Lough Derg

Sampling Fish for the
Water Framework Directive -
Lakes 2009

ACKNOWLEDGEMENTS

1.1 Introduction

Lough Derg (Plate 1.1, Fig. 1.1) is the third largest lake in Ireland and the largest and most southerly lake on the Shannon system, stretching for 40km from Portumna, Co. Galway in the north to Killaloe, Co. Clare and Ballina, Co. Tipperary in the south. It is a long, relatively narrow lake, bordered by counties Tipperary, Galway and Clare.

Lough Derg is a mixed fishery, with salmon, trout, pollan, coarse fish and pike present (O'Reilly, 2007). It is a very popular fishing destination, especially during mayfly season, when average trout weights are close to 1kg and fish up to 5kg can be taken (O'Reilly, 2007).

The lake is categorised as typology class 12 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. deep (>4m), greater than 50ha and high alkalinity (>100mg/l CaCO3). The surface area of the lake is approximately 13,000ha. It is relatively shallow towards the northern end with depths averaging 6m (NPWS, 2004); however it narrows towards the southern end with depths reaching up to 36m. Water levels are regulated by the Electricity Supply Board due to the presence of Ireland's largest hydroelectric power station, Ardnacrusha, which is located at the end of a purpose built channel (the head-race canal) connected to the River Shannon, approximately 8km below the southern end of the lake. The northern end of the lake is bordered by relatively flat, agricultural land, while the lower reaches of the lake are bordered by the Slieve Aughty Mountains in the west and the Arra Mountains in the east.

In the early 1990's Lough Derg was classified as highly eutrophic and in 1997 the presence of zebra mussel was confirmed in the lower lough (Minchin *et al.,* 2002). This confirmation of the plankton feeding zebra mussel coincided with a significant increase in water clarity (NPWS, 2004).

The north-eastern shore of Lough Derg has been designated as a Special Area of Conservation, with six habitats listed on Annex I of the E.U. Habitats Directive. Four of these habitats are regarded as priority habitats - *Cladium* fen, alluvial woodland, limestone pavement and yew woodland (NPWS 2003). The lake itself is a Special Protection Area that supports important numbers of wintering wildfowl (NPWS, 2003). Lough Derg is also of conservation interest for the fish and freshwater invertebrate species present. The lake contains a landlocked population of sea lamprey (*Petromyzon marinus*) and all three species of lamprey are present in the Lower River Shannon catchment. The fish species, pollan (*Coregonus autumnalis*), which is listed on Annex V of the EU Habitats Directive is present in Lough Derg; one of only five sites in Ireland (RoI and NI) where it is known to occur (Lough Neagh, Lower Lough Erne, Lough Ree and Lough Derg and Lough Allen) (NPWS, 2004; Harrison *et al*., 2010). A native fish biodiversity project is currently in operation on the lake. The aim of this project is to answer a number of questions regarding the populations of brown trout and pollan using the most up to date and sophisticated scientific techniques (ShRFB, 2009).

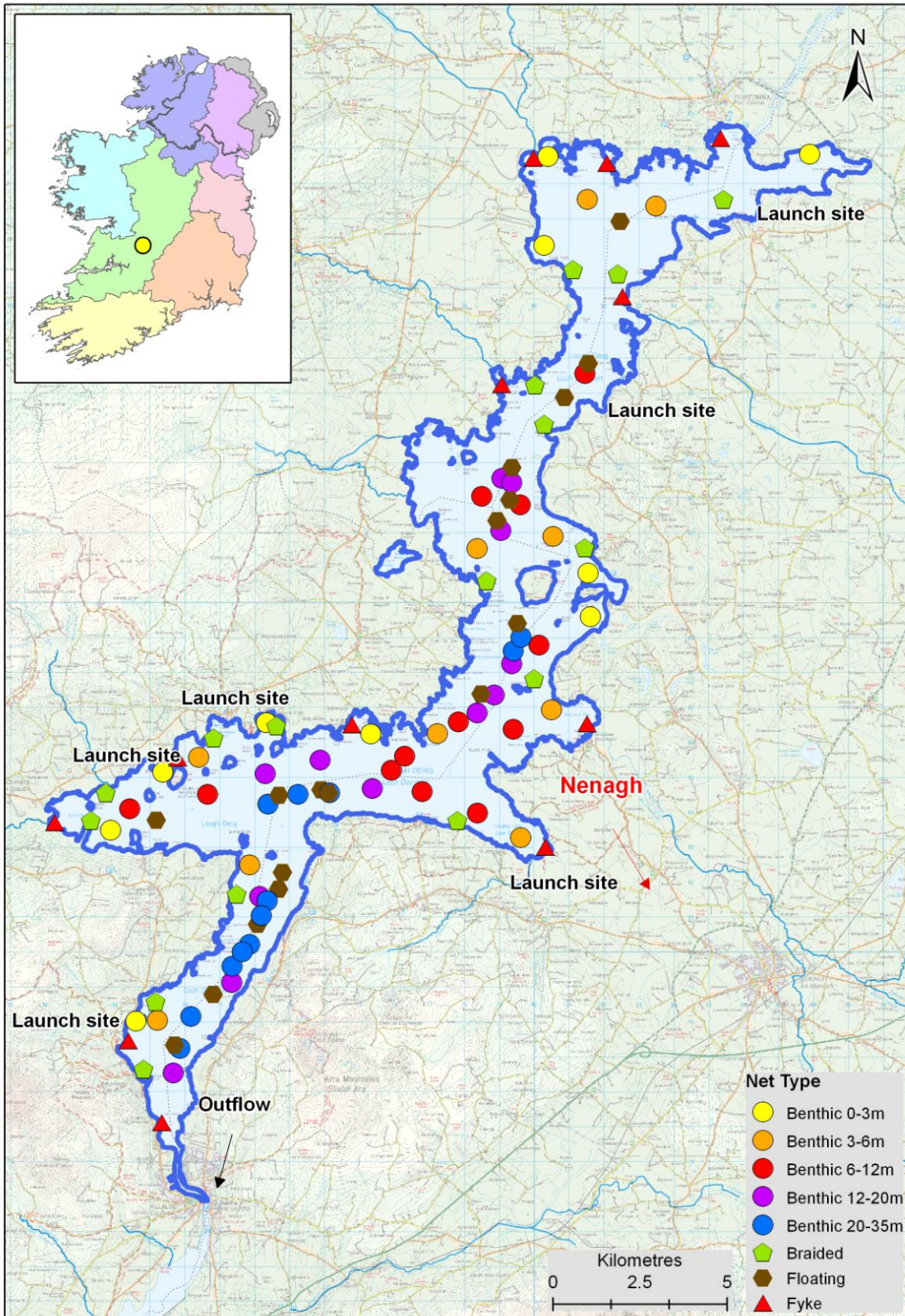**Plate 1.1. Lough Derg between Tuamgraney and Twomilegate (Co. Clare)**

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

1.2 Methods

The lake was surveyed over eight nights between the 29th of June and the 10th of July 2009. A total of 12 sets of Dutch fyke nets, 52 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (10 @ 0-2.9m, 10 @ 3-5.9m, 12 @ 6-11.9m, 12 @ 12-19.9 and 8 @ 20-34.9m) and 16 surface monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed randomly in the lake (82 sites). The netting effort was supplemented using 16 benthic braided survey gill nets (62.5mm mesh knot to knot) at 16 additional sites. Survey locations were randomly selected within each depth zone using a grid placed over the map of the lake. A further three benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets and three surface monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were set in areas where it was thought pollan were most likely to occur. 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 trout, roach, bream, hybrids, tench 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 seven fish species and one type of hybrid were recorded on Lough Derg during the survey, with a total of 1233 fish being captured (Table 1.1). Perch was the most abundant fish species recorded, followed by roach x bream hybrids and roach. Small numbers of brown trout were also captured in the gill nets. Eels were captured in fyke nets only.

Table 1.1. List of fish species recorded (including numbers captured) during the survey on Lough Derg, June/July 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	522	0	7	7	536
Rutilus rutilus x Abramis brama	Roach x bream hybrid	35	209	14	0	258
Rutilus rutilus	Roach	200	30	14	3	247
Abramis brama	Bream	7	30	0	0	37
Salmo trutta	Brown trout	14	3	9	0	26
Esox lucius	Pike	3	1	0	1	5
Tinca tinca	Tench	0	1	0	0	1
Anguilla anguilla	European eel	0	0	0	123	123

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 Derg and four other similar lakes were assessed and no overall significant difference was found (Kruskal-Wallis) (Fig. 1.2). However, Independent-Samples Mann-Whitney U tests between each lake showed that Lough Derg had a significantly lower mean brown trout CPUE than Lough Carra ($z = -1.966$, $P<0.05$).

The differences in the mean perch CPUE between Lough Derg and four other similar lakes were also assessed, with no significant differences being found (Fig. 1.3).

The differences in the mean roach CPUE between Lough Derg and two other similar lakes were assessed and found to be statistically significant (Kruskal-Wallis, $P<0.001$) (Fig. 1.4). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Derg had a significantly lower mean roach CPUE than Lough Cullin ($z = -3.020$, $P<0.001$).

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

Scientific name	Common name	
		Mean CPUE
Perca fluviatilis	Perch	0.174 (0.030)
Rutilus rutilus x Abramis brama	Roach x bream hybrid	0.092 (0.020)
Rutilus rutilus	Roach	0.081 (0.017)
Abramis brama	Bream	0.013 (0.006)
Salmo trutta	Brown trout	0.009 (0.002)
Esox lucius	Pike	0.002 (0.001)
Tinca tinca	Tench	0.0004 (0.0004)
Anguilla anguilla	European eel	0.171 (0.024)
		Mean BPUE
Rutilus rutilus x Abramis brama	Roach x bream hybrid	75.903 (18.114)
Rutilus rutilus	Roach	24.194 (4.369)
Perca fluviatilis	Perch	11.954 (2.524)
Abramis brama	Bream	6.626 (2.934)
Salmo trutta	Brown trout	2.559 (0.793)
Esox lucius	Pike	1.175 (0.865)
Tinca tinca	Tench	0.183 (0.183)
Anguilla anguilla	European eel	31.860 (5.613)

* 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.
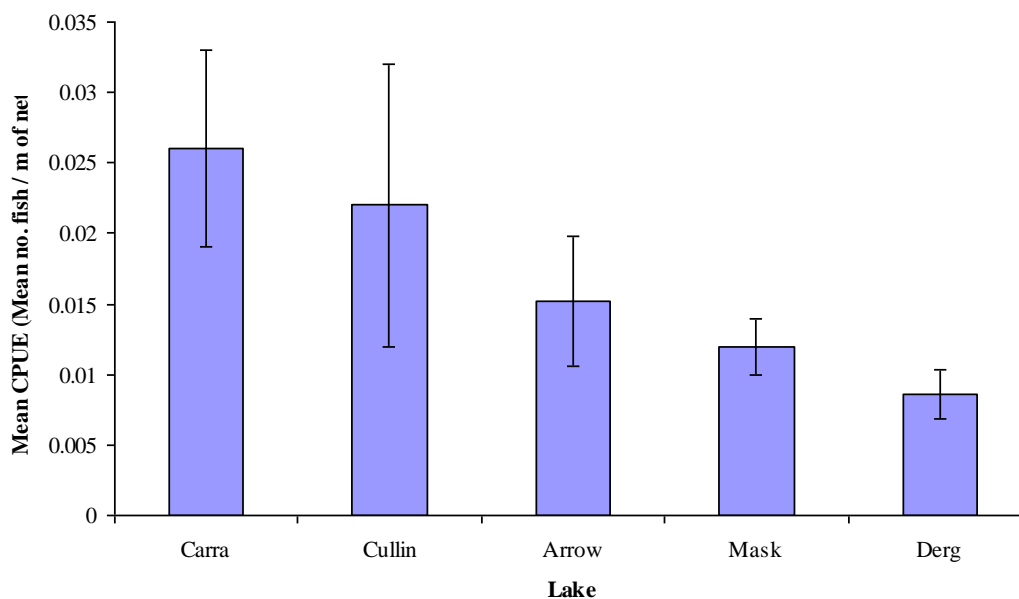

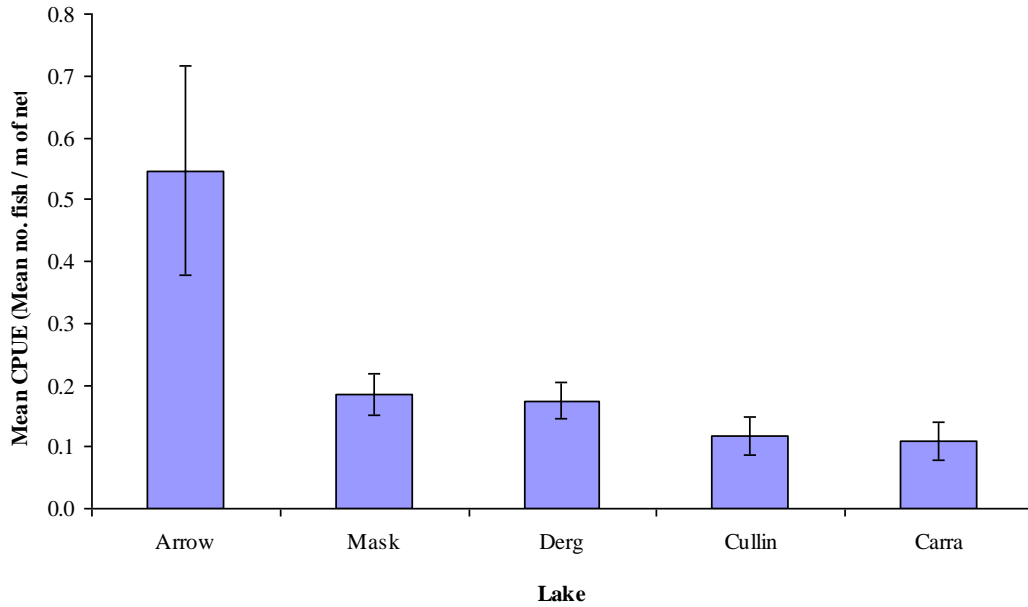**Fig. 1.2. Mean (±S.E.) brown trout CPUE in five lakes surveyed during 2009**

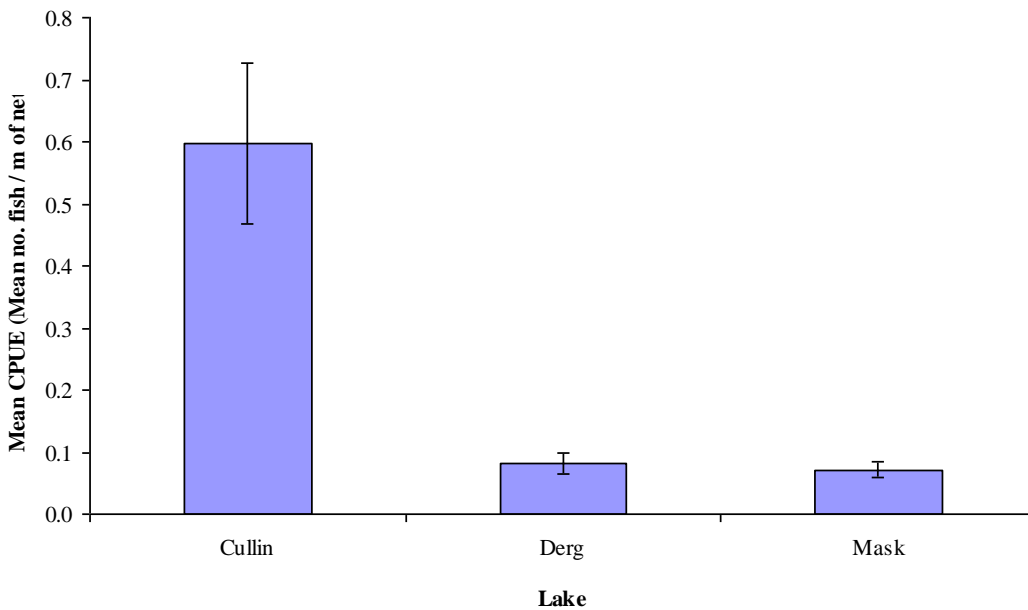**Fig. 1.3. Mean (±S.E.) perch CPUE in five lakes surveyed during 2009**

Fig. 1.4. Mean (±S.E.) roach CPUE in three lakes surveyed during 2009

1.3.3 Length frequency distributions

Brown trout ranged in length from 17.1cm to 49.2cm (mean = 25.8cm) (Fig. 1.5). Perch ranged in length from 3.2cm to 31.0cm (mean = 13.2cm) (Fig.1.6). Roach x bream hybrids ranged in length from 19.5cm to 41.0cm (mean = 34.2cm) (Fig.1.7). Roach ranged in length from 6.5cm to 36.1cm

(mean = 22.5cm) (Fig.1.8). Bream ranged in length from 24.7cm to 36.0cm. Pike ranged in length from 8.0cm to 62.7cm. Eels ranged from 29.2cm to 61.6cm. One tench was captured measuring 30.8cm in length.
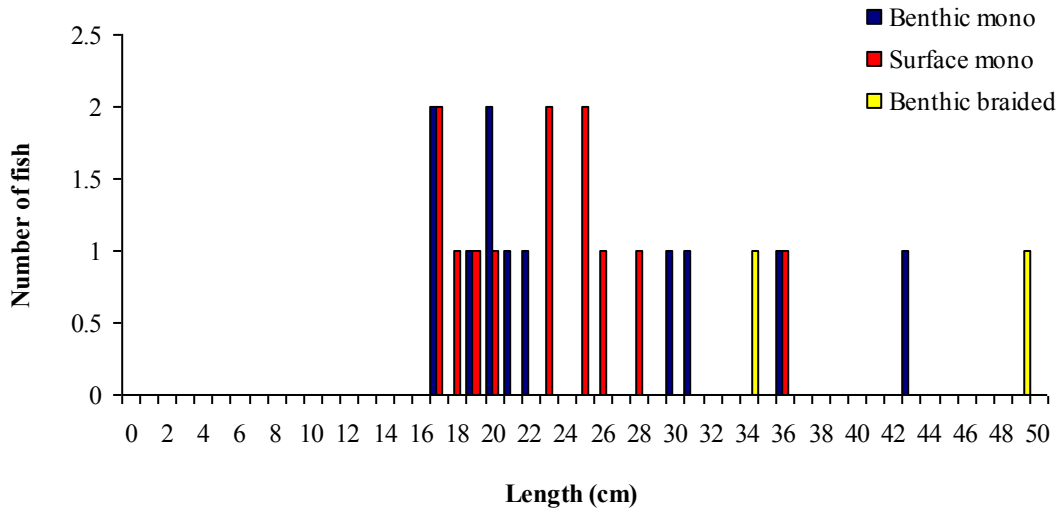

Fig. 1.5. Length frequency of brown trout (n=25) captured on Lough Derg, June/July 2009
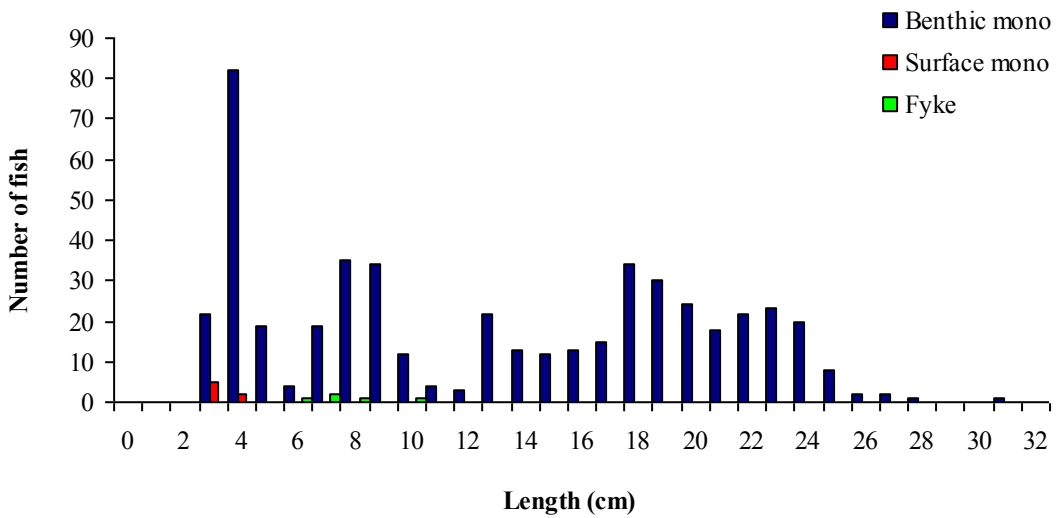

Fig. 1.6. Length frequency of perch (n=506) captured on Lough Derg, June/July 2009
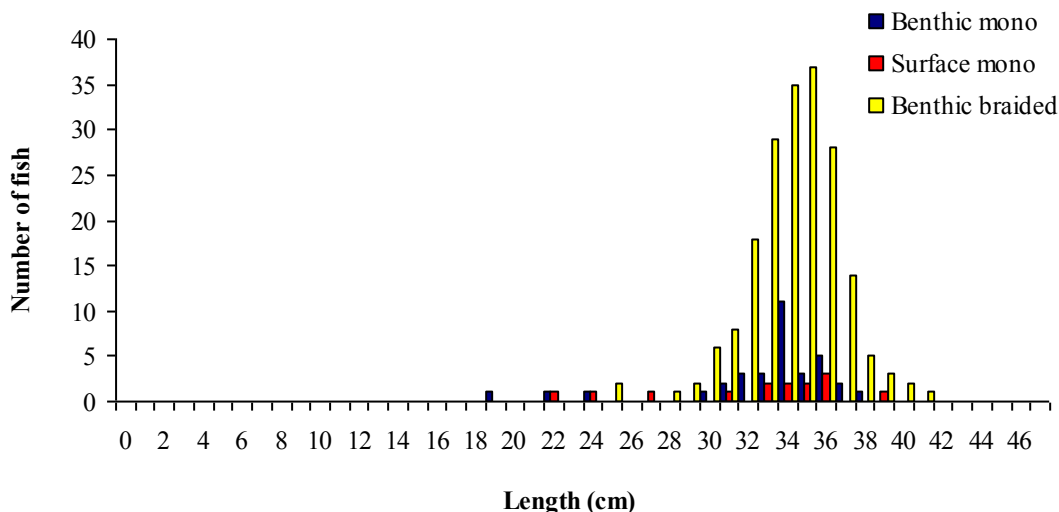
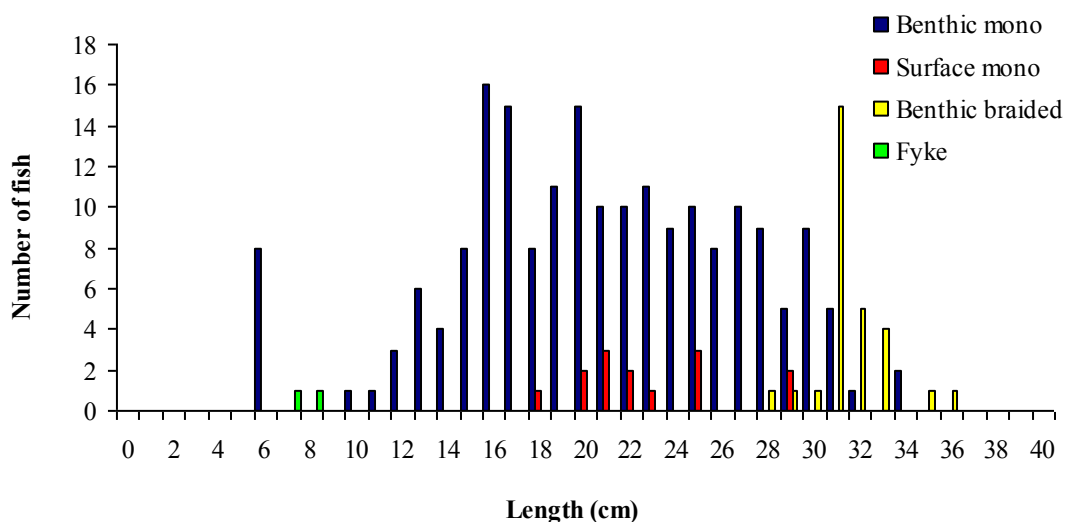**Fig. 1.7. Length frequency of roach x bream hybrids (n=240) captured on Lough Derg, June/July 2009**

Fig. 1.8. Length frequency of roach (n=240) captured on Lough Derg, June/July 2009

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). Mean brown trout L4 was 38.2cm indicating a very fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971).

Eleven age classes of perch were present, ranging from 0+ to 11+, with a mean L1 of 6.0cm (Table 1.4). The dominant age class was 0+ corresponding to the 3cm to 5cm length class (Fig. 1.6). Nine age classes of roach x bream hybrids were present, ranging from 5+ to 14+. Thirteen age classes of

roach were present, ranging from 1+ to 14+, with a mean L1 of 3.5cm (Table 1.5). Three age classes of pike were present, ranging from 2+ to 7+ and seven age classes of bream were present, ranging from 5+ to 12+.

Table 1.3. Mean (±SE) brown trout length at age for Lough Derg, June/July 2009

	L_1	L_2	L_3	L_4	L_5
Mean	7.4 (0.3)	15.2(0.7)	28.6 (1.4)	38.2 (1.7)	43.2 (2.5)
N	24	19	6	3	2
Range	4.6-9.7	9.5-22.5	22.2-31.6	35.3-41.1	40.6-45.6

Table 1.4. Mean (±SE) perch length at age for Lough Derg, June/July 2009

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}
Mean	6.0 (0.1)	11.8 (0.1)	17.2 (0.2)	20.8 (0.3)	22.7 (0.3)	21.9 (0.7)	21.7 (0.4)	23.9 (0.6)	26.2 (1.0)	28.4 (1.5)	30.4
N	205	155	125	63	39	8	4	4	3	2	1
Range	4.1-8.3	8.3-15.7	9.8-21.2	13.8-24.4	17.0-27.1	19.1-24.5	20.8-22.8	22.9-25.5	24.9-28.1	26.9-29.8	30.4-30.4

Table 1.5. Mean (±SE) roach length at age for Lough Derg, June/July 2009

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}	L_{12}	L_{13}	L_{14}
Mean	3.5 (0.1)	8.2 (0.1)	13.0 (0.2)	17.4 (0.3)	21.0 (0.3)	24.1 (0.3)	25.9 (0.4)	27.0 (0.4)	28.3 (0.5)	29.7 (0.6)	30.4 (0.5)	31.2 (1.0)	33.2	34.2
N	91	86	84	64	49	40	24	13	9	7	5	2	1	1
Range	2.3-4.9	5.3-11.1	8.6-18.3	11.1-22.4	15.0-24.5	20.0-27.3	21.7-29.7	24.0-29.8	26.4-30.1	27.6-31.9	28.9-32.0	30.2-32.1	33.2-33.2	34.2-34.2

1.4 Summary

Perch was the dominant species in terms of abundance (CPUE) and roach x bream hybrids were the dominant species in terms of biomass (BPUE).

The mean brown trout CPUE in Lough Derg was significantly lower than the mean trout CPUE for Lough Carra, but not statistically different from the other three lakes included in the comparison. Brown trout ranged in age from 1+ to 5+ 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).

Although Lough Arrow exhibited a higher mean perch CPUE than Lough Derg, this was not statistically significant. Perch age classes ranged from 0+ to 11+, indicating reproductive success in each of the previous number of years.

The mean roach CPUE in Lough Derg was significantly lower than Lough Cullin but similar to Lough Mask. Roach age classes ranged from 1+ to 14+, 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 Derg has been assigned an ecological status classification of Poor/Bad based on the fish populations present.

The EPA has assigned an overall status of Poor to Lough Derg 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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The Central and Regional
Fisheries Boards