National Research Survey Programme

Lakes 2015

Lough Mask

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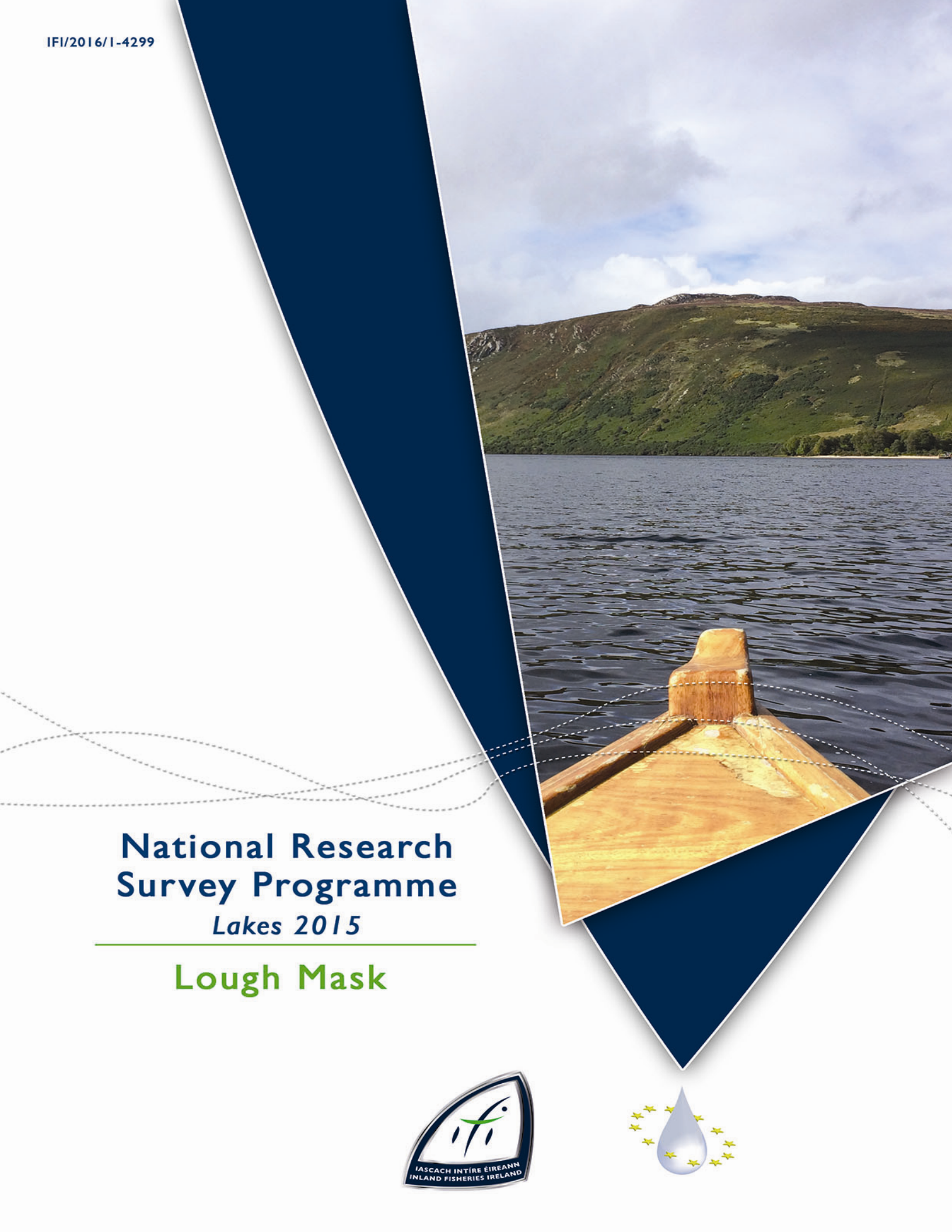
Inland Fisheries Ireland

National Research Survey Programme

**Fish Stock Survey of Lough Mask,
June 2015**

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1.1 Introduction

Lough Mask is situated north of Lough Corrib, adjacent to the town of Ballinrobe, Co. Mayo (Plate 1.1, Fig. 1.1). It is the sixth largest lake in Ireland with a surface area of approximately 8,218ha. The length of the lake from north to south is approximately 16km and the width is approximately 6.4km at its widest point (O' Reilly, 2007). The main rivers flowing into Lough Mask are the Cloon, Robe, Owenbrin, Finny, Glensaul, Glentraig and the Keel River, which is the out flowing river from Lough Carra. Lough Mask is linked to Lough Corrib by the Cong Canal.

Lough Mask is generally a shallow lake with a mean depth of 5m; however it attains a maximum depth of 57m along a long narrow trench on the western shore of the lake (NPWS, 2004). The lake is categorised as typology class 12 (as designated by the EPA for the purposes of the WFD), i.e. deep (>4m), greater than 50ha and high alkalinity (>100mg/l $CaCO_3$). The underlying geology of Lough Mask is Carboniferous limestone, with areas of shale and sandstone, and it is an excellent example of a lowland oligotrophic lake (NPWS, 2004).

Lough Mask, Carra and Cloon make up the Lough Carra/Lough Mask Special Area of Conservation (SAC) complex. Six habitats listed on Annex I of the EU Habitats Directive are found in this site, including two priority habitats - limestone pavement and Cladium fen (NPWS, 2004). This is also an important SAC for otter, a species that is listed on Annex II of the E.U. Habitats Directive (NPWS, 2004). The zebra mussel, an invasive species in Ireland, was confirmed to be present in Lough Mask in 2008.

Lough Mask is noted for its populations of brown trout and ferox trout, with the average size of brown trout ranging from 0.6kg to 1.4kg. The larger ferox trout can reach up to 9kg in weight (O'Reilly, 2007). The lake was previously surveyed in 1996 as part of a fish stock assessment by IFI's research section using seven-panel benthic braided survey gill nets. Five fish species were recorded; brown trout, Arctic char, pike, perch and a single roach (O'Grady *et al*., 1996).

The lake was also previously surveyed by IFI using an additional sampling method designed specifically for the WFD fish monitoring programme in 2009 and 2012 (Kelly *et al*., 2010 and 2013). During both of these WFD surveys, perch were found to be the dominant species present in the lake. Roach, brown trout, Arctic char, bream, pike and eels were also captured during both surveys.

The survey had two objectives:

1. Assess the status of the fish stocks in the lake as part of IFIs 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).

An additional experimental survey using hydroacoustic and pelagic gillnetting techniques was carried out on Lough Mask over ten nights from the 25th of May to the 12th of June 2015. This survey was carried out as part of a Ph.D. research project which aims to incorporate hydroacoustic technology into the existing standard sampling protocols used to assign ecological and conservation status for the Water Framework and Habitats Directive for conservation and endangered fish species. The experimental survey concentrated on the deeper sections of the lake (depth >12m) and covered *circa* 125km of hydroacoustic transects. A separate report will also be available in due course.

This report summarises the results of the 2015 fish stock survey (e.g. species composition, abundance and age structure) carried out on Lough Mask using both methods above, while the method intercalibration results will be dealt with in a separate report.
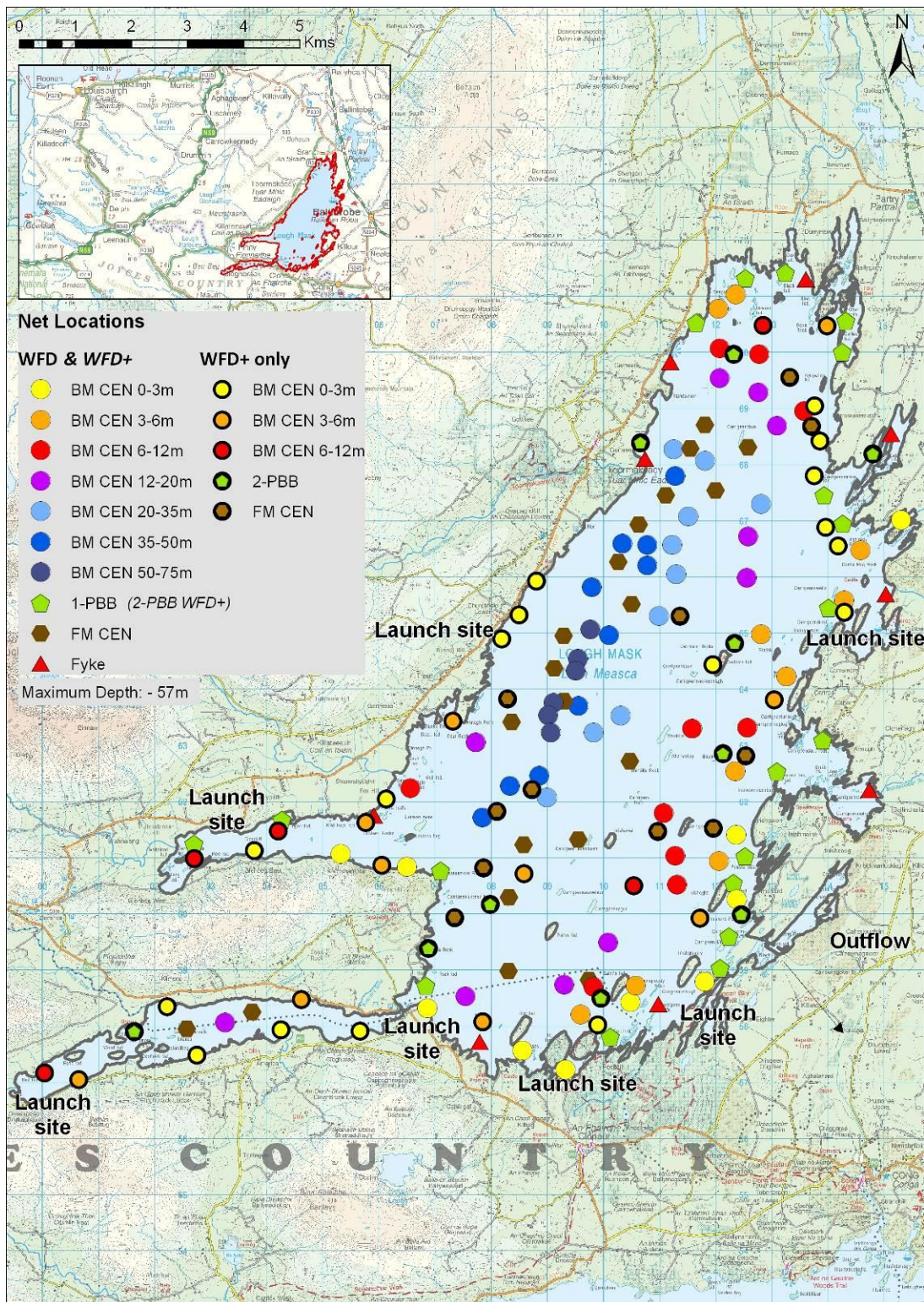
Plate 1.1. Lough Mask

Fig. 1.1. Location map of Lough Mask showing locations and depths of each net (outflow is indicated on map) (WFD+ survey nets were not set in previous surveys).

1.2 Methods

Lough Mask was surveyed over eight nights between the 8th and the 18th of June 2015. A total of nine Dutch fyke nets (Fyke), 98 benthic monofilament multi-mesh (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets (BM CEN) and 30 surface floating monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets were deployed in the lake. The netting effort was supplemented using 30 two-panel benthic braided (63.5mm and 88.9mm mesh knot to knot) survey gill nets (2-PBB).

The nets were deployed in the same locations as randomly chosen in the previous surveys. Site locations for additional survey gill nets (WFD+) were chosen randomly within fixed depth zones (Fig. 1.1). 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, sea trout, salmon, roach, bream and pike. 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 eight fish species and one type of hybrid were recorded on Lough Mask in June 2015, with 1001 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Perch was the most abundant fish species recorded, followed by roach, brown trout, bream, Arctic char, eels, pike, roach x bream hybrids and stone loach (Table 1.1). During the previous WFD survey in 2009 the same species composition was recorded with the exception of roach x bream hybrids, which were present during the 2012 WFD survey but were not captured in 2009 and stone loach which were only recorded in the 2015 survey (Kelly *et al*., 2010 and 2013).

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

Scientific name	Common name	Number of fish captured				
		2-PBB	BM CEN	FM CEN	Fyke	Total
Perca fluviatilis	Perch	1	556	0	15	572
Rutlius Rutilus	Roach	1	298	2	1	302
Salmo trutta	Brown trout	4	49	9	2	64
Abramis brama	Bream	34	2	0	0	36
Salvelinus alpinus	Arctic char	0	9	1	0	10
Esox lucius	Pike	0	4	0	2	6
Rutlius Rutilus x Abramis brama	Roach x bream hybrid	0	2	0	0	2
Barbatula barbatula	Stone loach	0	1	0	0	1
Anguilla anguilla	European eel	0	1	0	7	8

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.

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

Table 1.2. Mean (S.E.) CPUE and BPUE (per metre of net) for all fish species captured on Lough Mask, 2015

Scientific name	Common name	Mean CPUE (± S.E.)**
Perca fluviatilis	Perch	0.113 (0.017)
Rutlius Rutilus	Roach	0.060 (0.010)
Salmo trutta	Brown trout	0.012 (0.002)
Abramis brama	Bream	0.004 (0.003)
Salvelinus alpinus	Arctic char	0.002 (0.001)
Esox lucius	Pike	0.001 (0.000)
Rutlius Rutilus x Abramis brama	Roach x bream hybrid	0.0004 (0.000)
Barbatula barbatula	Stone loach	0.0002 (0.000)
Anguilla anguilla	European eel	0.013 (0.013)*
		Mean BPUE (± S.E.)*
Perca fluviatilis	Perch	5.655 (0.858)
Rutlius Rutilus	Roach	11.689 (2.148)
Salmo trutta	Brown trout	5.012 (0.884)
Abramis brama	Bream	6.469 (4.552)
Salvelinus alpinus	Arctic char	0.131 (0.060)
Esox lucius	Pike	1.151 (0.889)
Rutlius Rutilus x Abramis brama	Roach x bream hybrid	0.269 (0.191)
Barbatula barbatula	Stone loach	0.001 (0.001)
Anguilla anguilla	European eel	5.007 (3.046)*

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 2-PBB to provide additional information on large coarse fish.

1.3.3 Length frequency distributions and growth

Brown trout

Brown trout captured during the 2015 survey ranged in length from 7.1cm to 51.4cm (mean = 28.0cm) (Fig. 1.2). Six age classes were present, ranging from 0+ to 5+, with a mean L1 of 6.6cm (Table 1.3). The dominant age class was 1+ (Fig. 1.2). Mean brown trout L4 in 2015 was 23.1cm indicating a very slow rate of growth for brown trout in this lake according to the classification scheme of Kennedy and Fitzmaurice (1971) (Table 1.3).
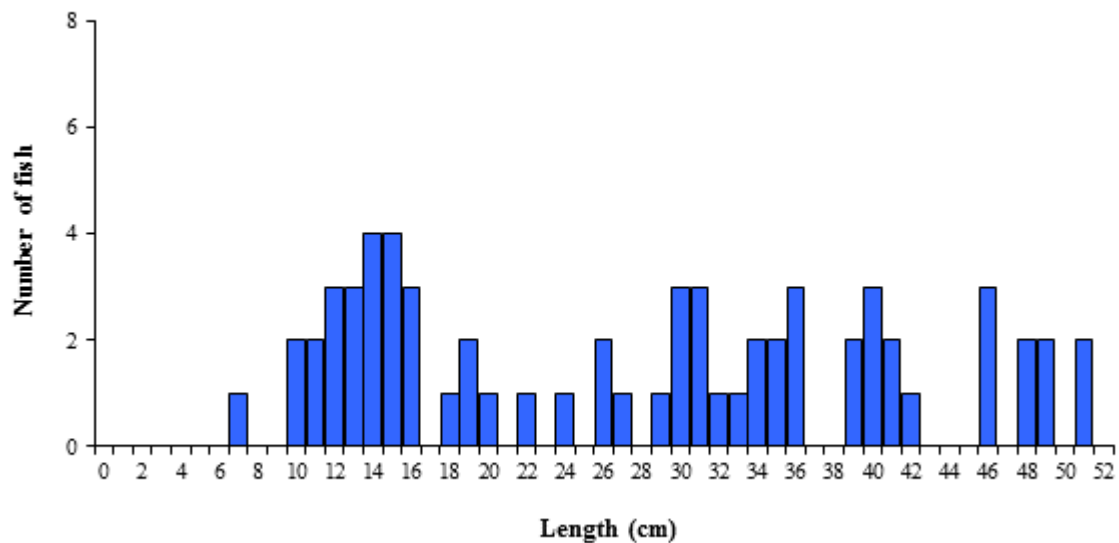

Fig. 1.2. Length frequency of brown trout captured on Lough Mask, 2015

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

	L_1	L_2	L_3	L_4	L_5	Growth Category
Mean (± S.E.)	6.6 (0.4)	12.9 (1.1)	21.1 (1.5)	23.1 (0.6)	25.3	Very slow
N	26	11	7	3	1	
Range	4.0-11.6	8.2-20.8	16.4-26.9	22.2-24.2	25.3-25.3	

Arctic char

Arctic char captured during the 2015 survey ranged in length from 10.0cm to 25.7cm (mean = 15.6cm) (Fig.1.3) with four age classes present, ranging from 1+ to 5+. The dominant age class was 1+ (Fig 1.3).
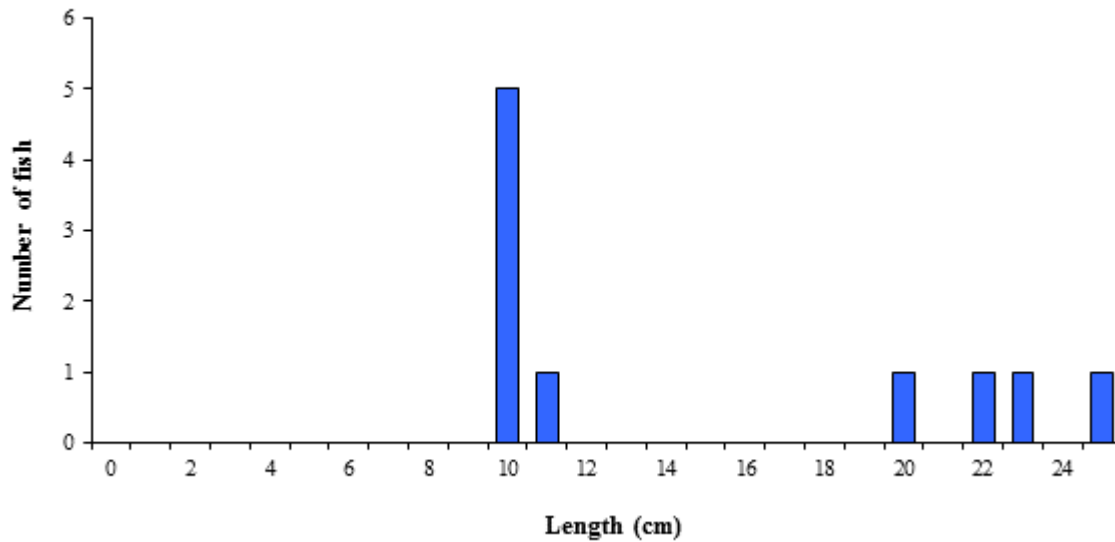

Fig. 1.3. Length frequency of Arctic char captured on Lough Mask, 2015

Perch

Perch captured during the 2015 survey ranged in length from 5.8cm to 37.2cm (mean = 13.6cm) (Fig.1.4) with ten age classes present, ranging from 1+ to 14+ with a mean L1 of 6.5cm (Table 1.4). The dominant age class was 2+ (Fig.1.4).
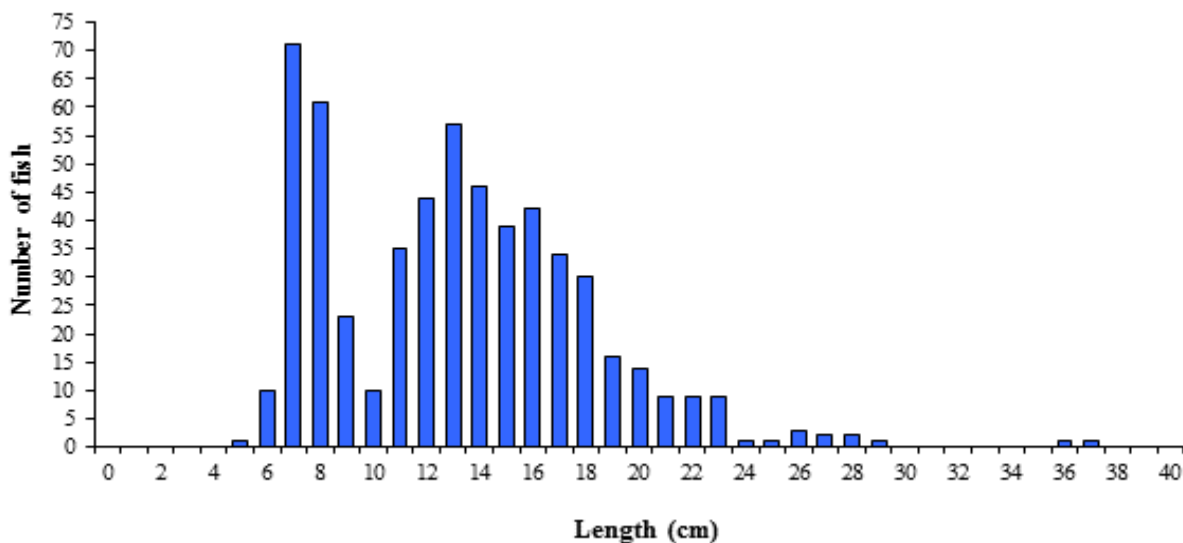

Fig. 1.4. Length frequency of perch captured on Lough Mask, 2015

Table 1.4. Mean (±SE) perch length (cm) at age for Lough Mask, June 2015

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}	L_{12}	L_{13}	L_{14}
Mean (± S.E.)	6.5 (0.1)	11.9 (0.2)	16.0 (0.4)	18.8 (0.5)	21.8 (0.6)	23.5 (0.8)	23.5 (1.2)	24.0 (1.4)	26.5 (1.5)	27.9 (2.0)	29.4 (3.6)	34.2	36.2	36.9
N	59	46	30	19	16	11	4	3	3	3	2	1	1	1
Range	4.7-9.7	9.3-15.5	12.9-19.8	15.3-24.3	17.5-27.6	19.4-28.7	20.2-26.0	21.1-25.4	23.5-28.6	24.2-31.3	25.8-33.0	34.2-34.2	36.2-36.2	36.9-36.9

Roach

Roach captured during the 2015 survey ranged in length from 5.3cm to 33.6cm (mean = 20.9cm) (Fig.1.5) with eleven age classes present, ranging from 1+ to 11+ with a mean L1 of 4.1cm (Table 1.5). The dominant age class was 3+ (Fig.1.5).
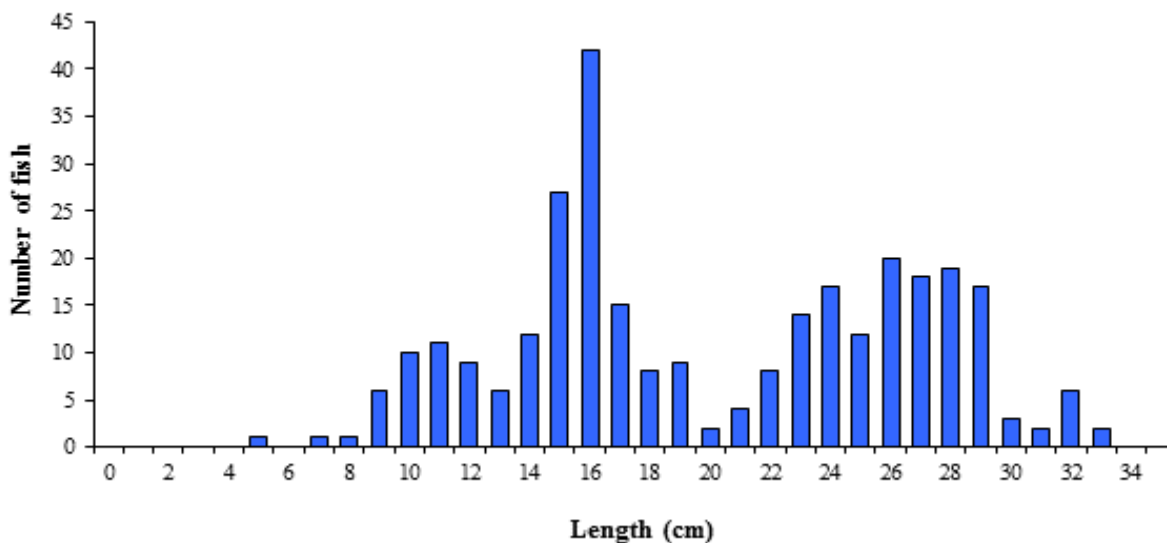

Fig. 1.5. Length frequency of roach captured on Lough Mask, 2015

Table 1.5. Mean (±S.E.) roach length (cm) at age for Lough Mask, June 2015

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}
Mean	4.1	8.9	13.6	17.8	21.8	24.3	26.7	28.8	29.9	30.7	31.8
(±S.E.)	(0.1)	(0.1)	(0.2)	(0.3)	(0.3)	(0.3)	(0.4)	(0.6)	(0.6)	(0.7)	
N	74	69	54	40	30	22	17	10	7	3	1
Range	3.1-	7.6-	10.6-	13.5-	17.0-	19.5-	23.8-	26.1-	28.7-	29.9-	31.8-
	5.2	10.4	16.9	21.6-	24.3	26.8	28.4	30.9	31.7	32.1	31.8

Other fish

Eels captured during the 2015 survey ranged in length from 43.4cm to 71.8cm. Bream ranged in length from 28.0cm to 46.8cm, pike ranged from 18.2cm to 85.5cm. Two roach x bream hybrids were captured and measured 31.5cm and 34.5cm and one stone loach was recorded at 8.2cm.

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.

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 a sub sample perch captured during the survey were dominated by *Gammarus* sp., zooplankton and *Asellus* sp. (Fig 1.6).
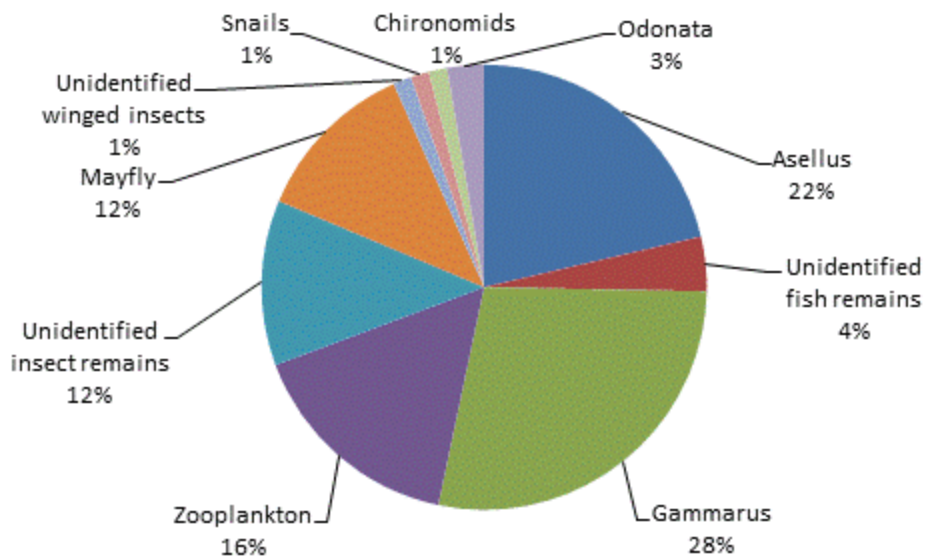

Fig. 1.6. Diet of perch captured on Lough Mask, June 2015 (% occurrence) n=55

Brown trout

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 sub sample of trout stomachs during the survey were dominated by *Asellus* sp. (Fig 1.7).
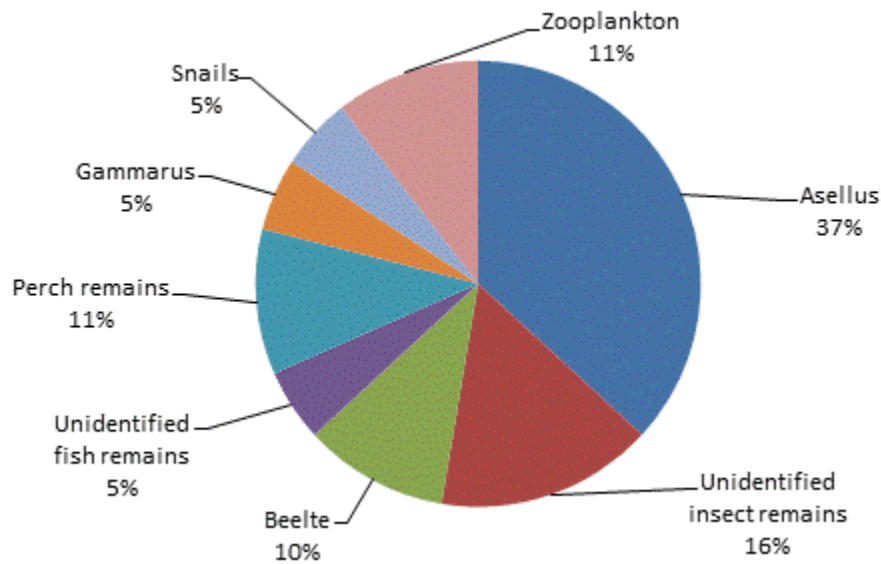
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Fig. 1.7. Diet of brown trout captured on Lough Mask, June 2015 (% occurrence) n=19

1.4 Summary and ecological status

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

Brown trout captured during the 2015 survey ranged in length from 7.1cm to 51.4cm and ranged in age from 0+ to 5+, indicating reproductive success in each of the previous six years. The dominant age class was 1+. Length at age analyses revealed that brown trout in the lake exhibit a very slow rate of growth according to the classification scheme of Kennedy and Fitzmaurice (1971).

Arctic char captured ranged in length from 10.0cm to 25.7cm (mean = 15.6cm) with four age classes present, ranging from 1+ to 5+. The dominant age class was 1+.

Perch ranged in length from 5.8cm to 37.2cm and ranged in age from 1+ to 14+, indicating reproductive success in ten of the previous fifteen years. The dominant age class was 2+.

Roach ranged in length from 5.3cm to 33.6cm ranging in age from 1+ to 11+ indicating reproductive success in eleven of the previous twelve years. The dominant age class was 3+.

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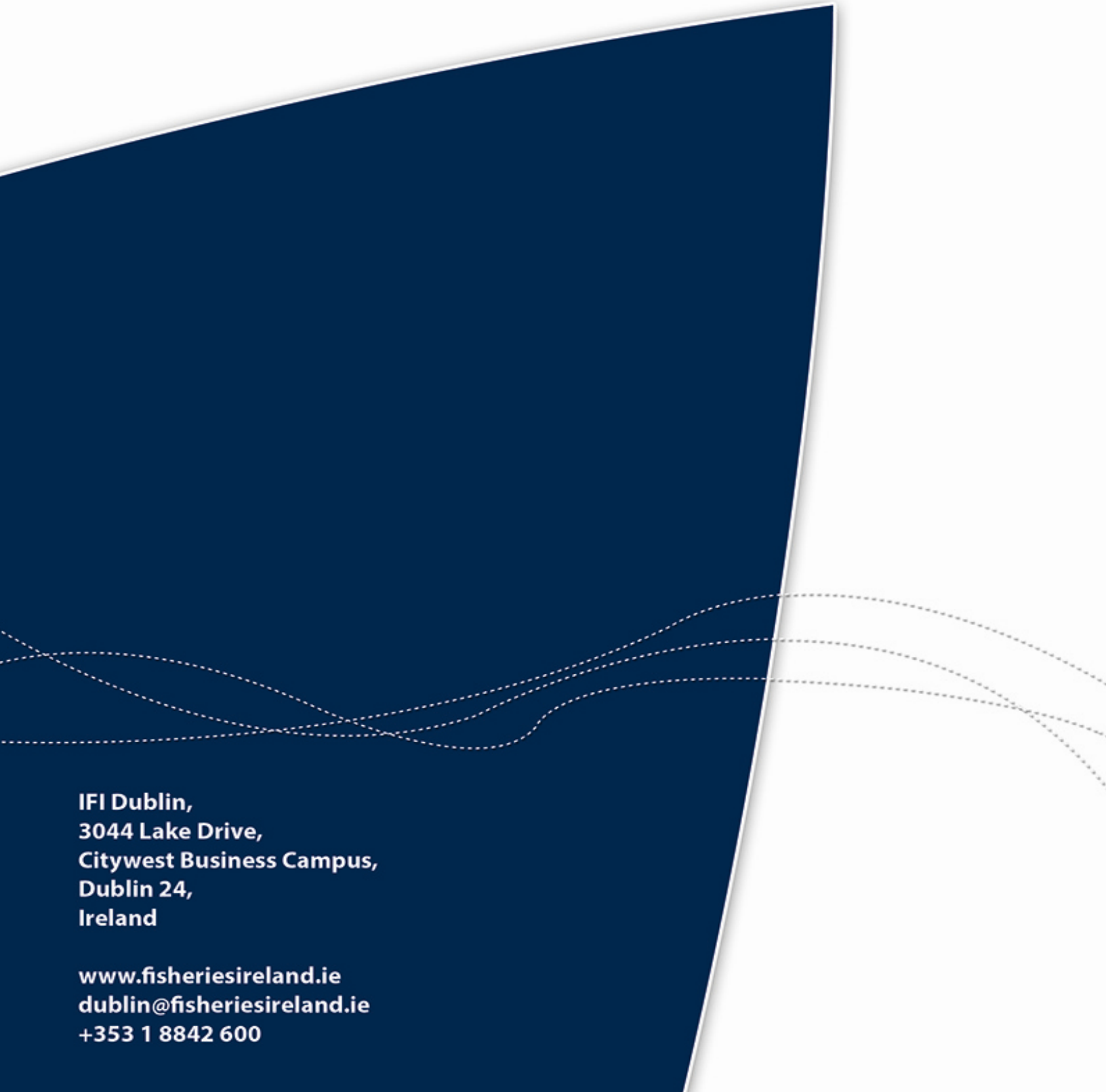
A multimetric fish ecological classification tool (Fish in Lakes – 'FIL') was developed for the island of Ireland (Ecoregion 17) using IFI and Agri-Food and Biosciences Institute Northern Ireland (AFBINI) data generated during the NSSHARE Fish in Lakes project (Kelly *et al.*, 2008). This tool was further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

In the 2010 to 2012 surveillance monitoring reporting period, the EPA assigned Lough Mask an overall draft ecological status of Good, 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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