Sampling Fish for the Water Framework Directive

Rivers 2010

Shannon International River Basin District

Iascach Intíre Éireann
Inland Fisheries Ireland

ACKNOWLEDGEMENTS

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

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

Furthermore, the authors would like to acknowledge the funding provided for the project from the Department of Communications, Energy and Natural Resources for 2010.

PROJECT STAFF

Project Director/Senior Research officer:	Dr. Fiona Kelly
Project Manager:	Dr. Andrew Harrison
Research Officer:	Dr. Ronan Matson
Research Officer:	Ms. Lynda Connor
Technician	Mr. Rory Feeney
Technician:	Ms. Emma Morrissey
Technician:	Ms. Róisín O'Callaghan
Technician:	Mrs. Ciara Wögerbauer
Technician / Fisheries Assistant:	Ms. Gráinne Hanna
GIS Officer:	Mr. Kieran Rocks
Fisheries Assistant:	Mr. Kevin Gallagher (Oct 2010 – Dec 2010)

TABLE OF CONTENTS

1. INTRODUCTION

Fish stock surveys were undertaken in 43 river sites throughout Ireland during the summer of 2010 as part of the programme of sampling fish for the Water Framework Directive (WFD). These surveys are required by both national and European law, with Annex V of the WFD stipulating that rivers are included within the monitoring programme and that the composition, abundance and age structure of fish fauna are examined (Council of the European Communities, 2000). Seven of the 43 surveys were conducted at river sites in the Shannon International River Basin District (ShIRBD) in May 2010 by staff from Inland Fisheries Ireland (IFI) (Table 2.1, 2.2 and Fig. 2.1).

Although fish survey work has been carried out in Ireland in the past, no project to date has been as extensive as the current on-going monitoring programme in providing data appropriate for WFD compliance. Continued surveying of these and additional river sites will provide a useful baseline and time-series dataset for future monitoring of water quality. This in turn will provide information for River Basin District (RBD) managers to compile and implement programmes of measures to improve degraded water bodies.

The ShIRBD is Ireland's largest RBD, covering a distance from where the River Shannon rises in the Cuilcagh Mountains in County Cavan, to as far south as the Dingle peninsula in County Kerry (Fig. 2.1). It contains Ireland's largest river – the River Shannon. The vast majority of this region is within the Republic of Ireland but it also encompasses a small part of County Fermanagh in Northern Ireland. Many counties across all four provinces are wholly or partly contained within this RBD. In Ulster, this includes Cavan and Fermanagh; in Connacht, this includes Galway, Leitrim, Mayo, Roscommon and Sligo; in Leinster, this includes Laois, Longford, Meath, Offaly and Westmeath; and in Munster, this includes Clare, Cork, Kerry, Limerick and Tipperary. The population of the region is over 670,000, but due to its geographic area, the overall population density is relatively low. The largest urban centre is Limerick City, while a number of other smaller towns also have significant populations, including Ennis, Tralee, Mullingar, Athlone and Tullamore. The Shannon IRBD is home to substantial agricultural activity, with dairy and meat production being the most economically important. Peat extraction is also important to the region for power generation, as well as tourism operations involving boating and angling (SHIRBD, 2009).

This report summarizes the main findings of the fish stock surveys in the seven river sites surveyed in the ShIRBD during 2010 and reports on the current ecological status of the fish stocks in each.

2. STUDY AREA

Seven river sites were surveyed in the Upper Shannon catchment within the ShIRBD. Six surveys were carried out on the River Shannon itself, with a further single survey on the Ballydangan River, a small tributary joining the River Shannon near Clonmacnoise. The sites ranged in surface area from 774m^2 for the Ballydangan River to 45,628m^2 for the River Shannon (Lanesborough, Site A). All sites in the ShIRBD were categorised as non-wadeable sites and were surveyed using boat-based electric fishing units.

Summary details of each site's location and physical characteristics are given in Tables 2.1 and 2.2, and the distribution of sites throughout the ShIRBD is shown in Figure 2.1.

Table 2.1. Location and codes of river sites surveyed for WFD surveillance monitoring, 2010

River	Site name	Catchment	Site Code	Waterbody code
ShIRBD Non-wadeable sites				
Shannon	Battle Br (A)	Shannon Upper	26S020500Fa	SH_26_3090
Shannon	Battle Br (B)	Shannon Upper	26S020500Fb	SH_26_3090
Shannon	Ballyleague Br Lanesboro (A)	Shannon Upper	26S021600Fa	SH_26_4162
Shannon	Ballyleague Br Lanesboro (B)	Shannon Upper	26S021600Fb	SH_26_4162
Shannon	Athlone: Burgess Park	Shannon Upper	26S021720F	SH_26_1448_1
Shannon	Clonmacnoise: at Jetty	Shannon Upper	26S021800F	SH_26_1448_3
Ballydangan	Br u/s Shannon R. Confl	Shannon Upper	26B140200F	SH_26_1341

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

River	Upstream catchment (km^2)	Wetted width (m)	Surface area (m^2)	Mean depth (m)	Max depth (m)
ShIRBD Non-wadeable sites					
Shannon (Battle Br A)	603.8	31.00	17577	1.00	1.50
Shannon (Battle Br B)	604.6	32.67	6468	3.00	3.00
Shannon (Ballyleague A)	2722.9	62.33	45628	1.50	1.50
Shannon (Ballyleague B)	2779.5	87.50	34825	1.59	1.59
Shannon (Athlone)	4655.4	95.40	44170	2.54	4.50
Shannon (Clonmacnoise)	4919.8	89.33	37252	6.00	6.00
Ballydangan (u/s Shannon R. Confluence)	25.7	3.50	774	0.50	0.50

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

3. METHODS

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

Fish from each pass were sorted and processed separately. Fish were identified and lengths and weights were recorded; sub-samples were measured when large numbers of fish were present. For the purpose of species identification, where recorded, juvenile river lamprey (*Lampetra fluviatilis*), brook lamprey (*Lampetra planeri*) and sea lamprey (*Petromyzon marinus*) were recorded as 'Lamprey sp.'. Sea trout and brown trout were recorded separately. For aging analyses, scales were taken from salmonids and most non-native fish species greater than 8.0cm in length. These fish were held in a large bin of oxygenated water after processing until they were fully recovered before being returned to the water. When present in a survey, a sub-sample of perch were retained for aging using opercular bones.

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

A sub-sample of the dominant fish species were aged (five fish from each 1cm size class). Fish scales were aged using a microfiche, and opercular bones were aged using an Olympus SZX10 microscope/digital camera system. Growth was determined by back-calculating lengths at the end of each winter (e.g. L1 is the mean length at the end of the first winter, L2 is the mean length at the end of the second winter, etc.).

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

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

4. RESULTS

4.1 Species composition, abundance and age structure

4.1.1 The River Shannon (Battle Bridge)

Plate 4.1. The River Shannon downstream of Battle Bridge, Co. Leitrim/Roscommon border

The River Shannon is Ireland's longest river, flowing for approximately 260km. It rises in the Cuilcagh Mountains in Co. Cavan and flows through three large lakes, Lough Allen, Lough Derg and Lough Ree, before entering the sea at Limerick. The Shannon is historically an important navigation route and is connected to many other waterways by a series of canals, including the Royal Canal, the Grand Canal and the Shannon–Erne Waterway. Together with its tributaries, the Shannon encompasses a massive catchment area. As the largest river in Ireland, it is no surprise that the Shannon is a great mixed fishery. The main channel itself contains good stocks of brown trout and also supports a good coarse fishery, whereas the tributaries of the lower catchment are better known for their game fishing (O'Reilly, 2009). There are several barriers that hinder the migration of fish upstream, including a weir at O' Briensbridge below Lough Derg, the hydroelectric power station at Ardnacrusha and a number of locks used for navigation.

The River Shannon (Battle Br.) sites were located approximately 2.5km downstream of Battle Bridge, north-west of the village of Leitrim (Fig. 4.1; Plate 4.1). Trout and coarse fishing is popular in this part of the River Shannon (O'Reilly, 2002). Two sites were surveyed, separated by approximately 100m.

Site A: One electric-fishing pass was conducted on the upstream section using three high-voltage boat-based electric fishing units on the 17th of May 2010, along a 567m length of channel (Fig. 4.1). The mean wetted width of the survey stretch was 31.0m and the mean depth was approximately 100cm. A total wetted area of 17,577m^2 was surveyed. Glide was the only habitat present, with a mixed substrate of cobble and gravel.

Site B: One electric-fishing pass was conducted on the downstream section using three high-voltage boat-based electric fishing units on the 17th of May 2010, along a 198m length of channel (Fig. 4.1). The mean wetted width of the survey stretch was 32.7m and the mean depth was approximately 300cm. A total wetted area of 6,468m^2 was surveyed. Glide was the only habitat present, with a mixed substrate of cobble and gravel.

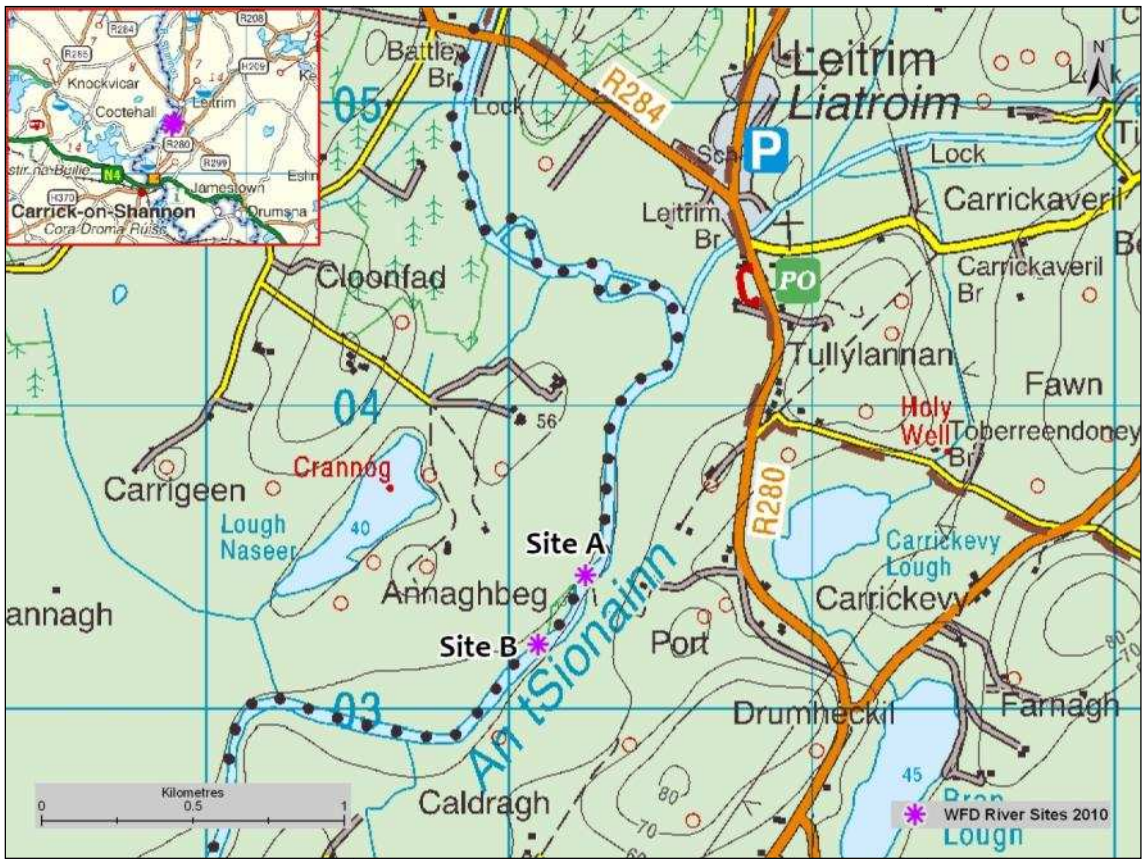

Fig. 4.1. Location of the River Shannon (Battle Br.) surveillance monitoring sites

A total of three fish species were recorded in the River Shannon (Battle Br.) site A. Roach was the most abundant species, followed by perch and pike (Table 4.1).

Table 4.1. Minimum density of each fish species (no./m^2) captured on the River Shannon (Battle Br.) site A, May 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
Rutilus rutilus	Roach	-	-	0.0031
Perca fluviatilis	Perch	-	-	0.0007
Esox lucius	Pike	-	-	0.0001
All Fish	All Fish	-	-	0.0039

Roach captured in the River Shannon (Battle Br.) site A ranged in length from 3.5cm to 25.0cm (Fig. 4.2). Six age classes (0+, 1+, 2+, 3+, 4+ and 6+) were present, accounting for approximately 20%, 13%, 41%, 22% 2% and 2% of the total roach catch respectively.

Perch captured in the River Shannon (Battle Br.) site A ranged in length from 6.1cm to 18.0cm (Fig. 4.3). Two pike were also recorded, measuring 36.5cm and 58cm in length and aged 2+ and 3+ respectively.

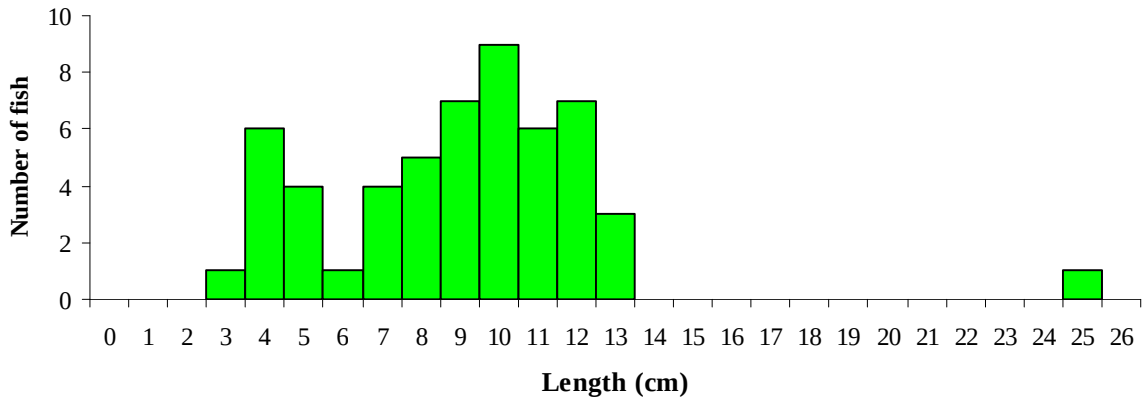

Fig. 4.2. Length frequency distribution of roach in the River Shannon (Battle Br.) site A May 2010 (n = 54)

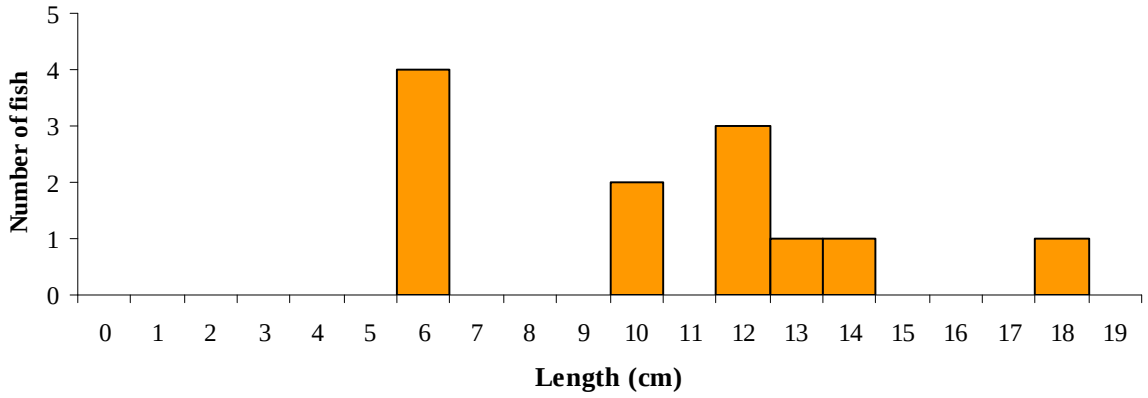

Fig. 4.3. Length frequency distribution of perch in the River Shannon (Battle Br.) site A May 2010 (n = 12)

A total of four fish species were recorded in the River Shannon (Battle Br.) site B. Roach was the most abundant species, followed by perch, pike and gudgeon (Table 4.2).

Table 4.2. Minimum density of each fish species (no./m^2) captured on the River Shannon (Battle Br.) site B, May 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
Rutilus rutilus	Roach	-	-	0.0181
Perca fluviatilis	Perch	-	-	0.0006
Esox lucius	Pike	-	-	0.0002
Gobio gobio	Gudgeon	-	-	0.0002
All Fish	All Fish	-	-	0.0190

Roach captured at the River Shannon (Battle Br.) site B ranged in length from 3.0cm to 23.6cm (Fig. 4.4). Nine age classes (0+, 1+, 2+, 3+, 4+, 5+, 6+, 7+ and 9+) were present, accounting for approximately 9%, 3%, 22%, 28%, 15%, 11%, 6%, 3%, and 2% of the total roach catch respectively.

Other species recorded included, perch ranging from 9.4cm to 14.1cm and single individuals of gudgeon, measuring 11.0cm and pike (aged 1+) measuring 21.3cm.

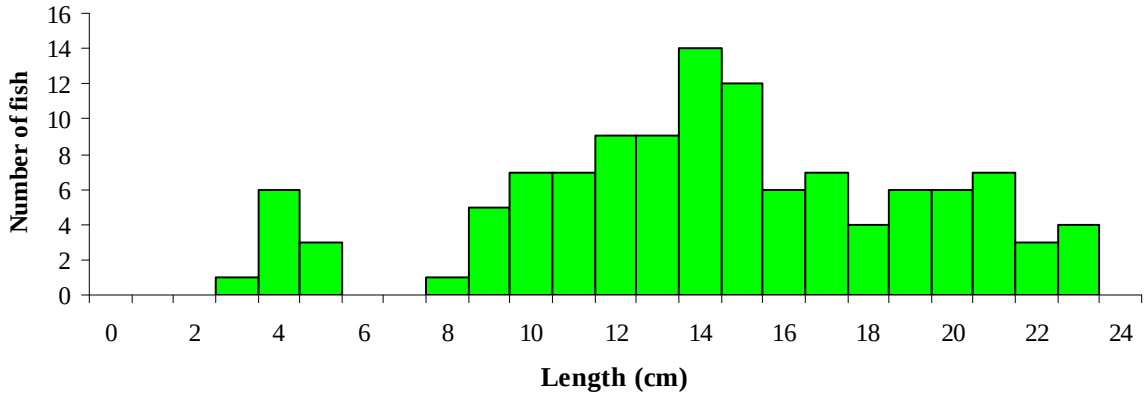

Fig. 4.4. Length frequency distribution of roach in the River Shannon (Battle Br.) site B May 2010 (n = 117)

4.1.2 The River Shannon (Lanesborough)

Plate 4.2. The River Shannon upstream of Lanesborough, Co. Longford/Roscommon border

The River Shannon (see Section 4.1.1 for description) separates the villages of Ballyleague, Co. Roscommon and Lanesborough, Co. Longford. Immediately downstream of Lanesborough, the Shannon enters Lough Ree. This location is very popular among coarse anglers due to a hot water stretch downstream of the power station outflow. Two sites were surveyed, separated by approximately 3km.

Site A: The first site surveyed was located approximately 3km upstream of the town (Plate 4.2, Fig. 4.5). One electric-fishing pass was conducted using three high-voltage boat-based electric fishing units on the 18th of May 2010 along a 732m length of channel. The mean wetted width of the survey stretch was 62.3m and the mean depth was approximately 150cm. A total wetted area of 45,628m^2 was surveyed. Glide was the only habitat present, with a mixed substrate of cobble, gravel and mud.

Site B: The second site surveyed was located in the centre of Lanesborough town, just upstream of where the river enters Lough Ree (Fig. 4.5). One electric-fishing pass was conducted using four high-voltage boat-based electric fishing units on the 18th of May 2010 along a 398m length of channel. The mean wetted width of the survey stretch was 87.5m and the mean depth was approximately 159cm. A

total wetted area of 34,825m^2 was surveyed. Glide was the dominant substrate present, with a mixed substrate of cobble, gravel and mud.

Fig. 4.5. Location of the River Shannon (Lanesborough) surveillance monitoring sites

A total of eight fish species were recorded in the River Shannon (Lanesborough) site A. Roach was the most abundant species, followed by perch, pike, lamprey, eels, gudgeon, rudd and bream (Table 4.3).

Table 4.3. Minimum density of each fish species (no./m^2) captured on the River Shannon (Lanesborough) site A, May 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
Rutilus rutilus	Roach	-	-	0.00243
Perca fluviatilis	Perch	-	-	0.00160
Esox lucius	Pike	-	-	0.00057
Lampetra sp.	Lamprey sp.	-	-	0.00022
Anguilla anguilla	Eel	-	-	0.00011
Gobio gobio	Gudgeon	-	-	0.00011
Scardinius erythrophthalmus	Rudd	-	-	0.00009
Abramis brama	Bream	-	-	0.00002
All Fish	All Fish	-	-	0.00515

Roach captured in the River Shannon (Lanesborough) site A ranged in length from 2.8cm to 21.1cm (Fig. 4.6). Five age classes (0+, 1+, 2+, 3+ and 4+) were present, accounting for approximately 38%, 30%, 20%, 11% and 2% of the total roach catch respectively.

Perch captured in the River Shannon (Lanesborough) site A ranged in length from 5.5cm to 25.6cm (Fig. 4.7). The dominant length class was from 5cm to 7cm, corresponding to the 0+ age class.

Pike captured in the River Shannon (Lanesborough) site A ranged in length from 3.5cm to 95.0cm (Fig. 4.8). Nine age classes (0+, 1+, 2+, 3+, 4+, 5+, 6+, 7+ and 8+) were present, accounting for approximately 4%, 38%, 19%, 12%, 4%, 8%, 4%, 8% and 4% of the total pike catch respectively.

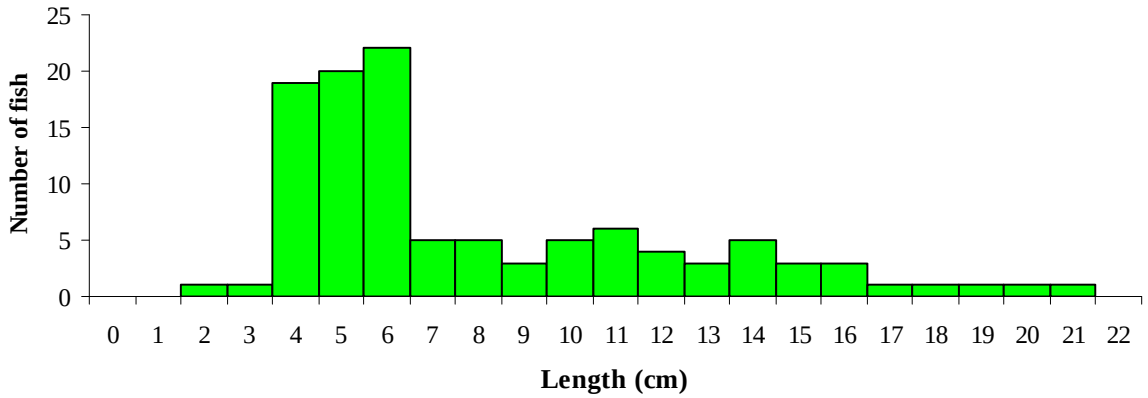

Fig. 4.6. Length frequency distribution of roach in the River Shannon (Lanesborough) site A, May 2010 (n = 110)

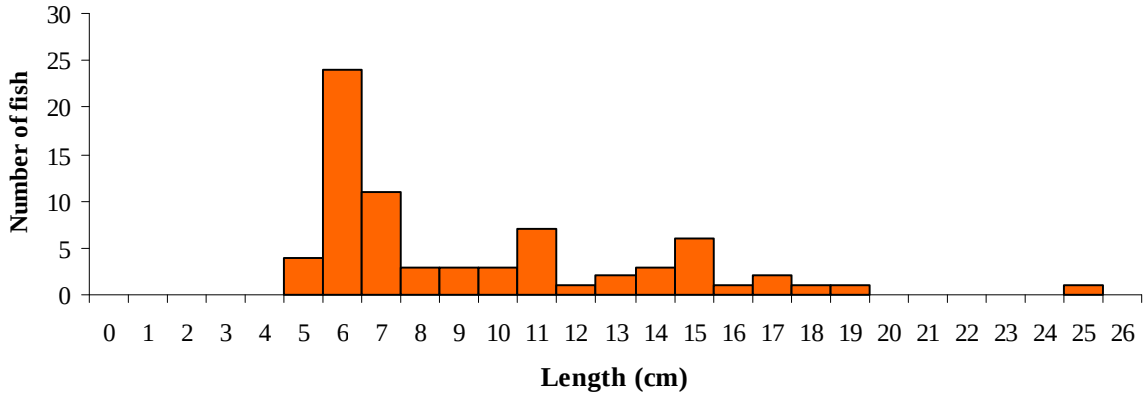

Fig. 4.7. Length frequency distribution of perch in the River Shannon (Lanesborough) site A, May 2010 (n = 73)

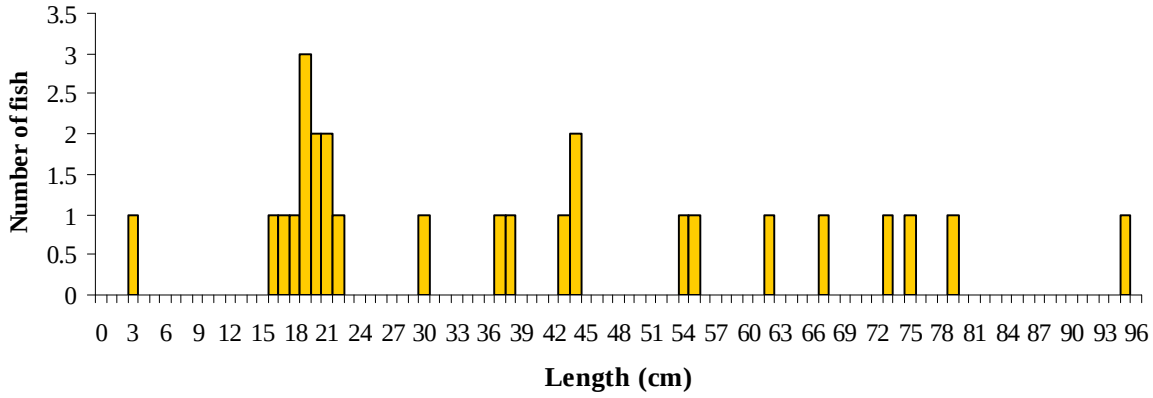

Fig. 4.8. Length frequency distribution of pike in the River Shannon (Lanesborough) site A, May 2010 (n = 26)

A total of eight fish species were recorded in the River Shannon (Lanesborough) site B. Roach was the most abundant species, followed by perch, pike, lamprey, eels, roach × bream hybrids, bream and rudd (Table 4.4).

Table 4.4. Minimum density of each fish species (no./m^2) captured on the River Shannon (Lanesborough) site B, May 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
Rutilus rutilus	Roach	-	-	0.00810
Perca fluviatilis	Perch	-	-	0.00190
Esox lucius	Pike	-	-	0.00032
Lampetra sp.	Lamprey sp.	-	-	0.00020
Anguilla anguilla	Eel	-	-	0.00009
Rutilus rutilus × *Abramis brama*	Roach × bream hybrid	-	-	0.00006
Abramis brama	Bream	-	-	0.00003
Scardinius erythrophthalmus	Rudd	-	-	0.00003
All Fish	All Fish	-	-	0.01071

Roach captured in the River Shannon (Lanesborough) site B ranged in length from 2.3cm to 27.5cm (Fig. 4.9). Eight age classes (0+, 1+, 2+, 3+, 4+, 5+, 6+ and 8+) were present, accounting for approximately 65%, 21%, 5%, 6%, 1%, 1%, 0.4% and 1% of the total roach catch respectively.

Perch captured in the River Shannon (Lanesborough) site B ranged in length from 2.5cm to 19.9cm (Fig. 4.10). The dominant length class was from 5cm to 7cm, corresponding to the 0+ age class.

Pike ranged in length from 18.6cm to 101.0cm (Fig. 4.11). Six age classes (1+, 2+, 5+, 6+, 7+ and 10+) were present, accounting for approximately 45%, 18%, 9%, 9%, 9% and 9% of the total pike catch respectively.

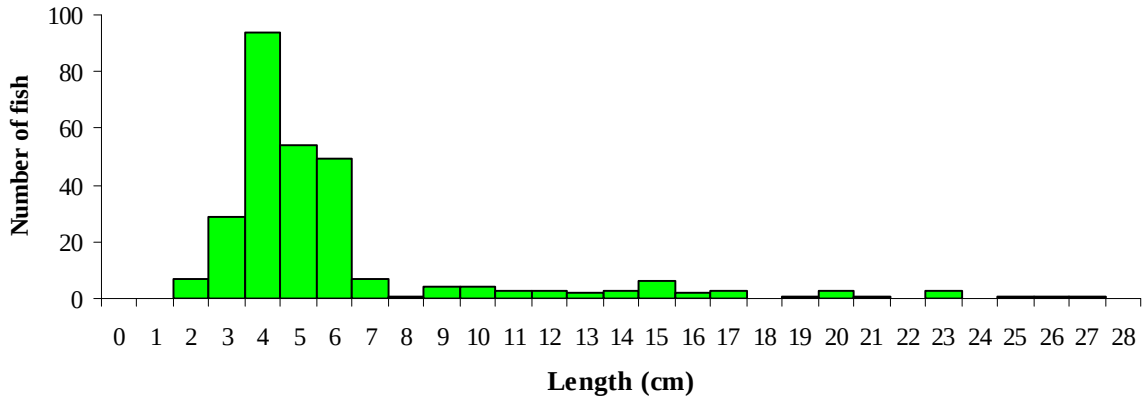

Fig. 4.9. Length frequency distribution of roach in the River Shannon (Lanesborough) site B, May 2010 (n = 282)

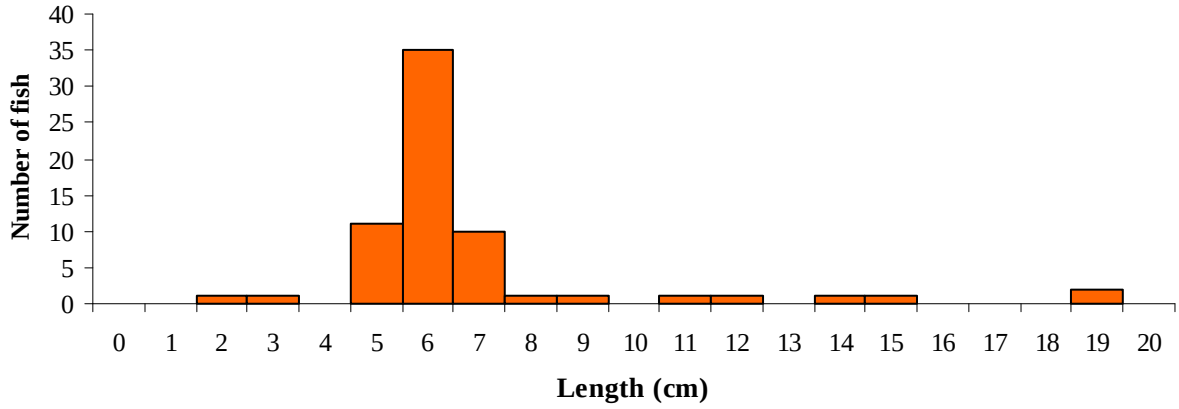

Fig. 4.10. Length frequency distribution of perch in the River Shannon (Lanesborough) site B, May 2010 (n = 66)

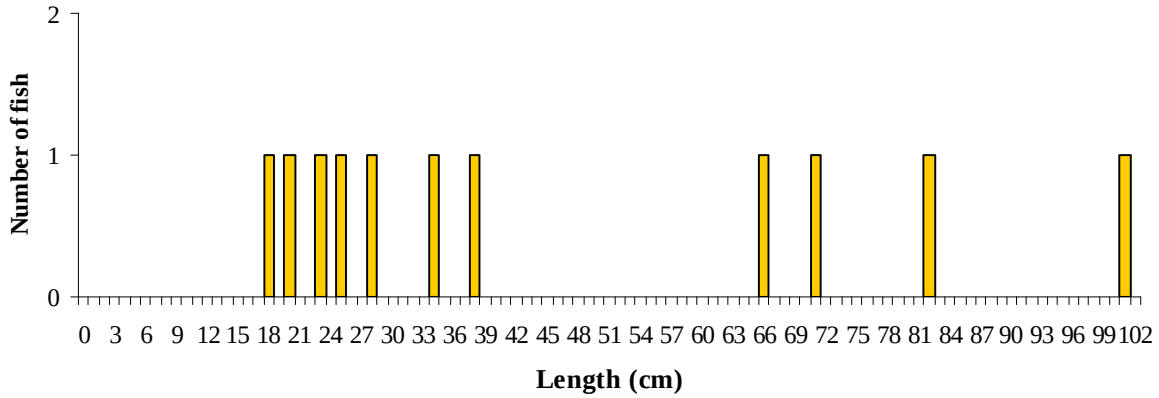

Fig. 4.11. Length frequency distribution of pike in the River Shannon (Lanesborough) site B, May 2010 (n = 11)

4.1.3 The River Shannon (Athlone)

Plate 4.3. The River Shannon downstream of Athlone, Co. Roscommon/Westmeath border

The River Shannon (see Section 4.1.1 for description) was also surveyed near Athlone Town. The survey site was located approximately 2km south of Athlone Town between Bunnaribba and Carrickynaghtan townlands (Plate 4.3, Fig. 4.12). One electric-fishing pass was conducted using four high-voltage boat-based electric fishing units on the 19th of May 2010 along a 463m stretch of river channel. The mean wetted width of the stretch surveyed was 95.4m and the mean depth was 254.0cm. A total wetted area of 44,170m^2 was surveyed. Glide was the only habitat type present, with a substrate of gravel, sand and mud.

Fig. 4.12. Location of the River Shannon (Athlone) surveillance monitoring site

A total of four fish species were recorded in the River Shannon (Athlone) site. Perch was the most abundant species, followed by pike, eel and roach (Table 4.5).

Table 4.5. Minimum density of each fish species (no./m^2) captured on the River Shannon (Athlone) site, May 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
Perca fluviatilis	Perch	-	-	0.0007
Esox lucius	Pike	-	-	0.0003
Anguilla anguilla	Eel	-	-	0.0001
Rutilus rutilus	Roach	-	-	0.0001
All Fish	All Fish	-	-	0.0012

Perch ranged in length from 6.3cm to 28.3cm (Fig. 4.13).

Pike ranged in length from 17.0cm to 52.5cm (Fig. 4.14). Three age classes (1+, 2+ and 3+) were present, accounting for approximately 25%, 67% and 8% of the total pike catch respectively.

Roach ranged in length from 3.8cm to 13.7cm and eels ranged in length from 26.6 to 63.0cm.

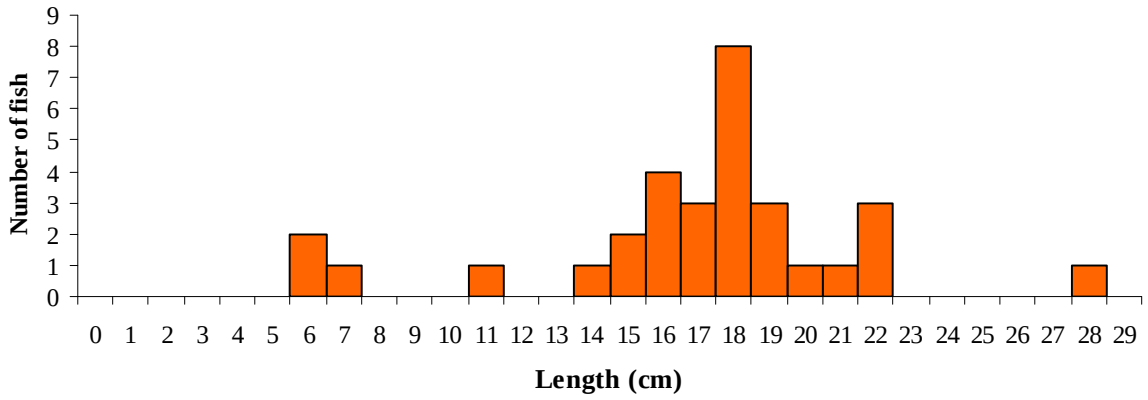

Fig. 4.13. Length frequency distribution of perch in the River Shannon (Athlone), May 2010 (n = 31)

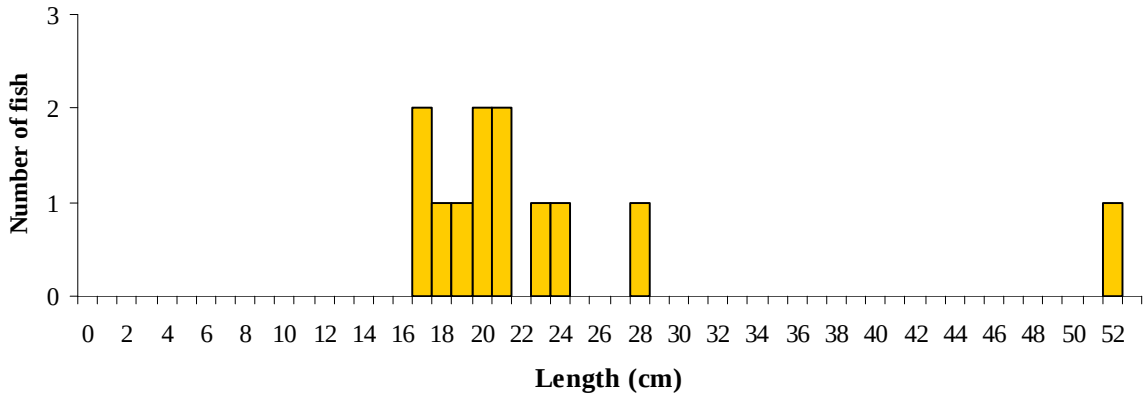

Fig. 4.14. Length frequency distribution of pike in the River Shannon (Athlone), August 2010 (n = 12)

4.1.4 River Shannon (Clonmacnoise)

Plate 4.4. The River Shannon upstream of Clonmacnoise, Co. Offaly/Roscommon border

The River Shannon (see Section 4.1.1 for description) was also sampled at Clonmacnoise.

The survey site was located approximately 1.5km upstream of the monastic ruins (Plate 4.4, Fig. 4.15). One electric-fishing pass was conducted using four high-voltage boat-based electric fishing units on the 20th of May 2010 along a 417m stretch of river channel. The mean wetted width of the stretch surveyed was 89.3m. The depth ranged from 2.0m to 6.0m. A total wetted area of 37252m^2 was surveyed. Glide was the only habitat present, with a substrate of mud and silt.

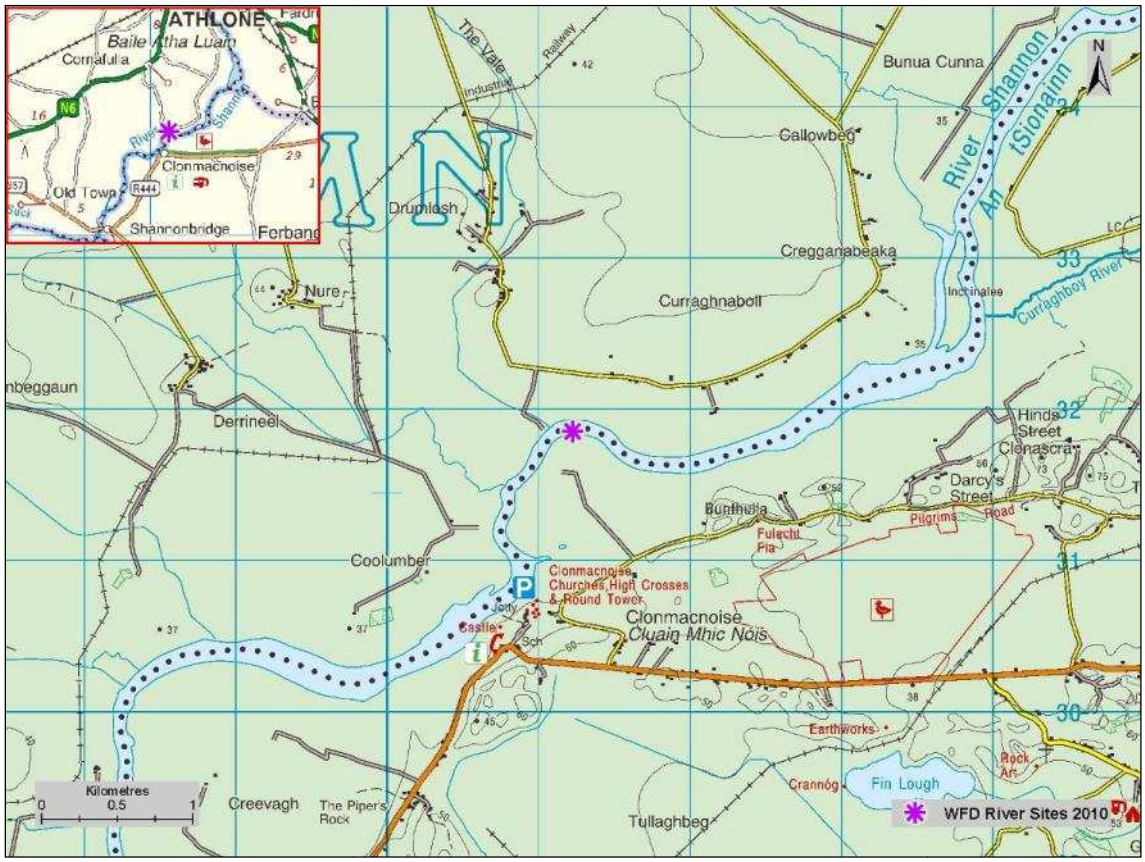

Fig. 4.15. Location of the River Shannon (Clonmacnoise) surveillance monitoring site

A total of five fish species were recorded in the River Shannon (Clonmacnoise) site. Roach was the most abundant species, followed by perch, pike, eels and lamprey (Table 4.6).

Table 4.6. Minimum density of each fish species (no./m^2) captured on the River Shannon (Clonmacnoise) site, May 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
Rutilus rutilus	Roach	-	-	0.00234
Perca fluviatilis	Perch	-	-	0.00204
Esox lucius	Pike	-	-	0.00043
Anguilla anguilla	Eel	-	-	0.00005
Lampetra sp.	Lamprey sp.	-	-	0.00003
All Fish	All Fish	-	-	0.00489

Roach ranged in length from 6.8cm to 26.1cm (Fig. 4.16). Seven age classes (1+, 2+, 3+, 4+, 5+, 6+, 7+ and 9+) were present, accounting for approximately 15%, 24%, 33%, 15%, 8%, 2%, 1% and 1% of the total roach catch respectively.

Perch ranged in length from 5.8cm to 29.6cm (Fig. 4.17). The dominant length class was from 6cm to 7cm, corresponding to the 0+ age class.

Pike ranged in length from 15.8cm to 59.5cm (Fig. 4.18). Three age classes (1+, 2+ and 3+) were present, accounting for approximately 75%, 13% and 13% of the total pike catch respectively.

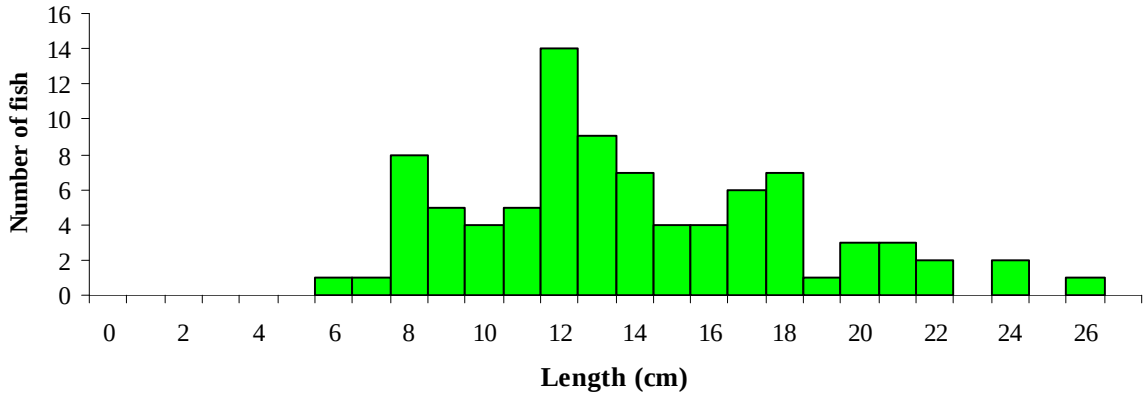

Fig. 4.16. Length frequency distribution of roach in the River Shannon (Clonmacnoise), May 2010 (n = 87)

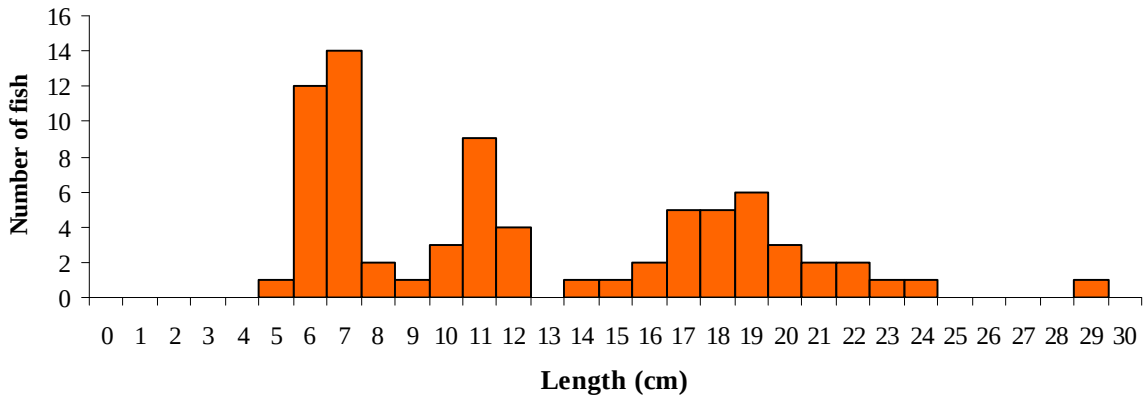

Fig. 4.17. Length frequency distribution of perch in the River Shannon (Clonmacnoise), May 2010 (n = 76)

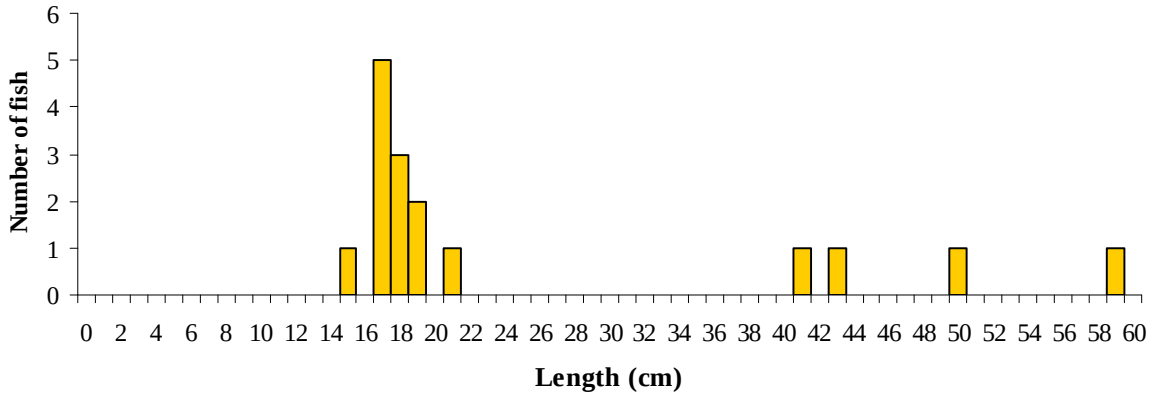

Fig. 4.18. Length frequency distribution of pike in the River Shannon (Clonmacnoise), May 2010 (n = 16)

4.1.5 The Ballydangan River

Plate 4.5. The Ballydangan River, just upstream of the River Shannon confluence

The Ballydangan River is a small tributary of the River Shannon. It rises near the village of Ballydangan in Co. Roscommon and drains flat areas of bog and farmland. Considerable peat extraction is carried out in the area just upstream of the study site.

The site is located within the River Shannon Callows SAC (Plate 4.5). This extensive area of seasonally flooded, semi-natural, lowland wet grassland contains extremely diverse plant communities and important habitats, including *Molinia* meadows and lowland hay meadows, which are both listed in Annex I of the Habitats Directive (NPWS, 2003). The otter, which is listed in Annex II of the same Directive, is present in the area, along with numerous waterfowl species. The survey site is also located within the Middle Shannon Callows SPA (NPWS, 2002).

The survey site was located just upstream of the confluence with the River Shannon (Plate 4.5, Fig. 4.19) adjacent to the Clonmacnoise Monastery. One electric-fishing pass was conducted using one boat-based electric-fishing unit on the 20th of May 2010 along a 221m stretch of river channel. The mean wetted width of the stretch surveyed was 3.5m and the mean depth was 50.0cm. A total wetted

area of 774m^2 was surveyed. Glide was the dominant habitat, with a substrate of mainly mud and peat.

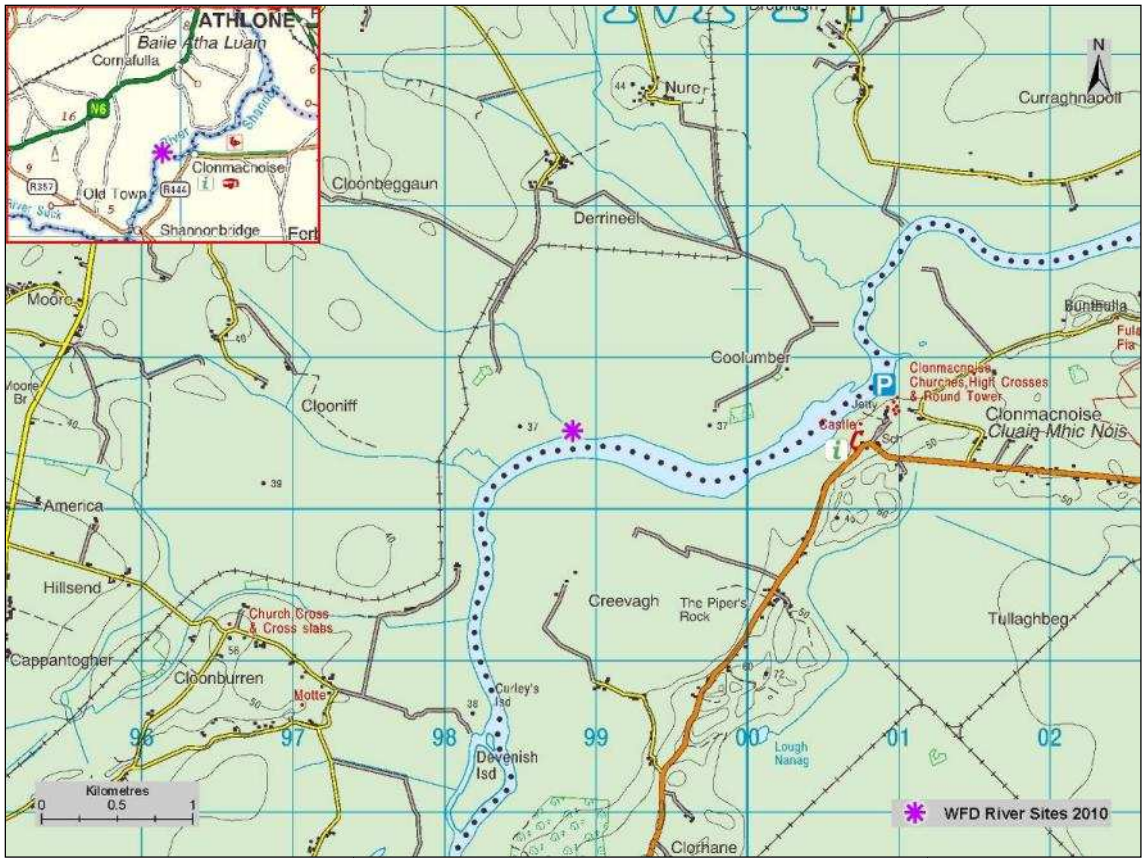

Fig. 4.19. Location of the Ballydangan River surveillance monitoring site

A total of six fish species were recorded in the Ballydangan River site. Perch was the most abundant species, followed by gudgeon, brown trout, pike, roach and lamprey (Table 4.7).

Table 4.7. Minimum density of each fish species (no./m^2) captured on the Ballydangan River site, May 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
Perca fluviatilis	Perch	-	-	0.028
Gobio gobio	Gudgeon	-	-	0.010
Salmo trutta fario	Brown trout	-	0.009	0.009
Esox lucius	Pike	-	-	0.009
Rutilus rutilus	Roach	-	-	0.005
Lampetra sp.	Lamprey sp.	-	-	0.001
All Fish	All Fish	-	-	0.063

Perch ranged in length from 6.7cm to 14.5cm (Fig. 4.20).

Seven brown trout were captured, ranging in length from 15.7cm to 30.4cm. Three age classes (1+, 2+ and 4+) were present, accounting for approximately 29%, 14% and 57% of the total brown trout catch respectively. The mean brown trout L1, L2, L3 and L4 were 9.0cm, 14.4cm, 22.4cm and 31.9cm respectively (Appendix 1). This indicates that the rate of growth for brown trout in this river site is 'fast' according to the classification scheme of Kennedy and Fitzmaurice (1971).

Pike ranged in length from 15.8cm to 59.5cm. Three age classes (1+, 2+ and 4+) were present, accounting for approximately 71%, 14% and 14% of the total pike catch respectively.

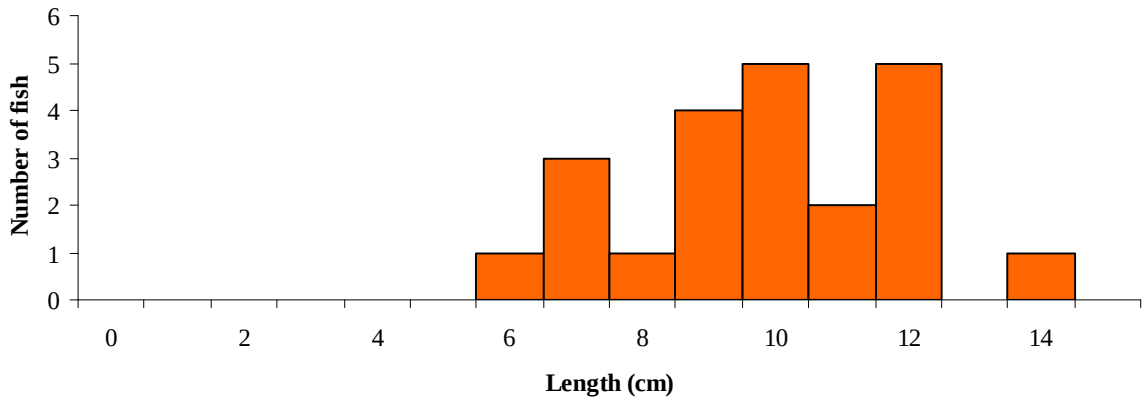

Fig. 4.20. Length frequency distribution of perch in the Ballydangan River, May 2010 (n = 22)

4.3 Community structure

4.3.1 Species richness and composition

A total of nine fish species and one hybrid were recorded within the seven ShIRBD sites surveyed during 2010 (Fig. 4.21). Perch, pike and roach were the most common fish species recorded, occurring in all sites, followed by eels (57%), lamprey (57%), gudgeon (43%), bream (29%) and rudd (29%). Brown trout and roach × bream hybrids were only recorded at one site each (Fig. 4.21).

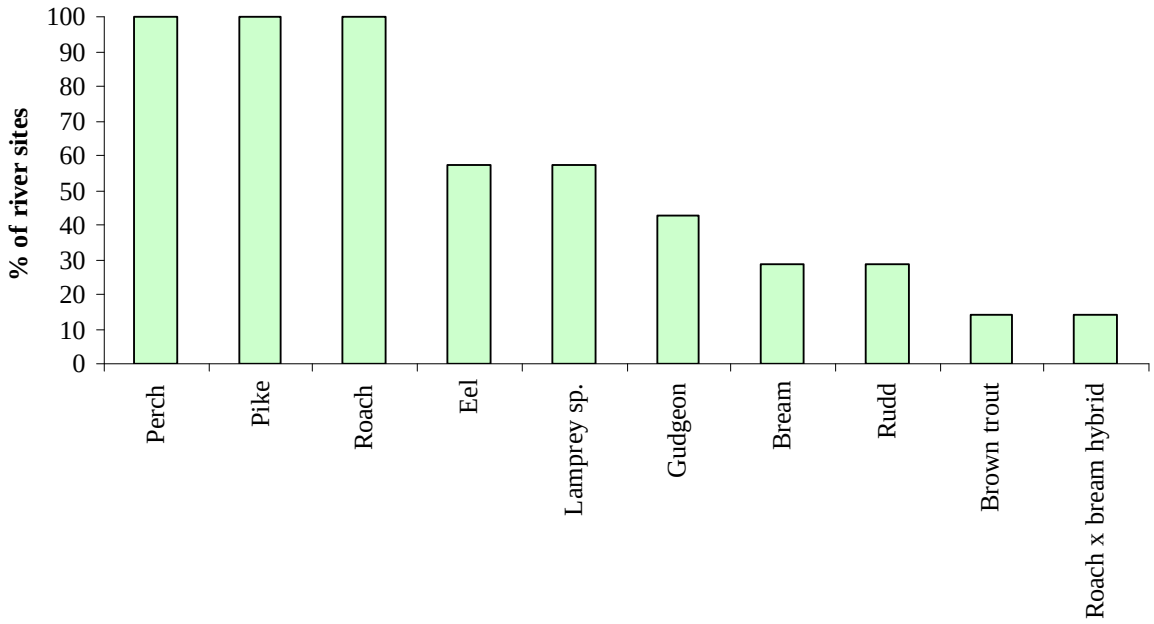

Fig. 4.21. Percentage of sites where each fish species was recorded in the ShIRBD for WFD SM monitoring 2010

Species richness ranged from three species in the River Shannon (Battle Br.) site A to eight species in the River Shannon (Lanesborough) site A (Table. 4.8). Kelly *et al*. (2008) classified fish species in Ireland into three groups: Group 1—native species (salmonids, three-spined stickleback, lamprey, eel and flounder); Group 2—non-native species that influence ecology (e.g. pike, perch, roach, minnow and stone loach); and Group 3—non-native species that generally do not influence ecology (e.g. gudgeon). Group 1 species were present in all but the two River Shannon (Battle Br.) sites, whereas Group 2 species were recorded in all seven sites. Group 3 species were recorded in three sites (Table 4.8).

Table 4.8. Species richness at each river site surveyed in the ShIRBD, May 2010

Site	Species richness	No. native species (Group 1)	No. non-native species (Group 2)	No. non-native species (Group 3)
NON-WADEABLE SITES				
Shannon (Battle Br. A)	3	0	3	0
Shannon (Battle Br. B)	4	0	3	1
Shannon (Lanesborough A)	8	2	5	1
Shannon (Lanesborough B)	7	2	5	0
Shannon (Athlone)	4	1	3	0
Shannon (Clonmacnoise)	5	2	3	0
Ballydangan	6	2	3	1

4.3.2 Species abundance and distribution

Abundance (minimum population density) and distribution maps for the most common fish species recorded within the seven ShIRBD sites surveyed during 2010 are shown below in Figures 4.22 to 4.32. Fish densities are generally higher in wadeable sites surveyed with bank-based electric-fishing gear than in non-wadeable sites surveyed with boat-based electric-fishing gear (Kelly *et al.*, 2009; Kelly *et al*. 2010; Kelly *et al*. 2011). This is primarily due to the tendency for younger trout and salmon to utilise shallow, riffle areas as nursery habitat, along with the difference in sampling efficiency of the two methods. As such, population densities recorded for each species using the two methods are displayed as separate colours on each map. All surveys within the ShIRBD conducted during 2010 were at non-wadeable sites using boat-based electric-fishing gear.

Brown trout were recorded in only one of the seven ShIRBD sites surveyed – the Ballydangan River, where only 1+ and older fish were recorded (0.009 fish/m^2) (Fig. 4.22 and 4.23).

Perch (Fig. 4.24), pike (Fig. 4.25) and roach (Fig. 4.26) were recorded in all seven of the sites surveyed. Eels (Fig. 4.27) and lamprey (Fig. 4.28) were recorded in four sites, gudgeon (Fig. 4.29) in three sites and bream (Fig. 4.30) and rudd (Fig. 4.31) in two sites. Roach × bream hybrids (Fig. 4.32) were only captured at one site (Shannon, Lanesborough site B).

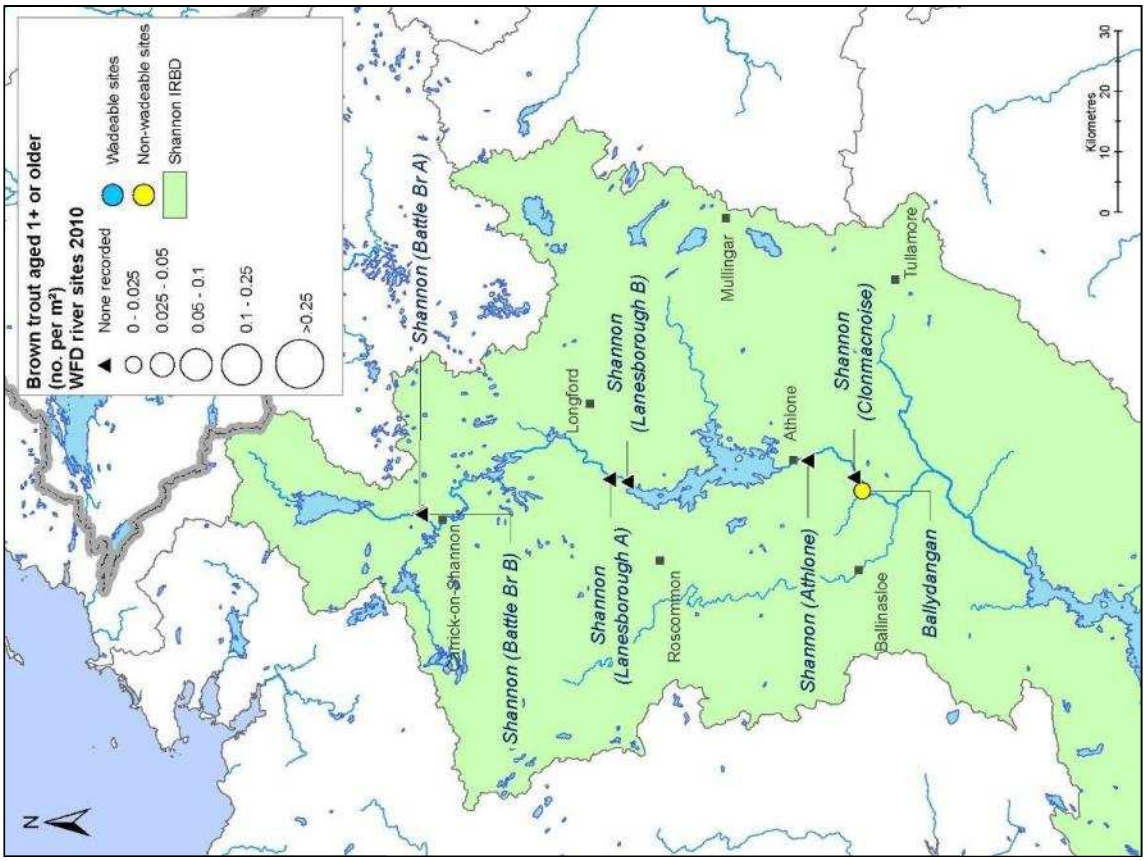

Fig. 4.23. Distribution map of 1+ or older brown trout in the ShIRBD, WFD surveillance monitoring 2010

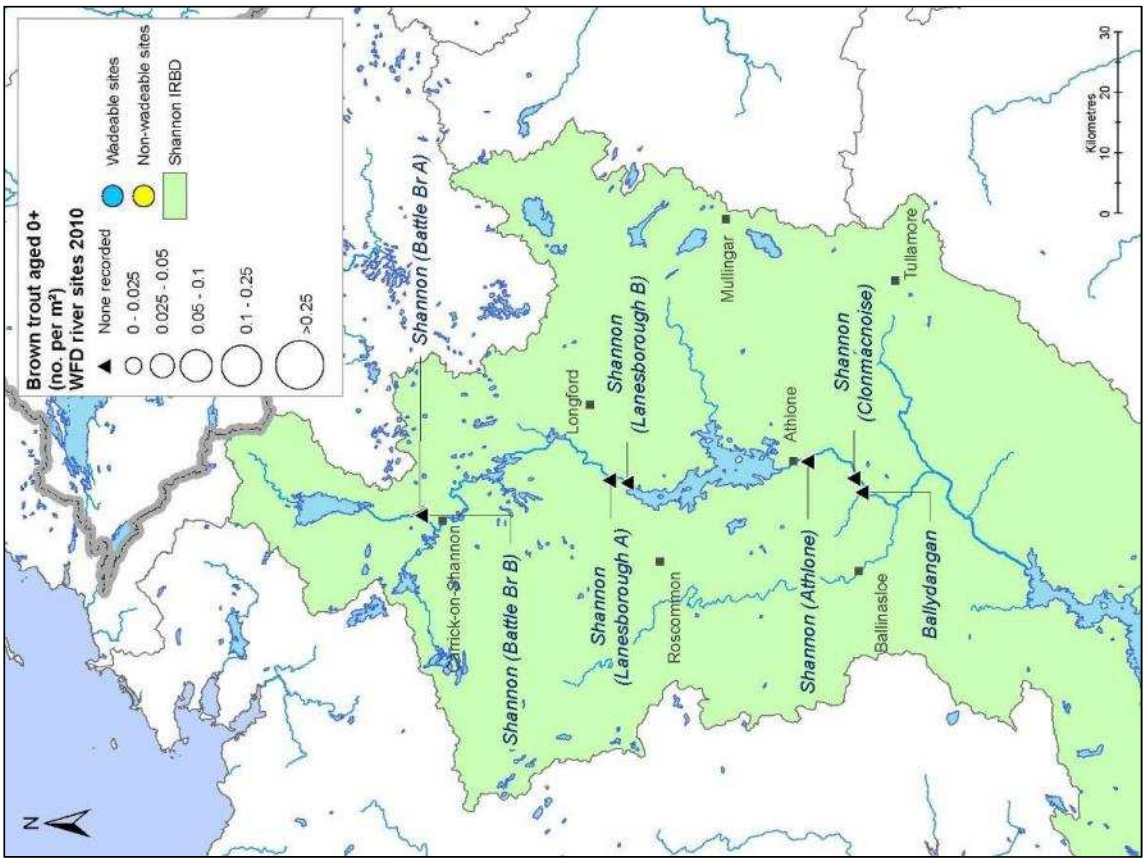

Fig. 4.22. Distribution map of 0+ brown trout in the ShIRBD, WFD surveillance monitoring 2010

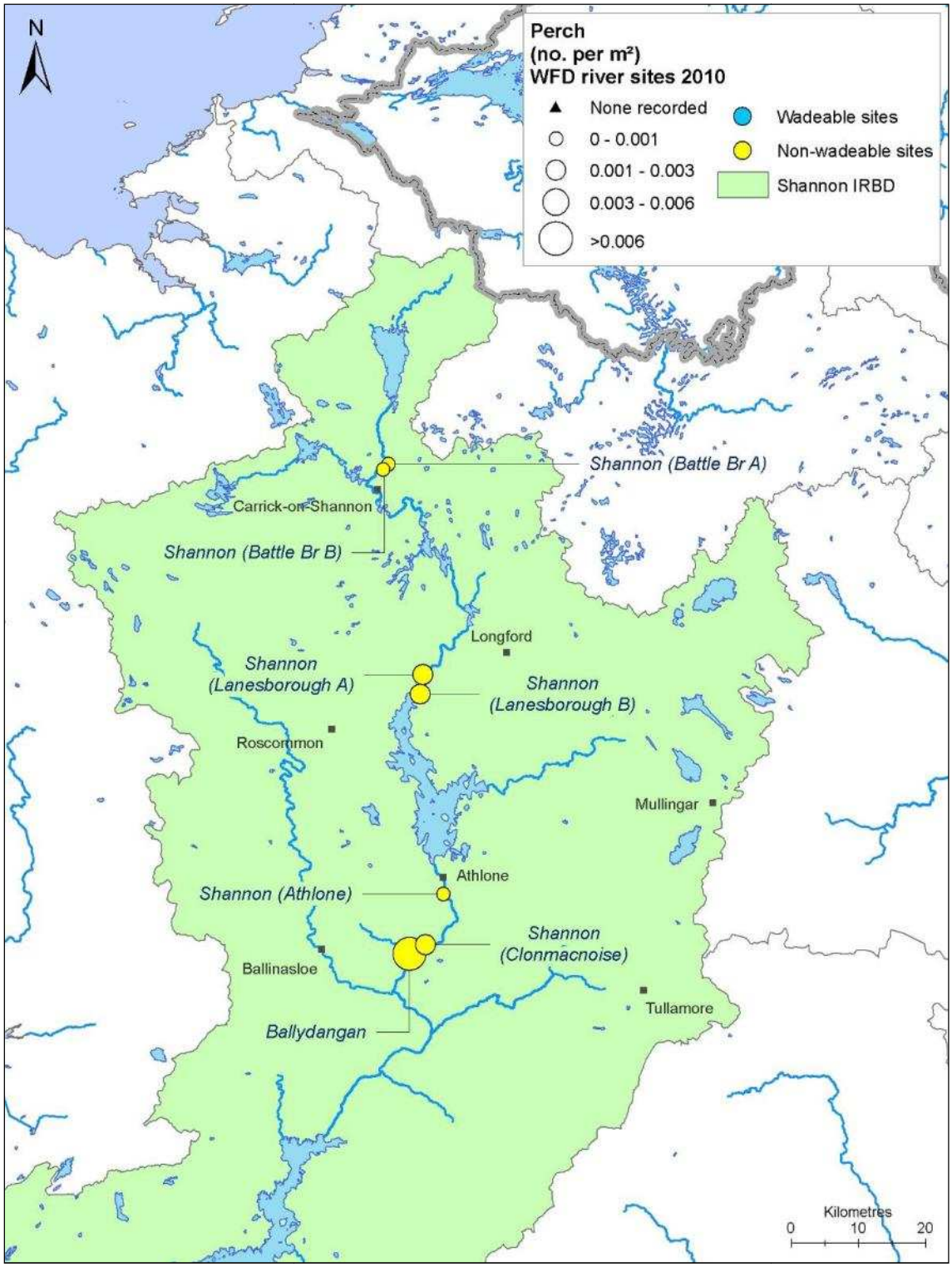

Fig. 4.24. Distribution map of perch in the ShIRBD, WFD surveillance monitoring 2010

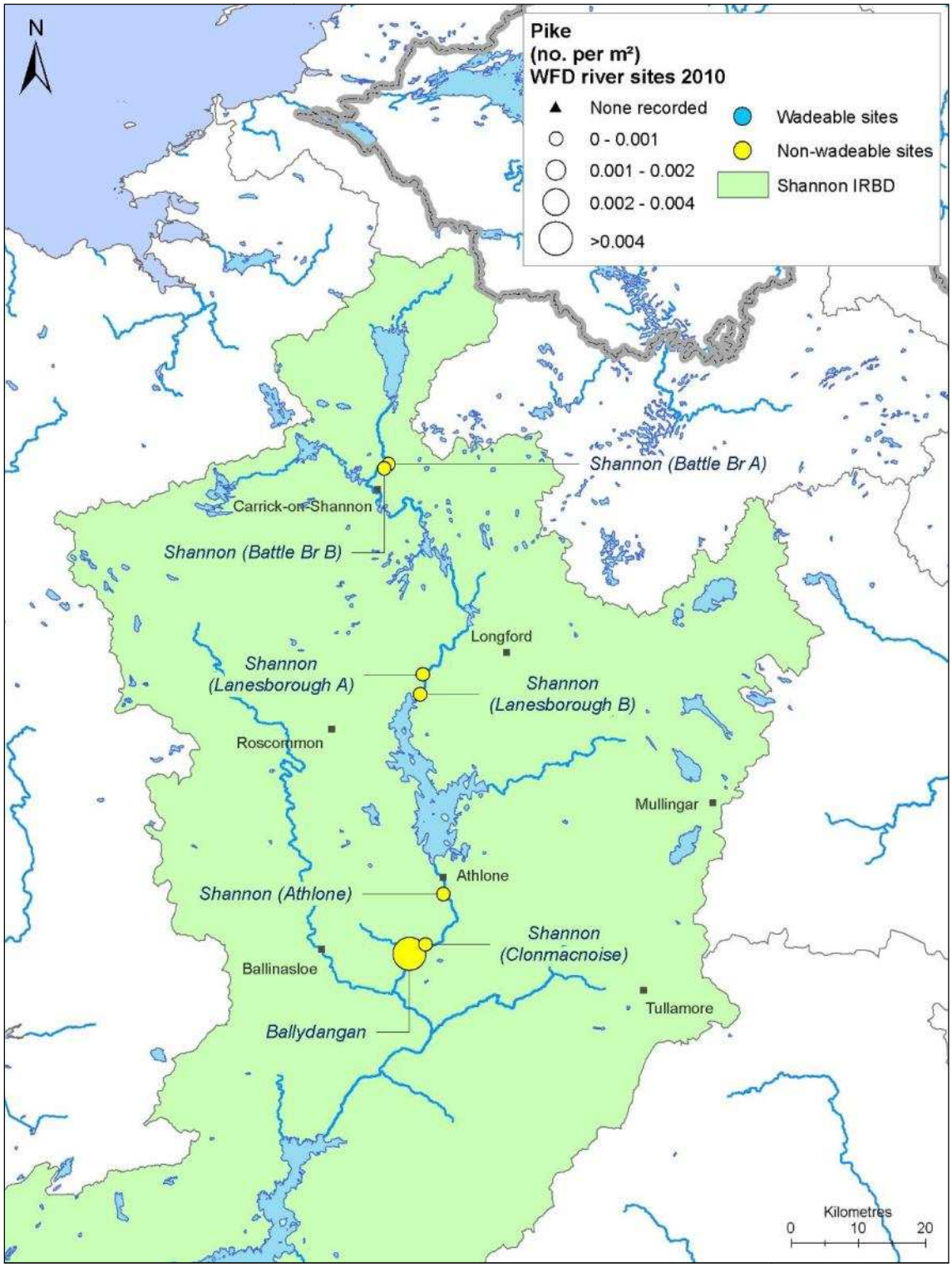

Fig. 4.25. Distribution map of pike in the ShIRBD, WFD surveillance monitoring 2010

Fig. 4.26. Distribution map of roach in the ShIRBD, WFD surveillance monitoring 2010

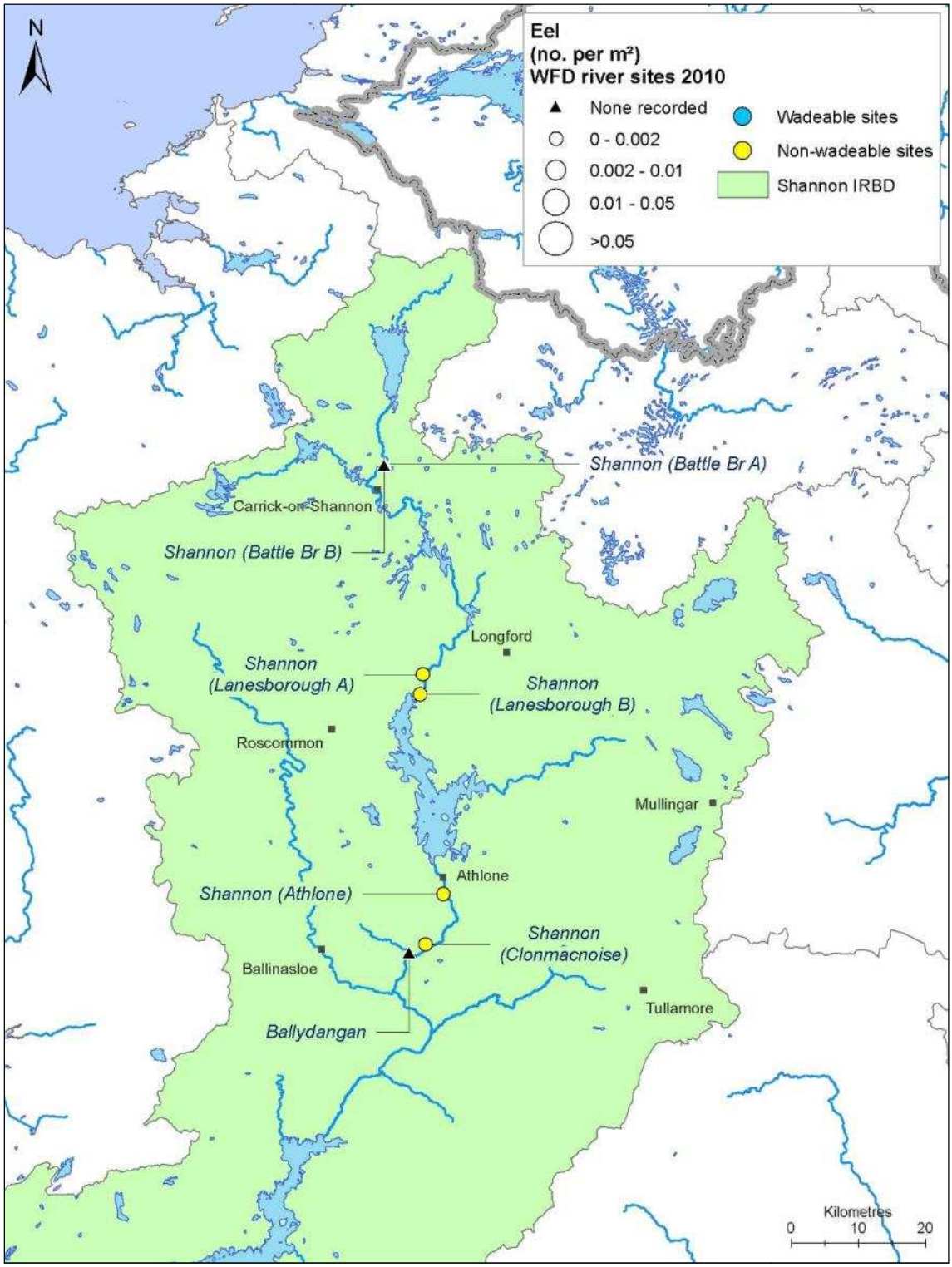

Fig. 4.27. Distribution map of eels in the ShIRBD, WFD surveillance monitoring 2010

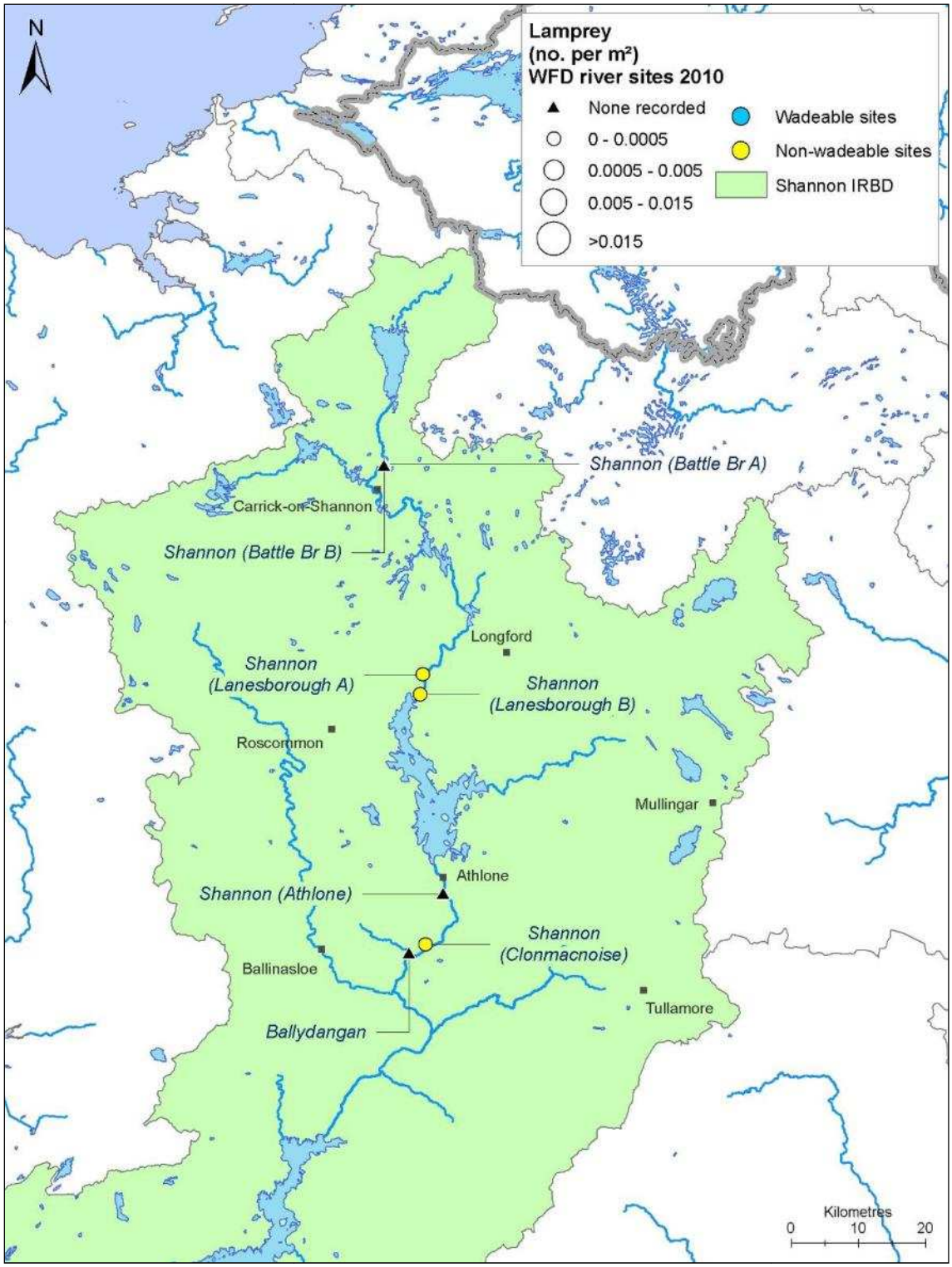

Fig. 4.28. Distribution map of lamprey in the ShIRBD, WFD surveillance monitoring 2010

Fig. 4.29. Distribution map of gudgeon in the ShIRBD, WFD surveillance monitoring 2010

Fig. 4.30. Distribution map of bream in the ShIRBD, WFD surveillance monitoring 2010

Fig. 4.31. Distribution map of rudd in the ShIRBD, WFD surveillance monitoring 2010

Fig. 4.32. Distribution map of roach × bream hybrids in the ShIRBD, WFD surveillance monitoring 2010

4.3.3 Age and growth of brown trout and roach

Growth rates based on back-calculated length-at-age data were analysed for brown trout and roach in each river site surveyed in the ShIRBD during 2010.

The Ballydangan was the only river site surveyed in the ShIRBD during 2010 in which brown trout were recorded. Three age classes were present: 1+, 2+ and 4+. The largest brown trout captured measured 46.9cm in length, weighed 1850g and was aged 4+. The brown trout in the Ballydangan River site were assigned a growth category as described by Kennedy and Fitzmaurice (1971), who examined the relationship between alkalinity and growth of brown trout in Irish streams and rivers. Brown trout growth was classified as 'fast' in the Ballydangan River site (Fig. 4.33, Appendix 1).

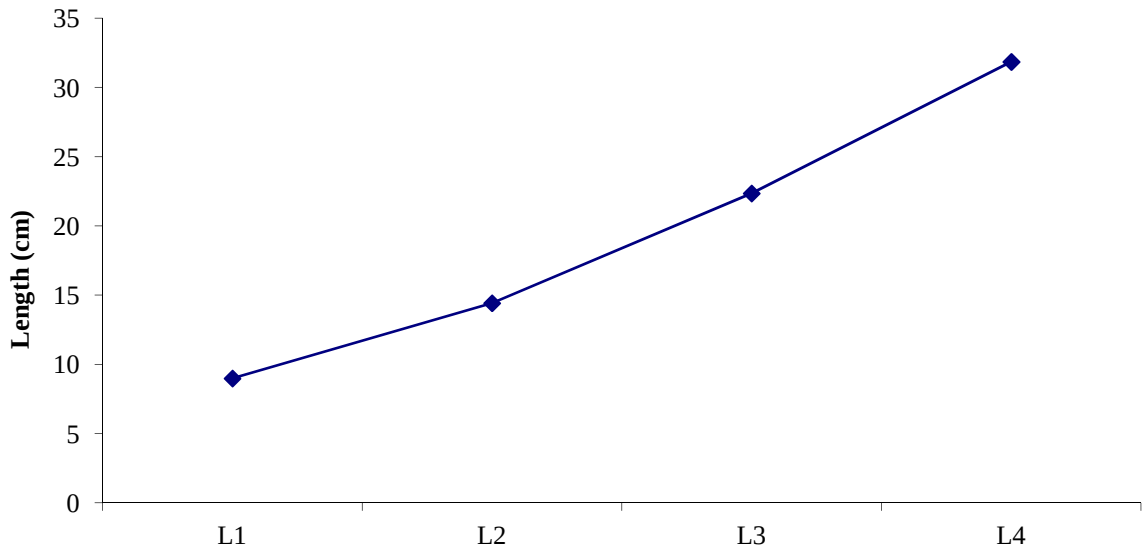

Fig. 4.33. Back-calculated length-at-age for brown trout in the Ballydangan River, WFD surveillance monitoring 2010

The mean back-calculated length-at-age data for roach are shown in Figure 4.34 and Appendix 2. Roach were recorded in all sites surveyed in the ShIRBD during 2010. Roach ages ranged from 0+ to 9+. The largest roach recorded in the ShIRBD during 2010 measured 27.5cm in length and weighed 426g.

All rivers in which roach were present contained fish aged 1+ and 2+. The mean L1 of roach ranged from 2.6cm in the Shannon (Battle Br.) site A to 3.5cm in the Shannon (Lanesborough) site B.

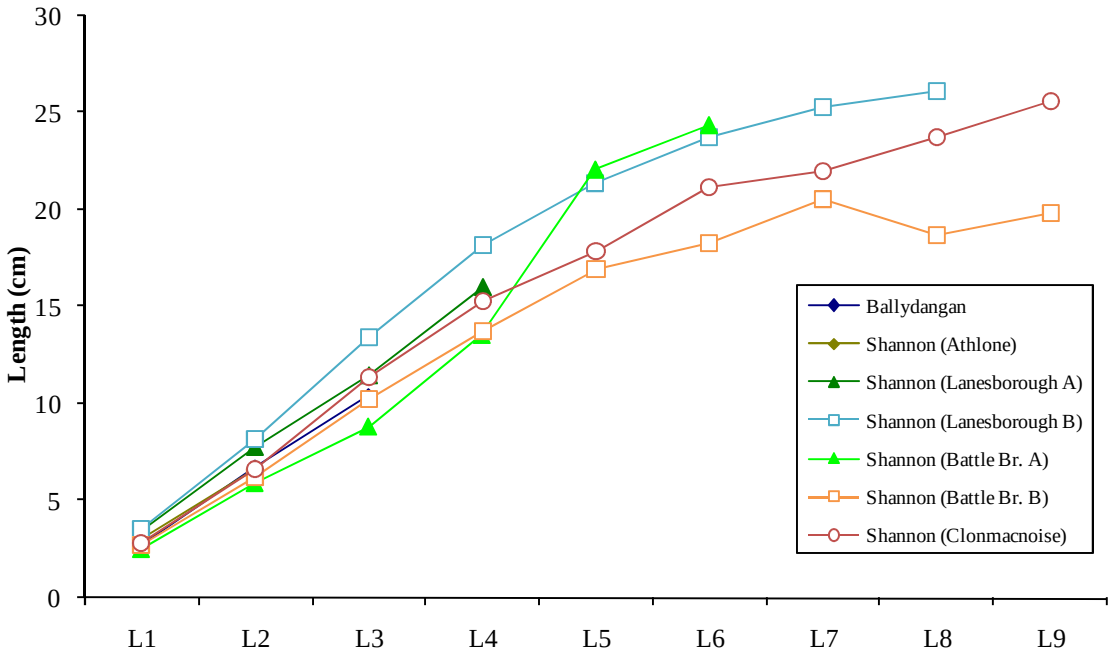

Fig. 4.34. Back-calculated length-at-age for roach in the ShIRBD, WFD surveillance monitoring 2010

4.4 Ecological status

An essential step in the WFD process is the classification of the ecological status of lakes, rivers and transitional waters, which in turn will assist in identifying objectives that must be set in the individual River Basin Management Plans.

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

Using FCS2 Ireland, along with expert opinion, each river site surveyed during 2010 has been assigned a fish ecological status class of "Moderate" (Table 4.9). The River Shannon at Battle Br. and Ballyleague Br. in 2008 and 2009 respectively were both also classified as "Moderate", indicating no change from these previous surveys.

Table 4.9. Ecological status of sites surveyed in the ShIRBD for surveillance monitoring 2010

River	Site code	Site name	Ecological status
ShIRBD Non-wadeable sites			
Shannon (Upper)	26S020500Fa	Battle Br. (A)	Moderate
Shannon (Upper)	26S020500Fb	Battle Br. (B)	Moderate
Shannon (Upper)	26S021600Fa	Ballyleague Br. (A)	Moderate
Shannon (Upper)	26S021600Fb	Ballyleague Br. (B)	Moderate
Shannon (Upper)	26S021720F	Athlone d/s of Burgess Park	Moderate
Shannon (Upper)	26S021800F	Clonmacnoise: at Jetty	Moderate
Ballydangan	26B140200F	Br u/s Shannon R. confluence	Moderate

5. DISCUSSION

A total of nine fish species and one hybrid were recorded during the 2010 sampling program within the ShIRBD. The highest species diversity recorded within any region throughout Ireland during 2010 was thirteen species. This was observed in both the Western and South Western River Basin Districts (WRBD and SWRBD), which contained a high number of non-native fish species. Information on fish species richness, composition, distribution and abundance throughout the whole country can be found in the WFD summary report for 2010 (Kelly *et al*., 2011).

The River Shannon (Lanesborough) site A was the most diverse site surveyed within the ShIRBD during 2010, with a total of eight species present. In contrast, the River Shannon (Battle Br.) site A exhibited the lowest species richness, with only three species recorded. The highest species diversity recorded in any site throughout the country was ten and this only occurred in one site within the SWRBD (River Blackwater at Lismore), where there was a high number of non-native fish present. Low species diversity is common in rivers throughout Ireland that contain only native fish species. Non-native species, however, are widespread throughout the ShIRBD (Kelly *et al*., 2009, Kelly *et al*., 2010, Kelly *et al*., 2011).

Pike, perch and roach were the most common species, recorded in all seven sites, whilst brown trout were only recorded in one site (Ballydangan River).

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

Following the methods of Kennedy and Fitzmaurice (1971), the growth of brown trout was classified as 'fast' in the Ballydangan, the only river site in the ShIRBD during 2010 in which brown trout were recorded.

Using the recently completed ecological classification tool for fish in rivers (FCS2 Ireland), along with expert opinion, each river site surveyed during 2010 has been assigned a draft ecological status classification based on the fish populations present. All sites surveyed in the ShIRBD during 2010 have been assigned a classification of "Moderate" status, with the River Shannon sites at Battle Br.

and Ballyleague Br., showing no change in ecological status from the previous surveys in 2008 and 2009.

6. REFERENCES

Barton, E. and Heard, J. (2005) Alien, Non-native and Invasive Marine Species. *Marine Life Topic Note. The Marine Biological Association of the United Kingdom*. Available at: http://www.marlin.ac.uk/PDF/MLTN_alien_non_natives.pdf

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

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

Eno, N.C., Clark, R.A. and Sanderson, W.G. (1997) *Non-Native Marine Species in British Waters: a Review and Directory*. Peterborough: Joint Nature Conservation Committee.

Kelly, F., Harrison, A., Connor, L., Allen, M., Rosell, R. and Champ, T. (2008) *North South Shared Aquatic Resource (NS Share) Lakes Project: FISH IN LAKES*. Task 6.9: Classification tool for Fish in Lakes Final Report. Available at: www.nsshare.com

Kelly, F., Connor, L., Wightman, G., Matson, R., Morrissey, E., O'Callaghan, R., Feeney, R., Hanna, G. and Rocks, K. (2009) *Sampling Fish for the Water Framework Directive – Summary Report 2008*. Central Fisheries Board.

Kelly, F.L., Harrison, A.J., Connor, L., Matson, R., Wightman, G., Morrissey, E., O'Callaghan, R., Feeney, R., Hanna, G., Wogerbauer, C. and Rocks, K. (2010) *Sampling fish for the Water Framework Directive – Summary report 2009*. Central Fisheries Board.

Kelly, F., Harrison, A., Connor, L., Matson, R., Morrissey, E., Feeney, R., Wogerbauer, C., O'Callaghan, R. and Rocks, K. (2011) *Sampling Fish for the Water Framework Directive – Summary Report 2010*. Inland Fisheries Ireland.

Kennedy, M. and Fitzmaurice, P. (1971) Growth and food of Brown Trout *Salmo Trutta* (L.) in Irish Waters. *Proceedings of the Royal Irish Academy*, **71 (B) (18),** 269-352.

O'Reilly, P. (2002) *Rivers of Ireland, a Flyfisher's Guide* (5th Edition). Merlin Unwin Books, Shropshire, UK.

O'Reilly, P. (2009) *Rivers of Ireland, a Flyfisher's Guide* (7th Edition). Merlin Unwin Books, Shropshire, UK.

NPWS (2002) Middle Shannon Callows SPA. *Site Synopsis, Site code: 004096*. Available at: http://www.npws.ie/media/npwsie/content/images/protectedsites/sitesynopsis/SY004096.pdf

NPWS (2003) River Shannon Callows. *Site Synopsis, Site code: 000216.* Available at: http://www.npws.ie/media/npwsie/content/images/protectedsites/sitesynopsis/SY000216.pdf

Scalera, R. and Zaghi, D. (2004) *Alien species and nature conservation in the EU. The role of the LIFE program.* LIFE focus, 56 pp., European Commission, Luxembourg. Available at: http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/alienspecies_en.pdf

SHIRBD (2009) *Shannon International River Basin District - River Basin Management Plan (2009-2015).* Shannon International River Basin District.

Stokes, K., O'Neill, K. and McDonald, R.A. (2006) *Invasive species in Ireland.* Report to Environment and Heritage Service and National Parks and Wildlife Service, 151 pp., Quercus, Queens University Belfast, Environment and Heritage Service Belfast and National Parks and Wildlife Service Dublin. Available at: http://www.npws.ie/en/media/Media,3701, en.pdf

APPENDIX 1

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

River		L1	L2	L3	L4	Growth category
Ballydangan	Mean	9.0	14.4	22.4	31.9	Fast
	S.D.	1.3	3.2	3.3	5.2	
	S.E.	0.5	1.6	1.9	3.0	
	n	6	4	3	3	
	Min	7.0	10.7	18.6	25.9	
	Max	10.6	18.2	25.0	35.2	

APPENDIX 2

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

River		L1	L2	L3	L4	L5	L6	L7	L8	L9
Ballydangan	Mean	2.7	6.8	10.5						
	S.D.	0.7	2.4	2.1						
	S.E.	0.4	1.4	1.5						
	n	3	3	2						
	Min	2.3	5.0	9.0						
	Max	3.5	9.5	12.0						
Shannon (Athlone)	Mean	3.0	6.6							
	S.D.	0.4	0.5							
	S.E.	0.2	0.3							
	n	3	3							
	Min	2.8	6.1							
	Max	3.5	7.2							
Shannon (Battle Br. A)	Mean	2.6	6.0	8.9	13.6	22.1	24.4			
	S.D.	0.3	0.9	1.1	1.4	n/a	n/a			
	S.E.	0.1	0.2	0.3	1.0	n/a	n/a			
	n	36	33	13	2	1	1			
	Min	2.0	4.3	7.0	12.6	22.1	24.4			
	Max	3.3	7.7	10.4	14.6	22.1	24.4			
Shannon (Battle Br. B)	Mean	2.7	6.2	10.2	13.8	17.0	18.3	20.6	18.7	19.8
	S.D.	0.8	1.2	2.1	2.6	3.0	2.7	2.8	0.7	0.4
	S.E.	0.1	0.1	0.2	0.4	0.6	0.7	1.1	0.5	0.3
	n	97	94	72	41	25	13	6	2	2
	Min	1.8	3.5	5.2	8.5	10.5	13.6	16.7	18.2	19.6
	Max	5.8	9.6	15.2	20.0	22.0	21.9	23.4	19.3	20.1
Shannon (Clonmacnoise)	Mean	2.8	6.7	11.4	15.3	17.9	21.2	22.0	23.8	25.6
	S.D.	0.7	1.6	1.9	2.1	2.1	2.3	0.5	n/a	n/a
	S.E.	0.1	0.2	0.3	0.4	0.6	1.2	0.3	n/a	n/a
	n	70	60	44	22	11	4	2	1	1
	Min	1.9	4.4	8.6	11.0	14.8	18.1	21.7	23.8	25.6
	Max	5.5	12.3	16.9	19.8	21.5	23.2	22.3	23.8	25.6
Shannon (Lanesborough A)	Mean	3.4	7.8	11.5	16.0					
	S.D.	0.8	1.8	2.3	2.1					
	S.E.	0.1	0.3	0.6	1.5					
	n	41	34	13	2					
	Min	2.1	4.6	8.6	14.6					
	Max	5.8	10.9	17.0	17.5					
Shannon (Lanesborough B)	Mean	3.5	8.2	13.5	18.1	21.3	23.8	25.3	26.1	
	S.D.	0.8	1.5	2.5	2.0	1.2	0.2	n/a	n/a	
	S.E.	0.1	0.3	0.5	0.8	0.6	0.1	n/a	n/a	
	n	37	35	24	6	4	2	1	1	
	Min	2.1	5.3	8.0	15.5	19.9	23.6	25.3	26.1	
	Max	5.7	10.9	17.9	21.5	22.8	23.9	25.3	26.1	

Inland Fisheries Ireland
Swords Business Campus,
Swords,
Co. Dublin,
Ireland.

Web: www.fisheriesireland.ie
Email: info@fisheriesireland.ie
Tel: +353 1 8842 600
Fax: +353 1 8360 060