

National Research Survey Programme

Lakes 2018

Doo Lough

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Iascach Iníre Éireann
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National Research Survey Programme

**Fish Stock Survey of Doo Lough,
October 2018**

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

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Cover photo: Netting survey on Lough Gur © Inland Fisheries Ireland

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1.1 Introduction

Doo Lough is located approximately 6km north-west of Leenaun, Co. Mayo (Plate 1.1, Fig. 1.1). It is one of four lakes situated in the Delphi fishery - Fin, Doo, Glencullin and Cunne. Glencullin Lough, located directly above Doo Lough, flows into the lake via a short stream. Doo Lough in turn drains into Fin Lough which is connected to Killary Harbour via the Bundorragha River.

The lake is approximately 3.5km in length and up to 750m wide. It has a surface area of 155ha, a maximum depth of 46m and an altitude of 30m a.s.l. The lake falls into typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), greater than 50ha and low alkalinity (<20mg/l CaCO₃).

Doo Lough forms part of the Mweelrea/Sheefry/Erriff candidate Special Area of Conservation (SAC) complex (NPWS, 2005). The site has been selected for containing active blanket bog, lagoons, machair, decalcified dunes and petrifying springs - all priority habitats on Annex I of the E.U. Habitats Directive. The SAC is also selected for containing the following species listed on Annex II of the same Directive - freshwater pearl mussel, Atlantic salmon, otter, the snails *Vertigo angustior* and *V. geyeri*, the plant slender naiad and the liverwort petalwort (NPWS, 2005).

Doo Lough is an oligotrophic lake (NPWS, 2005) and was once famous for its sea trout fishery, which has been in decline since the late 1980s due to problems with sea lice. Doo Lough holds brown trout, sea trout, Arctic char and gets both a spring and grilse salmon run (O' Reilly, 2007).

This lake was previously surveyed as part of the Water Framework Directive surveillance monitoring programme in 2009, 2012 and 2015 (Kelly *et al.*, 2010, 2013 and 2016). During the 2015 survey, brown trout were found to be the dominant species present in the lake followed by Arctic char. Sea trout, three-spined stickleback, salmon and eels were also captured during the surveys.

This report summarises the results of the 2018 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme.



Plate 1.1. Dool Lough, looking north from the launch site.

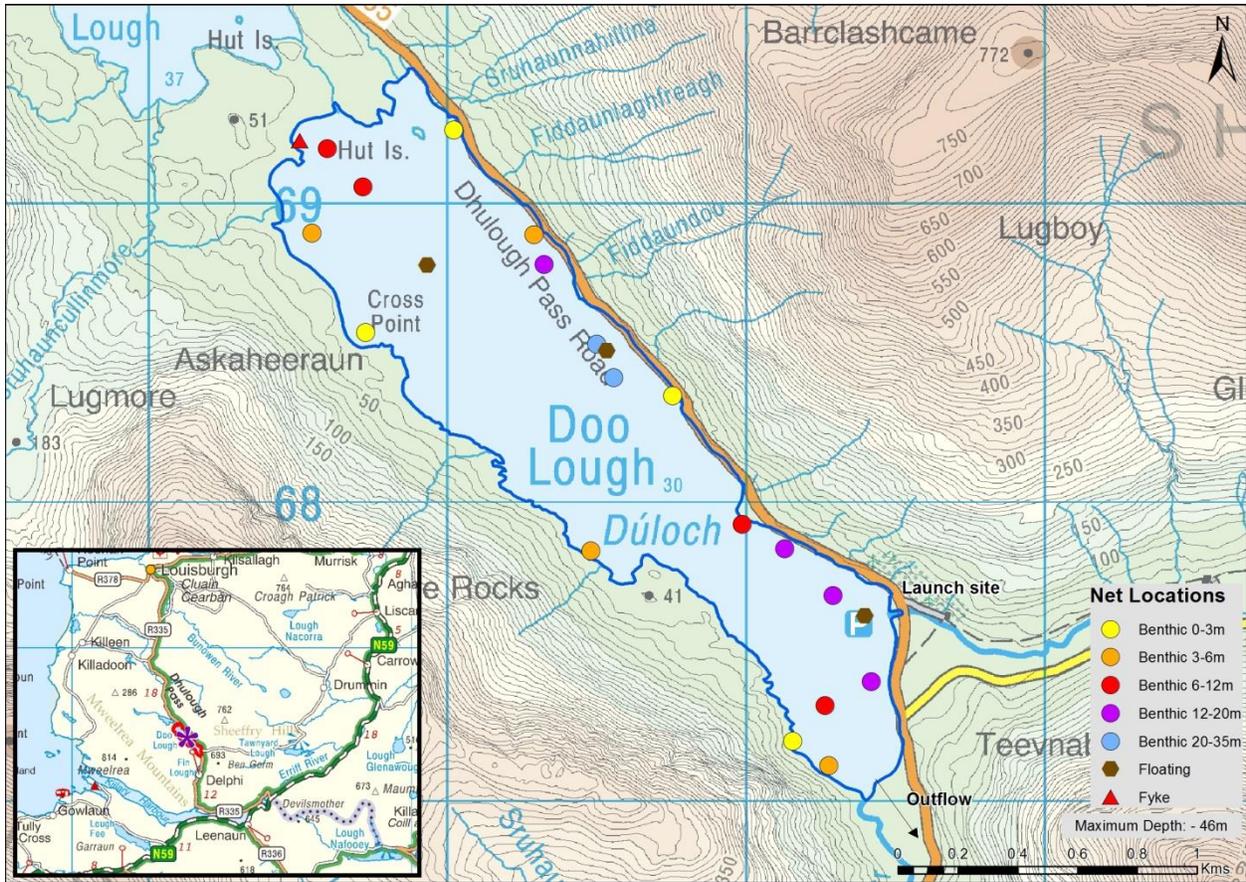


Fig. 1.1. Location map of Doo Lough showing locations and depths of each net (outflow is indicated on map)



1.2 Methods

1.2.1 Netting methods

Doo Lough was surveyed over two nights between the 1st and 3rd of October 2018. A total of one set of Dutch fyke nets (Fyke), 18 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, 4 @ 6-11.9m, 4 @ 12-19.9m and 2 @ 20-34.9m) and three 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 (22 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 all trout, salmon and Arctic char. Live fish were returned to the water whenever practical or 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 five fish species (sea trout are included as a separate 'variety' of trout) were recorded in Doo Lough in October 2018, with 263 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most abundant fish species recorded, followed by Arctic char, three-spined stickleback, eels and salmon. During the previous surveys in 2009, 2012 and 2015 the same species composition was recorded (Kelly *et al.*, 2010, 2013 and 2016).

Table 1.1. Number of each fish species captured by each gear type during the survey on Doo Lough, October 2018

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Salmo trutta</i>	Brown trout	157	1	19	177
	Sea trout	27	0	0	27
<i>Salvelinus alpinus</i>	Arctic char	37	0	0	37
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	20	0	0	20
<i>Salmo salar</i>	Salmon	1	0	0	1
<i>Anguilla anguilla</i>	European eel	0	0	1	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. Mean CPUE and BPUE for all fish species captured in the 2009, 2012 and 2015 surveys are summarised in Table 1.2 and illustrated in Figures 1.2 and 1.3.

Brown trout

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE). The mean brown trout CPUE and BPUE increased over the three sampling occasions (Table 1.2; Figs. 1.2 and 1.3).

Arctic char

The mean Arctic char CPUE and BPUE also fluctuated slightly over the four sampling occasions. Mean CPUE and BPUE were higher in 2015 and 2018 in comparison to the other years (Table 1.2; Figs. 1.2 and 1.3).



Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Doo Lough, 2009, 2012, 2015 and 2018

Scientific name	Common name	2009	2012	2015	2018
Mean CPUE					
<i>Salmo trutta</i>	Brown trout	0.057 (0.018)	0.136 (0.034)	0.121 (0.030)	0.254 (0.063)
	Sea trout	0.012 (0.0050)	0.012 (0.004)	0.012 (0.004)	0.041 (0.013)
<i>Salvelinus alpinus</i>	Arctic char	0.023 (0.011)	0.021 (0.006)	0.072 (0.036)	0.0556 (0.020)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.006 (0.003)	0.001 (0.001)	0.021 (0.007)	0.030 (0.015)
<i>Salmo salar</i>	Salmon	0.001 (0.001)	0.004 (0.002)	0.004 (0.002)	0.002 (0.002)
<i>Anguilla anguilla</i>	European eel*	0.017 (0.017)*	0.042 (0.025)*	0.025 (0.008)*	0.017 (0.000)*
Mean BPUE					
<i>Salmo trutta</i>	Brown trout	3.437 (1.242)	7.072 (1.987)	9.887 (3.116)	17.615 (4.521)
	Sea trout	4.824 (1.839)	5.404 (2.292)	8.447 (3.203)	10.692 (3.871)
<i>Salvelinus alpinus</i>	Arctic char	1.135 (0.770)	1.342 (0.396)	3.8641 (2.089)	4.036 (1.457)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.025 (0.012)	0.001 (0.001)	0.029 (0.009)	0.033 (0.017)
<i>Salmo salar</i>	Salmon	0.008 (0.0080)	4.672 (3.229)	3.519 (3.460)	0.011 (0.011)
<i>Anguilla anguilla</i>	European eel*	3.967 (3.967)*	6.158 (4.675)*	5.629 (0.812)*	2.492 (0.000)*

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

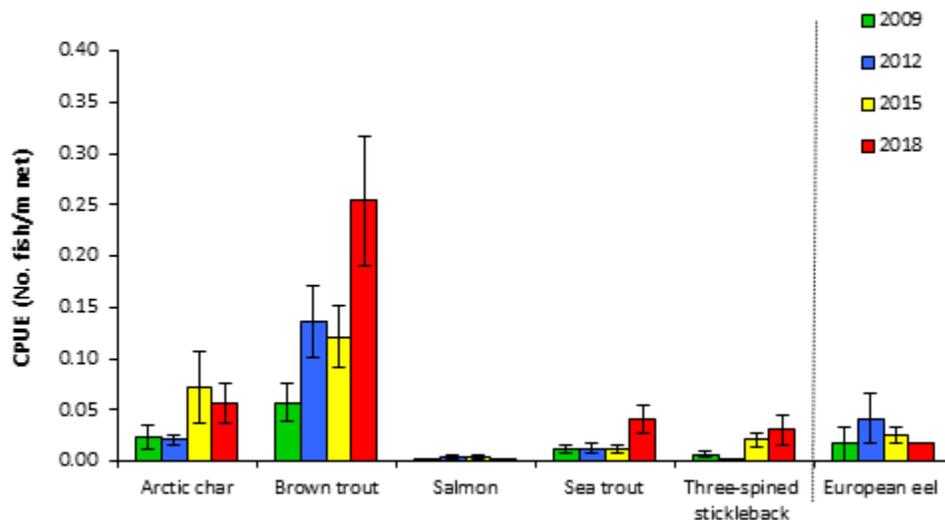


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Doo Lough (Eel CPUE based on fyke nets only), 2009, 2012, 2015 and 2018

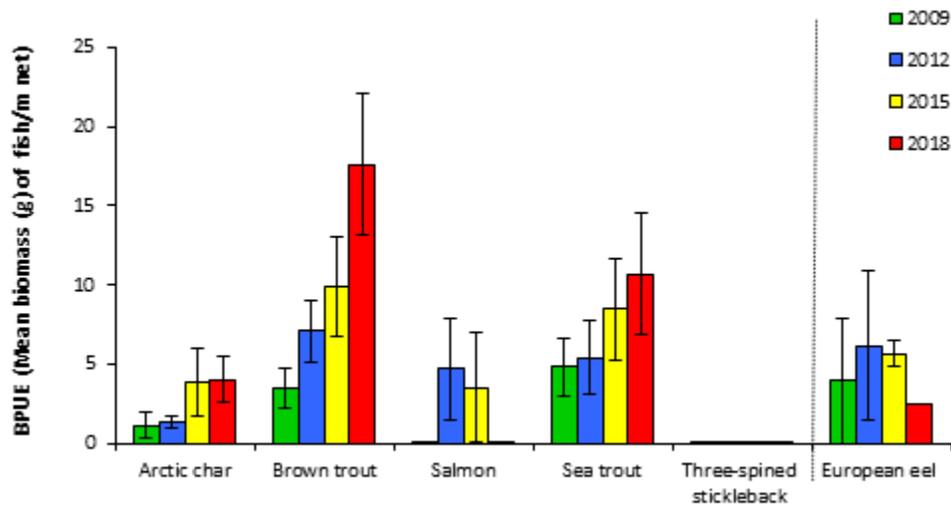


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Doo Lough (Eel BPUE based on fyke nets only), 2009, 2012, 2015 and 2018



1.3.3 Length frequency distributions and growth

Brown trout

Brown trout captured during the 2018 survey ranged in length from 7.7cm to 32.0cm (mean = 17.3cm) (Fig. 1.4). Six age classes were present, ranging from 0+ to 5+, with a mean L1 of 5.9cm (Table 1.3). Mean brown trout L4 in 2018 was 19.7cm indicating a very slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.3). Brown trout captured during the 2009, 2012 and 2015 surveys had similar length and age ranges with some larger fish recorded in 2012 and 2015 (Fig.1.4).

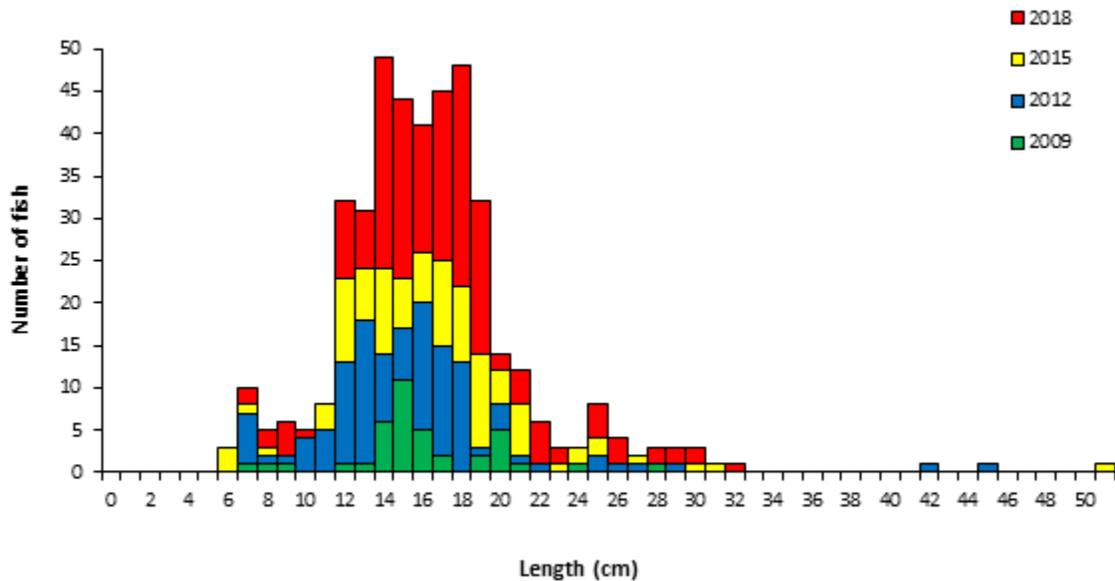


Fig. 1.4. Length frequency of brown trout captured on Doo Lough, 2009, 2012, 2015 and 2018

Table 1.3. Mean (\pm S.E.) brown trout length (cm) at age for Doo Lough, October 2018

	L ₁	L ₂	L ₃	L ₄	L ₅	Growth Category
Mean (\pm S.E.)	5.9 (0.1)	11.8 (0.3)	16.1 (0.5)	19.7 (0.7)	23.1 (0.8)	Very slow
N	78	56	27	12	5	
Range	3.8-9.4	7.3-18.1	11.4-22.2	15.7-23.0	21.1-25.4	



Arctic char

Arctic char captured during the 2018 survey ranged in length from 7.0cm to 21.1cm (mean = 18.2cm) (Fig.1.5) with two age classes present, ranging from 3+ to 4+. Arctic char captured during the 2009, 2012 and 2015 surveys had a similar length and age range with the smallest range exhibited in the 2009 survey and the largest range was observed in 2015 (Fig.1.5).

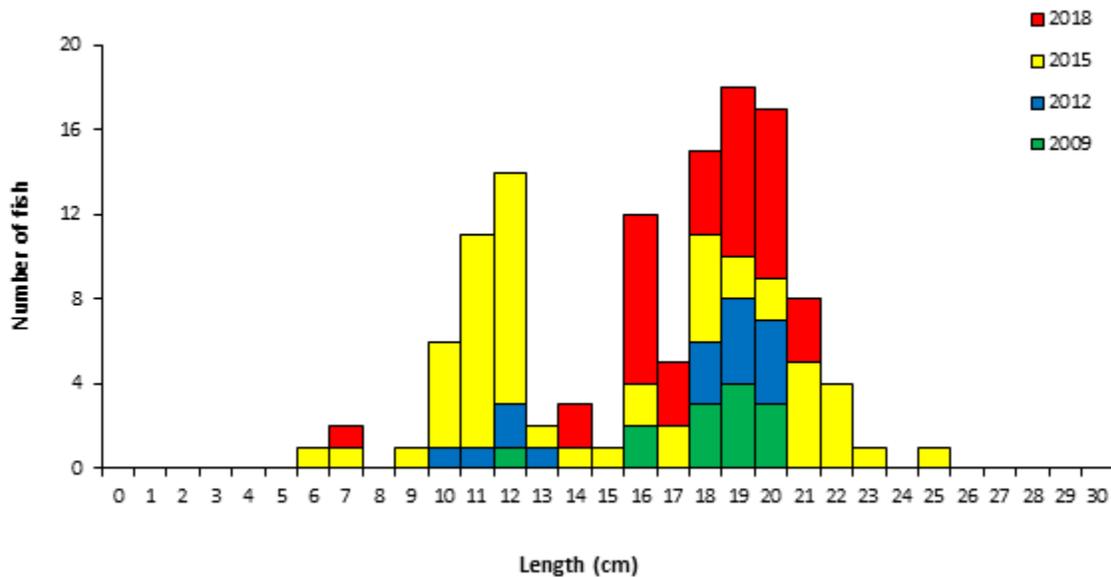


Fig. 1.5. Length frequency of Arctic char captured on Doo Lough, 2009, 2012, 2015 and 2018

Other fish species

One eel and one salmon were captured measuring 46.2cm and 8.5cm respectively. Sea trout captured during the 2018 survey ranged in length from 21.7cm to 51.0cm and were aged at 2.0+ to 3.3sm+. Three-spined stickleback ranged in length from 3.2cm and 5.5cm.



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 brown trout and Arctic char captured during the survey were examined and are presented below.

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 103 stomachs were examined. Of these 61 were found to contain no prey items. Of the remaining 42 stomachs containing food, 45% contained unidentified digested material, 31% zooplankton, 17% invertebrates, 5% fish and 2% invertebrates/fish (Fig. 1.6).

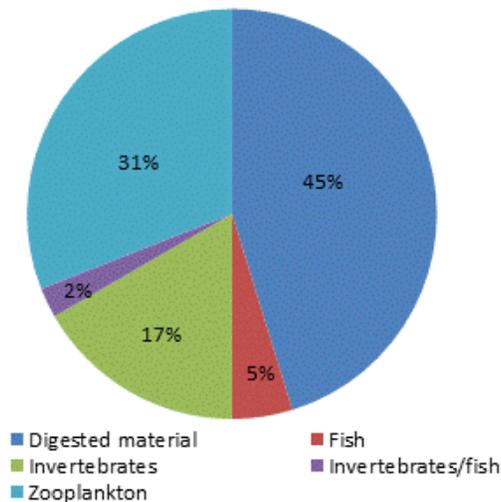


Fig 1.6. Diet of brown trout (n=42) captured on Doo Lough, 2018 (% FO)

Arctic char

A total of 24 Arctic char stomachs were examined. Of these, two were empty and the remaining 22 contained 77% invertebrates and 23% unidentified digested material (Fig. 1.7).

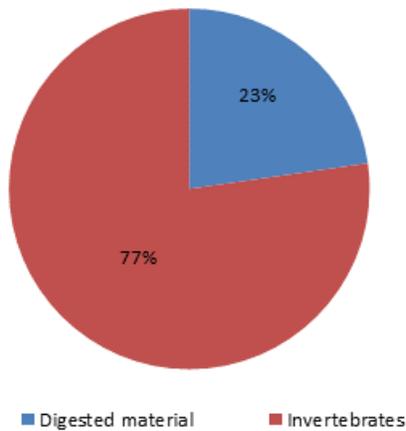


Fig 1.7. Diet of Arctic char (n=22) captured on Doo Lough, 2018 (% FO)

1.4 Summary and ecological status

A total of five fish species (sea trout are included as a separate ‘variety’ of trout) were recorded in Doo Lough in October 2018. Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2018 survey.

The mean brown trout CPUE and BPUE increased over the three sampling occasions. Brown trout ranged in length from 7.7cm to 32.0cm and ranged in age from 0+ to 5+, indicating reproductive success in each of the previous six years. 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).

The mean Arctic char CPUE and BPUE fluctuated slightly over the four sampling occasions; however, there was an increase in 2015 and 2018 in comparison to the other years. Arctic char ranged in length from 7.0cm to 21.1cm and out of the fish that were aged, they ranged from 3+ to 4+.

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, Doo Lough has been assigned an ecological status of High for 2018 based on the fish populations present. In previous years the lake was also assigned a fish status of High in 2009, 2012 and 2015.

In the 2010 to 2015 surveillance monitoring reporting period, the EPA assigned Doo Lough an overall ecological status of Good.



1.5 References

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