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Sampling Fish for the Water Framework Directive

Lakes 2012

Lough Mask

Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Lough Mask, June 2012

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Cover photo: Netting survey on Dromore Lough © Inland Fisheries Ireland

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1.1 Introduction

Lough Mask is situated north of Lough Corrib, adjacent to the town of Ballinrobe, Co. Mayo (Plate 1.1, Fig. 1.1). It is the sixth largest lake in Ireland with a surface area of approximately 8218ha. The length of the lake from north to south is approximately 16km and the width is approximately 6.4km at its widest point (O‘ Reilly, 2007). The main rivers flowing into Lough Mask are the Cloon, Robe, Owenbrin, Finny, Glensaul, Glentraig and the Keel River, which is the out flowing river from Lough Carra. Lough Mask is linked to Lough Corrib by the Cong Canal.

Lough Mask is generally a shallow lake with a mean depth of 5m; however it attains a maximum depth of 57m along a long narrow trench on the western shore of the lake (NPWS, 2004). The lake is categorised as typology class 12 (as designated by the EPA for the purposes of the WFD), i.e. deep (>4m), greater than 50ha and high alkalinity (>100mg/l CaCO3). The underlying geology of Lough Mask is Carboniferous limestone, with areas of shale and sandstone, and it is an excellent example of a lowland oligotrophic lake (NPWS, 2004).

Lough Mask, Carra and Cloon make up the Lough Carra/Lough Mask Special Area of Conservation (SAC) complex. Six habitats listed on Annex I of the EU Habitats Directive are found in this site, including two priority habitats - limestone pavement and Cladium fen (NPWS, 2004). This is also an important SAC for otter, a species that is listed on Annex II of the E.U. Habitats Directive (NPWS, 2004). The zebra mussel, an invasive species in Ireland, was confirmed to be present in Lough Mask in 2008.

Lough Mask is noted for its populations of brown trout and ferox trout, with the average size of brown trout ranging from 0.6kg to 1.4kg. The larger ferox trout can reach up to 9kg in weight (O’Reilly, 2007). In a previous comprehensive fish stock survey of Lough Mask undertaken by IFI (previously the Central Fisheries Board and the Western Regional Fisheries Board) in 1996, five fish species were recorded; brown trout, Arctic char, pike, perch and a single roach (O’Grady *et al*., 1996).

The lake was also previously surveyed in June 2009 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al*., 2010). During this survey, perch were found to be the dominant species present in the lake. Roach, brown trout, Arctic char, bream, pike and eels were also captured during the survey.

Plate 1.1. Lough Mask looking towards the south-west shore

Plate 1.1. Lough Mask (Upper Lough Mask) looking towards Maumtrasna

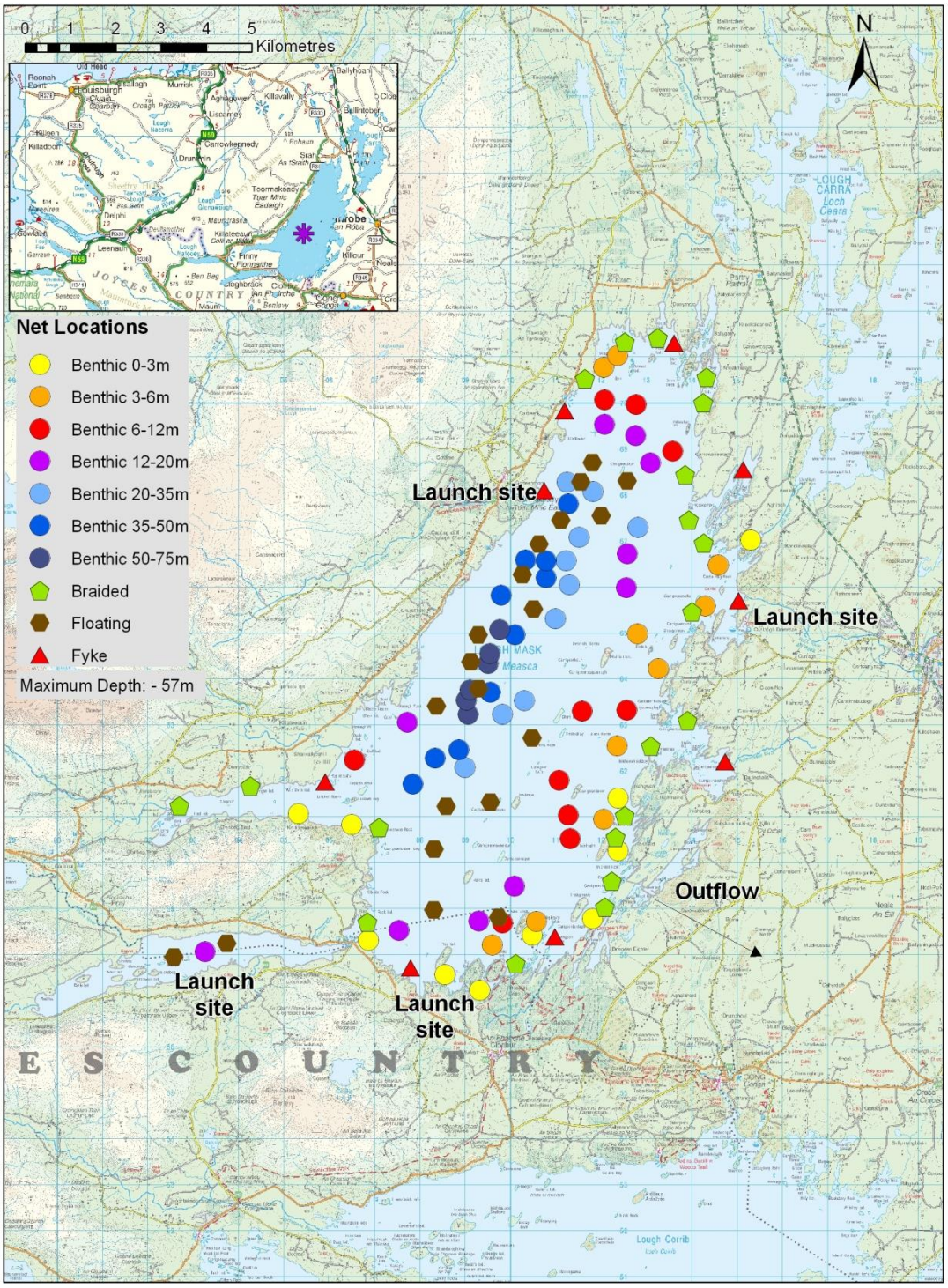

Fig. 1.1. Location map of Lough Mask showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

Lough Mask was surveyed over six nights between the 5th and the 15th of June 2012. A total of nine sets of Dutch fyke nets, 66 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (10 @ 0-2.9m, 10 @ 3-5.9m, 10 @ 6-11.9m, 10 @ 12-19.9m, 10 @ 20-34.9m, 10 @ 35-49.9m and 6 @ 50-74.9m) and 20 surface monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed randomly in the lake (95 sites). The netting effort was supplemented using 20 benthic braided gill nets (62.5mm mesh knot to knot) at 20 additional sites. Nets were deployed in the same locations as were randomly selected in the previous survey in 2009. 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, Arctic char, roach, bream, roach x bream hybrids 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 Mask in June 2012, with 473 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Perch was the most abundant fish species recorded, followed by roach, brown trout, Arctic char, bream, pike, eels and roach x bream hybrids. During the previous survey in 2009 the same species composition was recorded with the exception of roach x bream hybrids, which were present during the 2012 survey but were not captured in 2009 (Kelly *et al.*, 2010).

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Mask, June 2012

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
Salmo trutta	Brown trout	31	0	5	4	40
Salvelinus alpinus	Arctic char	5	0	0	0	5
Perca fluviatilis	Perch	193	1	0	54	248
Rutlius Rutilus	Roach	119	0	0	3	122
Abramis brama	Bream	0	41	0	0	41
Esox lucius	Pike	1	0	0	1	2
Rutlius Rutilus x Abramis brama	Roach x bream hybrid	1	0	0	0	1
Anguilla anguilla	European eel	0	0	0	14	14

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 2009 and 2012 are summarised in Table 1.2. Mean CPUE and BPUE for all fish species is illustrated in Figures 1.2 and 1.3.

Although the mean brown trout and Arctic char CPUE and BPUE were lower in 2012 than in 2009, these differences were not statistically significant (Fig. 1.2 and Fig. 1.3).

The differences in the mean brown trout CPUE and BPUE between Lough Mask and six similar lakes was assessed, with overall significant differences being found (Kruskal-Wallis, $P<0.05$) (Fig. 1.4 and Fig. 1.5). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Mask had a significantly lower mean brown trout CPUE and BPUE than Lough Carra ($z = 1.825$, $P<0.05$ and $z = 2.375$, $P<0.05$).

The mean perch CPUE and BPUE was also significantly lower in 2012 than in 2009 (Mann-Whitney, $z = 1.793$, $P<0.05$ and $z = 1.688$, $P<0.05$) (Fig. 1.2 and Fig. 1.3).

The differences in the mean perch CPUE and BPUE between Lough Mask and six similar lakes was assessed, with overall significant differences being found (Kruskal-Wallis, $P<0.05$) (Fig. 1.6 and Fig. 1.7). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Mask had a significantly lower mean perch CPUE and BPUE than Lough Arrow ($z = 3.277$, $P<0.05$ and $z = 3.021$, $P<0.05$), Lough Bunny ($z = 2.795$, $P<0.05$ and $z = 2.243$, $P<0.05$), Lough Carra ($z = 2.903$, $P<0.05$ and z

= 2.991, P<0.05), Lough Cullin (z = 2.111, P<0.05 and z = 1.858, P<0.05), Lough Derg (z = 2.351, P<0.05 and z = 2.679, P<0.05) and Inchicronan Lough (z = 2.767, P<0.05 and z = 2.19, P<0.05).

Although the mean roach CPUE and BPUE also appeared lower in 2012 than in 2009, these differences were not statistically significant (Fig. 1.2 and Fig. 1.3).

The differences in the mean roach CPUE and BPUE between Lough Mask and three similar lakes was assessed, with overall significant differences being found (Kruskal-Wallis, P<0.05) (Fig. 1.8 and Fig. 1.9). Independent-Samples Mann-Whitney U tests between each lake showed that Lough Mask had a significantly lower mean roach CPUE than Lough Arrow (z = 2.021, P<0.05), Lough Cullin (z =3.906, P<0.05) and Lough Derg (z = 2.118, P<0.05).

Independent-Samples Mann-Whitney U tests between each lake showed that Lough Mask had a significantly lower mean roach BPUE than Lough Cullin (z = 3.619, P<0.05) and Lough Derg (z = 2.022, P<0.05) and a significantly higher mean roach BPUE than Lough Arrow (z = 2.095, P<0.05).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Mask, 2009 and 2012

Scientific name	Common name	2009	2012
		Mean CPUE	
Salmo trutta	Brown trout	0.012 (0.002)	0.011 (0.002)
Salvelinus alpinus	Arctic char	0.009 (0.003)	0.001 (0.001)
Perca fluviatilis	Perch	0.184 (0.033)	0.064 (0.013)
Rutlius Rutilus	Roach	0.071 (0.012)	0.035 (0.007)
Abramis brama	Bream	0.005 (0.004)	0.013 (0.008)
Esox lucius	Pike	0.002 (0.001)	0.0004 (0.0003)
Rutlius Rutilus x Abramis brama	Roach x bream hybrid	-	0.0003 (0.0003)
Anguilla anguilla	European eel	0.015 (0.009)	0.026 (0.015)
		Mean BPUE	
Salmo trutta	Brown trout	7.449 (2.390)	1.081 (0.260)
Salvelinus alpinus	Arctic char	0.973 (0.491)	0.118 (0.059)
Perca fluviatilis	Perch	13.860 (2.519)	4.707 (1.158)
Rutlius Rutilus	Roach	24.334 (4.628)	11.541 (2.412)
Abramis brama	Bream	2.841 (2.717)	14.998 (9.527)
Esox lucius	Pike	8.075 (3.940)	1.561 (1.551)
Rutlius Rutilus x Abramis brama	Roach x bream hybrid	-	0.134 (0.134)
Anguilla anguilla	European eel	3.552 (1.744)	8.854 (5.611)

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

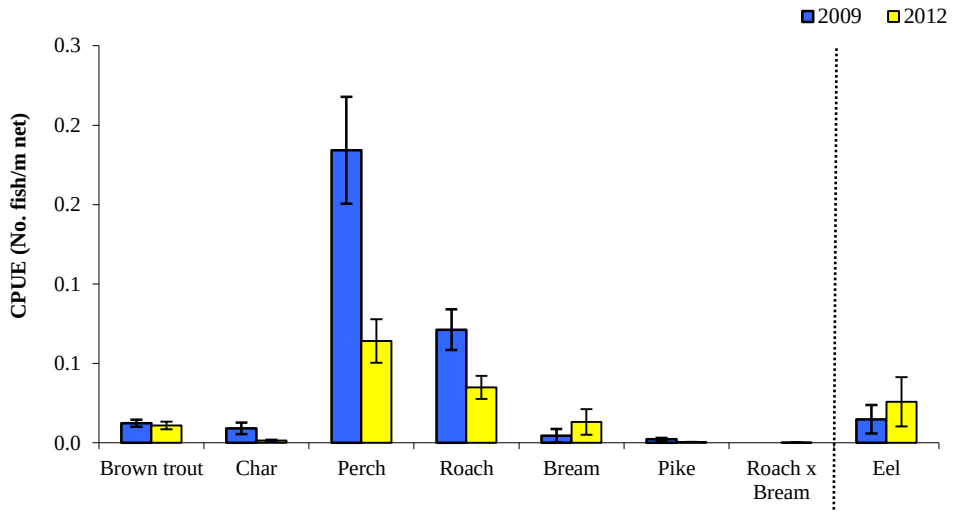

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Lough Mask (Eel CPUE based on fyke nets only), 2009 and 2012

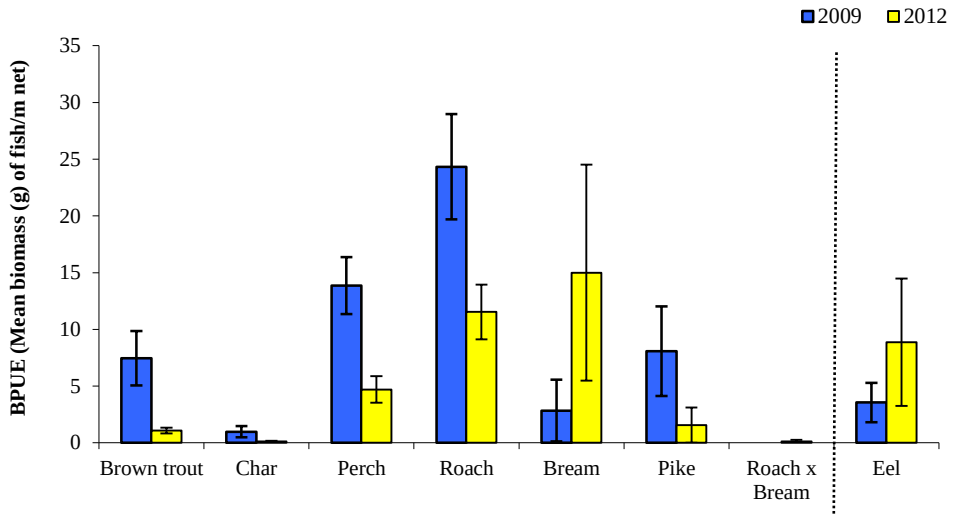

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Lough Mask (Eel BPUE based on fyke nets only), 2009 and 2012

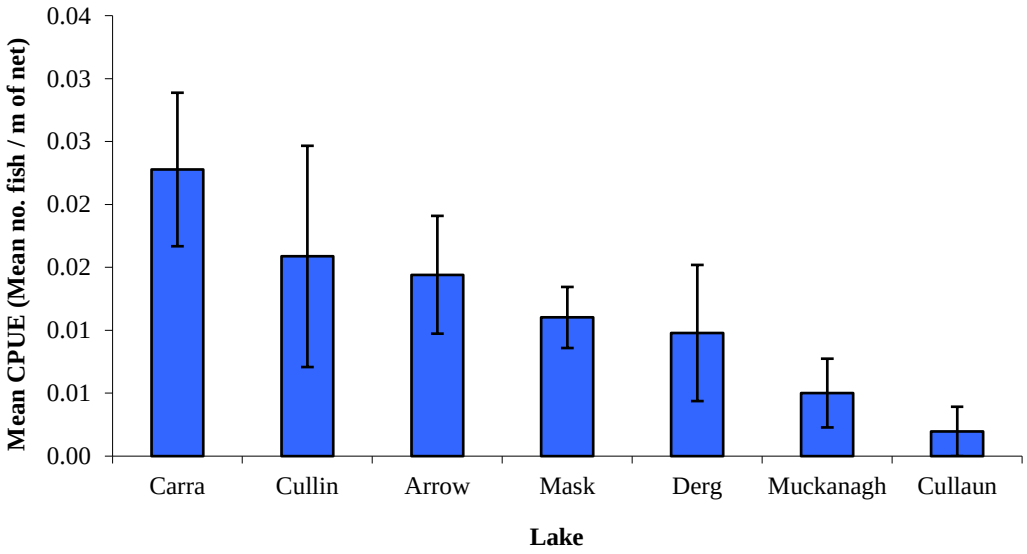

Fig. 1.4. Mean (±S.E.) brown trout CPUE in seven lakes surveyed during 2012

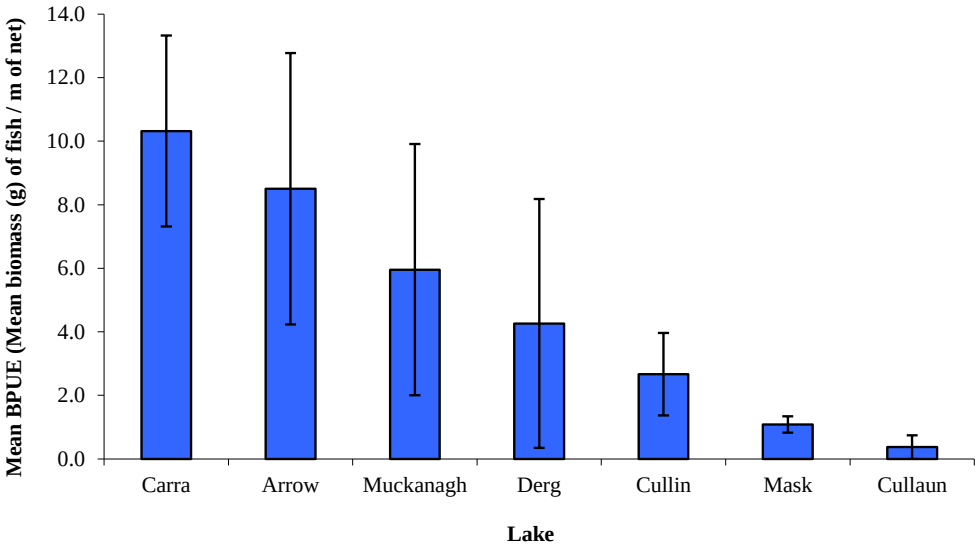

Fig. 1.5. Mean (±S.E.) brown trout BPUE in seven lakes surveyed during 2012

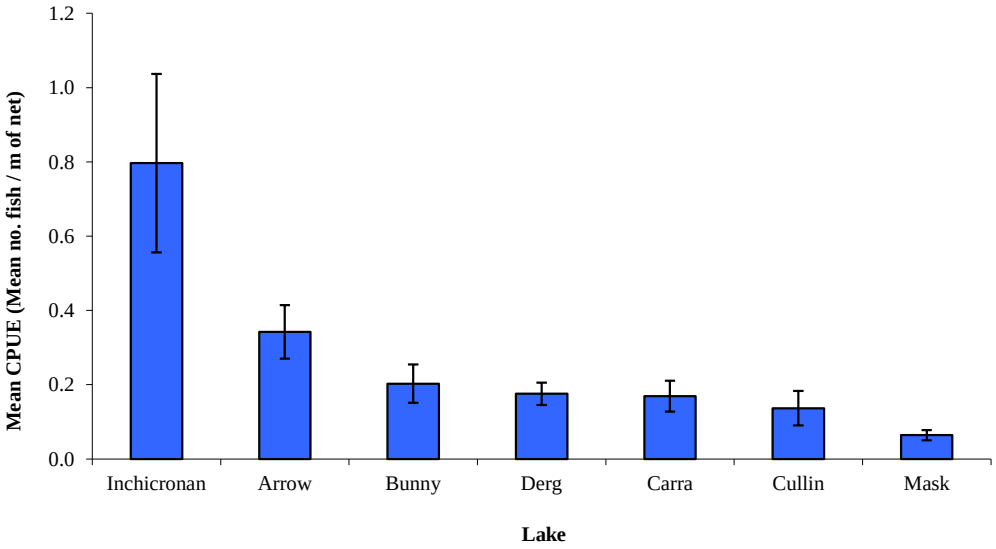

Fig. 1.6. Mean (±S.E.) perch CPUE in seven lakes surveyed during 2012

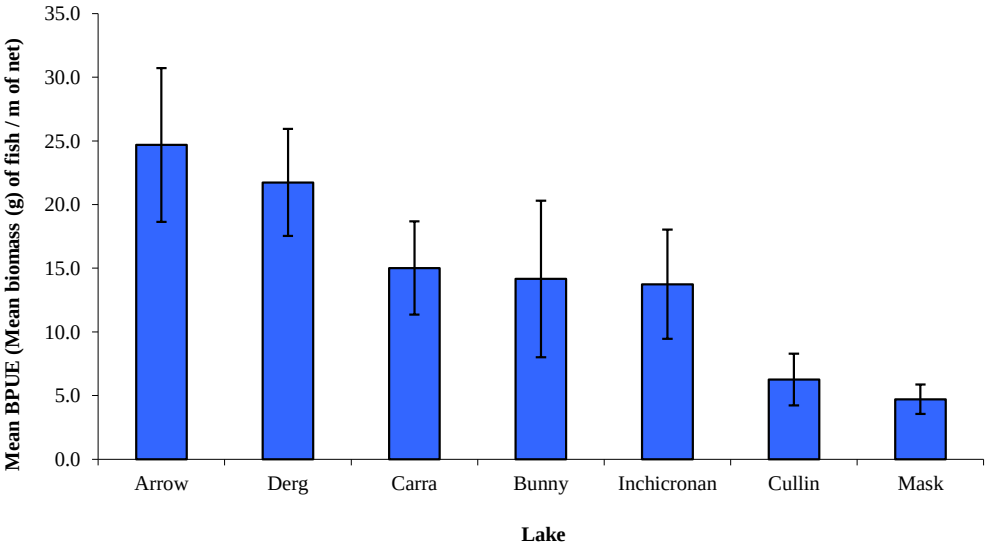

Fig. 1.7. Mean (±S.E.) perch BPUE in seven lakes surveyed during 2012

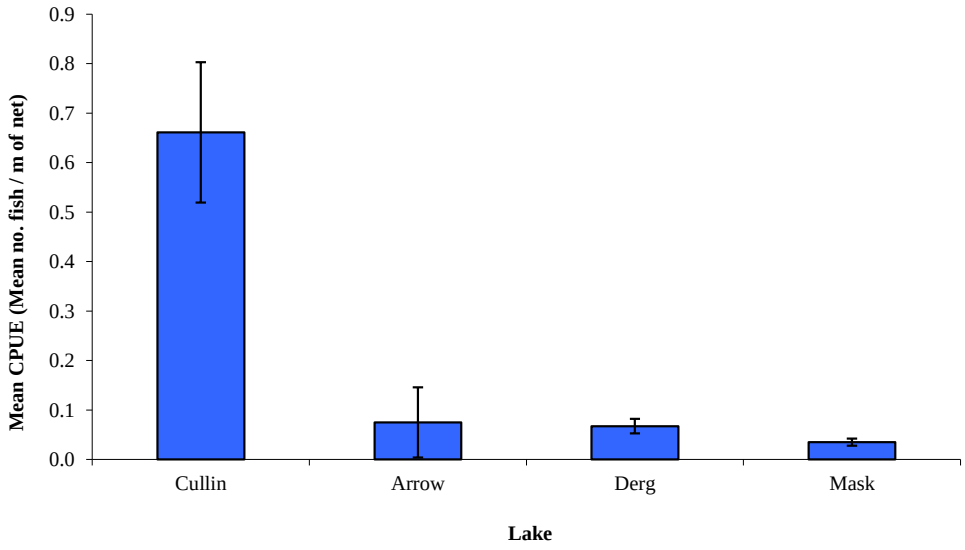

Fig. 1.8. Mean (±S.E.) roach CPUE in four lakes surveyed during 2012

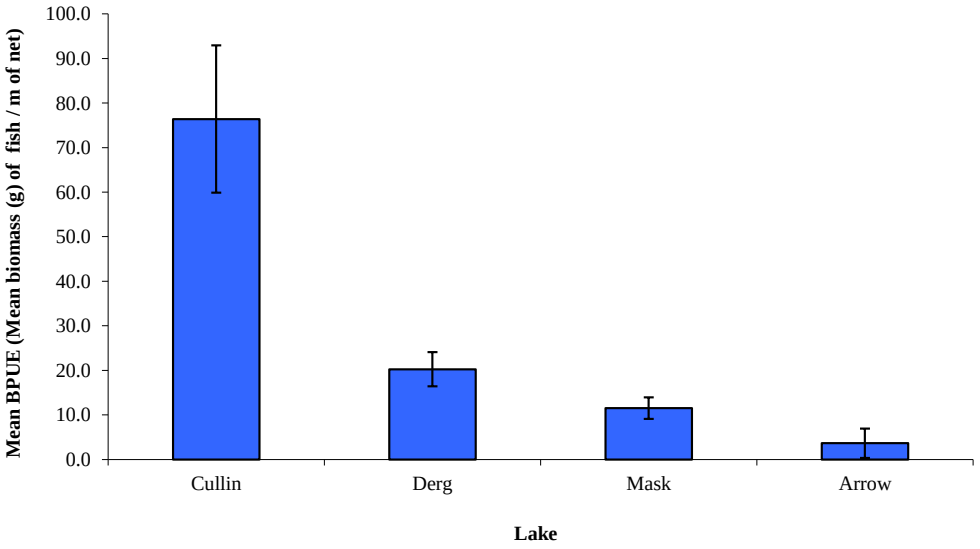

Fig. 1.9. Mean (±S.E.) roach BPUE in four lakes surveyed during 2012

1.3.3 Length frequency distributions

Brown trout captured during the 2012 survey ranged in length from 5.0cm to 35.5cm (mean = 18.7cm) (Fig. 1.6). Brown trout captured during the 2009 survey ranged in length from 10.8cm to 68.2cm (Fig. 1.6).

Arctic char captured during the 2012 survey ranged in length from 10.5cm to 24.0cm (mean = 18.1cm) (Fig. 1.7). Arctic char captured during the 2009 survey ranged in length from 11.7cm to 31.0cm (Fig. 1.7).

Perch captured during the 2012 survey ranged in length from 6.0cm to 41.1cm (mean = 15.4cm) (Fig. 1.8). Perch captured during the 2009 survey ranged in length from 5.7cm to 44.4cm (Fig. 1.8).

Eels captured during the 2012 survey ranged in length from 44.1cm to 63.6cm, bream ranged in length from 29.5cm to 48.0cm and roach ranged in length from 5.8cm to 34.2cm. One roach x bream hybrid was recorded at 28.6cm and two pike were recorded at 21.0cm and 87.3cm.

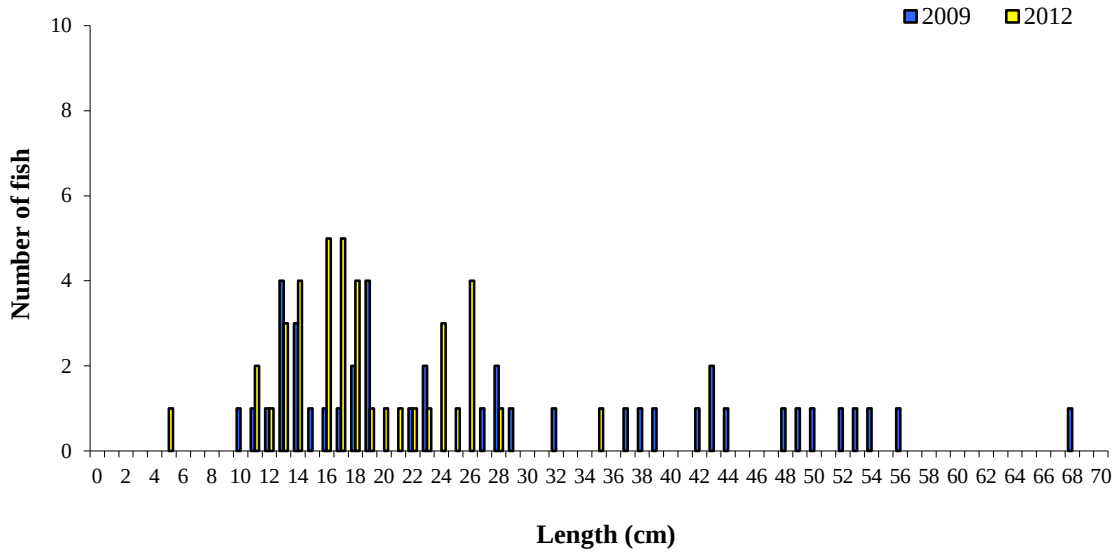

Fig. 1.6. Length frequency of brown trout captured on Lough Mask, 2009 and 2012

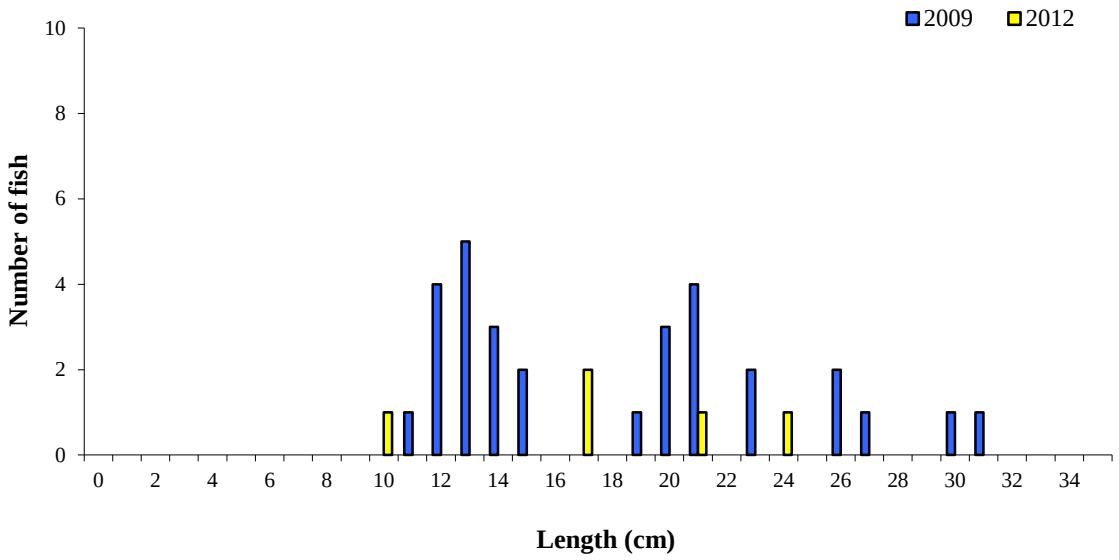

Fig. 1.7. Length frequency of Arctic char captured on Lough Mask, 2009 and 2012

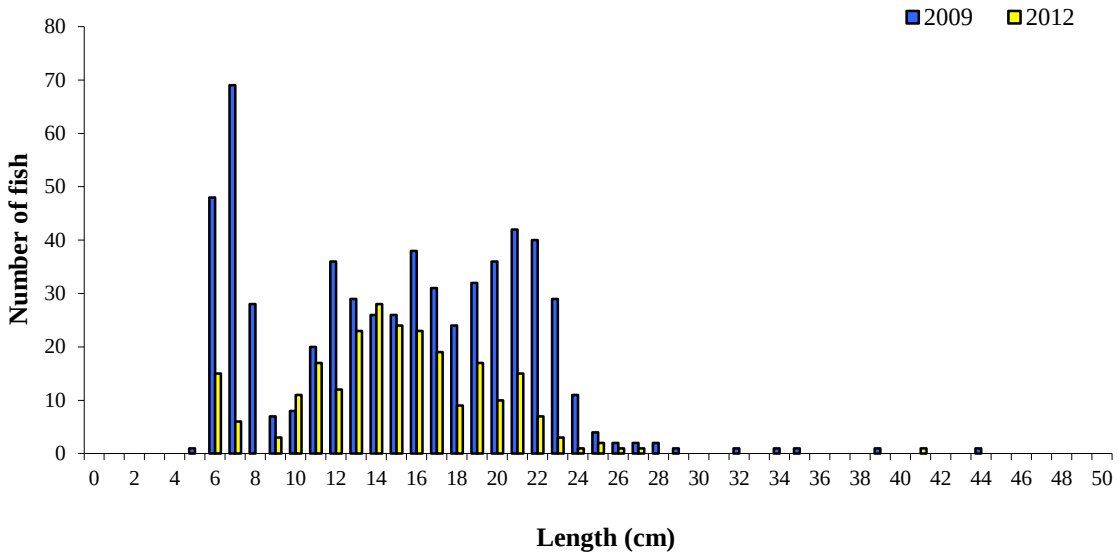

Fig. 1.8. Length frequency of perch captured on Lough Mask, 2009 and 2012

1.3.4 Fish age and growth

Three age classes of brown trout were present, ranging from 1+ to 3+, with a mean L1 of 6.6cm (Table 1.3). In the 2009 survey, brown trout (including ferox) ranged from 1+ to 6+ with a mean L1 of 7.3cm.

Nine age classes of perch were present, ranging from 1+ to 12+, with a mean L1 of 5.8cm (Table 1.4). The dominant age class was 1+ (Fig 1.8). In the 2009 survey, perch ranged from 0+ to 10+ with a mean L1 of 5.7cm.

Nine age classes of roach were present, ranging from 1+ to 9+, with a mean L1 of 2.6cm (Table 1.5). In the 2009 survey, roach ranged from 1+ to 10+ with a mean L1 of 3.4cm.

Three age classes of Arctic char were present, ranging from 1+ to 4+. In the 2009 survey, Arctic char ranged from 1+ to 5+.

Table 1.3. Mean (±SE) brown trout length (cm) at age for Lough Mask, June 2012

	L_1	L_2	L_3
Mean	6.6 (0.3)	13.9 (0.6)	21.1 (1.7)
N	31	20	7
Range	3.6-10.9	9.9-19.6	16.2-28.7

Table 1.4. Mean (±SE) perch length (cm) at age for Lough Mask, June 2012

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}	L_{12}
Mean	5.8 (0.1)	10.6 (0.2)	14.9 (0.2)	18.4 (0.3)	20.9 (0.4)	22.1 (0.7)	23.6 (1.2)	30.5 (5.5)	37.6	39.0	40.7	41.1
N	85	77	62	39	28	19	10	2	1	1	1	1
Range	4.4-8.5	7.6-15.3	11.8-22.1	14.8-23.3	16.1-26.9	18.8-29.8	20.0-33.7	25.0-35.9	37.9-37.9	39.0-39.0	40.7-40.7	41.1-41.1

Table 1.5. Mean (±SE) roach length (cm) at age for Lough Mask, June 2012

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9
Mean	2.6 (0.1)	6.8 (0.2)	12.6 (0.3)	18.4 (0.4)	22.7 (0.4)	25.9 (0.5)	28.8 (0.6)	30.3 (0.5)	31.7 (1.2)
N	74	73	70	65	54	34	10	6	3
Range	1.5-6.0	3.3-11.1	6.3-19.6	11.0-25.6	16.3-29.1	20.7-31.7	25.5-32.3	28.5-32.5	29.6-33.8

1.4 Summary

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

Although the mean brown trout CPUE and BPUE in Lough Mask were lower in 2012 than in the 2009 survey, these differences were not statistically significant. The mean brown trout CPUE and BPUE in Lough Mask was significantly lower than Lough Carra, another similar lake surveyed. Brown trout ranged in age from 1+ to 3+, indicating reproductive success in three of the previous four years.

The mean perch CPUE and BPUE in Lough Mask was significantly lower in 2012 than in the 2009 survey. The mean perch CPUE and BPUE in Lough Mask was significantly lower than Lough Arrow, Lough Bunny, Lough Carra, Lough Cullin, Lough Derg and Inchicronan Lough. Perch ranged in age from 1+ to 12+, indicating reproductive success in nine of the previous thirteen years.

Although the mean roach CPUE and BPUE in Lough Mask was lower in 2012 than in the 2009 survey, these differences were not statistically significant. The mean roach CPUE in Lough Mask was significantly lower than Lough Arrow, Lough Cullin and Lough Derg, other similar lakes surveyed. The mean roach BPUE in Lough Mask was significantly lower than Lough Derg and Lough Cullin and significantly higher than Lough Arrow, other similar lakes surveyed. Roach ranged in age from 1+ to 9+, indicating reproductive success in nine of the previous ten years.

Arctic char ranged in age from 1+ to 4+, indicating reproductive success in three of the previous five 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 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, Lough Mask has been assigned an ecological status of Good based on the fish populations present in 2012. The ecological status assigned to the lake based on the 2009 survey data was also Good.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Lough Mask an overall ecological status of Good, based on all monitored physico-chemical and biological elements, including fish. This status classification will be revised at the end of 2012.

1.5 References

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