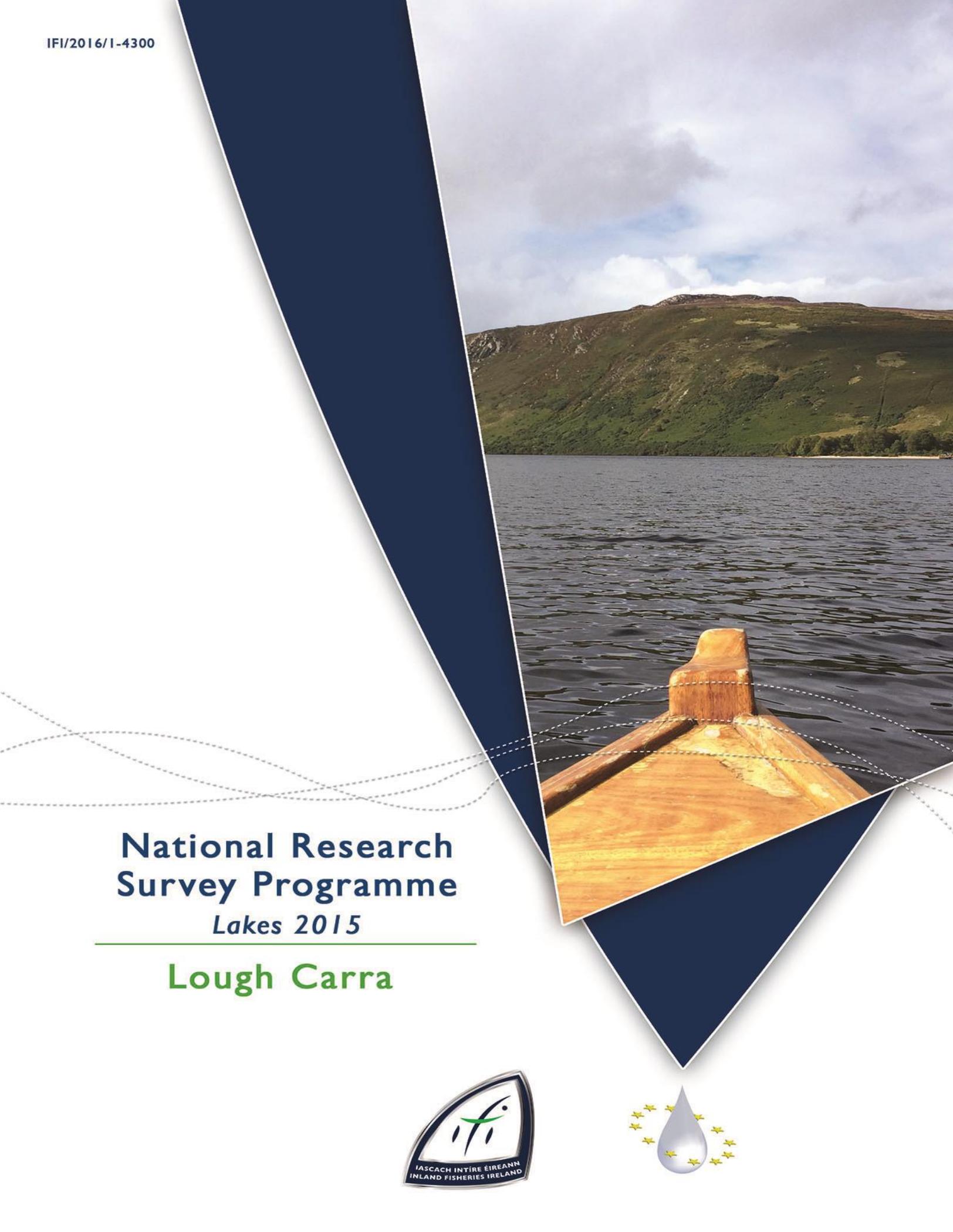


National Research Survey Programme

Lakes 2015

Lough Carra





Inland Fisheries Ireland
National Research Survey Programme
**Fish Stock Survey of Lough Carra,
July 2015**

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

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1.1 Introduction

Lough Carra is situated in County Mayo and forms the most northerly part of the Great Western Lakes system of Lough Corrib, Lough Mask and Lough Carra (Plate 1.1, Fig. 1.1). The lake is located approximately 5km north of Ballinrobe, Co. Mayo.

Lough Carra is the largest marl lake in Ireland, with a surface area of approximately 1600ha (NPWS, 2004; Irvine *et al.*, 2003). It is a hard water lake which acquires most of its water via the feeder streams that flow in at various points around its perimeter (Huxley and Huxley, 2009). The majority of the lake is shallow with a mean depth of approximately 1.8m; however, there are sections of the lake where depths reach over 19m (Huxley and Huxley, 2009). Lough Carra is well known for its green/blue colour which is due to the formation of calcareous encrustations (NPWS, 2004). The lake contains well developed stonewort communities with *Chara curta*, *C. desmacantha*, *C. rudis* and *C. contraria* also recorded (NPWS, 2004).

The lake is categorised as typology class 10 (as designated by the EPA for the purposes of the Water Framework Directive (WFD)), i.e. shallow (<4m), greater than 50ha and highly alkaline (>100mg/l CaCO₃).

The average size of the brown trout taken from Lough Carra is greater than any of the other western lakes and the lake has previously produced a specimen of 8.2kg (O' Reilly, 2007). Lough Carra is believed to be one of the few remaining wild brown trout calcareous lakes within the EU (Irvine *et al.* 2003). During the 1990s fishery rehabilitation and enhancement works were undertaken in Lough Carra's spawning streams by Inland Fisheries Ireland (IFI) (previously the Central and Regional Fisheries Boards) and this has led to greatly increased recruitment of juvenile brown trout to the lake (O' Grady, 2009).

The lake was surveyed eight times from 1978 to 2009 as part of a fish stock assessment by IFI's research section using seven-panel benthic braided survey gill nets; brown trout, perch and pike were recorded on all occasions. The most recent results (March 2009) using this survey method suggests that the lake supports an excellent and healthy stock of brown trout, possibly one of the best in the country (IFI, 2009).

The lake was also previously surveyed by IFI for the WFD fish surveillance monitoring programme in 2009 and 2012 (Kelly *et al.*, 2010 and 2013). During both of these surveys perch were found to be the dominant species present in the lake. Brown trout, three-spined stickleback, 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 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).

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



Plate 1.1. Lough Carra

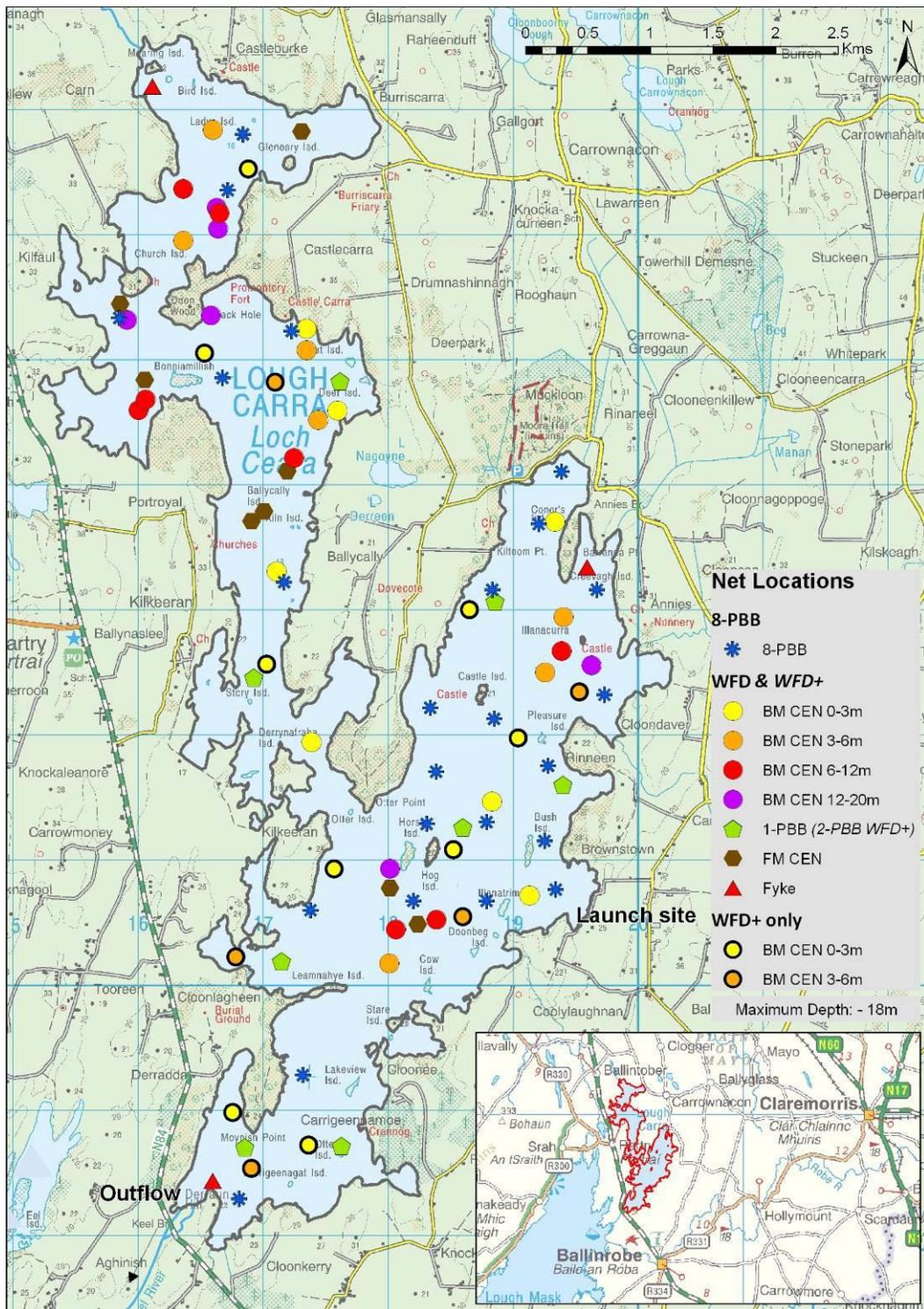


Fig. 1.1. Location map of Lough Carra showing locations, net type, depths and category of each net (outflow is indicated on map)



1.2 Methods

1.2.1 Netting methods

Lough Carra was surveyed over four nights between the 29th of June and the 3rd of July 2015. A total of three Dutch fyke nets (Fyke), 42 benthic monofilament multi-mesh (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets (BM CEN) and eight 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 eight two-panel benthic braided (63.5mm and 88.9mm mesh knot to knot) survey gill nets (2-PBB).

A total of 24 eight-panel benthic braided survey gill nets (8-PBB) were also deployed on the lake. These are composed of eight 27.5m long panels each a different mesh size, tied together randomly. The panels ranged from 2" (25.4mm mesh knot to knot) to 5" (63.5mm mesh knot to knot) in 0.5" (12.5mm) increments (O'Grady, 1981) with the addition of a 7" (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, pike and roach. 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 IFI's National Research Survey Programme (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 Carra in July 2015, with 988 fish being captured. The number of each species captured by each net type is shown in Table 1.1. Perch was the most abundant fish species recorded, followed by brown trout, three-spined stickleback, pike, eels and roach. During the previous surveys the same species composition was recorded (Kelly *et al.*, 2010 and 2013) (O' Grady *et al.*, 2009) apart from roach which were captured in the lake for the first time during the 2015 survey (Table 1.1).

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

Scientific name	Common name	Number of fish captured					
		8-PBB	2-PBB	BM CEN	FM CEN	Fyke	Total
<i>Perca fluviatilis</i>	Perch	198	0	466	0	4	668
<i>Salmo trutta</i>	Brown trout	205	5	31	0	0	241
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0	0	43	0	0	43
<i>Esox Lucius</i>	Pike	21	0	8	0	2	31
<i>Rutilus rutilus</i>	Roach	1	0	0	0	0	1
<i>Anguilla Anguilla</i>	European eel	0	0	0	0	4	4

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.

Brown trout and perch were the two most dominant fish species in terms of abundance (CPUE) and perch was the most dominant species in terms of biomass (BPUE) (Table 1.2).



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

Scientific name	Common name	8-PBB	WFD+**
Mean CPUE (±S.E.)			
<i>Perca fluviatilis</i>	Perch	0.038 (0.013)	0.256 (0.048)
<i>Salmo trutta</i>	Brown trout	0.039 (0.006)	0.018 (0.004)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.000 (0.000)	0.023 (0.008)
<i>Esox lucius</i>	Pike	0.004 (0.001)	0.005 (0.002)
<i>Rutilus rutilus</i>	Roach	0.0002 (0.0002)	0.000 (0.000)
<i>Anguilla anguilla</i>	Eel	0.000 (0.000) *	0.022 (0.022)*
Mean BPUE (±S.E.)			
<i>Perca fluviatilis</i>	Perch	-	19.075 (3.869)
<i>Salmo trutta</i>	Brown trout	-	10.267 (2.509)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	0.021 (0.008)
<i>Esox lucius</i>	Pike	-	1.442 (0.426)
<i>Rutilus rutilus</i>	Roach	-	0.000 (0.000)
<i>Anguilla anguilla</i>	Eel	-	8.589 (8.589)*

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

Brown trout

Brown trout captured during the 2015 survey ranged in length from 6.0cm to 54.5cm (mean = 35.6cm) (Fig. 1.2). Six age classes were present, ranging from 0+ to 5+, with a mean L1 of 8.0cm (Table 1.3). The dominant age class was 4+ (Fig. 1.2). Mean brown trout L4 in 2015 was 36.8cm 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).

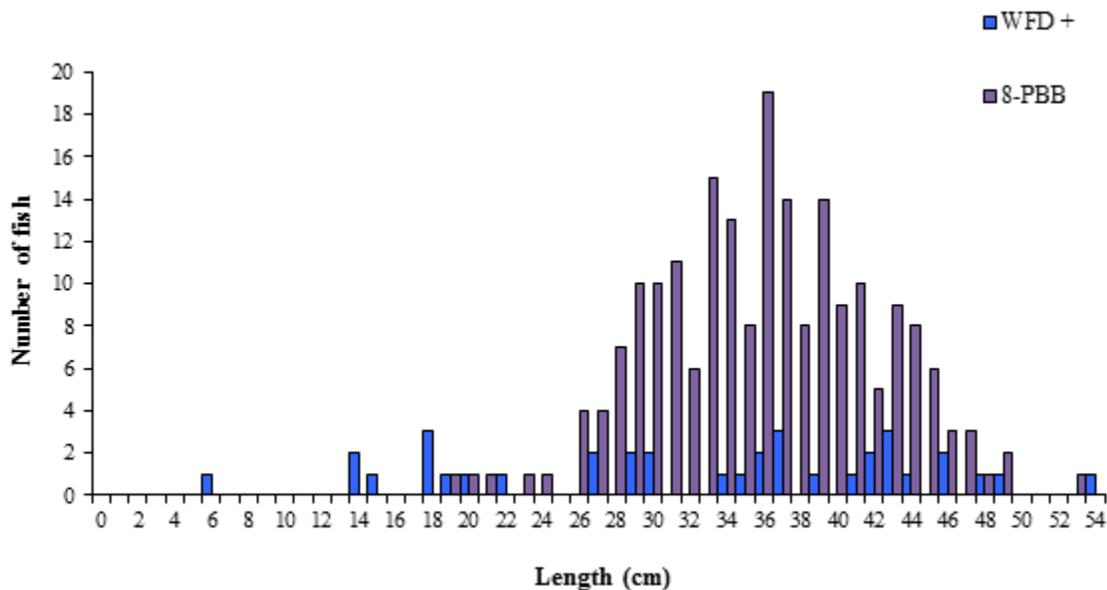


Fig. 1.2. Length frequency of brown trout captured on Lough Carra, 2015

Table 1.3. Mean (\pm SE) brown trout length (cm) at age for Lough Carra, July 2015

	L ₁	L ₂	L ₃	L ₄	L ₅	Growth Category
Mean (\pm S.E.)	8.0 (0.2)	19.7 (0.5)	29.6 (0.5)	36.8 (0.6)	43.3 (1.0)	Very fast
N	85	73	55	35	15	
Range	4.6-12.2	11.4-27.4	20.5-36.8	28.6-42.5	38.2-51.7	



Perch

Perch captured during the 2015 survey ranged in length from 3.9cm to 39.1cm (mean = 16.4cm) (Fig.1.3) with five age classes present, ranging from 1+ to 5+ with a mean L1 of 6.7cm (Table 1.4). The dominant age class was 2+ (Fig. 1.3).

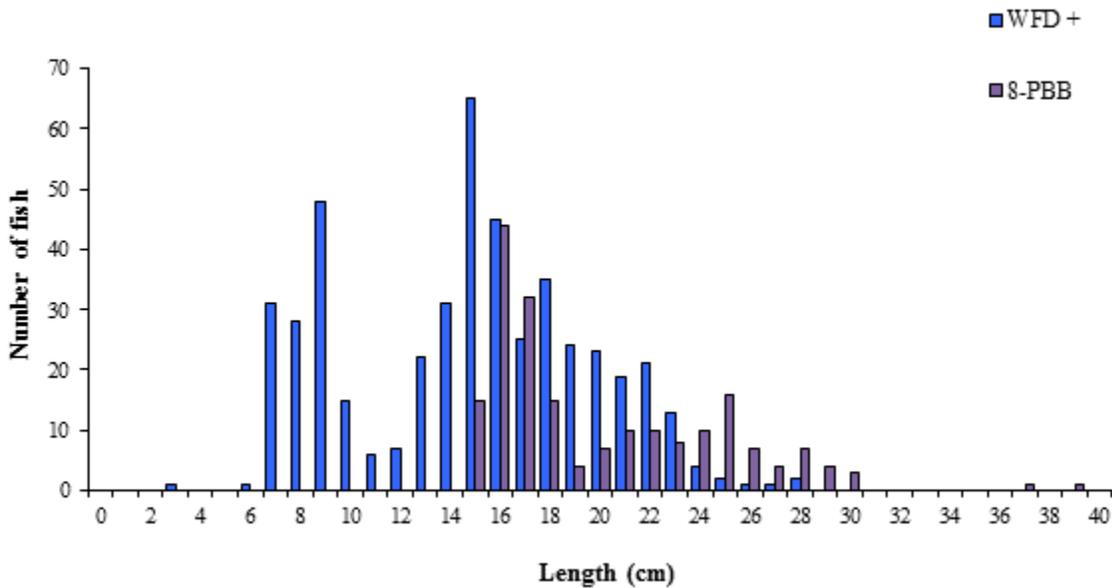


Fig. 1.3. Length frequency of perch captured on Lough Carra, 2015

Table 1.4. Mean (\pm SE) perch length (cm) at age for Lough Carra, July 2015

	L ₁	L ₂	L ₃	L ₄	L ₅
Mean (\pm SE)	6.7 (0.2)	13.7 (0.3)	20.6 (0.6)	24.3 (1.8)	26.2
N	59	44	24	3	1
Range	4.1-11.2	9.3-18.3	14.5-24.7	21.2-27.5	26.2-26.2

Other fish

Eels captured during the 2015 survey ranged in length from 49.0cm to 74.0cm and pike ranged in length from 22.2cm to 97.2cm. Three-spined stickleback ranged in length from 3.0cm to 5.2cm and one roach measuring 20.1cm and aged 3+ was also recorded.

1.3.4 Stomach content 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.

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 trout stomachs during the survey were dominated by zooplankton, insect and fish remains (Fig. 1.4).

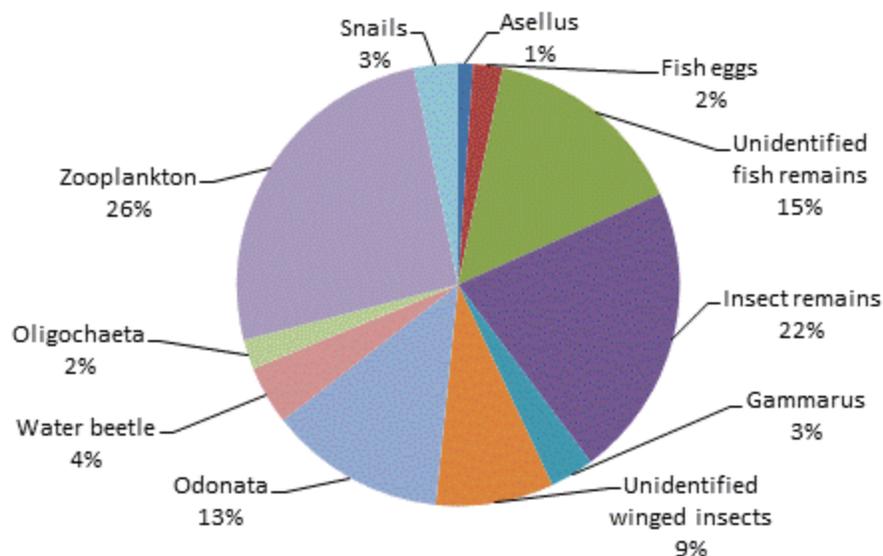


Fig. 1.4. Diet of brown trout captured on Lough Carra 2015 (% occurrence) n=63

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 molluscs (snails), insect and fish remains (Fig 1.5).



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 Carra has been assigned an ecological status of Good for 2009 and High in 2012 and 2015 based on the fish populations present.

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



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A dark blue geometric shape, resembling a stylized wave or a folded piece of paper, occupies the lower-left portion of the page. It features several white dashed lines that curve across its surface, creating a sense of movement and depth. The shape is set against a plain white background.

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