SWRFB 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 South Western Regional Fisheries Board (SWRFB) between July and early October 2008 by staff from the Central Fisheries Board (CFB) and the SWRFB. 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 SWRFB covers an area of around 8,200km^2 and contains most of counties Cork and Kerry. Due to the numerous bays and inlets along its western coast, it has a very long coastline of nearly 2,000km. The main lakes in the region include Lough Leane and Lough Caragh in Co. Kerry and Lough Allua in Co. Cork. A series of reservoirs also dot the River Lee west of Ballincollig. The main river systems in this region include the Bandon, Lee, Laune and Maine. Expanding urban areas and agriculture are among the greatest pressures within the SWRFB, particularly in the eastern part, while the western half contains some of Ireland's most scenic and popular tourist locations. Cork City is the largest urban area within this district and is the main centre for industry. A growing population in the region is putting ever increasing pressure on water supplies and wastewater treatment facilities.

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

2. STUDY AREA

Nine river sites in the SWRFB were surveyed (Table 2.1, Fig. 2.1). The sites ranged in surface area from 202.5m^2 (Tyshe) to 10,580m^2 (Owenreagh). The sites were spread out over five river catchments - the Glashaboy, the Lee, the Maine, the Tyshe and the Laune, and were categorised into two catchment size classes: <100km^2 and <1,000km^2. Four sites were surveyed using bank based electric fishing units (hand-set sites) and five sites were surveyed using boat based electric fishing units (boat sites).

Table 2.1. List of river sites surveyed for WFD surveillance monitoring in the SWRFB, July to October 2008, details of catchment area (km^2), wetted width, surface area (m^2), mean depth (m) and max depth (m) are included

Site	Catchment	Easting	Northing	Catchment Size u/s of the site (km^2)	Width (m)	Area (m^2)	Mean Depth (m)	Max Depth (m)
Hand-set sites								
Glashaboy	Glashaboy	166998	084251	<100	4.03	363.00	0.32	0.54
Martin	Lee	159943	075433	<100	6.83	307.50	0.30	0.76
Shanowen	Maine	101250	109130	<100	7.33	623.33	0.26	0.5
Tyshe	Tyshe	076025	122380	<100	4.50	202.50	0.47	0.67
Boat sites								
Flesk	Laune	096920	089392	<1000	24.80	7440.00	0.73	1.4
Gweestin	Laune	083810	094979	<100	8.40	1092.00	0.44	0.8
Lee (Inchinossig)	Lee	114647	066603	<100	10.40	2080.00	0.45	0.72
Maine	Maine	089124	104806	<1000	16.40	5248.00	0.48	0.9
Owenreagh	Laune	088398	082121	<100	23.00	10580.00	0.79	1.9

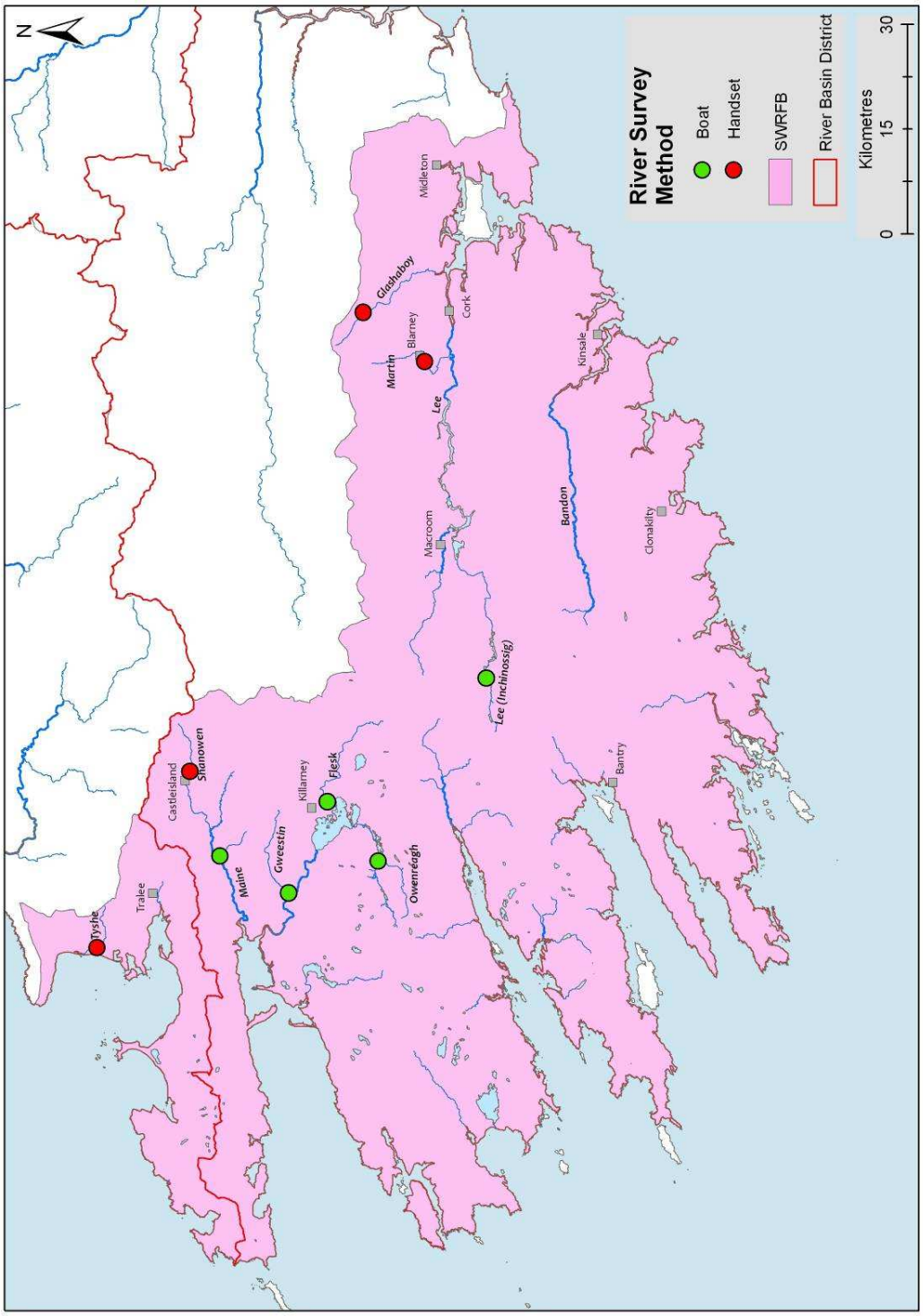

Fig. 2.1. Location map of river sites surveyed within the SWRFB, WFD surveillance monitoring 2008

3. METHODS

Electric fishing is the method of choice for surveillance monitoring of fish in rivers in order to obtain a representative sample of the fish assemblage at each sampling site. The technique complies with the 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 Glashaboy River

Plate 4.1. The Glashaboy River at Ballyvorisheen Bridge

The Glashaboy River (Plate 4.1) rises in Co. Cork a few kilometres south-east of Mallow and flows past the towns of Carrignavar and Glanmire before reaching the sea in Cork Harbour. Two bank based electric fishing units were used to conduct an electric fishing survey (three fishings) along a 90m stretch of river channel on the 24th of July 2008. The stretch sampled was located just downstream of Ballyvorisheen Bridge, two kilometres north of Carrignavar (Fig. 4.1). The site had an average width of 4.0m and an average depth of 0.32m. The total wetted area sampled was 363m^2. There was little or no shade at this site except along the very edges where riparian vegetation hung over the water. Aquatic vegetation was quite diverse with a range of different types, including emergent *Apium nodiflorum*, *Rorippa nasturtium-aquaticum*, *Oenanthe crocata* and *Sparganium erectum*, floating *Ranunculus* sp. and *Callitriche* sp., and

submerged mosses, including *Fontinalis antipyretica* and *Amblystegium riparium.* Glides and pools were dominant in this stretch, with the substrate evenly mixed between cobble, gravel and sand.

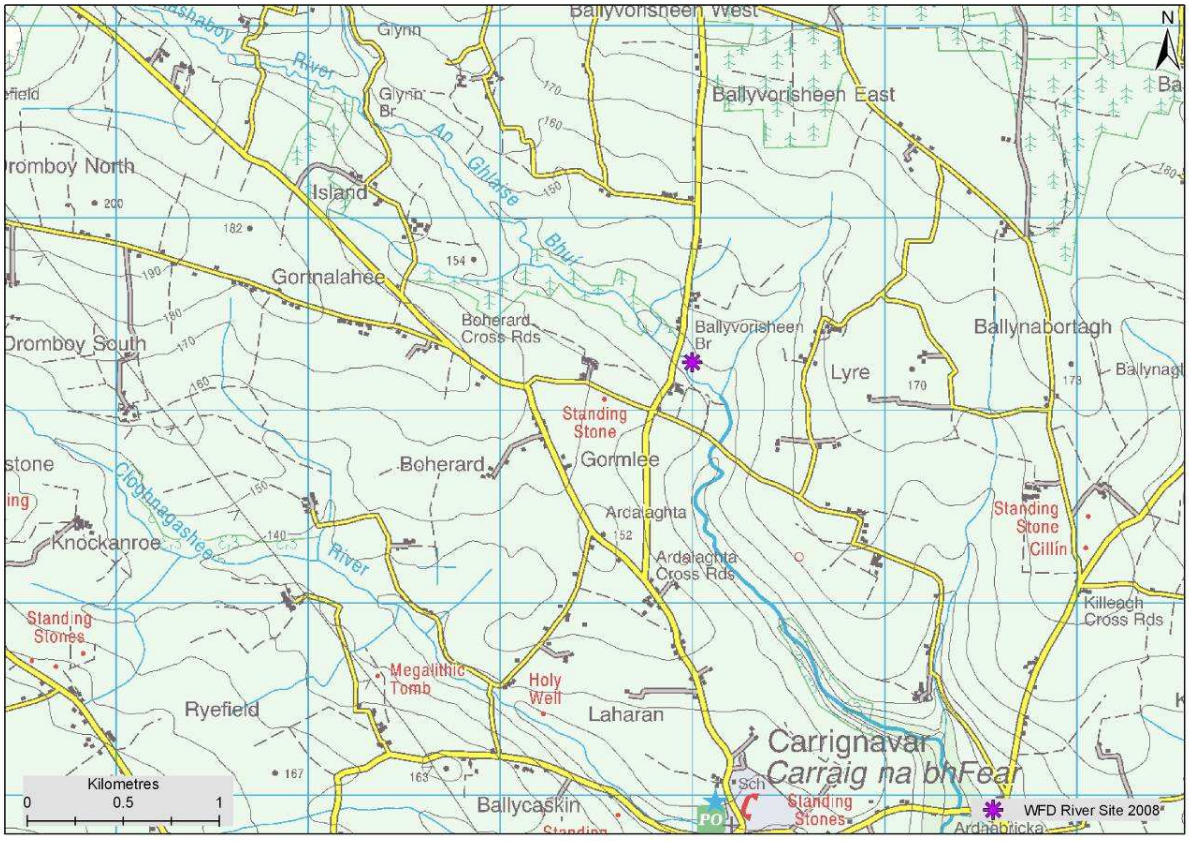

Fig. 4.1. Location of the Glashaboy River WFD surveillance monitoring site 2008

Four fish species were recorded in the Glashaboy River (Table 4.1). Brown trout were by far the most abundant, followed by stone loach.

Table 4.1. Density of fish (no./m^2) in the Glashaboy River site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.4325	0.4022	0.8354
Barbatula barbatula	Stone loach	-	-	0.0662
Anguilla anguilla	Eel	-	-	0.0441
Salmo salar	Salmon	0.0000	0.0331	0.0331
All fish	**All fish**	-	-	**0.9788**

Brown trout ranged in length from 4.9cm to 23.8cm (Fig. 4.2). The age classes 0+, 1+, 2+ and 3+ were present, accounting for approximately 52%, 34%, 10% and 5% of the population respectively. Mean L1, L2 and L3 of brown trout were 7.1cm, 13.3cm and 17.3cm respectively (Appendix 1). Trout growth in the Glashaboy River was categorised as slow (Appendix 1) based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971).

Eels, ranging in length from 11.4cm to 38.4cm, were present in the Glashaboy River site (Fig. 4.3). Salmon, ranging in length from 11.5cm to 15.4cm (Fig. 4.4) were recorded in two age classes, 1+ and 2+, accounting for 8% and 92% of the population respectively. Mean L1 and L2 of salmon were 6.0cm and 9.5cm respectively (Appendix 2).

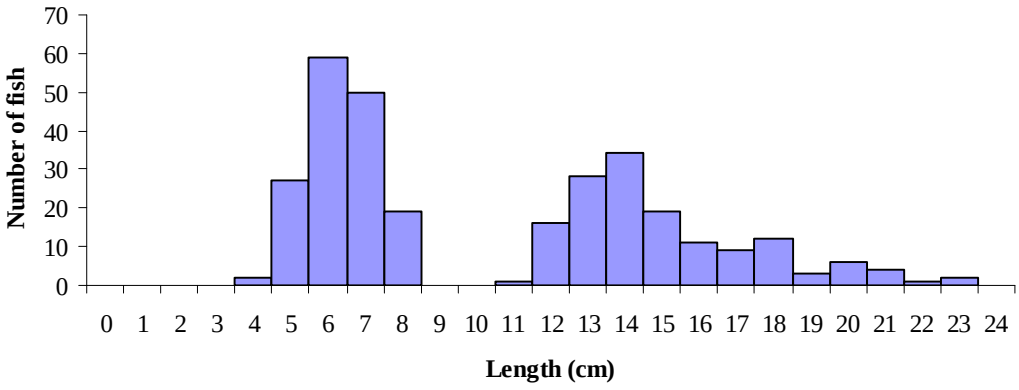

Fig. 4.2. Length frequency distribution for brown trout in the Glashaboy River, July 2008 (n = 303)

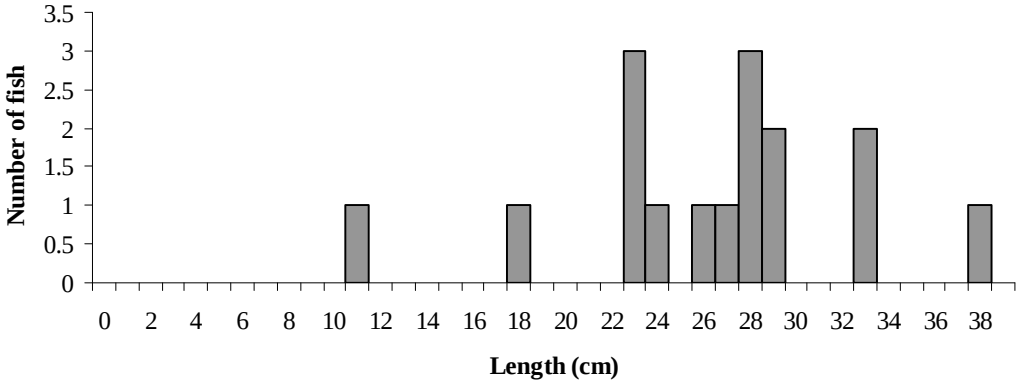

Fig. 4.3. Length frequency distribution for eels in the Glashaboy River, July 2008 (n = 16)

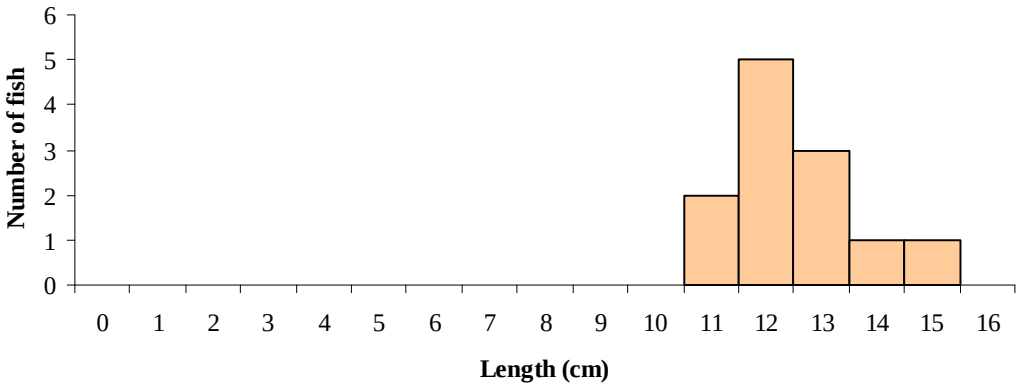

Fig. 4.4. Length frequency distribution for salmon in the Glashaboy River, July 2008 (n = 12)

4.1.2 The River Martin

Plate 4.2. The River Martin at Bawnafinny Bridge

The River Martin (Plate 4.2) rises in the hills approximately half way between Mallow and Blarney in Co. Cork. It flows south through the town of Blarney, reaching the Shournagh River and then the River Lee 0.5 kilometres north-west of Carrigohane. An electric fishing survey was conducted along a 45m length of river channel on the 23rd of July 2008. The survey site was located on the upstream side of Bawnafinny Bridge, one kilometre south-west of Blarney (Fig. 4.5). Three electric fishing passes were conducted using two bank based electric fishing units. The average width of the channel was 6.8m and had a mean depth of 0.30m. Riffle and glide were the dominant habitat types, with a river bed composed mainly of cobble substrate. Land use along the adjacent riverbank was pasture, with trees providing light shading. Macrophyte vegetation at this site consisted of submerged aquatic bryophytes including *Fontinalis antipyretica* and *Cinclidotus fontinaloides*, and emergents such as *Mentha aquatica*, *Veronica beccabunga* and *Rorippa nasturtium-aquaticum*. Floating species noted included *Ranunculus* sp. and *Callitriche* sp.

Fig. 4.5. Location of the River Martin WFD surveillance monitoring site 2008

Six fish species were recorded in the River Martin (Table 4.2). Salmon were the most abundant species, with a density of more than one individual per square metre.

Table 4.2. Density of fish (no./m^2) in the River Martin site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
Salmo salar	Salmon	1.1187	0.2049	1.0249
Lampetra spp.	Lamprey	-	-	0.1432
Salmo trutta	Brown trout	0.1073	0.1366	0.1139
Barbatula barbatula	Stone loach	-	-	0.0260
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0195
Anguilla anguilla	Eel	-	-	0.0098
All fish	**All fish**	**-**	**-**	**1.3372**

Salmon ranged in length from 4.0cm to 13.9cm (Fig. 4.6). Two age classes were represented, 0+ and 1+, which corresponded to 85% and 15% of the salmon population respectively. The average length of salmon at L1 was 5.4cm (Appendix 2).

Lamprey were present mainly in the muddy margins of the right hand bank and they ranged in length from 4.9cm to 13.6cm (Fig. 4.7).

Brown trout ranged in length from 5.4cm to 26.1cm (Fig. 4.8) and were recorded across age classes 0+, 1+, 2+ and 3+, representing 44%, 16%, 33% and 7% of the population respectively. Brown trout had mean L1, L2 and L3 lengths of 6.7cm, 12.7cm and 18.2cm respectively (Appendix 1). The growth of brown trout in the River Martin site was categorised as slow (Appendix 1) based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971).

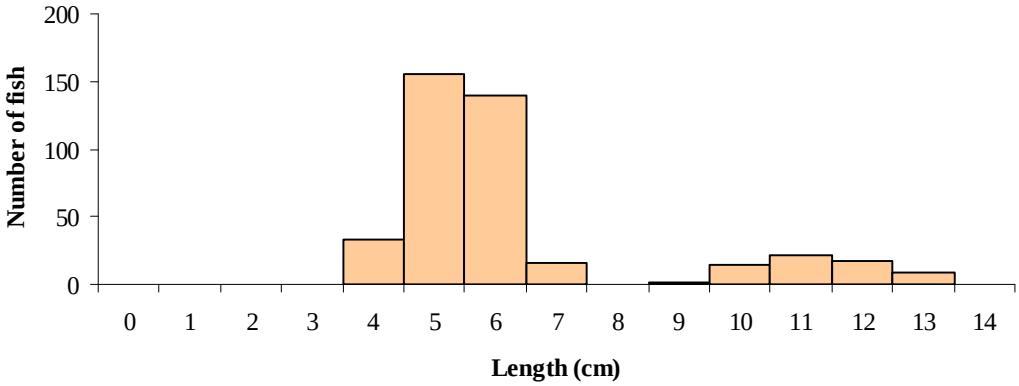

Fig. 4.6. Length frequency distribution for salmon in the Martin River, July 2008 (n = 407)

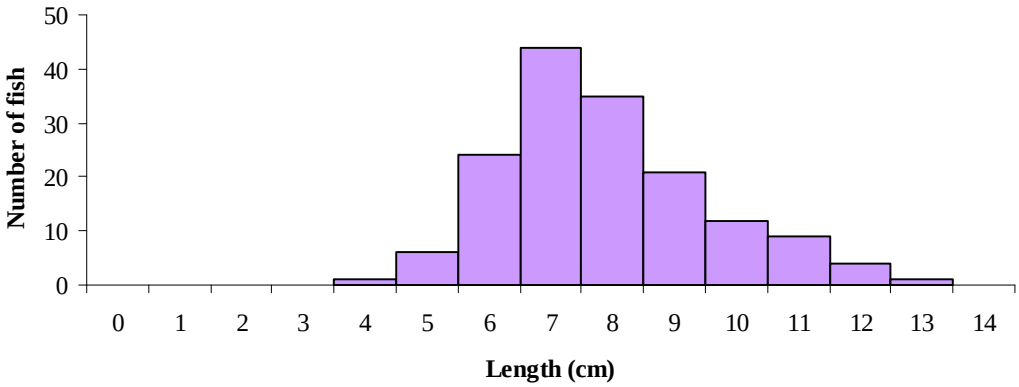

Fig. 4.7. Length frequency distribution for lamprey in the Martin River July, 2008 (n = 157)

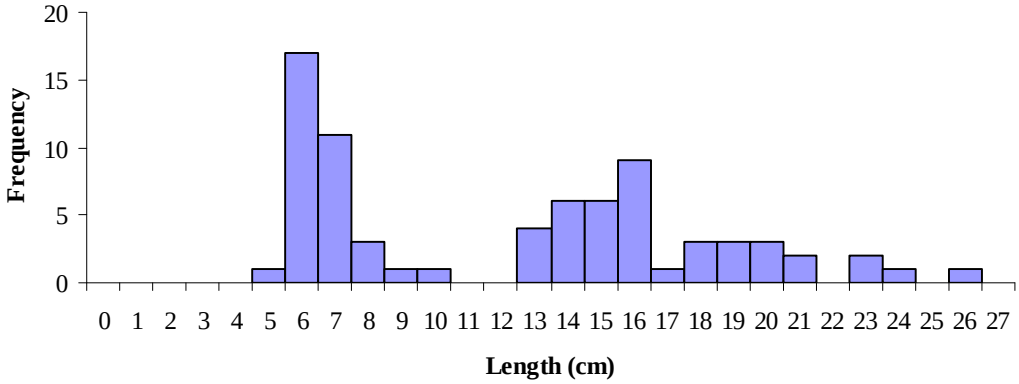

Fig. 4.8. Length frequency distribution for brown trout in the Martin River, July 2008 (n = 75)

4.1.3 The Shanowen River

Plate 4.3. The Shanowen River upstream of the Maine confluence

The Shanowen River (Plate 4.3) rises in the mountains approximately seven kilometres east of the town of Castleisland in Co. Kerry. It flows westwards towards Castleisland where it joins with the River Maine. An electric fishing survey was conducted along an 85m stretch of river channel on the 22nd of July 2008. Three fishings were carried out using two bank based electric fishing units. The survey site was located downstream of the last bridge before the confluence with the River Maine, approximately one kilometre south-east of Castleisland (Fig. 4.9). The site had a mean width of 14m and a mean depth of 0.48m, with a total wetted area sampled of 623.3m^2. Shade levels were patchy throughout the site, with a mosaic of heavy and light patches of shading along the river corridor. Habitat was evenly divided between riffle, glide and pool, and the site had a mixture of substrate ranging from bedrock to sand. Sampling at this site was made difficult by a blanket of green algae and biofilm covering the submerged rocks. Submerged

bryophytes such as *Fontinalis antipyretica*, *Chiloscyphus polyanthus* and *Rhynchostegium riparoides* were dominant within the channel, and there were also patches of *Oenanthe crocata*.

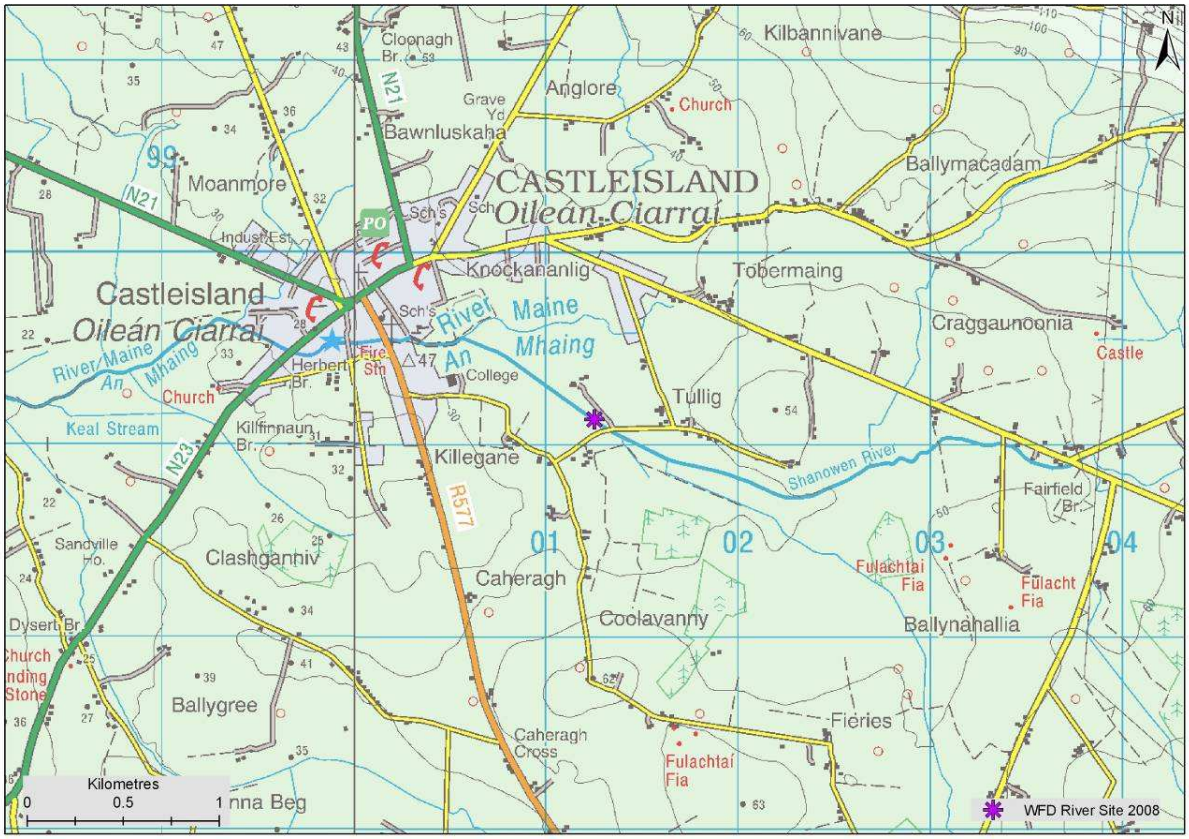

Fig. 4.9. Location of the Shanowen River WFD surveillance monitoring site 2008

Five fish species were present in the Shanowen River (Table 4.3). Salmon was the most abundant species, with over one individual captured per square metre.

Table 4.3. Density of fish (no./m^2) in the Shanowen River site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
Salmo salar	Salmon	0.8037	0.1909	1.1107
Anguilla anguilla	Eel	-	-	0.0835
Salmo trutta	Brown trout	0.0305	0.0385	0.0690
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0209
Lampetra spp.	Lamprey	-	-	0.0064
All fish	**All fish**	**-**	**-**	**1.2904**

Salmon ranged in length from 4.5cm to 14.2cm (Fig. 4.10). Two salmon age groups were recorded, 0+ and 1+, representing approximately 72% and 28% of the population respectively. The mean L1 length of salmon was 5.7cm (Appendix 2). Eels ranging from 10.5cm to 41.4cm in length were recorded (Fig. 4.11).

Brown trout ranged in length from 5.6cm to 21.5cm (Fig. 4.12) and were present across three age classes, 0+, 1+ and 2+, corresponding to 41%, 49% and 7% of the population respectively. Mean L1 and L2 of brown trout were 8.5cm and 16.2cm respectively (Appendix 1). Brown trout growth in the Shanowen River was categorised as fast (Appendix 1) based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971).

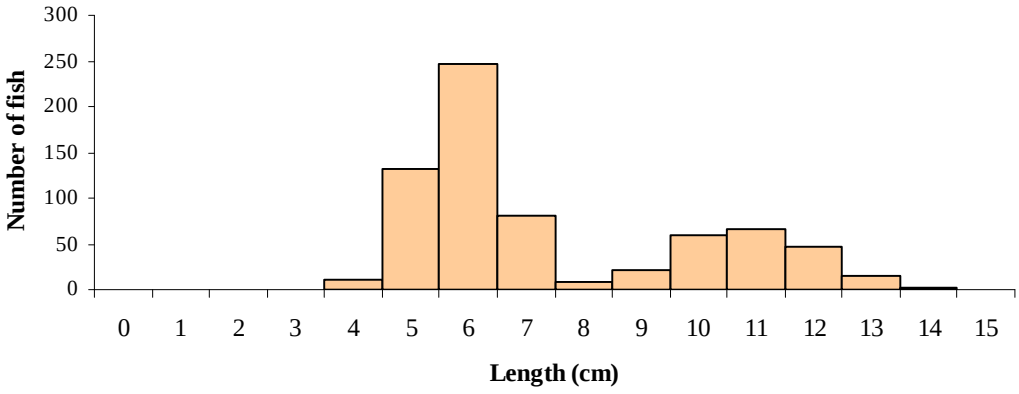

Fig. 4.10. Length frequency distribution for salmon in the Shanowen River, July 2008 (n = 692)

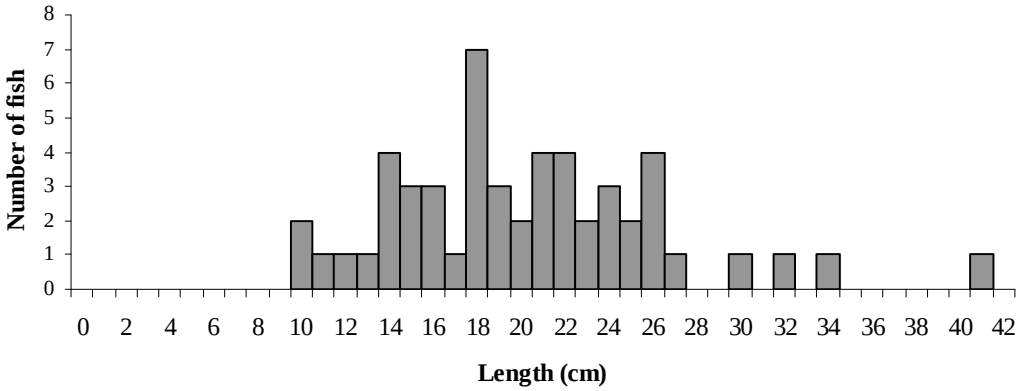

Fig. 4.11. Length frequency distribution for eels in the Shanowen River, July 2008 (n = 52)

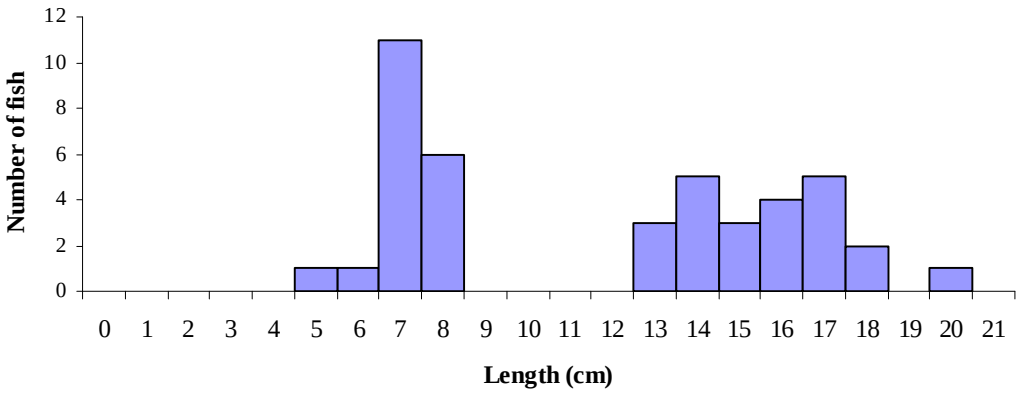

Fig. 4.12. Length frequency distribution for brown trout in the Shanowen River, July 2008 (n = 43)

4.1.4 The Tyshe River

Plate 4.4. The Tyshe River near Banna House

The Tyshe River (Plate 4.4) is located in north Co. Kerry, rising a few kilometres north-east of Ardfert. It flows north-westwards for approximately ten kilometres, draining farmland, until it joins the sea at Banna Strand (Fig. 4.13). It is a small river with a low gradient and a high degree of channelisation. An electric fishing survey was conducted along a 45m stretch of river channel on the 21st of July 2008. Three passes were conducted using two bank based electric fishing units. The survey site was located upstream of a bridge near the Banna Beach resort (Fig. 4.13). The channel had a mean depth of 0.47m and mean width of 4.5m, with a total wetted area of 202.5m^2. The banks of this channel were steep and high, with no tall vegetation to provide shade to the river channel. *Phalaris arundinacea*, a tall grass, was present on the river margins. There were a few aquatic macrophytes present in high abundance. *Enteromorpha* was strewn all along the channel, as well as *Myriophyllum spicatum*, *Potamogeton natans* and *Potamogeton crispus*. The substrate was almost 100% mud, making this almost stagnant site rather awkward to sample.

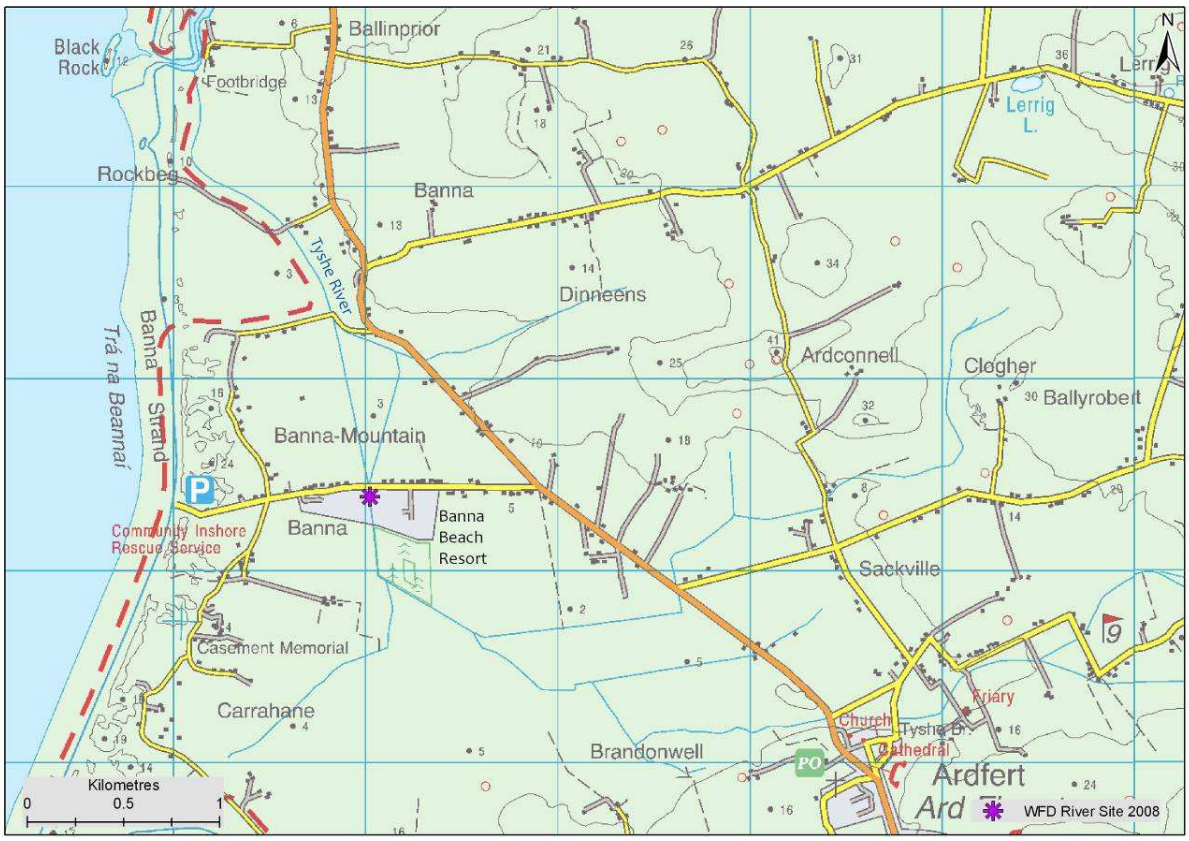

Fig. 4.13. Location of the Tyshe River WFD surveillance monitoring site 2008

Three fish species were recorded in the Tyshe River (Table 4.4). Eels and 3-spined stickleback were both highly abundant. The low gradient and close proximity to the sea also enabled flounder to inhabit the site.

Table 4.4. Density of fish (no./m^2) in the Tyshe River site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
Anguilla anguilla	Eel	-	-	1.0963
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.9580
Platichthys flesus	Flounder	-	-	0.0099
All fish	**All fish**	**-**	**-**	**2.0642**

Eels were abundant in the Tyshe River, ranging in size from 6.9cm to 32.4cm (Table 4.4; Fig. 4.14). Three-spined stickleback, ranging in size from 1.3cm to 5.6cm, also occurred in high densities at the site, with nearly one individual recorded per square metre sampled (Table 4.4; Fig. 4.15).

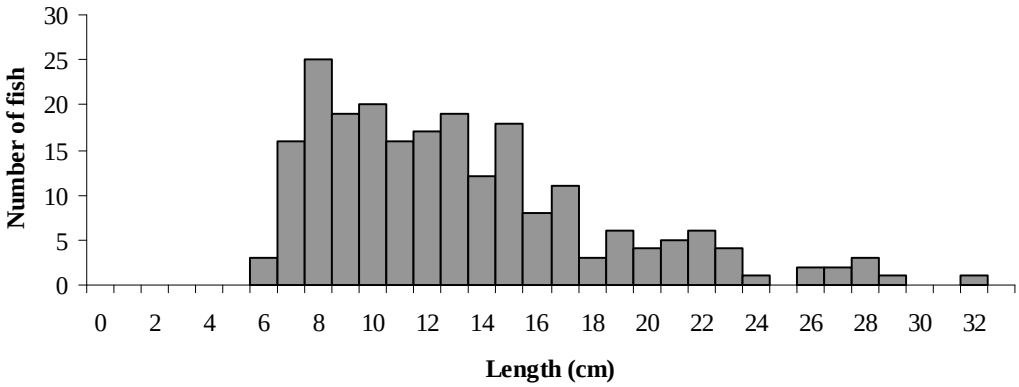

Fig. 4.14. Length frequency distribution for eels in the Tyshe River, July 2008 (n = 222)

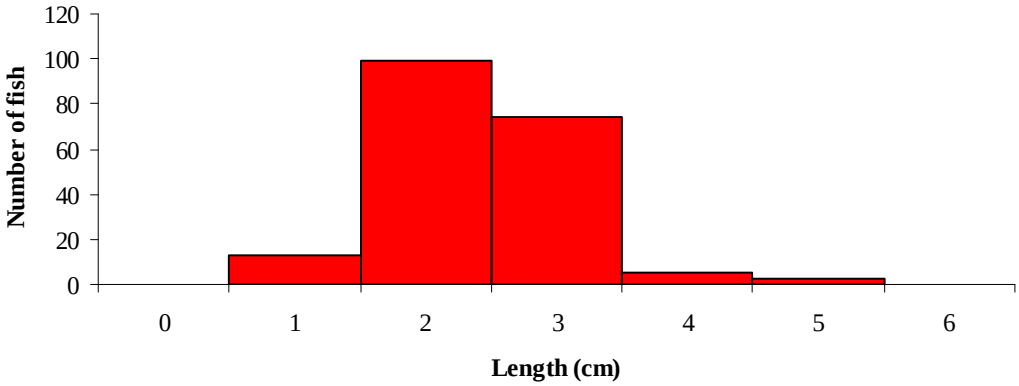

Fig. 4.15. Length frequency distribution for 3-spined stickleback in the Tyshe River, July 2008 (n = 194)

4.2 Boat sites

4.2.1 The River Flesk

Plate 4.5. The River Flesk at Flesk Bridge

The River Flesk (Plate 4.5) rises in the Derrynasaggart Mountains in south-west Co. Kerry. It flows north-westwards through Killarney before entering Lough Leane. As it leaves the lake it joins with the River Laune and flows for another 20 kilometres north-west, eventually reaching the sea near Killorglin at Castlemaine Harbour. An electric fishng survey was conducted along a 300m stretch of the river channel on the 8th of September 2008 upstream of Flesk Bridge (Fig. 4.16). One fishing was carried out using three boat based electric fishing units. The habitat was largely dominated by glide. Some instream vegetation was present on a substrate mainly comprising cobble. The site had an average width of 24.8m and an average depth of 0.7m. The total wetted area sampled was 7,440.0m^2. The river channel was somewhat wide, which largely restricted any shading to the margins.

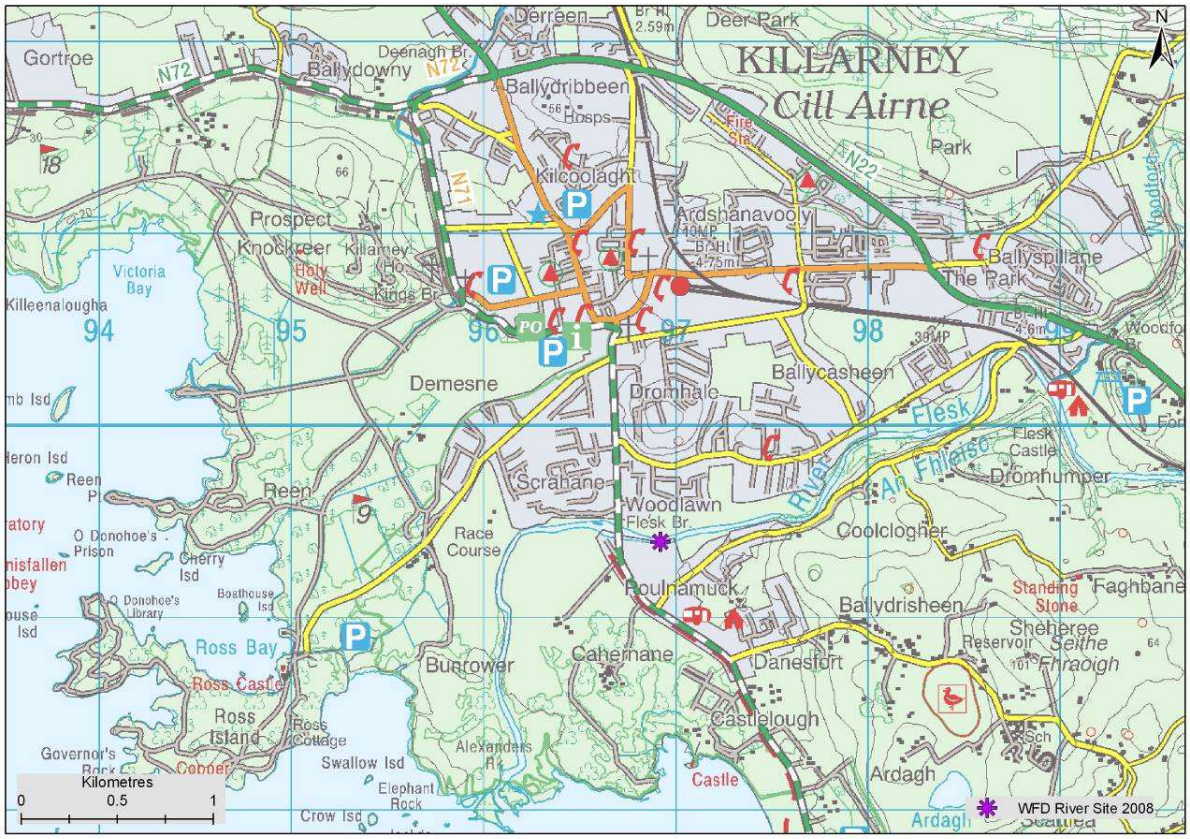

Fig. 4.16. Location of the River Flesk surveillance WFD surveillance monitoring site 2008

Three fish species were recorded in the River Flesk. Salmon were the most abundant species present, followed by eels and brown trout (Table 4.5).

Table 4.5. Density of fish (no./m^2) in the River Flesk site (fish density has been calculated as minimum estimates based on one fishing)

Species name	Common name	0+	1+ & older	Total density
Salmo salar	Salmon	0.0022	0.0106	0.0128
Anguilla anguilla	Eel	-	-	0.0007
Salmo trutta	Brown trout	0.0004	0.0003	0.0009
All fish	**All fish**	-	-	**0.014**

Salmon ranged in length from 5.5cm to 13.0cm (Fig. 4.17) and were present in both the 0+ and 1+ age classes, accounting for 17% and 83% of the population respectively (Appendix 1). The mean length of salmon at L1 was 5.2cm. A low number of brow trout were captured, ranging in length from 7.5cm to 20.5cm. Brown trout growth was categorised as fast (Appendix 1) based on a classification of growth in

rivers by Kennedy and Fitzmaurice (1971). Eels ranged in length from 13.9cm to 35.5cm, with a mean of 21.9cm.

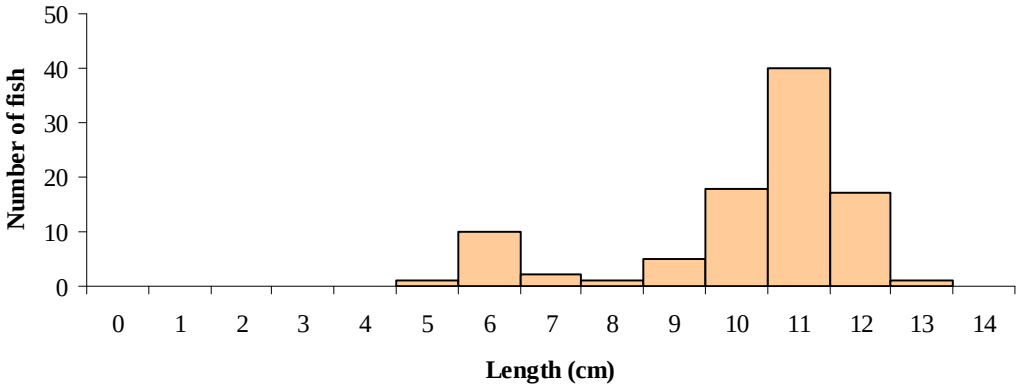

Fig. 4.17. Length frequency distribution for salmon in the River Flesk, September 2008 (n = 95)

4.2.2 The Gweestin River

Plate 4.6. The Gweestin River at Gweestin Bridge

The Gweestin River (Plate 4.6) is a tributary of the River Laune. It joins the Laune just before the town of Killorglin which flows into the sea at Castlemaine Harbour. An electric fishing survey was conducted along a 130m stretch of the Gweestin River on the 22nd of September 2008. Three fishings were carried out using two boat based electric fishing units. The survey site was located upstream of Gweestin Bridge, approximately seven kilometres south-east of Killorglin (Fig. 4.18). The site was dominated by glide, with a substrate made up mainly of cobble and gravel. The mean width at the site was 8.4m and the mean depth was 0.44m. The total wetted area sampled was 1,092.0m^2. Bank side trees provided some shading to the river channel.

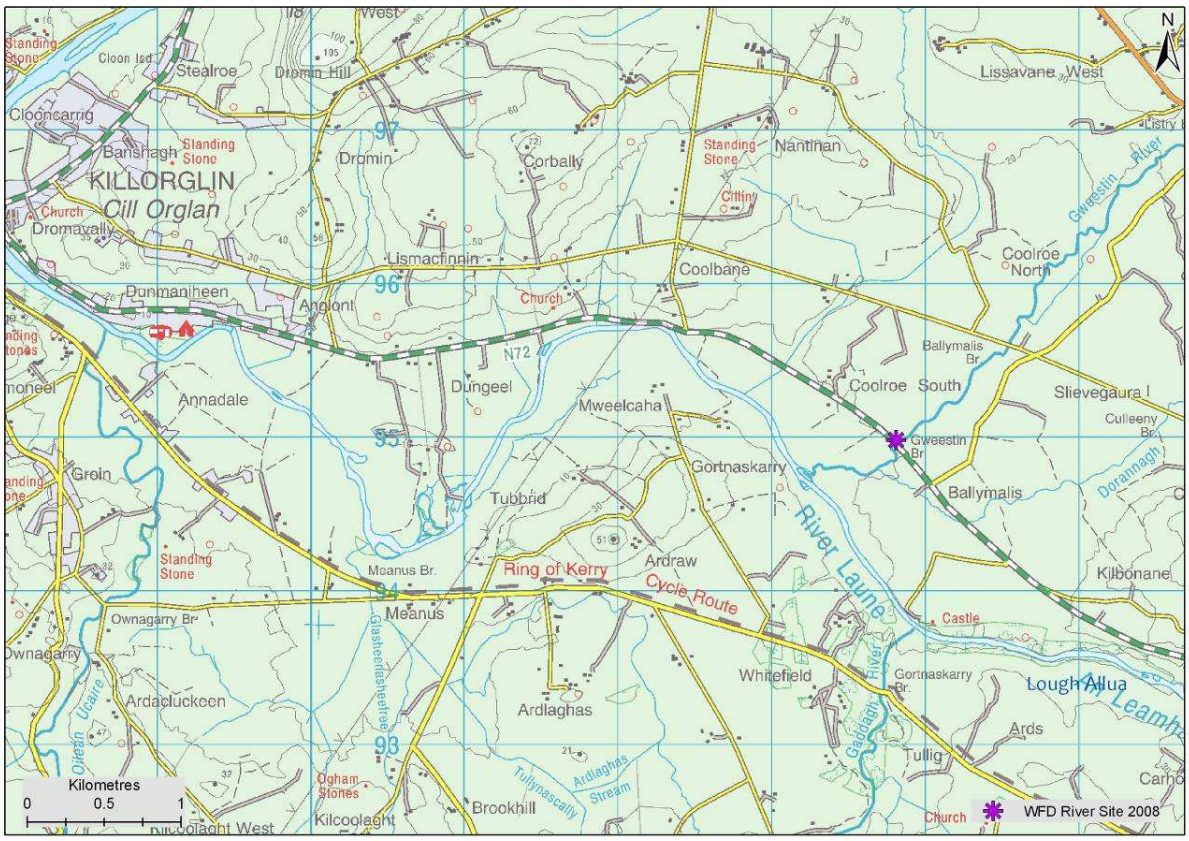

Fig. 4.18. Location of the Gweestin River WFD surveillance monitoring site 2008

Five fish species were recorded in the Gweestin River, along with sea trout. Salmon was the most abundant species, followed by brown trout and minnow (Table 4.6.).

Table 4.6. Density of fish (no./m^2) in the Gweestin River site (fish density has been calculated as minimum estimates based on one fishing)

Species name	Common name	0+	1+ & older	Total density
Salmo salar	Salmon	0.0147	0.0339	0.0485
Salmo trutta	Brown trout	0.000	0.0266	0.0266
Phoxinus phoxinus	Minnow	-	-	0.0229
Anguilla anguilla	Eel	-	-	0.0028
Salmo trutta	Sea trout	-	-	0.0028
Lampetra spp.	Lamprey	-	-	0.0018
All fish	**All fish**	**-**	**-**	**0.1053**

Salmon ranged in length from 5.2cm to 13.1cm (Fig. 4.19). Mean L1 and L2 were 4.3cm and 10.2cm respectively (Appendix 2). Three age classes (0+, 1+ and 2+) were present which accounted for approximately 9%, 83% and 9% of the population respectively.

Brown trout ranged in length from 15.0cm to 32.7cm (Fig. 4.20). Scale and length frequency analysis revealed that there were four age classes of brown trout present at the site: 1+ (38% of the population), 2+ (41%), 3+ (14%) and 4+ (7%). Mean L1, L2, L3 and L4 were 7.2cm, 16.5cm, 21.6cm and 29.0cm respectively (Appendix 1). Growth rate was classified as fast based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971) (Appendix 1). Sea trout at the site ranged from 25.7 to 38.1cm in length, with mean L1, L2, L3 and L4 values of 8.6cm, 16.6cm, 22.7cm and 26.1cm respectively.

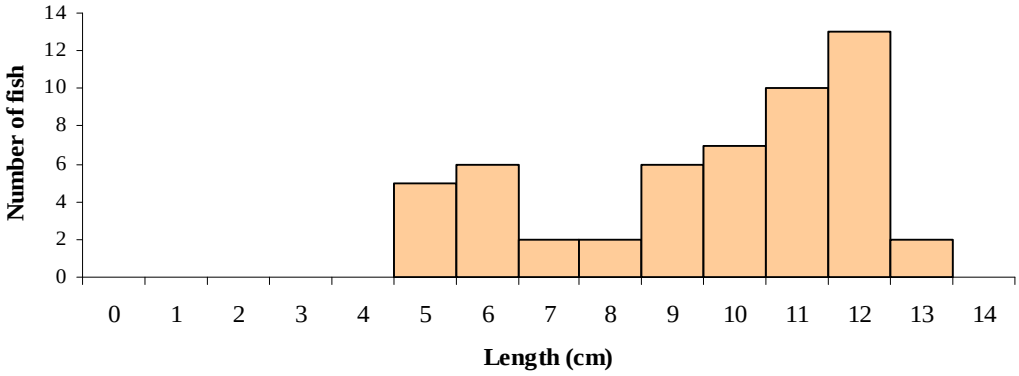

Fig. 4.19. Length frequency distribution for salmon in the Gweestin River, September 2008 (n = 53)

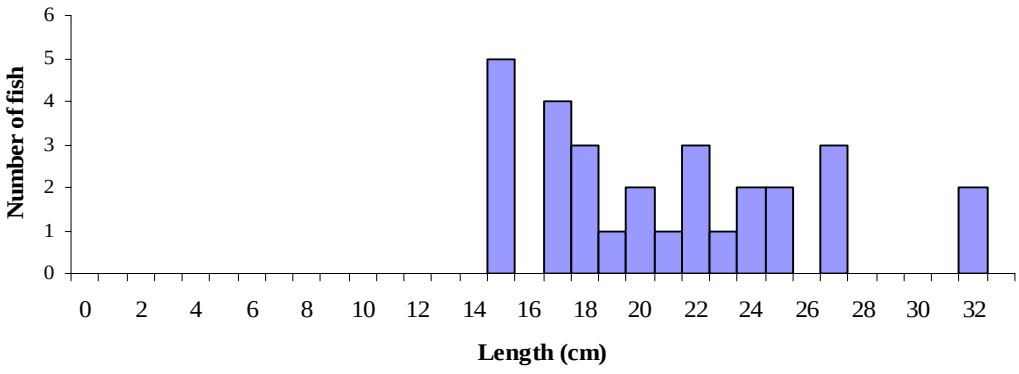

Fig. 4.20. Length frequency distribution for brown trout in the Gweestin River, September 2008 (n = 29)

4.2.3 The River Lee

Plate 4.7. The River Lee at Inchinossig Bridge

The River Lee (Plate 4.7) rises in Co. Cork in the Shehy Mountains near the Cork–Kerry border. It drains Gouganebarra Lake and flows eastwards through Ballingeary, Lough Allua and Cork City before entering the sea at Cork Harbour. An electric fishing survey was conducted along a 200m stretch of river on the 4th of September 2008, immediately upstream of Inchinossig Bridge in Ballingeary (Fig. 4.21). Three fishings were conducted using two boat based electric fishing units. The site had an average width of 10.4m and an average depth of 0.45m, with a total wetted area sampled of 2,080.0m^2. The site was dominated by cobble and boulder, with a habitat consisting mainly of riffle and glide. Trees along the river bank provided a medium level of shading to the river channel.

Fig. 4.21. Location of the River Lee WFD surveillance monitoring site 2008

Five fish species were recorded in the River Lee. Brown trout were the most abundant species, followed by perch (Table 4.7).

Table 4.7. Density of fish (no./m^2) in the River Lee site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
Salmo trutta	Brown trout	0.0010	0.0159	0.0168
Perca fluviatilis	Perch	-	-	0.0019
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0010
Esox lucius	Pike	-	-	0.0005
Lampetra spp.	Lamprey	-	-	0.0005
All fish	**All fish**	**-**	**-**	**0.0197**

Lengths of brown trout ranged from 7.5cm to 24.8cm (fig. 4.22). Scale analysis showed that the age classes 0+, 1+, 2+ and 3+ were present, accounting for approximately 6%, 26%, 66% and 3% of the population respectively. The mean length at L1, L2 and L3 were 6.8cm, 13.9cm and 17.9cm respectively

(Appendix 1). Brown trout growth was categorised as slow (Appendix 1) based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971).

Perch ranged in length from 16.0cm to 19.6cm, with ages ranging from 2+ to 5+. Mean perch L1 was 6.0cm (Appendix 5).

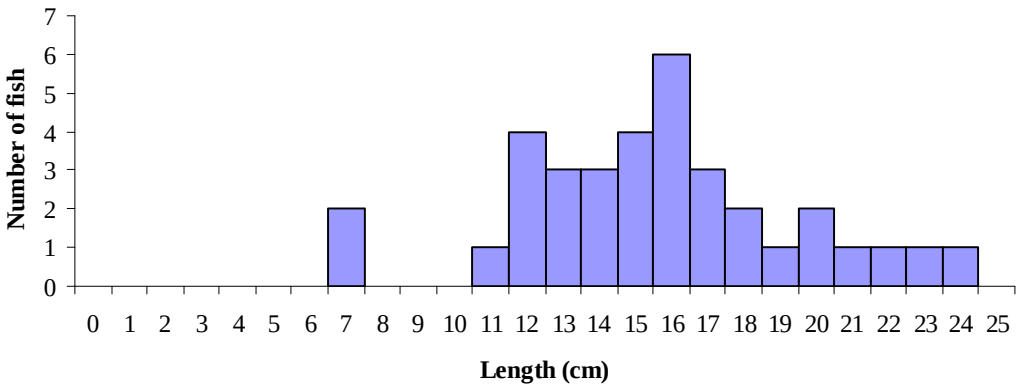

Fig. 4.22. Length frequency distribution for brown trout in the River Lee at Inchinossig Bridge, September 2008 (n = 35)

4.2.4 The River Maine

Plate 4.8. The River Maine at Maine Bridge (Lower)

The River Maine (Plate 4.8) rises near Castleisland in Co. Kerry and flows westwards through the town of Castlemaine where it is joined by the Brown Flesk. It travels some 30 kilometres south-west until it reaches the sea at Castlemaine Harbour. An electric fishing survey was conducted along a 320m stretch of river channel on the 23rd of September 2008. Three fishings were carried out using three boat based electric fishing units. The site was located upstream of Maine Bridge, which is approximately five kilometres north-east of Castlemaine (Fig. 4.23). The site had an average width of 16.4m and an average depth of 0.48m. The total wetted area sampled was 5,248.0m^2. The habitat type was well mixed between riffle, glide and pool, and the predominant substrate types were cobble and gravel. The channel was reasonably wide at this stretch resulting in only light shading of the river channel throughout.

Fig. 4.23. Location of the River Maine WFD surveillance monitoring site 2008

Seven fish species were recorded in the River Maine, along with sea trout. Salmon was the most abundant fish species, followed by eel and brown trout (Table 4.8).

Table 4.8. Density of fish (no./m^2) in the River Maine site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
Salmo salar	Salmon	0.0057	0.0248	0.0305
Anguilla anguilla	Eel	-	-	0.0143
Salmo trutta	Brown trout	0.0002	0.0131	0.0133
Platichthys flesus	Flounder	-	-	0.0046
Lampetra spp.	Lamprey	-	-	0.0017
Phoxinus phoxinus	Minnow	-	-	0.0013
Salmo trutta	Sea trout	-	-	0.0010
Gasterosteus aculeatus	3-Spined stickleback	-	-	0.0004
All fish	**All fish**	**-**	**-**	**0.0671**

Salmon ranged in length from 4.0cm to 66.5cm (Fig. 4.24). Five age classes were present; 0+, 1+, 2+, 3+ and 4+. Salmon fry (0+ fish) accounted for 18% of the population and 1+ were the dominant age class, accounting for 76% of the population. The average lengths at L1, L2, L3 and L4 were 5.2cm, 17.1cm, 43.6cm and 55.4cm respectively (Appendix 2).

Brown trout ranged in length from 6.7cm to 29.7cm (Fig. 4.25). Fish were recorded across the age classes 0+, 1+, 2+ and 3+, accounting for approximately 2%, 75%, 22% and 1% of the population respectively. The mean L1, L2 and L3 lengths for brown trout were 8.3cm, 16.6cm and 24.4cm respectively (Appendix 1). Brown trout growth in the River Maine was categorised as fast (Appendix 1) based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971).

Five sea trout were also recorded in the River Maine, with the largest measuring 35.1cm in length. Mean L1, L2 and L3 were 5.9cm, 14.6cm and 32.2cm respectively.

Eels ranging in length from 5.0cm to 35.5cm (Fig. 4.26), with a mean of 18.1cm were recorded at the site. Flounder were also captured, ranging in length from 3.6cm to 11.5cm (Fig. 4.27).

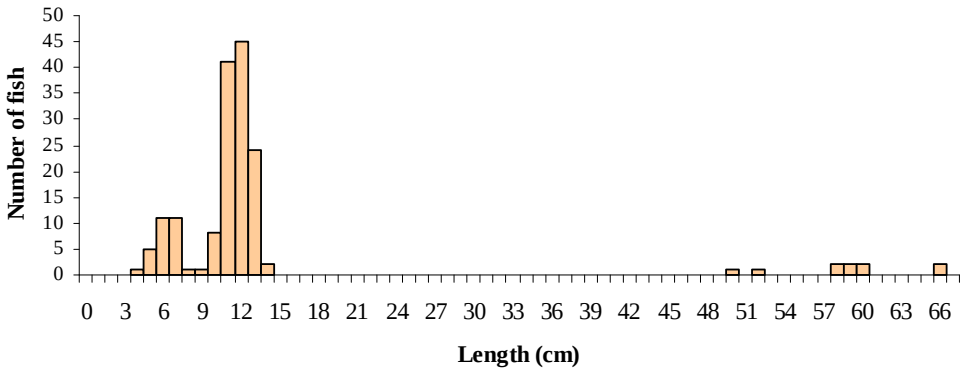

Fig. 4.24. Length frequency distribution for salmon in the River Maine, Sept 2008 (n=160)

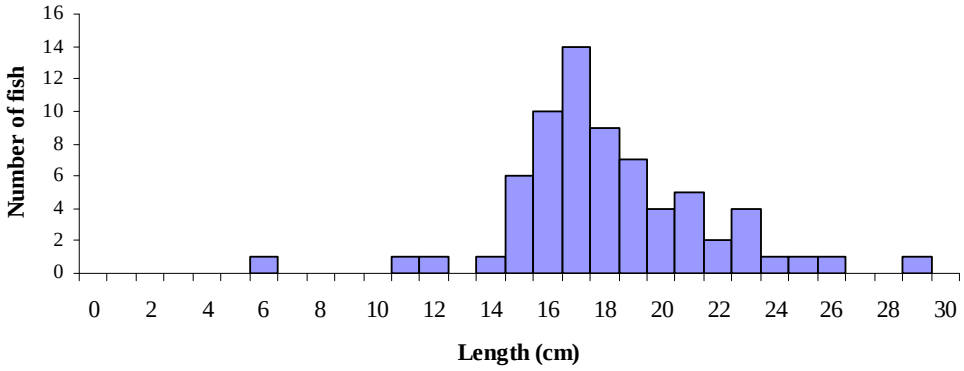

Fig. 4.25. Length frequency distribution for brown trout in the River Maine, Septe 2008 (n=75)

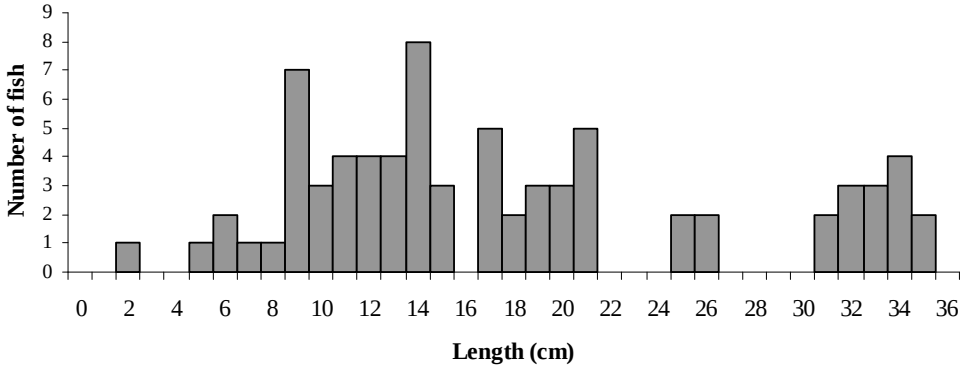

Fig. 4.26. Length frequency distribution for eels in the River Maine, Sept 2008 (n=70)

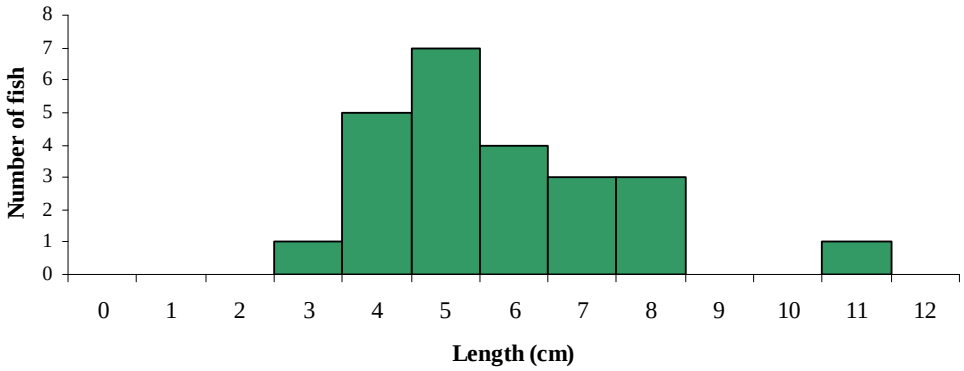

Fig. 4.27. Length frequency distribution for flounder in the River Maine, Sept 2008 (n=24)

4.2.5 The Owenreagh River

Plate 4.9. The Owenreagh River u/s of the upper lake

The Owenreagh River (Plate 4.9) is located in Co. Kerry. It rises in the Macgillycuddy's Reeks and flows in an easterly direction for approximately seven kilometres, receiving many torrential streams flowing off the surrounding mountainsides and then turns north for four kilometres before joining the Gearhameen River which flows for another two kilometres before entering the western end of the Upper Lake Killarney (Anon, 2010) (Fig. 4.28). The river is located within the Killarney National Park, Macgillycuddy's Reeks and Caragh River catchment SAC. The river is one of the 27 sub-basins which have been designated as SAC for the freshwater pearl mussel.

An electric fishing survey was conducted on the 23rd of September 2008 along a 460m stretch of river channel immediately upstream of the last bridge before the Upper Lake (Fig. 4.28). Two boat based electric fishing units were used to conduct three fishings. The site had a mean width of 23.0m and a mean depth of 0.79m. The substrate at the survey site was quite varied, but comprised mainly cobble and

gravel. Land use on either side of the river site was pasture, and the channel was heavily shaded by trees. The habitat consisted mainly of riffle and pool, with little glide.

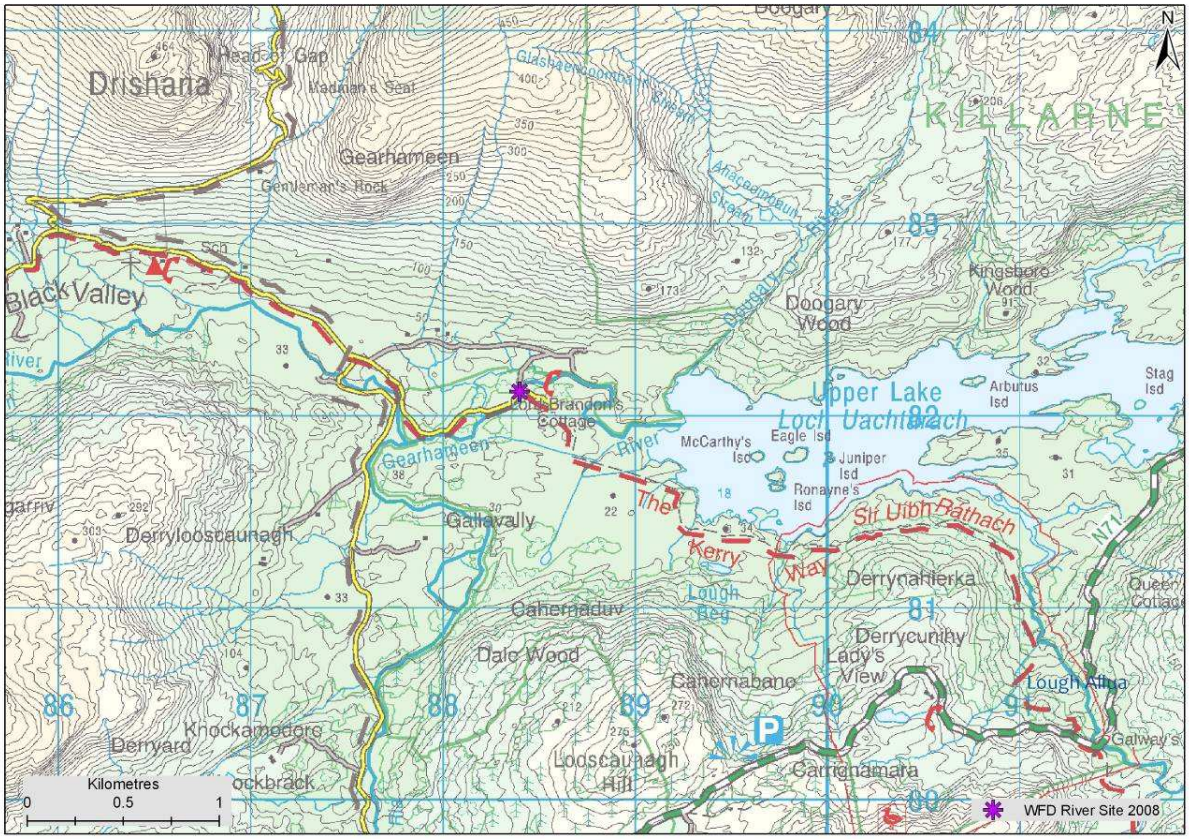

Fig. 4.28. Location of the Owenreagh River WFD surveillance monitoring site 2008

Four fish species were recorded in the Owenreagh River (Table. 4.9). Minnow was the most abundant species, followed by salmon.

Table 4.9. Density of fish (no./m^2) in the Owenreagh River site (fish density has been calculated as minimum estimates based on three fishings)

Species name	Common name	0+	1+ & older	Total density
Phoxinus phoxinus	Minnow	-	-	0.0041
Salmo salar	Salmon	0.0015	0.0007	0.0022
Anguilla anguilla	Eel	-	-	0.0017
Salmo trutta	Brown trout	0.0001	0.0002	0.0003
All fish	**All fish**	**-**	**-**	**0.0082**

Salmon ranged in length from 4.6cm to 11.5cm (Fig. 4.29). Two age classes were recorded, 0+ and 1+, accounting for approximately 70% and 30% of the population respectively. Mean L1 for salmon was 3.7cm (Appendix 2). Eels ranged in length from 9.6cm to 48.3cm (Fig. 4.30). Only three brown trout were recorded, ranging from 4.5cm to 17.8cm in length. Brown trout growth rate was categorised as fast (Appendix 1) based on a classification of growth in rivers by Kennedy and Fitzmaurice (1971).

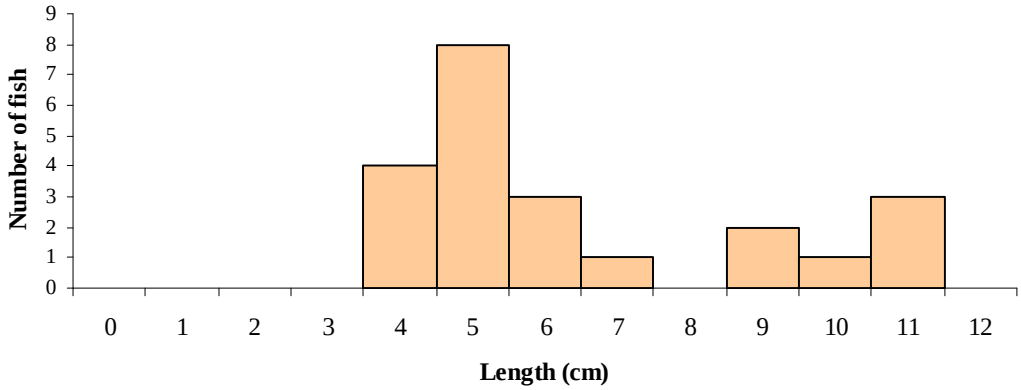

Fig. 4.29. Length frequency distribution for salmon in the Owenreagh River, September 2008 (n = 23)

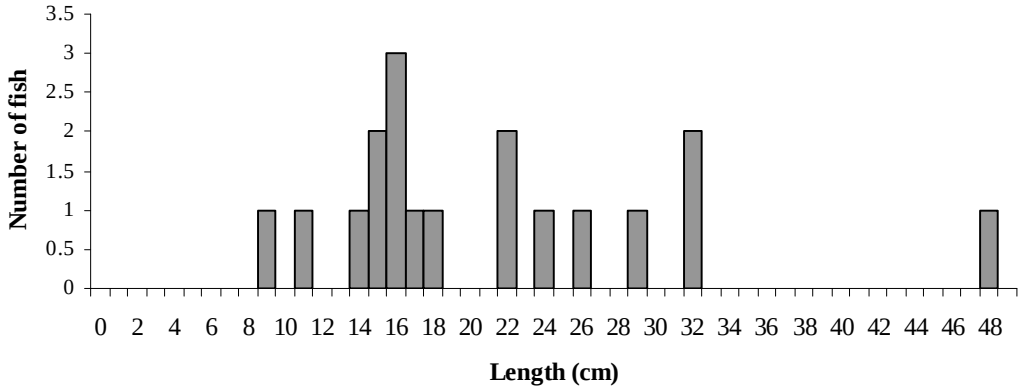

Fig. 4.30. Length frequency distribution for eels in the Owenreagh River, September 2008 (n = 18)

4.3 Community structure

4.3.1 Species richness and composition

A total of eleven fish species (sea trout were included as a separate variety of trout) were recorded at the nine river sites sampled during 2008 in the SWRFB (Fig. 4.31). No single species was recorded in all of the nine sites surveyed within the SWRFB. Brown trout and eels were the two most widespread species, occurring in 89% of the sites surveyed (Fig. 4.31). Pike and perch were the least widespread species, each being recorded in only 11% of sites.

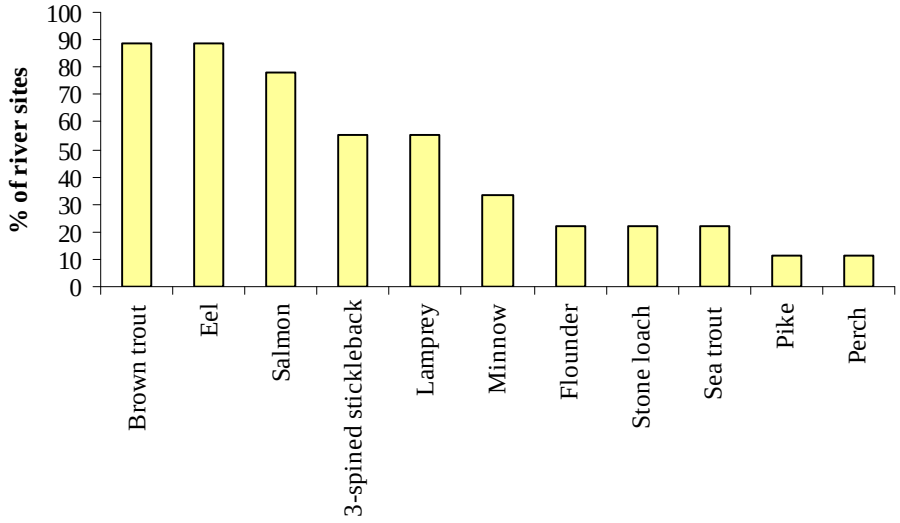

Fig. 4.31. Percentage of sites in which each fish species was present (total of 9 SWRFB river sites)

Fish species richness ranged from three species at two river sites (Flesk and Tyshe) to a maximum of eight species at one site, i.e. the Maine (Table 4.10). Native fish species were present at all sites surveyed (Table 4.10). Non-native species group 2 (e.g. pike, perch and minnow) were recorded at six of the sites surveyed in the SWRFB. Non-native group 3 fish species (e.g. gudgeon) were absent from all the sites surveyed (Table 4.10) (Table 4.12). Kelly *et al* (2008) give an explanation of the different fish groups.

Table 4.10. Species richness at each river sites surveyed in the SWRFB, July to October 2008

Site	Species richness	No. native species (Group 1)	No. non-native species (Group 2)	No. non-native species (Group 3)
		Boat sites		
Maine	8	7	1	0
Gweestin	6	5	1	0
Lee (Inchinossig)	5	3	2	0
Womanagh	4	4	0	0
Owenreagh	4	3	1	0
Flesk	3	3	0	0
		Hand-set sites		
Martin	6	5	1	0
Shanowen	5	5	0	0
Glashaboy	4	3	1	0
Tyshe	3	3	0	0

4.3.2 Species abundance and distribution

Distribution maps for all fish species encountered within the SWRFB are shown below in Figures 4.32 to 4.42. Brown trout and salmon are split into two maps to show fry (0+) and older fish (≥1+). Brown trout fry and brown trout ≥1+ both showed a good distribution throughout the region; however, densities were markedly higher in the Glashaboy River and the River Martin (Figs. 4.32 and 4.33). Salmon fry and salmon ≥1+ also exhibited a good distribution throughout the region, with greatest densities in the Shanowen River and the River Martin (Figs. 4.34 and 4.35).

Eels were also well distributed, being present in all sites except for the River Lee at Inchinossig Bridge with the highest densities being recorded in the Tyshe and Shanowen sites (Fig. 4.36). Three-spined stickleback were recorded in most sites except for those within the Laune catchment, namely the Flesk, the Owenreagh and the Gweestin, as well as the Glashaboy (Fig. 4.37). Juvenile lamprey were also present in most sites but were especially abundant in the River Martin along the muddy banks and among tree roots (Fig. 4.38). Minnow (Fig. 4.39), flounder (Fig. 4.40) and sea trout (Fig. 4.41) were mainly restricted to the sites in north-west Co. Kerry, whereas stone loach were only distributed within the eastern part of the region in two of the Co. Cork sites, the Glashaboy River and the River Martin (Fig. 4.42).

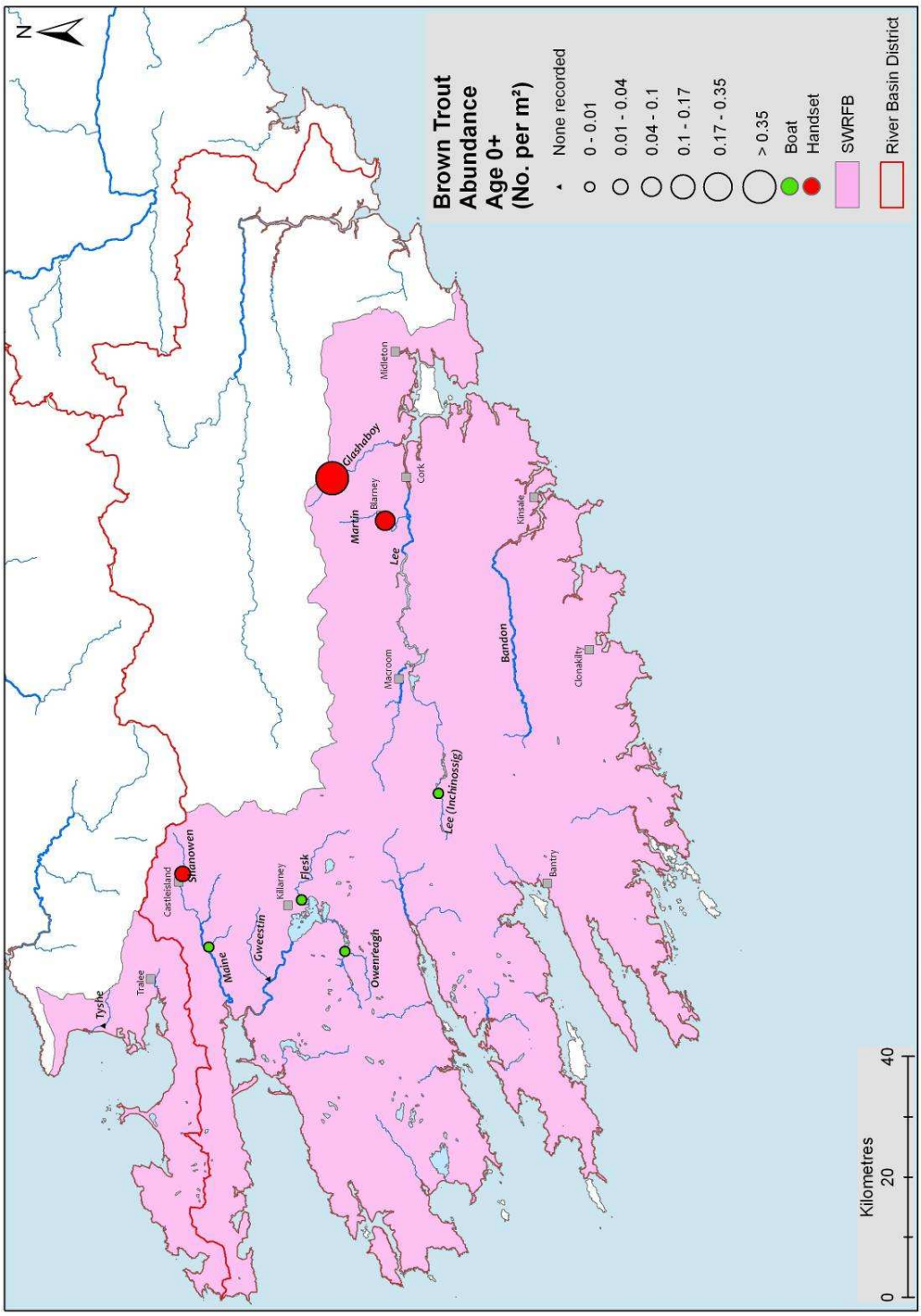

Fig. 4.32. Distribution map for 0+ brown trout in the SWRFB, WFD surveillance monitoring 2008

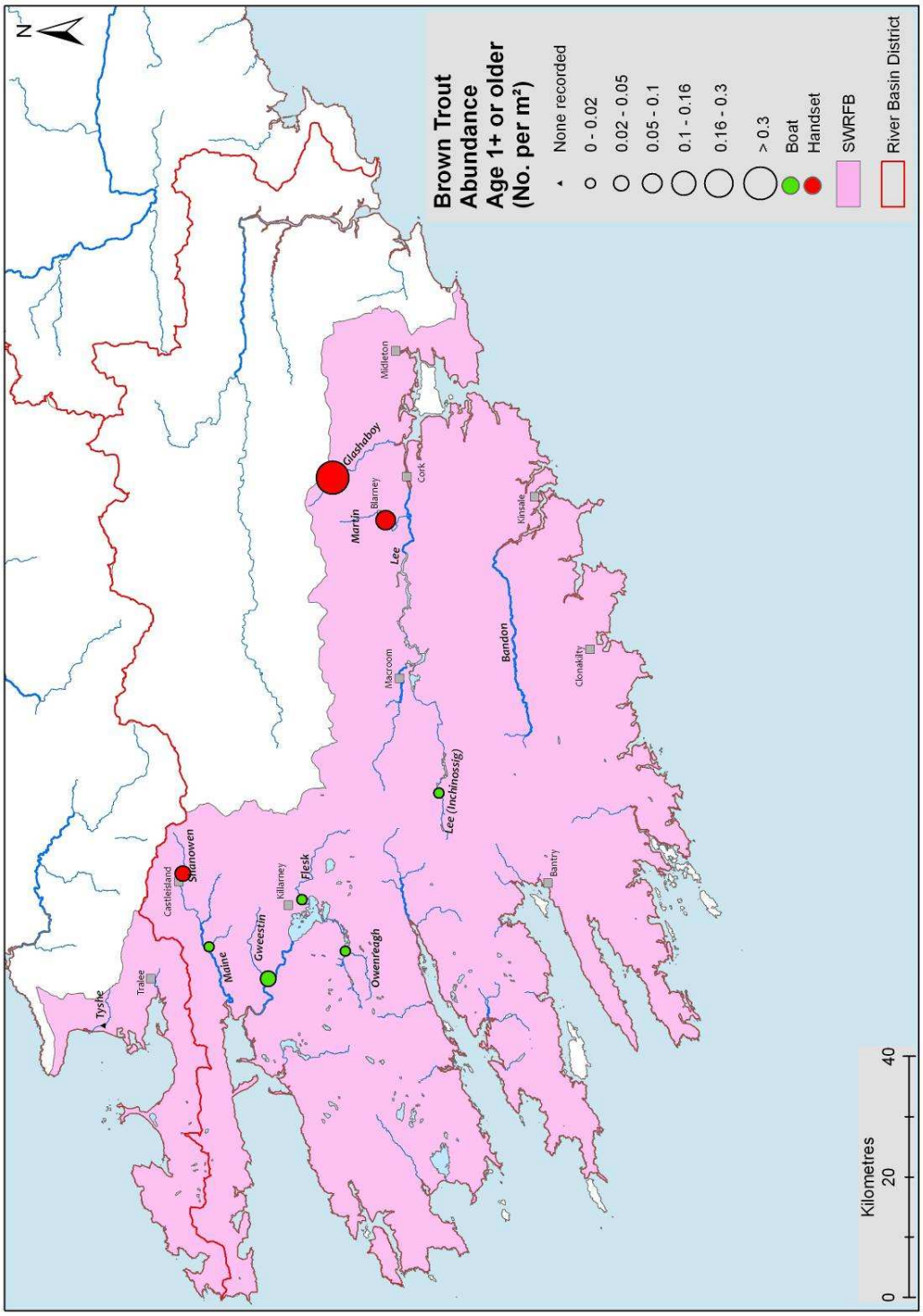

Fig. 4.33. Distribution map for 1+ brown trout in the SWRFB, WFD surveillance monitoring 2008

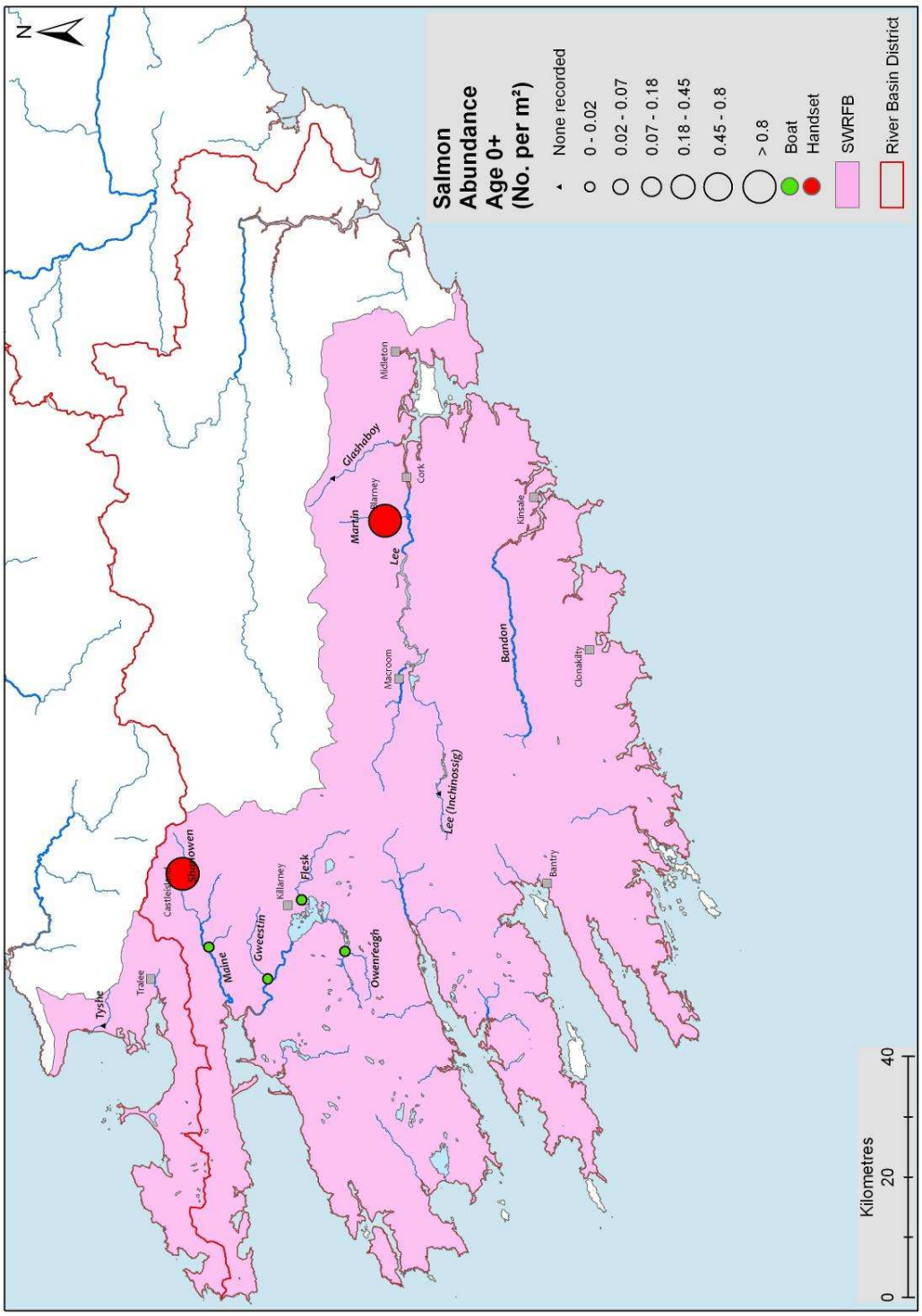

Fig. 4.34. Distribution map for 0+ salmon in the SWRFB, WFD surveillance monitoring 2008

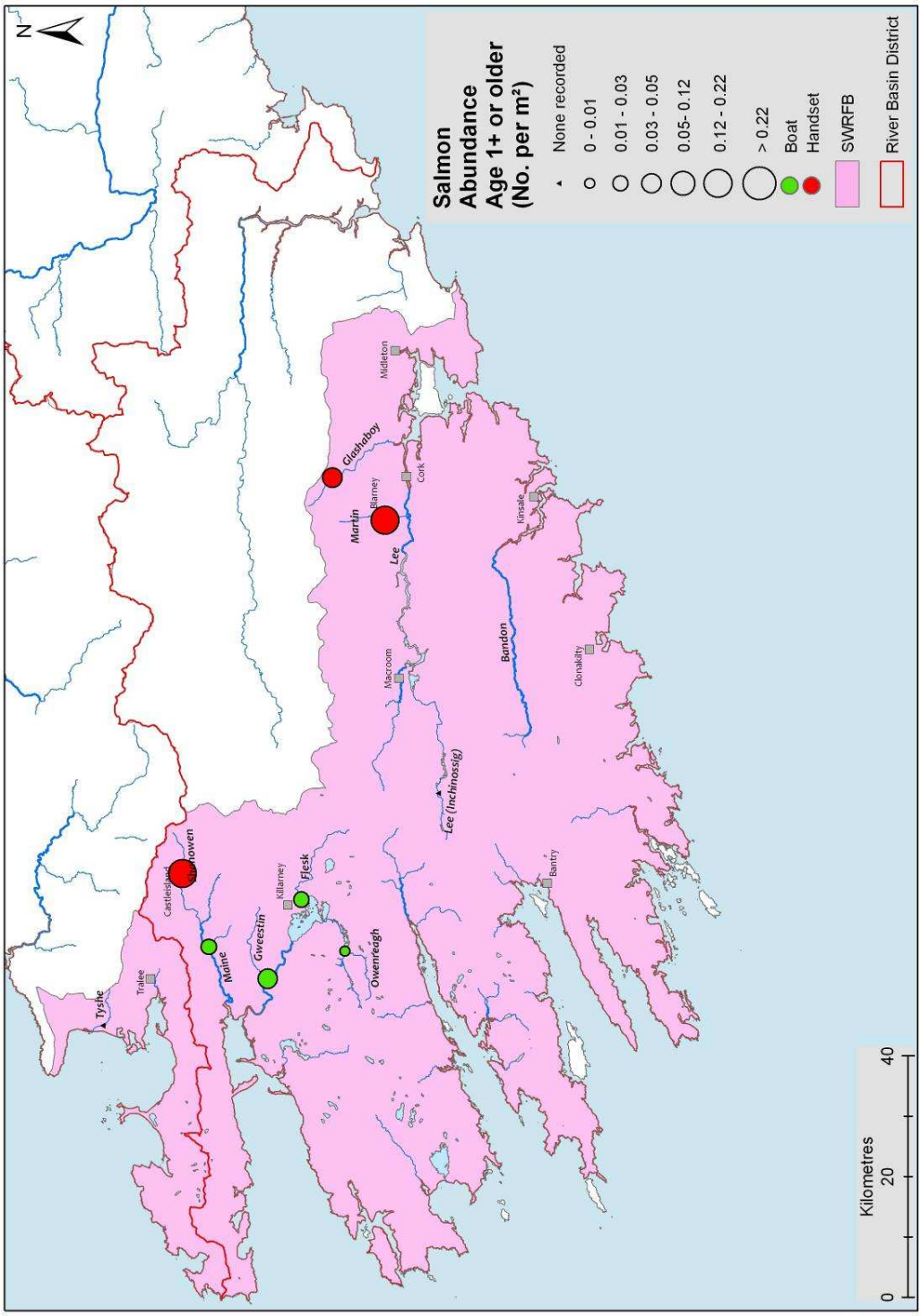

Fig. 4.35. Distribution map for 1+ salmon in the SWRFB, WFD surveillance monitoring 2008

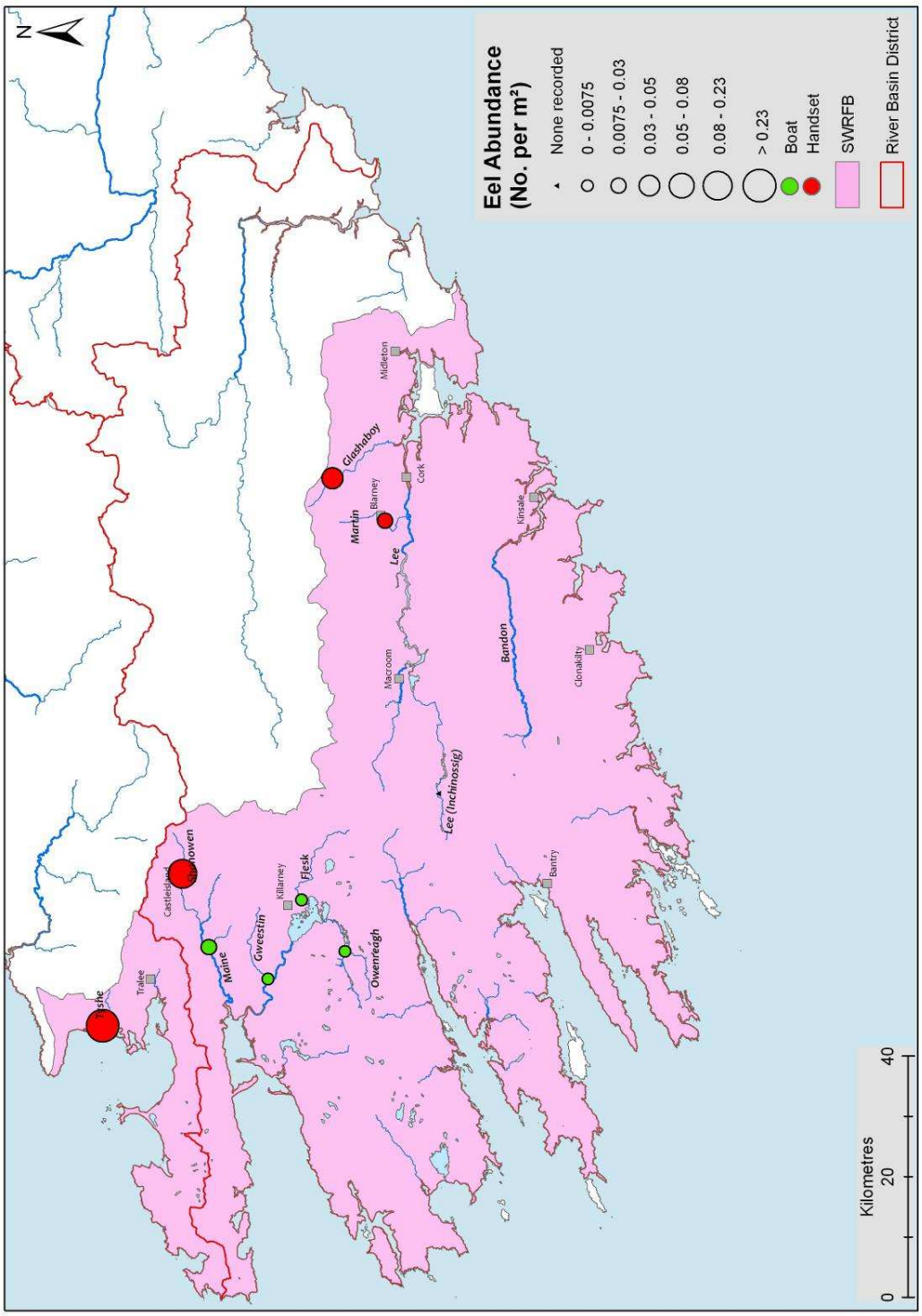

Fig. 4.36. Distribution map for eels in the SWRFB, WFD surveillance monitoring 2008

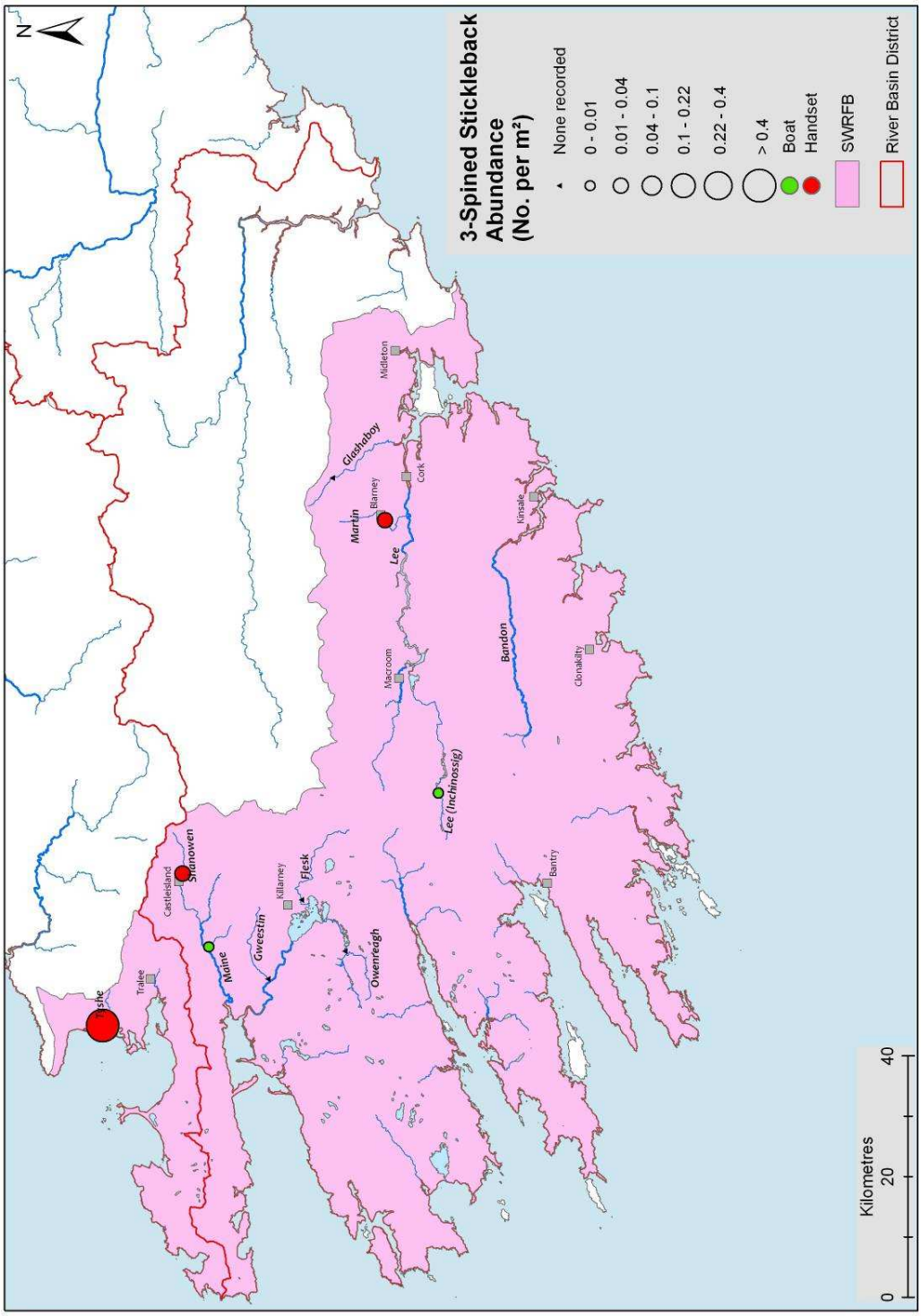

Fig. 4.37. Distribution map for 3-spined stickleback in the SWRFB, WFD surveillance monitoring 2008

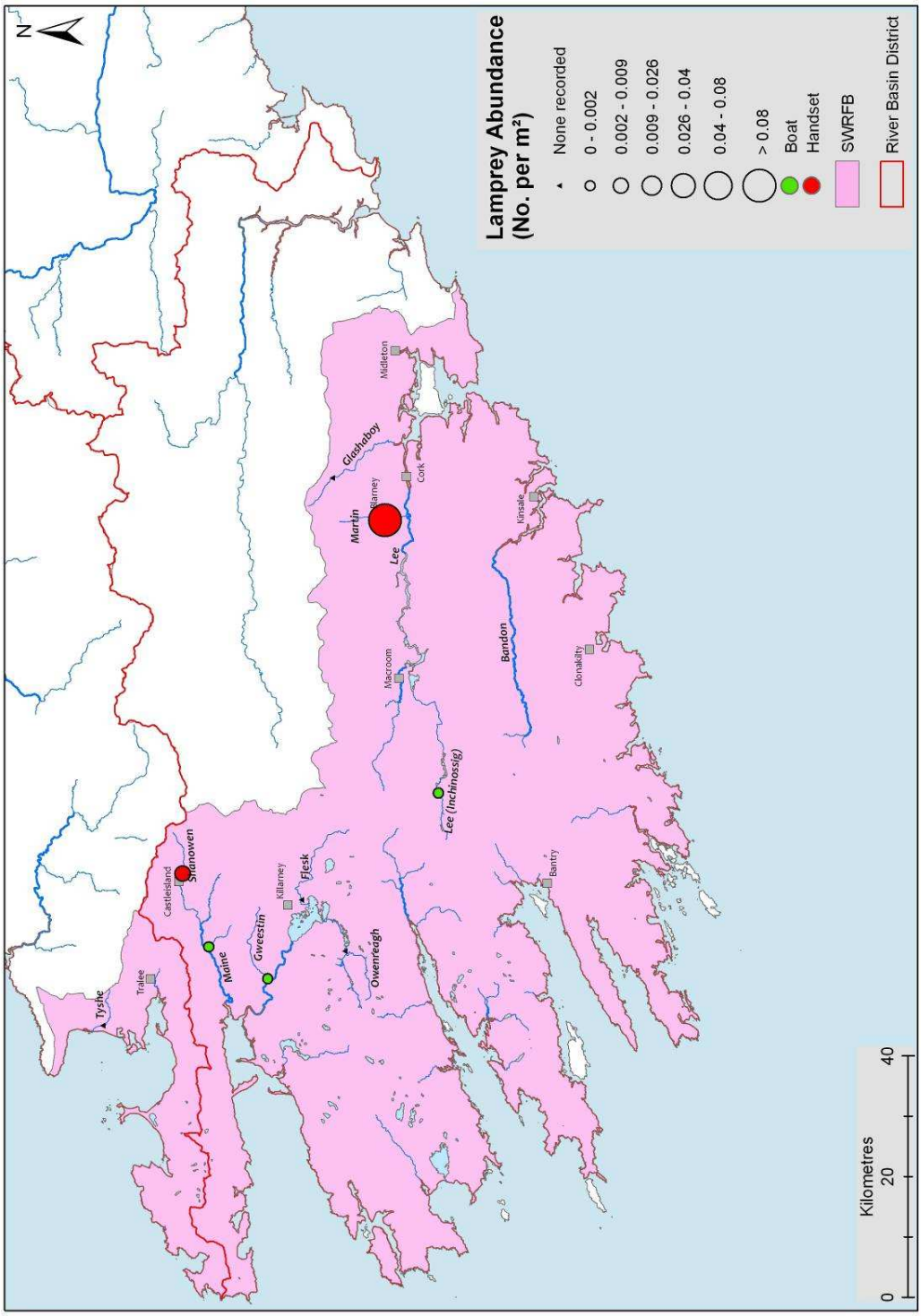

Fig. 4.38. Distribution map for lamprey in the SWRFB, WFD surveillance monitoring 2008

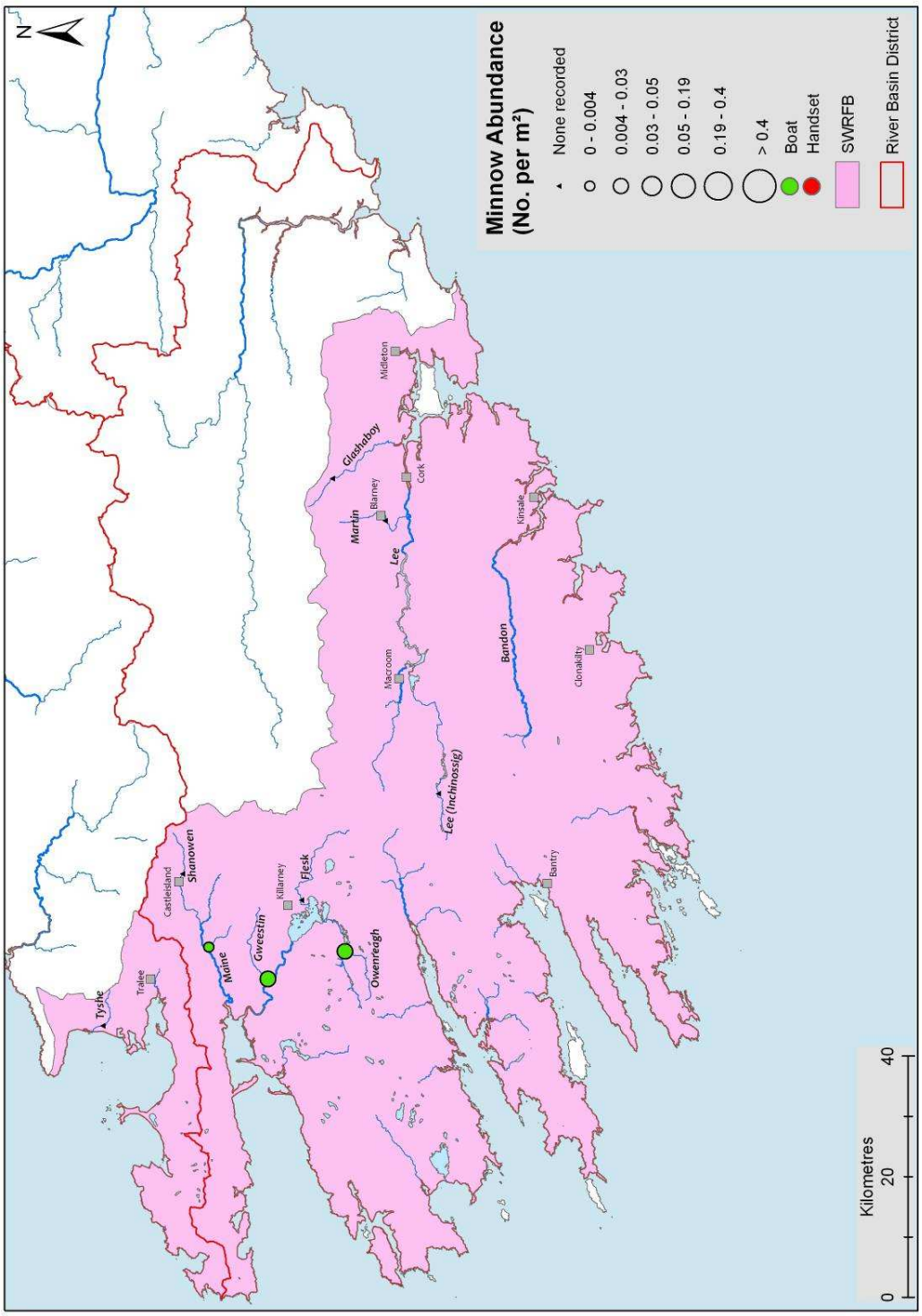

Fig. 4.39. Distribution map for minnow in the SWRFB, WFD surveillance monitoring 2008

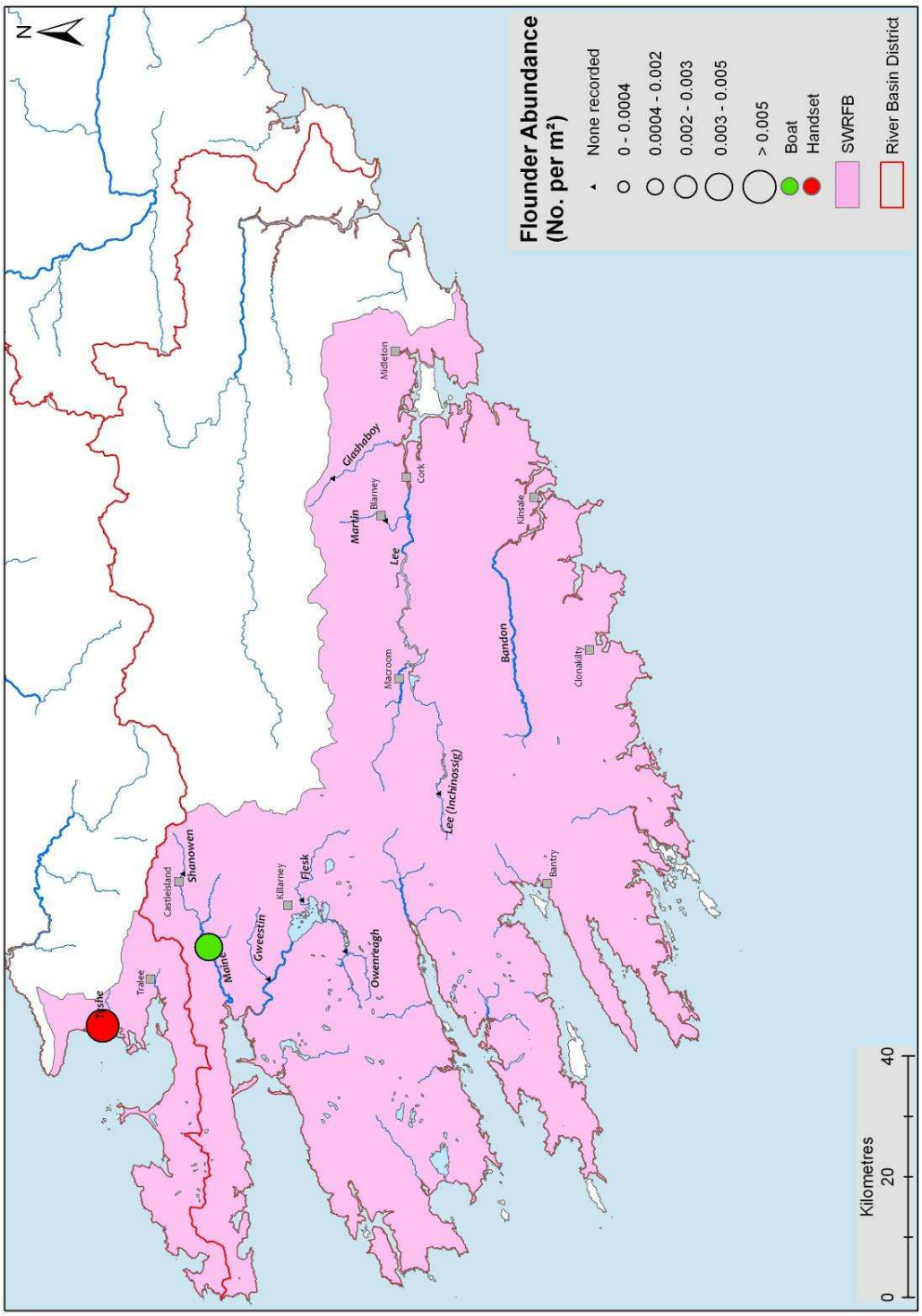

Fig. 4.40. Distribution map for flounder in the SWRFB, WFD surveillance monitoring 2008

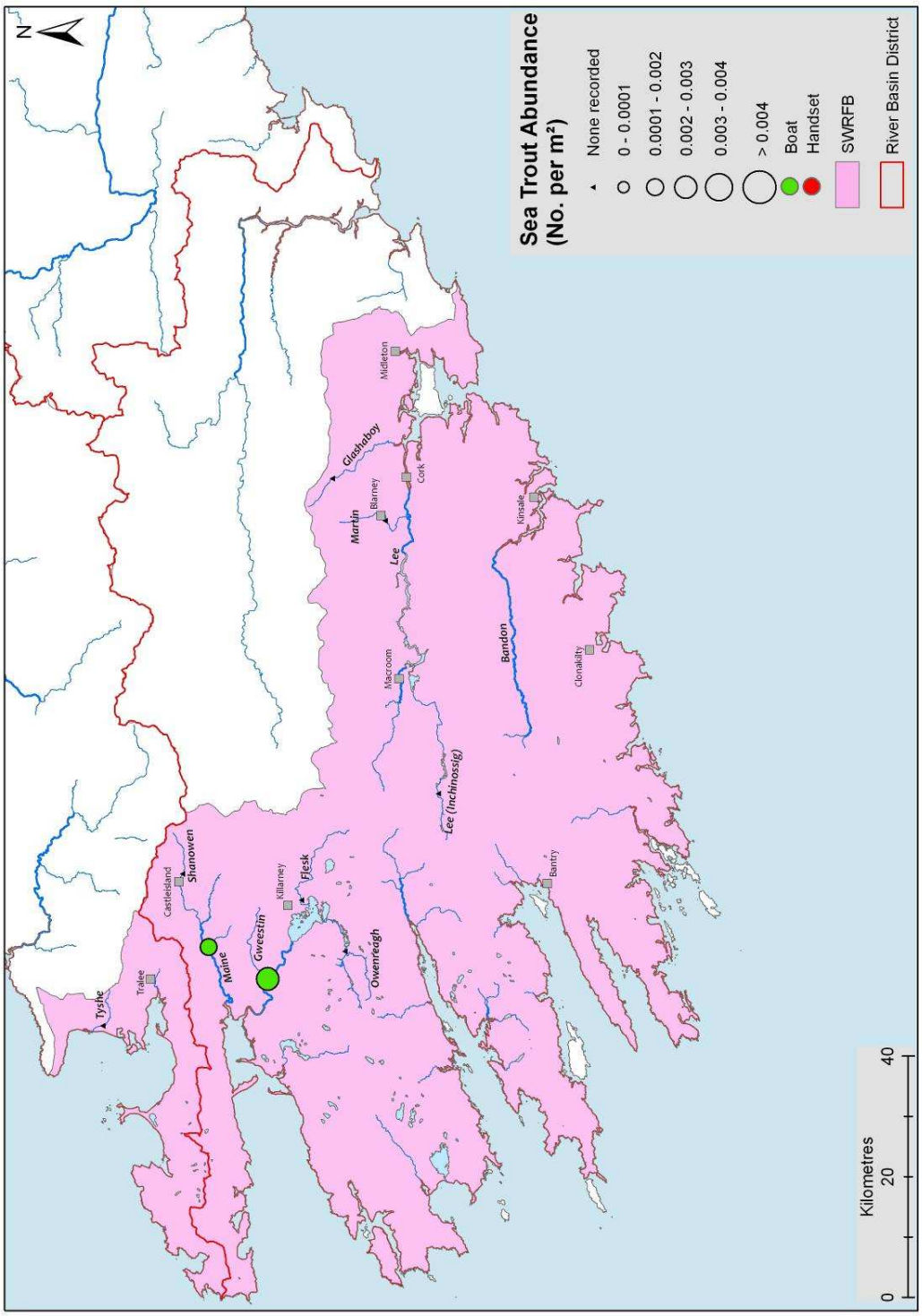

Fig. 4.41. Distribution map for sea trout in the SWRFB, WFD surveillance monitoring 2008

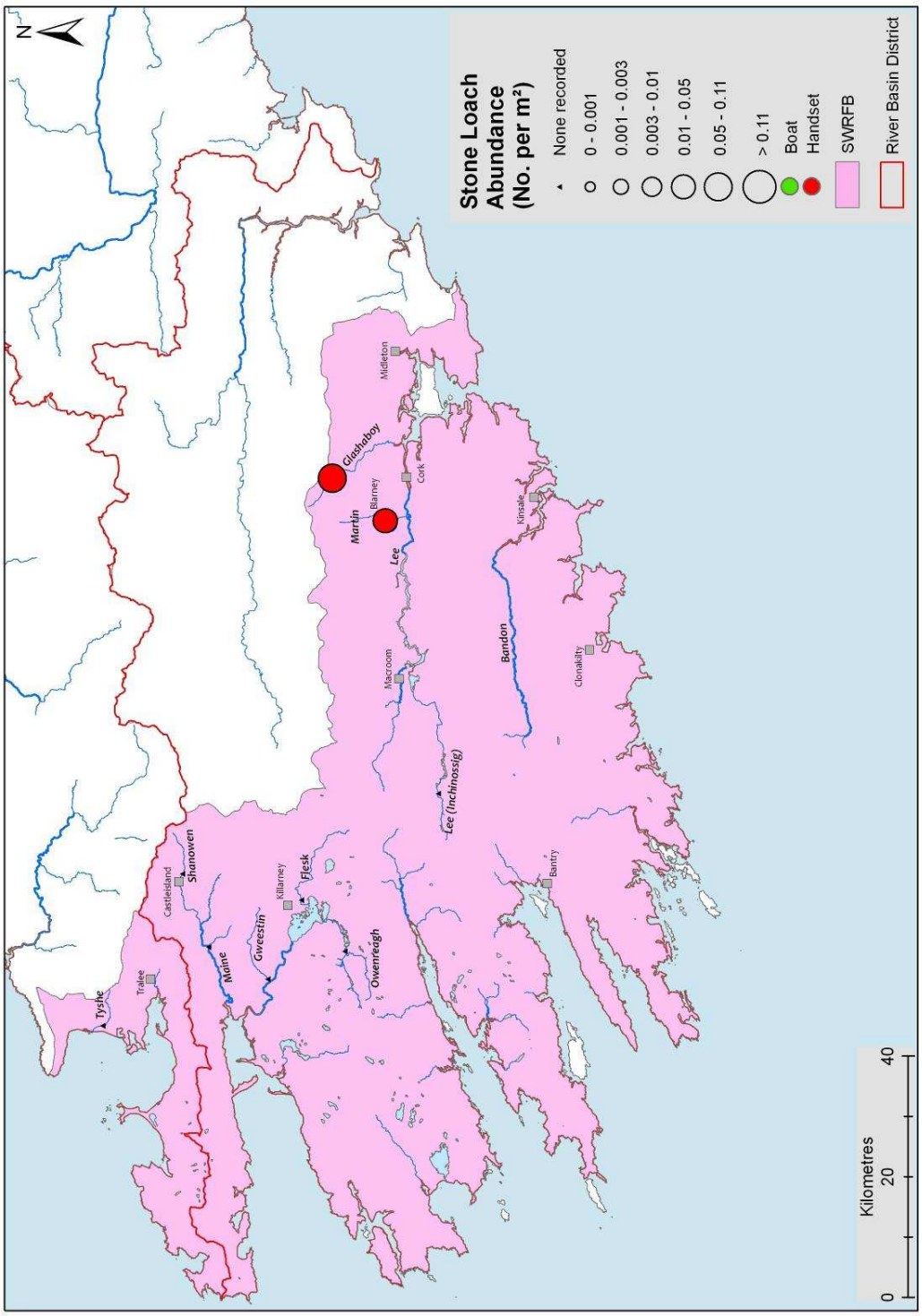

Fig. 4.42: Distribution map for stone loach in the SWRFB, WFD surveillance monitoring 2008

4.3.3 Growth of salmon, brown trout and sea trout

Age and growth of fish were determined for the dominant fish species on each river site, comprising a range of age groups (from 0+ to 4+ depending on species). Brown trout ages ranged from 0+ to 4+ with 1+ and 2+ being the dominant age classes at most sites. Most river sites that contained brown trout had individuals aged up to 3+ in their populations. The Gweestin was the only river to contain the 4+ age class and this was also the largest brown trout (length 32.5cm and weight 0.44kg) recorded during the surveys in the SWRFB.

According to the growth categories of brown trout in relation to alkalinity described by Kennedy and Fitzmaurice (1971), fish growth was slow in the Glashaboy, the Lee and the Martin and was fast in the Flesk, the Gweestin, the Maine, the Owenreagh and the Shanowen. The River Maine generally showed the fastest growth at L2 and L3 of any river (Fig. 4.43).

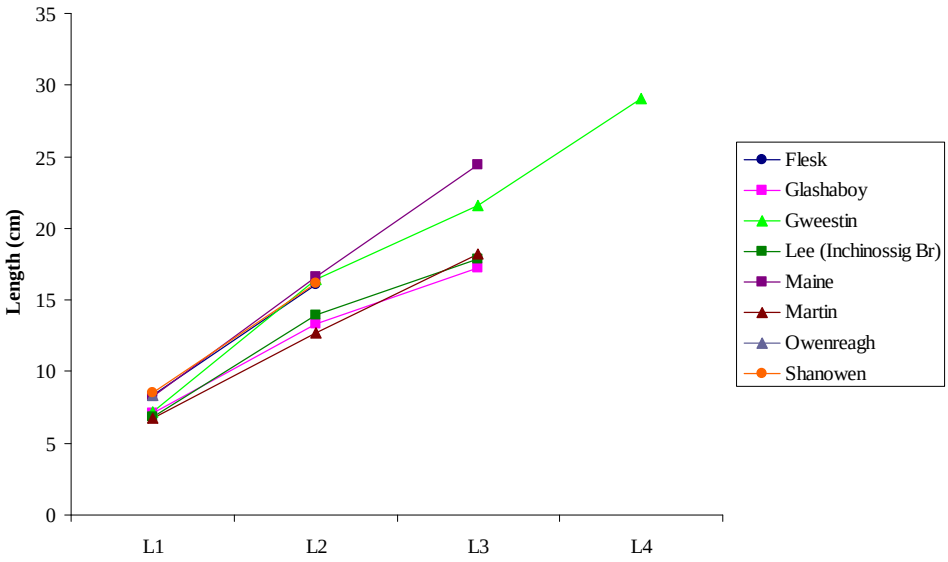

Fig. 4.43. Back calculated lengths for brown trout in each river.

Salmon aged 0+ and 1+ were recorded in most of the SWRFB rivers, but only three rivers had 2+ salmon present; the Maine, the Glashaboy and the Gweestin. The graph and table of back calculated lengths for salmon in the SWRFB rivers are shown in Figure 4.44 and Appendix 2.

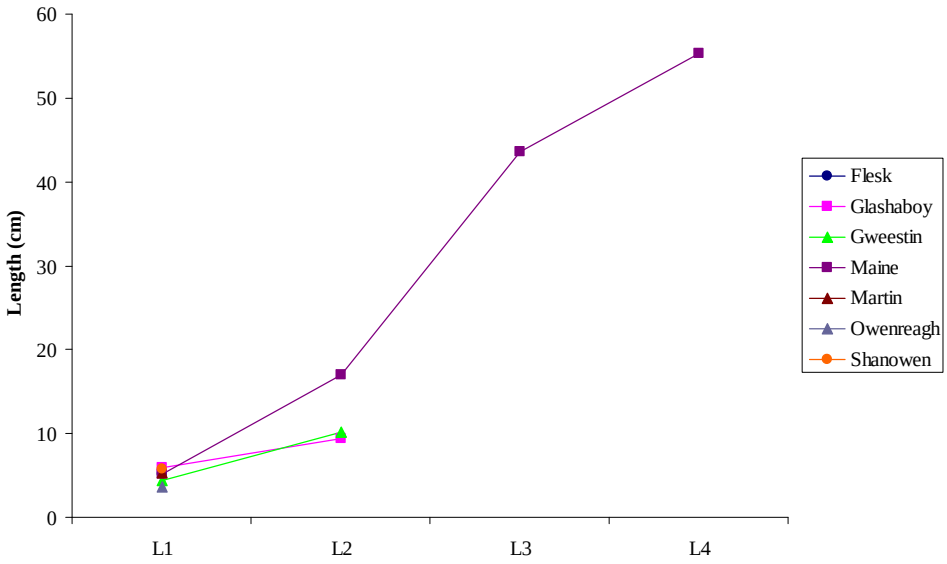

Fig. 4.44. Back calculated lengths for salmon in each river.

Sea trout were only present in two rivers, the Gweestin and the Maine. Sea trout in the Maine were aged up to age three years old, whereas sea trout in the Gweestin were as old as four years. The graph and table of back calculated lengths for sea trout in the SWRFB rivers are given in Figure 4.45 and Appendix 3.

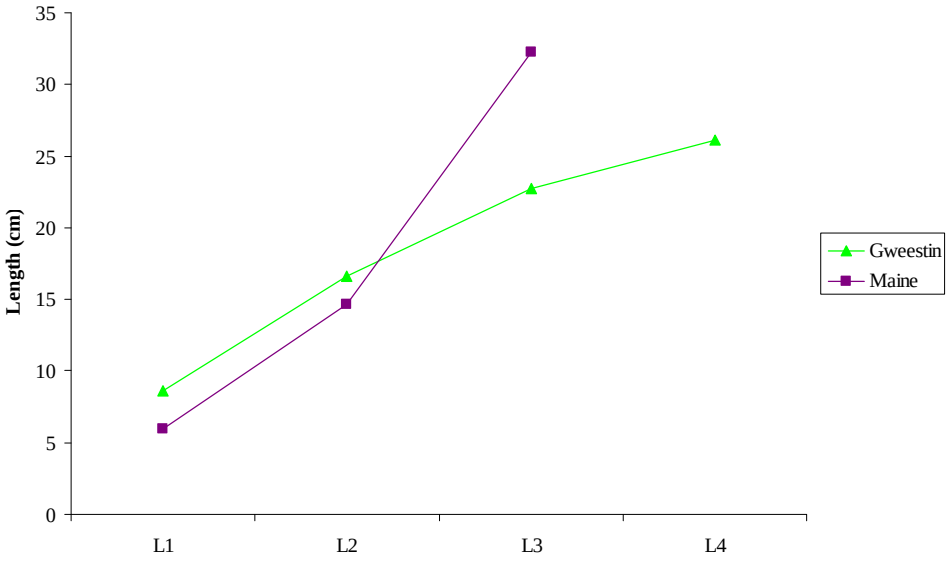

Fig. 4.45. Back calculated lengths for sea trout in each river.

5. DISCUSSION

A total of ten fish species were recorded within the SWRFB during the WFD 2008 sampling programme. Sea trout were also present in two sites. In a similar trend to the rest of the country, brown trout and eels were widely distributed throughout this region, occurring in 89% of sites surveyed. Pike and perch were the least widespread species and were both only recorded within a single site, the Lee at Inchinossig Bridge. In terms of overall diversity, the Maine River had the highest number of species present, with a total of seven. The highest species diversity recorded in any site throughout the country was ten and this only occurred in one site within the ShRFB where there was a high number of non-native coarse fish present. The Tyshe River had the lowest species diversity with only three species recorded, however this is typical of small streams with only native fish present.

Salmon fry and parr densities were highest in the Shanowen and Martin survey sites. The densities recorded at these sites were also among the highest when compared to data from other sites surveyed during 2008 (Kelly *et al.*, 2009). The Shanowen and Martin recorded the second and third highest densities for 0+ salmon out of all the sites surveyed during 2008 and the Shanowen was the third highest for salmon parr.

Brown trout were present in most river sites. The highest density for 0+ and 1+ and older brown trout recorded in the SWRFB during 2008 was recorded in the Shanowen and this was also relatively high when compared to sites surveyed in other regions (Kelly *et al.*, 2009). Brown trout exhibited the fastest growth rates in the Gweestin, Flesk, Maine, Owenreagh and Shanowen Rivers, while the slowest growth was observed in the Glashaboy, Lee (Inchinossig) and Martin river sites. Brown trout growth throughout the country was generally observed to be faster in larger rivers, with higher levels of alkalinity (Kelly *et al.*, 2009).

Non-native species (i.e. pike, perch, minnow and stoneloach) were recorded in six of the nine rivers surveyed in the SWRFB. 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. The three rivers containing only native species were the Tyshe, the Shanowen and the Flesk. Kelly *et al*. (2008) categorised non-native fish species in Ireland into two categories (Group 2, which are those that influence ecology and Group 3, which are those that generally have no influence on the ecology). Four group 2 species (pike, perch, minnow and stone loach) were recorded in the SWRFB region. Minnow and stone loach appear to be quite common throughout the country, while pike and perch are generally more confined to certain areas, including the ShRFB and NRFB (Kelly *et al.*, 2009). A single specimen of pike and a small number of perch were recorded in the Lee River at Inchinossig Bridge. These results suggest that the river sites

surveyed to date for the WFD within the SWRFB are still relatively free of non-native species, however 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 gudgeon 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 SWRFB rivers (L1=back calculated length at the end of the first winter etc.)

River		L1	L2	L3	L4	Growth category
Flesk	Mean	8.36	16.08			Fast
	SD	2.73	n/a			
	n	2	1			
	Range min.	6.43	16.08			
	Range max.	10.29	16.08			
Glashaboy	Mean	7.11	13.31	17.25		Slow
	SD	1.34	2.21	0.88		
	n	46	20	5		
	Range min.	4.05	10.36	16.08		
	Range max.	9.57	17.45	18.35		
Gweestin	Mean	7.15	16.46	21.59	29.02	Fast
	SD	1.55	4.45	3.1	n/a	
	n	26	16	5	1	
	Range min.	4.02	8.83	17.61	29.02	
	Range max.	10.3	23.52	25.15	29.02	
Lee (Inchinossig Br)	Mean	6.8	13.93	17.88		Slow
	SD	1.21	1.69	n/a		
	n	25	19	1		
	Range min.	4.95	11.39	17.88		
	Range max.	9.23	16.69	17.88		
Maine	Mean	8.3	16.63	24.44		Fast
	SD	1.56	2.41	n/a		
	n	42	12	1		
	Range min.	4.31	10.88	24.44		
	Range max.	11.39	19.42	24.44		
Martin	Mean	6.71	12.73	18.21		Slow
	SD	1.46	2.44	2.3		
	n	28	18	2		
	Range min.	4.37	9.23	16.58		
	Range max.	9.33	17.62	19.84		
Owenreagh	Mean	8.53	16.16			Fast
	SD	1.45	0.62			
	n	24	3			
	Range min.	6.7	15.56			
	Range max.	10.86	16.8			
Shanowen	Mean	8.53	16.16			Fast
	SD	1.45	0.62			
	n	24	3			
	Range min.	6.7	15.56			
	Range max.	10.86	16.8			

Appendix 2

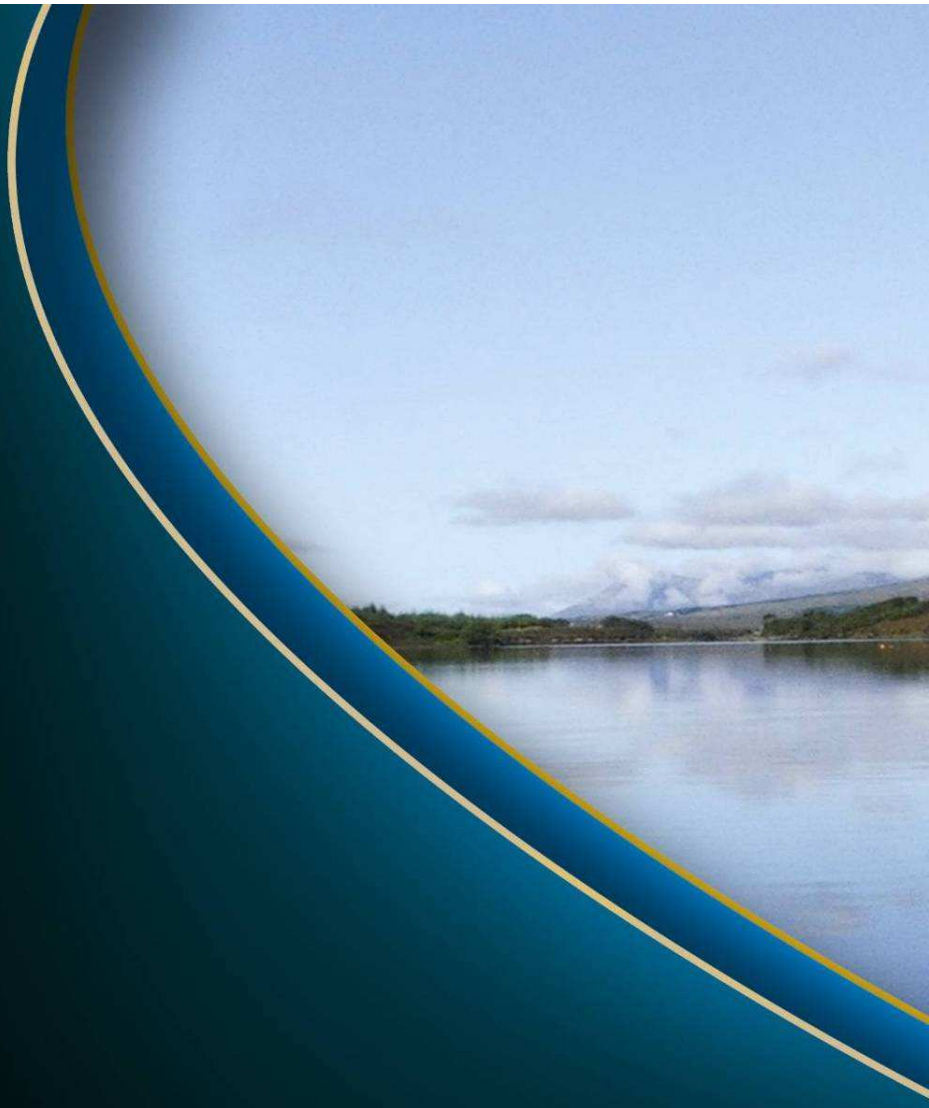
Summary of the growth of salmon in the SWRFB rivers (L1=back calculated length at the end of the first winter etc.)

River		L1	L2	L3	L4
Flesk	Mean	5.16			
	SD	1.1			
	n	20			
	Range min.	3.31			
	Range max.	6.98			
Glashaboy	Mean	5.98	9.48		
	SD	1.05	n/a		
	n	12	1		
	Range min.	3.55	9.48		
	Range max.	7.43	9.48		
Gweestin	Mean	4.33	10.18		
	SD	0.75	0.79		
	n	32	3		
	Range min.	3.02	9.34		
	Range max.	5.79	10.92		
Maine	Mean	5.21	17.09	43.58	55.37
	SD	1.18	11.07	4.08	4
	n	30	9	8	2
	Range min.	3.29	10.29	37.11	52.54
	Range max.	7.91	41.05	50.09	58.19
Martin	Mean	5.38			
	SD	0.82			
	n	26			
	Range min.	4			
	Range max.	7.04			
Owenreagh	Mean	3.65			
	SD	0.42			
	n	6			
	Range min.	2.86			
	Range max.	3.97			
Shanowen	Mean	5.71			
	SD	1.22			
	n	20			
	Range min.	3.94			
	Range max.	9.12			

Appendix 3

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

River		L1	L2	L3	L4
Gweestin	Mean	8.59	16.64	22.71	26.11
	SD	2.43	2.6	2.46	n/a
	n	3	3	2	1
	Range min.	6.74	14.13	20.98	26.11
	Range max.	11.34	19.32	24.45	26.11
Maine	Mean	5.92	14.63	32.24	
	SD	1.41	3.11	n/a	
	n	5	5	1	
	Range min.	4.31	12.49	32.24	
	Range max.	8.16	20	32.24	



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