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National Research Survey Programme

Lakes 2015

Kindrum Lough

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National Research Survey Programme

Fish Stock Survey of Kindrum Lough, July 2015

Fiona L. Kelly, Lynda Connor, Karen Delanty, John Coyne, Emma Morrissey, William Corcoran, Daniel Cierpial, Ronan Matson, Paul Gordon, Rossa O' Briain, Kieran Rocks, Laura Walsh, Sinead O'Reilly, Roisin O' Callaghan, Ronan Cooney and Dave Timbs.

Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

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Cover photo: Netting survey on Lough Dan © 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 $CaCO_3$). 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 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.

This lake was surveyed as part of the Water Framework Directive and was also surveyed in 2006 as part of the NSSHARE Fish in Lakes Project (Kelly *et al*., 2007) and in 2009 and 2012 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al*., 2010 and 2013). In all years brown trout was found to be the dominant species, followed by Arctic char, three-spined stickleback and eel.

Plate 1.1. Kindrum Lough

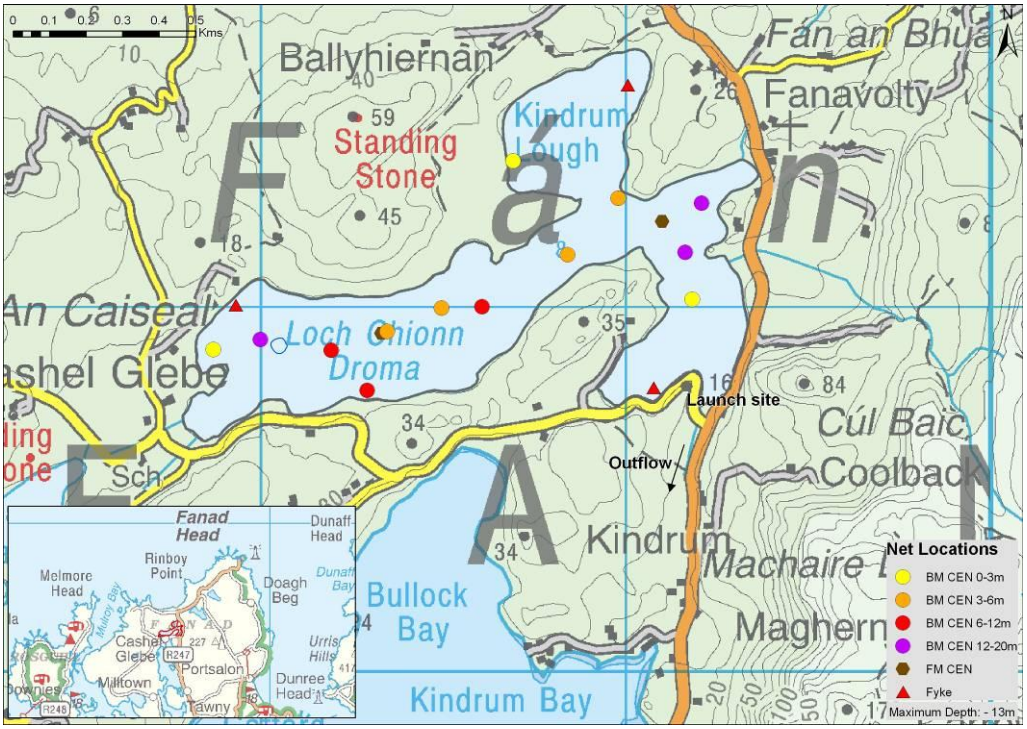

Fig. 1.1. Location map of Kindrum Lough showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

1.2.2 Netting methods

Kindrum Lough was surveyed over one night on the 7th of July 2015. A total of three sets of Dutch fyke nets (fyke), 13 benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets (3 @ 0-2.9m, 4 @ 3-5.9m, 3 @ 6-11.9m and 3 @ 12-19.9m) and two surface monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets were deployed randomly in the lake (18 sites). Nets were deployed in the same locations as were randomly selected in the previous surveys in 2006, 2009 and 2012. 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 brown 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.

1.2.2 Biosecurity - disinfection and decontamination procedures

Procedures are required for disinfection of equipment in order to prevent dispersal of alien species and other organisms to uninfected waters. A standard operating procedure was compiled by Inland Fisheries Ireland for this purpose (Caffrey, 2010) and is followed by staff on the IFI NRSP team when moving between water bodies.

1.3 Results

1.3.1 Species Richness

A total of four fish species were recorded on Kindrum Lough in July 2015, with 245 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Three spined- stickleback was the most abundant fish species recorded, followed by brown trout, eels and Arctic char. During the previous surveys in 2006, 2009 and 2012 the same species composition was recorded with the exception of salmon, which were not captured during the 2009 or 2015 surveys but were recorded during the 2006 and 2012 surveys (Kelly *et al*., 2010 and 2013).

Table 1.1. Number of each fish species captured by each gear type during the survey on Kindrum Lough, July 2015

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
Salmo trutta	Brown trout	86	2	1	89
Salvelinus alpinus	Arctic char	5	0	0	5
Gasterosteus aculeatus	Three-spined stickleback	142	0	0	142
Anguilla anguilla	European eel	0	0	9	9

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 the 2009, 2012 and 2015 surveys are summarised in Table 1.2. Mean CPUE and BPUE for all species is illustrated in Figure 1.2 and 1.3.

Brown trout:

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE). Although the mean brown trout CPUE increased slightly over the three sampling occasions, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3). There were also no significant differences in mean BPUE across the three sampling years.

Arctic char:

The mean Arctic char CPUE and BPUE was significantly lower in 2012 and 2015 compared to 2009 (Kruskal-Wallis H=6.1, P<0.05 and Kruskal-Wallis H=5.7, P<0.001 respectively) (Table 1.2; Fig 1.2 and 1.3).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Kindrum Lough, 2009, 2012 and 2015

Scientific name	Common name	2009	2012	2015
			Mean CPUE	
Salmo trutta	Brown trout	0.116 (0.027)	0.132 (0.031)	0.164 (0.046)
Salvelinus alpinus	Arctic char	0.047 (0.014)	0.002 (0.002)	0.009 (0.005)
Gasterosteus aculeatus	Three-spined stickleback	0.035 (0.021)	0.131 (0.053)	0.263 (0.123)
Anguilla anguilla	European eel	0.006 (0.006)	0.089 (0.045)	0.050 (0.035)
			Mean BPUE	
Salmo trutta	Brown trout	30.438 (7.844)	25.176 (5.745)	34.324 (10.131)
Salvelinus alpinus	Arctic char	7.591 (2.386)	0.447 (0.447)	1.920 (0.963)
Gasterosteus aculeatus	Three-spined stickleback	0.029 (0.018)	0.120 (0.048)	0.314(0.148)
Anguilla anguilla	European eel	0.456 (0.456)	11.238 (5.624)	4.381 (2.533)

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

*Eel CPUE and BPUE based on fyke nets only

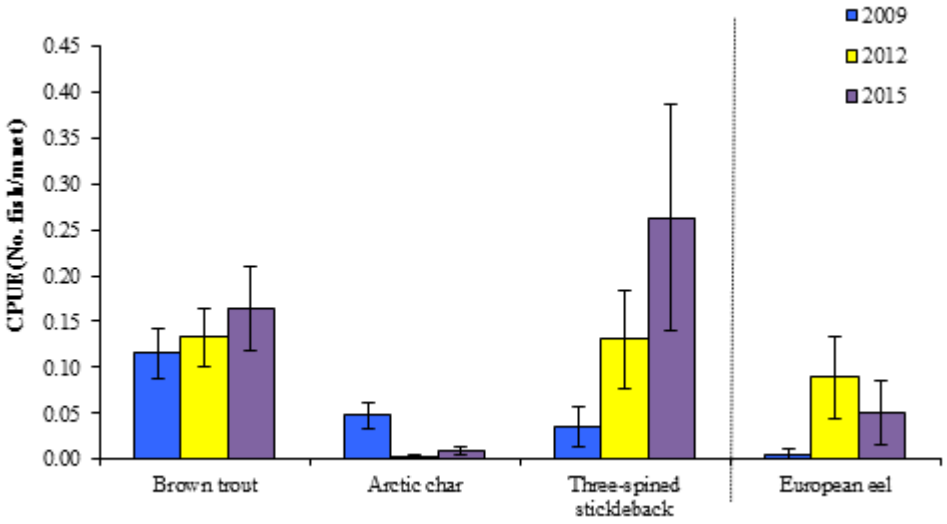

Fig. 1.2. Mean (±S.E.) CPUE for all fish species captured in Kindrum Lough (Eel CPUE based on fyke nets only), 2009, 2012 and 2015

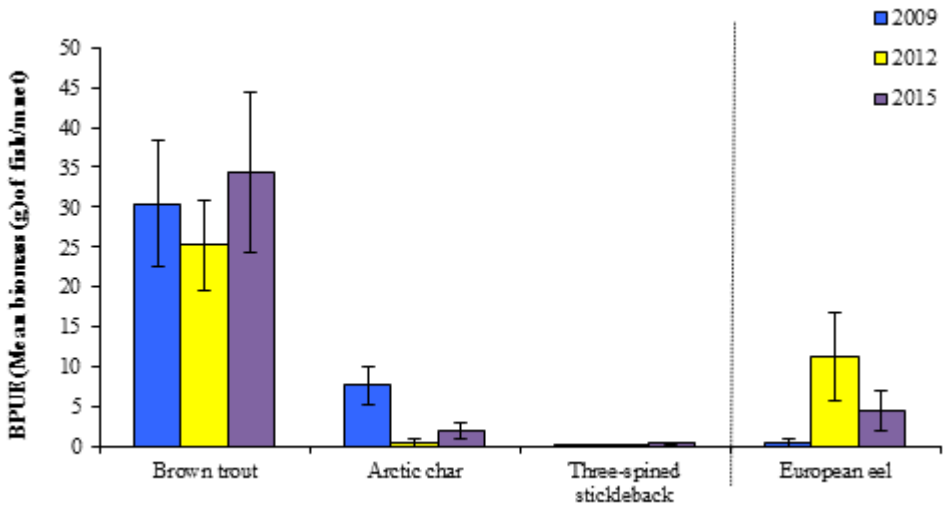

Fig. 1.3. Mean (±S.E.) BPUE for all fish species captured in Kindrum Lough (Eel BPUE based on fyke nets only), 2009, 2012 and 2015

1.3.3 Length frequency distributions and growth

Brown trout:

Brown trout captured during the 2015 survey ranged in length from 12.8cm to 37.5cm (mean = 24.7cm) (Fig. 1.4). Five age classes were present, ranging from 1+ to 5+, with a mean L1 of 7.1cm (Table 1.3). The dominant age class was 3+ (Fig. 1.4). Mean brown trout L4 in 2015 was 26.9cm indicating a slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.3). Brown trout captured during the 2009 and 2012 surveys had similar length and age ranges, with some larger and older fish recorded in the 2009 and 2012 surveys (Fig.1.4).

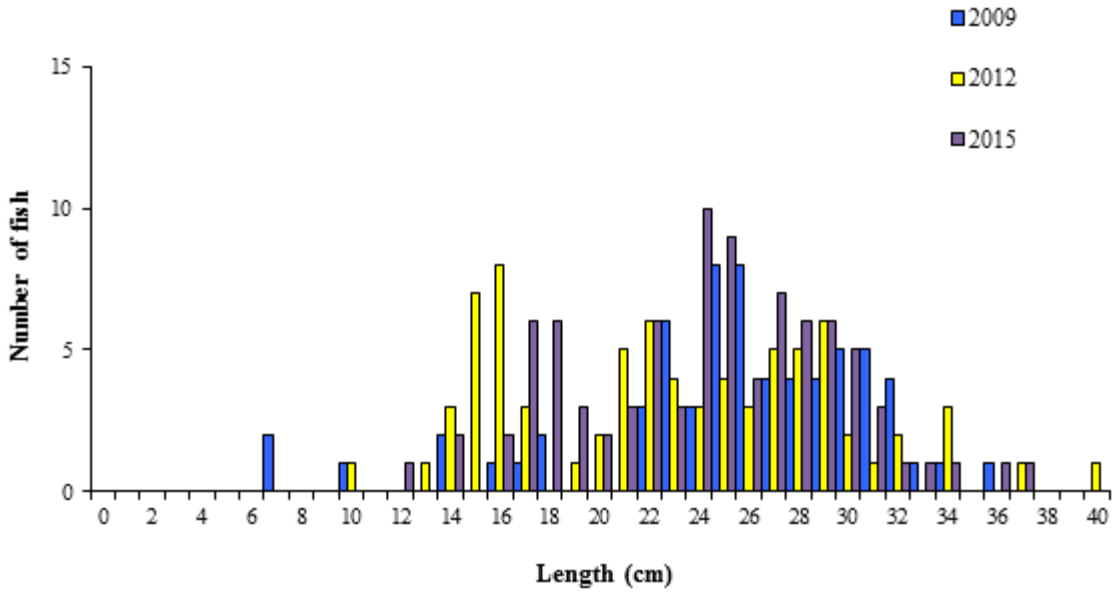

Fig. 1.4. Length frequency of brown trout captured on Kindrum Lough, 2015

Table 1.3. Mean (±S.E.) brown trout length (cm) at age for Kindrum Lough, July 2015

	L_1	L_2	L_3	L_4	L_5	Growth Category
Mean (± S.E.)	7.1 (0.1)	14.5 (0.2)	21.2 (0.3)	26.9 (0.6)	31.0 (0.8)	Slow
N	51	47	36	15	5	
Range	5.2-8.8	10.5-17.5	16.1-23.5	23.4-31.5	29.8-34.3	

Arctic char:

Arctic char captured during the 2015 survey ranged in length from 22.0cm to 26.6cm (mean = 24.5cm) (Fig.1.5) with three age classes present, ranging from 2+ to 4+ (Table 1.4). Arctic char captured during the 2009 and 2015 surveys had similar lengths to each other, with only one char recorded in the 2012 survey. Age ranges reflected the length range, with larger age ranges seen in the 2009 and 2015 surveys (Fig.1.5).

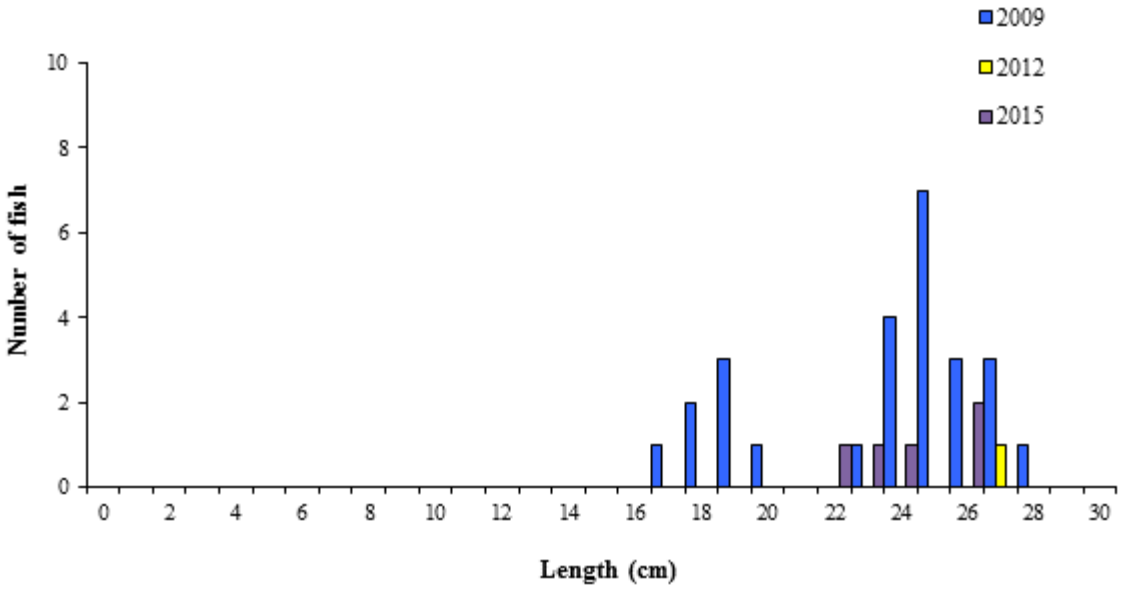

Fig. 1.5. Length frequency of Arctic char captured on Kindrum Lough, 2015

Other fish:

Eels captured during the 2015 survey ranged in length from 30.0cm to 48.5cm. Three-spined stickleback ranged in length from 3.8cm to 5.2cm.

1.3.4 Stomach and diet analysis

Feeding studies provide a good indication of the availability of food items and the angling methods that are likely to be successful. However, the value of stomach content analysis is limited unless undertaken over a long period as diet may change on a daily basis depending on the availability of food items. Adult trout usually feed principally on crustaceans (*Asellus* sp. and *Gammarus* sp.), insects (principally chironomid larvae and pupae) and molluscs (snails) (Kennedy and Fitzmaurice, 1971, O'Grady, 1981).

The food items recorded in a subsample of trout captured during the survey were dominated by zooplankton (Fig 1.6).

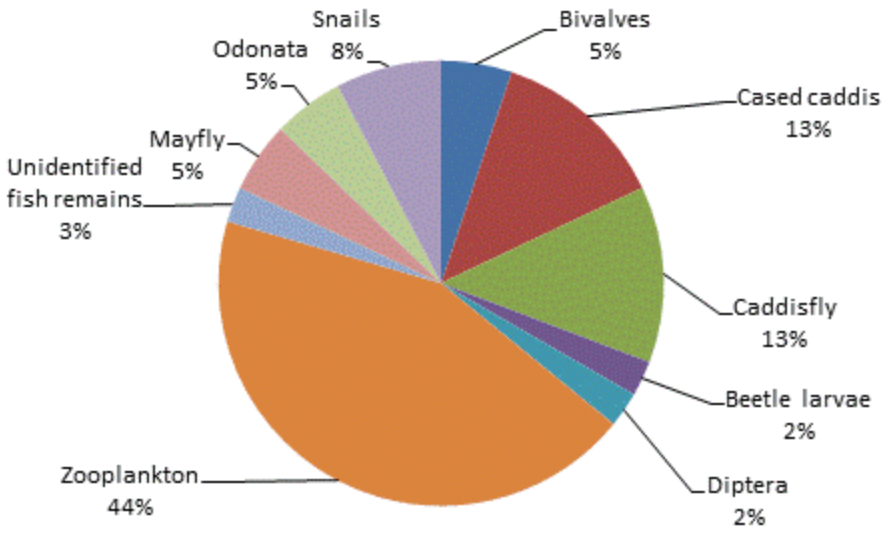

Fig. 1.6. Diet of brown trout captured on Kindrum Lough 2015 (% occurrence) n=29

1.4 Summary and ecological status

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE) captured in the survey gill nets during the 2015 survey.

Although the mean brown trout CPUE increased slightly over the three sampling occasions, these differences were not statistically significant. There were also no significant differences in mean BPUE across the three sampling years. Brown trout ranged in age from 1+ to 5+, indicating reproductive success in five of the previous six years. The dominant age class was 3+. 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 and BPUE was significantly lower in 2012 and 2015 compared to 2009. Arctic char ranged in age from 2+ to 4+, with no 0+ or 1+ fish being captured.

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.*, 2012b). Using the FIL2 classification tool, Kindrum Lough has been assigned an ecological status of Moderate for 2006, 2009, 2012 and 2015 based on the fish populations present.

In the 2010 to 2012 surveillance monitoring reporting period, the EPA assigned Kindrum Lough an overall draft ecological status of Moderate, based on all monitored physico-chemical and biological elements, including fish. This status classification will be revised during 2016.

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IFI Dublin,
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland

www.fisheriesireland.ie
dublin@fisheriesireland.ie
+353 1 8842 600