

NWRFB Rivers



Sampling Fish for the Water Framework Directive - Rivers 2008



The Central and Regional
Fisheries Boards

PROJECT PERSONNEL

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1. INTRODUCTION

Fish stock surveys were undertaken in 83 rivers throughout Ireland during the summer of 2008 as part of the programme for sampling fish for the Water Framework Directive. Nine of these sites were located within the North Western Regional Fisheries Board (NWRFB). The sites 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 data appropriate for WFD compliance. Continued surveying of these and additional river sites will provide a useful baseline for monitoring water quality in the future.

The NWRFB covers an area of around 5,850 km² and spans counties Mayo, Sligo, Roscommon and Leitrim. Excluding its many islands, it has a shoreline of nearly 1000 kilometres. The NWRFB is inundated with heavy rainfall, resulting in there being countless lakes within the region, including Lough Conn, Lough Cullin, Lough Gill and Lough Arrow. Among the major rivers in the NWRFB are the Moy, the Glenamoy and the Owenmore. The main urban centres in the district are Ballina, Castlebar and Sligo.

This report summarizes the main findings of the fish stock surveys in the 11 river water bodies surveyed in the NWRFB during 2008 and reports the current status of the fish stocks in each.

2. STUDY AREA

Nine river sites in four river catchments (Ballinglen, Glenamoy, Moy and Srahmore) were surveyed in the NWRFB (Table 2.1, Fig. 2.1). Five of these were completed using hand-set electric fishing gear, while the other four were completed with boat electric fishing gear (Table 2.1).

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

Site	Catchment	Easting	Northing	Catchment Size (km ²)	Width (m)	Area (m ²)	Mean depth (m)	Max depth (m)
Handset sites								
Ballinglen	Ballinglen	110251	334201	<100	6.73	471	0.25	68
Clydagh (Castlebar)	Moy	114364	296515	<10	5.18	467	0.19	0.35
Glennamong	Srahmore	94724	302350	<100	7.68	692	0.31	0.9
Moy (Cloonbaniff)	Moy	152241	319249	<100	7.32	659	0.1	0.31
Tobercurry	Moy	147543	311356	<100	3.55	320	0.16	0.29
Boat sites								
Behy	Moy	128756	318151	<100	6.72	806	0.66	1.12
Castlebar	Moy	117089	292029	<100	6.32	632	0.32	0.48
Deel (Crossmolina)	Moy	117974	318579	<1000	18.4	5943	1	1.9
Glenamoy	Glenamoy	89384	333757	<100	10.6	2184	0.35	0.55

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 Ballinglen River*



Plate 4.1. The Ballinglen River; taken from Ballinglen Bridge looking downstream

The Ballinglen River (Plate 4.1) is a small, spate river that rises in the hills just south of Ballycastle in Co. Mayo. It flows northwards through the village of Ballycastle and then into the sea two kilometres downstream at Bunatrahir Bay (Fig. 2.1). A stretch of channel measuring 70m in length was surveyed on the 28th of July 2008 upstream of Ballinglen Bridge (Fig. 4.1). Three fishings were carried out using three bank based electric fishing units. The site was dominated by cobble, with some boulders present. The habitat was divided equally between riffle, glide and pool. There were medium levels of shade throughout the channel and macrophyte types were mixed among emergents such as *Mentha aquatica*, *Oenanthe crocata* and *Veronica beccabunga*, as well as bryophyte species including *Fontinalis antipyretica* and *Chiloscyphus polyanthus*. Himalayan Balsam (*Impatiens glandulifera*), an invasive weed, was also present along the banks. The mean width and depth of the channel was 6.7m and 0.25m respectively. The total wetted area was 471m² (Table 2.1).



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

Three fish species were recorded in the Ballinglen River during the survey (Table 4.1). Salmon was by far the most abundant species present, followed by brown trout.

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

Species name	Common name	0+	1+ & older	Total density
<i>Salmo salar</i>	Salmon	0.4371	0.3034	0.7451
<i>Salmo trutta</i>	Brown trout	0.0106	0.1124	0.1231
<i>Anguilla anguilla</i>	Eel	-	-	0.0594
All fish	All fish	-	-	0.9276

Salmon were the most abundant species recorded at the site and ranged in length from 2.5cm to 13.0cm (Fig. 4.2). Length frequency and age analysis revealed that there were three age classes present in the salmon population at the site; 0+, 1+ and 2+. 1+ salmon ranged in length from 8.1cm to 12.7cm. Only two 2+ salmon were recorded, measuring 12.6cm and 12.8cm in length. 40% of the population comprised

of 1+ fish, while only 1% of the population sampled were made up of 2+ fish and length frequency analysis demonstrates that 0+ salmon ranged in length from 2.5cm to 6.0cm, thus representing 59% of the population. The mean length of salmon at L1 was 5.0cm and 9.8cm at L2 (Appendix 2).

Brown trout abundance was much lower than that for salmon, but a wider range of ages were represented. Brown trout ranged in length from 6.0cm to 22.3cm (Fig 4.3). The largest brown trout recorded measured 21.2cm and weighed 113.5g. Four age classes were present at the site, i.e. 0+, 1+, 2+ and 3+. 1+ and 2+ brown trout accounted for the largest proportion of the population at the site, i.e. 41% and 26% respectively. The mean length of brown trout at L1, L2 and L3 was 7.33 cm, 12.74 cm and 16.41 cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971) the trout growth rate in the Ballinglen River was categorised as very slow (Appendix 1).

Eels ranged in length from 11.3 cm to 33.1 cm (Fig. 4.4).

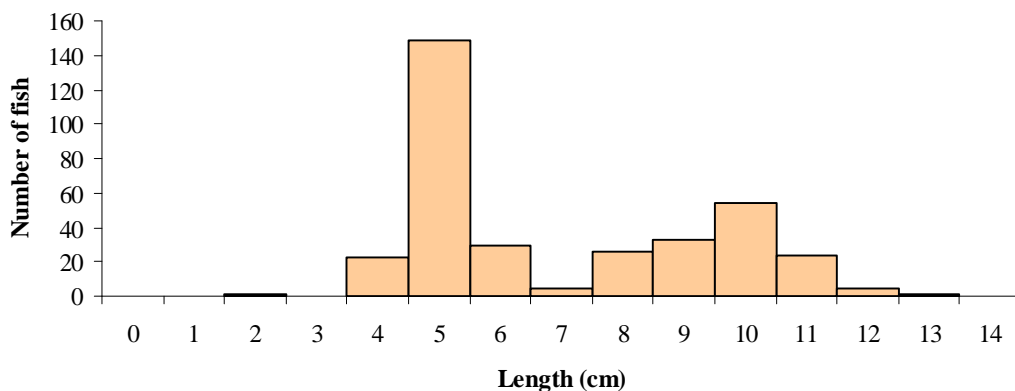


Fig 4.2. Length frequency distribution of salmon in the Ballinglen River, July 2008 (n = 351)

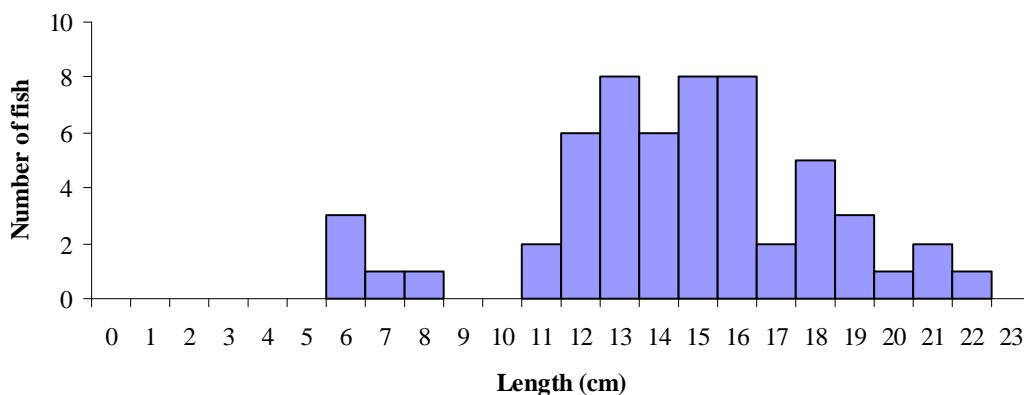


Fig. 4.3. Length frequency distribution of brown trout in the Ballinglen River, July 2008 (n = 58)

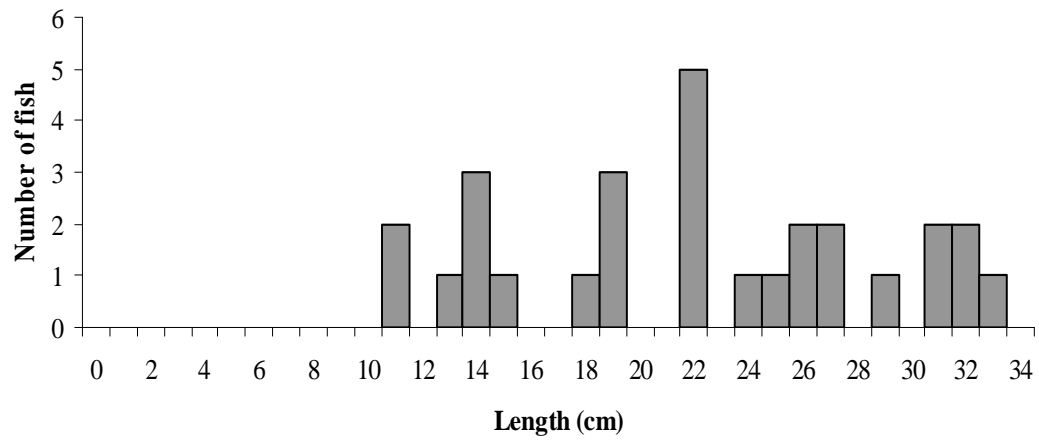


Fig. 4.4. Length frequency distribution of eels in the Ballinglen River, July 2008 (n = 28)

4.1.2 The Clydagh River



Plate 4.2. The Clydagh River, looking downstream of the site

The Clydagh River (Plate 4.2) is a spate river that rises in the mountains north of Castlebar in Co. Mayo. It flows north eastwards into Lough Cullin and joins the River Moy near Foxford. A 90m stretch of channel was sampled on the 30th of July 2008 downstream of the bridge (Fig. 4.5). Three fishings were carried out using two bank based electric fishing units. The site was dominated by cobble and boulder. Gravel and sand were also present but to a lesser extent. The majority of the habitat comprised of riffles, followed by glides and pools. The channel had a mean width of 5.2m and a mean depth of 0.2m, giving a total wetted area of 466.5m² (Table 2.1). Shading provided by bank side vegetation was low. Instream vegetation was also quite sparse and was limited to only a few species.

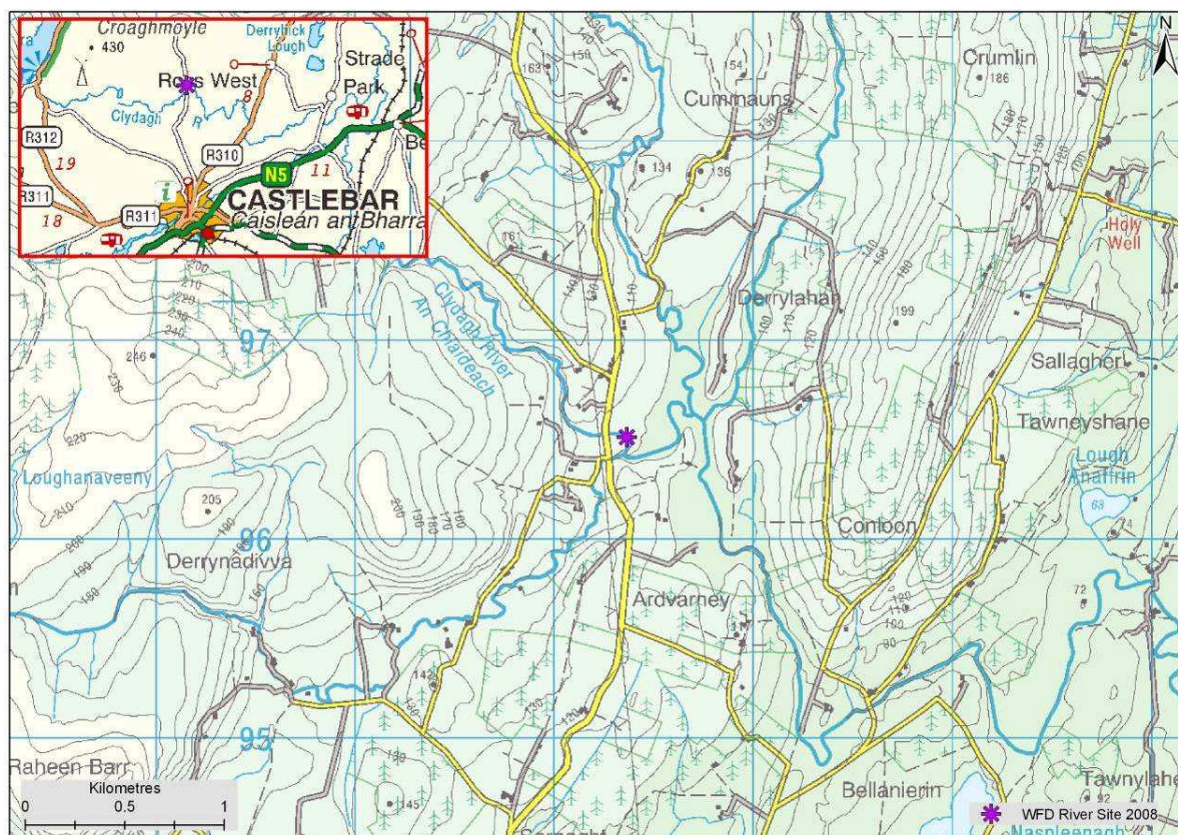


Fig. 4.5. Location of the Clydeagh River surveillance monitoring site

Three fish species were recorded in the Clydeagh River (Table 4.2). Salmon was the most abundant species captured, followed by brown trout and eel.

Table 4.2. Density of fish (no./m²) in the Clydeagh River site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
<i>Salmo salar</i>	Salmon	0.0021	0.0836	0.0858
<i>Salmo trutta</i>	Brown trout	0.0150	0.0386	0.0536
<i>Anguilla anguilla</i>	Eel	-	-	0.0022
All fish	All fish	-	-	0.1416

Salmon ranged in length from 6.4cm to 12.1cm (Fig. 4.6). One year old salmon (1+) accounted for the greatest proportion of the salmon population at the site accounting for 88%. The mean length of salmon was 6.3cm at L1 and 10.2cm at L2 (Appendix 2).

Three age classes of brown trout were present at the site, i.e. 0+, 1+ and 2+ (Fig. 4.7). 1+ was the dominant age class accounting for 48% of the population at the site, 0+ fish comprised 28% of the

population and the remaining 24% consisted of 2+ fish. The largest brown trout recorded was a two year old fish measuring 17.3cm in length and 55.5g in weight. The mean length of brown trout at L1 and L2 was 7.6cm and 13.2cm respectively (Appendix 1). Trout growth in the Clydagh was categorised as slow, based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971) (Appendix 1).

Only a single eel was captured during the Clydagh survey and it measured 52.1cm in length and weighed 210.5g.

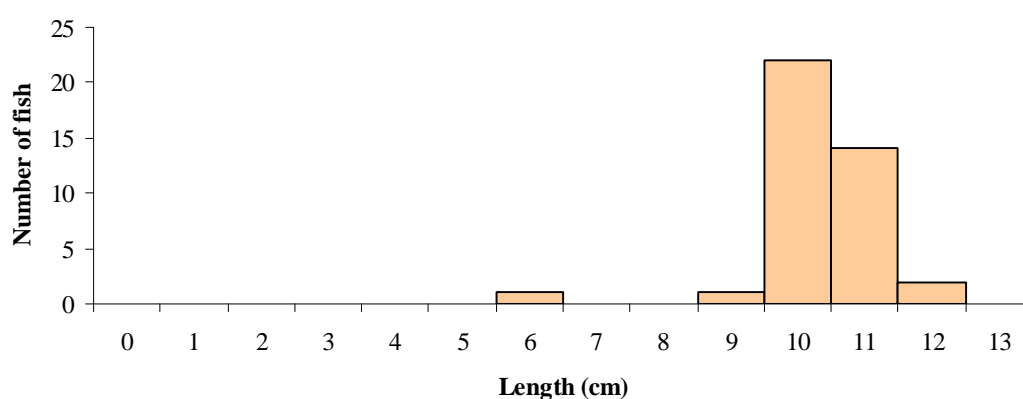


Fig. 4.6: Length frequency distribution of salmon in the Clydagh River, July 2008 (n = 40)

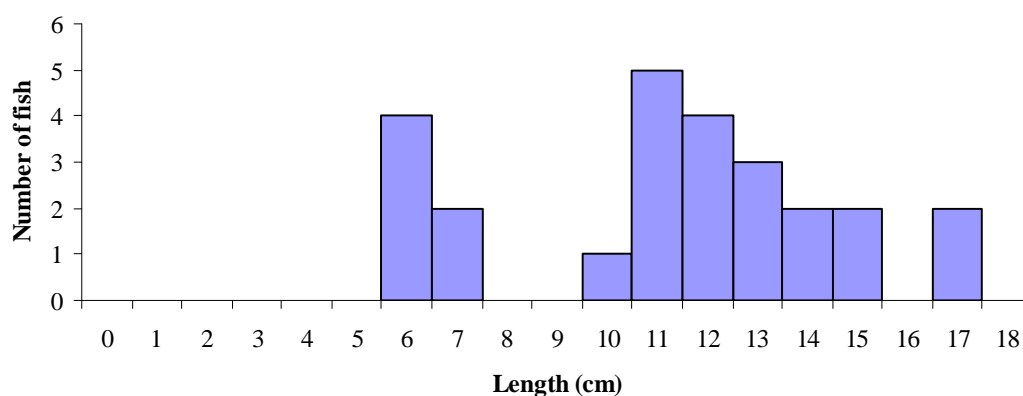


Fig. 4.7: Length frequency distribution for brown trout in the Clydagh River, July 2008 (n = 25)

4.1.3 The Glennamong River



Plate 4.3. The Glennamong River upstream of Lough Feeagh

The Glennamong River rises in the Nephin Beg Mountains, Co. Mayo and flows south eastwards into Lough Feeagh and then into Furnace Lake (Plate 4.3). The river drains peat land and forested areas until it enters the sea at Newport Bay. A 90m stretch of channel was sampled on the 6th of August 2008, downstream of the Glennamong foot bridge (Fig. 4.8). Three fishings were carried out using three bank based electric fishing units. The site was equally dominated by cobble and boulder with the remainder made up of gravel and sand. The majority of the habitat comprised of riffles and glides, with a small proportion of pools. The channel had a mean width of 7.7m and a mean depth of 0.37m, giving a total wetted area of 691.5m² (Table 2.1). The channel was relatively exposed and was only lightly shaded by marginal vegetation. The instream vegetation was almost entirely composed of bryophytes.



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

Three fish species were recorded in the Glennamang River (Table 4.3). Salmon was the most common species, followed by brown trout and eel.

Table 4.3. Density of fish (no./m²), Glennamang river site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
<i>Salmo salar</i>	Salmon	0.0014	0.0463	0.0477
<i>Salmo trutta</i>	Brown trout	0.0145	0.0159	0.0304
<i>Anguilla anguilla</i>	Eel	-	-	0.0043
All fish	All fish	-	-	0.0825

Salmon ranged in length from 7.4cm to 13.2cm (Fig. 4.9). Three age classes were present at the site; 0+, 1+ and 2+. One year old salmon were the dominant age class present at the site and accounted for approximately 88%. The mean length of salmon was 5.0cm at L1 and 8.9cm at L2 (Appendix 2).

Brown trout ranged in length from 5.4cm to 18.5cm (Fig. 4.10). Three age classes of brown trout were present at the site. 48% of the fish captured were aged 0+, 33% were 1+ fish and 2+ fish accounted for the

remaining 19% of the population at the site. The mean length of brown trout at L1 and L2 was 6.2cm and 12.3cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971) the trout growth rate in the Glennamong River was categorised as very slow (Appendix 1).

A small number of eels were recorded in the Glennamong River, ranging in length from 28.5cm to 33.6cm.

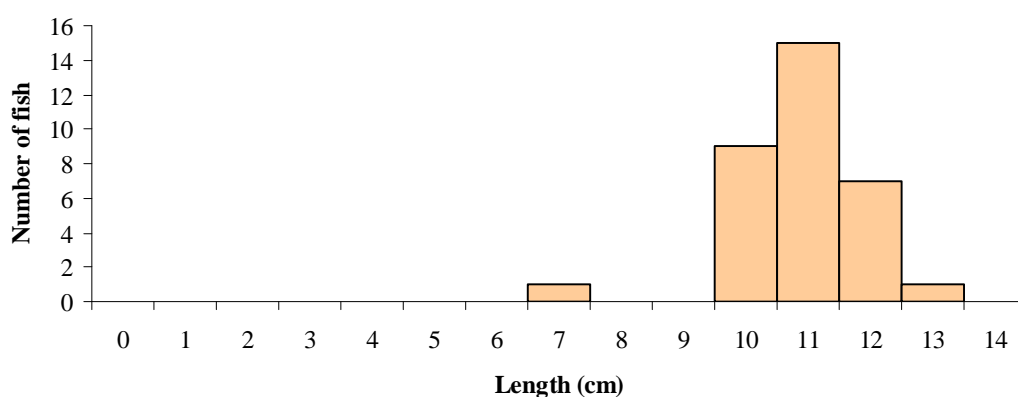


Fig. 4.9: Length frequency distribution of salmon in the Glennamong River, August 2008 (n = 33)

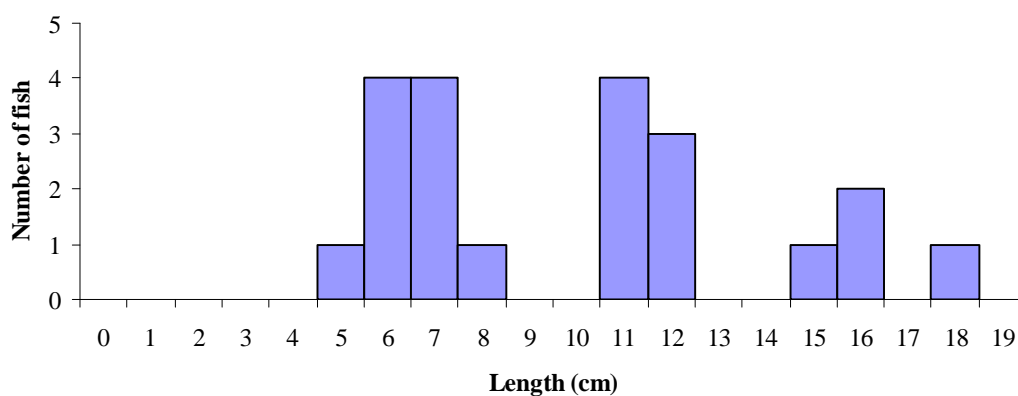


Fig. 4.10: Length frequency distribution of brown trout in the Glennamong River, August 2008 (n = 21)

4.1.4 The River Moy (Cloonbaniff Bridge)



Plate 4.4. The River Moy, downstream of Cloonbaniff Bridge

The River Moy (Plate 4.4) is one of Ireland's most famous salmon rivers and is home to the famous Ridge Pool in the town of Ballina, Co. Mayo. It also provides good angling for sea trout (O'Reilly, 2002). The River Moy rises in the Ox Mountains in Co. Sligo and flows into the sea at Killala Bay near Ballina. A 90m stretch of channel was sampled on the 31st July 2008, downstream of the bridge at Cloonbaniff (Fig. 4.11). Three fishings were carried out using two bank based electric fishing units. The mean width of the channel was 7.3m and the mean depth was 0.1m. The wetted area sampled amounted to 658.5m².

Trees along the banks of the river provided heavy shading to the channel. The site was dominated by gravels with sand and cobble occurring to a lesser extent. The majority of the habitat comprised of glide while the remainder was made up of riffle and pool. There was a rich diversity of macrophytes present in the Moy. Emergent species such as *Mentha aquatica*, *Oenanthe crocata* and *Ranunculus flammula* were spread along the shallow margins, while bryophytes (mosses) including *Chiloscyphus polyanthus* and *Fontinalis antipyretica* were submerged within the channel. Two floating species, *Callitriche* sp. and *Potamogeton polygonifolius* were also recorded.

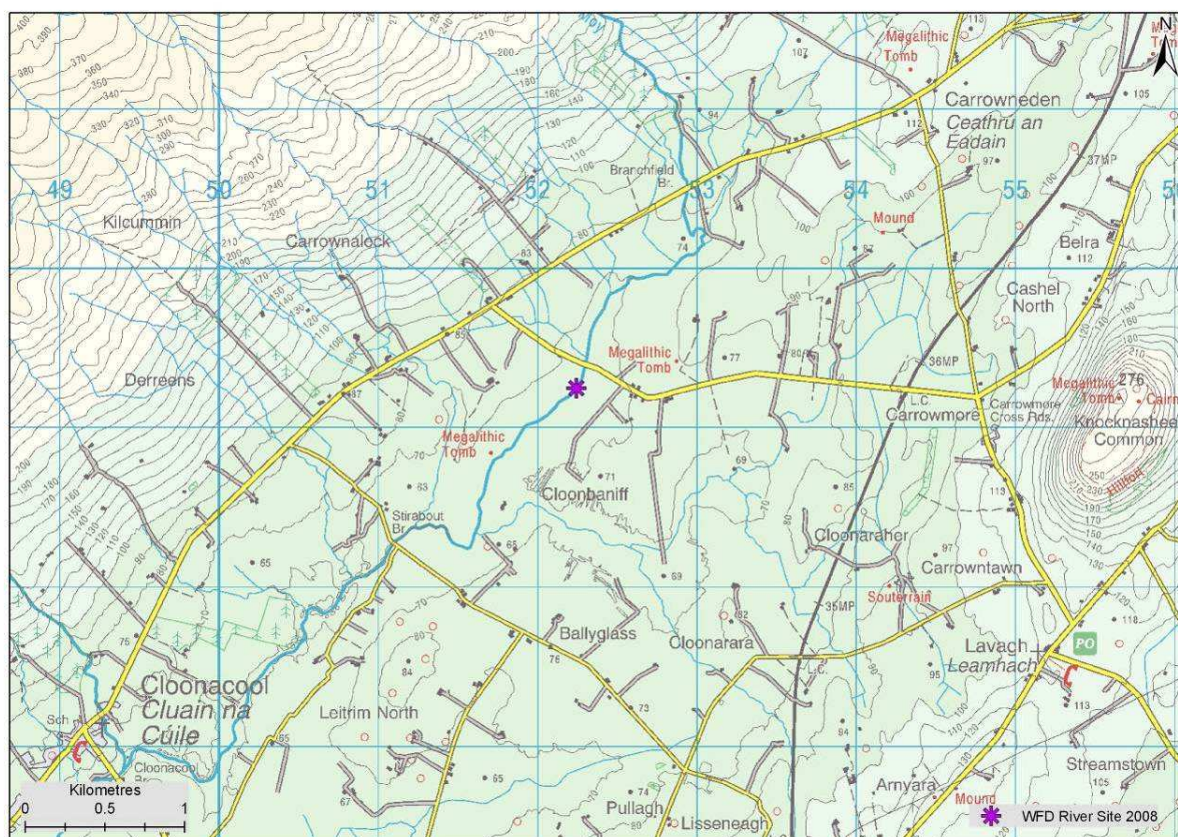


Fig. 4.11: Location of the River Moy surveillance monitoring site

Four fish species were recorded in the River Moy (Table 4.4). Juvenile salmon were the most abundant species present at this site.

Table 4.4. Density of fish species (no./m²) recorded on the River Moy (fish density has been calculated as minimum estimates based on 3 fishings)

Species name	Common name	0+	1+ & older	Total density
<i>Salmo salar</i>	Salmon	0.7547	0.000	0.7547
<i>Salmo trutta</i>	Brown trout	0.0258	0.000	0.0258
<i>Lampetra</i> spp.	Lamprey	-	-	0.0258
<i>Gasterosteus aculeatus</i>	3-Spined stickleback	-	-	0.0182
All fish	All fish	-	-	0.8242

Only salmon fry (0+) were recorded at this site during the survey, ranging in length from 3.1cm to 7.3cm (Fig. 4.12). Again all brown trout sampled were fry, ranging in length from 4.1cm to 7.9cm (Fig. 4.13).

Juvenile lamprey ranged in length from 6.0cm to 12.5cm (Fig. 4.14). 3-spined stickleback were also recorded, ranging in length from 2.5cm to 3.0cm.

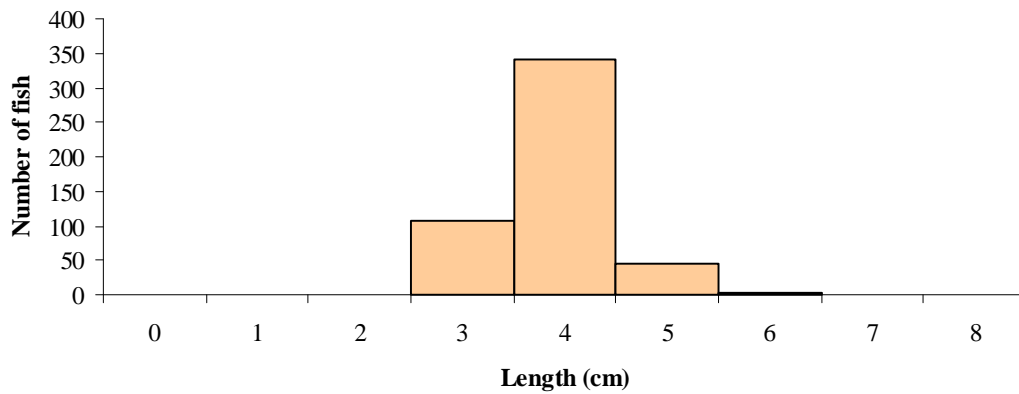


Fig. 4.12: Length frequency distribution for salmon in the River Moy, July 2008 (n = 497)

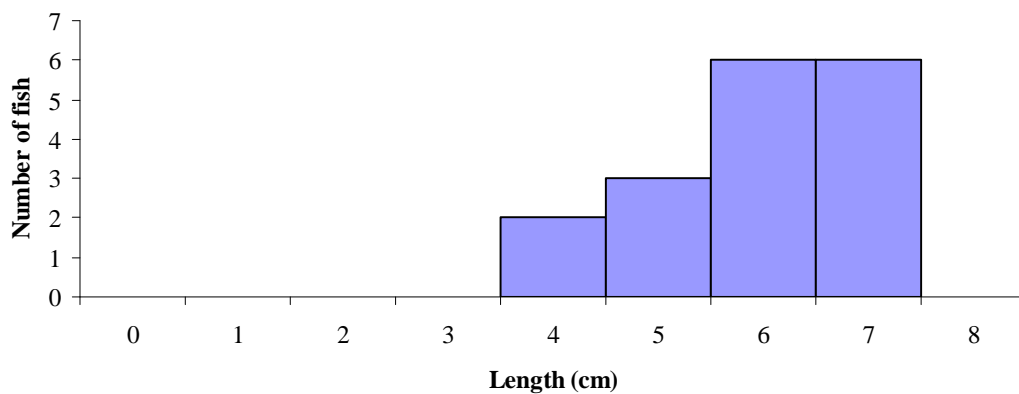


Fig. 4.13: Length frequency distribution for brown trout in the River Moy, July 2008 (n = 17)

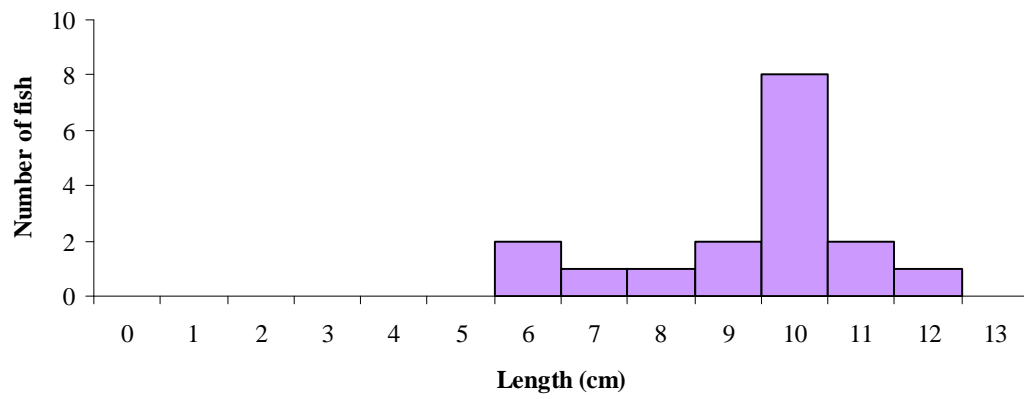


Fig. 4.14: Length frequency distribution for lamprey in the River Moy, July 2008 (n = 17)

4.1.5 The Tobercurry River



Plate 4.5. The Tobercurry River, upstream of the confluence with the River Moy

The Tobercurry River (Plate 4.5) rises in the Ox Mountains and flows south eastwards where it joins the River Moy to the west of Tobercurry, County Sligo. A 90m stretch of channel was sampled on the 27th of July 2008, downstream of the bridge at the Moy – Tobercurry confluence (Fig. 4.15). Three fishings were carried out using one bank based electric fishing unit. The mean width of the channel was 3.6m and the mean depth was 0.2m. The total wetted area fished was 319.7m². Trees along the banks of the river provided heavy shading to the channel. The site was dominated by cobbles with the remainder made up of boulders and sand. The majority of the habitat comprised of glides with some areas of riffle and pools present. Small pockets of emergent macrophyte species were strewn about the channel. Species such as *Apium nodiflorum*, *Mentha aquatica*, *Rorippa nasturtium-aquaticum* and *Sparganium erectum* were present along the margins, while *Rhynchostegium riparioides* was the dominant moss within the channel itself.

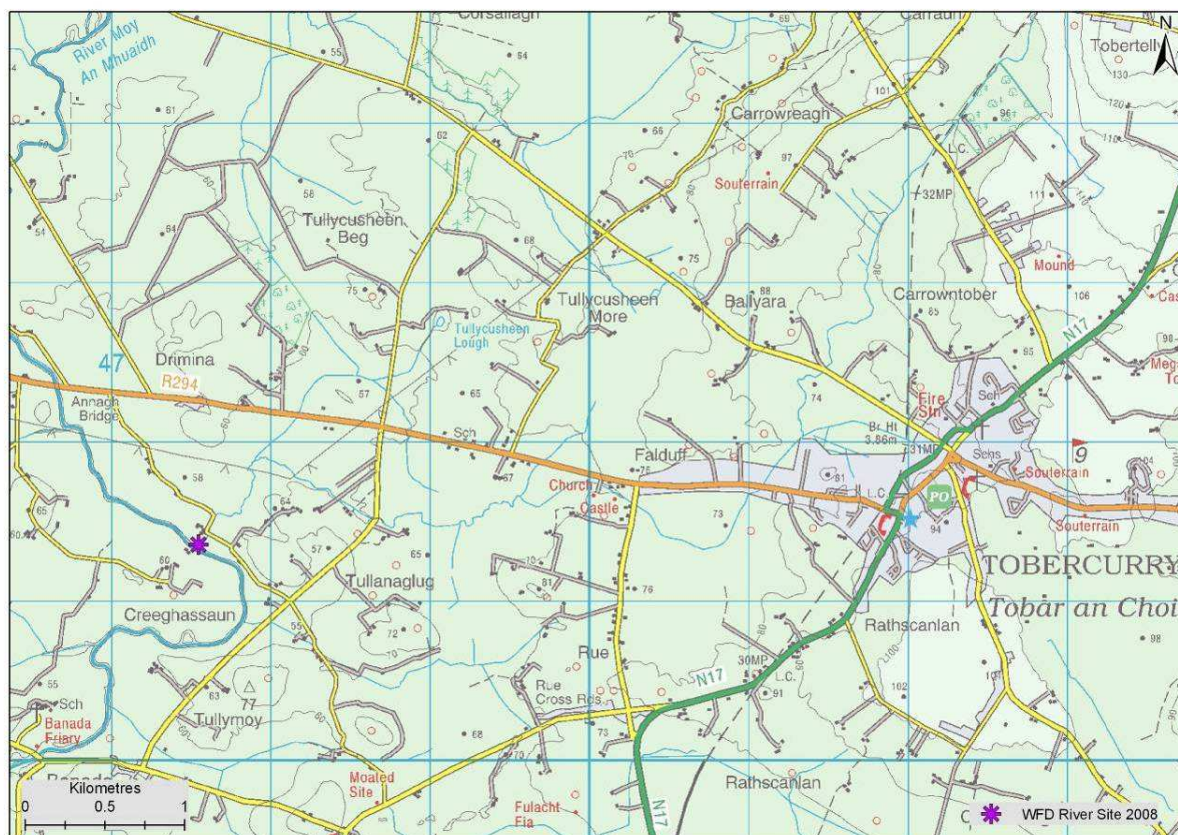


Fig. 4.15. Location of the Tobercurry River surveillance monitoring site

A total of six fish species were recorded in the Tobercurry River (Table 4.5). Salmon were the most abundant species, followed by brown trout.

Table 4.5. Density of fish species (no./m²) recorded on the Tobercurry River (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total
<i>Salmo salar</i>	Salmon	1.2764	0.2284	1.5055
<i>Salmo trutta</i>	Brown trout	0.0563	0.0063	0.0626
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.0282
<i>Gasterosteus aculeatus</i>	3-Spined stickleback	-	-	0.0157
<i>Anguilla anguilla</i>	Eel	-	-	0.0031
<i>Barbatula barbatula</i>	Stone loach	-	-	0.0031
All fish	All fish	-	-	1.6182

Salmon ranged in length from 3.1cm to 12.9cm (Fig. 4.16). Salmon fry constituted the greatest proportion of the salmon population at the site (85%), followed by salmon parr (15%). The mean length of salmon at L1 was 4.1cm and at L2 was 10.2cm (Appendix 2).

Brown trout ranged in length from 4.2cm to 14.5cm (Fig 4.17). Only two of these fish were aged as 1+. Length frequency analysis reveals the 0+ age class accounted for approximately 90% of the brown trout population at the site. The mean L1 for brown trout in the Tobercurry River was 6.1cm (Appendix 1).

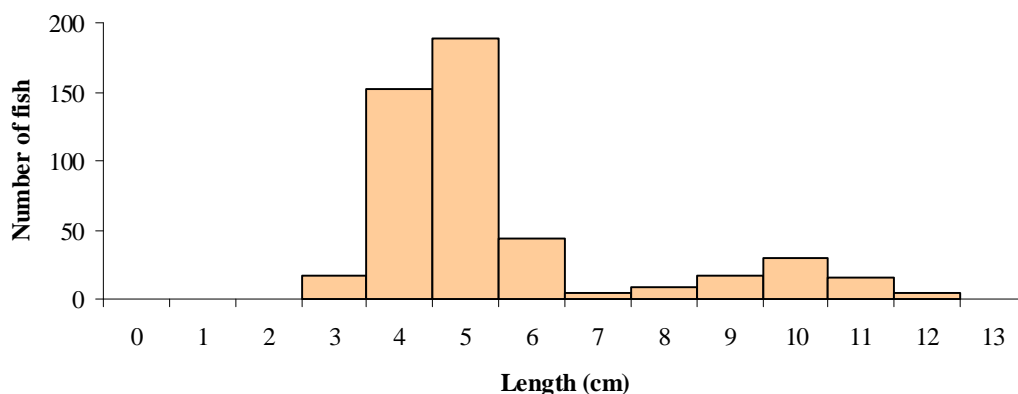


Fig. 4.16: Length frequency distribution for salmon in the Tobercurry River, July 2008 (n = 481)

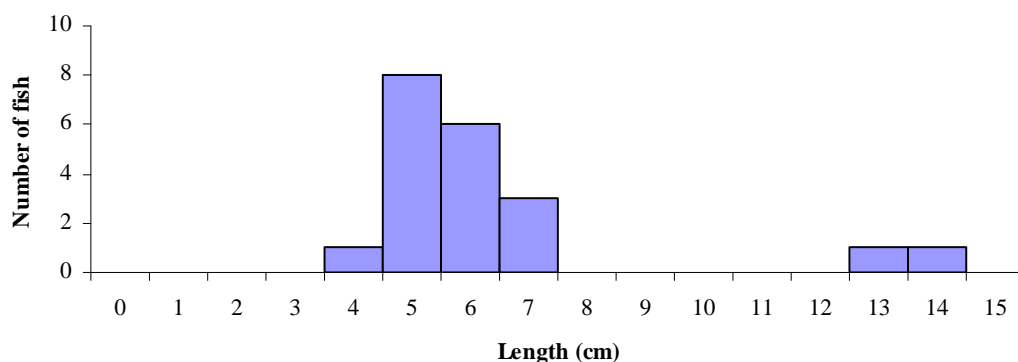


Fig. 4.17: Length frequency distribution for brown trout in the Tobercurry River, July 2008 (n = 20)

4.2 Boat sites

4.2.1 The Behy River



Plate 4.6. The Behy River at Behy Bridge

The Behy River (Plate 4.6) rises in the Ox Mountains near Bunnyconnellan in Co. Mayo. It flows east through Ballina to join with the River Moy. A 120m stretch of channel was sampled on the 5th of August 2008, upstream of Behy Bridge (Fig. 4.18). The mean width of the channel was 6.7m and the mean depth was 0.7m. The total wetted area fished was 806m² (Table 2.1). Three fishings were carried out using one boat based electric fishing unit. Trees and shrubs along the banks of the river provided light shading to the channel. Aquatic macrophyte vegetation was mixed within the site. Bryophytes included *Chiloscyphus polyanthus*, *Fontinalis antipyretica* and *Rhynchostegium riparioides* and emergent vegetation included *Phragmites Australis*, *Sparganium erectum* and *Apium nodiflorum*. Two floating species, *Potamogeton natans* and *Callitriche* sp., were also recorded. The site was dominated by gravels with the remainder made up of mud, silt, sand and cobble. The majority of the habitat comprised of pools along with a smaller proportion of glide and riffle.

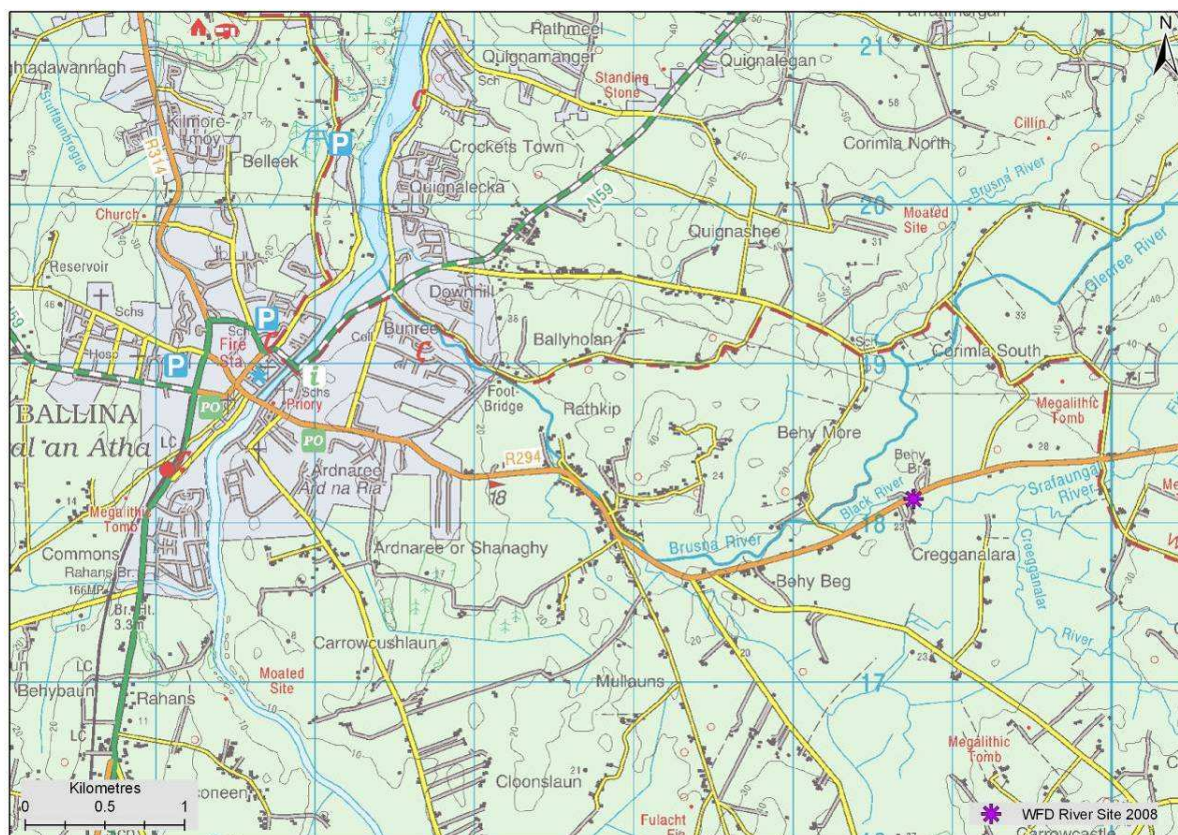


Fig. 4.18. Location of the Behy River surveillance monitoring site

Three fish species were recorded in the Behy River (Table 4.6). Salmon was the most common species followed by brown trout. Only a single 3-spined stickleback was captured.

Table 4.6. Density of fish species (no./m²) recorded on the Behy River (fish density has been calculated as minimum estimates based on 3 fishings)

Species name	Common name	0+	1+ & older	Total
<i>Salmo salar</i>	Salmon	0.0112	0.1067	0.1178
<i>Salmo trutta</i>	Brown trout	0.0037	0.0744	0.0781
<i>Gasterosteus aculeatus</i>	3-Spined stickleback	-	-	0.0012
All fish	All fish	-	-	0.1972

Salmon ranged in length from 5.9cm to 13.6cm (Fig. 4.19). Salmon parr were the dominant age class present and made up 91% of the population at the site. The mean length of salmon in the Behy River at L1 was 5.4cm (Appendix 2).

Brown trout ranged in length from 7.0cm to 22.6cm (Fig. 4.20). The largest brown trout present was 2+, measured 22.6cm and weighed 138.5g. The brown trout population comprised of 1+ fish (73%), followed

by 2+ (22%) and 0+ fish (5%). The mean length of brown trout at L1 and L2 was 6.8cm and 14.1cm respectively. Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971) the trout growth rate in the Behy River was categorised as slow (Appendix 1).

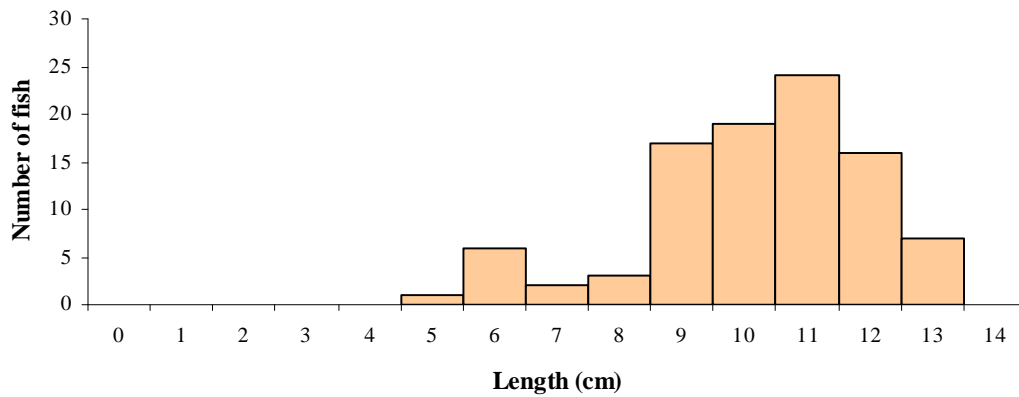


Fig. 4.19. Length frequency distribution for salmon in the Behy River, August 2008 (n = 95)

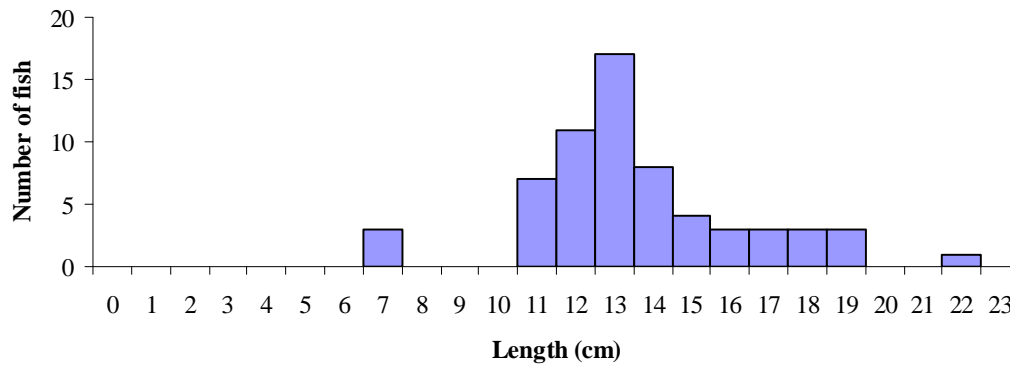


Fig. 4.20. Length frequency distribution for brown trout in the Behy River, August 2008 (n = 63)

4.2.2 The Castlebar River



Plate 4.7. The Castlebar River

The Castlebar River (Plate 4.7) is a tributary of the rivers Clydagh and Moy. It rises as a series of small streams and lakes southwest of Castlebar, Co. Mayo, flowing north-eastwards through the town itself, before later joining the Clydagh River approximately eight kilometres south of Foxford. This is a limestone river that has been badly polluted in the past, with brown trout stocks suffering severely (O'Reilly 2002). A 100m stretch of channel was surveyed on the 7th of July 2008, downstream of a bridge approximately two kilometres outside of Castlebar along the N5 (Fig. 4.21). Three fishings were carried out using one boat based electric fishing unit. The mean width of the channel was 6.3m and the mean depth was 0.3m. The total wetted area surveyed was 632m². Trees and shrubs along the banks of the river provided light shading to the channel. The site was equally dominated by boulders and cobbles, while the habitat comprised of riffle and glide.



Fig. 4.21: Location of the Castlebar River surveillance monitoring site

Four fish species were recorded in the Castlebar River, of which eel were the most abundant.

Table 4.7. Density of fish species (no./m²) recorded on the Castlebar River (fish density has been calculated as minimum estimates based on 3 fishings)

Species name	Common name	0+	1+ & older	Total density
<i>Anguilla anguilla</i>	Eel	-	-	0.0807
<i>Salmo trutta</i>	Brown trout	0.0000	0.0032	0.0032
<i>Salmo salar</i>	Salmon	0.0000	0.0016	0.0016
<i>Perca fluviatilis</i>	Perch	-	-	0.0016
All fish	All fish	-	-	0.0870

Eels ranged in length from 13.4cm to 51.0cm (Fig. 4.22). Only a small number of brown trout (22.5cm and 23.2cm) and salmon parr (15.2cm) were captured during the survey. Appendix 1 and 2 show a summary of growth for each of these species respectively.

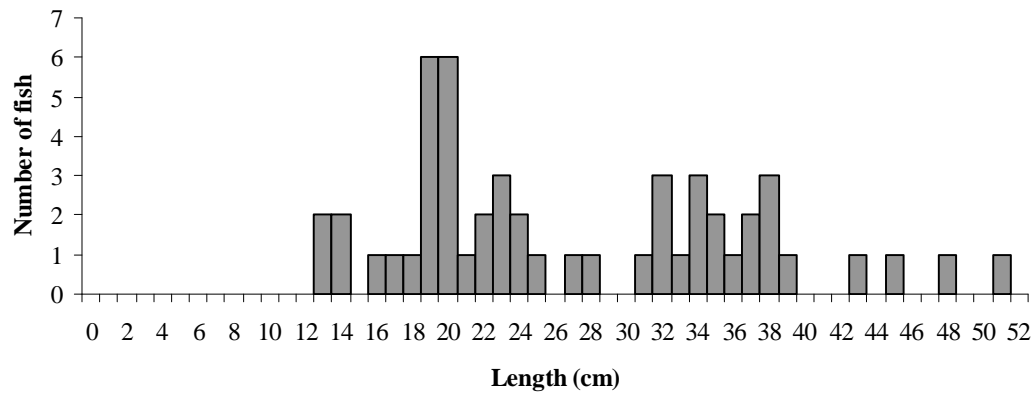


Fig. 4.22. Length frequency distribution for eels in the Castlebar River, July 2008 (n = 51)

4.2.3 The Deel River at Crossmolina



Plate 4.8. The Deel River

The Deel River (Plate 4.8) rises in the Nephin Beg Range in Co. Mayo and flows north-eastwards through Crossmolina before entering Lough Conn. It continues further south through Lough Cullin, eventually meeting the River Moy near Foxford. A 323m stretch of channel was surveyed on the 9th of July 2008 downstream of the bridge at Castle Gore (Fig. 4.23). Three fishings were carried out using three boat based electric fishing units. The average width of the channel was 18.4m and the average depth was 1.0m. A total of 5,943.2 m² wetted area was surveyed. Trees and shrubs along the banks of the river provided a moderate amount of shading to the channel. The site was dominated by boulders and bedrock, while the habitat was comprised solely of glide.

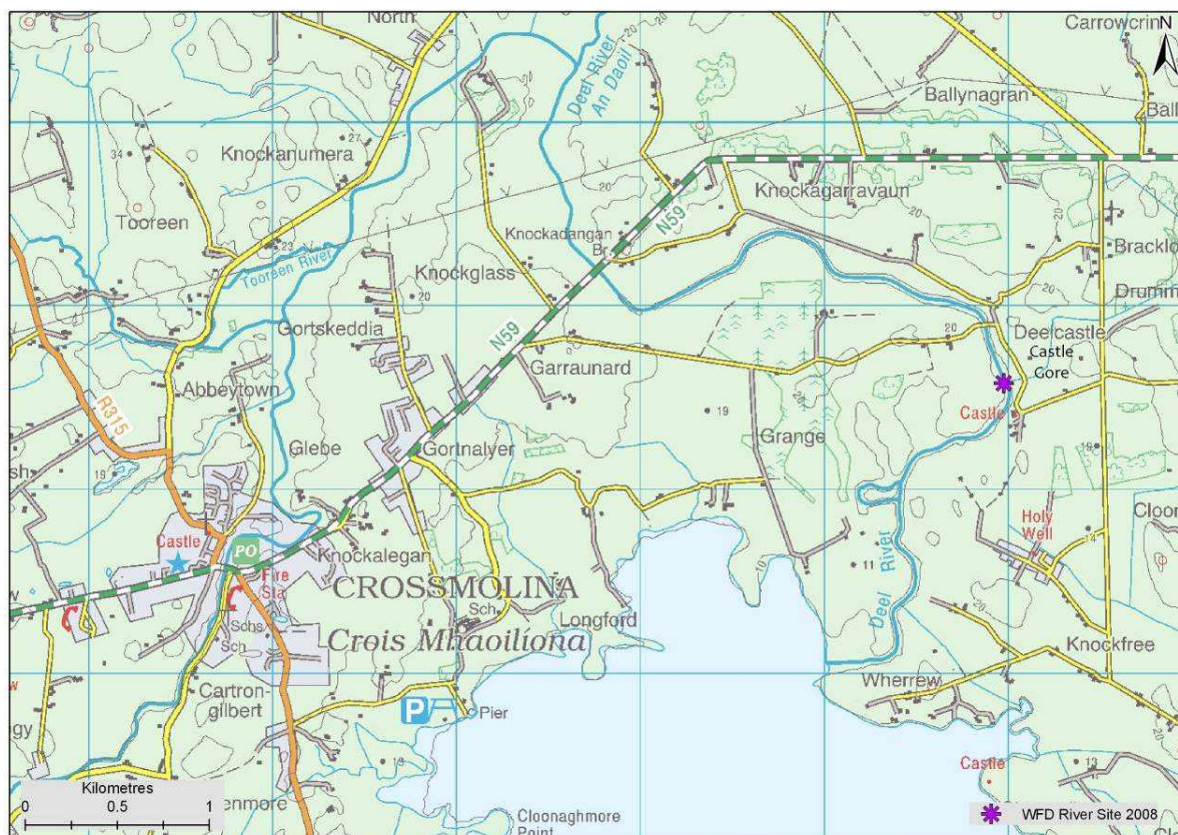


Fig. 4.23. Location of the Deel River (Crossmolina) surveillance monitoring site

There were six fish species recorded in the River Deel, of which roach was the most common (Table 4.8).

Table 4.8. Density of fish species (no./m²) recorded on the Deel River at Crossmolina (fish density has been calculated as minimum estimates based on 3 fishings)

Species name	Common name	0+	1+ & older	Total
<i>Rutilus rutilus</i>	Roach	-	-	0.0113
<i>Perca fluviatilis</i>	Perch	-	-	0.0030
<i>Salmo salar</i>	Salmon	0.0002	0.0027	0.0029
<i>Esox lucius</i>	Pike	-	-	0.0024
<i>Anguilla anguilla</i>	Eel	-	-	0.0019
<i>Salmo trutta</i>	Brown trout	0.0000	0.0002	0.0002
All fish	All fish	-	-	0.0215

Roach ranged in length from 5.4cm to 25.5cm and ages ranged from 1+ to 7+ (Fig. 4.24). Perch ranged in length from 7.4cm to 22.0cm and encompassed ages from 1+ to 4+ (Fig. 4.25).

Salmon ranged in length from 5.9cm to 65.0cm. Adult salmon comprised the greatest percentage (65%) at the site. This was followed by the 1+ (18%), 2+ (12%) and 0+ (6%) age classes. The mean length of salmon at L1, L2 and L3 was 6.1 m, 18.1cm and 37.7cm respectively (Appendix 2).

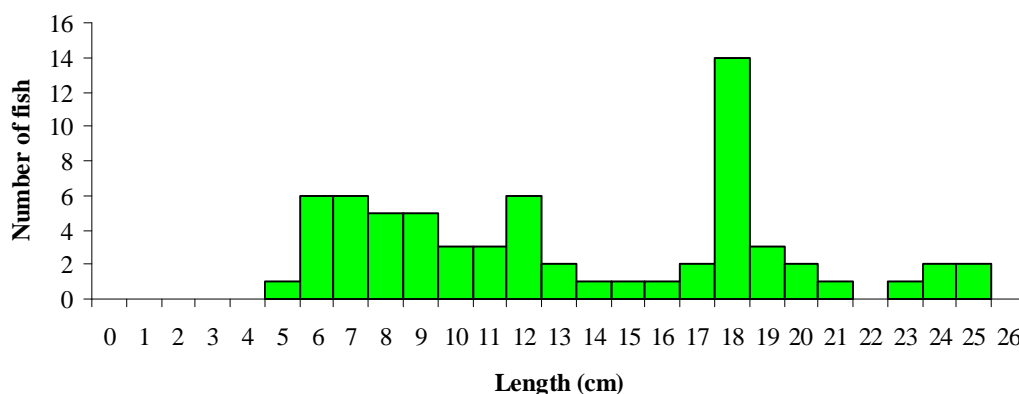


Fig. 4.24. Length frequency distribution for roach in the Deel River (Crossmolina), July 2008
(n = 67)

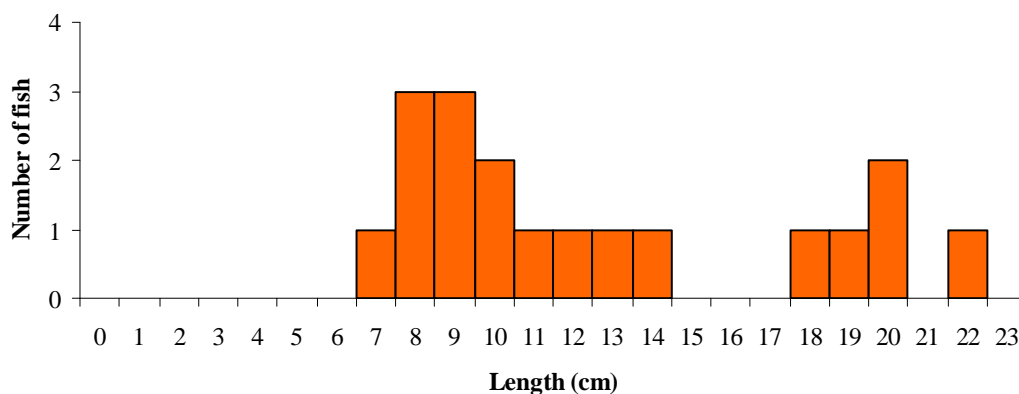


Fig. 4.25. Length frequency distribution for perch in the Deel River (Crossmolina), July 2008
(n = 18)

4.2.4 The Glenamoy River



Plate 4.9. The Glenamoy River at Glenamoy Bridge

The Glenamoy River (Plate 4.9) rises in northwest Co. Mayo. It is joined by many small tributaries as it flows westwards through Glenamoy Village and into the sea at Sruwaddacon Bay. It is considered to be a good fishing river with substantial numbers of both salmon and sea trout (O'Reilly 2002). An electric fishing survey was conducted on the Glenamoy river on the 8th of July 2008 along a stretch of river channel measuring 206m in length. Two sets of boat mounted electric fishing equipment were used to conduct three fishings. The survey site was located upstream of the Glenamoy Bridge (Fig. 4.26). The mean channel width at the time of the survey was 10.6m and the mean depth was 0.4m. The wetted area sampled was 2,183.6 m² (Table 2.1). Trees and shrubs along the banks of the river provided a light amount of shading to the channel. The site was equally dominated by cobbles and gravels, while the habitat was comprised mainly of glide with some areas of riffle.

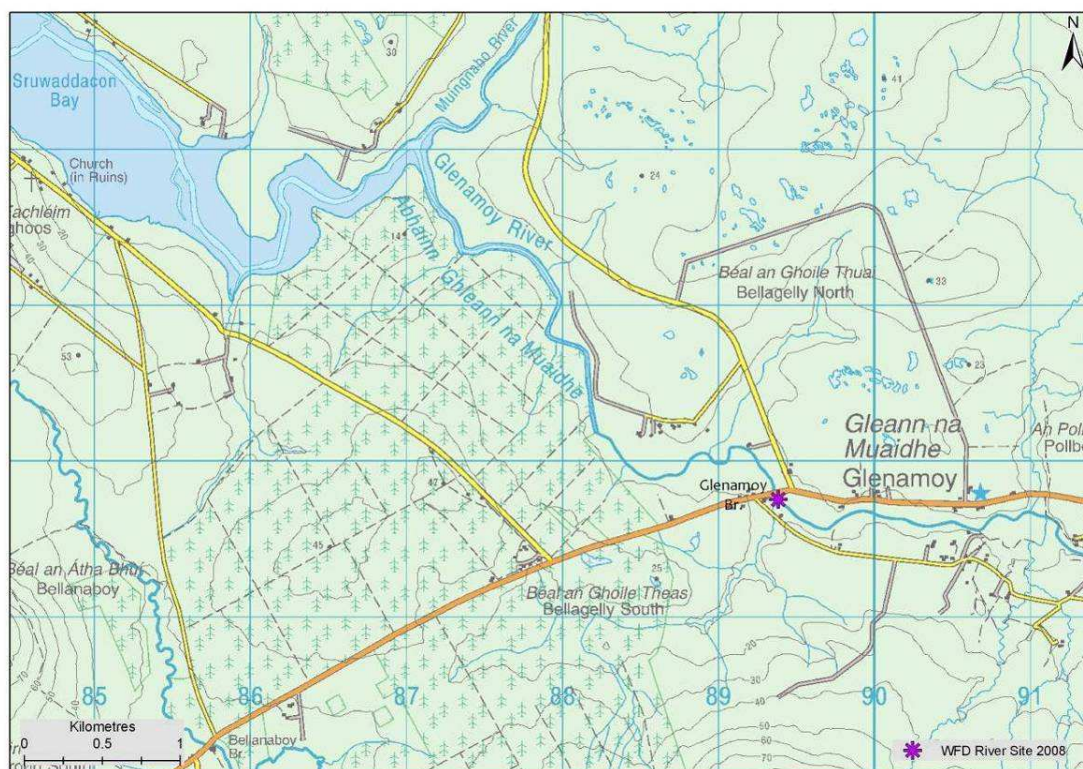


Fig. 4.26. Location of the Glenamoy River surveillance monitoring site

Five fish species were recorded on the Glenamoy River (Table 4.9). Salmon was the most common species followed by brown trout. (Sea trout are included as a separate variety of brown trout (Table 4.9).

Table 4.9. Density of fish species (no./m²) recorded on the Glenamoy River (fish density has been calculated as minimum estimates based on 3 fishings)

Species name	Common name	0+	1+ & older	Total density
<i>Salmo salar</i>	Salmon	0.0078	0.0554	0.0632
<i>Salmo trutta</i>	Brown trout	0.0000	0.0408	0.0408
<i>Anguilla anguilla</i>	Eel	-	-	0.0128
<i>Salmo trutta</i>	Sea trout	-	-	0.0064
<i>Platichthys flesus</i>	Flounder	-	-	0.0028
<i>Gasterosteus aculeatus</i>	3-Spined stickleback	-	-	0.0014
All fish	All fish	-	-	0.1273

Salmon ranged in length from 7.7cm to 12.8cm (Fig 4.27). Three age classes were represented; 0+, 1+ and 2+. One year old salmon (1+) were the most abundant age class present in the population, comprising 79%. This was followed by fry (0+) at 12.3 % and 2+ fish at 8.7%. The mean length of salmon was 4.7cm at L1 and 7.5cm at L2 (Appendix 2).

Brown trout ranged in length from 11.1cm to 24.0cm (Fig. 4.28). The largest brown trout specimen (24.0cm and 169g) was 4+ in age. No brown trout fry were recorded during this survey; however, all other ages up to 4+ were represented. 30% of the brown trout population was comprised of fish aged 1+. The remaining 70% was divided between the 2+ (67%), 3+ (1.5%) and 4+ (1.5%) age classes. The mean length of brown trout at L1, L2, L3 and L4 was 6.5cm, 12.3cm, 16.7cm and 22.2cm respectively (Appendix 1). Based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971), the trout growth rate in the Glenamoy River was categorised as very slow (Appendix 1).

Eels ranged in length from 12.4cm to 33.0cm (Figure 4.29). Sea trout captured ranged in length from 25.2cm to 29.5cm (mean = 27.0 cm).

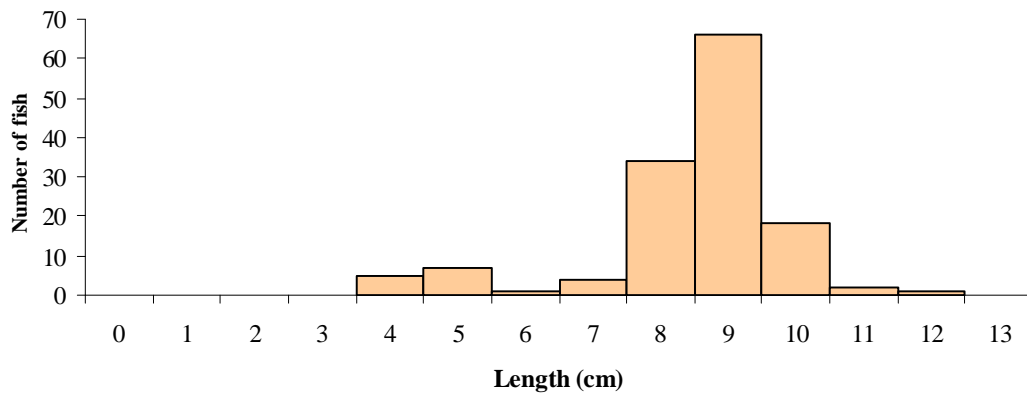


Fig. 4.27. Length frequency distribution for salmon in the Glenamoy River, July 2008 (n = 138)

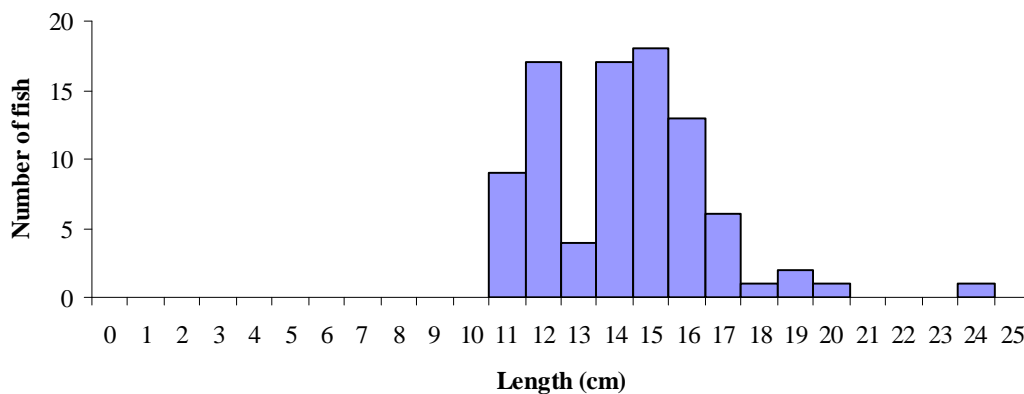


Fig. 4.28. Length frequency distribution for brown trout in the Glenamoy River, July 2008 (n = 89)

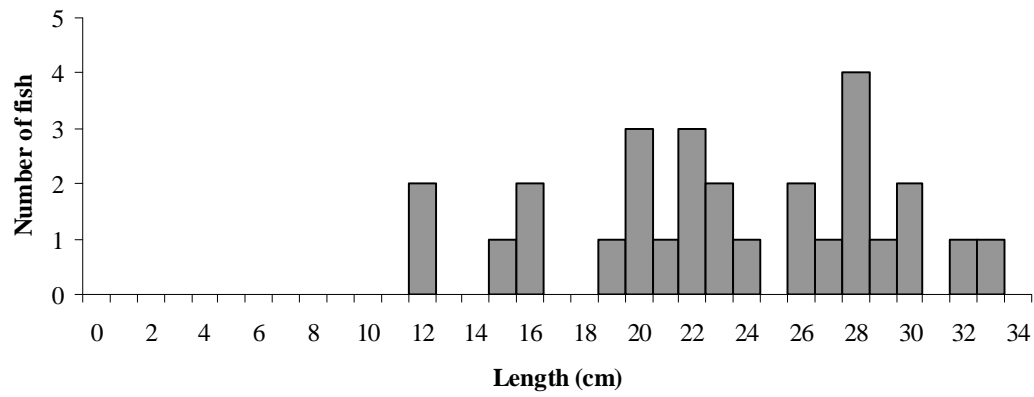


Fig. 4.29. Length frequency distribution for eel in the Glenamoy River, July 2008 (n = 28)

4.3 Community Structure

4.3.1. Species richness and composition

Nine river sites were surveyed within the NWRFB with a total of 12 fish species (sea trout were included as a separate variety of trout) being recorded. Only salmon and brown trout occurred within 100% of the sites visited (Fig. 4.30). Six fish species – minnow, flounder, roach, stone loach, pike and lamprey – occurred at only 8% of sites (Fig. 4.30).

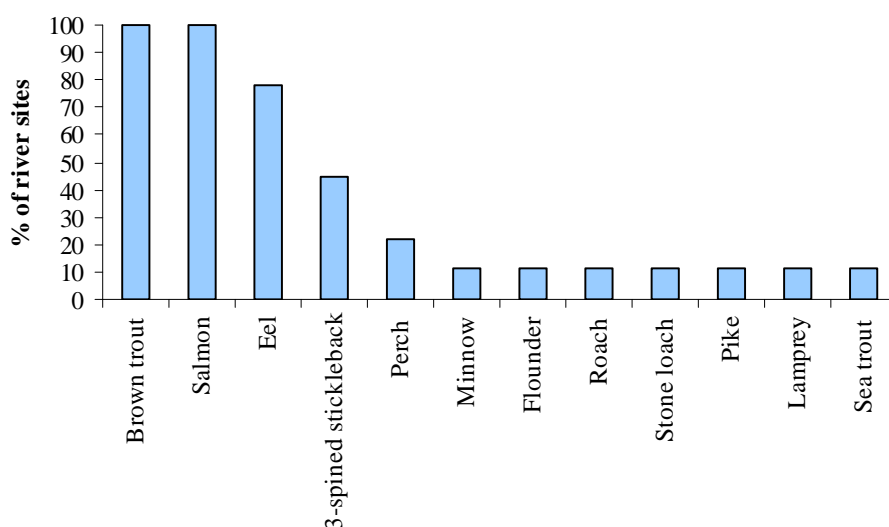


Fig. 4.30. Percentage of sites where each fish species was present (total of 9 NWRFB river sites surveyed) for WFD SM monitoring 2008

The most diverse species assemblages were recorded in the Deel, Glenamoy and Tobercurry rivers, which each had six fish species present, whereas the Ballinglen, Behy, Clydagh, Glennamong each had only three species present (Table 4.10).

Native species (e.g. salmon, brown trout, etc.) were present at all sites surveyed (Table 4.10). Non native species (group 2 – e.g. pike, perch, roach, pike and minnow) were recorded at three (Tobercurry, Deel and Castlebar) of the twelve sites surveyed in the NWRFB. Non native group 3 fish species (e.g. stone loach) were only present at one site (Tobercurry) site surveyed (Table 4.12). Kelly *et al* (2008) give an explanation of the different fish groups.

Table 4.10. Species richness at each river site surveyed in the NWRFB, Jul to Oct 2008

Site	Species richness	No. native species (Group 1)	No. non-native species (Group 2)	No. non-native species (Group 3)
HAND SET SITES				
Tobercurry	6	4	2	1
Moy (Cloonbaniff)	4	4	0	0
Ballinglen	3	3	0	0
Clydagh	3	3	0	0
Glennamong	3	3	0	0
BOAT SITES				
Glenamoy	6	6	0	0
Deel (Crossmolina)	6	3	3	0
Castlebar	4	3	1	0
Behy	3	3	0	0

4.3.2 Species abundance and distribution

The distribution maps for all species encountered within the NWRFB are shown in Figs. 4.31 to 4.37. Brown trout and salmon are divided into two maps to show, fry (0+) and older fish ($\geq 1+$). Salmon were well distributed throughout the river sites surveyed (Fig. 4.31 and 4.32). Salmon greater than 1+ were recorded from all sites in the NWRFB except at the Moy at Cloonbaniff site. However, good recruitment was recorded at this site for the 0+ year class. The highest density of 1+ and older salmon was recorded on the Ballinglen (0.30fish/m²) followed by the Tobercurry site (0.23fish/m²) (Fig. 4.31). The highest densities of salmon fry recorded were on the Tobercurry (1.27fish/m²) followed by the Moy (0.75fish/m²) and the Ballinglen (0.44fish/m²) sites (Fig. 4.32). The Tobercurry site also recorded the highest density of salmon fry of any site surveyed for WFD during 2008 (Kelly *et al.*, 2008).

The abundance of 0+ and 1+ and older brown trout was relatively low at many sites in the region in comparison to other sites surveyed during 2008. Brown trout were not recorded from the Glenamoy, Deel or Castlebar sampling sites. However, low densities were recorded from these sites for the 1+ age groups with the highest density being recorded on the Ballinglen site (0.11fish/m²) (Fig. 4.34).

The greatest densities of eel were recorded from the Castlebar River (Fig. 4.33). No eels were captured from the Behy or the Moy sites. Despite being the fourth most widespread fish species throughout the region, 3-spined stickleback (Fig. 4.36) were only present in four rivers; the Tobercurry, Moy, Behy and Glenamoy. Non-native fish species, such as pike, perch and roach, were relatively rare within the region. All three species were recorded in the Deel River. The Castlebar River was the only other site to have perch present (Fig. 4.37).





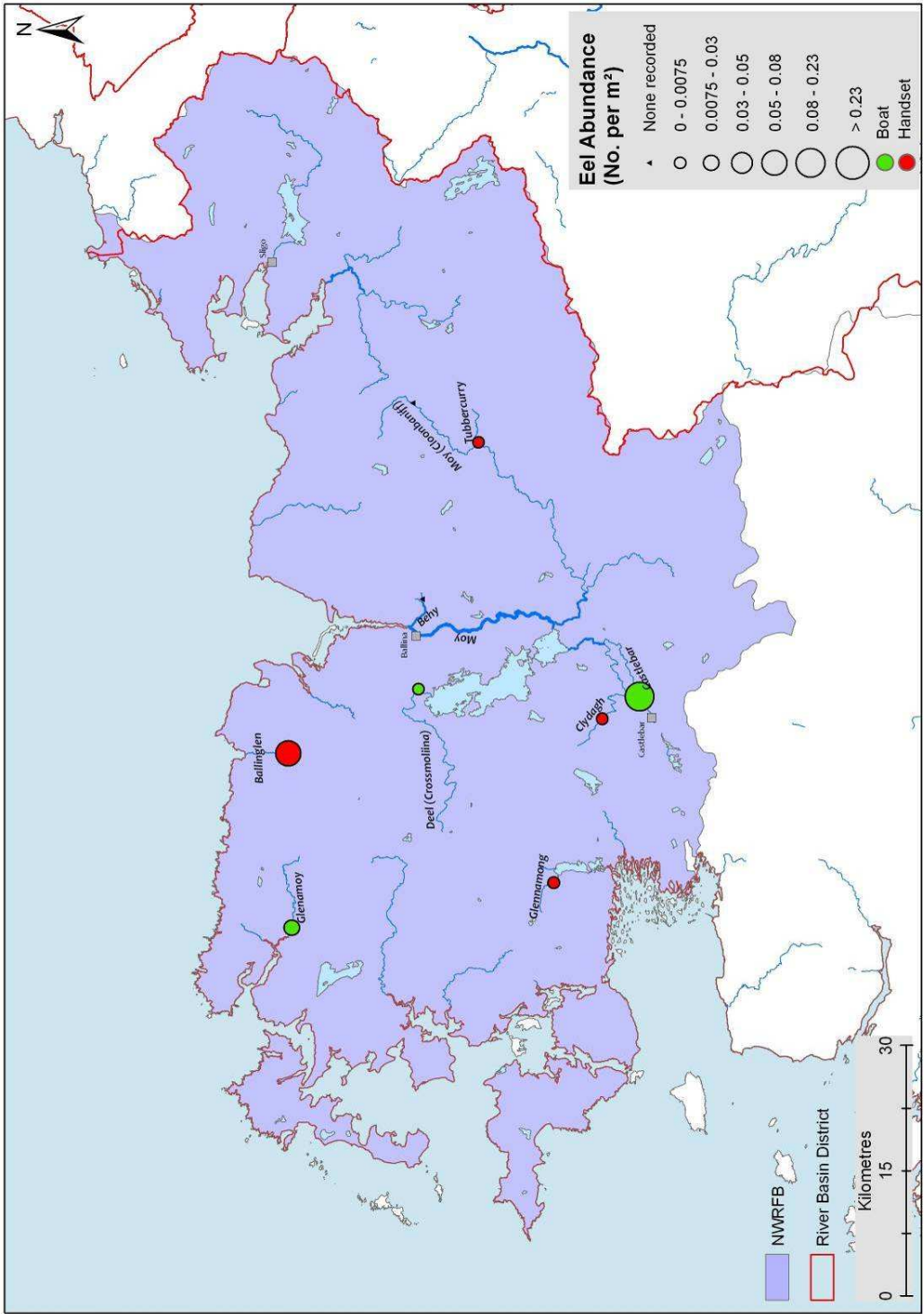


Fig. 4.33: Distribution map for eel in the NWRFB, WFD surveillance monitoring 2008

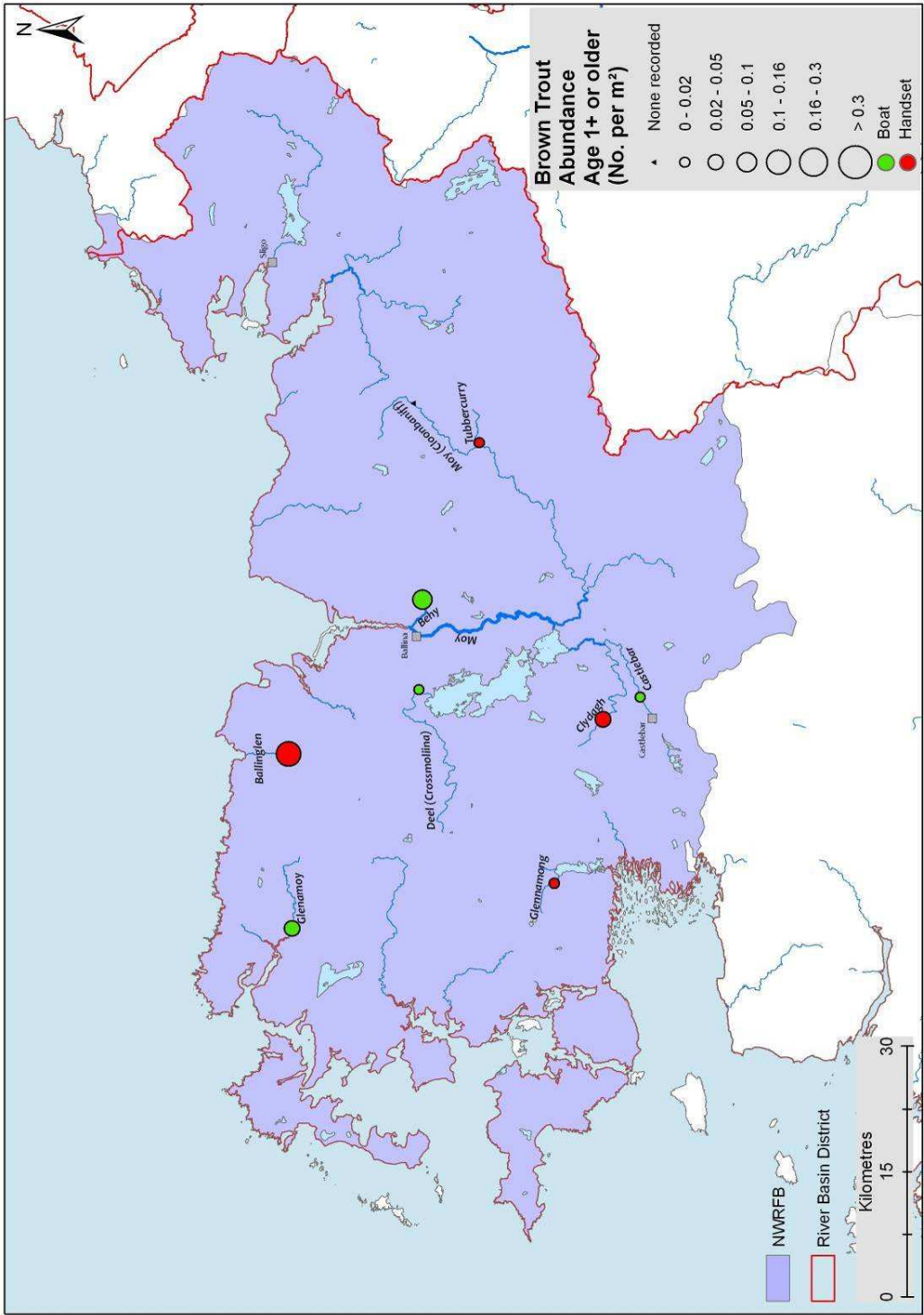


Fig. 4.34: Distribution map for 1+ brown trout in the NWRFB, WFD surveillance monitoring 2008





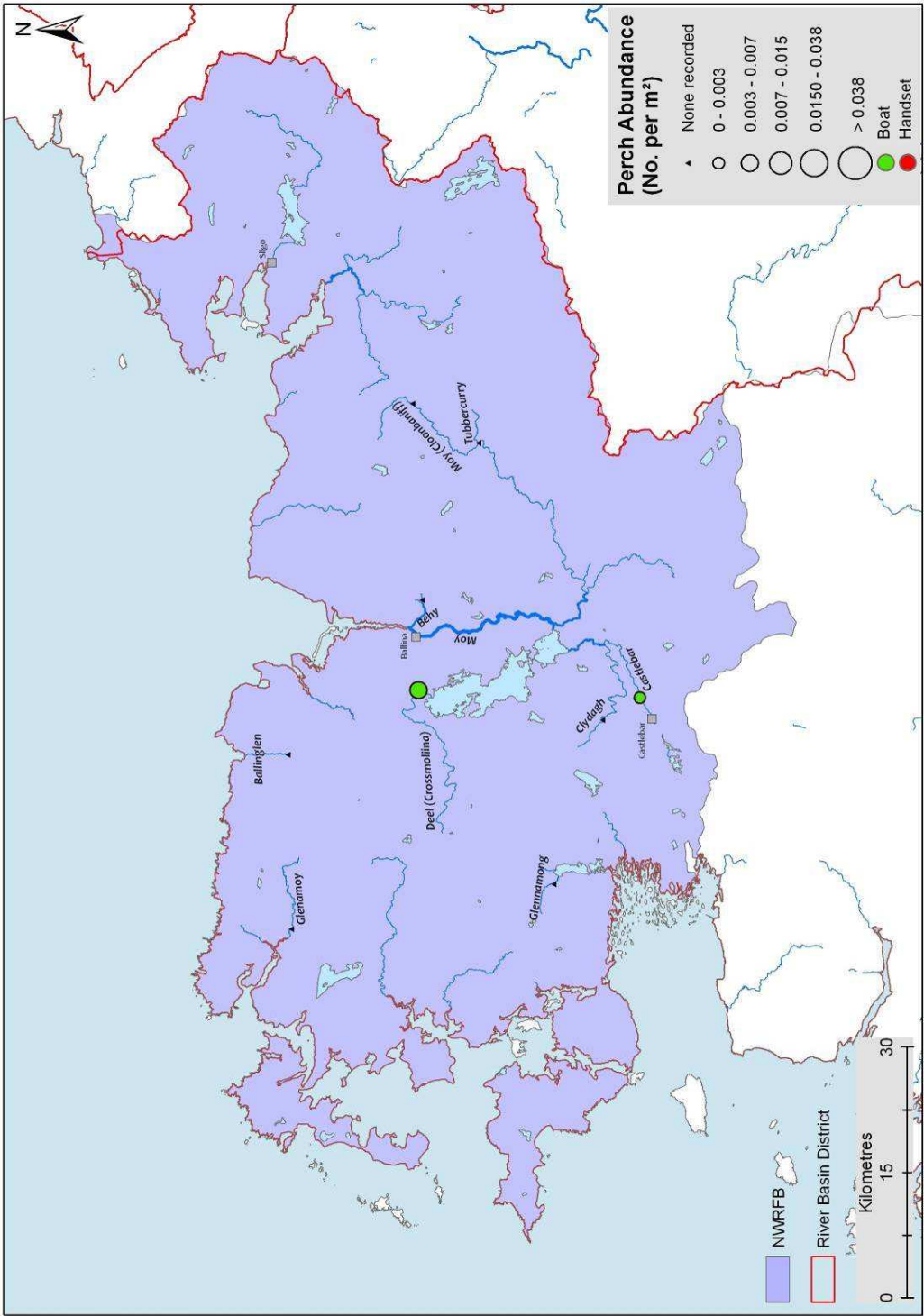


Fig. 4.37: Distribution map for perch in the NWRFB, WFD surveillance monitoring 2008

4.3.3 Growth for brown trout and salmon

Age and growth of fish were determined for the dominant fish species on each river site, comprising a range of age groups. Brown trout ages ranged from 0+ to 4+, with 0+ and 1+ being the dominant age classes at most sites. The oldest and largest brown trout recorded was a 4+ fish (length 24.0cm and weight 0.17kg) recorded on the Glenamoy site. According to the growth categories of brown trout in relation to alkalinity described by Kennedy and Fitzmaurice (1971), growth of brown trout was very slow in the Ballinglen, the Glenamoy and the Glennamong, and was slow in the Behy and the Clydagh. The fastest growth was observed in the Behy. Growth of 1+ brown trout from the Castlebar site was considerably greater (L1) than those seen in other brown trout populations surveyed in the region.

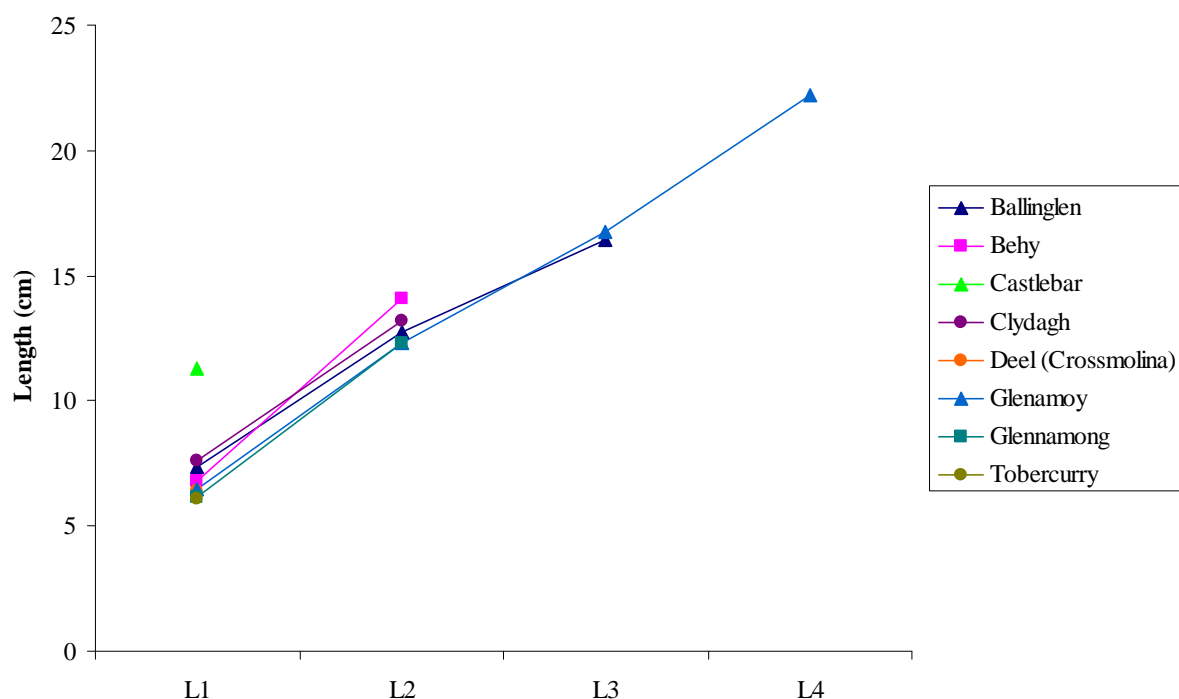


Fig 4.38. Back calculated lengths for brown trout in each river

Figure 4.39 and Appendix 2 show the graph and summary of back calculations for salmon. Similar to the growth patterns seen among brown trout in the region, salmon from the Castlebar River had considerably greater L1 lengths than other fish from the region. The higher growth observed in the River Deel at L2 and L3 was due to the presence of adult salmon at this site.

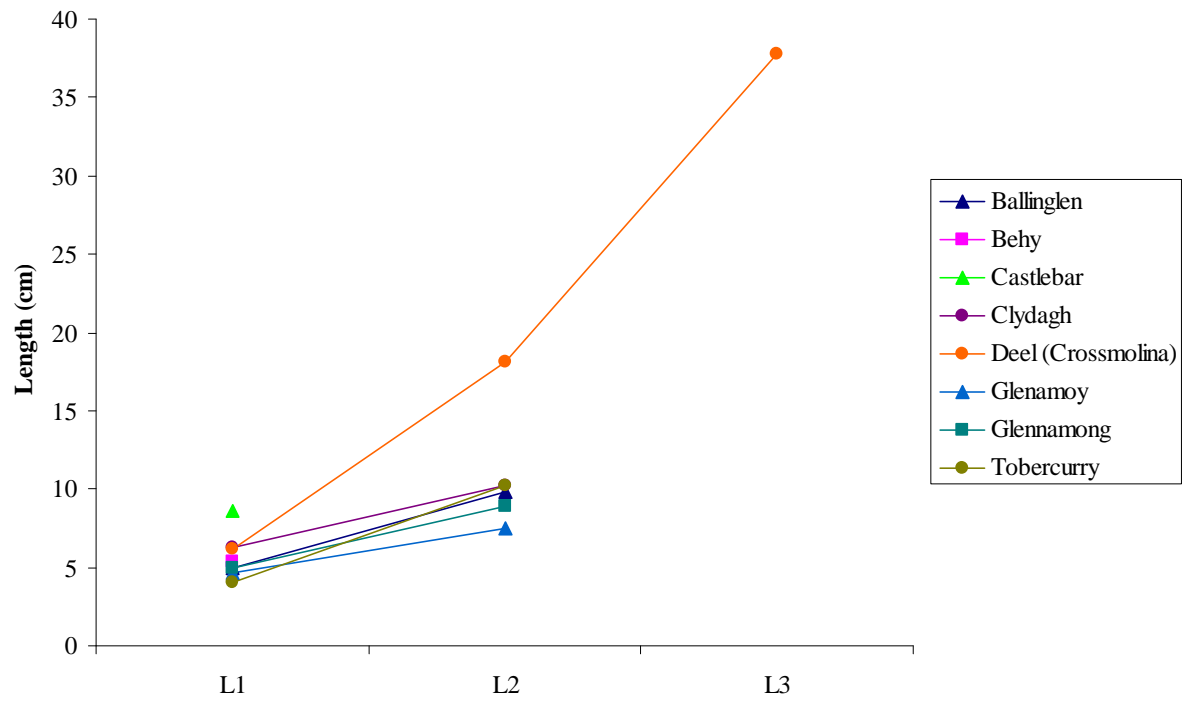


Fig. 4.39. Back calculated lengths for salmon in each river

5. DISCUSSION

There were 12 fish species (sea trout were included as a separate variety of trout) recorded during the 2008 WFD fish in rivers sampling program in the North Western Regional Fisheries Board. Of the 12 species, only a few were commonly distributed throughout the region. The rest were restricted to only one or two sites. Brown trout and salmon were the most widespread species, occurring in 100% of the sites surveyed. Eels were the next most recorded species and were present in 89% of sites. The Deel and Tobercurry were the most diverse sites, each containing six species. The lowest number of species recorded was three, in the Ballinglen, Behy, Clydagh and Glennamong Rivers.

Growth for trout within the sites surveyed in the region was classified as slow (Behy and Clydagh) and very slow (Ballinglen, the Glenamoy and the Glennamong) according to the growth categories of brown trout in relation to alkalinity described by Kennedy and Fitzmaurice (1971). Brown trout ages ranged from 0+ to 4+, with 0+ and 1+ being the dominant age classes at most sites. Only the Ballinglen and Glenamoy rivers recorded fish older than 2+. The oldest and largest brown trout recorded was a 4+ fish (length 24.0cm and weight 0.17kg) recorded on the Glenamoy site. The NWRFB river sites recorded some of the highest densities for salmon of any of the regions surveyed in 2008 (Kelly *et al.*, 2009). The Tobercurry, Ballinglen and Moy appear to be good nursery streams and had particularly high densities of salmon, with fry making up the majority of fish present.

Non-native species were recorded in only three out of the nine rivers surveyed, these being the Tobercurry, Castlebar and Deel. Eno *et al.* (1997) differentiate between both 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. Kelly *et al.* (2008) categorised non-native species in Ireland into two categories (Group 2, which are those that influence ecology, and Group 3, which are those that generally do not influence ecology). Five group 2 species (perch, pike, minnow, roach and stone loach) were recorded in the NWRFB region. Minnow and stone loach appear to be quite common throughout the country, while pike, perch and roach are more confined to certain areas, including the ShRFB and southern part of the NRFB (Kelly *et al.*, 2009). The Tobercurry River had only small numbers of minnow and stone loach, while only a single perch was captured in the Castlebar. Therefore the Deel River accounted for most of the non-native species within the sites surveyed. These results suggest that the rivers surveyed for the WFD to date in the NWRFB are still relatively free of non-native species but that these species may become more of a concern in the future. The low diversity of non-native coarse fish and notable absence of species such as roach and perch may be attributed, to some extent, to the lack of connectivity to systems within other regions where these fish are present, such as the ShRFB and NRFB.

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 will therefore be calculated once this tool has been developed.

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Appendix 1

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

River		L1	L2	L3	L4	Growth category
Ballinglen	Mean	7.33	12.74	16.41		Very slow
	SD	1.43	2.00	1.57		
	n	47	23	4		
	Range min.	4.21	9.80	15.10		
	Range max.	10.10	17.05	18.49		
Behy	Mean	6.78	14.07			Slow
	SD	1.08	1.74			
	n	36	11			
	Range min.	5.08	10.67			
	Range max.	8.86	15.92			
Castlebar	Mean	11.32				
	SD	3.63				
	n	2				
	Range min.	8.75				
	Range max.	13.88				
Clydagh	Mean	7.59	13.17			Slow
	SD	1.67	1.87			
	n	18	6			
	Range min.	3.58	9.68			
	Range max.	9.59	14.37			
Deel	Mean	6.39				
	SD	n/a				
	n	1				
	Range min.	6.39				
	Range max.	6.39				
Glenamoy	Mean	6.46	12.29	16.73	22.19	Very slow
	SD	1.24	1.22	0.03	n/a	
	n	35	24	2	1	
	Range min.	4.16	10.20	16.71	22.19	
	Range max.	9.55	14.58	16.75	22.19	
Glennamong	Mean	6.15	12.29			Very slow
	SD	0.89	2.00			
	n	11	4			
	Range min.	4.60	10.25			
	Range max.	7.38	14.76			
Tobercurry	Mean	6.08				
	SD	0.40				
	n	2				
	Range min.	5.80				
	Range max.	6.37				

Appendix 2

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

River		L1	L2	L3
Ballinglen	Mean	4.97	9.82	
	SD	1.03	0.51	
	n	24	2	
	Range min.	3.34	9.46	
	Range max.	7.00	10.18	
Behy	Mean	5.39		
	SD	0.87		
	n	31		
	Range min.	3.87		
	Range max.	6.95		
Castlebar	Mean	8.62		
	SD	n/a		
	n	1		
	Range min.	8.62		
	Range max.	8.62		
Clydagh	Mean	6.30	10.21	
	SD	0.85	3.97	
	n	31	4	
	Range min.	4.47	6.99	
	Range max.	7.70	15.40	
Deel (Crossmolina)	Mean	6.14	18.12	37.74
	SD	2.38	13.08	5.35
	n	16	13	11
	Range min.	3.37	9.13	29.40
	Range max.	9.92	48.13	44.01
Glenamoy	Mean	4.67	7.54	
	SD	0.87	0.86	
	n	17	4	
	Range min.	3.27	6.66	
	Range max.	6.59	8.72	
Glennamong	Mean	4.97	8.89	
	SD	0.87	1.56	
	n	32	4	
	Range min.	3.00	7.26	
	Range max.	6.59	10.95	
Tobercurry	Mean	4.09	10.21	
	SD	0.71	n/a	
	n	22	1	
	Range min.	3.20	10.21	
	Range max.	5.47	10.21	

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