.E)	
		2104	2019
<i>Perca fluviatilis</i>	Perch	-	0.181 (0.059)
<i>Salmo trutta</i>	Brown trout	0.126 (0.025)	0.014 (0.005)
<i>Salvelinus alpinus</i>	Arctic char	-	0.001 (0.001)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.012 (0.05)	-
<i>Phoxinus phoxinus</i>	Minnow	0.042 (0.014)	-
<i>Anguilla anguilla</i> *	European eel*	0.056 (0.019)	0.044 (0.013)*

Scientific name	Common name	Mean BPUE (\pm S.E)	
		2104	2019
<i>Perca fluviatilis</i>	Perch	NA	19.393 (6.240)
<i>Salmo trutta</i>	Brown trout	NA	7.148 (5.105)
<i>Salvelinus alpinus</i>	Arctic char	NA	0.136 (0.136)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	NA	-
<i>Phoxinus phoxinus</i>	Minnow	NA	-
<i>Anguilla anguilla</i> *	European eel*	NA	12.083 (3.276)*

Note: On the rare occasion 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

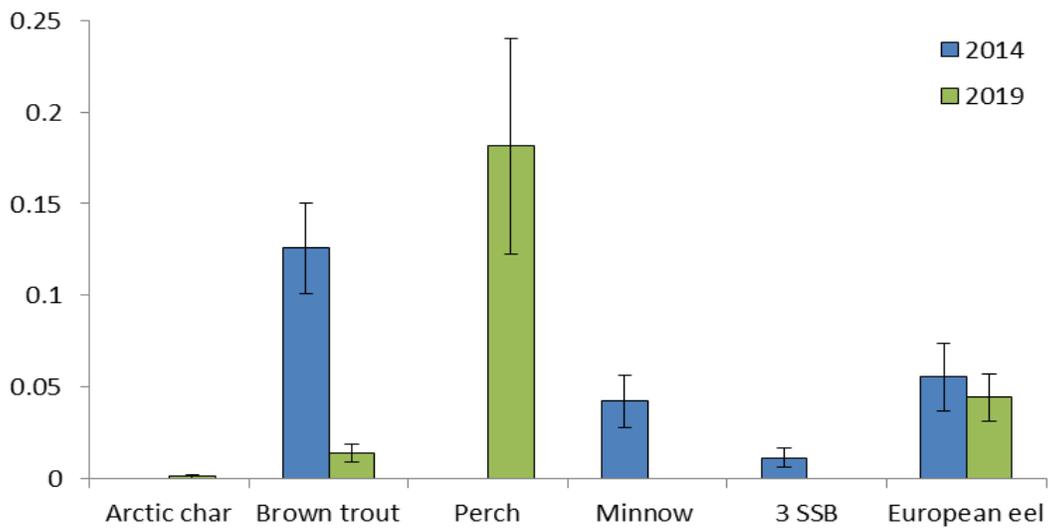


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Derryclare Lough (Eel CPUE based on fyke nets only), 2014 and 2019

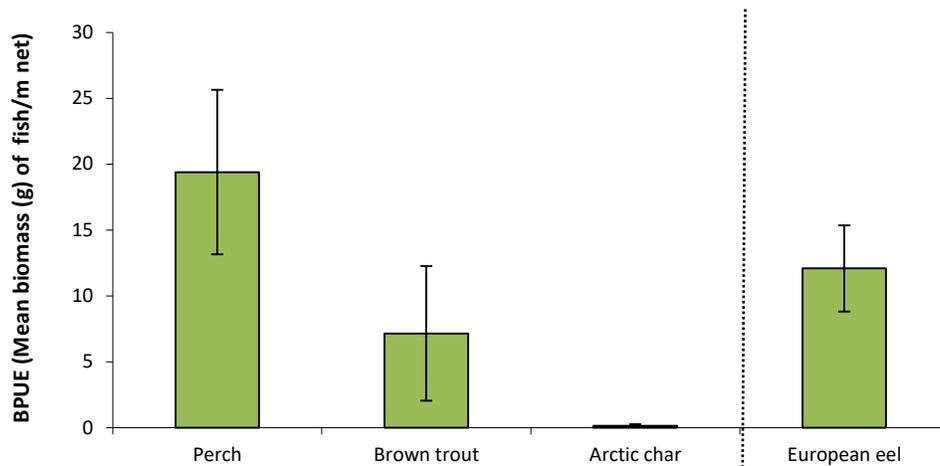


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Derryclare Lough (Eel BPUE based on fyke nets only), 2019

1.3.3 Length frequency distributions and growth

Perch

Perch captured during the 2019 survey ranged in length from 10.0cm to 36.5cm (mean = 18.3cm). Five age classes were present, ranging from 1+ to 6+, with a mean L1 of 8.1cm. The dominant age class was 3+ (Table 1.3, Fig 1.4.).

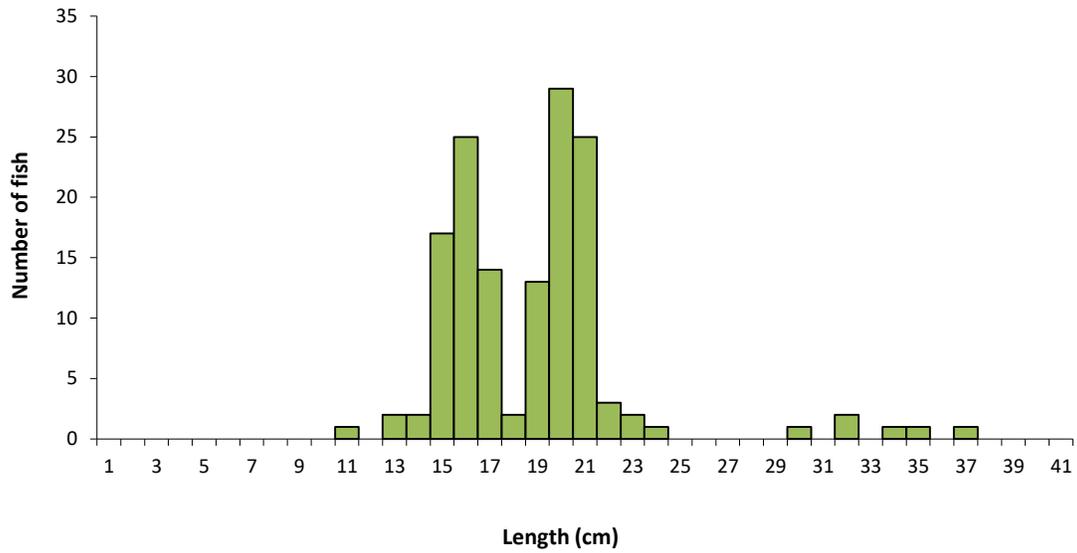


Fig. 1.4. Length frequency of perch captured on Derryclare Lough, 2019

Table 1.3. Mean (\pm S.E.) perch length (cm) at age for Derryclare Lough, September 2019

	L₁	L₂	L₃	L₄	L₅	L₆
Mean (\pm S.E.)	8.1 (0.2)	14.4 (0.3)	19.7 (0.4)	29.1 (0.3)	30.5 (0.4)	32.7 (0.8)
N	46	29	26	6	6	4
Range	5.5-11.4	10.4-17.6	17.0-24.4	28.4-30.2	29.1-31.6	30.4-34.2



Brown trout

Brown trout captured during the 2019 survey ranged in length from 9.8cm to 71.7cm (mean = 24.9cm) (Fig. 1.5). Five age classes were present, which were 1+ through to 4+ and a single 9+ fish. No 0+ fish were recorded in the survey. The calculated L1 of brown trout was 7.2 cm. The dominant age classes were 1+ and 2+ (Table 1.4, Fig 1.5). In 2014 brown trout were captured in larger numbers, ranged in length from 9.9cm to 36.5cm, with 3+ being the dominant age class

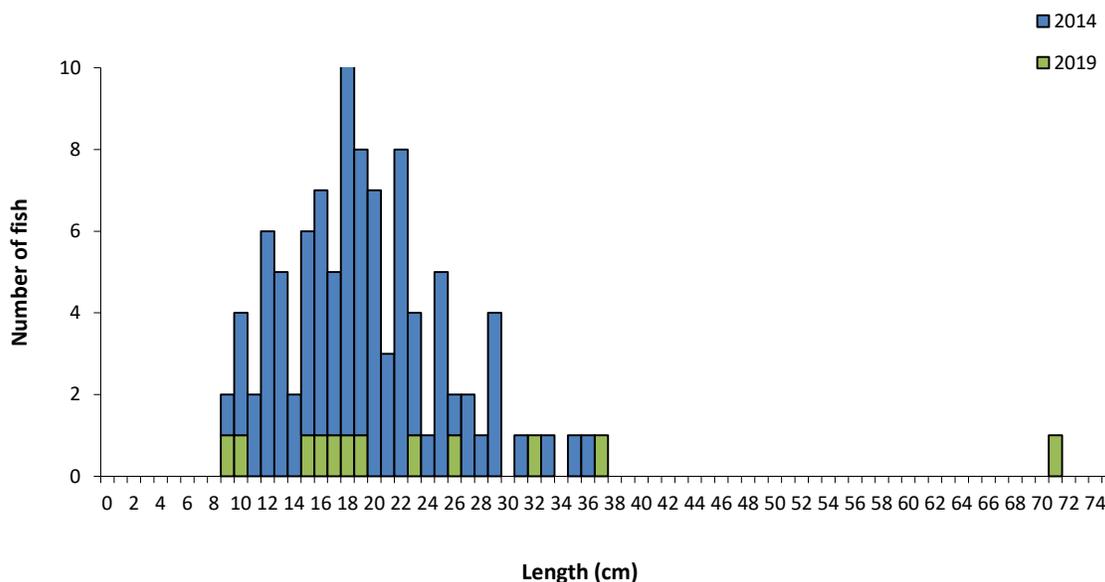


Fig. 1.5. Length frequency of brown trout captured on Derryclare Lough, 2014 and 2019

Table 1.4. Mean (\pm S.E.) brown trout length (cm) at age for Derryclare Lough, September 2019

	L ₁	L ₂	L ₃
Mean (\pm S.E.)	7.2 (0.2)	15.5 (0.6)	22.7 (1.1)
N	8	5	2
Range	6.7-8.0	14.7-17.7	21.5-23.8

Other fish species

European eel ranged in length from 30.0cm to 69.5cm. One Arctic char measuring 20.7cm and aged 3+ was recorded.

1.3.4 Stomach and diet analysis

Dietary analysis studies provide a good indication of the availability of food items and the angling methods that are likely to be successful. However, the value of stomach content analysis is limited unless undertaken over a long period as diet may change on a daily basis depending on the availability of food items. The stomach contents of a subsample of perch and brown trout captured during the survey were examined and are presented below.

Perch

Perch initially start to feed on pelagic zooplankton. Once they reach an intermediate size they start feeding on benthic resources eventually moving on to feed on fish once they are large enough (Hjelm *et al.*, 2000). A total of 46 stomachs were examined, of these 14 were found to contain no prey items. Of the 32 remaining stomachs 63% contained invertebrates, 28% contained zooplankton and 9% unidentified digested material (Fig. 1.6).

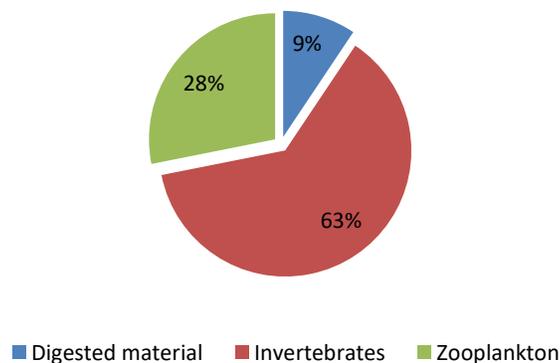


Fig 1.6. Diet of perch (n=32) captured on Derryclare Lough, 2019 (% FO)

Other species

A total of seven brown trout stomachs were examined. Four were found to contain no prey items, two stomachs contained invertebrate remains and one stomach contained unidentified digested material. A single Arctic char stomach was examined and was found to contain unidentified digested material.



1.4 Summary and ecological status

A total of four fish species were recorded in Derryclare Lough in September 2019. Perch and Arctic char were recorded in the survey, but were not captured during the previous survey in 2014. Brown trout and eels were also present.

Perch was the dominant species in terms of both abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2019 survey. Perch ranged in length from 10.0cm to 36.5cm. Five age classes were present, ranging from 1+ to 6+, indicating reproductive success in five of the previous seven years. The dominant age class was 3+.

Brown trout ranged in length from 9.8cm to 71.7cm. Five age classes were present, ranging from 1+ to 9+. The dominant age classes were 1+ and 2+.

Since the previous survey in 2014, there has been a shift in the species composition in Derryclare Lough. Perch are now the dominant species, having been absent from the 2014 survey; while brown trout abundances have decreased since 2014. Arctic char were absent from the 2014 survey but a single individual was recorded in 2019, indicating that a small population still exists in the lake. The population of Arctic char may now be so small that it is difficult to capture using conventional sampling methods and could be on the verge of extinction. Introductions of perch and other non-indigenous species to new areas can cause declines in Arctic char populations in small oligotrophic lakes and can also lead to extinctions in some lakes (Kelly *et al.*, 2014, Kelly *et al.*, 2017, Connor *et al.*, 2019 and Morrissey-McCaffrey *et al.*, 2018). Arctic char populations are generally sensitive to the presence of other fish species and have a tendency to be less dominant where they co-exist in Ireland (Igoe and Hammer, 2004). Arctic char conservation in Ireland should focus on protecting the remaining populations and preventing the dispersal of non-indigenous fish species to lakes where Arctic char are present because, unlike other stressors (e.g. pollution), species introductions are almost impossible to reverse (Connor *et al.*, 2019 and Morrissey-McCaffrey *et al.*, 2018). In Ireland, lake morphology (e.g. size and depth) may also influence the coexistence potential of brown trout and species such as pike, with implications for brown trout conservation following introduction of novel species (McLoone *et al.*, 2018).

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 Derryclare Lough has been assigned an ecological status of High for 2019 based on the fish populations present.



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