



Sampling Fish for the Water Framework Directive

Lakes 2011

Lough Owel



Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Lough Owel, July 2011

Fiona L. Kelly, Lynda Connor, Emma Morrissey, Ciara Wogerbauer, Ronan Matson, Rory Feeney and
Kieran Rocks

Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin

CITATION: Kelly, F.L., Connor, L., Morrissey, E., Wogerbauer, C., Matson, R., Feeney, R. and Rocks, K. (2012)
Water Framework Directive Fish Stock Survey of Lough Owel, July 2011. Inland Fisheries Ireland, Swords
Business Campus, Swords, Co. Dublin, Ireland.

Cover photo: Lynda and Fiona gill netting © Inland Fisheries Ireland

ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of the regional director Ms. Amanda Mooney and the staff from IFI, Limerick. The authors would also like to gratefully acknowledge the help and cooperation of all their colleagues in IFI, Swords.

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Energy and Natural Resources for 2011.

We would also like to thank Dr. Martin O'Grady (IFI) and No. 3 Operational Wing, Irish Air Corps (Aer Chór na hÉireann) for the aerial photographs.

The report includes Ordnance Survey Ireland data reproduced under OSi Copyright Permit No. MP 007508.

*Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright.
© Ordnance Survey Ireland, 2011.*

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 falls into 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 CaCO₃).

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 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.

Fish stock surveys were undertaken regularly on Lough Owel by Inland Fisheries Ireland (previously the Central Fisheries Board and the Shannon Regional Fisheries Board) during the 1980s (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 char from Lough Owel were as large as 1.4kg, but this can never be proven (Went, 1945). An attempt was made to reintroduce char to Lough Owel in 1995, however there is no evidence that they have become established (Tierney *et al.*, 2000).

More recently Lough Owel was surveyed in 2008 as part of the Water Framework Directive surveillance monitoring programme (Kelly *et al.*, 2009). During this survey, 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 and eels were also captured during the survey.

This report summarises the results of the 2011 fish stock survey carried out on the lake, as part of the Water Framework Directive surveillance monitoring programme.



Plate 1.1. Lough Owel (Photo courtesy of IFI and No. 3 Operational Wing, Irish Air Corps (Aer Chór na hÉireann))

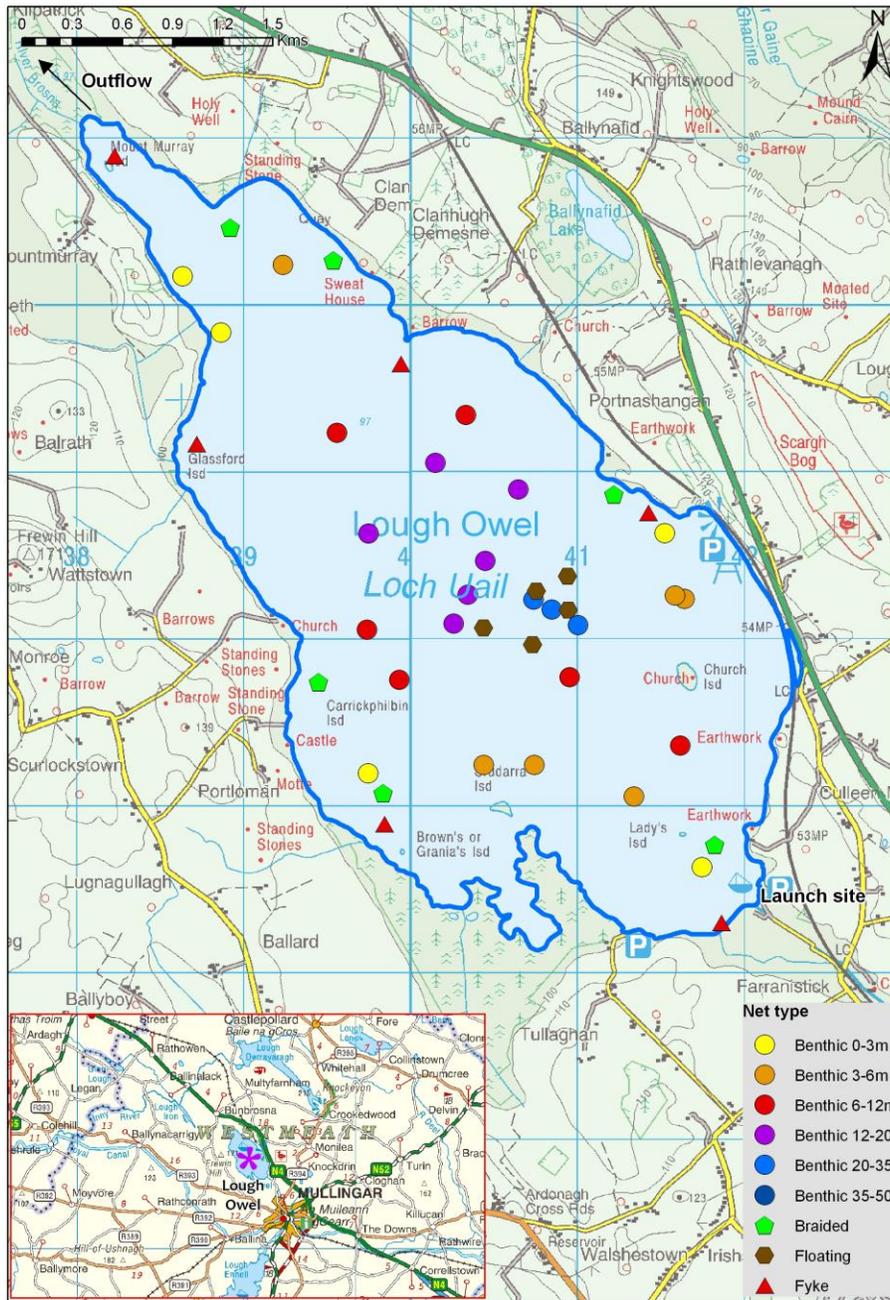


Fig. 1.1. Location map of Lough Owel showing locations and depths of each net (outflow is indicated on map)

1.2 Methods

Lough Owel was surveyed over three nights between the 18th and the 21st of July 2011. A total of six sets of Dutch fyke nets, 25 benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (5 @ 0-2.9m, 5 @ 3-5.9m, 6 @ 6-11.9m, 6 @ 12-19.9m and 3 @ 20-34.9m) and five floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets were deployed in the lake (36 sites). The netting effort was supplemented using six benthic braided survey gill nets (62.5mm mesh knot to knot) at six additional sites. Nets were deployed in the same locations as were randomly selected in the previous survey in 2008. 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 apart from perch were measured and weighed on site and scales were removed from all brown trout, roach, rudd, pike, tench and hybrids. 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 retained for further analysis.

1.3 Results

1.3.1 *Species Richness*

A total of eight fish species and one type of hybrid were recorded on Lough Owel in July 2011, with 595 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. Roach, pike, tench, brown trout, rudd, three-spined stickleback, roach x rudd hybrids and eels were also recorded. During the previous survey in 2008 the same species composition was recorded.

Table 1.1. Number of each fish species captured by each gear type during the survey on Lough Owel, July 2011

| Scientific name | Common name | Number of fish captured | | | | Total |
|--|-----------------------|----------------------------------|----------------------------------|---------------------------|-----------|-------|
| | | Benthic mono multimesh gill nets | Surface mono multimesh gill nets | Benthic braided gill nets | Fyke nets | |
| <i>Perca fluviatilis</i> | Perch | 479 | 0 | 0 | 1 | 480 |
| <i>Gasterosteus aculeatus</i> | 3-spined stickleback | 13 | 0 | 0 | 39 | 52 |
| <i>Scardinius erythrophthalmus</i> | Rudd | 26 | 0 | 0 | 0 | 26 |
| <i>Rutilus rutilus</i> | Roach | 14 | 0 | 0 | 0 | 14 |
| <i>Tinca tinca</i> | Tench | 0 | 0 | 4 | 4 | 8 |
| <i>Salmo trutta</i> | Brown trout (stocked) | 3 | 2 | 0 | 0 | 5 |
| <i>Anguilla anguilla</i> | Eel | 0 | 0 | 0 | 4 | 4 |
| <i>Rutilus rutilus x Scardinius erythrophthalmus</i> | Roach x Rudd | 3 | 0 | 0 | 0 | 3 |
| <i>Salmo trutta</i> | Brown trout (wild) | 2 | 0 | 0 | 0 | 2 |
| <i>Esox lucius</i> | Pike | 1 | 0 | 0 | 0 | 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 in 2008 and 2011 are summarised in Table 1.2. Mean CPUE and BPUE for all fish species is illustrated in Figures 1.2 and 1.3.

Although the mean perch CPUE and BPUE was lower in 2011 than in 2008, these differences were not statistically significant.

The differences in the mean perch CPUE between Lough Owel and four other similar lakes were assessed, with no overall significant differences being found (Fig. 1.4).

The differences in the mean perch BPUE between Lough Owel and four other similar lakes were also assessed, with no overall significant differences being found (Fig. 1.5). However, Independent-Samples Mann-Whitney U tests between each lake showed that Lough Owel had a significantly higher mean perch BPUE than Lough Leane ($z = -2.321$, $P < 0.05$).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Lough Owel, 2008 and 2011

| Scientific name | Common name | 2008 | 2011 |
|--|-----------------------|----------------|----------------|
| Mean CPUE | | | |
| <i>Salmo trutta</i> | Brown trout (wild) | 0.001 (0.001) | 0.001 (0.001) |
| <i>Salmo trutta</i> | Brown trout (stocked) | 0.006 (0.003) | 0.003 (0.002) |
| <i>Perca fluviatilis</i> | Perch | 0.677 (0.111) | 0.381 (0.077) |
| <i>Esox lucius</i> | Pike | 0.001 (0.001) | 0.001 (0.001) |
| <i>Rutilus rutilus</i> | Roach | 0.024 (0.013) | 0.011 (0.004) |
| <i>Scardinius erythrophthalmus</i> | Rudd | 0.004 (0.002) | 0.021 (0.008) |
| <i>Tinca tinca</i> | Tench | 0.001 (0.001) | 0.005 (0.003) |
| <i>Gasterosteus aculeatus</i> | 3-spined stickleback | 0.026 (0.018) | 0.025 (0.016) |
| <i>Rutilus rutilus x Scardinius erythrophthalmus</i> | Roach x Rudd | 0.009 (0.004) | 0.002 (0.001) |
| <i>Anguilla anguilla</i> | European eel | 0.002 (0.002) | 0.011 (0.008) |
| Mean BPUE | | | |
| <i>Salmo trutta</i> | Brown trout (wild) | 0.056 (0.056) | 0.087 (0.066) |
| <i>Salmo trutta</i> | Brown trout (stocked) | 3.227 (2.308) | 1.939 (1.207) |
| <i>Perca fluviatilis</i> | Perch | 42.583 (7.202) | 39.549 (8.191) |
| <i>Esox lucius</i> | Pike | 6.871 (6.732) | 0.231 (0.231) |
| <i>Rutilus rutilus</i> | Roach | 1.2 (0.871) | 0.966 (0.542) |
| <i>Scardinius erythrophthalmus</i> | Rudd | 14.504 (9.233) | 7.651 (3.334) |
| <i>Tinca tinca</i> | Tench | 0.324 (0.273) | 3.185 (2.392) |
| <i>Gasterosteus aculeatus</i> | 3-spined stickleback | 0.096 (0.07) | 0.029 (0.017) |
| <i>Rutilus rutilus x Scardinius erythrophthalmus</i> | Roach x Rudd | 6.410 (3.397) | 0.58 (0.423) |
| <i>Anguilla anguilla</i> | European eel | 0.608 (0.394) | 1.761 (1.325) |

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

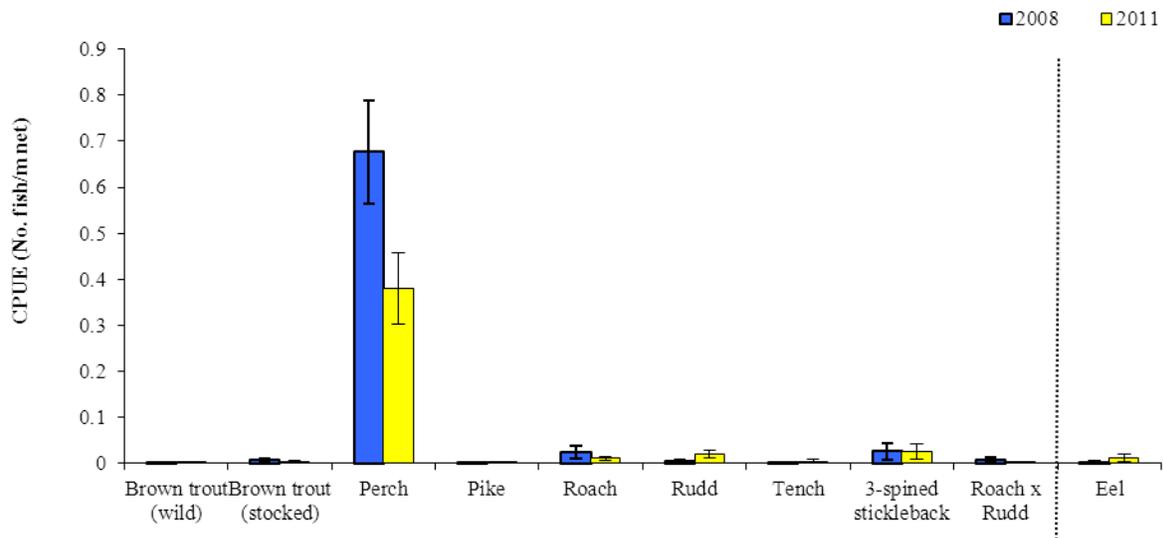


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Lough Owel (Eel CPUE based on fyke nets only), 2008 and 2011

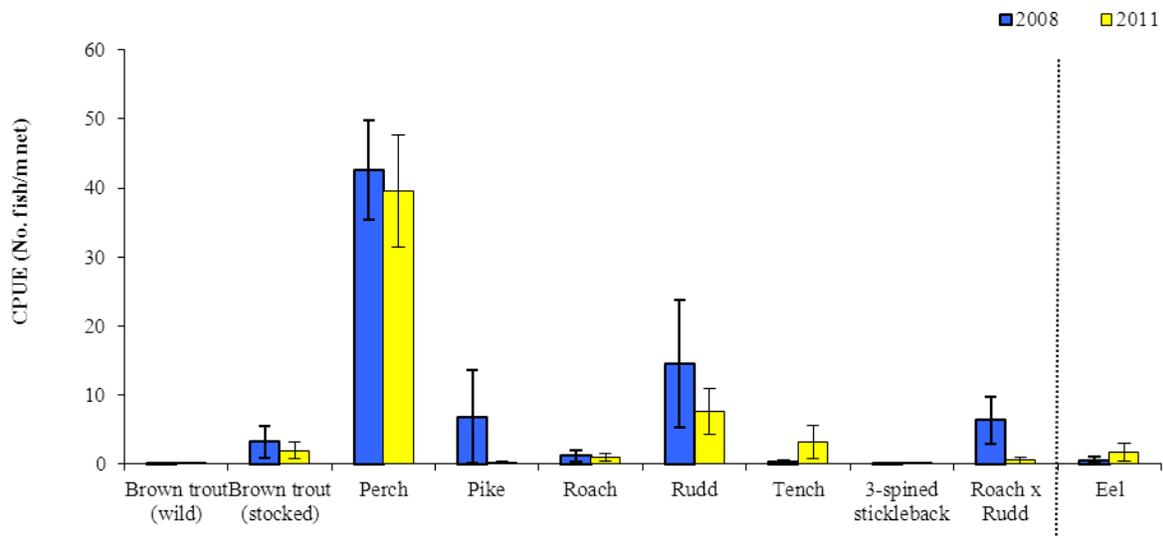


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Lough Owel (Eel CPUE based on fyke nets only), 2008 and 2011

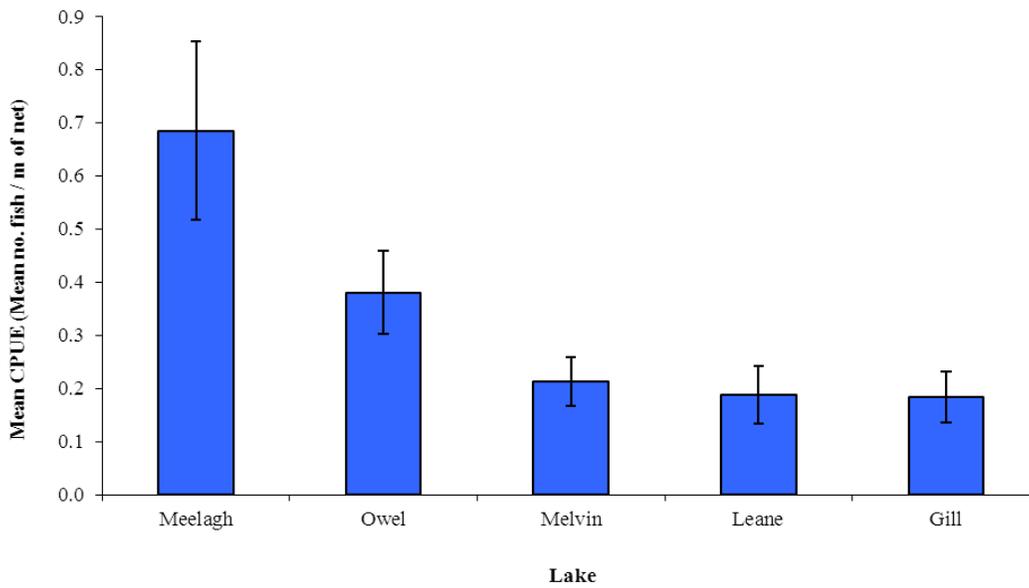


Fig. 1.4. Mean (\pm S.E.) perch CPUE in five lakes surveyed during 2011

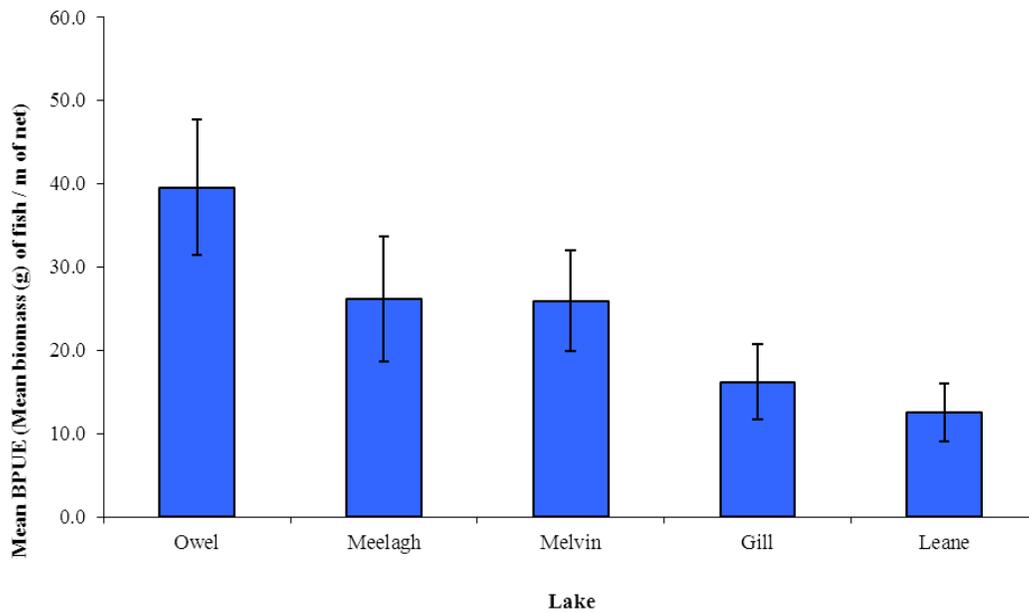


Fig. 1.5. Mean (\pm S.E.) perch BPUE in five lakes surveyed during 2011

1.3.3 Length frequency distributions

Perch captured during the 2011 survey ranged in length from 3.8cm to 29.2cm (mean = 17.4cm) (Fig.1.6).

Perch captured during the 2008 survey had lengths ranging from 3.0cm to 33.5cm (Fig.1.6).

Rudd captured during the 2011 survey ranged in length from 17.7cm to 34.8cm (mean = 25.1cm) (Fig. 1.7). Rudd captured during the 2008 survey ranged in length from 19.2cm to 35.0cm (Fig. 1.7).

Roach x rudd hybrids captured during the 2011 survey ranged in length from 20.2cm to 24.6cm, roach ranged in length from 7.5cm to 27.0cm, tench ranged in length from 21.0cm to 39.5cm, three-spined stickleback ranged from 1.0cm to 4.5cm and eels ranged in length from 45.5cm to 49.4cm. Brown trout ranged in length from 14.0cm to 49.5cm. One pike was recorded at 33.7cm.

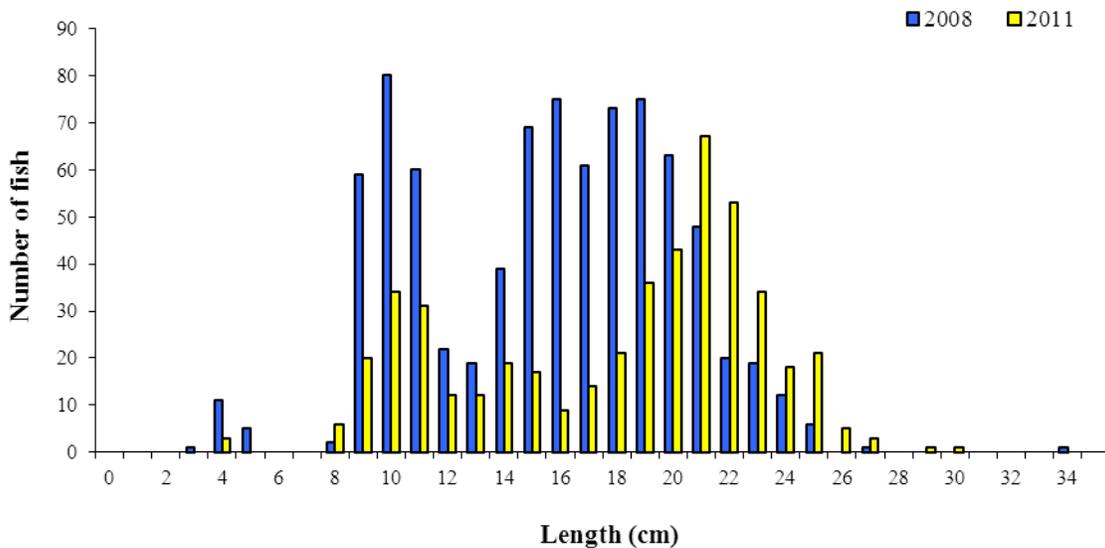


Fig. 1.6. Length frequency of perch captured on Lough Owel

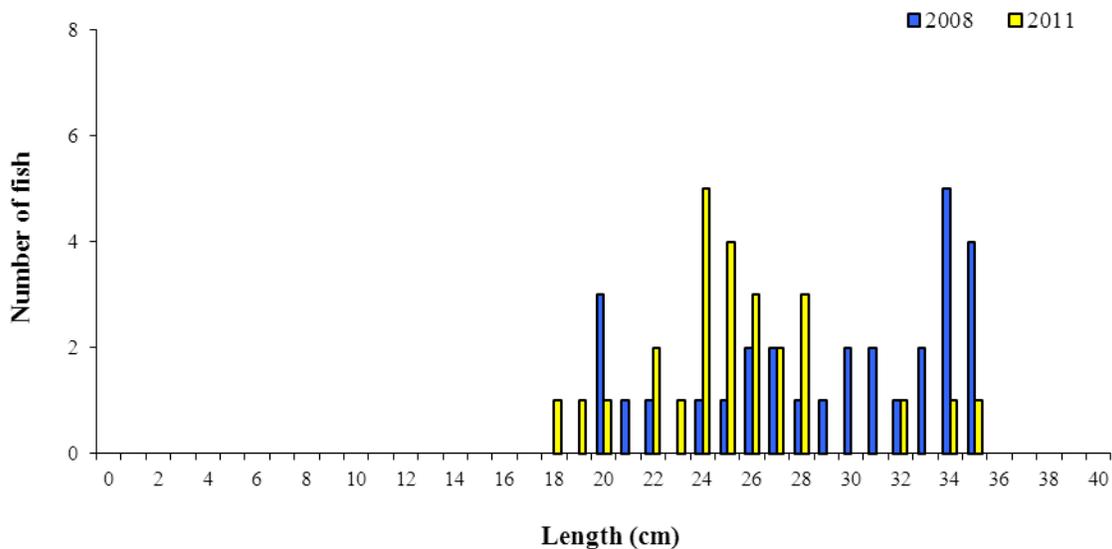


Fig. 1.7. Length frequency of rudd captured on Lough Owel

1.3.4 Fish age and growth

Eight age classes of perch were present, ranging from 0+ to 7+ indicating reproductive success in each of the previous eight years, with a mean L1 of 5.9cm (Table 1.3). In the 2008 survey, perch ranged from 0+ to 6+ with a mean L1 of 6.3cm. The dominant age classes of perch were 1+ and 2+.

Five age classes of rudd were present, ranging from 4+ to 8+, with a mean L1 of 2.2cm. In the 2008 survey, rudd ranged from 5+ to 10+ with a mean L1 of 4.0cm. The dominant age class of rudd was 5+, with ages ranging from 4+ to 8+.

Two wild brown trout were aged at 1+ and 2+, with a mean L1 of 5.0cm and five stocked brown trout ranged in age from 1+ to 6+.

Table 1.3. Mean (\pm SE) perch length (cm) at age for Lough Owel, July 2011

| | L₁ | L₂ | L₃ | L₄ | L₅ | L₆ | L₇ |
|-------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Mean | 5.9 (0.1) | 11.4 (0.1) | 16.5 (0.2) | 19.8 (0.2) | 22.1 (0.3) | 24.1 (0.5) | 25.0 (2.5) |
| N | 112 | 89 | 65 | 54 | 37 | 15 | 2 |
| Range | 4.5-9.2 | 7.3-16.1 | 11.4-20.4 | 16.4-23.7 | 18.6-25.4 | 21.2-28.7 | 22.3-27.5 |

1.4 Summary

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

Although the mean perch CPUE and BPUE was lower in 2011 than in 2008, these differences were not statistically significant. The mean perch CPUE in Lough Owel was similar to the other lakes assessed, with no statistically significant differences being found between lakes. The mean perch BPUE in Lough Owel was significantly higher than that recorded in Lough Leane, Co. Kerry, another similar lake surveyed. Perch ranged in age from 0+ to 7+, with 0+ and 1+ fish being captured indicating reproductive success in recent years. The dominant age classes of perch were 1+ and 2+.

Wild brown trout ranged in age from 1+ to 2+, indicating reproductive success in recent years.

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.*, 2012). Using the FIL2 classification tool, Lough Owel has been assigned an ecological status of Good based on the fish populations present. The ecological status assigned to the lake based on the 2008 survey data was Moderate.

In the 2007 to 2009 surveillance monitoring reporting period, the EPA assigned Lough Owel an overall ecological status of Moderate, based on all monitored physico-chemical and biological elements, including fish. This status classification will be revised at the end of 2012.

1.5 References

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

A large, dark blue abstract shape occupies the lower-left portion of the page. It has a white border and contains several white dashed lines that curve across it. The shape is irregular, with a pointed top and a jagged bottom edge.

**Inland Fisheries Ireland
Swords Business Campus,
Swords,
Co. Dublin,
Ireland.**

**Web: www.fisheriesireland.ie
Email: info@fisheriesireland.ie
Tel: +353 1 8842 600
Fax: +353 1 8360 060**