

# National Research Survey Programme

*Lakes 2015*

**Lough Cullin**





Inland Fisheries Ireland

National Research Survey Programme

**Fish Stock Survey of Lough Cullin,  
August 2015**

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



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## 1.1 Introduction

Lough Cullin is a large, shallow lake situated to the west of Foxford, which is connected to Lough Conn by a narrow inlet at Pontoon, Co. Mayo (Plate 1.1, Fig. 1.1). The outflow from the lake discharges directly into the River Moy south-west of Foxford (NPWS, 2004). Lough Cullin has a surface area of 1019.3ha with a maximum depth of approximately 3m (O' Reilly 2007). The underlying geology of the lake is mainly granite with some areas of limestone present in the southern region of the catchment (NPWS, 2004). 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 CaCO<sub>3</sub>).

Lough Cullin is located within the River Moy Special Area of Conservation (NPWS, 2005). The underlying geology of the majority of the site is Carboniferous limestone, with areas of Carboniferous sandstone, Dalradian quartzites and schists also present. Some of the tributaries at the east and south of Lough Conn, and all in Lough Cullin are underlain by granite. The site has been selected as a candidate SAC for containing alluvial wet woodlands, raised bog, old oak woodlands (present on the shores of Lough Cullin), degraded raised bog and Rhynchosporion depressions (*Rhynchospora alba*), all priority habitats on Annex I of the E.U. Habitats Directive. This SAC has also been selected due to the presence of the following species, listed on Annex II of the same Directive – Atlantic salmon, otter, sea and brook lamprey and white-clawed crayfish (NPWS, 2005). Lough Cullin is a moderately hard water lake with relatively low colour and good water clarity. The phytoplankton in the lake is dominated by diatoms and blue-green algae (NPWS, 2005). Lough Cullin also supports important concentrations of wintering waterfowl and is designated as a Special Protection Area, as one of the few breeding sites for Common Scoter in Ireland (NPWS, 2005).

Lough Cullin was once regarded as one of Ireland's premier brown trout fisheries, but was often considered to be the 'poor relation' of Lough Conn. Historically, in angling terms, Lough Cullin was noted for supporting a large population of relatively small (<0.5kg) brown trout (O' Grady and Delanty, 2001). Today brown trout averaging 0.3kg to 0.45kg are often caught, with some weighing up to 1.8kg (O' Reilly 2007). The lake was also regarded as a very important salmon fishery and receives a run of salmon during the spring and summer months (NPWS, 2004; O' Reilly 2007). In fact, all the salmon, of which there can be many, destined for Lough Conn and its inflowing rivers must pass through Lough Cullin.



Lough Cullin was previously surveyed in 1994, 1998 and 2001 as part of a fish stock assessment by IFI's research section using seven-panel benthic braided survey gill nets (O' Grady and Delanty, 2001). These surveys revealed that the brown trout population declined dramatically between 1995 and 2001. Eutrophication problems have been evident in the lake in recent years. There has been a population of rudd in the lake since the 1960s; however roach, a highly prolific non-native species, became established in the lake in the 1990s (O' Grady and Delanty, 2001).

The lake was also previously surveyed by IFI for the WFD fish monitoring programme in 2009 and 2012 (Kelly *et al.*, 2010 and 2013). During both of these surveys roach were found to be the dominant species present in the lake. Perch, brown trout, tench, pike and eels were also captured during the surveys.

The survey had two objectives:

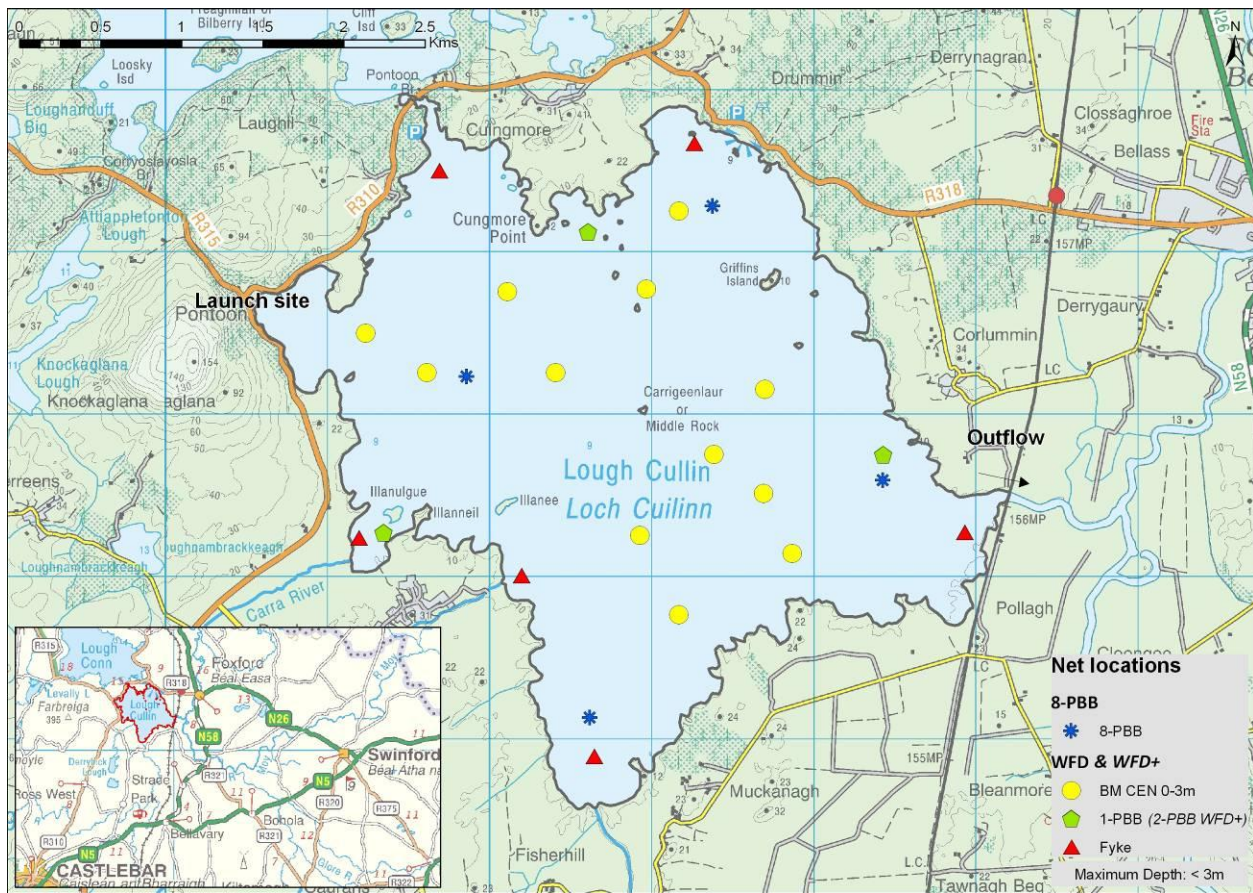
1. Assess the status of the fish stocks in the lake as part of IFI's WFD surveillance monitoring programme and also the national brown trout and coarse fish research programmes.
2. Undertake a method intercalibration exercise using the existing WFD multi method approach (benthic and floating multi-mesh monofilament survey gill nets, fyke nets, but adding supplementary two panel braided survey gill nets instead of one panel braided survey gill nets (WFD+)) and the method established by IFI in the late 1970s to assess the status of brown trout in lakes (seven panel braided survey gill nets), but adding an additional 88.90mm panel to these latter nets (8-PBB).

This report summarises the results of the 2015 fish stock survey (e.g. species composition, abundance and age structure) on Lough Cullin using both methods above, while the method intercalibration results will be dealt with in a separate report.



**Plate 1.1. Lough Cullin**





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



## **1.2 Methods**

### ***1.2.2 Netting methods***

Lough Cullin was surveyed over three nights between the 10<sup>th</sup> and the 13<sup>th</sup> of August 2015. A total of 6 Dutch fyke nets (Fyke) and 12 benthic monofilament multi-mesh (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets (BM CEN) were deployed in the lake. The netting effort was supplemented using 3 two-panel benthic braided (63.5mm and 88.9mm mesh knot to knot) survey gill nets (2-PBB).

Four eight-panel benthic braided survey gill nets (8-PBB) were also deployed during the survey. These survey gill nets are composed of eight 27.5m long panels each a different mesh size, tied together randomly. The panels ranged from 2" (50.8mm stretched mesh, 25.4mm mesh knot to knot) to 5" (127mm stretched mesh, 63.5mm mesh knot to knot) in half inch (12.7mm) increments (O'Grady, 1981) with the addition of a 7" (177.8mm stretched mesh, 88.9mm mesh knot to knot) panel.

The nets were deployed in the same locations as randomly chosen in the previous surveys. Site locations for additional nets (WFD+) were chosen randomly within fixed depth zones. 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 also randomised.

All fish apart from perch were measured and weighed on site and scales were removed from all brown trout, roach, pike and tench. 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 six fish species were recorded on Lough Cullin in August 2015, with 640 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Roach was the most abundant fish species recorded, followed by perch, brown trout, eels, pike and tench (Table 1.1). During the previous WFD surveys in 2009 and 2012 the same species composition was recorded with the exception of three-spined stickleback, which were present during the 2012 survey but were not captured in 2009 or 2015 and pike, which were present during the 2009 and 2015 surveys but were not captured in 2012 (Kelly *et al.*, 2010 and 2013). The IFI surveys conducted in 1994, 1998 and 2001 captured salmon, sea trout, rudd and roach x rudd hybrids in addition to the above species (O' Grady and Delanty, 2001).

**Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Cullin, August 2015**

Scientific name	Common name	Number of fish captured				
		8-PBB	2-PBB	BM CEN	Fyke	Total
<i>Rutilus rutilus</i>	Roach	251	0	277	9	537
<i>Perca fluviatilis</i>	Perch	7	0	35	0	42
<i>Salmo trutta</i>	Brown trout	8	0	18	0	26
<i>Esox lucius</i>	Pike	6	0	0	2	8
<i>Tinca tinca</i>	Tench	0	0	0	1	1
<i>Anguilla anguilla</i>	European eel	0	0	0	26	26

### 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 are summarised in Table 1.2.

Roach was the dominant fish species in terms of abundance and biomass (Table 1.2).



**Table 1.2. Mean (S.E.) CPUE and BPUE (per metre of net) for all fish species captured on Lough Cullin, 8-PBB, WFD and WFD+**

Scientific name	Common name	8-PBB	WFD+ **
<b>Mean CPUE (<math>\pm</math> S.E.)</b>			
<i>Rutilus rutilus</i>	Roach	0.285 (0.096)	0.447 (0.101)
<i>Perca fluviatilis</i>	Perch	0.008 (0.005)	0.056 (0.041)
<i>Salmo trutta</i>	Brown trout	0.009 (0.003)	0.029 (0.011)
<i>Exos lucius</i>	Pike	0.007 (0.002)	0.002 (0.002)
<i>Tinca tinca</i>	Tench	-	0.001 (0.001)
<i>Anguilla anguilla</i>	European eel	-	0.072 (0.023)*
<b>Mean BPUE (<math>\pm</math> S.E.)</b>			
<i>Rutilus rutilus</i>	Roach	-	44.846 (12.708)
<i>Perca fluviatilis</i>	Perch	-	5.617 (4.830)
<i>Salmo trutta</i>	Brown trout	-	7.630 (2.777)
<i>Exos lucius</i>	Pike	-	0.027 (0.027)
<i>Tinca tinca</i>	Tench	-	0.024 (0.024)
<i>Anguilla anguilla</i>	European eel	-	10.535 (3.039)*

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

\*\*CPUE and BPUE data above for all fish species except eels are not comparable to earlier surveys as an extra panel was added to the supplementary nets (now 2-PBB) to provide additional information on large coarse fish.

### 1.3.3 Length frequency distributions and growth

#### Roach

Roach captured during the 2015 survey ranged in length from 6.5cm to 30.0cm (mean = 18.7cm) (Fig.1.2) with eleven age classes present, ranging from 1+ to 11+ with a mean L1 of 2.8cm (Table 1.3). The dominant age class was 6+ (Fig.1.2).

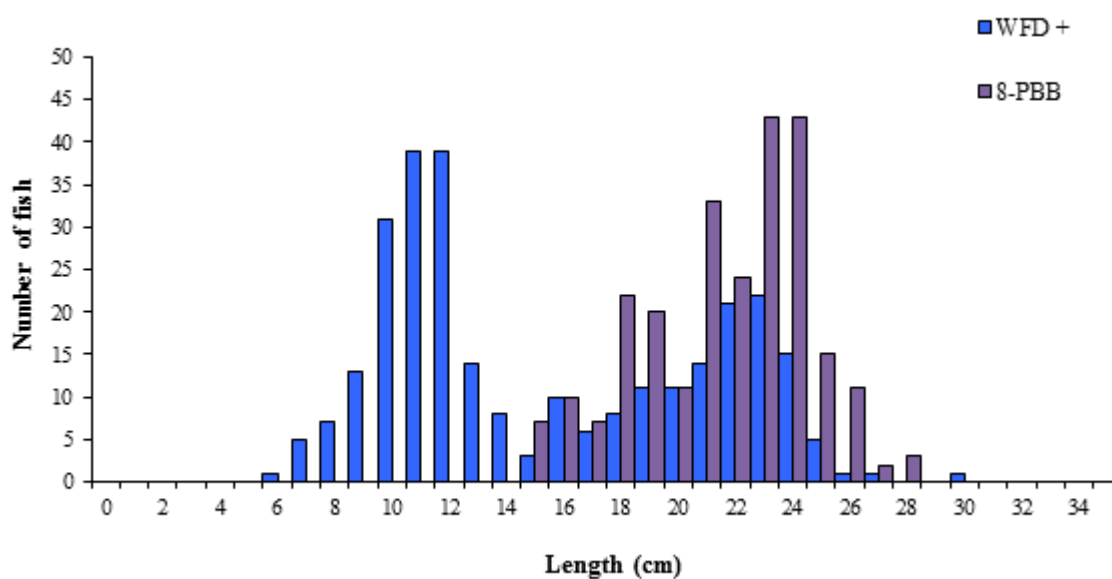


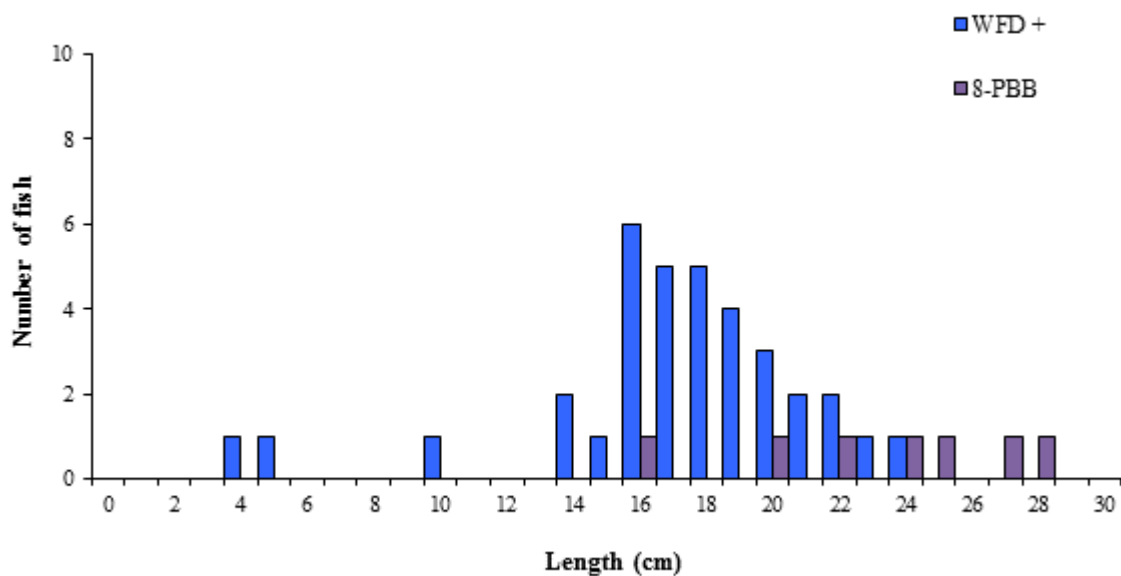
Fig. 1.2. Length frequency of roach captured on Lough Cullin, 2015

Table 1.3. Mean ( $\pm$ S.E.) roach length (cm) at age for Lough Cullin, August 2015

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	L <sub>6</sub>	L <sub>7</sub>	L <sub>8</sub>	L <sub>9</sub>	L <sub>10</sub>	L <sub>11</sub>
Mean ( $\pm$ S.E.)	2.8 (0.1)	6.5 (0.2)	9.8 (0.3)	13.1 (0.3)	16.1 (0.3)	18.6 (0.3)	20.8 (0.4)	23.0 (0.4)	24.1 (0.6)	26.0 (0.9)	27.2 (0.8)
N	62	58	41	37	33	28	22	15	8	3	2
Range	1.7- 3.9	4.2- 9.5	8.1- 15.1	10.8- 17.2	12.9- 21.3	14.7- 24.7	17.4- 26.5	19.7- 25.4	21.8- 26.8	24.1- 27.1	26.4- 28.1

## Perch

Perch captured during the 2015 survey ranged in length from 4.9cm to 28.1cm (mean = 18.6cm) (Fig.1.3) with six age classes present, ranging from 0+ to 6+ with a mean L1 of 6.5cm (Table 1.4).



**Fig. 1.3. Length frequency of perch captured on Lough Cullin, 2015**

**Table 1.4. Mean ( $\pm$ SE) perch length (cm) at age for Lough Cullin, August 2015**

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	L <sub>6</sub>
Mean ( $\pm$ S.E.)	6.5 (0.2)	12.8 (0.4)	16.8 (0.7)	17.4 (0.9)	20.4 (1.5)	22.6
N	25	24	11	3	3	1
Range	4.8-10.1	9.8-18.7	12.8-20.2	15.7-18.4	17.6-22.8	22.6-22.6

## Brown trout

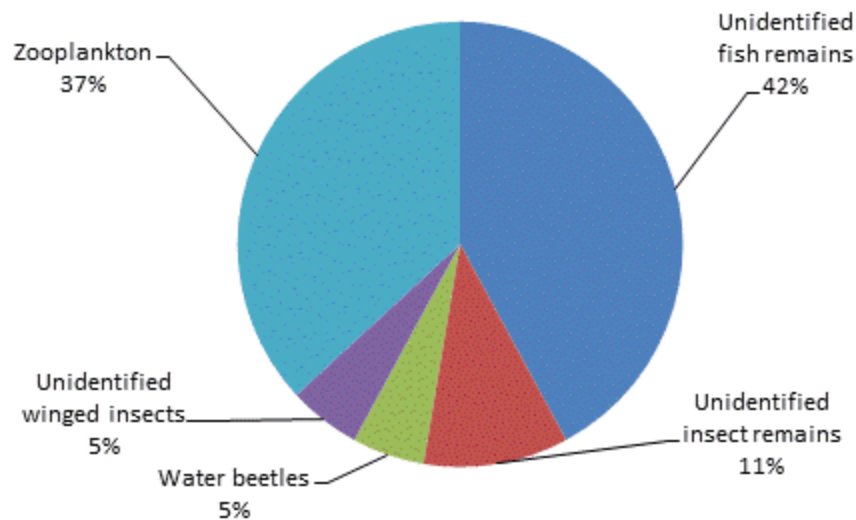


### 1.3.4 Stomach and diet analysis

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.

#### Perch

Perch initially start to feed on pelagic zooplankton. Once they reach an intermediate size they start feeding on benthic resources eventually moving on to feed on fish once they are large enough (Hjelm *et al.*, 2000). The food items recorded in perch stomachs during the survey were dominated by unidentified fish remains and zooplankton (Fig 1.5).



**Fig. 1.5. Diet of perch captured on Lough Cullin 2015 (% occurrence) n=18**



#### **1.4 Summary and ecological status**

Roach was the dominant species in terms of abundance (CPUE) captured in the survey gill nets during the 2015 survey.

Roach ranged in length from 6.5cm to 30.0cm with eleven age classes present, ranging from 1+ to 11+ indicating reproductive success in eleven of the previous twelve years. The dominant age class was 5+.

Perch ranged in length from 4.9cm to 28.1cm with six age classes present, ranging from 0+ to 6+ indicating reproductive success in each of the previous seven years.

Brown trout ranged in length from 17.9cm to 53.6cm and ranged in age from 1+ to 5+ indicating reproductive success in five of the previous six years. Length at age analyses revealed that brown trout in the lake exhibit a fast rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

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.

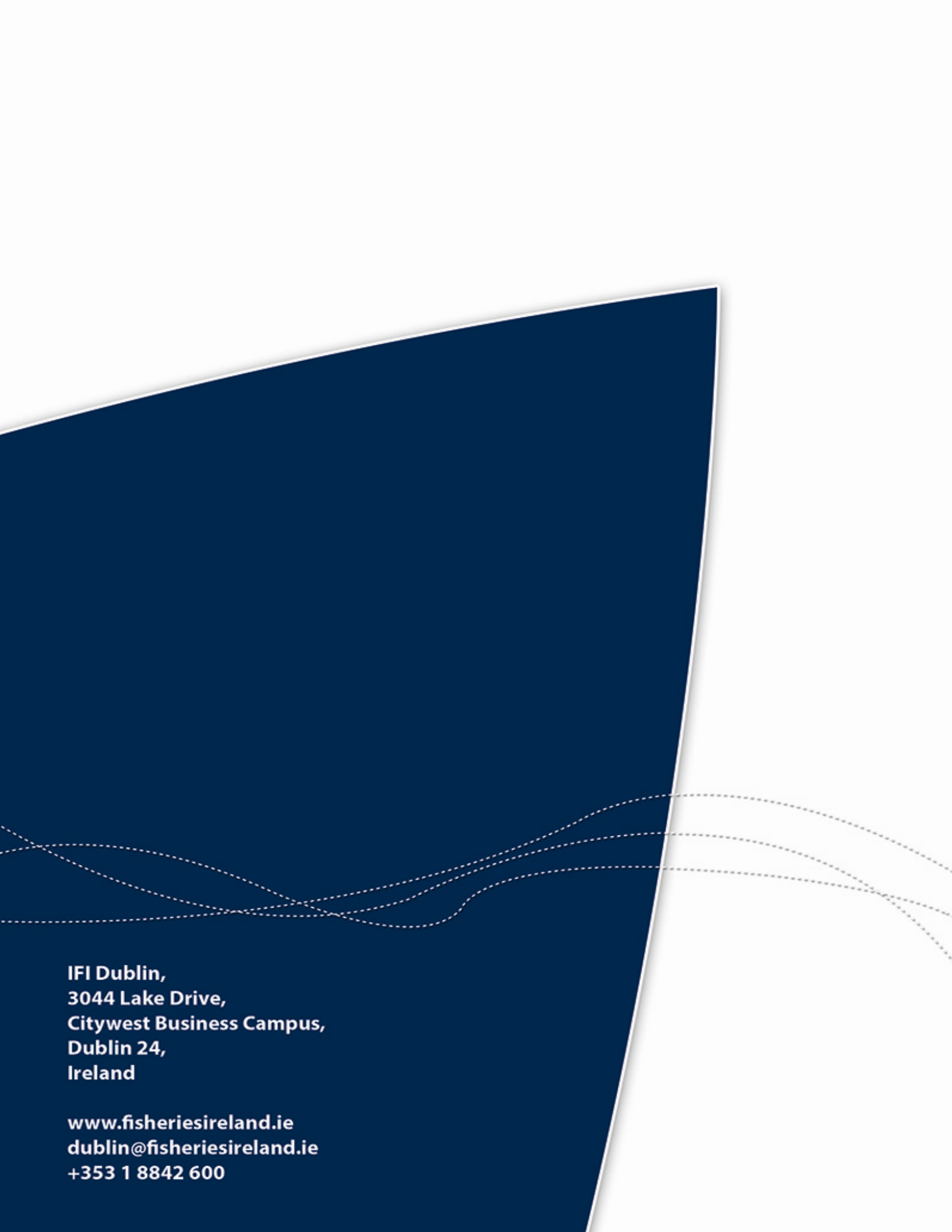
A multimetric fish ecological classification tool (Fish in Lakes – ‘FIL’) was developed for the island of Ireland (Ecoregion 17) using IFI and Agri-Food and Biosciences Institute Northern Ireland (AFBNI) data generated during the NSSHARE Fish in Lakes project (Kelly *et al.*, 2008). This tool was further 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, Lough Cullin has been assigned an ecological status of Moderate for 2015 and Poor for 2009 and 2012 based on the fish populations present.

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



## 1.5 References

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