



Sampling Fish for the Water Framework Directive

Lakes 2012

Kindrum Lough



Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Kindrum Lough, July 2012

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

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1.1 Introduction

Kindrum Lough is located approximately 5km northwest of Portsalon 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 CaCO₃). 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 rare plant species are found along the shores of the lake. Slender naiad (*Najas flexilis*) is listed on Annex II of the EU Habitats Directive and the stonewort *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).

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) confirming the presence of brown trout and Arctic char in the lake.

The lake was also surveyed in July 2006 and 2009 as part of the NSSHARE Fish in Lakes Project (Kelly *et al.*, 2007) and as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2010). In both years brown trout was found to be the dominant species, followed by Arctic char, three-spined stickleback and eel.



Plate 1.1. Kindrum Lough



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 11th and the 13th of July 2012. 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 @ 12-19.9m) 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 in the previous surveys in 2009 and 2006. 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 and Arctic char. 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 on Kindrum Lough in July 2012, with 207 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most abundant fish species recorded, followed by three-spined stickleback, eels and Arctic char. 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 Kindrum Lough, July 2012

Scientific name	Common name	Number of fish captured			Total
		Benthic mono multimesh gill nets	Surface mono multimesh gill nets	Fyke nets	
<i>Salmo trutta</i>	Brown trout	72	2	3	77
<i>Salvelinus alpinus</i>	Arctic char	1	0	0	1
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	36	0	77	113
<i>Anguilla anguilla</i>	European eel	0	0	16	16

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 different 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 Kindrum Lough and two 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 Kindrum Lough had a significantly higher mean brown trout CPUE and BPUE than Lough Muckno ($P < 0.05$).

The mean Arctic char CPUE and BPUE were considerably lower in 2012 than in 2009 and these differences were statistically significant (Mann-Whitney, $P < 0.05$) (Fig. 1.6 and Fig. 1.7)

The differences in the mean Arctic char CPUE and BPUE between Kindrum Lough and three 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 Kindrum Lough had a significantly lower mean Arctic char CPUE and BPUE than Doo Lough ($P < 0.05$).

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

Scientific name	Common name	2009	2012
Mean CPUE			
<i>Salmo trutta</i>	Brown trout	0.116 (0.027)	0.132 (0.031)
<i>Salvelinus alpinus</i>	Arctic char	0.047 (0.014)	0.002 (0.002)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.035 (0.021)	0.131 (0.053)
<i>Anguilla anguilla</i>	European eel	0.006 (0.006)	0.089 (0.045)
Mean BPUE			
<i>Salmo trutta</i>	Brown trout	30.438 (7.844)	25.176 (5.745)
<i>Salvelinus alpinus</i>	Arctic char	7.591 (2.386)	0.447 (0.447)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.029 (0.018)	0.120 (0.048)
<i>Anguilla anguilla</i>	European eel	0.456 (0.456)	11.238 (5.624)

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

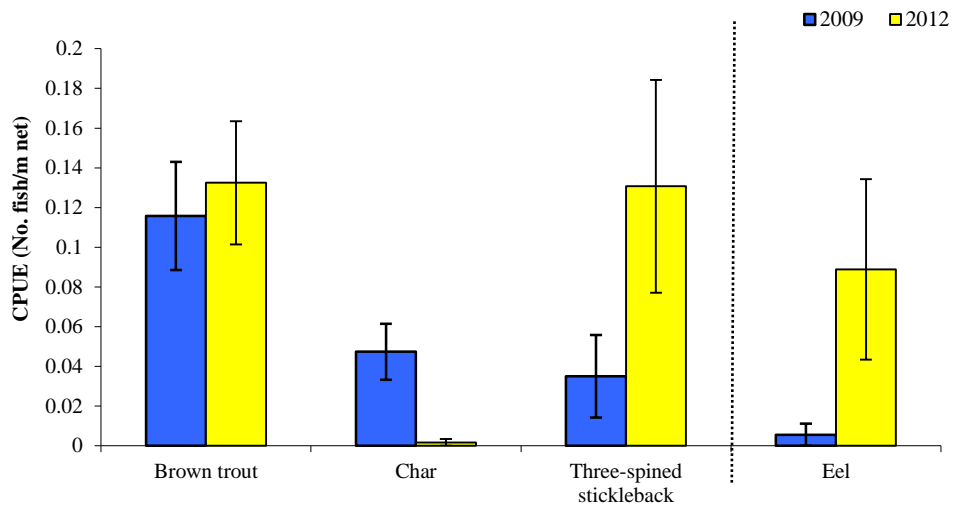


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Kindrum Lough (Eel CPUE based on fyke nets only), 2009 and 2012

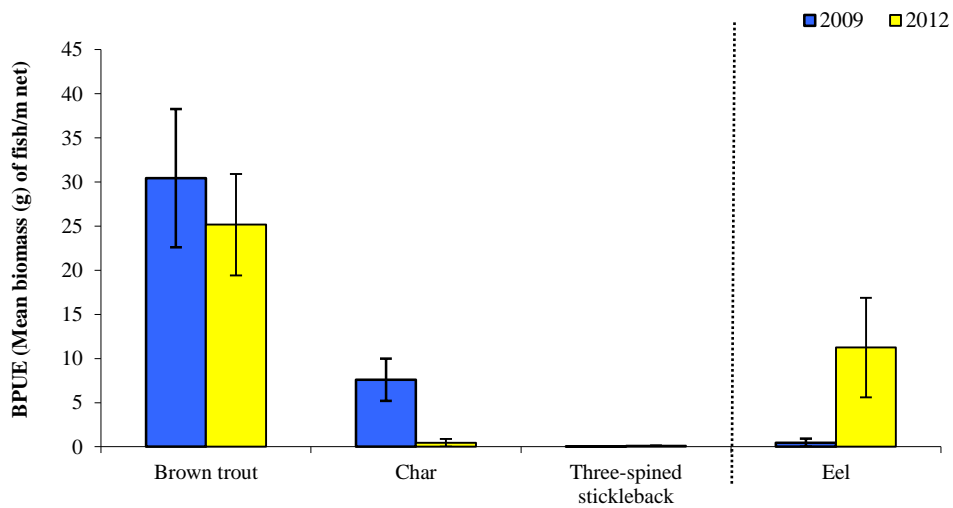


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Kindrum Lough (Eel BPUE based on fyke nets only), 2009 and 2012

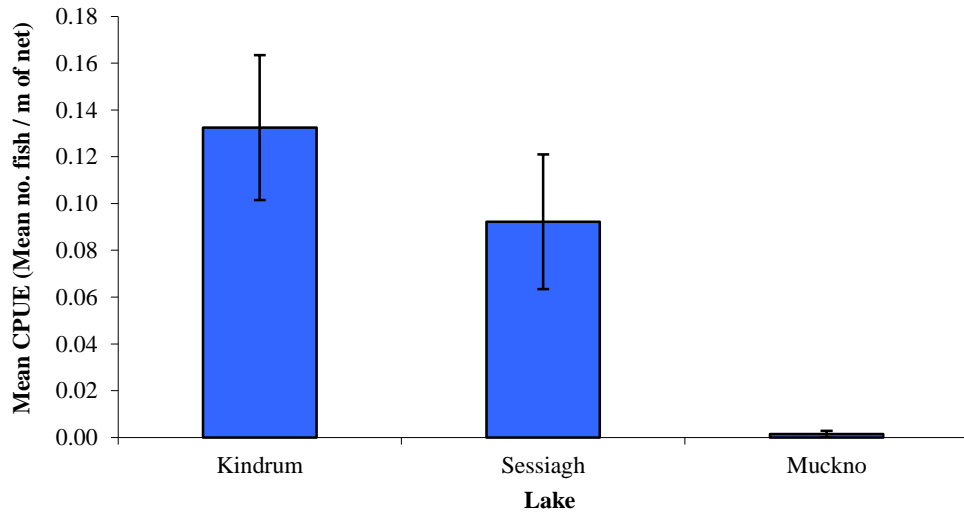


Fig. 1.4. Mean (\pm S.E.) brown trout CPUE in three lakes surveyed during 2012

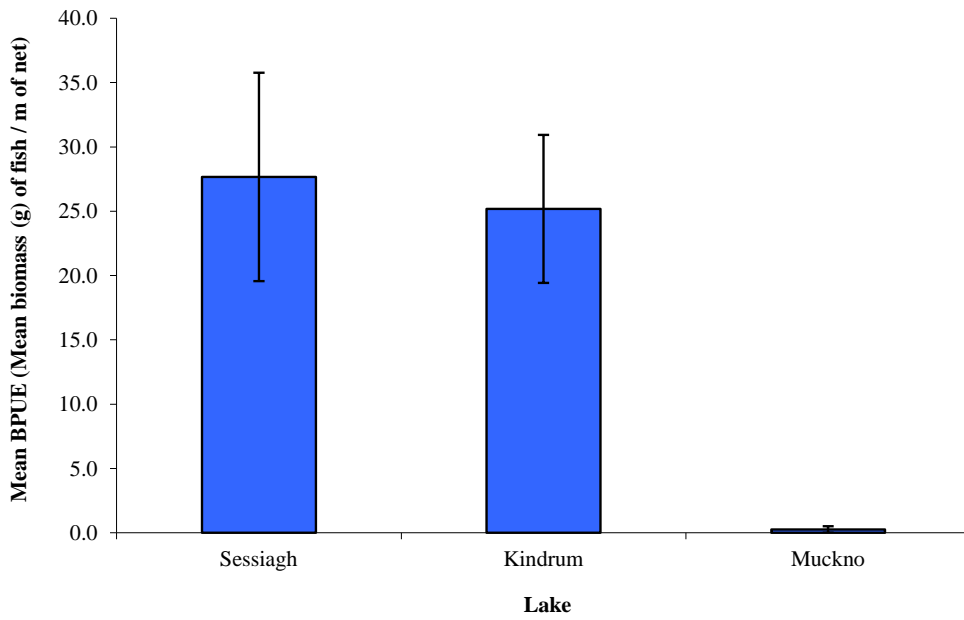


Fig. 1.5. Mean (\pm S.E.) brown trout BPUE in three lakes surveyed during 2012

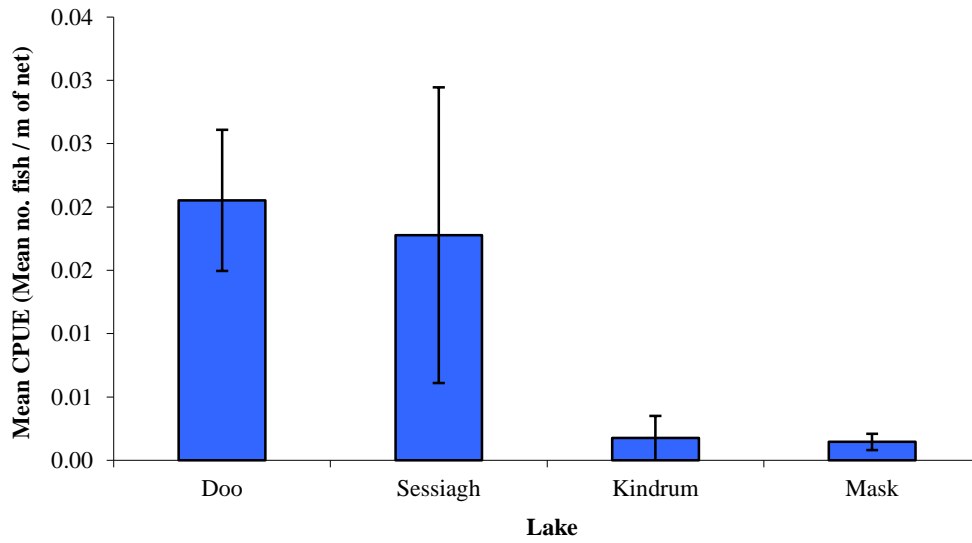


Fig. 1.6. Mean (\pm S.E.) Arctic char CPUE in four lakes surveyed during 2012

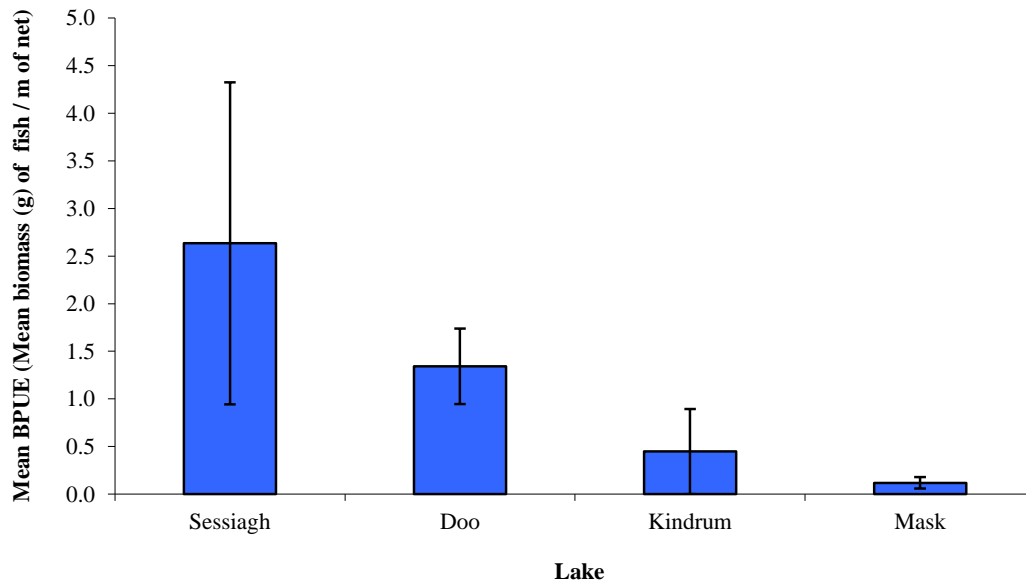


Fig. 1.7. Mean (\pm S.E.) Arctic char BPUE in four lakes surveyed during 2012

1.3.3 Length frequency distributions

Brown trout captured during the 2012 survey ranged in length from 10.8cm to 40.5cm (mean = 23.4cm) (Fig. 1.6). Brown trout captured during the 2008 survey ranged in length from 7.2cm to 36.2cm (Fig. 1.6).

One Arctic char was captured during the 2012 survey and measured 27.0cm (Fig. 1.7). Arctic char captured during the 2009 survey ranged in length from 17.1cm to 28.0cm (Fig. 1.7).

Eels captured during the 2012 survey ranged in length from 30.5cm to 54.3cm and three-spined stickleback ranged in length from 2.1cm to 5.5cm.

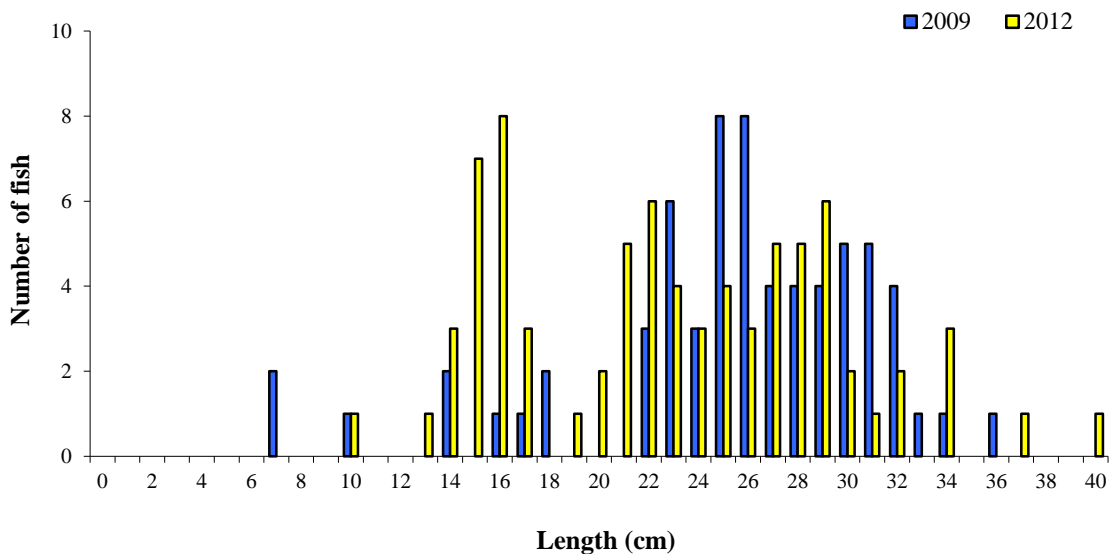


Fig. 1.6. Length frequency of brown trout captured on Kindrum Lough, 2009 and 2012

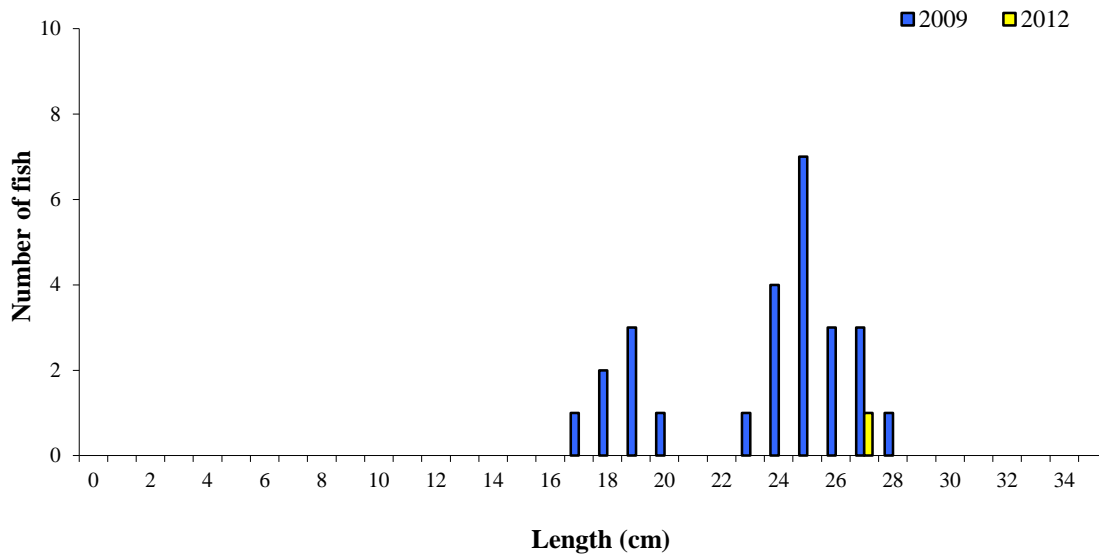


Fig. 1.7. Length frequency of Arctic char captured on Kindrum Lough, 2009 and 2012

1.3.4 Fish age and growth

Four age classes of brown trout were present, ranging from 1+ to 4+, with a mean L1 of 6.7cm (Table 1.3). The dominant age class was 1+ (Fig. 1.6). In the 2009 survey, brown trout ranged from 0+ to 4+ with a mean L1 of 7.2cm. Mean brown trout L4 in 2012 was 35.2cm indicating a very fast rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971).

Table 1.3. Mean (\pm SE) brown trout length (cm) at age for Kindrum Lough, July 2012

	L₁	L₂	L₃	L₄
Mean	6.7 (0.2)	19.5 (0.6)	26.6 (0.6)	35.2 (2.4)
N	67	51	24	3
Range	3.3-10.7	10.2-27.7	21.3-33.0	30.4-38.3

1.4 Summary

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

Although the mean brown trout CPUE and BPUE in Kindrum Lough were slightly different in 2012 than in the 2009 survey, these differences were not statistically significant. The mean brown trout CPUE and BPUE in Kindrum Lough was significantly higher than Lough Muckno and similar to those calculated for Lough Sessiagh in 2012. Brown trout ranged in age from 1+ to 4+, indicating reproductive success in four of the previous five 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). The dominant age class was 1+.

The mean Arctic char CPUE and BPUE in Kindrum Lough was significantly lower in 2012 than in the 2009 survey. The mean Arctic char CPUE and BPUE in Kindrum Lough was significantly lower than Doo Lough, another similar lake surveyed.

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, Kindrum 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 also Moderate.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Kindrum Lough 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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