

South Western River Basin District Rivers



Sampling Fish for the Water Framework Directive - Rivers 2009



The Central and Regional
Fisheries Boards

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1. INTRODUCTION

Fish stock surveys were undertaken in 54 river sites throughout Ireland during the summer of 2009 as part of the programme of sampling fish for the Water Framework Directive (WFD). These surveys are required by both national and European law, with Annex V of the WFD stipulating that rivers are included within the monitoring programme and that the composition, abundance and age structure of fish fauna are examined (Council of the European Communities, 2000). Seven of the 54 surveys were carried out at river sites in the South Western River Basin District between July and early September 2009 by staff from the Central Fisheries Board (CFB), South Western Regional Fisheries Board (SWRFB) and Southern Regional Fisheries Board (SRFB) (Table 2.1, 2.2 and Fig. 2.1). Although fish survey work has been carried out in Ireland in the past, no project to date has been as extensive as the current on-going monitoring programme in providing data appropriate for WFD compliance. Continued surveying of these and additional river sites will provide a useful baseline and time-series dataset for future monitoring of water quality. This in turn will provide information for River Basin District managers to compile and implement programmes of measures to improve degraded water bodies.

The fisheries service in Ireland is currently undergoing a major organisational transition. This follows the recent government plan for the rationalisation of state agencies outlined in the 2009 budget. The eight separate fisheries organisations, comprising the Central Fisheries Board (CFB) and seven Regional Fisheries Boards (RFBs) are set to merge into one single entity and become Inland Fisheries Ireland (IFI). As a result of these changes, the previous administrative zones, the RFBs, will be realigned along the boundaries of River Basin Districts (RBDs) and will in some cases transcend international boundaries. Previous WFD fish surveys were reported based on the seven different RFBs; however, reporting will now reflect these new administrative changes and will group water bodies according to River Basin Districts.

Up until 2010 the SWRFB occupied a relatively small area in the extreme south-west of the country. The South Western River Basin District (SWRBD) covers most of this area but also includes the Blackwater catchment in north Co. Cork, previously a part of the SRFB.

The SWRBD (Fig. 2.1) is mainly comprised of Counties Cork and Kerry, but also contains parts of Limerick, Tipperary and Waterford. It has a total land area of 11,000km², equating to nearly a sixth of the entire country, along with 4,000km² of marine waters. Expanding urban areas and agriculture are among the greatest pressures on the region, particularly in the eastern areas, 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 (SWRBD, 2009).

This report summarizes the main findings of the fish stock surveys in the seven river water bodies surveyed in the SWRBD during 2009 and reports the current status of the fish stocks in each.

2. STUDY AREA

Seven river sites were surveyed in three river catchments within the SWRBD; the Argideen, Bandon and Munster Blackwater catchments. The sites ranged in surface area from 405m² for the River Funshion to 21,840m² for the River Blackwater at Killavullen Bridge and were divided into two categories for reporting purposes, i.e. hand-set and boat sites.

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

Table 2.1. Location and codes of river sites surveyed for WFD surveillance monitoring, 2009

River	Site name	Catchment	Site Code	Waterbody code
SWRBD Hand-set sites				
Argideen	Ford S of Reengarrigeen	Argideen	IE20A020200	SW_20_2251
Funshion	Brackbaun Br.	Blackwater	IE18F050030	SW_18_11
SWRBD Boat sites				
Awbeg	Kilcummer Br.	Blackwater	IE18A051300	SW_18_2677
Bandon	Bridge near Desert Station	Bandon	IE20B020600	SW_20_2230_1
Blackwater	Killavullen Br.	Blackwater	IE18B021900	SW_18_2292_5
Blackwater	Nohaval Br.	Blackwater	IE18B020200	SW_18_450
Bride	Bridge N of Ballynella	Blackwater	IE18B050500	SW_18_2778

Table 2.2. Details of river sites surveyed for WFD surveillance monitoring, 2009

River	Upstream catchment (km ²)	Wetted width (m)	Surface area (m ²)	Mean depth (m)	Max depth (m)
SWRBD Hand-set sites					
Argideen	1698.67	12.16	547	0.49	0.82
Funshion	16.19	9.00	405	0.22	0.35
SWRBD Boat sites					
Awbeg	350.44	15.80	3792	0.46	0.80
Bandon	337.05	21.40	5543	0.57	0.80
Blackwater (Killavullen)	1256.72	40.00	21840	1.10	2.00
Blackwater (Nohaval)	89.00	11.40	2029	0.44	1.00
Bride	226.78	16.80	4754	0.46	0.70

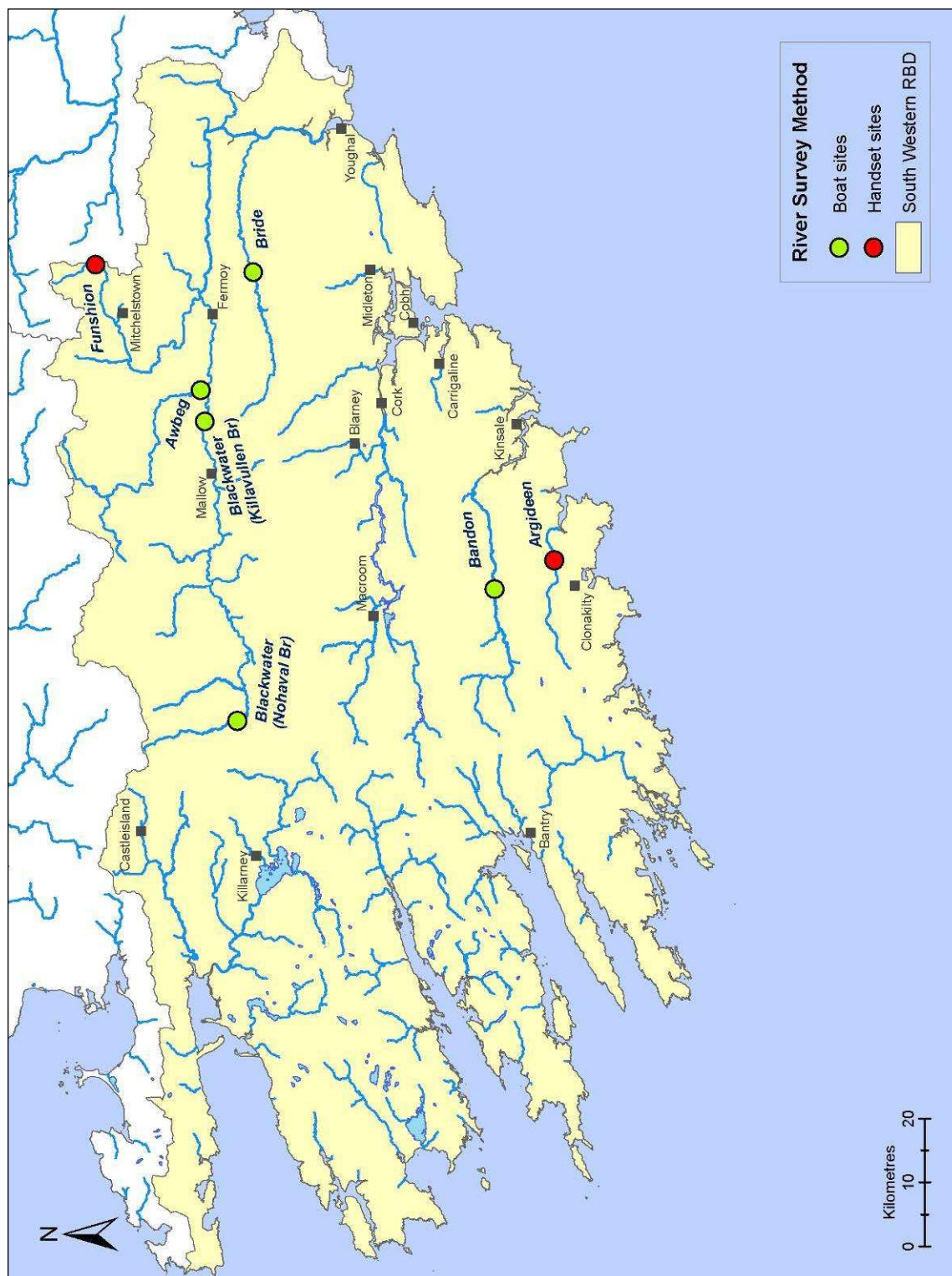


Fig. 2.1. Location map of river sites surveyed throughout the SWRBD for WFD fish surveillance monitoring 2009

3. METHODS

Electric-fishing (Plates 3.1 and 3.2) is the method of choice for surveillance monitoring of fish in rivers to obtain a representative sample of the fish assemblage at each sampling site. This 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. 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 were taken, along with a multi-habitat kick-sample of macroinvertebrates. Macrophyte surveys were carried out on selected wadeable streams.

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

In order to draw comparisons between sites, fish densities were calculated using data from the first fishing pass, as three fishing passes were not possible or practical at all sites. The number captured in the first pass was divided by the total area surveyed to give a minimum population density for each species.

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



Plate 3.1. Electric fishing using hand-set units on the Glashaboy River (SWRBD)



Plate 3.2. Electric fishing using boat-based units on the Nenagh River (ShIRBD)

4. RESULTS

4.1 Wadeable hand-set sites

4.1.1 *The Argideen River*

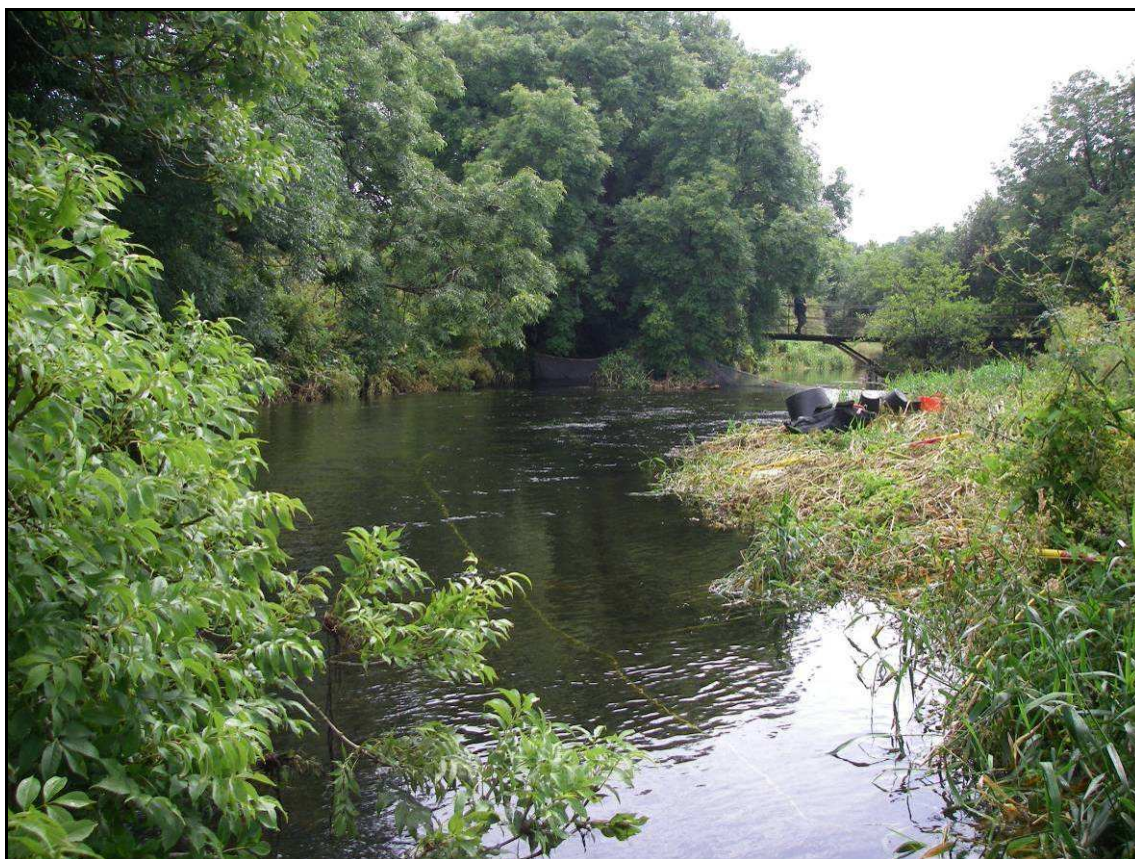


Plate 4.1. The Argideen River near Timoleague, Co. Cork

The Argideen River (Plate 4.1) is located in south Co. Cork. It rises in the hills north-west of Clonakilty and flows eastwards towards Timoleague before entering the sea at Courtmacsharry Harbour. Although salmon are present, the Argideen is best known as a sea trout fishery. When conditions are favourable, it is believed to be among the best in Ireland, with stocks improving steadily over the past few years (O'Reilly, 2009). The survey site, located approximately 5km north-east of Clonakilty (Fig. 4.1), lies approximately 4.5km upstream of Courtmacsherry Estuary SAC.

Three electric-fishing passes were conducted using three bank-based electric-fishing units on the 22nd of July 2009 along a 45m length of channel. The mean wetted width of the stretch surveyed was 12.2m and the mean depth was 49.0cm. This site was dominated by pools, with a substrate of mainly cobble. There was a wide variety of macrophyte vegetation present at this site, including both submerged and floating species. A total wetted area of 547m² was surveyed.

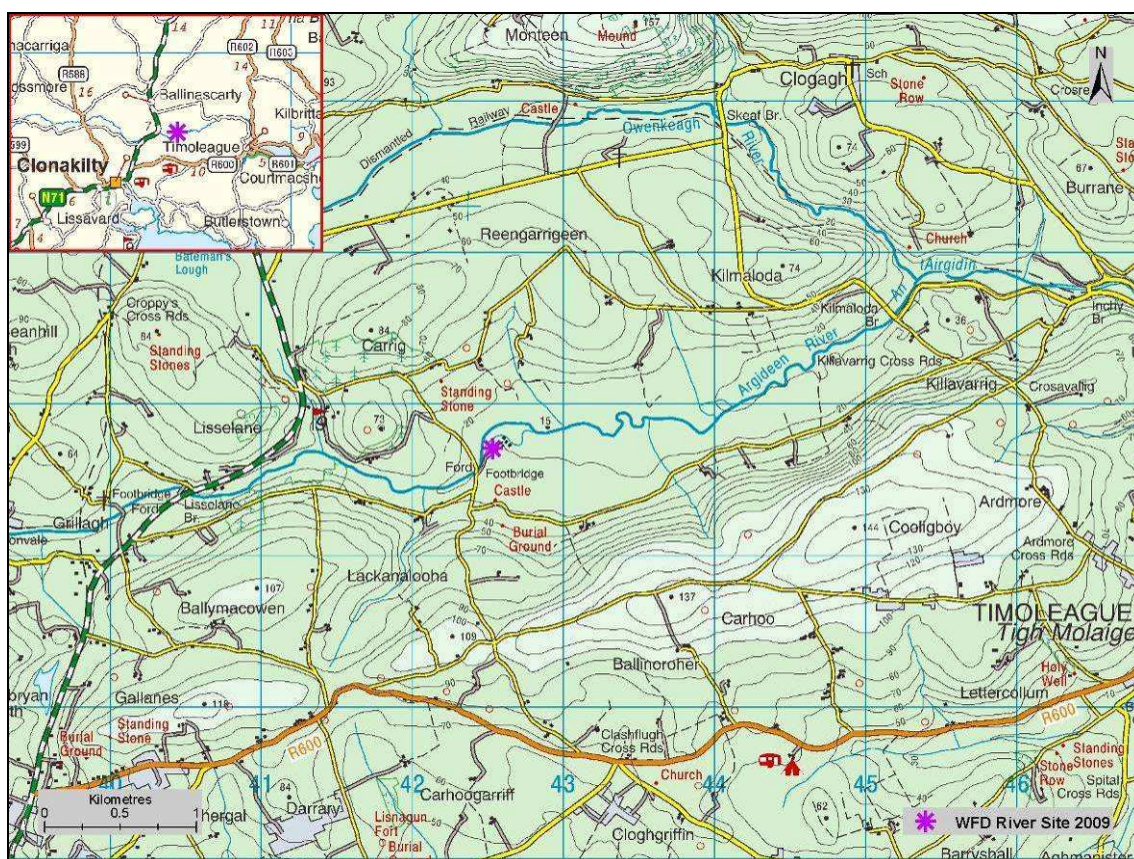


Fig. 4.1. Location of the Argideen River surveillance monitoring site

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

Table 4.1. Density of fish (no./m²), Argideen River site (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.1499	0.0969	0.2467
<i>Anguilla anguilla</i>	European eel	-	-	0.0201
<i>Salmo trutta</i>	Brown trout	0.0073	0.0073	0.0146
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.0091
<i>Barbatula barbatula</i>	Stone loach	-	-	0.0037
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.0018
All fish	All fish	-	-	0.2961

Salmon ranged in length from 4.4cm to 13.7cm (Fig. 4.2). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 60%, 39% and 1% (one individual) of the total salmon catch respectively. Mean salmon L1 and L2 were 4.5cm and 7.6cm respectively (Appendix 2).

European eels ranged in length from 13.4cm to 34.6cm (Fig. 4.3).

Brown trout ranged in length from 4.5cm to 21.7cm (Fig. 4.4). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 50%, 19% and 31% of the total brown trout catch respectively. Mean brown trout L1 and L2 were 5.8cm and 15.2cm respectively (Appendix 1). This indicates a relatively slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

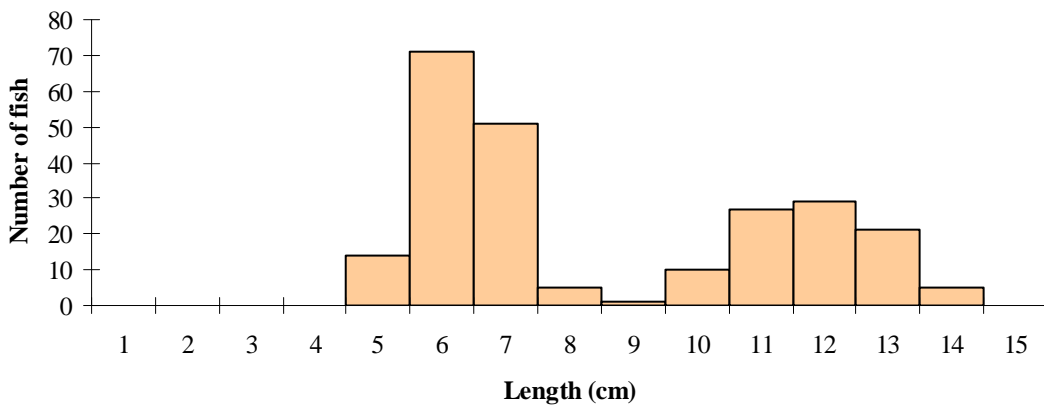


Fig. 4.2. Length frequency distribution of salmon in the Argideen River site, July 2009 (n = 234)

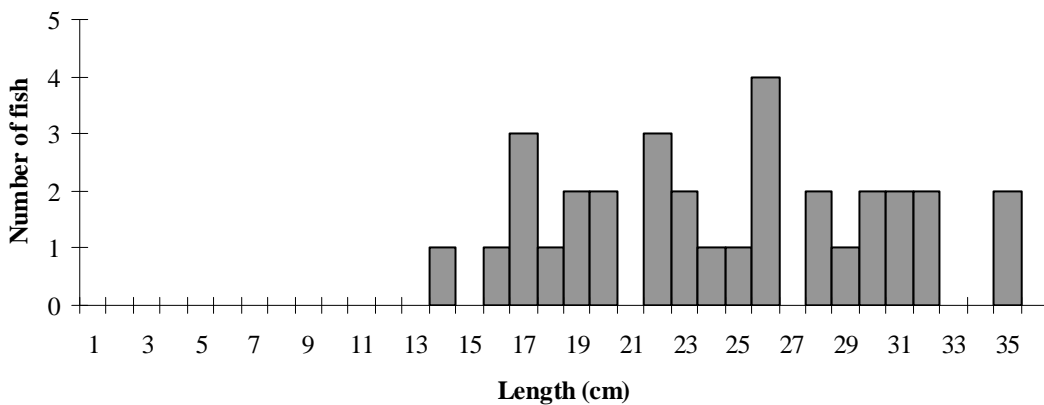


Fig. 4.3. Length frequency distribution of eels in the Argideen River site, July 2009 (n = 32)

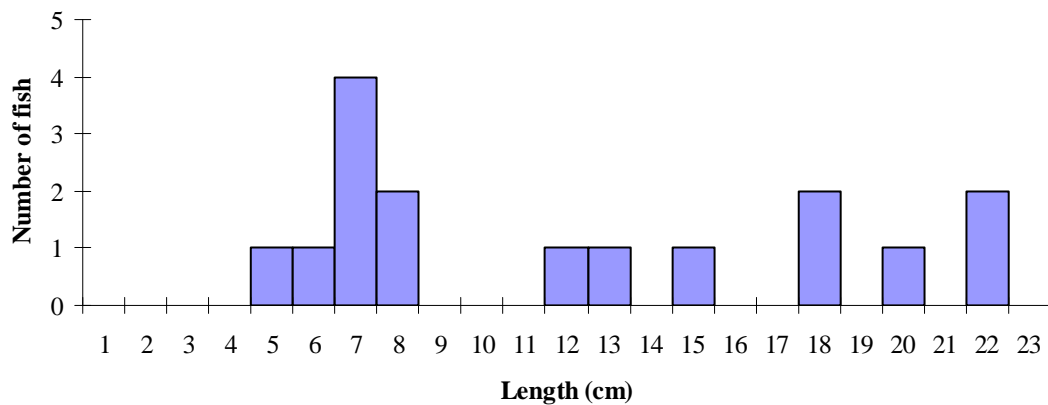


Fig. 4.4. Length frequency distribution of brown trout in the Argideen River site, July 2009 (n = 16)

4.1.2 The River Funshion



Plate 4.2. The River Funshion at Brackbaun Bridge on the border of Counties Limerick & Tipperary

The River Funshion (Plate 4.2) is a tributary of the River Blackwater (Munster). It rises in the Galty Mountains along the border of Counties Limerick and Tipperary and flows south-west towards Kildorrery, Co. Cork before eventually joining the River Blackwater a few kilometres south of Kilworth, Co. Cork. Brown trout fishing is popular along this river (O'Reilly, 2009).

The survey site was located upstream of Brackbaun Bridge, several kilometres north-east of Mitchelstown (Fig. 4.5). Three electric-fishing passes were conducted using three bank-based electric-fishing units on the 22nd of July 2009 along a 45m length of channel. The mean wetted width of the surveyed stretch was 9.0m and the mean depth was 22.0cm. Riffle completely dominated the channel, whilst the substrate was composed of mainly cobble. A total wetted area of 405m² was surveyed.

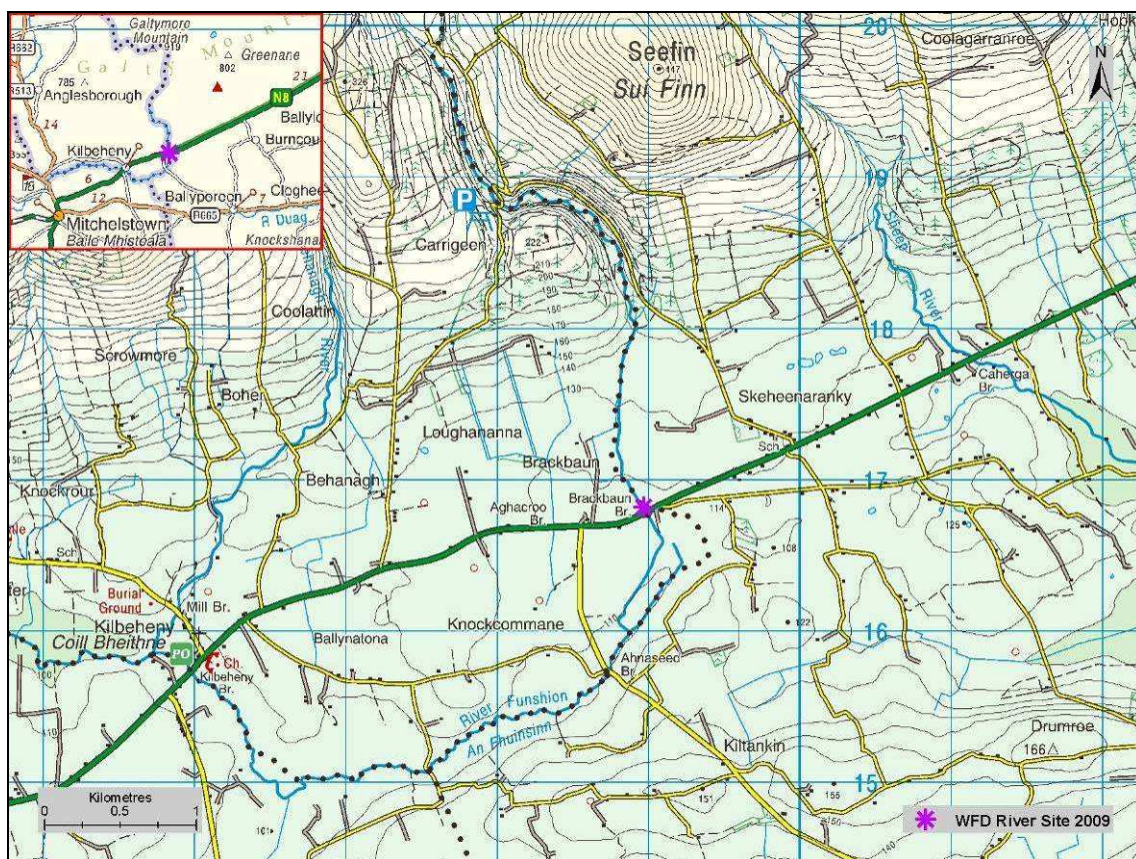


Fig. 4.5. Location of the River Funshion surveillance monitoring site

Two fish species were captured in the River Funshion site. Brown trout was the most abundant species, followed by salmon (Table 4.2).

Table 4.2. Density of fish (no./m²), Funshion River site (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
<i>Salmo trutta</i>	Brown trout	0.0691	0.0420	0.1111
<i>Salmo salar</i>	Salmon	0.0198	0.0593	0.0790
All fish	All fish	-	-	0.1901

Brown trout ranged in length from 4.2cm to 19.1cm (Fig. 4.6). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 68%, 29%, 1%, and 1% of the total brown trout catch respectively. Mean brown trout L1 and L2 were 5.8cm and 15.2cm respectively, indicating a slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

Salmon ranged in length from 4.0cm to 13.5cm (Fig. 4.7). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 24%, 73% and 3% of the total salmon catch respectively. Mean salmon L1 and L2 were 5.2cm and 10.0cm respectively (Appendix 2).

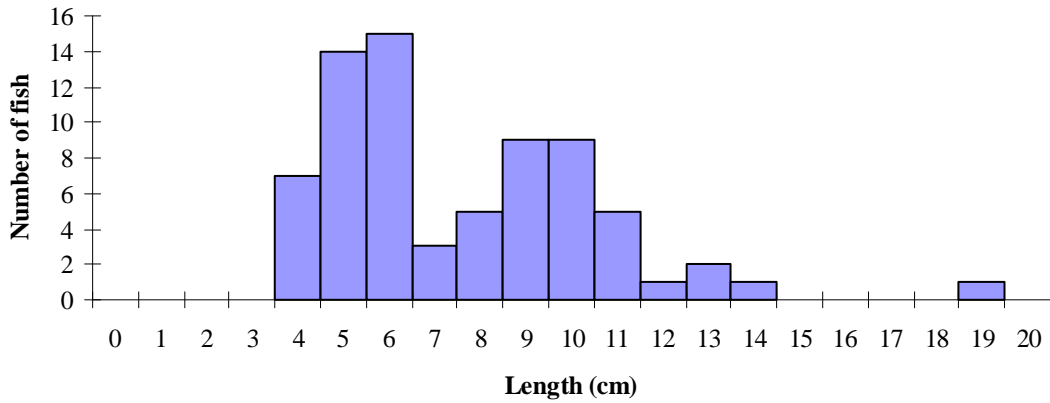


Fig. 4.6. Length frequency distribution of brown trout in the River Funshion site, July 2009 (n = 72)

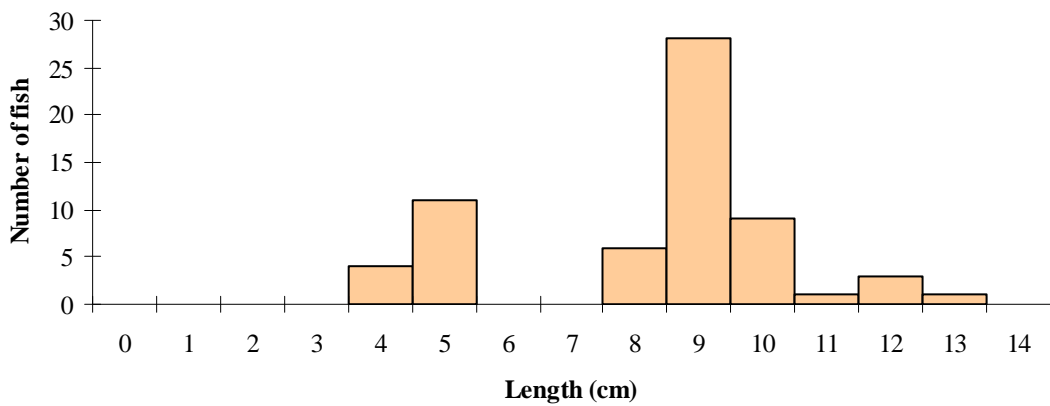


Fig. 4.7. Length frequency distribution of salmon in the River Funshion site, July 2009 (n = 63)

4.2. Boat sites

4.2.1 *The Awbeg River (Buttevant)*



Plate 4.3. The Awbeg River at Kilcummer Bridge near Castletownroche, Co. Cork

The Awbeg River (Plate 4.3) is a tributary of the River Blackwater (Munster). It rises west of the Ballyhoura Mountains in north Co. Cork and flows in a south-eastwardly direction through Buttevant and Doneraile, before eventually joining the River Blackwater a few kilometres south of Castletownroche, Co. Cork. Brown trout fishing is popular along this river, although their growth rates have been noted as slow due to relatively low average water temperatures (O'Reilly, 2009). This site is located within the Blackwater River (Cork/Waterford) SAC, further details of which can be found in section 4.2.3 of this report.

The survey site was located downstream of Kilcummer Bridge, approximately 0.5km north of its confluence with the Munster Blackwater (Fig. 4.8). One electric-fishing pass was conducted using two boat-based electric-fishing units on the 8th of July 2009 along a 240m length of channel. The mean wetted width of the stretch surveyed was 15.8m and the mean depth was 46.0cm. The habitat was made up entirely of riffle over a substrate of cobble and gravel, while various submerged and emergent macrophytes were scattered throughout. A total wetted area of 3,792m² was surveyed.



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

A total of five fish species were recorded in the Awbeg River site. Salmon was the most abundant species, followed by brown trout, European eel, dace and stone loach (Table 4.3).

Table 4.3. Density of fish (no./m²), Awbeg River site (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.0024	0.0208	0.0232
<i>Salmo trutta</i>	Brown trout	-	0.0116	0.0116
<i>Anguilla anguilla</i>	European eel	-	-	0.0018
<i>Leuciscus leuciscus</i>	Dace	-	-	0.0005
<i>Barbatula barbatula</i>	Stone loach	-	-	0.0003
All fish	All fish	-	-	0.0374

Salmon ranged in length from 5.0cm to 13.6cm (Fig. 4.9). Two age classes (0+ and 1+) were present, accounting for approximately 10% and 90% of the total salmon catch respectively. Mean salmon L1 was 4.6cm (Appendix 2).

Brown trout ranged in length from 12.0cm to 34.2cm (Fig. 4.10). Four age classes (1+, 2+, 3+ and 4+) were present, accounting for approximately 36%, 50%, 11%, and 2% of the total brown trout catch respectively. Mean brown trout L1, L2, L3 and L4 were 7.9cm, 14.6cm, 21.5cm and 31.7cm respectively, indicating a slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

European eels ranged in length from 11.9cm to 40.2cm.

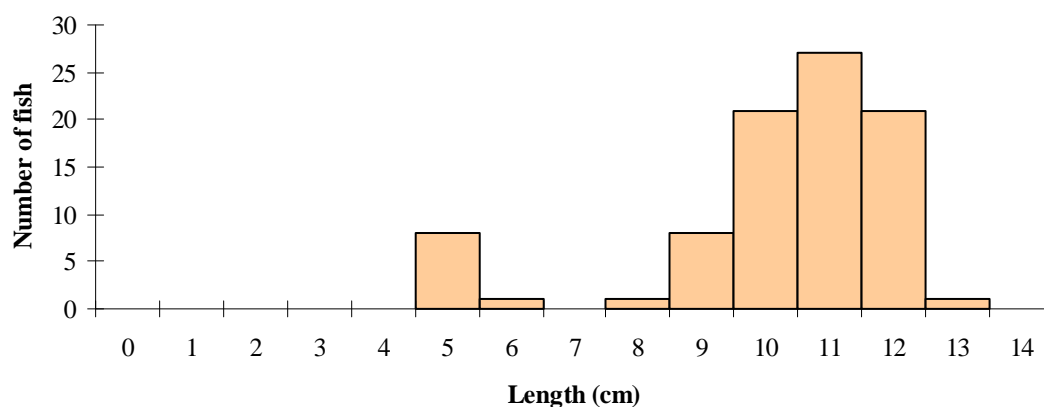


Fig. 4.9. Length frequency distribution of salmon in the Awbeg River site, July 2009 (n = 88)

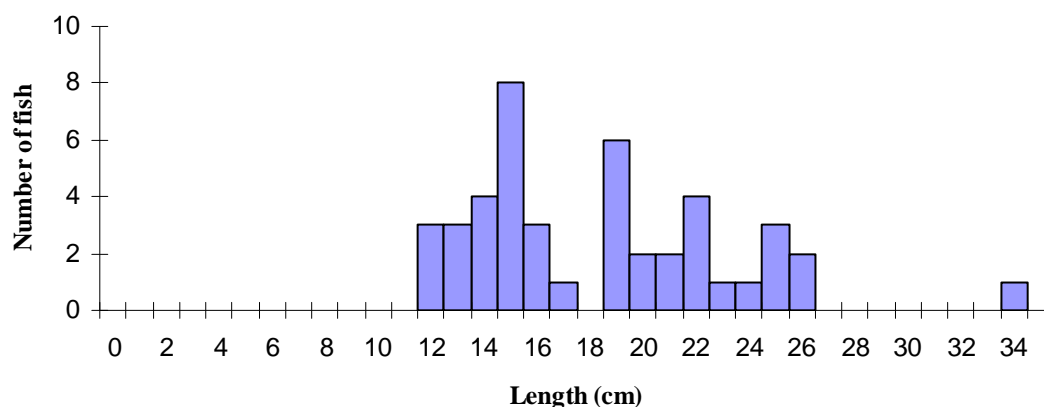


Fig. 4.10. Length frequency distribution of brown trout in the Awbeg River site, July 2009 (n = 44)

4.2.2 The Bandon River



Plate 4.4. The Bandon River, upstream of Murragh Bridge near Enniskean, Co. Cork

The Bandon River (Plate 4.4) rises in the Shehy Mountains approximately 8km west of Dunmanway in Co. Cork. It flows eastwards towards the town of Bandon before entering the sea at Kinsale Harbour. The Bandon River contains good healthy stocks of brown trout, sea trout and salmon, and as a result it is very popular among all types of angler (O'Reilly, 2009).

The survey site was located upstream of Murragh Bridge, approximately two kilometres east of Enniskean (Fig. 4.11). One electric-fishing pass was conducted using three boat-based electric-fishing units on the 28th of July 2009 along a 259m length of channel. The mean wetted width of the stretch surveyed was 21.4m and the mean depth was 57.0cm. Pools dominated the river channel, which had a mixed substrate of cobble and gravel. Macrophyte vegetation was abundant throughout the channel, with submerged and emergent species both present. A total wetted area of 5,543m² was surveyed.



Fig. 4.11. Location of the Bandon River surveillance monitoring site

A total of six fish species were recorded in the Bandon River site. Salmon was the most abundant species, followed by brown trout, European eel, stone loach, three-spined stickleback and juvenile lamprey (Table 4.4).

Table 4.4. Density of fish (no./m²), Bandon River site (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.0018	0.0013	0.0031
<i>Salmo trutta</i>	Brown trout	0.0013	-	0.0013
<i>Anguilla anguilla</i>	European eel	-	-	0.0002
<i>Barbatula barbatula</i>	Stone loach	-	-	0.0002
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	-	-	0.0002
	Lamprey sp.	-	-	0.0002
All fish	All fish	-	-	0.0051

Salmon ranged in length from 5.5cm to 13.1cm (Fig. 4.12). Two age classes (0+ and 1+) were present, accounting for approximately 59% and 41 % of the total salmon catch respectively. Mean salmon L1 was 4.1cm (Appendix 2).

Brown trout ranged in length from 6.1cm to 8.6cm. All fish captured were aged 0+; therefore the brown trout growth rate in the Bandon River could not be classified.

Individual specimens of lamprey (10.5cm), three-spined stickleback (5.1cm) and European eel (27.0cm) were also recorded.

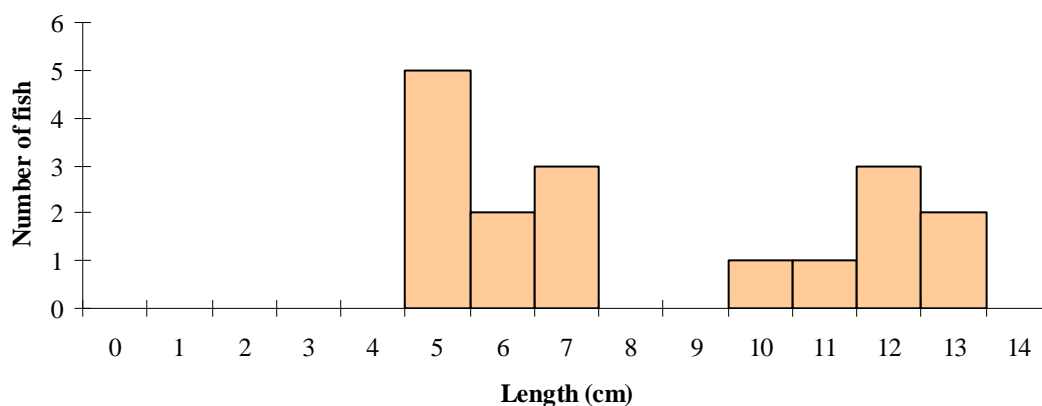


Fig. 4.12. Length frequency distribution of salmon in the Bandon River site, July 2009 (n = 17)

4.2.3 The River Blackwater (Killavullen Bridge)



Plate 4.5. The River Blackwater, upstream of the bridge in Killavullen, Co. Cork

The River Blackwater (Plate 4.5) is one of Munster's largest rivers. It rises in the Derrynasaggart Mountains and divides Co. Cork and Co. Kerry for many miles before entering Co. Cork near Rathmore. It flows eastwards through Mallow and Fermoy, widening out near Cappoquin, before heading south to enter the sea at Youghal Harbour. Fishing in the Blackwater is considered to be reasonably good for salmon, brown trout and sea trout. Good runs of salmon throughout the year provide good sport for anglers. Brown trout, however, have been noted as quite small within this river (O'Reilly, 2009).

The survey site, situated upstream of Killavullen Bridge (Fig. 4.13) is located within the Blackwater River (Cork/Waterford) SAC, which covers the entire length of the River Blackwater, including many of its upstream tributaries. This SAC was selected for a number of habitats listed in Annex I of the EU habitats Directive, including alluvial wet woodland and tidal mudflats. A number of Annex II listed species are also present, such as Atlantic salmon, river, brook and sea lamprey, twaite shad, crayfish and the freshwater pearl mussel (NPWS, 2006).

One electric-fishing pass was conducted using five boat-based electric-fishing units on the 7th of July 2009 along a 546m length of channel. This was a relatively wide stretch of channel, with a mean wetted width of 40.0m and a mean depth of 110.0cm. The habitat consisted mainly of glide and riffle over a substrate of cobble and gravel. Among the vegetation present was the non-native species Himalayan balsam, which is becoming an increasing threat to river bank habitats in Ireland. A total wetted area of 21,840m² was surveyed.

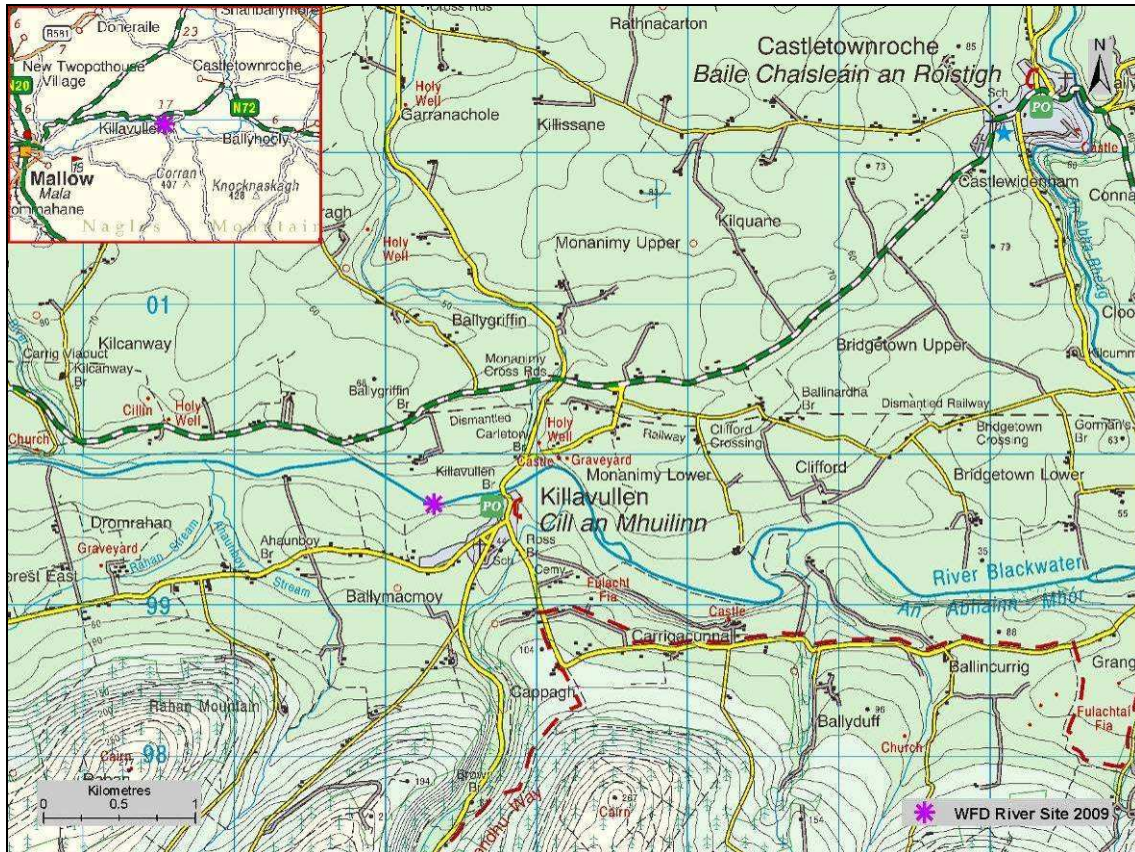


Fig. 4.13. Location of the River Blackwater (Killavullen Br.) surveillance monitoring site

A total of eight fish species were recorded in the River Blackwater at Killavullen Bridge. Dace was the most abundant species, followed by salmon, brown trout, gudgeon, minnow, stone loach, roach and European eel (Table 4.5).

Table 4.5. Density of fish (no./m²), Munster River Blackwater (Killavullen Bridge) (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
<i>Leuciscus leuciscus</i>	Dace	-	-	0.0028
<i>Salmo salar</i>	Salmon	0.0003	0.0020	0.0023
<i>Salmo trutta</i>	Brown trout	-	0.0017	0.0017
<i>Gobio gobio</i>	Gudgeon	-	-	0.0004
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.0002
<i>Barbatula barbatula</i>	Stone loach	-	-	0.0001
<i>Rutilus rutilus</i>	Roach	-	-	0.0001
<i>Anguilla anguilla</i>	European eel	-	-	0.0000
All fish	All fish	-	-	0.0076

Dace ranged in length from 9.0cm to 25.0cm (Fig. 4.14). Six age classes (2+, 3+, 4+, 5+, 7+ and 8+) were present, with the majority of specimens belonging to the 3+ age class.

Salmon ranged in length from 5.0cm to 17.6cm (Fig.4.15). Two age classes (0+ and 1+) were present, accounting for approximately 14% and 86% of the total salmon catch respectively. Mean salmon L1 was 4.5cm (Appendix 2).

Brown trout ranged in length from 13.2cm to 38.1cm (Fig 4.16). Four age classes (1+, 2+, 3+ and 6+) were present, accounting for approximately 16%, 53%, 29% and 3% of the total brown trout catch respectively. Mean brown trout L1, L2, L3, L4, L5 and L6 were 6.9cm, 14.7cm, 21cm, 22.3cm, 29.5cm and 34.2cm respectively, indicating a slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

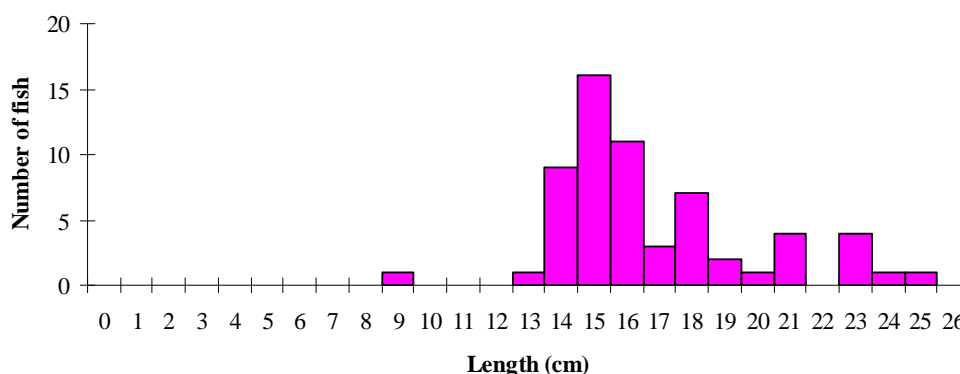


Fig. 4.14. Length frequency distribution of Dace in the River Blackwater (Killavullen Br.), July 2009 (n = 61)

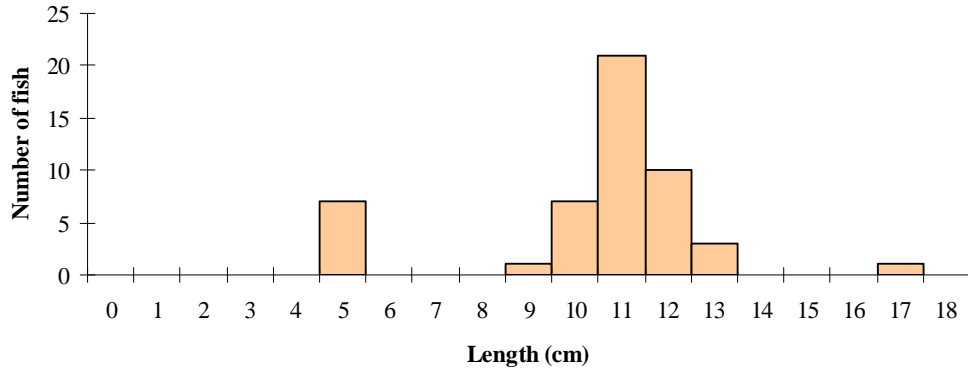


Fig. 4.15. Length frequency distribution of salmon in the River Blackwater (Killavullen Br.), July 2009 (n = 50)

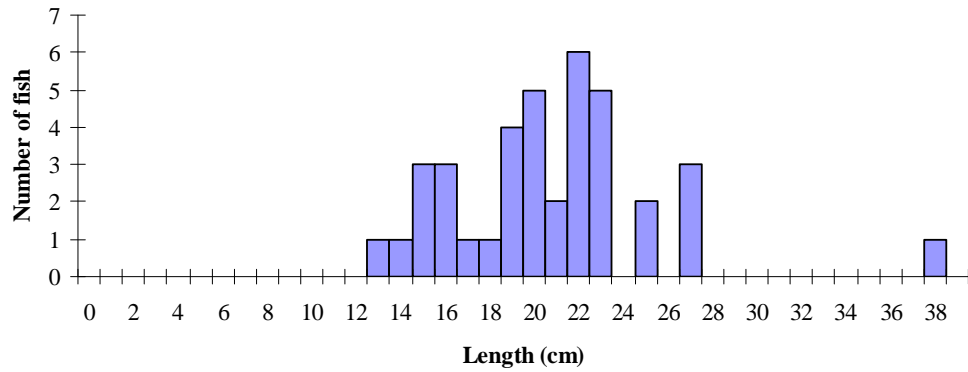


Fig. 4.16. Length frequency distribution of brown trout in the River Blackwater (Killavullen Br.), July 2009 (n = 38)

4.2.4 The River Blackwater (Nohaval Bridge)



Plate 4.6. The River Blackwater (Nohaval Br.), upstream of Rathmore, Co. Cork

A second site on the River Blackwater was surveyed, just upstream of Nohaval Bridge (Plate 4.6), approximately 2km north of Rathmore, Co. Cork (Fig. 4.17). This site is also located within the Blackwater River (Cork/Waterford) SAC. See Section 4.2.3 of this report for further details.

One electric-fishing pass was conducted using two boat-based electric-fishing units on the 23rd of July 2009 along a 178m length of channel. The mean wetted width of the stretch surveyed was 11.4m and the mean depth was 44.0cm. Riffle and pool dominated the habitat, whilst the most common substrate was cobble. The invasive plant, Himalayan balsam was also present at this site. A total wetted area of 2,029m² was surveyed.

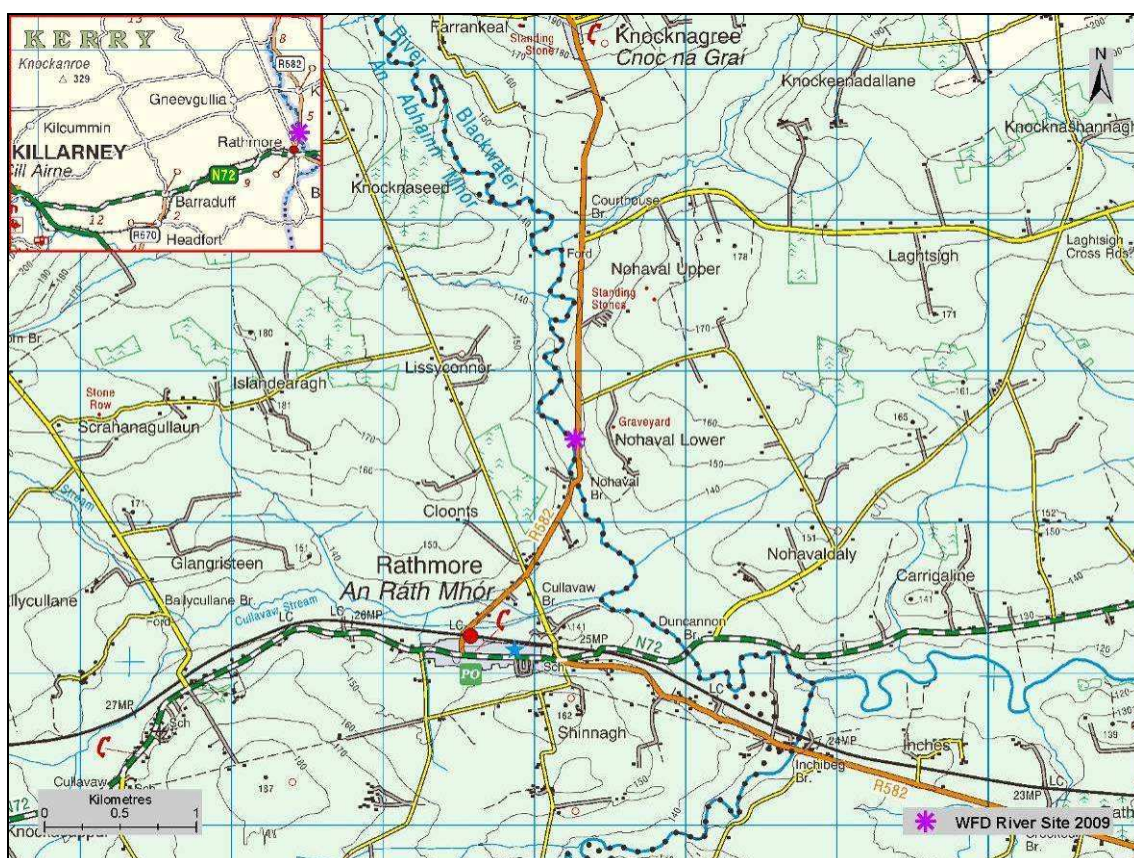


Fig. 4.17. Location of the River Blackwater (Nohaval Br.) surveillance monitoring site

A total of five fish species were recorded in the River Blackwater, Nohaval Bridge site. Brown trout was the most abundant species, followed by salmon, minnow, European eel and stone loach (Table 4.6).

Table 4.6. Density of fish (no./m²), River Blackwater (Nohaval Br. site) (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
<i>Salmo trutta</i>	Brown trout	-	0.0246	0.0246
<i>Salmo salar</i>	Salmon	0.0010	0.0059	0.0069
<i>Phoxinus phoxinus</i>	Minnow	-	-	0.0025
<i>Anguilla anguilla</i>	European eel	-	-	0.0010
<i>Barbatula barbatula</i>	Stone loach	-	-	0.0005
All fish	All fish	-	-	0.0355

Brown trout ranged in length from 12.3 to 26.4cm (Fig 4.18). Four age classes (1+, 2+, 3+ and 4+) were present, accounting for approximately 42%, 42%, 14% and 2% of the total brown trout catch respectively. Mean brown trout L1, L2, L3 and L4 were 7.3cm, 15.3cm, 20.2cm and 25.1cm

respectively, indicating a slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

Salmon ranged in length from 5.4cm to 11.9cm (Fig.4.19). Two age classes (0+ and 1+) were present, accounting for approximately 14% and 86% of the total salmon catch respectively. Mean salmon L1 was 4.6cm (Appendix 2).

Minnnow ranged in length from 5.8cm to 6.8cm. European eels ranged from 25.5cm to 31.8cm, and one 9.0cm stone loach was also recorded.

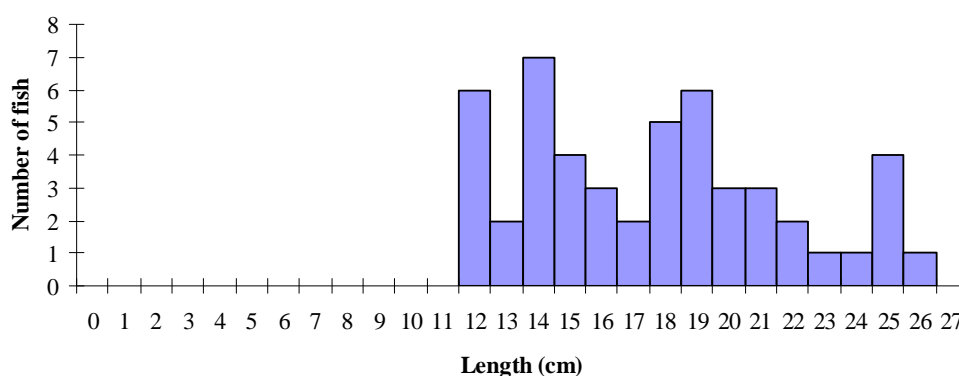


Fig. 4.18. Length frequency distribution of brown trout in the River Blackwater (Nohaval Br.), July 2009 (n = 50)

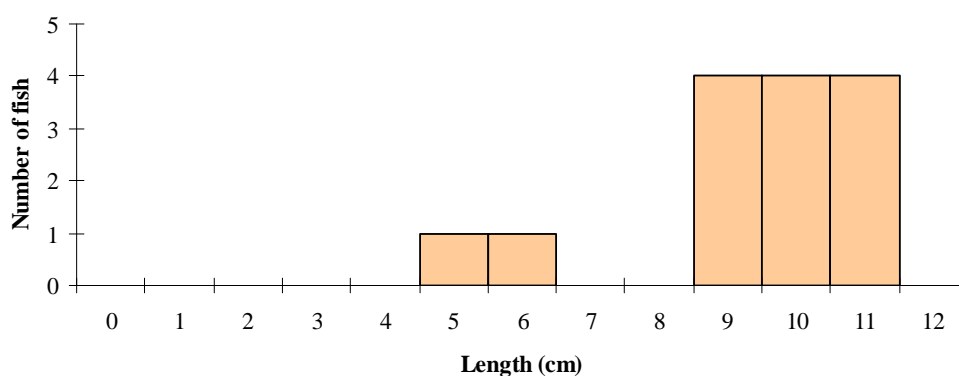


Fig. 4.19. Length frequency distribution of salmon in the River Blackwater (Nohaval Br.), July 2009 (n = 14)

4.2.5 The River Bride



Plate 4.7. The River Bride, east of Castlelyons, Co. Cork

The River Bride (Plate 4.7) is a large tributary of the River Blackwater (Munster). It rises in the Nagles Mountains of north Co. Cork and flows eastwards before joining the River Blackwater near Villierstown in Co. Waterford. It remains tidal for a relatively long stretch, from the River Blackwater confluence up as far as Tallowbridge. Salmon, brown trout and sea trout fishing are all popular on the River Bride (O'Reilly, 2009). The tidal reaches provide an important refuge for fish in low water, until higher levels allow passage further upstream (O'Reilly, 2009).

The survey site was located in Co. Cork, just upstream of a ford and footbridge, a few kilometres south-east of Castlelyons (Fig. 4.20). This site is also located within the Blackwater River (Cork/Waterford) SAC. For more details see Section 4.2.3 of this report. One electric-fishing pass was conducted using three boat-based electric-fishing units on the 24th of July 2009 along a 283m length of river channel. The mean wetted width of the stretch surveyed was 16.8m and the mean depth was 46.0cm. The channel was entirely composed of glide over a substrate of gravel and cobble. The invasive bank-side plants, Himalayan balsam and giant hogweed were both present at this site. A total wetted area of 4,754m² was surveyed.

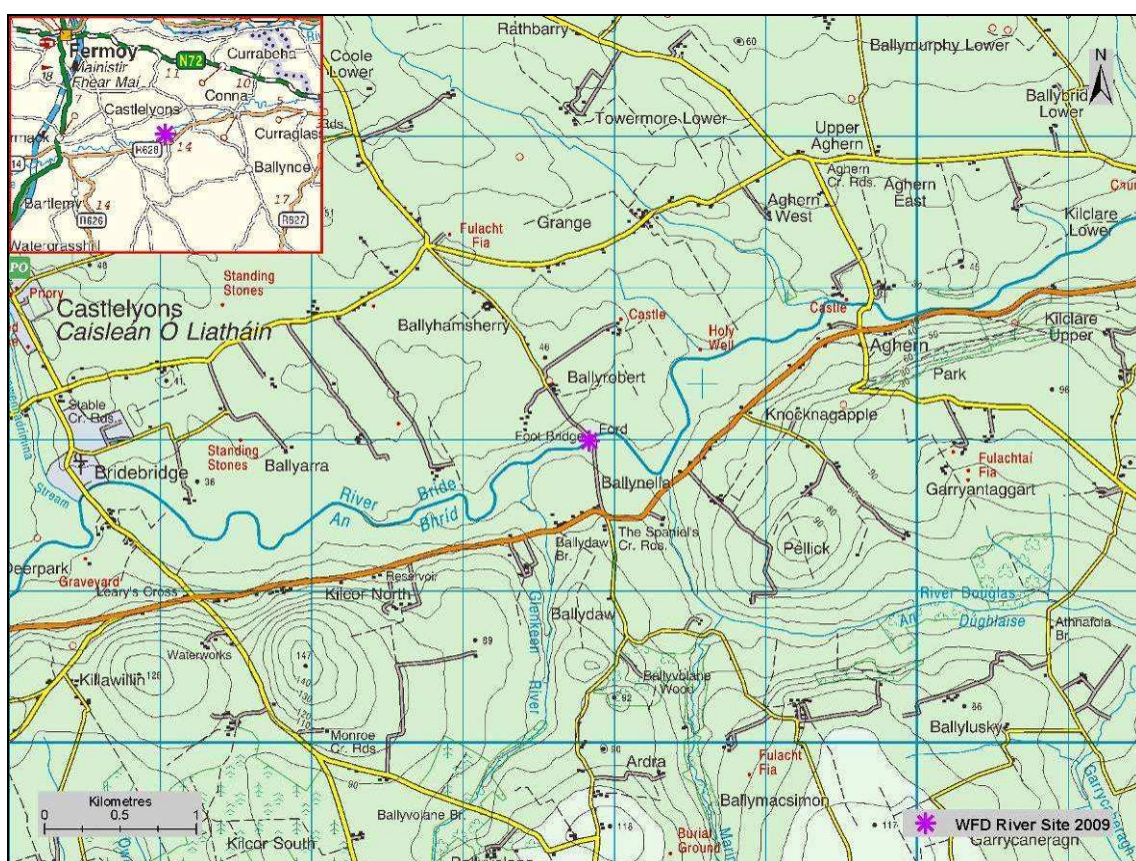


Fig. 4.20. Location of the River Bride surveillance monitoring site

A total of four fish species were recorded in the River Bride site, as well as sea trout. Salmon was the most abundant species, followed by brown trout, European eel and stone loach (Table 4.7).

Table 4.7. Density of fish (no./m²), River Bride site (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.0044	0.0143	0.0187
<i>Salmo trutta</i>	Brown trout	0.0004	0.0164	0.0168
<i>Anguilla anguilla</i>	European eel	-	-	0.0011
<i>Barbatula barbatula</i>	Stone loach	-	-	0.0006
<i>Salmo trutta</i>	Sea trout	-	-	0.0002
All fish	All fish	-	-	0.0374

Salmon ranged in length from 5.5cm to 14.1cm (Fig.4.21). Two age classes (0+ and 1+) were present, accounting for approximately 24% and 76% of the total salmon catch respectively. Mean salmon L1 was 5.9cm (Appendix 2).

Brown trout ranged in length from 7.3 to 30cm (Fig 4.22). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 3%, 64%, 30% and 4% of the total brown trout catch respectively. Mean brown trout L1, L2 and L3 were 7.7cm, 16.9cm and 22.6cm respectively, indicating a fast rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

European eels ranged in length from 15.3cm to 35.5cm. Stone loach ranged in length from 9.0cm to 10.0cm, and one sea trout was captured measuring 29.5cm and aged 2+.

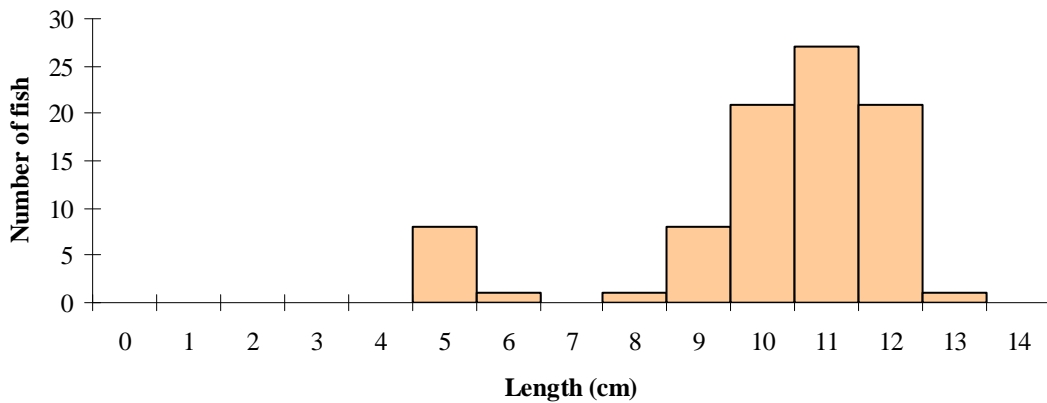


Fig. 4.21. Length frequency distribution of salmon in the River Bride site, July 2009 (n = 89)

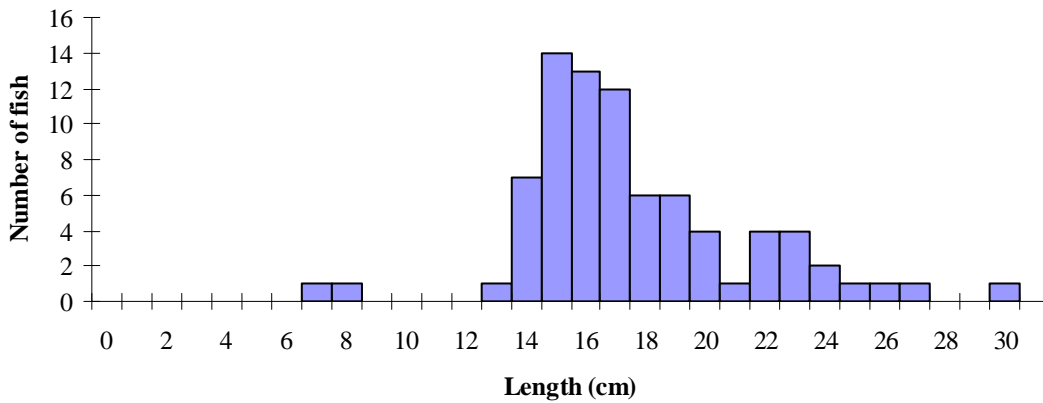


Fig. 4.22. Length frequency distribution of brown trout in the River Bride site, July 2009 (n = 80)

4.3 Community structure

4.3.1 Species richness and composition

A total of 10 fish species (sea trout are included as a separate variety of trout) were recorded within the seven SWRBD sites surveyed (Fig.4.23). Brown trout and salmon were the most common fish species, occurring at all sites within the region. This was followed by eels (86%), stone loach (86%), minnow (43%) three-spined stickleback (29%) and dace (29%). Gudgeon, lamprey, roach and sea trout were only recorded in one site each.

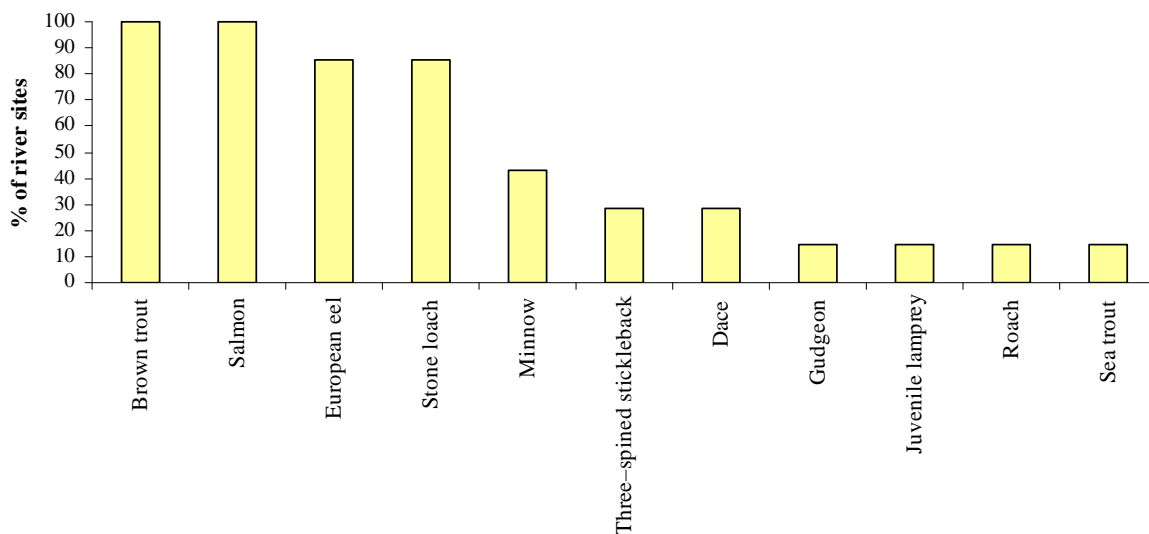


Fig. 4.23. Percentage of sites where each fish species was recorded in the SWRBD for WFD SM monitoring 2009

Species richness ranged from two species in the River Funshion to a maximum of eight species in the River Blackwater at Killavullen Bridge (Table 4.8). Kelly *et al.*, (2008) classified fish species in Ireland into three groups. Group 1 – native species (e.g. salmonids, three-spined stickleback, lamprey and eel) were present at all sites surveyed, Group 2 – non-native species that influence ecology (e.g. dace, roach, minnow, stoneloach) were recorded in all sites except for the Funshion River and Group 3 – non-native species that generally don't influence ecology (e.g. gudgeon) were recorded in only one site (River Blackwater at Killavullen Bridge).

Table 4.8. Species richness at each river site surveyed in the SWRBD, July to October 2009

Site	Species richness	No. native species (Group 1)	No. non-native species (Group 2)	No. non-native species (Group 3)
HAND-SET SITES				
Argideen	6	4	2	0
Funshion	2	2	0	0
BOAT SITES				
Blackwater (Killavullen Br.)	8	3	4	1
Bandon	6	5	1	0
Awbeg (Buttevant)	5	3	2	0
Blackwater (Nohaval Br.)	5	3	2	0
Bride	4	3	1	0

4.3.2 Species abundance and distribution

Abundance (minimum population density) and distribution maps for the most common fish species recorded within the SWRBD during 2009 are shown below in Figures 4.24 to 4.43. Recorded fish densities are generally much higher in surveys using hand-set electric-fishing gear than in those conducted with boat-based electric-fishing gear. This is primarily due to the tendency for younger trout and salmon to utilise shallow, riffle areas as nursery habitat and may also be due to the difference in sampling efficiency of the two methods. As such, population densities recorded for each species using the two methods are displayed on separate maps. For comparative purposes, densities from surveys conducted during 2008 are also displayed.

Brown trout were present at all seven of the sites surveyed. The highest density of brown trout fry (0+) amongst boat sites was in the Bandon River site (0.001 fish/m², Fig. 4.24), whilst the highest density of 1+ and older brown trout amongst boat sites was in the River Blackwater at Nohaval Bridge (0.02 fish/m², Fig. 4.26). The highest density of both brown trout fry (0+) and 1+ and older fish recorded amongst the hand-set sites was in the River Funshion site (0.07 fish/m² and 0.04 fish/m² respectively, Fig. 4.25 and Fig. 4.27). The River Bride site was the only river in which sea trout were recorded (0.0002 fish/m²).

Salmon were also recorded in all of the SWRBD sites surveyed. The highest density of 0+ salmon recorded amongst boat sites was in the River Bride site (0.004 fish/m², Fig. 4.28), whilst the highest density of 1+ and older salmon was in the Awbeg River site (0.02 fish/m², Fig. 4.30). The highest density of both salmon fry (0+) and parr (1+ and older) amongst hand-set sites were recorded in the Argideen River site with values of 0.15 fish/m² and 0.10 fish/m² respectively (Fig. 4.29 and Fig. 4.31).

European eels were also well distributed throughout the SWRBD, occurring in six sites (Fig. 4.32 and Fig. 4.33). They were only absent from the River Funshion site. Three-spined stickleback were only recorded in two sites in the southern end of the region, in the Bandon and Argideen Rivers (Fig. 4.36 and Fig. 4.37). Stone loach exhibited the same distribution as eels, only being absent from the River

Funshion site (Fig. 4.38 and Fig. 4.39). Minnow were recorded in three sites (Fig 4.40 and Fig. 4.41), the River Blackwater (Killavullen), River Blackwater (Nohaval) and Argideen River. Dace were recorded in the River Blackwater (Killavullen) and Awbeg River (Fig. 4.42 and Fig. 4.43). Gudgeon, Lamprey and Roach were only found in a single location, the River Blackwater at Killavullen Bridge.

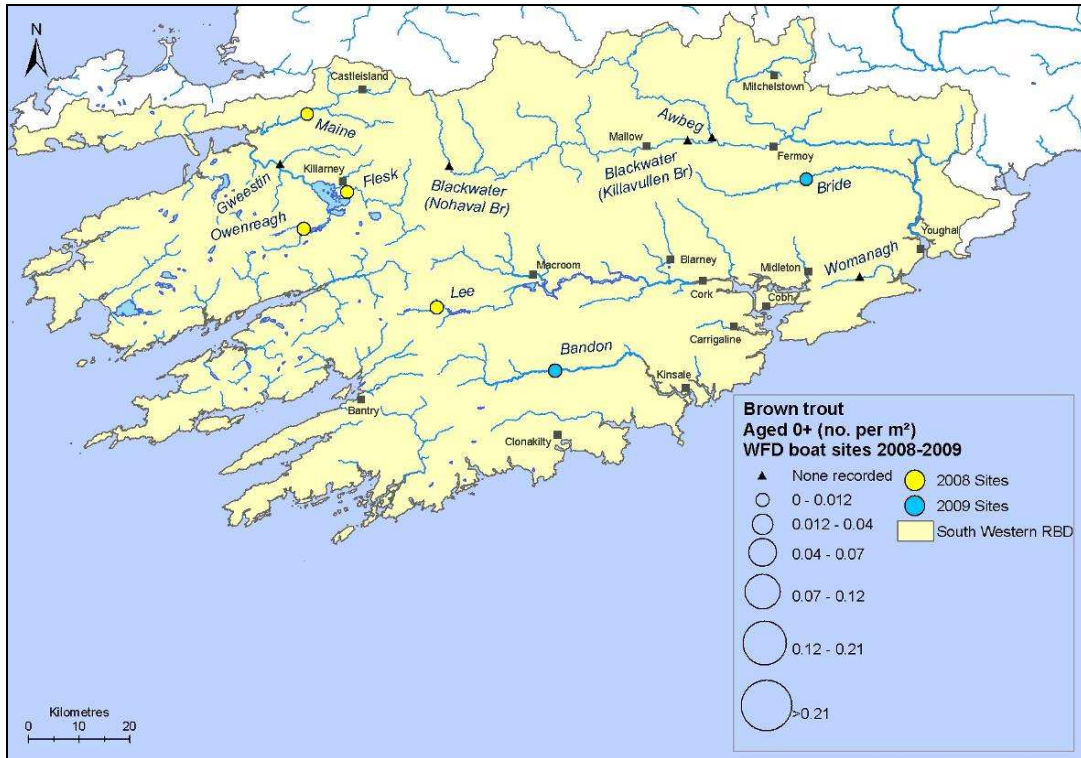


Fig. 4.24. Distribution of 0+ brown trout in SWRBD boat sites, WFD rivers 2008–2009

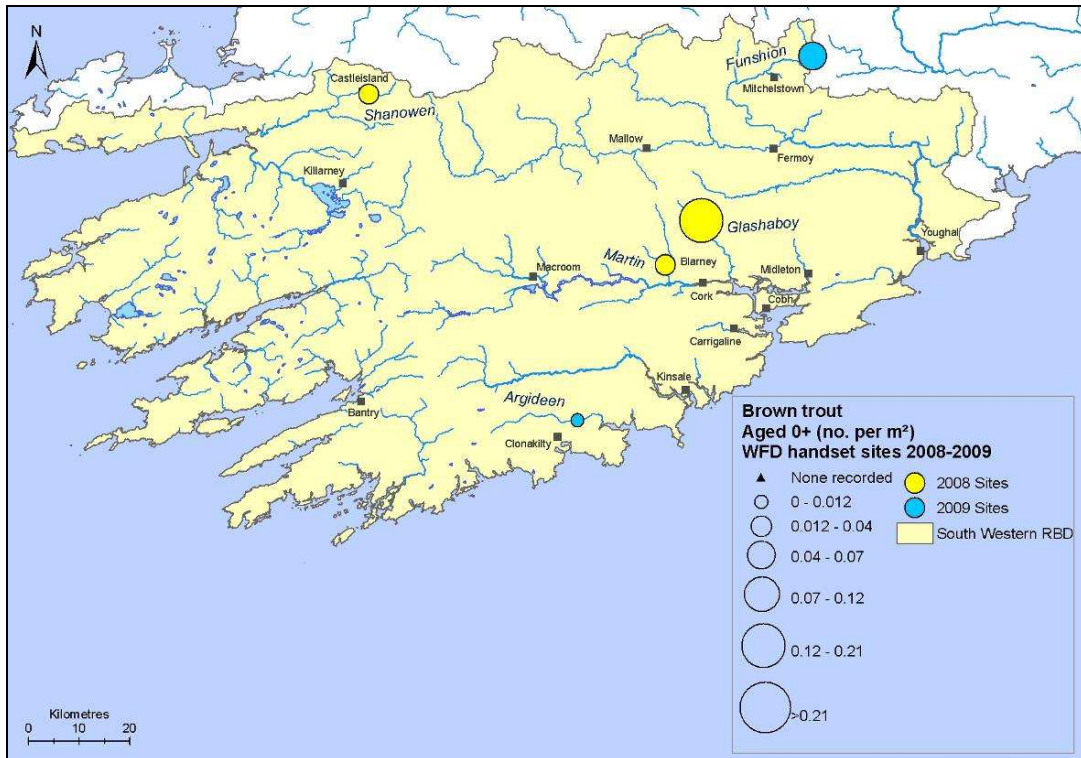


Fig. 4.25. Distribution of 0+ brown trout in SWRBD hand-set sites, WFD rivers 2008–2009

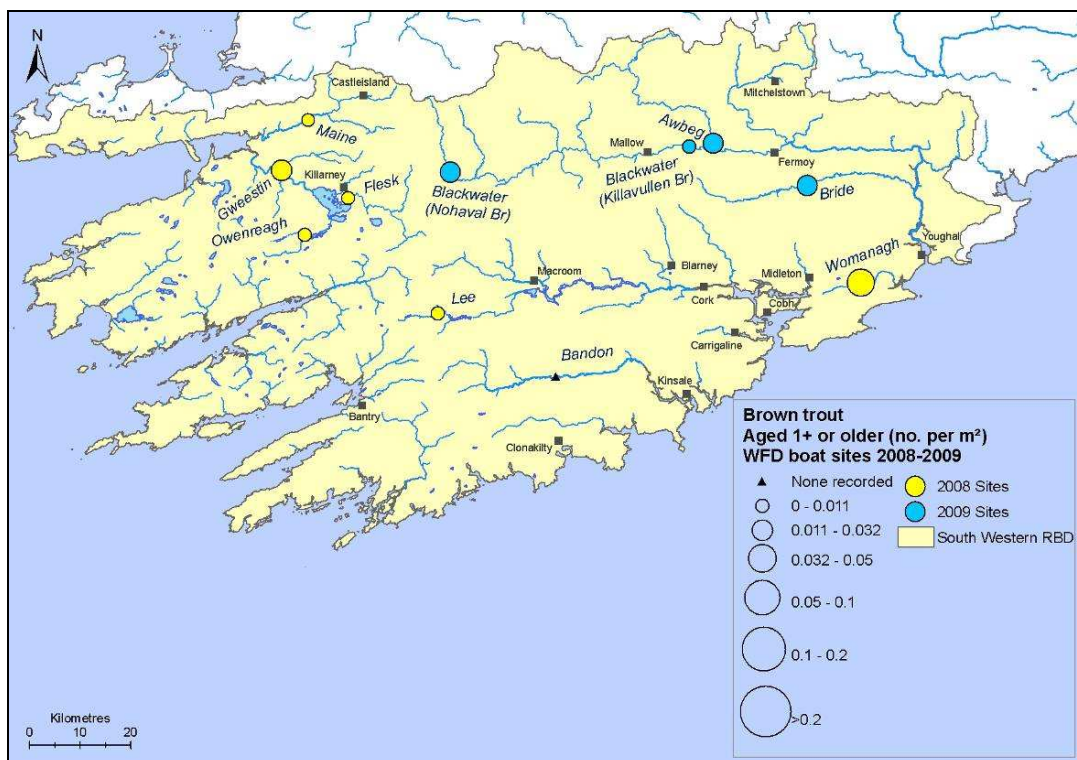


Fig. 4.26. Distribution of 1+ or older brown trout in SWRBD boat sites, WFD rivers 2008–2009

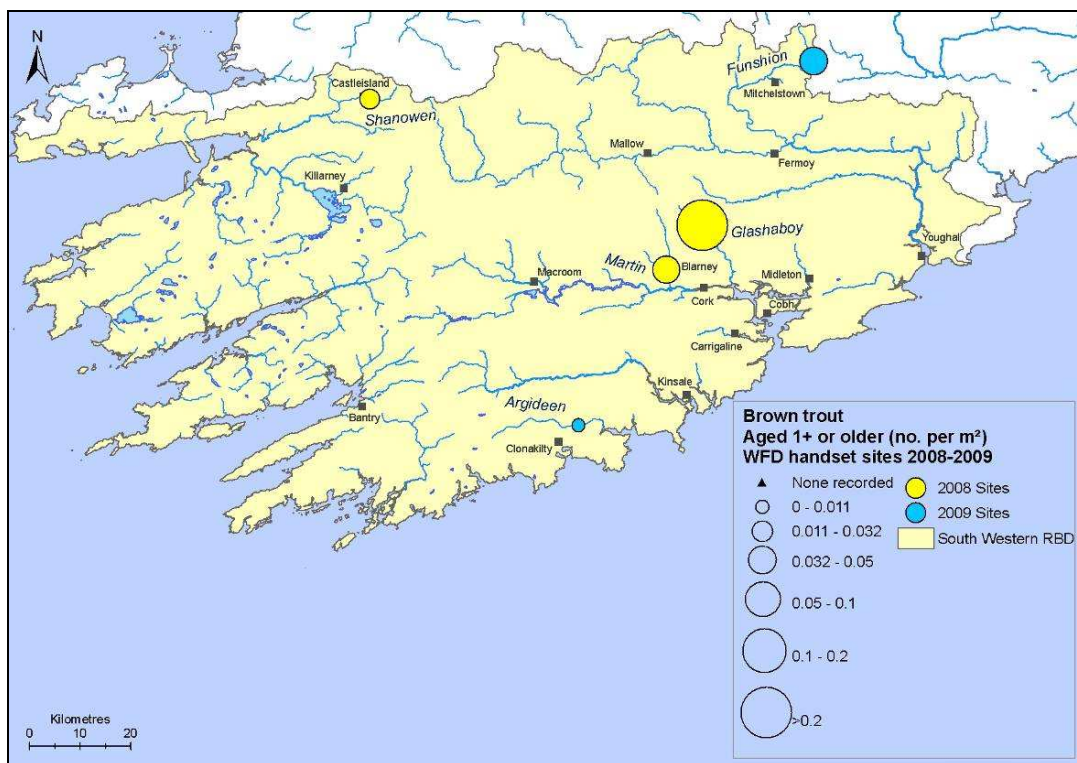


Fig. 4.27. Distribution of 1+ or older brown trout in SWRBD hand-set sites, WFD rivers 2008–2009

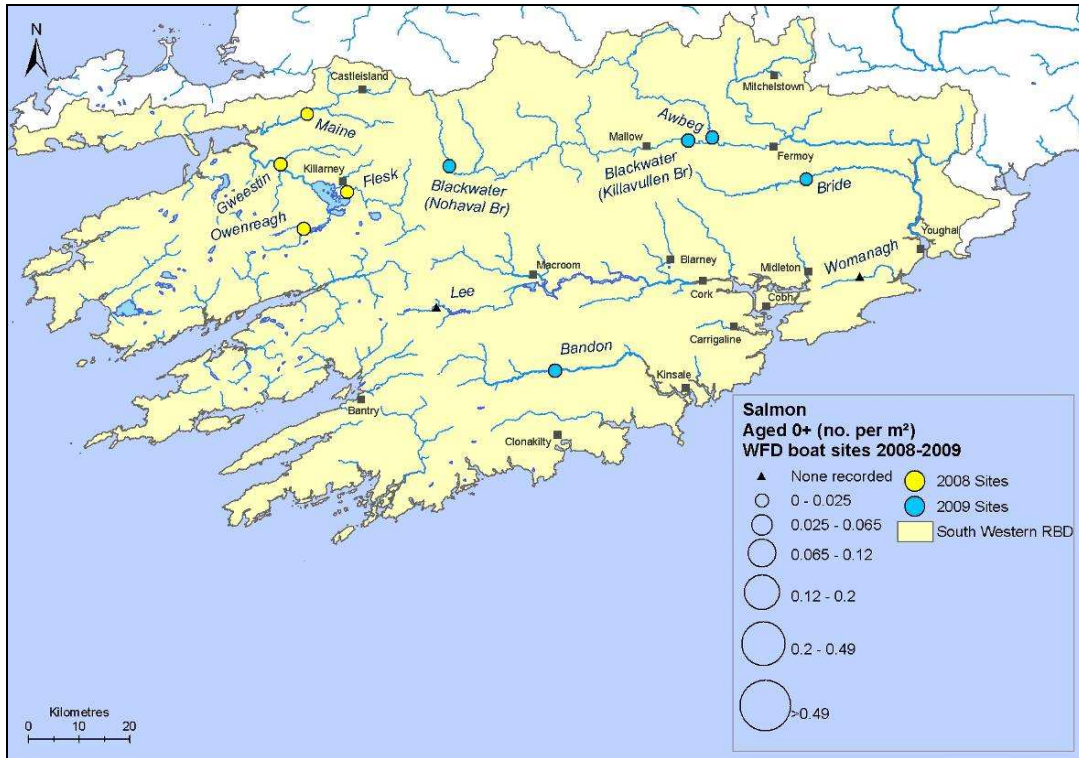


Fig. 4.28. Distribution of 0+ salmon in SWRBD boat sites, WFD rivers 2008–2009

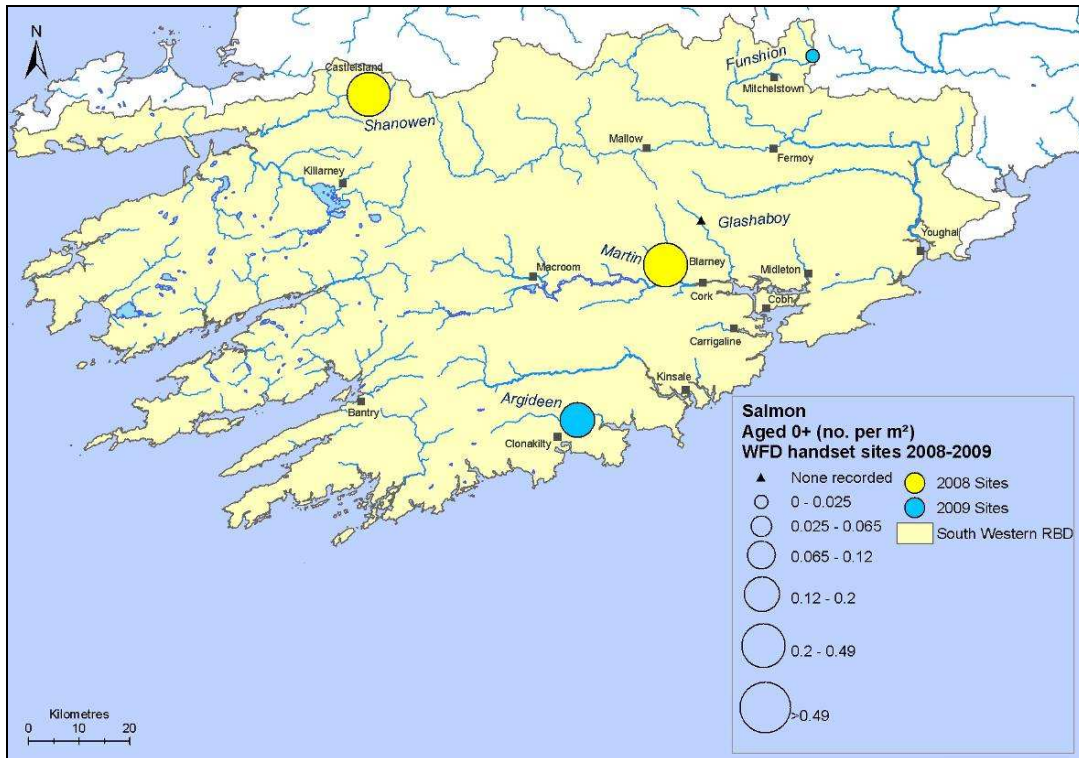


Fig. 4.29. Distribution of 0+ salmon in SWRBD hand-set sites, WFD rivers 2008–2009

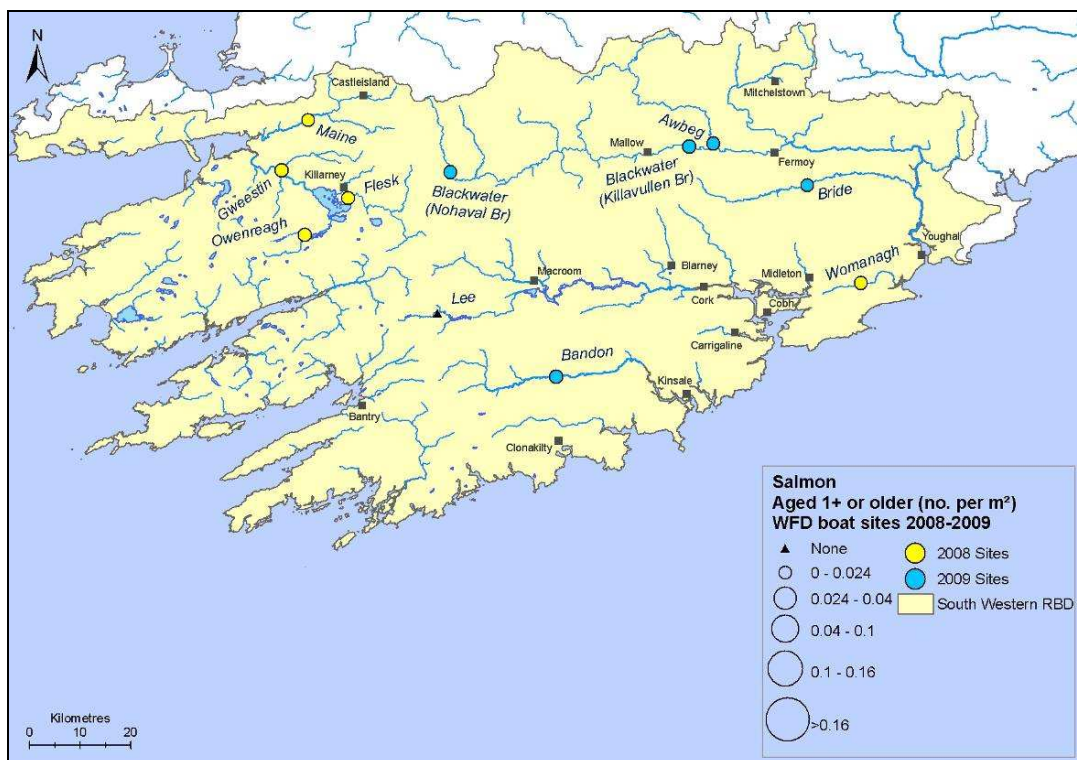


Fig. 4.30. Distribution of 1+ or older salmon in SWRBD boat sites, WFD rivers 2008–2009

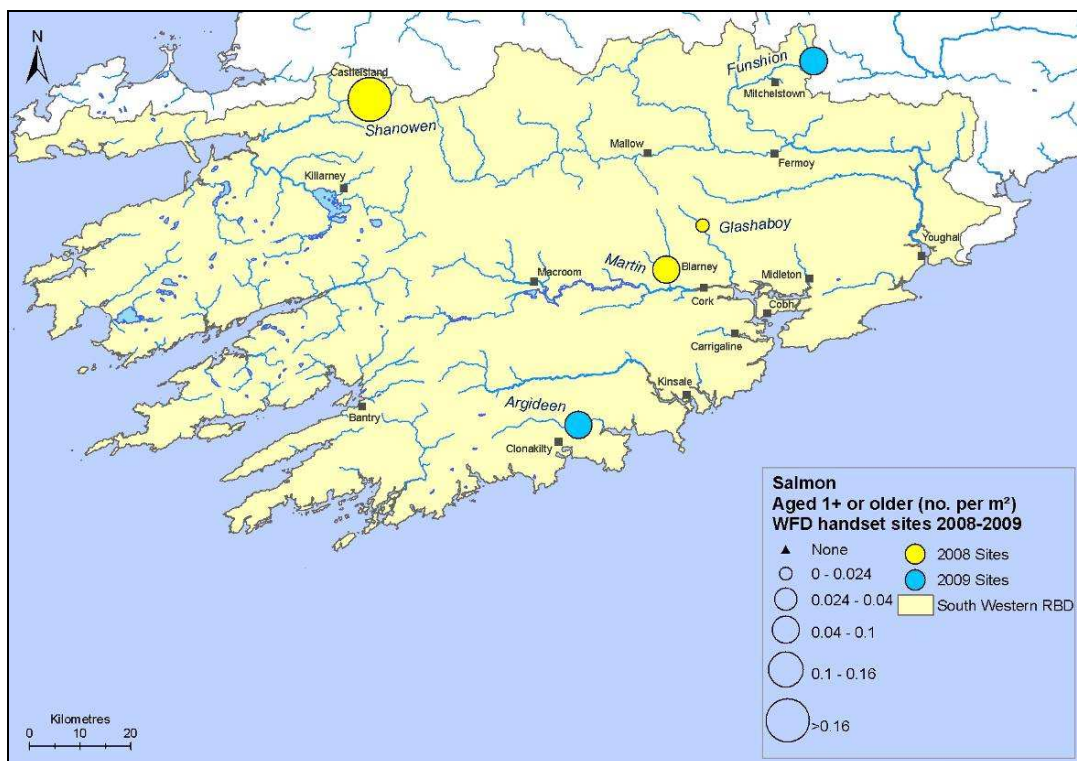


Fig. 4.31. Distribution of 1+ or older salmon in SWRBD hand-set sites, WFD rivers 2008–2009

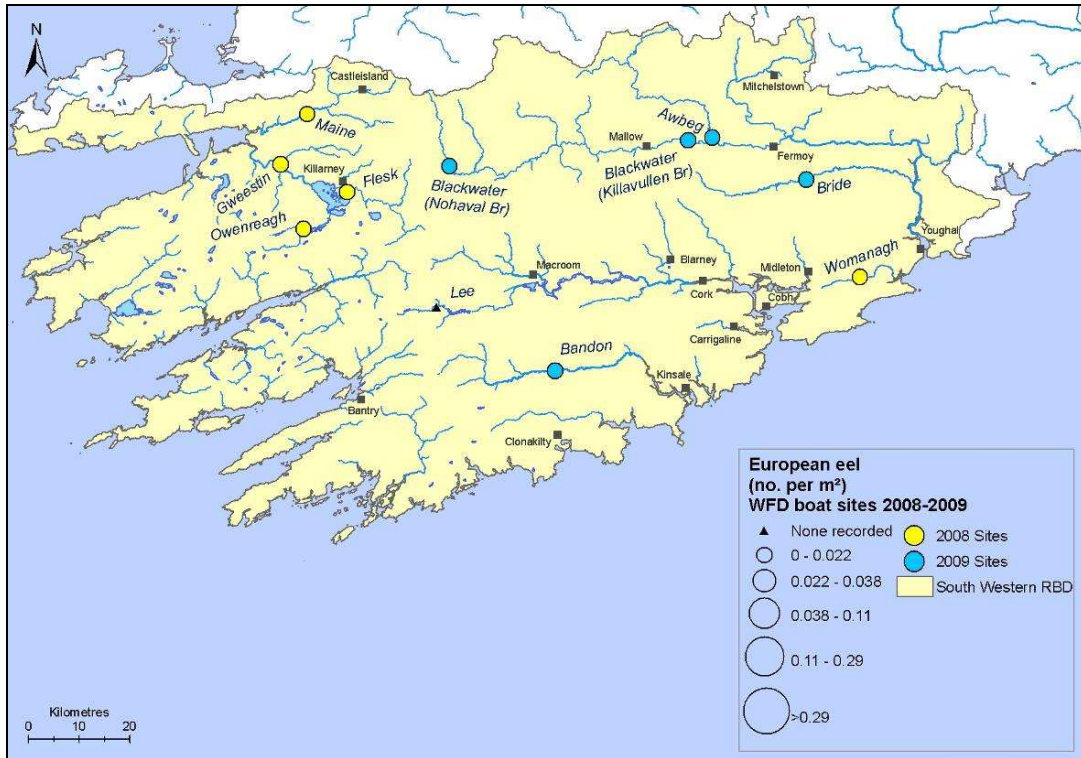


Fig. 4.32. Distribution of European eel in SWRBD boat sites, WFD rivers 2008–2009

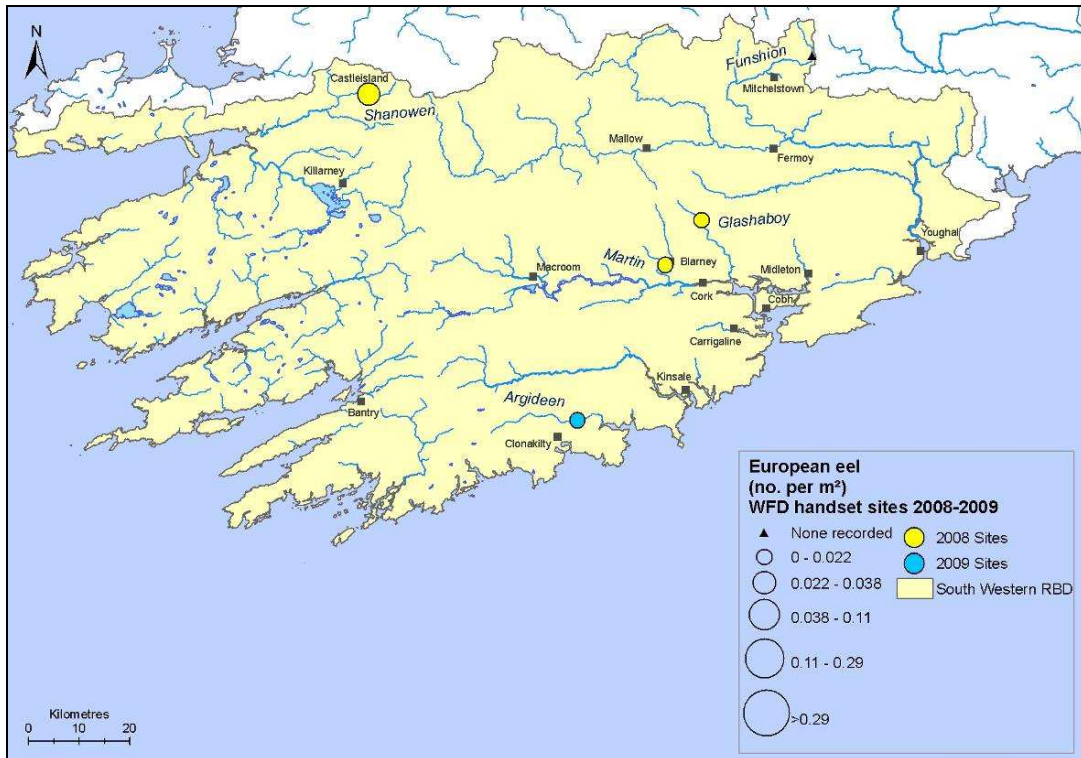


Fig. 4.33. Distribution of European eel in SWRBD hand-set sites, WFD rivers 2008–2009

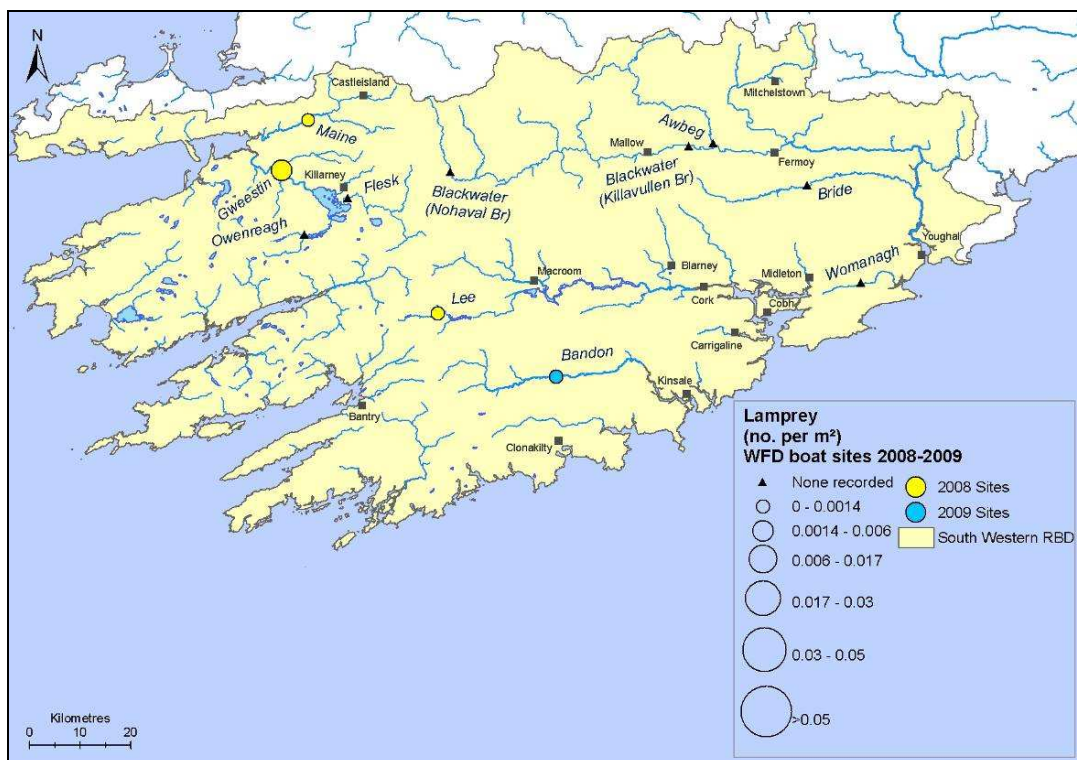


Fig. 4.34. Distribution of lamprey in SWRBD boat sites, WFD rivers 2008–2009

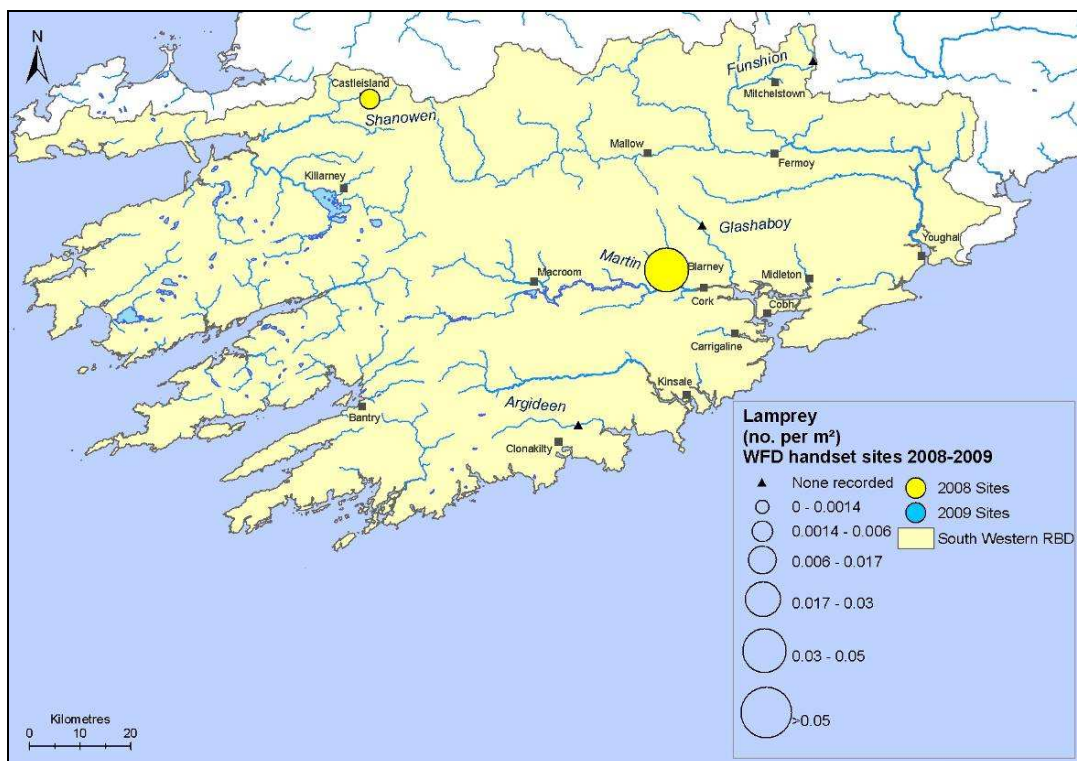


Fig. 4.35. Distribution of lamprey in SWRBD hand-set sites, WFD rivers 2008–2009

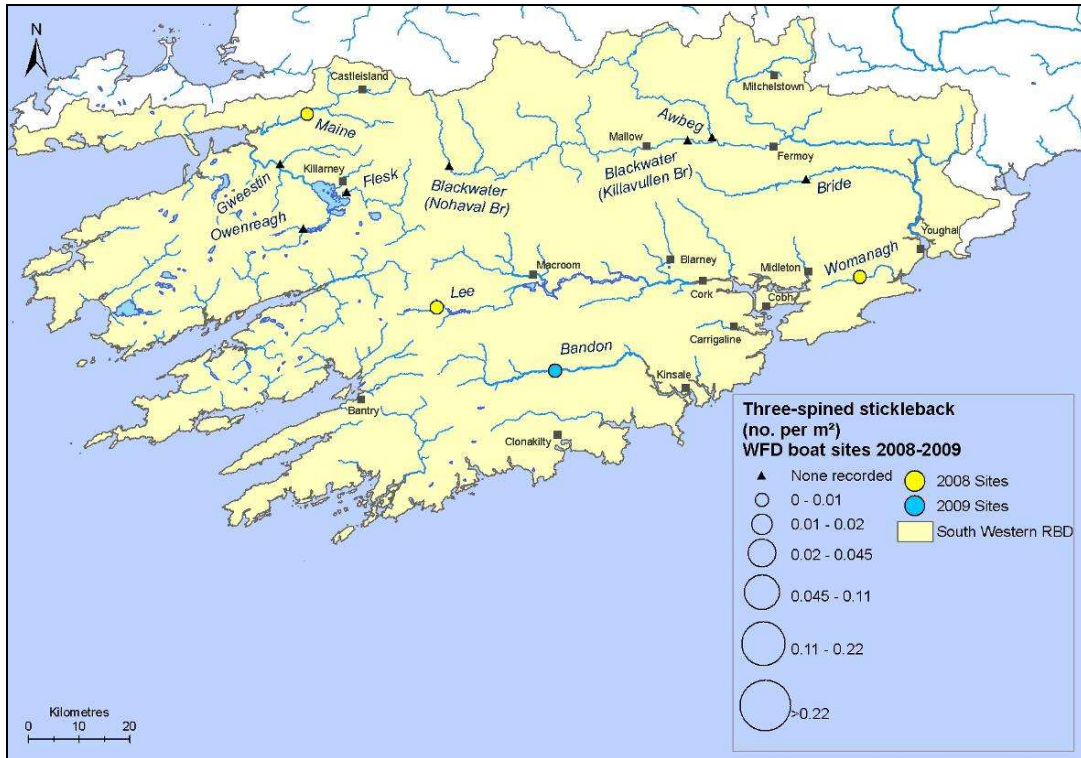


Fig. 4.36. Distribution of three-spined stickleback in SWRBD boat sites, WFD rivers 2008–2009

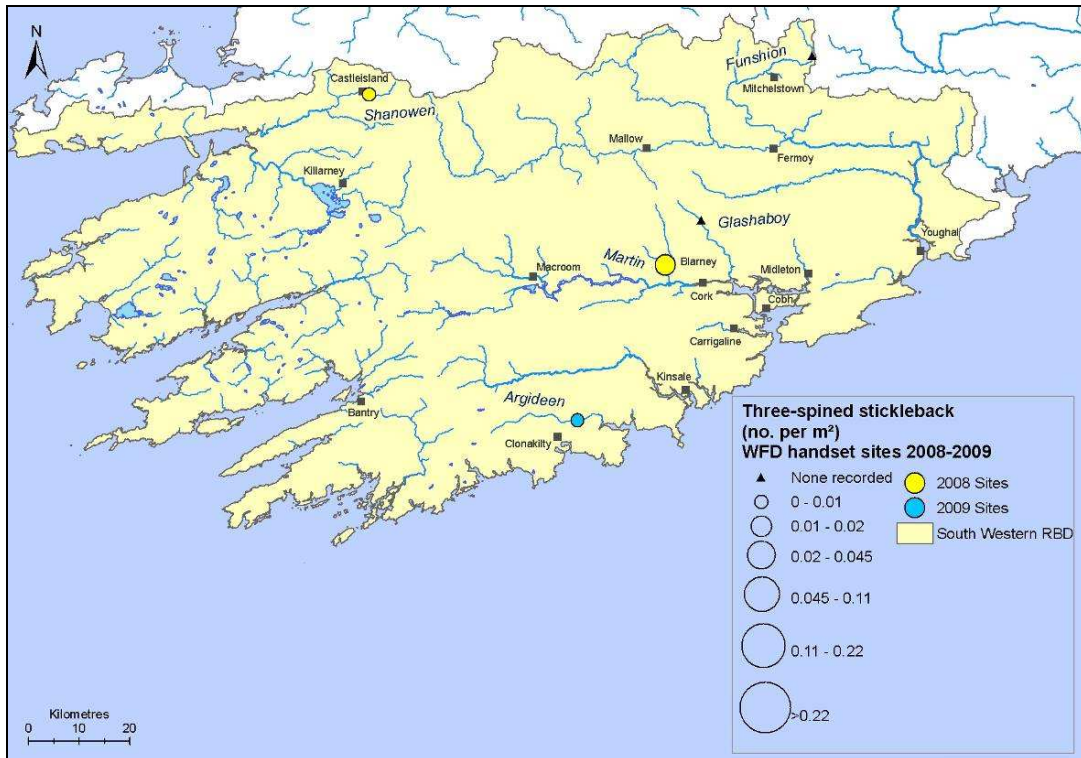


Fig. 4.37. Distribution of three-spined stickleback in SWRBD hand-set sites, WFD rivers 2008–2009

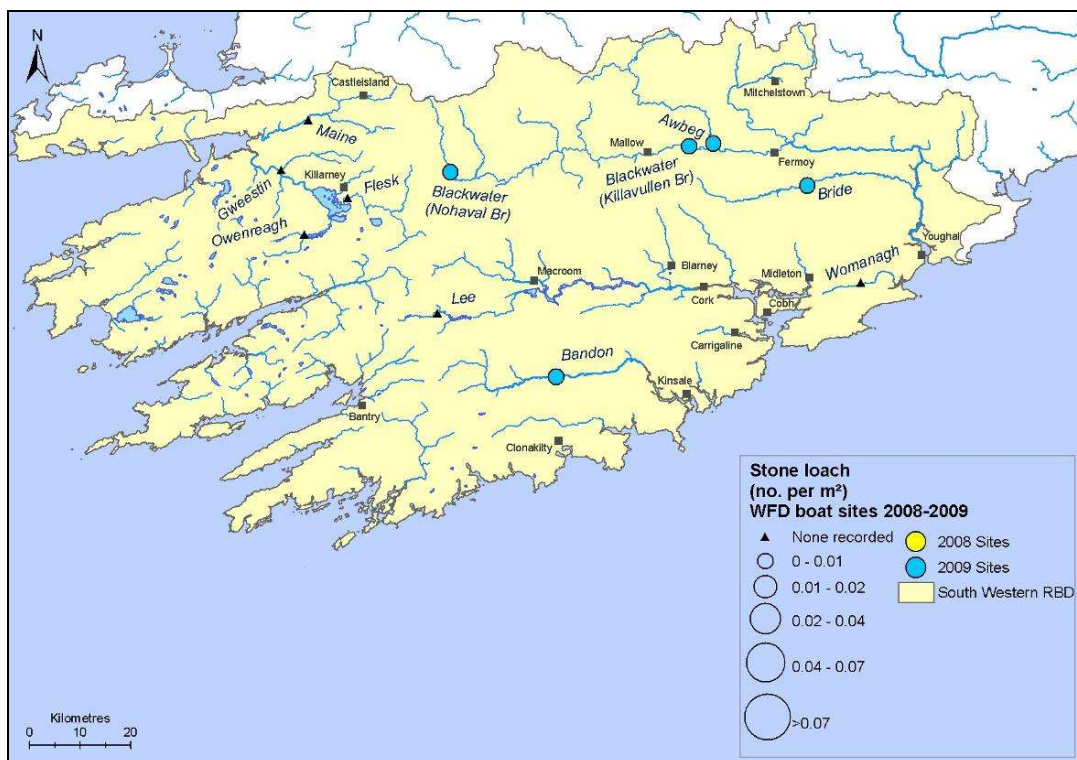


Fig. 4.38. Distribution of stone loach in SWRBD boat sites, WFD rivers 2008–2009

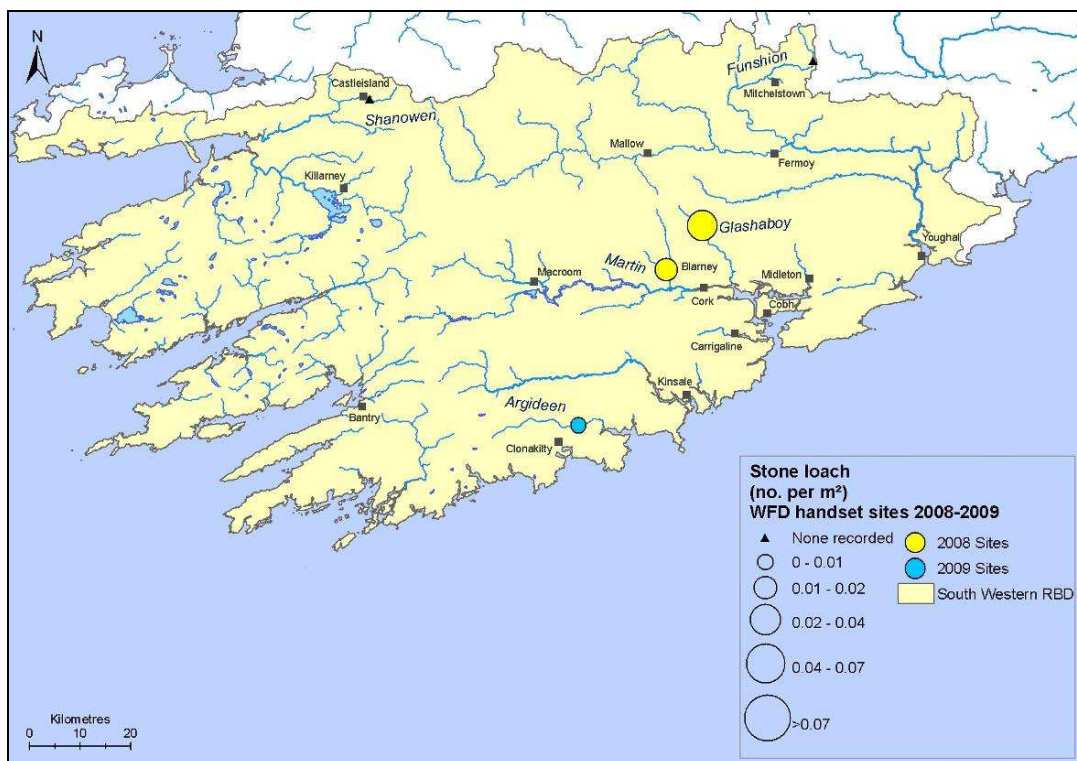


Fig. 4.39. Distribution of stone loach in SWRBD hand-set sites, WFD rivers 2008–2009

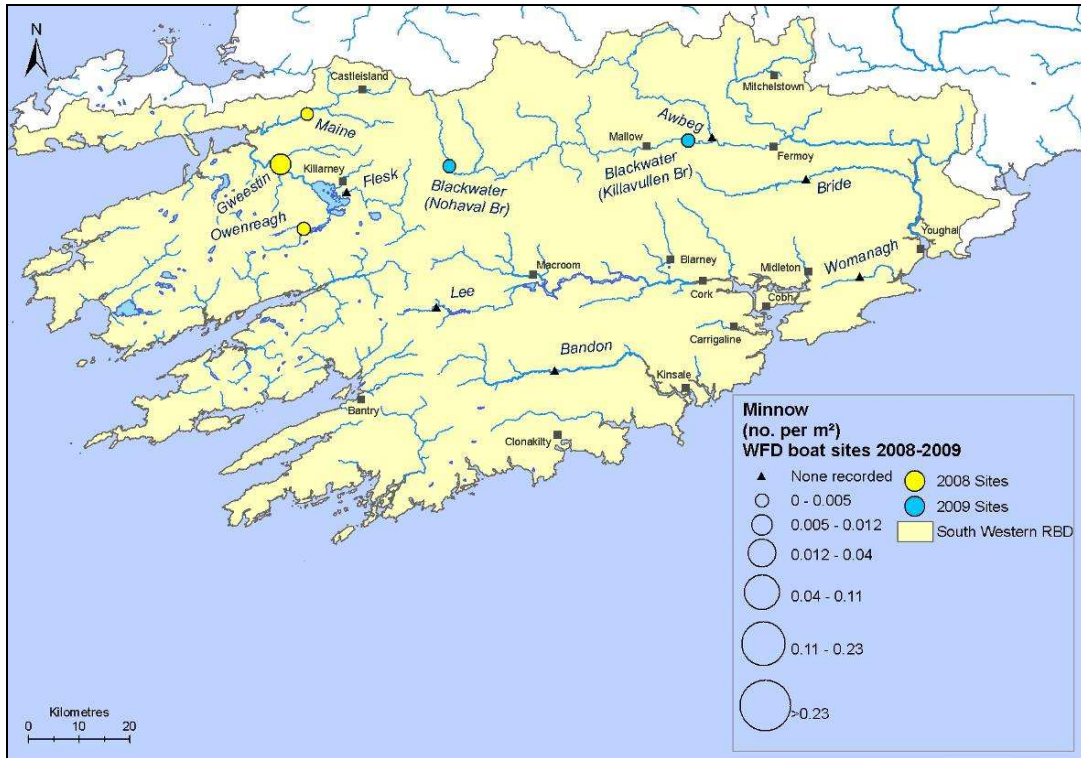


Fig. 4.40. Distribution of minnow in SWRBD boat sites, WFD rivers 2008–2009

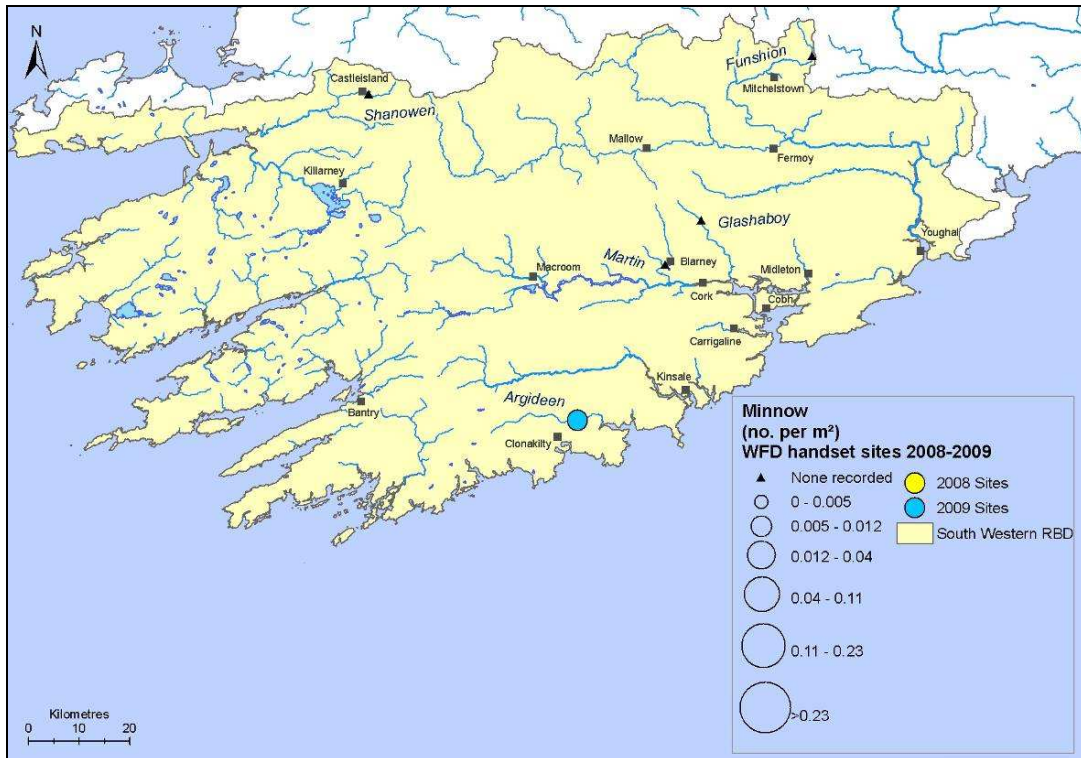


Fig. 4.41. Distribution of minnow in SWRBD hand-set sites, WFD rivers 2008–2009

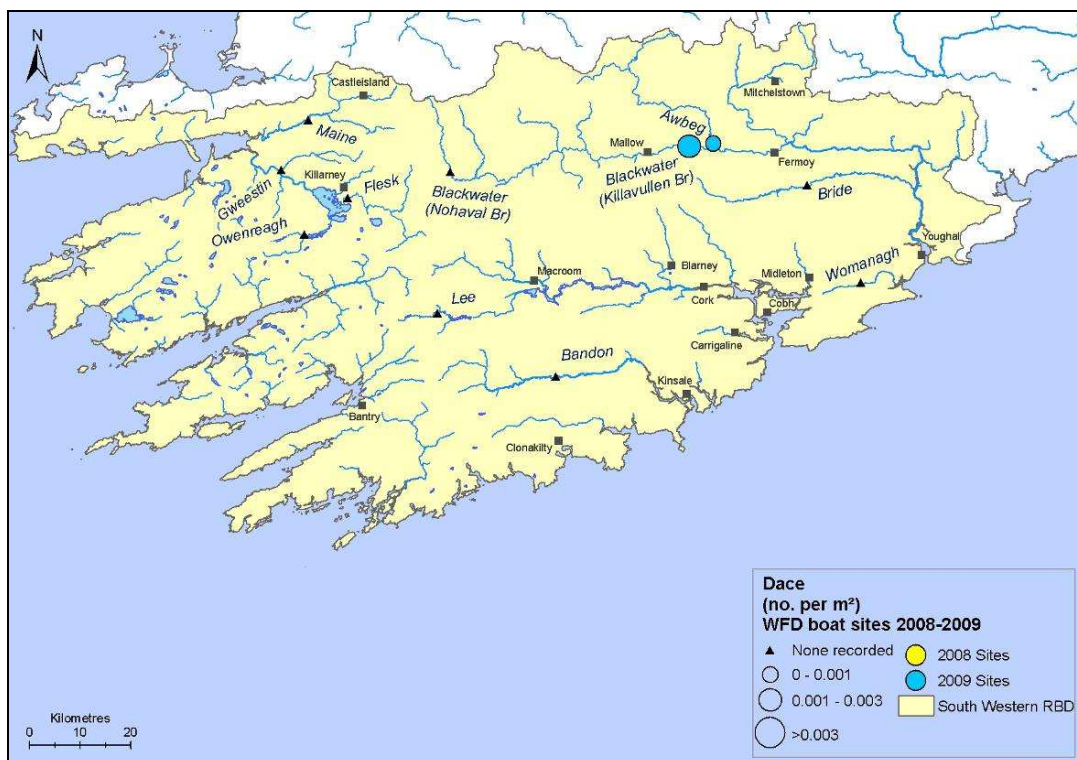


Fig. 4.42. Distribution of dace in SWRBD boat sites, WFD rivers 2008–2009

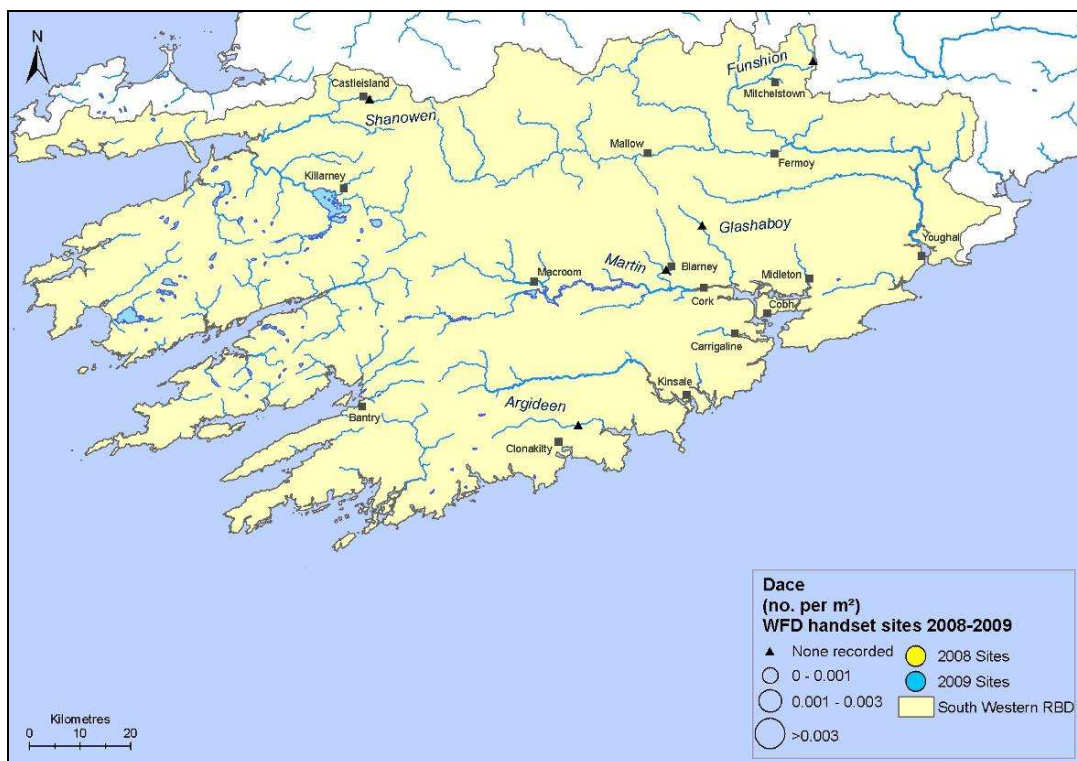


Fig. 4.43. Distribution of dace in SWRBD hand-set sites, WFD rivers 2008–2009

4.3.3 Age and growth of brown trout and salmon

Age and growth were determined for brown trout and salmon, which were the dominant fish species at most sites. Brown trout ages ranged from 0+ to 6+, with 0+ and 1+ being the dominant age classes at most sites. The largest brown trout (6+, length 38.1cm and weight 0.60kg) recorded was captured on the River Blackwater at Killavullen Bridge. Juvenile salmon were recorded in three age classes; 0+, 1+ and 2+, with the majority within the 1+ age category. The largest salmon recorded was captured in the River Bride, measuring 14.1cm in length.

Length-at-age analyses and growth curves are presented for brown trout (Fig. 4.44 and Appendix 1) and salmon (Fig. 4.45 and Appendix 2). The brown trout at each river site were assigned growth categories described by Kennedy and Fitzmaurice (1971), who examined the relationship between alkalinity and growth of trout in Irish streams and rivers. Growth was classified as very slow in the River Funshion, slow in the Argideen River, Awbeg River, River Blackwater (Killavullen) and River Blackwater (Nohaval) and fast on the River Bride.

The River Bride had the highest mean salmon L1. Data for mean salmon L2 were only available for the Argideen River and the River Funshion, which had the higher of the two (Fig. 4.45).

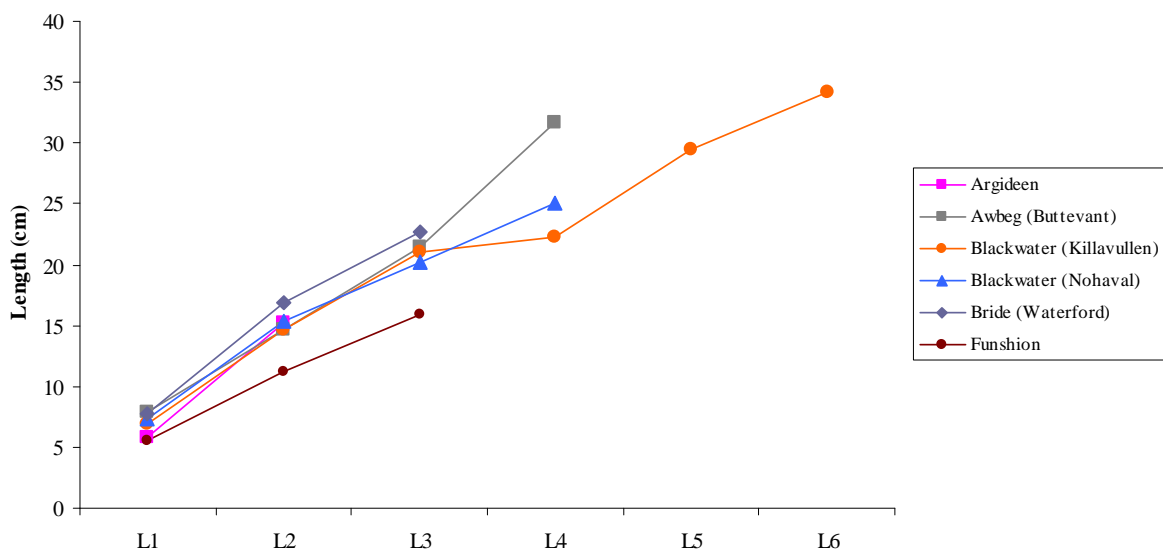


Fig. 4.44. Back calculated lengths for brown trout in each river site, WFD surveillance monitoring 2009

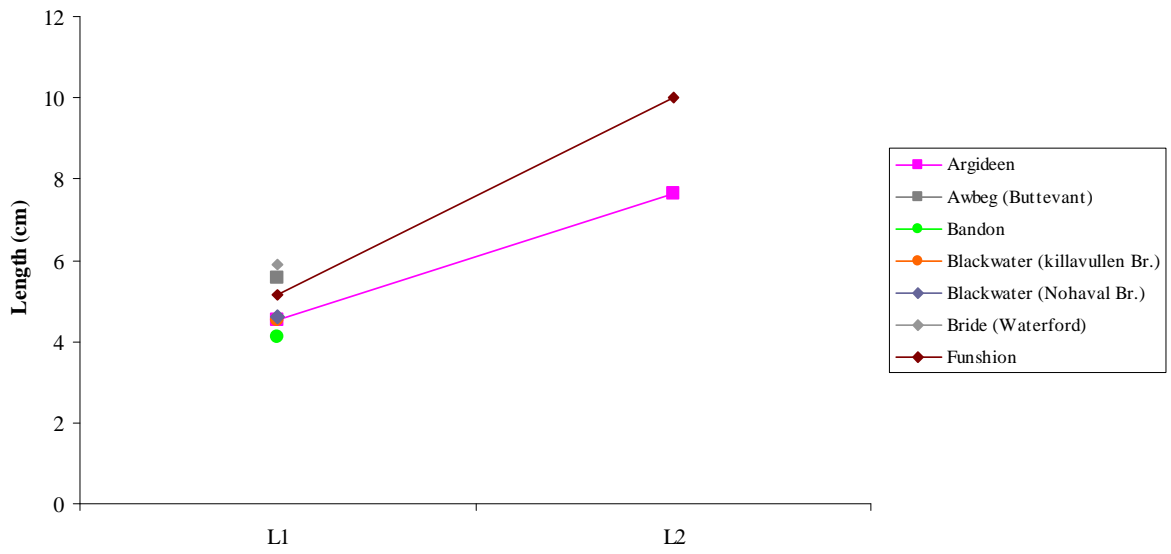


Fig. 4.45. Back calculated lengths for salmon in each river site, WFD surveillance monitoring 2009

5. DISCUSSION

A total of eleven fish species (sea trout are included as a separate variety of trout) were recorded in the SWRBD during the 2009 WFD surveillance monitoring program. This is comparable to the number of species recorded in other River Basin Districts. The main summary report provides results for the whole country (Kelly *et al.*, 2010).

Brown trout and salmon were the two most widely distributed species in the SWRBD, occurring in all seven sites. The River Blackwater (Killavullen Bridge) was the most diverse site, with eight species present. The highest species diversity recorded in any site throughout the country was eleven and this only occurred in one site within the SERBD where a high number of non-native fish species were present. The River Funshion had the lowest diversity within the SWRBD, with only two species present. Such a low species diversity is commonly found around Ireland in small wadeable streams that contain only native fish species (Kelly *et al.*, 2009).

The River Bride was the only river in which sea trout were recorded. European eels and stone loach were also well distributed, only being absent from the River Funshion. Minnow were recorded in three sites, while three-spined stickleback were present in only two sites. Dace, which are becoming more of a concern in the region due mainly to the potential competition for resources with native brown trout populations, were captured at two sites, the River Blackwater (Killavullen) and the Awbeg River. Gudgeon, lamprey and roach were also all found in one single location; the River Blackwater at Killavullen Bridge.

Ireland's indigenous fauna has come under increasing threat from non-native introductions. Invasions by non-native species represent one of the greatest threats to natural biodiversity, second only to habitat destruction (Scalera and Zaghi, 2004). Non-native and invasive species can transform ecosystems, threatening both indigenous and high conservation status species (Stokes *et al.*, 2006), with impacts including displacement through competition for space and food. Direct impacts through predation are also evident (Barton and Heard, 2005).

Non-native fish species were recorded in six of the seven rivers surveyed in the SWRBD. 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 only river containing exclusively native fish was the River Funshion. Kelly *et al.* (2008) categorised non-native species in Ireland into two categories (Group 2, which are those that influence the ecology, and Group 3, which are those that generally have no influence on the ecology). Four Group 2 species (minnow, dace, stone loach and roach) and one Group 3 species (gudgeon) were recorded within the SWRBD. The presence of dace is particularly pertinent due to the potential negative impacts on the native salmonid populations.

Following the methods of Kennedy and Fitzmaurice (1971), brown trout growth was classified as very slow in the River Funshion, slow in the Argideen River, Awbeg River, River Blackwater (Killavullen) and River Blackwater (Nohaval) and fast on the River Bride.

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. No fish classification method currently exists in Ireland for classifying river water quality based on fish populations. Currently, ecological status classifications are based on expert opinion using information collected during a project to investigate the relationship between fish stocks, ecological quality ratings (Q-values), environmental factors and degree of eutrophication (Kelly *et al.*, 2007c). An ecological classification tool, however, is being developed for the Republic of Ireland and Northern Ireland, along with a separate version for Scotland to comply with the requirements of the WFD. Agencies throughout each of the three regions have contributed data to be used in the model, which is being developed under the management of the Scotland & Northern Ireland Forum for Environmental Research (SNIFFER). It was recommended during the earlier stages of this project that an approach similar to that developed by the Environment Agency in England and Wales (FCS2) be used. This scheme works by comparing various fish community metric values within a site (observed) to those predicted (expected) for that site under reference (un-impacted) conditions using a geo-statistical model based on bayesian probabilities. The proposed method will provide an Ecological Quality Ratio (EQR) between 1 and 0 for all sites. Five class boundaries will be defined along this range, to correspond with the five ecological status classes of High, Good, Moderate, Poor and Bad. Confidence levels will then be assigned to each class and represented as probabilities. Work on the rivers classification tool is still ongoing and is due for completion in mid-2010.

6. REFERENCES

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APPENDIX 1

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

River		L1	L2	L3	L4	L5	L6	Growth category
Argideen	Mean	5.8	15.2					Slow
	S.D.	2.9	5.2					
	S.E.	1.5	3.7					
	n	4	2					
	Range min.	3.4	11.5					
	Range max.	10.0	18.9					
Awbeg (Buttevant)	Mean	7.9	14.6	21.5	31.7			Slow
	S.D.	1.3	3.0	2.7	n/a			
	S.E.	0.2	0.6	1.1	n/a			
	n	37	25	6	1			
	Range min.	5.5	9.8	17.5	31.7			
	Range max.	11.1	22.7	24.7	31.7			
Blackwater (Killavullen)	Mean	6.9	14.7	21.0	22.3	29.5	34.2	Slow
	S.D.	1.8	3.7	3.0	n/a	n/a	n/a	
	S.E.	0.3	0.7	0.9	n/a	n/a	n/a	
	n	38	32	12	1	1	1	
	Range min.	3.7	8.7	16.4	22.3	29.5	34.2	
	Range max.	11.3	20.3	25.9	22.3	29.5	34.2	
Blackwater (Nohaval)	Mean	7.3	15.3	20.2	25.1			Slow
	S.D.	1.7	2.6	2.3	n/a			
	S.E.	0.3	0.6	1.0	n/a			
	n	41	23	5	1			
	Range min.	4.3	11.1	16.4	25.1			
	Range max.	10.9	23.4	22.0	25.1			
Bride	Mean	7.7	16.9	22.6				Fast
	S.D.	1.4	2.5	2.8				
	S.E.	0.2	0.5	2.0				
	n	46	22	2				
	Range min.	4.9	12.5	20.6				
	Range max.	10.6	23.0	24.6				
Funshion	Mean	5.5	11.2	15.9				Very slow
	S.D.	1.1	1.7	n/a				
	S.E.	0.3	1.2	n/a				
	n	17	2	1				
	Range min.	3.5	10.0	15.9				
	Range max.	7.0	12.4	15.9				

APPENDIX 2

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

River		L1	L2
Argideen	Mean	4.5	7.6
	S.D.	1.0	n/a
	S.E.	0.2	n/a
	n	38	1
	Range min.	3.5	7.6
	Range max.	8.3	7.6
Awbeg	Mean	5.6	
	S.D.	0.7	
	S.E.	0.1	
	n	21	
	Range min.	4.1	
	Range max.	6.8	
Bandon	Mean	4.1	
	S.D.	0.6	
	S.E.	0.2	
	n	7	
	Range min.	3.2	
	Range max.	5.0	
Blackwater (killavullen Br.)	Mean	4.5	
	S.D.	1.4	
	S.E.	0.3	
	n	22	
	Range min.	2.6	
	Range max.	8.8	
Blackwater (Nohaval Br.)	Mean	4.6	
	S.D.	0.8	
	S.E.	0.2	
	n	12	
	Range min.	3.7	
	Range max.	6.5	
Bride	Mean	5.9	
	S.D.	0.8	
	S.E.	0.2	
	n	17	
	Range min.	4.6	
	Range max.	7.2	
Funshion	Mean	5.2	10.0
	S.D.	1.4	1.3
	S.E.	0.3	0.9
	n	18	2
	Range min.	3.7	9.1
	Range max.	8.1	10.9

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