National Research Survey Programme

Lakes 2019

Ardderry Lough

IFI/2020/1-4500

Iascach Intíre Éireann
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Fish Stock Survey of Ardderry Lough, August 2019

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

CITATION: Corcoran, W., Connor, L., Bateman, A., Cierpial, D., Coyne, J., McLoone, P., Twomey, C., Rocks, K., Gordon, P., Lopez, S., Matson, R., O' Briain, R. and Kelly, F.L. (2020) Fish Stock Survey of Ardderry Lough, July 2019. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

Cover photo: Aerial view of Lough Shindilla, Co. Galway © Inland Fisheries Ireland

ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of all their colleagues in Inland Fisheries Ireland.

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Climate Action and Environment for 2019.

1.1 Introduction

Ardderry Lough is the second lake on the Screebe system in Co. Galway (Plate 1.1, Fig 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. (Fig. 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 falls into 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 $CaCO_3$).

The lake holds a stock of brown trout, the average size of which is 0.3kg (O' Reilly, 2007). Ardderry Lough was previously surveyed in 2007, 2010, 2013 and 2016 as part of the WFD surveillance monitoring programme (Kelly and Connor, 2007 and Kelly *et al.*, 2011, 2014 and 2017). During the 2016 survey, perch was found to be the dominant species present in the lake. Brown trout and eels were also captured.

This report summarises the results of the 2019 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme.

Plate 1.1. Aerial view of Ardderry Lough

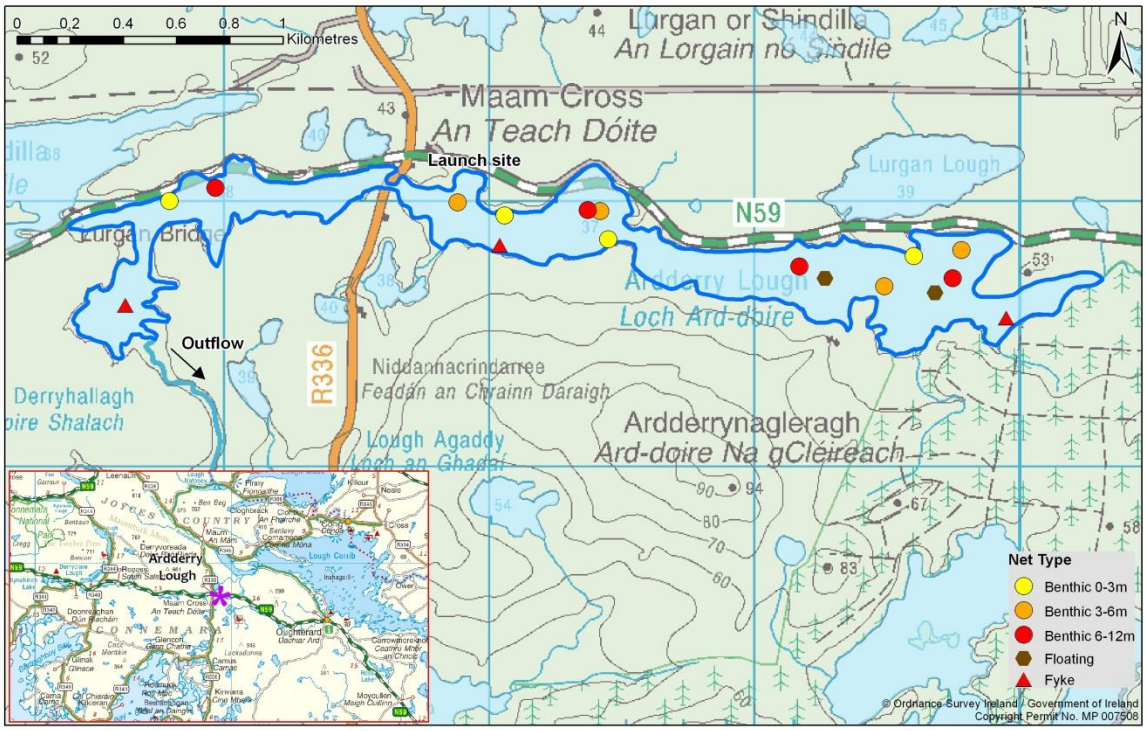

Fig. 1.1. Location map of Ardderry Lough showing net locations and depths of each net (outflow is indicated on map)

1.2 Methods

1.2.1 Netting methods

Ardderry Lough was surveyed over one night, from the 20th to the 21st of August 2019. 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. 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

Two fish species were recorded in the fish stock survey on Ardderry Lough in August 2019, with 145 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Perch was the most abundant fish species recorded, followed by brown trout. During previous surveys in 2007, 2010, 2013 and 2016 the same species composition was recorded. In addition sea trout were recorded in 2010 only, Arctic char were recorded in 2007 and 2010 only, salmon were recorded in 2007 only, minnow were captured in 2016, and European eel were recorded in 2007, 2010, 2013 and 2016 (Kelly and Connor, 2007 and Kelly *et al*., 2011, 2014 and 2017).

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

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
Perca fluviatilis	Perch	125	0	10	135
Salmo trutta	Brown trout	10	0	0	10

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 2007, 2010, 2013, 2016 and 2019 surveys are summarised in Table 1.2 and illustrated in Figures 1.2 and 1.3.

Perch

Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE). The mean perch CPUE increased from 2007to 2016 and decreased from 2016 to 2019 and (Table 1.2; Fig. 1.2.). The mean perch BPUE increased from 2007 to 2013, and decreased from 2013 to 2019 (Table 1.2; Fig. 1.3).

Brown trout

The mean brown trout CPUE and BPUE remained relatively stable during the five sampling occasions. The mean CPUE was higher in 2019 compared to previous surveys while the mean BPUE in 2019 was higher than 2016 but lower than 2007, 2010 and 2013 (Table 1.2; Figs. 1.2 and 1.3).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Ardderry Lough, 2007, 2010, 2013, 2016 and 2019

Scientific name	Common name	2007	2010	2013	2016	2019
				Mean CPUE		
Perca fluviatilis	Perch	0.127 (0.042)	0.187 (0.042)	0.278 (0.094)	0.302 (0.076)	0.255 (0.068)
Salmo trutta	Brown trout	0.019 (0.007)	0.017(0.009)	0.018 (0.007)	0.012 (0.005)	0.020 (0.011)
	Sea trout	-	0.002 (0.002)	-	-	-
Salvelinus alpinus	Arctic char	0.015 (0.007)	0.002 (0.002)	-	-	-
Salmo salar	Salmon	0.002 (0.002)	-			
Phoxinus phoxinus	Minnow	-	-	-	0.002 (0.002)	-
Anguilla anguilla	European eel*	0.002 (0.001))	0.133 (0.034)	0.006 (0.006)	0.028 (0.015)	-
				Mean BPUE		
Perca fluviatilis	Perch	18.200 (5.641)	19.339 (4.534)	22.449 (7.911)	19.404 (4.989)	15.137 (3.922)
Salmo trutta	Brown trout	3.347 (1.340)	2.400 (1.526)	2.445 (0.897)	1.689 (0.761)	2.335 (1.283)
	Sea trout	-	0.458 (0.458)	-	-	-
Salvelinus alpinus	Arctic char	1.950 (0.901)	0.378 (0.378)	-	-	-
Salmo salar	Salmon	4.901 (4.901)				
Phoxinus phoxinus	Minnow	-	-	-	0.001 (0.001)	-
Anguilla anguilla	European eel*	3.616 (1.838)	18.088 (6.748)	0.656 (0.656)	1.807 (0.904)	-

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

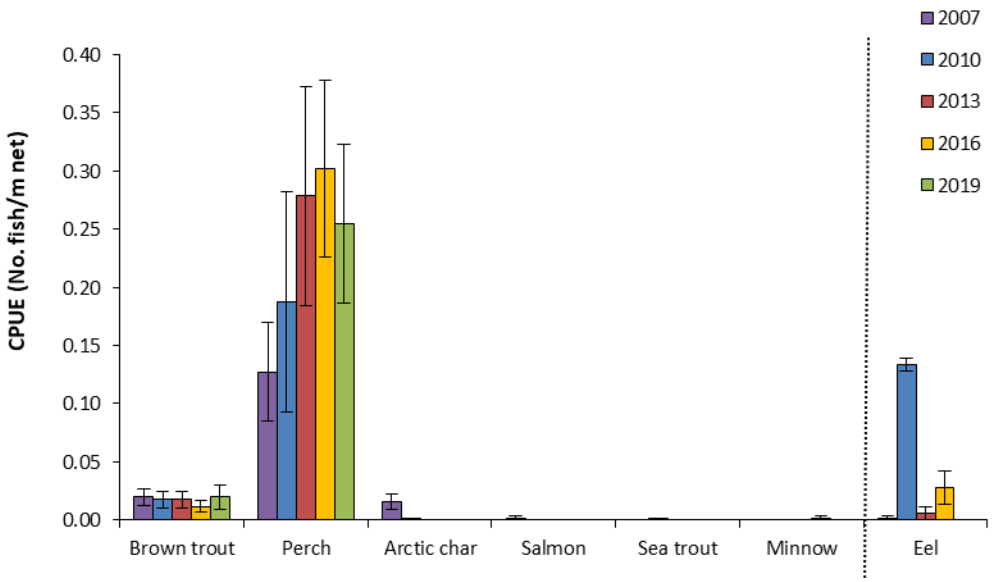

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Ardderry Lough (Eel CPUE based on fyke nets only), 2007, 2010, 2013, 2016 and 2019

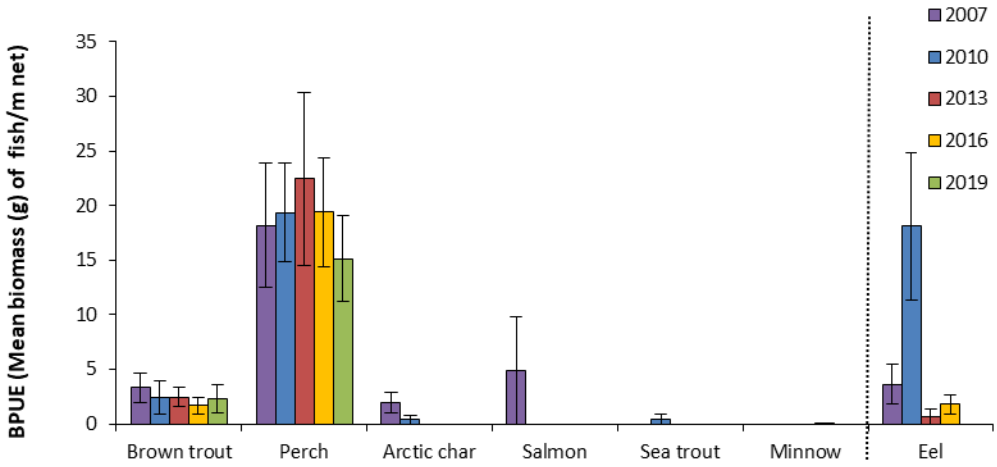

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Ardderry Lough (Eel CPUE based on fyke nets only), 2007, 2010, 2013, 2016 and 2019

1.3.3 Length frequency distributions and growth

Perch

Perch captured during the 2019 survey ranged in length from 6.6cm to 22.0cm (mean = 16.0cm) (Fig. 1.4). Perch captured during the 2007, 2010, 2013 and 2016 surveys had a broadly similar length range to 2019 with the 2007 survey recording some larger fish. Nine age classes were present in 2019, ranging from 0+ to 10+, with a mean L1 of 6.7cm, no 8+ or 9+ fish were recorded (Table 1.3). The dominant age class was 1+.

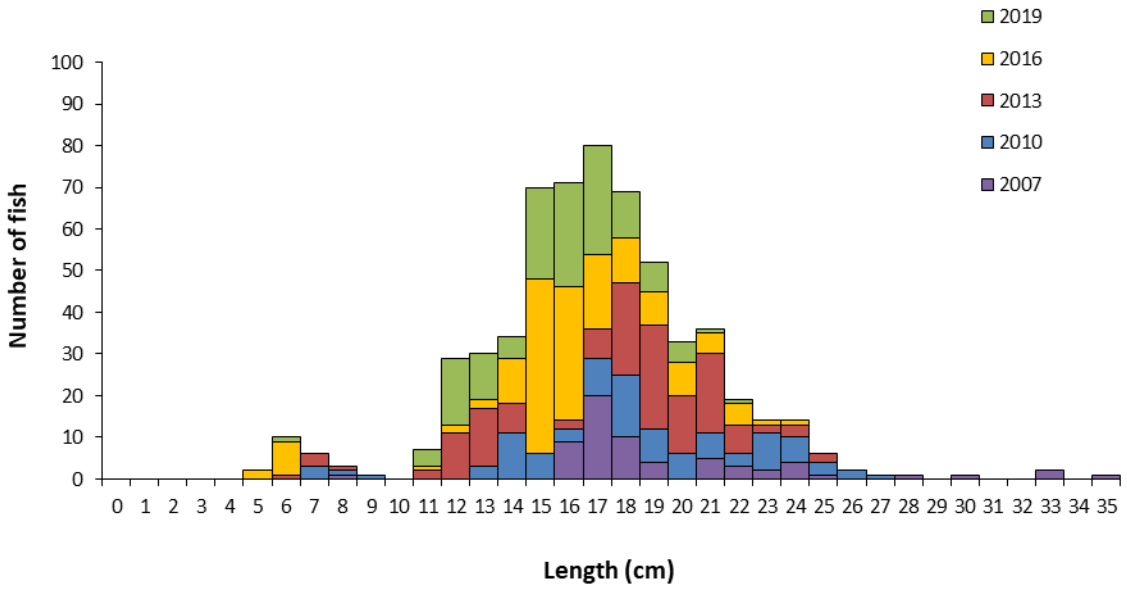

Fig. 1.4. Length frequency of perch captured on Ardderry Lough, 2007, 2010, 2013, 2016 and 2019

Table 1.3. Mean (±S.E.) length (cm) at age for perch recorded on Ardderry Lough, August 2019

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}
Mean (±S.E.)	6.7 (0.1)	12.6 (0.2)	15.2 (0.2)	16.9 (0.3)	17.9 (0.3)	18.4 (0.4)	19.5 (0.9)	20.9	21.3	21.6
N	46	35	27	21	18	14	3	1	1	1
Range	5.3-8.8	9.5-14.9	12.8-17.6	14.2-19.3	15.1-20.2	15.9-20	17.8-20.5	-	-	-

Brown trout

Brown trout captured during the 2019 survey ranged in length from 16.0cm to 27.3cm (mean = 21.8cm) (Fig. 1.5). Brown trout captured during the 2007, 2010, 2013 and 2016 surveys had similar length ranges, with some larger and older fish recorded in the 2007 survey (Fig.1.5). Three age classes were recorded ranging from 1+ to 3+, with a mean L1 of 7.5cm (Table 1.4). The dominant age class was 3+. Brown trout captured during the 2007, 2010, 2013 and 2016 surveys had similar age ranges, with the oldest fish (4+) recorded in 2007 and 2010.

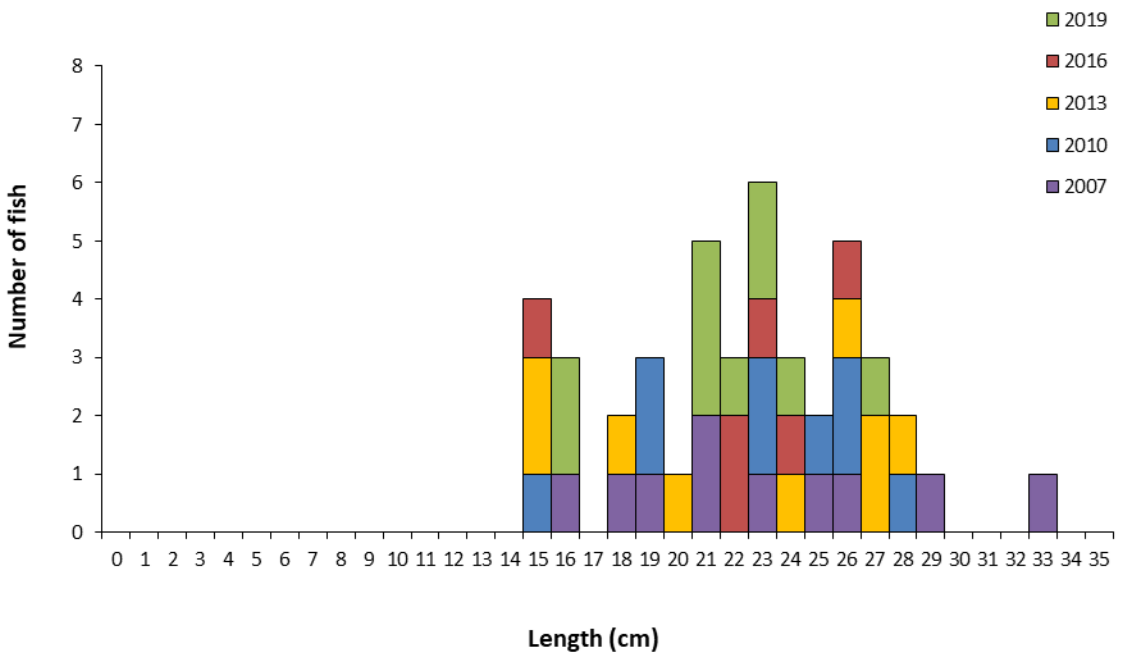

Fig. 1.5. Length frequency of brown trout captured on Ardderry Lough, 2007, 2010, 2013, 2016 and 2019

Table 1.4. Mean (±S.E.) length (cm) at age for brown trout recorded on Ardderry Lough, August 2019

	L_1	L_2	L_3
Mean (±S.E.)	7.5 (0.5)	15.4 (0.9)	21.1 (1.0)
N	9	7	4
Range	4.5-8.9	11.0-18.7	18.9-23.7

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 sub-sample 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 48 stomachs were examined. Of these 26 were found to contain no prey items. Of the remaining 22 stomachs containing food, 82% contained invertebrates, 14% zooplankton and 4% unidentified digested material (Fig. 1.6).

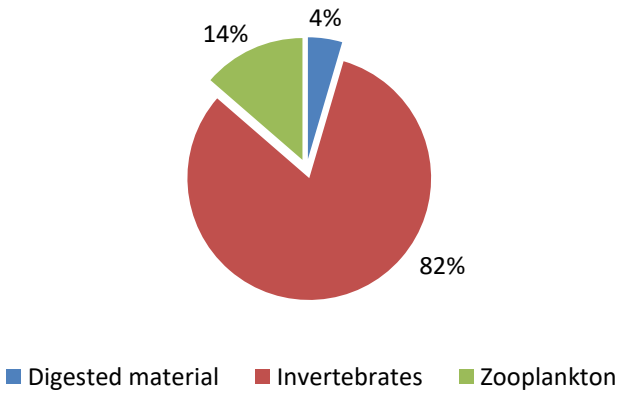

Fig 1.6. Diet of perch (n=22) captured on Ardderry Lough, 2019 (% FO)

Brown trout

Adult trout usually feed principally on crustaceans (*Asellus* sp. and *Gammarus* sp.), insects (principally chironomid larvae and pupae) and molluscs (snails) (Kennedy and Fitzmaurice, 1971, O'Grady, 1981). A total of 10 stomachs were examined. Of these five were found to contain no prey items. Of the five remaining stomachs containing food, 100% contained invertebrates.

1.4 Summary and ecological status

A total of two fish species were recorded in Ardderry Lough in July 2019. Perch was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2019 survey.

The mean perch CPUE was lower in 2019 than in 2016 and 2013. The mean BPUE was also lower than 2016. Perch ranged in length from 6.6cm to 22.0cm. Nine age classes were present, ranging from 0+ to 10+; no 8+ or 9+ fish were captured. This indicates reproductive success in nine of the previous 11 years. The dominant age class was 1+.

The mean brown trout CPUE and BPUE has remained relatively stable over the five surveys between 2007 and 2019. Brown trout ranged in length from 16.0cm to 27.3cm and ranged in age from 1+ to 3+, indicating reproductive success in the three previous years.

Arctic char have not been recorded in fish stock surveys on the lake since 2010 indicating that the population is either extinct or so small that it is difficult to capture using standard sampling methods.

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, Ardderry Lough has been assigned an ecological status of Good for 2019 based on the fish populations present. In previous years the lake was also assigned a fish status of Good in 2007, 2010, 2013 and 2016 (Fig. 1.7).

In the 2013 to 2018 surveillance monitoring reporting period, the EPA assigned Ardderry Lough an overall draft ecological status of Good, based on all monitored physico-chemical and biological elements, including fish.

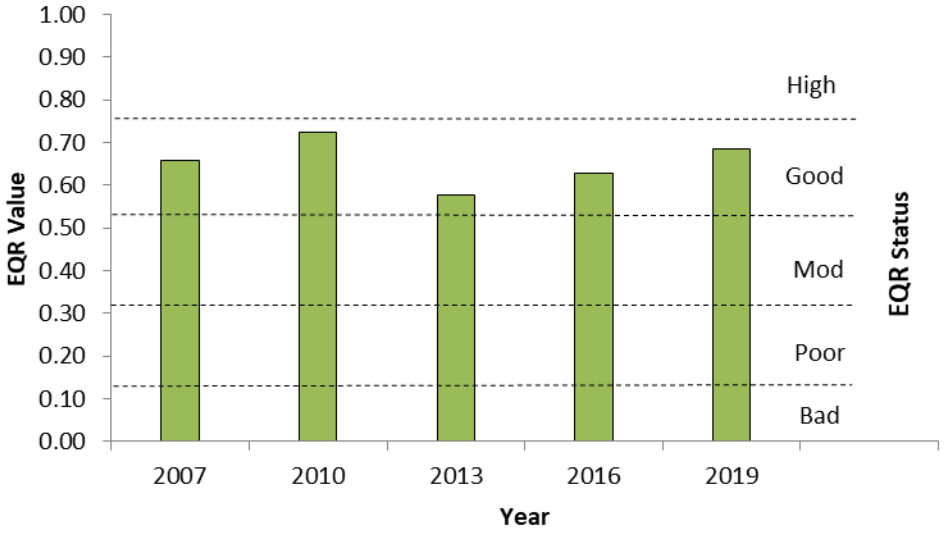

Fig. 1.7. Fish ecological status, Ardderry Lough, 2007, 2010, 2013, 2016 and 2019 (dashed line indicates EQR status boundaries)

1.5 References

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