

Lough Melvin



Sampling Fish for the Water Framework Directive - Lakes 2008



The Central and Regional
Fisheries Boards

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1.1 Introduction

Lough Melvin (Plate 1.1, Fig. 1.1) is situated in the north-west of Ireland and is bordered by Co. Leitrim and Co. Fermanagh. The lake is 12 kilometres in length, with a maximum width of less than three kilometres and a surface area of 2,125ha. The lake is greater than 10m in depth over 28% of its area, with a shallower area around the islands in the Fermanagh section and at the western end. Approximately 46% of the lake is less than 5m in depth. A deep trench runs east-west from Rossinver Bay towards the Drowes river outflow and has a maximum depth of 45m (Ferguson, 1986; Girvan and Foy, 2003). The geology of the catchment is dominated by Carboniferous rocks, predominantly sandstones and shales. The lake is categorised as typology class 8 (as designated by the EPA for the Water Framework Directive), i.e. deep (>4m), greater than 50ha and moderate alkalinity (20-100mg/l CaCO_3). It has also been classed as 1a (i.e. at risk of failing to meet good status by 2015) in the WFD characterization report (EPA, 2005). Lough Melvin has been designated as a Special Area of Conservation (SAC) based on the fact that it is an oligo-mesotrophic lake, a lake category listed on Annex I of the EU Habitats Directive (NPWS, 2005). The lake is also designated as an SAC due to the presence of Atlantic salmon and otter, both species listed on Annex II of the same Directive.



Plate 1.1. Aerial view of Lough Melvin (Photo courtesy of CFB and No. 3 Operational Wing, Irish Air Corps [Aer Chór na hÉireann])

Lough Melvin is one of the most important salmon and trout fisheries in the north-west of Ireland. It is an excellent example of a natural, post-glacial salmonid lake. The lake holds a relict population of Arctic

char, Atlantic salmon (both of which are listed on the Irish Red Data Book as vulnerable), perch and brown trout (NPWS, 2005). It is the brown trout that are of primary interest to most anglers. Three distinct varieties of brown trout (*Salmo trutta*) occur in this lake: sonaghan (*Salmo nigripinnis*), gillaroo (*Salmo stomachius*) and ferox (*Salmo ferox*). These have been found to be genetically distinct species and can be readily identified on the basis of their morphological and meristic features (Ferguson, 1986). The three types of trout exhibit distinct feeding patterns: sonaghan feed primarily on cladocerans, chironomid pupae and *Chaoborus*; gillaroo feed almost exclusively on benthic animals, including snails, trichopteran larvae and *Gammarus* spp. and ferox trout feed primarily on fish, including perch, Arctic char and brown trout (Ferguson, 1986).

The water quality of Lough Melvin has been surveyed intermittently since 1990 and the lake has consistently demonstrated mesotrophic characteristics (Champ, 1998; McGarrigle *et al*, 2002; Girvan and Foy, 2003). The water in Lough Melvin is heavily peat stained, which is thought to be the principal factor limiting primary production; the algal crop did not appear to change in diversity or abundance between 1990 and 2001/2002, but monitoring work on the lake has shown a substantial shift towards phosphorus enrichment with mean total phosphorus concentrations in the open water increasing from 19µg to 30µg P/l since 1990 (Girvan and Foy, 2003). There is evidence that blue green algal blooms are now more severe than previously. The health and status of the lake is particularly vulnerable to human activities, such as an increase in phosphorus loadings from housing, forestry and agriculture within the surrounding catchment (Campbell and Foy, 2008). As part of the EU Intereg IIIA programme, a Catchment Management Plan was developed for Lough Melvin to promote the attainment of good ecological status and address the threat of nutrient enrichment, particularly from agriculture, forestry and domestic waste water (Campbell and Foy, 2008).

The lake has been surveyed for fish previously, primarily to evaluate brown trout stocks, by the Central Fisheries Board (CFB) and the Northern Regional Fisheries Board (NRFB) in 1986 and 2001 using the standard CFB netting method for assessing brown trout stocks in lakes (seven panels of survey gill nets ranging from 51mm to 127mm mesh size) (O'Grady, 1981; Delanty and O'Grady, 2001). It was also surveyed in 2005 using a similar method to that deployed during this survey, i.e. a method based on the European standard method for multimesh gill netting that was tested and developed during the NS Share "Fish in Lakes Project (Kelly *et al.*, 2007).

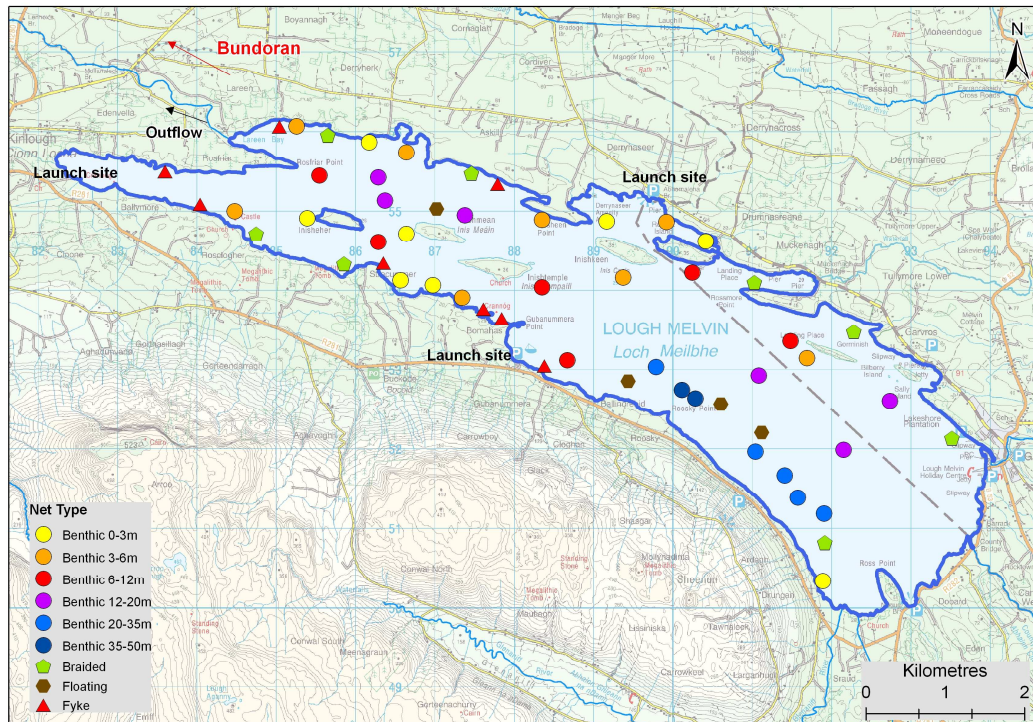


Fig. 1.1: Location map of Lough Melvin showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

The lake was surveyed over four nights from the 14th to the 18th of July 2008. A total of eight sets of Dutch fyke nets, 35 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) survey gill nets (8 @ 0-2.9m, 8 @ 3-5.9m, 6 @ 6-11.9m, 6 @ 12-19.9m, 5 @ 20-34.9m and 2 @ 35-49.9m) and four surface floating monofilament multi-mesh (12 panel, 5-55mm mesh size) survey gill nets were deployed randomly in the lake (47 sites). The netting effort was supplemented using eight benthic braided (62.5mm mesh knot to knot) survey gill nets (eight additional sites). Survey sites were similar to those selected in the 2005 survey. A handheld GPS was used to mark the precise location of each net.

All fish apart from perch were measured and weighed on site, and scales were removed from trout, salmon, rudd and hybrids. 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

Fish species recorded during the survey in July 2008 included rudd, salmon, Arctic char, perch, eel, four types of brown trout (brown trout, sonaghan, gillaroo and ferox) and roach x rudd hybrids. A list of the species encountered and numbers captured by each gear type is compiled in Table 1.1. A total of 811 fish

were captured during the survey. Perch was the dominant fish species captured in the gill nets, followed by rudd. Eel was the most common fish species captured in the fyke nets.

A previous study in 2005 (Kelly *et al.*, 2007) showed the same species composition in the lake, except for the presence of 3-spine stickleback in the 2005 survey. Genetic analysis on fish from the 2008 survey confirmed the presence of roach x rudd hybrids in the lake. In contrast, only rudd were identified in the 2005 survey.

Table 1.1. List of fish species recorded (including numbers captured) during the survey on Lough Melvin, July 2008

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
<i>Salmo trutta</i>	Brown trout	17	0	3	0	20
<i>Salmo nigripinnis</i>	Sonaghan	7	0	18	0	25
<i>Salmo stomachicus</i>	Gillaroo	8	1	0	0	9
<i>Salmo ferox</i>	Ferox	3	1	0	0	4
<i>Salmo salar</i>	Salmon	0	4	0	0	4
<i>Salvelinus alpinus</i>	Char	1	0	0	0	1
<i>Perca fluviatilis</i>	Perch	479	0	0	22	501
<i>Scardinius erythrophthalmus</i>	Rudd	126	6	6	3	141
	Roach x rudd hybrid	28	0	0	4	32
<i>Anguilla anguilla</i>	Eel	0	0	0	74	74

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 (all types of brown trout have been grouped) are shown in Table 1.2. Mean CPUE for both surveys is shown in Figure 1.2. There was a significant difference in the mean CPUE of brown trout between 2005 and 2008, with fewer brown trout captured in 2008 (Mann-Whitney U test, $z = -3.221$, $p = 0.001$). There was an increase in mean CPUE for both perch and rudd between 2005 and 2008, however these were not statistically significant (Table 1.2; Fig. 1.2). Eel CPUE was lower in 2008 than in 2005, however again this was not statistically significant (Table 1.2; Fig. 1.2).

Table 1.2. Mean (S.E.) CPUE and Mean (S.E.) BPUE on Lough Melvin

Year	2005	2008
Mean CPUE (mean no. of fish per m of net)		
Brown trout	0.061 (0.0011)	0.023 (0.0069)
Arctic char	0.002 (0.0011)	0.0006 (0.0006)
Salmon	0.002 (0.0011)	0.003 (0.0016)
Perch	0.193 (0.0709)	0.297 (0.0597)
Rudd	0.066 (0.0222)	0.085 (0.0329)
Roach x Rudd hybrid	-	0.018 (0.0077)
3-spined stickleback	0.001 (0.0008)	-
Eel	0.252 (0.0497)	0.154 (0.0407)
Mean BPUE (mean weight (g) of fish/m of net)		
Brown trout	13.202 (2.6804)	7.700 (1.8308)
Arctic char	0.287 (0.1963)	0.012 (0.0121)
Salmon	2.792 (1.9517)	6.862 (4.5373)
Perch	12.729 (3.7809)	21.145 (4.7239)
Rudd	11.308 (3.8712)	12.782 (3.6536)
Roach x Rudd hybrid	-	4.486 (1.9331)
3-spined stickleback	0.001 (0.0007)	-
Eel	7.403 (2.9343)	17.414 (5.2023)

* 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.

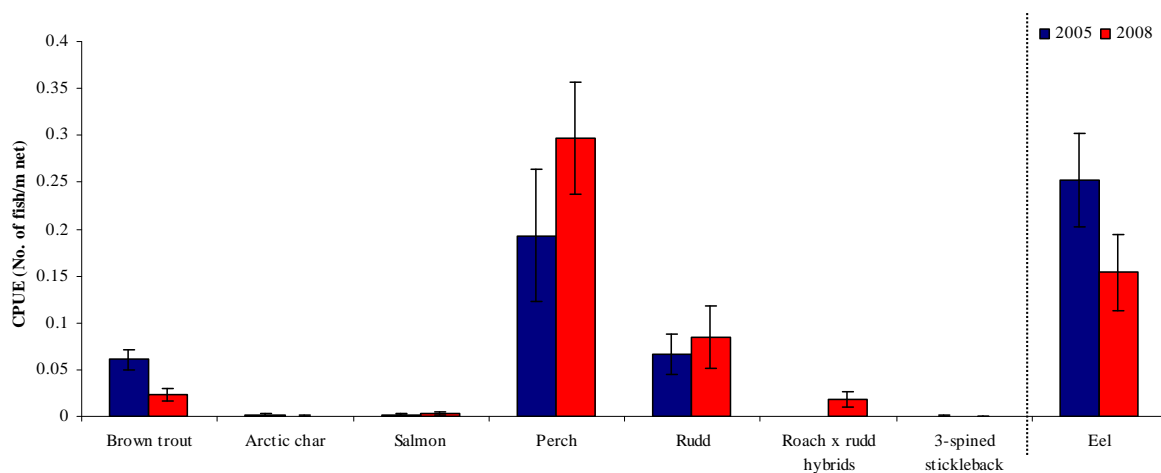


Fig. 1.2. Mean (±S.E.) CPUE on Lough Melvin (Eel CPUE based on fyke nets only)

1.3.3 Length frequency distributions

Length frequency data for perch, rudd and brown trout from 2005 and 2008 are shown in Figures 1.3, 1.4 and 1.5 respectively. Perch captured in 2008 ranged in length from 4.0cm to 33.4cm (mean = 15.6cm) (Fig. 1.3). This is similar to the 2005 survey (range 4.0cm to 35.2cm). Rudd captured in 2008 ranged in length from 9.5cm to 34.0cm (mean = 18.8cm), with a greater proportion of juvenile rudd being present in

the 2008 survey compared with the 2005 survey (Fig. 1.4). Brown trout captured in 2008 ranged in length from 10.3cm to 41.5cm (Fig. 1.5). This is a similar size range to that recorded during the 2005 survey, with the exception of three large ferox trout captured in 2005.

Eels captured in 2008 ranged in length from 29.0cm to 58.1cm. Roach x rudd hybrids ranged in length from 16.0cm to 31.1cm. Adult salmon ranged from 56.0cm to 75.5cm. One Arctic char was captured, measuring 12.0cm in length.

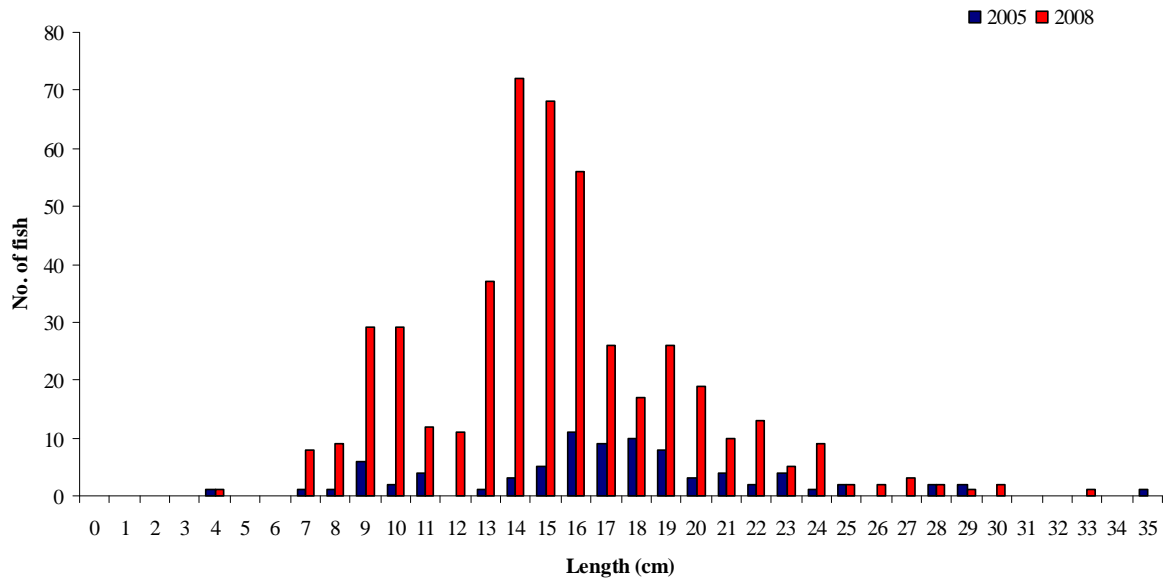


Fig. 1.3. Length frequency of perch captured on Lough Melvin, 2005 and 2008

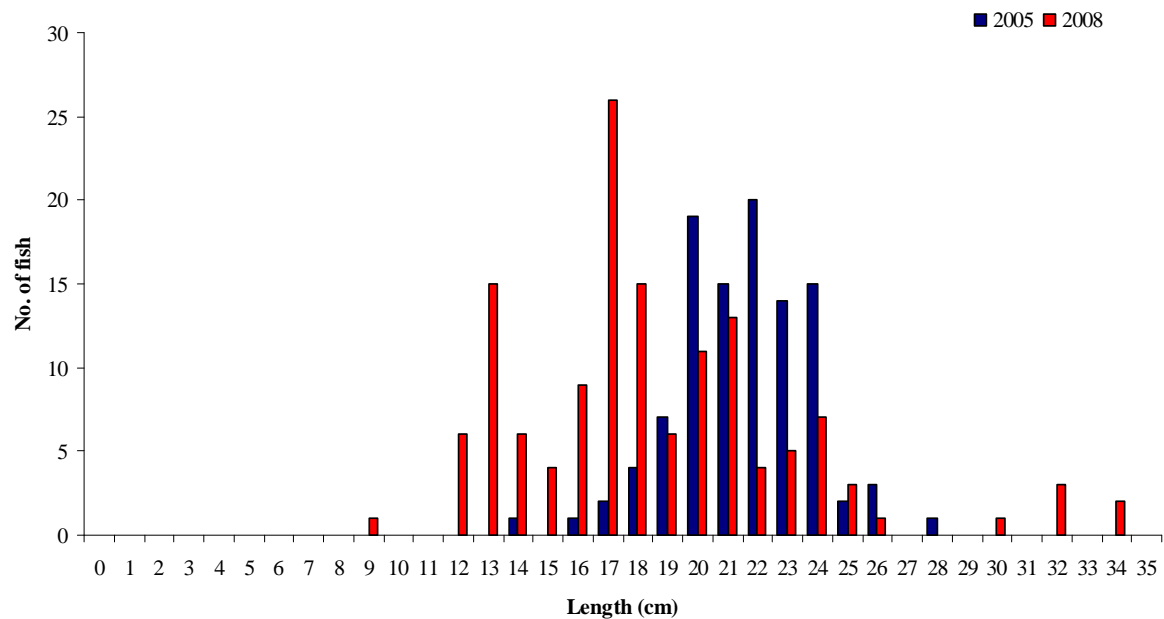


Fig. 1.4. Length frequency of rudd captured on Lough Melvin, 2005 and 2008

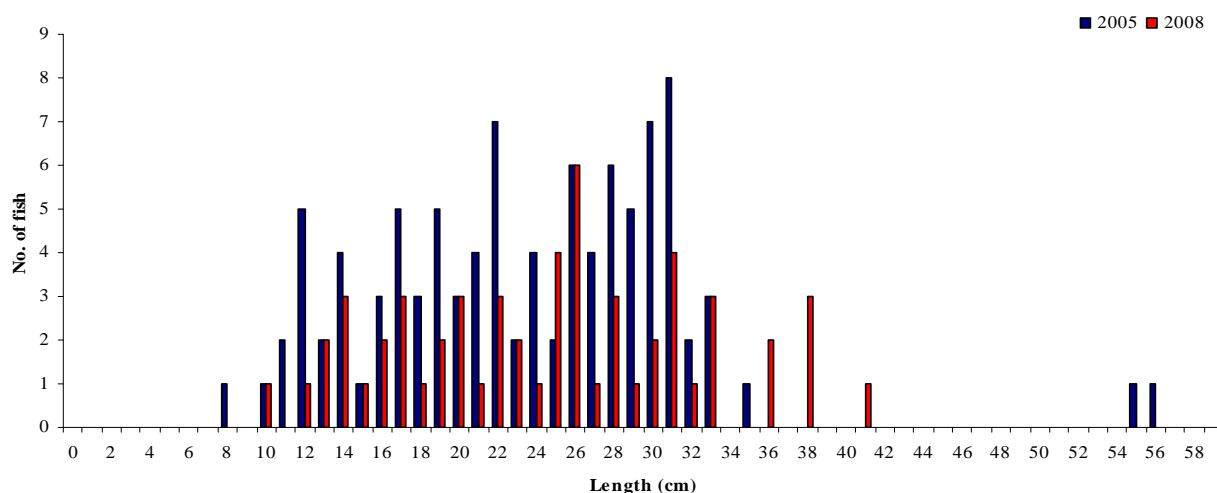


Fig. 1.5. Length frequency of brown trout (all types of brown trout have been grouped) captured on Lough Melvin, July 2005 and 2008

1.3.4 Fish age and growth

Perch ranged in age from 1+ to 6+ in the 2008 survey (Table 1.3), similar to age ranges recorded in 2005 (0+ to 6+). However, there were no 0+ perch recorded during the current survey.

Brown trout (all types combined) ranged in age from 1+ to 7+ in the current survey (Table 1.4) and from 1+ to 6+ in 2005. Gillaroo were aged between 2+ and 4+, sonaghan were aged from 2+ to 6+ and ferox trout ranged from 5+ to 7+. Mean brown trout L4 was 27.2cm in 2008, compared with 30.2cm in 2005.

Rudd ranged in age from 1+ to 10+ in the current survey and from 3+ to 10+ in 2005. Roach x rudd hybrids were aged between 4+ and 7+.

Table 1.3. Mean (\pm S.E.) perch length at age for Lough Melvin, July 2008

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆
Mean	5.9 (0.09)	13.4 (0.20)	19.4 (0.25)	22.2 (0.36)	24.8 (0.68)	27.06
N	100	76	40	30	17	1
Range	4.2-8.7	9.1-18.3	15.3-24.2	17.2-26.9	18.7-29.4	27.0-27.0

Table 1.4. Mean (\pm S.E.) brown trout length at age for Lough Melvin, July 2008

	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇
Mean	6.6 (0.13)	14.07 (0.30)	21.5 (0.42)	27.2 (0.54)	32 (0.76)	35.2 (1.17)	37.8
N	57	49	33	15	7	3	1
Range	4.9-8.4	9.8-20.8	16.4-27.7	23.3-30.2	29.6-35.4	32.9-36.5	37.8-37.8

1.4 Summary

Results from the current survey show that perch was the dominant fish species in Lough Melvin, followed by rudd, eels and brown trout. This was similar to the species composition encountered during the 2005 survey. Mean perch CPUE, however, was lower than the mean perch CPUE among other moderate alkalinity lakes surveyed during 2008, e.g. Lough Leane and Lough Skeagh Upper (Kelly *et al.*, 2009). In contrast, mean rudd CPUE was much higher than the mean rudd CPUE among other moderate alkalinity lakes surveyed (Kelly *et al.*, 2009). Mean eel CPUE was also higher than the mean eel CPUE amongst all moderate alkalinity lakes surveyed during 2008 (Kelly *et al.*, 2009).

Perch growth was faster than the mean growth rates amongst all moderate alkalinity lakes surveyed during 2008, e.g. Lough Gill and Lough Talt. Rudd also exhibited higher mean L1 to L6 when compared to other similar lakes surveyed during 2008.

Fish specimens were captured during the 2008 survey that were characteristic of roach x rudd hybrids. Therefore tissue samples were retained for genetic analysis which confirmed that, although the population consisted predominately of rudd, small numbers of roach x rudd hybrids were also present. These hybrids were subsequently aged and were found to range from 4+ to 11+. Although no roach x rudd hybrids were recorded in 2005, it is likely that some of the 'rudd' specimens captured were in fact roach x rudd hybrids. A subsample of pharyngeal teeth from the cyprinids captured in 2005 were examined and all fish were identified as rudd, however no genetic analysis was conducted at this time. Furthermore, a survey conducted by the Central Fisheries Board in 2001 recorded roach x rudd hybrids (identified using pharyngeal teeth), ranging in age from 3+ to 6+. This suggests that roach x rudd hybrids may have been present in the lake since 1996. However, no pure roach have been recorded in Lough Melvin to date. This study displays the difficulties in identifying hybrids of roach and rudd in the field and in the laboratory and that in some cases genetic analysis is required to confirm identifications.

Lough Melvin contains three unique brown trout species and a small endangered population of Arctic char. Somewhat alarmingly, mean brown trout (all types combined) CPUE has more than halved between the 2005 survey (0.061 fish/m of net) and the 2008 survey (0.023 fish/m of net). This coincides with an increase (although not statistically significant) of approximately 50% in mean perch CPUE and a slight increase in mean rudd CPUE. Furthermore, only one Arctic char was recorded in the current survey, indicating that the population remains small and is therefore extremely vulnerable.

This reduction in native (and unique) trout species, along with the increase in abundance of perch and rudd, gives some cause for concern. Perhaps even more concerning is the continued presence of roach x rudd hybrids in the current survey. Roach have not as yet been recorded in Lough Melvin and their introduction could have serious ecological consequences on the native brown trout and Arctic char populations. It is therefore suggested that the fish populations in Lough Melvin should be closely monitored due to its highly important status from a biodiversity point of view. It is also recommended that a targeted hydroacoustic survey be carried out in tandem with the netting survey in 2011 to assess the status and the size of the Arctic char population in the lake.

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, Lough Melvin has been assigned a draft classification of good ecological status for fish. This has remained the same since 2005. The EPA has assigned an overall classification of moderate status to Lough Melvin in an interim draft classification. This is based on physico-chemical parameters and biotic elements, such as macroinvertebrates, macrophytes and fish.

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