National Research Survey Programme

Lakes 2015

Lakes 2015

Lough Owel

IASCACH INTÍRE ÉIREANN
INLAND FISHERIES IRELAND

Inland Fisheries Ireland

National Research Survey Programme

**Fish Stock Survey of Lough Owel,
July 2015**

Fiona L. Kelly, Lynda Connor, Karen Delanty, Paul McLoone, 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.

ACKNOWLEDGEMENTS

1.1 Introduction

Lough Owel is located approximately four kilometres north-west of Mullingar, Co. Westmeath in the Upper Shannon catchment (Plate 1.1, Fig. 1.1). The lake has a surface area of 102ha and a maximum depth of 21m. The underlying geology of the lake is limestone. The lake is categorised as typology class 8 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), greater than 50ha and moderate alkalinity (20-100 mg/l $CaCO_3$).

Lough Owel is a public water supply for Mullingar and is also the water supply for the Royal Canal. The lake is fed by four small streams (Ballyboy, Frewin, Kilpatrick and Portnashangan) and is also spring fed. With the exception of Lough Carra in county Mayo, this lake is the best example of a large spring fed calcareous lake in Ireland. The lake is of major conservation significance as it contains three habitats (alkaline fens, transition mires and hard water lakes) that are listed on Annex I of the EU Habitats Directive (NPWS, 1999). Water quality in the lake has been monitored regularly since the 1970s. Mean concentrations of total phosphorus, mean transparency and mean chlorophyll a placed Lough Owel in the mesotrophic category between 1998 and 2002 (Devins, M., 1998; McGarrigle *et al.,* 2002; OECD, 1982).

Lough Owel is one of the important trout lakes in the midlands and has a resident stock of wild brown trout. The lake also holds stocks of pike, perch and rudd. Spawning and nursery grounds for trout are limited; therefore trout stocks are maintained by stripping the ova from wild adult trout. These are then hatched out at the Inland Fisheries Ireland (IFI) fish farm and large numbers of the resulting fry and adult fish are later stocked back into the lake. The first triploid brown trout ever stocked into any water in Ireland were stocked into Lough Owel in March 2011. Triploid trout are infertile, and unable to breed with each other or cross breed with wild brown trout. IFI is monitoring the performance of these fish and have removed the adipose fin to help anglers identify the fish.

The lake was surveyed during the 1980s, as well as 1979 and 2005, as part of a fish stock assessment by IFI's research section using seven-panel benthic braided survey gill nets (CFB 1981; CFB1982; CFB1983; CFB 1984; CFB 1985; CFB, 1986 and CFB, 1987). These surveys revealed that there were excellent stocks of brown trout in the lake (wild and stocked F1 wild fish). At the time there was also a population of perch and a small pike population in the lake. Rudd were identified as being present in the lake during 1985 (CFB, unpublished data). Historically the lake held a population of Arctic char; however they have been extinct for some time, the last specimen being authenticated from the lake in 1886 (Went, 1945). There is an old unsubstantiated report that Arctic char from Lough Owel were as large as 1.4kg, but this can never be proven (Went, 1945). An attempt was made to reintroduce Arctic

char to Lough Owel in 1995, however there is no evidence that they became established (Tierney *et al.*, 2000).

The lake was also previously surveyed by IFI for the WFD fish surveillance monitoring programme in 2008, 2011 and 2014 (Kelly *et al.*, 2009, 2012a and 2015). During these surveys, perch were found to be the dominant species present in the lake. Brown trout, roach, pike, three-spined stickleback, tench, roach x rudd hybrids, rudd, rainbow trout and eels were also recorded during these 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).

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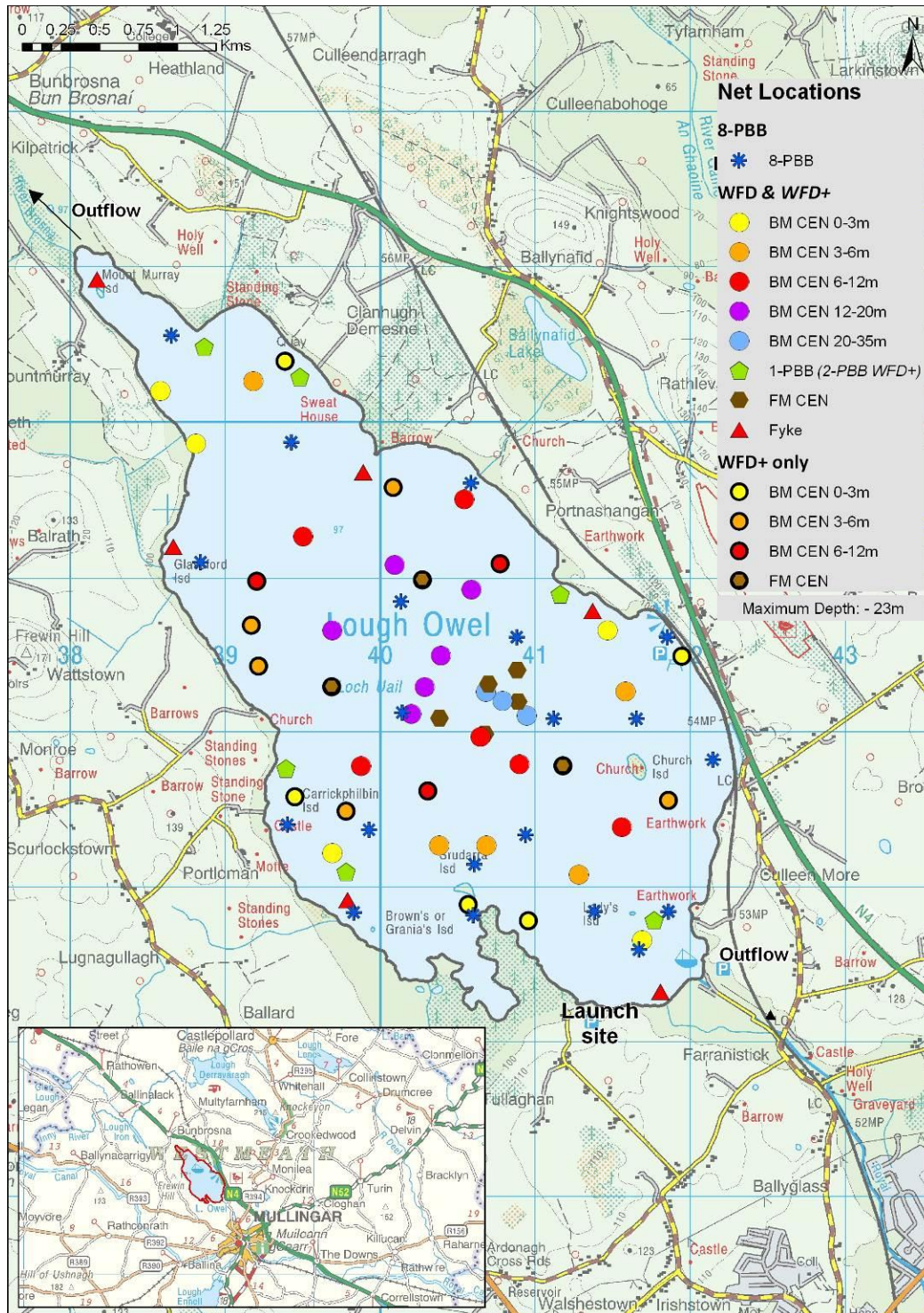
Plate 1.1. Lough Owel

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

1.2 Methods

1.2.2 Netting methods

Lough Owel was surveyed over four nights between the 27th and the 31st of July 2015. A total of six Dutch fyke nets (Fyke), 38 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 six two-panel benthic braided (63.5mm and 88.9mm mesh knot to knot) survey gill nets (2-PBB).

A total of 20 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 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, roach, hybrids, rudd 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 seven fish species and one type of hybrid were recorded on Lough Owel in July 2015, with 1632 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, roach x rudd hybrids, brown trout, rudd, tench, pike and eels (Table 1.1). During the previous WFD surveys in 2008, 2011 and 2014 the same species composition was recorded with the exception of rainbow trout, which were only captured during the 2014 survey. Also pike, rudd and eels were not captured during the 2014 survey but were recorded during the 2008, 2011 and 2015 surveys (Kelly *et al*., 2009, 2012a and 2015). The IFI surveys conducted from 1979 to 2005 captured the same species composition as above.

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

Scientific name	Common name	Number of fish captured					
		8-PBB	2-PBB	BM CEN	FM CEN	Fyke	Total
Perca fluviatilis	Perch	459	0	566	1	3	1029
Rutilus rutilus	Roach	374	4	97	0	1	476
Rutilus rutilus x Scardinius erythrophthalmus	Roach x Rudd hybrid	39	2	11	0	0	52
Salmo trutta	Brown trout (stocked)	34	0	7	1	0	42
Salmo trutta	Brown trout (wild)	2	0	2	1	0	5
Scardinius erythrophthalmus	Rudd	8	0	4	0	0	12
Tinca tinca	Tench	9	1	1	0	0	11
Esox lucius	Pike	4	0	0	0	0	4
Anguilla anguilla	Eel	0	0	0	0	1	1

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 and roach were the two most dominant fish species in terms of abundance (CPUE) and 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 Owel, 8-PBB, WFD and WFD+

Scientific name	Common name	8-PBB	WFD+
		Mean CPUE (±S.E.)	
Perca fluviatilis	Perch	0.104 (0.033)	0.327 (0.054)
Rutilus rutilus	Roach	0.085 (0.020)	0.057 (0.015)
Rutilus rutilus x Scardinius erythrophthalmus	Roach x Rudd hybrid	0.009 (0.004)	0.007 (0.003)
Salmo trutta	Brown trout (wild)	0.000 (0.000)	0.002 (0.001)
Salmo trutta	Brown trout (stocked)	0.008 (0.003)	0.005 (0.002)
Scardinius erythrophthalmus	Rudd	0.001 (0.001)	0.007 (0.003)
Tinca tinca	Tench	0.002 (0.001)	0.001 (0.001)
Esox lucius	Pike	0.001 (0.001)	-
Anguilla anguilla	Eel	-	0.002 (0.001)*
		Mean BPUE (±S.E.)**	
Perca fluviatilis	Perch	-	29.713 (4.581)
Rutilus rutilus	Roach	-	13.709 (3.534)
Rutilus rutilus x Scardinius erythrophthalmus	Roach x Rudd hybrid	-	5.723 (2.242)
Salmo trutta	Brown trout (wild)	-	0.207 (0.149)
Salmo trutta	Brown trout (stocked)	-	2.603 (1.428)
Scardinius erythrophthalmus	Rudd	-	5.723 (2.242)
Tinca tinca	Tench	-	1.050 (0.745)
Esox lucius	Pike	-	-
Anguilla anguilla	Eel	-	0.249 (0.249)*

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

Wild brown trout captured during the 2015 survey ranged in length from 17.5cm to 60.3cm (Fig. 1.2). Six age classes were present, ranging from 1+ to 6+, with a mean L1 of 8.3cm (Table 1.3). Stocked brown trout ranged in length from 18.2cm to 49.0cm and were aged from 1+ to 5+ (Table 1.3). The dominant age class was 2+ (Fig. 1.2). Mean brown trout L4 in 2015 was 40.4cm 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).
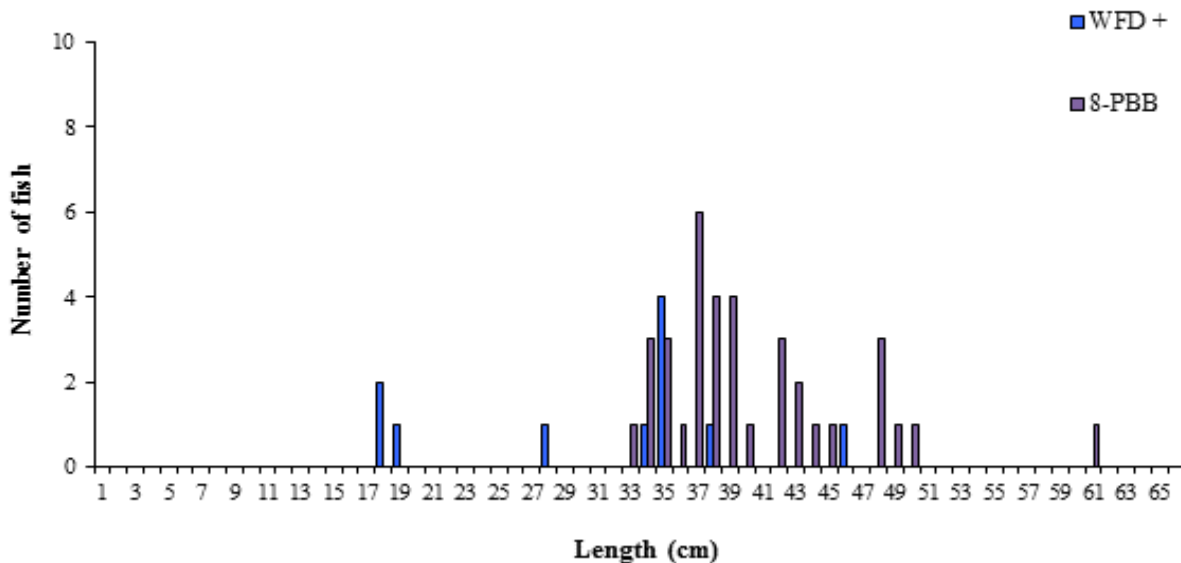

Fig. 1.2. Length frequency of brown trout (wild and stocked) captured on Lough Owel, 2015

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

	L_1	L_2	L_3	L_4	L_5	L_6	Growth Category
Mean (± S.E.)	8.3 (0.6)	17.8 (2.6)	31.5 (2.6)	40.4 (0.9)	48.6	55.9	Very fast
N	5	3	2	2	1	1	
Range	6.9-10.2	12.7-21.4	28.9-34.0	39.5-41.3	48.6-48.6	55.9-55.9	

Perch

Perch captured during the 2015 survey ranged in length from 4.5cm to 37.7cm (mean = 17.3cm) (Fig.1.3) with eleven age classes present, ranging from 0+ to 10+ with a mean L1 of 5.9cm (Table 1.4). The dominant age class was 3+ (Fig. 1.3).
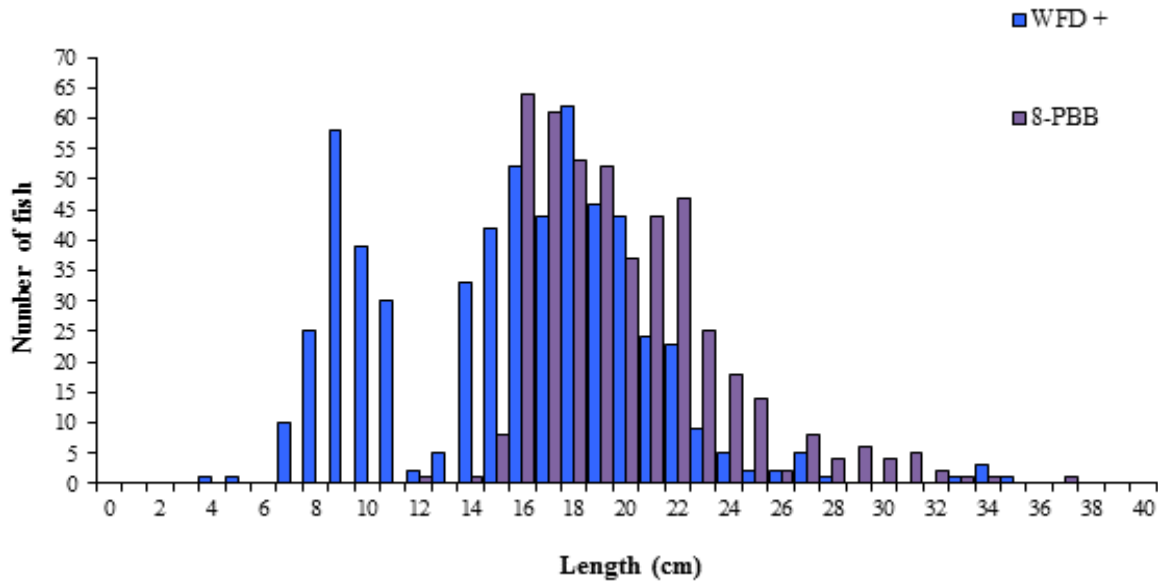

Fig. 1.3. Length frequency of perch captured on Lough Owel, 2015

Table 1.4. Mean (±S.E.) perch length (cm) at age for Lough Owel, July 2015

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}
Mean (±S.E.)	5.9 (0.2)	11.6 (0.2)	17.3 (0.4)	19.8 (0.7)	20.7 (0.5)	22.4 (0.7)	24.4 (0.9)	27.0 (1.8)	32.2 (0.9)	32.5
N	59	44	32	16	11	8	6	4	2	1
Range	4.2-9.4	9.4-16.2	13.7-22.8	16.0-24.4	17.8-22.8	18.9-25.3	20.8-26.6	21.8-30.3	31.3-33.1	32.5-32.5

Roach

Roach captured during the 2015 survey ranged in length from 7.7cm to 38.0cm (mean = 24.4cm) (Fig.1.4) with eight age classes present, ranging from 2+ to 10+ with a mean L1 of 2.3cm (Table 1.5). The dominant age class was 4+ (Fig. 1.4).
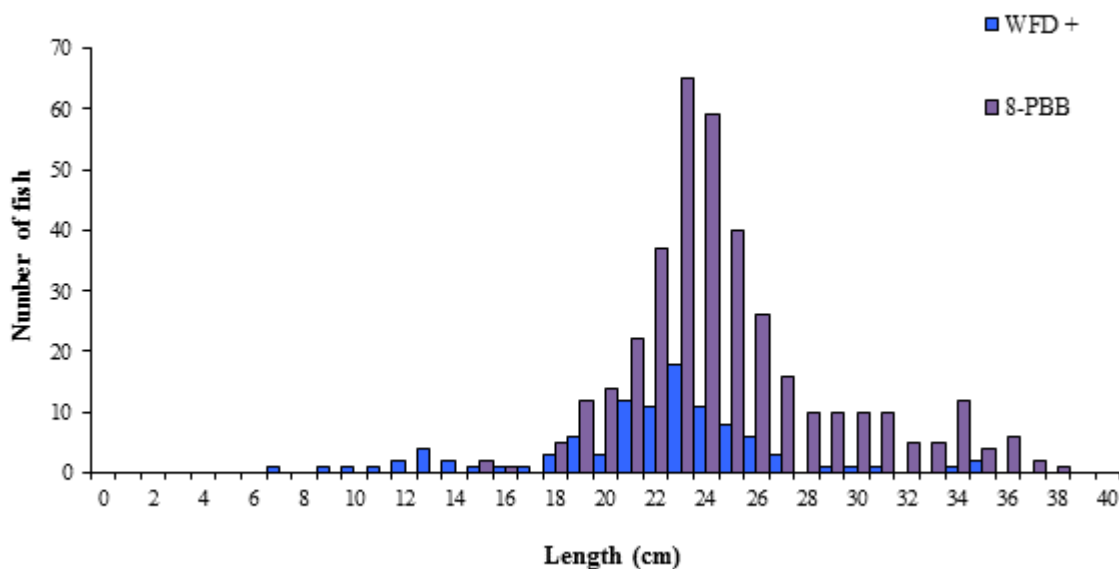

Fig. 1.4. Length frequency of roach captured on Lough Owel, 2015

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

	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}
Mean (± S.E.)	2.3 (0.1)	6.5 (0.2)	12.2 (0.4)	17.8 (0.5)	22.3 (0.6)	25.3 (0.6)	27.9 (0.6)	30.9 (0.6)	32.7 (0.6)	34.1 (1.0)
N	70	70	68	58	39	28	23	19	13	7
Range	1.4-3.3	3.6-10.4	6.2-17.9	8.9-24.4	12.9-27.5	16.9-30.6	19.1-32.5	25.6-35.2	28.7-35.8	29.8-37.2

Other fish

One eel at 40.0cm was captured during the 2015 survey. Roach x rudd hybrids ranged in length from 22.7cm to 40.0cm, rudd ranged in length from 11.5cm to 36.5cm, tench ranged from 28.5cm to 46.2cm and pike 27.0cm to 91.0cm.

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 zooplankton and insect and fish remains (Fig 1.5).
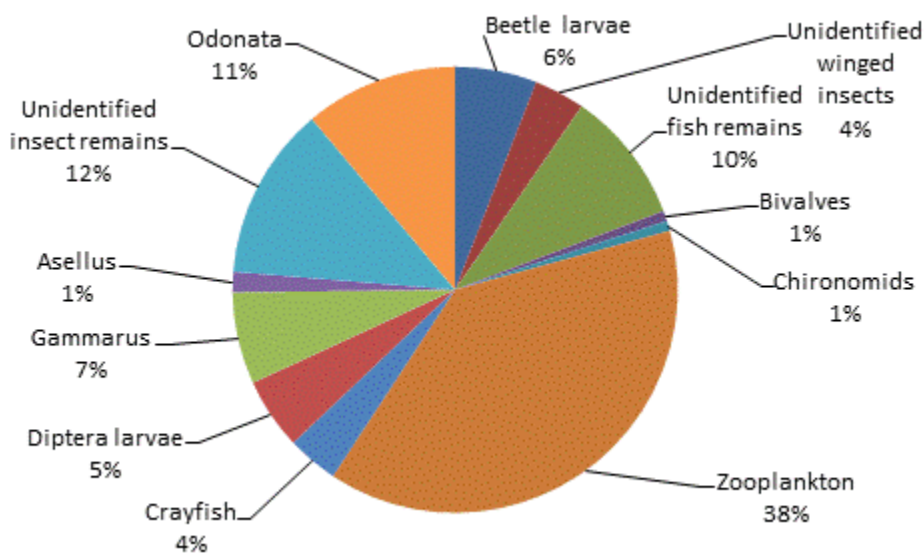

Fig. 1.5. Diet of perch captured on Lough Owel 2015 (% occurrence) n=130

1.4 Summary and ecological status

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

Wild brown trout ranged in length from 17.5cm to 60.3cm with six age classes present, ranging from 1+ to 6+. Stocked brown trout ranged in length from 18.2cm-49.0cm and were aged from 1+ to 5+. The dominant age class was 2+. 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).

Perch ranged in length from 4.5cm to 37.7cm and ranged in age from 0+ to 10+, indicating reproductive success in each of the previous eleven years. The dominant age class was 3+.

Roach ranged in length from 7.7cm to 38.0cm and ranged in age from 2+ to 10+, indicating reproductive success in each of the previous eleven years. The dominant age class was 4+.

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 Owel has been assigned an ecological status of Moderate for 2008 and 2014 and Good for 2011 and 2015 based on the fish populations present.

In the 2010 to 2012 surveillance monitoring reporting period, the EPA assigned Lough Owel 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

Caffrey, J. (2010) *IFI Biosecurity Protocol for Field Survey Work*. Inland Fisheries Ireland.

CFB (1981) Central and Regional Fisheries Board - Annual Report - 1981

CFB (1982) Central and Regional Fisheries Board - Annual Report - 1982

CFB (1983) Central and Regional Fisheries Board - Annual Report - 1983

CFB (1984) Central and Regional Fisheries Board - Annual Report - 1984

CFB (1985) Central and Regional Fisheries Board - Annual Report - 1985

CFB (1986) Central and Regional Fisheries Board - Annual Report - 1986

CFB (1987) Central and Regional Fisheries Board - Annual Report - 1987

Devins, M. (1998) *Water Quality Survey Of Lough Owel (March-October 1997).* A report to Westmeath County Council. Aquatic Services Unit, Zoology Department, UCC.

Hjelm, J., Persson, L., and Christensen, B. (2000) Growth, morphological variation and ontogenetic niche shifts in perch (*Perca fluviatilis*) in relation to resource availability. *Oecologia*, **122, (2),** 190-199.

Kelly, F.L., Harrison, A., Connor, L., Allen, M., Rosell, R. and Champ, T. (2008) *FISH IN LAKES Task 6.9: Classification tool for Fish in Lakes. FINAL REPORT*. Central Fisheries Board, NS Share project.

Kelly, F.L., Connor, L., Wightman, G., Matson, R., Morrissey, E., O' Callaghan, R., Feeney, R., Hanna, G. and Rocks, K., (2009) *Sampling fish for the Water Framework Directive - Summary report 2008.* Central and Regional Fisheries Board report.

Kelly, F., Harrison A., Connor, L., Matson, R., Morrissey, E., Wogerbauer, C., Feeney, R., O'Callaghan, R. and Rocks, K. (2012a) *Sampling Fish for the Water Framework Directive – Summary Report 2011*. Inland Fisheries Ireland.

Kelly, F.L., Harrison, A.J., Allen, M., Connor, L. and Rosell, R. (2012b) Development and application of an ecological classification tool for fish in lakes in Ireland. *Ecological Indicators*, **18**, 608-619.

Kelly, F., Connor, L., Matson, R., Feeney, R., Morrissey, E., Coyne, J. and Rocks, K. (2015) *Sampling Fish for the Water Framework Directive – Summary Report 2014*. Inland Fisheries Ireland.

Kennedy, M. and Fitzmaurice, P. (1971) Growth and food of brown trout *Salmo trutta* (L.) in Irish waters. *Proceedings of the Royal Irish Academy*, **71B** (18), 269-352.

McGarrigle, M.L., Bowman, J.J., Clabby, K.J., Lucey, J., Cunningham, P., MacCarthaigh, Keegan, M., Cantrell, B., Lehane, M., Clenaghan, C. and Toner, P.F. (2002) *Water Quality in Ireland 1998 to 2000*. Environmental Protection Agency, Wexford.

NPWS (1999) *Site Synopsis. Lough Owel. Site Code 000688*. Site Synopsis report, National Parks and Wildlife Service.

OECD (Organisation for Economic Cooperation and Development) (1982) *Eutrophication of Waters, Monitoring, Assessment and Control*. Paris, OECD.

Tierney, D.T., O' Grady, M. and Fitzmaurice, P. (2000) *The Irish Char Salvelinus alpinus L. Archival project*. Central Fisheries Board.