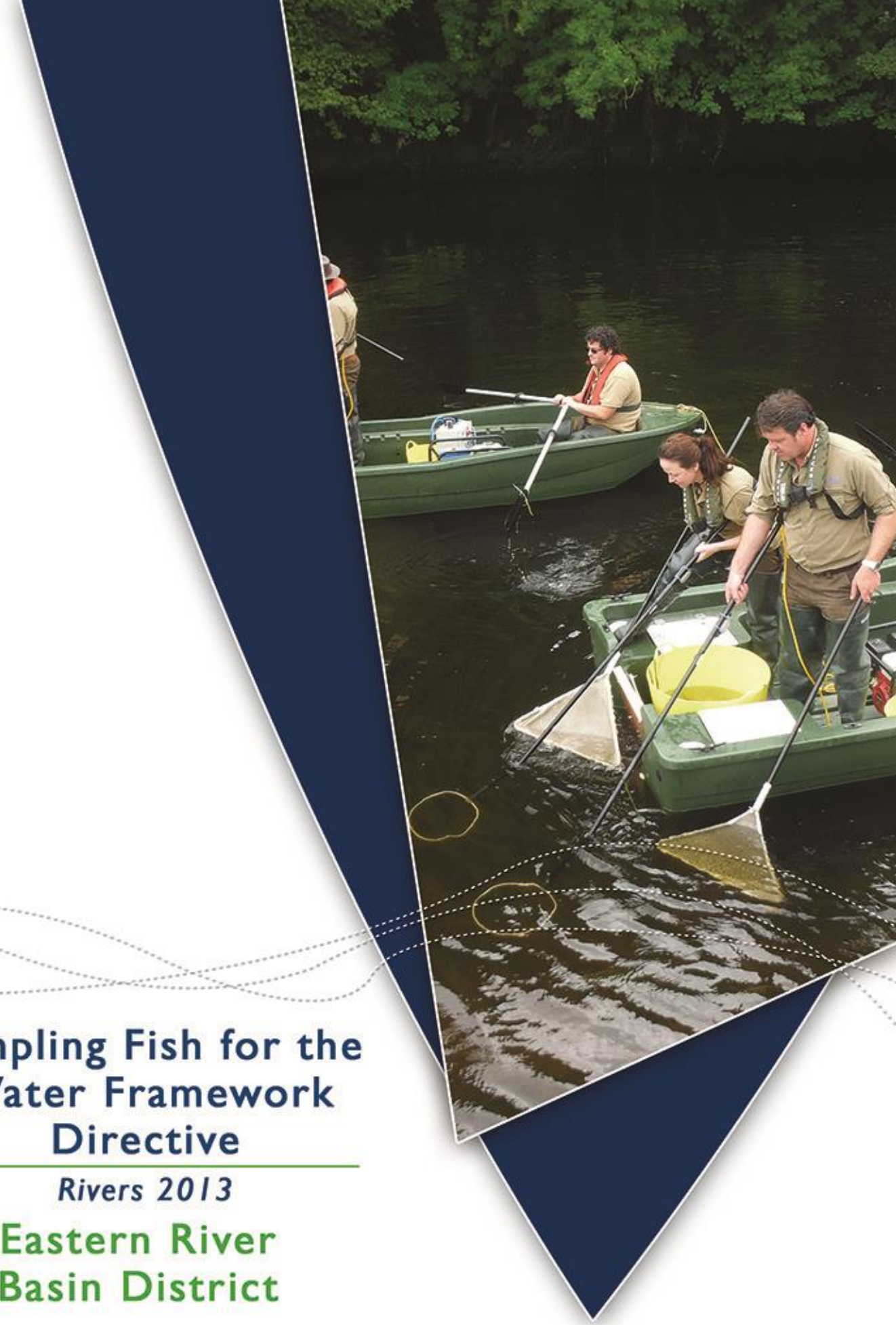
IFI/2014/1-4209



Sampling Fish for the Water Framework Directive

Rivers 2013

Eastern River Basin District

Iascach Intíre Éireann
Inland Fisheries Ireland

Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Rivers in the Eastern River Basin District, 2013

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

Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24

CITATION: Kelly, F.L., Matson, R., Connor, L., Feeney, R., Morrissey, E., Coyne, J. and Rocks, K. (2014) Water Framework Directive Fish Stock Survey of Rivers in the Eastern River Basin District. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

Cover photo: WFD team electric-fishing © Inland Fisheries Ireland

ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of the regional director Mr. William Walsh and staff from IFI Blackrock as well as various other offices throughout the region. The authors also gratefully acknowledge the help and cooperation of colleagues in IFI Swords.

We would like to thank the landowners and angling clubs that granted us access to their land and respective fisheries.

Furthermore, the authors would like to acknowledge the funding provided for the project from the Department of Communications, Energy and Natural Resources for 2013.

PROJECT STAFF

Project Director/Senior Research Officer:	Dr. Fiona Kelly
Project Manager:	Ms. Lynda Connor
Research Officer:	Dr. Ronan Matson
Technician	Mr. Rory Feeney
Technician:	Ms. Emma Morrissey
Technician:	Mr. John Coyne
GIS Officer:	Mr. Kieran Rocks
Fisheries Assistant:	Mr. Johannes Bulfin (Jul 2013 – Dec 2013)
Fisheries Assistant:	Mr. John Finn (Jul 2013 – Dec 2013)
Fisheries Assistant:	Ms. Karen Kelly (Jul 2013 – Dec 2013)
Fisheries Assistant:	Ms. Roisín O'Callaghan (Jul 2013 – Dec 2013)
Fisheries Assistant:	Ms. Laura Walsh (Jul 2013 – Dec 2013)

TABLE OF CONTENTS

1. INTRODUCTION

Fish stock surveys were undertaken in 75 river sites (56 waterbodies) throughout Ireland during the summer of 2013 as part of the programme of sampling fish for the Water Framework Directive (WFD). These surveys are required by both national and European law, with Annex V of the WFD stipulating that rivers are included within the monitoring programme and that the composition, abundance and age structure of fish fauna are examined (Council of the European Communities, 2000). Eight river sites were surveyed in the Eastern River Basin District (ERBD) from July to September 2013 by staff from Inland Fisheries Ireland (Table 2.1, 2.2 and Fig. 2.1).

Although fish survey work has been carried out in Ireland in the past, no project to date has been as extensive as the current on-going monitoring programme in providing data appropriate for WFD compliance. Continued surveying of these and additional river sites will provide a useful baseline and time-series dataset for future monitoring of water quality. This in turn will provide information for River Basin District (RBD) managers to compile and implement programmes of measures to improve degraded water bodies. As 2013 is the sixth year of the rivers sampling programme, many of the sites surveyed this year are repeat surveys of those carried out in previous years. As a result, surveys this year can be compared with those from before, to determine whether the status of our rivers is improving or deteriorating.

This report summarises the results of the 2013 fish stock survey carried out on each site in the ERBD, as part of the Water Framework Directive surveillance monitoring programme.

2. STUDY AREA

Eight river sites were surveyed in four river catchments within the ERBD during 2013: the Avoca, Boyne, Liffey and Vartry catchments (Table 2.1). The sites ranged in surface area from 313m^2 at the Avonbeg River to 8,748m^2 for the River Liffey (Kilcullen). The River Liffey sites were surveyed with boat-based electric fishing units. All other sites were wadeable and surveyed using bank-based electric fishing units. Summary details for each site's location and physical characteristics are given in Tables 2.1 and 2.2, and the distribution of sites throughout the ERBD is shown in Figure 2.1.

Table 2.1. Location and codes of river sites surveyed for WFD surveillance monitoring, ERBD 2013

River	Site name	Catchment	Site Code	Waterbody code
ERBD Wadeable sites				
Avonbeg River	Greenan Br._A	Avoca	10A040600A	EA_10_99
Blackwater (Kells), River	Lough Ramor_A	Boyne	07B010800A	EA_07_1035
Dodder, River	Bohernabreena_A	Liffey	09D010100A	EA_09_1656
Dodder, River	Beaver Row_B	Liffey	09D010900B	EA_09_587
Dodder, River	Mount Carmel_A	Liffey	09D010680A	EA_09_587
Vartry River	Newrath Br._A	Vartry	10V010300A	EA_10_1601
ERBD Non-Wadeable sites				
Liffey, River	Ballyward Br._A	Liffey	09L010250A	EA_09_1175
Liffey, River	Kilcullen Br._A	Liffey	09L010700A	EA_09_1870_2

Table 2.2. Details of river sites surveyed for WFD surveillance monitoring, ERBD 2013

Site name	Upstream catchment (km^2)	Wetted width (m)	Surface area (m^2)	Mean depth (m)	Max depth (m)
ERBD Wadeable sites					
Avonbeg (Greenan Br._A)	72.13	7.82	313	0.28	0.64
Blackwater (Kells), (Lough Ramor_A)	124.12	9.77	391	0.24	0.49
Dodder (Bohernabreena_A)	31.82	7.32	315	0.19	0.59
Dodder (Beaver Row_B)	104.58	13.90	514	0.23	0.72
Dodder (Mount Carmel_A)	93.22	9.68	339	0.19	0.45
Vartry (Newrath Br._A)	102.98	7.72	347	0.22	0.48
ERBD Non-Wadeable sites					
Liffey (Ballyward Br._A)	87.70	11.60	3503	0.33	0.79
Liffey (Kilcullen Br._A)	449.86	24.17	8748	0.38	1.50

Fig. 2.1. Location map of river sites surveyed throughout the ERBD for WFD fish surveillance monitoring, 2013

3. METHODS

Electric-fishing is the method of choice for the surveillance monitoring of fish in rivers and to obtain a representative sample of the fish assemblage for each survey site. This technique complies with European Committee for Standardisation (CEN) guidelines for fish stock assessment in wadeable rivers (CEN, 2003). At each site, the sample stretch was isolated where possible using stop nets, with one to three fishings carried out using bank-based or boat-based electric fishing units. Each site ideally contained all habitat types, including riffle, glide and pool. A suite of physical and chemical parameters were also recorded.

Fish from each pass were sorted and processed separately. During processing, the species of each fish was identified, with its length and weight measured. Sub-samples were sometimes taken when large numbers of fish were present. For the purpose of species identification, juvenile river lamprey (*Lampetra fluviatilis*), brook lamprey (*Lampetra planeri*) and sea lamprey (*Petromyzon marinus*) were recorded as 'Lamprey sp.'. Sea trout and brown trout were listed separately. For ageing analyses, scales were taken from fish greater than 8.0cm for salmonids and most non-native fish species. After processing, fish were held in large bins of oxygenated water until they were fully recovered, before returning them to the water.

For various reasons, including river width and flow rate, stop nets could not be deployed at every site, thus making three fishing passes impractical. Therefore, in order to draw comparisons between sites, fish densities were calculated using data from the first fishing pass only. The number captured in the first pass was divided by the total area surveyed to give a minimum density for each species.

A subsample of the dominant fish species was aged (five fish from each 1cm size class). Fish scales were aged using a microfiche reader. Growth was determined by back-calculating lengths at the end of each winter (e.g. L1 is the mean length at the end of the first winter and L2 is the mean length at the end of the second winter, etc.).

4. RESULTS

4.1 River surveys

4.1.1 The Avonbeg River

One site was electric fished on the Avonbeg River as part of the WFD surveillance monitoring programme in rivers 2013. The survey site was located upstream of Greenan Br., 4km west of Rathdrum, Co. Wicklow (Fig. 4.1; Plate 4.1). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 17th of July 2013, along a 40m length of channel. Riffle and glide dominated the habitat, over a substrate of mainly boulder and cobble. The vegetation at this site was dominated by bryophytes, with a diverse number of aquatic and semi-aquatic mosses and liverworts present on the boulders throughout the stretch.

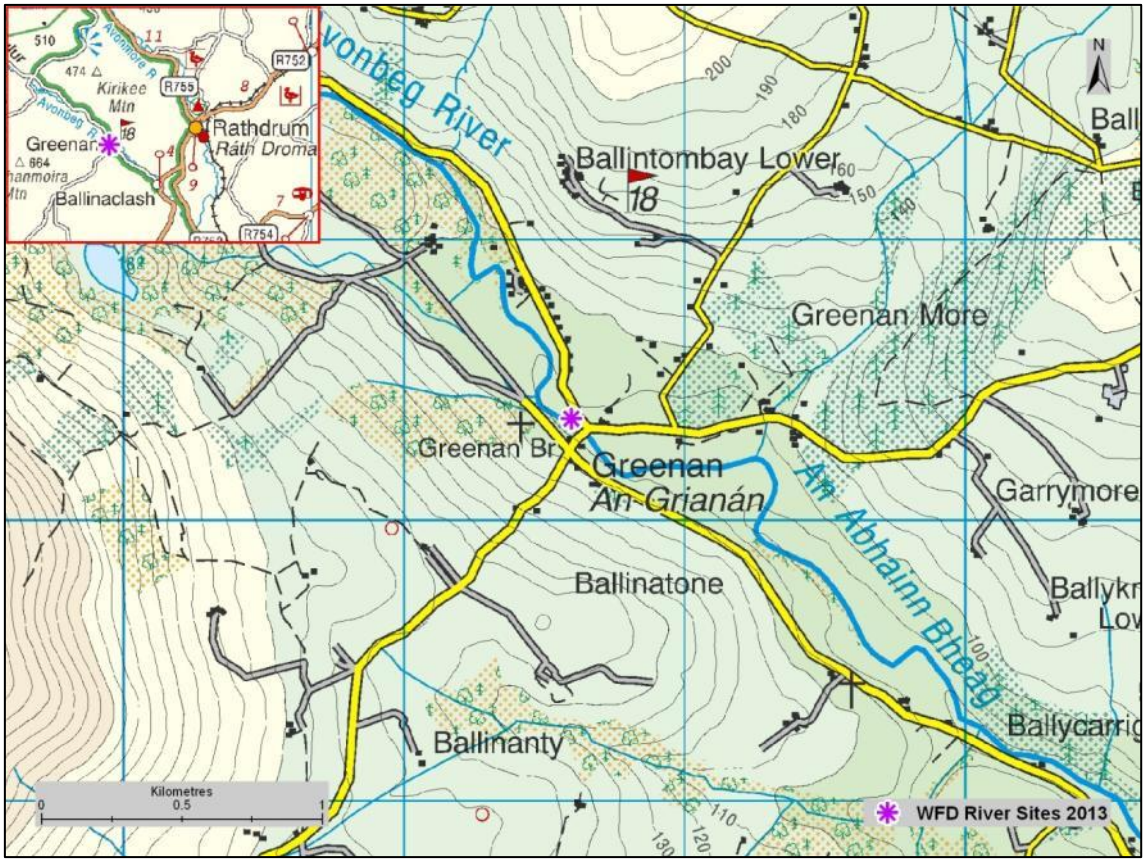


Fig. 4.1. Location of the Avonbeg River (Greenan Br.) surveillance monitoring site

Plate 4.1. The Avonbeg River at Greenan Br., Co. Wicklow

Two fish species were recorded in the Avonbeg River during the 2013 survey (Table 4.1). Salmon was the most abundant species recorded, followed by brown trout.

Table 4.1. Density of fish (no./m^2), Avonbeg River (Greenan Br.) (fish density has been calculated as minimum estimates based on one fishing)

	Total minimum density	
Species	**2010**	**2013**
Salmon	0.089	0.109
0+ Salmon	0.003	0.013
1++ Salmon	0.087	0.096
Brown trout	0.016	0.032
0+ Brown trout	-	0.013
1++ Brown trout	0.016	0.019
European eel	0.003	-
All Fish	0.107	0.141

Brown trout captured during the 2013 survey ranged in length from 7.2cm to 28.1cm (mean = 12.1cm) (Fig. 4.2). Four age classes (0+, 1+, 2+ and 5+) were present, accounting for 29%, 43%, 21% and 7% of the total brown trout catch respectively. Brown trout captured during the 2010 survey ranged in length from 7.4cm to 17.4cm (mean = 10.6cm). Three age classes were present (1+, 2+ and 3+), accounting for approximately 73%, 20% and 7% of the brown trout catch respectively.

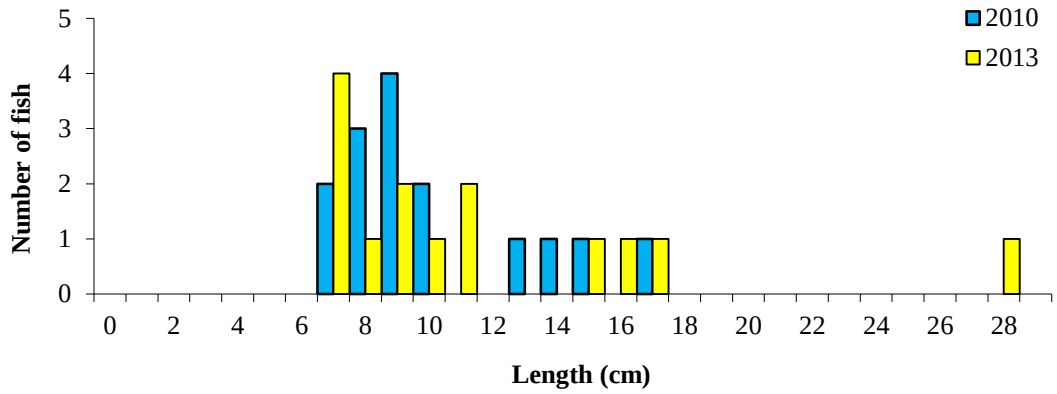


Fig. 4.2. Length frequency distribution of brown trout in the Avonbeg River (Greenan Br.), June 2010 (n=15) and July 2013 (n = 14)

Salmon captured during the 2013 survey ranged in length from 4.8cm to 12.8cm (mean = 9.6cm) (Fig. 4.3). Three age classes (0+, 1+ and 2+) were present, accounting for 13%, 44% and 44% of the total salmon catch respectively. Salmon captured during the 2010 survey ranged in length from 4.5cm to 12.7cm (mean = 8.8cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 2%, 94% and 4% of the salmon catch respectively.

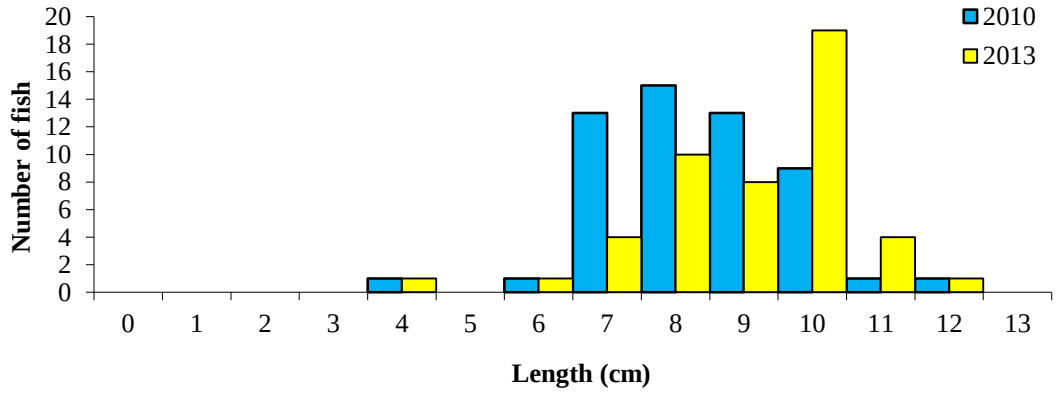


Fig. 4.3. Length frequency distribution of salmon in the Avonbeg River (Greenan Br.), June 2010 (n=54) and July 2013 (n = 48)

4.1.2 The River Blackwater (Kells)

One site was electric fished on the River Blackwater (Kells) as part of the WFD surveillance monitoring programme in rivers 2013. The survey site was located just upstream of Lough Ramor in Virginia, Co. Cavan (Fig. 4.4; Plate 4.2). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 7th of August 2013, along a 40m length of channel. Riffle and glide dominated the habitat, while the substrate was mainly composed of cobble. The vegetation at this site consisted mainly of bryophytes and a small number of emergent and floating species.

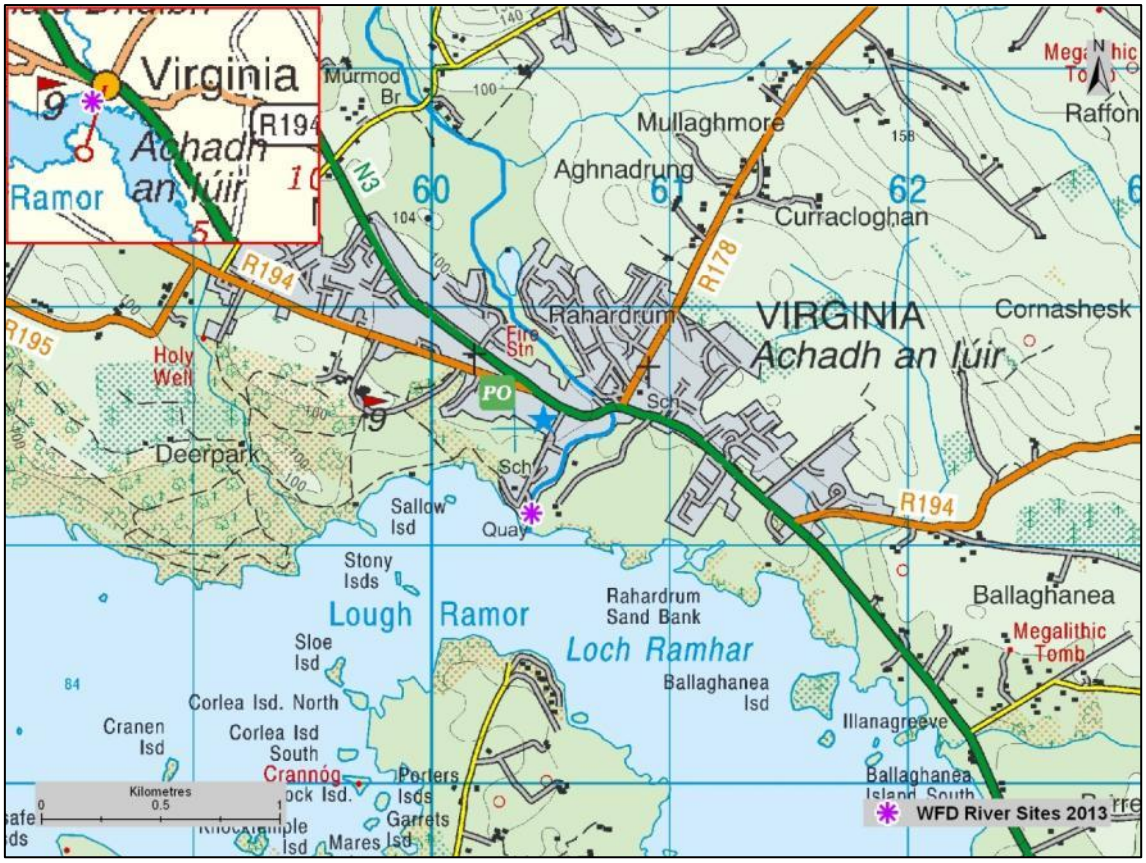


Fig. 4.4. Location of the River Blackwater (Kells) (Lough Ramor) surveillance monitoring site

Plate 4.2. The River Blackwater (Kells) at Lough Ramor, Virginia, Co. Cavan

Eight fish species were recorded in the River Blackwater (Kells) at Lough Ramor during the 2013 survey (Table 4.2). Brown trout was the most abundant species recorded, followed by gudgeon, minnow, roach, salmon, European eel, perch and three-spined stickleback.

Table 4.2. Density of fish (no./m^2), River Blackwater (Kells) (Lough Ramor) (fish density has been calculated as minimum estimates based on one fishing)

	Total minimum density	
Species	**2009**	**2013**
Brown trout	0.329	0.212
0+ Brown trout	0.273	0.143
1++ Brown trout	0.056	0.069
Gudgeon	0.051	0.038
Minnow	0.007	0.031
Roach	0.215	0.013
Salmon	0.041	0.010
0+ Salmon	0.034	0.003
1++ Salmon	0.007	0.008
European eel	0.017	0.010
Perch	0.007	0.008
Three-spined stickleback	-	0.005
Stone loach	0.002	-
All Fish	0.669	0.328

Brown trout captured during the 2013 survey ranged in length from 4.5cm to 25.0cm (mean = 10.1cm) (Fig. 4.5). Three age classes (0+, 1+and 2+) were present, accounting for 66%, 32% and 2% of the total brown trout catch respectively. Brown trout captured during the 2009 survey ranged in length from 5.3cm to 23.1cm (mean = 9.1cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 88%, 12% and <0.5% of the brown trout catch respectively.

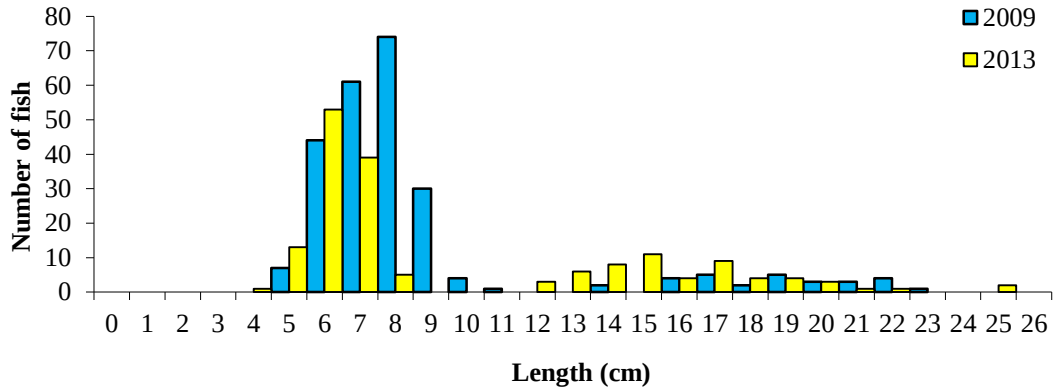


Fig. 4.5. Length frequency distribution of brown trout in the River Blackwater (Kells) (Lough Ramor), August 2009 (n=250) and August 2013 (n = 167)

Salmon captured during the 2013 survey ranged in length from 6.0cm to 12.8cm (mean = 9.3cm) (Fig. 4.6). Two age classes (0+ and 1+) were present, each accounting for 50% of the total salmon catch. Salmon captured during the 2009 survey ranged in length from 5.0cm to 15.2cm (mean = 7.2cm). Two age classes were present (0+ and 1+), accounting for 88% and 12% of the salmon catch respectively.

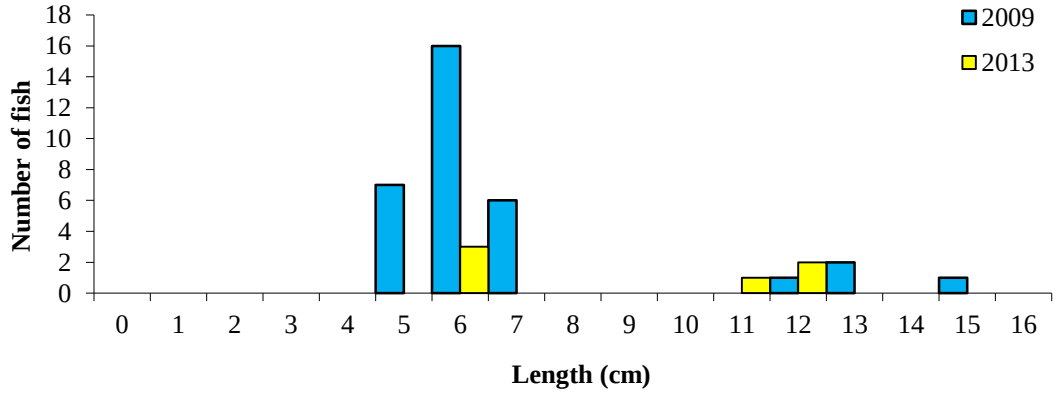


Fig. 4.6. Length frequency distribution of salmon in the River Blackwater (Kells) (Lough Ramor), August 2009 (n=33) and August 2013 (n = 6)

Eels captured during the 2013 survey ranged in length from 13.3cm to 44.5cm (mean = 23.5cm) (Fig. 4.7). Eels captured during the 2009 survey ranged in length from 10.8cm to 36.5cm (mean = 20.1cm).

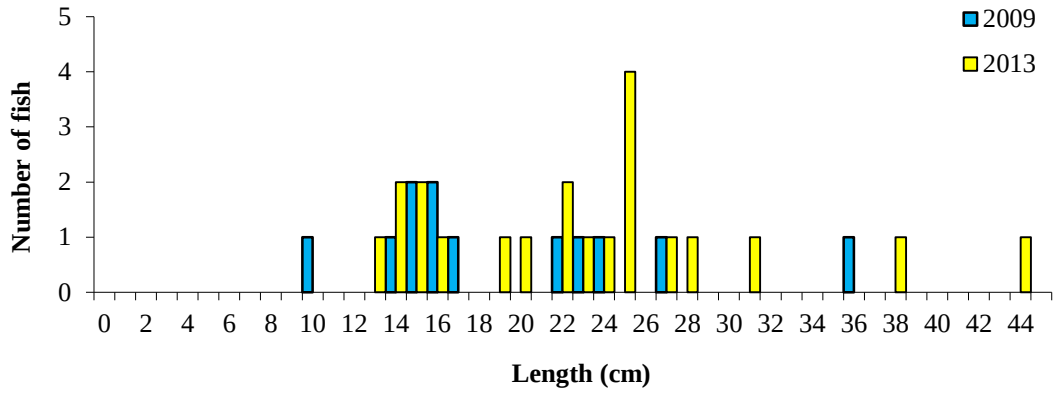


Fig. 4.7. Length frequency distribution of eels in the River Blackwater (Kells) (Lough Ramor), August 2009 (n=12) and August 2013 (n = 21)

Roach captured during the 2013 survey ranged in length from 3.2cm to 17.8cm (mean = 6.6cm) (Fig. 4.8). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for 75%, 8%, 8% and 8% of the total roach catch respectively. Roach captured during the 2009 survey ranged in length from 2.7cm to 6.5cm (mean = 3.9cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 95%, 4% and 1% of the roach catch respectively.

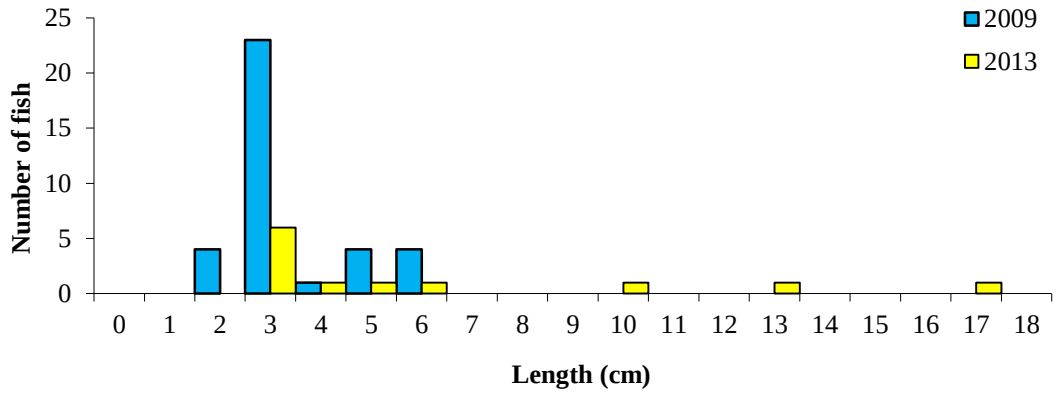


Fig. 4.8. Length frequency distribution of roach in the River Blackwater (Kells) (Lough Ramor), August 2009 (n=36) and August 2013 (n = 12)

4.1.3 The River Dodder

Three sites were electric fished on the River Dodder as part of the WFD surveillance monitoring programme in rivers 2013; the River Dodder, Beaver Row, the River Dodder, Mount Carmel Hospital and the River Dodder, Bohernabreena.

The Beaver Row survey site was located just upstream of the footbridge at Beaver Row, Donnybrook, Dublin (Fig. 4.9; Plate 4.3). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 3rd of August 2013, along a 37m length of channel. Glide was the most abundant habitat, while the substrate consisted largely of cobble. The right hand bank consisted of a vertical wall, making vegetation scarce. As a result, the site consisted mainly of tall riparian species, restricted to the wide left hand bank.

The Mount Carmel survey site was located just downstream of the foot bridge on the river opposite Mount Carmel Hospital (Fig. 4.9; Plate 4.4). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 1st of July 2013, along a 35m length of channel. Riffle and glide dominated the habitat, while the substrate was almost entirely made up of cobble. The vegetation at this site consisted of algae, mosses and a small number of riparian species.

The Bohernabreena survey site was located within a field along the Dublin Mountains Way, approximately 2.5km south of Oldbawn, Co. Dublin (Fig. 4.10; Plate 4.5). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 1st of July 2013, along a 43m length of channel. Riffle dominated the habitat, while the substrate consisted largely of cobble. Vegetation at this site was scarce, consisting of only a few mosses and liverworts.

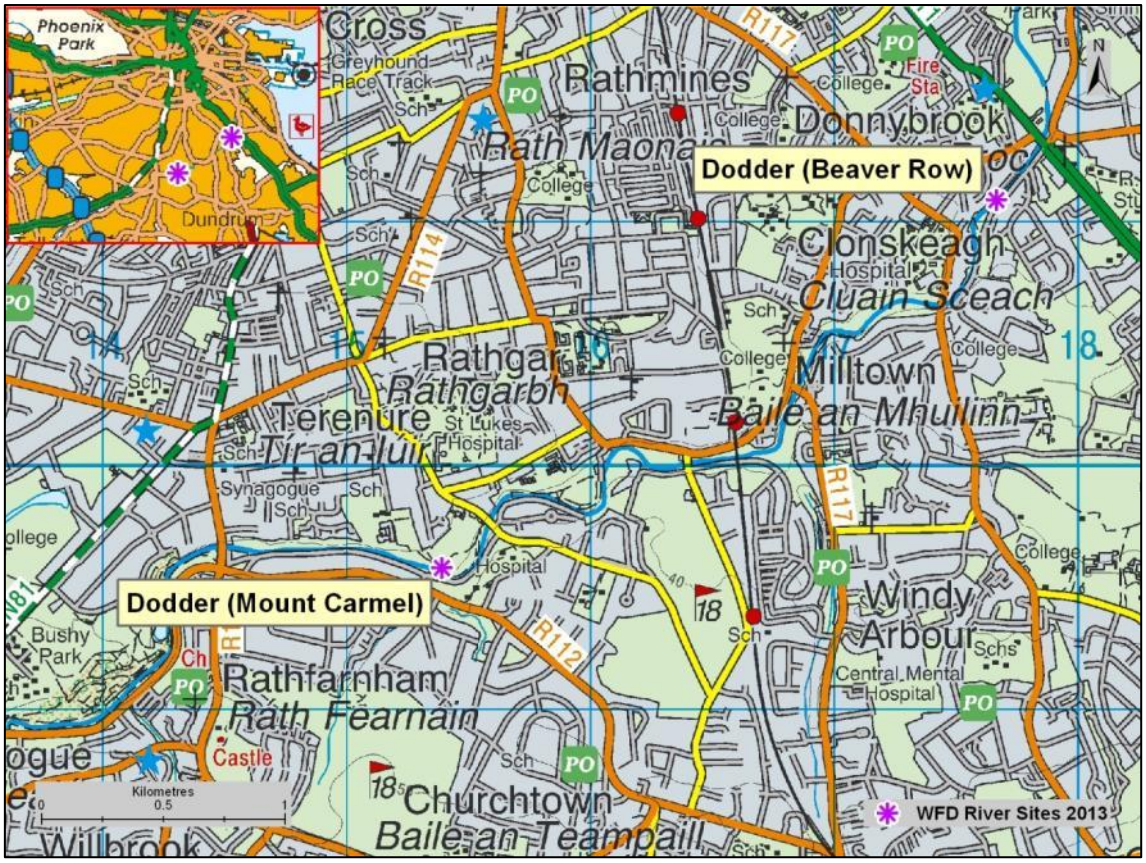


Fig. 4.9. Location of the River Dodder (Beaver Row and Mount Carmel) surveillance monitoring sites

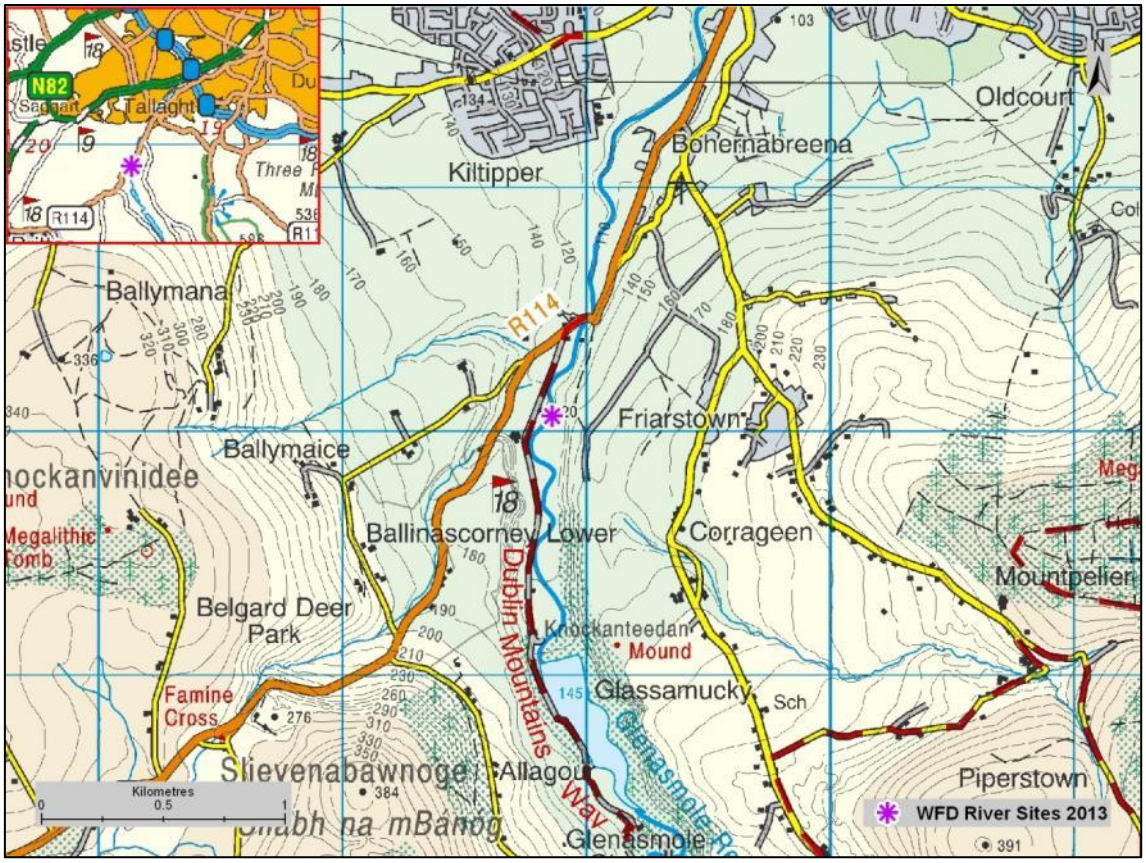


Fig. 4.10. Location of the River Dodder (Bohernabreena) surveillance monitoring site

Plate 4.3. The River Dodder at Beaver Row, Dublin

Plate 4.4. The River Dodder at Mount Carmel, Dublin

Plate 4.5. The River Dodder at Bohernabreena, Dublin

River Dodder (Beaver Row)

Seven fish species were recorded in the River Dodder at Beaver Row during the 2013 survey (Table 4.3). Salmon was the most abundant species recorded, followed by brown trout, European eel, stone loach, flounder, three-spined stickleback and Lamprey sp.

Table 4.3. Density of fish (no./m^2), River Dodder (Beaver Row) (fish density has been calculated as minimum estimates based on one fishing)

	Total minimum density	
Species	**2011**	**2013**
Salmon	0.586	0.226
0+ Salmon	0.567	0.208
1++ Salmon	0.019	0.017
Brown trout	0.297	0.134
0+ Brown trout	0.292	0.126
1++ Brown trout	0.005	0.008
European eel	0.027	0.052
Stone loach	0.010	0.004
Flounder	-	0.004
Three-spined stickleback	0.010	0.002
Lamprey sp.	-	0.002
Minnow	0.008	-
All Fish	0.938	0.424

Brown trout captured during the 2013 survey ranged in length from 5.0cm to 16.3cm (mean = 6.7cm) (Fig. 4.11). Three age classes (0+, 1+ and 2+) were present, accounting for 95%, 4% and 1% of the total brown trout catch respectively. Brown trout captured during the 2011 survey ranged in length from 4.5cm to 24.2cm (mean = 7.5cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 99%, 0.5% and 0.5% of the brown trout catch respectively.

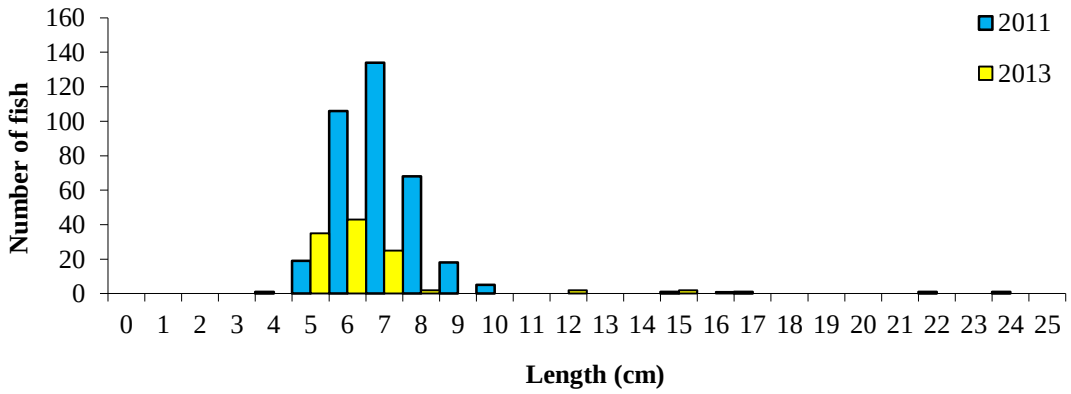


Fig. 4.11. Length frequency distribution of brown trout in the River Dodder (Beaver Row), July 2011 (n=355) and July 2013 (n = 110)

Eels captured during the 2013 survey ranged in length from 11.1cm to 32.4cm (mean = 20.5cm) Brown trout captured during the 2011 survey ranged in length from 12.0cm to 35.2cm (mean = 23.9cm).

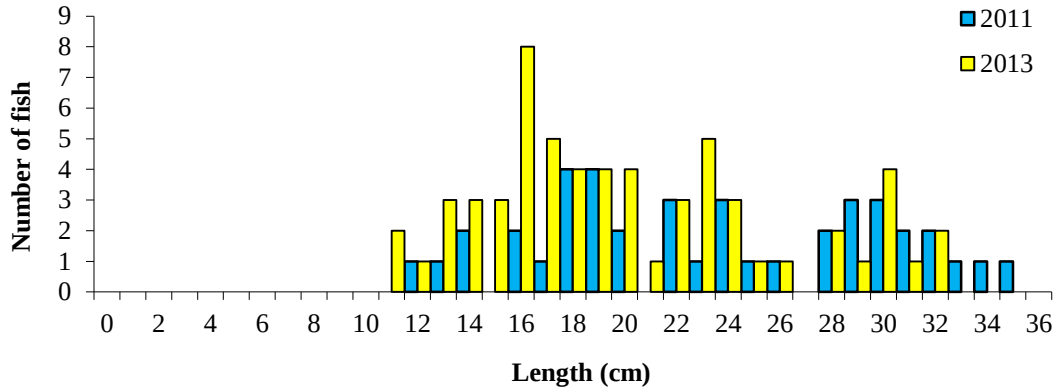


Fig. 4.12. Length frequency distribution of eels in the River Dodder (Beaver Row), July 2011 (n=41) and July 2013 (n = 61)

Salmon captured during the 2013 survey ranged in length from 3.5cm to 16.6cm (mean = 6.0cm) (Fig. 4.13). Three age classes (0+, 1+ and 2+) were present, accounting for 96%, 3% and 1% of the total salmon catch respectively. Salmon captured during the 2011 survey ranged in length from 4.1cm to 18.8cm (mean = 6.4cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 97%, 3% and 0.1% of the salmon catch respectively.

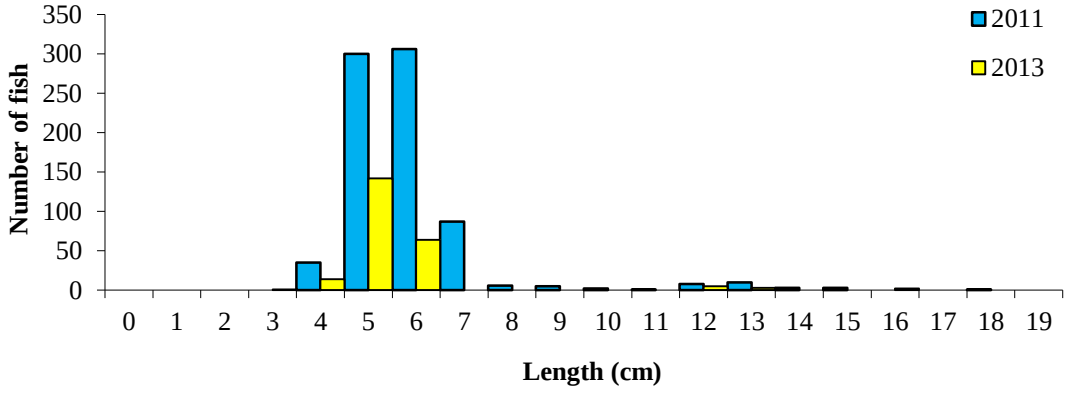


Fig. 4.13. Length frequency distribution of salmon in the River Dodder (Beaver Row), July 2011 (n=767) and July 2013 (n = 231)

River Dodder (Mount Carmel)

Two fish species were recorded in the River Dodder at Mount Carmel during the 2013 survey (Table 4.4). Brown trout was the most abundant species recorded, followed by European eel.

Table 4.4. Density of fish (no./m^2), River Dodder (Mount Carmel) (fish density has been calculated as minimum estimates based on one fishing)

	Total minimum density	
Species	**2011**	**2013**
Brown trout	0.111	0.221
0+ Brown trout	0.091	0.150
1++ Brown trout	0.020	0.071
European eel	0.002	0.009
Three-spined stickleback	0.069	-
Stone loach	0.034	-
Minnow	0.002	-
All Fish	0.219	0.230

Brown trout captured during the 2013 survey ranged in length from 4.5cm to 23.2cm (mean = 8.3cm) (Fig. 4.14). Three age classes (0+, 1+ and 2+) were present, accounting for 74%, 25% and 2% of the total brown trout catch respectively. Brown trout captured during the 2011 survey ranged in length from 5.4cm to 33.0cm (mean = 9.1cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 89%, 10% and 1% of the brown trout catch respectively.

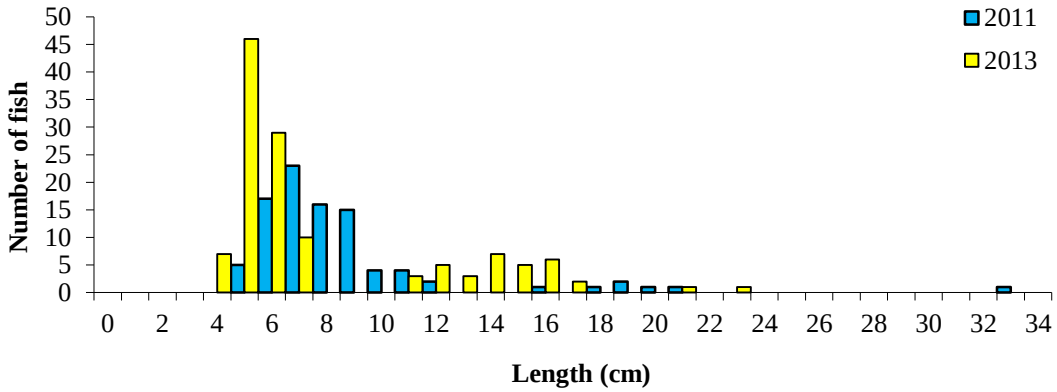


Fig. 4.14. Length frequency distribution of brown trout in the River Dodder (Mount Carmel), September 2011 (n=93) and July 2013 (n = 125)

River Dodder (Bohernabreena)

Two species were recorded in the River Dodder at Bohernabreena during the 2013 survey (Table 4.5). Brown trout was the most abundant species recorded, followed by stone loach.

Table 4.5. Density of fish (no./m^2), River Dodder (Bohernabreena) (fish density has been calculated as minimum estimates based on one fishing)

	Total minimum density	
Species	**2011**	**2013**
Brown trout	0.234	0.086
0+ Brown trout	0.095	-
1++ Brown trout	0.139	0.086
Stone loach	0.004	0.003
European eel	0.004	-
All Fish	0.241	0.089

Brown trout captured during the 2013 survey ranged in length from 10.4cm to 20.7cm (mean = 13.5cm) (Fig. 4.15). Two age classes (1+ and 2+) were present, accounting for 56% and 44% of the total brown trout catch respectively. Brown trout captured during the 2011 survey ranged in length from 4.5cm to 18.8cm (mean = 10.2cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 36%, 58% and 6% of the brown trout catch respectively.

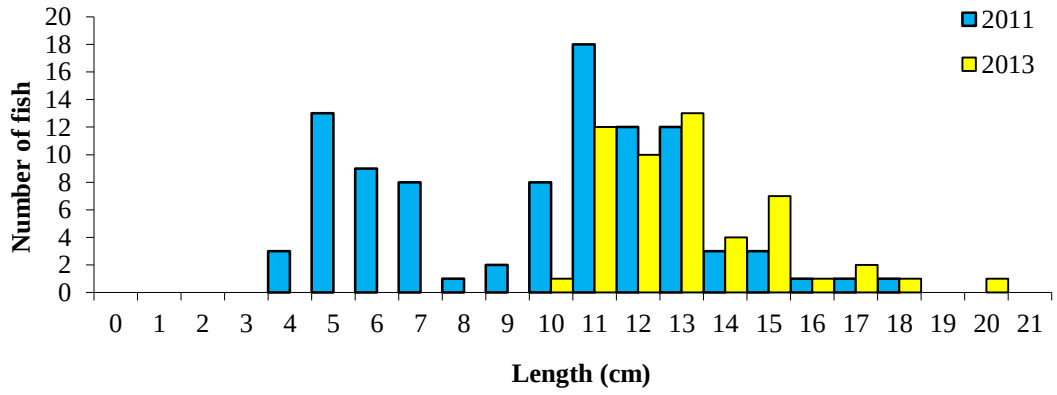


Fig. 4.15. Length frequency distribution of brown trout in the River Dodder (Bohernabreena), July 2011 (n=95) and July 2013 (n = 52)

4.1.4 The River Liffey

Two sites were electric fished on the River Liffey as part of the WFD surveillance monitoring programme in rivers 2013; the River Liffey, Ballyward Br. and the River Liffey, Kilcullen.

The Ballyward Br. survey site was located 400m metres upstream of Ballyward Br., Kilbride, Co. Wicklow (Fig. 4.16; Plate 4.6). Three electric-fishing passes were conducted using two boat-based electric fishing units on the 11th of September 2013, along a 302m length of channel. Glide dominated the habitat, while the substrate consisted mostly of gravel and sand. Vegetation at this site was scarce.

The Kilcullen survey site was located just downstream of Kilcullen Br., Kilcullen, Co. Kildare (Fig. 4.17; Plate 4.7). One electric-fishing pass was conducted using four boat-based electric fishing units on the 10th of September 2013, along a 362m length of channel. Glide dominated the habitat, while the substrate consisted mostly of cobble and gravel. The vegetation at this site was diverse, with a number of different groups represented, including, bryophytes, submergent, emergent and riparian species.

Fig. 4.16. Location of the River Liffey (Ballyward Br.) surveillance monitoring site

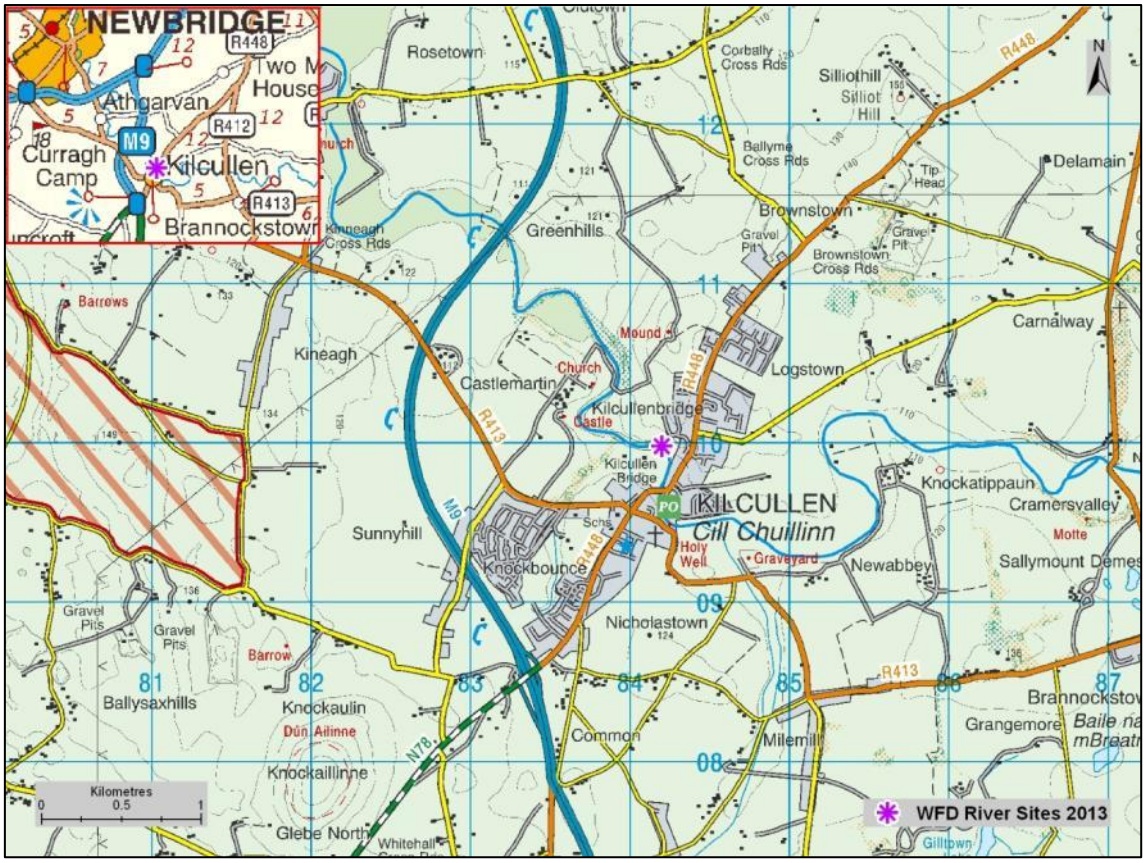


Fig. 4.17. Location of the River Liffey (Kilcullen Br.) surveillance monitoring site

Plate 4.6. The River Liffey at Ballyward Br., Co. Wicklow

Plate 4.7. The River Liffey at Kilcullen Br., Co. Kildare

River Liffey (Ballyward)

Six fish species were recorded in the River Liffey at Ballyward Br. during the 2013 survey (Table 4.6). Minnow was the most abundant species recorded, followed by brown trout, perch, stone loach, pike and three-spined stickleback.

Table 4.6. Density of fish (no./m^2), River Dodder (Ballyward Br.) (fish density has been calculated as minimum estimates based on one fishing)

	Total minimum density		
Species	**2009**	**2012**	**2013**
Minnow	0.001	0.006	0.047
Brown trout	0.003	0.013	0.018
0+ Brown trout	0.001	0.003	0.005
1++ Brown trout	0.001	0.010	0.013
Perch	-	0.0005	0.002
Stone loach	-	0.0002	0.0003
Pike	-	-	0.0003
Three-spined stickleback	-	-	0.0003
Roach	0.0002	-	-
All Fish	0.004	0.020	0.068

Brown trout captured during the 2013 survey ranged in length from 7.4cm to 29.8cm (mean = 16.1cm) (Fig. 4.18). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for 31%, 32%, 37% and 1% of the total brown trout catch respectively. Brown trout captured during the 2012 survey ranged in length from 5.3cm to 36.8cm (mean = 17.8cm). Five age classes were present (0+, 1+, 2+, 3+ and 4+), accounting for approximately 23%, 33%, 32, 11% and 1% of the brown trout catch respectively. Brown trout captured during the 2009 survey ranged in length from 6.8cm to 29.7cm (mean = 15.0cm). Five age classes were present (0+, 1+, 2+, 3+ and 4+), accounting for approximately 45%, 18%, 18%, 9% and 9% of the brown trout catch respectively.

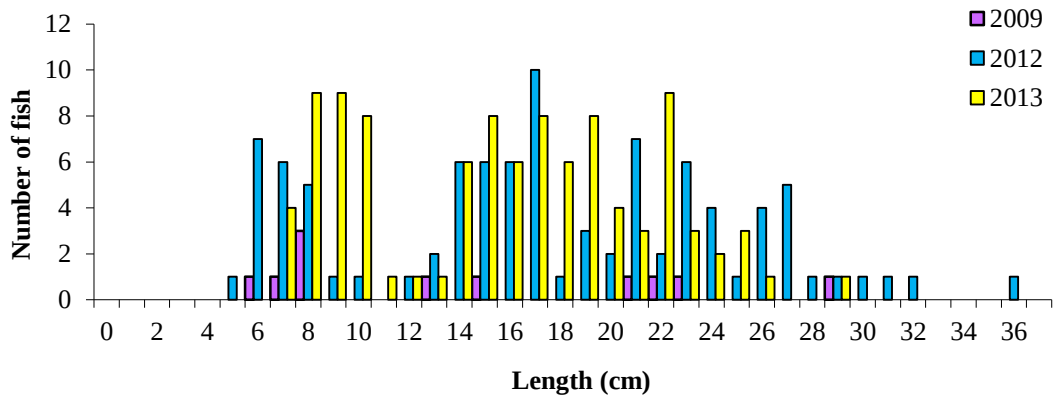


Fig. 4.18. Length frequency distribution of brown trout in the River Liffey (Ballyward Br.), August 2009 (n=11), September 2012 (n=93) and September 2013 (n = 101)

River Liffey (Kilcullen)

Six fish species were recorded in the River Liffey at Kilcullen during the 2013 survey (Table 4.7). Brown trout was the most abundant species recorded, followed by salmon, minnow, stone loach, perch and European eel.

Table 4.7. Density of fish (no./m^2), River Liffey (Kilcullen Br.) (fish density has been calculated as minimum estimates based on one fishing)

	Total minimum density	
Species	**2008**	**2013**
Brown trout	0.019	0.024
0+ Brown trout	0.006	0.013
1++ Brown trout	0.013	0.011
Salmon	0.012	0.021
0+ Salmon	0.002	0.006
1++ Salmon	0.010	0.015
Minnow	-	0.004
Stone loach	0.0001	0.001
Perch	-	0.0002
European eel	0.0003	0.0001
All Fish	0.031	0.050

Brown trout captured during the 2013 survey ranged in length from 6.5cm to 36.0cm (mean = 14.6cm) (Fig. 4.19). Six age classes (0+, 1+, 2+, 3+, 4+ and 5+) were present, accounting for approximately 55%, 19%, 14%, 10%, 1% and 0.5% of the total brown trout catch respectively. Brown trout captured during the 2008 survey ranged in length from 5.9cm to 50.3cm (mean = 19.3cm). Five age classes were present (0+, 1+, 2+, 3+ and 4+), accounting for approximately 30%, 31%, 30%, 5% and 4% of the brown trout catch respectively.

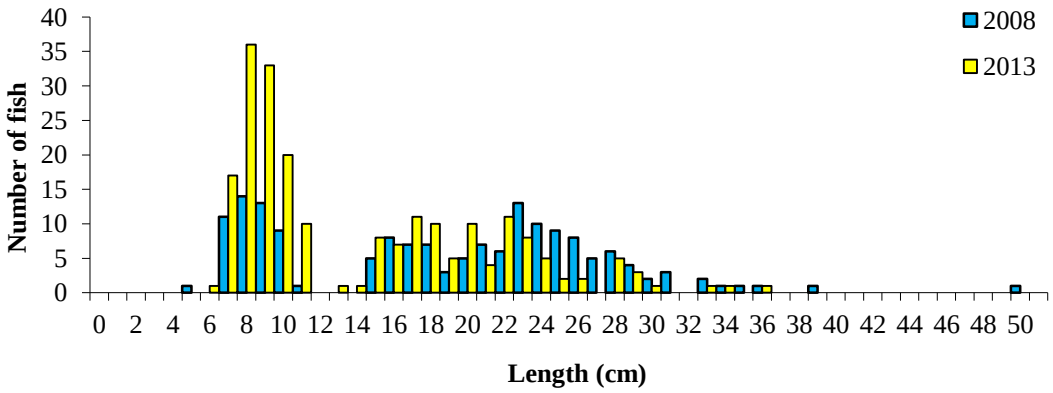


Fig. 4.19. Length frequency distribution of brown trout in the River Liffey (Kilcullen Br.), August 2008 (n=164) and September 2013 (n = 214)

Salmon captured during the 2013 survey ranged in length from 6.0cm to 18.1cm (mean = 12.3cm) (Fig. 4.20). Three age classes (0+, 1+ and 2+) were present, accounting for 28%, 71% and 1% of the total salmon catch respectively. Salmon captured during the 2008 survey ranged in length from 7.0cm to 18.9cm (mean = 13.6cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 18%, 71% and 10% of the salmon catch respectively.

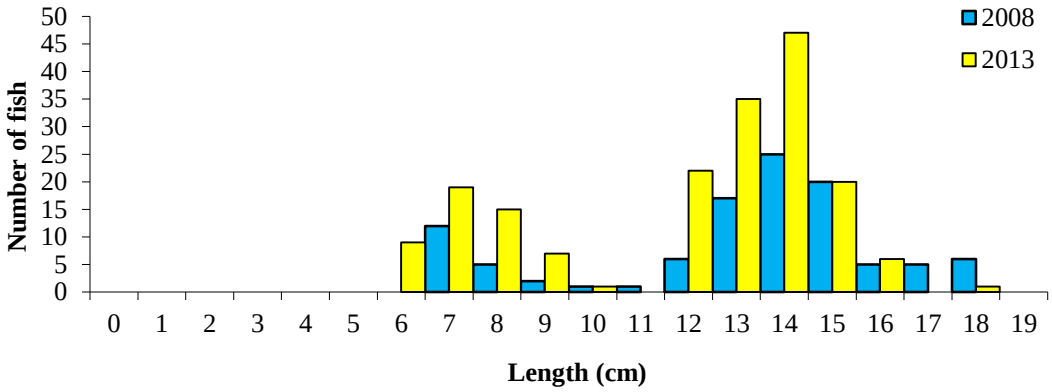


Fig. 4.20. Length frequency distribution of salmon in the River Liffey (Kilcullen Br.), August 2008 (n=105) and September 2013 (n = 182)

4.1.5 The Vartry River

One site was electric fished on the Vartry River as part of the WFD surveillance monitoring programme in rivers 2013. The survey site was located downstream of Newrath Br., halfway between Ashford and Rathnew, Co. Wicklow (Fig. 4.21; Plate 4.8). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 12th of September 2013, along a 45m length of channel. Riffle dominated the habitat, while the substrate consisted of cobble and gravel. The vegetation at this shaded site consisted mainly of bryophytes.

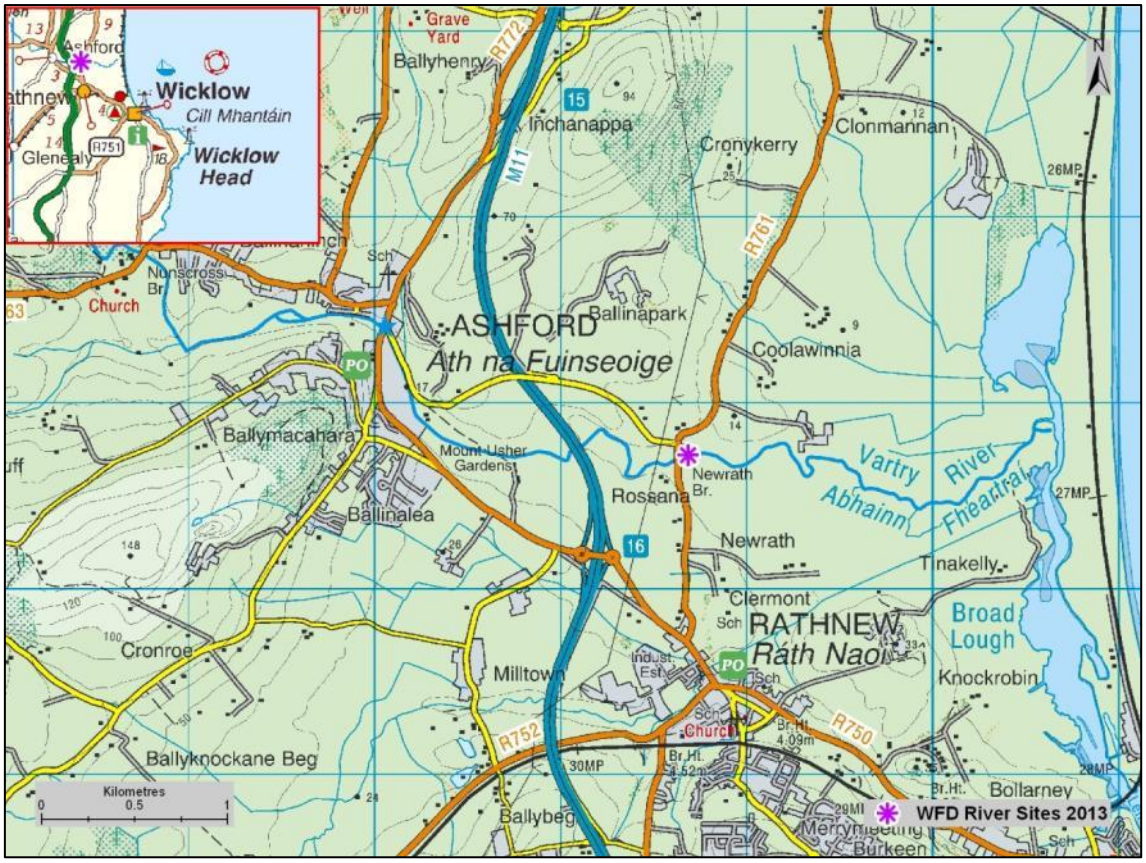


Fig. 4.21. Location of the Vartry River (Newrath Br.) surveillance monitoring site

Plate 4.8. The Vartry River at Newrath Br., Co. Wicklow

Eight fish species (including sea trout) were recorded in the Vartry River at Newrath Br. during the 2013 survey (Table 4.1). Brown trout was the most abundant species recorded, followed by salmon, flounder, European eel, sea trout, minnow, three-spined stickleback and lamprey.

Table 4.8. Density of fish (no./m^2), Vartry River (Newrath Br.) (fish density has been calculated as minimum estimates based on one fishing)

Species	Total minimum density 2013
Brown trout	0.098
0+ Brown trout	0.072
1++ Brown trout	0.026
Salmon	0.058
0+ Salmon	0.052
1++ Salmon	0.006
Flounder	0.029
European eel	0.014
Sea trout	0.014
Minnow	0.012
Three-spined stickleback	0.006
Lamprey sp.	0.003
All Fish	0.233

Brown trout captured during the 2013 survey ranged in length from 5.6cm to 26.5cm (mean = 10.9cm) (Fig. 4.22). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for 78%, 9%, 9% and 3% of the total brown trout catch respectively.

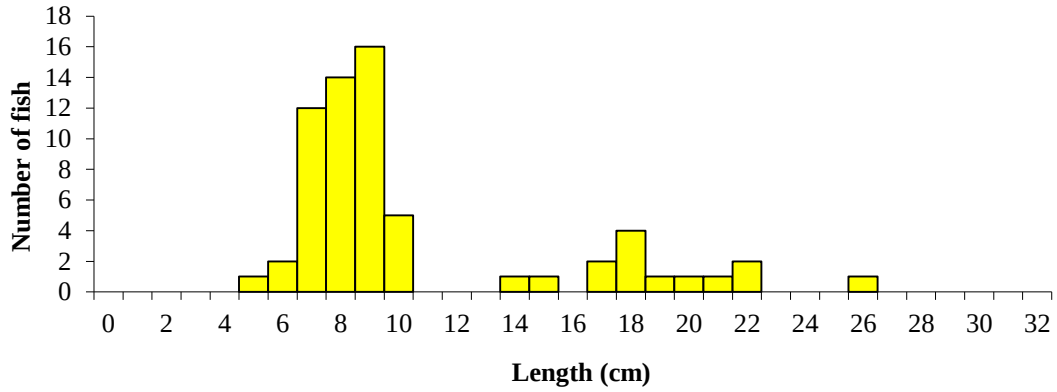


Fig. 4.22. Length frequency distribution of brown trout in the Vartry River (Newrath Br.) site, September 2013 (n = 64)

Salmon captured during the 2013 survey ranged in length from 5.9cm to 15.2cm (mean = 8.2cm) (Fig. 4.23). Two age classes (0+ and 1+) were present, accounting for approximately 91% and 9% of the total salmon catch respectively.

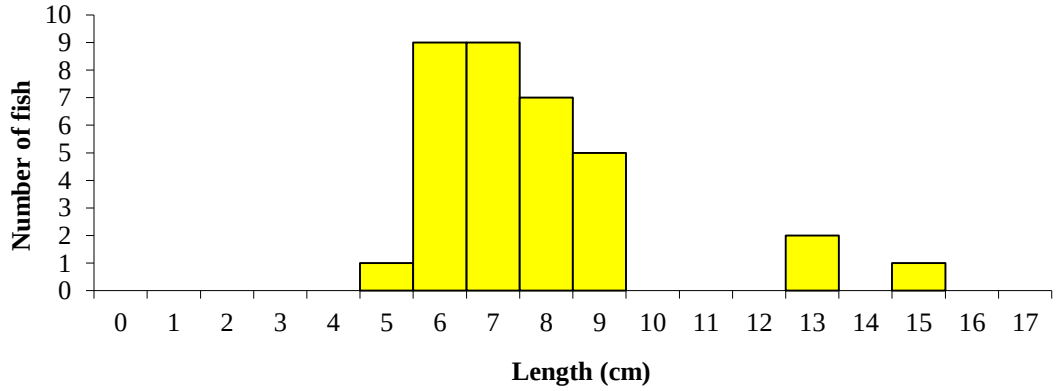


Fig. 4.23. Length frequency distribution of salmon in the Vartry River (Newrath Br.) site, September 2013 (n = 34)

4.2 Community Structure

A total of 13 fish species were recorded within the eight ERBD sites surveyed during 2013 (Fig. 4.24). Brown trout was the most common fish species recorded, occurring in all eight sites, followed by European eel, salmon, three-spined stickleback, stone loach, minnow, perch, flounder and lamprey. Sea trout, roach, pike and gudgeon were only recorded at one site each.

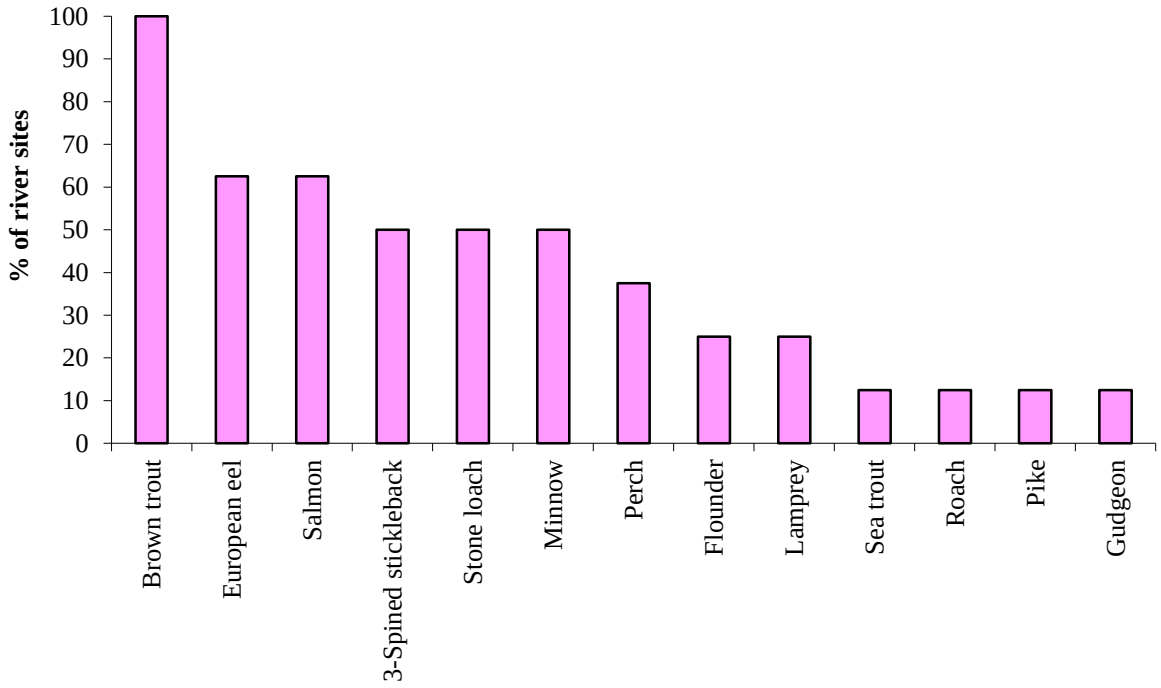


Fig. 4.24. Percentage of sites where each fish species was recorded in the ERBD for WFD SM monitoring 2013

4.3 Age and growth

Growth rates based on back-calculated length-at-age data were analysed for selected species in each river site surveyed in the ERBD during 2013.

The mean back-calculated length-at-age data for brown trout in the ERBD are shown in Figure 4.25 and Appendix 1. Brown trout were recorded at all 8 sites, with each containing brown trout aged 1+ or older. Ages ranged from 0+ to 5+, with fish aged 0+ and 1+ comprising the most abundant age classes within the region. The largest brown trout recorded in the ERBD in 2013 was caught in the River Liffey at Kilcullen Br., which measured 36.0cm in length and weighed 602g. The brown trout at each river site were assigned growth categories described by Kennedy and Fitzmaurice (1971), who examined the relationship between alkalinity and growth of brown trout in Irish streams and rivers. Using this method, the growth rate can only be reliably estimated from fish at sites where individual fish are 2+ or older, and where sufficient numbers are caught. Growth was considered very slow at the Dodder (Bohernabreena) and Vartry River (Newrath Br.), slow at the River Liffey (Ballyward Br.) and fast at the River Liffey (Kilcullen) (Appendix 1).

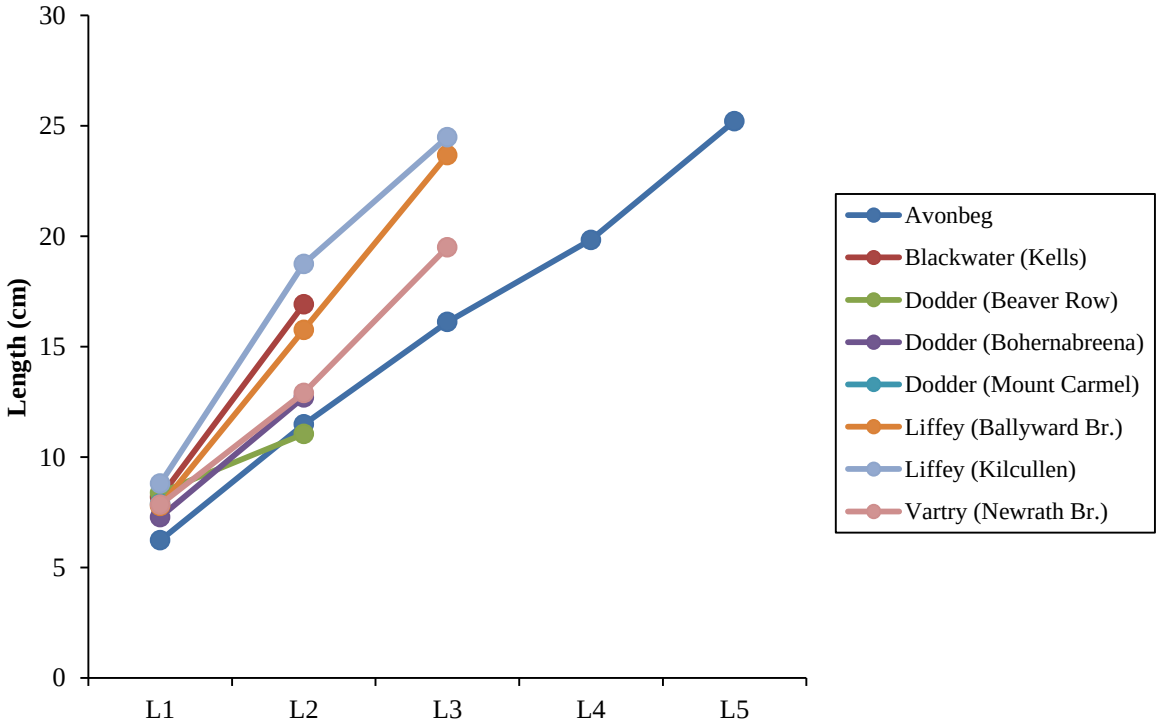


Fig. 4.25. Back calculated lengths for brown trout in each river, WFD surveillance monitoring 2013

The mean back-calculated length-at-age data for salmon in the ERBD are shown in Figure 4.26 and Appendix 2. Salmon were recorded in five of the eight river sites and ranged in age from 0+ to 2+. The most abundant age class was 0+. The largest juvenile salmon recorded in the ERBD during 2013 was caught in the River Liffey (Kilcullen Br.), measured 18.1cm, weighed 79.5g and was aged 2+.

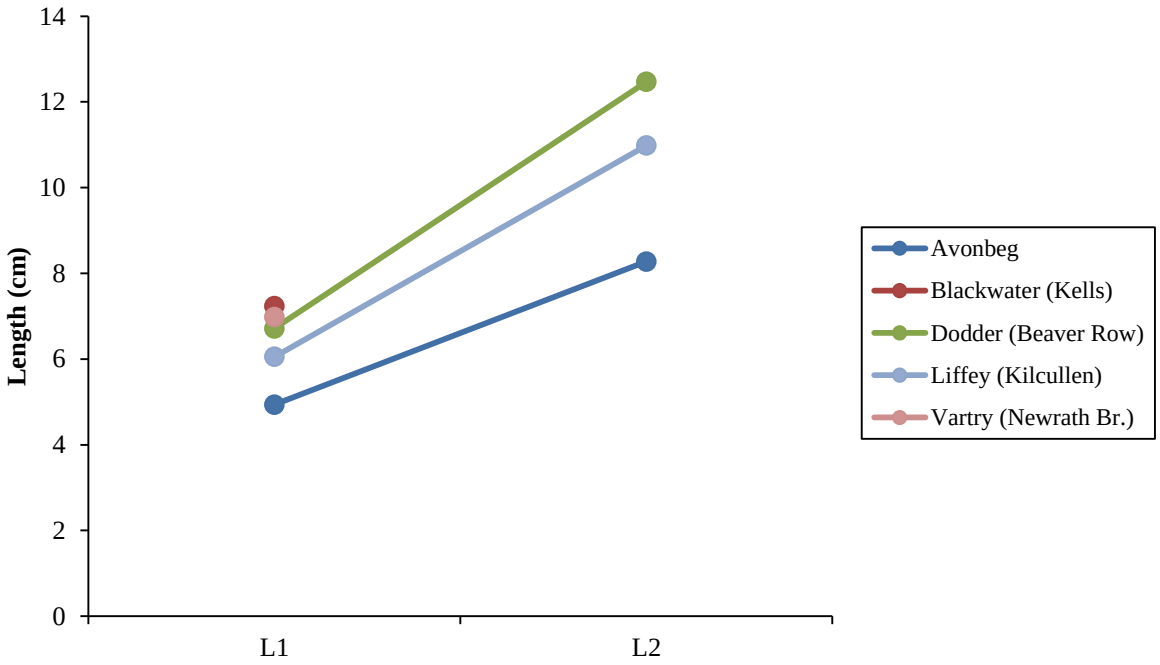


Fig. 4.26. Back calculated lengths for salmon in each river, WFD surveillance monitoring 2013

4.4 Ecological status

An essential step in the WFD process is the classification of the ecological status of lakes, rivers and transitional waters, which in turn will assist in identifying objectives that must be set in the individual River Basin District Management Plans. Following an approach similar to that developed by the Environment Agency in England and Wales, the Fisheries Classification Scheme 2 (FCS2) has been developed for the Republic of Ireland and Northern Ireland, along with a separate version for Scotland, to comply with the requirements of the WFD. Agencies throughout each of the three regions contributed data to be used in the model, which was developed under the management of the Scotland & Northern Ireland Forum for Environmental Research (SNIFFER). This method is a geostatistical model based on Bayesian probabilities, that makes probabilistic comparisons of observed fish counts with expected (predicted) fish counts under reference (un-impacted conditions). This classification system (SNIFFER, 2011) generates Ecological Quality Ratings (EQRs) between 1 and 0 for each site, corresponding to the five different ecological status classes of High, Good, Moderate, Poor and Bad. Confidence levels are then assigned to each class and represented as probabilities. The confidence level for a site is expressed as the probability of that site being assigned to each different status class, with the highest class probability being the overall classification.

Using this tool and expert opinion, each site surveyed in 2013 was assigned a draft fish classification status (Table 4.9). One site was classed as High, four as Good and three as Moderate. When comparing the status this year with that from previous years, there was an improvement on the River Liffey at Kilcullen Br., a deterioration on the River Dodder at Beaver Row and Bohernabreena and all other sites remained unchanged.

Table 4.9. Ecological status of sites surveyed in the ERBD for surveillance monitoring 2013 (figures in brackets indicate confidence of site status being correct)

River	Site name	Site Code	Previous ecological status	Ecological status 2013
ERBD Wadeable sites				
Avonbeg	Greenan Br._A	10A040600A	Good (2010)	Good
Blackwater (Kells)	Lough Ramor_A	07B010800A	Moderate (2009)	Moderate (59%)
Dodder	Bohernabreena_A	09D010100A	Good (96%)(2011)	Moderate
Dodder	Beaver Row_B	09D010900B	High (70%)(2011)	Good (97%)
Dodder	Mount Carmel_A	09D010680A	Moderate (88%)(2011)	Moderate
Vartry	Newrath Br._A	10V010300A	Good (2008)	Good (79%)
ERBD Non-Wadeable sites				
Liffey	Ballyward Br._A	09L010250A	Good (2009), Good (2012)	Good
Liffey	Kilcullen Br._A	09L010700A	Good (69%)(2008)	High (55%)

5. DISCUSSION

A total of 13 fish species (including sea trout) were recorded during the 2013 WFD surveillance monitoring programme for fish in rivers within the ERBD. Brown trout was the most commonly encountered species in the ERBD, recorded in all eight sites. The River Blackwater (Kells) at Lough Ramor and Vartry River (Newrath Br.) were the most diverse sites surveyed within the ERBD in 2013 with a total of 12 species (sea trout are included as a separate 'variety' of trout) recorded in each. The site that recorded the lowest diversity in this region was the River Dodder, Bohernabreena site, with only two species (brown trout and eels) present. The greatest abundances of brown trout and salmon were recorded in River Dodder (Mount Carmel) and River Dodder (Beaver Row) sites respectively.

Following the methods of Kennedy and Fitzmaurice (1971), growth was considered very slow at the Dodder (Bohernabreena) and Vartry River (Newrath Br.), slow at the River Liffey (Ballyward Br.) and fast at the River Liffey (Kilcullen) (Appendix 1).

The Fish Classification Scheme 2 (FCS2) tool for assessing the ecological status of rivers has been recently developed for the Republic of Ireland which is compliant with the requirements of the WFD. Using this tool and expert opinion, each site surveyed in 2013 was assigned a draft fish classification status. One site was classed as High, four as Good and three as Moderate.

6. REFERENCES

CEN (2003) *Water Quality — Sampling of Fish with Electricity*. European Standard. Ref. No. EN 14011:2000.

Council of the European Communities (2000) Establishing a framework for Community action in the field of water policy. Directive of the European Parliament and of the Council establishing a framework for community action in the field of water policy (2000/60/EC). *Official Journal of the European Communities*, **43**, 1-73.

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.

SNIFFER (2011*) River Fish Classification Tool: Science Work*. WFD68c, Phase 3, Final Report. Scotland and Northern Ireland Forum for Environmental Research.

APPENDIX 1

Summary of the growth of brown trout in rivers (L1=back calculated length at the end of the first winter etc.)

River		L1	L2	L3	L4	L5	Growth category
Avonbeg (Grenna Br.)	Mean	6.23	11.48	16.12	19.84	25.21	n/a
	S.D.	1.35	0.89	n/a	n/a	n/a	
	S.E.	0.43	0.45	n/a	n/a	n/a	
	n	10	4	1	1	1	
	Min	4.83	10.80	16.12	19.84	25.21	
	Max	8.99	12.80	16.12	19.84	25.21	
Blackwater (Kells)	Mean	8.20	16.91				n/a
(Lough Ramor)	S.D.	2.19	5.20				
	S.E.	0.36	3.67				
	n	38	2				
	Min	4.73	13.24				
	Max	12.27	20.59				
Dodder (Beaver Row)	Mean	8.39	11.04				n/a
	S.D.	2.60	n/a				
	S.E.	1.30	n/a				
	n	4	1				
	Min	5.78	11.04				
	Max	11.74	11.04				
Dodder (Bohernabreena)	Mean	7.28	12.70				Very slow
	S.D.	0.95	1.76				
	S.E.	0.19	0.51				
	n	26	12				
	Min	5.39	10.22				
	Max	9.13	16.88				
Dodder (Mount Carmel)	Mean	7.89					n/a
	S.D.	1.50					
	S.E.	0.28					
	n	28					
	Min	5.74					
	Max	12.56					
Liffey (Ballyward Br.)	Mean	7.79	15.76	23.68			Slow
	S.D.	1.55	2.38	n/a			
	S.E.	0.21	0.44	n/a			
	n	52	29	1			
	Min	4.92	12.06	23.68			
	Max	11.93	21.04	23.68			

APPENDIX 1 continued

Summary of the growth of brown trout in rivers (L1=back calculated length at the end of the first winter etc.)

River		L1	L2	L3	L4	L5	Growth category
Liffey (Kilcullen Br.)	Mean	8.81	18.75	24.49			Fast
	S.D.	2.08	3.33	3.71			
	S.E.	0.29	0.62	1.07			
	n	52	29	12			
	Min	5.37	14.35	19.79			
	Max	14.92	28.14	31.67			
Vartry (Newrath Br.)	Mean	7.85	12.91	19.50			Very slow
	S.D.	1.73	2.54	1.94			
	S.E.	0.46	0.90	1.38			
	n	14	8	2			
	Min	4.90	8.10	18.13			
	Max	9.89	15.90	20.88			

APPENDIX 2

Summary of the growth of salmon in rivers (L1=back calculated length at the end of the first

River		L1	L2
Avonbeg (Greenan Br.)	Mean	4.94	8.27
	S.D.	0.73	0.57
	S.E.	0.16	0.18
	n	20	10
	Min	3.67	7.28
	Max	6.39	9.04
Blackwater (Kells)	Mean	7.24	
(Lough Ramor)	S.D.	0.55	
	S.E.	0.32	
	n	3	
	Min	6.63	
	Max	7.71	
Dodder (Beaver Row)	Mean	6.72	12.47
	S.D.	0.61	0.42
	S.E.	0.22	0.30
	n	8	2
	Min	5.53	12.17
	Max	7.50	12.76
Liffey (Kilcullen Br.)	Mean	6.05	10.98
	S.D.	1.03	0.09
	S.E.	0.20	0.06
	n	26	2
	Min	4.34	10.92
	Max	8.00	11.04
Vartry (Newrath Br.)	Mean	6.98	
	S.D.	0.70	
	S.E.	0.41	
	n	3	
	Min	6.21	
	Max	7.58	

APPENDIX 3

Summary of the growth of pike in rivers (L1=back calculated length at the end of the first winter etc.)

River		L1	L2
Liffey (Ballyward Br.)	Mean	16.60	28.67
	S.D.	0.79	n/a
	S.E.	0.56	n/a
	n	2	1
	Min	16.04	28.67
	Max	17.17	28.67

APPENDIX 4

Summary of the growth of sea trout in rivers (L1=back calculated length at the end of the first winter etc.)

River		L1	L2	L3
Liffey (Ballyward Br.)	Mean	6.63	16.57	27.62
	S.D.	n/a	n/a	n/a
	S.E.	n/a	n/a	n/a
	n	1	1	1
	Min	6.63	16.57	27.62
	Max	6.63	16.57	27.62

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

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