



# Sampling Fish for the Water Framework Directive

*Lakes 2012*

**Lough Dan**



Iascach Intíre Éireann  
Inland Fisheries Ireland

## Water Framework Directive Fish Stock Survey of Lough Dan, August 2012

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

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## 1.1 Introduction

Lough Dan is situated 5km west of Roundwood, Co.Wicklow (Plate 1.1, Fig. 1.1). It is a moraine-dammed lake situated in a steep sided valley in the Wicklow Mountains. Lough Dan is fed by Lough Tay via the Cloghoge River from the north and is drained to the south by the Avonmore River (Fig. 1.1).

Lough Dan has a surface area of 106ha, a mean depth of 13.5m, a maximum depth of 40m and is located at an altitude of 203m a.s.l. The lake is categorised as typology class 4 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. deep (>4m), greater than 50ha and low alkalinity (<20mg/l CaCO<sub>3</sub>).

The surrounding geology of the lake is mostly granite. Most of the lake is surrounded by private lands, though the north-west corner is part of the Wicklow Mountains National Park. The lake forms part of the Wicklow Mountain Special Area of Conservation, is privately owned and fishing is not permitted (NPWS, 2001; O' Reilly, 2007). The Wicklow Mountain SAC has been designated as such for including 10 habitats which are listed on Annex I of the EU Habitats Directive. These include heath, blanket bog and upland grasslands. Due to the underlying rock strata in the SAC, the water of the rivers and streams tends to be acidic. The water is generally oligotrophic and free from nutrient enrichment. The deep lakes in the SAC, such as Lough Dan, are characteristically species poor (NPWS, 2001).

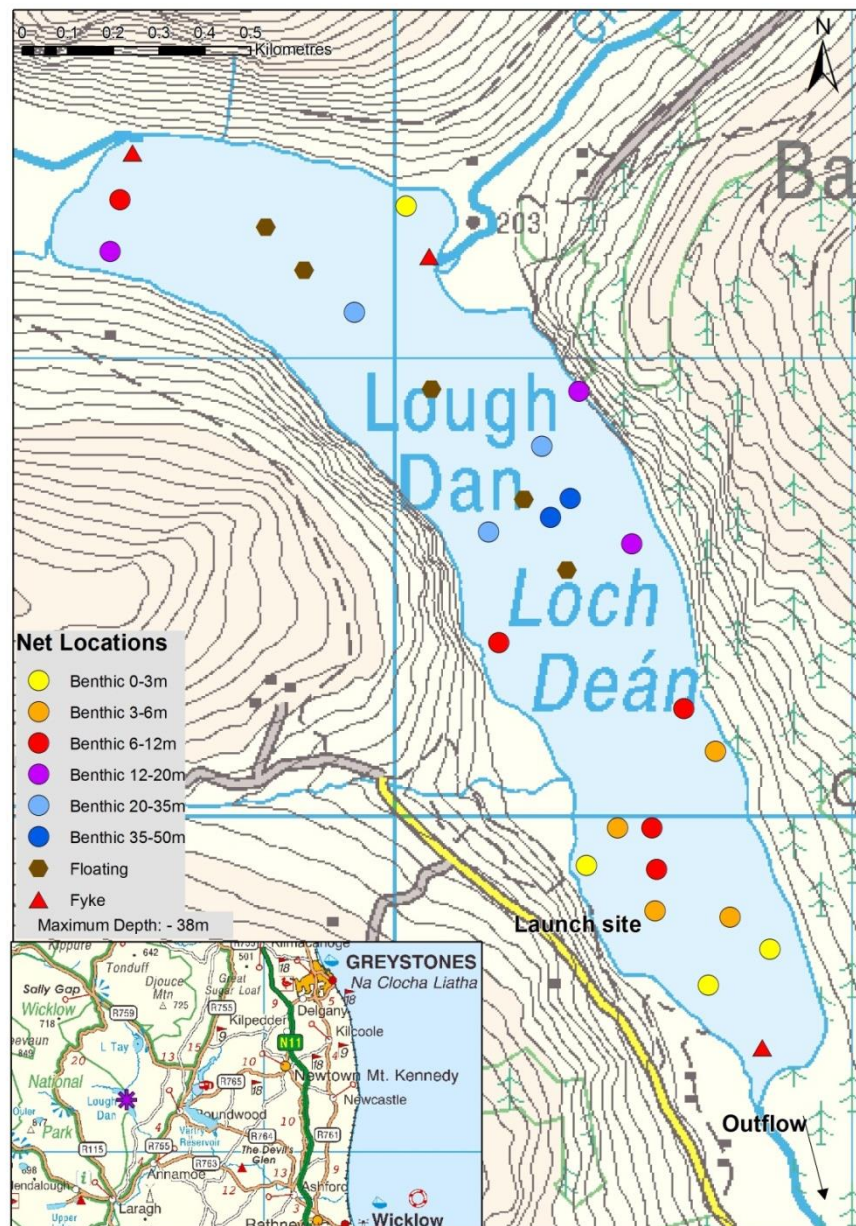
Lough Dan holds a good stock of small, slow growing brown trout. A population of Arctic char was historically present in the lake (Went, 1945 and 1971; Tierney *et al.*, 2000); however, the last authenticated record was validated in 1988 by the Natural History Museum of Ireland (Tierney *et al.*, 2000). The lake was previously surveyed in 1985 and 1989 by Inland Fisheries Ireland (IFI) (previously the Central Fisheries Board) (IFI, unpublished data). IFI (previously the Eastern Regional Fisheries Board) also surveyed the lake in May and October 1994 and resurveyed it in association with University College Dublin in 1996. No Arctic char were recorded during any of these surveys (Bowman, 1991; Igoe and Kelly-Quinn, 2002) and it was concluded that the population was extinct, probably as a result of acidification.

The lake was also previously surveyed by IFI in August 2009 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2010). During this survey, brown trout were found to be the dominant species present in the lake. Eels were also captured during the survey.



**Plate 1.1. Lough Dan**





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

## 1.2 Methods

Lough Dan was surveyed over two nights from the 14<sup>th</sup> to the 17<sup>th</sup> of August 2012. A total of three sets of Dutch fyke nets, 21 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 5 @ 6-11.9m, 3 @ 12-19.9m, 3 @ 20-34.9m and 2 @ 35-49.9m) and five surface monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed randomly in the lake (29 sites). Nets were deployed in the same locations as were randomly selected in the previous survey in 2009. 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 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 returned to the laboratory for further analysis.

## 1.3 Results

### 1.3.1 Species Richness

A total of three fish species were recorded on Lough Dan in August 2012, with 333 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 eels and minnow. During the previous survey in 2009 the same species composition was recorded with the exception of minnow, which were present during the 2012 survey but were not captured in 2009 (Kelly *et al.*, 2010).

**Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Dan, August 2012**

Scientific name	Common name	Number of fish captured			
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Fyke nets	Total
<i>Salmo trutta</i>	Brown trout	292	25	6	323
<i>Phoxinus phoxinus</i>	Minnow	2	0	0	2
<i>Anguilla anguilla</i>	European eel	0	0	8	8

### 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 2009 and 2012 are summarised in Table 1.2. Mean CPUE and BPUE for all fish species is illustrated in Figures 1.2 and 1.3.

Although the mean brown trout CPUE and BPUE was higher in 2012 than in 2009, these differences were not statistically significant (Fig. 1.2 and Fig. 1.3).

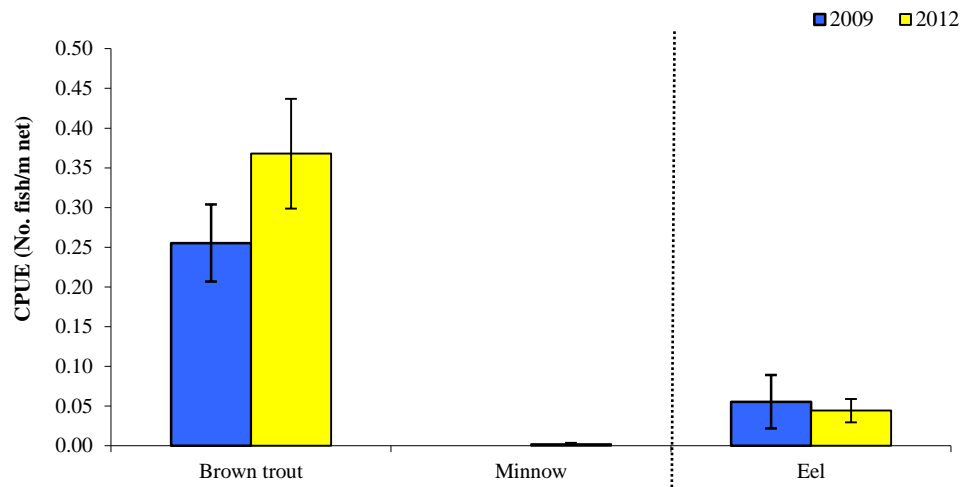
The differences in the mean brown trout CPUE and BPUE between Lough Dan and two similar lakes was assessed, with an overall significant difference being found (Kruskal-Wallis,  $P < 0.05$ ) (Fig. 1.4 and Fig. 1.5). Independent-Samples Mann-Whitney U test between each lake showed that Lough Dan had a significantly higher mean brown trout CPUE and BPUE than Doo Lough, Co. Mayo ( $P < 0.05$ ).

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

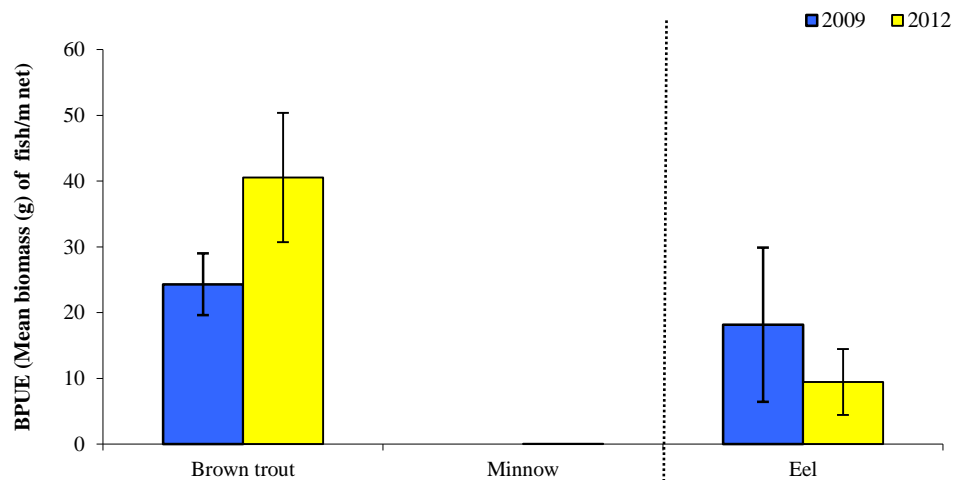
Scientific name	Common name	2009	2012
<b>Mean CPUE</b>			
<i>Salmo trutta</i>	Brown trout	0.255 (0.048)	0.368 (0.069)
<i>Phoxinus phoxinus</i>	Minnow	-	0.002 (0.002)
<i>Anguilla anguilla</i>	European eel	0.056 (0.034)	0.044 (0.015)
<b>Mean BPUE</b>			
<i>Salmo trutta</i>	Brown trout	24.314 (4.696)	40.554 (9.826)
<i>Phoxinus phoxinus</i>	Minnow	-	0.007 (0.005)
<i>Anguilla anguilla</i>	European eel	18.161 (11.717)	9.444 (4.996)

\* On the rare occasion where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species.

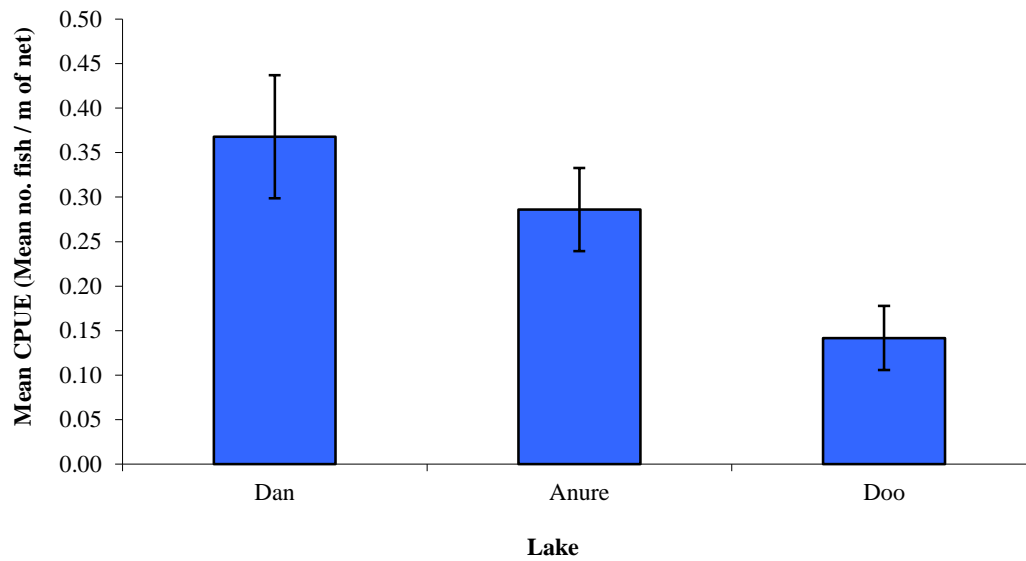




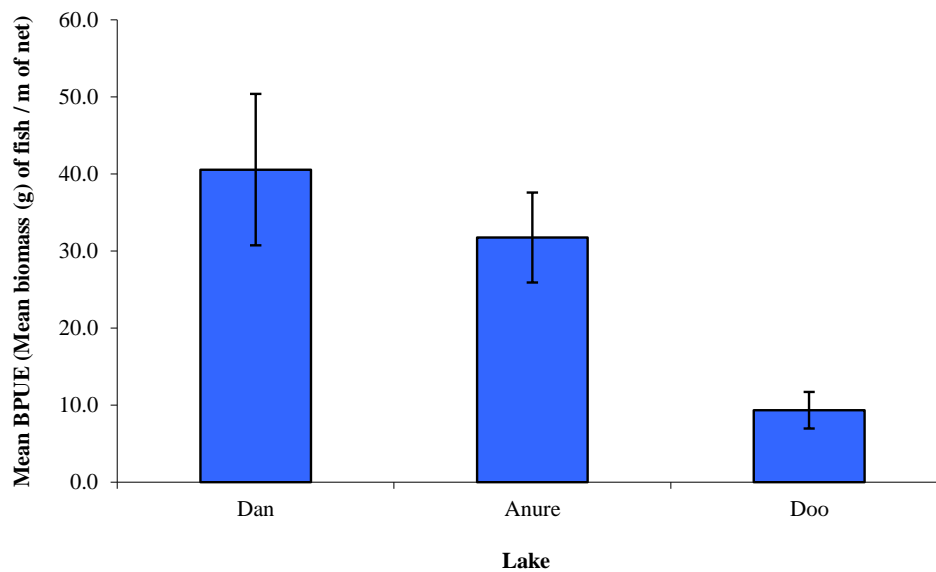
**Fig. 1.2. Mean ( $\pm$ S.E.) CPUE for all fish species captured in Lough Dan (Eel CPUE based on fyke nets only), 2009 and 2012**



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



**Fig. 1.4. Mean ( $\pm$ S.E.) brown trout CPUE in three lakes surveyed during 2012**

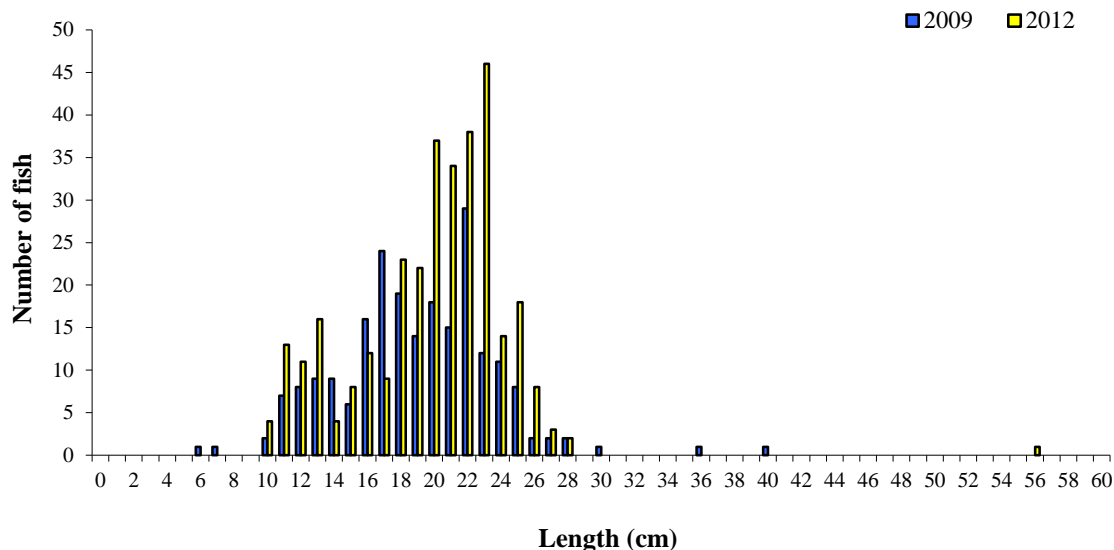


**Fig. 1.5. Mean ( $\pm$ S.E.) brown trout BPUE in three lakes surveyed during 2012**

### 1.3.3 Length frequency distributions

Brown trout captured during the 2012 survey ranged in length from 10.5cm to 56.5cm (mean = 20.2cm) (Fig. 1.6). Brown trout captured during the 2009 survey ranged in length from 6.1cm to 40.0cm (Fig. 1.6).

Eels captured during the 2012 survey ranged in length from 40.3cm to 60.2cm and two minnow were recorded at 6.8cm and 7.2cm.



**Fig. 1.6. Length frequency of brown trout captured on Lough Dan, 2009 and 2012**

### 1.3.4 Fish age and growth

Six age classes of brown trout were present, ranging from 1+ to 6+, with a mean L1 of 5.8cm (Table 1.3). In the 2009 survey, brown trout ranged from 0+ to 5+ with a mean L1 of 5.4cm. Mean brown trout L4 in 2011 was 22.5cm 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. Mean ( $\pm$ SE) brown trout length (cm) at age for Lough Dan, August 2012**

	<b>L<sub>1</sub></b>	<b>L<sub>2</sub></b>	<b>L<sub>3</sub></b>	<b>L<sub>4</sub></b>	<b>L<sub>5</sub></b>	<b>L<sub>6</sub></b>
Mean	5.8 (0.1)	13.5 (0.3)	19.9 (0.4)	23.3 (0.6)	25.2 (0.4)	27.1 (0)
N	87	69	51	16	2	1
Range	3.5-8.7	9.3-19.5	15.0-26.0	18.9-26.6	24.7-25.6	27.1-27.1

## 1.4 Summary

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets.

Although the mean brown trout CPUE and BPUE in Lough Dan was slightly higher in 2012 than in the 2009 survey, these differences were not statistically significant. The mean brown trout CPUE and BPUE in Lough Dan was significantly higher than for Doo Lough, Co. Mayo. Brown trout ranged in age from 1+ to 6+, indicating reproductive success in six of the previous seven 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).

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 by 2015 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 (AFBNI) 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, Lough Dan has been assigned an ecological status of Good based on the fish populations present in 2012. The ecological status assigned to the lake based on the 2009 survey data was also Good.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Lough Dan an overall ecological status of Moderate, based on all monitored physico-chemical and biological elements, including fish. This status classification will be revised at the end of 2012.

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