



Sampling Fish for the Water Framework Directive

Rivers 2010

Western River Basin District



Iascach Intíre Éireann
Inland Fisheries Ireland

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1. INTRODUCTION

Fish stock surveys were undertaken in 43 river sites throughout Ireland during the summer of 2010 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). Twelve of the 43 surveys were carried out at river sites in the Western River Basin District (WRBD) between June and August 2010 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.

The WRBD stretches along 2,700km of coastline from County Sligo in the north to Co. Clare in the south (Fig. 2.1). Many offshore islands are included within this RBD, along with numerous Special Areas of Conservation (SACs). Some of Ireland's largest lakes are within the WRBD, including Lough Corrib, Lough Mask and Lough Conn. These lakes separate areas dominated by peat and forestry in the west, from karst limestone areas in the east.

This report summarizes the main findings of the fish stock surveys in the twelve river sites surveyed in the WRBD during 2010 and reports the current status of the fish stocks in each.

2. STUDY AREA

Twelve river sites were surveyed in five river catchments within the WRBD: the Corrib, Moy, Ballysadare, Garvogue and Screeb catchments. Sites ranged in surface area from 305m² for the Owenriff River to 12,558m² for the River Moy (Bleanmore). 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, 2010

River	Site name	Catchment	Site code	Waterbody code
WRBD Wadeable sites				
Abbert	Bridge at Bullaun	Corrib	30A010500F	WE_30_3424
Moy	Cloonbaniff Br.	Moy	34M020050F	WE_34_3035
Owenriff	1km d/s of Lough Agraiffard	Corrib	30O020100F	WE_30_3396
WRBD Non-wadeable sites				
Ballysadare	Ballysadare Br.	Ballysadare	35B050100F	WE_35_2107
Bonet	1.8 km d/s Dromahaire Bridge	Garvogue	35B060600F	WE_35_3842
Clare	Corrofin Br	Corrib	30C010800F	WE_30_258
Clare	Kiltroge Castle Br.	Corrib	30C011300F	WE_30_258_5
Moy	At Bleanmore	Moy	34M020750F	WE_34_1935
Moy	Ford 2 km u/s Gweestion River	Moy	34M020650F	WE_34_1462_3
Owenmore (Sligo)	300 m u/s Unshin River confluence	Ballysadare	35O060900F	WE_35_2107
Robe	Akit Br.	Corrib	30R010600F	WE_30_3370_4
Screeb	d/s of Loughaunfree	Screeb	31S010570F	WE_31_2305

Table 2.2. Details of river sites surveyed for WFD surveillance monitoring, 2010

River	Upstream catchment (km ²)	Wetted width (m)	Surface area (m ²)	Mean depth (m)	Max depth (m)
WRBD Wadeable sites					
Abbert (Bullaun)	211.9	7.92	356	0.12	0.20
Moy (Cloonbaniff)	16.1	7.95	358	0.30	0.70
Owenriff (d/s L. Agraiffard)	44.1	6.78	305	0.28	0.60
WRBD Non-wadeable sites					
Ballysadare (Ballysadare Br.)	641.9	24.60	7872	1.33	2.50
Bonet (D/s Dromohaire)	292.2	21.30	6326	1.50	2.00
Clare (Corrofin)	704.3	19.00	6118	1.30	1.40
Clare (Kiltroge)	1072.7	14.60	3416	0.53	0.60
Moy (Bleanmore)	949.0	39.00	12558	1.25	2.50
Moy (Gweestion)	558.9	30.17	10981	0.90	1.50
Owenmore (U/s Unshin confl)	416.3	23.33	3197	0.92	2.00
Robe (Akit Br.)	253.7	16.25	7703	1.33	2.50
Screeb (d/s Loughaunfree)	28.2	17.00	2499	1.50	2.50



Fig. 2.1. Location map of river sites surveyed throughout the WRBD for WFD fish surveillance monitoring 2010

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 (Plates 3.1 and 3.2). This technique complies with European Committee for Standardisation (CEN) guidelines for fish stock assessment in wadeable rivers (CEN, 2003). At each site, where possible, the stretch sampled was isolated using stop nets and one to three fishing passes were conducted using bank-based electric fishing units or boat-based electric fishing units. Each survey encompassed all habitat types: riffle, glide and pool. A number of physical habitat variables were measured at each site. Water samples for chemical analyses were also taken, along with a multi-habitat kick-sample of macroinvertebrates. Macrophyte surveys were conducted on a selected number of wadeable streams.

Fish from each pass were sorted and processed separately. Fish were identified and lengths and weights were recorded; sub-samples were measured when large numbers of fish were present. For the purpose of species identification, where recorded, 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 recorded separately. For aging analyses, scales were taken from salmonids and most non-native fish species greater than 8.0cm in length. These fish were held in a large bin of oxygenated water after processing until they were fully recovered before being returned to the water. When present in a survey, a sub-sample of perch were retained for aging using opercular bones.

Three fishing passes were not possible or practical at all sites. Therefore in order to standardise abundance estimates across all sites, fish densities were calculated using data from the first fishing pass only. The number captured in the first fishing pass was divided by the total area surveyed to give a minimum population density for each species.

A sub-sample 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 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, L2 is the mean length at the end of the second winter, etc.).



Plate 3.1. Electric-fishing using bank-based units on the Owenriff River (WRBD)



Plate 3.2. Electric-fishing using boat-based units on the River Shannon (Clonmacnoise)

4. RESULTS

4.1 Wadeable sites

4.1.1 *The Abbert River*



Plate 4.1. The Abbert River at Bullaun Bridge, Co. Galway

The Abbert River rises east of the village of Monivea in Co. Galway (Plate 4.1, Fig. 4.1). It flows in a north-westerly direction to join the River Clare at Anbally, midway between Tuam and Claregalway. Having previously been modified by a drainage scheme, rehabilitation work has successfully restored this river, and it is now considered good for brown trout fishing (O'Reilly, 2002).

The Abbert River site is located within the Lough Corrib Special Area of Conservation (SAC), an area noted for 14 different habitats listed in Annex I of the Habitats Directive. Important habitats include petrifying springs, lowland oligotrophic lakes, hardwater lakes and floating river vegetation. Otter and freshwater pearl mussels, both listed in Annex II of the Habitats Directive, are important within this SAC (NPWS, 2006a).

The survey site was located just upstream of Bullaun Bridge, approximately 2.5km from its confluence with the River Clare (Fig. 4.1). Three electric-fishing passes were conducted using three

bank-based electric-fishing units on the 14th of July 2010 along a 45m length of river channel. The mean wetted width of the stretch surveyed was 7.9m and the mean depth was 12.0cm. A total wetted area of 356m² was surveyed. Glide and riffle were the dominant habitat types, with a substrate of mainly cobble and boulder. Macrophytes present included various bryophyte and emergent species as well as small amounts of filamentous green algae.

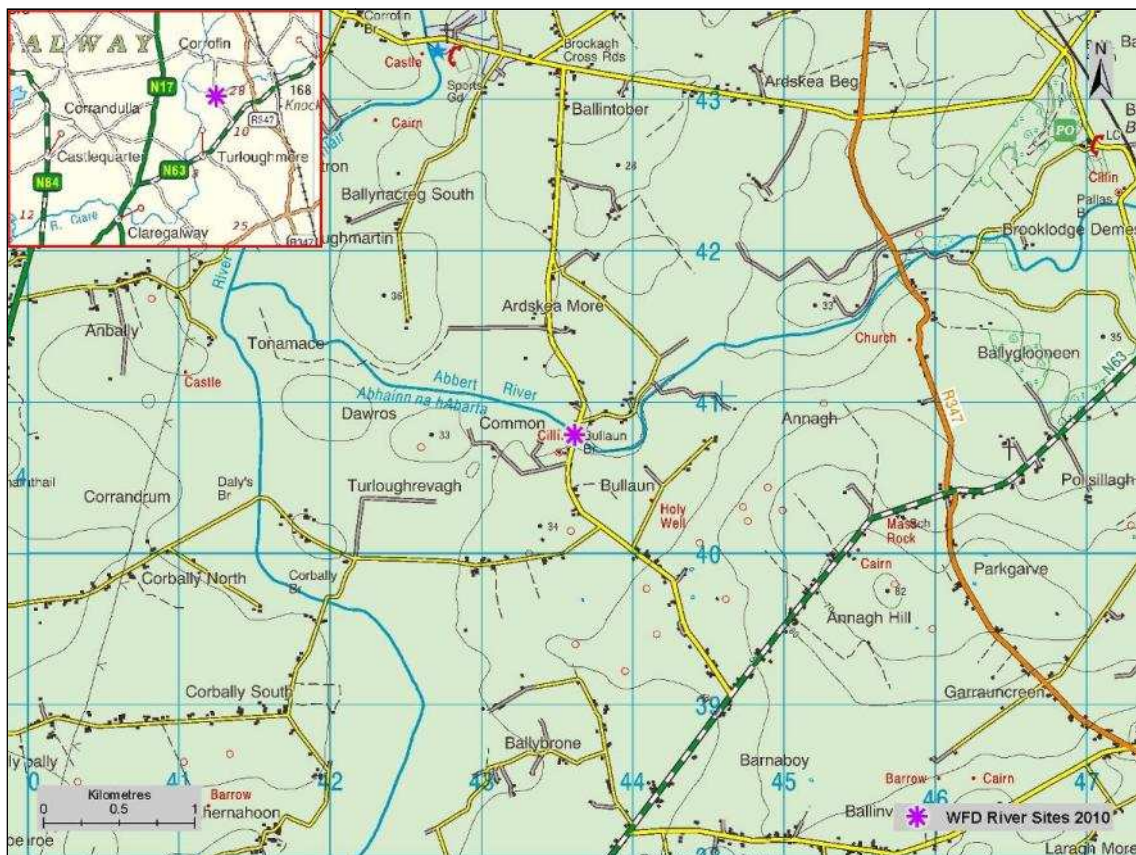


Fig. 4.1. Location of the Abbett River surveillance monitoring site

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

Table 4.1. Minimum density of each fish species (no./m²) captured on the Abbett River site, July 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.090	0.199	0.289
<i>Salmo trutta fario</i>	Brown trout	0.132	0.042	0.174
<i>Barbatula barbatula</i>	Stone loach	-	-	0.006
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.003
All Fish	All Fish	-	-	0.472

Salmon ranged in length from 2.6cm to 12.7cm (Fig. 4.2). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 39%, 58% and 10% of the total salmon catch respectively. The mean salmon L1 and L2 were 4.6cm and 7.3cm respectively (Appendix 2).

Brown trout ranged in length from 3.6cm to 15.9cm (Fig. 4.3). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 79%, 20% and 1% of the total brown trout catch respectively. The mean brown trout L1 and L2 were 6.7cm and 10.7cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is ‘very slow’ according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

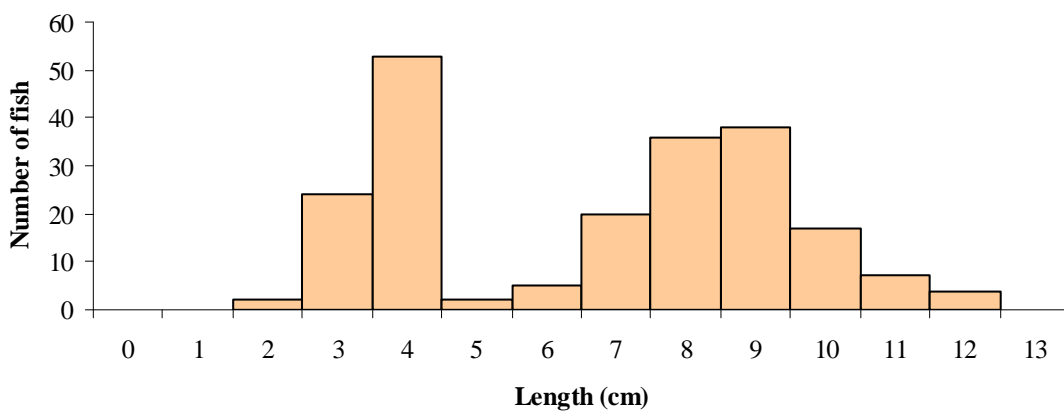


Fig. 4.2. Length frequency distribution of salmon in the Abbert River site, July 2010 (n = 208)

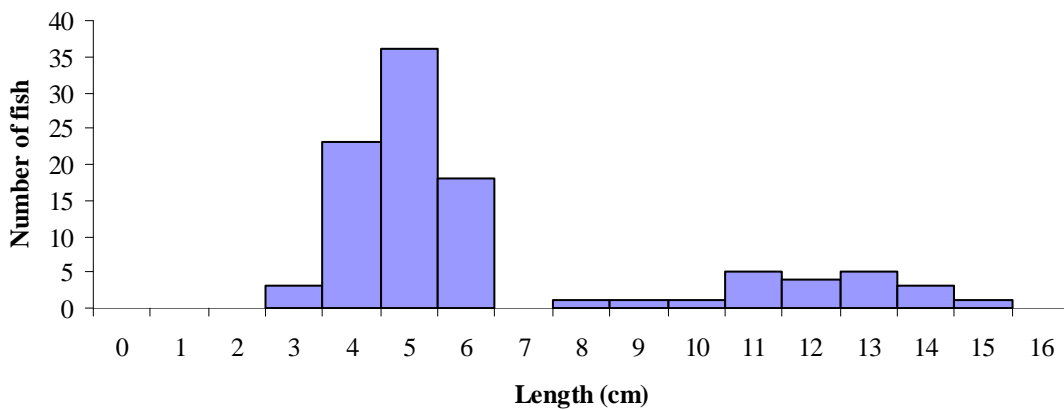


Fig. 4.3. Length frequency distribution of brown trout in the Abbert River site, July 2010 (n = 101)

4.1.2 The River Moy (Cloonbaniff)



Plate 4.2. The River Moy near Cloonbaniff, Co. Sligo

The River Moy rises in the Ox Mountains in Co. Sligo and flows in an anti-clockwise loop before heading northwards towards Ballina, Co. Mayo and into the sea at Killala Bay. It is one of Ireland's best salmon rivers and is home to the famous Ridge Pool in Ballina. It also provides good angling for sea trout (O'Reilly, 2002).

This site is located within the River Moy SAC, which encompasses the entire freshwater section of the main River Moy channel. A number of habitats listed in Annex I of the Habitats Directive are present, including alluvial wet woodland and raised bog, as well as species listed in Annex II, such as salmon, otter, sea lamprey, brook lamprey and white-clawed crayfish (NPWS, 2010).

The survey site was located 4.5km upstream of the village of Cloonacool (Plate 4.2; Fig. 4.4). This site was previously surveyed in July 2008 (Kelly *et al.*, 2009). Three electric-fishing passes were conducted using three bank-based electric-fishing units on the 12th of July 2010 along a 45m length of river channel. The stretch surveyed had a mean wetted width of 8.0m and a mean depth of 30.0cm. A total wetted area of 358m² was surveyed. Pool was the dominant habitat present, with a substrate of

gravel and sand. Mosses and liverworts dominated the macrophyte vegetation, along with small emergent species along the margins.

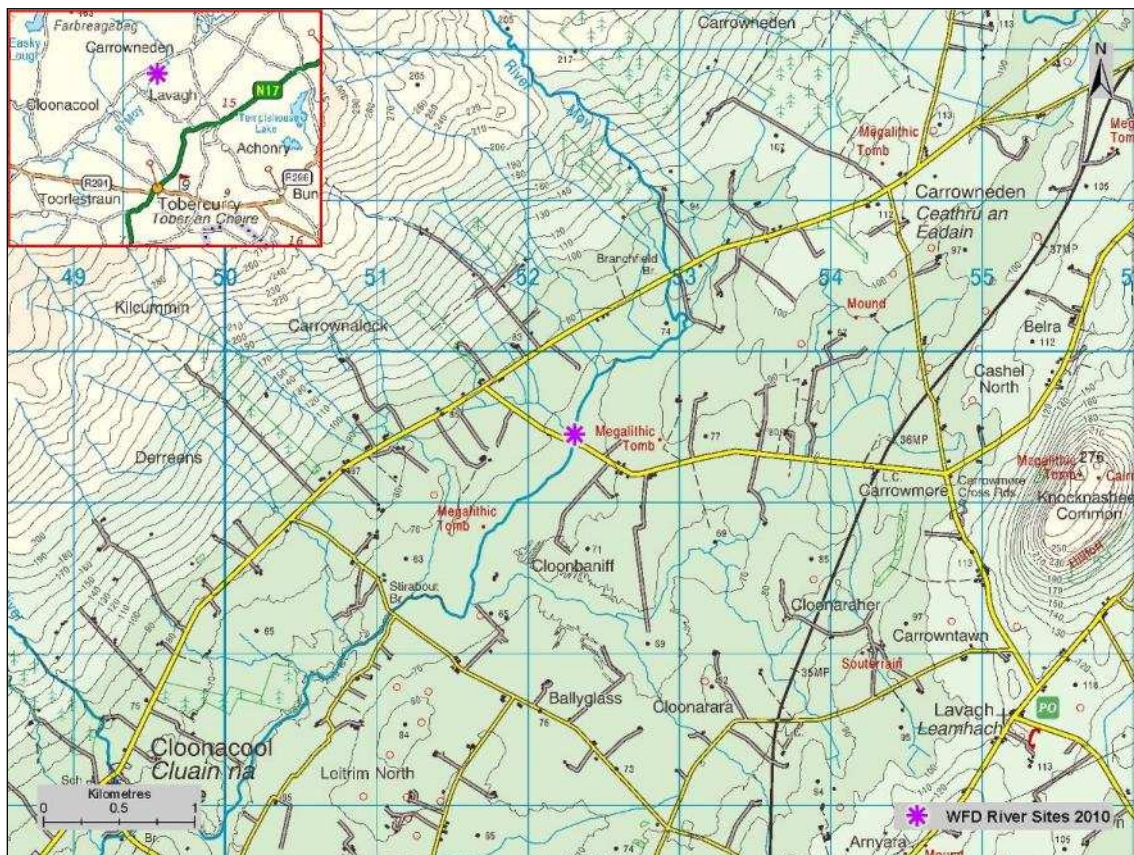


Fig. 4.4. Location of the River Moy (Cloonbaniff) surveillance monitoring site

A total of five fish species were recorded in the River Moy (Cloonbaniff) site. Minnow was the most abundant species, followed by salmon, brown trout, three-spined stickleback and stone loach (Table 4.2).

Table 4.2. Minimum density of each fish species (no./m²) captured on the River Moy (Cloonbaniff) site, July 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.165
<i>Salmo salar</i>	Salmon	0.014	0.025	0.039
<i>Salmo trutta fario</i>	Brown trout	0.003	0.028	0.031
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.003
<i>Barbatula barbatula</i>	Stone loach	-	-	0.003
All Fish	All Fish	-	-	0.235

Salmon ranged in length from 3.2cm to 10.1cm (Fig. 4.5). Two age classes (0+ and 1+) were present, accounting for 48% and 52% of the total salmon catch respectively. The mean salmon L1 was 4.6cm (Appendix 2).

Brown trout ranged in length from 5.0cm to 20.6cm (Fig. 4.6). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 10%, 58% and 32% of the total brown trout catch respectively. The mean brown trout L1 and L2 were 7.1cm and 13.3cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is ‘slow’ according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

Other species recorded included minnow ranging in length from 4.0cm to 7.6cm and single specimens of three-spined stickleback (5.0cm) and stone loach (5.2cm).

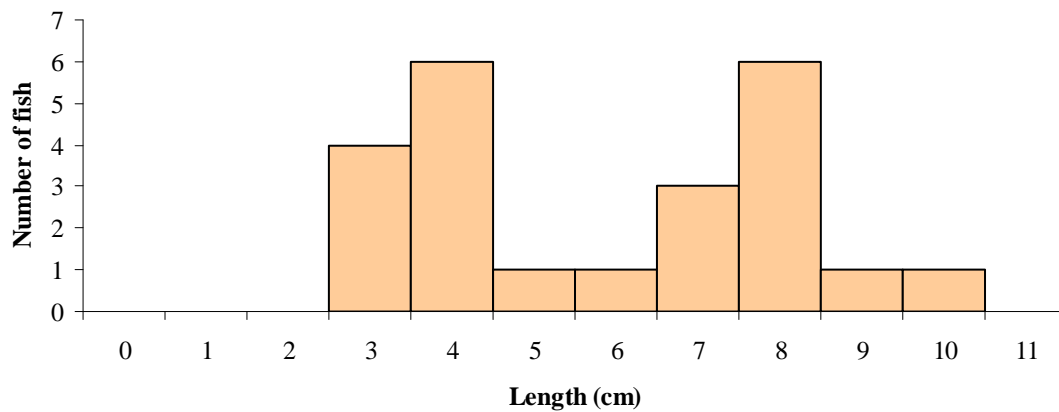


Fig. 4.5. Length frequency distribution of salmon in the River Moy (Cloonbaniff) site, July 2010 (n = 23)

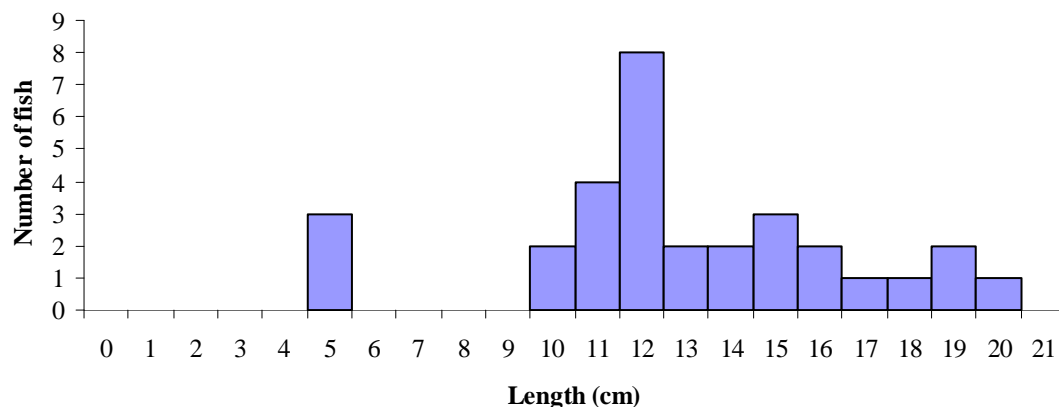


Fig. 4.6. Length frequency distribution of brown trout in the River Moy (Cloonbaniff) site, July 2010 (n = 31)

4.1.3 The Owenriff River



Plate 4.3. The Owenriff River, near Glengowla, Co. Galway

The Owenriff River is also known as the Oughterard River. It rises on Shannawona Mountain, approximately 11km south-west of Oughterard and flows in an easterly direction into the town, passing through a number of small lakes along the way. This is a spate river that gets good runs of salmon; however, its trout tend to be small and undesirable to anglers (O'Reilly, 2002).

The Owenriff River site is located within the Lough Corrib Special Area of Conservation (SAC), an area noted for 14 different habitats listed in Annex I of the Habitats Directive. Important habitats include petrifying springs, lowland oligotrophic lakes, hardwater lakes and floating river vegetation. Otter and freshwater pearl mussels, both listed in Annex II of the Habitats Directive, are important within this SAC (NPWS, 2006a).

The survey site was located approximately 0.5km upstream of the old Glengowla silver and lead mine site (Plate 4.3; Fig. 4.7). Three electric-fishing passes were conducted using three bank-based electric-fishing units on the 7th of July 2010 along a 45m length of river channel. The stretch surveyed had a mean wetted width of 6.8m and a mean depth of 28.0cm. A total wetted area of 305m² was surveyed. Glide and riffle were the dominant habitat types with a substrate of mainly

cobble. Vegetation present included submerged and floating macrophytes as well as a number of common riparian species.

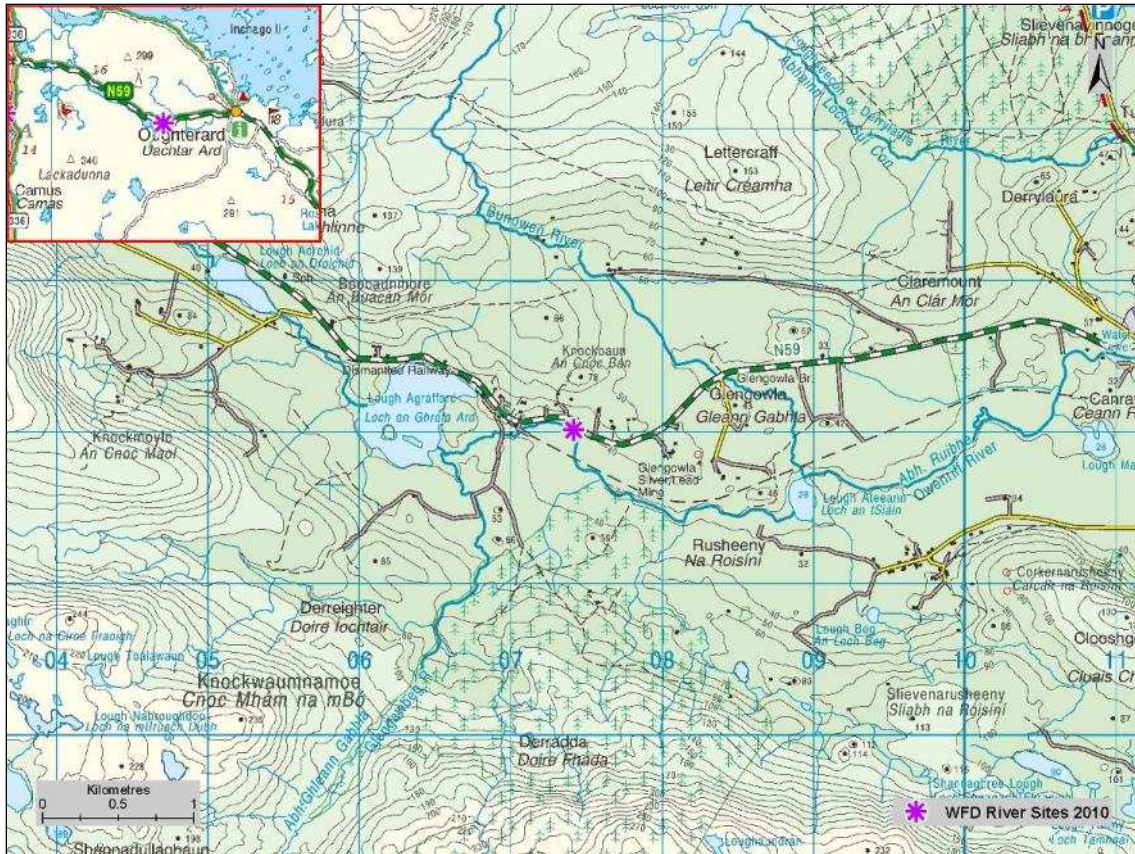


Fig. 4.7. Location of the Owenriff River surveillance monitoring site

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

Table 4.3. Minimum density of each fish species (no./m²) captured on the Owenriff River site, July 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.154
<i>Salmo salar</i>	Salmon	0.082	0.049	0.131
<i>Salmo trutta fario</i>	Brown trout	0.003	0.010	0.013
All Fish	All Fish	-	-	0.298

Salmon ranged in length from 2.8cm to 17.6cm (Fig. 4.8). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 51%, 36%, 10% and 2% of the total salmon catch respectively. The mean salmon L1, L2 and L3 were 3.9cm, 7.6cm and 14.1cm respectively (Appendix 2).

Only six brown trout were captured at the Owenriff site, ranging in length from 4.5cm to 26.0cm. Three age classes (0+, 1+ and 3+) were present, accounting for approximately 33%, 50%, and 17% of the total brown trout catch respectively. The mean brown trout L1, L2 and L3 were 5.5cm, 14.6cm and 22.1cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is 'slow' according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

Minnow ranged in length from 3.0cm to 5.8cm.

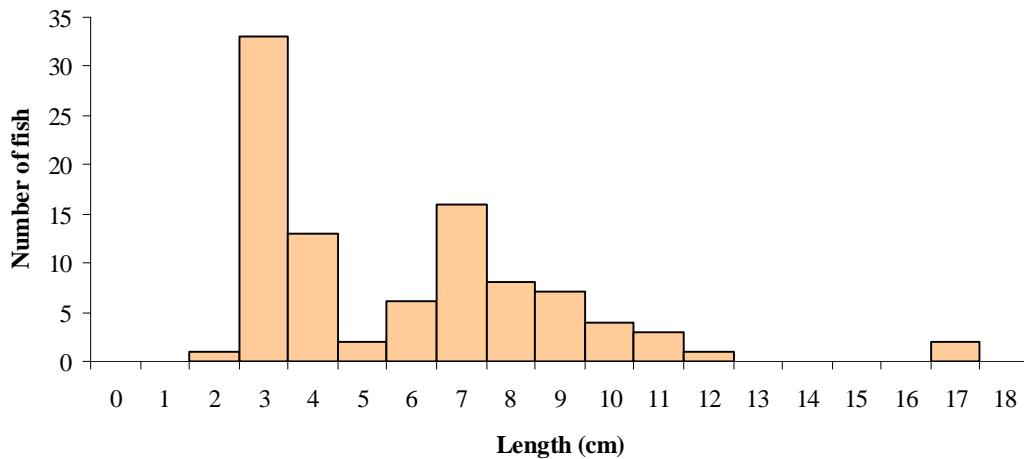


Fig. 4.8. Length frequency distribution of salmon in the Owenriff River site, July 2010 (n = 96)

4.2 Non-wadeable sites

4.2.1 *The Ballysadare River*



Plate 4.4. The Ballysadare River near Ballysadare, Co. Sligo

The Ballysadare River is a relatively short stretch of river channel that arises from the confluence of the Owenbeg, Owenmore and Unshin Rivers. The Owenbeg and Owenmore join together approximately 2km south-west of Collooney and later join with the Unshin 3km downstream of the village, to become the Ballysadare River. The Ballysadare River then continues for another 4km, before entering the sea at Ballysadare Bay. Angling for salmon and brown trout are both popular on this river, with sea trout also present in the tidal zones (O'Reilly, 2002).

The Ballysadare River is part of the Unshin River SAC, an example of a pristine river containing floating river vegetation and alluvial wet woodland habitats, both of which are listed in Annex I of the Habitats Directive. Populations of salmon and otter, both of which are listed in Annex II of the directive, are also present (NPWS, 2006b).

The survey site was located just upstream of Ballysadare (Plate 4.4; Fig. 4.9). One electric-fishing pass was conducted using four boat-based electric-fishing units on the 16th of June 2010 along a 320m

length of river channel. The mean wetted width of the stretch surveyed was 24.6m and the mean depth was 100.0cm. A total wetted area of 7,872m² was surveyed. Glide and riffle were the dominant habitat types, with a substrate of mainly cobble.



Fig. 4.9. Location of the Ballysadare River surveillance monitoring site

A total of nine fish species were recorded in the Ballysadare River site. Salmon was the most abundant species, followed by perch, eels, brown trout, minnow, roach, three-spined stickleback, pike and lamprey (Table 4.4).

Table 4.4. Minimum density of each fish species (no./m²) captured on the Ballysadare River site, June 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.00102	0.01651	0.01753
<i>Perca fluviatilis</i>	Perch	-	-	0.00851
<i>Anguilla anguilla</i>	Eel	-	-	0.00343
<i>Salmo trutta fario</i>	Brown trout	-	0.00152	0.00152
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.00114
<i>Rutilus rutilus</i>	Roach	-	-	0.00051
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.00038
<i>Esox lucius</i>	Pike	-	-	0.00038
<i>Lampetra</i> sp.	Lamprey sp.	-	-	0.00013
All Fish	All Fish	-	-	0.03354

Salmon ranged in length from 4.4cm to 13.1cm (Fig. 4.10). Two age classes (0+ and 1+) were present, accounting for approximately 6% and 94% of the total salmon catch respectively. The mean salmon L1 was 5.3cm (Appendix 2).

Perch ranged in length from 7.5cm to 21.1cm (Fig. 4.11). Eel ranged in length from 20.6cm to 64.4cm (Fig. 4.12).

Brown trout ranged in length from 13.7cm to 29.5cm (Fig. 4.13). Three age classes (1+, 2+ and 3+) were present, accounting for approximately 58%, 33% and 8% of the total brown trout catch respectively. The mean brown trout L1, L2 and L3 were 9.5cm, 20.9cm and 25.9cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is 'fast' according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

Other species recorded included perch ranging in length from 7.5cm to 21.1cm, eels from 20.6cm to 64.4cm, minnow from 3.8cm to 5.7cm, roach from 6.5cm to 17.3cm, three-spined stickleback from 2.6cm to 2.8cm, pike from 26.4cm to 84.2cm and a single lamprey measuring 7.0cm.

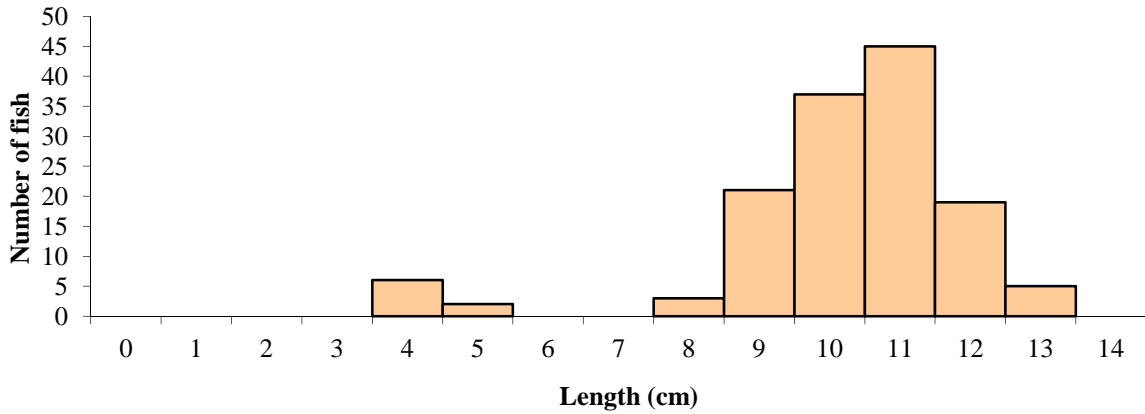


Fig. 4.10. Length frequency distribution of salmon in the Ballysadare River site, June 2010 (n = 138)

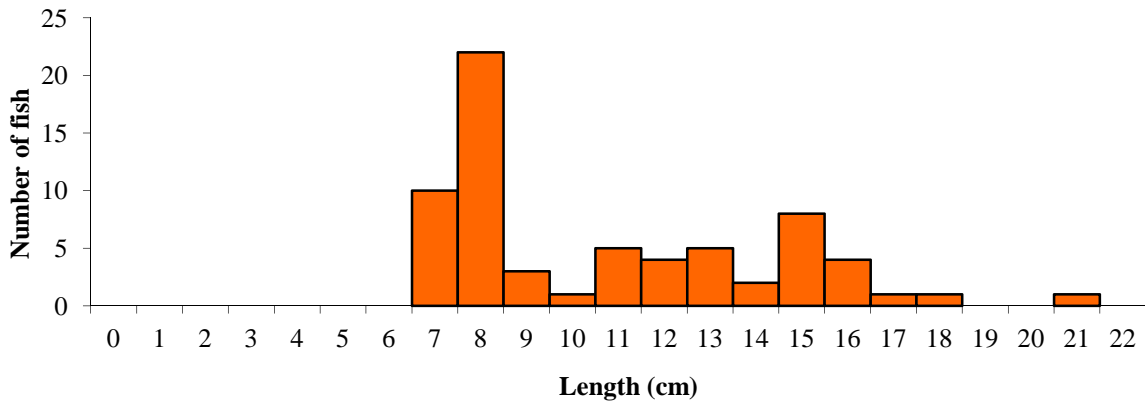


Fig. 4.11. Length frequency distribution of perch in the Ballysadare River site, June 2010 (n = 67)

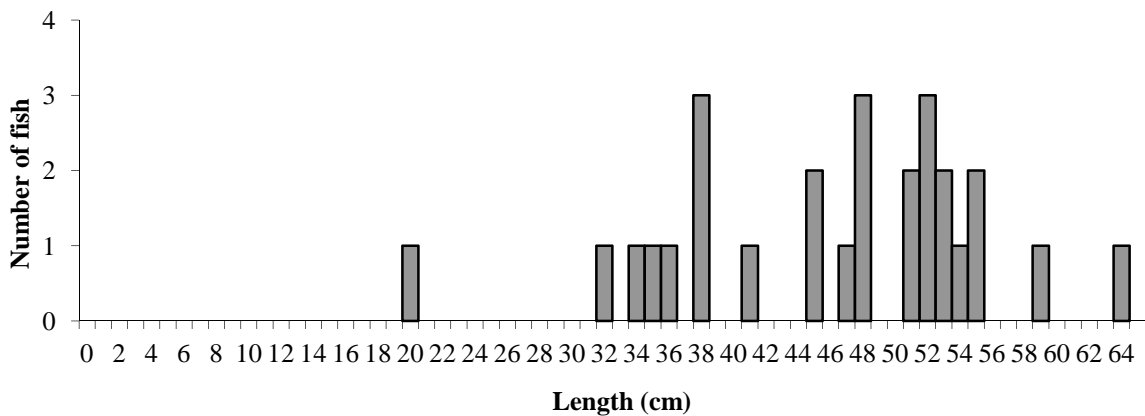


Fig. 4.12. Length frequency distribution of eels in the Ballysadare River site, June 2010 (n = 27)

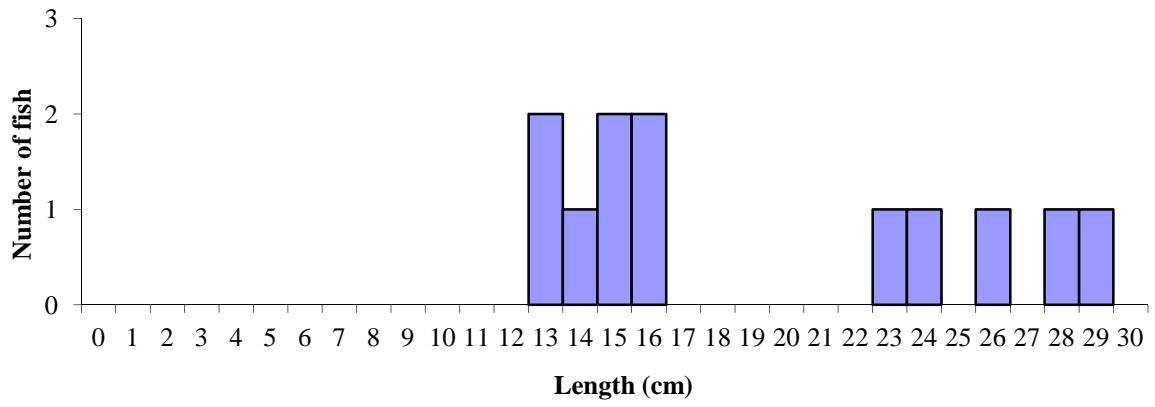


Fig. 4.13. Length frequency distribution of brown trout in the Ballysadare River site, June 2010 (n = 12)

4.2.2 The Bonet River



Plate 4.5. The Bonet River, Dromahair, Co. Leitrim

The Bonet River rises in the Dartry Mountains in Co. Leitrim. It flows through Glenade Lough and onwards in a south-westerly direction, before looping northwards through Dromahair and into Lough Gill. The outflow from Lough Gill is the Garvoge River, passing through Sligo town and joining the sea at Sligo harbour. Salmon and brown trout fishing is considered to be relatively good on this river (O'Reilly, 2002).

The Bonet River site is situated within the Lough Gill SAC, which is noted for the presence of natural eutrophic lakes, a habitat listed in Annex I of the Habitats Directive. It also contains a number of species listed in Annex II of the Habitats Directive, including salmon, otter, sea, river and brook lamprey as well as white clawed crayfish (NPWS, 2006c).

The survey site was located downstream of Dromahair (Plate 4.5; Fig. 4.14). One electric-fishing pass was conducted using three boat-based electric-fishing units on the 16th of August 2010 along a 297m length of river channel. The mean wetted width of the stretch surveyed was 21.3m and the mean depth was 150.0cm. A total wetted area of 6,326m² was surveyed. Glide was the dominant habitat present, over a substrate of mainly sand.

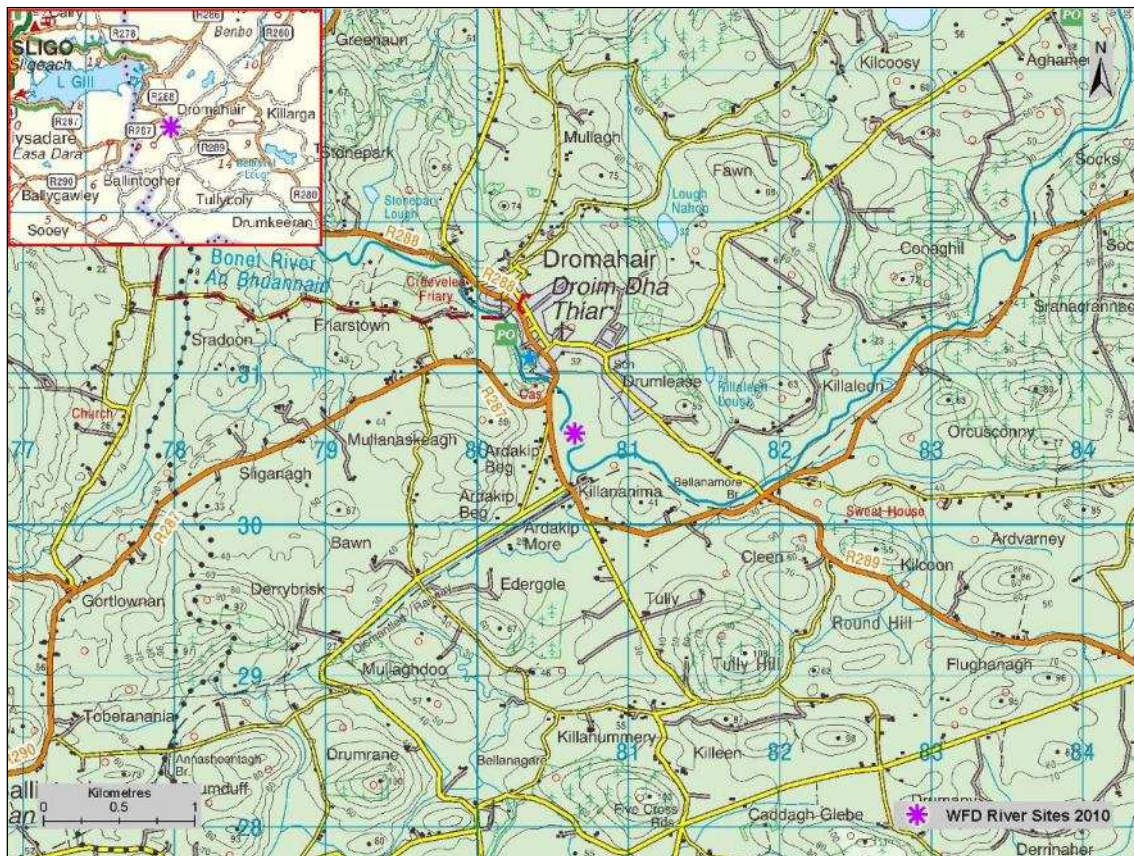


Fig. 4.14. Location of the Bonnet River surveillance monitoring site

A total of nine fish species were recorded in the Bonnet River site. Minnow was the most abundant species, followed by gudgeon, three-spined stickleback, lamprey, perch, stone loach, brown trout, salmon and eels (Table 4.5).

Table 4.5. Minimum density of each fish species (no./m²) captured on the Bonnet River site, August 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.11287
<i>Gobio gobio</i>	Gudgeon	-	-	0.04126
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.01960
<i>Lampetra</i> sp.	Lamprey sp.	-	-	0.00806
<i>Perca fluviatilis</i>	Perch	-	-	0.00063
<i>Barbatula barbatula</i>	Stone loach	-	-	0.00063
<i>Salmo trutta fario</i>	Brown trout	-	0.00016	0.00016
<i>Salmo salar</i>	Salmon	-	0.00016	0.00016
<i>Anguilla anguilla</i>	Eel	-	-	0.00016
All Fish	All Fish	-	-	0.18353

Minnow ranged in length from 1.5cm to 3.4cm (Fig. 4.15). Gudgeon ranged in length from 2.2cm to 4.8cm (Fig. 4.16). Three-spined stickleback ranged in length from 1.7cm to 4.9cm (Fig. 4.17). Juvenile lamprey ranged in length from 7.3cm to 14.2cm (Fig. 4.18).

Only one brown trout and one salmon were captured, measuring 24.6cm and 10.6cm in length, and aged 3+ and 1+ respectively. Other species recorded included, gudgeon ranging in length from 2.2cm to 4.8cm, three-spined stickleback from 1.7cm to 4.9cm, lamprey from 7.3cm to 14.2cm, perch from 3.6cm to 12.6cm, stone loach from 3.6cm to 6.7cm and a single eel measuring 33.2cm.

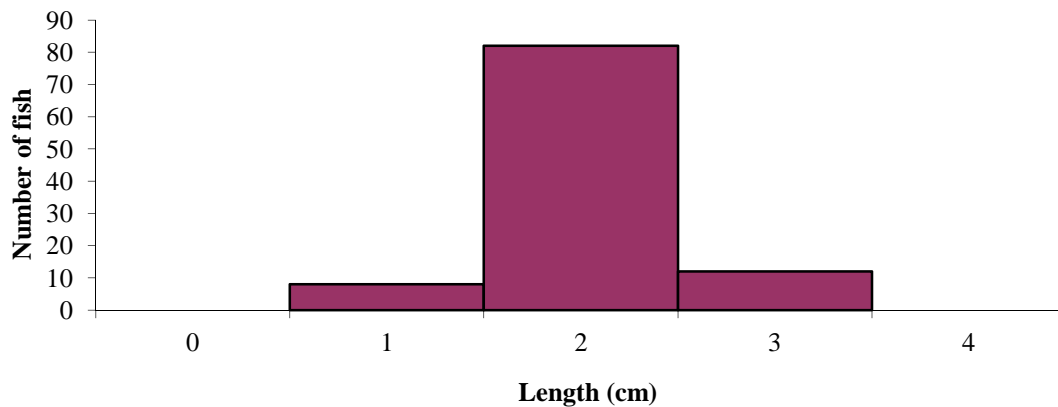


Fig. 4.15. Length frequency distribution of minnow in the Bonet River site, August 2010 (n = 102)

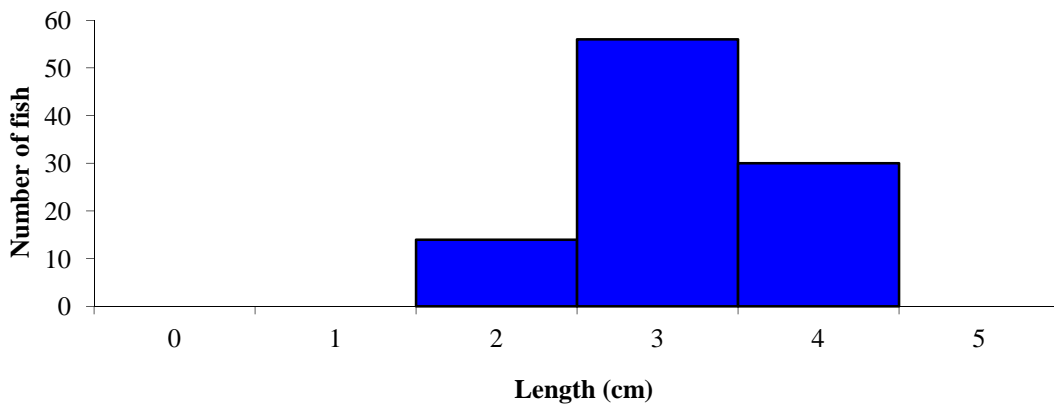


Fig. 4.16. Length frequency distribution of gudgeon in the Bonet River site, August 2010 (n = 100)

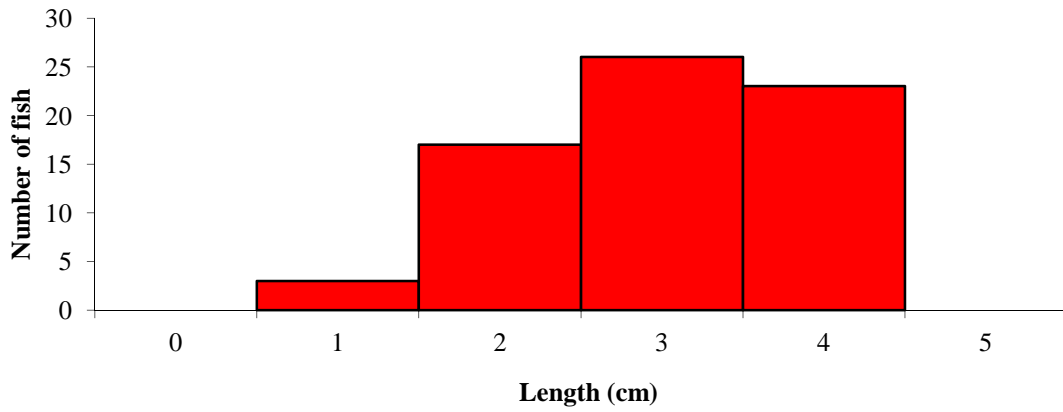


Fig. 4.17. Length frequency distribution of three-spined stickleback in the Bonet River site, August 2010 (n = 69)

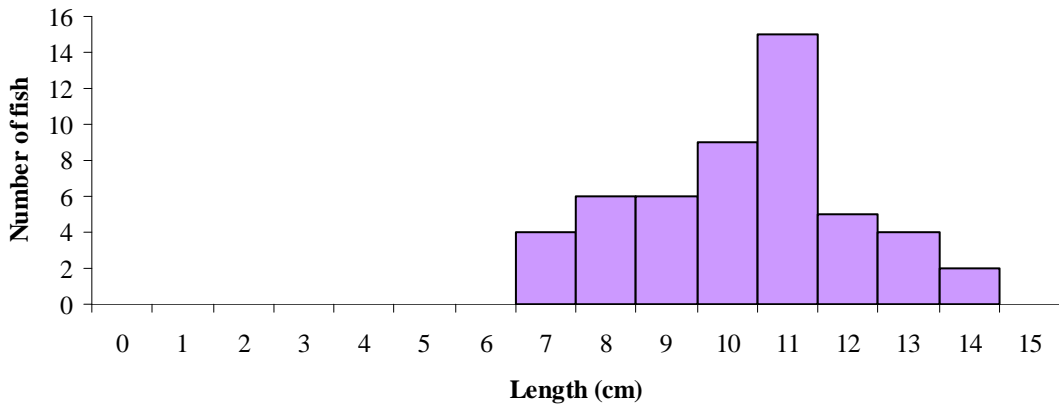


Fig. 4.18. Length frequency distribution of lamprey in the Bonet River site, August 2010 (n = 51)

4.2.3 The River Clare (Corrofin)



Plate 4.6. The River Clare, north of Corrofin, Co. Galway

The River Clare rises near Ballyhaunis in Co. Mayo as the Dalgan River. It joins the Sinking River, at Bellaconeen and continues in a southerly direction passing Tuam and Claregalway on its way to Lough Corrib. Throughout the centuries, this river posed a constant threat of flooding and often burst its banks. In a major arterial drainage scheme in the 1950s and 1960s, one of Ireland's largest ever, the main channel of the Clare was widened and deepened, primarily to improve agricultural land within the catchment. The River Clare is known for good stocks of salmon and brown trout (O'Reilly, 2002).

This site is located within the Lough Corrib Special Area of Conservation (SAC), an area noted for 14 different habitats listed in Annex I of the Habitats Directive. Important habitats include petrifying springs, lowland oligotrophic lakes, hardwater lakes and floating river vegetation. Otter and freshwater pearl mussels, both listed in Annex II of the Habitats Directive, are important within this SAC (NPWS, 2006a).

The survey site was located approximately 1km north of Corrofin (Plate 4.6; Fig. 4.19). One electric-fishing pass was conducted using three boat-based electric-fishing units on the 10th of August 2010

along a 322m length of river channel. The mean wetted width of the stretch surveyed was 19.0m and the mean depth was 130.0cm. A total wetted area of 6,118m² was surveyed. Glide was the dominant habitat present, with a substrate of mainly of cobble and gravel. Submerged macrophyte vegetation was abundant throughout the channel.



Fig. 4.19. Location of the River Clare (Corrofin) surveillance monitoring site

A total of eight fish species were recorded in the River Clare (Corrofin) site (Table 4.6). Salmon was the most abundant species, followed by roach, three-spined stickleback, pike, perch, stone loach, brown trout and nine-spined stickleback.

Table 4.6. Minimum density of each fish species (no./m²) captured on the River Clare (Corrofin) site, August 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.00065	0.00605	0.00670
<i>Rutilus rutilus</i>	Roach	-	-	0.00588
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.00572
<i>Esox lucius</i>	Pike	-	-	0.00294
<i>Perca fluviatilis</i>	Perch	-	-	0.00229
<i>Barbatula barbatula</i>	Stone loach	-	-	0.00180
<i>Salmo trutta fario</i>	Brown trout	0.00033	0.00033	0.00065
<i>Pungitius pungitius</i>	Nine-spined stickleback	-	-	0.00033
All Fish	All Fish	-	-	0.02632

Juvenile salmon ranged in length from 6.4cm to 16.2cm, and one adult salmon measuring 62cm in length was also recorded (Fig. 4.20). Two age classes (0+ and 1+) were present in the juvenile salmon sample, accounting for approximately 10% and 90% of the total juvenile salmon catch respectively. The mean salmon L1 was 5.3cm (Appendix 2).

Roach ranged in length from 2.8cm to 9.8cm (Fig. 4.21). Two age classes (0+ and 1+) were present, accounting for approximately 44% and 56% of the total roach catch respectively. The mean roach L1 was 3.4cm.

Pike ranged in length from 10.5cm to 62.8cm (Fig. 4.22). Four age classes (0+, 1+, 2+ and 4+) were present, accounting for approximately 78%, 6%, 11% and 6% of the total pike catch respectively.

Four brown trout were captured, ranging in length from 7.8cm to 50.0cm. Three age classes (0+, 1+ and 4+) were present, accounting for approximately 50%, 25% and 25% of the total brown trout catch respectively.

Other species recorded included, three-spined stickleback ranging in length from 2.2cm to 5.6cm, perch from 5.8cm to 21.9cm and stone loach from 6.5cm to 8.9cm. In addition, this was the only river site surveyed for WFD surveillance monitoring during 2010 in which nine-spined stickleback were recorded. Two individuals measuring 4.0cm and 4.1cm were captured.

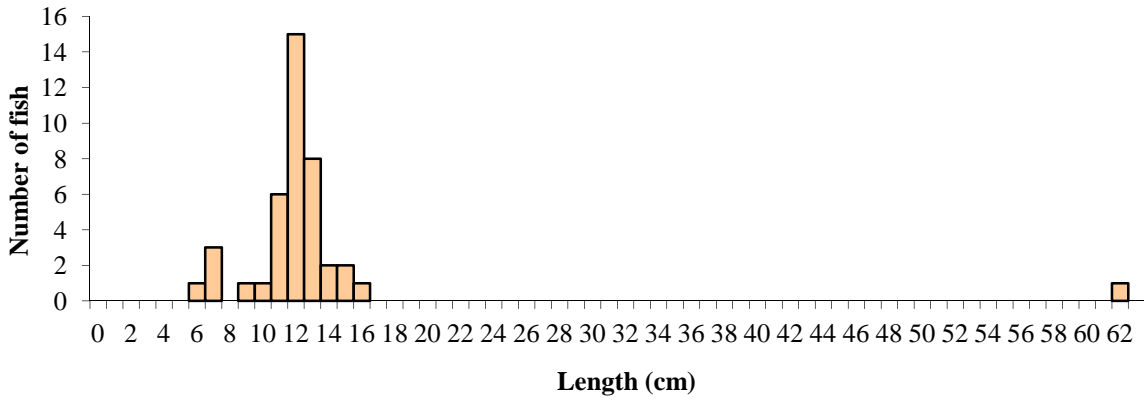


Fig. 4.20. Length frequency distribution of salmon in the River Clare (Corrofin), August 2010 (n = 41)

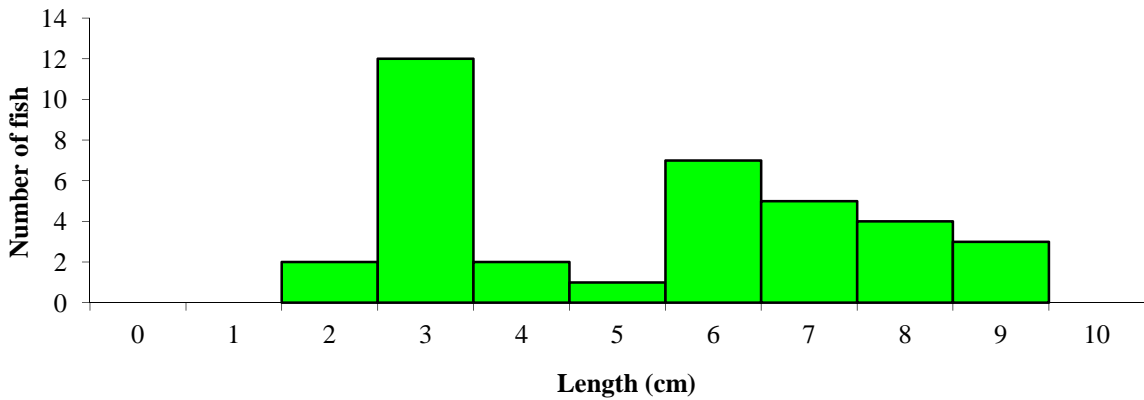


Fig. 4.21. Length frequency distribution of roach in the River Clare (Corrofin), August 2010 (n = 36)

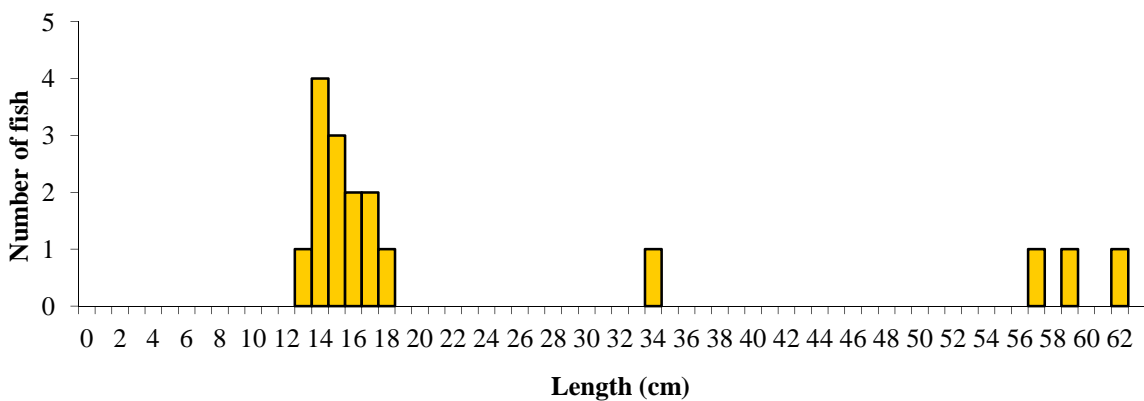


Fig. 4.22. Length frequency distribution of pike in the River Clare (Corrofin), August 2010 (n = 17)

4.2.4 The River Clare (Kiltroge)



Plate 4.7. The River Clare at Kiltroge Castle, Co. Galway

A second site was surveyed on the River Clare near the village of Claregalway in Co. Galway (Plate 4.7; Fig. 4.23).

The survey site was located downstream of the bridge beside the ruins of Kiltroge Castle, approximately 2km east of Claregalway in Co. Galway (Fig. 4.23). One electric-fishing pass was conducted using two boat-based electric-fishing units on the 24th of August 2010 along a 234m stretch of river channel. The stretch surveyed had a mean wetted width of 14.6m and a mean depth of 53.0cm. A total wetted area of 3,416m² was surveyed. Glide was the only habitat present, with a substrate of mainly cobble and gravel.



Fig. 4.23. Location of the River Clare (Kiltroge) surveillance monitoring site

A total of eight fish species were recorded in the River Clare (Kiltroge) site. Salmon was the most abundant species, followed by roach, perch, three-spined stickleback, brown trout, pike lamprey and eels (Table 4.7).

Table 4.7. Minimum density of each fish species (no./m²) captured on the River Clare (Kiltroge) site, August 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.01171	0.01873	0.03044
<i>Rutilus rutilus</i>	Roach	-	-	0.01288
<i>Perca fluviatilis</i>	Perch	-	-	0.01229
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.00732
<i>Salmo trutta fario</i>	Brown trout	0.00263	0.00439	0.00702
<i>Esox lucius</i>	Pike	-	-	0.00059
<i>Lampetra</i> sp.	Lamprey sp.	-	-	0.00029
<i>Anguilla anguilla</i>	Eel	-	-	0.00029
All Fish	All Fish	-	-	0.07113

Juvenile salmon ranged in length from 6.0cm to 16.6cm. One adult salmon measuring 54.5cm in length was also recorded (Fig. 4.24). Two age classes (0+ and 1+) were present in the juvenile salmon sample, accounting for approximately 39% and 61% of the total juvenile salmon catch respectively. The adult salmon was aged 1.1+. The mean salmon L1 was 5.3cm (Appendix 2).

Roach ranged in length from 3.4cm to 10.4cm (Fig. 4.25). Two age classes (0+ and 1+) were present, accounting for approximately 32% and 68% of the total roach catch respectively. The mean roach L1 was 3.8cm. Perch ranged in length from 1.9cm to 8.0cm (Fig. 4.26).

Brown trout ranged in length from 8.2cm and 37.1cm (Fig. 4.27). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 38%, 29%, 29% and 4% of the total brown trout catch respectively. The mean brown trout L1, L2 and L3 were 8.3cm, 18.8cm and 31.2cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is ‘very fast’ according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

Other species recorded included, perch ranging in length from 1.9cm to 8.0cm, three-spined stickleback from 3.1cm to 6.1cm, two pike measuring 17.3cm and 41.9cm and a single specimen of lamprey (8.9cm).

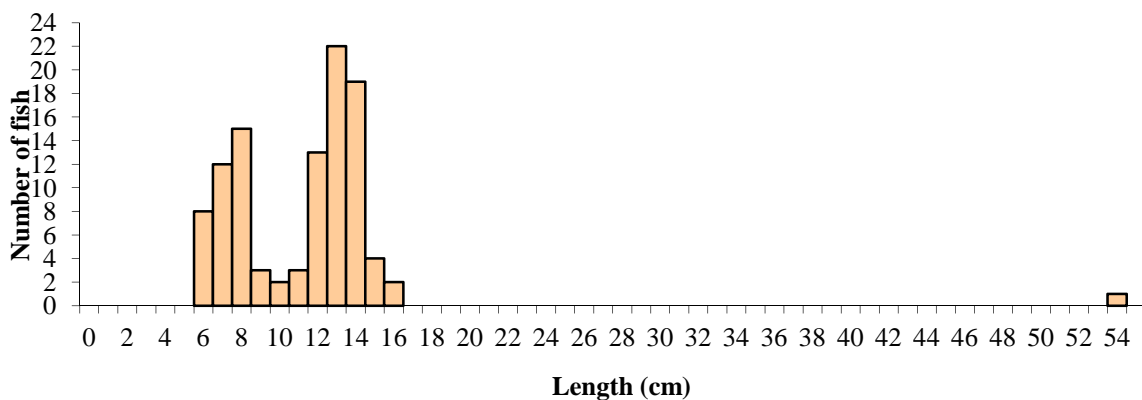


Fig. 4.24. Length frequency distribution of salmon in the River Clare (Kiltroge), August 2010 (n = 104)

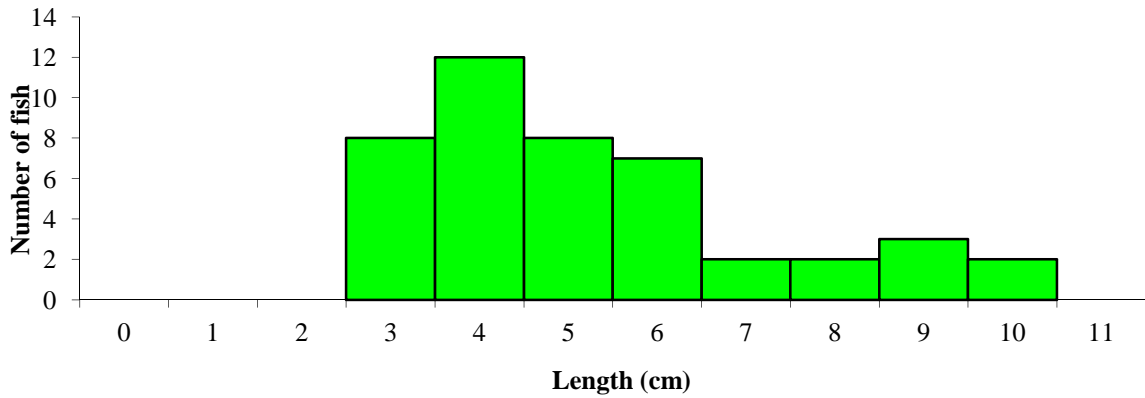


Fig. 4.25. Length frequency distribution of roach in the River Clare (Kiltroe), August 2010 (n = 44)

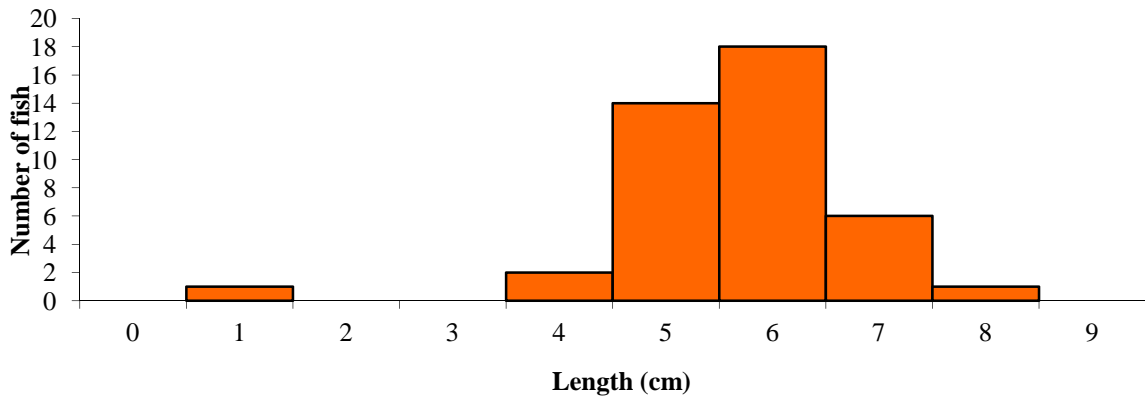


Fig. 4.26. Length frequency distribution of perch in the River Clare (Kiltroe), August 2010 (n = 42)

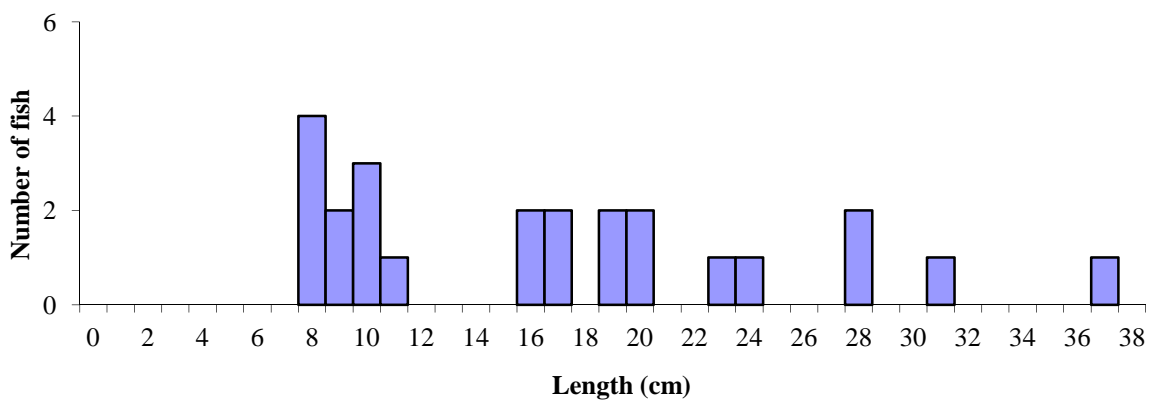


Fig. 4.27. Length frequency distribution of brown trout in the River Clare (Kiltroe), August 2010 (n = 24)

4.2.5 The River Moy (Gweestion)



Plate 4.8. The River Moy, 2km upstream the Gweestion River confluence, Co. Mayo

The second site sampled on the River Moy (see section 4.1.2 for details) was located approximately 6km west of Swinford in Co. Mayo (Plate 4.8; Fig. 4.28).

The survey site was located approximately 2.5km upstream of the confluence with the Gweestion River (Fig. 4.28). One electric-fishing pass was conducted using four boat-based electric-fishing units on the 14th of June 2010 along a 364m length of river channel. The mean wetted width of the stretch surveyed was 30.2m and the mean depth was 90.0cm. A total wetted area of 10,980m² was surveyed. Glide was the dominant habitat present, with a substrate composed of mainly cobble and boulder.



Fig. 4.28. Location of the River Moy (Gwestion) surveillance monitoring site

A total of eight fish species (sea trout are included as a separate ‘variety’ of trout) were recorded in the River Moy (Gwestion) site. Salmon was the most abundant species, followed by roach, brown trout, minnow, eels, perch, sea trout and three-spined stickleback (Table 4.8).

Table 4.8. Minimum density of each fish species (no./m²) captured on the River Moy (Gwestion) site, June 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.00064	0.02823	0.02887
<i>Rutilus rutilus</i>	Roach	-	-	0.00592
<i>Salmo trutta fario</i>	Brown trout	-	0.00501	0.00501
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.00455
<i>Anguilla anguilla</i>	Eel	-	-	0.00064
<i>Perca fluviatilis</i>	Perch	-	-	0.00027
<i>Salmo trutta trutta</i>	Sea trout	-	-	0.00018
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.00018
All Fish	All Fish	-	-	0.04563

Salmon ranged in length from 3.2cm to 11.6cm (Fig. 4.29). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 2%, 93% and 5% of the total salmon catch respectively. The mean salmon L1 and L2 were 4.4cm and 7.4cm respectively (Appendix 2).

Roach ranged in length from 6.9cm to 27.1cm (Fig. 4.30). Eight age classes (1+ to 8+) were present, accounting for approximately 2%, 6%, 14%, 12%, 31%, 18%, 15% and 2% of the total roach catch respectively.

Brown trout ranged in length from 11.9cm to 28.7cm (Fig. 4.31). Four age classes (1+, 2+, 3+ and 4+) were present, accounting for approximately 29%, 44%, 22%, and 5% of the total brown trout catch respectively. The mean brown trout L1, L2, L3, and L4 were 7.3cm, 14.2cm, 19.5cm and 24.3cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is ‘slow’ according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

Other species recorded included minnow ranging in length from 3.1cm to 7.8cm, eels ranging from 18.2 to 46.2cm and perch from 12.8cm to 18.1cm.

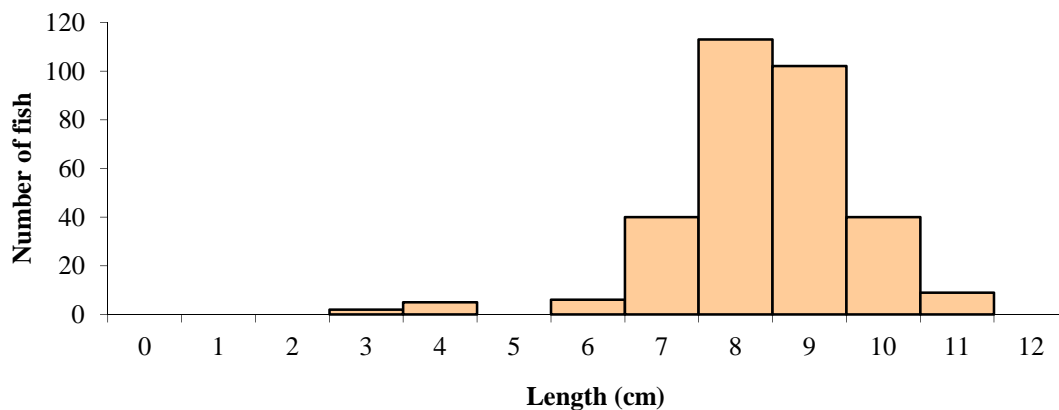


Fig. 4.29. Length frequency distribution of salmon in the River Moy (Gweestion), June 2010 (n = 317)

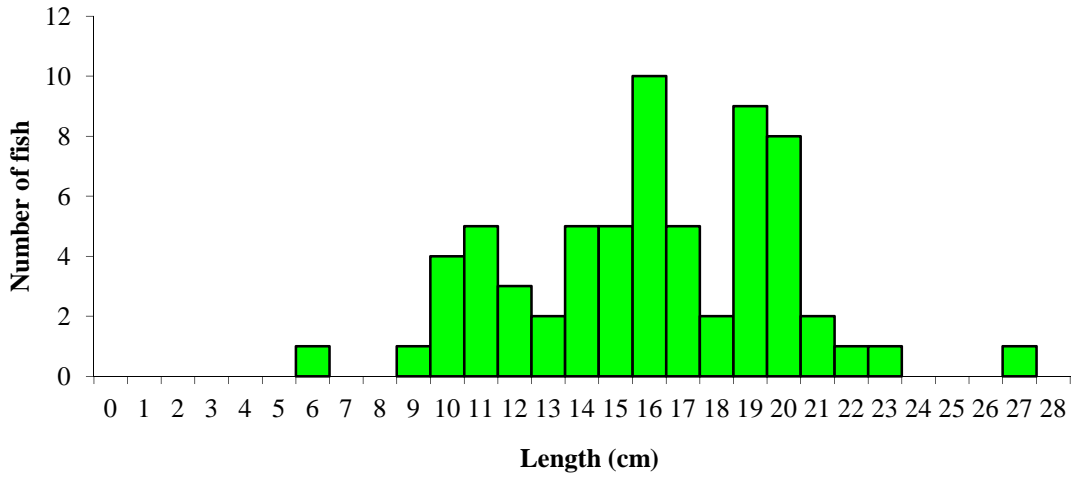


Fig. 4.30. Length frequency distribution of roach in the River Moy (Gweestion), June 2010 (n = 65)

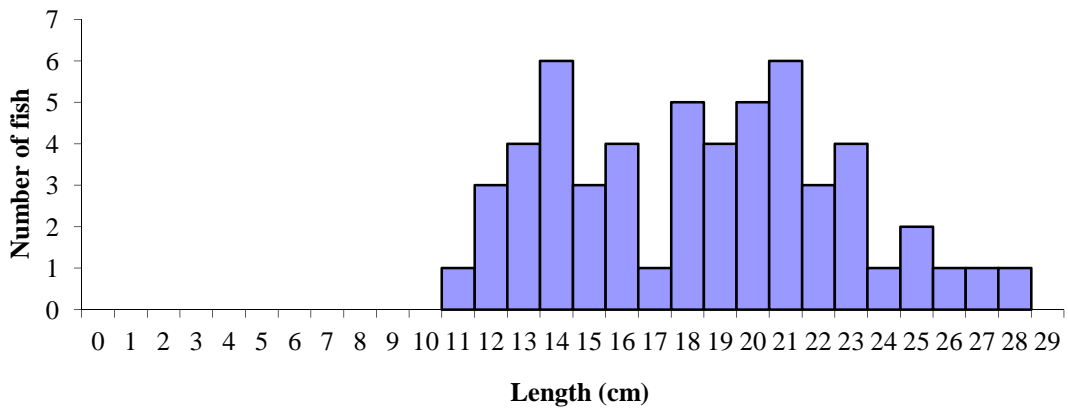


Fig. 4.31 Length frequency distribution of brown trout in the River Moy (Gweestion), June 2010 (n = 55)

4.2.6 The River Moy (Bleanmore)



Plate 4.9. The River Moy at Bleanmore, Co. Mayo

The third site surveyed on the River Moy (see section 4.1.2 for details) was located approximately 3km south of Foxford in Co. Mayo (Plate 4.9; Fig. 4.32). One electric-fishing pass was conducted using four boat-based electric-fishing units on the 15th of June 2010 along a 322m length of river channel. The mean wetted width of the stretch surveyed was 39.0m and the mean depth was 125.0cm. A total wetted area of 6,326m² was surveyed. Glide and pool were the dominant habitat types present, with a mixed substrate of boulder, cobble and gravel.

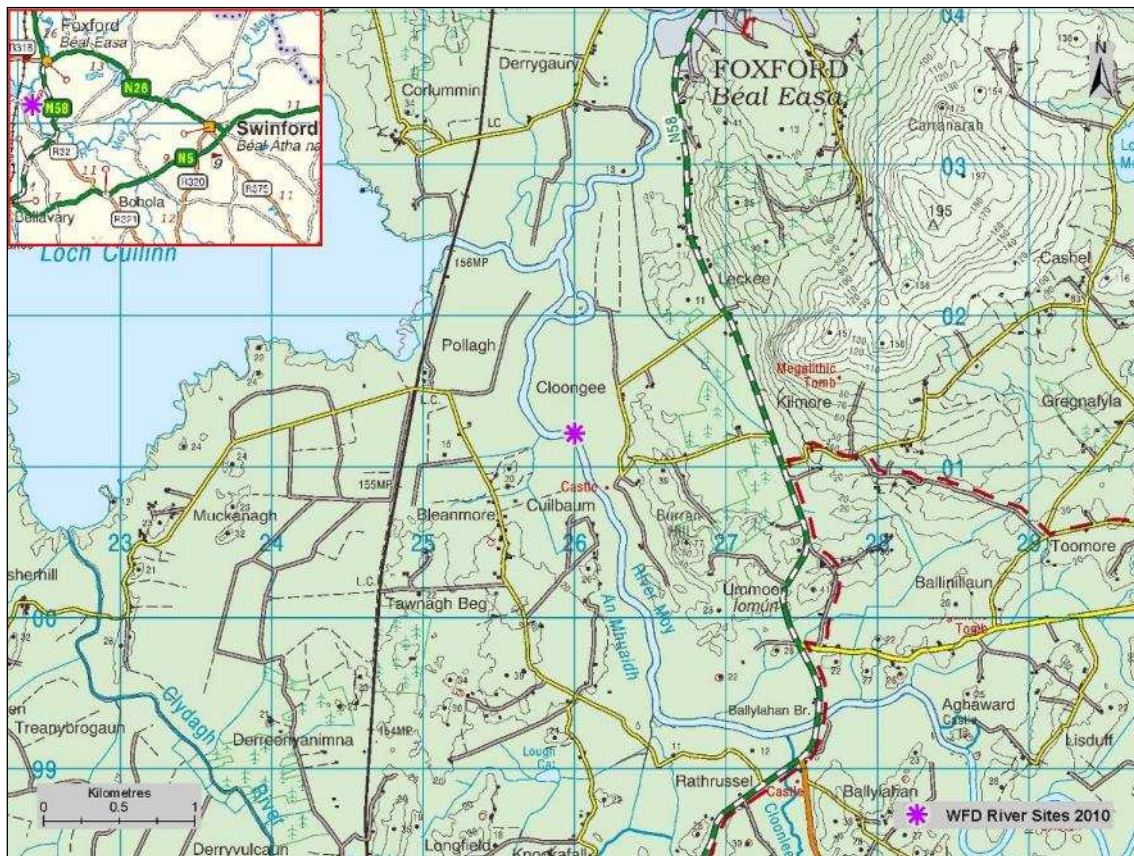


Fig. 4.32. Location of the River Moy (Bleanmore) surveillance monitoring site

A total of eight fish species were recorded in the River Moy (Bleanmore) site. Roach was the most abundant species, followed by salmon, eels, perch, brown trout, minnow, three-spined stickleback and pike (Table 4.9).

Table 4.9. Minimum density of each fish species (no./m²) captured on the River Moy (Bleanmore) site, June 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Rutilus rutilus</i>	Roach	-	-	0.00653
<i>Salmo salar</i>	Salmon	0.00016	0.00366	0.00382
<i>Anguilla anguilla</i>	Eel	-	-	0.00096
<i>Perca fluviatilis</i>	Perch	-	-	0.00088
<i>Salmo trutta fario</i>	Brown trout	-	0.00064	0.00064
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.00032
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.00016
<i>Esox lucius</i>	Pike	-	-	0.00016
All Fish	All Fish	-	-	0.01346

Roach ranged in length from 4.4cm to 22.0cm (Fig. 4.33). Seven age classes (1+ to 7+) were present, accounting for approximately 28%, 13%, 20%, 17%, 20%, 1% and 1% of the total roach catch respectively.

Salmon ranged in length from 6.6cm to 12.2cm (Fig. 4.34). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 4%, 88% and 8% of the total salmon catch respectively. The mean salmon L1 and L2 were 4.2cm and 7.1cm respectively (Appendix 2).

Eight brown trout were captured, ranging in length from 13.6cm to 27.5cm. Three age classes (1+, 2+ and 3+) were present, accounting for approximately 63%, 25% and 13% of the total brown trout catch respectively. The mean brown trout L1, L2, and L3 were 8.2cm, 14.6cm and 21.7cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is ‘slow’ according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

Other species recorded included eels ranging in length from 16.3cm to 52.1cm, perch from 7.9cm to 18.0cm, minnow from 6.5cm to 9.2cm, two specimens of three-spined stickleback measuring 4.0cm and 6.0cm and two pike measuring 27.5cm and 30.2cm.

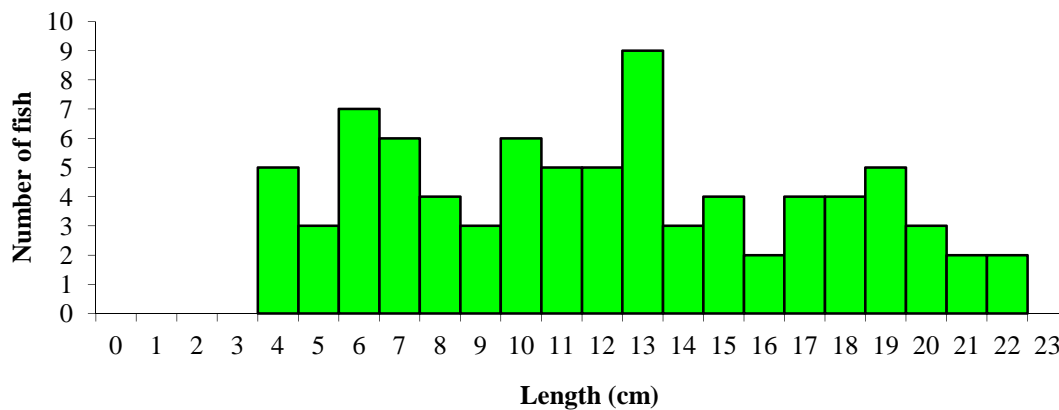


Fig. 4.33. Length frequency distribution of roach in the River Moy (Bleanmore), June 2010 (n = 82)

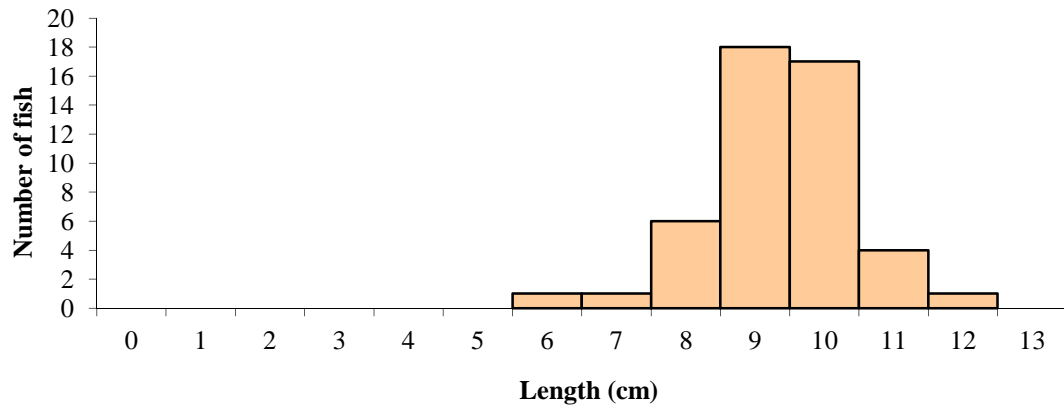


Fig. 4.34. Length frequency distribution of salmon in the River Moy (Bleanmore), June 2010 (n = 48)

4.2.7 The Owenmore River

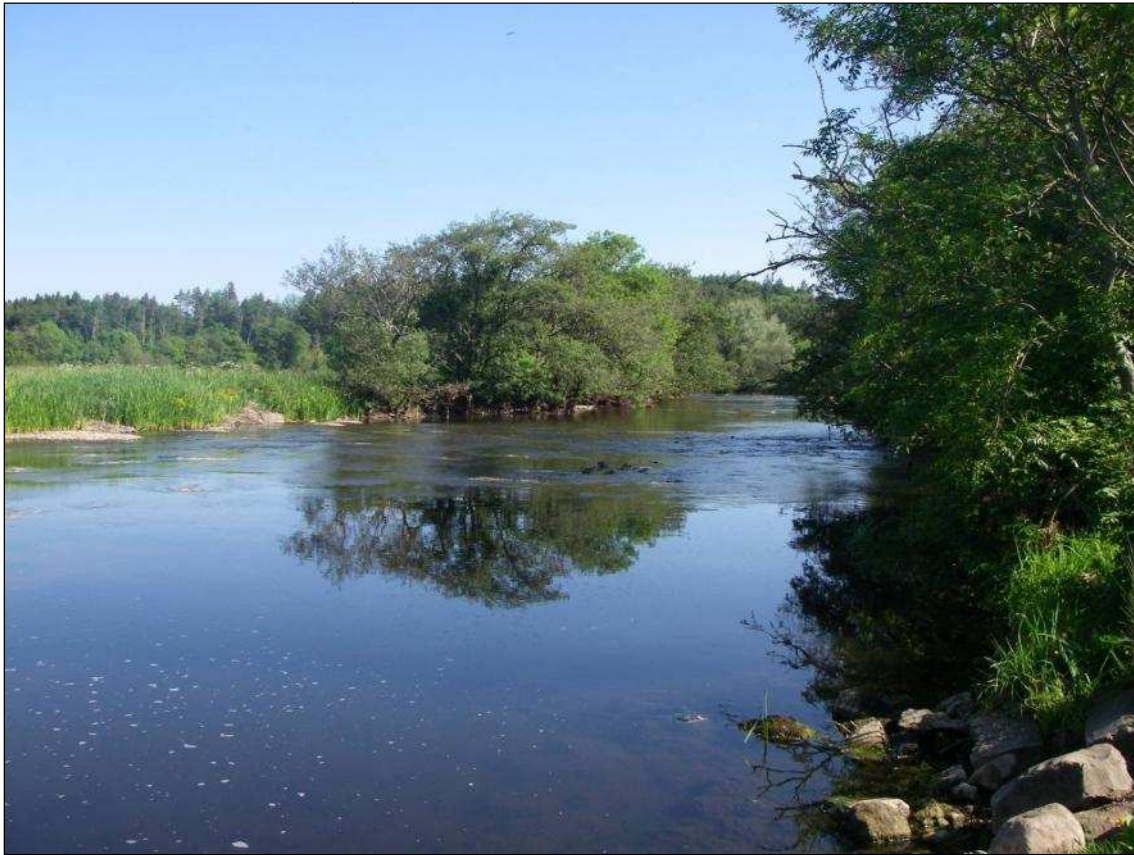


Plate 4.10. The Owenmore River at Collooney, Co.Sligo

The Owenmore River rises in south Co. Sligo and flows in a northerly direction towards Collooney, where it joins with the Ballysadare River (Plate 4.10, Fig. 4.35). It is considered a relatively good angling river for both brown trout and pike (O'Reilly, 2002).

The Owenmore River flows through the Unshin River SAC, which is an example of a pristine river containing floating river vegetation and alluvial wet woodland habitats, both of which are listed in Annex I of the Habitats Directive. Populations of salmon and otter, both of which are listed in Annex II of the Directive, are also present (NPWS, 2006b).

The survey site was located approximately 0.5km upstream of the confluence with the Ballysadare River, just outside Collooney (Fig. 4.35). One electric-fishing pass was conducted using three boat-based electric-fishing units on the 16th of June 2010 along a 137m length of river channel. The mean wetted width of the stretch surveyed was 23.3m and the mean depth was 92.0cm. A total wetted area of 3,197m² was surveyed. Glide and riffle were the main habitat types present, with a substrate of mainly cobble and boulder.

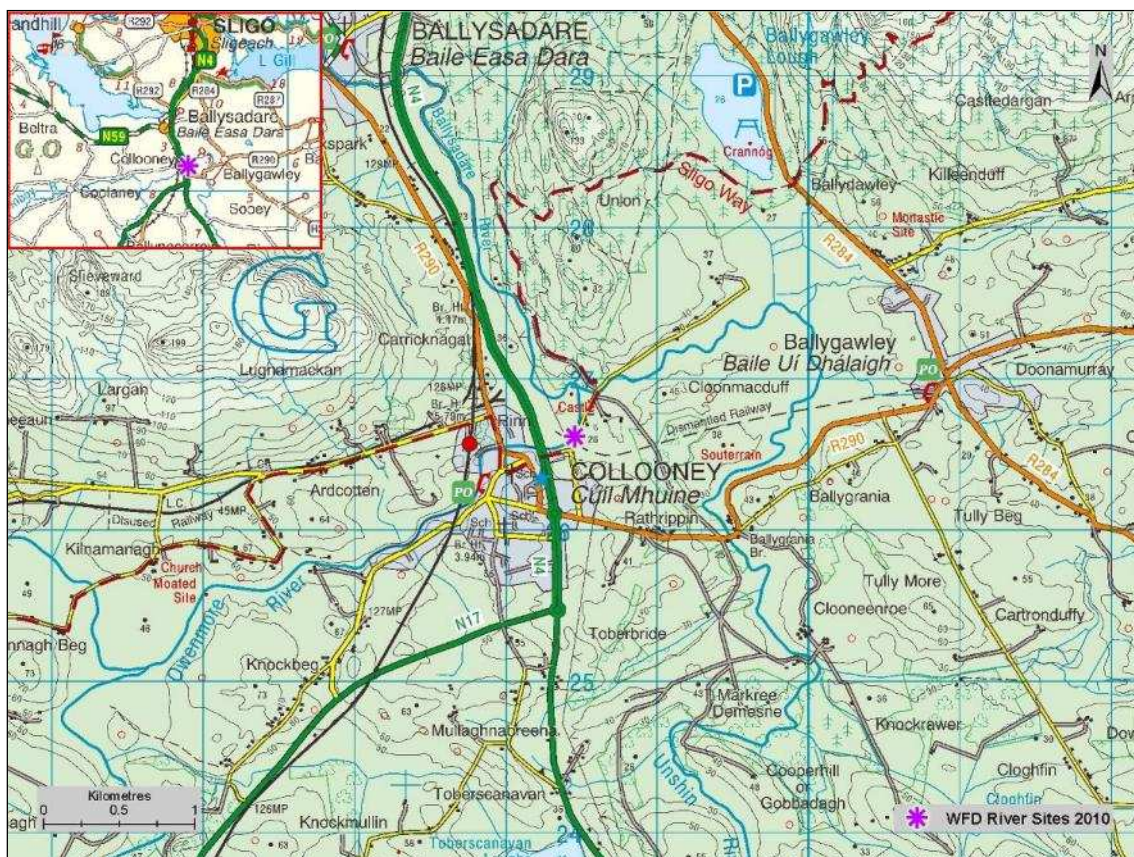


Fig. 4.35. Location of the Owenmore River surveillance monitoring site

A total of six fish species were recorded in the Owenmore River site. Salmon was the most abundant species, followed by brown trout, eels, minnow, lamprey and perch (Table 4.10).

Table 4.10. Minimum density of each fish species (no./m²) captured on the Owenmore River site, June 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.04630	0.05819	0.10448
<i>Salmo trutta fario</i>	Brown trout	-	0.00657	0.00657
<i>Anguilla anguilla</i>	Eel	-	-	0.00375
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.00250
<i>Lampetra</i> sp.	Lamprey sp.	-	-	0.00063
<i>Perca fluviatilis</i>	Perch	-	-	0.00063
All Fish	All Fish	-	-	0.11856

Salmon ranged in length from 3.3cm to 12.9cm (Fig. 4.36). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 44%, 54% and 1% of the total salmon catch respectively. The mean salmon L1 and L2 were 5.4cm and 9.2cm respectively (Appendix 2).

Brown trout ranged in length from 8.3cm to 31.5cm (Fig. 4.37). Three age classes (1+, 2+ and 3+) were present, accounting for approximately 24%, 57% and 19% of the total brown trout catch respectively. The mean brown trout L1, L2 and L3 were 7.8cm, 16.7cm and 25.5cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is ‘fast’ according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

Other species recorded included, eels ranging in length from 22.8cm to 53.8cm, minnow from 4.6cm to 8.2cm, two specimens of perch measuring 18.1cm and 19.2cm and two lamprey measuring 9.6cm and 13.4cm.

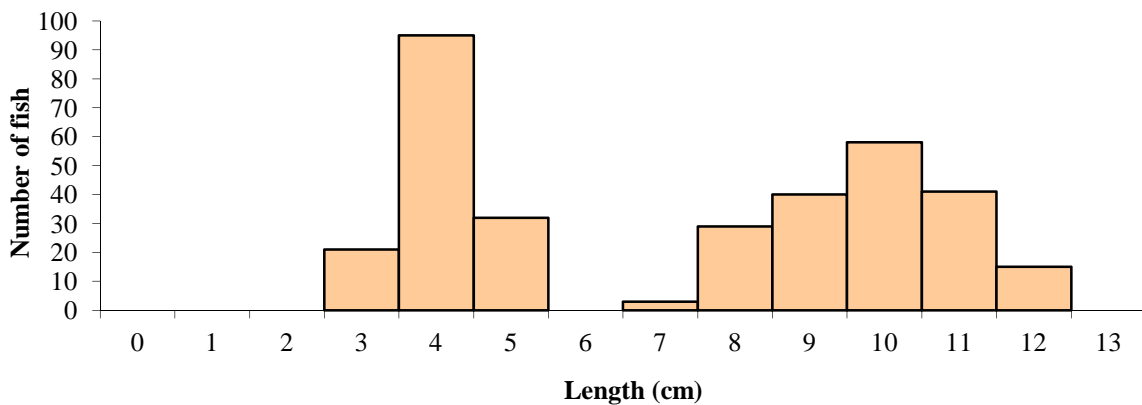


Fig. 4.36. Length frequency distribution of brown trout in the Owenmore River, June 2010 (n = 334)

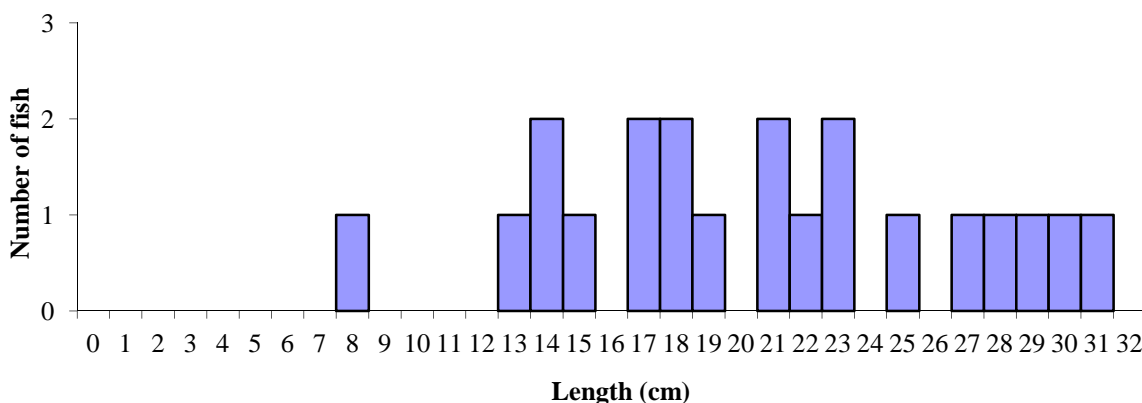


Fig. 4.37. Length frequency distribution of brown trout in the Owenmore River, June 2010 (n = 21)

4.2.8 The Robe River



Plate 4.11. The Robe River upstream of Akit Bridge, Ballinrobe, Co. Mayo

The Robe River rises south-west of Ballyhaunis in Co. Mayo. It flows in a south-westerly direction past Claremorris and towards Ballinrobe, before entering Lough Mask. In the past, pollution and drainage destroyed the brown trout stocks in this river (O'Reilly 2002). In recent years, however, it has made a huge recovery and become one of the best brown trout fisheries in the region (O'Reilly, 2009).

The survey site was located upstream of Akit Bridge, just north of Ballinrobe (Fig. 4.38). One electric-fishing pass was conducted using two boat-based electric-fishing units on the 19th of July 2010 along a 474m length of river channel. The mean wetted width of the stretch surveyed was 16.3m and the mean depth was 133.0cm. A total wetted area of 7,703m² was surveyed. Glide was the dominant habitat type, with a substrate of cobble and gravel.

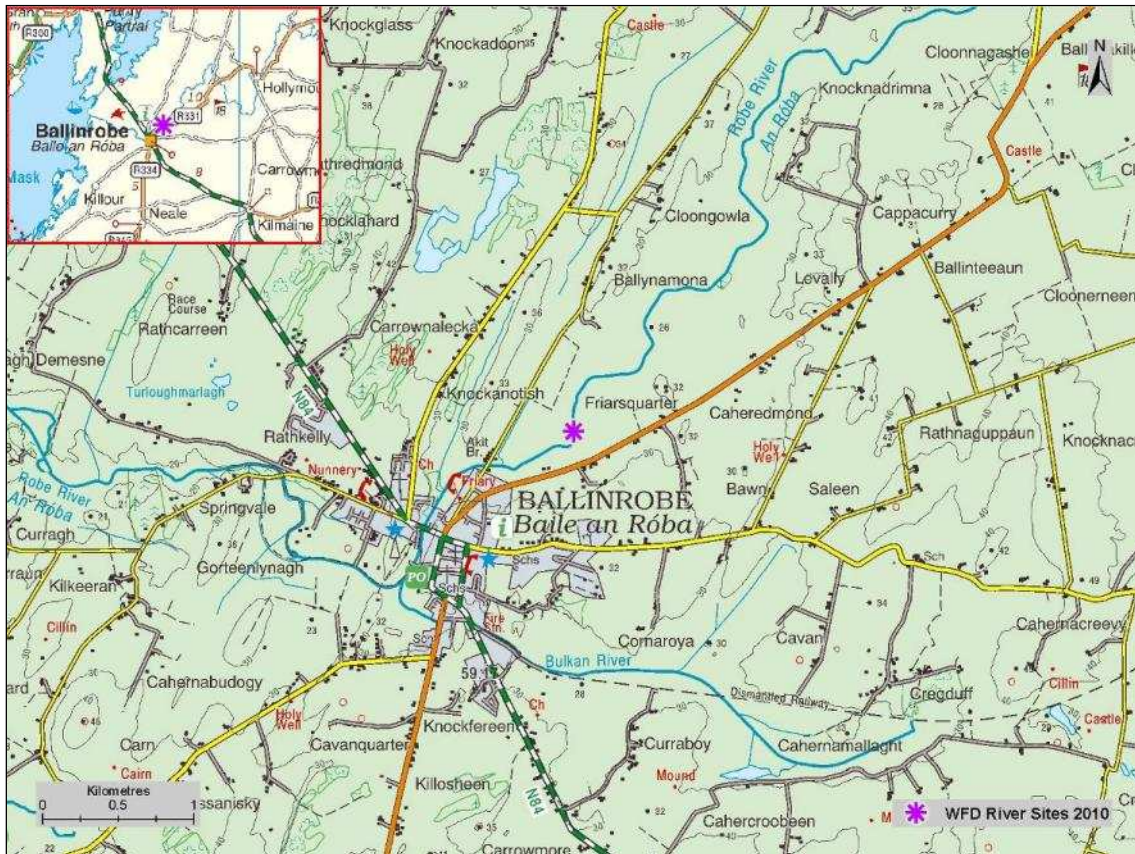


Fig. 4.38. Location of the Robe River surveillance monitoring site

A total of four fish species were recorded in the Robe River site. Minnow was the most abundant species, followed by brown trout, perch and eels (Table 4.11).

Table 4.11. Minimum density of each fish species (no./m²) captured on the Robe River (Akit Br.) site, July 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.00805
<i>Salmo trutta fario</i>	Brown trout	-	0.00052	0.00052
<i>Perca fluviatilis</i>	Perch	-	-	0.00026
<i>Anguilla anguilla</i>	Eel	-	-	0.00013
All Fish	All Fish	-	-	0.00896

Minnow ranged in length from 1.8cm to 5.5cm (Fig. 4.39).

Four brown trout were captured, ranging in length from 25.6cm to 45.0cm. Three age classes (2+, 3+ and 4+) were present, accounting for approximately 50%, 25% and 25% of the total brown trout catch

respectively. The mean brown trout L1, L2 and L3 were 6.6cm, 18.0cm and 20.6cm respectively (Appendix 1). This indicates that growth of brown trout in this river site is ‘fast’ according to the classification of brown trout growth in rivers described by Kennedy and Fitzmaurice (1971).

A single eel was recorded in the Robe, measuring 71.0cm in length.

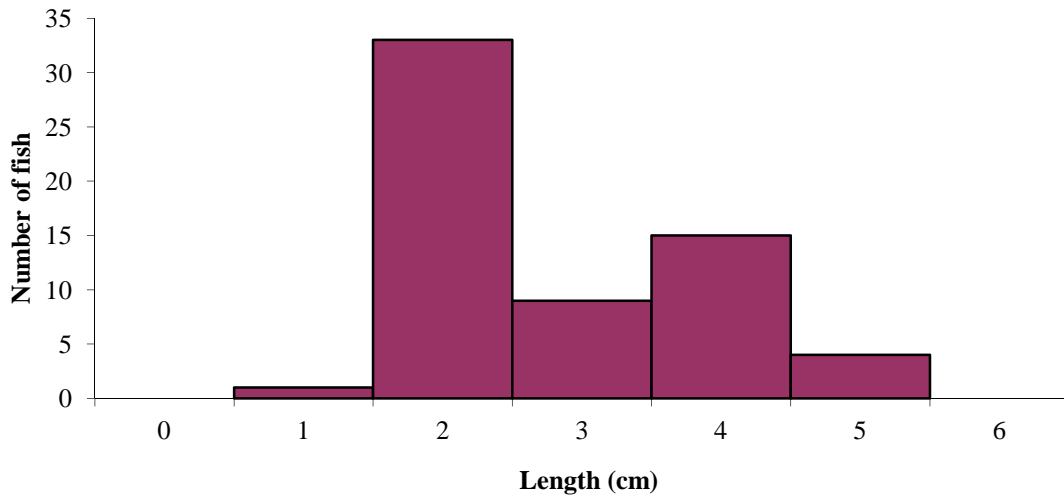


Fig. 4.39. Length frequency distribution of minnow in the Robe River July 2010 (n = 62)

4.2.9 The Screeb River



Plate 4.12. The Screeb River in Connemara, Co. Galway

The Screeb River encompasses a complicated network of small lakes and interconnecting channels in Connemara, Co. Galway. It rises near Maam Cross and flows in a southerly direction, reaching the sea at Camus Bay. This river is popular among salmon and sea trout anglers and is supplemented each year by the release of smolts from the local Screeb hatchery (O'Reilly, 2009).

The Screeb River flows through the Connemara Bog Complex SAC, which contains several habitats listed in Annex I of the Habitats Directive, including floating vegetation, lagoons, oligotrophic lakes and dystrophic lakes. This SAC also protects several species listed in Annex II of the Habitats Directive, including salmon and otter (NPWS, 2006d).

The survey site was located approximately 3km downstream of Maam Cross, near Loughaunfree, (Fig. 4.40). One electric-fishing pass was conducted using two boat-based electric-fishing units on the 20th of July 2010 along a 147m length of river channel. The mean wetted width of the stretch surveyed was 17.0m and the mean depth was 150.0cm. A total wetted area of 2,499m² was surveyed. Glide was the dominant habitat type, with a substrate of sand, mud and silt.



Fig. 4.40. Location of the River Screeb surveillance monitoring site

Two minnow were the only fish recorded in the Screeb River site during this survey (Table 4.12).

Table 4.12. Minimum density of each fish species (no./m²) captured on the Screeb River site, July 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.00080
All Fish	All Fish	-	-	0.00080

As fish numbers were so low in this site it is planned to resurvey the site and survey additional sites on the river in 2012 to verify the status of the fish communities.

4.3 Community structure

4.3.1 Species richness and composition

A total of 13 fish species (sea trout are included as a separate ‘variety’ of trout) and one hybrid were recorded within the 12 WRBD sites surveyed (Fig. 4.41). Brown trout was the most common fish species, occurring in all but one of the sites surveyed (92%). This was followed by salmon (83%), minnow (75%), perch (67%), three-spined stickleback (67%), eels (58%), roach (42%), lamprey (33%), pike (33%) and stone loach (33%). Gudgeon, nine-spined stickleback and sea trout were each recorded at only one site (13%).

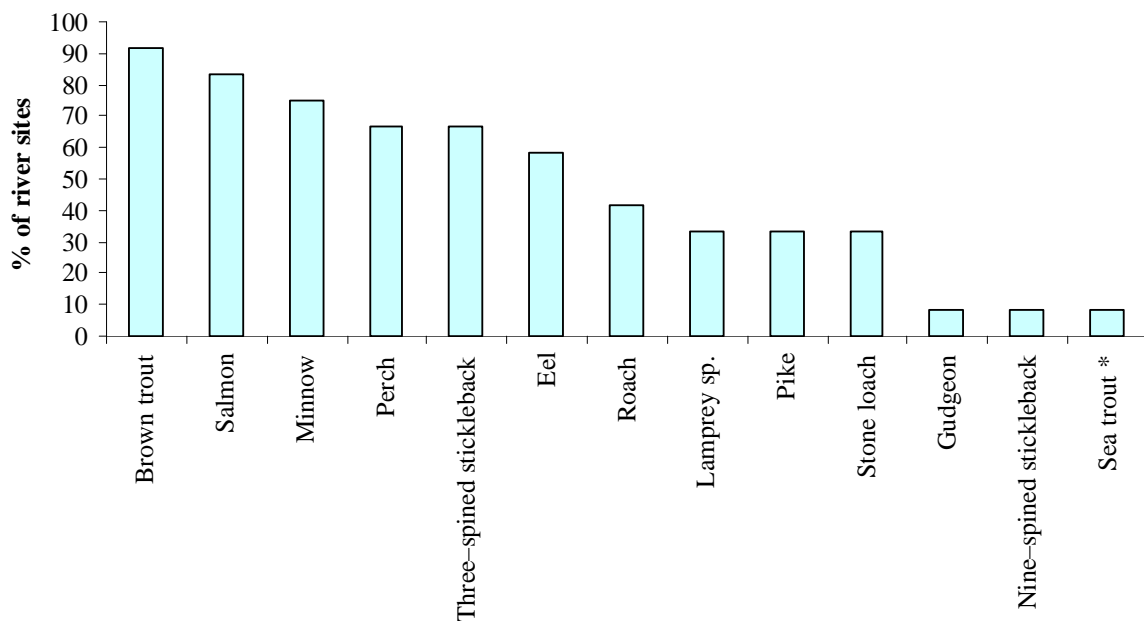


Fig. 4.41. Percentage of sites where each fish species was recorded in the WRBD for WFD SM monitoring 2010

Fish species richness for each site within the WRBD is shown in Table 4.12 below. Species richness ranged from one species in the Screeb River to a maximum of nine species recorded in both the Ballysadare and Bonet Rivers. Kelly *et al.*, (2008) classified fish species in Ireland into three groups. Group 1 – native species (e.g. salmonids, three-spined stickleback, lamprey and eel) were present at all sites surveyed except for the Screeb River, Group 2 – non-native species that influence ecology (e.g. pike, perch, minnow and stone loach) were recorded in all of the sites and Group 3 – non-native species that generally don’t influence ecology (e.g. gudgeon) were recorded at only one site (Clare River at Corrofin).

Table 4.12. Species richness at each river site surveyed in the WRBD, June to August 2010

Site	Species richness	No. native species (Group 1)	No. non-native species (Group 2)	No. non-native species (Group 3)
WADEABLE SITES				
Moy (Cloonbaniff)	5	2	3	0
Abbert	4	3	1	0
Owenriff	3	2	1	0
NON-WADEABLE SITES				
Ballysadare	9	5	4	0
Bonet	9	5	3	1
Clare (Corrofin)	8	4	4	0
Clare (Kiltroge)	8	5	3	0
Moy (Bleanmore)	8	4	4	0
Moy (Gweestion)	8*	5	3	0
Owenmore (Sligo)	6	3	3	0
Robe	4	2	2	0
Screeb	1	0	1	0

* Sea trout are counted as a separate variety of brown trout here

4.3.2 Species abundance and distribution

Abundance (minimum population density) and distribution maps for the most common fish species recorded within the WRBD WFD surveillance monitoring sites during 2010 are shown in Figures 4.42 to 4.58. Fish densities are generally higher in wadeable sites surveyed with bank-based electric-fishing gear than in non-wadeable sites surveyed with boat-based electric-fishing gear (Kelly *et al.*, 2009; Kelly *et al.* 2010; Kelly *et al.* 2011). This is primarily due to the tendency for younger trout and salmon to utilise shallow, riffle areas as nursery habitat, in contrast to glide and pool areas which is the preferred habitat for adult fish, along with the difference in sampling efficiency of the two methods. As such, population densities recorded for each species using the two methods are displayed as separate colours on each map.

Brown trout were the most widely distributed species in the WRBD, occurring in 11 of the 12 sites surveyed during 2010. The greatest densities of brown trout fry (0+) for the non-wadeable and wadeable sites were 0.058 fish/m² (Abbert River) and 0.132 fish/m² (Owenmore River) respectively (Fig. 4.42). For 1+ and older fish, the highest densities were recorded in the Owenmore and Abbert Rivers with values of 0.007 fish/m² and 0.042 fish/m² respectively (Fig. 4.43). Sea trout were only recorded in the River Moy (Gweestion) site (Fig. 4.44).

Salmon were recorded in ten sites surveyed within the WRBD during 2010. The greatest densities of fry (0+) for the non-wadeable and wadeable sites were 0.046 fish/m² (Owenmore River) and 0.09 fish/m² (Abbert River) respectively (Fig. 4.45). For 1+ and older fish, the highest densities were recorded in the River Moy (Gweestion) and Abbert River with values of 0.028 fish/m² and 0.199 fish/m² respectively (Fig. 4.46).

Of the remaining species captured, minnow (Fig. 4.47) were recorded in nine sites, perch (Fig. 4.48) and three-spined stickleback (Fig. 4.49) were recorded in eight sites, eels (Fig. 4.50) in seven sites, roach (Fig. 4.51) in five sites, lamprey (Fig. 4.52), pike (Fig. 4.53) and stone loach (Fig. 4.54) in four sites. Gudgeon (Fig. 4.55) and nine-spined stickleback (Fig. 4.56) were recorded in one site each.

The River Clare (Corrofin) site was the only surveillance monitoring river site surveyed nationwide during 2010 in which nine-spined stickleback were recorded.

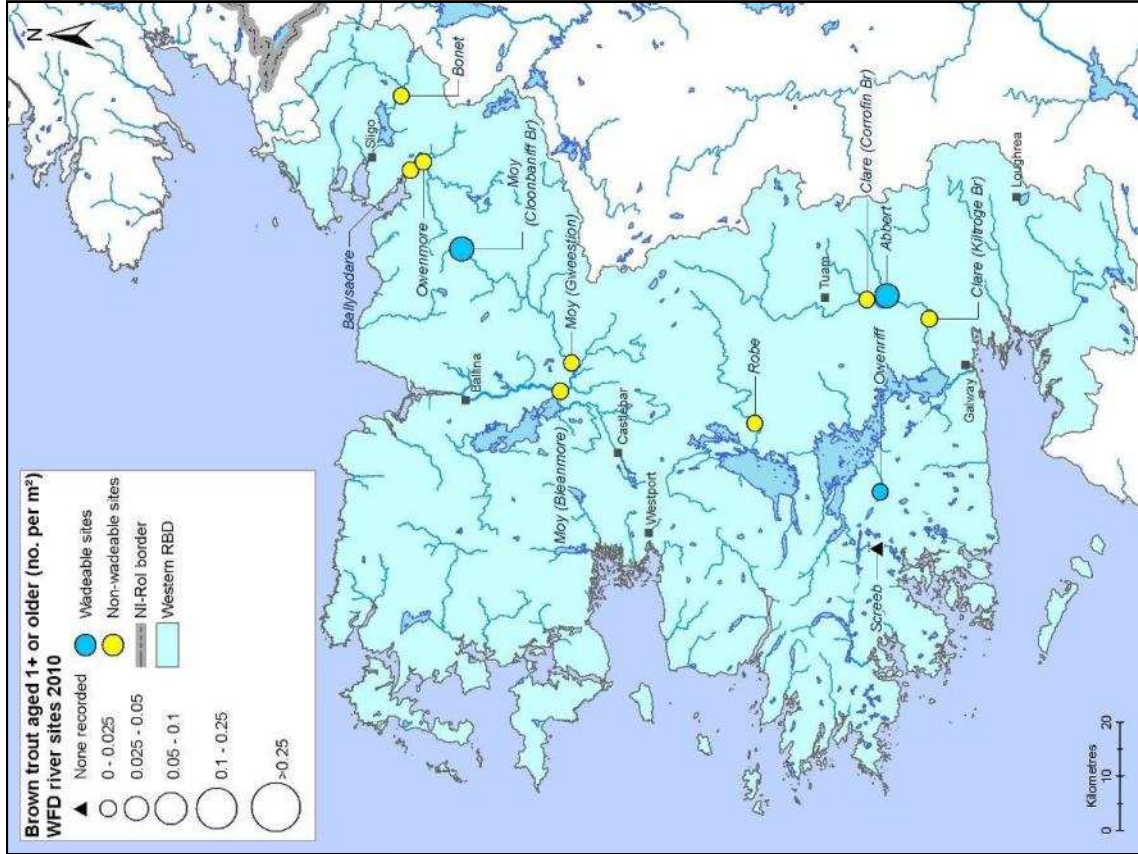


Fig. 4.43. Distribution map for 1+ or older brown trout in the WRBD, WFD surveillance monitoring 2010

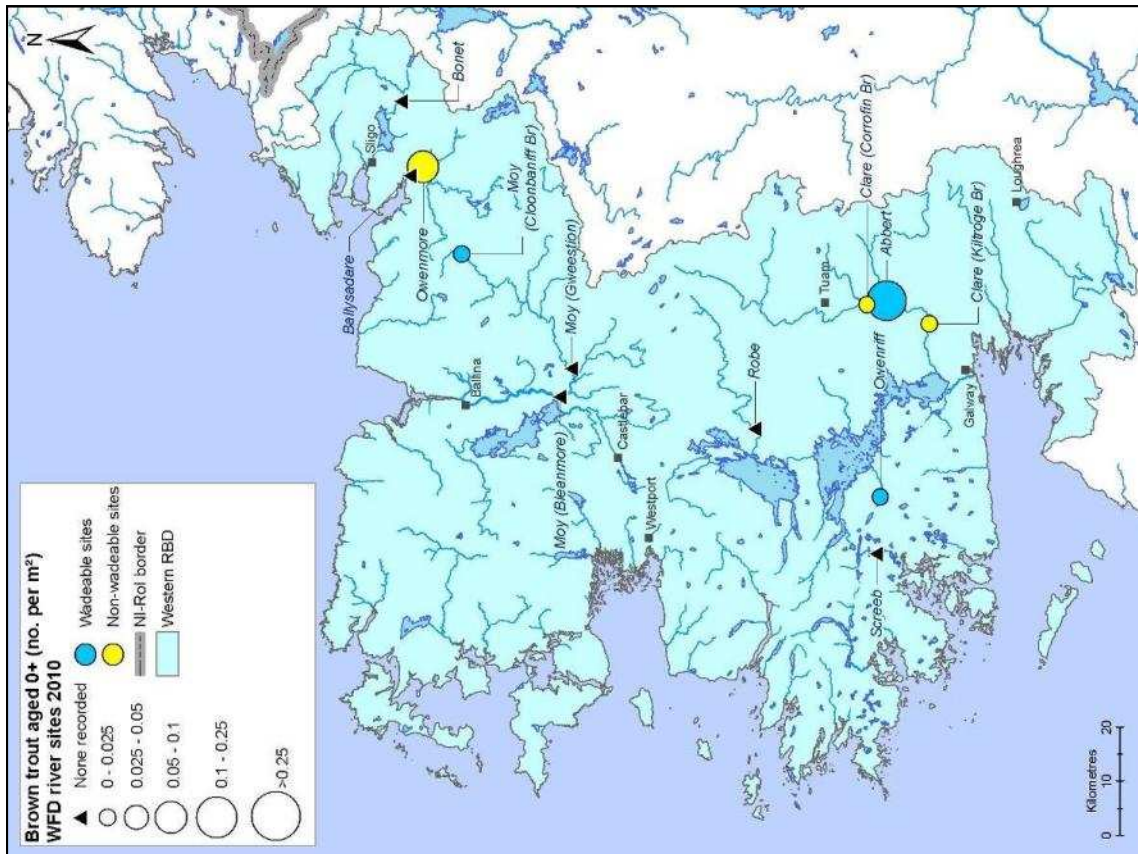


Fig. 4.42. Distribution map for 0+ brown trout in the WRBD, WFD surveillance monitoring 2010



Fig. 4.44. Distribution map for sea trout in the WRBD, WFD surveillance monitoring 2010

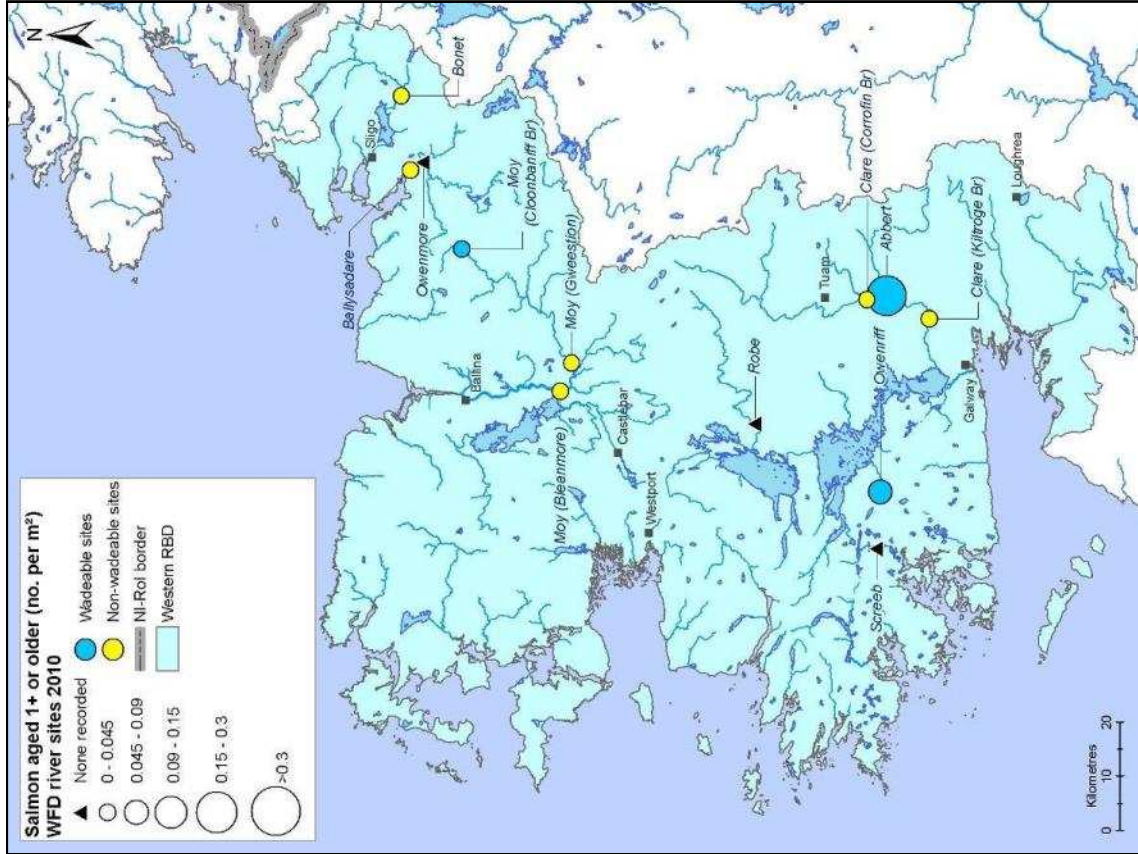


Fig. 4.46. Distribution map for 1+ or older salmon in the WRBD, WFD surveillance monitoring 2010

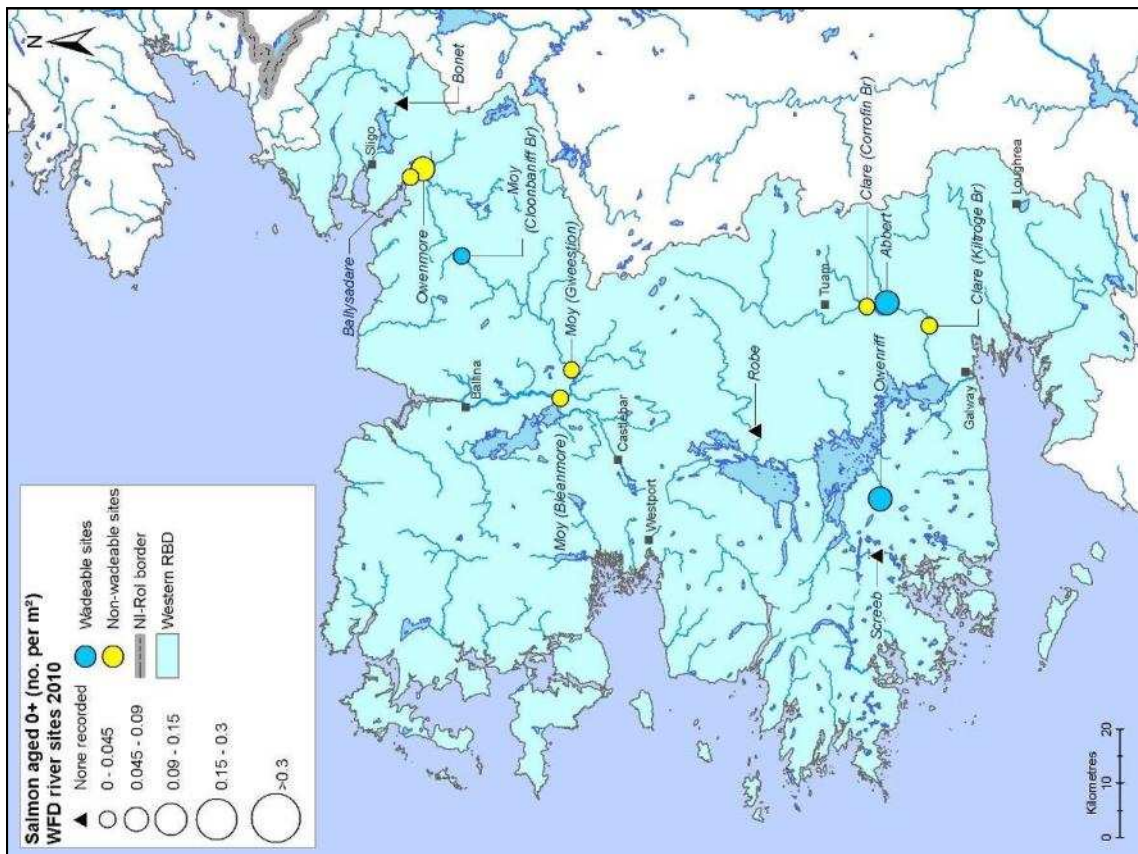


Fig. 4.45. Distribution map for 0+ salmon in the WRBD, WFD surveillance monitoring 2010



Fig. 4.47. Distribution map for minnow in the WRBD, WFD surveillance monitoring 2010

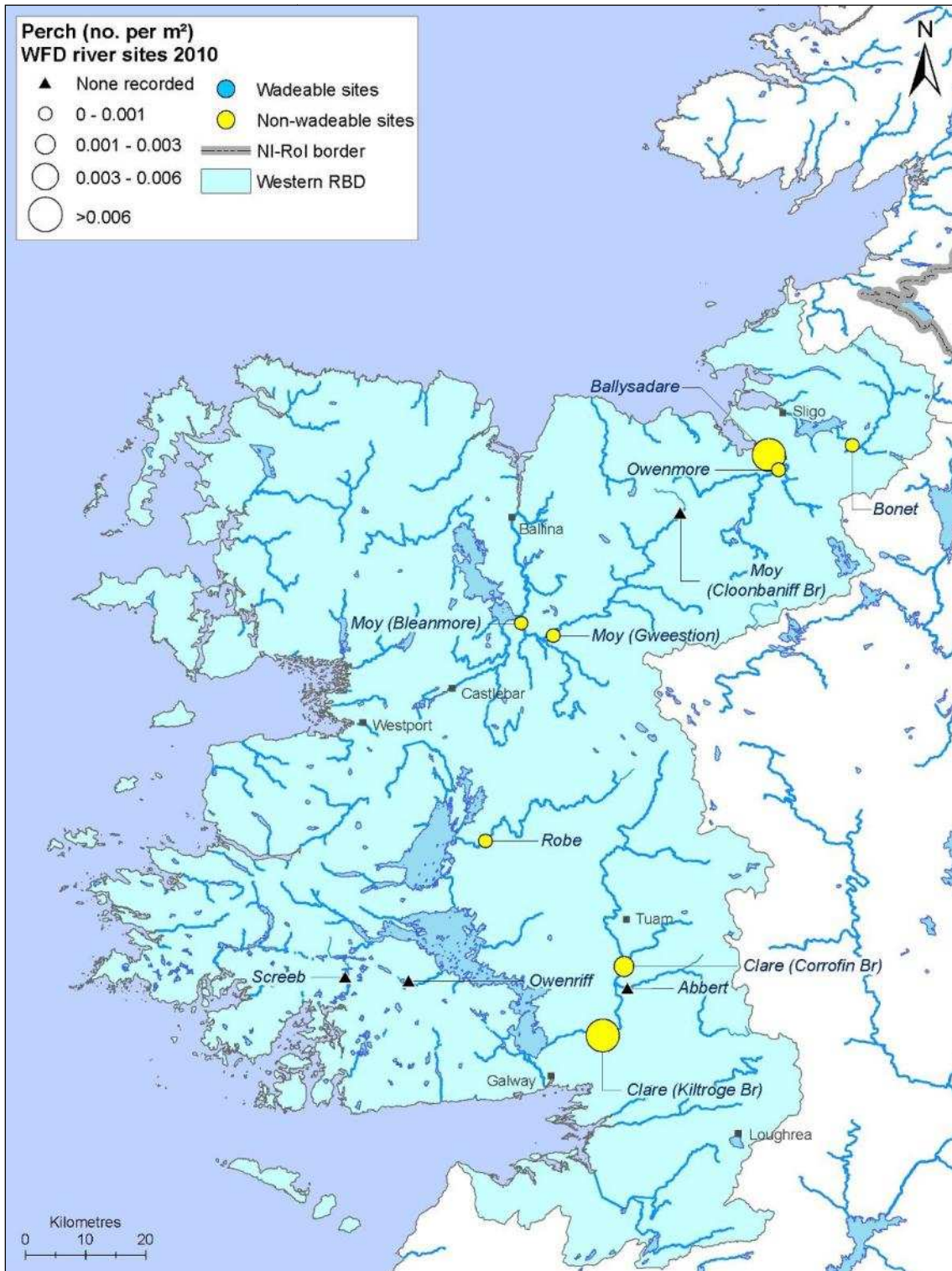


Fig. 4.48. Distribution map for perch in the WRBD, WFD surveillance monitoring 2010



Fig. 4.49. Distribution map for three-spined stickleback in the WRBD, WFD surveillance monitoring 2010



Fig. 4.50. Distribution map for eels in the WRBD, WFD surveillance monitoring 2010



Fig. 4.51. Distribution map for roach in the WRBD, WFD surveillance monitoring 2010

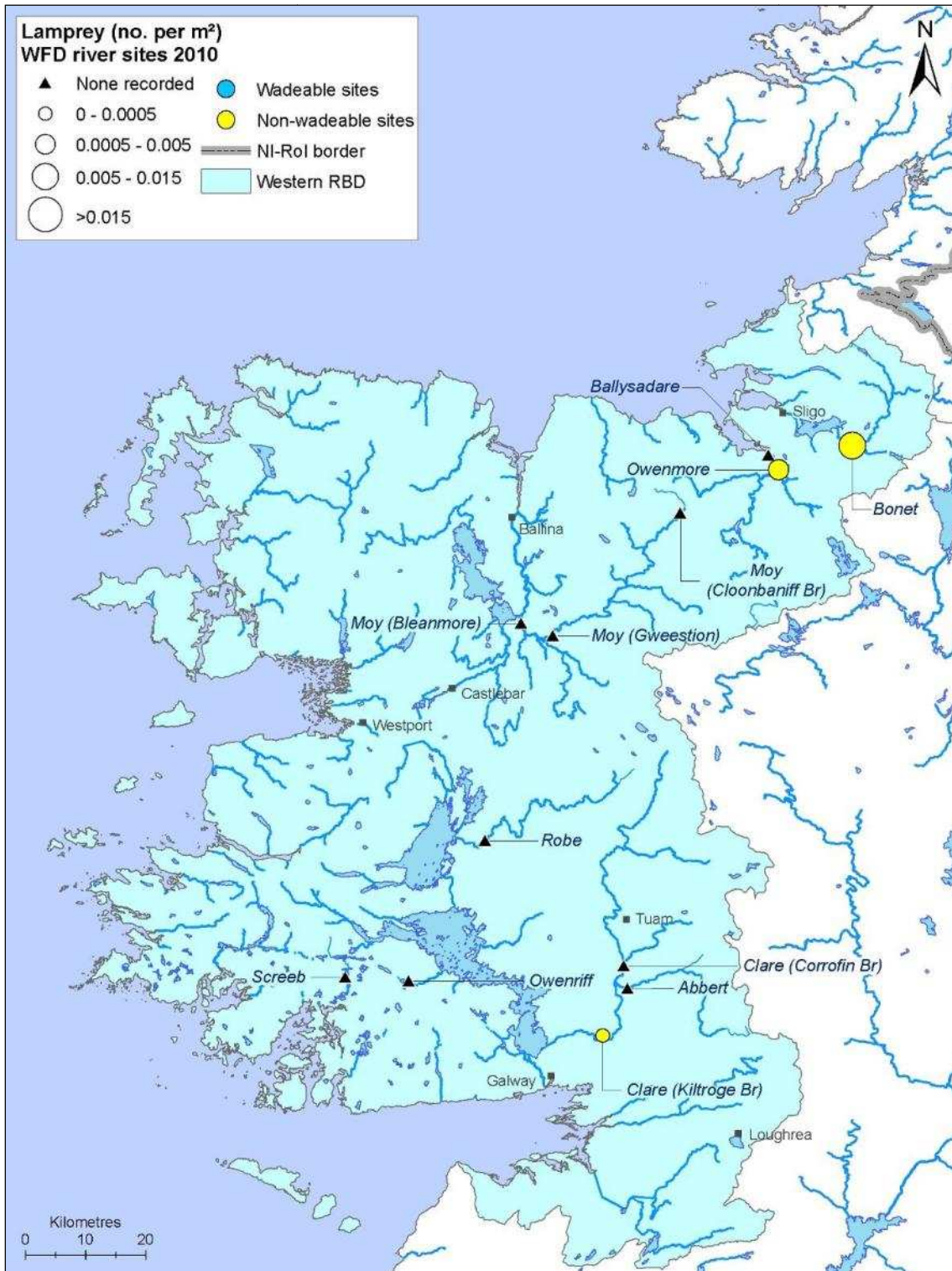


Fig. 4.52. Distribution map for lamprey in the WRBD, WFD surveillance monitoring 2010



Fig. 4.53. Distribution map for pike in the WRBD, WFD surveillance monitoring 2010



Fig. 4.54. Distribution map for stone loach in the WRBD, WFD surveillance monitoring 2010



Fig. 4.55. Distribution map for gudgeon in the WRBD, WFD surveillance monitoring 2010



Fig. 4.56. Distribution map for nine-spined stickleback in the WRBD, WFD surveillance monitoring 2010

4.3.3 Growth rates of brown trout, salmon and roach

Growth rates based on back-calculated length-at-age data were analysed for brown trout (Fig. 4.57) and salmon (Fig. 4.58) in each river site surveyed in the WRBD during 2010.

Brown trout were recorded in all sites except for the Screeb river. The largest brown trout recorded in the WRBD during 2010 was captured in the River Clare (Corrofin), measuring 50cm in length. 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. Accordingly, the growth of brown trout was classified as ‘very slow’ in the Abbert site, ‘slow’ in the Bonet, Moy (Bleanmore), Moy (Cloonbaniff), Moy (Gweestion) and Owenriff sites, ‘fast’ in the Ballysadare, Owenmore and Robe sites and ‘very fast’ in the Clare (Kiltroge) site (Appendix 1).

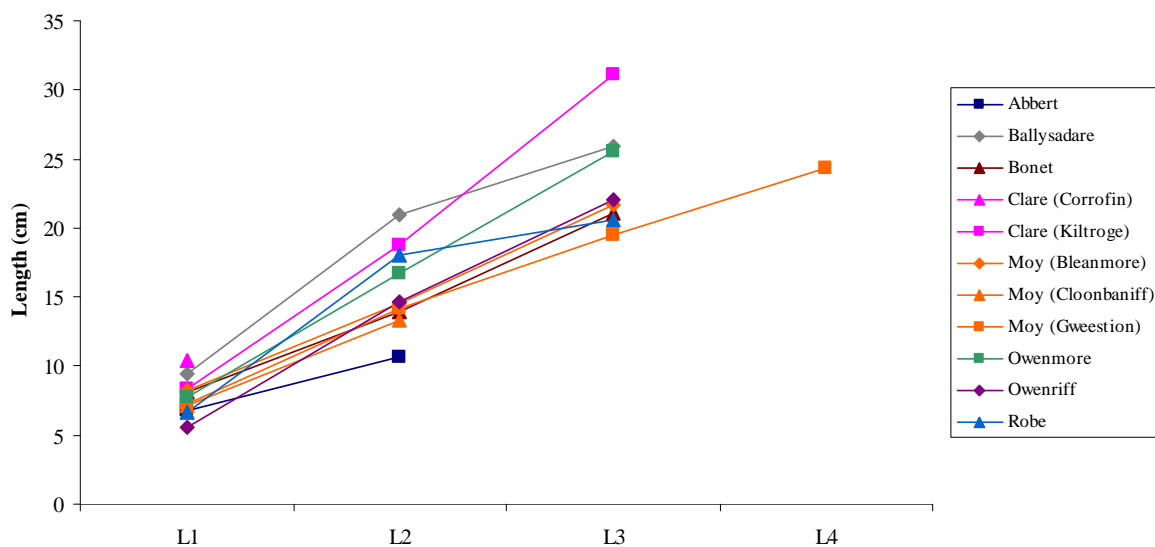


Fig. 4.57. Back calculated lengths for brown trout in the WRBD, WFD surveillance monitoring 2010

Salmon were recorded in all sites except for the Robe and the Screeb. The largest juvenile salmon recorded in the WRBD during 2010 was captured in the Owenriff site, measuring 17.6cm in length. Adult salmon were captured in both sites on the River Clare, the largest of which was recorded in the Clare (Corrofin) site, measuring 62cm in length. Most rivers in which juvenile salmon were present contained fish aged at least 2+. Unusually, the Owenriff had small numbers of relatively old juvenile salmon that were aged 3+ and had a mean L3 of 14.1cm. The mean salmon L1 ranged from 3.9cm in the Owenriff site to 5.4cm in the Owenmore site. The mean salmon L2 ranged from 7.1cm in the Abbert and the Moy (Bleanmore) sites to 9.2cm in the Owenmore site.

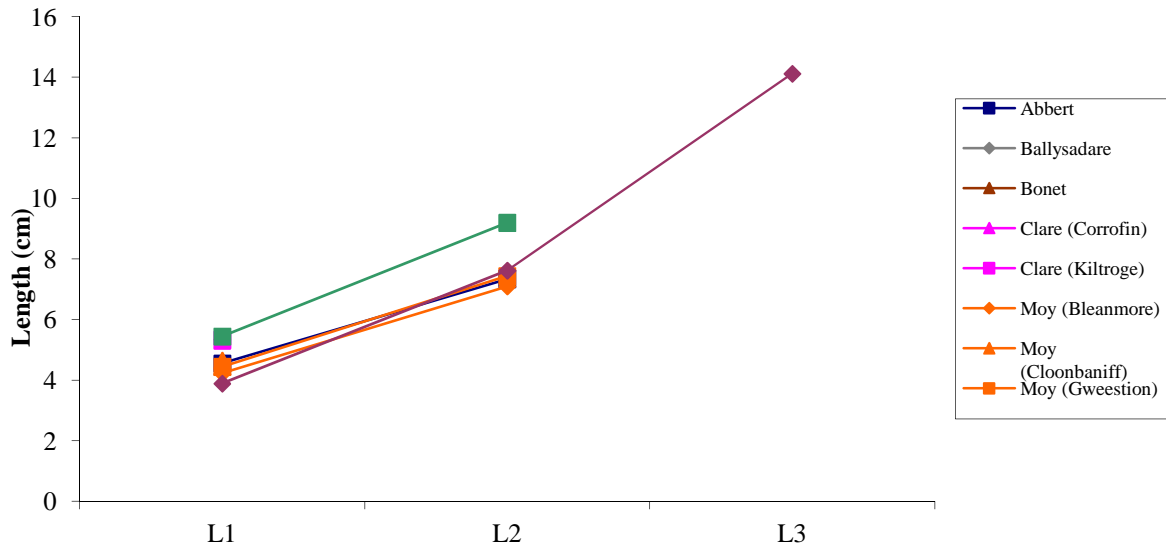


Fig. 4.58. Back calculated lengths for salmon in the WRBD, WFD surveillance monitoring 2010

The mean back-calculated length-at-age data for roach in the WRBD are shown in Figure 4.59 and Appendix 3. Roach were recorded in five sites surveyed in the WRBD during 2010 - Ballysadare, Clare (Corrofin), Clare (Kiltroge), Moy (Bleanmore) and Moy (Gweestion). Roach ages ranged from 0+ to 8+, with fish aged 1+ being the most abundant age class at three out of the five sites. The largest roach recorded in the WRBD during 2010 measured 27.1cm in length, weighed 364g and was aged 8+. The mean L1 of roach ranged from 1.9cm in the Moy (Gweestion) site to 3.8cm in the Clare (Kiltroge) site (Appendix 3).

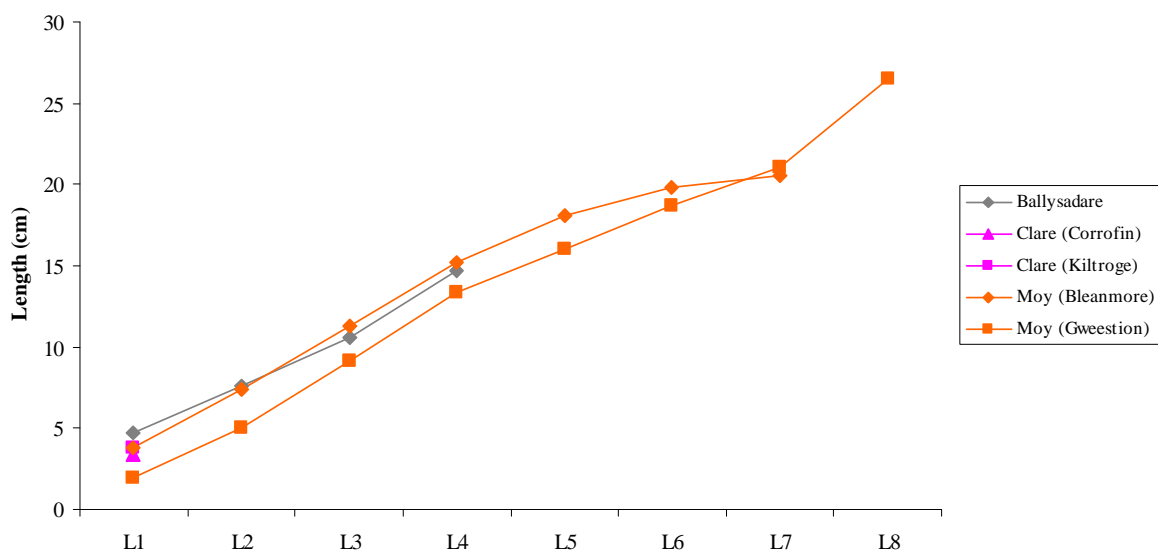


Fig. 4.59. Back calculated lengths for roach in the WRBD, WFD surveillance monitoring 2010

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 Management Plans.

An ecological classification tool for fish in rivers has recently been developed for Ecoregion 17 (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 have contributed data which was used in the model development. It was recommended during the earlier stages of this project that an approach similar to that developed by the Environment Agency in England and Wales (Fisheries Classification Scheme 2, or 'FCS2') be used. This approach has broadly been followed and improved to develop the new classification tool – 'FCS2 Ireland'. The tool works by comparing various fish community metric values within a site (observed) to those predicted (expected) for that site under reference (un-impacted) conditions using a geo-statistical model based on Bayesian probabilities. The resultant output is an Ecological Quality Ratio (EQR) between 1 and 0, with five class boundaries defined along this range corresponding with the five ecological status classes of High, Good, Moderate, Poor and Bad. Confidence levels are assigned to each class and represented as probabilities.

Using FCS2 Ireland, along with expert opinion, each river site surveyed during 2010 has been assigned a draft fish ecological status class (Table 4.13).

All sites surveyed in the WRBD have been assigned a classification of at least Moderate status, with seven sites achieving Good status.

Table 4.13. Ecological status of sites surveyed in the WRBD for surveillance monitoring 2010

River	Site code	Site name	Fish ecological status (2010)	Previous Fish ecological status (2008-2009)
WRBD Wadeable sites				
Abbert	30A010500F	Bridge at Bullaun	Good	-
Moy	34M020050F	Cloonbaniff Br.	Moderate	Moderate
Owenriff	30O020070F	D/s of Lough Agraiffard	Good	-
WRBD Non-wadeable sites				
Ballysadare	35B050100F	Ballysadare Br.	Good	-
Bonet	35B060600F	1.8 km d/s Dromahair Br.	Moderate	-
Clare	30C010800F	Corrofin Br.	Moderate	-
Clare	30C011150F	Kiltroe Castle Br.	Good	-
Moy	34M020750F	At Bleanmore	Good	-
Moy	34M020650F	Ford 2 km u/s Gweestion River	Good	-
Owenmore (Sligo)	35O060900F	300m u/s Unshin confluence	Good	-
Robe	30R010600F	Akit Br.	Moderate	-
Screeb	31S010300F	d/s of Loughaunfree	N/A*	-

*Note: * denotes that site requires a resurvey to confirm status, additional sites within the waterbody will also be surveyed to support existing data*

5. DISCUSSION

A total of 13 fish species (sea trout are included as a separate ‘variety’ of trout) were recorded in the WRBD during the 2010 WFD surveillance monitoring program. This was the highest species diversity recorded for any region and equal to the number recorded in the South Western River Basin District (SWRBD), where there was also a high number of non-native species present. Information on fish species richness, composition, distribution and abundance throughout the whole country can be found in the WFD summary report for 2010 (Kelly *et al.*, 2011).

The Ballysadare and Bonet Rivers were the two most diverse sites surveyed within the WRBD during 2010, with a total of nine species present in each. The highest species diversity recorded in any site throughout the country was ten and this only occurred in one site within the SWRBD (River Blackwater at Lismore), where there was a high number of non-native fish present. Low species diversity is common in rivers throughout Ireland that contain only native fish species, a trait common in many rivers along the western coast of Ireland (Kelly *et al.*, 2009, Kelly *et al.*, 2010, Kelly *et al.*, 2011).

Brown trout were the most commonly encountered species within the WRBD, being recorded in 11 of the 12 sites surveyed, whilst salmon were present in ten of the sites surveyed. The highest densities of both brown trout and salmon were recorded in the Abbert River in Co. Galway. The River Moy (Gweestion) was the only WRBD site during 2010 in which sea trout were recorded.

Ireland’s indigenous fauna has come under increasing threat from non-native introductions. Invasions by non-native species represent one of the greatest threats to natural biodiversity, second only to habitat destruction (Scalera and Zaghi, 2004). Non-native and invasive species can transform ecosystems, threatening both indigenous and high conservation status species (Stokes *et al.*, 2006), with impacts including displacement through competition for space and food. Direct impacts through predation are also evident (Barton and Heard, 2005). Eno *et al.* (1997) differentiate between non-native and alien species, with the former being those that have established themselves and the latter being those that have not established themselves and cannot do so without some sort of human intervention. A total of six non-native fish species were recorded in the WRBD during 2010.

Following the methods of Kennedy and Fitzmaurice (1971), the growth of brown trout was classified as ‘very slow’ in the Abbert site, ‘slow’ in the Bonet, Moy (Bleanmore), Moy (Cloonbaniff), Moy (Gweestion) and Owenriff sites, ‘fast’ in the Ballysadare, Owenmore and Robe sites and ‘very fast’ in the Clare (Kiltroge) site (Appendix 1). In particular, the Ballysadare, Clare (Corrofin), Clare (Kiltroge), Owenmore and Robe sites had the highest mean values for L1 to L3 amongst all river sites surveyed throughout the country during 2010.

Using the recently completed ecological classification tool for fish in rivers (FCS2 Ireland), along with expert opinion, each river site surveyed during 2010 has been assigned a draft ecological status

classification based on the fish populations present. All sites surveyed in the WRBD have been assigned a classification of at least Moderate status, with seven sites achieving Good status.

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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	L4	Growth category
Abbert	Mean	6.7	10.7			Very slow
	S.D.	1.6	n/a			
	S.E.	0.4	n/a			
	n	18	1			
	Min	3.3	10.7			
	Max	8.8	10.7			
Ballysadare	Mean	9.5	20.9	25.9		Fast
	S.D.	1.6	3.1	n/a		
	S.E.	0.5	1.4	n/a		
	n	12	5	1		
	Min	7.4	17.8	25.9		
	Max	12.4	25.1	25.9		
Bonet	Mean	8.1	13.9	21.0		Slow
	S.D.	n/a	n/a	n/a		
	S.E.	n/a	n/a	n/a		
	n	1	1	1		
	Min	8.1	13.9	21.0		
	Max	8.1	13.9	21.0		
Clare (Corrofin)	Mean	10.4				n/a
	S.D.	n/a				
	S.E.	n/a				
	n	1				
	Min	10.4				
	Max	10.4				
Clare (Kiltroge)	Mean	8.3	18.8	31.2		Very fast
	S.D.	2.1	4.6	n/a		
	S.E.	0.5	1.6	n/a		
	n	15	8	1		
	Min	4.7	11.0	31.2		
	Max	11.6	23.4	31.2		
Moy (Bleanmore)	Mean	8.2	14.6	21.7		Slow
	S.D.	2.0	3.0	n/a		
	S.E.	0.7	1.7	n/a		
	n	8	3	1		
	Min	4.5	11.2	21.7		
	Max	10.0	16.9	21.7		
Moy (Cloonbaniff)	Mean	7.1	13.3			Slow
	S.D.	1.6	2.1			
	S.E.	0.3	0.7			
	n	26	8			
	Min	3.6	10.8			
	Max	10.0	17.2			

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	Growth category
Moy (Gweestion)	Mean	7.3	14.2	19.5	24.3	Slow
	S.D.	1.7	2.7	1.7	2.2	
	S.E.	0.2	0.5	0.5	1.6	
	n	49	34	12	2	
	Min	4.1	9.4	16.1	22.7	
	Max	10.9	19.6	22.7	25.9	
Owenmore (Sligo)	Mean	7.8	16.7	25.5		Fast
	S.D.	1.9	3.3	0.8		
	S.E.	0.4	0.9	0.6		
	n	19	14	2		
	Min	3.3	11.9	25.0		
	Max	10.5	24.6	26.1		
Owenriff	Mean	5.5	14.6	22.1		Slow
	S.D.	1.2	n/a	n/a		
	S.E.	0.6	n/a	n/a		
	n	4	1	1		
	Min	4.2	14.6	22.1		
	Max	6.6	14.6	22.1		
Robe	Mean	6.6	18.0	20.6		Fast
	S.D.	2.2	1.4	n/a		
	S.E.	1.3	0.8	n/a		
	n	3	3	1		
	Min	4.6	16.6	20.6		
	Max	9.0	19.4	20.6		

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	L3	L4
Abbert	Mean	4.6	7.3		
	S.D.	1.6	0.7		
	S.E.	0.3	0.3		
	n	25	7		
	Min	2.2	6.4		
	Max	7.4	8.4		
Ballysadare	Mean	5.3			
	S.D.	1.2			
	S.E.	0.2			
	n	34			
	Min	2.8			
	Max	8.1			
Bonet River	Mean	4.4			
	S.D.	n/a			
	S.E.	n/a			
	n	1			
	Min	4.4			
	Max	4.4			
Clare (Corrofin)	Mean	5.3			
	S.D.	1.1			
	S.E.	0.2			
	n	22			
	Min	2.8			
	Max	7.8			
Clare (Kiltroge)	Mean	5.3			
	S.D.	1.0			
	S.E.	0.2			
	n	25			
	Min	3.5			
	Max	7.0			
Moy (Bleanmore)	Mean	4.2	7.1		
	S.D.	0.8	0.8		
	S.E.	0.2	0.5		
	n	20	3		
	Min	2.8	6.2		
	Max	5.7	7.8		
Moy (Cloonbaniff)	Mean	4.6			
	S.D.	1.7			
	S.E.	0.7			
	n	6			
	Min	2.6			
	Max	7.2			

APPENDIX 2 continued

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

River		L1	L2	L3	L4
Moy (Gweestion)	Mean	4.4	7.4		
	S.D.	1.0	0.5		
	S.E.	0.2	0.2		
	n	25	6		
	Min	2.4	7.0		
	Max	7.0	8.1		
Owenmore (Sligo)	Mean	5.4	9.2		
	S.D.	1.2	2.0		
	S.E.	0.2	1.4		
	n	35	2		
	Min	2.9	7.8		
	Max	7.4	10.6		
Owenriff	Mean	3.9	7.6	14.1	
	S.D.	1.1	1.6	1.8	
	S.E.	0.2	0.5	1.3	
	n	25	12	2	
	Min	2.6	4.8	12.8	
	Max	6.5	10.5	15.4	

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	L5	L6	L7	L8
Ballysadare	Mean	4.8	7.6	10.6	14.7				
	S.D.	n/a	n/a	n/a	n/a				
	S.E.	n/a	n/a	n/a	n/a				
	n	1	1	1	1				
	Min	4.8	7.6	10.6	14.7				
	Max	4.8	7.6	10.6	14.7				
Clare (Corrofin)	Mean	3.4							
	S.D.	0.9							
	S.E.	0.4							
	n	5							
	Min	2.6							
	Max	4.7							
Clare (Kiltroge)	Mean	3.8							
	S.D.	0.6							
	S.E.	0.2							
	n	8							
	Min	2.9							
	Max	4.8							
Moy (Bleanmore)	Mean	3.8	7.3	11.3	15.2	18.1	19.8	20.5	
	S.D.	1.2	1.5	1.6	1.7	1.4	1.1	n/a	
	S.E.	0.2	0.2	0.2	0.3	0.3	0.8	n/a	
	n	58	51	44	29	18	2	1	
	Min	2.0	4.4	8.2	11.1	14.4	19.0	20.5	
	Max	6.0	10.1	14.3	17.9	20.7	20.6	20.5	
Moy (Gweestion)	Mean	1.9	5.1	9.1	13.3	16.1	18.7	21.1	26.5
	S.D.	0.5	1.2	1.6	1.7	1.6	1.8	2.1	n/a
	S.E.	0.1	0.2	0.2	0.3	0.3	0.4	0.7	n/a
	n	52	51	47	38	31	17	9	1
	Min	1.1	3.0	6.0	9.6	12.5	15.0	18.1	26.5
	Max	4.5	8.4	14.1	17.1	19.5	22.9	25.3	26.5



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