Lough Carra

Sampling Fish for the Water Framework Directive - Lakes 2009

The Central and Regional Fisheries Boards

ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of the CEO Dr. Greg Forde, Assistant CEO Ms. Amanda Mooney and their staff from the Western Regional Fisheries Board. The authors would also like to gratefully acknowledge the help and cooperation of all their colleagues in the Central Fisheries Board (CFB).

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Energy and Natural Resources for 2009.

1.1 Introduction

Lough Carra is situated in County Mayo and forms the most northerly part of the Great Western Lakes system of Loughs Corrib, Mask and Carra (Plate 1.1, Fig. 1.1). The lake is located approximately 5km north of Ballinrobe, Co. Mayo.

Lough Carra is the largest marl lake in Ireland, with a surface area of approximately 1600ha (NPWS, 2004; Irvine *et al.*, 2003). It is a hard water lake which acquires most of its water via the feeder streams that flow in at various points around its perimeter (Huxley and Huxley, 2009). The majority of the lake is shallow with a mean depth of approximately 1.8m; however, there are sections of the lake where depths reach over 19m (Huxley and Huxley, 2009). Lough Carra is well known for its green/blue colour which is due to the formation of calcareous encrustations (NPWS, 2004). The lake contains well developed stonewort communities with *Chara curta, C. desmacantha, C. rudis* and *C. contraria* also recorded (NPWS, 2004).

There are approximately 73 islands scattered throughout the lake, varying in size from less than 50m² to just over 10,000m^2. The lake is categorised as typology class 10 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. shallow (<4m), greater than 50ha and highly alkaline (>100mg/l CaCO3).

Plate 1.1. Lough Carra

Results from a recent (March 2009) survey on Lough Carra suggest that the lake supports an excellent and healthy stock of brown trout, possibly one of the best in the country (CFB, 2009). The average size of the brown trout taken from Lough Carra is greater than any of the other western lakes and the lake has previously produced a specimen of 8.2kg (O' Reilly, 2007). Lough Carra is believed to be one of the few remaining wild brown trout calcareous lakes within the EU (Irvine *et al.* 2003).

During the 1990s fishery rehabilitation and enhancement works were undertaken in Lough Carra's spawning streams by the Fisheries Boards and this has led to greatly increased recruitment of juvenile brown trout to the lake. These works have resulted in a doubling of the adult stock in the lake, compared to the stock levels of the 1970's (O'Grady, 2009). Other fish species present in Lough Carra include pike, perch and eel. This species composition has not changed since the early 1960's (Inland Fisheries Trust unpublished data).

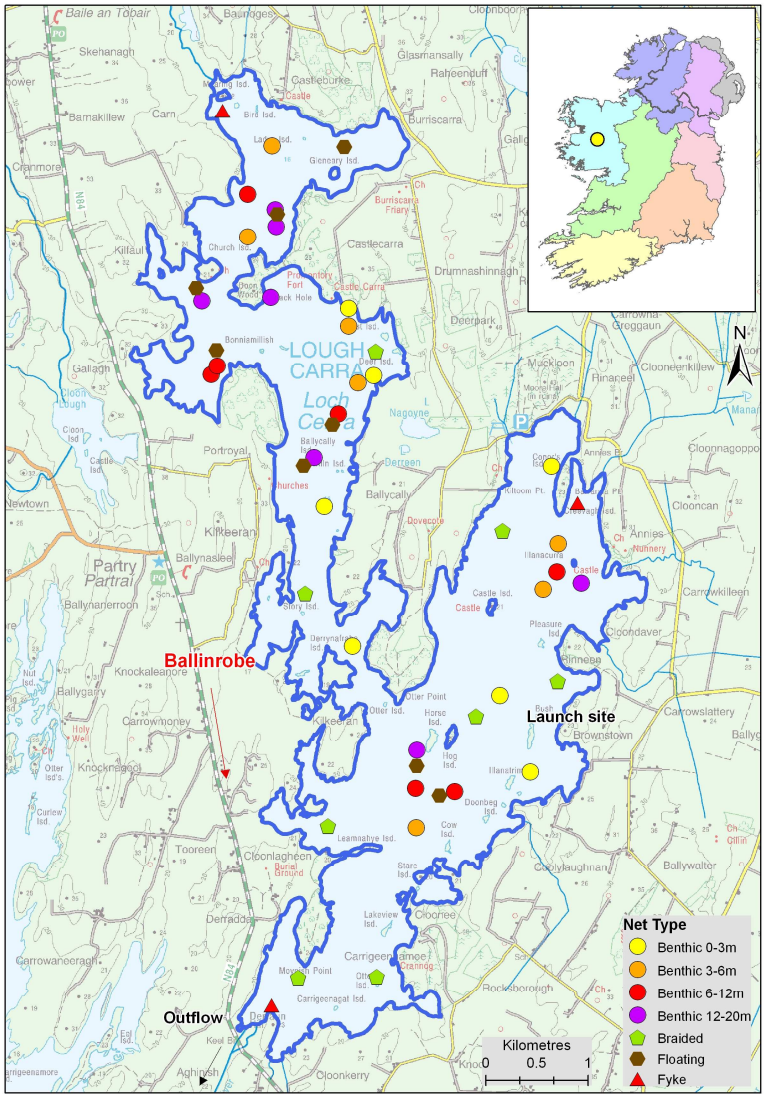

Fig. 1.1. Location map of Lough Carra showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

Lough Carra was surveyed over three nights from the 22nd to the 25th of June 2009. A total of three sets of Dutch fyke nets, 28 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (7 @ 0-2.9m, 7 @ 3-5.9m, 7 @ 6-11.9m and 7 @ 12-19.9m) and eight surface floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed randomly in the lake (36 sites). The netting effort was supplemented using eight benthic braided (62.5mm mesh knot to knot) survey gill nets (8 additional sites). Survey locations were randomly selected within each depth zone using a grid placed over a 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 trout and pike. 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 five fish species were recorded on Lough Carra in June 2009, with 221 fish being captured (Table 1.1). Perch (Plate 1.2) followed by brown trout were the most abundant fish species recorded. Small numbers of pike and three-spined stickleback were also captured. Eels were recorded in fyke nets only.

Plate 1.2. Perch recorded on Lough Carra (5.6cm to 34.5cm)

Table 1.1. List of fish species recorded (including numbers captured) during the survey on Lough Carra, June 2009

Scientific name	Common name	Number of fish captured				
		Benthic mono multimesh gill nets	Benthic braided gill nets	Surface mono multimesh gill nets	Fyke nets	Total
Perca fluviatilis	Perch	132	14	6	0	152
Salmo trutta	Brown trout	22	10	3	0	35
Gasterosteus aculeatus	Three-spined stickleback	10	0	4	0	19
Esox lucius	Pike	3	0	0	0	3
Anguilla anguilla	Eel	0	0	0	12	12

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 are summarised in Table 1.2.

The differences in the mean brown trout CPUE between Lough Carra and four other similar lakes were assessed (Fig. 1.2). There was no significant difference in the mean brown trout CPUE among the five lakes assessed (Kruskal-Wallis). However, Independent-Samples Mann-Whitney U tests between each lake showed that Lough Carra had a significantly higher mean brown trout CPUE than Lough Derg ($z = -1.966$, $P<0.05$). The differences in the mean perch CPUE between Lough Carra and four other similar lakes were assessed with no significant differences being found (Fig. 1.3).

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

Scientific name	Common name	
		Mean CPUE
Perca fluviatilis	Perch	0.109 (0.030)
Salmo trutta	Brown trout	0.026 (0.007)
Gasterosteus aculeatus	Three-spined stickleback	0.013 (0.008)
Esox lucius	Pike	0.002 (0.001)
Anguilla anguilla	European eel	0.067 (0.029)
		Mean BPUE
Perca fluviatilis	Perch	18.160 (6.131)
Salmo trutta	Brown trout	17.105 (6.153)
Esox lucius	Pike	0.495 (0.294)
Gasterosteus aculeatus	Three-spined stickleback	0.013 (0.008)
Anguilla anguilla	European eel	19.207 (6.079)

* On the rare occasion where biomass data was unavailable for an individual fish, this was determined from a length/weight regression for that species. Standard error is displayed in brackets.

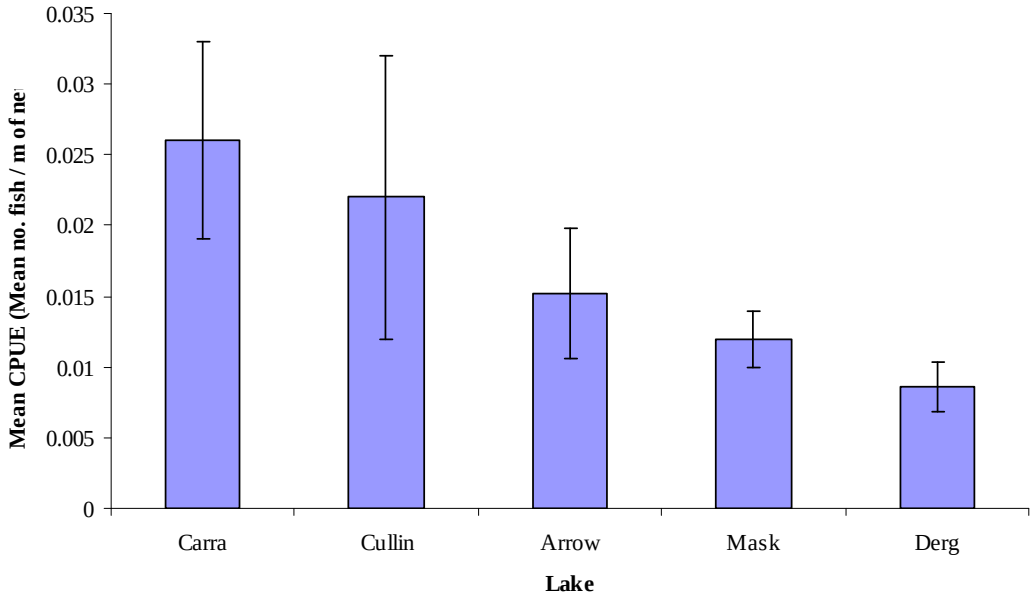

Fig. 1.2. Mean (±S.E.) brown trout CPUE in five lakes surveyed during 2009

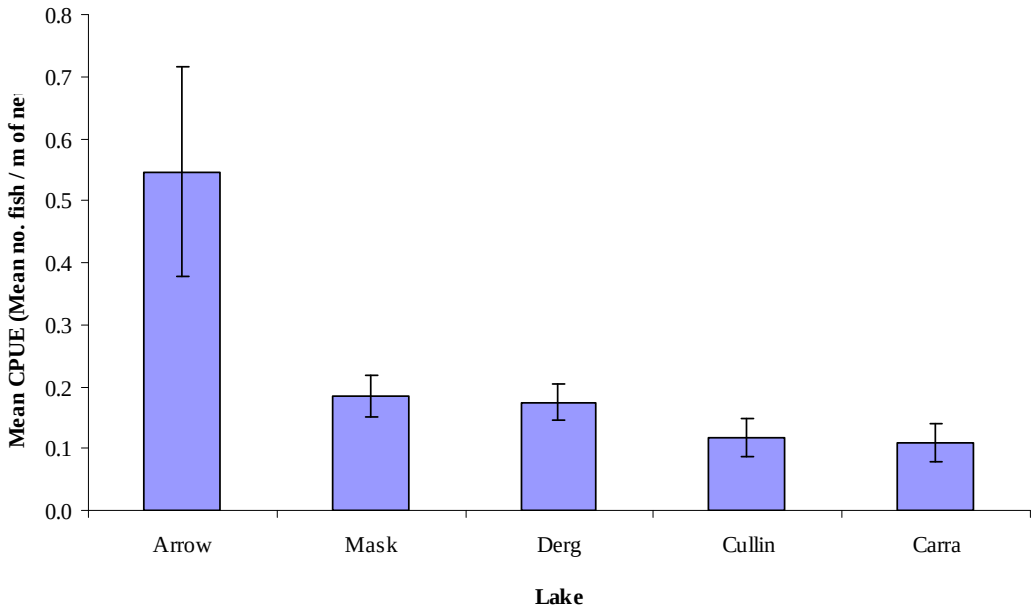

Fig. 1.3. Mean (±S.E.) perch CPUE in five lakes surveyed during 2009

1.3.3 Length frequency distributions

Brown trout ranged in length from 13.5cm to 53.0cm (mean = 33.9cm) (Fig. 1.4). Perch ranged in length from 5.6cm to 34.5cm (mean = 18.3cm) (Fig.1.5). Pike ranged in length from 28.2cm to 34.0cm. Eels ranged in length from 36.5cm to 69.0cm and three-spined stickleback ranged from 3.5cm to 5.0cm.

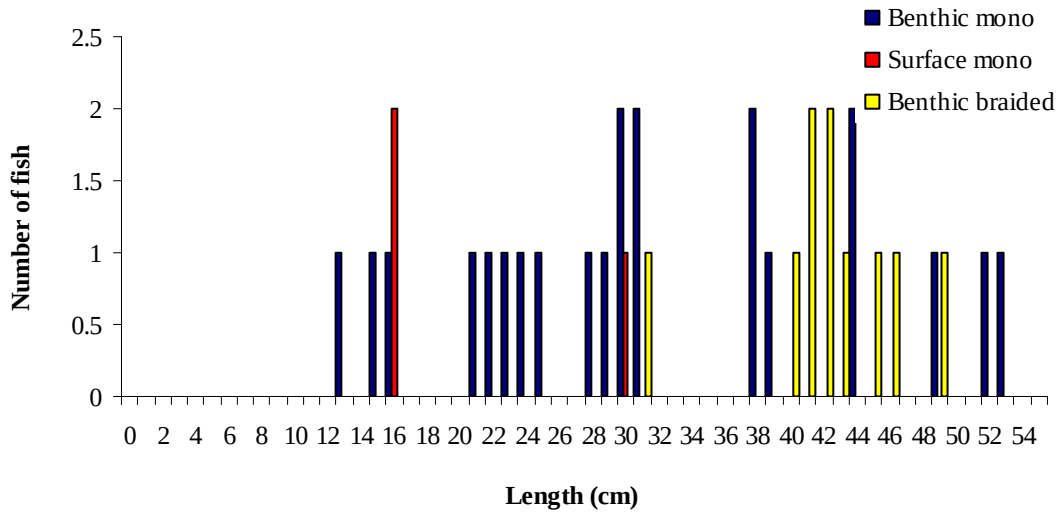

Fig. 1.4. Length frequency of brown trout (n=35) captured on Lough Carra, June 2009

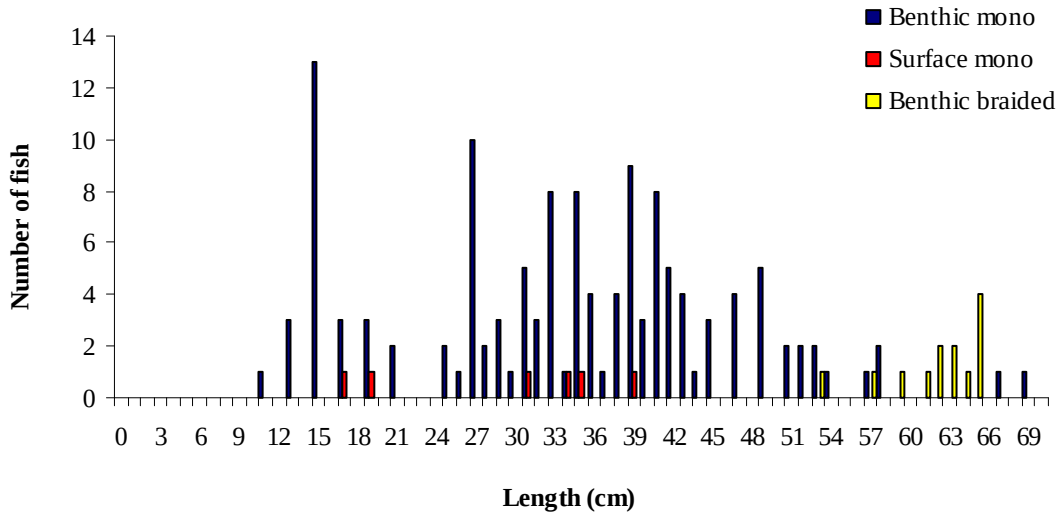

Fig. 1.5. Length frequency of perch (n=151) captured on Lough Carra, June 2009

1.3.4 Fish age and growth

Five age classes of brown trout were present, ranging from 1+ to 6+, with a mean L1 of 6.9cm (Table 1.3). Mean brown trout L4 was 40.0cm (Table 1.3) indicating a very fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971).

Eight age classes of perch were present, ranging from 1+ to 7+, with a mean L1 of 6.3cm (Table 1.4). The three pike captured were all aged 3+.

Table 1.3. Mean (±SE) brown trout length (cm) at age for Lough Carra, June 2009

	L_1	L_2	L_3	L_4	L_5	L_6
Mean	6.9 (0.2)	19.1 (0.7)	31.9 (1.1)	40.0 (1.7)	42.0 (1.2)	45.4 (1.3)
N	33	28	16	9	4	4
Range	4.3-9.2	12.2-25.2	22.4-38.4	33.3-48.6	40.0-45.1	42.8-47.8

Table 1.4. Mean (±SE) perch length (cm) at age for Lough Carra, June 2009

	L_1	L_2	L_3	L_4	L_5	L_6	L_7
Mean	6.3 (0.1)	12.6 (0.2)	18.7 (0.3)	24.0 (0.7)	27.1 (1.2)	27.0 (1.4)	33.8
N	120	108	80	38	14	5	1
Range	4.3-9.3	8.0-16.8	10.5-25.1	15.6-29.4	21.4-32.4	23.2-31.6	33.8-33.8

1.4 Summary

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

The mean brown trout CPUE in Lough Carra was significantly higher than the mean CPUE in Lough Derg. Although Lough Carra exhibited a higher mean brown trout CPUE than Lough Cullin, Lough Arrow and Lough Mask, these differences were not statistically significant. Brown trout ranged in age from 1+ to 6+ indicating reproductive success in the last number of years. Length at age analyses revealed that brown trout in the lake exhibit a very fast rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

The mean perch CPUE in Lough Carra was relatively low when compared to other similar type lakes; however, these differences were not statistically significant. Similarly, although Lough Arrow exhibited a higher mean perch CPUE than Lough Carra, this was not statistically significant. Perch ages ranged from 1+ to 7+, indicating reproductive success in each of the previous number of years.

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 WFD multimetric fish classification tool has been developed for the island of Ireland (Ecoregion 17) using CFB and Agri-Food and Biosciences Northern Ireland (AFBINI) data generated during the NSSHARE Fish in Lakes project (Kelly *et al.*, 2008). Using this tool, Lough Carra has been assigned an ecological status classification of Good based on the fish populations present.

The EPA has assigned an overall status of Moderate to Lough Carra in an 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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