Carrowmore Lake

Sampling Fish for the Water Framework Directive - Lakes 2008

The Central and Regional Fisheries Boards

ACKNOWLEDGEMENTS

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1.1 Introduction

Carrowmore Lake (Plate 1.1 and Fig. 1.1) is situated in Co. Mayo, just over three kilometres north-west of Bangor Erris in the Owenmore catchment. The slopes of Knocknascollop mountain rise up along the western shore. The lake is over six kilometres long and almost five kilometres at its widest point. It has a surface area of 926ha and has a maximum depth of 2.9m. The lake falls into typology class 6 (as designated by the EPA for the Water Framework Directive), i.e. shallow (mean depth <4m), greater than 50ha and moderate alkalinity (20-100mg/l $CaCO_3$).

The lake forms part of the Carrowmore Lake Complex SAC, containing many rare and important species of plants. The shoreline is dominated by Soft Rush (*Juncus effusus*), Yellow Iris (*Iris pseudacorus*), Common Club-rush (*Scirpus lacustris*) and Common Reed (*Phragmites australis*). Mediterranean Heath (*Erica erigena*), a species found frequently in parts of west Mayo, but rare in west Galway and unknown elsewhere in Ireland, is also prominent. Marsh Saxifrage (*Saxifraga hirculus*) also occurs at the site. This species is listed under Annex II of the European Habitats Directive. Most of the lakes catchment is covered in a blanket of bog overlying glacial gravel deposits. The Carrowmore Lake Complex also supports various important bird species such as Greenland White-fronted Geese, Golden Plover, Merlin, Sandwich Tern and Arctic Tern (NPWS, 1997).

Algal blooms occur from time to time on the lake and in recent years the North Western Regional Fisheries Board have carried out a detailed study into the causes and factors relating to the eutrophication of Carrowmore Lake (NWRFB, 2005). The main cause of the enrichment problem was found to be land use practices, mainly agriculture and forestry, and this is by far regarded as the most significant environmental threat currently facing this lake. Wind induced turbulence is also an important factor in relation to phosphorous mobilisation from the sediment, due to the shallow nature of the lake (NWRFB, 2005). Carrowmore Lake is also utilised for water abstraction and a pump house is present on the lake shore.

The lake holds good stocks of salmon, brown trout and sea trout, and is regarded as one of the best salmon fishing loughs in the country, although stocks are under pressure due to the recent eutrophication of the lake (NWRFB, 2005).

Plate 1.1. Carrowmore Lake

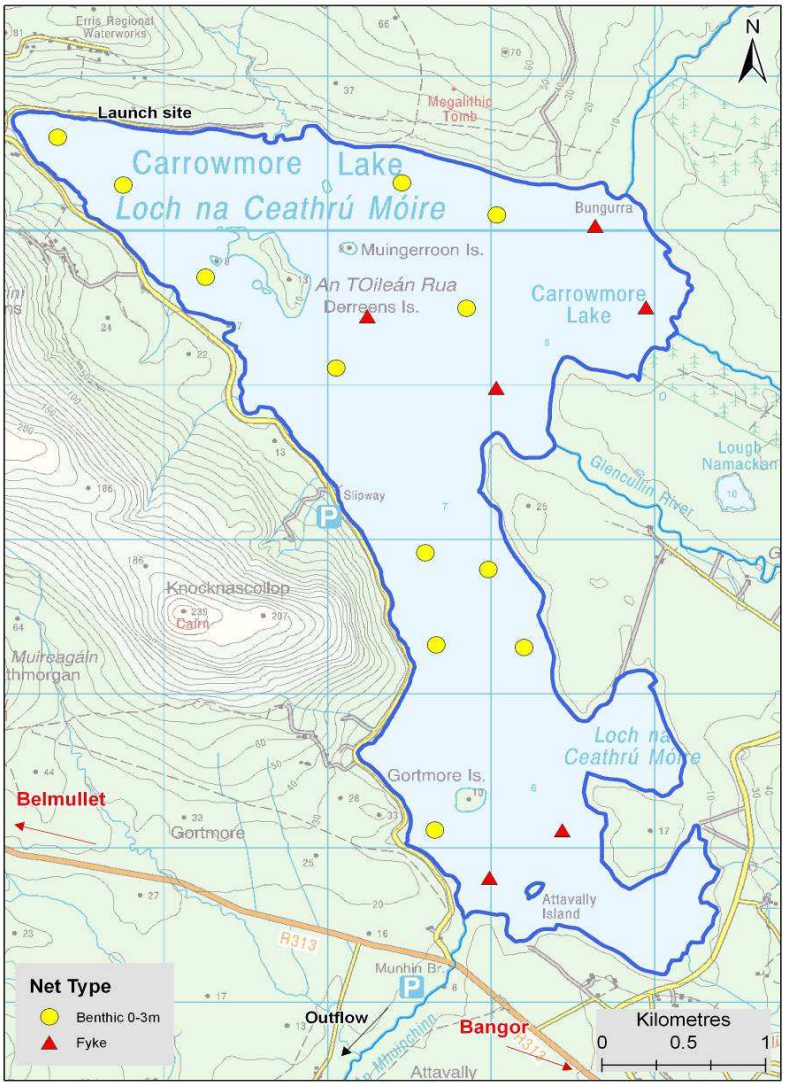

Fig. 1.1. Location map of Carrowmore Lake showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

The lake was surveyed over one night on the 11th of June 2008. A total of six sets of Dutch fyke nets, 12 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) survey gill nets (12 @ 0-2.9m) were deployed randomly in the lake (18 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 were measured and weighed on site and scales were removed from brown trout and sea 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 during the survey. Sea trout were also captured. The number of each species captured by each gear type is shown in Table 1.1. A total of 732 fish were captured during the survey. Three-spined stickleback was the most common fish species encountered in the benthic gill nets, followed by brown trout and sea trout. Fifteen eels were also captured during the survey.

Table 1.1. List of fish species recorded (including numbers captured) during the survey on Carrowmore Lake, June 2008

Scientific name	Common name	Number of fish captured		
		Benthic mono multimesh gill nets	Fyke nets	Total
Gasterosteus aculeatus	3-spined stickleback	462	136	598
Salmo trutta	Brown trout	99	1	100
	Sea trout	19	0	19
Anguilla anguilla	Eel	0	15	15

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 captured 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.

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 Carrowmore Lake, June 2008

Gear type	Brown trout	Sea trout	3-spined stickleback	Eel
Mean CPUE (mean number of fish/m of net)				
Gill nets (all)	0.275	0.053	1.283	-
Fyke nets	0.003	0.000	0.378	0.042
Mean BPUE (mean weight (g) of fish/m of net)				
Gill nets (all)	19.297	3.350	5.133	-
Fyke nets	0.0833	0.000	1.511	5.011

* In 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*

Brown trout ranged in length from 12.3cm to 44.0cm (mean = 19.2cm) (Fig. 1.2). Sea trout ranged in length from 18.5cm to 23.5cm (Fig. 1.3). Three-spined stickleback ranged in length from 3.0cm to 6.0cm (Fig. 1.4). Eels ranged in length from 30.2cm to 49cm.

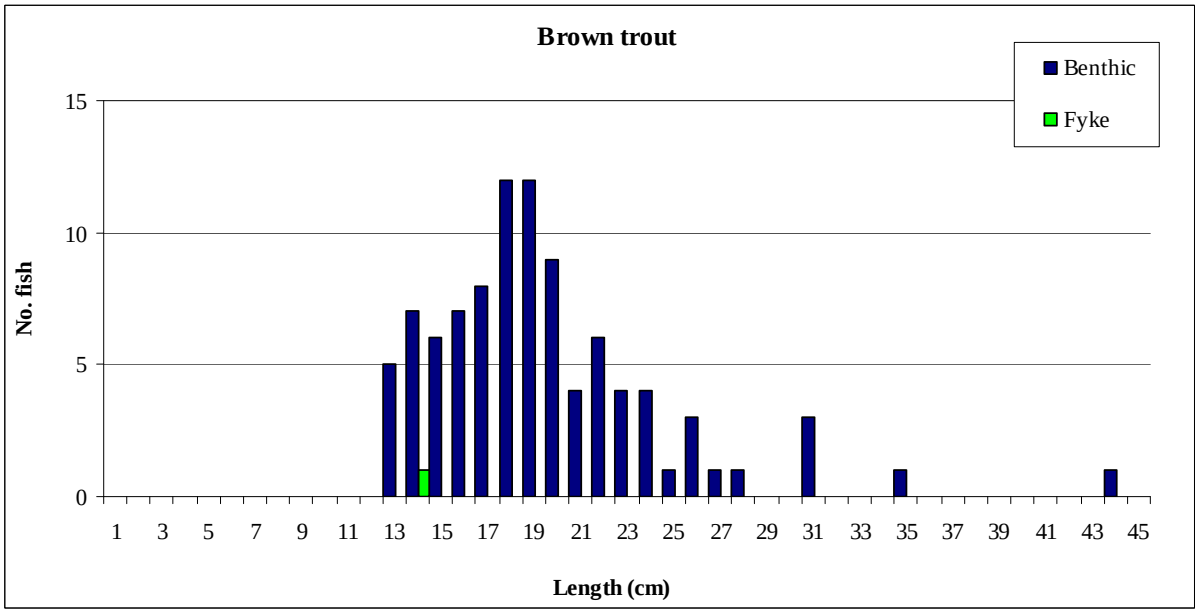

Fig. 1.2. Length frequency of brown trout captured on Carrowmore Lake, June 2008

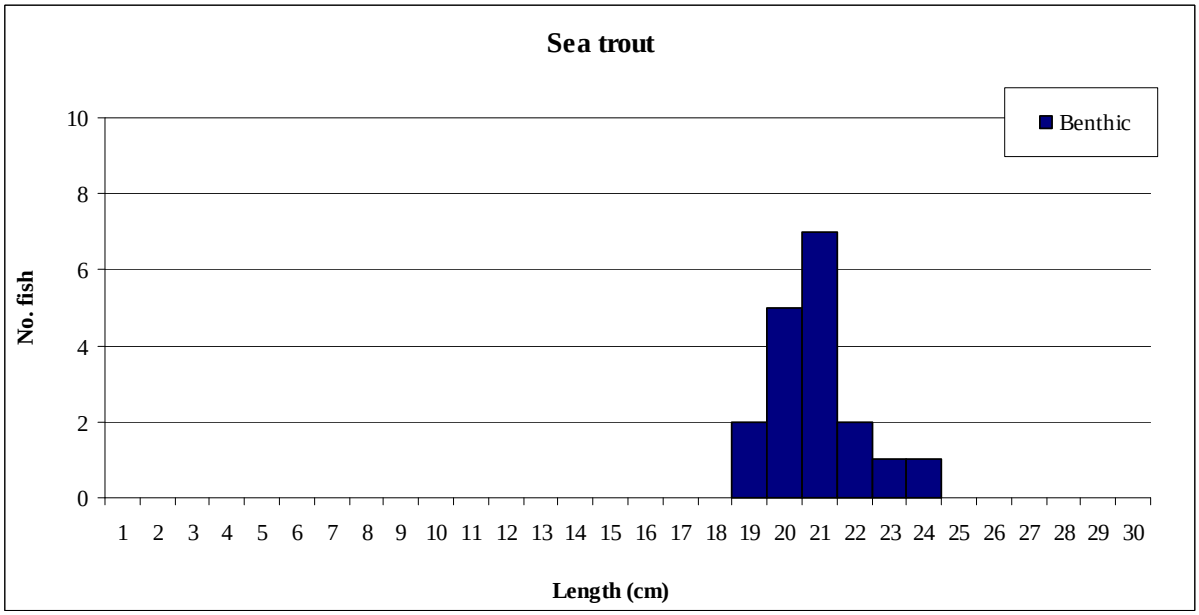

Fig. 1.3. Length frequency of sea trout captured on Carrowmore Lake, June 2008

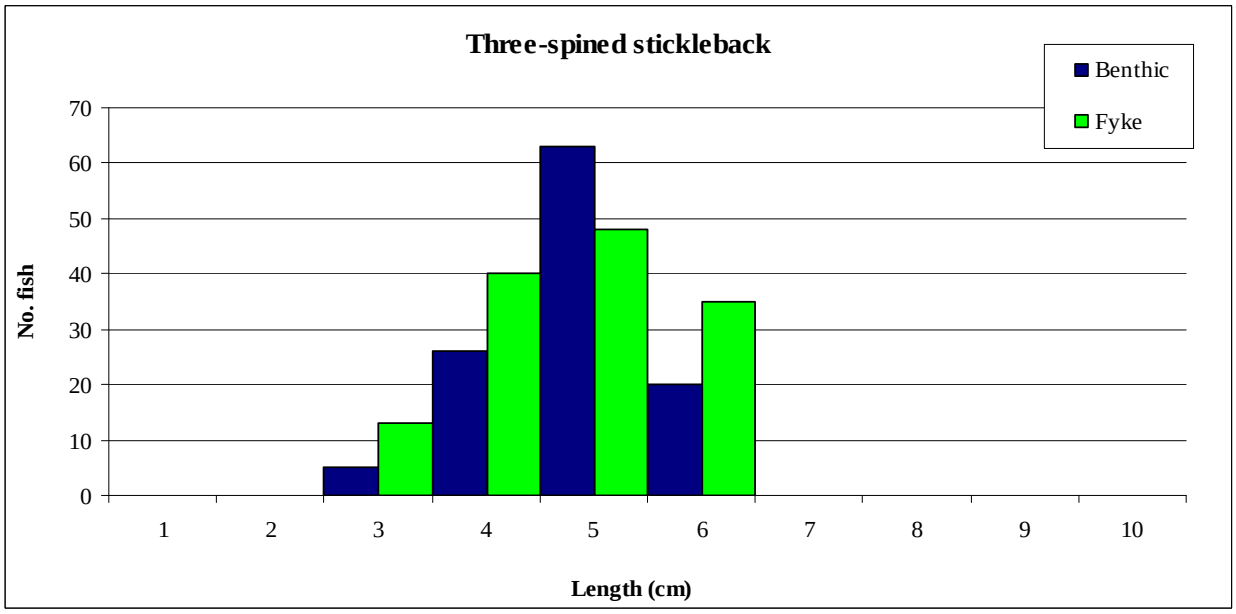

Fig. 1.4. Length frequency of three-spined stickleback captured on Carrowmore Lake, June 2008

1.3.4 *Fish age and growth*

Brown trout ranged in age from 1+ to 6+. Brown trout aged 2+ accounted for the largest proportion of the population captured in the gill nets (approximately 41%), followed by 3+ (35%)and 1+ (14%). Mean brown trout L4 was 23.5cm, indicating that the growth of brown trout in Carrowmore Lake is very slow, based on a classification developed by Kennedy and Fitzmaurice (1971).

Table 1.3. Mean (SD) brown trout length at age (cm) for Carrowmore Lake, June 2008

	L1	L2	L3	L4	L5	L6
Mean	6.3 (1.16)	13.5 (2.06)	18.8 (1.92)	23.5 (2.47)	28.4 (4.9)	33.8 (6.6)
N	54	47	29	10	4	3
Range	4.0-8.8	9.8-18.6	15.9-23.0	21.2-27.8	25.4-35.8	29.0-41.4

1.4 Summary

Three-spined stickleback was the commonest fish species recorded in Carrowmore Lake, followed by brown trout, sea trout and eels. Data analysis has shown that the CPUE for brown trout was above average when compared with other moderate alkalinity lakes surveyed during 2008 (Kelly *et al*., 2009). Only Lough Fern and Lough Melvin had a higher mean brown trout CPUE in the moderate alkalinity lake category. Eels were found to have a low CPUE when compared with other moderate alkalinity lakes (Kelly *et al*., 2009).

Kennedy and Fitzmaurice (1971) related growth rates to alkalinity and classified the growth of lake trout generally into four different categories. This description was applied to trout from Carrowmore Lake and hence trout were classified as having very slow growth. Growth of trout in the lake was below average in comparison with other moderate alkalinity lakes surveyed during 2008, e.g. Lough Owel and Lough Fern.

The fish population in Carrowmore Lake should be closely monitored as it is under a number of environmental pressures, principally eutrophication and water abstraction. Both these pressures can negatively impact on the native fish population present in the lake. The increase in nutrient levels in the lake may reduce the amount of oxygen available to the resident salmonid populations and hence affect their survival rates. The lowering of water levels as a consequence of water abstraction can also be detrimental to the spawning success of resident fish populations that may utilise shallow, gravelly lake margins as spawning substrate in the absence of suitable inflowing streams. In the case of Carrowmore Lake, however, this is unlikely to be a major issue, as there are several inflowing streams that can potentially be utilised by spawning fish. Assessing/monitoring spawning activity in these streams would be useful to identify the principle spawning streams and importance (if any) of the littoral lake area as spawning habitat.

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 new WFD multimetric fish classification tool has been developed for the island of Ireland (Ecoregion 17) using Agri-Food and Biosciences Institute Northern Ireland (AFBINI) and CFB data (Kelly *et al*., 2008). Using this tool and expert opinion, Carrowmore Lake has been assigned a draft classification of good ecological status for fish. The EPA has assigned moderate status to Carrowmore Lake in an overall interim draft classification. This is based on physico-chemical parameters and biotic elements, such as macroinvertebrates, macrophytes and fish.

1.5 References

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