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# Sampling Fish for the Water Framework Directive

Rivers 2012

## Western River Basin District



Iascach Intíre Éireann  
Inland Fisheries Ireland

## Water Framework Directive Fish Stock Survey of Rivers in the Western River Basin District 2012

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## 1. INTRODUCTION

Fish stock surveys were undertaken in 58 river sites throughout Ireland during the summer of 2012 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). Eleven of these surveys were carried out at river sites in the Western River Basin District (WRBD) from May to July 2012 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 2012 is the fifth year of the rivers sampling programme, many of the sites surveyed this year are repeat surveys of those carried out in 2009. 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 2012 fish stock survey carried out on each site in the WRBD, as part of the Water Framework Directive surveillance monitoring programme.

## 2. STUDY AREA

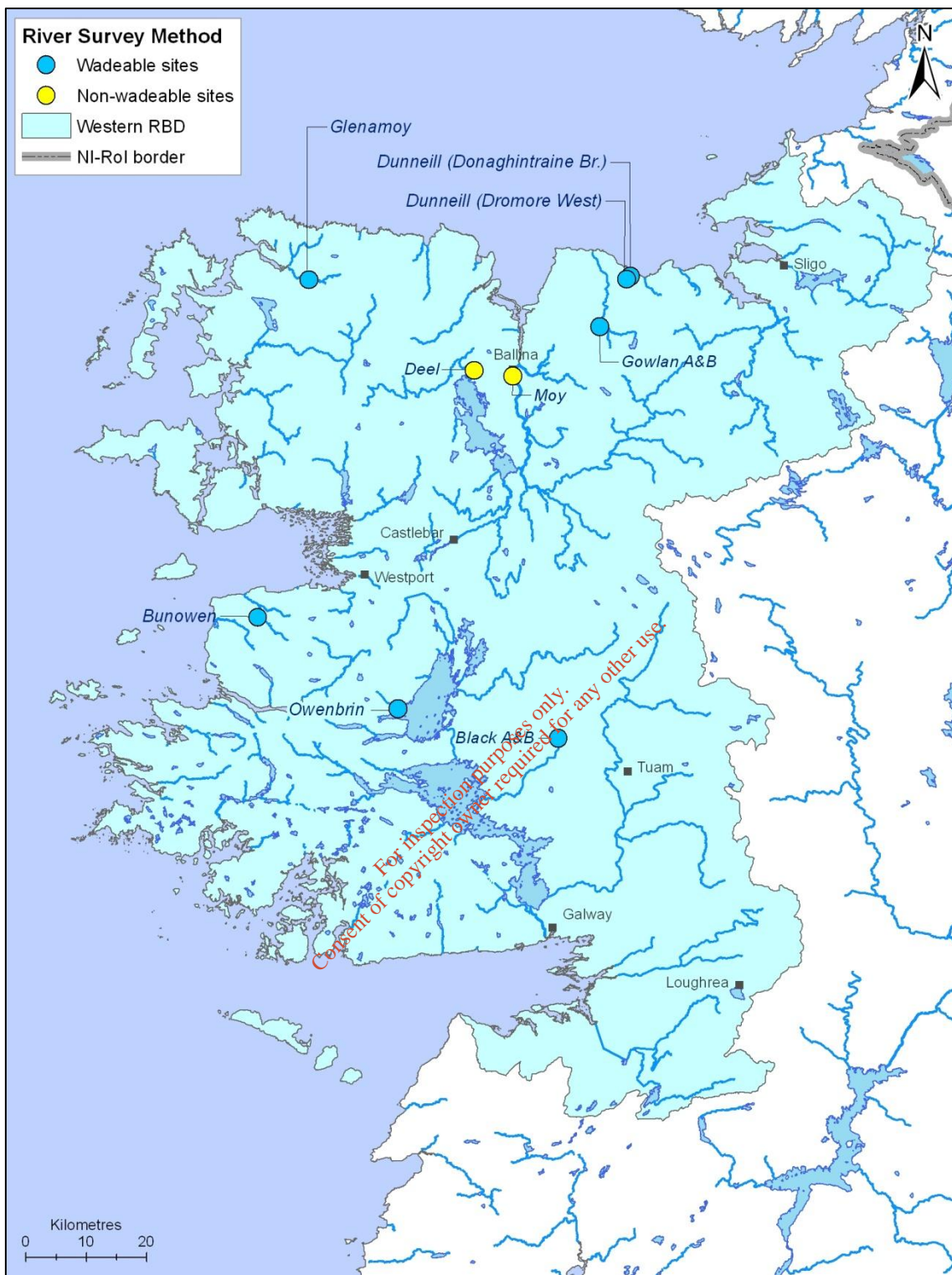
Eleven river sites were surveyed in six river catchments within the WRBD during 2012: the Bunowen, Corrib, Dunneill, Easky, Glenamoy and Moy catchments. The sites ranged in surface area from 205m<sup>2</sup> for the Gowlan River (Track west of Lough Black\_A) to 17,861m<sup>2</sup> for the River Moy (upstream of Ardnaree Bridge). 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 river sites surveyed for WFD surveillance monitoring, WRBD 2012**

River	Site name	Catchment	Site Code	Waterbody code
<b>WRBD Wadeable sites</b>				
Black (Shrule)	Br. at Kilshanvy_A	Corrib	30B020100A	WE_30_2928
Black (Shrule)	Br. at Kilshanvy_B	Corrib	30B020100B	WE_30_2928
Bunowen (Louisburgh)	Tully Br._A	Bunowen	32B030100A	WE_32_3740
Dunneill	Donaghintraine Br._A	Dunneill	35D060200A	WE_35_1430
Dunneill	Dromore West_A	Dunneill	35D060170A	WE_35_3210
Glenamoy	Glenamoy Village_A	Glenamoy	33G010075A	WE_33_3238
Gowlan	Track west of Lough Black_A	Easky	35G030050A	WE_35_1187
Gowlan	Track west of Lough Black_B	Easky	35G030050B	WE_35_1187
Owenbrin	Br. u/s Lough Mask_A	Corrib	30O010200A	WE_30_1063
<b>WRBD Non-Wadeable sites</b>				
Deel (Crossmolina)	Bridge at Castle Gore_A	Moy	34D010400A	WE_34_3896_3
Moy	U/s Ardnaree Br._A	Moy	34M021020A	WE_34_3982

**Table 2.2. Details of river sites surveyed for WFD surveillance monitoring, WRBD 2012**

River	Upstream catchment (km <sup>2</sup> )	Wetted width (m)	Surface area (m <sup>2</sup> )	Mean depth (m)	Max depth (m)
<b>WRBD Wadeable sites</b>					
Black (Shrule) (Br. at Kilshanvy_A)	3.12	6.55	262	0.34	0.61
Black (Shrule) (Br. at Kilshanvy_B)	3.12	6.45	206	0.43	0.81
Bunowen (Louisburgh) (Tully Br._A)	28.11	8.35	334	0.32	0.70
Dunneill (Donaghintraine Br._A)	24.35	8.63	389	0.18	0.32
Dunneill (Dromore West_A)	13.77	10.88	468	0.55	11.00
Glenamoy (Glenamoy Village_A)	74.80	10.48	419	0.19	0.32
Gowlan (Track west of Lough Black_A)	17.00	5.13	205	0.38	0.70
Gowlan (Track west of Lough Black_B)	17.00	6.43	257	0.34	0.70
Owenbrin (Br. u/s Lough Mask_A)	23.82	8.48	339	0.36	0.68
<b>WRBD Non-Wadeable sites</b>					
Deel (Crossmolina) (Bridge at Castle Gore_A)	229.59	19.00	4085	0.92	1.70
Moy (U/s Ardnaree Br._A)	1948.13	45.33	17861	1.93	4.35



**Fig. 2.1. Location map of river sites surveyed throughout the WRBD for WFD fish surveillance monitoring 2012**

### 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 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 Black River

Two sites were electric fished on the Black River as part of the WFD surveillance monitoring programme in rivers 2012: the Black River Site A and Site B at Kilshanvy Bridge.

The Black River Site A was located just upstream of Kilshanvy Bridge, approximately 13km northeast of Tuam, Co. Galway (Fig. 4.1; Plate 4.1). Three electric-fishing passes were conducted using two bank-based electric fishing units on the 18<sup>th</sup> of July 2012, along a 40m length of channel. Glide dominated the habitat, while the substrate consisted mostly of cobble. The vegetation at this site was dominated by emergent bank-side and riparian species, as well as a few aquatic mosses.

The Black River Site B was located upstream of Site A (Fig. 4.1). Three electric-fishing passes were conducted using two bank-based electric fishing units on the 18<sup>th</sup> of July 2012, along a 32m length of channel. Glide dominated the habitat, while the substrate consisted mostly of cobble. The vegetation at this site was dominated by emergent bank-side and riparian species, as well as a few aquatic mosses.



**Fig. 4.1. Location of the Black River surveillance monitoring sites**



**Plate 4.1. The Black River at Kishanvy Bridge, Co. Mayo**

***Black River (Site A)***

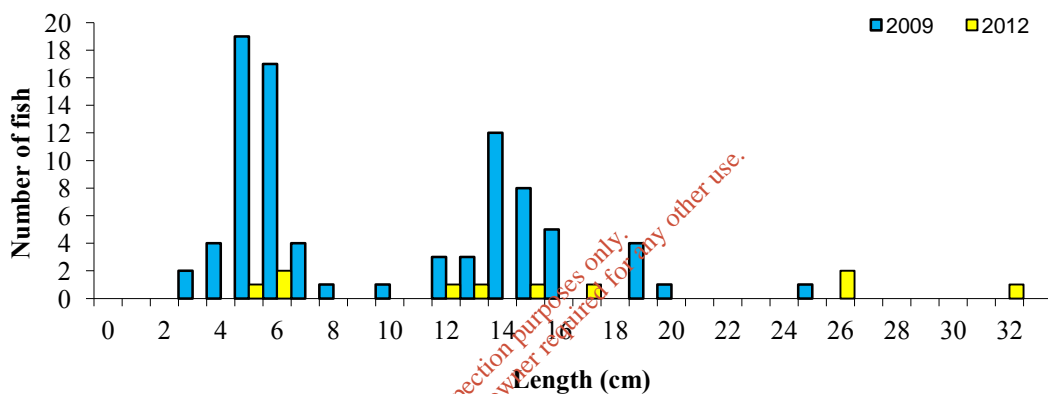
A total of three fish species were recorded in the Black River Site A (Table 4.1). Salmon was the most abundant species, followed by three-spined stickleback and brown trout.

**Table 4.1. Density of fish (no./m<sup>2</sup>), Black River Site A (fish density has been calculated as minimum estimates based on one fishing)**

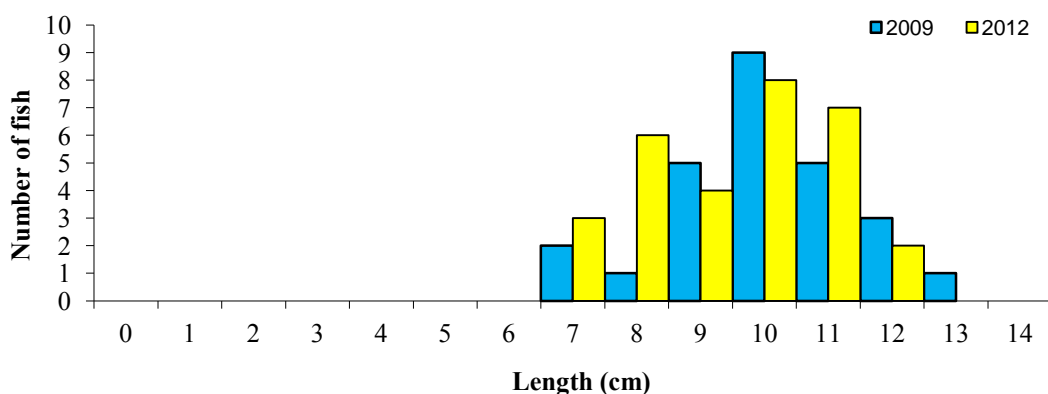
Common name	2009			2012		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.007	0.063	0.070	0.000	0.080	0.080
Three-spined stickleback	-	-	0.030	-	-	0.034
Brown trout	0.115	0.100	0.215	0.008	0.023	0.031
European eel	-	-	0.007	-	-	-
All Fish	-	-	0.322	-	-	0.145

Brown trout captured during the 2012 survey ranged in length from 5.6cm to 32.2cm (mean = 16.2cm) (Fig. 4.2). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for 30%, 40%, 20% and 10% of the total brown trout catch respectively. Brown trout captured during the 2009 survey ranged in length from 3.6cm to 25.4cm (mean = 10.2cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 54%, 45% and 1% of the brown trout catch respectively.

Salmon captured during the 2012 survey ranged in length from 7.4cm to 12.9cm (mean = 10.0cm) (Fig. 4.3). Only one age class (1+) was present. Salmon captured during the 2009 survey ranged in length from 7.6cm to 13.5cm (mean = 10.6cm). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 8%, 85% and 8% of the salmon catch respectively.



**Fig. 4.2. Length frequency distribution of brown trout in the Black River, Site A, July 2009 (n = 85) and August 2012 (n = 10)**



**Fig. 4.3. Length frequency distribution of salmon in the Black River, Site A, July 2009 (n = 26) and August 2012 (n = 30)**

**Black River (Site B)**

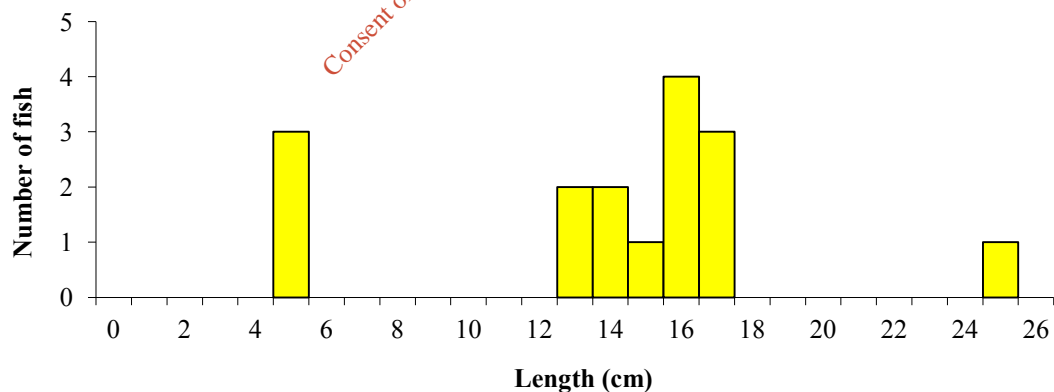
A total of three fish species were recorded in the Black River Site B (Table 4.2). Salmon and brown trout were the most abundant species, caught in equal numbers followed by three-spined stickleback.

**Table 4.2. Density of fish (no./m<sup>2</sup>), Black River Site B (fish density has been calculated as minimum estimates based on one fishing)**

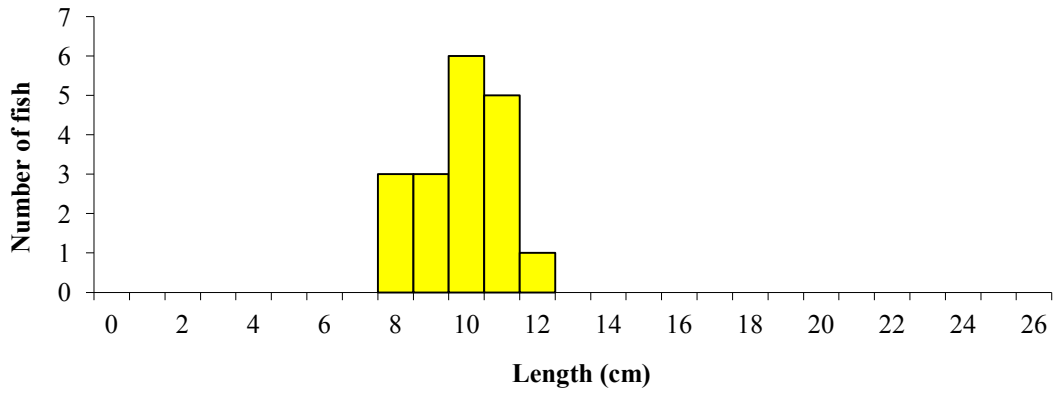
Common name	2012		Total minimum density
	0+	1+ & older	
Brown trout	0.015	0.044	0.058
Salmon	0.000	0.058	0.058
Three-spined stickleback	-	-	0.019
All Fish	-	-	0.136

Brown trout captured during the 2012 survey ranged in length from 5.4cm to 25.5cm (mean = 14.5cm) (Fig. 4.4). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 19%, 75% and 6% of the brown trout catch respectively.

Salmon captured during the 2012 survey ranged in length from 8.6cm to 12.2cm (mean = 10.4cm) (Fig. 4.5). Only one age class (1+) was present.



**Fig. 4.4. Length frequency distribution of brown trout in the Black River Site B, August 2012 (n = 16)**

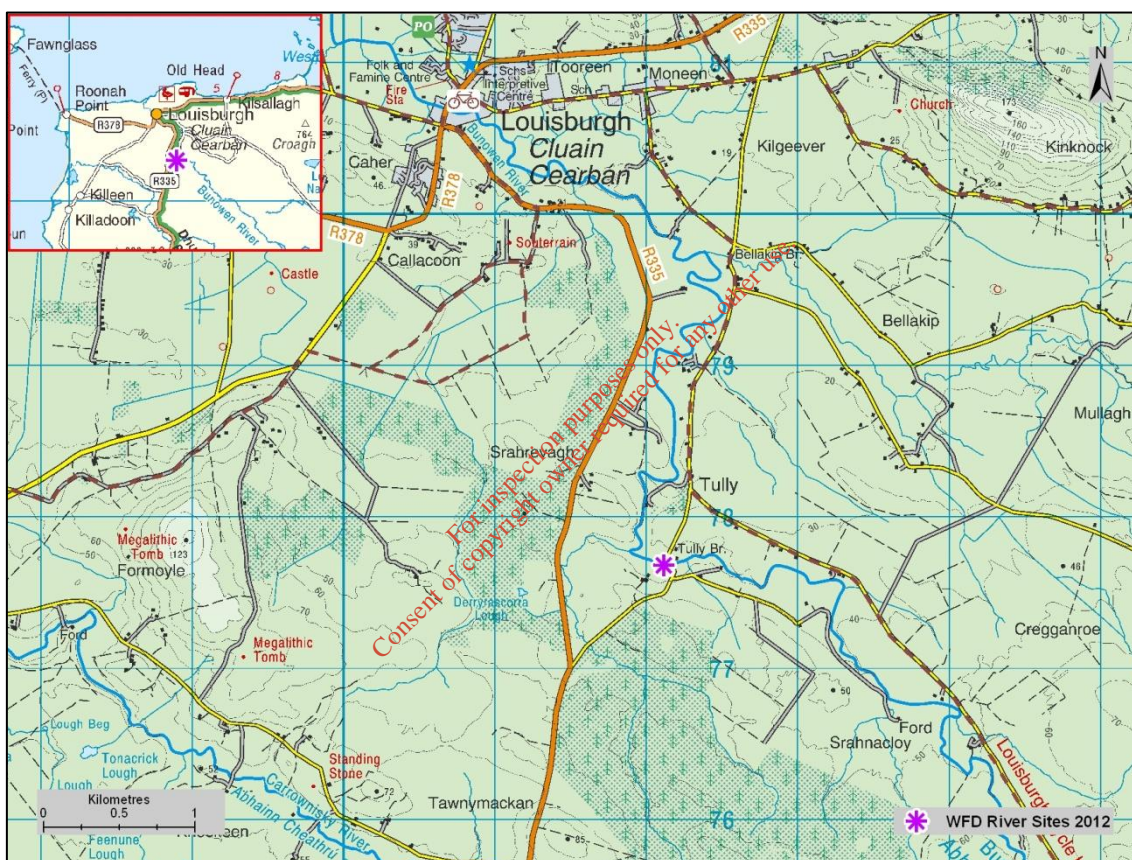


**Fig. 4.5. Length frequency distribution of salmon in the Black River Site B, August 2012 (n = 18)**

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#### 4.1.2 The Bunowen River

One site was electric fished on the Bunowen River as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was located downstream of Tully Bridge, approximately 3.5km north of Louisburgh, Co. Mayo (Fig. 4.6; Plate 4.2). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 19<sup>th</sup> of July 2012, along a 40m length of channel. Glide dominated the habitat, while the substrate consisted largely of cobble. Vegetation at this site was diverse, consisting of a large number of mosses and liverworts, as well as a number of emergent and bank-side species.



**Fig. 4.6. Location of the Bunowen River surveillance monitoring site**



**Plate 4.2. The Bunowen River at Tully Bridge, Co. Mayo**

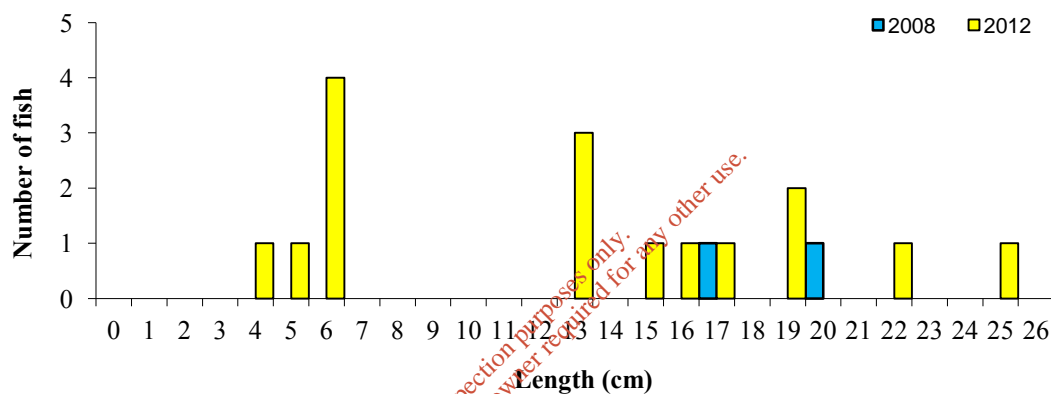
A total of three fish species were recorded in the Bunowen River site (Table 4.3). Salmon was the most abundant species, followed by brown trout and eels.

**Table 4.3. Density of fish (no./m<sup>2</sup>), Bunowen River (fish density has been calculated as minimum estimates based on one fishing)**

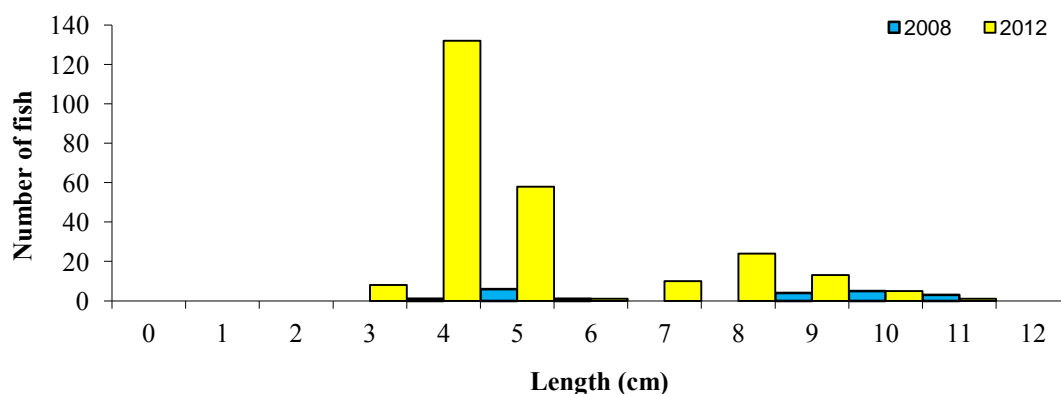
Common name	2008			2012		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.003	0.005	0.008	0.338	0.099	0.437
Brown trout	0.000	0.001	0.001	0.012	0.015	0.027
European eel	-	-	-	-	-	0.006
Sea trout	-	-	0.002	-	-	-
All Fish	-	-	0.011	-	-	0.470

Brown trout captured during the 2012 survey ranged in length from 4.3cm to 25.0cm (mean = 13.1cm) (Fig. 4.7). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for 38%, 19%, 19% and 25% of the total brown trout catch respectively. Only two brown trout were recorded in 2008, measuring 17.2cm and 20.8cm, with only one age class (2+) present.

Salmon captured during the 2012 survey ranged in length from 3.2cm to 11.5cm (mean = 5.6cm) (Fig. 4.8). Three age classes (0+, 1+ and 2+) were present, accounting for 79%, 21% and <0.5% of the total brown trout catch respectively. Salmon captured during the 2008 survey ranged in length from 4.8cm to 11.8cm (mean = 8.4cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 40%, 50% and 10% of the salmon catch respectively.



**Fig. 4.7. Length frequency distribution of brown trout in the Bunowen River site, October 2008 (n = 2) and July 2012 (n = 16)**



**Fig. 4.8. Length frequency distribution of salmon in the Bunowen River site, October 2008 (n = 20) and July 2012 (n = 252)**

### 4.1.3 The Deel River

One site was electric fished on the Deel River (Crossmolina) as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was located downstream of a bridge at Deel Castle, approximately 7km West of Ballina, Co. Mayo (Fig. 4.9; Plate 4.3). Three electric-fishing passes were conducted using three boat-based electric fishing units on the 30<sup>th</sup> of July 2012, along a 215m length of channel. Glide dominated the habitat, while the substrate consisted largely of gravel and cobble.



**Fig. 4.9. Location of the Deel River surveillance monitoring site**



**Plate 4.3. The Deel River at Deel Castle near Ballina, Co. Mayo**

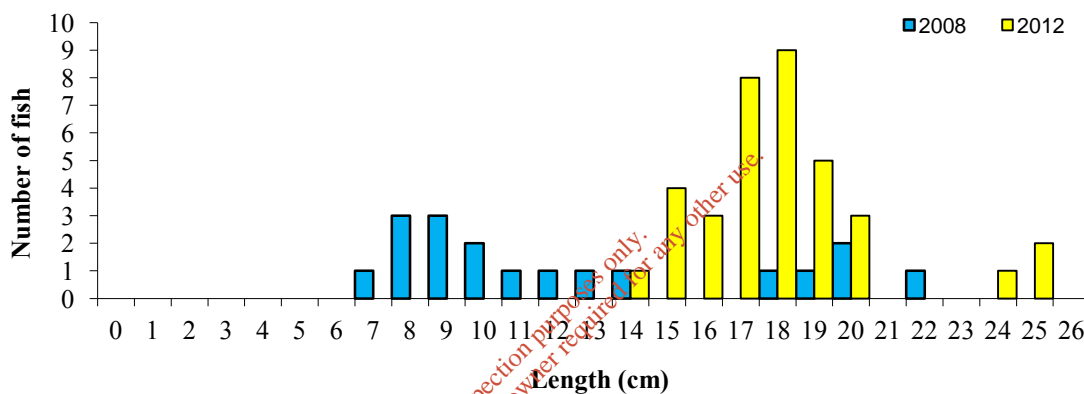
A total of six species were recorded in the Deel River site (Table 4.4). Roach was the most abundant species, followed by perch, European eel, salmon and juvenile lamprey and pike.

**Table 4.4 Density of fish (no./m<sup>2</sup>), Deel River (fish density has been calculated as minimum estimates based on one fishing)**

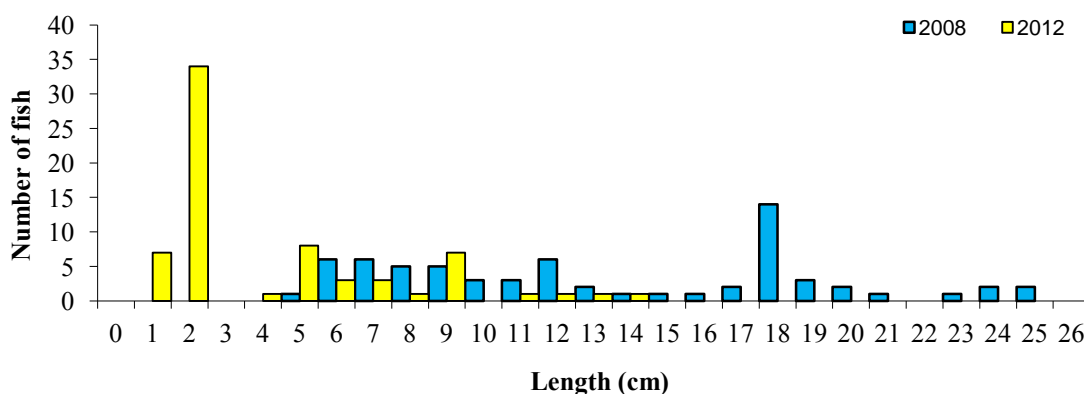
Common name	2008			2012		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Roach	-	-	0.0050	-	-	0.0130
Perch	-	-	0.0030	-	-	0.0060
European eel	-	-	0.0010	-	-	0.0005
Salmon	0.0002	0.0020	0.0022	0.0000	0.0002	0.0002
Lamprey juvenile	-	-	-	-	-	0.0002
Pike	-	-	0.0010	-	-	0.0010
Brown trout	0.0000	0.0002	0.0002	-	-	-
All Fish	-	-	0.0120	-	-	0.0210

Perch captured during the 2012 survey ranged in length from 14.2cm to 25.4cm (mean = 18.5cm) (Fig. 4.10). Perch captured during the 2008 survey ranged in length from 7.4cm to 22.0cm (mean = 13.0cm)

Roach captured during the 2012 survey ranged in length from 1.7cm to 14.8cm (mean = 4.5cm) (Fig. 4.11). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 60%, 19%, 15% and 6% of the total roach catch respectively. Roach captured during the 2008 survey ranged in length from 5.4cm to 25.5cm (mean = 13.9cm). Seven age classes (1+, 2+, 3+, 4+, 5+, 6+ and 7+) were present, accounting for approximately 15%, 27%, 18%, 16%, 18%, 4% and 1% of the total roach catch respectively.



**Fig. 4.10. Length frequency distribution of perch in the Deel River site, July 2008 (n = 27) and July 2012 (n = 27)**



**Fig. 4.11. Length frequency distribution of roach in the Deel River site, July 2008 (n = 67) and July 2012 (n = 68)**

#### 4.1.4 The Dunneill River

Two sites were electric fished on the Dunneill River as part of the WFD surveillance monitoring programme in rivers 2012; the Dunneill (Donaghintraîne Br.) and Dunneill River (Dromore West) (Fig. 4.12).

One site was electric fished on the Dunneill River (Donaghintraîne) as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was located upstream of Donaghintraîne Br., less than 1km northeast of Dromore West, Co. Sligo (Fig. 4.12; Plate 4.4). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 16<sup>th</sup> of July 2012, along a 45m length of channel. Riffle dominated the habitat, while the substrate consisted mostly of cobble. The vegetation at this site was dominated by aquatic and semi-aquatic mosses and liverworts.

One site was electric fished on the Dunneill River (Dromore West) as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was located further upstream of the Donaghintraîne Br. site, in the middle of Dromore West Village, Co. Sligo (Fig. 4.12; Plate 4.5). Three electric-fishing passes were conducted using two bank-based electric fishing units on the 16<sup>th</sup> of July 2012, along a 43m length of channel. Riffle dominated the habitat, while the substrate consisted largely of cobble. The vegetation at this site consisted of a small number of aquatic and semi-aquatic mosses and liverworts, as well as emergent bank-side species.

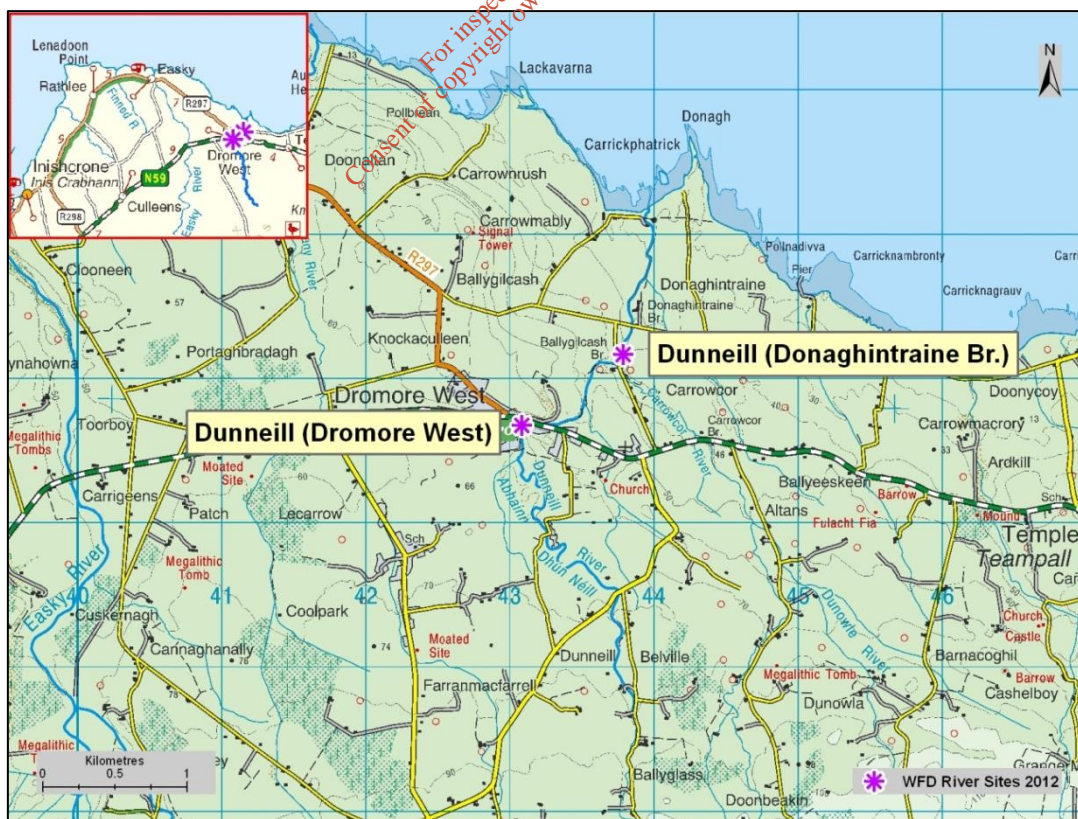


Fig. 4.12. Location of the Dunneill River surveillance monitoring sites



**Plate 4.4. The Dunneill River at Donaghintraire Bridge, Co. Sligo**



**Plate 4.5. The Dunneill River at Dromore West, Co. Sligo**

### *Dunneill River (Donaghintraîne Bridge)*

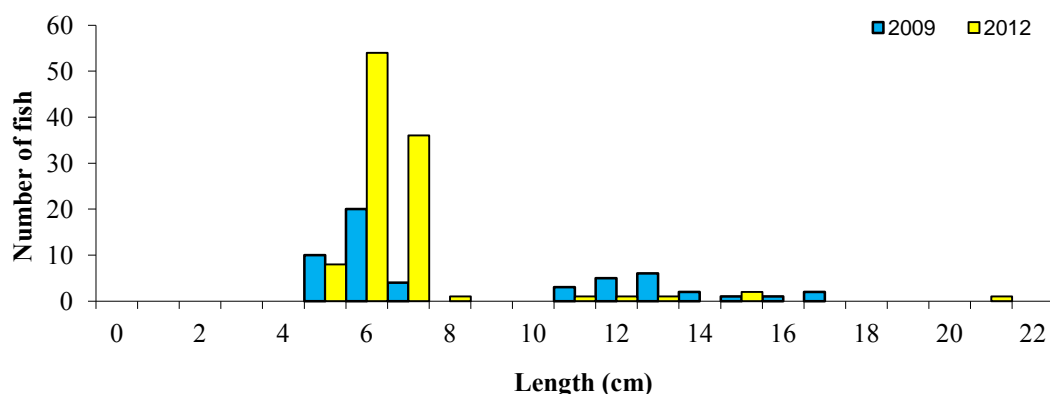
A total of three fish species were recorded in the Dunneill (Donaghintraîne) River site (Table 4.5). Brown trout was the most abundant species followed by European eels and three-spined stickleback.

**Table 4.5. Density of fish (no./m<sup>2</sup>), Dunneill River (Donaghintraîne Bridge) (fish density has been calculated as minimum estimates based on one fishing)**

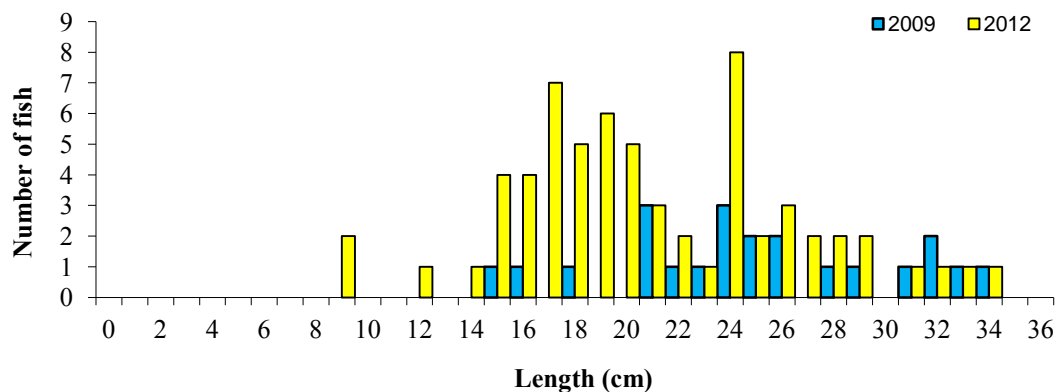
Common name	2009			2012		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Brown trout	0.054	0.037	0.091	0.154	0.010	0.165
European eel	-	-	0.021	-	-	0.077
Three-spined stickleback	-	-	-	-	-	0.003
All Fish	-	-	0.112	-	-	0.245

Brown trout captured during the 2012 survey ranged in length from 5.1cm to 21.7cm (mean = 7.3cm) (Fig. 4.13). Three age classes (0+, 1+ and 2+) were present, accounting for 94%, 5% and 1% of the total brown trout catch respectively. Brown trout captured during the 2009 survey ranged in length from 5.2cm to 17.9cm (mean = 9.0cm). Three age classes were also present (0+, 1+ and 2+), accounting for approximately 63%, 31% and 6% of the brown trout catch respectively.

European eels captured during the 2012 survey ranged in length from 9.1cm to 34.1cm (mean = 21.3cm) (Fig. 4.14). European eels captured during the 2009 survey ranged in length from 15.9cm to 34.6cm (mean = 25.5cm).



**Fig. 4.13. Length frequency distribution of brown trout in the Dunneill River (Donaghintraîne Br.) site, July 2009 (n = 54) and July 2012 (n = 105)**



**Fig. 4.14. Length frequency distribution of European eels in the Dunneill River (Donaghintraire Br.) site, July 2009 (n = 22) and July 2012 (n = 64)**

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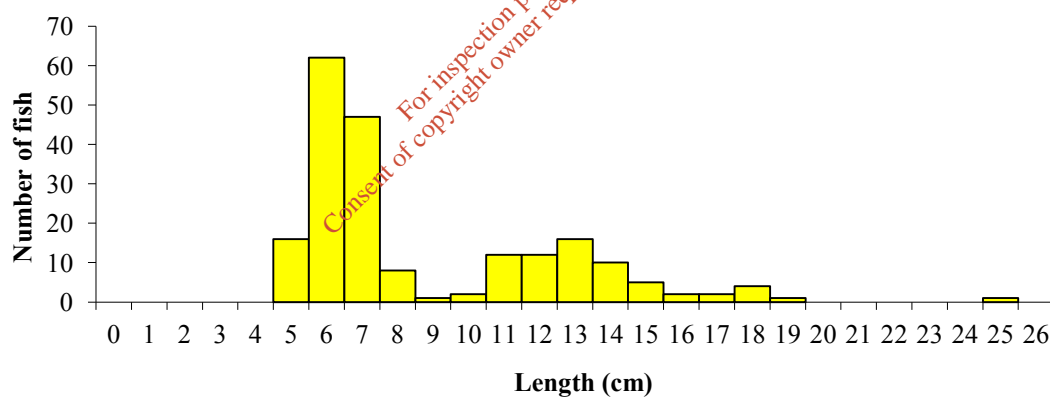
### *Dunneill River (Dromore West)*

Only two fish species were recorded in the Dunneill (Dromore West) River site (Table 4.6). Brown trout was the most abundant species, followed by European eels.

**Table 4.6. Density of fish (no./m<sup>2</sup>), Dunneill River (Dromore West) (fish density has been calculated as minimum estimates based on one fishing)**

Common name	2012		Total minimum density
	0+	1+ & older	
Brown trout	0.179	0.109	0.288
European eel	-	-	0.009
All Fish	-	-	0.297

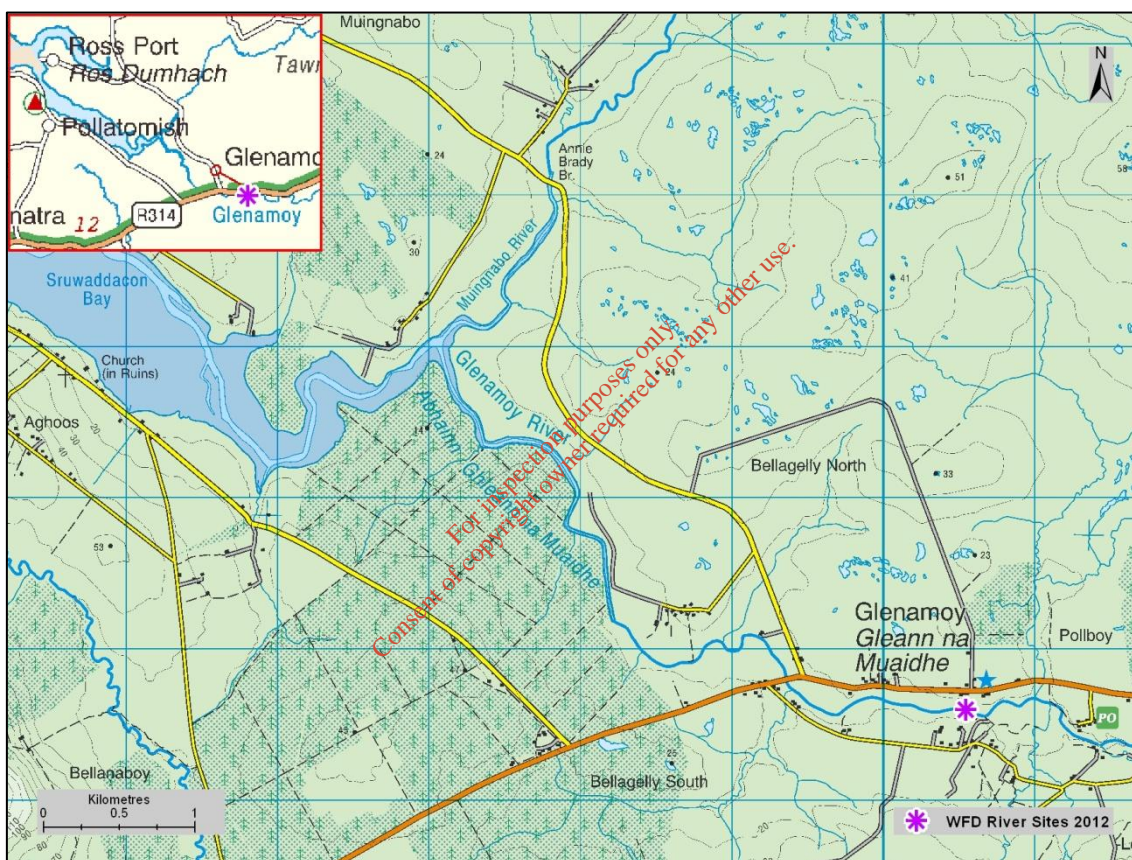
Brown trout captured during the 2012 survey ranged in length from 5.0cm to 25.1cm (mean = 9.2cm) (Fig. 4.15). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 67%, 23%, 10% and <0.5% of the total brown trout catch respectively.



**Fig. 4.15. Length frequency distribution of brown trout in the Dunneill River (Dromore West) site, July 2012 (n = 201)**

#### 4.1.5 The Glenamoy River

One site was electric fished on the Glenamoy River as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was in Glenamoy, Co. Mayo, approximately 4km upstream of where it enters the sea at Sruwaddacon Bay (Fig. 4.16; Plate 4.6). Two electric-fishing passes were conducted using three bank-based electric fishing units on the 31<sup>st</sup> of July 2012, along a 40m length of channel. Riffle dominated the habitat, while the substrate consisted mostly of cobble and gravel. Vegetation at this site was diverse, consisting of a large number of mosses and liverworts, as well as a small number of other emergent bank-side species.



**Fig. 4.16. Location of the Glenamoy River surveillance monitoring site**



**Plate 4.6. The Glenamoy River at Glenamoy, Co. Mayo**

A total of four fish species were recorded in the Glenamoy River site (Table 4.7). Salmon was the most abundant species, followed by European eels, brown trout and three-spined stickleback.

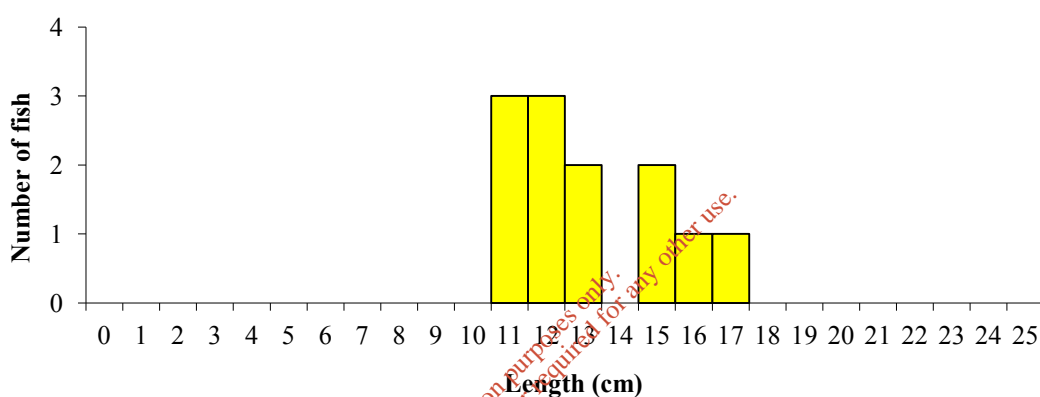
**Table 4.7. Density of fish (no./m<sup>2</sup>), Glenamoy River (fish density has been calculated as minimum estimates based on one fishing)**

Common name	2012		Total minimum density
	0+	1+ & older	
Salmon	0.129	0.095	0.224
European eel	-	-	0.041
Brown trout	0.000	0.021	0.021
Three-spined stickleback	-	-	0.002
All Fish	-	-	0.289

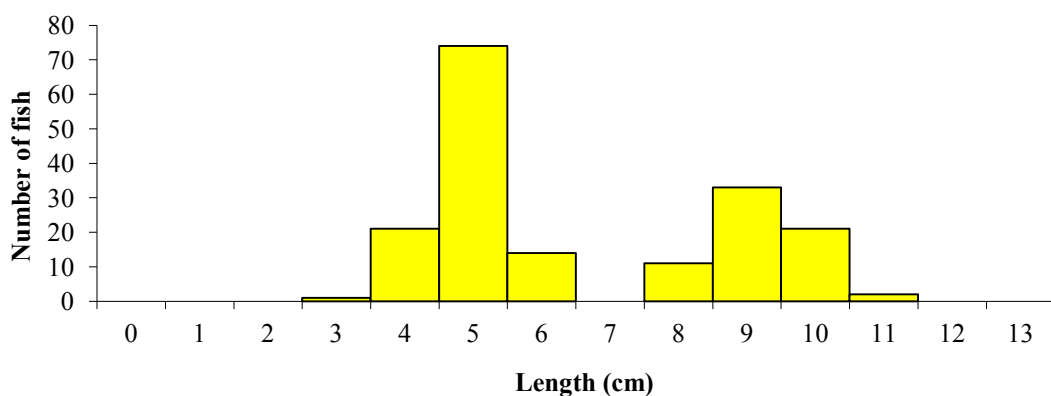
Brown trout captured during the 2012 survey ranged in length from 11.2cm to 17.0cm (mean = 13.6cm) (Fig. 4.17). Two age classes (0+, 1+) were present, accounting for 58%, 42% of the total brown trout catch respectively.

Salmon captured during the 2012 survey ranged in length from 3.8cm to 11.1cm (mean = 7.0cm) (Fig. 4.18). Two age classes (0+ and 1+) were present, accounting for approximately 62% and 38% of the total salmon catch respectively.

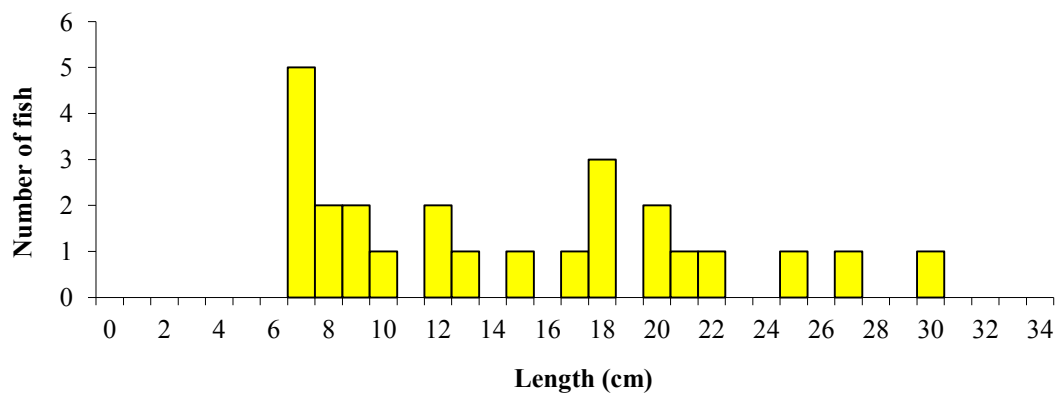
European eels captured during the 2012 survey ranged in length from 7.2cm to 30.0cm (mean = 15.1cm) (Fig. 4.19).



**Fig. 4.17. Length frequency distribution of brown trout in the Glenamoy River site, July 2012 (n = 12)**



**Fig. 4.18. Length frequency distribution of salmon in the Glenamoy River site, July 2012 (n = 177)**



**Fig. 4.19. Length frequency distribution of European eels in the Glenamoy River site, July 2012 (n = 25)**

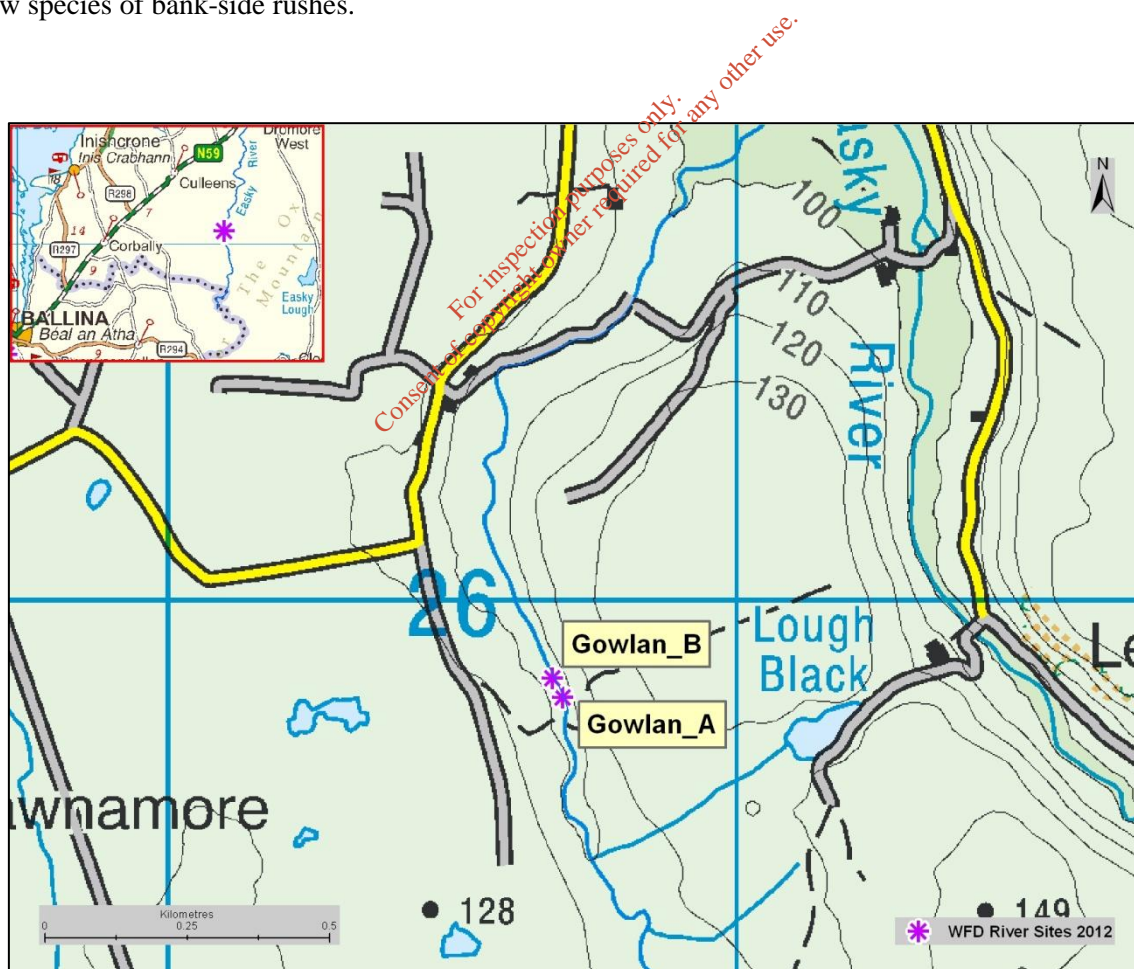
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#### 4.1.6 The Gowlan River

Two sites were electric fished on the Gowlan River as part of the WFD surveillance monitoring programme in rivers 2012; the Gowlan River Site A and the Gowlan River Site B.

Site A was located just downstream of a bridge on the Gowlan River west of Lough Black, on an upstream tributary of the Easky River, approximately 12km south of Easky, Co. Sligo (Fig. 4.20). Three electric-fishing passes were conducted using two bank-based electric fishing units on the 17<sup>th</sup> of July 2012, along a 40m length of channel. Pool dominated the habitat, while the substrate consisted largely of boulder. The vegetation at this site consisted of a diverse number of mosses, liverworts as well as a few species of bank-side rushes.

Site B was located further downstream, adjacent to the ‘A’ site (Fig. 4.20; Plate 4.7). Three electric-fishing passes were conducted using two bank-based electric fishing units on the 17<sup>th</sup> of July 2012, along a 40m length of channel. Pool dominated the habitat, while the substrate consisted largely of boulder. The vegetation at this site consisted of a diverse number of mosses, liverworts as well as a few species of bank-side rushes.



**Fig. 4.20. Location of the Gowlan River surveillance monitoring sites**



**Plate 4.7. The Gowlan River west of Lough Black, Co. Sligo**

#### Gowlan (Site A)

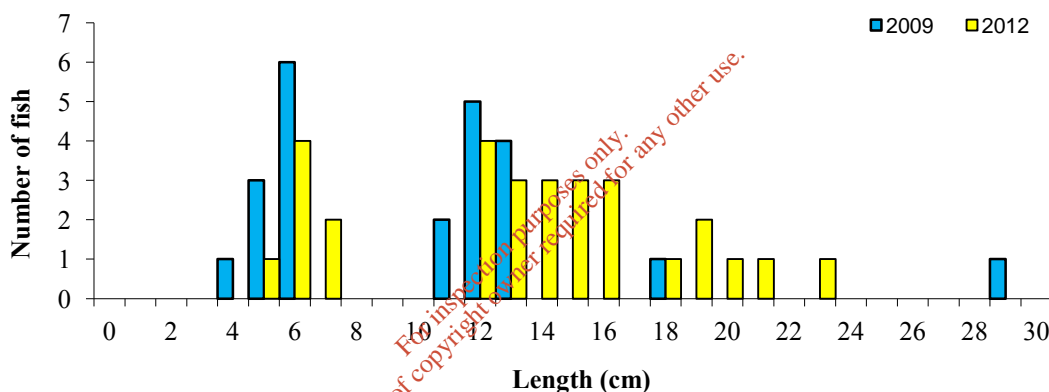
Three fish species were recorded in the Gowlan River Site A (Table 4.8). Salmon was the most abundant species, followed by brown trout and European eels.

**Table 4.8. Density of fish (no./m<sup>2</sup>), Gowlan River Site A (fish density has been calculated as minimum estimates based on one fishing)**

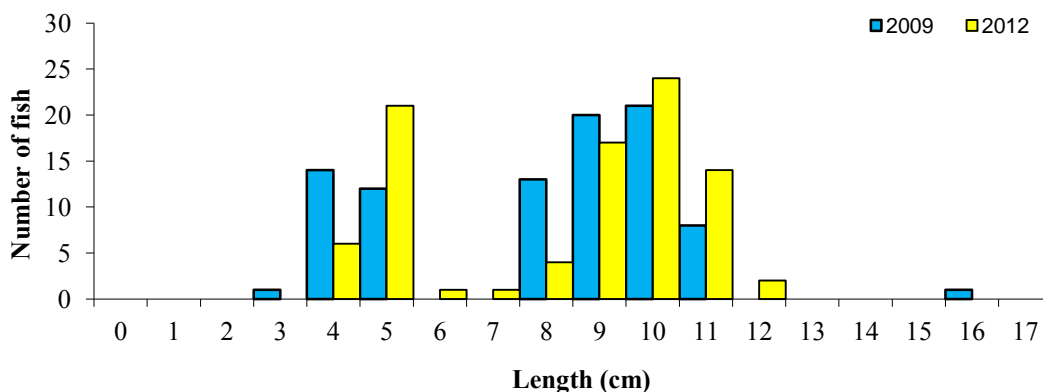
Common name	2009			2012		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.040	0.110	0.150	0.088	0.200	0.287
Brown trout	0.017	0.020	0.037	0.010	0.083	0.093
European eel	-	-	-	-	-	0.015
All Fish	-	-	0.186	-	-	0.394

Brown trout captured during the 2012 survey ranged in length from 5.9cm to 23.3cm (mean = 13.8cm) (Fig. 4.21). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for 24%, 17%, 45% and 14% of the total brown trout catch respectively. Brown trout captured during the 2009 survey ranged in length from 4.9cm to 29.1cm (mean = 10.6cm). Four age classes were also present (0+, 1+, 2+ and 3+), accounting for approximately 43%, 48%, 4% and 4% of the brown trout catch respectively.

Salmon captured during the 2012 survey ranged in length from 4.5cm to 12.1cm (mean = 8.7cm) (Fig. 4.22). Two age classes (0+ and 1+) were present, accounting for approximately 31% and 69% of the total salmon catch respectively. Salmon captured during the 2009 survey ranged in length from 3.9cm to 16.4cm (mean = 8.4cm). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 30%, 69% and 1% of the salmon catch respectively.



**Fig. 4.21. Length frequency distribution of brown trout in the Gowlan River site, July 2009 (n = 23) and July 2012 (n = 29)**



**Fig. 4.22. Length frequency distribution of salmon in the Gowlan River site, July 2009 (n = 90) and July 2012 (n = 90)**

## Gowlan (Site B)

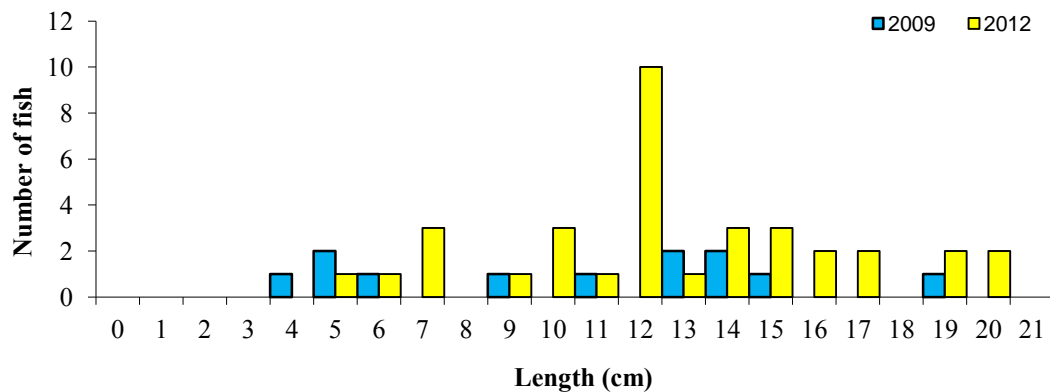
A total of four fish species (sea trout are included as a separate ‘variety’ of trout) were recorded in the Gowlan River Site B (Table 4.9). Salmon was the most abundant species, followed by brown trout, European eels and sea trout.

**Table 4.9. Density of fish (no./m<sup>2</sup>), Gowlan River Site B (fish density has been calculated as minimum estimates based on one fishing)**

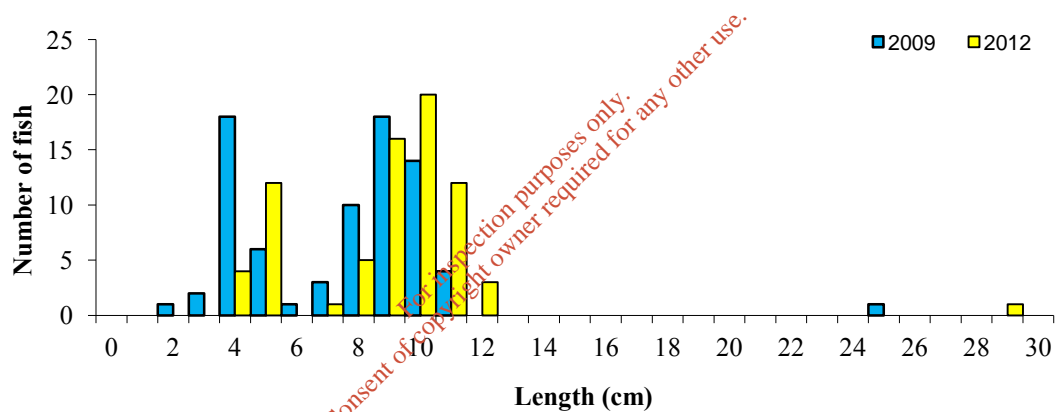
Common name	2009			2012		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Salmon	0.064	0.104	0.168	0.027	0.159	0.187
Brown trout	0.012	0.020	0.032	0.004	0.093	0.097
European eel	-	-	-	-	-	0.008
Sea trout	-	-	0.004	-	-	0.004
All Fish	-	-	0.204	-	-	0.295

Brown trout captured during the 2012 survey ranged in length from 5.8cm to 20.2cm (mean = 13.1cm) (Fig. 4.23). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for 14%, 51%, 29% and 6% of the total brown trout catch respectively. Brown trout captured during the 2009 survey ranged in length from 4.8cm to 19.2cm (mean = 11.1cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 33%, 50% and 17% of the brown trout catch respectively.

Salmon captured during the 2011 survey ranged in length from 4.4cm to 29.3cm (mean = 9.4cm) (Fig. 4.24). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 22%, 75% and 3% of the total salmon catch respectively. Salmon captured during the 2009 survey ranged in length from 2.9cm to 25.5cm (mean = 8.0cm). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 22%, 75% and 3% of the salmon catch respectively.



**Fig. 4.23. Length frequency distribution of brown trout in the Gowlan River site B, July 2009 (n = 12) and July 2012 (n = 35)**



**Fig. 4.24. Length frequency distribution of salmon in the Gowlan River site B, July 2009 (n = 78) and July 2012 (n = 74)**

#### 4.1.7 The River Moy

One site was electric fished on the River Moy (Ardnaree Br.) as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was located approximately 1.2km upstream of Ardnaree Br. on the southern end of Ballina, Co. Mayo (Fig. 4.25; Plate 4.8). One electric-fishing pass was conducted using one boat-based electric fishing unit that fished close to each side of the channel: each side was fished separately. This was a partial survey of the entire channel, with fish density estimates reflecting only the area of channel effectively fished. The survey was carried out on the 17<sup>th</sup> of May 2012, along a 394m length of channel. Glide dominated the habitat, while the substrate consisted mostly of mud and silt.

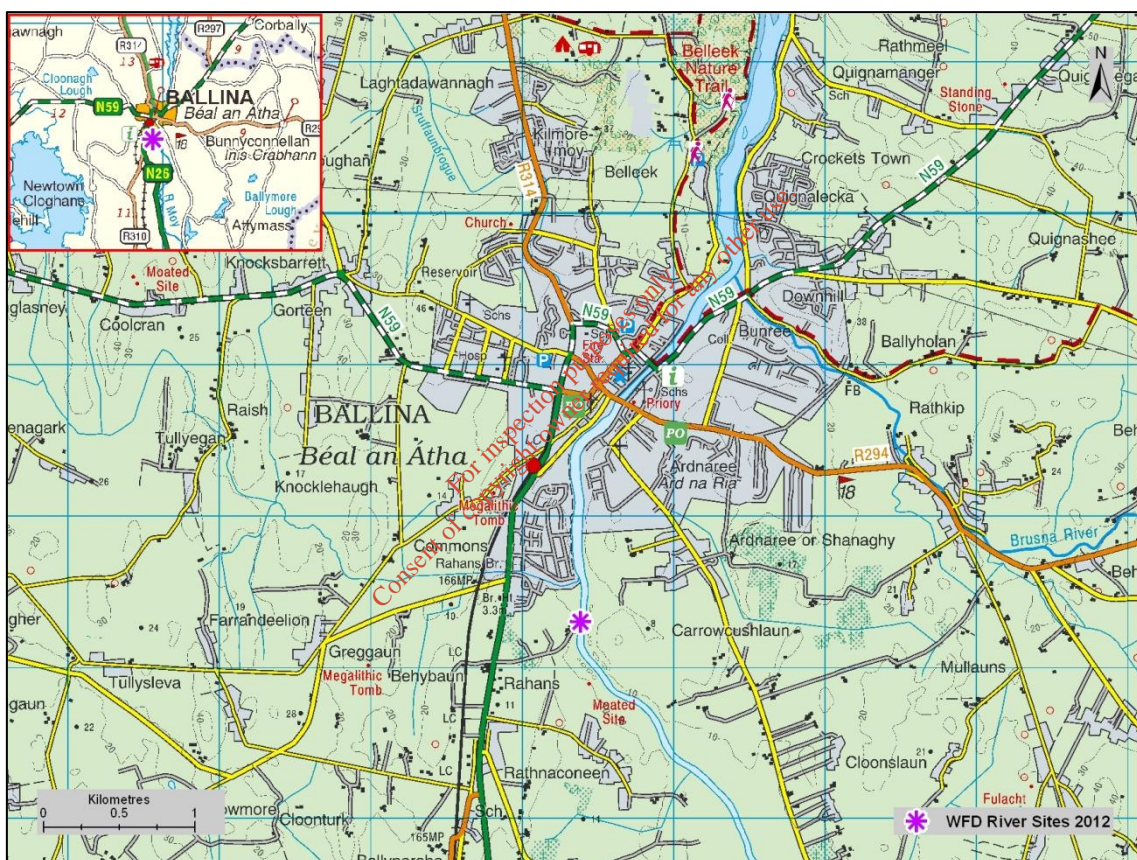


Fig. 4.25. Location of the River Moy (Ardnaree) surveillance monitoring site



**Plate 4.8. The River Moy near Ardnaree Bridge, Ballina, Co. Mayo**

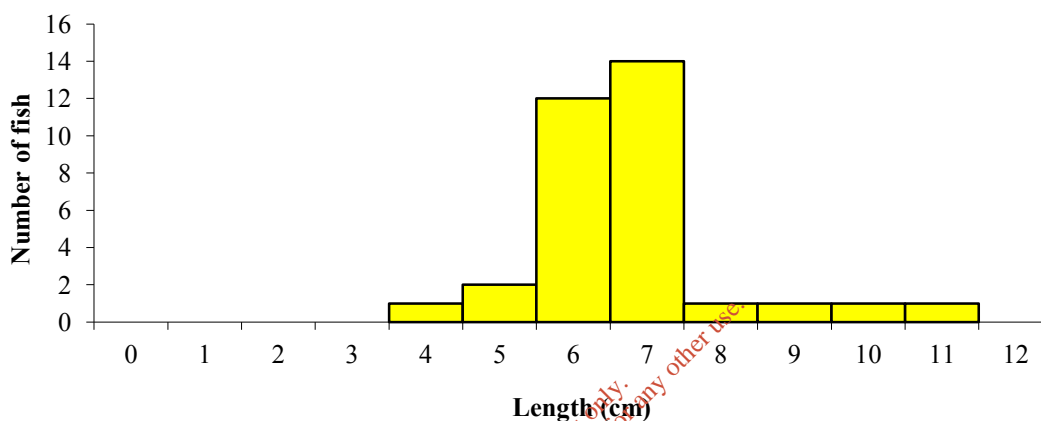
A total of seven fish species were recorded in the River Moy site (Table 4.10). Roach was the most abundant species, followed by salmon, lamprey, three-spined stickleback, brown trout, European eels and minnow.

**Table 4.10. Density of fish (no./m<sup>2</sup>), River Moy (fish density has been calculated as minimum estimates based on one fishing)**

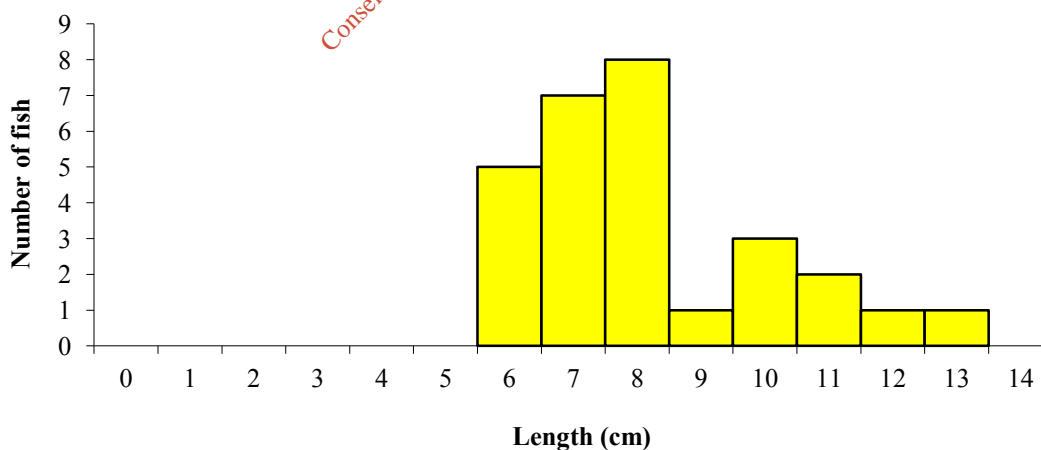
Common name	2012		Total minimum density
	0+	1+ & older	
Roach	-	-	0.007
Salmon	0.0002	0.0057	0.006
Lamprey juvenile	-	-	0.001
Three-spined stickleback	-	-	0.001
Brown trout	0.000	0.0002	0.0002
European eel	-	-	0.0002
Minnow	-	-	0.0002
All Fish	-	-	0.004

Roach captured during the 2011 survey ranged in length from 4.0cm to 11.0cm (mean = 7.0cm) (Fig. 4.26). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for 60%, 19%, 15% and 6% of the total brown trout catch respectively.

Salmon captured during the 2011 survey ranged in length from 6.2cm to 13.5cm (mean = 8.5cm) (Fig. 4.27). Three age classes (0+, 1+ and 2+) were present, accounting for 4%, 82% and 14% of the total brown trout catch respectively.



**Fig. 4.26. Length frequency distribution of roach in the River Moy site, May 2012 (n = 33)**



**Fig. 4.27. Length frequency distribution of salmon in the River Moy site, May 2012 (n = 27)**

#### 4.1.8 The Owenbrin River

One site was electric fished on the Owenbrin River as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was located upstream of a bridge near Killateeuan, approximately 7km southwest of Toormakeady, Co. Mayo (Fig. 4.28; Plate 4.9). Three electric-fishing passes were conducted using three bank-based electric fishing units on the 18<sup>th</sup> of July 2012, along a 40m length of channel. Riffle and glide dominated the habitat, while the substrate consisted mostly of cobble. Vegetation at this site was sparse, with only a small number of floating and bank-side species present.



**Fig. 4.28. Location of the Owenbrin River surveillance monitoring site**



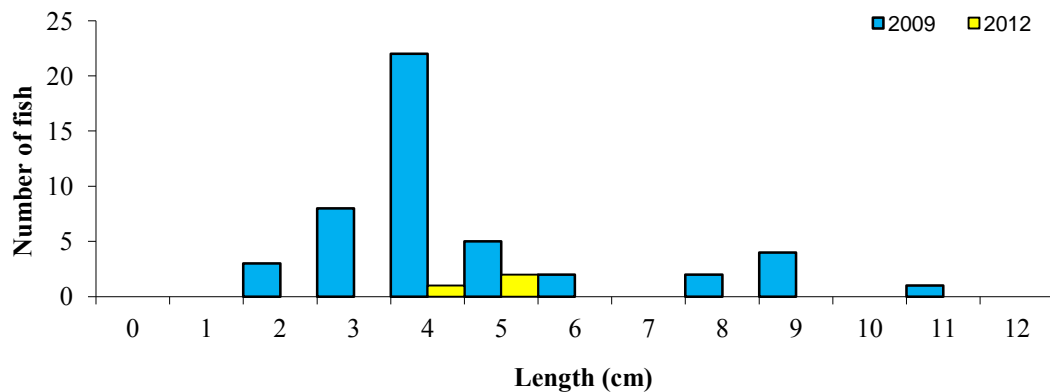
**Plate 4.9. The Owenbrin River, Killateeun, Co. Mayo**

A total of four fish species were recorded in the Owenbrin River site. Minnow was the most abundant species, followed by brown trout, European eels and lamprey, with the latter two species represented by only a single individual.

**Table 4.11. Density of fish (no./m<sup>2</sup>), Owenbrin River (fish density has been calculated as minimum estimates based on one fishing)**

Common name	2009			2012		
	0+	1+ & older	Total minimum density	0+	1+ & older	Total minimum density
Minnow	-	-	0.368	-	-	0.298
Brown trout	0.062	0.005	0.067	0.006	0.000	0.006
European eel	-	-	-	-	-	0.003
Lamprey juvenile	-	-	-	-	-	0.003
Stone loach	-	-	0.012	-	-	-
Perch	-	-	0.002	-	-	-
Salmon	0.000	0.002	0.002	-	-	-
All Fish	-	-	0.451	-	-	0.309

Brown trout captured during the 2012 survey ranged in length from 4.8cm to 5.5 cm (mean = 5.1cm) (Fig. 4.29). Only one age class (0+) was present. Brown trout captured during the 2009 survey ranged in length from 2.3cm to 11.2cm (mean = 5.1cm). Three age classes were present (0+, 1+ and 2+), accounting for approximately 85%, 13% and 2% of the brown trout catch respectively.



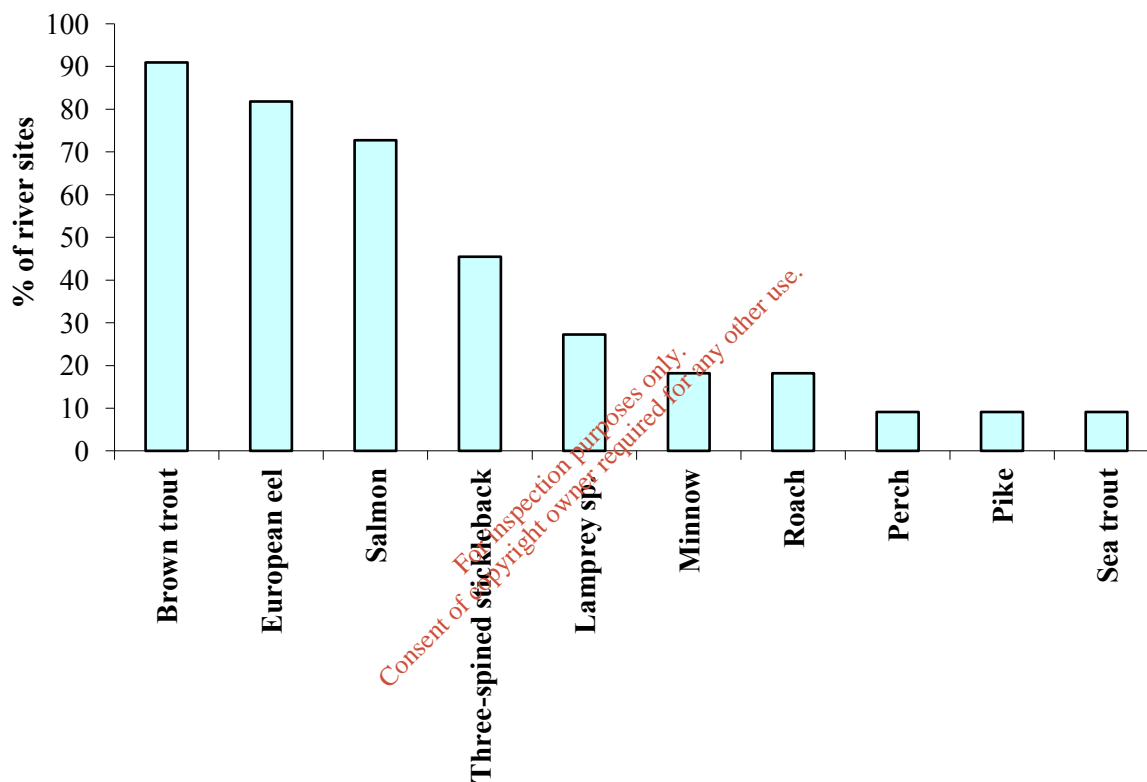
**Fig. 4.29. Length frequency distribution of brown trout in the Owenbrin River site, July 2009 (n = 47) and July 2012 (n = 3)**

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## 4.2 Community structure

### 4.2 Species distribution

A total of ten fish species (sea trout are included as a separate ‘variety’ of trout) were recorded within the eleven WRBD sites surveyed during 2012 (Fig. 4.30). Brown trout was the most widespread species, followed by eels, salmon, three-spined stickleback, lamprey, minnow and roach. Perch, pike and sea trout only occurred at one site each.



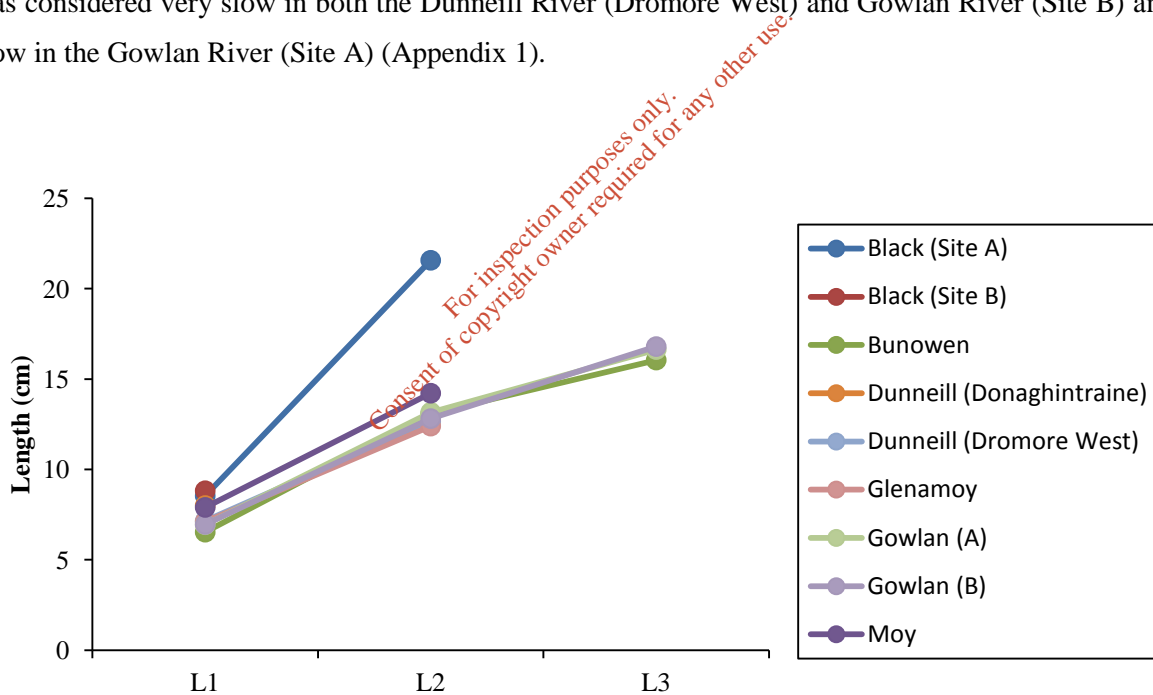
**Fig. 4.30. Percentage of sites where each fish species was recorded in the WRBD for WFD SM monitoring 2012**

### 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 2012.

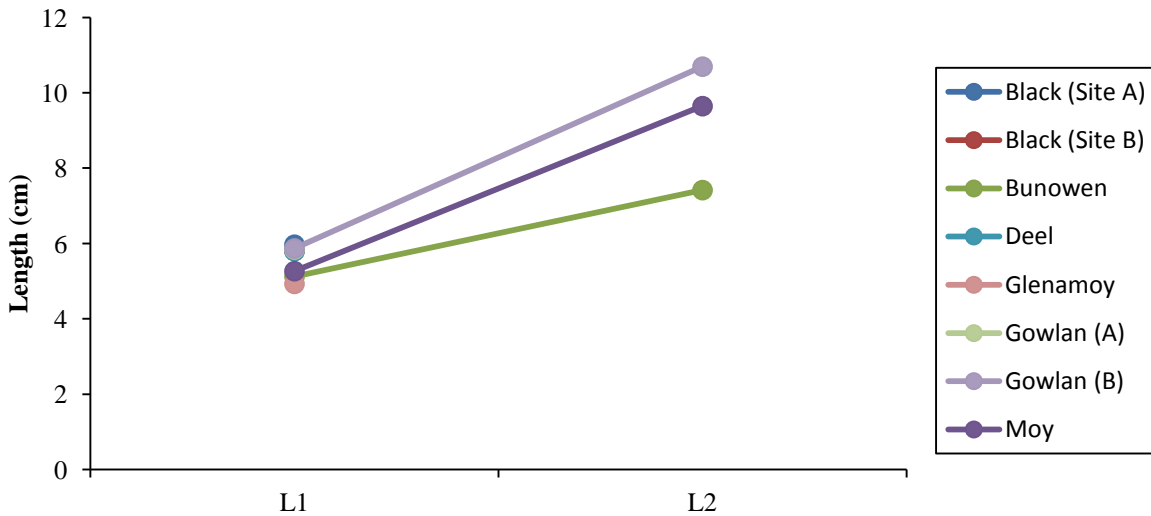
The mean back-calculated length-at-age data for brown trout captured during the 2012 WFD monitoring programme in the WRBD are shown in Figure 4.31 and Appendix 1. Brown trout were recorded in 10 sites, with eight sites containing brown trout aged 1+ or older. Ages ranged from 0+ to 3+, and fish aged 0+ comprised the most abundant age class within the region. The largest brown trout recorded in the WRBD in 2012 was caught in the Black River (Site A), which measured 32.2cm in length and weighed 365.5g and was aged 3+.

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 could only be reliably estimated from fish at sites where individual fish were 2+ or older and where sufficient numbers were caught. Growth was considered very slow in both the Dunneill River (Dromore West) and Gowlan River (Site B) and slow in the Gowlan River (Site A) (Appendix 1).



**Fig. 4.31. Back calculated lengths for brown trout in the WRBD, WFD surveillance monitoring 2012**

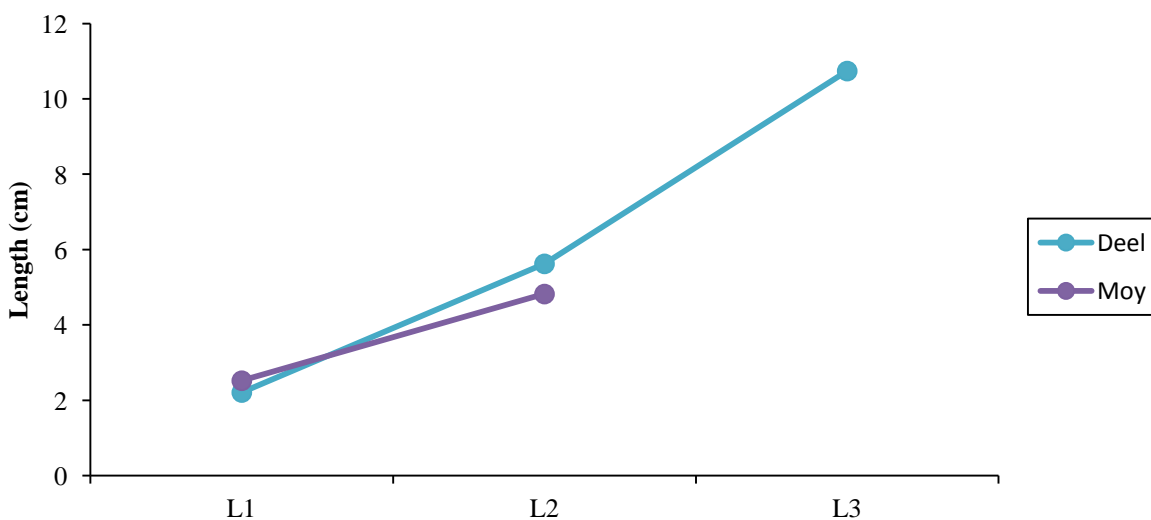
The mean back-calculated length-at-age data for juvenile salmon in the WRBD are shown in Figure 4.32 and Appendix 2. Salmon were recorded in eight sites, with each of these sites containing salmon aged 1+ or older. Ages ranged from 0+ to 2+, with individuals aged 0+ and 1+ similarly abundant within the region. The largest juvenile salmon recorded in the WRBD in 2012 was caught in the River Moy, which measured 13.5cm in length, weighed 26.5g and was aged 2+.



**Fig. 4.32. Back calculated lengths for salmon in the WRBD, WFD surveillance monitoring 2012**

Sea trout were only recorded in one site, with only one individual caught. The mean back-calculated length-at-age data is shown in Appendix 3. Sea trout ageing was carried out as described in Poole (2010). This fish was aged 3.0+, a 3-year old smolt that returned to freshwater after only a few months at sea (finnock, total age 3+).

The mean back-calculated length-at-age data for roach in the WRBD are shown in Figure 4.33 and Appendix 4. Roach were recorded in only two sites and ranged in age from 0+ to 3+, with those in the 0+ and 1+ age category the most abundant. The largest roach recorded in the WRBD in 2012 was caught in the Deel River, which measured 14.8cm in length, weighed 40.0g and was aged 3+.



**Fig. 4.33. Back calculated lengths for roach in the WRBD, WFD surveillance monitoring 2012**

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#### 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 2012 has been assigned a draft fish classification status (Table 4.12). One site was classed as High, eight sites as Good and one site as Moderate. The River Moy was not classified due to river conditions during the time of the survey being inappropriate for collection of reliable data (Table 4.12). When comparing the status this year with that from previous years (seven sites from 2008 and 2009), six sites showed no change in status, while the remaining site, the Gowlan River Site A, showed an improvement, from Good to High.

**Table 4.12. Ecological status of sites surveyed in the WRBD for surveillance monitoring 2012 (figures in brackets indicate confidence in class)**

River	Site Code	Site name	Previous ecological status	Ecological status 2012
<b>WRBD Wadeable sites</b>				
Black (Shrule)	30B020100A	Br. at Kilshanvy_A	Good (2009)	Good
Black (Shrule)	30B020100B	Br. at Kilshanvy_B	N/A	Good (70%)
Bunowen (Louisburgh)	32B030100A	Tully Br._A	Good	Good (87%)
Dunneill	35D060200A	Donaghintraine Br._A	Good (2009)	Good
Dunneill	35D060170A	Dromore West_A	N/A	Good
Glenamoy	33G010075A	Glenamoy Village_A	N/A	Good (60%)
Gowlan	35G030050A	Track west of Lough Black_A	Good (2009)	High (75%)
Gowlan	35G030050B	Track west of Lough Black_B	Good (2009)	Good (97%)
Owenbrin	30O010200A	Br. u/s L. Mask_A	Good (2008)	Good
<b>WRBD Non-Wadeable sites</b>				
Deel (Crossmolina)	34D010400A	Bridge at Castle Gore_A	Moderate (2008)	Moderate
Moy	34M021020A	U/s Ardnaree Br._A	N/A	N/A

## 5. DISCUSSION

A total of ten fish species (sea trout are included as a separate ‘variety’ of trout) were recorded during the 2012 WFD surveillance monitoring programme for fish in rivers within the WRBD. Brown trout and European eels were the most commonly encountered species in the WRBD, recorded in all but one site, followed by salmon and three-spined stickleback. The River Moy (Ardnaree Br.) site was the most diverse site surveyed within the WRBD in 2012, with a total of seven species present. The site that recorded the lowest diversity in this region was the Dunneill River (Dromore West) site, with only two species present, brown trout and eels. The greatest abundances of brown trout were recorded in the Dunneil River sites (Dromore West and Donaghintraîne respectively), while salmon were most abundant in the Bunowen and Glenamoy Rivers.

Following the methods of Kennedy and Fitzmaurice (1971), the growth rate of brown trout was deemed very slow in the Dunneill River (Dromore West) and Gowlan River (Site B) and slow in the Gowlan River (Site A).

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 2012 was assigned a draft fish classification status. One site was classed as High, eight sites as Good and one site as Moderate. Of the seven repeated sites, six showed no change in status, while the remaining one improved from Good to High.

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## 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.

Poole, R. (ED). (2010). Manual on Sea Trout Ageing, Digital Scale Reading and Growth Methodology, Produced by the participants of the Celtic Sea Trout Project Workshop on Sea Trout Age Determination and Digital Scale Reading Methodology. 24<sup>th</sup>-28<sup>th</sup> May 2010. <http://www.celticseatrout.com/>

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## 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
<b>Black River (Shrule) (Site A)</b>	Mean	8.53	21.56		n/a
	S.D.	1.36	2.13		
	S.E.	0.55	1.51		
	n	6	2		
	Min	6.48	20.05		
	Max	9.79	23.07		
<b>Black River (Shrule) (Site B)</b>	Mean	8.82			n/a
	S.D.	0.76			
	S.E.	0.23			
	n	11			
	Min	7.10			
	Max	9.65			
<b>Bunowen River (Louisburgh)</b>	Mean	6.53	13.07	16.04	n/a
	S.D.	1.43	1.38	n/a	
	S.E.	0.58	0.69	n/a	
	n	6	4	1	
	Min	5.12	12.22	16.04	
	Max	8.58	15.14	16.04	
<b>Dunneill River (Donaghintraire)</b>	Mean	8.00			n/a
	S.D.	1.62			
	S.E.	0.73			
	n	5			
	Min	5.90			
	Max	10.20			
<b>Dunneill River (Dromore West)</b>	Mean	7.15	12.65		Very Slow
	S.D.	1.32	1.96		
	S.E.	0.24	0.52		
	n	31	14		
	Min	4.60	9.90		
	Max	10.00	15.30		
<b>Glenamoy River</b>	Mean	7.10	12.39		n/a
	S.D.	1.00	1.19		
	S.E.	0.32	0.69		
	n	10	3		
	Min	5.20	11.20		
	Max	8.18	13.59		

**APPENDIX 1 continued**

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

<b>River</b>		<b>L1</b>	<b>L2</b>	<b>L3</b>	<b>Growth category</b>
<b>Gowlan River (Site A)</b>	Mean	6.94	13.16	16.63	Slow
	S.D.	1.73	2.34	2.58	
	S.E.	0.48	0.67	1.49	
	n	13	12	3	
	Min	4.29	9.54	13.67	
	Max	9.86	16.46	18.46	
<b>Gowlan River (Site B)</b>	Mean	6.95	12.81	16.79	Very Slow
	S.D.	1.76	1.47	0.17	
	S.E.	0.38	0.46	0.12	
	n	21	10	2	
	Min	4.54	10.47	16.67	
	Max	10.32	15.15	16.91	
<b>Moy, River</b>	Mean	7.89	14.21		n/a
	S.D.	n/a	n/a		
	S.E.	n/a	n/a		
	n	1	1		
	Min	7.89	14.21		
	Max	7.89	14.21		

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## 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
<b>Black River (Site A)</b>	Mean	5.97	
	S.D.	1.12	
	S.E.	0.24	
	n	21	
	Min	4.69	
	Max	8.63	
<b>Black River (Site B)</b>	Mean	5.80	
	S.D.	0.71	
	S.E.	0.17	
	n	17	
	Min	4.82	
	Max	7.27	
<b>Bunowen River (Louisburgh)</b>	Mean	5.13	7.42
	S.D.	1.18	n/a
	S.E.	0.28	n/a
	n	18	1
	Min	3.17	7.42
	Max	7.78	7.42
<b>Deel River (Crossmolina)</b>	Mean	5.80	
	S.D.	0.48	
	S.E.	0.28	
	n	3	
	Min	5.49	
	Max	6.36	
<b>Glenamoy River</b>	Mean	4.93	
	S.D.	0.81	
	S.E.	0.20	
	n	16	
	Min	3.40	
	Max	6.27	
<b>Gowlan River (Site A)</b>	Mean	5.84	
	S.D.	1.49	
	S.E.	0.86	
	n	3	
	Min	4.40	
	Max	7.38	

**APPENDIX 2 continued**

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

<b>River</b>		<b>L1</b>	<b>L2</b>
<b>Gowlan River (Site B)</b>	Mean	5.87	10.70
	S.D.	1.06	0.74
	S.E.	0.24	0.52
	n	20	2
	Min	3.84	10.17
	Max	7.91	11.22
<b>Moy, River</b>	Mean	5.27	9.65
	S.D.	1.23	1.64
	S.E.	0.26	0.82
	n	22	4
	Min	3.01	7.36
	Max	7.74	11.25

**APPENDIX 3**

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

<b>River</b>		<b>L1</b>	<b>L2</b>	<b>L3</b>
<b>Gowlan</b>	Mean	4.81	13.12	17.93
	S.D.	n/a	n/a	n/a
	S.E.	n/a	n/a	n/a
	n	1	1	1
	Min	4.81	13.12	17.93
	Max	4.81	13.12	17.93

#### APPENDIX 4

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

River		L1	L2	L3
<b>Deel River (Crossmolina)</b>	Mean	2.21	5.62	10.74
	S.D.	0.63	0.99	2.28
	S.E.	0.14	0.28	1.14
	n	21	12	4
	Min	1.09	3.92	7.84
	Max	4.24	7.27	13.29
<b>Moy, River</b>	Mean	2.52	4.82	
	S.D.	0.42	0.36	
	S.E.	0.11	0.18	
	n	15	4	
	Min	1.82	4.55	
	Max	3.17	5.32	

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