

Lough Sheelin



Sampling Fish for the Water Framework Directive - Lakes 2008



The Central and Regional
Fisheries Boards

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1.1 Introduction

Lough Sheelin (Plate 1.1, Fig. 1.1) is situated in counties Cavan, Meath and Westmeath in the Inny catchment. The lake is located north-east of Finnea, Co. Westmeath. It is seven kilometres long and has a surface area of 1,900 hectares. The River Inny passes through the lake. Lough Sheelin is a relatively shallow lake with a mean depth of 4.4m, a maximum depth of 15m and 51% percent of the lake is less than 5m in depth (Champ *pers. comm.*). The geology of the catchment is predominantly Carboniferous limestone, but Silurian/Ordovician formations underlie the western and northern drainage basin. The lake is eutrophic, and falls into typology class 12 (as designated by the EPA for the Water Framework Directive), i.e. deep (>4m), greater than 50ha and high alkalinity (>100 mg/l CaCO₃).

In the 1960s and 1970s Lough Sheelin was one of Ireland's top trout angling lakes, managed and developed by the Inland Fisheries Trust (now the Central and Regional Fisheries Boards). Phosphorus originating from intensive agricultural developments has caused progressive enrichment of Lough Sheelin since the early 1970s (Champ, 1998 and 2003). This has resulted in the trout population diminishing and the fish stock becoming dominated by cyprinids (O' Grady, *pers comm.*). The lake has been stocked with brown trout in recent years, with around 16,000 2+ fish introduced in 2004, followed by between 3,000 and 6,000 per year thereafter. The water quality in the lake and the catchment has been monitored on a continuous basis by the Shannon Regional Fisheries Board (ShRFB) and the Central Fisheries Board (CFB) since the 1970s (Champ, 1979, 1991, 1993, 1998; Duggan and Champ, 1992; Kerins *et al.*, 2007). A recently published study has shown a modest decrease in the total phosphorus loadings to the lake between 1988 and 2005, suggesting that the phosphorus losses from the catchment are slowly declining (Kerins *et al.*, 2007).

The fish population in Lough Sheelin has been surveyed regularly since 1978 by the CFB and ShRFB using a gill netting technique that was developed in the late 1970s (O' Grady, 1981) to assess trout stocks (trout > 19.8cm in length) on selected lake fisheries. Other fish species are also captured as a by-catch during these surveys which have proved to be an effective management tool in illustrating the fluctuations in fish stocks over time (Delanty and O'Grady, 2001). An extensive database has been developed based on this method. The standing crop of trout (> 19.8cm) in Lough Sheelin varied between 100,000 and 120,000 fish in the early 1980s and has since decreased substantially (O' Grady *et al.*, 2008). Unfortunately roach, a non-native species, were introduced into the lake during the 1970s and their population has fluctuated dramatically since that time. Lough Sheelin currently holds stocks of brown trout, pike, perch, roach, tench, 3-spined stickleback, 9-spined stickleback and eels.

Zebra mussels (*Dreissena polymorpha*), an invasive species in Ireland, were first noted in Lough Sheelin during 2003 and it is thought they were introduced to the lake in 2000 and 2001. Large populations of the mussel have been evident in the lake since 2004 (O' Grady *et al.*, 2008).



Plate 1.1. Lough Sheelin (Photo courtesy of CFB and No. 3 Operational Wing, Irish Air Corps [Aer Chór na hÉireann])

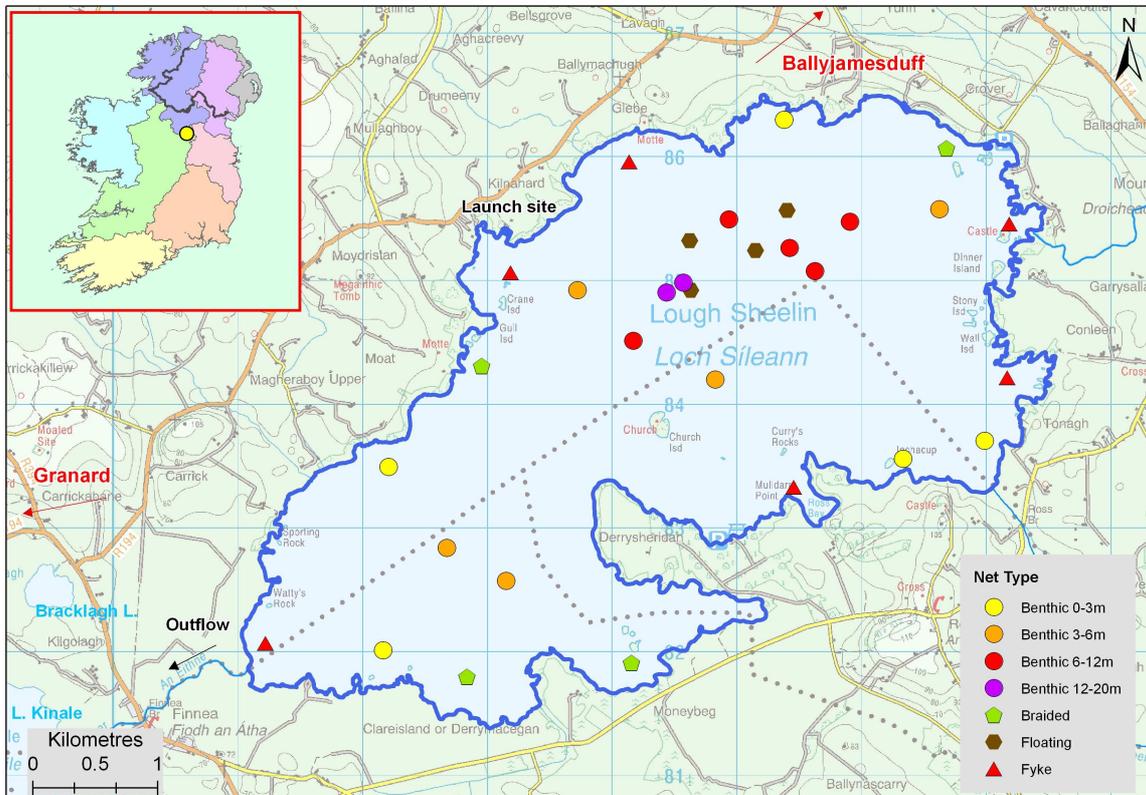


Fig. 1.1. Location map of Lough Sheelin showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

The lake was surveyed over two nights from the 2nd to the 3rd of July 2008. A total of six sets of Dutch fyke nets, 17 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) survey gill nets (5 @ 0-2.9 m, 5 @ 3-5.9 m, 5 @ 6-11.9 m and 2 @ 12 -19.9 m) and four surface floating monofilament multi-mesh (12 panel, 5-55mm mesh size) survey gill nets were deployed randomly in the lake (21 sites). The netting effort was supplemented using four benthic braided (62.5 mm mesh knot to knot) survey gill nets (four additional sites). Survey locations were randomly selected using a grid placed over the map of the lake. 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 brown trout, roach, roach x bream hybrids, pike and bream. 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 six fish species and one hybrid were recorded on Lough Sheelin in July 2008. A list of the species encountered and numbers captured by each gear type is shown in Table 1.1. A total of 666 fish were captured during the survey. Perch, followed by roach were the most common fish species encountered in the benthic gill nets. Small numbers of brown trout were also captured in the gill nets.

Table 1.1. List of fish species recorded (including numbers captured) during the survey on Lough Sheelin, July 2008

Scientific names	Common names	Number of fish captured				Total
		Benthic mono multimesh gill nets	Benthic braided gill nets	Surface mono multimesh gill nets	Dutch fykes	
<i>Salmo trutta</i>	Brown trout	1	1	1	0	3
<i>Perca fluviatilis</i>	Perch	519	0	9	0	528
<i>Rutilus rutilus</i>	Roach	109	1	2	0	112
	Roach x Bream	9	3	0	0	12
<i>Esox lucius</i>	Pike	4	1	0	0	5
<i>Abramis brama</i>	Bream	4	0	0	0	4
<i>Anguilla anguilla</i>	Eel	0	0	0	2	2

1.3.2 Fish abundance

Fish abundance was calculated as the mean number of fish caught per metre of net, i.e. mean CPUE. Fish biomass was calculated as the mean weight of fish caught per metre of net, i.e. mean BPUE. A summary of CPUE and BPUE data for each species and gear type is shown in Table 1.2. Perch were the dominant fish species in terms of abundance (CPUE) and biomass (BPUE).

Table 1.2. Mean CPUE (mean number of fish per m of net) and mean BPUE (mean weight of fish per m of net) for all fish species recorded on Lough Sheelin, July 2008

Gear type	Brown trout	Perch	Pike	Roach	Roach x Bream	Bream	Eel
Mean CPUE (mean number of fish/m of net)							
Gill nets (all)	0.004	0.703	0.007	0.149	0.016	0.005	-
Fyke nets	0.000	0.003	0.000	0.000	0.000	0.000	0.006
Mean BPUE (mean weight (g) of fish/m of net)							
Gill nets (all)	1.648	53.143	7.796	12.789	8.441	2.242	-
Fyke nets	0.000	0.558	0.000	0.000	0.000	0.000	1.396

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

1.3.3 Length frequency distributions

Perch ranged in length from 3.0cm to 35.6cm (mean = 13.7cm) (Fig. 1.2). Roach ranged in length from 6.0cm to 30.0cm (mean = 15.2cm) (Fig. 1.3). Roach x bream hybrids ranged in length from 23.5cm to 38.0cm. The three brown trout captured ranged from 27.1cm to 45.1cm, and bream ranged from 15.3cm to 40.8cm in length. Two eels captured had lengths of 49.9cm and 64.4cm. Pike lengths ranged from 34.4cm to 66.0cm.

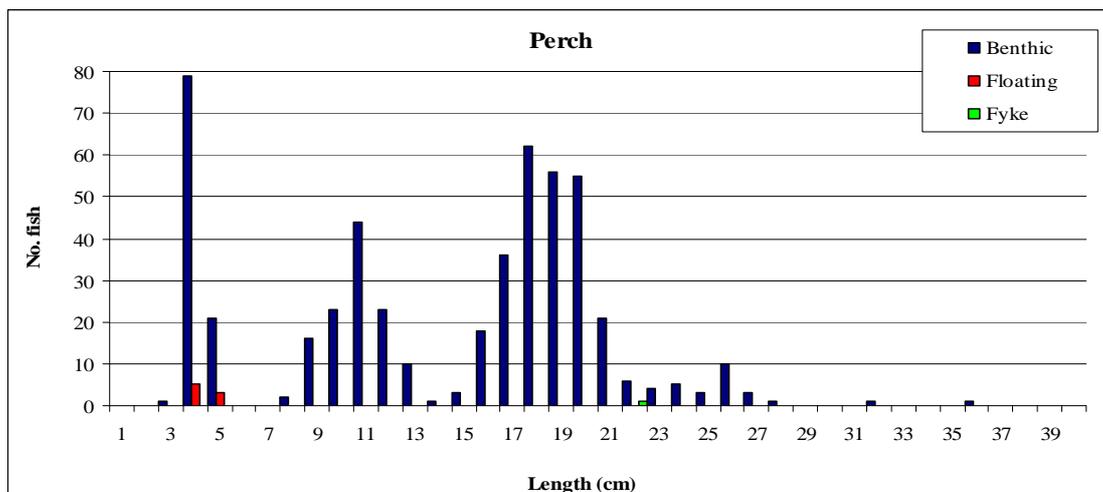


Fig. 1.2. Length frequency of perch captured on Lough Sheelin, July 2008

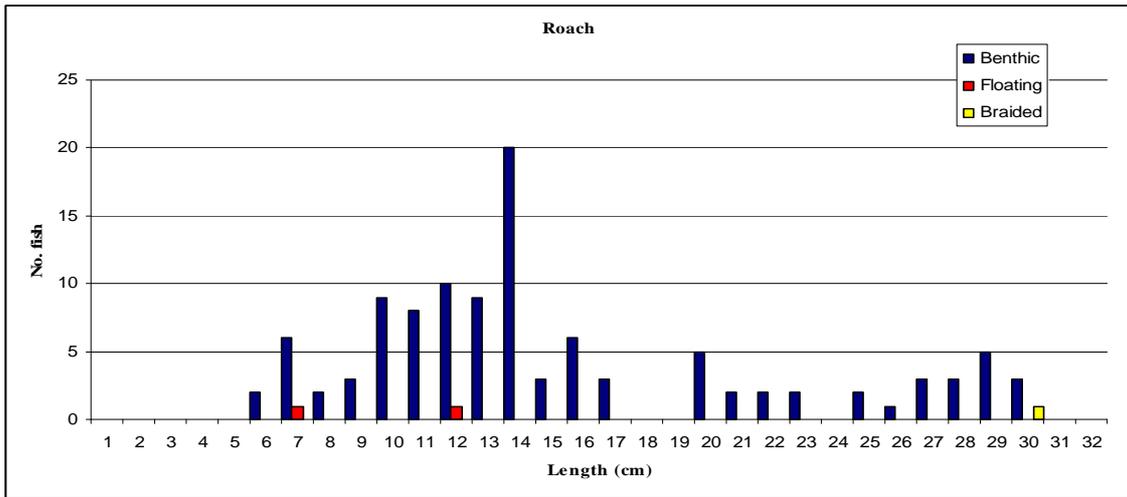


Fig. 1.3. Length frequency of roach captured on Lough Sheelin, July 2008

1.3.4 Fish age and growth

Five age classes of perch were recorded during the survey; 0+ to 3+ and 5+. Length frequency and age analysis revealed that 2+ was the dominant age category of perch in the lake during the survey, accounting for approximately 51% of the population, followed by 1+ (23%) and 0+ (21%). Mean perch L1 was 7.0cm (Table 1.3).

Roach ranged in age from 1+ to 7+. Length frequency and age analysis showed that 3+ was the dominant age class, accounting for 40% of the roach population. Mean roach L1 was 4.0cm (Table 1.4).

Five pike were recorded and these ranged in age from 2+ to 4+. Most roach x bream hybrids ranged from 5+ to 8+, with two aged 10+.

Unfortunately it was only possible to age one of the three brown trout captured and this was aged at 3+ (27.8cm and 201.5g).

Table 1.3. Mean (SD) perch length at age for Lough Sheelin, July 2008

	L ₁	L ₂	L ₃	L ₄	L ₅
Mean	7 (0.77)	14.6 (2.31)	22.8 (1.81)	30.1 (1.73)	37.2 (3.15)
N	86	61	23	2	2
Range	5.3-8.9	9.4-20	19.1-26	28.8-31.3	30.4-34.9

Table 1.4. Mean (SD) roach length at age for Lough Sheelin, July 2008

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇
Mean	4.0 (0.48)	7.3 (0.67)	10.8 (1.05)	14.9 (1.62)	19.0 (1.84)	23.7 (1.81)	27.4 (1.48)
N	63	58	45	25	19	13	6
Range	3-5.3	6-8.7	9.1-12.9	12.8-18.9	16.5-22.7	20.6-26.5	26-29.3

1.4 Summary

Perch were the dominant fish species in Lough Sheelin at the time of sampling, followed by roach and roach x bream hybrids.

The survey has shown that the mean CPUE for perch in the lake was moderate when compared with other high alkalinity lakes surveyed during 2008, such as Corglass Lough and Lough Egish. However, perch BPUE was relatively high in comparison to other lakes surveyed (Kelly *et al*, 2009).

Brown trout CPUE and BPUE was relatively low when compared to other lakes surveyed during 2008 (Kelly *et al*, 2009). O' Grady *et al* (2008) have shown that the brown trout population in the lake has been unstable since the 1970s, mainly due to eutrophication (primarily phosphorus emanating from agricultural sources). Furthermore, as is the case with all stocked lakes, the timing of the survey in relation to when the lake was last stocked can also have an influence on the number of brown trout captured.

The mean CPUE and BPUE for roach was relatively low when compared to other high alkalinity lakes surveyed during 2008 (Kelly *et al*, 2009). Unfortunately this non native species was introduced into the lake in the 1970s. Roach is one of the most invasive and prolific freshwater species that has been introduced to Irish waters in the last 100 years and has been associated with declines in native fish and other species. O' Grady *et al* (2008) have shown that the roach population in Lough Sheelin expanded greatly in the late 1980s during a time when enrichment was high in the lake. This expansion was followed by a population collapse during the 1990s which can be correlated with a decrease in chlorophyll a values. Subsequently another expansion in roach stocks was observed from 1998 to 2005 and this was again followed by a collapse in the stocks from 2005 to the present day. This second collapse in the roach stocks may be attributed to the establishment of a large zebra mussel population in the lake resulting in a decrease in algal blooms (O' Grady *et al*, 2008). Angling is very important to the local economy, therefore fish populations in this lake should continue to be monitored closely.

Perch growth was linear in Lough Sheelin and much faster in comparison with other high alkalinity lakes, such as Lough Egish and Annaghmore Lake; for example, a 37.0cm perch from Lough Egish, Co. Monaghan was aged at 9+, whereas a perch of a similar size from Lough Sheelin was aged at 5+. The roach population in Lough Sheelin also displayed linear growth. The growth rate was below average initially for the first four years when compared with other high alkalinity lakes. After the fourth year, other roach populations displayed a slowing of growth, but in Lough Sheelin, linear growth continued and L6 and L7 were average for high alkalinity lakes.

Hatchery reared fish have been released into the lake to increase numbers for angling purposes, as the native stock have been unstable in the lake since the 1970s. Many factors must be considered before fish stocking is carried out, as inappropriate stocking could have detrimental effects on the local

environment. Some fears exist that stocked fish may pass on parasites or diseases to the wild fish population when introduced to a lake. These fish may also change the genetic composition and fitness of wild stocks through interbreeding. There is also concern that stocked fish may out-compete native fish for food and habitat. However, netting surveys and angling catches indicate that stocked and wild trout do not mix and that wild stocks occupy the best feeding areas at any particular time (O’Grady, 2008). A review of the survival of stocked fish in this lake is recommended, and the stocking policy for the lake should also be reviewed and revised. Stocking programmes developed should be consistent with EU legislation (WFD, Habitats Directive and the Fish Health Directive) and national programmes such as the National Biodiversity Plan. The revised stocking policy for the lake should include a review of habitat and spawning potential of the wild brown trout population, catch and release policy, bag limits, etc.

An essential step in the WFD monitoring process is the classification of the ecological status of lakes, which in turn will assist in identifying the objectives that must be set in the individual River Basin Management Plans. This work 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 new WFD fish classification tool has been developed for the island of Ireland (Ecoregion 1) using Republic of Ireland (CFB) and Northern Ireland (Agri-Food and Biosciences Institute) data generated during the North South Share Fish in Lakes project (Kelly *et al*, 2008). Using this tool and expert opinion on non-native/alien species, Lough Sheelin has been assigned a draft classification of moderate status for fish. The EPA has assigned an overall status of Moderate to Lough Sheelin in an interim draft classification. This is based on physico-chemical parameters and other biotic elements such as macroinvertebrates, macrophytes and fish.

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