Kindrum Lough

Sampling Fish for the Water Framework Directive - Lakes 2009

The Central and Regional Fisheries Boards

ACKNOWLEDGEMENTS

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1.1 Introduction

Kindrum Lough is located approximately 22km north of Millford on the Fanad Peninsula, Co. Donegal (Plate 1.1, Fig. 1.1). The lake has a surface area of 67ha, a mean depth of 6.6m and a maximum depth of 15.0m. The lake is moderately alkaline and is categorised as typology class 8 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. deep (>4m), greater than 50ha and moderately alkaline (20-100mg/l $CaCO_3$). The Cashlan Stream drains into the southern arm of the lake. The outflow, which is approximately 0.7km in length, flows into Mulroy Bay and has been used by Fanad Fisheries Ltd. as a water supply for their hatchery operations in the past (Gargan and Roche, 1992). The lake has been classed as 1b (i.e. at risk of failing to meet the objective pending further investigation) in the WFD Characterisation report (EPA, 2005).

Kindrum Lough is a lowland lake situated 9m a.s.l. It is of considerable conservation significance as a lowland oligotrophic lake, a habitat that is listed on Annex I of the EU Habitats Directive. Two plant species listed on the Irish Red Data Book are found along the shores of the Lough including slender naiad (*Najas flexilis*) and the stonewort, *Nitella spanioclema*. Slender naiad is listed on Annex II of the EU Habitats Directive and *Nitella spanioclena* is an extremely rare species that is endemic to Ireland, where it has been recorded only from Kindrum Lough (NPWS, 1999). Kindrum Lough is also home to a population of Arctic char (*Salvelinus alpinus*) (Igoe and Hammar 2004, Kelly *et al.*, 2007) a fish species listed in the Irish Red Data Book as vulnerable (King *et al*., 2011).

Plate 1.1. Kindrum Lough

Kindrum Lough is the most popular angling water in this area of the Fanad Peninsula, with access being relatively good to a significant portion of the lake shore. O' Reilly (2007) referred to "nice" trout being present in Kindrum lake, which are taken mainly by spinning. The lake was previously

surveyed in 1992 (Gargan and Roche, 1992) and 2006 (Kelly *et al*, 2007), with both of these surveys confirming the presence of brown trout and Arctic char in the lake.

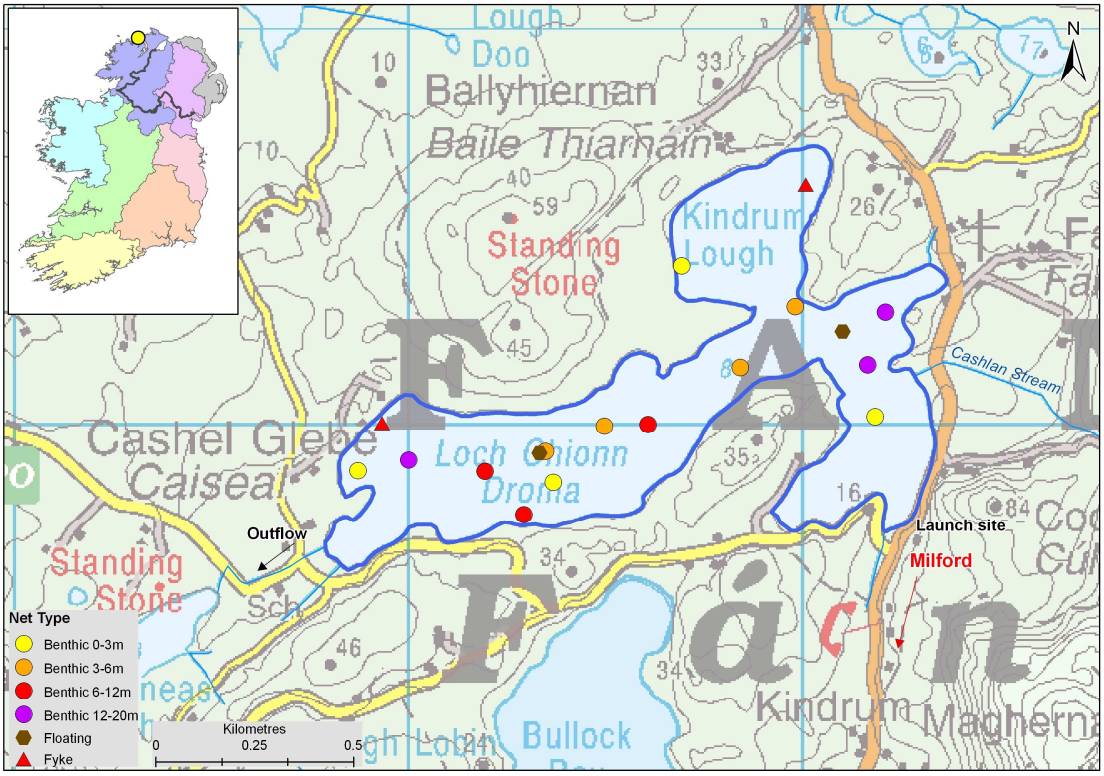

Fig. 1.1. Location map of Kindrum Lough showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

Kindrum Lough was surveyed over two nights between the 15th and the 17th of July 2009. A total of three sets of Dutch fyke nets, 14 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 3 @ 6-11.9m and 3 @ 12-19.9) and two surface monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed randomly in the lake (19 sites). Nets were deployed in the same locations as were randomly selected for the previous 2006 survey. 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. 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 four fish species were recorded in Kindrum Lough in July 2009, with 114 fish being captured (Table 1.1). Brown trout followed by Arctic char were the most abundant fish species recorded. Small numbers of three-spined stickleback were also recorded. One eel was also captured during the survey. A previous survey in 2006, (Kelly *et al.*, 2007) found the same species composition in the lake, with brown trout recorded as the dominant species followed by Arctic char. However, eels were not as abundant and three-spined stickleback were more abundant in the current survey.

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

Scientific name	Common name	Number of fish captured			
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Fyke nets	Total
Salmo trutta	Brown trout	64	2	0	66
Salvelinus alpinus	Arctic char	26	1	0	27
Gasterosteus aculeatus	Three-spined stickleback	20	0	0	20
Anguilla anguilla	European eel	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 are summarised in Table 1.2.

Although the mean CPUE of brown trout and Arctic char was lower in 2009 than 2006 (Fig. 1.2), this was not statistically significant. There was no significant difference in the mean brown trout CPUE from 2009 between Kindrum Lough and Lough Sessiagh (a similar lake type) (Fig. 1.3).

The differences in the mean Arctic char CPUE between Kindrum Lough and three other similar lakes were also 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 Kindrum Lough had a significantly higher mean Arctic char CPUE than Lough Mask ($z = -4.344$, $P<0.001$).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Kindrum Lough, 2006 and 2009

Scientific name	Common name	2006	2009
		Mean CPUE	
Salmo trutta	Brown trout	0.152 (0.034)	0.116 (0.027)
Salvelinus alpinus	Arctic char	0.059 (0.030)	0.047 (0.014)
Gasterosteus aculeatus	Three-spined stickleback	0.002 (0.002)	0.035 (0.021)
Anguilla anguilla	European eel	0.083 (0.029)	0.006 (0.006)
		Mean BPUE	
Salmo trutta	Brown trout	31.575 (7.110)	30.439 (7.844)
Salvelinus alpinus	Arctic char	10.393 (4.773)	7.591 (2.386)
Gasterosteus aculeatus	Three-spined stickleback	0.001 (0.001)	0.029 (0.018)
Anguilla anguilla	European eel	13.553 (9.474)	0.456 (0.456)

* 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.

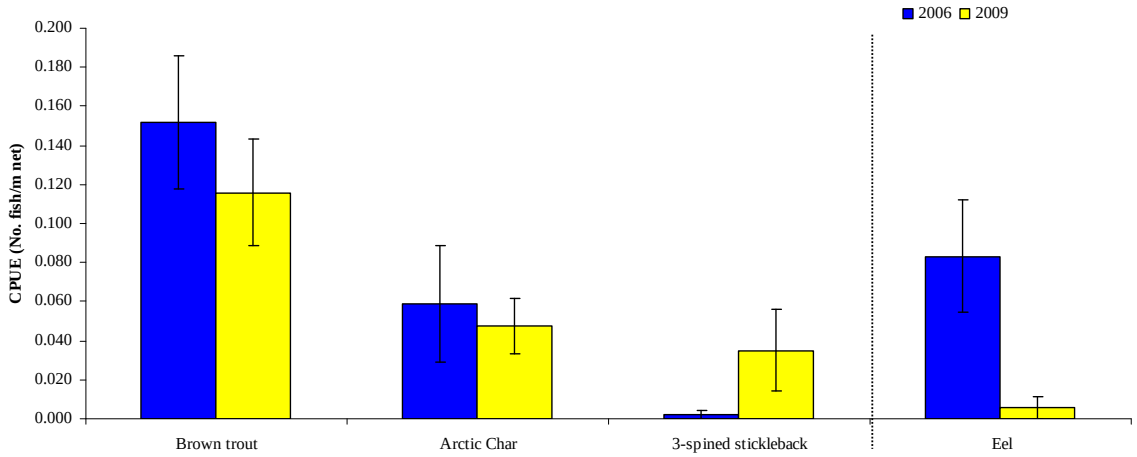

Fig. 1.2. Mean (±S.E.) CPUE of four fish species on Kindrum Lough (Eel CPUE based on fyke nets only)

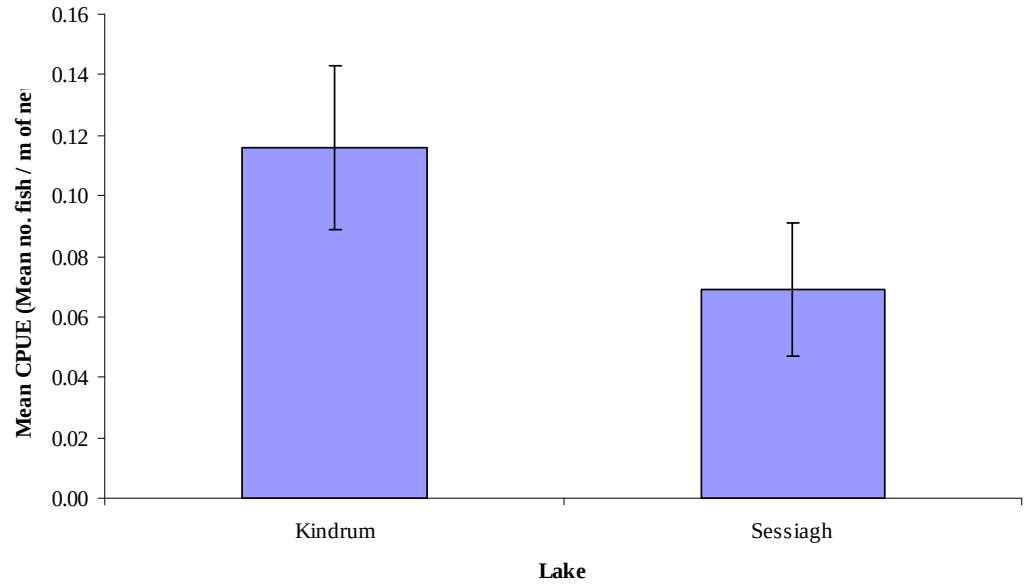

Fig. 1.3. Mean (±S.E.) brown trout CPUE in two lakes surveyed during 2009

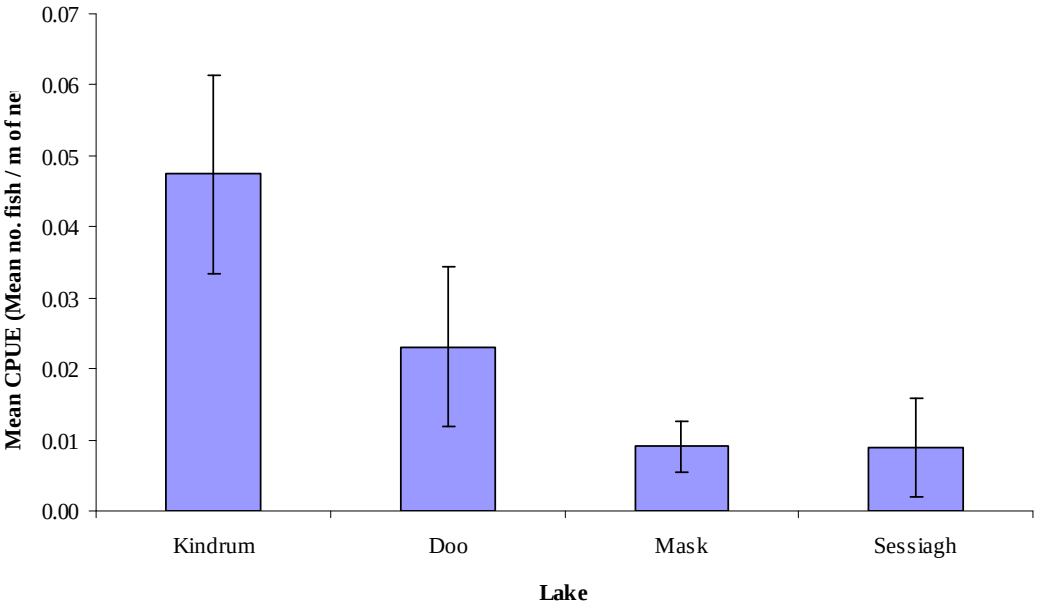

Fig. 1.4. Mean (±S.E.) Arctic char CPUE in four lakes surveyed during 2009

1.3.3 Length frequency distributions

Brown trout ranged in length from 7.2cm to 36.2cm (mean = 25.8cm) (Fig. 1.5). Brown trout from the 2006 survey had similar lengths, ranging from 7.0cm to 34.6cm (Fig. 1.5) (Kelly *et al.*, 2007). Arctic char ranged in length from 17.1cm to 28.0cm (mean = 23.9cm) (Fig.1.6). Char from the 2006 survey also had similar lengths ranging from 13.5cm to 28.8cm (Fig. 1.6) (Kelly *et al.*, 2007). The

single eel captured during the current survey measured 36.0cm in length. All three-spined stickleback measured 4.5cm in length.

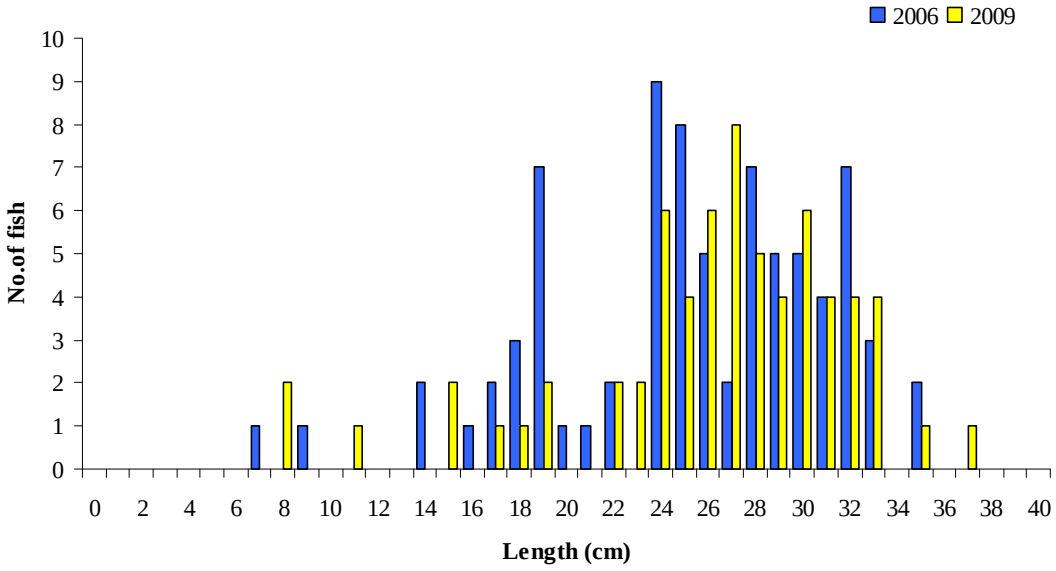

Fig. 1.5. Length frequency of brown trout captured in Kindrum Lough

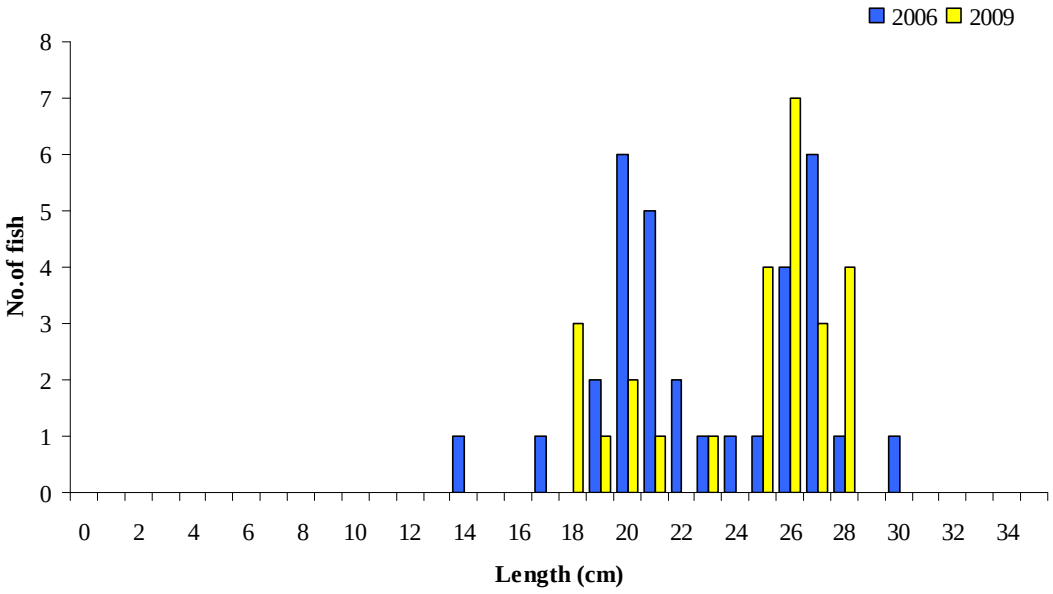

Fig. 1.6. Length frequency of Arctic char captured in Lough Kindrum

1.3.4 Fish age and growth

Five age classes of brown trout were present, ranging from 0+ to 4+, with a mean L1 of 7.2cm (Table 1.3). Brown trout captured during the 2006 survey also ranged in age from 0+ to 4+, with a mean L1 of 7.6cm (Kelly *et al.*, 2007). Mean brown trout L4 in 2009 was 29.2cm indicating a slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971).

Five age classes of Arctic char were present, ranging from 1+ to 5+. Arctic char captured during the 2006 survey ranged in age from 1+ to 4+ (Kelly *et al.*, 2007).

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

	L_1	L_2	L_3	L_4
Mean	7.2 (0.2)	20.0 (0.5)	25.8 (0.8)	29.2 (0.9)
N	62	55	20	5
Range	4.6-10.8	11.0-25.6	20.4-34.8	26.7-32.5

1.4 Summary

Brown trout was the dominant species in terms of both abundance (CPUE) and biomass (BPUE), followed by Arctic char.

The mean brown trout CPUE in Lough Kindrum was slightly higher than that exhibited in Lough Sessiagh; however, this was not statistically significant. Brown trout ranged in age from 0+ to 4+, indicating reproductive success in each of the previous four years. Length at age analyses revealed that brown trout in the lake exhibit a slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

The mean Arctic char CPUE in Lough Kindrum was significantly higher than Lough Mask. Although Doo Lough and Lough Sessiagh exhibited a lower mean Arctic char CPUE than Lough Kindrum, this was not statistically significant. Arctic char ranged in age from 1+ to 5+, indicating reproductive success in each 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 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 Kindrum has been assigned a fish classification of High status.

The EPA has assigned an overall status of Good to Lough Kindrum 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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