ShRFB Rivers

Rivers 2008

Sampling Fish for the Water Framework Directive -



The Central and Regional Fisheries Boards

PROJECT PERSONNEL

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1. INTRODUCTION

Fish stock surveys were undertaken in 83 river sites throughout Ireland during the summer of 2008 as part of the programme for sampling fish for the Water Framework Directive. Twenty-nine of these sites were located within the Shannon Regional Fisheries Board (ShRFB and surveys were undertaken on these between July and early October 2008 by staff from the Central Fisheries Board (CFB) and the ERFB (Fig. 2.1). The sites surveyed were selected based on criteria set down by the Environmental Protection Agency. These surveys are required by both Irish and European law (Council of the European Communities, 2000). Annex V of the European Water Framework Directive (WFD) stipulates 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). Although fish survey work has been carried out in Ireland in the past, no project to date has been as extensive as the present study in providing WFD compliant data on all fish species. Continued surveying of these and additional river sites will provide a useful baseline for monitoring water quality in the future.

The ShRFB is home to Ireland's longest river and is Ireland's largest regional fisheries board. Many counties from across all four provinces are encompassed within this region. The ShRFB covers an area of over 17,700km², stretching from where the River Shannon rises in County Cavan to as far south as Kerry Head. Its coastline is around 560 kilometers long, much of which is accounted for by the Shannon Estuary. There are numerous lakes within the ShRFB, including Lough Allen, Lough Ree and Lough Derg. The Shannon River itself is the largest river within the region and has some major tributaries, such as the Rivers Inny and Suck. Two of the major independent rivers in the Shannon Region are the River Feale in Co. Kerry and Maigue River in Co. Limerick. The population of the region is spread over a number of large towns, the largest of which is Limerick City. Other urban centres include Athlone, Ennis, Mullingar and Tullamore. The Shannon region contains a lot of agricultural activity, with dairy and meat production being the most economically important. Peat extraction is also important to the region for power generation, and the region's waterways provide an important amenity for tourism activities involving boating and fishing.

This report summarizes the main findings of the fish stock surveys in the 29 river waterbodies surveyed in the ShRFB during 2008 and reports the current status of the fish stocks in each of these.

2. STUDY AREA

Twenty-nine sites were surveyed within the ShRFB in 2008. Eight of these were sampled using bank based electric-fishing units (hand-set sites) and the remaining 21 were sampled using boat based electric-fishing units (boat sites). Table 2.1 and Figure 2.1 show the list of sites sampled and their locations within the ShRFB.

Site	Catchment	Easting	Northing	Catchment Size (km ²)	Width (m)	Area (m ²)	Mean Depth (m)	Max Denth (m)
			Hand-set	sites	(11)	(111)	Deptil (III)	Deptii (iii)
Boor	Shannon Upr	209753	234942	<100	4.80	413	0.51	1.11
Bow	Shannon Lwr	166601	186922	<100	5.47	492	0.27	0.61
Broadford	Bunratty	160845	172127	<100	3.60	288	0.48	0.6
Glenfelly Stream	Shannon Lwr	220199	201371	<10	3.06	275	0.21	0.52
Gourna	Bunratty	148253	164353	<100	3.78	341	0.31	0.53
Graney	Shannon Lwr	155530	190009	<100	5.43	435	0.26	0.45
Inny (Oldcastle)	Inny	254918	279257	<100	2.87	258	0.42	0.67
Little (Cloghan)	Shannon Lwr	206305	217768	<100	3.80	171	0.30	0.53
			Boat sit	es				
Brosna (Clonony)	Shannon Lwr	204896	220903	<10000	22.00	8800	1.05	2
Brosna (Pollagh)	Shannon Lwr	219013	225727	<1000	28.00	12432	1.32	1.85
Camlin	Shannon Upr	209657	277707	<1000	11.21	2802	0.87	1.04
Clodiagh (Tullamore)	Shannon Lwr	225710	225628	<1000	7.60	1201	0.65	1.08
Cross	Shannon Upr	203693	239201	<1000	6.20	1091	1.27	1.9
Deel (Newcastlewest)	Shannon Est Sth	132454	128637	<1000	8.60	1720	0.60	1.01
Feale	Feale	106919	130913	<1000	31.00	9765	0.44	1
Feorish	Shannon Upr	190029	310567	<100	9.05	17512	1.77	2.15
Fergus (Clonroad)	Fergus	134524	177868	<100	23.20	10069	1.86	3
Inny (Shrule)	Inny	213517	255885	<10000	18.80	7144	0.73	1.3
Kilcrow	Shannon Lwr	179808	205671	<1000	10.20	2815	0.63	0.97
Little Brosna	Shannon Lwr	205262	203497	<1000	10.65	2130	0.57	0.78
Maigue	Shannon Est Sth	147928	144017	<1000	28.40	14683	1.19	1.9
Mountnugent	Inny	249044	285710	<100	7.54	1373	0.67	1.26
Scramoge	Shannon Upr	191810	277708	<1000	10.10	2939	1.53	2
Shannon (Battle Br.)	Shannon Upr	194824	305035	<1000	33.20	20916	0.97	2
Silver (Kilcormac)	Shannon Lwr	213810	219891	<1000	7.68	998	0.75	1.11
Smearlagh	Feale	103052	132839	<1000	15.20	3526	0.39	1.07
Suck (Ballyforan)	Suck	181589	246423	<10000	35.80	12172	0.66	1.04
Suck (Cloondacarra)	Suck	167185	278205	<1000	9.20	1923	0.58	0.83
Tullamore	Shannon Lwr	229267	225275	<1000	6.83	1281	0.71	1.05

Table 2.1. List of river sites surveyed for WFD surveillance monitoring in the ShRFB, July to October 2008, details of catchment area (km²), wetted width, surface area (m²), mean depth (m) and max depth (m) are included



Fig. 2.1. Location map of river sites surveyed throughout the ShRFB for WFD surveillance monitoring 2008

3. METHODS

Electric fishing is the method of choice for surveillance monitoring of fish in rivers in order to obtain a representative sample of the fish assemblage at each sampling site. The technique complies with European Committee for Standardisation (CEN) guidelines for fish stock assessment in wadeable rivers (CEN, 2003). At each site the stretch sampled was isolated, where possible, using stop nets and one to three fishings were carried out using bank-based electric fishing units (hand-sets) or boat-based electric fishing units carried in flat-bottomed boats. Each site ideally included all habitat types: riffle, glide and pool. At each site, a number of physical habitat variables were measured, water samples for chemical analyses and a multihabitat kick sample for macroinvertebrates were taken, and a macrophyte survey was conducted.

Fish captured in each fishing occasion were sorted and processed separately. During processing, the species of each fish was identified and its length and weight were measured; sub-samples were weighed when large numbers of fish were present. For species identification, river lamprey (*Lampetra fluviatilis*) and brook lamprey (*Lampetra planeri*) were treated as a single species. Scales were taken from salmonids greater than 8.0cm and from most coarse fish species. Opercular bones were used to age perch captured. All fish were held in a large bin of oxygenated water after processing until they were fully recovered and were then returned to the water. Samples of eels were retained for further analysis.

A subsample of the dominant fish species were aged (five fish from each 1cm size class). Fish scales were aged using a microfiche reader. Opercular bones were aged using an epidioscope and an Olympus microscope (SZX10)/digital camera system. Growth rates were determined by back-calculating lengths at the end of each winter, L1 being the mean length at the end of the first winter, etc.



Plate 3.1. Electric fishing in a small wadeable stream using bank based units

4. RESULTS

- 4.1 Wadeable hand-set sites
- 4.1.1 The Boor River



Plate 4.1. The Boor River just north of Ballynahown

The Boor (Plate 4.1) is a small stream draining farmland along the Offaly–Westmeath border. It joins the Shannon River just south of the point where the borders of Co. Roscommon, Co. Westmeath and Co. Offaly meet. The Boor has been straightened considerably and has very high banks on each side. On the 24th of September 2008, two bank-based electric-fishing units were used to conduct three fishings along an 86m stretch of river channel at the bridge located approximately two kilometers north of Ballynahown on the N62 (Fig. 4.1). The site comprised 44m upstream and 42m downstream of the bridge. Despite its narrow mean width of 4.8m, the Boor was quite deep in places and had an average depth of 0.5m. The total wetted area sampled was 412.8 m². The site was dominated by mud and silt substrate, with some

cobble and gravel, and consisted mainly of glide habitat. Trees along the banks provided heavy shading to the channel upstream of the bridge, while downstream of the bridge there was minimal shading. The adjacent land is primarily pasture. The Boor River being quite a deep and slow moving channel was quite poor in macrophyte vegetation. The dominant species present were tall vascular emergent plants, such as *Sparganium erectum* and *Phalaris arundinacea*.



Fig. 4.1. Location of the Boor River WFD surveillance monitoring site 2008

The Boor had quite a diverse fish fauna, with eight species recorded (Table 4.1). Brown trout was the most abundant species, followed by gudgeon.

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0412	0.1225	0.1817
Gobio gobio	Gudgeon	-	-	0.0436
Phoxinus phoxinus	Minnow	-	-	0.0194
Lampetra spp.	Lamprey	-	-	0.0097
Barbatula barbatula	Stone loach	-	-	0.0097
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0048
Anguilla anguilla	Eel	-	-	0.0048
Rutilus rutilus	Roach	-	-	0.0024
All fish	All fish	-	-	0.2762

Table 4.1. Density of fish (no./m²), Boor River site (fish density has been calculated as minimum estimates based on 3 fishings)

Brown trout in the Boor River ranged in length from 6.0cm to 23.4cm (Fig. 4.2). Scale analysis showed that age classes from 0+ to 3+ were present. Length frequency and age analysis indicate that 0+, 1+, 2+ and 3+ fish account for approximately 25%, 32%, 41% and 1% of the brown trout population respectively at the site. The largest brown trout captured was a 2+ fish measuring 23.4cm in length and 151.5g in weight. Mean L1, L2 and L3 of trout in the Boor River were 7.2cm, 15.8cm and 20.8cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the Boor River was categorised as slow (Appendix 1).



Fig. 4.2. Length frequency distribution for brown trout in the Boor River, September 2008 (n = 75)

4.1.2 The Bow River



Plate 4.2. The Bow River at the Bow River Bridge

The Bow River (Plate 4.2) is a small stream in Co. Clare that flows south out of the Slieve Aughty Mountains into Lough Derg approximately two kilometres west of Holy Island on the lake. Two bankbased electric-fishing units were used to conduct three fishings along a 90m river stretch located downstream of Bow River Bridge, about three kilometres northeast of Scarriff on the 29th of August 2008 (Fig. 4.3). The mean channel width and depth were 5.5m and 0.3m respectively. The total wetted area sampled was 492.3 m².

Unlike many of the other streams in the Shannon region, the Bow was a heavily shaded channel with a relatively steep gradient. The adjacent land was mainly pasture. The site was dominated by cobble and boulder substrate, and the habitat types were a mixture of riffle, glide and pool. Other than bryophytes (mosses), macrophyte vegetation was rare in the Bow River. Three common submerged bryophytes were recorded: *Fontinalis antipyretica, Rhynchostegium riparioides* and *Chiloscyphus polyanthus*.

Racomitrium aciculare is typical in a site like this and was observed on boulders protruding through the surface of the water in the splash zone. *Oenanthe crocata* was the only emergent species seen, and other species present were mostly bank side and woodland bryophytes such as *Lunularia cruciata*, *Marchantia polymorpha* and *Mnium hornum*



Fig 4.3. Location of the Bow River WFD surveillance monitoring site 2008

Five fish species were recorded in the Bow River (Table 4.2). Brown trout was by far the most abundant species, followed by salmon.

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.1686	0.3291	0.4977
Salmo salar	Salmon	0.0041	0.0711	0.0752
Barbatula barbatula	Stone loach	-	-	0.0508
Anguilla anguilla	Eel	-	-	0.0203
Phoxinus phoxinus	Minnow	-	-	0.0020
All fish	All fish	-	-	0.6460

Table 4.2. Density of fish (no./m²), Bow River site (fish density has been calculated as minimum estimates based on 3 fishings)

Brown trout in the Bow River ranged from 5.0cm to 25.0cm in length (Fig. 4.4). Scale analysis showed that the age classes 0+ to 4+ were present. Length frequency and age analysis indicate that 0+, 1+, 2+, 3+ and 4+ fish account for approximately 34%, 43%, 19%, 3% and 1% of the brown trout population respectively. The largest brown trout recorded were a pair of 4+ fish that both measured 25.0cm in length and 182.0 g in weight. Mean L1, L2, L3 and L4 of brown trout in the Bow River were 6.2cm, 11.9cm, 16.2cm and 20.4cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the Bow River was categorised as very slow (Appendix 1).

Salmon ranged in length from 6.4cm to 12.5cm (Fig. 4.5). Scale analysis showed that 1+ fish ranged from 9.9cm to 12.5cm. Scale and length frequency analyses indicate that 0+ and 1+ fish accounted for approximately 5% and 95% of the juvenile salmon population at the site, respectively. The mean L1 length was 5.0cm.

Eels ranged in length from 27.6cm to 42.1cm at the site.



Fig. 4.4. Length frequency distribution for brown trout in the Bow River, August 2008 (n = 245)



Fig. 4.5. Length frequency distribution for salmon in the Bow River, August 2008 (n = 37)

4.1.3 The Broadford River



Plate 4.3. The Broadford River at Scott's Bridge

The Broadford River (Plate 4.3), also known as the Glenomra River in its upper reaches, rises in the Slieve Bearnagh Mountains in Co. Clare. After passing through the village of Broadford, it flows into Doon Lough, about nine kilometres southwest of Tulla, Co. Clare. On the 27th of August 2008, two bank-based electric-fishing units were used to conduct three fishings along an 80m stretch of river just downstream of Scott's Bridge, approximately four kilometers east of the village of Broadford (Fig. 4.6). The site had a mean width of 3.6m and a mean depth of 0.5m, and the total wetted area sampled was 288m². The adjacent land on one bank consisted of poor quality pasture and gorse scrub, providing no shade to the site, whereas the opposite bank had a small coniferous forestry plantation along part of its length. The site's substrate was dominated by cobble and gravel, with some sand and mud. The habitat consisted exclusively of glide within the area sampled. Instream vegetation was quite sparse at this site and *Phalaris arundinacea* was the most frequently encountered macrophyte species, occupying much of the margins. Other plants present included *Oenanthe crocata* and *Glyceria fluitans*.



Fig 4.6. Location of the Broadford River WFD surveillance monitoring site 2008

Four fish species were recorded in the Broadford River (Table 4.3). The most abundant species was 3-spined stickleback, followed by salmon.

Species name	Common name	0+	1+ & older	Total density
Gasterosteus aculeatus	3-Spined stickleback	-	-	1.1076
Salmo salar	Salmon	0.0556	0.0069	0.0625
Salmo trutta	Brown trout	0.0069	0.0174	0.0243
Anguilla anguilla	Eel	-	-	0.0069
All fish	All fish	-	-	1.2014

 Table 4.3. Density of fish (no./m²), Broadford River site (fish density has been calculated as minimum estimates based on 3 fishings)

Three-spined stickleback in the Broadford River varied in length from 1.0cm to 5.1cm (Fig. 4.7). The density of 3-spined stickleback was high, with over one individual present in every square metre sampled.

Salmon ranged from 6.5cm to 15.4cm in length (Fig. 4.8). Scale analysis showed that 0+ and 1+ fish were present. The data indicate that 0+ and 1+ fish accounted for approximately 89% and 11% of the juvenile salmon population respectively. Mean L1 of salmon was 6.3cm.

Brown trout at the site ranged in length from 6.9cm to 16.5cm. Two eels were recorded at the site and these were 18.2cm and 20.9cm in length.



Fig. 4.7: Length frequency distribution for 3-spined stickleback in Broadford River, August 2008 (n = 319)



Fig. 4.8: Length frequency distribution for salmon in Broadford River, August 2008 (n = 18)

4.1.4 The Glenfelly River



Plate 4.4. The Glenfelly River at Glenafelly Bridge

The Glenfelly River (Plate 4.4) is a small stream that rises in the Slieve Bloom Mountains and flows north-west until it joins the Camcor River about four kilometres west of Kinnitty, Co. Offaly. On the 4th of September 2008, one bank based electric-fishing unit was used to conduct three fishings along a 90m stretch of the Glenfelly upstream of Glenafelly Bridge, which is approximately five kilometres southeast of Kinnitty (Fig. 4.9). The average channel width and depth was 3.1m and 0.2m respectively. The total wetted area was 275.0m². The dominant substrate at the site was cobble and gravel. The majority of the habitat was riffle, with some glides and pools. The main land use adjacent to the site was forestry, and a medium amount of shading was provided by bank-side vegetation. The vegetation was dominated by bryophytes such as *Chiloscyphus polyanthus*, *Hyocomium amoricum* and *Rhynchostegium riparioides*. The only emergent species encountered was *Rorippa nasturtium-aquaticum*.



Fig 4.9. Location of the Glenfelly River WFD surveillance monitoring site 2008

Only brown trout were recorded at the site in the Glenfelly Stream (Table 4.4).

Table 4.4. Density of fish (no./	m ²), Glenfelly River site (fish densi	ty has been calculated as minimum
	estimates based on 3 fishings)	

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.3273	0.1564	0.4837
All fish	All fish	0.3273	0.1564	0.4837

Brown trout ranged in length from 5.2cm to 16.5cm at the site. Trout fry constituted 68% of the total population sampled and the 1+ and 2+ age classes accounted for approximately 30% and 2% of the population respectively. The largest brown trout recorded was a 1+ fish which measured 16.5cm and 60.5g. The mean length of brown trout at L1 and L2 was 5.7cm and 11.3cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth rate in the Glenfelly River was categorised as very slow (Appendix 1).



Fig. 4.10. Length frequency distribution for brown trout in the Glenfelly River, September 2008 (n = 133)

4.1.5 The Gourna River



Plate 4.5. The Gourna River at Carrowmore Bridge

The Gourna River (Plate 4.5) is a small river that rises in the hills east of Sixmilebridge in Co. Clare. It flows southwards into the Owengarney River, which in turn flows into the Shannon Estuary near Bunratty. The survey site was located approximately 120m upstream of Carrowmore Bridge, which is approximately two kilometres south of Sixmilebridge (Fig. 4.11). On the 26th of August 2008, two bankbased electric-fishing units were used to conduct three fishings along a 90m stretch of the Gourna River. The mean channel width and depth was 3.8m and 0.3m respectively. The total wetted area sampled was 340.5m². A medium amount of shading was provided from the bank side vegetation. The dominant substrate at the site was gravel, followed by sand, cobble and boulder. Half of the habitat at the site was pasture, which was separated from the channel by a continuous line of trees on one bank. The vegetation present consisted of some species generally recognised as calcareous. Bryophytes such as *Conocephalun conicum* and *Pellia endivijfolia* were seen along the banks, while in the water itself, species

such as *Fontinalis antipyretica* and *Rhynchostegium riparioides* were recorded. Emergent macrophytes included some of the smaller shallow water species such as *Apium nodiflorum* and *Rorippa nasturtium-aquaticum*, however, *Veronica beccabunga* was the most common.



Fig 4.11. Location of the Gourna River WFD surveillance monitoring site 2008

Six fish species were recorded in the Gourna River (Table 4.5). Three-spined stickleback was the most abundant species, followed by salmon.

Species name	Common name	0+	1+ & older	Total density
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.3994
Salmo salar	Salmon	0.1703	0.0235	0.1938
Lampetra spp.	Lamprey	-	-	0.1615
Salmo trutta	Brown trout	0.0441	0.1087	0.1527
Anguilla anguilla	Eel	-	-	0.0118
Barbatula barbatula	Stone loach	-	-	0.0088
All fish	All fish	-	-	0.9281

 Table 4.5. Density of fish (no./m²), Gourna River site (fish density has been calculated as minimum estimates based on 3 fishings)

Length frequency data for 3-spined stickleback, salmon, lamprey and brown trout captured on the Gourna River are compiled in Figs 4.12 to 4.15. 3-spined stickleback ranged in length from 1.8cm to 4.3cm (Fig. 4.12). Juvenile lamprey ranged in length from 4.0cm to 13.2cm.

Salmon ranged in length from 4.8cm to 14.2cm. Scale and length frequency analysis revealed that there were three age classes (0+, 1+ and 2+) present at the site. These data indicate that 0+, 1+ and 2+ fish comprise 87%, 12% and 2% of the juvenile salmon population respectively. Mean L1 and L2 for salmon was 6.2cm and 9.4cm respectively.

Brown trout at the Gourna River site ranged in length from 5.2cm to 22.8cm (Fig. 4.5). Scale and length frequency analysis showed that the population was made up of four age classes ranging from 0+ to 3+. The data indicate 0+ (fry) made up 29% of the population and that 1+, 2+ and 3+ fish accounted for 44%, 25% and 2% respectively. The largest brown trout recorded was a 3+ fish measuring 22.8cm and weighing 134.5g. The mean length of brown trout at L1, L2 and L3 was 8.1cm, 14.2cm and 18.2cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the Gourna River was categorised as slow (Appendix 1).



Fig. 4.12. Length frequency distribution for 3-spined stickleback in the Gourna River, August 2008 (n = 136)



Fig. 4.13. Length frequency distribution for salmon in the Gourna River, August 2008 (n = 66)



Fig. 4.14. Length frequency distribution for lamprey in the Gourna River, August 2008 (n = 55)



Fig. 4.15. Length frequency distribution for brown trout in the Gourna River (n = 52)

4.1.6 The Graney River



Plate 4.6. The Graney River at Caher Bridge

The Graney River (Plate 4.6), also known as the Caher River, is a small river in Co. Clare that rises in the Slieve Aughty Mountains and drains Lough Graney and Lough O'Grady as it flows southeast into Lough Derg. An electric fishing survey (three fishings using three bank-based electric-fishing units) was conducted along an 80m stretch of river channel downstream of Caher Bridge, approximately ten kilometres northwest of Scarriff on the 28th of August 2008, TFig. 4.16). The dominant substrate at the site was gravel, with boulder, cobble and sand also present. The mean channel width was 5.4m and the mean depth was 0.3m. The total wetted area sampled was 434.5m². Approximately 50% of the site comprised of glides, with riffles and pools also present. The main land use adjacent to the site was pasture, which was separated from the channel by a continuous line of mature trees on both banks that heavily shaded the site. Bryophytes were ubiquitous at this site, with many different types present.

Woodland mosses including *Thamnobryum alopecurum*, *Mnium hornum* and *Plagiomnium undulatum* were present along the shaded banks.



Fig 4.16. Location of the Graney River WFD surveillance monitoring site 2008

Five fish species were recorded in the Graney River (Table 4.6). Brown trout was the most abundant species, followed by lamprey.

Table 4.6.	Density of fish (no./m ²),	Graney River site	e (fish density	has been	calculated as	; minimum
		estimates based or	n 3 fishings)			

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.1657	0.1450	0.3130
Lampetra spp.	Lamprey	-	-	0.0414
Salmo salar	Salmon	0.0000	0.0138	0.0138
Anguilla anguilla	Eel	-	-	0.0023
Rutilus rutilus	Roach	-	-	0.0023
All fish	All fish	-	-	0.3728

Brown trout in the Graney River ranged in length from 4.6cm to 20.5cm (Fig. 4.17). Scale analysis showed that the age classes 1+, 2+ and 3+ were present in the population. The data indicate that 0+ trout accounted for 53% of the population and that 1+, 2+ and 3+ trout made up 40%, 6% and 1%, respectively. The largest brown trout captured was a 3+ fish that measured 20.5cm and weighed 109.5g. The mean length of brown trout at L1, L2 and L3 was 6.4cm, 12.5cm and 17.6cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the Graney River was therefore categorised as very slow (Appendix 1).

Salmon ranged in length from 10.3 to 12.8cm at the site. Lamprey lengths varied from 8.2cm to 15.4cm. One specimen of roach and eel were recorded and these measured 14.5cm and 36.2cm in length respectively.



Fig. 4.17. Length frequency distribution for brown trout in the Graney River, August 2008 (n = 136)

4.1.7 The River Inny at Oldcastle



Plate 4.7. The River Inny near Oldcastle

The Upper Inny (Plate 4.7) rises on Slieve na Callaigh near Oldcastle in Co. Meath and flows eastwards along the border between Co. Meath and Co. Cavan until it joins Lough Sheelin. An electric fishing survey was conducted on the 8th of September 2008, (three fishings using one bank-based electric-fishing unit) along a 90m stretch of river approximately 150m downstream of Tubride Bridge, which is located one kilometre south of Oldcastle (Fig. 4.18). The mean width of the site was 2.9m and the mean depth was 0.4m. A total wetted area of 258m² was sampled.

The dominant substrate at the site was cobble and gravel, with some boulder and mud also present. Approximately 85% of the habitat comprised of glide and riffle, with pools making up the remainder. The main land use adjacent to the site was pasture, which was separated from the channel by fencing on one bank and a thick hedgerow providing light shade on the other. Filamentous green algae, and two commonly encountered mosses, *Rhynchostegium riparioides* and *Fontinalis antipyretica*, were recorded

instream at the site. *Phalaris arundinacea, Rorippa nasturtium-aquaticum* and *Apium nodiflorum* were encountered along the banks and in the shallow water along the margins.



Fig 4.18. Location of the Inny River at Oldcastle WFD surveillance monitoring site 2008

Only two fish species were recorded at the Inny (Oldcastle) site (Table 4.7). Brown trout was by far the most abundant, followed by 3-spined stickleback.

Table 4.7. Dens	ity of fish (no./m ²),	, River Inny (Oldcastle	e) site (fish density	has been ca	lculated as
	minin	num estimates based o	n 3 fishings)		

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.6357	0.1938	0.8295
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0426
All fish	All fish	-	-	0.8721

Brown trout at the Inny (Oldcastle) site ranged from 5.5cm to 18.3cm in length. Scale and length frequency analysis showed that the 0+, 1+ and 2+ age classes were present in the population. The data indicate that 0+ fry account for approximately 77% of the population and that 1+ and 2+ fish made up 18% and 5% respectively. The largest brown trout recorded was a 2+ fish that measured 18.3cm in length and 69.0g in weight. The mean length of brown trout at L1 and L2 was 6.6cm and 11.5cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), the growth rate of trout in the Upper Inny was therefore categorised as very slow (Appendix 1).



Fig. 4.19. Length frequency distribution for brown trout in the River Inny at Oldcastle, September 2008 (n = 214)

4.1.8 The Little River



Plate 4.8. The Little River

The Little River (Plate 4.8) is a small tributary that joins the River Brosna approximately two kilometres upstream of its confluence with the River Shannon. The channel was included in the Office of Public Works (OPW) arterial drainage scheme for the Brosna catchment, and this is reflected in the trapezoidal cross-section of the river channel. An electric fishing survey was conducted on the 3rd of September 2008, (three fishings using a single bank-based electric-fishing unit) along a 45m stretch of the Little River at the bridge on the R356 approximately two kilometres south-west of Cloghan (Fig. 4.20). The mean channel width was 3.8m and the mean depth was 0.3m. The total wetted area sampled was 171m². The dominant substrate at the site was cobble, followed by gravel, sand and boulder. The primary habitat was glide. The main land use adjacent to the site was pasture, which was separated from the channel by fencing on one bank and by a thick hedgerow that provided medium to heavy shading along the other bank. Emergent plants, including *Sparganium erectum* and *Mentha aquatica*, were more common along the

channel of this river than bryophytes. Among the submerged species recorded were the vascular plant *Potamogeton* sp. and the bryophyte *Amblystegium riparium*.



Fig 4.20: Location of the Little River WFD surveillance monitoring site 2008

Six fish species were recorded in the Little River (Table 4.8). Minnow was the most abundant species, followed by brown trout.

Table 4.8. Density of fish (no./m ²), Little River site (fish density has been calculated as minimum
estimates based on 3 fishings)

Species name	Common name	0+	1+ & older	Total density
Phoxinus phoxinus	Minnow	-	-	0.2983
Salmo trutta	Brown trout	0.0936	0.0819	0.1754
Lampetra spp.	Lamprey	-	-	0.0351
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0175
Gobio gobio	Gudgeon	-	-	0.0059
Rutilus rutilus	Roach	-	-	0.0059
All fish	All fish	-	-	0.5380

Minnow captured ranged between 3.3cm and 7.0cm in length (Fig. 4.21).

Brown trout ranged in length from 7.2cm to 24.2cm (Fig 4.22 Scale analysis showed that 0+, 1+ and 2+ fish were present in the population. The data indicates that 0+ fry made up 53% of the population and that 1+ and 2+ fish made up 20% and 27% respectively. The mean length of brown trout at L1 and L2 was 7.0cm and 13.4cm respectively. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the Little River was therefore categorised as slow (Appendix 1).



Fig. 4.21. Length frequency distribution for minnow in the Little River, September 2008 (n = 51)



Fig. 4.22. Length frequency distribution for brown trout in the Little River, September 2008 (n = 30)

4.1 Boat sites

4.2.1 The River Brosna (Clonony)



Plate 4.9. The River Brosna at Moystown Bridge, Clonony

The River Brosna (Plate 4.9) rises in Lough Ennell near Mullingar in Co. Westmeath and is a major tributary of the River Shannon. The Brosna catchment is calcareous but also contains one of the largest areas of peat bog and active peat harvesting in the country, resulting in a major influx of peat silt and sediment into the river (O'Reilly, 2002). In addition, the Brosna catchment has been arterially drained by the OPW. The river is noted for having good stocks of trout and coarse fish and is thus a popular angling destination (O'Reilly, 2002).

An electric fishing survey was conducted on the 23rd of July 2008, using four boat-based electric-fishing units (single fishing only) along a 400m stretch of the Brosna located immediately upstream of Moystown Bridge, approximately three kilometres north-west of Cloghan in Co. Offaly (Fig. 4.23). The site, which is located almost four kilometres upstream from the Brosna's confluence with the River Shannon, had a

mean width of 22.0m and a mean depth of 1.1m. The total wetted area sampled was 8,800 m². The upper half of the site consisted of glide habitat, and the substrate was dominated by mud and silts. The lower half of the site was composed entirely of riffle habitat and was dominated by boulder and cobble substrate. The main land use adjacent to the site was pasture, which was separated from the channel by fencing and by numerous trees that provided medium shade to the channel.



Fig 4.23. Location of the River Brosna (Clonony) WFD surveillance monitoring site 2008

The Brosna (Clonony) site had a relatively high species diversity, with ten fish species recorded (Table 4.9). The most abundant species was brown trout, followed by roach.

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0001	0.0072	0.0073
Rutilus rutilus	Roach	-	-	0.0065
Perca fluviatilis	Perch	-	-	0.0043
Gobio gobio	Gudgeon	-	-	0.0009
Esox lucius	Pike	-	-	0.0006
Salmo salar	Salmon	0.0000	0.0006	0.0006
Abramis brama	Bream	-		0.0003
Barbatula barbatula	Stone loach	-	-	0.0003
Anguilla anguilla	Eel	-	-	0.0001
Phoxinus phoxinus	Minnow	-	-	0.0001
All fish	All fish	-	-	0.0210

Table 4.9. Density of fish (no./m²), River Brosna (Clonony) site (fish density has been calculated as minimum estimates based on 1 fishing)

Brown trout in the River Brosna (Clonony) ranged in length from 8.0cm to 43.0cm (Fig. 4.24). Scale analysis showed that ages ranged from 0+ to 4+. The data shows that 0+ fry made up 2% of the population and that 1+, 2+, 3+ and 4+ fish accounted for 33%, 47%, 17% and 2%, respectively. The largest brown trout recorded was a 4+ fish measuring 43cm in length and 940g in weight. The mean length of brown trout at L1, L2, L3 and L4 being 6.9cm, 15.6cm, 20.9cm and 34.7cm respectively. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the River Brosna was therefore categorised as fast (Appendix 1). Four juvenile salmon were recorded at the site and these ranged in length from 12.cm to 14.8cm and were all aged at 1+.

Roach in the River Brosna (Clonony) ranged in length from 8.4cm to 21.0cm (Fig. 4.25). All age classes from 2+ to 7+ were present. The largest roach was a 7+ fish measuring 21cm in length and 158g in weight. Perch ranged in length from 14.2cm to 23.5cm. The largest individual perch captured measured 23.5cm in length and 202g in weight. Perch were present in the age classes 2+ to 6+. Growth summary tables for roach and perch are shown in Appendix 3 and 5 respectively. Pike ranged in length from 47.6cm to 59.2cm and weights ranged from 0.83kg to 7.84kg. Three bream were recorded at the site and their lengths varied from 33.9cm to 36.4cm.


Fig. 4.24. Length frequency distribution for brown trout in the Brosna River at Clonony, July 2008 (n = 64)



Fig. 4.25. Length frequency distribution for roach in the Brosna River at Clonony, July 2008 (n = 57)



Fig. 4.26. Length frequency distribution for perch in the Brosna River at Clonony, July 2008 (n = 38)

4.2.2 The River Brosna (Pollagh)



Plate 4.10. The River Brosna at Pollagh Bridge

The second site on the River Brosna (Plate 4.10) was situated was located immediately upstream of an unnamed road bridge which is located approximately 500m northwest of Pollagh village in Co. Offaly. Similar to the other site on the River Brosna, this site also suffers from poor water quality due to peat harvesting and ongoing agricultural activity. The River Brosna (Pollagh) was surveyed using four boatbased electric-fishing units, conducting one fishing along a 444m stretch of channel on the 22nd of July 2008. The channel had a mean width of 28m and a mean depth of 1.3m. The total area fished was 12,432m². The entire site was composed of uniform glide habitat and had a substrate consisting entirely of mud and silt. The main land use on the right-hand bank was pasture and was fenced off to prevent cattle from accessing the channel. The land adjacent to the left-hand bank was used for timber production. Both bank slopes were virtually devoid of trees and thus shading was minimal. There was little or no instream vegetation, which is likely due to routine channel maintenance by OPW and consistently deep water.



Fig 4.27. Location of the River Brosna (Pollagh) WFD surveillance monitoring site 2008

Six fish species were recorded at the Brosna (Pollagh) site (Table 4.10). Roach was the most abundant species, followed by perch.

Species name	Common name	0+	1+ & older	Total density
Rutilus rutilus	Roach	-	-	0.0071
Perca fluviatilis	Perch	-	-	0.0021
Esox lucius	Pike	-	-	0.0004
Phoxinus phoxinus	Minnow	-	-	0.0002
Anguilla anguilla	Eel	-	-	0.0001
Gobio gobio	Gudgeon	-	-	0.0001
All fish	All fish	-	-	0.0100

 Table 4.10. Density of fish (no./m²), River Brosna (Pollagh) site (fish density has been calculated as minimum estimates based on 1 fishing)

Length frequency data for both roach and perch are shown in Figure 4.28 and Figure 4.29 respectively. Roach ranged in length from 5.3cm to 29.5cm, with age classes present between 0+ and 7+. The largest roach was a 7+ fish measuring 29.5cm and weighing 449.0g. Appendix 3 shows a summary of roach growth. Perch ranged in length from 4.0cm to 20.0cm, and the age classes present in the population ranged from 1+ to 3+. The largest perch was a 3+ fish measuring 20.0cm in length and weighing 164.7g. A summary of perch growth is shown in Appendix 5.

Five pike were recorded at the site, the smallest measured 41.5cm in length and weighed 0.53kg and the largest was 90.0cm in length and weighed 6.43kg. One specimen of a gudgeon was recorded and this was 12.cm in length.



Fig. 4.28. Length frequency distribution for roach in the Brosna River at Pollagh, July 2008 (n = 88)



Fig. 4.29. Length frequency distribution for perch in the Brosna River at Pollagh, July 2008 (n = 26)

4.2.3 The Camlin River



Plate 4.11. The River Camlin at Ballykenny Bridge

The Camlin River (Plate 4.11) rises in Cloonfin Lough approximately four kilometres east of Ballinalee in Co. Longford and flows in a westerly direction through Longford to join the Shannon just south of Lough Forbes outside Newtown Forbes. The Camlin, which is joined by many small tributaries, is a limestone river that holds good stocks of trout and is also stocked every year with juvenile and adult trout (O'Reilly, 2002).

An electric fishing survey was conducted on the 25th of September 2008, using two boat-based electricfishing units (three fishings) along a 250m stretch upstream of Ballykenny Bridge, which is located approximately two kilometres upstream from the Camlin's confluence with the River Shannon (Fig. 4.30). A trackway parallel to the river allowed easy access to the site. The site had a mean width of 11.2m and a mean depth of 0.9m. The total wetted area fished amounted to 2,801.7m². The site was composed entirely of glide habitat, and the trapezoidal nature of the channel suggests that it had been drained or channelised in the past. The depth of the channel made it difficult to accurately assess the exact types and proportions of substrate, but probing with the boat oars determined that the river bottom was solid and rocky. The main land use adjacent to the site was pasture. The bank slopes had a few scattered trees which provided light shade to the channel. The Camlin River at this survey site was relatively deep and as a result no bryophyte vegetation was recorded. Some of the vascular plants recorded were *Apium nodiflorum, Phalaris arundinacea*, and *Potamogeton natans*



Fig 4.30. Location of the Camlin River WFD surveillance monitoring site 2008

A total of five fish species were caught in the Camlin River (Table 4.11), with roach being the most abundant species, followed by perch.

Species name	Common name	0+	1+ & older	Total density
Rutilus rutilus	Roach	-	-	0.0132
Perca fluviatilis	Perch	-	-	0.0100
Gobio gobio	Gudgeon	-	-	0.0054
Esox lucius	Pike	-	-	0.0032
Salmo trutta	Brown trout	0.0000	0.0014	0.0011
All fish	All fish	-	-	0.0328

 Table 4.11. Density of fish (no./m²), Camlin River site (fish density has been calculated as minimum estimates based on 3 fishings)

Roach in the Camlin River ranged in length from 7.2cm to 20.1cm (Fig 4.31). Scale analysis reveals that there were five age classes of roach present at the site, i.e. 1+ to 5+ inclusive. See Appendix 3 for a summary of roach growth.

Perch in the Camlin River ranged in length from 13.1cm to 23.0cm (Fig. 4.32). Gudgeon ranged in length from 9.3cm to 12.7cm (Fig. 4.33). Three brown trout were recorded and ranged from 21.1cm to 51.2cm in length. The mean length at L1 for the three trout was 8.6cm (Appendix 1).



Fig. 4.31. Length frequency distribution for roach in the Camlin River, September 2008 (n = 37)



Fig. 4.32. Length frequency distribution for perch in the Camlin River, September 2008 (n = 28)



Fig. 4.33. Length frequency distribution for gudgeon in the Camlin River, September 2008 (n = 15)

4.2.4 The Clodiagh River



Plate 4.12. The River Clodiagh at Rahan

The 40 kilometre long Clodiagh River (Plate 4.12) rises in the Slieve Bloom Mountains and flows northwards through Co. Offaly to its confluence with the River Brosna, which is approximately three and a half kilometres south of Ballycumber. This channel is maintained by the OPW and provides some of the best trout fishing in the Brosna catchment (O'Reilly 2002). An electric fishing survey was conducted on a stretch of channel measuring 158m in length on the 21st of July 2008 using two boat-based electric-fishing units. Three fishings were conducted at the site. The site is located immediately upstream of Rahan Bridge which is located in Rahan, County Offaly, seven kilometres upstream from the Clodiagh's confluence with the River Brosna (Fig. 4.34). The mean channel width was 7.6m, and the mean depth was 0.7m. The total wetted area sampled was 1,200m². The site was composed entirely of glide habitat, which is common in arterially drained channels. The substrate was composed predominately of gravel, with some mud and silt. The main land use adjacent to the site was pasture, which was separated from the channel by fencing and by numerous trees that provided heavy shade to the channel. Instream vegetation

was nonexistent (0%), which could be due to routine channel maintenance by OPW along with shading provided by tree cover.



Fig 4.34. Location of the Clodiagh River WFD surveillance monitoring site 2008

A total of seven fish species were recorded in the Clodiagh River (Table 4.12), with brown trout being the most abundant species, followed by minnow.

Table 4.12. Density of fish (no./m ²), Clodiagh River site (fish density has been calcula	ted as
minimum estimates based on 3 fishings)	

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0017	0.0541	0.0558
Phoxinus phoxinus	Minnow	-	-	0.0033
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0033
Lampetra spp.	Lamprey	-	-	0.0025
Barbatula barbatula	Stone loach	-	-	0.0017
Salmo salar	Salmon	0.0000	0.0008	0.0008
Anguilla anguilla	Eel	-	-	0.0008
All fish	All fish	-	-	0.0683

Brown trout in the Clodiagh River ranged in length from 7.1cm to 32.5cm (Fig. 4.35). Three age classes were identified during scale analysis, 1+ to 3+ inlcusive. Only 3% of the population was represented by 0+ fry, with 1+, 2+ and 3+ fish accounting for 46%, 45% and 6% of the population respectively. The mean length of brown trout at L1, L2 and L3 was 7.9cm, 19.09cm and 27.3cm respectively. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), the trout growth rate in the River Clodiagh was therefore categorised as fast (Appendix 1).



Fig. 4.35. Length frequency distribution for brown trout in the Clodiagh River, July 2008 (n = 67)

4.2.5 The Cross River



Plate 4.13. The Cross River

The Cross River (Plate 4.13) is a low lying limestone stream that rises in Co Roscommon approximately four kilometres southwest of Lough Funshinagh. It flows in a south westerly direction until it joins the River Shannon two kilometres south of Athlone. Although the Cross River is a good stream for trout fishing and has undergone rehabilitation work, it was previously damaged by drainage work in 2001 (O'Reilly 2002). An electric fishing survey was conducted on the 25th of July 2008 along a 176m stretch of channel. One boat-based electric-fishing unit was used to conduct three fishings. The site was located immediately upstream of an unnamed bridge in Co. Roscommon, 250m upstream from the Cross's confluence with the River Shannon, approximately two kilometres south of Athlone (Fig. 4.36). The mean channel width was 6.2m, and the mean depth was 1.3m. The total wetted area sampled was 1,091m². This site was composed entirely of glide habitat, with evidence of previous drainage work obvious. The substrate was composed exclusively of mud and silt. The main land use adjacent to the site was pasture. The river bank was not fenced, but steep vertical banks prevented cattle from accessing the

channel. A few mature willow trees were present in the riparian zone; however, these were too far away from the channel to provide any shade to the river.



Fig 4.36. Location of the Cross River WFD surveillance monitoring site 2008

A total of five fish species were recorded in the Cross River (Table 4.13), with perch being the most abundant species, followed by roach.

Table 4.13. Density of fish (no./m ²	²), Cross River site	(fish density ha	as been ca	alculated as	minimum
	estimates based or	n 3 fishings)			

Species name	Common name	0+	1+ & older	Total density
Perca fluviatilis	Perch	-	-	0.0706
Rutilus rutilus	Roach	-	-	0.0394
Esox lucius	Pike	-	-	0.0174
Gobio gobio	Gudgeon	-	-	0.0064
Salmo trutta	Brown trout	0.0000	0.0018	0.0018
All fish	All fish			0.1356

Perch in the Cross River ranged in length from 6.0cm to 17.4cm (Fig. 4.37). Appendix 5 gives a summary of perch growth. Aging analysis revealed that there were five age classes of perch present at the site, i.e. 1+ to 5+ inclusive.

The relatively low number of roach captured resulted in a rather fragmented distribution in length classes (Fig. 4.38). Roach ranged in length from 6.1cm to 24.8cm (Fig. 4.38). All age classes from 1+ to 8+ were present, except for the 7+ age class. A growth summary for roach is shown in Appendix 3.

The two brown trout recorded during this survey measured 19.6cm and 30.8cm in length. Their mean L1, L2, L3 and L4 lengths were calculated as 7.3cm, 17.0cm, 22.0cm and 27.2cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth rate in the Cross was therefore categorised as fast (Appendix 1).



Fig. 4.37. Length frequency distribution for perch in the Cross River, July 2008 (n = 77)



Fig. 4.38. Length frequency distribution for roach in the Cross River, July 2008 (n = 43)

4.2.6 The River Deel (Newcastlewest)



Plate 4.14. The River Deel near Balliniska

The River Deel (Plate 4.14) rises on the border between Co. Cork and Co. Limerick. It flows northwards through the towns of Rathkeale and Askeaton before reaching the Shannon Estuary. The River Deel drains a large area of prime agricultural land, and as such suffers from agricultural run-off. The river was drained in the 1970s by the OPW as part of their arterial drainage scheme. An electric fishing survey was conducted on the 17th of July 2008 along a 200m stretch of the River Deel. Two boat-based electric-fishing units were used to conduct three fishings. The site extended both up and downstream of an unnamed bridge in the townland of Balliniska, approximately seven kilometres south-east of Newcastle West, Co. Limerick. The mean length and depth of the channel was 8.6m and 0.6m respectively. The total area of river fished was 1,720m². Like most drained channels, the site was composed entirely of glide habitat. The substrate was composed predominately of cobble followed by gravel. The main land use adjacent to the site was pasture, which has been fenced off to prevent cattle from accessing the

channel. A few trees were present along the bank slopes of the river and these provide light shade to the channel. Instream vegetation was moderate (10%) and consisted of *Typha* sp. and *Iris pseudacorus*.



Fig 4.39. Location of the River Deel (Newcastlewest) WFD surveillance monitoring site, 2008

A total of six fish species were recorded in the River Deel (Table 4.14), with brown trout being the most abundant species, followed by minnow.

Table 4.14. Density of fish (no./m ²), River Deel site (fish density has been calculated as minimu	ım
estimates based on 3 fishings)	

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0	0.1488	0.1488
Phoxinus phoxinus	Minnow	-	-	0.0483
Barbatula barbatula	Stone loach	-	-	0.0081
Gobio gobio	Gudgeon	-	-	0.0047
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0012
Anguilla anguilla	Eel	-	-	0.0012
All fish	All fish	-	-	0.2122

Brown trout ranged in length from 13.5cm to 36.5cm (Fig 4.40). No trout fry were recorded in this site but all other ages classes from 1+ to 4+ were captured. The 1+, 2+, 3+ and 4+ age classes accounted for 68%, 22%, 10% and 1% of the population respectively. The mean length of brown trout at L1, L2, L3 and L4 was 6.9cm, 18.9cm, 27.6cm and 34.5cm respectively. The heaviest brown trout weighed 558g and measured 35.6cm in length.



Fig. 4.40. Length frequency distribution for brown trout in the River Deel, July 2008 (n = 256)

4.2.7 The River Feale



Plate 4.15. The River Feale at Duagh Bridge

The River Feale (Plate 4.15) rises in the Mullaghareirk Mountains on the Cork–Limerick county border. It flows in a south westerly direction through Listowel and eventually into the sea south of Ballybunion, Co. Kerry. The River Feale provides some of the best sea trout and salmon fishing in Ireland, even far upstream, with regular spates enabling fish to progress upstream easily, while many deep pools hold them in numbers (O'Reilly, 2002). The lower portion of the River Feale has been arterially drained, but the drainage scheme does not extend past Listowel. The Feale is fed by a number of streams, including the River Smearlagh, which suffered a bog slide in August 2008. The survey site is located upstream of where the Smearlagh enters the Feale, and the slide should have little impact on this section of the Feale in the future.

An electric fishing survey was conducted on the 15th of July 2008, just before the bog slide on the Smearlagh, along a 315m stretch of the River Feale immediately downstream of Duagh Bridge. Four

boat-based electrofishing units were used to conduct a single fishing. The site was located approximately two kilometres east of Duagh village and just over eight kilometres south-east of Listowel, Co. Kerry (Fig. 4.41). The mean channel width was 31m and the mean depth was 0.4m. The total wetted area sampled was 9,765m². The habitat present was composed mostly of glide and was dominated by a cobble substrate. The main land use adjacent to the site was pasture. The river is not fenced on the right bank, allowing cattle access to the river, but the left bank was nearly vertical, restricting their access to the channel on this side. The riparian zone had a continuous line of trees on both banks, although they only provided light shade to the river due to their distance from the channel. The instream vegetation was nonexistent (0%), probably due to the river's fast flow and tendency to flood during heavy rainfall.



Fig 4.41. Location of the River Feale WFD surveillance monitoring site 2008

Five fish species were recorded in the River Feale site, and a single sea trout was also captured (Table 4.15). Salmon was the most abundant species, followed by minnow.

Species name	Common name	0+	1+ & older	Total density
Salmo salar	Salmon	0.0014	0.0079	0.0093
Phoxinus phoxinus	Minnow	-	-	0.0022
Salmo trutta	Brown trout	0.0000	0.0010	0.0010
Anguilla anguilla	Eel	-	-	0.0006
Lampetra spp.	Lamprey	-	-	0.0002
Salmo trutta	Sea trout	-	-	0.0001
All fish	All fish	-	-	0.0134

 Table 4.15. Density of fish (no./m²), River Feale site (fish density has been calculated as minimum estimates based on 1 fishing)

Salmon ranged in length from 4.8cm to 12.7cm at the site (Fig. 4.42). There were two distinct salmon length classes present, ranging from 4cm to 6cm and from 8cm to 12cm (Fig. 4.42), corresponding to the presence of two age classes, 0+ and 1+ respectively. The mean L1 for salmon was 4.9cm (Appendix 2).

Brown trout measured from 13.0cm to 27.2cm in length. The brown trout population comprised of 30% 1+ fish and 70% 2+ fish. The mean length of brown trout at L1 and L2 was 7.1cm and 16.8cm respectively. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the River Feale was therefore categorised as fast (Appendix 1).



Fig. 4.42. Length frequency distribution for salmon in the River Feale, July 2008 (n = 91)

4.2.8 The Feorish River



Plate 4.16. The Feorish River at Leiterra Bridge

The Feorish River (Plate 4.16) is a small limestone river that rises in the hills north of Ballyfarnon in Co. Sligo. It drains Lough Skean and Lough Meelagh before flowing east into the River Shannon upstream of Wooden Bridge. On the 2nd of September 2008, one boat-based electric-fishing unit was used to conduct a fishing survey downstream of Leiterra Bridge, which is approximately one kilometre south-west of Keadew in Co. Roscommon and five kilometres upstream from the confluence with the River Shannon (Fig. 4.43). Due to high water levels surveying was carried out under difficult conditions, and the site covered a 1,935m stretch of channel. The mean width of the channel was 9.1m and the mean depth was 1.8m. The site was composed entirely of glide habitat. The main land use adjacent to the site was pasture, and the bank slopes had a few trees distributed intermittently that provided little shade to the channel, apart from one section of coniferous forestry near Leiterra Bridge. The Feorish contained instream plants such as *Potomogeton natans* and *Fontinalis antipyretica*. *Phalaris arundinacea* was also frequently encountered along the gentle sloping banks.



Fig 4.43. Location of the Feorish River WFD surveillance monitoring site 2008

Due to the conditions under which the Feorish River was sampled, this site will be surveyed again in 2009. The flow of water was fast and therefore the authors are not confident that the survey results are reliable (Table 4.16). Roach was the most abundant fish species, followed by brown trout.

Species name	Common name	0+	1+ & older	Total density
Rutilus rutilus	Roach			0.0009
Salmo trutta	Brown trout	0.0001	0.0007	0.0008
Esox lucius	Pike			0.0003
Gobio gobio	Gudgeon			0.0001
All fish	All fish			0.0020

 Table 4.16. Density of fish (no./m²), Feorish River site (fish density has been calculated as minimum estimates based on 1 fishing)

Roach ranged in length from 7.3cm to 15.7cm, with a mean length of 10.4cm. Appendix 3 shows a summary of growth for roach in each river within the ShRFB. Brown trout ranged in length from 9.0cm to 49.9cm, with a mean length of 22.4cm (Fig. 4.45).



Fig. 4.44. Length frequency distribution for roach in the Feorish River, September 2008 (n = 15)



Fig. 4.45. Length frequency distribution for brown trout in the Feorish River, September 2008 (n = 14)

4.2.9 The River Fergus



Plate 4.17. The River Fergus at Clonroad Bridge

The River Fergus (Plate 4.17) in Co. Clare is 60 kilometres in length and drains a rich limestone catchment which includes many interconnected loughs (O'Reilly, 2002). It flows through Ennis and Clarecastle before joining the Shannon Estuary. The river floods Ennis periodically, and work is underway on the Ennis flood relief scheme to relieve flooding that has plagued the town for centuries. The River Fergus is a noted brown trout dry-fly river and a spring salmon fishery in its lower reaches (O'Reilly, 2002).

The survey site extends upstream of Clonroad Bridge, which is located in Ennis, Co. Clare, and was surveyed on the 18th July 2008 (Fig. 4.46). Three boat-based electric-fishing units were used to conduct the survey (one fishing) on a 434m stretch of the River Fergus that had an average width of 23.2m and an average depth of 1.9m. The site was composed predominately of glide habitat, and the substrate was composed primarily of cobble. The main land use adjacent to the site was entirely urban; however, a substantial riparian buffer strip composed of mature trees provided a medium amount of shade to the site.

Instream vegetation was light (3%) and consisted of *Typha* sp., *Iris pseudacorus*, *Callitriche* sp. and *Potamogeton* sp.



Fig 4.46. Location of the River Fergus WFD surveillance monitoring site 2008

Eight fish species were recorded in the River Fergus (Table 4.17). Eel was the most abundant species, followed by brown trout.

 Table 4.17. Density of fish (no./m²), River Fergus site (fish density has been calculated as minimum estimates based on 1 fishing)

Species name	Common name	0+	1+ & older	Total density
Anguilla anguilla	Eel	-	-	0.0032
Salmo trutta	Brown trout	0.0000	0.0025	0.0025
Perca fluviatilis	Perch	-	-	0.0009
Salmo salar	Salmon	0.0000	0.0007	0.0007
Platichthys flesus	Flounder	-	-	0.0004
Esox lucius	Pike	-	-	0.0004
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0001
Lampetra spp.	Lamprey	-	-	0.0001
All fish	All fish	-	-	0.0082

Eels ranged in length from 13.6cm to 58.0cm (Fig. 4.47). Brown trout ranged in length from 14.5cm and 35.2cm (Fig. 4.48). Age classes ranged from 1+ to 5+, with 40% of brown trout aged at 2+ and 22% aged 1+. The mean lengths of brown trout at L1, L2, L3 and L4 were 6.9cm, 13.9cm, 21.4cm and 26.3cm respectively. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the River Fergus was categorised as fast (Appendix 1). The largest brown trout recorded was 5+, measuring 35.2cm in length and weighing 626g.

Perch ranged in length from 5.1cm to 22.4cm, with a mean length of 16.0cm. The mean length of perch at L1 was 6.5cm (Appendix 5). Only a small number of salmon (juvenile and adult) were captured in the Fergus. The mean L1, L2 and L3 lengths were 7.0cm, 15.5cm and 41.4cm respectively.



Fig. 4.47. Length frequency distribution for eels in the Fergus River, July 2008 (n = 32)



Fig. 4.48. Length frequency distribution for brown trout in the Fergus River, July 2008 (n = 25)

4.2.10 The River Inny (Shrule Br.)



Plate 4.18. The River Inny at Shrule Bridge

The River Inny (Plate 4.18) rises near Oldcastle in Co. Meath and has a catchment of over 1,128km². The Inny is a major tributary of the River Shannon, draining several large lakes in the Midlands and is the largest river that flows into Lough Ree, apart from the Shannon. An aqueduct carrying the Royal Canal crosses the Inny near Abbeyshrule in Co. Longford. The Inny is a noted brown trout fishery and also holds large stocks of coarse fish. In 2005, an angler caught a chub from the river (Caffrey *et al.*, 2007a).

An electric fishing survey was conducted on a 380m stretch of the River Inny at Shrule Bridge on the 30th of July 2008, using four boat-based electric-fishing units (one fishing) (Fig. 4.49). The site had a mean width of 18.8m and a mean depth of 0.7m. The site was composed predominately of glide habitat, and the substrate primarily of cobble, gravel and boulder. The main land use adjacent to the site was pasture. The left bank had a few scattered trees present. Spoil heaps from the OPW Inny drainage scheme were also present. The right bank had a continuous line of mature trees overhanging the channel in many places,

providing a medium amount of shade and important overhead cover for fish. Instream vegetation was light (2%) and consisted of *Iris pseudacorus* and *Callitriche* sp.



Fig 4.49. Location of the River Inny (Shrule Br.) WFD surveillance monitoring site 2008

Nine fish species were recorded in the Inny River at Shrule Bridge (Table 4.18). The most abundant species was brown trout, followed by minnow.

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0087	0.0056	0.0143
Phoxinus phoxinus	Minnow	-	-	0.0115
Gobio gobio	Gudgeon	-	-	0.0073
Rutilus rutilus	Roach	-	-	0.0043
Perca fluviatilis	Perch	-	-	0.0017
Esox lucius	Pike	-	-	0.0006
Anguilla anguilla	Eel	-	-	0.0006
Barbatula barbatula	Stone loach	-	-	0.0006
Leuciscus cephalus	Chub	-	-	0.0001
Roach×bream hybrid	Roach×bream hybrid	-	-	0.0001
All fish	All fish	-	-	0.0410

 Table 4.18. Density of fish (no./m²), River Inny (Shrule) site (fish density has been calculated as minimum estimates based on 1 fishing)

Brown trout ranged in length from 6.8cm to 29.7cm (Fig. 4.50). Scale analysis showed that five age classes were present between 0+ and 4+. The data indicate 61% of the population at the site were composed of 0+ fry while 1+, 2+, 3+ and 4+ fish accounted for approximately 11%, 20%, 7% and 2% of the population respectively. The mean length of brown trout in the Inny (Shrule) at L1, L2, L3 and L4 was 8.1cm, 14.2cm, 20.4cm and 24.1cm respectively (Appendix 1). Based on a classification of trout growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the River Inny was therefore categorised as slow (Appendix 1). The largest brown trout recorded was a 3+ fish measuring 29.7cm in length and 332.4g in weight.

Minnow ranged in length from 3.2cm to 7.2cm (Fig. 4.51). Gudgeon were 5.8cm and 15.0cm in length (Fig. 4.52). Roach ranged in length from 6.4cm to 20.0cm (Fig. 4.53). Scale analysis showed that age classes ranging from 1+ to 5+ were present. Back-calculated lengths for roach were recorded between 3.3cm at L1 and 18.4cm at L5 (Appendix 3).

During the survey, one chub (an invasive non native species in Ireland) was captured. This fish, measuring 31.1cm in length and 462g in weight, was radio-tagged by staff from Queen's University Belfast and was returned to the river as part of a study monitoring the impacts of chub in the river.



Fig. 4.50. Length frequency distribution for brown trout in the River Inny at Shrule Bridge, July 2008 (n = 102)



Fig. 4.51. Length frequency distribution for minnow in the River Inny at Shrule Bridge, July 2008 (n = 82)



Fig. 4.52. Length frequency distribution for gudgeon in the River Inny at Shrule Bridge, July 2008 (n = 52)



Fig. 4.53. Length frequency distribution for roach in the River Inny at Shrule Bridge, July 2008 (n = 31)

4.2.11 The Kilcrow River



Plate 4.19. The Kilcrow River at Ballyshrule Bridge

The Kilcrow River (Plate 4.19), also known as the Killimor River, drains farmland in Co. Galway before heading south and flowing into the northern end of Lough Derg. The Kilcrow is a medium-sized, fast-flowing limestone river that is popular as a trout fishery and has been overfished in the past (O'Reilly, 2002). The channel becomes choked with weeds in the late summer and has been drained by the OPW as part of the Killimor Drainage Scheme. An electric fishing survey was conducted along a 276m stretch of the Kilcrow upstream of Ballyshrule Bridge on the 4th of July 2008 using two boat-based electric-fishing units (three fishings) (Fig. 4.54). The site had an average width of 10.2m and average depth of 0.6m. The site was composed predominately of glide habitat, which is typical of drained channels, and the substrate was composed primarily of gravel. The main land use adjacent to the site was pasture, but there was a substantial riparian buffer strip composed of trees that provided a medium amount of shade to the channel. Instream vegetation was abundant (75%) and consisted of *Scirpus lacustris*, *Typha* sp., *Iris pseudacorus*, *Calltriche* sp. and *Potomogeton* sp.



Fig 4.54. Location of the Kilcrow River WFD surveillance monitoring site 2008

Nine fish species were recorded in the Kilcrow River (Table 4.19). Perch was the most abundant species, followed by roach.

Species name	Common name	0+	1+ & older	Total density
Perca fluviatilis	Perch	-	-	0.0377
Rutilus rutilus	Roach	-	-	0.0320
Gobio gobio	Gudgeon	-	-	0.0188
Esox lucius	Pike	-	-	0.0053
Salmo trutta	Brown trout	0.0007	0.0011	0.0018
Barbatula barbatula	Stone loach	-	-	0.0018
Anguilla anguilla	Eel	-	-	0.0014
Phoxinus phoxinus	Minnow	-	-	0.0007
Salmo salar	Salmon	0.0000	0.0004	0.0004
All fish	All fish	-	-	0.0998

 Table 4.19. Density of fish (no./m²), Kilcrow River site (fish density has been calculated as minimum estimates based on 3 fishings)

Perch ranged in length from 8.7cm to 23.0cm (Fig. 4.55). Age classes recorded comprised of 1+, 2+, 3+ and 4+, accounting for approximately 24%, 60%, 13% and 3% of the population respectively. The mean length of perch at L1 was 6.5cm (Appendix 5).

Roach ranged in length from 6.0cm to 16.0cm (Fig. 4.56). The three age classes present, 1+, 2+ and 3+, accounted for approximately 40%, 52% and 8% of the population respectively. The mean length of roach at L1, L2 and L3 was 4.0cm, 7.7cm and 11.36cm respectively (Appendix 3). The third most abundant fish species recorded was gudgeon, with specimens captured ranging in length from 5.5cm to 10.5cm (Fig. 4.57), with a mean of 8.4cm.



Fig. 4.55. Length frequency distribution for perch in the Kilcrow River, July 2008 (n = 106)


Fig. 4.56. Length frequency distribution for roach in the Kilcrow River, July 2008 (n = 90)



Fig. 4.57. Length frequency distribution for gudgeon in the Kilcrow River, July 2008 (n = 53)

4.2.12 The Little Brosna River



Plate 4.20. The Little Brosna River at Riverstown Bridge

The Little Brosna River (Plate 4.20) is a limestone river that rises near Roscrea in Co. Offaly. It flows in a northerly direction until meeting the River Shannon several kilometres south-west of Banagher, Co. Offaly. Two boat-based electric-fishing units were used to conduct a fish stock survey (one fishing) along a 200m stretch of the Little Brosna upstream of Riverstown Bridge on the 30th of September 2008 (Fig. 4.58). The mean width of the channel was 10.7m and the mean depth was 0.6m. The site was composed predominately of glide habitat, with a gravel and cobble substrate. The main land use adjacent to the site was pasture. The right bank had a continuous line of mature trees that provided a light amount of shade to the channel. Instream vegetation density was also low (9%). A variety of plant species were recorded in the Little Brosna. Filamentous green algae covered much of the river bed, along with submerged mosses, such as *Fontinalis antipyretica*, *Amblystegium riparium and Cinclidotus fontinaloides*. Vascular species were also common and included *Apium inundatum*, *Ranunculus penicillatus*, *Phalaris arundinacea* and *Sparganium erectum*. *Lemna minor* was recorded floating on the surface in slower flowing areas.



Fig 4.58. Location of the Little Brosna River WFD surveillance monitoring site 2008

Due to inclement weather conditions, water levels in the Little Brosna River were relatively high at the time of the survey, making sampling difficult. As a result, this river may need to be surveyed again under more favourable conditions. Three fish species were recorded in the Little Brosna River (Table 4.20). Brown trout was the most abundant species, followed by salmon.

 Table 4.20. Density of fish (no./m²), Little Brosna River site (fish density has been calculated as minimum estimates based on 1 fishing)

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0009	0.0169	0.0178
Salmo salar	Salmon	0.0033	0.0061	0.0094
Barbatula barbatula	Stone loach	-	-	0.0009
All fish	All fish	-	-	0.0282

Brown trout ranged in length from 10.1cm to 36.4cm (Fig. 4.59), with a mean length of 24.7cm. Age classes captured at the site were 0+, 2+ and 3+, accounting for approximately 5%, 84% and 11% of the population respectively; no 1+ fish were recorded. The mean length of brown trout at L1, L2 and L3 was

8.3cm, 16.8cm and 23.1cm respectively. Based on a classification of brown trout growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the Little Brosna River was categorised as fast (Appendix 1).

Salmon ranged in length from 8.2cm to 20.9cm (Fig. 4.60), with a mean length of 11.0cm. The three age classes present, 0+, 1+ and 2+, accounted for approximately 50%, 49% and 1% of the salmon population respectively. Mean length at L1 was 5.8cm (Appendix 2). Two stone loach were also captured, both measuring 10cm in length.



Fig. 4.59. Length frequency distribution for brown trout in the Little Brosna River, September 2008 (n = 38)



Fig. 4.60. Length frequency distribution for salmon in the Little Brosna River, September 2008 (n = 20)

4.2.13 The Maigue River



Plate 4.21. The Maigue River at Castleroberts Bridge

The Maigue River (Plate 4.21) is a limestone stream with a large catchment in Co. Limerick. It flows in a north-westerly direction through Limerick's Golden Vale and passes through Adare, eventually reaching the Shannon Estuary. The Maigue was regarded as one of Ireland's premier trout rivers up until the start of an arterial drainage scheme in the 1970s, which subsequently channelised the river, destroying its natural character (O'Reilly, 2002). The Maigue catchment has high nutrient export rates as it drains intensively cultivated agricultural land, contributing significantly to the nutrient budget of the Shannon Estuary, especially where phosphorous inputs are concerned (Marine Institute, 1999). The river also holds a population of dace, an invasive species in Ireland, which were first recorded in the Maigue in 1990 (Caffrey *et al.*, 2007b).

A fish stock survey was carried out along a 517m stretch of the Maigue River on the 16th of July 2008 using four boat-based electric-fishing units (three fishings). The site extended above and below Castleroberts Bridge, which is located approximately two kilometres south-east of Adare (Fig. 4.61). The

average width of the site was 31.0m and the average depth was 1.2m. The site was composed predominately of glide habitat, which is typical of drained channels, and the substrate was composed primarily of gravel and cobble. The main land use adjacent to the site was pasture. The bank slopes contained isolated scattered trees that provided light shade to the channel. Instream vegetation was light (5%) and consisted of *Typha* sp., *Nuphur lutea*, *Scirpus lacustris*, *Iris pseudacorus*, *Callitriche* sp. and *Potamogeton* sp.



Fig 4.61. Location of the Maigue River WFD surveillance monitoring site 2008

Six fish species were recorded in the Maigue River, although their densities were quite low. Brown trout was the most abundant species, followed by eels.

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0000	0.0106	0.0106
Anguilla anguilla	Eel	-	-	0.0030
Barbatula barbatula	Stone loach	-	-	0.0029
Salmo salar	Salmon	0.0001	0.0014	0.0016
Phoxinus phoxinus	Minnow	-	-	0.0007
Lampetra spp.	Lamprey	-	-	0.0003
All fish	All fish	-	-	0.0191

 Table 4.21. Density of fish (no./m²), Maigue River site (fish density has been calculated as minimum estimates based on 3 fishings)

Brown trout ranged in length from 17.0cm to 42.5cm (Fig. 4.62) and had a mean length of 25.3cm. Age classes ranged from 1+ to 4+, with 2+ fish accounting for the majority of the population. The mean lengths of brown trout at L1, L2, L3 and L4 were 7.2cm, 19.8cm, 28.6cm and 40.1cm respectively. Based on a classification of brown trout growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the Maigue River was categorised as very fast (Appendix 1).

Salmon ranged in length from 7.6cm to 75.2cm (Fig. 4.63), with a mean length of 40.6cm. Four age classes, 0+, 1+, 2+ and 3+ were present, with most of the population consisting of 2+ and 3+ fish. The mean length of salmon at L1, L2 and L3 was 7.7cm, 30.9cm and 48.4cm respectively (Appendix 2).

Eels ranged from 9.2cm to 41.0cm in length (Fig. 4.64), with a mean of 26.2cm. Stone loach ranged in length from 3.5cm to 11.0cm (Fig. 4.65), with a mean of 8.2cm.



Fig.4.62. Length frequency distribution for brown trout in the Maigue River, July 2008 (n = 156)



Fig. 4.63. Length frequency distribution for salmon in the Maigue River, July 2008 (n = 23)



Fig. 4.64. Length frequency distribution for eels in the Maigue River, July 2008 (n = 44)



Fig. 4.65. Length frequency distribution for stone loach in the Maigue River, July 2008 (n = 43)

4.2.14 The Mountnugent River



Plate 4.22. The Mountnugent River at Mountnugent Bridge

The Mountnugent River (Plate 4.22) rises in Co. Cavan near Ballyjamesduff. It flows south-westwards into Lough Sheelin. A fish stock survey was undertaken along a 182m stretch of the river on the 23rd of September 2008 using one boat-based electric-fishing unit. The site extends upstream of Mountnugent Bridge, which is located in Mountnugent village near the north-east shore of Lough Sheelin. The mean channel width was 7.5m, and the mean depth was 0.7m. The site was composed predominately of glide habitat, and the substrate was composed primarily of mud and silt. The main land use adjacent to the site was pasture. The bank slopes contained a short section with a continuous line of trees; however, most of the site had only isolated trees providing light shading to the channel. The emergent macrophyte species recorded in the Mountnugent River were *Sparganium erectum*, *Phalaris arundinacea* and *Oenanthe crocata*. Other plants within the channel included the bryophyte *Amblystegium riparium* and the vascular plant *Ranunculus penicillatus*.



Fig 4.66. Location of the Mountnugent River WFD surveillance monitoring site 2008

Four fish species were recorded in the Mountnugent River (Table 4.22). Brown trout was by far the most abundant species, followed by gudgeon.

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0015	0.0962	0.0976
Gobio gobio	Gudgeon	-	-	0.0066
Perca fluviatilis	Perch	-	-	0.0044
Barbatula barbatula	Stone loach	-	-	0.0007
All fish	All fish	-	-	0.1093

 Table 4.22. Density of fish (no./m²), Mountnugent River site (fish density has been calculated as minimum estimates based on 3 fishings)

Brown trout at the site ranged in length from 8.2cm to 59.0cm (Fig. 4.6). Age classes from 0+ to 6+, with the exception of 5+, were present in the brown trout population. 0+ fry accounted for approximately 1% of the population, fish aged 1+ or 2+ accounted for approximately 81%, and fish aged 3+ or older

accounted for approximately 17%. The mean length of brown trout at L1, L2, L3 and L4 was 7.4cm, 17.8cm, 28.5cm, 35.2cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the Mountnugent River was categorised as very fast (Appendix 1). The largest brown trout captured was a 3+ fish measuring 55.9cm in length and 2.08kg in weight.

Gudgeon ranged in length from 8.8cm to 13.8cm. Perch measuring between 11.0cm and 12.5cm were recorded. A single stone loach was also recorded, measuring 8.6cm in length.



Fig. 4.67. Length frequency distribution for brown trout in the Mountnugent River, September 2008 (n = 134)

4.2.15 The Scramoge River



Plate 4.23. The Scramoge River at Cloonconny Bridge

The Scramoge River (Plate 4.23) rises about one kilometre south of Tulsk in north Co. Roscommon and meanders eastwards, draining a series of small lakes west of Strokestown before turning north-eastwards to flow into Kilglass Lough. A fish stock survey was undertaken on the 1st of September 2008, using two boat-based electric-fishing units, along a 291m stretch of river (Fig. 4.68). The mean channel width was 10.1m and the mean depth was 1.5m. The site was composed entirely of glide habitat with a substrate of mainly sand and gravel. The adjacent land was used for pasture. The channel itself was relatively deep, with gentle grassy banks on either side that had no trees, thus providing no shade. The Scramoge was a relatively deep site and consequently had little or no bryophyte vegetation. The species that were encountered were *Amblystegium riparium* and *Fontinalis antipyretica*. The bulk of the vegetation recorded was composed of the riparian plants, *Veronica beccabunga* and *Sparganium erectum*, and the floating plants *Potamogeton natans* and *Nuphur lutea*. The submerged *Myriophyllum spicatum* was also present in low quantities.



Fig 4.68. Location of the Scramoge River WFD surveillance monitoring site 2008

Four fish species were recorded in the Scramoge River (Table 4.23). Perch was the most abundant species, followed by roach.

 Table 4.23. Density of fish (no./m²), Scramoge River site (fish density has been calculated as minimum estimates based on 1 fishing)

Species name	Common name	0+	1+ & older	Total density
Perca fluviatilis	Perch	-	-	0.0153
Rutilus rutilus	Roach	-	-	0.0065
Esox lucius	Pike	-	-	0.0034
Anguilla anguilla	Eel	-	-	0.0003
All fish	All fish	-	-	0.0255

Perch ranged in length from 5.7cm to 26.0cm (Fig. 4.69) with a mean length of 13.4cm. The growth summary for perch is shown in Appendix 5. Roach recorded ranged from 9.6cm to 22.1cm in length (Fig. 4.70), with a mean of 15.5cm. Three age classes (2+, 3+ and 4+) were present within the roach population, with 2+ and 3+ fish being the dominant age classes. The mean length of roach at L1 was 2.7cm (Appendix 3). Pike were also recorded during the survey, ranging in length from 23.9cm to 50.7cm, with a mean length of 37.9cm. Age classes from 1+ to 3+ were present. Mean pike L1 was 19.43cm (Appendix 4).



Fig. 4.69. Length frequency distribution for perch in the Scramoge River, September 2008 (n = 45)



Fig. 4.70. Length frequency distribution for roach in the Scramoge River, September 2008 (n = 19)

4.2.16 The River Shannon (Battle Bridge)



Plate 4.24. The River Shannon at Battle Bridge

The River Shannon is Ireland's longest river, flowing for approximately 250 kilometres from its source in the Cuilcagh Mountains, Co. Cavan through three large lakes; Lough Allen, Lough Derg and Lough Ree, to the sea at Limerick. Together with its tributaries, the Shannon encompasses a large catchment area of over 15,000km². As a fishery the Shannon is mixed between coarse and game fishing: coarse fishing is popular in the main channel, while game fishing is more common on its tributaries. The Shannon is historically an important navigation route and is connected to many other waterways by a series of canals, including the River Erne system via the Shannon–Erne Waterway. There are several barriers that hinder the migration of fish upstream, including a weir at O'Briens bridge below Lough Derg, the hydro-electric power station at Ardnacrusha and a number of locks used for navigation.

A fish stock survey was conducted on the Upper Shannon at Battle Bridge on the 29th of July 2008 at a (Fig. 4.71). Five boat-based electric-fishing units were used to conduct one fishing along a 630m stretch of channel with an average width of 33.2m and an average depth of 1.0m. The site was composed equally

of glide and riffle habitat, with a substrate of mainly cobble. The channel itself was relatively deep with glides above the bridge and a shallow riffle below. The main land use adjacent to the stretch was pasture. The banks were lined with mature trees that provided a medium amount of shade to the channel. Instream vegetation was moderate (10%) and consisted of *Typha* sp., *Iris pseudacorus, Callitriche* sp. and *Potamogeton* sp.



Fig 4.71. Location of the River Shannon (Battle Br.) WFD surveillance monitoring site 2008

Six fish species were recorded in the River Shannon at Battle Bridge (Table 4.24). Roach was the most abundant species, followed by perch.

Species name	Common name	0+	1+ & older	Total density
Rutilus rutilus	Roach	-	-	0.0043
Perca fluviatilis	Perch	-	-	0.0013
Salmo trutta	Brown trout	0.0001	0.0005	0.0006
Gobio gobio	Gudgeon	-	-	0.0004
Anguilla anguilla	Eel	-	-	0.0004
Esox lucius	Pike	-	-	0.0002
All fish	All fish	-	-	0.0072

 Table 4.24. Density of fish (no./m²), River Shannon (Battle Bridge) site (fish density has been calculated as minimum estimates based on 1 fishing)

Roach ranged in length from 5.1cm to 27.0cm (Fig. 4.72). Age classes ranged from 1+ to 8+. The most dominant age classes present were, 1+ (20%), 2+ (27%) and 3+ (17%). The mean length of roach at L1 was 2.8cm (Appendix 3).

Perch ranged in length from 6.5cm to 19.8cm (Fig. 4.73), with a mean of 13.6cm. Age classes present ranged from 1+ to 5+. The mean length recorded for L1 was 6.1cm (Appendix 5).

Brown trout ranged in length from 7.3cm to 38.0cm (Fig. 4.74). Fish were aged from 0+ to 4+. Age classes 1+ and 3+ combined, accounted for 80% of the population at the site. The mean length of brown trout at L1, L2, L3 and L4 was 7.0cm, 15.9cm, 23.0cm and 34.0cm respectively. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), trout growth in the River Shannon at Battle Bridge was categorised as fast. The largest brown trout recorded was a 4+ fish measuring 38.0cm in length and 606.0g in weight.



Fig. 4.72. Length frequency distribution for roach in the River Shannon at Battle Bridge, July 2008 (n = 90)



Fig. 4.73. Length frequency distribution for perch in the River Shannon at Battle Bridge, July 2008 (n = 27)



Fig. 4.74. Length frequency distribution for brown trout in the River Shannon at Battle Bridge, July 2008 (n = 12)

4.2.17 The Silver River (Kilcormac)



Plate 4.25. The Silver River at Lumcloon Bridge

The Silver River (Plate 4.25) rises in the Slieve Bloom Mountains in Co. Offaly and flows northwestwards through peatland. It joins with the River Brosna approximately three kilometres south-east of Ferbane. The river is part of the Brosna catchment and has been arterially drained by the OPW. The Silver River is noted for holding fair stocks of trout, but difficult banks and dangerous wading conditions create problems for anglers (O'Reilly, 2002). A fish stock survey was conducted on the 1st of October 2008 at a site located immediately downstream of Lumcloon Bridge (Fig. 4.75). One fishing using two boat-based electric-fishing units was carried out over a stretch of river measuring 130m. The average channel width was 7.7m, and the average depth was 0.8m. The total wetted area sampled was 997.5m². The site was composed predominately of glide habitat, which is typical of drained channels, and the substrate was composed primarily of gravel and mud/silt. The main land use adjacent to the site was pasture with the bank slopes possessing a few scattered trees that provided light shade to the channel. Instream vegetation was moderate (11%) and contained a diverse array of macrophyte species. Some of the submerged plants encountered were the bryophyte *Amblystegium riparium* and the vascular plant *Potamogeton crispus*, both of which are commonly regarded as indicators of nutrient enriched conditions. *Apium nodiflorum* and *Phalaris arundinacea* were two emergent species recorded. Bryophytes were ubiquitous at this site, both instream and along the banks.



Fig 4.75. Location of the Silver River WFD surveillance monitoring site 2008

Four fish species were recorded in the Silver River (Table 4.25). Brown trout was the most abundant species, followed by stone loach.

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0000	0.0421	0.0421
Barbatula barbatula	Stone loach	-	-	0.0020
Gobio gobio	Gudgeon	-	-	0.0020
Salmo salar	Salmon	-	-	0.0010
All fish	All fish	-	-	0.0471

 Table 4.25. Density of fish (no./m²), Silver (Kilcormac) River site (fish density has been calculated as minimum estimates based on 1 fishing)

Brown trout ranged in length from 7.2cm to 32.0cm, with a mean length of 18.2cm (Fig. 4.76). Four age class between 1+ and 4+ were recorded. 1+ brown trout accounted for 45% of the population, while fish aged 2+ accounted for 20% of the population. The mean lengths of brown trout at L1, L2, L3 and L4 were 7.7cm, 15.3cm, 20.4cm and 29.0cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971) (Appendix 1) trout growth in the Silver River was categorised as slow. The largest brown trout recorded in the Silver River was a 4+ individual that measured 34.0cm and weighed 346.0g.



Fig. 4.76. Length frequency distribution for brown trout in the Silver River, October 2008 (n = 42)

4.2.18 The Smearlagh River



Plate 4.26. The Smearlagh River at Kennelly's Bridge

The Smearlagh River (Plate 4.26) rises in the foothills of the Glan and Stack's Mountains in Co. Kerry. The Smearlagh is a tributary of the River Feale, joining just south-east of Listowel, Co. Kerry (Fig. 4.77). Anglers consider the Smearlagh to be a challenging river with good stocks of sea trout and salmon (O'Reilly, 2002). The river is very important as a salmon and trout nursery but was devastated in August 2008 when two bog slides occurred in the area, killing thousands of fish. Construction work for a wind farm on Ballincollig hill in the Maghanknockane area, together with unseasonably high levels of rainfall were blamed for the disaster. An electric fishing survey was conducted on the Smearlagh, at a site down stream of Kennelly's Bridge on the 14th July 2008, just before the bog slides (Fig. 4.77). Three fishings were carried out at the site using two boat-based electric-fishing units. The stretch sampled measured 323m in length, had an average width of 15.2m and an average depth of 0.4m. The predominant habitat was glide, and the substrate was dominated by cobble and gravel. The main land use adjacent to the site

was pasture, with the bank slopes possessing numerous scattered trees providing a light amount of shade to the channel. Instream vegetation was nonexistent (0%).



Fig 4.77. Location of the Smearlagh River WFD surveillance monitoring site 2008

Five fish species were recorded in the Smearlagh River (Table 4.26). Salmon was the most abundant species, followed by brown trout.

 Table 4.26. Density of fish (no./m²), Smearlagh River site (fish density has been calculated as minimum estimates based on 3 fishings)

Species name	Common name	0+	1+ & older	Total density
Salmo salar	Salmon	0.0051	0.0369	0.0420
Salmo trutta	Brown trout	0.0000	0.0281	0.0281
Salmo trutta	Sea trout	-	-	0.0065
Phoxinus phoxinus	Minnow	-	-	0.0031
Anguilla anguilla	Eel	-	-	0.0020
Lampetra spp.	Lamprey	-	-	0.0003
All fish	All fish	-	-	0.0820

Salmon captured at the site measured between 5.0cm and 12.9cm in length (Fig. 4.78), with a mean of 10.7cm. Two age classes (1+ and 2+) were present, accounting for 98% and 2% of the salmon population respectively. The mean length of salmon at L1 was 4.7cm and at L2 was 8.6cm (Appendix 2).

Brown trout ranged in length from 13.1cm to 28.1cm (Fig. 4.79), with a mean of 16.6cm. Three age classes (1+, 2+ and 3+) were present accounting for 66%, 32% and 2% of the population respectively. The mean lengths of brown trout at L1, L2 and L3 were 6.9cm, 14.3cm and 25.5cm respectively. The largest individual recorded was 3+ and measured 28.1cm and weighed 232.0g. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971) (Appendix 1) brown trout growth in the Smearlagh River was categorised as fast.

A number of sea trout were also recorded during the survey, ranging in length from 26.1cm to 36.4cm (Fig. 4.80). The mean length of sea trout at L1 was 8.0cm. The largest sea trout captured measured 36.4cm in length and weighed 543.0g.



Fig. 4.78. Length frequency distribution for salmon in the Smearlagh River, July 2008 (n = 148)



Fig. 4.79. Length frequency distribution for brown trout in the Smearlagh River, July 2008 (n = 99)



Fig. 4.80. Length frequency distribution for sea trout in the Smearlagh River, July 2008 (n = 23)

4.2.19 The River Suck (Ballyforan)



Plate 4.27. The River Suck at Ballyforan Bridge

The River Suck (Plate 4.27) rises close to the border Co. Mayo and Co. Roscommon and flows eastward . where it eventually joins the River Shannon in Shannonbridge at the border between Counties Roscommon, Galway and Offaly. An electric fishing survey was conducted at a site located immediately upstream of Ballyforan Bridge on the 23^{rd} of July 2008 (Fig. 4.81). The channel was very wide with slow-flowing water. Four boat-based electric-fishing units were used to conduct one fishing at the site. The stretch fished measured 340m and had an average width of 35.8m and depth of 0.7m. The site was composed predominately of glide habitat and had a substrate of mainly cobble, with significant amounts of boulder and gravel also present. The adjacent land was primarily used for pasture. There was a long continuous line of trees on the left hand bank, but they were too far away from the channel to provide any shade. The right hand bank was very low and prone to flooding. Due to the lack of shade and wide shallow nature of the channel, there was a high density of aquatic vegetation (90% instream cover). Plants such as *Typha* sp., *Potamogeton* sp. and *Callitriche* sp. were all abundant.



Fig 4.81. Location of the River Suck (Ballyforan Br.) WFD surveillance monitoring site 2008

Nine fish species were recorded in the River Suck (Ballyforan) (Table 4.27). Roach was by far the most abundant species, followed by perch.

Species name	Common name	0+	1+ & older	Total density
Rutilus rutilus	Roach	-	-	0.0332
Perca fluviatilis	Perch	-	-	0.0067
Gobio gobio	Gudgeon	-	-	0.0050
Phoxinus phoxinus	Minnow	-	-	0.0019
Esox lucius	Pike	-	-	0.0007
Barbatula barbatula	Stone loach	-	-	0.0006
Anguilla anguilla	Eel	-	-	0.0005
Salmo trutta	Brown trout	0.0001	0.0001	0.0002
Abramis brama	Bream	-	-	0.0001
All fish	All fish	-	-	0.0487

 Table 4.27. Density of fish (no./m²), River Suck (Ballyforan) site (fish density has been calculated as minimum estimates based on 1 fishing)

Roach ranged in length from 5.0cm to 21.5cm (Fig. 4.82), with a mean length of 12.6cm. Age classes ranged from 1+ to 6+, with the dominant age classes being 2+ (43% of the population), 3+(30%) and 4+ (15%). The mean length of roach at L1 was 3.5cm (Appendix 3).

Perch were also abundant, although much less so than roach. Perch ranged in length from 9.3cm to 25.6cm, with a mean of 14.8cm (Fig. 4.83). Perch were aged from 1+ to 5+, with a single fish aged 8+. The mean L1 recorded was 6.3cm (Appendix 5). Gudgeon measured between 6.5cm and 13.3cm in length (Fig. 4.84); with a mean of 10.2cm.



Fig. 4.82. Length frequency distribution for roach in the River Suck at Ballyforan, July 2008 (n = 404)



Fig. 4.83. Length frequency distribution for perch in the River Suck at Ballyforan, July 2008 (n = 81)



Fig. 4.84. Length frequency distribution for gudgeon in the River Suck at Ballyforan, July 2008 (n = 61)

4.2.20 The River Suck (Cloondacarra)



Plate 4.28. The River Suck at Cloondacarra Bridge

The second site on the River Suck (Cloondacarra) is shown in Plate 4.28. An electric fishing survey was conducted at a site immediately upstream of Cloondacarra Bridge, which is located approximately two kilometres south-west of Castlerea, Co. Roscommon (Fig. 4.85) on the 28th of July 2008. The channel itself was narrow and quite deep, with slow flowing water. Three fishings were carried out using two boat-based electric-fishing units along a stretch of river measuring of 209m in length. The mean channel width and depth were 9.2m and 0.6m respectively. The site was composed exclusively of glide habitat and had a substrate of mainly boulder. The adjacent land was pasture on the right hand side and forestry on the left; however, the trees were not close enough to provide any level of shading to the river channel. Due to the lack of shade and slow flowing nature the channel there was a high density of aquatic vegetation (85% instream cover). Some of the species encountered were *Sparganium erectum*, *Typha* sp., *Apium* sp., *Glyceria* sp., *Potamogeton* sp. and *Callitriche* sp.



Fig 4.85. Location of the River Suck (Cloondacarra Br.) WFD surveillance monitoring site 2008

Eight fish species were recorded in the River Suck at Cloondacarra Bridge (Table 4.28). Roach was the most abundant species, followed by perch.

Species name	Common name	0+	1+ & older	Total density
Rutilus rutilus	Roach	-	-	0.1108
Perca fluviatilis	Perch	-	-	0.0302
Phoxinus phoxinus	Minnow	-	-	0.0229
Esox lucius	Pike	-	-	0.0109
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0036
Barbatula barbatula	Stone loach	-	-	0.0026
Anguilla anguilla	Eel	-	-	0.0005
Salmo trutta	Brown trout	0.0000	0.0005	0.0005
All fish	All fish	-	-	0.1820

 Table 4.28. Density of fish (no./m²), River Suck (Cloondacarra) site (fish density has been calculated as minimum estimates based on 3 fishings)

Roach ranged in length from 5.5cm to 16.3cm (Fig. 4.86). Age classes ranged from 1+ to 4+. The two most dominant age classes were 1+ and 2+ accounting for 25% and 66% of the roach population at the site. The mean lengths of roach at L1, L2, L3 and L4 were 3.9cm, 6.6cm, 9.6cm and 12.7cm respectively (Appendix 3).

Perch ranged in length from 7.4cm to 22.5cm, with a mean of 12.4cm (Fig. 4.87). Perch were aged from 1+ to 4+. The mean length at L1, L2, L3 and L4 was 6.4cm, 9.7cm, 14.7cm and 18.8cm respectively (Appendix 5). Minnow had recorded lengths of between 2.1cm and 8.1cm, with a mean length of 5.3cm (Fig. 4.88).



Fig. 4.86. Length frequency distribution for roach in the River Suck at Cloondacarra, July 2008 (n = 213)



Fig. 4.87. Length frequency distribution for perch in the River Suck at Cloondacarra, July 2008 (n = 58)



Fig. 4.88. Length frequency distribution for minnow in the River Suck at Cloondacarra, July 2008 (n = 44)

4.2.21 The Tullamore River



Plate 4.29. The Tullamore River at Ballycowan Bridge

The Tullamore River (Plate 4.29) rises just east of Tullamore town, Co. Offaly and flows westwards to join the Clodiagh River. The river is part of the Brosna drainage scheme and has been drained by the OPW. An electric fishing survey was conducted on the Tullamore River at a site located immediately downstream of Ballycowan Bridge on the 29th of September 2008 (Fig. 4.89). The site is located approximately one kilometres upstream from the Tullamore's confluence with the Clodiagh and is just downstream of the aqueduct carrying the Grand Canal across the river (Fig. 4.89). Three fishings were conducted along a 187.5m stretch using two boat based electric fishing units. The channel had an average width of 6.8m and an average depth of 0.7m. The total wetted area sampled was 1,281.3m². The site was composed entirely of glide habitat, which is common for drained channels. The substrate was loose underfoot and was predominately comprised of gravel, with some mud and silt. Mollusc shells were abundant on the river bed. The main land use adjacent to the site was pasture, separated from the channel by steep high banks. A few scattered trees were present, providing minimal shade to the river channel.

Aquatic macrophyte vegetation was quite rare in both the channel and along the banks, which could be due to routine channel maintenance by the OPW. Filamentous green algae and *Potamogeton* sp. were observed in the water and *Glyceria maxima* was common on the banks.



Fig 4.89. Location of the Tullamore River WFD surveillance monitoring site 2008

Six fish species were recorded in the Tullamore River (Table 4.29). Minnow was the most abundant species, followed by brown trout.

Species name	Common name	0+	1+ & older	Total density
Phoxinus phoxinus	Minnow	-	-	0.1647
Salmo trutta	Brown trout	0.0016	0.0250	0.0265
Gobio gobio	Gudgeon	-	-	0.0125
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0094
Rutilus rutilus	Roach	-	-	0.0039
Esox lucius	Pike	-	-	0.0023
All fish	All fish	-	-	0.2193

 Table 4.29. Density of fish (no./m²), Tullamore River site (fish density has been calculated as minimum estimates based on 3 fishings)

Minnow lengths ranged from 2.5cm to 7.9cm, with a mean length of 5.8cm (Fig. 4.90). Brown trout ranged in length from 7.7cm to 30.4cm (Fig. 4.91). All age classes between 0+ and 4+ were recorded, with 50% of the fish aged at 2+. The mean lengths of brown trout at L1, L2, L3 and L4 were 7.5cm, 15.0cm, 20.4cm and 23.0cm respectively. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971) (Appendix 1) trout growth in the Tullamore River was therefore categorised as slow. The heaviest brown trout was aged at 3+, measured 30.4cm in length and weighed 370.0g. Gudgeon ranged in length from 4.9cm to 12.7cm, with a mean length of 7.0cm (Fig. 4.92).



Fig. 4.90. Length frequency distribution for minnow in the Tullamore River, September 2008 (n = 211)


Fig. 4.91. Length frequency distribution for brown trout in the Tullamore River, September 2008 (n = 34)



Fig. 4.92. Length frequency distribution for gudgeon in the Tullamore River, September 2008 (n = 16)

4.3 Community structure

4.3.1 Species richness and composition

A total of fourteen fish species, as well as sea trout and roach×bream hybrids, were recorded within the 29 sites surveyed in the ShRFB during 2008 for WFD surveillance monitoring (Fig. 4.93). Brown trout was the most widespread species, occurring in 93% of sites. Chub, flounder and roach×bream hybrids occurred in only 3% of sites.



Fig. 4.93. Percentage of sites where each fish species was present (total of 29 ShRFB river sites surveyed) for WFD SM monitoring 2008

The River Brosna (Clonony Bridge) had the greatest diversity of species, with ten fish species recorded, while the Glenfelly River had the lowest diversity, with only one species (Table 4.30). Native fish species were present at all sites surveyed (Table 4.30). Non native species (group 2 - e.g. pike, roach, perch, minnow, etc.) were recorded at 26 of the 29 sites surveyed in the ShRFB. Diversity of non-native group 2 species ranged from one to six species. Non native group 3 fish species (e.g. gudgeon) were present at 15 of the 29 sites (Table 4.30). Kelly *et al* (2008) give an explanation of the different fish groups.

Site	Species	No. native species	No. non-native	No. non-native
Site	richness	(Group 1)	species (Group 2)	species (Group 3)
		Boat set sites		
Brosna (Clonony)	10	3	6	1
Kilcrow	9	3	5	1
Suck (Ballyforan)	9	2	6	1
Inny (Shrule)	9	2	6	1
Fergus (Clonroad)	8	6	2	0
Suck (Cloondacarra)	8	3	5	0
Clodiagh (Tullamore)	7	5	2	0
Feale	6	5	1	0
Smearlagh	6	5	1	0
Maigue	6	4	2	0
Deel (Newcastlewest)	6	3	2	1
Shannon (Battle Bridge)	6	2	3	1
Tullamore	6	2	3	1
Brosna (Pollagh)	6	1	4	1
Camlin	5	1	3	1
Cross	5	1	3	1
Silver	4	2	1	1
Feorish	4	1	2	1
Mountnugent	4	1	2	1
Little Brosna	3	2	1	0
		Wadeable hand-set s	sites	
Boor	8	4	3	1
Gourna	6	5	1	0
Little (Cloghan)	6	3	2	1
Graney	5	4	1	0
Bow	5	3	2	0
Broadford	4	4	0	0
Scramoge	4	1	3	0
Inny (Oldcastle)	2	2	0	0
Glenfelly	1	1	0	0

Table 4.30. Specie	s richness at each rive	r site surveved in the	e ShRFB, July to	October 2008
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4.3.2 Species abundance and distribution

Distribution maps for all fish species recorded during the surveys within the ShRFB are shown below in Figures 4.94 to 4.107. Brown trout and salmon densities are split into two maps to show fry (0+) and older fish (\geq 1+).

Brown trout aged 0+ and 1+ or older were distributed throughout the whole region, although both age groups were captured in greater densities in the smaller wadeable streams (Figs. 4.94 and 4.95). The highest density of 0+ trout was recorded on the Inny site at Oldcastle, follwed by the Glenfelly stream and the Bow River, whereas the highest density of 1+ and older brown trout was recorded on the Bow River site, followed by the Inny at Oldcastle and the Glenfelly stream site. In contrast, salmon aged 0+ and 1+

or older (Figs. 4.96 and 4.97), were only recorded in sites downstream of Lough Ree (0+ only recorded at seven sites and salmon parr recorded at 13 sites) and were generally captured in lower densities than brown trout. Sea trout were only captured in two sites, the Smearlagh and Feale, both of which were located relatively close to the sea (Fig. 4.98). Three-spined stickleback were captured in about a third of the rivers sampled, and the greatest densities were recorded in the Broadford and the Gourna (Fig. 4.99). Lamprey were only recorded in the lower reaches of the region below Lough Ree and were recorded in high densities in the Gourna and Graney Rivers (Fig. 4.100). Eels, minnow and stone loach were all scattered throughout the region. Densities of minnow and stone loach varied throughout the region and densities of eel were quite low (Fig. 4.101, Fig. 4.102 and Fig. 4.103). Species such as gudgeon, roach, perch and pike, were mostly recorded in the Upper Shannon catchment (Fig. 4.104, Fig. 4.105, Fig. 4.106 and Fig. 4.107); the Fergus River was the furthest south that any of these species were captured. Pike and perch were only captured in the larger river (boat) sites.



Fig. 4.94. Distribution map for 0+ brown trout in the ShRFB WFD surveillance monitoring 2008



Fig. 4.95. Distribution map for 1+ brown trout in the ShRFB WFD surveillance monitoring 2008



Fig. 4.96. Distribution map for 0+ salmon in the ShRFB WFD surveillance monitoring 2008



Fig. 4.97. Distribution map for 1+ salmon in the ShRFB WFD surveillance monitoring 2008



Fig. 4.98. Distribution map for sea trout in the ShRFB WFD surveillance monitoring 2008



Fig. 4.99. Distribution map for 3-spined stickleback in the ShRFB WFD surveillance monitoring 2008



Fig. 4.100. Distribution map for lamprey in the ShRFB WFD surveillance monitoring 2008



Fig. 4.101. Distribution map for eels in the ShRFB WFD surveillance monitoring 2008



Fig. 4.102. Distribution map for minnow in the ShRFB WFD surveillance monitoring 2008



Fig. 4.103. Distribution map for stone loach in the ShRFB WFD surveillance monitoring 2008



Fig. 4.104. Distribution map for gudgeon in the ShRFB WFD surveillance monitoring 2008



Fig. 4.105. Distribution map for roach in the ShRFB for WFD surveillance monitoring 2008



Fig. 4.106. Distribution map for perch in the ShRFB WFD surveillance monitoring 2008



Fig. 4.107. Distribution map for pike in the ShRFB WFD surveillance monitoring 2008

4.3.3 Growth of selected fish species

Age and growth of fish were determined for the dominant fish species on each river site, comprising a range of age groups. All rivers for which fish scales were examined had 1+ brown trout present and 3+ fish were also present at most sites where brown trout were recorded. Twelve river sites had individuals aged 4+, but only two sites had any brown trout older than this: A single brown trout aged 5+ was recorded at the River Fergus site and a single trout aged 6+ trout was present on the Mountnugent River site.

Mean back-calculated lengths for brown trout in the ShRFB are shown in Figures 4.108 to 4.110 and in Appendix 1 (L1 = back-calculated length at the end of the first winter, etc.). According to the growth categories of brown trout in relation to alkalinity described by Kennedy and Fitzmaurice (1971), fish growth was very slow at four sites, slow at six sites, fast at ten sites and very fast at four sites (Appendix 1). The River Suck (Cloondacarra) had the highest mean L1 and L2 for trout, whereas the Kilcrow had the highest mean L3 and the Maigue had the highest L4; scale analysis indicates that a number of slob trout were captured during the survey of the Maigue. The Glenfelly River had the lowest mean L1 and L2 for trout, and the Bow River had the lowest mean L3 and L4 (Figs. 4.108 to 4.110).



Fig. 4.108. Back-calculated lengths for brown trout in rivers in the Bunratty, Feale, Fergus and Shannon Estuary South catchments.



Fig. 4.109. Back-calculated lengths for brown trout in rivers in the Lower Shannon catchments



Fig. 4.110. Back-calculated lengths for brown trout in rivers in the Upper Shannon catchments.

Mean back-calculated lengths for salmon in the ShRFB are shown in Figure 4.111 and Appendix 2. Salmon were present in 13 out of the 29 sites surveyed. All sites had juvenile salmon aged at least 1+ present, but only five sites had juvenile salmon aged at least 2+. Two rivers had adult salmon that were captured while returning from the sea; these fish were three years old in the River Fergus and aged two and three years old in the Maigue River. The Maigue River had the highest mean L1, and the Graney River had the lowest mean L1 (Fig. 4.111).



Fig. 4.111. Back calculated lengths for salmon in each river.

Mean back-calculated lengths for roach in the ShRFB are shown in Figure 4.112 and Appendix 3. Roach were present in 13 out of the 29 sites surveyed. Where present, all rivers had roach aged up to 3+ present. Roach aged up to 8+ were captured in two rivers, the River Shannon (Battle Bridge) and Cross River. The Boor River, the Graney River and the River Suck (Cloondacarra) had the lowest mean L1, L2 and L3 for roach respectively. The Kilcrow River had the highest mean L1 and L2, but the Graney River had the highest mean L3. Figure 4.112 illustrates the River Brosna (Pollagh) to have a higher growth rate than other rivers between L5 and L8, but these lengths were measured from only a few apparently fast-growing fish.



Fig. 4.112. Back calculated lengths for roach in each river.

Mean back-calculated lengths for pike in the ShRFB river sites are shown in Figure 4.113 and Appendix 4. Pike were present in 11 rivers out of the 29 surveyed in the ShRFB. All rivers with pike present had individuals aged at least 3+, except for the Tullamore River where only 0+ pike were captured. The River Brosna (Pollagh) and the River Suck (Ballyforan) were the only two rivers that had pike as old as 6+. Figure 4.113 clearly shows that the River Inny (Shrule) had the lowest mean lengths for L1 to L4 whereas the River Brosna (Pollagh) had the greatest mean lengths for L1 to L6 (Fig. 4.113).

Mean back-calculated lengths for perch in the ShRFB rivers are shown in Figure 4.114 and Appendix 5. Perch were present in 11 of the 29 river sites surveyed, and all included perch aged at least 3+. Four of the rivers had perch aged at least 5+; the oldest perch recorded was an 8+ individual in the River Suck (Ballyforan). The River Brosna (Pollagh) had the lowest mean L1, but perch in the Cross River appeared to have a slower growth rate than any of the other rivers between L2 and L5. Perch in the River Inny (Shrule) had the greatest mean L1 and L2 (Fig. 4.114).



Fig. 4.113. Back calculated lengths for pike in each river.



Fig. 4.114. Back calculated lengths for perch in each river.

5. DISCUSSION

Most of the river sites in the ShRFB were surveyed using boat mounted electric fishing equipment, which reflects the fact that these rivers were, on average, larger in size than rivers sampled in other regions. Further evidence for this is the amount of larger and older fish present in ShRFB river sites. Rivers in the ShRFB tended to have lower gradients than some of the other regions, resulting in slower flowing channels. Inclement weather conditions during the summer of 2008 hindered progress in this region, as water levels took a longer amount of time to subside after flooding events.

In general, the greatest fish species richness was recorded in the larger rivers and the lowest in the smaller wadeable streams. A total of 14 pecies of fish were recorded during the 2008 sampling program in the ShRFB; sea trout and roach x bream hybrids were also captured. Brown trout was the most widespread species and occurred in all but two of the sites surveyed, the Scramoge River and the River Brosna (Pollagh). The River Brosna (Clonony) had the greatest species diversity, with ten fish species present, whereas the Glenfelly River had the lowest diversity with only one species present- brown trout. The Glenfelly River was also the site with the lowest species diversity of any river site sampled throughout the entire country during 2008.

Some of the largest brown trout captured during the 2008 surveillance WFD fish monitoring programme anywhere in the country were recorded in the ShRFB. The Mountnugent River in particular was home to some of the biggest and oldest brown trout, some of which measured over 50cm. Growth of brown trout was generally faster in the larger rivers and those with the highest alkalinity levels (Kelly *et al.*, 2009). The Kilcrow, Maigue, Mountnugent and Suck (Cloondacarra) all had very fast brown trout growth, while the slowest growth was observed in some of the smallest and shallowest rivers, including the Bow, Glenfelly, the Graney and the Inny (Oldcastle).

Non-native fish species were recorded in 26 of the 29 rivers surveyed in the ShRFB. 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. The three rivers containing only native fish species were the Broadford River, River Inny (Oldcastle) and Glenfelly River. Kelly *et al.* (2008) placed non-native species in Ireland into two categories (Group 2, which are those that influence ecology and Group 3, which are those that generally have no influence on ecology). Seven group 2 (bream, chub, minnow, pike, perch, roach and stone loach) and one group 3 species (gudgeon) were recorded in the ShRFB region. Minnow and stone loach appear to be quite common throughout the country, while pike, perch, roach and gudgeon are more confined to certain areas, including the ShRFB and the southern part of the Northern Rgional Fisheries Board (Kelly *et al.*, 2009). The River Suck (Ballyforan) and the River Brosna (Clonony) were the only

two sites in the ShRFB, and among only three in the entire country, to have bream present. In this current survey, the River Inny (Shrule) was the only site to contain chub (a non-native invasive species) and one of only two sites in the whole country to have roach x bream hybrids present. Only a single individual, however, was recorded for each species. Non-native species are widespread throughout the ShRFB region. This is possibly due to the connectivity of river systems in the region facilitated by the Shannon-Erne Waterway and the large number of lakes. Anglers in particular must be made aware of the potential negative impacts of these non-native species on Irelands native fish fauna as 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 species can also transform ecosystems, threatening native and high conservation status species (Stokes *et al.*, 2006).

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. There is currently no WFD compliant classification tool for fish in Irish rivers. However; a new project (WFD68) has been initiated (summer 2009) through the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) to develop a rivers fish classification tool for ROI, NI and Scotland and is due for completion in May 2010. Ecological status classes for fish at surveillance monitoring sites will therefore be calculated once this tool has been developed.

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Appendix 1

of the first winter etc.) River L1 L2 L3 L4 L5 **L6 Growth category** Boor Mean 7.17 15.75 20.79 Slow 1.29 SD 1.67 n/a 41 25 1 n 4.36 12.79 20.79 Range min. 20.79 Range max. 10.13 19.08 Bow Mean 6.24 11.86 16.17 20.40 Very slow SD 1.50 1.44 1.25 0.85 52 29 2 7 n Range min. 3.62 9.59 14.03 19.79 Range max. 10.23 14.93 18.00 21.00 Broadford Mean 7.81 SD0.72 5 n 7.20 Range min. 8.92 Range max. Brosna (Clonony Br) Mean 6.87 15.58 20.93 34.67 Fast 1.83 4.25 SD 2.65 n/a n 56 38 10 1 Range min. 3.90 10.29 16.60 34.67 Range max. 11.64 21.10 27.39 34.67 8.55 Camlin Mean SD n/a 1 n Range min. 8.55 Range max. 8.55 Clodiagh Mean 7.88 19.04 27.32 Fast SD 1.47 2.96 1.66 54 29 3 n 5.45 11.49 25.78 Range min. 29.08 Range max. 11.46 23.30 Cross Mean 7.26 17.01 21.95 27.20 Fast 0.08 SD 3.66 n/a n/a 2 2 1 n 1 Range min. 7.21 14.42 21.95 27.20 21.95 Range max. 7.32 19.60 27.20 **Deel (Newcastlewest)** 6.93 27.60 Mean 18.85 34.54 Fast SD 2.03 4.31 2.67 n/a 81 46 15 1 n Range min. 3.58 8.92 23.19 34.54 Range max. 12.73 26.57 31.92 34.54

Summary of the growth of brown trout in the ShRFB rivers (L1=back calculated length at the end

Appendix 1 continued

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

River		L1	L2	L3	L4	L5	L6	Growth category
Feale	Mean	7.06	16.84					Fast
	SD	2.38	3.65					
	n	10	7					
	Range min.	4.67	14.02					
	Range max.	11.66	24.42					
Fergus (Clonroad Br)	Mean	6.87	13.88	21.41	26.31	32.98		Fast
	SD	1.87	2.43	2.35	n/a	n/a		
	n	21	16	6	1	1		
	Range min.	4.57	10.09	17.79	26.31	32.98		
	Range max.	11.60	17.89	23.83	26.31	32.98		
Glenfelly Stream	Mean	5.66	11.30					Very slow
	SD	1.34	0.93					
	n	26	3					
	Range min.	3.89	10.67					
	Range max.	8.08	12.37					
Gourna	Mean	8.13	14.24	18.16				Slow
	SD	1.47	2.30	n/a				
	n	30	13	1				
	Range min.	4.60	9.96	18.16				
	Range max.	10.49	17.12	18.16				
Graney	Mean	6.36	12.46	17.57				Very slow
	SD	1.32	2.05	n/a				
	n	61	8	1				
	Range min.	3.77	10.30	17.57				
	Range max.	9.32	15.50	17.57				
Inny (Oldcastle)	Mean	6.57	11.50					Very slow
	SD	1.28	2.49					
	n	34	8					
	Range min.	4.20	7.87					
	Range max.	9.26	14.12					
Inny (Shrule Br)	Mean	8.07	14.22	20.38	24.14			Slow
	SD	2.64	3.59	5.55	1.22			
	n	33	24	7	2			
	Range min.	4.07	6.59	13.40	23.28			
	Range max.	13.81	19.96	28.24	25.00			
Kilcrow	Mean	10.13	20.97	29.52	35.73			Very fast
	SD	1.34	n/a	n/a	n/a			
	n	3	1	1	1			
	Range min.	9.32	20.97	29.52	35.73			
	Range max.	11.68	20.97	29.52	35.73			

Appendix 1 continued

of the first winter etc.)								
River		L1	L2	L3	L4	L5	L6	Growth category
Little	Mean	6.95	13.37					Slow
	SD	1.85	3.57					
	n	14	8					
	Range min.	4.15	10.02					
	Range max.	9.71	18.32					
Little Brosna	Mean	8.31	16.81	23.12				Fast
	SD	2.05	4.58	2.51				
	n	28	28	4				
	Range min.	4.71	9.16	19.94				
	Range max.	12.94	25.16	25.68				
Maigue	Mean	7.72	19.78	28.64	40.05			Very fast
-	SD	1.69	5.83	4.06	n/a			
	n	98	75	25	1			
	Range min.	4.28	10.39	22.08	40.05			
	Range max.	11.71	29.10	36.30	40.05			
Mountnugent	Mean	7.39	17.80	28.48	35.22	33.63	40.02	Very fast
U	SD	1.57	3.94	5.62	10.38	n/a	n/a	·
	n	75	44	21	3	1	1	
	Range min.	3.92	10.65	18.95	27.67	33.63	40.02	
	Range max.	11.51	29.07	42.44	47.05	33.63	40.02	
Shannon (Battle Br)	Mean	7.03	15.88	22.99	34.00			Fast
	SD	2.13	4.03	3.24	n/a			
	n	11	7	5	1			
	Range min.	4.68	10.65	19.84	34.00			
	Range max.	11.60	23.20	28.40	34.00			
Silver	Mean	7.67	15.34	20.35	29.00			Slow
	SD	1.54	3.23	2.68	n/a			
	n	33	13	6	1			
	Range min.	4.41	10.22	17.56	29.00			
	Range max.	10.41	19.57	24.00	29.00			
Smearlagh	Mean	6.90	14.25	25.48				Fast
8	SD	1.46	2.64	n/a				
	n	38	20	1				
	Range min.	3.38	11.36	25.48				
	Range max.	9.74	19.65	25.48				
Suck (Ballyforan Br)	Mean	8.48	17.35	25.06				Fast
······································	SD	n/a	n/a	n/a				
	n	4	1	4				
	Range min	8.48	17.35	25.06				
	Range may	8.48	17 35	25.06				

Summary of the growth of brown trout in the	e ShRFB rivers	(L1=back cal	culated length a	it the end
of the fi	irst winter etc.)			

Appendix 1 continued

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

		/ ****						
River		L1	L2	L3	L4	L5	L6	Growth category
Suck (Cloondacarra Br)	Mean	11.32	22.64					Very fast
	SD	n/a	n/a					
	n	1	1					
	Range min.	11.32	22.64					
	Range max.	11.32	22.64					
Tullamore	Mean	7.48	14.99	20.44	23.03			Slow
	SD	1.47	2.74	3.34	n/a			
	n	32	29	9	1			
	Range min.	4.38	8.18	15.60	23.03			
	Range max.	9.86	18.97	24.42	23.03			

Appendix 2

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

River	,	L1	L2	L3
Bow	Mean	5.04		
	SD	1.18		
	n	15		
	Range min.	3.53		
	Range max.	6.91		
Broadford	Mean	6.27		
	SD	0.02		
	n	2		
	Range min.	6.25		
	Range max.	6.29		
Brosna (Clonony)	Mean	5.03		
	SD	0.24		
	n	5		
	Range min.	4.80		
	Range max.	5.37		
Clodiagh	Mean	4.66		
	SD	n/a		
	n	1		
	Range min.	4.66		
	Range max.	4.66		
Feale	Mean	4.93		
	SD	0.79		
	n	20		
	Range min.	3.45		
	Range max.	6.53		
Fergus	Mean	7.03	15.46	41.42
	SD	3.95	2.70	5.42
	n	7	4	4
	Range min.	4.09	13.11	36.30
	Range max.	14.52	18.88	49.08
Gourna	Mean	6.24	9.36	
	SD	0.65	n/a	
	n	7	1	
	Range min.	5.59	9.36	
	Range max.	7.34	9.36	
Graney	Mean	4.48		
	SD	0.46		
	n	6		
	Range min.	3.91		
	Range max.	4.98		

Dimon		T 1	1.2	т 2
Kiver			L2	L3
Kilcrow	Mean	4.86		
	SD	n/a		
	n	1		
	Range min.	4.86		
	Range max.	4.86		
Little Brosna	Mean	5.76	10.45	
	SD	0.93	n/a	
	n	11	1	
	Range min.	3.95	10.45	
	Range max.	7.04	10.45	
Maigue	Mean	7.74	30.92	48.83
-	SD	2.30	15.48	7.43
	n	21	17	9
	Range min.	4.52	10.44	35.09
	Range max.	11.27	52.08	62.00
Silver	Mean	6.08		
	SD	n/a		
	n	1		
	Range min.	6.08		
	Range max.	6.08		
Smearlagh	Mean	4.71	8.60	
0	SD	0.83	n/a	
	n	20	1	
	Range min.	3.31	8.60	
	Range max.	6.30	8.60	

Appendix 2 continued

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

River		L1	L2	L3	L4	L5	L6	L7	L8
Boor	Mean	2.20	7.26	11.88					
	SD	n/a	n/a	n/a					
	n	1	1	1					
	Range min.	2.20	7.26	11.88					
	Range max.	2.20	7.26	11.88					
Brosna (Clonony)	Mean	2.87	6.46	10.39	13.65	15.97	18.04	19.96	
	SD	0.71	1.07	1.31	1.37	0.96	0.57	n/a	
	n	48	48	35	24	12	5	1	
	Range min.	2.00	4.17	8.23	11.85	14.56	17.11	19.96	
	Range max.	4.89	8.59	12.73	16.69	17.38	18.64	19.96	
Brosna (Pollagh)	Mean	2.78	6.56	11.18	15.78	21.20	24.05	28.14	
	SD	0.39	0.83	1.28	1.39	0.92	1.61	n/a	
	n	54	52	47	25	3	2	1	
	Range min.	2.09	4.78	8.76	12.51	20.16	22.91	28.14	
	Range max.	3.97	9.59	14.06	18.64	21.88	25.19	28.14	
Camlin	Mean	2.71	6.51	10.35	13.75	15.46			
	SD	0.59	0.96	1.60	2.76	0.15			
	n	37	32	15	8	2			
	Range min.	2.01	4.33	7.29	10.52	15.36			
	Range max.	4.73	8.93	12.27	17.98	15.57			
Cross	Mean	3.01	6.31	10.60	14.68	17.92	19.36	21.76	23.40
	SD	0.69	0.93	1.48	1.46	2.32	0.25	n/a	n/a
	n	36	35	22	21	8	2	1	1
	Range min.	1.35	4.35	7.61	12.16	15.13	19.18	21.76	23.40
	Range max.	4.17	7.79	12.58	17.18	22.02	19.54	21.76	23.40

Appendix 3

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

Appendix	3	continued
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	Summary of the growth of roach in the ShRFB rivers	(L1=back calculated length at the end of the first winter etc.)
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River		L1	L2	L3	L4	L5	L6	L7	L8
Graney	Mean	2.42	6.21	12.08					
	SD	n/a	n/a	n/a					
	n	1	1	1					
	Range min.	2.42	6.21	12.08					
	Range max.	2.42	6.21	12.08					
Inny (Shrule)	Mean	3.31	6.92	11.11	15.56	18.40			
	SD	0.95	1.60	1.88	1.66	n/a			
	n	26	20	12	6	1			
	Range min.	2.00	4.66	8.34	12.69	18.40			
	Range max.	5.96	10.16	14.73	17.00	18.40			
Kilcrow	Mean	4.00	7.74	11.36					
	SD	0.68	1.14	1.32					
	n	41	27	6					
	Range min.	2.79	6.00	10.01					
	Range max.	5.43	9.58	13.03					
Little (Cloghan)	Mean	3.45	6.44	10.12	13.34	15.64	17.48		
	SD	n/a	n/a	n/a	n/a	n/a	n/a		
	n	1	1	1	1	1	1		
	Range min.	3.45	6.44	10.12	13.34	15.64	17.48		
	Range max.	3.45	6.44	10.12	13.34	15.64	17.48		
Scramoge	Mean	2.69	6.51	11.46	15.43				
	SD	0.48	0.80	1.54	1.56				
	n	18	18	14	7				
	Range min.	2.03	5.26	9.18	13.87				
	Range max.	3.57	7.91	14.10	17.78				

Appendix 3 continued

Summary of the growth of roach in the ShRFB rivers (L1=back calculated length at the end of the first winter etc.)
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River		L1	L2	L3	L4	L5	L6	L7	L8
Shannon (Battle Bridge)	Mean	2.83	6.26	10.23	13.68	16.46	19.24	22.29	24.47
	SD	0.86	1.49	1.55	1.64	1.55	1.28	1.83	n/a
	n	71	57	42	29	16	6	5	1
	Range min.	1.50	3.05	7.45	10.60	14.05	17.26	20.06	24.47
	Range max.	5.11	9.82	15.32	16.36	19.01	20.45	24.35	24.47
Suck (Ballyforan)	Mean	3.53	6.83	10.52	14.00	16.26	17.86		
	SD	0.57	0.66	0.92	1.11	1.35	0.40		
	n	52	49	34	20	5	2		
	Range min.	2.73	5.23	8.19	11.94	14.19	17.57		
	Range max.	4.94	8.30	12.22	16.22	17.75	18.14		
Suck (Cloondacarra)	Mean	3.89	6.59	9.56	12.67				
	SD	0.64	0.81	0.71	1.12				
	n	40	28	14	5				
	Range min.	2.55	5.11	8.68	11.57				
	Range max.	5.03	8.24	10.87	14.19				
Appendix 4

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

River		L1	L2	L3	L4	L5	L6
Brosna (Clonony)	Mean	21.97	37.94	50.79			
	SD	3.05	2.37	2.78			
	n	5	5	3			
	Range min.	17.73	35.11	48.07			
	Range max.	25.34	41.38	53.63			
Brosna (Pollagh)	Mean	24.70	45.89	57.21	75.57	80.66	85.75
	SD	5.07	4.52	7.90	n/a	n/a	n/a
	n	5	4	3	1	1	1
	Range min.	18.74	41.98	51.54	75.57	80.66	85.75
	Range max.	29.88	50.94	66.23	75.57	80.66	85.75
Camlin	Mean	20.39	37.85	47.90			
	SD	3.81	1.21	n/a			
	n	3	2	1			
	Range min.	16.10	37.00	47.90			
	Range max.	23.38	38.71	47.90			
Cross	Mean	22.17	34.49	48.03			
	SD	2.22	3.39	2.07			
	n	19	13	4			
	Range min.	19.10	30.66	45.51			
	Range max.	26.32	41.88	50.43			
Fergus (Clonroad)	Mean	18.66	39.29	53.84	63.32		
	SD	3.20	11.38	9.47	7.24		
	n	4	3	3	3		
	Range min.	14.87	31.09	45.95	58.12		
	Range max.	22.52	52.28	64.35	71.59		
Inny (Shrule)	Mean	16.45	23.45	35.64	44.55		
	SD	2.89	3.26	n/a	n/a		
	n	4	4	1	1		
	Range min.	12.45	21.16	35.64	44.55		
	Range max.	18.83	28.24	35.64	44.55		
Kilcrow	Mean	21.93	36.51	50.09	60.82		
	SD	1.60	1.40	2.97	n/a		
	n	13	12	5	1		
	Range min.	19.47	33.69	46.79	60.82		
	Range max.	24.63	38.66	54.50	60.82		
Scramoge	Mean	19.43	29.57	38.06			
	SD	4.34	3.96	5.18			
	n	10	5	4			
	Range min.	14.40	24.72	33.81			
	Range max.	24.11	35.68	45.34			

Appendix 4 continued

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

River		L1	L2	L3	L4	L5	L6
Shannon (Battle Bridge)	Mean	17.14	30.46	44.68			
	SD	0.69	4.48	n/a			
	n	5	4	1			
	Range min.	16.35	25.61	44.68			
	Range max.	17.83	35.25	44.68			
Suck (Ballyforan)	Mean	20.17	32.98	43.68	53.46	71.40	79.05
	SD	2.29	3.82	1.87	4.06	n/a	n/a
	n	9	9	5	4	1	1
	Range min.	18.07	28.33	41.26	50.80	71.40	79.05
	Range max.	24.49	37.85	45.36	59.50	71.40	79.05
Suck (Clonony)	Mean	18.76	31.56	44.33	53.84	61.18	
	SD	1.14	1.61	1.89	2.23	n/a	
	n	10	8	5	3	1	
	Range min.	16.85	29.32	42.06	51.31	61.18	
	Range max.	20.93	34.40	46.69	55.54	61.18	

River		I 1	I 2	I 3	I 4	I 5	I 6	17	18
	M		12	15 70	10.0	20.00	21.52	LI	Lo
Brosna (Clonony)	Mean	0.01	12	15.72	18.8	20.69	21.52		
	SD	0.96	1.27	1.59	1.83	1.19			
	n	31	31	24	8	3	1		
	Range min.	4.93	10.06	13.13	15.75	19.37			
	Range max.	8.9	15.02	18.45	21.37	21.7			
Brosna (Pollagh)	Mean	5.74	11.22	16.28					
	SD	0.72	1.06	0.94					
	n	22	21	3					
	Range min.	4.5	8.88	15.4					
	Range max.	7.04	13.03	17.28					
Cross	Mean	6.4	8.95	11.38	12.92	13.17			
	SD	0.96	1.52	1.8	1.51				
	n	35	24	10	7	1			
	Range min.	4.62	7.11	9.49	11.41				
	Range max.	8.47	12.13	14.3	15.98				
Fergus (Clonroad)	Mean	6.53	11.2	15.84	18.99				
	SD	0.62	1.05	0.46	1.46				
	n	7	4	4	3				
	Range min.	5.45	10.2	15.46	17.34				
	Range max.	7.31	12.61	16.48	20.09				
Inny (Shrule)	Mean	8.23	12.18	13.88					
	SD	1.35	1.79	2.54					
	n	11	7	2					
	Range min.	6.04	9.06	12.08					
	Range max.	10.21	14.56	15.68					

Appendix 5

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Appendix 5

River		L1	L2	L3	L4	L5	L6	L7	L8
Kilcrow	Mean	6.51	10.95	15.52	19.72				
	SD	0.89	1.13	2.11	0.19				
	n	54	40	12	3				
	Range min.	4.76	8.82	11.28	19.5				
	Range max.	8.69	14.16	18.04	19.86				
Shannon (Battle Br.)	Mean	6.07	10.19	13.48	16.19	18.78			
	SD	0.86	1.49	2.11	1.12				
	n	24	22	9	2	1			
	Range min.	4.33	7.48	10.86	15.4				
	Range max.	7.51	13.43	18.28	16.99				
Suck (Ballyforan)	Mean	6.31	11.13	15.42	18.77	19.46	20.23	21.63	24
	SD	0.95	1.61	1.25	2	1.7			
	n	41	38	12	6	2	1	1	1
	Range min.	4.64	8.99	13.41	15.73	18.25			
	Range max.	9.12	14.32	17.25	21.22	20.66			
Suck (Cloondacarra)	Mean	6.38	9.65	14.7	18.75				
	SD	1.02	0.94	0.95	0.69				
	n	31	23	4	2				
	Range min.	4.78	7.88	13.56	18.26				
	Range max.	9.47	11.12	15.76	19.25				

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

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