

National Research Survey Programme

Lakes 2015

Doo Lough





Inland Fisheries Ireland

National Research Survey Programme

**Fish Stock Survey of Doo Lough,
October 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.

CITATION: Kelly, F.L., Connor, L., Delanty, K., McLoone, P., Coyne, J., Morrissey, E., Corcoran, W., Cierpial, D., Matson, R., Gordon, P., O' Briain, R., Rocks, K., Walsh, L., O' Reilly, S., O' Callaghan, R., Cooney, R. and Timbs, D. (2016) Fish Stock Survey of Doo Lough, October 2015. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

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

© Inland Fisheries Ireland 2016



ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of all their colleagues in Inland Fisheries Ireland.

Mr. Michael Wade from Delphi Fishery, Co. Mayo provided access to Doo Lough and his assistance is gratefully acknowledged.

The authors would also like to acknowledge the funding provided for the project from the Department of Communications, Energy and Natural Resources for 2015.

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, 2015.*



1.1 Introduction

Doo Lough is located approximately 6km north-west of Leenaun, Co. Mayo (Plate 1.1, Fig. 1.1). It is one of four lakes situated in the Delphi fishery - Fin, Doo, Glencullin and Cunne. Glencullin Lough, located directly above Doo Lough, flows into the lake via a short stream. Doo Lough in turn drains into Fin Lough which is connected to Killary Harbour via the Bundorraha River.

The lake is approximately 3.5km in length and up to 750m wide. It has a surface area of 155ha, a maximum depth of 46m and an altitude of 30m a.s.l. The lake falls into typology class 4 (as designated by the EPA for the Water Framework Directive), i.e. deep (mean depth >4m), greater than 50ha and low alkalinity (<20mg/l CaCO₃).

Doo Lough forms part of the Mweelrea/Sheefry/Erriff candidate Special Area of Conservation complex (NPWS, 2005). The site has been selected for containing active blanket bog, lagoons, machair, decalcified dunes and petrifying springs - all priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected for containing the following species listed on Annex II of the same Directive - freshwater pearl mussel, Atlantic salmon, otter, the snails *Vertigo angustior* and *V. geyeri*, the plant slender naiad and the liverwort petalwort (NPWS, 2005).

Doo Lough is an oligotrophic lake (NPWS, 2005) and was once famous for its sea trout fishery, which has been in decline since the late 1980s due to problems with sea lice. Doo Lough holds brown trout, sea trout, Arctic char and gets both a spring and grilse salmon run (O' Reilly, 2007).

This lake was previously surveyed as part of the Water Framework Directive surveillance monitoring programme in 2009 and 2012 (Kelly *et al.*, 2010 and 2013). During both of these surveys, brown trout were found to be the dominant species present in the lake. Arctic char, sea trout, three-spined stickleback, salmon and eels were also captured during the surveys.

An additional experimental survey using hydroacoustic and pelagic gillnetting techniques was carried out on Doo Lough over two nights from the 6th to the 8th of October 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* 8km of hydroacoustic transects. A separate report will be available in due course.



Plate 1.1. Doo Lough

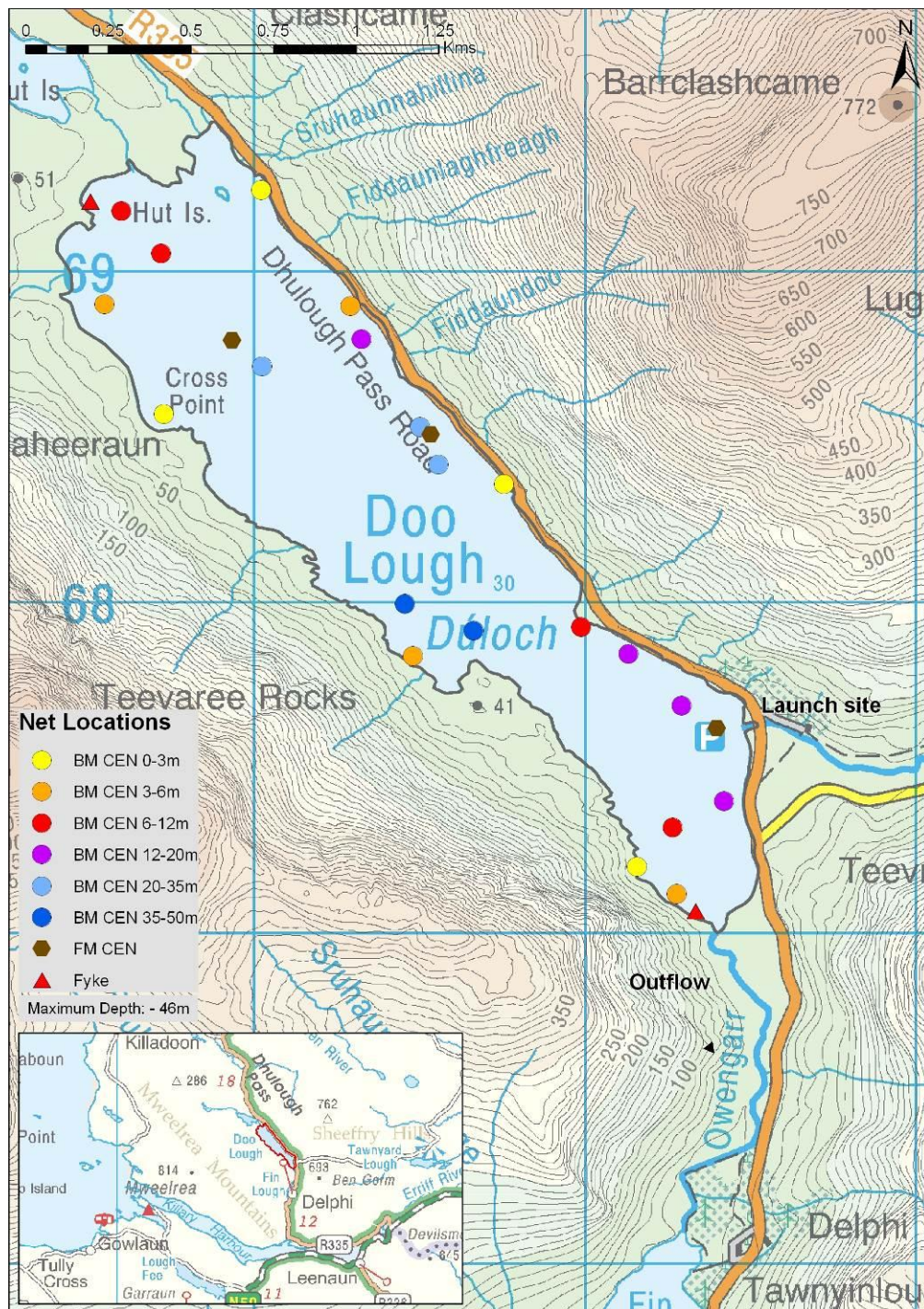


Fig. 1.1. Location map of Doo Lough showing locations and depths of each net (outflow is indicated on map)



1.2 Methods

1.2.2 Netting methods

Doo Lough was surveyed over two nights between the 7th and the 9th of October 2015. A total of two sets of Dutch fyke nets (fyke), 21 benthic monofilament multi-mesh (BM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets (4 @ 0-2.9m, 4 @ 3-5.9m, 4 @ 6-11.9m, 4 @ 12-19.9m, 3 @ 20-34.9m and 2 @ 35-49.9m) and three surface monofilament multi-mesh (FM CEN) (12 panel, 5-55mm mesh knot to knot) CEN standard survey gill nets were deployed randomly in the lake (26 sites). Nets were deployed in the same locations as were randomly selected in the previous surveys in 2009 and 2012. 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 were measured and weighed on site and scales were removed from all brown trout and Arctic char, sea trout and salmon. 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 in IFI when moving between water bodies.



1.3 Results

1.3.1 Species Richness

A total of five fish species (sea trout are included as a separate ‘variety’ of trout) were recorded in Doo Lough in October 2015, with 184 fish being captured. The number of each species captured by each gear type is shown in Table 1.1. Brown trout was the most abundant fish species recorded, followed by Arctic char, three-spined stickleback, sea trout, eels and salmon. During the previous surveys in 2009 and 2012 the same species composition was recorded (Kelly *et al.*, 2010 and 2013).

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

Scientific name	Common name	Number of fish captured			
		BM CEN	FM CEN	Fyke	Total
<i>Salmo trutta</i>	Brown trout	88	6	1	95
	Sea trout	9	0	0	9
<i>Salvelinus alpinus</i>	Arctic char	54	2	0	56
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	15	0	2	17
<i>Salmo salar</i>	Salmon	3	0	0	3
<i>Anguilla anguilla</i>	European eel	1	0	3	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 in the 2009, 2012 and 2015 surveys are summarised in Table 1.2. Mean CPUE and BPUE for all species is illustrated in Figure 1.2 and 1.3.

Brown trout

Brown trout was the dominant species in terms of abundance (CPUE) and biomass (BPUE). Although the mean brown trout CPUE fluctuated slightly over the three sampling occasions, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3). There were also no significant differences in mean BPUE across the three sampling years, although the BPUE increased.



Arctic char

The mean Arctic char CPUE and BPUE was higher in 2015 than in 2009 and 2012, however, these differences were not statistically significant (Table 1.2; Fig 1.2 and 1.3).

Table 1.2. Mean (S.E.) CPUE and BPUE for all fish species captured on Doo Lough, 2009, 2012 and 2015

Scientific name	Common name	2009	2012	2015
Mean CPUE				
<i>Salmo trutta</i>	Brown trout	0.057 (0.018)	0.136 (0.034)	0.121 (0.030)
	Sea trout	0.011 (0.004)	0.012 (0.004)	0.012 (0.004)
<i>Salmo salar</i>	Salmon	0.001 (0.001)	0.004 (0.002)	0.004 (0.002)
<i>Salvelinus alpinus</i>	Arctic char	0.023 (0.005)	0.021 (0.005)	0.072 (0.036)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.006 (0.003)	0.001 (0.001)	0.021 (0.007)
<i>Anguilla anguilla</i>	European eel	0.016 (0.016)	0.041 (0.025)	0.025 (0.008)
Mean BPUE				
<i>Salmo trutta</i>	Brown trout	3.437 (1.242)	7.072 (1.987)	9.887 (3.116)
	Sea trout	4.824 (1.839)	5.404 (2.292)	8.447 (3.203)
<i>Salmo salar</i>	Salmon	0.007 (0.007)	4.671 (3.229)	3.519 (3.460)
<i>Salvelinus alpinus</i>	Arctic char	1.135 (0.769)	1.342 (0.395)	3.8641 (2.089)
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	0.025 (0.012)	0.001 (0.001)	0.029 (0.009)
<i>Anguilla anguilla</i>	European eel	3.966 (3.966)	6.158 (4.675)	5.629 (0.812)

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

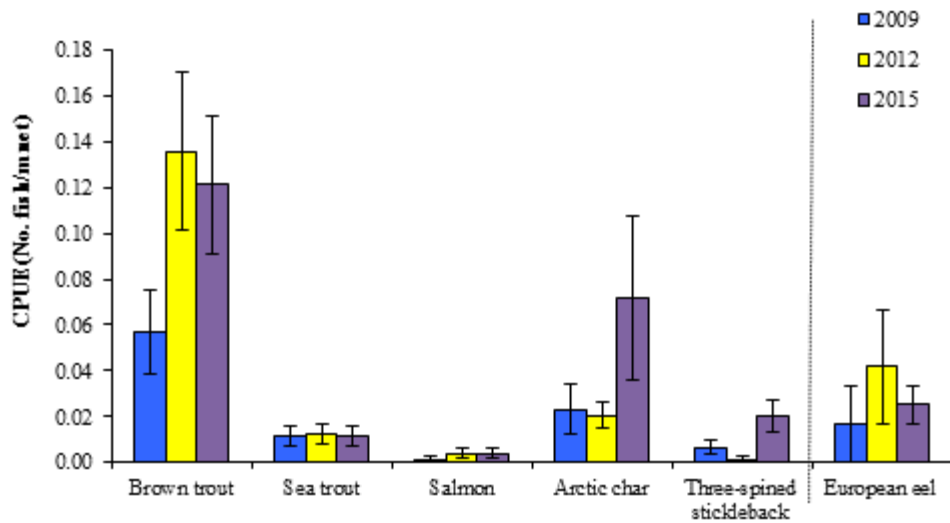


Fig. 1.2. Mean (\pm S.E.) CPUE for all fish species captured in Doo Lough (Eel CPUE based on fyke nets only), 2009, 2012 and 2015

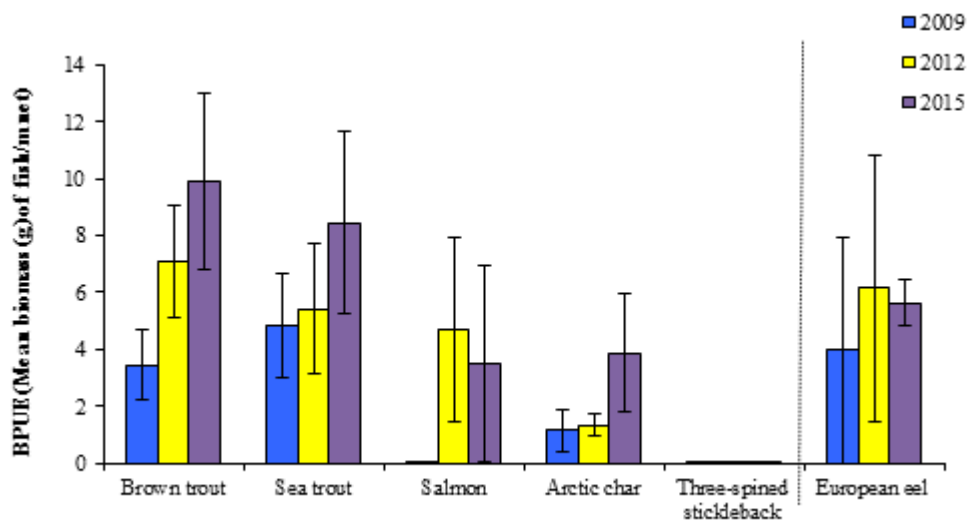


Fig. 1.3. Mean (\pm S.E.) BPUE for all fish species captured in Doo Lough (Eel BPUE based on fyke nets only), 2009, 2012 and 2015

1.3.3 Length frequency distributions and growth

Brown trout

Brown trout captured during the 2015 survey ranged in length from 6.2cm to 51.3cm (mean = 17.2cm) (Fig. 1.4). Six age classes were present, ranging from 0+ to 5+, with a mean L1 of 6.4cm (Table 1.3). The dominant age class was 2+ (Fig. 1.4). Mean brown trout L4 in 2015 was 24.7cm 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). Brown trout captured during the 2009 and 2012 surveys had similar length and age ranges, with some larger and older fish recorded in the 2012 and 2015 surveys (Fig.1.4).

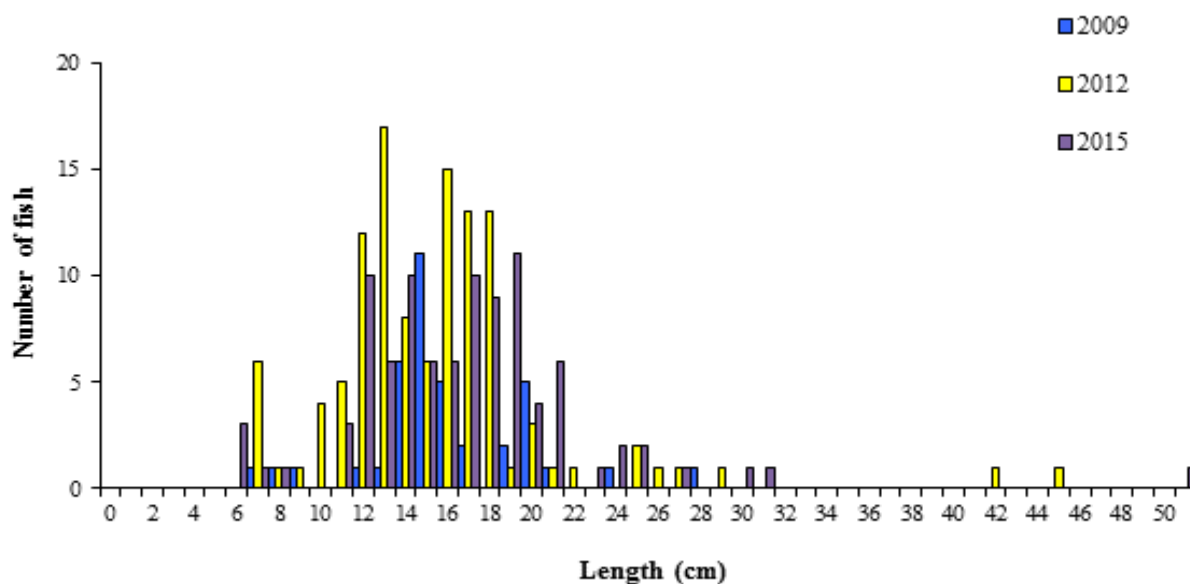


Fig. 1.4. Length frequency of brown trout captured on Doo Lough, 2015

Table 1.3. Mean (\pm S.E.) brown trout length (cm) at age for Doo Lough, July 2015

	L₁	L₂	L₃	L₄	L₅	Growth Category
Mean (\pm S.E.)	6.4 (0.1)	13.5 (0.3)	19.5 (0.6)	24.7 (1.8)	29.0	Very slow
N	41	32	16	4	1	
Range	5.2-8.6	10.8-16.8	15.7-24.3	21.5-29.3	29.0-29.0	

Arctic char

Arctic char captured during the 2015 survey ranged in length from 6.0cm to 25.4cm (mean = 15.2cm) (Fig.1.5) with five age classes present, ranging from 0+ to 5+. Arctic char captured during the 2009 and 2012 surveys had a narrower length and age range (Fig.1.5).

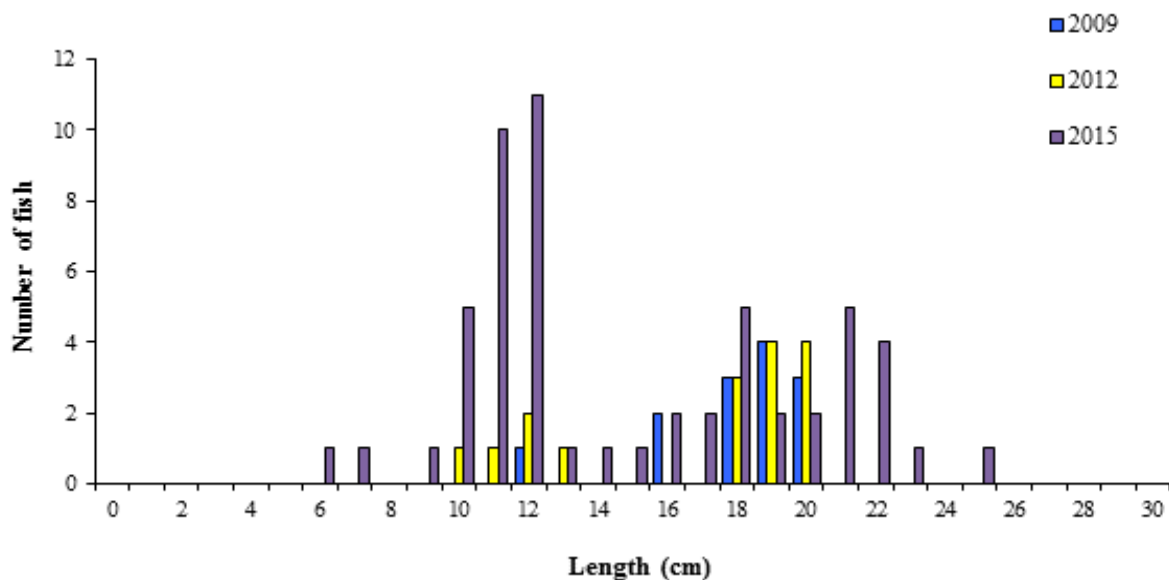


Fig. 1.5. Length frequency of Arctic char captured on Doo Lough, 2015

Other fish species

Eels captured during the 2015 survey ranged in length from 36.5cm to 57.4cm. Three salmon captured were aged 1+ and 2.1+ and measured 11.1cm to 64.1cm. Sea trout ranged in length from 32.6cm to 54.0cm and ages ranged from 2.1+ to 3.3+. Three-spined stickleback ranged in length from 4.0cm to 6.3cm.

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.

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 subsample of trout captured during the survey were dominated by unidentified insect and fish remains (Fig 1.6).

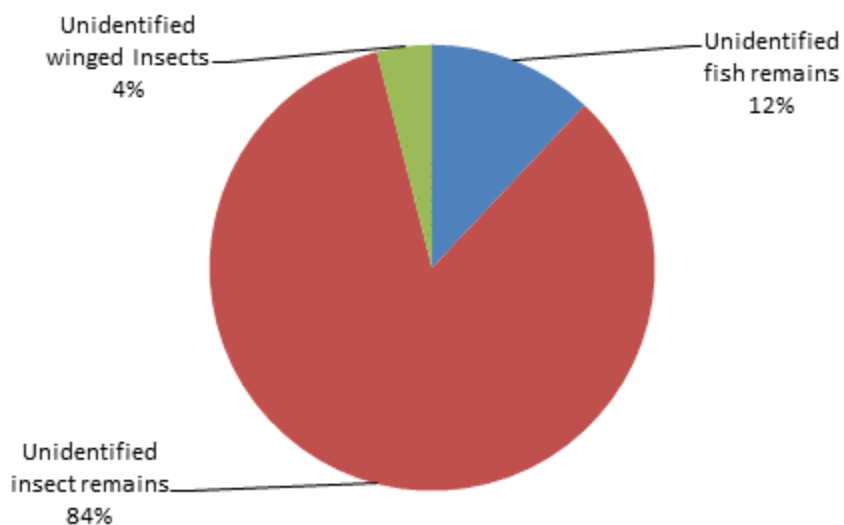


Fig 1.7. Diet of brown trout captured on Doo Lough 2015 (% occurrence) n=24

1.4 Summary and ecological status

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

The mean brown trout CPUE fluctuated slightly over the three sampling years; however, these differences were not statistically significant. There were also no significant differences in mean BPUE across the three sampling years. Brown trout ranged in age from 0+ to 5+, indicating reproductive success in the previous six years. The dominant age class was 2+. 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).



The mean Arctic char CPUE and BPUE was higher in 2015 than in 2009 and 2012; however, these differences were also not statistically significant. Arctic char ranged in age from 0+ to 5+, with five age classes present.

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, Doo Lough has been assigned an ecological status of High for 2009, 2012 and 2015 based on the fish populations present.

In the 2010 to 2012 surveillance monitoring reporting period, the EPA assigned Doo Lough 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.
- 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., Harrison A., Connor, L., Matson, R., Morrissey, E., O'Callaghan, R., Wogerbauer, C., Feeney, R., Hanna, G. and Rocks, K. (2010) *Sampling Fish for the Water Framework Directive – Summary Report 2009*. The Central and Regional Fisheries Boards.
- 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.
- Kelly, F., Connor, L., Matson, R., Feeney, R., Morrissey, E., Wogerbauer, C. and Rocks, K. (2013) *Sampling Fish for the Water Framework Directive – Summary Report 2012*. 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*, **71 (B) (18)**, 269-352.
- NPWS (2005) Site synopsis: *Mweelrea/Sheeffry/Erriff Complex*. Site code: 001932. Site Synopsis report, National Parks and Wildlife Service.
- O' Grady, M.F. (1981). A study of brown trout (*Salmo trutta* L.) populations in selected Irish lakes. Ph.D. Thesis, National University of Ireland.
- O' Reilly P (2007) *Loughs of Ireland. A Flyfisher's Guide*. 4th edition. Merlin Unwin Books.

A series of three overlapping, wavy, dotted lines in a light grey color, extending horizontally across the lower portion of the dark blue background.

**IFI Dublin,
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland**

**www.fisheriesireland.ie
dublin@fisheriesireland.ie
+353 1 8842 600**