Sampling Fish for the Water Framework Directive

Lakes 2012

Muckanagh Lough

Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Muckanagh Lough, September 2012

Fiona L. Kelly, Lynda Connor, Emma Morrissey, Ciara Wogerbauer, Ronan Matson, Rory Feeney and Kieran Rocks

Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin

ACKNOWLEDGEMENTS

1.1 Introduction

Muckanagh Lough is located within the Fergus catchment, approximately 10km east of the village of Corrofin, Co. Clare (Plate 1.1, Fig. 1.1). It is a shallow lake, with a mean depth of 3m, a maximum depth of 19m and a surface area of 95ha. 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 high alkalinity (>100mg/l CaCO3). The lake is located in the "East Burren Complex" Special Area of Conservation. The East Burren Complex SAC is a large area that encompasses all the high ground in the east Burren. A total of 12 different habitats listed on Annex I of the EU Habitats Directive are included within the site, including areas of limestone pavement, calcareous grasslands, heath scrub, woodlands and calcareous lakes and turloughs (NPWS, 2001). The SAC exhibits some of the best and most extensive areas of oligotrophic limestone wetlands to be found in the Burren and in Europe. Some of the most extensive calcareous swamp fen communities in the country also occur within this complex (NPWS, 2001).

Muckanagh Lough has historically held a good stock of brown trout (O'Reilly, 1998). A survey carried out by the Inland Fisheries Trust during 1970 recorded stocks of brown trout and pike in the lake. Although perch, rudd and tench were present in the inlet canal in 1970, none of these species were recorded during this previous survey (Inland Fisheries Trust, unpublished data). The lake was previously stocked with brown trout during 1977; however test netting of the lake revealed that none of these fish survived (Inland Fisheries Trust, unpublished data).

The lake was also surveyed in August 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. Rudd, brown trout, three-spined stickleback, tench, pike and eels were also captured during the survey.
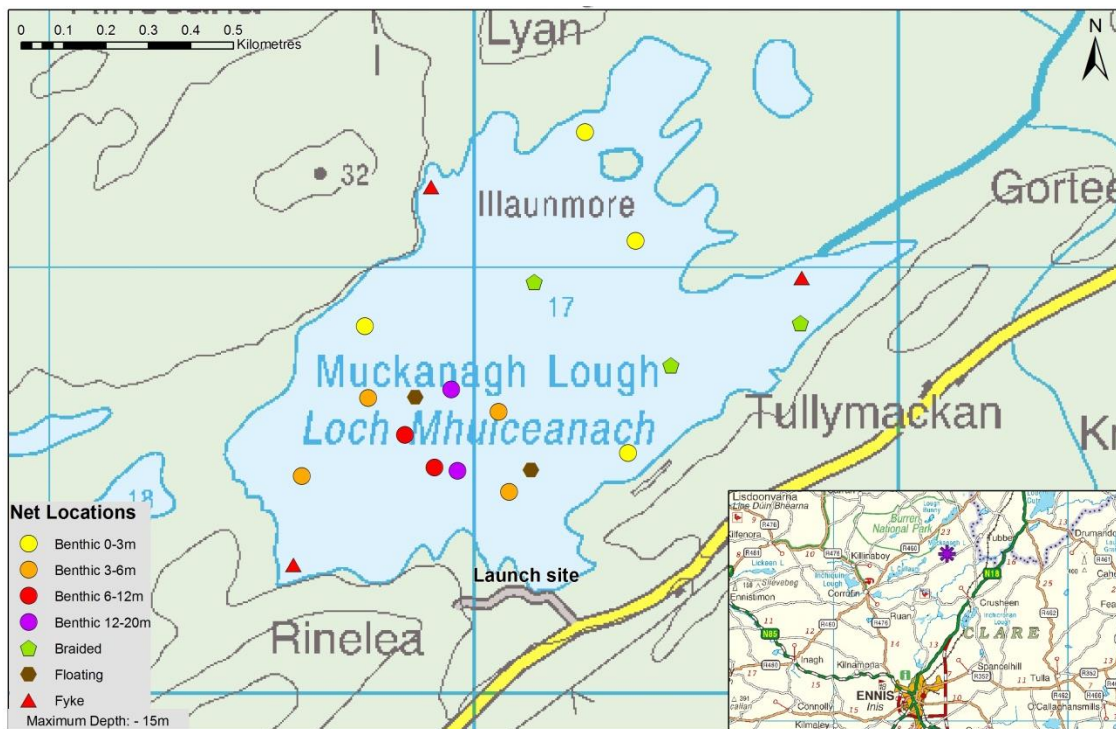
Plate 1.1. Muckanagh Lough

Fig. 1.1. Location map of Muckanagh Lough showing locations and depths of each net

1.2 Methods

Muckanagh Lough was surveyed over two nights between the 10th and the 12th of September 2012. A total of three sets of Dutch fyke nets, 12 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 2 @ 6-11.9m and 2 @ 12-19.9m) and two surface monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed randomly in the lake (17 sites). The netting effort was supplemented using three benthic braided survey gill nets (62.5mm mesh knot to knot) at three 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 all brown trout, rudd 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 were recorded on Muckanagh Lough in September 2012, with 121 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 rudd, pike, brown trout, three-spined stickleback, tench and eels. A similar species composition was recorded during the previous survey in 2009 (Kelly *et al.*, 2010).

Table 1.1. Number of each fish species captured by each gear type during the survey on Muckanagh Lough, September 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	3	0	0	0	3
Perca fluviatilis	Perch	92	0	0	0	92
Scardinius erythropthalmus	Rudd	13	0	4	0	17
Esox lucius	Pike	4	1	0	0	5
Tinca tinca	Tench	1	1	0	0	2
Gasterosteus aculeatus	Three-spined stickleback	1	0	0	0	1
Anguilla anguilla	European eel	0	0	0	1	1

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 CPUE and BPUE were slightly higher 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 Muckanagh Lough 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 Muckanagh Lough had a significantly lower mean brown trout CPUE than Lough Carra ($z = 1.665$, $P<0.05$).

Although the mean perch CPUE also appeared slightly higher in 2012 than in 2009, this difference was not statistically significant (Fig. 1.2), however, the mean perch BPUE was significantly higher in 2012 than in 2009 (Mann-Whitney, $P<0.05$) (Fig. 1.3).

The differences in the mean perch CPUE and BPUE between Muckanagh Lough and three similar lakes was assessed, with no overall significant difference being found (Fig. 1.6 and Fig. 1.7).

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

Scientific name	Common name	2009	2012
		Mean CPUE	
Salmo trutta	Brown trout	0.003 (0.002)	0.005 (0.02)
Perca fluviatilis	Perch	0.063 (0.033)	0.153 (0.053)
Scardinius erythropthalmus	Rudd	0.026 (0.010)	0.028 (0.014)
Esox lucius	Pike	0.014 (0.005)	0.008 (0.004)
Tinca tinca	Tench	0.001 (0.001)	0.004 (0.002)
Gasterosteus aculeatus	Three-spined stickleback	0.002 (0.002)	0.002 (0.002)
Anguilla anguilla	European eel	0.139 (0.098)	0.005 (0.005)
		Mean BPUE	
Salmo trutta	Brown trout	0.335 (0.235)	5.957 (3.953)
Perca fluviatilis	Perch	0.332 (0.159)	5.911 (3.377)
Scardinius erythropthalmus	Rudd	2.837 (1.207)	4.000 (2.664)
Esox lucius	Pike	8.123 (5.644)	9.046 (8.439)
Tinca tinca	Tench	0.250 (0.250)	4.339 (2.989)
Gasterosteus aculeatus	Three-spined stickleback	0.003 (0.003)	0.003 (0.003)
Anguilla anguilla	European eel	35.505 (26.673)	1.883 (1.883)

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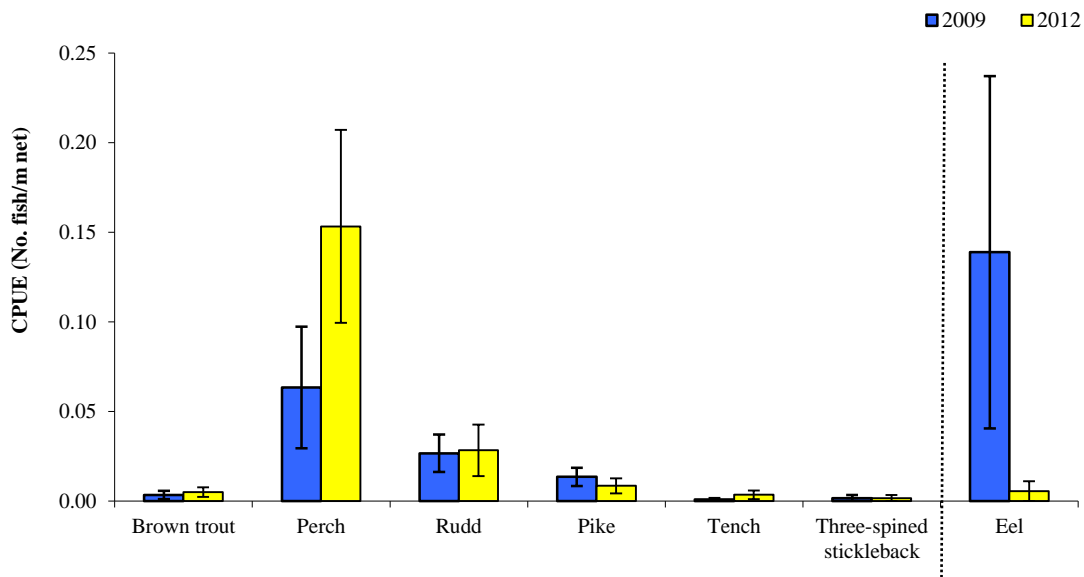

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Muckanagh Lough (Eel CPUE based on fyke nets only), 2009 and 2012
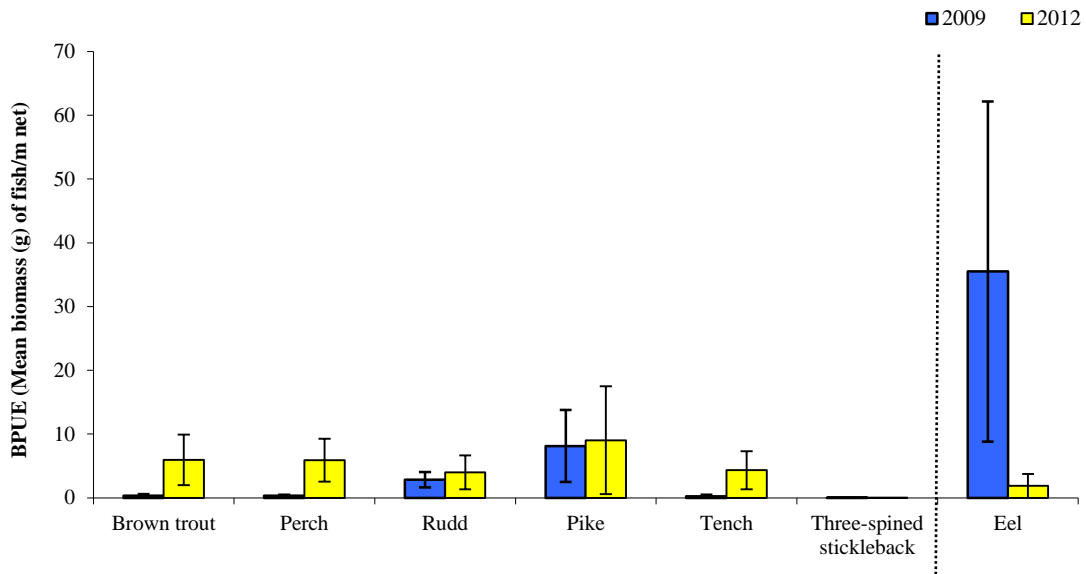
Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Muckanagh Lough (Eel BPUE based on fyke nets only), 2009 and 2012
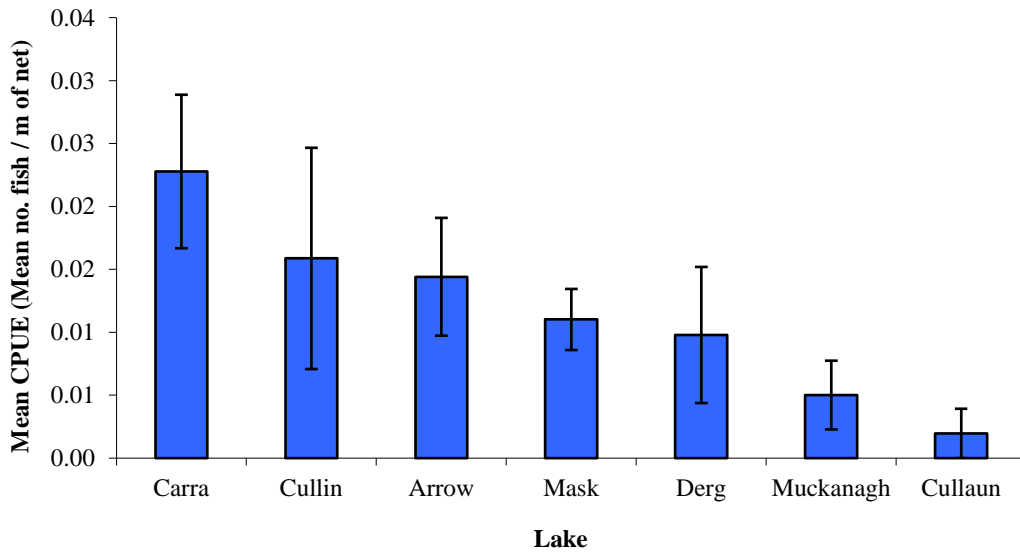

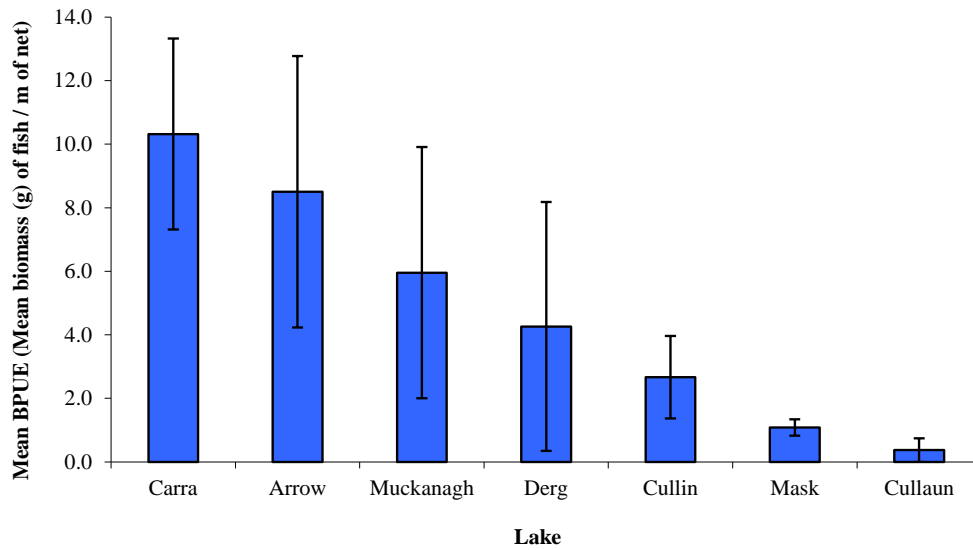**Fig. 1.4. Mean (±S.E.) brown trout CPUE in seven lakes surveyed during 2012**

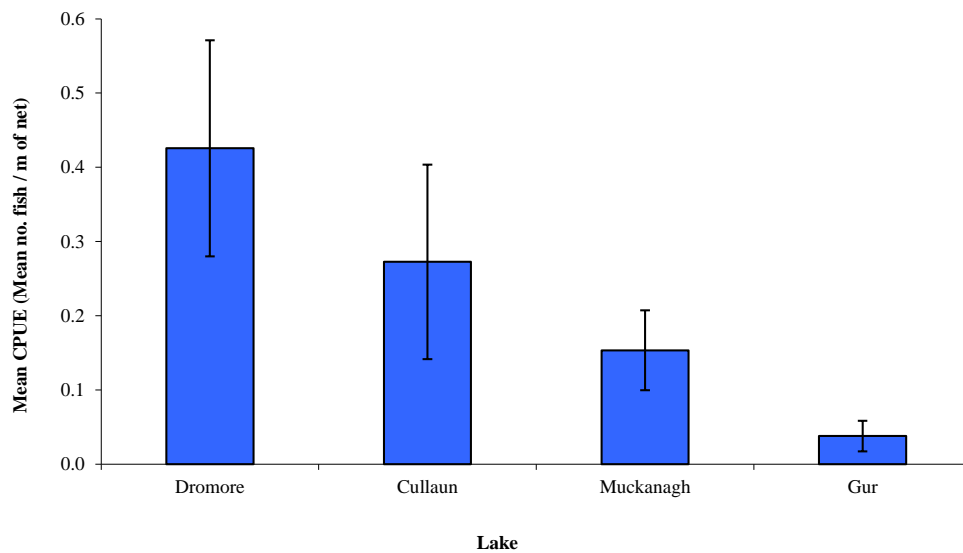**Fig. 1.5. Mean (±S.E.) brown trout BPUE in seven lakes surveyed during 2012**

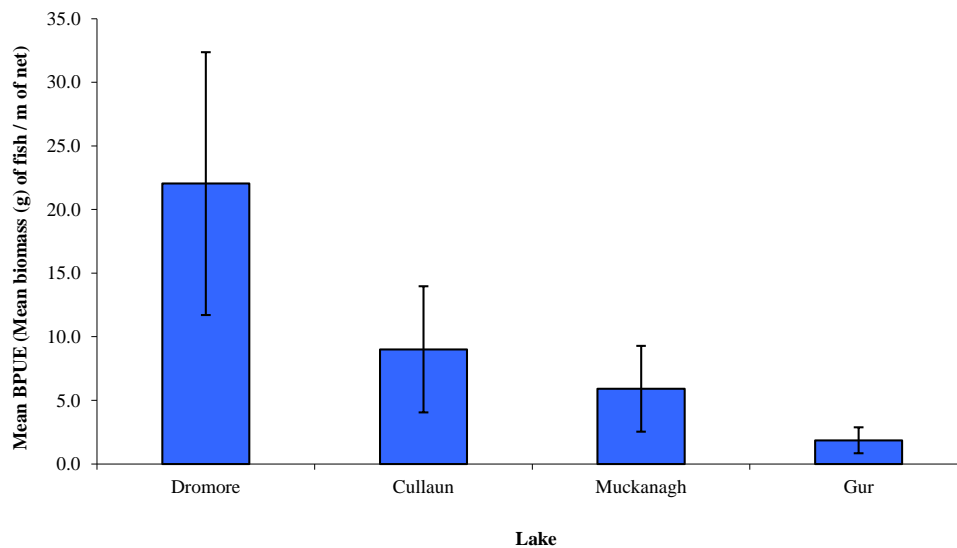**Fig. 1.6. Mean (±S.E.) perch CPUE in four lakes surveyed during 2012**

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

1.3.3 Length frequency distributions

Brown trout captured during the 2012 survey ranged in length from 21.3cm to 51.8cm (mean = 41.6cm) (Fig. 1.6). Brown trout captured during the 2009 survey ranged in length from 18.4cm to 21.8cm (Fig. 1.6).

Perch captured during the 2012 survey ranged in length from 4.0cm to 28.0cm (mean = 11.1cm) (Fig. 1.7). Perch captured during the 2009 survey ranged in length from 5.8cm to 13.8cm (Fig. 1.7).

Eels captured during the 2012 survey ranged in length from 15.4cm to 83.0cm, rudd ranged in length from 12.0cm to 24.8cm and two tench were recorded at 41.5cm and 45.0cm. One eel was recorded at 58.7cm and one three-spined stickleback was measured at 5.2cm.
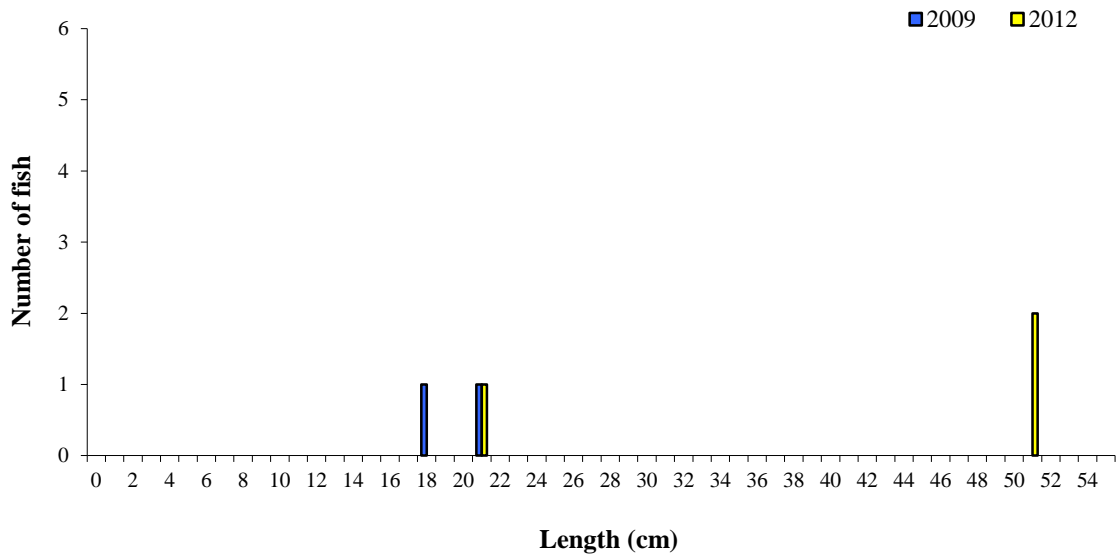
Fig. 1.6. Length frequency of brown trout captured on Muckanagh Lough, 2009 and 2012
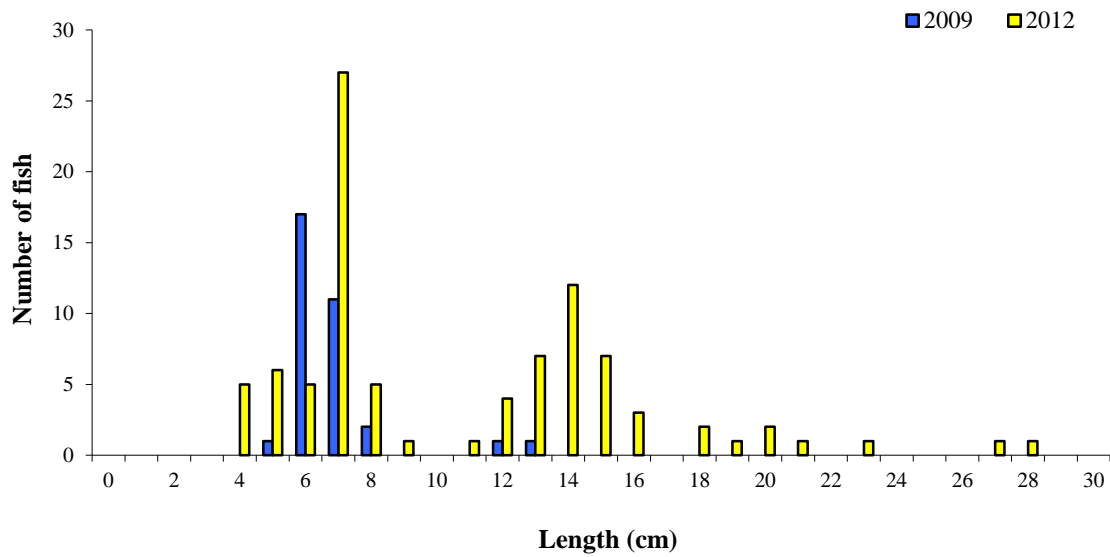

Fig. 1.7. Length frequency of perch captured on Muckanagh Lough, 2009 and 2012

1.3.4 Fish age and growth

Two age classes of brown trout were present, 1+ and 4+, with a mean L1 of 8.3cm (Table 1.3). In the 2009 survey, brown trout captured were aged at 2+ with a mean L1 of 6.1cm. Brown trout that were captured exhibited a very fast rate of growth in this lake.

Six age classes of perch were present, 0+ and 5+, with a mean L1 of 6.2cm (Table 1.4). In the 2009 survey, perch ranged from 0+ to 1+ with a mean L1 of 6.0cm.

Six age classes of rudd were present, 2+ and 7+, with a mean L1 of 2.3cm (Table 1.5). In the 2009 survey, rudd ranged from 2+ to 4+ with a mean L1 of 2.9cm.

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

	L_1	L_2	L_3	L_4
Mean	8.3 (0.3)	19.4 (0)	41.0 (0)	47.5 (0)
N	2	1	1	1
Range	8.0-8.6	19.4-19.4	41.0-41.0	47.5-47.5

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

	L_1	L_2	L_3	L_4	L_5
Mean	6.2 (0.1)	12.8 (0.3)	16.7 (2.3)	19.3 (1.4)	26.0 (0)
N	55	19	4	2	1
Range	3.5-8.0	9.9-16.4	13.7-23.3	17.9-20.8	26.0-26.0

Table 1.5. Mean (±SE) rudd length (cm) at age for Muckanagh Lough, September 2012

	L_1	L_2	L_3	L_4	L_5	L_6	L_7
Mean	2.3 (0.2)	5.7 (0.3)	11.2 (0.4)	15.8 (0.4)	18.6 (0.4)	20.4 (0.7)	22.8 (0)
N	17	17	16	9	8	6	1
Range	1.3-3.7	3.8-9.4	8.2-14.5	13.9-17.7	16.7-20.2	18.0-22.2	22.8-22.8

1.4 Summary

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

Although the mean brown trout CPUE and BPUE in Muckanagh Lough were slightly higher in 2012 than in the 2009 survey, these differences were not statistically significant. The mean brown trout CPUE in Muckanagh Lough was significantly lower than Lough Carra, another similar lake surveyed. Brown trout ranged in age from 1+ to 4+, indicating reproductive success in two of the previous five years. Length at age analyses revealed that brown trout captured in the lake exhibited a very fast rate of growth.

Although the mean perch CPUE in Muckanagh Lough was slightly higher in 2012 than in the 2009 survey, this difference was not statistically significant, however, the mean perch BPUE was significantly higher in 2012 than in 2009. The mean perch CPUE and BPUE in Muckanagh Lough was similar to the other lakes assessed during 2012, with no statistically significant differences being found between lakes. Perch ranged in age from 0+ to 5+, indicating reproductive success in six of the previous six 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, Muckanagh Lough has been assigned an ecological status of Moderate based on the fish populations present in 2012. The ecological status assigned to the lake based on the 2009 survey data was Good.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Muckanagh Lough an overall ecological status of Moderate, 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

Kelly, F.L., Harrison, A., Connor, L., Allen, M., Rosell, R. and Champ, T. (2008) *FISH IN LAKES Task 6.9: Classification tool for Fish in Lakes. FINAL REPORT*. Central Fisheries Board, NS Share project.

Kelly, F., Harrison A., Connor, L., Matson, R., Morrissey, E., O'Callaghan, R., Wogerbauer, C., Feeney, R., Hanna, G. and Rocks, K. (2010) *Sampling Fish for the Water Framework Directive – Summary Report 2009*. The Central and Regional Fisheries Boards.

Kelly, F.L., Harrison, A.J., Allen, M., Connor, L. and Rosell, R. (2012) Development and application of an ecological classification tool for fish in lakes in Ireland. *Ecological Indicators*, **18**, 608-619.

NPWS (2001) Site Synopsis: East Burren Complex, Site code 001926. Site Synopsis report, National Parks and Wildlife Service.

O' Reilly, P. (1998) *Loughs of Ireland - A Flyfisher's Guid*e. 3rd Edition. Merlin Unwin Books.