



**Sampling Fish for the  
Water Framework  
Directive**

*Lakes 2013*

**Glen Lough**



Iascach Intíre Éireann  
Inland Fisheries Ireland

## Water Framework Directive Fish Stock Survey of Glen Lough, August 2013

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CITATION: Kelly, F.L., Connor, L., Morrissey, E., Coyne, J., Matson, R., Feeney, R. and Rocks, K. (2014)  
Water Framework Directive Fish Stock Survey of Glen Lough, August 2013. Inland Fisheries Ireland, 3044  
Lake Drive, Citywest Business Campus, Dublin 24.

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## **ACKNOWLEDGEMENTS**

The authors wish to gratefully acknowledge the help and co-operation of the regional director Dr. Milton Matthews and the staff from IFI, Ballyshannon. The authors would also like to gratefully acknowledge the help and cooperation of all their colleagues in IFI, Swords.

The authors would also like to thank Mr. Hilary Keegan for granting access during the survey.

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Energy and Natural Resources for 2013.

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## 1.1 Introduction

Glen Lough is located in the Lackagh catchment, approximately 5km east of Creeslough, Co. Donegal, with Glen village at the northern end of the lake (Plate 1.1, Fig. 1.1). 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 21m. 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 and 2010 as part of the NSSHARE Fish in Lakes Project and the WFD monitoring programme respectively (Kelly *et al.*, 2007 and Kelly *et al.*, 2011). During the 2010 survey, brown trout were found to be the dominant species present in the lake. Arctic char, eels, minnow and salmon were also captured during the survey.



Plate 1.1. Glen Lough

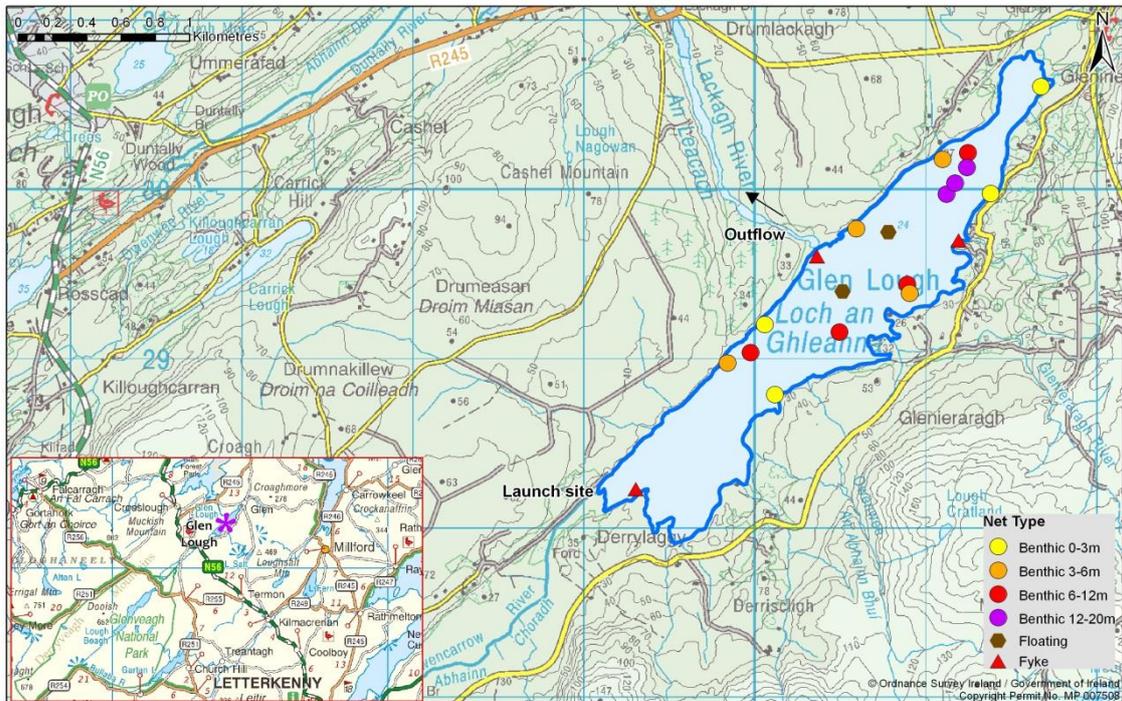


Fig. 1.1. Location map of Glen Lough showing net locations and depths of each net (outflow is indicated on map)

## 1.2 Methods

Glen Lough was surveyed over two nights from the 17<sup>th</sup> to the 19<sup>th</sup> of August 2013. 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.

An additional experimental survey using hydroacoustic and pelagic gillnetting techniques was carried out on Glen Lough in parallel to the WFD fish stock survey. This survey was carried out as part of a Ph.D. research project which aims to incorporate hydroacoustic technology into the existing standard sampling protocols used to assign ecological and conservation status for the Water Framework and Habitats Directive for conservation and endangered fish species. The experimental survey concentrated on the deeper sections of the lake (depth >12m) and covered *circa* 20km of hydroacoustic transects. A separate report will be available in due course.

## 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 on Glen Lough in July 2013, with 229 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), minnow, eels and salmon. During the previous survey in 2010 the same species composition was recorded with the exception of sea trout, which were not captured during the 2010 survey but were recorded during the 2013 survey.

**Table 1.1. Number of each fish species captured by each gear type during the survey on Glen Lough, July 2013**

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	125	4	1	130
<i>Salvelinus alpinus</i>	Arctic char	43	1	0	44
<i>Phoxinus phoxinus</i>	Minnow	26	0	0	26
<i>Salmo salar</i>	Salmon	13	0	0	13
<i>Salmo trutta</i>	Sea trout	1	0	0	1
<i>Anguilla anguilla</i>	European eel	0	0	15	15



**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 the 2010 and 2013 surveys are summarised in Table 1.2. Mean CPUE and BPUE for all species is illustrated in Figure 1.2 and 1.3.

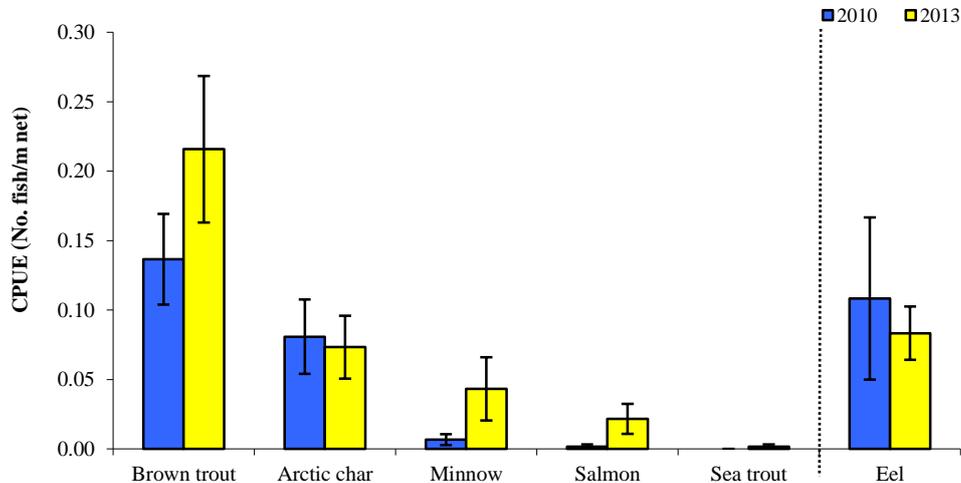
Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) followed by Arctic char. Although the mean brown trout CPUE and BPUE was higher in 2013 than in 2010, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3). The mean Arctic char CPUE and BPUE was slightly lower in 2013 than in 2010, however, these differences were also not statistically significant (Table 1.2; Fig 1.2 and 1.3).

**Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on on Glen Lough, 2010 and 2013**

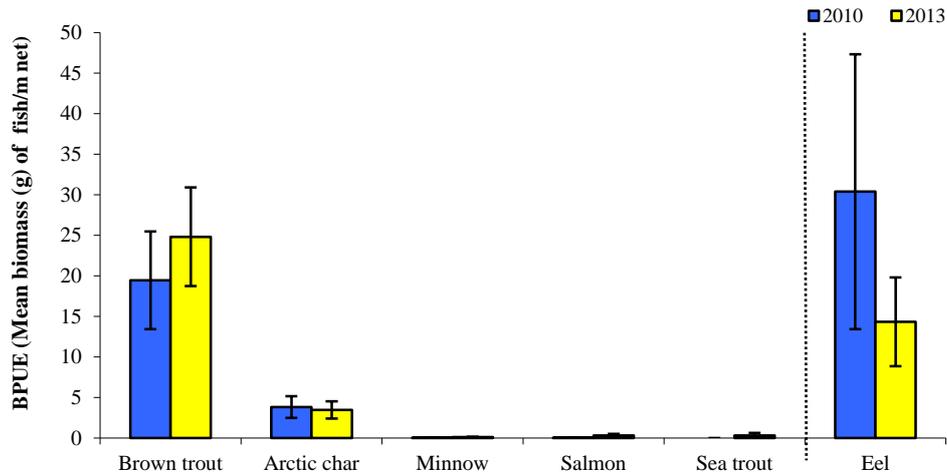
Scientific name	Common name	2010	2013
<b>Mean CPUE</b>			
<i>Salmo trutta</i>	Brown trout	0.137 (0.032)	0.216 (0.053)
<i>Salvelinus alpinus</i>	Arctic char	0.081 (0.027)	0.073 (0.023)
<i>Salmo salar</i>	Salmon	0.001 (0.002)	0.022 (0.011)
<i>Salmo trutta</i>	Sea trout	-	0.002 (0.002)
<i>Phoxinus phoxinus</i>	Minnow	0.006 (0.004)	0.043 (0.023)
<i>Anguilla anguilla</i>	European eel*	0.108 (0.058)	0.083 (0.019)
<b>Mean BPUE</b>			
<i>Salmo trutta</i>	Brown trout	19.451 (6.019)	24.819 (6.069)
<i>Salvelinus alpinus</i>	Arctic char	3.802 (1.334)	3.453(1.057)
<i>Salmo salar</i>	Salmon	0.013 (0.013)	0.321 (0.168)
<i>Salmo trutta</i>	Sea trout	-	0.307 (0.307)
<i>Phoxinus phoxinus</i>	Minnow	0.019 (0.011)	0.113 (0.055)
<i>Anguilla anguilla</i>	European eel*	30.383 (16.950)	14.317 (5.464)

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.

\*Eel CPUE and BPUE based on fyke nets only



**Fig. 1.2. Mean ( $\pm$ S.E.) CPUE for all fish species captured in Glen Lough (Eel CPUE based on fyke nets only), 2010 and 2013**



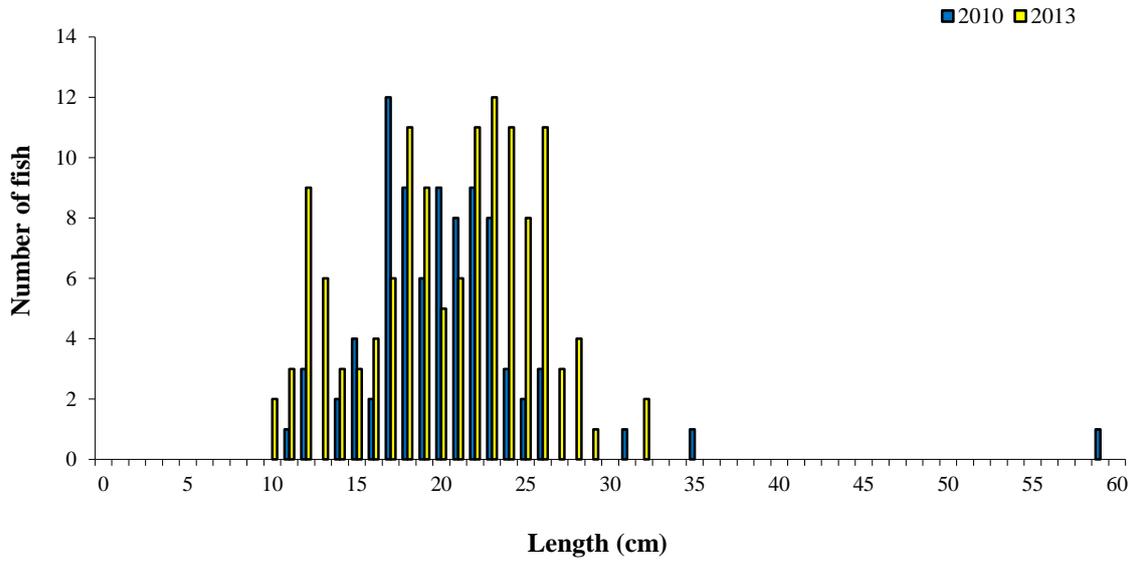
**Fig. 1.3. Mean ( $\pm$ S.E.) BPUE for all fish species captured in Glen Lough (Eel BPUE based on fyke nets only), 2010 and 2013**

### *1.3.3 Length frequency distributions and growth*

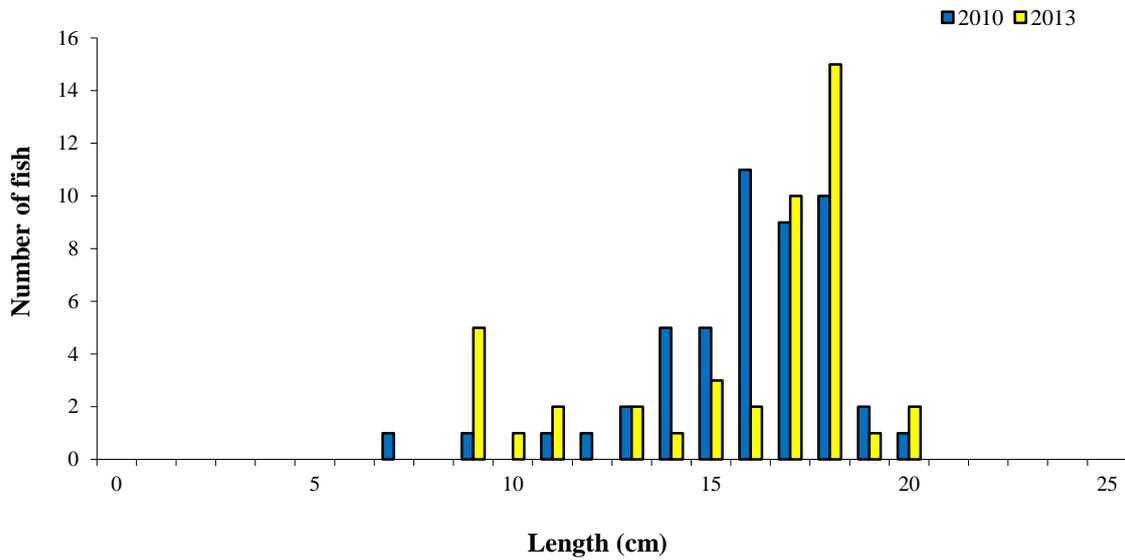
Brown trout captured during the 2013 survey ranged in length from 10.5cm to 32.2cm (mean = 20.7cm) (Fig. 1.4) with five age classes present, ranging from 1+ to 5+, with a mean L1 of 5.1cm (Table 1.3). The dominant age class was 4+ (Fig. 1.4). Mean brown trout L4 in 2013 was 23.1cm indicating a very slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971). Brown trout captured during the 2010 survey ranged in length from 11.7cm to 59.5cm (Fig. 1.4) and had a similar age range and growth rate to the 2013 survey. The dominant age class was 2+ (Fig. 1.4).

Arctic char captured during the 2013 survey ranged in length from 9.0cm to 19.5cm (mean = 15.4cm) (Fig.1.5) with four age classes present, ranging from 1+ to 4+. Arctic char captured during the 2010 survey had similar lengths and ages ranged from 2+ to 6+ (Fig.1.5). The dominant age class in both years was 3+ (Fig.1.5).

Minnow captured during the 2013 survey ranged in length from 3.5cm to 7.3cm and eels ranged from 34.9cm to 55.1cm. All juvenile salmon captured were aged 1+ and ranged in length from 8.0cm to 13.5cm. One sea trout measuring 23.5cm was aged at 2.0+.



**Fig. 1.4. Length frequency of brown trout captured on Glen Lough, 2010 and 2013**



**Fig. 1.5. Length frequency of Arctic char captured on Glen Lough**

**Table 1.3. Mean ( $\pm$ SE) brown trout length (cm) at age for Glen Lough, August 2013**

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>
Mean	5.1 (0.1)	11.3 (0.3)	18.0 (0.3)	23.1 (0.3)	24.8 (1.0)
N	105	100	85	44	8
Range	3.1-9.0	7.1-19.2	13.5-23.9	17.9-24.8	20.7-30.5

#### 1.4 Summary

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2013 survey.

Although the mean brown trout CPUE and BPUE was higher in 2013 than in 2010, these differences were not statistically significant. Brown trout ranged in age from 1+ to 5+, indicating reproductive success in five of the previous six years. The dominant age class was 4+. 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).

Although the mean Arctic char CPUE and BPUE was slightly lower in 2013 than in 2010, these differences were not statistically significant. Arctic char ranged in age from 1+ to 4+, with no 0+ 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 (Kelly *et al.*, 2012). Using the FIL2 classification tool, Glen Lough has been assigned an ecological status of High for both 2010 and 2013 based on the fish populations present.

In the 2010 to 2012 surveillance monitoring reporting period, the EPA assigned Glen Lough an overall draft ecological status of Good, based on all monitored physico-chemical and biological elements, including fish.

## 1.5 References

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