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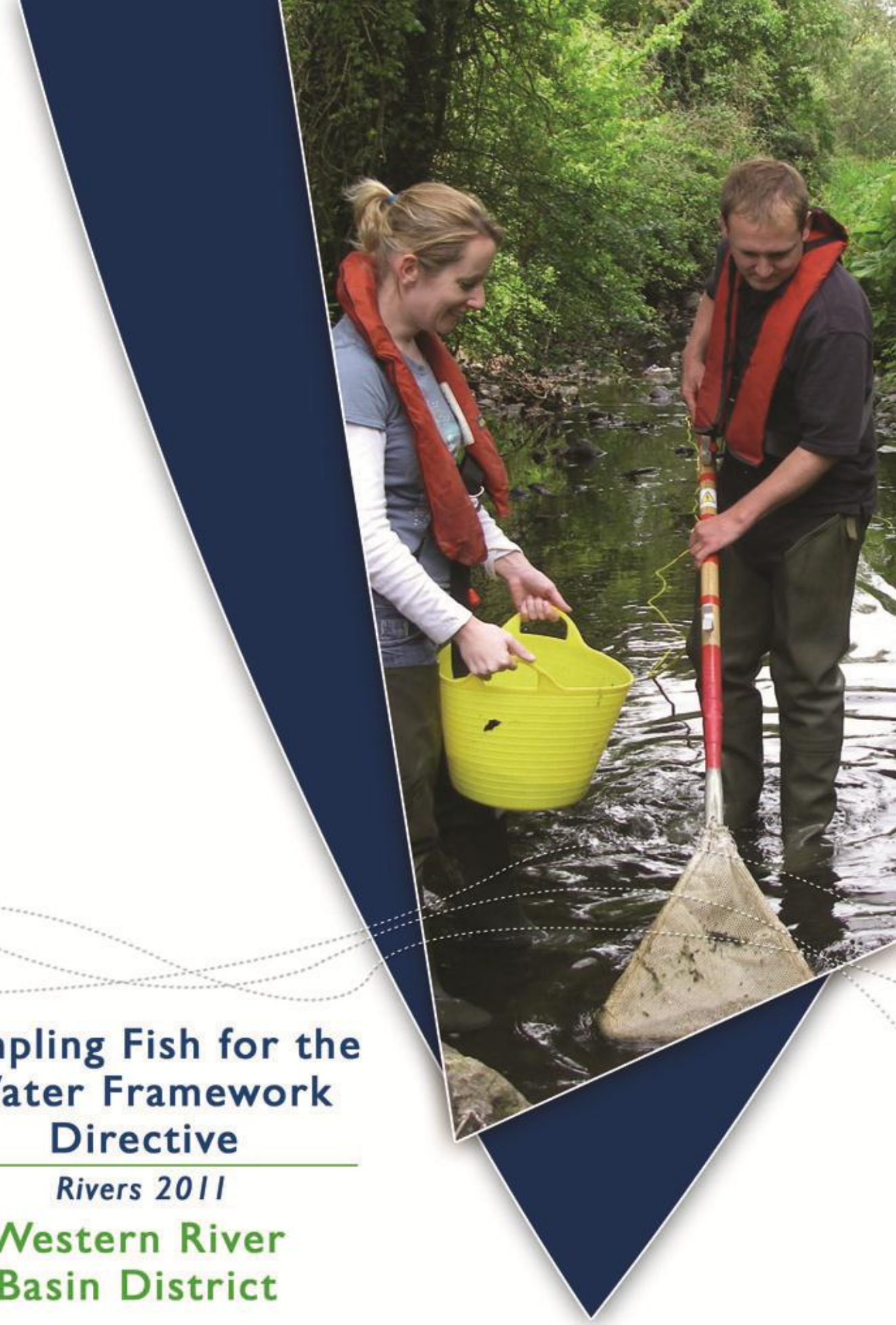

Sampling Fish for the Water Framework Directive

Rivers 2011

Western River Basin District

Iascach Intíre Éireann
Inland Fisheries Ireland

Water Framework Directive Fish Stock Survey of Rivers in the Western River Basin District

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CITATION: Kelly, F.L., Matson, R., Connor, L., Feeney, R., Morrissey, E., Wogerbauer, C. and Rocks, K. (2012) Water Framework Directive Fish Stock Survey of Rivers in the Western River Basin District. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin, Ireland.

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ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the help and co-operation of the regional director Dr. J.J. Connelly and staff from IFI Galway and Ballina 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 2011.

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TABLE OF CONTENTS

1. INTRODUCTION **3**
2. STUDY AREA **4**
3. METHODS **6**
4. RESULTS **7**
4.1 River surveys **7**
4.1.1 The Ballinglen River **7**
4.1.2 The Behy River **11**
4.1.3 The Castlebar River **15**
4.1.4 The Clydagh (Castlebar) River **18**
4.1.5 The Glennamong River **21**
4.1.6 The Tobercurry River **24**
4.2 Species distribution **27**
4.3 Age and growth **28**
4.4 Ecological status **30**
5. DISCUSSION **31**
6. REFERENCES **32**
APPENDIX 1 ..... **33**
APPENDIX 2 ..... **34**
APPENDIX 3 ..... **35**

1. INTRODUCTION

Fish stock surveys were undertaken in 65 river sites throughout Ireland during the summer of 2011 as part of the programme for 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). Six of these surveys were carried out at river sites in the Western River Basin District (WRBD) in August 2011 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 2011 is the fourth year of the rivers sampling programme, many of the sites surveyed this year are repeat surveys of those carried out in 2008. As a result, surveys this year can be compared with surveys from before to determine whether the status of our rivers is improving or deteriorating.

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

2. STUDY AREA

Six river sites were surveyed in three river catchments within the WRBD during 2011: the Ballinglen, Moy and Srahmore catchments. The sites ranged in surface area from 124m^2 for the Tobercurry River to 531m^2 for the Glennamong River. The sites were divided into two categories for reporting purposes: wadeable sites, which were surveyed with bank-based electric fishing units, and non-wadeable sites, which were surveyed with boat-based electric fishing units. Summary details of each site's location and physical characteristics are given in Tables 2.1 and 2.2, and the distribution of sites throughout the WRBD is shown in Figure 2.1.

Table 2.1. Location and codes of wadeable river sites surveyed for WFD surveillance monitoring, WRBD 2011

River	Site name	Catchment	Site Code	Waterbody code
Ballinglen	Ballinglen Br.	Ballinglen	33B010100	WE_33_2091
Behy	Behy Br.	Moy	34B080400	WE_34_3999
Castlebar	Br. 2.5 km d/s Castlebar	Moy	34C010200	WE_34_3953
Clydagh(Castlebar)	Br. NW Ardvarney	Moy	34C050030	WE_34_314
Glennamong	Br. u/s Lough Feeagh	Srahmore	32G030100	WE_32_2441
Tobercurry	Br. just u/s of Moy	Moy	34T020200	WE_34_2633

Table 2.2. Details of wadeable river sites surveyed for WFD surveillance monitoring, ERBD 2011

River	Upstream catchment (km^2)	Wetted width (m)	Surface area (m^2)	Mean depth (m)	Max depth (m)
Ballinglen (Ballinglen Br.)	33.11	9.90	416	0.15	0.36
Behy (Behy Br.)	35.33	6.93	291	0.14	0.26
Castlebar (Br. 2.5 km d/s Castlebar)	90.15	6.98	335	0.08	0.15
Clydagh (Castlebar) (Br. NW Ardvarney)	6.25	5.57	256	0.08	0.20
Glennamong (Br. u/s Lough Feeagh)	15.27	7.08	531	0.20	0.70
Tobercurry (Br. just u/s of Moy)	24.73	2.82	124	0.18	0.36

Fig. 2.1. Location map of river sites surveyed throughout the WRBD for WFD fish surveillance monitoring 2011

3. METHODS

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

Fish from each pass were sorted and processed separately (Plate 3.2). During processing, the species of each fish was identified and its length and weight were measured; sub-samples were measured when large numbers of fish were present. For the purpose of species identification, river lamprey (*Lampetra fluviatilis*) and brook lamprey (*Lampetra planeri*) were treated as one. 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. These fish were held in a large bin of oxygenated water after processing until they were fully recovered and were then returned to the water. Opercular bones were taken from perch for ageing. Samples of European eels were retained for further analysis.

For various reasons, including river width and the practicalities of using stop-nets, three fishing passes were not possible or practical at all sites. 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 density for each species.

A subsample of the dominant fish species were aged (five fish from each 1cm size class). Fish scales were aged using a microfiche, and opercular bones were aged using an Olympus SZX10 microscope/digital camera system. Growth rates were 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, L2 is the mean length at the end of the second winter, etc.).

4. RESULTS

4.1 River surveys

4.1.1 The Ballinglen River

One site was electric fished on the Ballinglen River as part of the WFD surveillance monitoring programme in rivers 2011. The survey site was located upstream of Ballinglen Bridge, approximately 4km south of Ballycastle (Fig. 4.1; Plate 4.1). Three electric-fishing passes were conducted using two bank-based electric fishing units on the 4th of August 2011, along a 42m length of channel. The mean wetted width of the channel was 9.90m and the mean depth was 15.0cm. A total wetted area of 416m^2 was surveyed. The habitat along this stretch of river was an even mix of riffle, glide and pool, while cobble dominated the substrate. This site had a rich variety of vegetation, with bryophytes and emergent bankside species abundant throughout. Three invasive plant species, montbretia, Himalayan balsam and rhododendron, were also recorded in close proximity to the stretch.

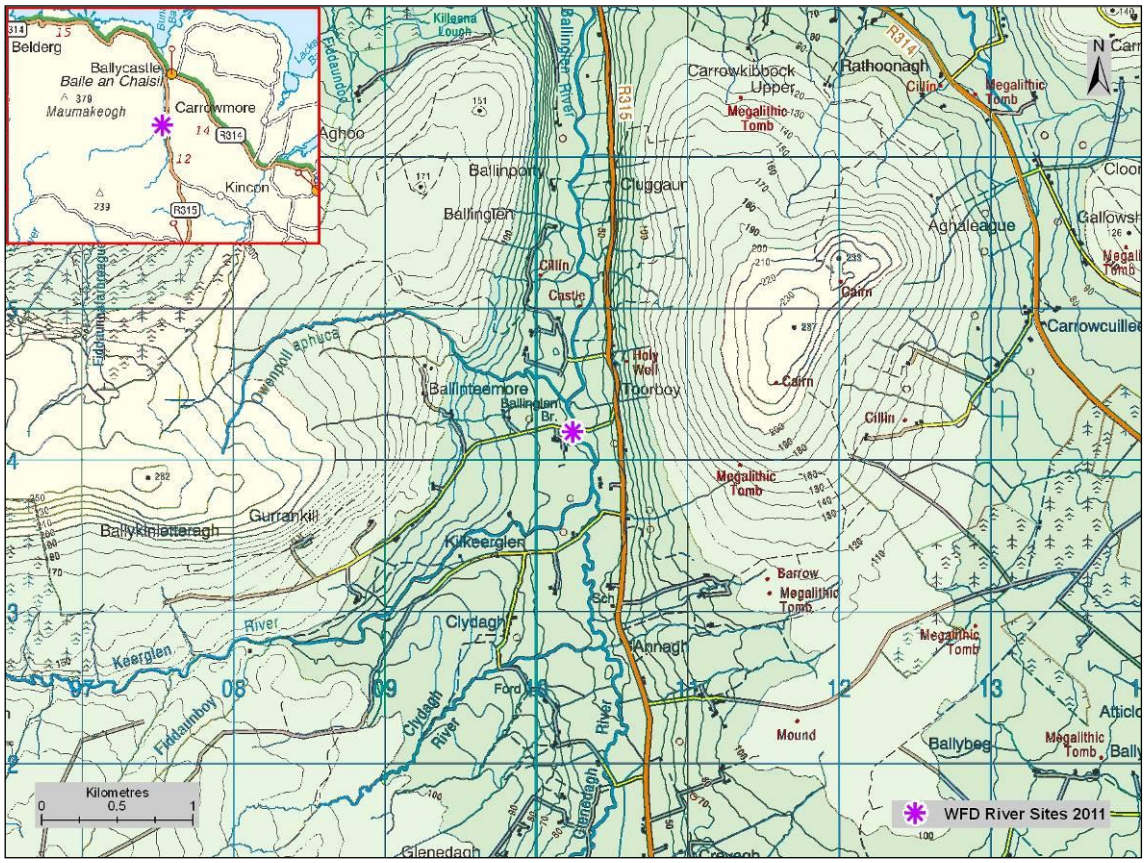

Fig. 4.1. Location of the Ballinglen River surveillance monitoring site

Plate 4.1. The Ballinglen River at Ballinglen Bridge, Co. Mayo

A total of three fish species were recorded in the Ballinglen River site. Salmon was the most abundant species, followed by brown trout and eel (Table 4.1). This river was also surveyed in 2008, with results from that survey also shown for comparative purposes. During the previous survey in 2008, the same species composition was present.

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

Common name	2008			2011		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.282	0.240	0.522	0.265	0.137	0.402
Brown trout	0.008	0.068	0.076	0.010	0.026	0.026
Eel	-	-	0.028	-	-	0.019
All Fish	-	-	0.626	-	-	0.447

Salmon captured during 2011 ranged in length from 4.0cm to 12.5cm (mean = 6.6cm) (Fig. 4.2). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 71%, 29% and 1% of the total salmon catch respectively. Salmon captured during the 2008 survey ranged in length from 2.5cm to 13.0cm (mean = 7.4cm) (Fig. 4.2). Three age classes (0+, 1+ and 2+) were also present, accounting for approximately 59%, 40% and 1% of the salmon catch respectively.

Brown trout captured during the 2011 survey ranged in length from 6.2cm to 20.1cm (mean = 13.4cm) (Fig. 4.3). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 21%, 42% and 37% of the total brown trout catch respectively. Brown trout captured during the 2008 survey ranged in length from 6.0cm to 22.3cm (mean = 15.0cm) (Fig 4.3). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 9%, 41%, 38% and 12% of the brown trout catch respectively.

Eels captured during the 2001 survey ranged in length from 11.9cm to 30.4cm (mean = 18.8cm) (Fig. 4.4). In 2008 they ranged in length from 11.3cm to 33.1cm (mean = 22.6cm).

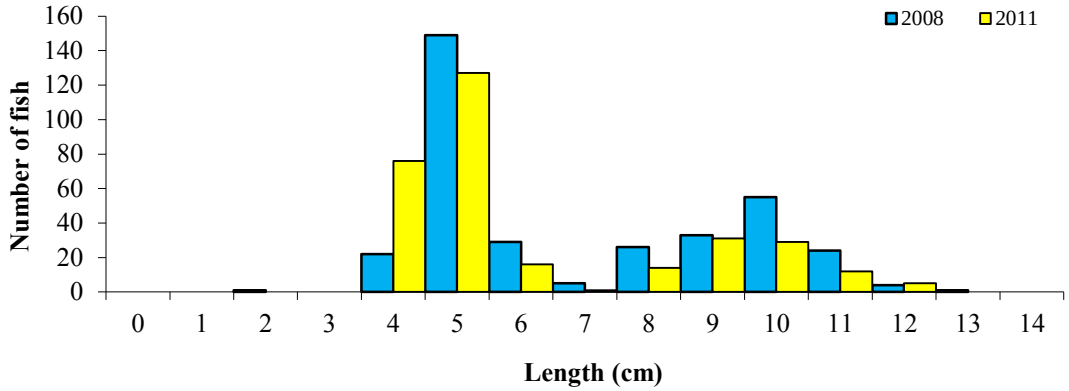

Fig. 4.2. Length frequency distribution of salmon in the Ballinglen River site, July 2008 (n = 349 (sub-sample)) August 2011 (n = 311)

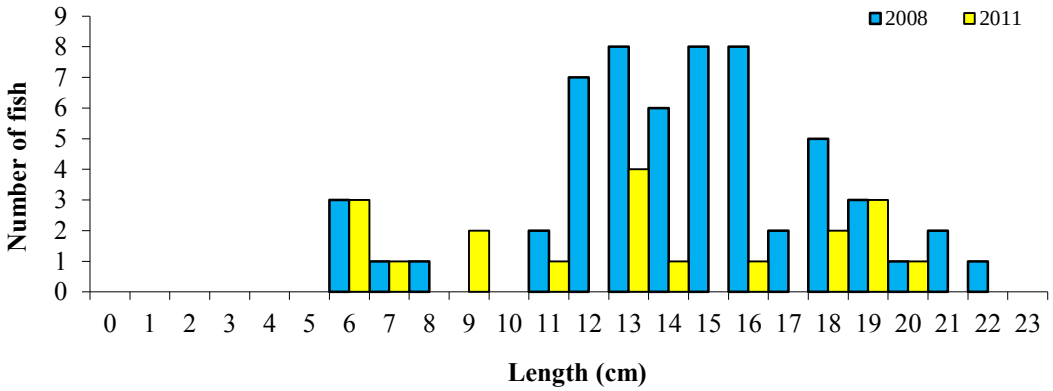

Fig. 4.3. Length frequency distribution of brown trout in the Ballinglen River site, July 2008 (n = 58) August 2011 (n = 19)

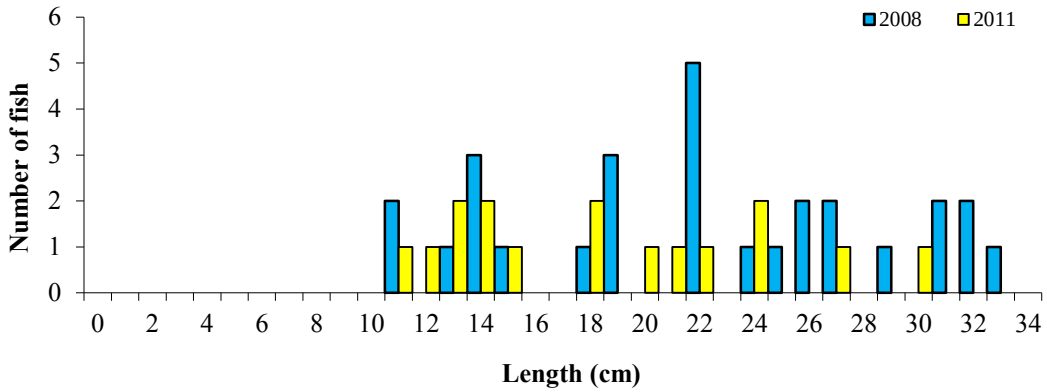

Fig. 4.4. Length frequency distribution of eels in the Ballinglen River site, July 2008 (n = 28) August 2011 (n = 16)

4.1.2 The Behy River

One site was electric fished on the Behy River as part of the WFD surveillance monitoring programme in rivers 2011. The survey site was located just upstream of Behy Bridge on the main road between Bunnyconnelan and Ballina (Fig. 4.5; Plate 4.2). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 4th of August 2011, along a 42m length of channel. The mean wetted width of the channel was 6.93m and the mean depth was 14.0cm. A total wetted area of 291m^2 was surveyed. Glide dominated the habitat along the stretch, while the substrate was a good mix of cobble, gravel and sand. A variety of vegetation was present at this site, including green filamentous algae, bryophytes and emergent bankside species.

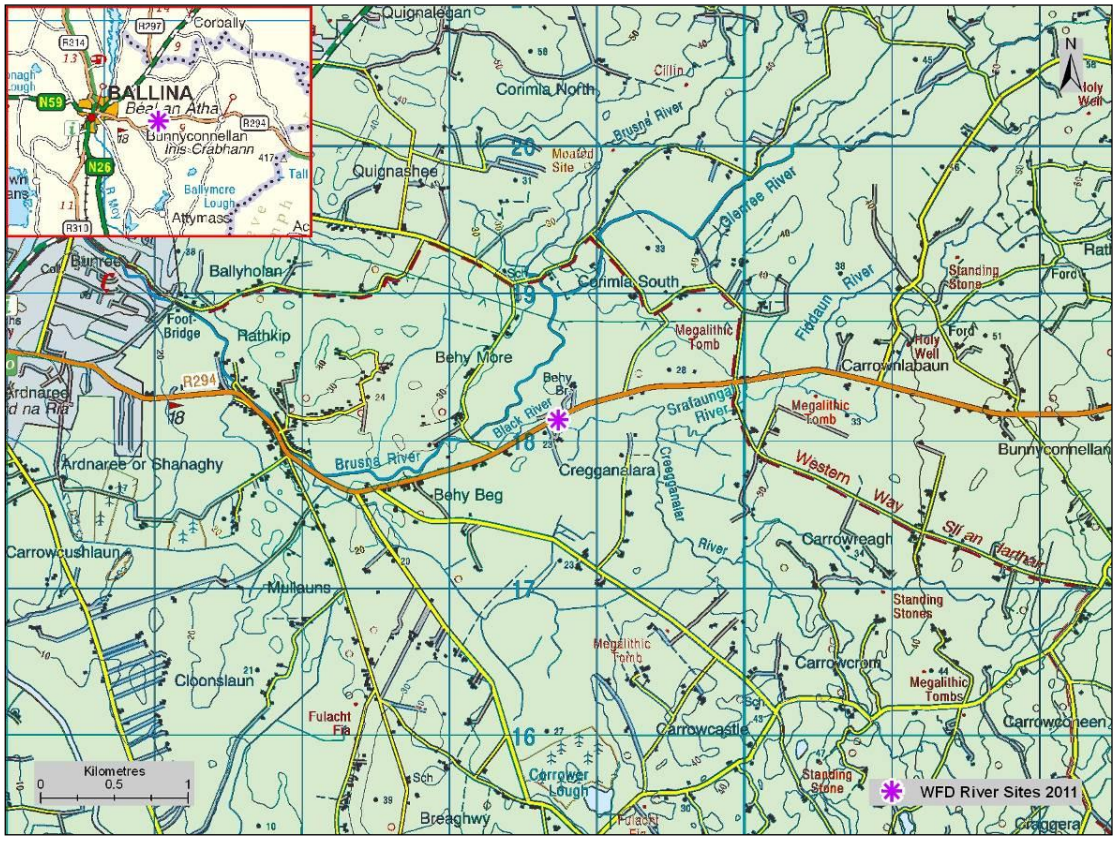

Fig. 4.5. Location of the Behy River surveillance monitoring site

Plate 4.2. The Behy River at Behy Bridge, Co. Mayo

A total of four fish species were recorded in the Behy River site. Salmon was the most abundant species, followed by brown trout, three-spined stickleback and eels (Table 4.3). This river was also surveyed in 2008, with results from that survey also shown for comparative purposes. During the previous survey in 2008, the same species composition was present, with the exception of eel, which were only recorded in the 2011 survey.

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

Common name	2008			2011		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.002	0.055	0.057	0.041	0.165	0.206
Brown trout	0.001	0.048	0.050	0.017	0.103	0.120
Three-spined stickleback	-	-	0.001	-	-	0.007
Eel	-	-	-	-	-	0.003
All Fish	-	-	0.108	-	-	0.337

Salmon captured during the 2011 survey ranged in length from 4.0cm to 13.4cm (mean = 9.2cm) (Fig. 4.6). Two age classes (0+ and 1+) were present, accounting for approximately 30% and 70% of the total salmon catch respectively. Salmon captured during the 2008 survey ranged in length from 5.9cm to 13.6cm (mean = 10.6cm) (Fig. 4.19). Two age classes (0+ and 1+) were present, accounting for approximately 9% and 91% of the salmon catch respectively.

Brown trout captured during the 2011 survey ranged in length from 6.3cm to 22.7cm (mean = 11.7cm) (Fig. 4.7). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 24%, 72%, 3% and 1% of the total brown trout catch respectively. Brown trout captured during the 2008 survey ranged in length from 7.0cm to 22.6cm (mean = 14.1cm) (Fig. 4.20). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 5%, 76% and 19% of the brown trout catch respectively.

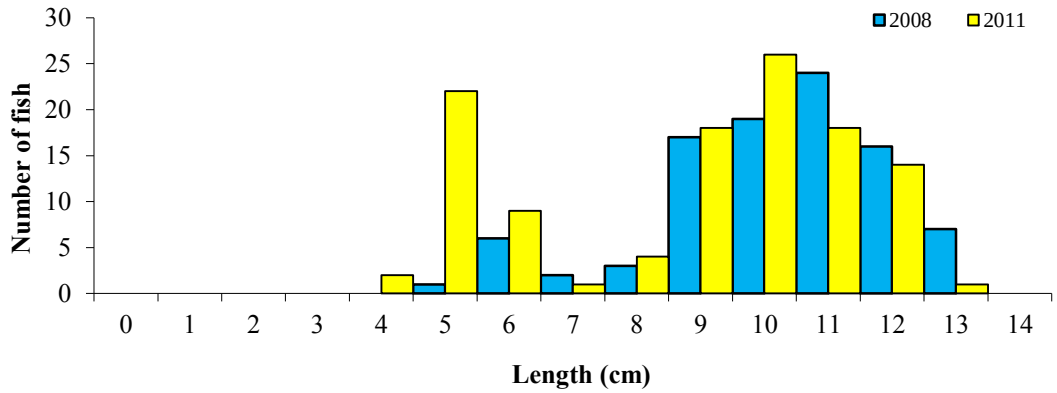

Fig. 4.6. Length frequency distribution of salmon in the Behy River site, August 2008 (n = 95) and August 2011 (n = 115)

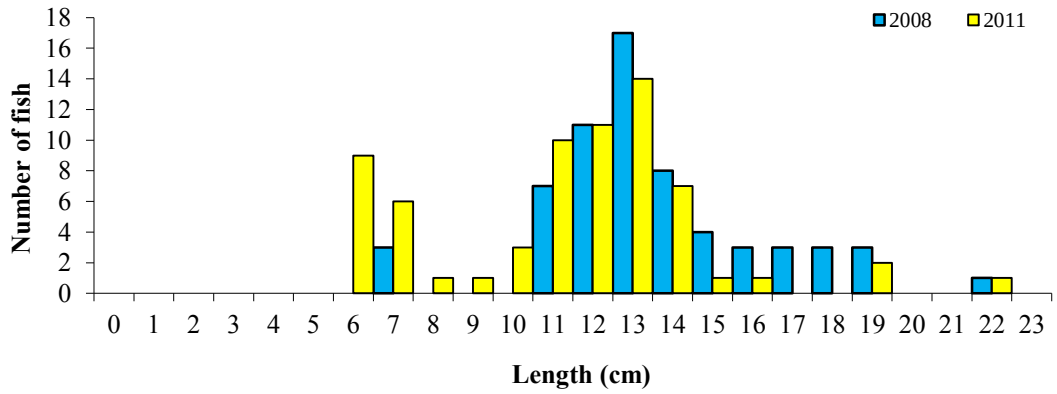

Fig. 4.7. Length frequency distribution of brown trout in the Behy River site, August 2008 (n = 63) and August 2011 (n = 67)

4.1.3 The Castlebar River

One site was electric fished on the Castlebar River as part of the WFD surveillance monitoring programme in rivers 2011. The survey site was located downstream of a bridge near Ballynew, on a minor road just off the main N5 route into Castlebar (Fig. 4.8; Plate 4.3). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 3rd of August 2011, along a 48m length of channel. The mean wetted width of the channel was 6.98m and the mean depth was 8.0cm. A total wetted area of 335m^2 was surveyed. Glide and riffle were the most prevalent habitat types along this stretch, while the substrate was a good mix of cobble, boulder and gravel. The vegetation along this site consisted mainly of filamentous green algae and a few emergent bankside species. Large bags of domestic waste were also present throughout the stretch and are visible in Plate 4.3.

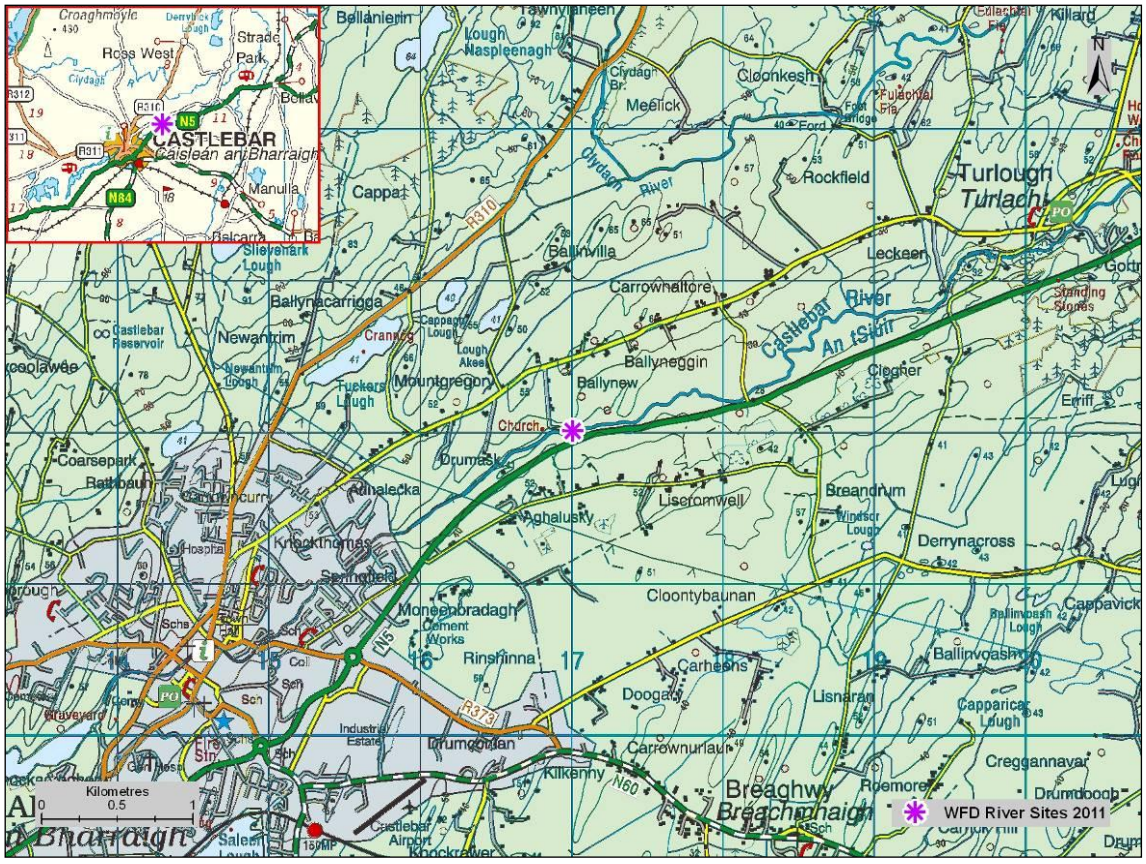

Fig. 4.8. Location of the Castlebar River surveillance monitoring site

Plate 4.3. The Castlebar River (Br. 2.5 km d/s Castlebar) downstream of Castlebar, Co. Mayo

A total of five fish species were recorded in the Castlebar River site. Eel was the most abundant species, followed by roach, salmon, brown trout and lamprey (Table 4.3). This river was also surveyed in 2008, with results also shown for comparative purposes. During the previous survey in 2008, the same species composition was present, with the exception of perch, which were only recorded in the 2008 survey.

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

Common name	2008			2011		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Eel	-	-	0.014	-	-	0.212
Roach	-	-	-	-	-	0.137
Salmon	0.000	0.002	0.002	0.009	0.000	0.009
Brown trout	0.000	0.003	0.003	0.000	0.003	0.003
Lamprey sp.	-	-	-	-	-	0.003
Perch	-	-	0.002	-	-	-
All Fish	-	-	0.021	-	-	0.364

Eels captured during the 2011 survey ranged in length from 12.3cm to 37.0cm (mean = 21.2cm). In 2008 they ranged in length from 13.4cm to 51.0cm (mean = 27.5cm).

Roach captured during the 2011 ranged in length from 6.1cm to 16.7cm (mean = 10.9cm) (Fig. 4.10). Four age classes (1+, 2+, 3+ and 4+) were present, accounting for approximately 13%, 29%, 41% and 17% of the total roach catch respectively. No roach were recorded at this site in 2008.

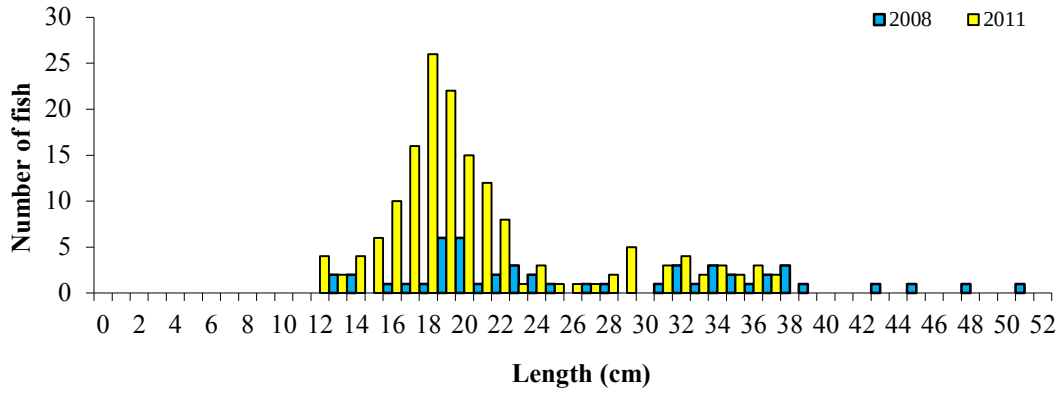

Fig. 4.9. Length frequency distribution of eels in the Castlebar River site, July 2008 (n = 51) and August 2011 (n = 158)

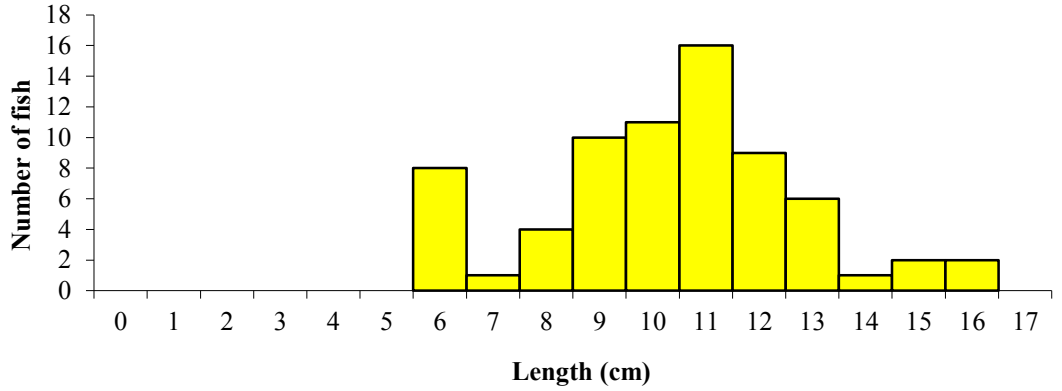

Fig. 4.10. Length frequency distribution of roach in the Castlebar River site, August 2011 (n = 70)

4.1.4 The Clydagh (Castlebar) River

One site was electric fished on the Clydagh River as part of the WFD surveillance monitoring programme in rivers 2011. The survey site was located just downstream of a large stone bridge, northwest of the townland of Ardvarney (Fig. 4.11; Plate 4.4). Three electric-fishing passes were conducted using one bank-based electric fishing unit on the 3rd of August 2011, along a 46m length of channel. The mean wetted width of the channel was 5.57m and the mean depth was 8.0cm. A total wetted area of 256m^2 was surveyed. Riffle was the most dominant habitat type present along this stretch, while the substrate consisted of a good mix of boulder, cobble and gravel. The vegetation at this site consisted mainly of a few bryophyte as well as emergent bankside species.

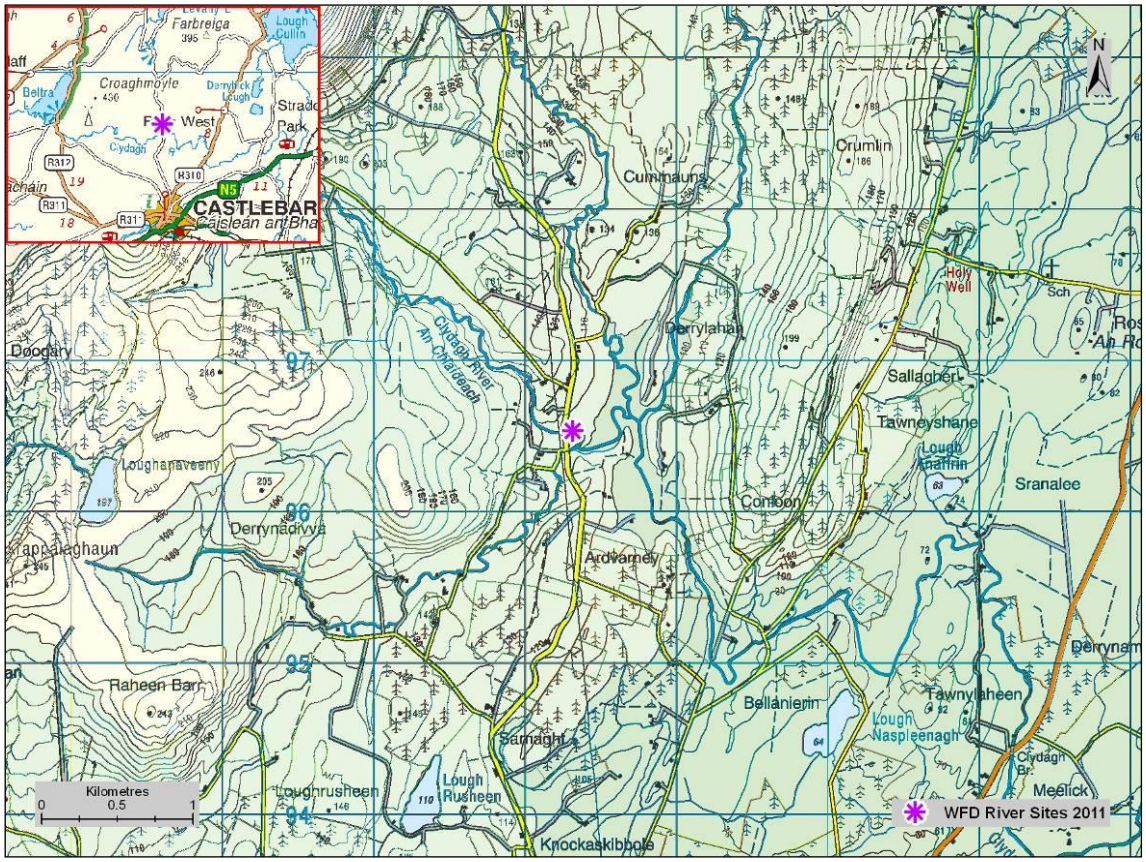

Fig. 4.11. Location of the Clydagh River surveillance monitoring site

Plate 4.4. The Clydagh River (bridge northwest of Ardvarney) near Castlebar, Co. Mayo

A total of two fish species were recorded in the Clydagh River site. Salmon was the most abundant species, followed by brown trout and eels (Table 4.4). This river was also surveyed in 2008, with results from that survey also shown for comparative purposes. During the previous survey in 2008, the same species composition was present, with the exception of eel, which were not recorded in the 2011 survey.

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

Common name	2008			2011		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.002	0.058	0.058	0.098	0.168	0.266
Brown trout	0.011	0.028	0.039	0.000	0.008	0.008
Eel	-	-	0.002	-	-	-
All Fish	-	-	0.099	-	-	0.273

Salmon captured during the 2011 survey ranged in length from 4.3cm to 13.3cm (mean = 8.1cm) (Fig. 4.12). Two age classes (0+ and 1+) were present, accounting for approximately 39% and 61% of the total salmon catch respectively. Salmon captured during the 2008 survey ranged in length from 6.4cm to 12.1cm (mean = 10.7cm) (Fig. 4.6). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 3%, 85% and 13% of the salmon catch respectively.

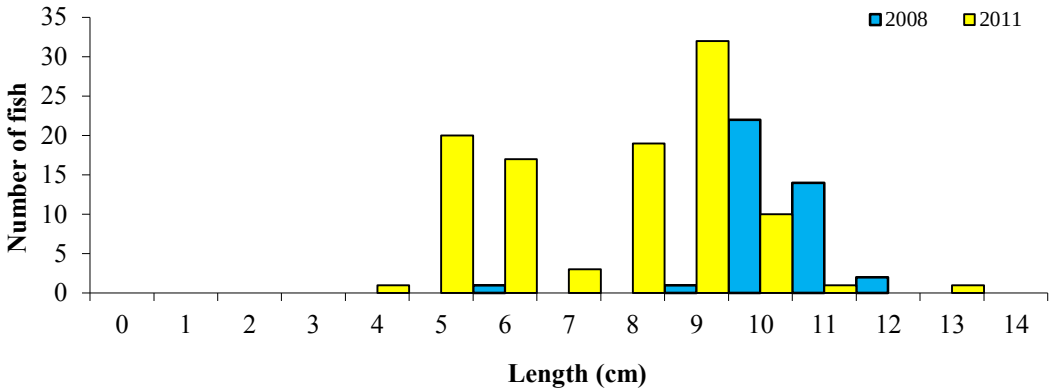

Fig. 4.12. Length frequency distribution of salmon in the Clydagh River site, July 2008 (n = 40) and August 2011 (n = 104)

4.1.5 The Glennamong River

One site was electric fished on the Glennamong River as part of the WFD surveillance monitoring programme in rivers 2011. The survey site was located downstream of a ford and footbridge approximately 1.5km upstream of Lough Feeagh (Fig. 4.13; Plate 4.5). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 2nd of August 2011, along a 75m length of channel. The mean wetted width of the channel was 7.08m and the mean depth was 20.0cm. A total wetted area of 531m^2 was surveyed. Riffle dominated the habitat along this stretch, while the substrate consisted of mainly cobble, boulder and gravel. The vegetation at this site consisted of mainly bryophytes.

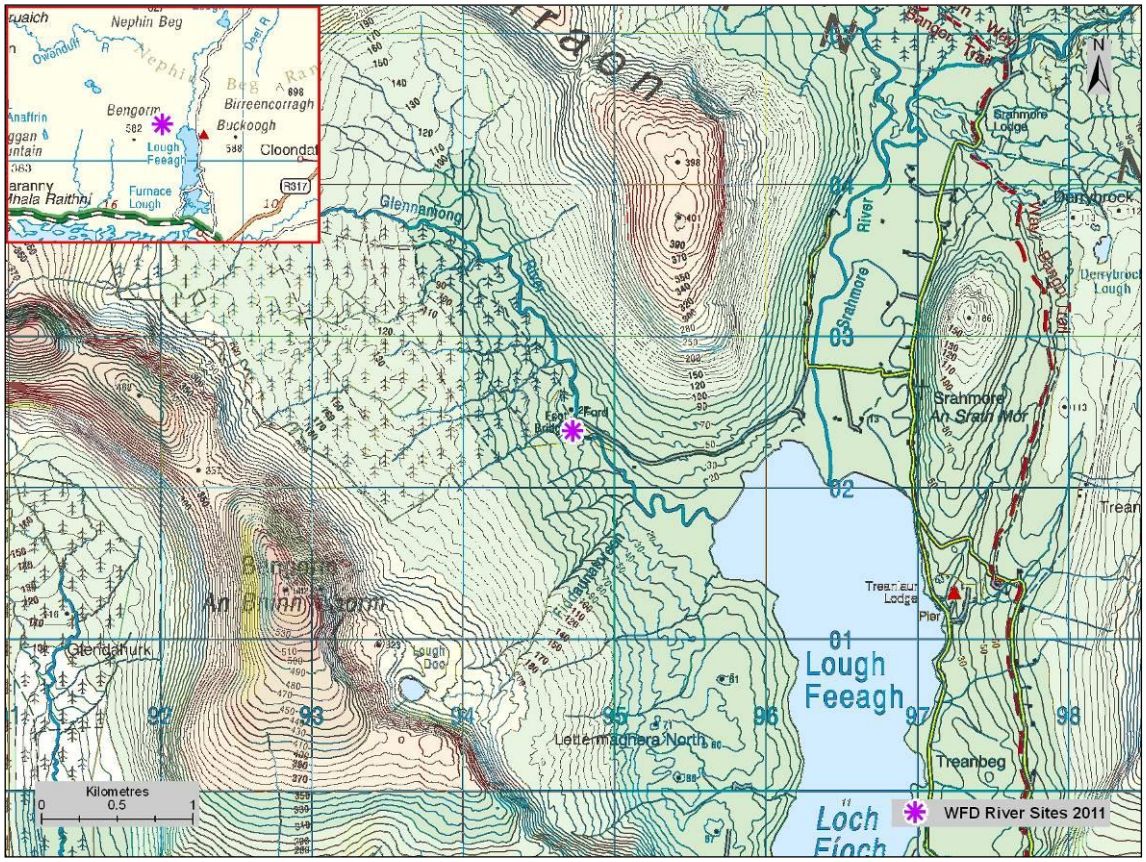

Fig. 4.13. Location of the Glennamong River surveillance monitoring site

Plate 4.5. The Glennamong River upstream of Lough Feeagh, Co. Mayo

A total of three fish species were recorded in the Glennamong River site. Salmon was the most abundant species, followed by brown trout and eels (Table 4.5). This river was also surveyed in 2008, with results from that survey also shown for comparative purposes. During the previous survey in 2008 the same species composition was present.

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

Common name	2008			2011		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.001	0.026	0.026	0.002	0.075	0.077
Brown trout	0.006	0.004	0.010	0.017	0.024	0.041
Eel	-	-	0.001	-	-	0.017
All Fish	-	-	0.038	-	-	0.136

Salmon captured during the 2011 survey ranged in length from 5.9cm to 12.4cm (mean = 10.5cm) (Fig. 4.14). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 2%, 88% and 10% of the total salmon catch respectively. Salmon captured during the 2008 survey ranged in length from 7.4cm to 13.2cm (mean = 11.3cm) (Fig. 4.14). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 3%, 85% and 12% of the salmon catch respectively.

Brown trout captured during the 2011 survey ranged in length from 5.0cm to 14.5cm (mean = 8.8cm) (Fig. 4.15). Two age classes (0+ and 1+) were present, both accounting for 50% of the total brown trout catch respectively. Brown trout captured during the 2008 survey ranged in length from 5.4cm to 18.5cm (mean = 10.4cm) (Fig. 4.15). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 48%, 33% and 19% of the brown trout catch respectively.

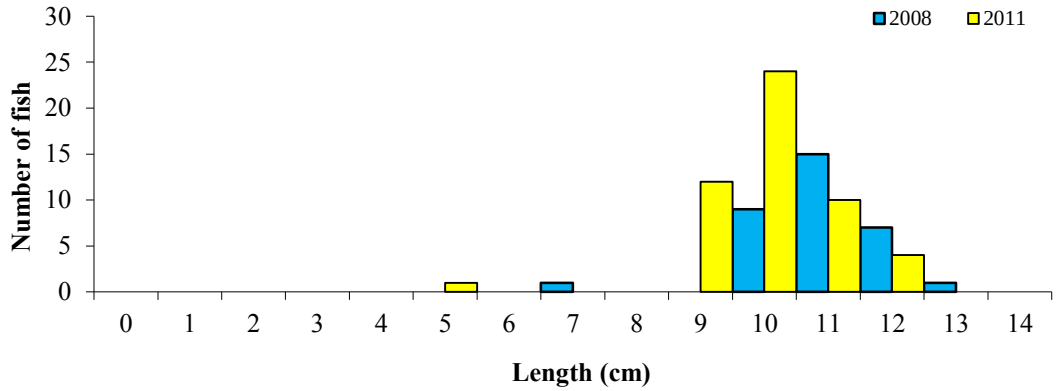

Fig. 4.14. Length frequency distribution of salmon in the Glennamong River site, August 2008 (n = 33) and August 2011 (n = 51)

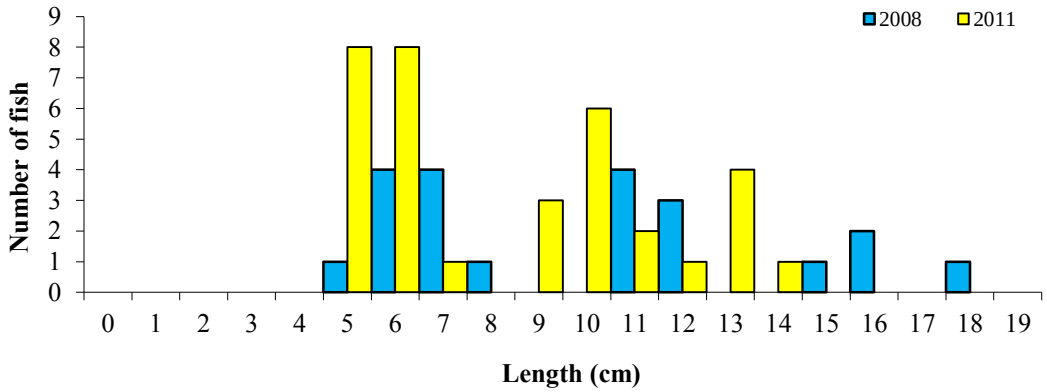

Fig. 4.15. Length frequency distribution of brown trout in the Glennamong River site, August 2008 (n = 21) and August 2011 (n = 34)

4.1.6 The Tobercurry River

One site was electric fished on the Tobercurry River as part of the WFD surveillance monitoring programme in rivers 2011. The survey site was located upstream stream of a small bridge, approximately 100m from the confluence with the River Moy (Fig. 4.16; Plate 4.6). Three electric-fishing passes were conducted using two bank-based electric fishing units on the 8th of August 2011, along a 44m length of channel. The mean wetted width of the channel was 2.82m and the mean depth was 18.0cm. A total wetted area of 124m^2 was surveyed. Riffle and glide dominated the habitat along this stretch, while the substrate was comprised of mainly gravel and cobble. The vegetation here was dominated by bryophytes and a few emergent bankside species.

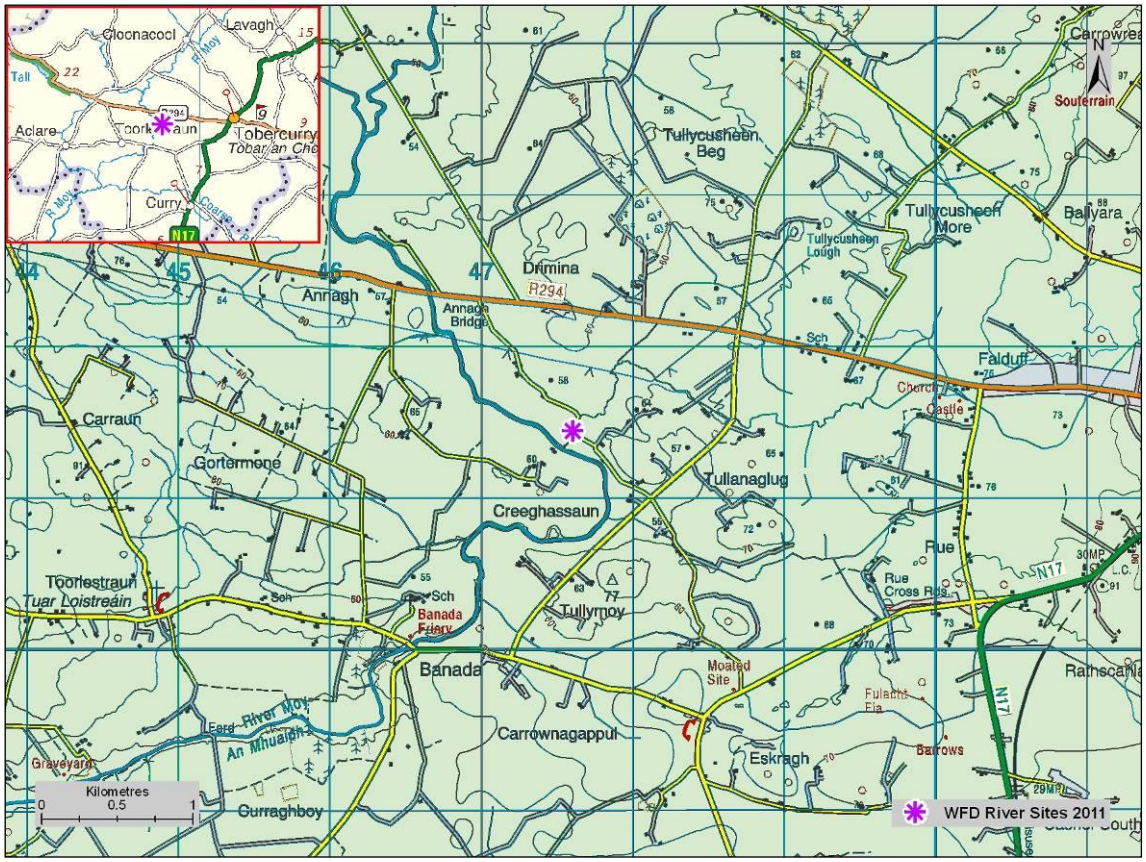

Fig. 4.16. Location of the Tobercurry River surveillance monitoring site

Plate 4.6. The Tobercurry River near Tobercurry, Co. Sligo

A total of five fish species were recorded in the Tobercurry site. Salmon was the most abundant species, followed by minnow, three-spined stickleback, stone loach and brown trout (Table 4.6). This river was also surveyed in 2008, with results from that survey also shown for comparative purposes. During the previous survey in 2008, the same species composition was present, with the exception of eel, which were not recorded in the 2011 survey.

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

Common name	2008			2011		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.570	0.153	0.723	0.323	0.250	0.573
Minnow	-	-	0.009	-	-	0.299
Three-spined stickleback	-	-	0.009	-	-	0.016
Stone loach	-	-	0.003	-	-	0.016
Brown trout	0.028	0.003	0.031	0.008	0.000	0.008
Eel	-	-	0.003	-	-	-
All Fish	-	-	0.779	-	-	0.912

Salmon captured during the 2011survey ranged in length from 4.2cm to 13.5cm (mean = 7.3cm) (Fig. 4.17). Two age classes (0+ and 1+) were present, accounting for approximately 64% and 36% of the total salmon catch respectively. Salmon captured during the 2008 survey ranged in length from 3.1cm to 12.9cm (mean = 5.9cm) (Fig. 4.16). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 85%, 15% and <1%% of the salmon catch respectively.

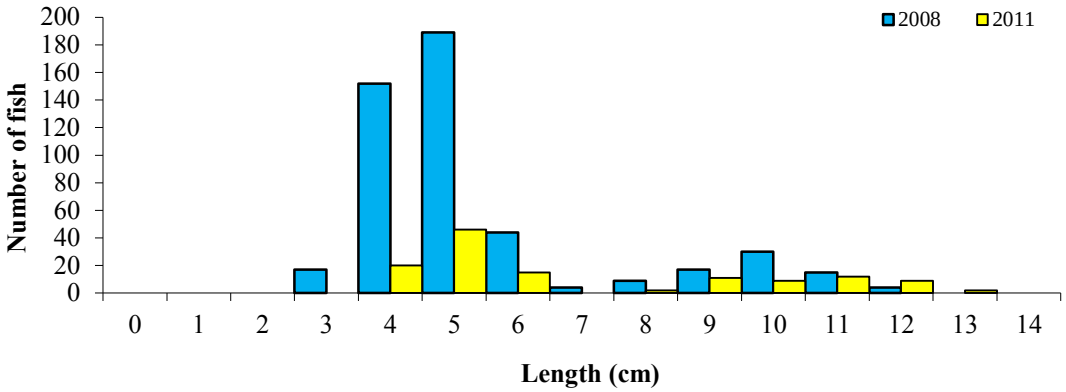

Fig. 4.17. Length frequency distribution of salmon in the Tobercurry River site, July 2008 (n = 481) and August 2011 (n = 126)

4.2 Community structure

4.2 Species distribution

A total of eight fish species were recorded within the six WRBD sites surveyed during 2011 (Fig. 4.18). Brown trout and salmon were the most widespread fish species, occurring in all sites, followed by eels and three-spined stickleback. Lamprey, minnow, roach and stone loach were only recorded at one site each.

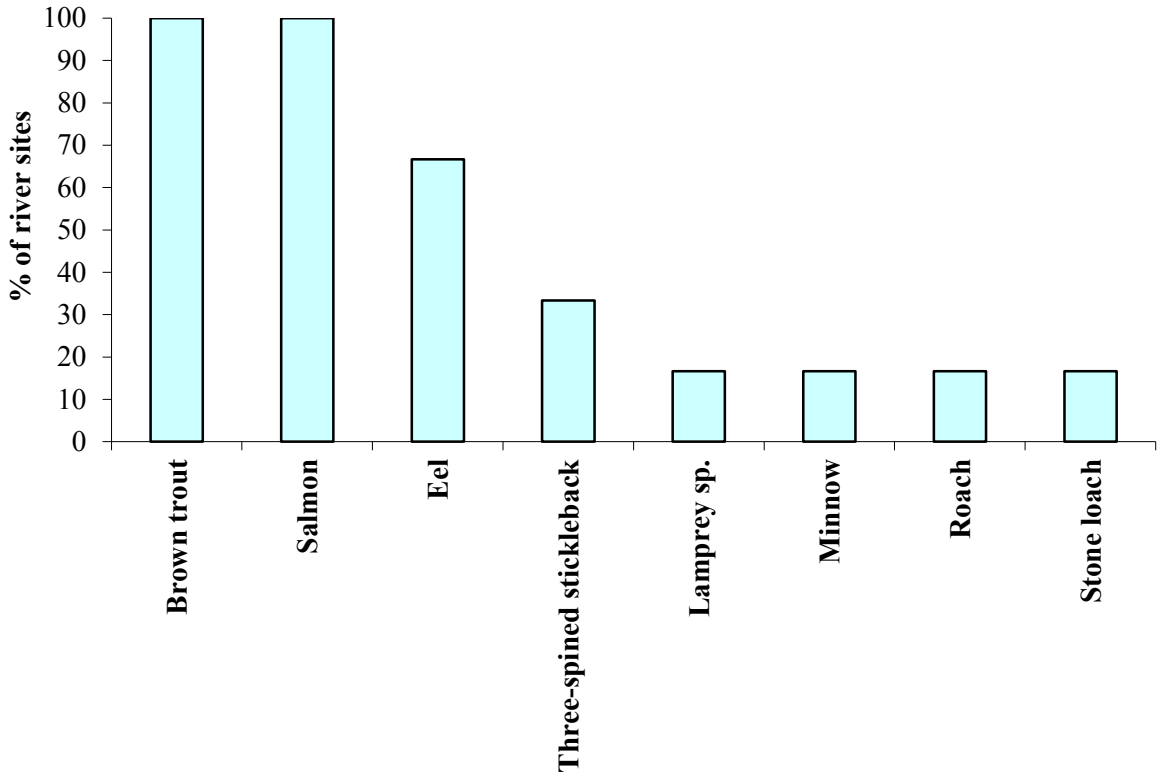

Fig. 4.18. Percentage of sites where each fish species was recorded in the WRBD for WFD SM monitoring 2011

4.3 Age and growth

Growth rates based on back-calculated length-at-age data were analysed for brown trout, salmon and roach in each river site surveyed in the WRBD during 2011.

The mean back-calculated length-at-age data for brown trout in the WRBD are shown in Figure 4.19 and Appendix 1. Brown trout were recorded in all six sites, with five sites containing brown trout aged 1+ or older. Ages ranged from 0+ to 3+, and fish aged 1+ comprised the most abundant age class within the region. The largest brown trout recorded in the WRBD in 2011 was caught in the Behy River, which measured 22.7cm in length, weighed 105g and was aged 3+.

The brown trout at each river site are 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, however, the growth rate could not be reliably estimated from fish at these sites as insufficient numbers of individual fish of 2+ or older were captured. Appendix 1 shows the data from those brown trout that were captured.

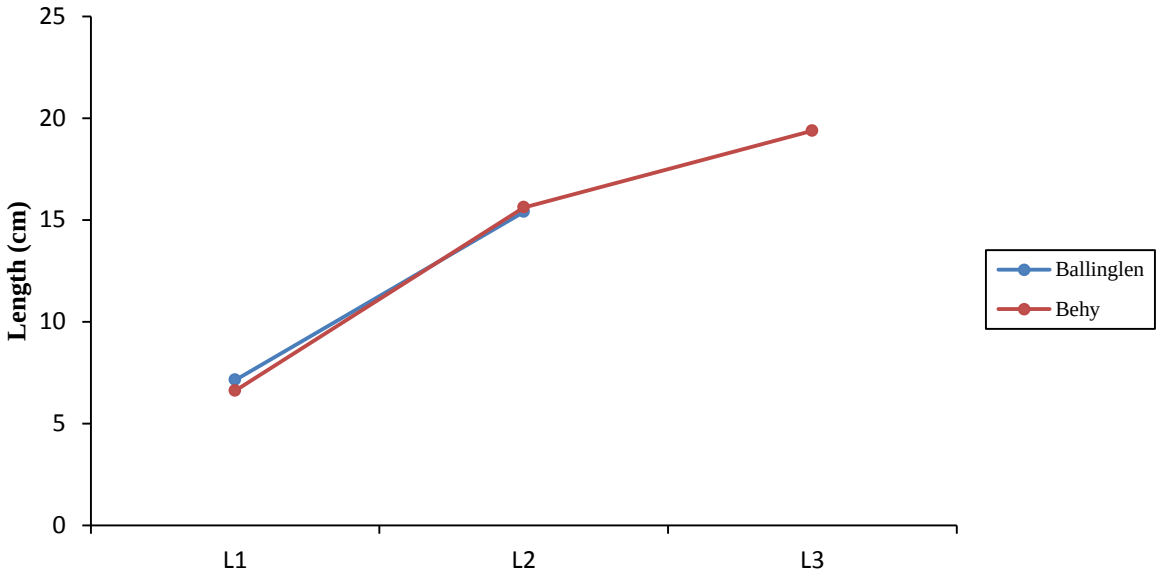

Fig. 4.19. Back calculated lengths for brown trout in the WRBD, WFD surveillance monitoring 2011

The mean back-calculated length-at-age data for juvenile salmon in the WRBD are shown in Figure 4.20 and Appendix 2. Salmon were recorded in all six sites, with five of these sites containing salmon aged 1+ or older. Ages ranged from 0+ to 2+, with individuals aged 0+ and 1+ comprising the most abundant age classes within the region. The largest juvenile salmon recorded in the WRBD in 2011 was caught in the Tobercurry River, which measured 13.5cm in length, weighed 28.5g and was aged 1+.

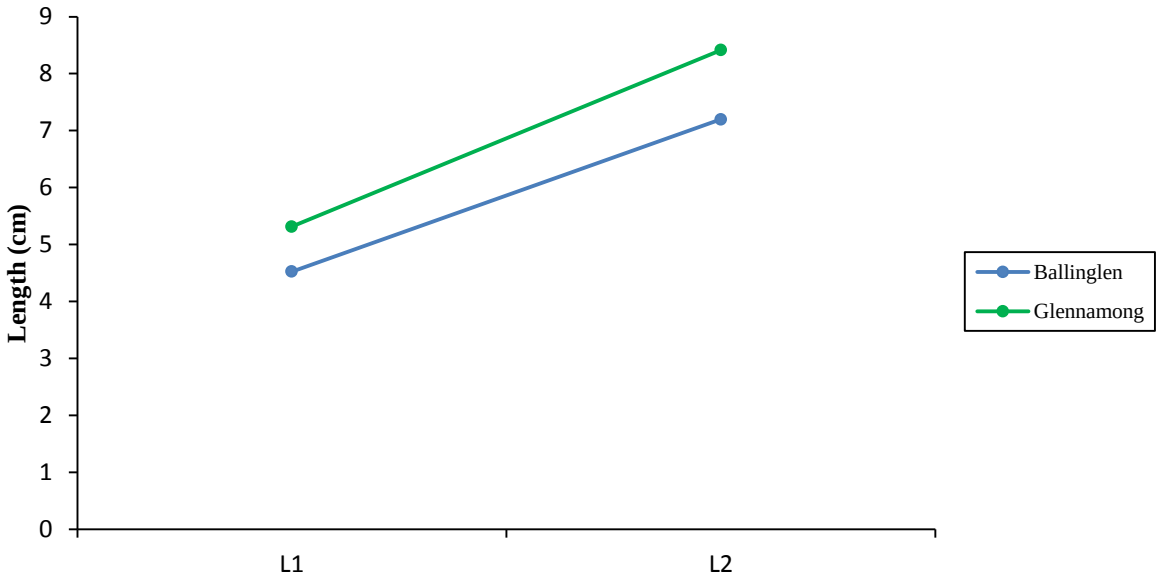

Fig. 4.20. Back calculated lengths for salmon in the WRBD, WFD surveillance monitoring 2011

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 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 2011 has been assigned a draft fish classification status (Table 4.13). Three sites in the WRBD were classified as "Good", two as "Moderate" and one as "Poor". All of these sites were surveyed in both 2008 and 2011 and when comparing the status for both years, five rivers showed some deterioration, with the remaining site on the Castlebar River, showing no change in status; "Poor" for both years.

Table 4.13. Ecological status of sites surveyed in the WRBD for surveillance monitoring 2011 (figures in brackets indicate confidence in class)

River	Site Code	Site name	Previous ecological status	Ecological status 2011
Ballinglen	33B010100	Ballinglen Br.	High (2008)	Good (92%)
Behy	34B080400	Behy Br.	High (2008)	High
Castlebar	34C010200	Br. 2.5 km d/s Castlebar	Poor (2008)	Poor (73%)
Clydagh(Castlebar)	34C050030	Br. NW Ardvarney	High (2008)	Moderate (87%)
Glennamong	32G030100	Br. u/s Lough Feeagh	Good (2008)	Moderate (94%)
Tobercurry	34T020200	Br. just u/s of Moy	High (2008)	Good (100%)

5. DISCUSSION

A total of eight fish species were recorded during the 2011 WFD surveillance monitoring programme for fish in rivers within the WRBD. Brown trout and salmon were the most commonly encountered species in the WRBD, recorded in all six sites, followed by eels and three-spined stickleback. The Castlebar and Tobercurry River sites were the most diverse sites surveyed within the WRBD in 2011, with a total of five species present. The site that recorded the lowest diversity in this region was the Clydagh River, with only two species present, brown trout and salmon. The greatest abundances of brown trout and salmon were recorded in the Behy and Tobercurry Rivers respectively.

Following the methods of Kennedy and Fitzmaurice (1971), the growth rate of brown trout could not be reliably ascertained for brown trout at these sites.

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 2011 has been assigned a draft fish classification status. Three sites in the WRBD were classified as "Good", two as "Moderate" and one as "Poor". All of these sites were surveyed in both 2008 and 2011 and when comparing the status for both years, five rivers showed some deterioration, with the remaining site on the Castlebar River, showing no change in status; "Poor" for both years.

6. REFERENCES

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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.

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	Growth Category
Ballinglen	Mean	7.14	15.39		n/a
	S.D.	1.40	1.07		
	S.E.	0.42	0.48		
	n	11	5		
	Min	4.08	13.98		
	Max	9.21	16.75		
Behy	Mean	6.61	15.61	n/a	n/a
	S.D.	1.11	0.60	n/a	
	S.E.	0.22	0.35	n/a	
	n	25	3	1	
	Min	4.58	14.95	19.38	
	Max	8.91	16.12	19.38	
Castlebar	Mean	n/a			n/a
	S.D.	n/a			
	S.E.	n/a			
	n	1			
	Min	6.13			
	Max	6.13			
Clydagh (Castlebar)	Mean	6.83			n/a
	S.D.	0.66			
	S.E.	0.38			
	n	3			
	Min	6.07			
	Max	7.32			
Glennamong	Mean	6.21			n/a
	S.D.	1.42			
	S.E.	0.37			
	n	15			
	Min	3.96			
	Max	8.48			

APPENDIX 2

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

River		L1	L2
Ballinglen	Mean	4.53	7.20
	S.D.	0.89	0.13
	S.E.	0.16	0.09
	n	30	2
	Min	2.46	7.11
	Max	6.43	7.29
Behy	Mean	4.58	
	S.D.	0.79	
	S.E.	0.16	
	n	24	
	Min	3.10	
	Max	6.06	
Clydagh (Castlebar)	Mean	5.39	
	S.D.	1.22	
	S.E.	0.30	
	n	16	
	Min	3.53	
	Max	8.79	
Glennamong	Mean	5.31	8.41
	S.D.	1.04	1.12
	S.E.	0.25	0.50
	n	17	5
	Min	3.63	6.75
	Max	7.46	9.58
Tobercurry	Mean	3.96	
	S.D.	0.63	
	S.E.	0.13	
	n	22	
	Min	2.86	
	Max	5.31	

APPENDIX 3

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

River		L1	L2	L3	L4
Castlebar	Mean	2.21	5.73	9.34	11.98
	S.D.	0.41	1.50	1.40	2.48
	S.E.	0.07	0.27	0.32	0.94
	n	33	31	19	7
	Min	1.70	3.79	6.69	9.12
	Max	3.27	11.40	12.16	15.34

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