



# Sampling Fish for the Water Framework Directive

Lakes 2010

**Glen Lough**



Iascach Intíre Éireann  
Inland Fisheries Ireland

## **ACKNOWLEDGEMENTS**

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## 1.1 Introduction

Glen Lough (Plate 1.1, Fig. 1.1) is located in the Lackagh catchment, approximately 5km east of Creeslough, Co. Donegal, with Glen village at the northern end of the lake. The lake is located approximately 1.5km upstream of the tidal limit of the Lackagh River and approximately 7km downstream of Lough Beagh (Glenveagh) on the Owencarrow River. The lake is situated at an altitude of 27m a.s.l., has a surface area of 168ha, a mean depth of 4.9m and a maximum depth of 14.1m. Glen Lough 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<sub>3</sub>). The lake has been classed as 1a (i.e. at risk of failing to meet good status by 2015) in the WFD Characterisation report (EPA, 2005). The geology of the area is predominantly granite, felsite and other intrusive rocks rich in silica.

Glen Lough is encompassed within the Cloghernagore Bog and Glenveagh National Park Special Area of Conservation (SAC). The site supports populations of Atlantic salmon and freshwater pearl-mussel (*Margaritifera margaritifera*); species that are both afforded protected status in Ireland and listed on Annex II of the EU Habitats Directive (NPWS, 2005). Several bird species listed on the Red Data Book and on Annex I of the EU Birds Directive breed within the SAC. Turf cutting and afforestation are the main threats to the SAC, with erosion, over grazing by sheep and deer and burning also having an impact (NPWS, 2005).

Glen Lough used to be one of the great spring salmon lakes; however, it never really recovered from the effects of the salmon disease UDN (Ulcerative Dermal Necrosis) in the 1960s (O' Reilly, 2007). In 1970 an Inland Fisheries Trust survey revealed the presence of brown trout only in the lake (IFT, unpublished data). A conclusion of the survey was that there was limited spawning in the upper reaches of the tributaries and impassable waterfalls restricting spawning to the lower reaches of the system. The lake is now best known as a sea trout fishery, even though numbers have declined in recent years (O' Reilly, 2007).

Glen Lough was previously surveyed in 2006 as part of the NSSHARE Fish in Lakes Project (Kelly *et al.*, 2007). During this survey, brown trout and Arctic char were found to be the dominant species present in the lake. Both adult and juvenile salmon, sea trout, minnow and eels were also captured during the survey.



Plate 1.1. Glen Lough

Glen Lough, Donegal

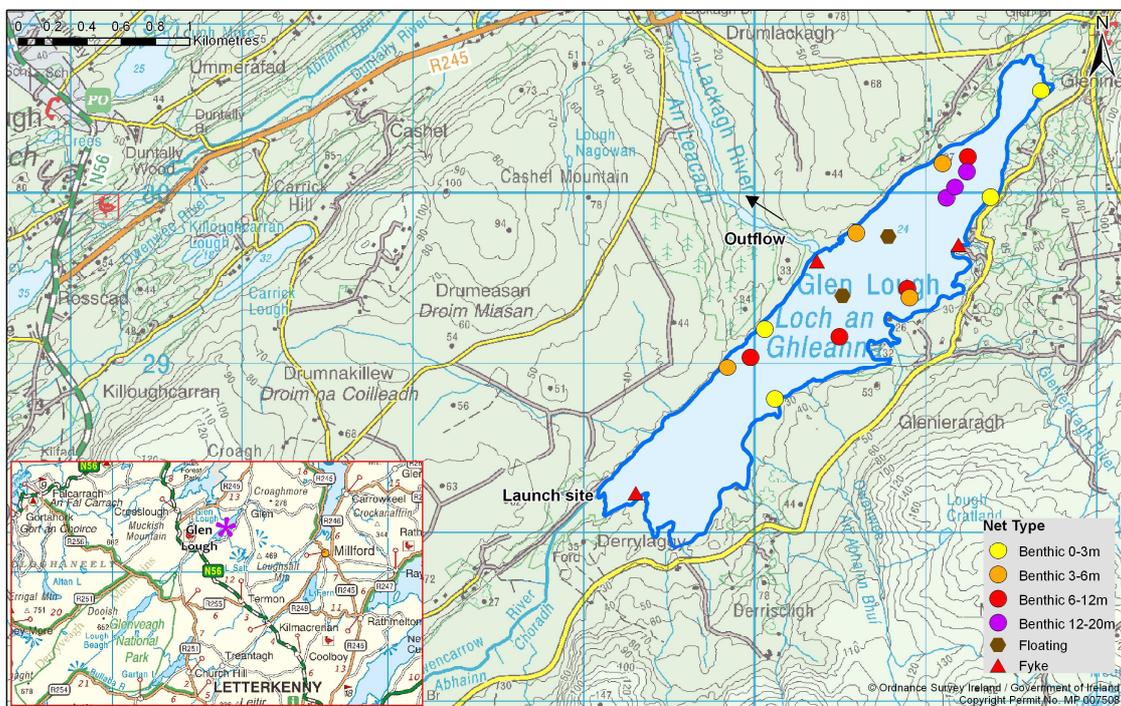


Fig. 1.1. Location map of Glen Lough showing net locations and depths of each net (outflow is indicated on map)

## 1.2 Methods

Glen Lough was surveyed over two nights from the 3<sup>rd</sup> to the 5<sup>th</sup> of August 2010. A total of three sets of Dutch fyke nets, 15 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 4 @ 6-11.9m and 3 @ 12-19.9m) and two floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (20 sites). Nets were deployed in the same locations as were randomly selected in the previous survey. 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 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.

## 1.3 Results

### 1.3.1 Species Richness

A total of five fish species were recorded on Glen Lough in August 2010, with 152 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 (Plate 1.2), eels, minnow and salmon. During the previous survey in 2006 the same species composition was recorded with the exception of sea trout, which were present during the 2006 survey but were not captured in the current survey.

**Table 1.1. Number of each fish species captured by each gear type during the survey on Glen Lough, August 2010**

Scientific name	Common name	Number of fish captured			Total
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Fyke nets	
<i>Salmo trutta</i>	Brown trout	75	5	4	84
<i>Salvelinus alpinus</i>	Arctic char	36	12	1	49
<i>Phoxinus phoxinus</i>	Minnow	4	0	0	4
<i>Salmo salar</i>	Salmon	1	0	0	1
<i>Anguilla anguilla</i>	European eel	1	0	13	14



**Plate 1.2. Arctic char from Glen Lough**

### ***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 2006 and 2010 are summarised in Table 1.2. Mean CPUE for all fish species is illustrated in Figure 1.2.

Although the mean brown trout, Arctic char and eel CPUE was lower in 2010 than in 2006, these differences were not statistically significant.

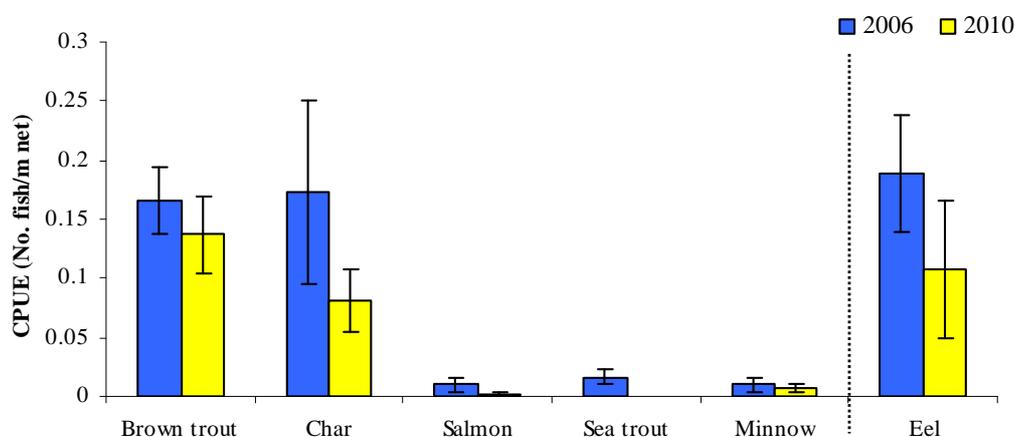
The differences in the mean brown trout CPUE between Glen Lough and two similar lakes was assessed, with no overall significant differences being found (Fig. 1.3). However, Independent-Samples Mann-Whitney U tests between each lake showed that Glen Lough had a significantly higher mean brown trout CPUE than Kylemore Lough ( $z = -2.191, P < 0.05$ ).

The differences in the mean Arctic char CPUE between Glen Lough and three other similar lakes were also assessed and found to be statistically significant (Kruskal-Wallis,  $P < 0.05$ ) (Fig. 1.4). Independent-Samples Mann-Whitney U tests between each lake showed that Glen Lough had a significantly higher mean Arctic char CPUE than Ardderry Lough ( $z = -3.401, P < 0.05$ ).

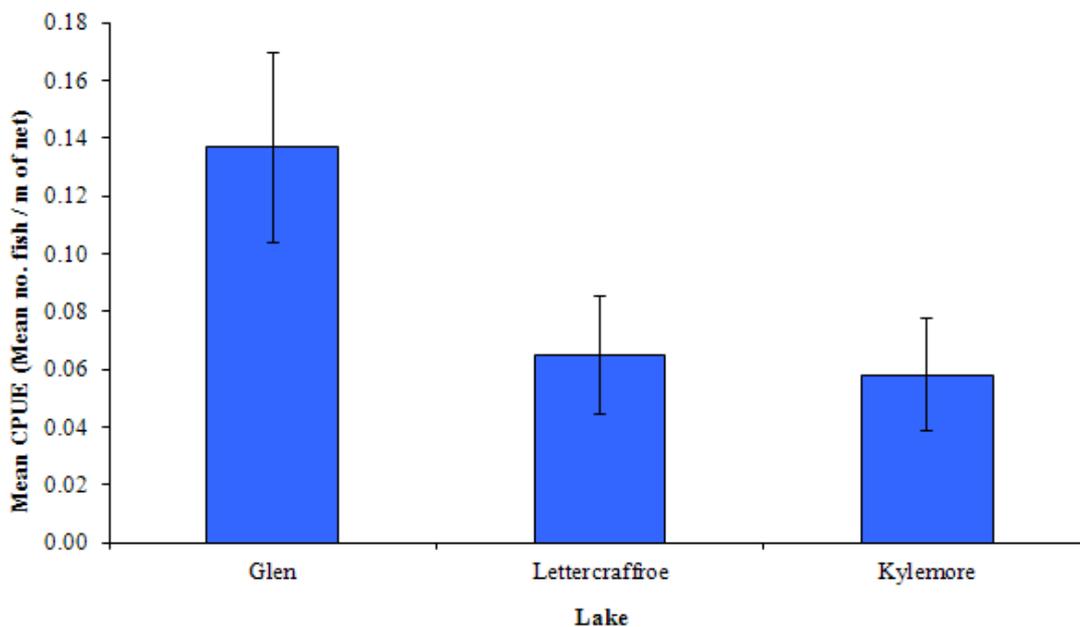
**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on on Glen Lough, 2006 and 2010**

Scientific name	Common name	2006	2010
<b>Mean CPUE</b>			
<i>Salmo trutta</i>	Brown trout	0.165 (0.288)	0.137 (0.032)
<i>Salvelinus alpinus</i>	Arctic char	0.173 (0.078)	0.081 (0.027)
<i>Salmo salar</i>	Salmon	0.016 (0.006)	0.001 (0.002)
	Sea trout	0.017 (0.006)	-
<i>Phoxinus phoxinus</i>	Minnow	0.010 (0.006)	0.006 (0.004)
<i>Anguilla anguilla</i>	European eel	0.189 (0.049)	0.108 (0.058)
<b>Mean BPUE</b>			
<i>Salmo trutta</i>	Brown trout	19.519 (4.372)	19.451 (6.019)
<i>Salvelinus alpinus</i>	Arctic char	8.221 (4.248)	3.802 (1.334)
<i>Salmo salar</i>	Salmon	10.053 (9.997)	0.013 (0.013)
	Sea trout	3.122 (1.322)	-
<i>Phoxinus phoxinus</i>	Minnow	0.017 (0.017)	0.019 (0.011)
<i>Anguilla anguilla</i>	European eel	35.887 (10.953)	30.383 (16.950)

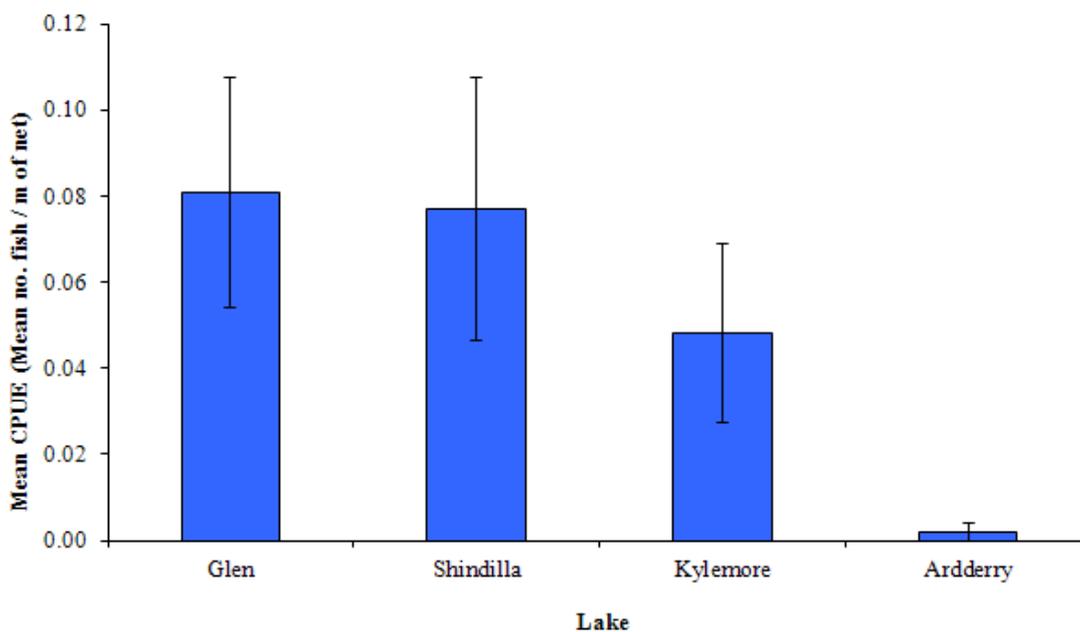
\* On the rare occasion where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species.



**Fig. 1.2. Mean ( $\pm$ S.E.) CPUE for all fish species captured in Glen Lough (Eel CPUE based on fyke nets only), 2006 and 2010**



**Fig. 1.3. Mean ( $\pm$ S.E.) brown trout CPUE in three lakes surveyed during 2010**

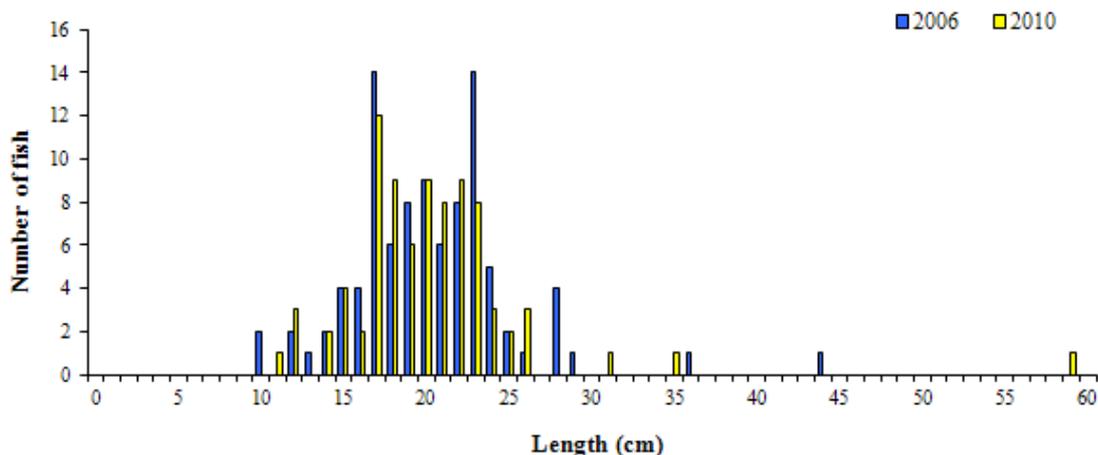


**Fig. 1.4. Mean ( $\pm$ S.E.) Arctic char CPUE in four lakes surveyed during 2010**

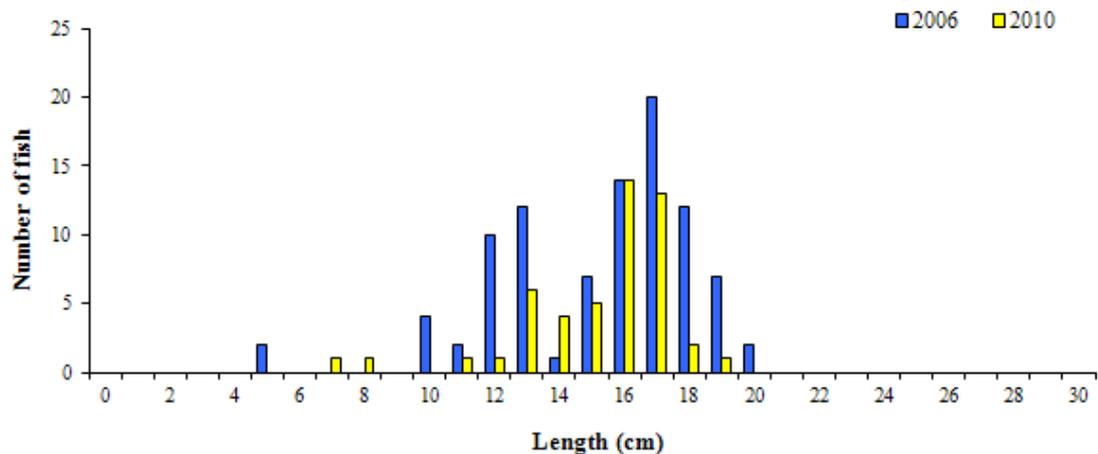
### *1.3.3 Length frequency distributions*

Brown trout captured during the 2010 survey ranged in length from 11.7cm to 59.5cm (mean = 20.7cm) (Fig. 1.5). Brown trout captured during the 2006 survey ranged in length from 10.0cm to

44.4cm (Fig. 1.5). Arctic char captured during the 2010 survey ranged in length from 7.0cm to 19.2cm (mean = 15.5cm) (Fig.1.6). Arctic char captured during the 2006 survey had lengths ranging from 5.0cm to 20.8cm (Fig.1.6). Minnow captured during the 2010 survey ranged in length from 5.5cm to 7.0cm and eels ranged in length from 30.5cm to 81.0cm.



**Fig. 1.5. Length frequency of brown trout captured on Glen Lough**



**Fig. 1.6. Length frequency of Arctic char captured on Glen Lough**

### 1.3.4 Fish age and growth

Five age classes of brown trout were present, ranging from 1+ to 5+, with a mean L1 of 7.4cm (Table 1.3). In the 2006 survey, brown trout ranged from 1+ to 6+ with a mean L1 of 6.9cm. Mean brown

trout L4 in 2010 was 24.8cm indicating a very slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971).

Five age classes of Arctic char were present, ranging from 2+ to 6+. A single juvenile salmon captured was aged 1+.

**Table 1.3. Mean ( $\pm$ SE) brown trout length (cm) at age for Glen Lough, August 2010**

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>
Mean	7.4 (0.2)	15.7 (0.2)	20.7 (0.3)	24.8 (1.3)	29.2
N	77	72	31	8	1
Range	5.0-11.8	19.1-12.8	16.1-27.3	21.6-33.0	29.2-29.2

#### 1.4 Summary

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

The mean brown trout CPUE in Glen Lough was significantly higher than Kylemore Lough. Brown trout ranged in age from 1+ to 5+, indicating reproductive success in five 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 in Glen Lough was significantly higher than Ardderry Lough, another similar lake surveyed. Arctic char ranged in age from 2+ to 6+, with no 0+ or 1+ fish being captured.

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 (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. Using the FIL2 classification tool, Glen Lough has been assigned an ecological status of High for both 2006 and 2010 based on the fish populations present.

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

## 1.5 References

- EPA (2005) Submission in accordance with Article 5 of Directive 2000/60/EC of the European Parliament and of the Council of 23rd October 2000 establishing a framework for community action in the field of water policy, and in accordance with EC-DE Environment D.2 document “Reporting Sheets for 2005 Reporting” dated 19 November 2004. Version 2, May 2005. Prepared by the Office of the Environment Assessment EPA, Johnstown Castle, Wexford.
- Kennedy, M. and Fitzmaurice, P. (1971) Growth and Food of Brown Trout *Salmo Trutta* (L.) in Irish Waters. *Proceedings of the Royal Irish Academy*, **71 (B) (18)**, 269-352.
- Kelly, F.L. Connor, L. and Champ, W.S.T. (2007) *A Survey of the Fish Populations in 46 lakes in the Northern Regional Fisheries Board, June to September 2005 and 2006*. North South Shared Aquatic Resource (NS Share) Lakes Project.
- Kelly, F.L., Harrison, A., Connor, L., Allen, M., Rosell, R. and Champ, T. (2008) *FISH IN LAKES Task 6.9: Classification tool for Fish in Lakes. FINAL REPORT*. Central Fisheries Board, NSSHARE project.
- NPWS (2005) Site synopsis: *Cloghernagore Bog and Glenveagh National Park*. Site code: 002047. Site Synopsis report, National Parks and Wildlife Service.
- O’ Reilly (2007) *Loughs of Ireland. A Flyfisher’s Guide*. 4<sup>th</sup> Edition. Merlin Unwin Books.

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