Eastern 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). Eleven of the 54 surveys were carried out at river sites in the Eastern River Basin District between July and August 2009 by staff from the Central Fisheries Board and Eastern Regional Fisheries Board (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 Eastern Regional Fisheries Board (ERFB) stretched from Co. Monaghan in the north to Co. Wexford in the south. The Eastern River Basin District (ERBD) covers most of this area but loses certain catchments in the north to the Neagh-Bann International River Basin District (NBIRBD) and in the south to the South Eastern River Basin District (SERBD).

The ERBD (Fig. 2.1) covers a land area of around 6,300km^2 and sea area of approximately 350km^2. It is situated mainly over the north-eastern part of Leinster, with a coastline of about 130km, stretching from south Co. Louth to north Wexford. Despite being much smaller than some of the other river basin districts, it contains the largest population of any. Approximately 1.6 million people live within the area, with most residing within the Greater Dublin area and its commuter belt. There are four hydrometric areas within the ERBD and the main river systems include the Boyne, the Nanny-Devlin, the Liffey and the Avoca/Vartry. The largest lake within this district is Poulaphuca

Reservoir, located in County Wicklow. Most of the land area within the ERBD is used for agriculture, with approximately 75% or the entire district used for this purpose (ERBD, 2009).

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

2. STUDY AREA

Nine river sites were surveyed in five river catchments: the Boyne, Dargle, Liffey, Nanny and Avoca catchments. The sites ranged in surface area from 266m^2 for the Athboy River to 5179m^2 for the River Liffey (Lucan) 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 ERBD 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
ERBD Hand-set sites				
Athboy	Bridge at Clonleasan House	Boyne	IE07A010100	EA_07_971
Blackwater	Just u/s of Lough Ramor	Boyne	IE07B010800	EA_07_1035
Dargle	1km u/s of Bray Br.	Dargle	IE10D010250	EA_10_1275
Glencree	Bridge u/s of Dargle R. confl.	Dargle	IE10G010200	EA_10_367
Glenealo	Bridge d/s of Upper Lake	Avoca	IE10G050200	EA_10_793
Nanny	Bridge at Julianstown	Nanny	IE08N010700	EA_08_814
ERBD Boat sites				
Boyne	Boyne Br.	Boyne	IE07B040200	EA_07_990
Liffey	d/s of Ballyward Br.	Liffey	IE09L010250	EA_09_1175
Liffey	Lucan Br.	Liffey	IE09L012100	EA_09_1870_5

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)
ERBD Hand-set sites					
Athboy	78.02	5.92	266	0.45	0.73
Blackwater	124.12	9.20	414	0.22	0.40
Dargle	113.14	16.02	593	0.27	0.72
Glencree	33.86	7.27	342	0.23	0.79
Glenealo	18.73	7.17	330	0.41	0.89
Nanny	221.68	11.73	505	0.41	0.95
ERBD Boat sites					
Boyne (Boyne Br.)	60.31	5.00	575	0.43	0.60
Liffey (Ballyward Br.)	87.70	13.00	4108	0.58	1.20
Liffey (Lucan)	1102.06	20.80	5179	0.65	1.50

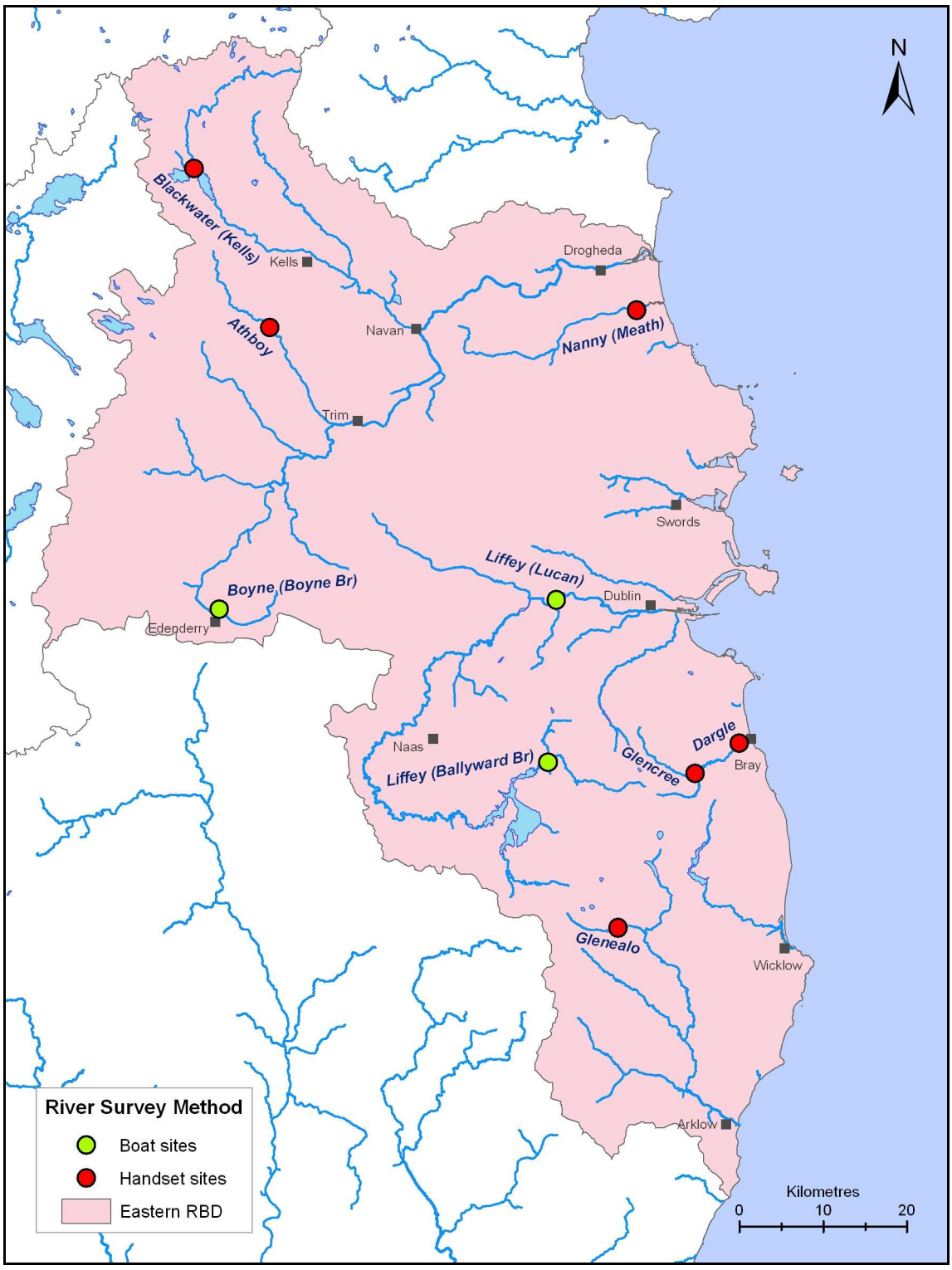

Fig. 2.1. Location map of river sites surveyed throughout the ERBD for WFD fish monitoring, 2009

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 River Liffey (Ballyward Bridge)

4. RESULTS

4.1 Wadeable hand-set sites

4.1.1 The Athboy River

Plate 4.1. The Athboy River in Clonleasan upstream of Athboy, Co. Meath

The Athboy River (Plate 4.1) is a tributary of the River Boyne. It rises near Crossakeel in Co. Meath and flows southwards through Athboy. As it heads further south, it becomes known as the Trimblestown River, until it finally enters the River Boyne, 3km west of Trim, Co. Meath. Anglers enjoy good stocks of brown trout throughout the river system, as fish migrate up from the River Boyne to spawn (O'Reilly, 2009). The survey site, located upstream of a bridge approximately 4.5km north-west of Athboy (Fig. 4.1), is situated within the River Boyne and River Blackwater Special Area of Conservation (SAC), selected for its alkaline fens and alluvial woodlands (both of which are listed in Annex I of the EU Habitats Directive) as well as species including Atlantic salmon, otter and river lamprey (NPWS, 2003).

Three electric-fishing passes were conducted using two bank-based electric fishing units on the 27th of July 2009 along a 45m length of channel. This was quite an open stretch of channel with little or no

light obstruction. The macrophyte vegetation was dominated mostly by emergent and marginal species along the banks and on shallow muddy portions of the stream. Significant amounts of green filamentous algae were also present. The substrate present in the channel was predominantly composed of fine and medium types, such as cobble, gravel, sand and silt. The dominant habitat types present were glide and pool. The mean wetted width of the channel was 5.9m and the mean depth was 45.0cm. A total wetted area of 266m^2 was surveyed.

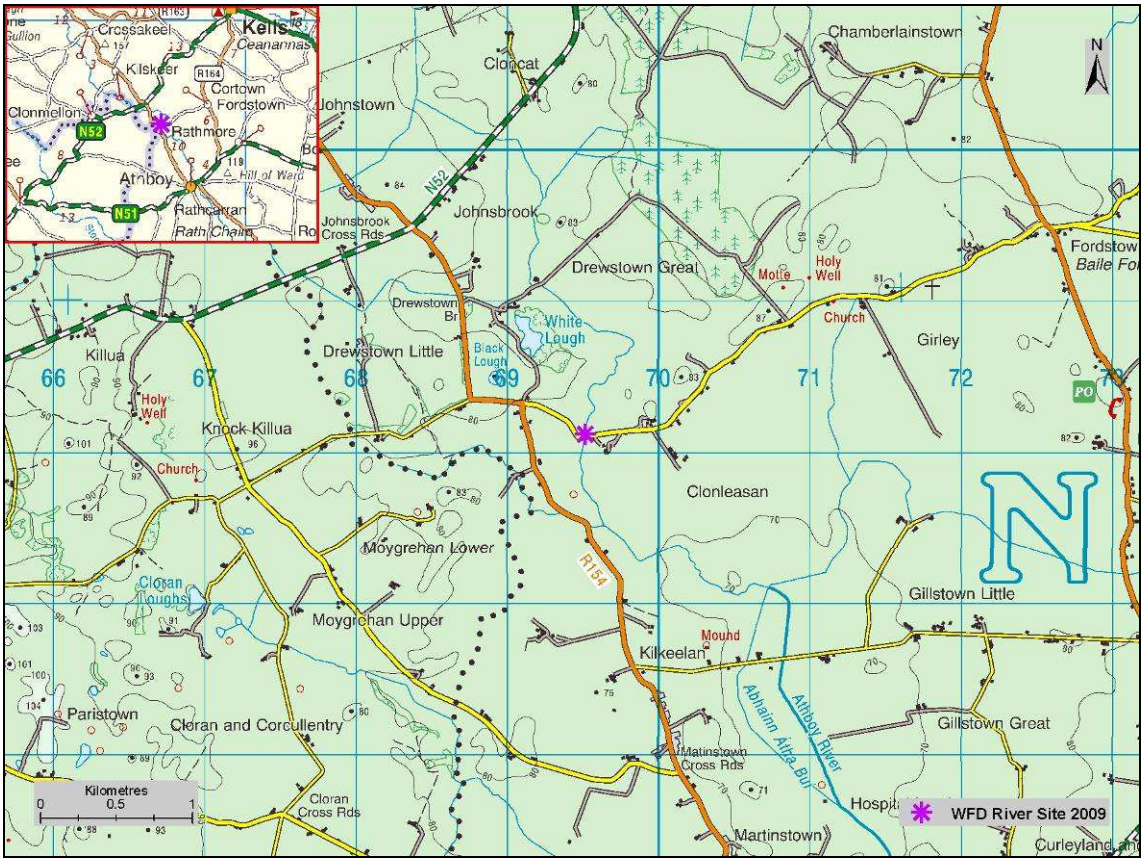

Fig. 4.1. Location of the Athboy River surveillance monitoring site

A total of six fish species were recorded in the Athboy River site. Brown trout was the most abundant species, followed by salmon, three-spined stickleback, European eel, stone loach and juvenile lamprey (Table 4.1).

Table 4.1. Density of fish (no./m^2), Athboy River site (fish density has been calculated as minimum estimates based on the first fishing)

Scientific name	Common name	0+	1+ & older	Total minimum density
Salmo trutta	Brown trout	0.1014	0.1315	0.2329
Salmo salar	Salmon	0.0225	0.0714	0.0939
Anguilla anguilla	European eel	-	-	0.0075
Gasterosteus aculeatus	Three-spined stickleback	-	-	0.0075
Barbatula barbatula	Stone loach	-	-	0.0038
	Lamprey sp.	-	-	0.0038
All fish	All fish	-	-	0.3493

Brown trout ranged in length from 4.9cm to 24.7cm (Fig. 4.2). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 41%, 42% and 18% of the total brown trout catch respectively. Mean brown trout L1 and L2 were 7.4cm and 14.6cm 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).

Salmon ranged in length from 4.6cm to 14.2cm (Fig. 4.3). Two age classes (0+ and 1+) were present, accounting for approximately 24% and 76% of the total salmon catch respectively (Fig. 4.3). Mean salmon L1 was 5.6cm (Appendix 2).

Two European eels were captured, measuring 37.8cm and 47.2cm. A single juvenile lamprey measuring 5.2cm was recorded.

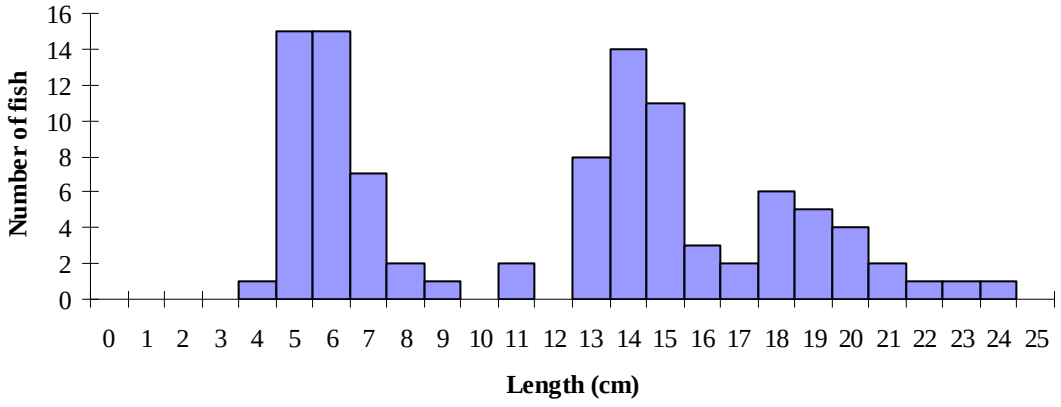

Fig. 4.2. Length frequency distribution of brown trout in the Athboy River site, July 2009 (n = 101)

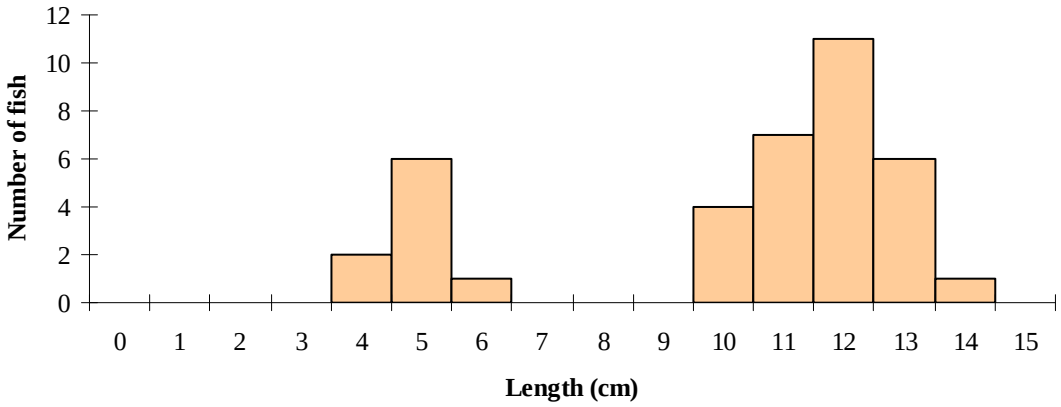

Fig. 4.3. Length frequency distribution of salmon in the Athboy River site, July 2009 (n = 38)

4.1.2 The River Blackwater (Kells)

Plate 4.2. The River Blackwater (Kells) upstream of confluence with Lough Ramor, Co. Cavan

The River Blackwater (Kells) (Plate 4.2) rises in the hills north-east of Baileborough in Co. Cavan. It flows south through Lough Ramor before turning south-east towards Kells, Co. Meath and finally joining with the River Boyne in Navan, Co. Meath. The stocks of brown trout within this river are generally reported as good and most stretches are considered to be worth fishing (O'Reilly, 2009; ERFB, 2010).

The survey site was located approximately 0.5km south of Virginia, Co. Cavan, just upstream of where it enters Lough Ramor (Fig. 4.4). Three electric-fishing passes were conducted using two bank-based electric fishing units and one backpack unit on the 10th of August 2009 along a 45m length of channel. The substrate within the channel surveyed was almost entirely cobble, while the habitat was a mix of riffle, glide and pool. The mean wetted width of the channel was 9.2m and the mean depth was 22.0cm. Various emergent macrophyte species were recorded at this site. A total wetted area of 414m^2 was surveyed.

Fig. 4.4. Location of the River Blackwater (Kells) surveillance monitoring site

A total of eight fish species were recorded in the River Blackwater (Kells) site. Brown trout was the most abundant species followed by roach, gudgeon, salmon, European eel, perch, minnow and stone loach (Table 4.2).

Table 4.2. Density of fish (no./m^2), River Blackwater (Kells) site (fish density has been calculated as minimum estimates based on the first fishing)

Scientific name	Common name	0+	1+ & older	Total minimum density
Salmo trutta	Brown trout	0.2729	0.0556	0.3285
Rutilus rutilus	Roach	-	-	0.2150
Gobio gobio	Gudgeon	-	-	0.0507
Salmo salar	Salmon	0.0338	0.0072	0.0411
Anguilla anguilla	European eel	-	-	0.0169
Perca fluviatilis	Perch	-	-	0.0072
Phoxinus phoxinus	Minnow	-	-	0.0072
Barbatula barbatula	Stone loach	-	-	0.0024
All fish	All fish	-	-	0.6691

Brown trout ranged in length from 5.3cm to 23.1cm (Fig.4.5). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 88%, 11.5% and 0.5% of the total brown trout catch respectively. Mean brown trout L1 and L2 were 7.3cm and 9.9cm respectively (Appendix 1), indicating a very slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

Roach was the second most abundant species recorded in the River Blackwater (Kells). All specimens captured were fry (0+), ranging in length from 2.7cm to 6.5cm.

Gudgeon were also relatively common, ranging in length from 6.8cm to 12.7cm (Fig. 4.6).

Juvenile salmon ranged in length from 5.0cm to 15.2cm (Fig. 4.7). Two age classes (0+ and 1+) were present, accounting for approximately 88% and 12% of the total salmon catch respectively. Mean salmon L1 was 6.5cm (Appendix 2).

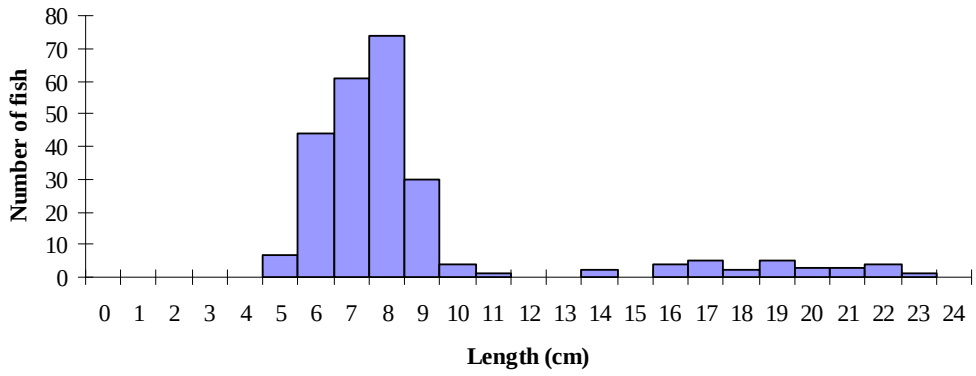

Fig. 4.5. Length frequency distribution of brown trout in the River Blackwater (Kells), August 2009 (n = 250)

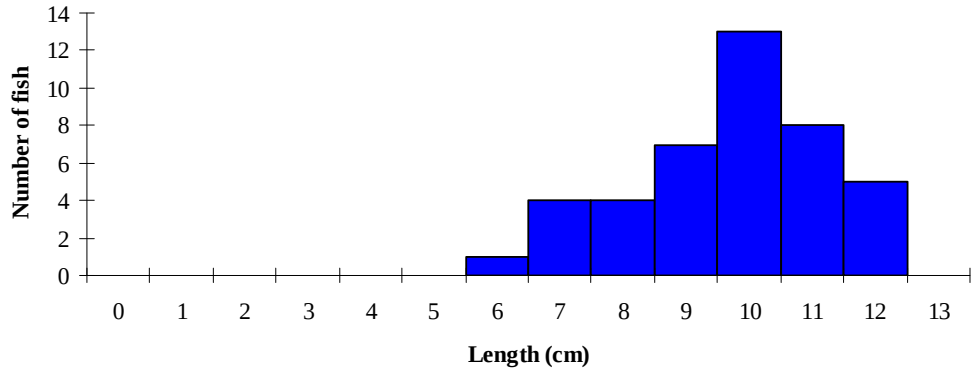

Fig. 4.6. Length frequency distribution of gudgeon in the River Blackwater (Kells) site, August 2009 (n = 42)

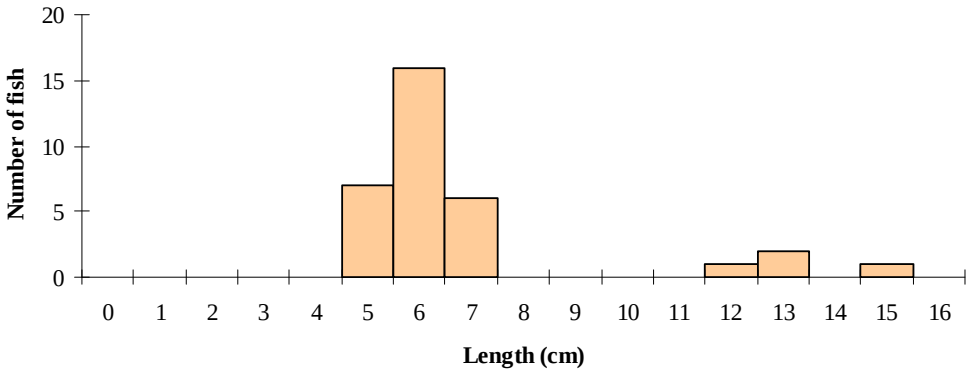

Fig. 4.7. Length frequency distribution of salmon in the River Blackwater (Kells) site, August 2009 (n = 33)

4.1.3 The Dargle River

Plate 4.3. The Dargle River upstream of Bray Bridge, Co. Wicklow

The Dargle River (Plate 4.3 and Fig. 4.8) rises in the Wicklow Mountains, 4km west of Powerscourt Waterfall. As it flows in a north-easterly direction, it is joined by both the Glencree and Glencullen Rivers. The Dargle is known as one of Ireland's best sea trout rivers and boasts catches of some of the largest sea trout ever caught in this country (O'Reilly, 2009; ERFB, 2010). Salmon fishing can also be good, but can vary greatly from season to season (O'Reilly, 2009). Significant portions of the Dargle River's upstream tributaries extend into the Wicklow Mountains SAC and SPA (Special Conservation Area). This is a large SAC which encompasses a total of 10 habitats listed in Annex I of the EU Habitats Directive, including blanket bog, dry heath and wet heath (NPWS, 2001 and 2004).

The survey site was located in Bray, Co. Wicklow, approximately 1.5km upstream of where it joins the sea (Fig. 4.8). Three electric-fishing passes were conducted using two bank-based electric-fishing units and one backpack unit on the 6th of August 2009 along a 37m length of channel. The survey site was situated on a relatively wide and open stretch of river (Plate 4.3). The habitat within the channel was evenly mixed between riffle, glide and pool, while the substrate was mostly cobble covered in a

layer of slippery algae. The instream macrophyte vegetation included common moss species, while the riparian edges had scatterings of grasses and willow herb. The mean wetted width of the channel was 16.0m and the mean depth was 27.0cm. A total wetted area of 593m^2 was surveyed.

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

A total of four fish species were recorded in the Dargle River, as well as sea trout. Salmon was the most abundant species, followed by European eel, flounder, brown trout and sea trout (Table 4.3).

Table 4.3. Density of fish (no./m^2), Dargle River site (fish density has been calculated as minimum estimates based on the first fishing)

Scientific name	Common name	0+	1+ & older	Total minimum density
Salmo salar	Salmon	0.1839	0.0894	0.2734
Anguilla anguilla	European eel	-	-	0.0202
Platichthys flesus	Flounder	-	-	0.0135
Salmo trutta	Brown trout	0.0017	0.0101	0.0118
Salmo trutta	Sea trout	-	-	0.0034
All fish	All fish	-	-	0.3223

Salmon ranged in length from 4.9cm to 15.4cm (Fig. 4.9). Two age classes (0+ and 1+) were present, accounting for approximately 64% and 36% of the total salmon catch respectively. Mean salmon L1 was 4.9cm (Appendix 2).

European eels ranged in length from 10.3cm to 29.7cm (Fig. 4.10), while flounder ranged in length from 1.5cm to 8.4cm (Fig. 4.11).

Brown trout ranged in length from 7.3cm to 21.4cm (Fig. 4.12). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 26%, 58% and 16% of the total brown trout catch respectively. Mean brown trout L1 and L2 were 7.1cm and 14.3cm respectively, indicating a slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

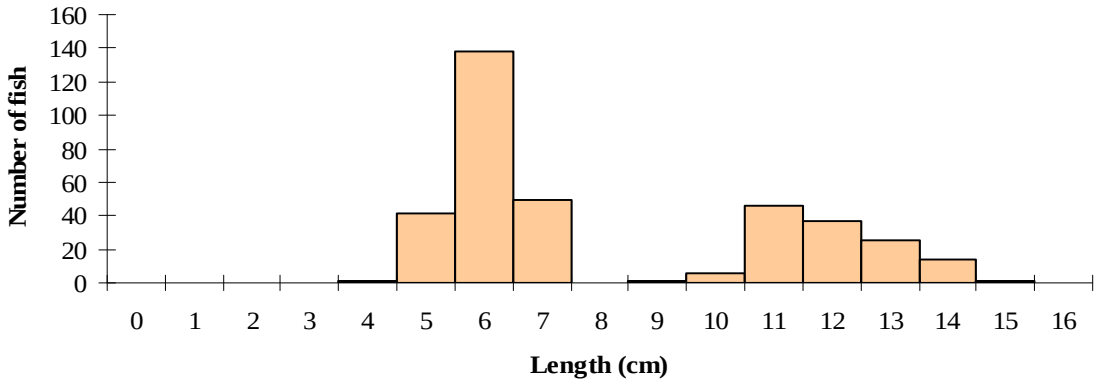

Fig. 4.9. Length frequency distribution of salmon in the Dargle River site, August 2009 (n = 361)

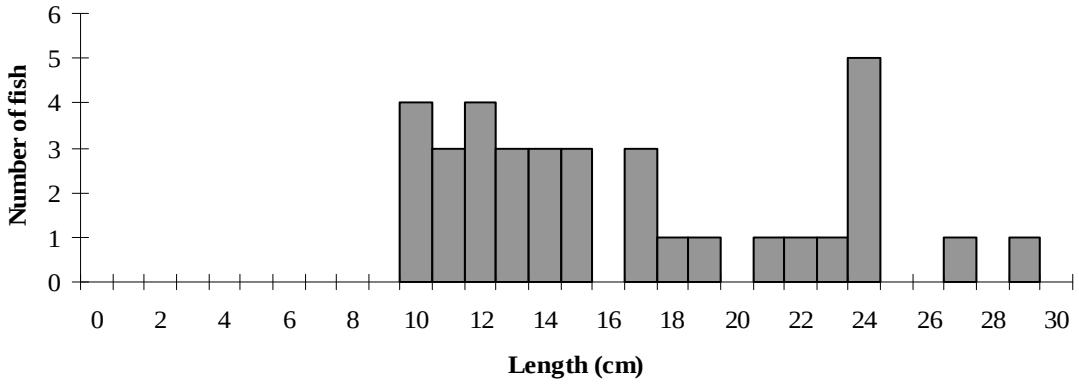

Fig. 4.10. Length frequency distribution of European eels in the Dargle River site, August 2009 (n = 35)

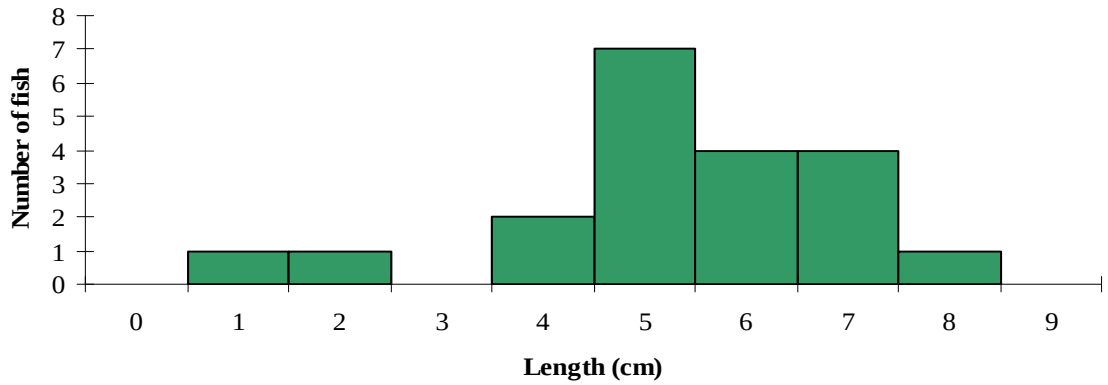

Fig. 4.11. Length frequency distribution of flounder in the Dargle River site, August 2009 (n = 20)

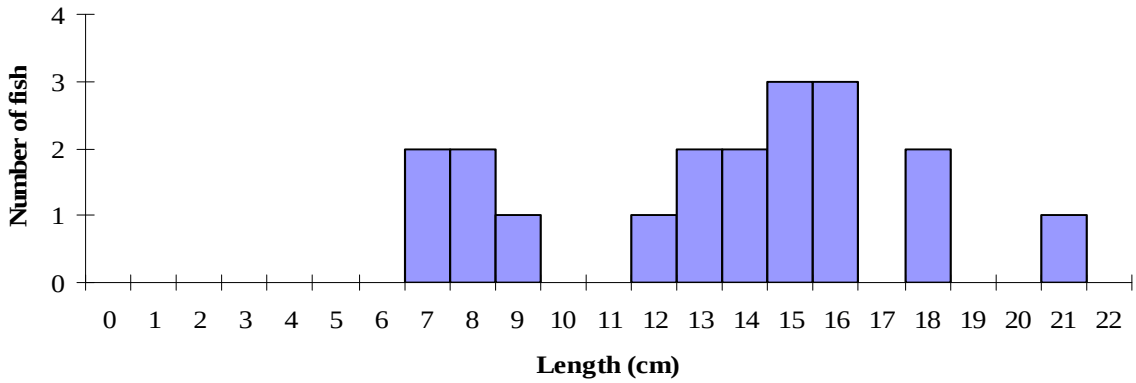

Fig. 4.12. Length frequency distribution of brown trout in the Dargle River site, August 2009 (n = 19)

4.1.4 The Glencree River

Plate 4.4. The Glencree River site upstream of Onagh Bridge, Co. Wicklow

The Glencree River (Plate 4.4) is a tributary of the Dargle River, rising in the Wicklow Mountains near Glendoo Mountain. It flows south-eastwards to join the Dargle near Balinagee Bridge, 3.5km south-west of Enniskerry. The Glencree is not really renowned as a fishery in its own right but is likely to make an important contribution, in terms of spawning, to the Dargle River downstream. Like the Dargle River, certain sections of this river's upstream tributaries are located within the Wicklow Mountains SAC and SPA (see Section 4.1.3).

The survey site was located in a picturesque wooded area near Onagh Bridge, Co. Wicklow, a few hundred metres upstream of the Dargle River confluence (Fig. 4.13). Three electric-fishing passes were conducted using two bank-based electric-fishing units on the 5th of August 2009 along a 47m length of channel. The area surveyed was quite shaded, with shade-tolerant mosses and liverworts among the most commonly recorded macrophyte species present. There was a good mix of all three habitat types (glide, riffle and pool) and cobble dominated the substrate. The mean wetted width of the channel was 7.27m and the mean depth was 27.0cm. A total area of 341.5m^2 was surveyed.

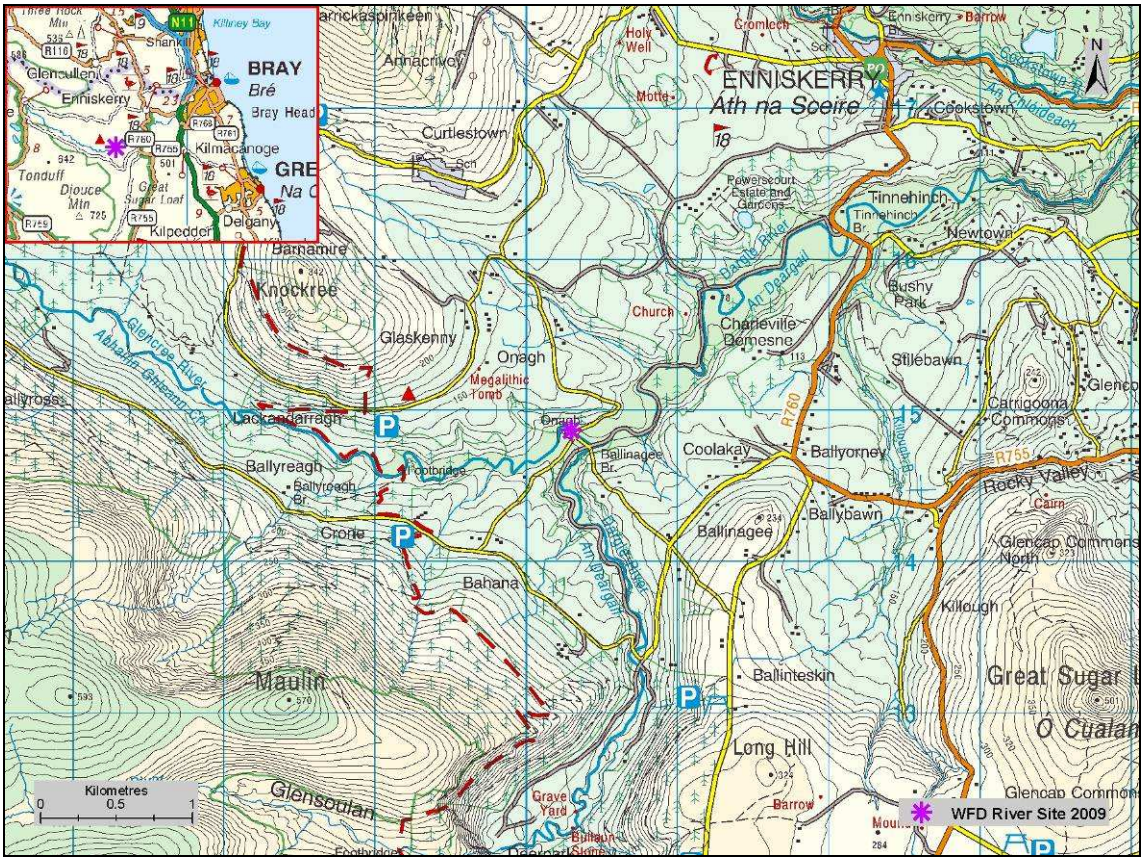

Fig. 4.13. Location of the Glencree River surveillance monitoring site

A total of four fish species were recorded in the Glencree River. Brown trout was the most abundant species, followed by salmon, European eel and stone loach (Table 4.4).

Table 4.4. Density of fish (no./m^2), Glencree River site (fish density has been calculated as minimum estimates based on the first fishing)

Scientific name	Common name	0+	1+ & older	Total minimum density
Salmo trutta	Brown trout	0.0644	0.0293	0.0937
Salmo salar	Salmon	0.0351	0.0264	0.0615
Anguilla anguilla	European eel	-	-	0.0029
Barbatula barbatula	Stone loach	-	-	0.0029
All fish	All fish	-	-	0.1610

Brown trout ranged in length from 5.0cm to 25.4cm (Fig. 4.14). Five age classes (0+, 1+, 2+, 3+ and 4+) were present, accounting for approximately 58%, 28%, 6%, 4% and 4% of the total brown trout catch respectively. Mean brown trout L4 was 20.0cm (Appendix 1), indicating a relatively 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 4.2cm to 13.6cm (Fig. 4.15). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 57%, 41% and 2% of the total salmon catch respectively. Mean salmon L1 and L2 were 4.8cm and 9.2cm respectively (Appendix 2).

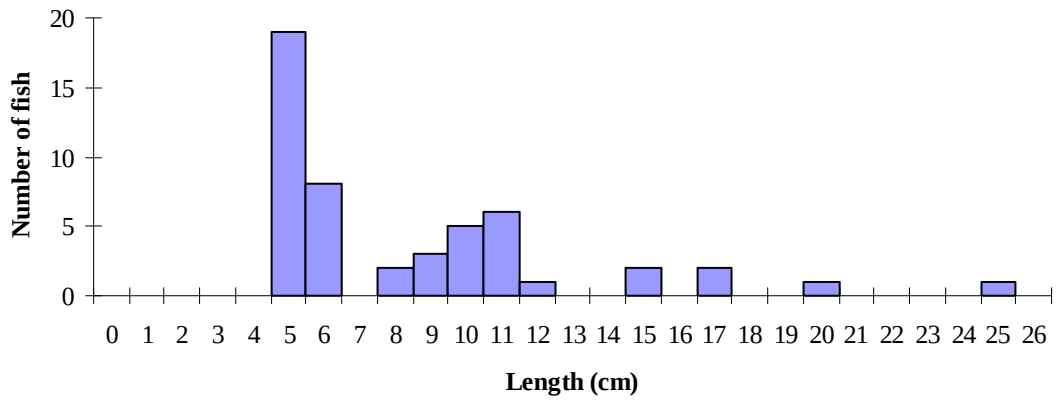

Fig. 4.14. Length frequency distribution of brown trout in the Glencree River site, August 2009 (n = 50)

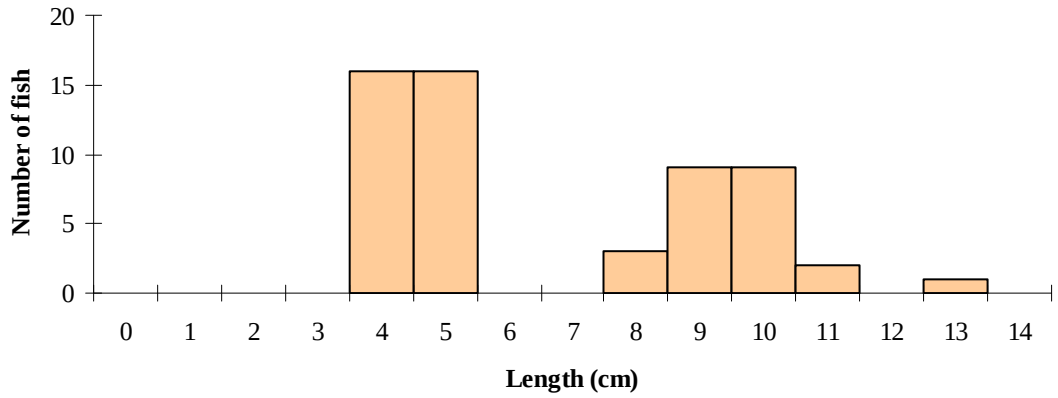

Fig. 4.15. Length frequency distribution of salmon in the Glencree River site, August 2009 (n = 56)

4.1.5 The Glenealo River

Plate 4.5. The Glenealo River site downstream of the Upper Lake in Glendalough, Co. Wicklow

The Glenealo River (Plate 4.5) is situated in the picturesque area of Glendalough in Co. Wicklow. It rises in the hills above the Upper Lake and flows through both the Upper and Lower Lakes, joining the Glendasan River near the Glendalough visitor centre. The survey site was located within the Wicklow Mountains SAC and SPA (see Section 4.1.3). The section of river surveyed was located between the two lakes just downstream of the Upper Lake (Fig. 4.16).

Three electric-fishing passes were conducted using two bank-based electric-fishing units on the 5th of August 2009 along a 46m length of channel. This channel was highly shaded and was restricted in its macrophyte diversity to mainly mosses and liverworts. The main substrate types present were cobble and gravel, which were covered in a slippery layer of algae. The habitat composition was evenly mixed between riffle, glide and pool. The mean wetted width of the channel was 7.2m and the mean depth was 41.0cm. A total wetted area of 330m^2 was surveyed.

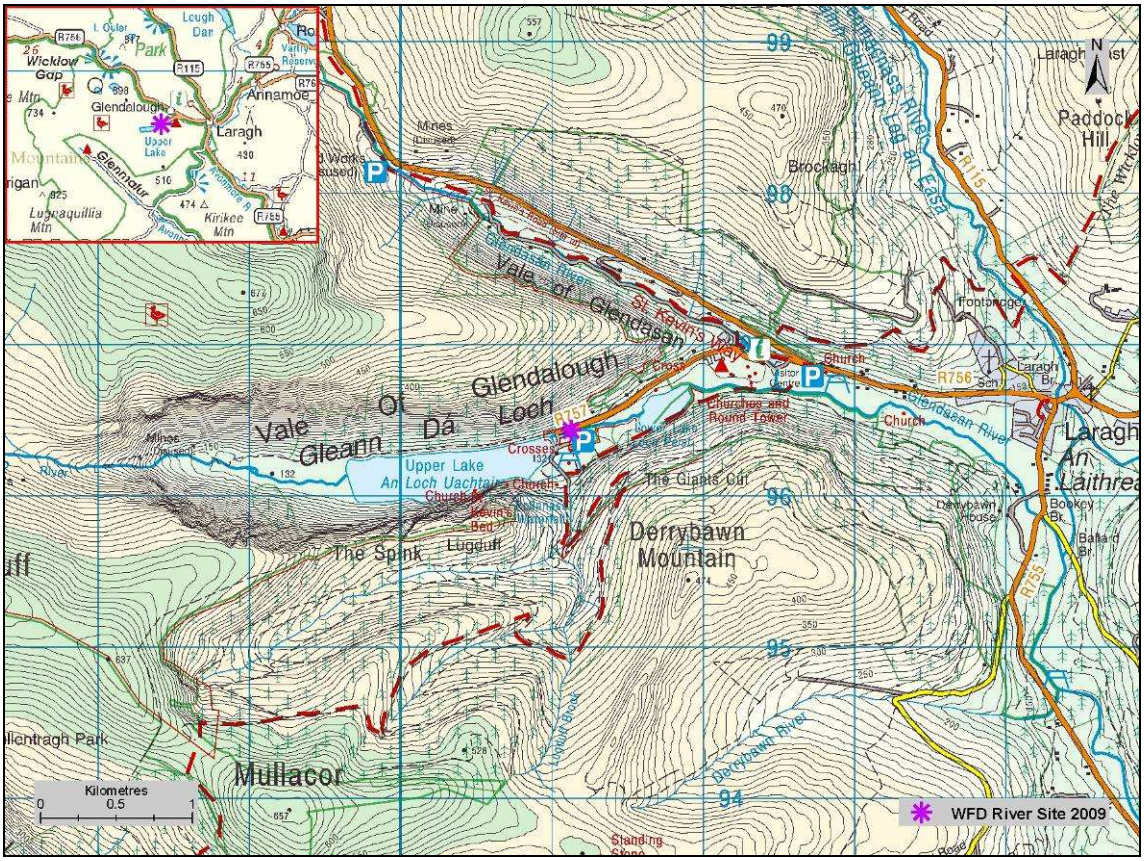

Fig. 4.16. Location of the Glenealo River surveillance monitoring site

A total of three fish species were recorded in the Glenealo River site. Brown trout was the most abundant species, followed by European eel and salmon (Table 4.5).

Table 4.5. Density of fish (no./m^2), Glenealo River (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
Salmo trutta	Brown trout	0.0394	0.0030	0.0394
Anguilla anguilla	European eel	-	-	0.0061
Salmo salar	Salmon	-	0.0030	0.0030
All fish	All fish	-	-	0.0485

Brown trout ranged in length from 3.2cm to 19.4cm (Fig. 4.17). Three age classes (0+, 1+ and 4+) were present, accounting for approximately 94%, 3% and 3% of the total brown trout catch respectively. Mean brown trout L4 was 18.2cm (Appendix 1), indicating a very slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

Only two salmon were captured in the Glenealo River site. These were both aged 1+ and measured 10.5cm and 11.0cm in length. Mean salmon L1 was 4.2cm (Appendix 2).

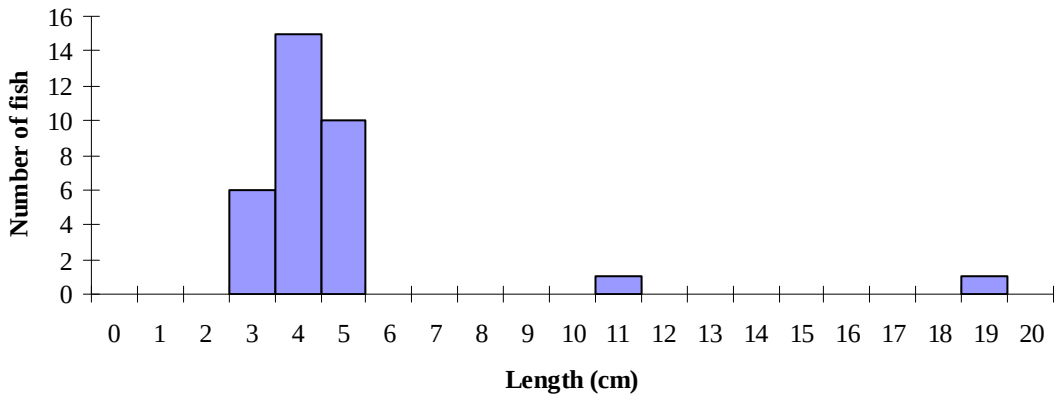

Fig. 4.17. Length frequency distribution of brown trout in the Glenealo River site, August 2009 (n = 33)

4.1.6 The River Nanny (Meath)

Plate 4.6. The River Nanny upstream of the bridge in Julianstown, Co. Meath

The River Nanny (Plate 4.6) rises approximately 3km south-east of Navan, Co. Meath and flows further eastwards through Duleek and Julianstown before reaching the sea at Laytown (Fig. 4.18). The Nanny is known as a good sea trout river and has decent stocks up to Julianstown. Brown trout fishing extends further upstream and contains a mix of both wild and stocked fish (O'Reilly, 2009). The survey site was located just south of Julianstown (Fig. 4.18). Illegal dumping was apparent in the area and significant amounts of household waste were dumped along the right-hand bank.

Three electric-fishing passes were conducted using two bank-based electric-fishing units on the 7th of August 2009 along a 43m length of channel. The channel surveyed had a mean wetted width of 11.7m and an mean depth of 41.0cm. Macrophyte vegetation present in the river included various mosses, as well as emergent and floating species. There was a good mix of habitat and substrate types, with glide and cobble dominating. A total wetted area of 505m^2 was surveyed.

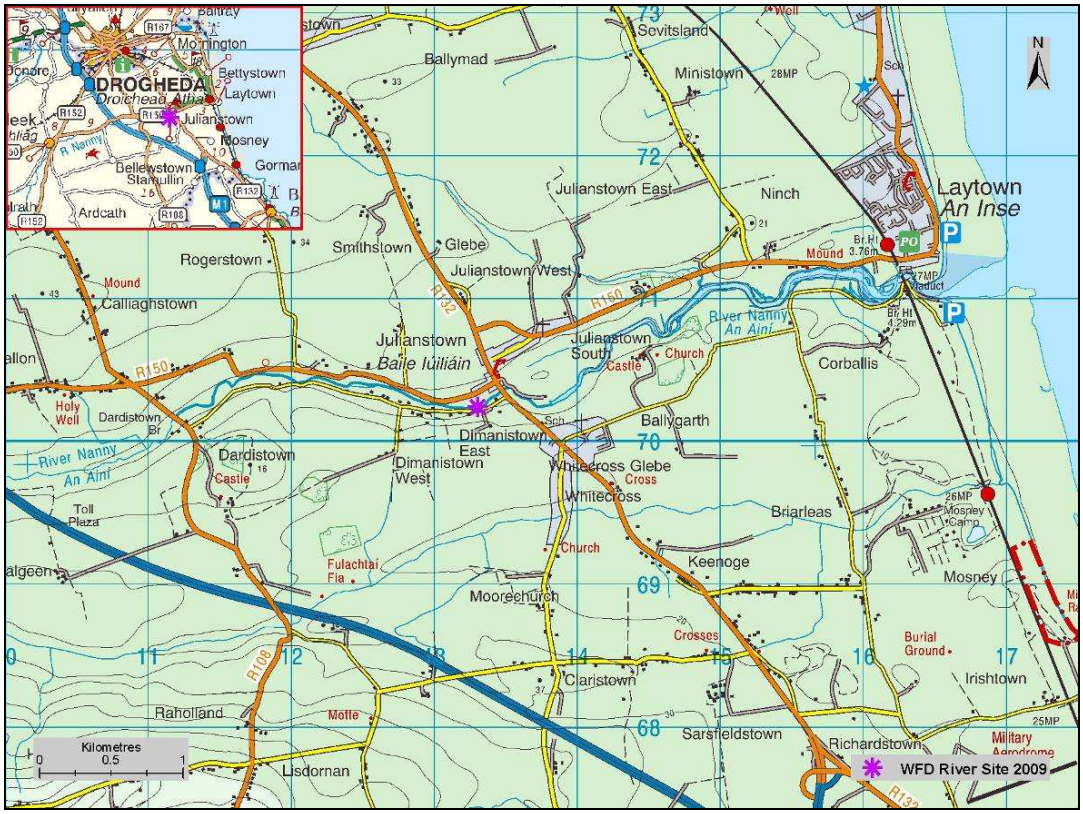

Fig. 4.18. Location of the River Nanny surveillance monitoring site

A total of seven fish species were recorded in the River Nanny. Minnow was the most abundant species, followed by stone loach, flounder, European eel, brown trout, three-spined stickleback and salmon (Table 4.6).

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

Scientific name	Common name	0+	1+ & older	Total minimum density
Phoxinus phoxinus	Minnow	-	-	0.1427
Barbatula barbatula	Stone loach	-	-	0.0674
Platichthys flesus	Flounder	-	-	0.0317
Anguilla anguilla	European eel	-	-	0.0297
Salmo trutta	Brown trout	0.0139	0.0059	0.0198
Gasterosteus aculeatus	Three-spined stickleback	-	-	0.0178
Salmo salar	Salmon	0.0040	-	0.0040
All fish	All fish	-	-	0.3132

Brown trout ranged in length from 7.1cm to 21.0cm (Fig. 4.19). Two age classes (0+ and 1+) were present, accounting for approximately 79% and 21% of the total brown trout catch respectively.

Mean brown trout L1 was 9.4cm (Appendix 1). Insufficient information was available to categorise the rate of growth of brown trout in this river.

Juvenile salmon fry (0+) was the only age class present, with specimens ranging in length from 5.3cm to 8.1cm .

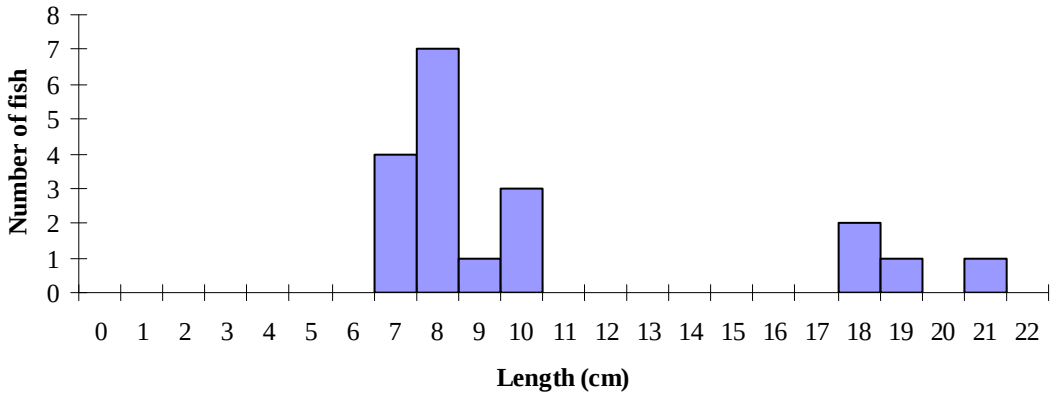

Fig. 4.19. Length frequency distribution of brown trout in the River Nanny (Meath), August 2009 (n = 19)

4.2 Boat sites

4.2.1 The River Boyne (Boyne Bridge)

Plate 4.7. The River Boyne site at Boyne Bridge near Edenderry, Co. Offaly, surveyed shortly after maintenance work by OPW

The River Boyne (Plate 4.7) rises in Co. Kildare in an area of flat agricultural land approximately 8.5km west of Edenderry. It flows along the border of Co. Kildare and Co. Offaly before entering Co. Meath. It drains land predominantly used for agriculture and flows through a number of towns, including Trim, Navan and Slane, before finally reaching the sea just east of Drogheda in Co. Louth. The Boyne and its tributaries provide one of Ireland's best game fisheries and offers good opportunities for brown trout, salmon and sea trout angling (O'Reilly, 2009; ERFB, 2010). An arterial drainage scheme was undertaken in the Boyne catchment by the Office of Public Works (OPW), on the main channel and tributaries upstream of Navan, between 1969 and 1985 to provide flood relief (O' Grady, 1991). Some stretches of the main channel and its tributaries are still subject to regular channel maintenance by the OPW (Plate 4.7).

The river stretch surveyed was situated quite close to the source, approximately 1.5km north of Edenderry (Fig. 4.20). The site itself is not within any assigned conservation area, however,

approximately 18km downstream the river enters the River Boyne and Blackwater SAC (see Section 4.1.1). The survey site showed evidence of recent drainage maintenance by the OPW on one bank (Plate 4.7).

Three electric-fishing passes were conducted using one boat-based electric-fishing unit on the 12th of August 2009 along a 115m length of channel. The mean wetted width of the channel was 5.0m and the mean depth was 43.0cm. Macrophyte vegetation was sparse along this stretch due to OPW maintenance works on the left-hand bank. Grasses dominated both banks. The channel substrate was composed entirely of mud and silt and glide was the only type of habitat present. A total wetted area of 575m^2 was surveyed.

Fig. 4.20. Location of the River Boyne (Boyne Br.) surveillance monitoring site

A total of six fish species were recorded in the River Boyne at Boyne Bridge. Brown trout was the most abundant species, followed by juvenile lamprey, three-spined stickleback, minnow, stone loach and European eel (Table 4.7). It was also evident that most of the fish captured during the survey were located on the opposite side of the river to the OPW bank works.

Table 4.7. Density of fish (no./m^2), River Boyne site (Boyne Br.) (fish density has been calculated as estimates based on the first fishing)

Scientific name	Common name	0+	1+ & older	Total minimum density
Salmo trutta	Brown trout	-	0.0730	0.0730
	Lamprey sp.	-	-	0.0070
Gasterosteus aculeatus	Three-spined stickleback	-	-	0.0052
Phoxinus phoxinus	Minnow	-	-	0.0052
Barbatula barbatula	Stone loach	-	-	0.0035
Anguilla anguilla	European eel	-	-	0.0017
All fish	All fish	-	-	0.0957

Brown trout ranged in length from 14.3cm to 31.0cm (Fig. 4.21). Three age classes (1+, 2+ and 3+) were present, accounting for approximately 49%, 36% and 15% of the total brown trout catch respectively (Fig. 4.21). Mean brown trout L1, L2 and L3 were 7.9cm, 16.8cm and 20.6cm respectively (Appendix 1), indicating a fast rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

Small numbers of minnow were recorded, ranging in length from 4.8cm to 6.3cm. Juvenile lamprey ranged in length from 7.5cm to 11.5cm. Only one eel was recorded, measuring 45.0cm.

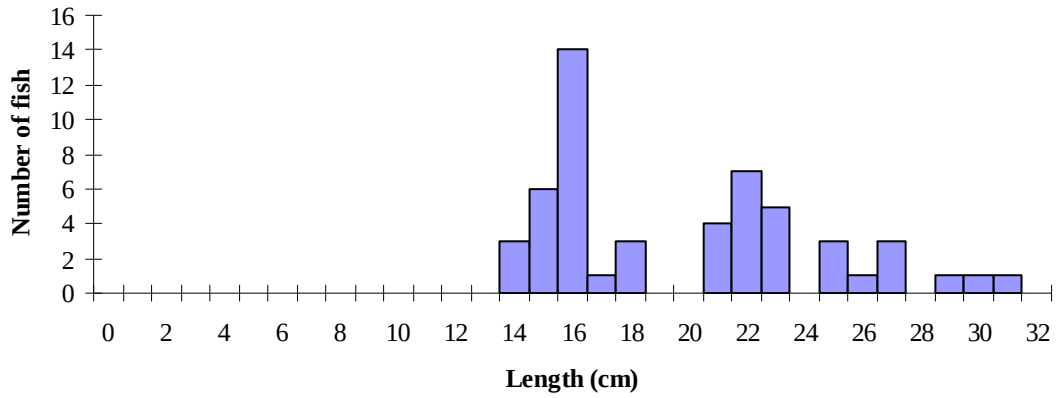

Fig. 4.21. Length frequency distribution of brown trout in the River Boyne (Boyne Br.), August 2009 (n = 53)

4.2.2 The River Liffey (Ballyward Bridge)

Plate 4.8. The River Liffey at Ballyward Bridge, Co. Wicklow

The River Liffey (Plate 4.8 and Fig. 4.22) is one of Ireland's largest and best known rivers. It rises in the Wicklow Mountains and flows westwards into Pollaphuca Reservoir before looping northwards through Kildare and east through Dublin City. The Liffey transforms dramatically throughout its course, changing from an acidic and rocky upland stream in the Wicklow Mountains to a rich, productive, gliding channel in the lower-lying parts of Kildare (O'Reilly, 2009). There are a number of anthropogenic pressures affecting the Liffey throughout its course, including pollution, water abstraction and channel modification (O'Reilly, 2009). Impassable barriers at Pollaphouca, Golden Falls and Leixlip pose a problem on this river, creating barriers to fish migration. Despite these pressures, however, fishing remains good in certain parts of the river, with salmon, brown trout and sea trout fishing all faring quite well (O'Reilly, 2009).

The first site surveyed on the River Liffey was located just upstream of the Brittas River confluence at Ballyward Bridge, approximately 3km upstream of the Pollaphuca Reservoir in Co. Wicklow (Fig. 4.22). The upper reaches of the Liffey contain good stocks of small brown trout that are believed to

move up from the reservoir. On occasion, specimen fish are caught, making this stretch quite popular among fly anglers (O'Reilly, 2009; ERFB, 2010).

One electric-fishing pass was conducted using two boat-based electric-fishing units on the 13th of August 2009 along a 316m length of channel. Cobble was the dominant substrate type, and the habitat was composed primarily of pools. The mean wetted width of the channel was 13.0m and the mean depth was 58.0cm. A total wetted area of 4108m^2 was surveyed.

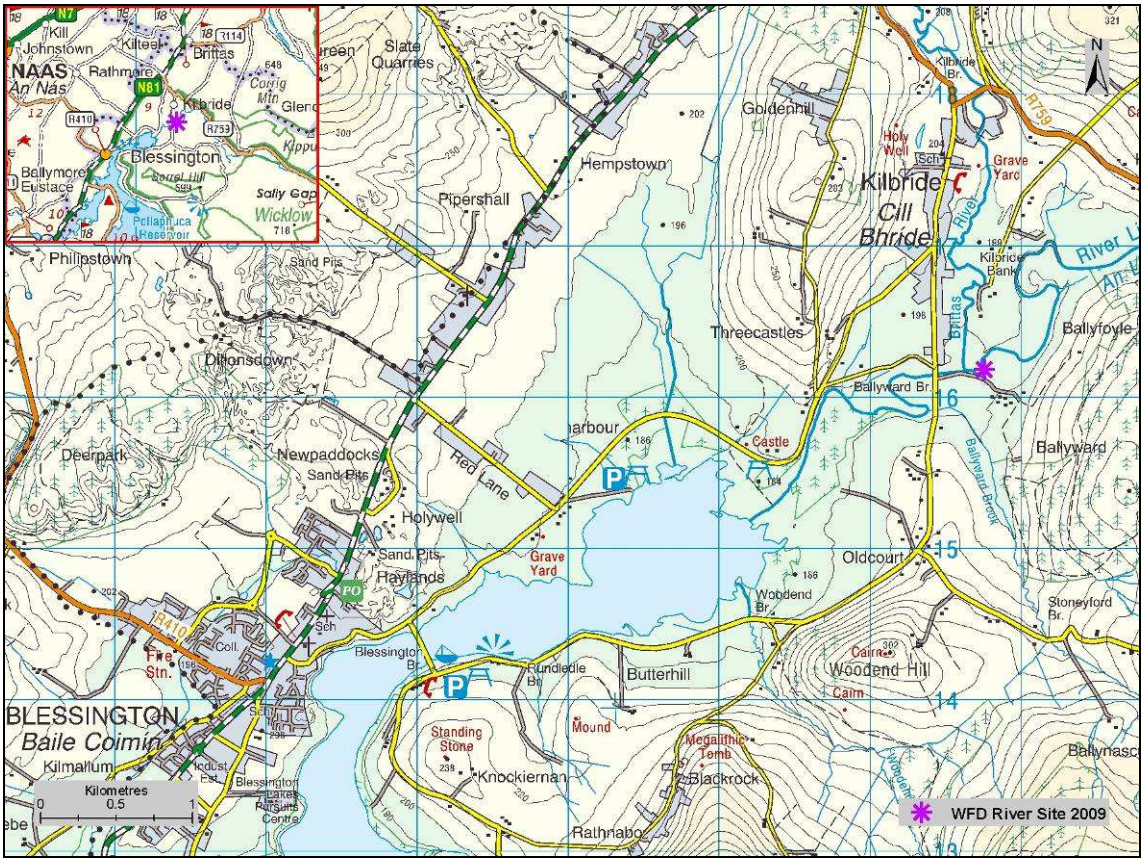

Fig. 4.22. Location of the River Liffey (Ballyward Br.) surveillance monitoring site

A total of three fish species were recorded in the River Liffey at Ballyward Bridge. Brown trout was the most abundant species, followed by minnow and roach (Table 4.8).

Table 4.8. Density of fish (no./m^2), River Liffey (Ballyward Br. site) (fish density has been calculated as minimum estimates based on the first fishing)

Scientific name	Common name	0+	1+ & older	Total minimum density
Salmo trutta	Brown trout	0.0012	0.0015	0.0027
Phoxinus phoxinus	Minnow	-	-	0.0012
Rutilus rutilus	Roach	-	-	0.0002
All fish	All fish	-	-	0.0041

Brown trout ranged in length from 6.8cm to 29.7cm (Fig. 4.23). Five age classes (0+, 1+, 2+, 3+ and 4+) were present, accounting for approximately 45%, 18%, 18%, 9% and 9% of the total brown trout catch respectively. Mean brown trout L1, L2 and L3 were 7.2cm, 16.3cm and 19.8cm respectively, indicating a relatively slow rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

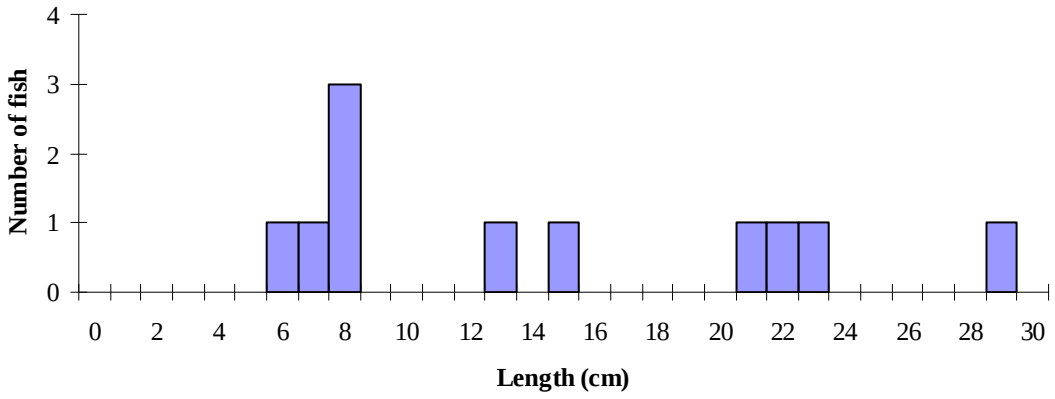

Fig. 4.23. Length frequency distribution of brown trout in the River Liffey (Ballyward Br.), August 2009 (n = 11)

4.2.3 The River Liffey (Lucan)

Plate 4.9. The River Liffey downstream of the bridge in Lucan, Co. Dublin

The second River Liffey survey site was located in Lucan village approximately 0.5km downstream of the Griffeen River confluence (Plate 4.9 and Fig. 4.24). More information on the River Liffey can be found in section 4.2.2.

One electric-fishing pass was conducted using four boat-based electric-fishing units on the 14th of August 2009 along a 249m length of channel. Cobble and gravel were the dominant substrate types present and there was a good mix of all three habitats (riffle, glide and pool). The mean wetted width and mean depth of the stretch sampled were 20.8m and 65.0cm respectively. A total wetted area of 5179m^2 was surveyed.

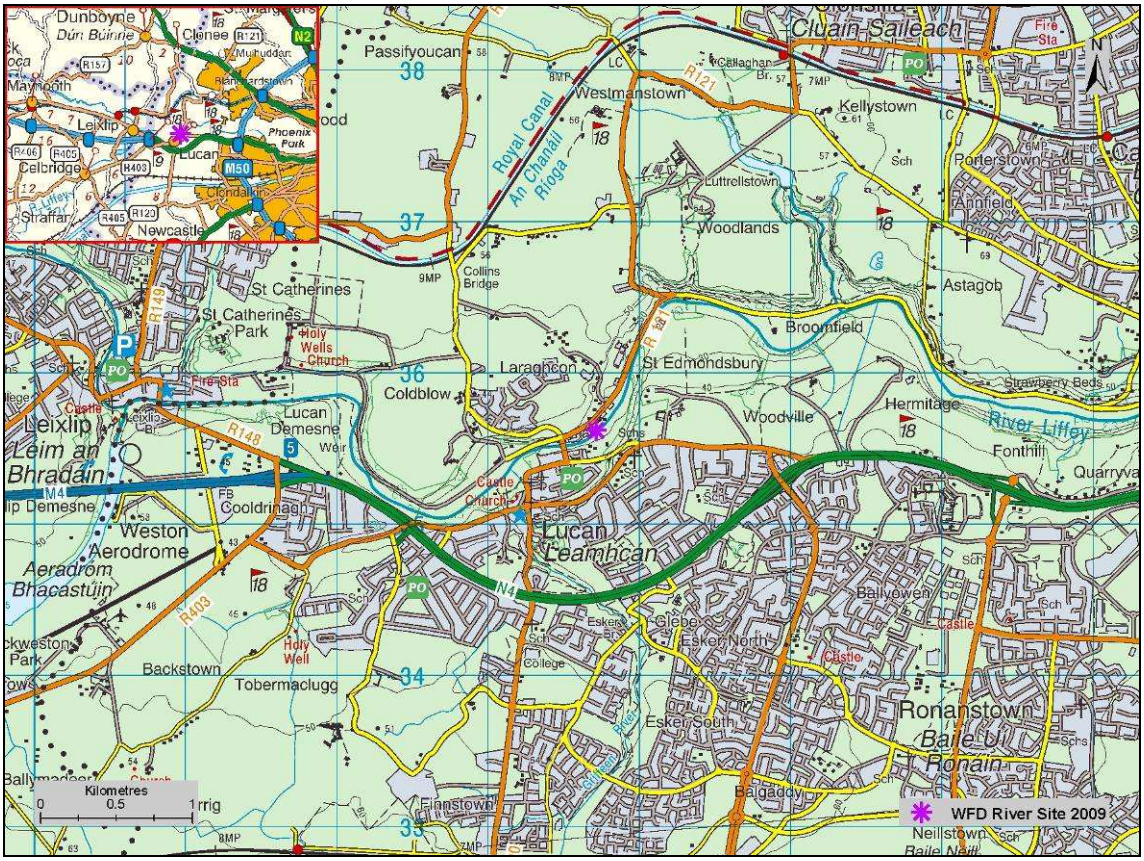

Fig. 4.24. Location of the River Liffey surveillance monitoring site

A total of seven fish species were recorded in the River Liffey (Lucan) site. Salmon was the most abundant species, followed by minnow, brown trout, European eel, stone loach, juvenile lamprey and roach (Table 4.9).

Table 4.9. Density of fish (no./m^2), River Liffey (Lucan site) (fish density has been calculated as minimum estimates based on the first fishing)

Species name	Common name	0+	1+ & older	Total minimum density
Salmo salar	Salmon	0.0098	0.0209	0.0307
Phoxinus phoxinus	Minnow	-	-	0.0120
Salmo trutta	Brown trout	0.0008	0.0073	0.0081
Anguilla anguilla	European eel	-	-	0.0017
Barbatula barbatula	Stone loach	-	-	0.0008
	Lamprey sp.	-	-	0.0004
Rutilus rutilus	Roach	-	-	0.0004
All fish	All fish	-	-	0.0541

Salmon ranged in length from 5.5cm to 18.2cm (Fig. 4.25). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 32%, 65% and 3% of the total salmon catch respectively. Mean salmon L1 and L2 were 5.9cm and 11.9cm respectively (Appendix 2).

Minnow were also abundant at this site, with lengths ranging from 2.5cm to 8.0cm (Fig. 4.26).

Brown trout ranged in length from 8.1cm to 46.5cm (Fig. 4.27). Five age classes (0+, 1+, 2+, 3+ and 5+) were present, accounting for approximately 9.5%, 50%, 29%, 9.5% and 2% of the total brown trout catch respectively. Mean brown trout L1, L2, L3, L4 and L5 were 9.5cm, 20.5, 29.8cm, 36.3cm and 42.7cm respectively, indicating a very fast rate of growth for brown trout in this river site according to the classification scheme of Kennedy and Fitzmaurice (1971).

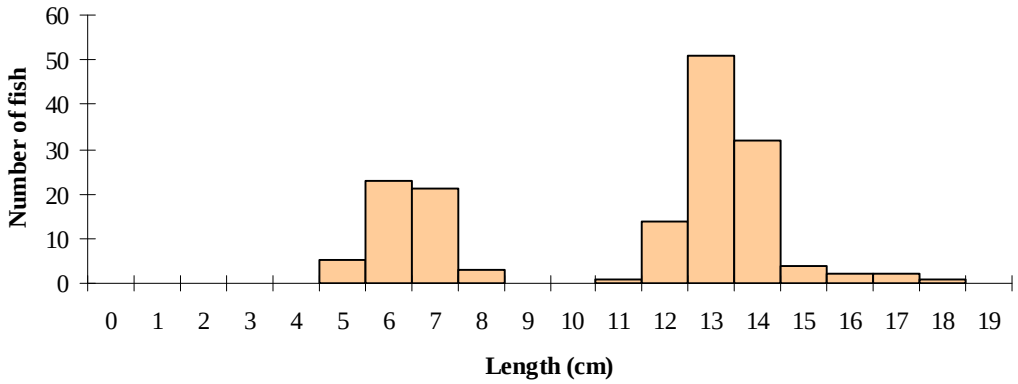

Fig. 4.25. Length frequency distribution of salmon in the River Liffey (Lucan), August 2009 (n = 159)

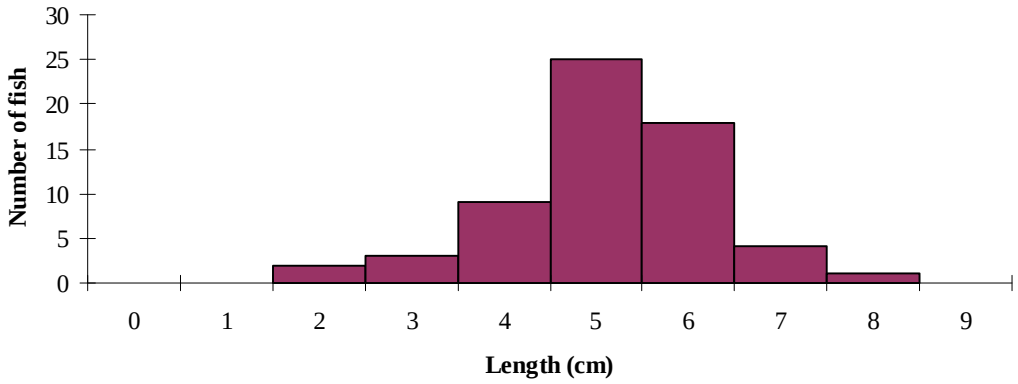

Fig. 4.26. Length frequency distribution of minnow in the River Liffey (Lucan), August 2009 (n = 62)

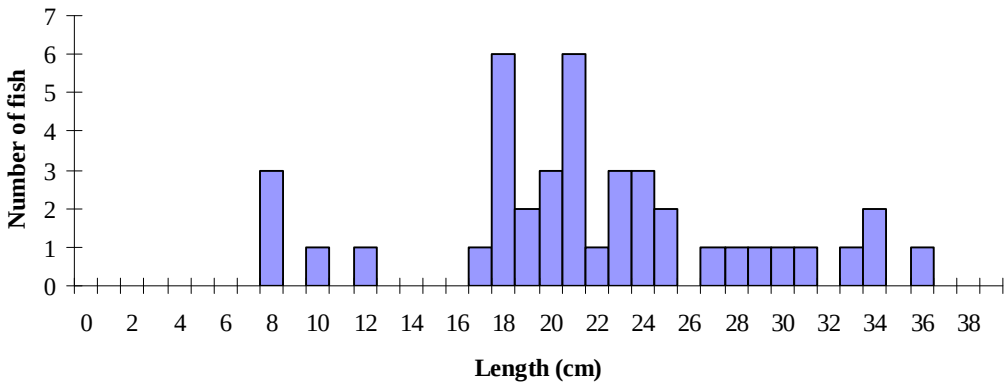

Fig. 4.27. Length frequency distribution of brown trout in the River Liffey (Lucan), August 2009 (n = 42)

4.3 Community structure

4.3.1 Species richness and composition

A total of 11 fish species (sea trout are included as a separate variety of trout) were recorded within the nine ERBD sites surveyed during 2009 (Fig. 4.28). Brown trout was the most common fish species recorded, occurring at all sites surveyed within the region. This was followed by eel (89%) salmon (78%), stone loach (67%), minnow (56%) lamprey (33%), three-spined stickleback (33%), roach (33%) and flounder (22%). Perch, gudgeon and sea trout were only recorded at one site each.

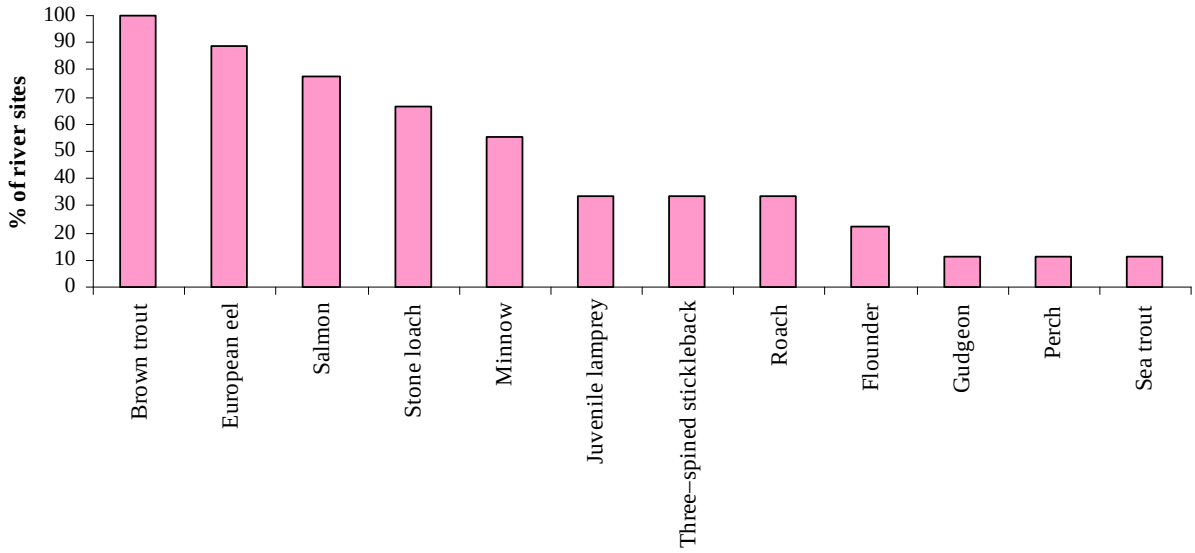

Fig. 4.28. Percentage of sites where each fish species was recorded in the ERBD for WFD SM monitoring 2009

Species richness ranged from three fish species at two sites (Glenealo River and the River Liffey at Ballyward Bridge) to a maximum of eight species recorded in the Blackwater River at Kells (Table 4.10). Kelly *et al*. (2008) classified fish species in Ireland into three groups. Group 1 – native species (e.g. salmonids, three-spined stickleback, lamprey, eel and flounder) were present at all sites surveyed. Group 2 – non-native species that influence ecology (e.g. perch, roach, minnow, stoneloach) were recorded at seven of the sites surveyed, and Group 3 – non-native species that generally don't influence ecology (e.g. gudgeon) were recorded in one site.

Table 4.10. Species richness at each river site surveyed in the ERBD, 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		
Blackwater	8	3	4	1
Nanny	7	5	2	0
Athboy	6	5	1	0
Dargle	4	4	0	0
Glencree	4	3	1	0
Glenealo	3	3	0	0
		BOAT SITES		
Liffey (Lucan)	7	4	3	0
Boyne (Boyne Br.)	6	4	2	0
Liffey (Ballyward Br.)	3	1	2	0

4.3.2 Species abundance and distribution

Abundance (minimum population density) and distribution maps for the most common fish species recorded within the ERBD are shown in Figures 4.29 to 4.54. 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 the sites surveyed, although fry (0+) were absent from the River Boyne site at Boyne Bridge. The highest density of brown trout fry among boat sites (Fig. 4.29) was in the River Liffey (Ballyward) (0.001 fish/m^2), whilst the highest density among hand-set sites (Fig. 4.30) was recorded in the River Blackwater (Kells) (0.27 fish/m^2). The River Boyne at Boyne Bridge (0.07 fish/m^2) contained the highest density of 1+ and older brown trout among the boat sites surveyed (Fig. 4.31) while the Athboy River contained the highest density among hand-set sites (0.13 fish/m^2) (Fig. 4.32).

Sea trout (Fig. 4.33 and 4.34) were only recorded in the Dargle River, a hand-set survey site, where they occurred in low numbers (0.003 fish/ m^2).

Salmon 0+ fry and 1+ and older parr and were captured in seven sites. Highest densities of salmon amongst boat survey sites were recorded on the River Liffey site at Lucan; salmon fry density was 0.01 fish/m^2 (Fig. 4.35) and 1+ and older salmon (parr) density was 0.02 fish/m^2 (Fig. 4.36). The highest densities of salmon (fry = 0.18 fish/m^2 and parr (1+ & older) = 0.09 fish/m^2) recorded among hand-set sites was on the Dargle River, (Fig 4.37 and 4.38).

European eels were also well distributed throughout the sites surveyed, occurring in eight out of the nine sites (Fig. 4.39 and 4.40). They were only absent from the River Liffey (Ballyward Br.) site.

Juvenile lamprey were recorded at the River Boyne (Boyne Bridge), the Athboy River and the River Liffey (Lucan) sites (Fig. 4.41 and 4.42).

Flounder were captured in the two sites closest to the coast; the River Nanny (Meath) and Dargle River (Fig. 4.43 and 4.44).

Three-spined stickleback were only present in two river sites, the River Nanny and Athboy River (Fig. 4.45 and 4.46).

Stone loach were widely distributed throughout the region, occurring in six of the nine sites (Fig. 4.47 and 4.48). They were most abundant in the River Nanny.

Minnow were present in a total of six river sites and were generally more prevalent in the smaller wadeable sites (Fig. 4.49 and 4.50).

Gudgeon were recorded in only one site, on the River Blackwater (Kells) (Fig. 4.51 and 4.52).

Roach were captured in three river sites, the River Blackwater, River Liffey (Lucan) and River Liffey (Ballyward) (Fig. 4.53 and 4.54).

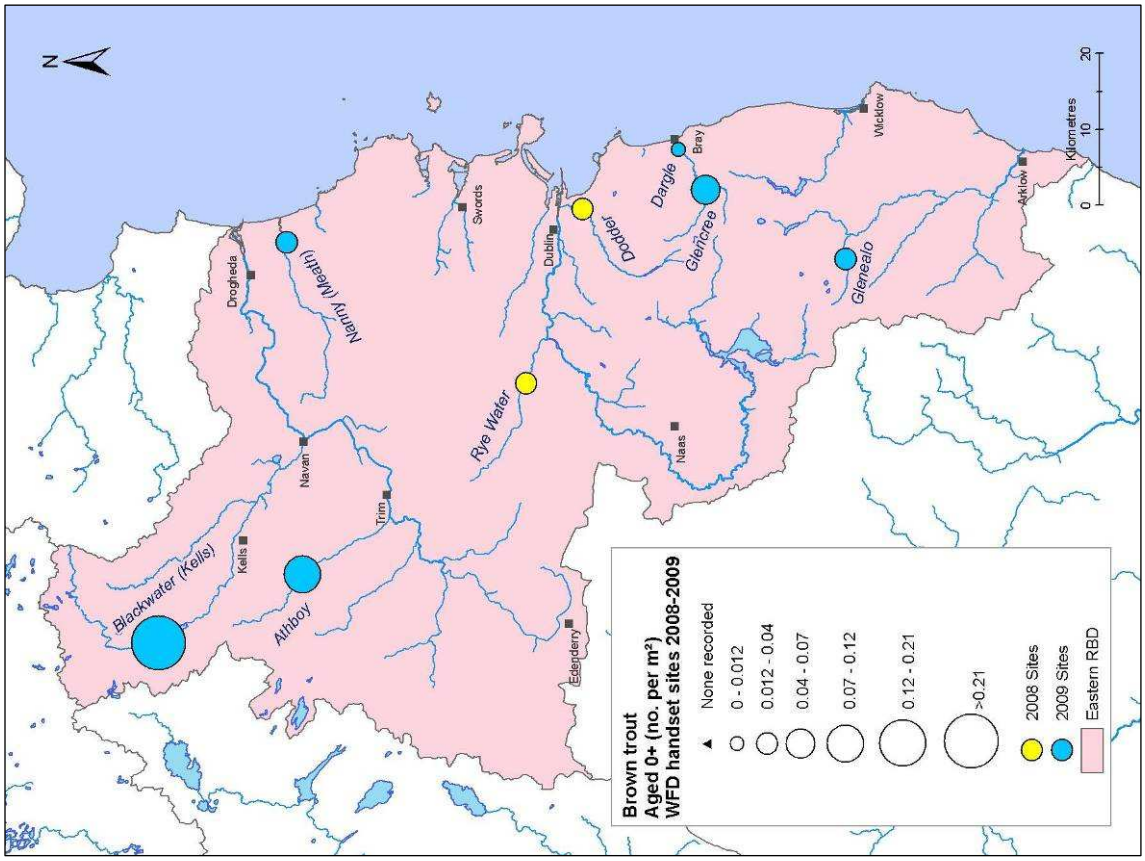

Fig. 4.30. Distribution map of 0+ brown trout in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

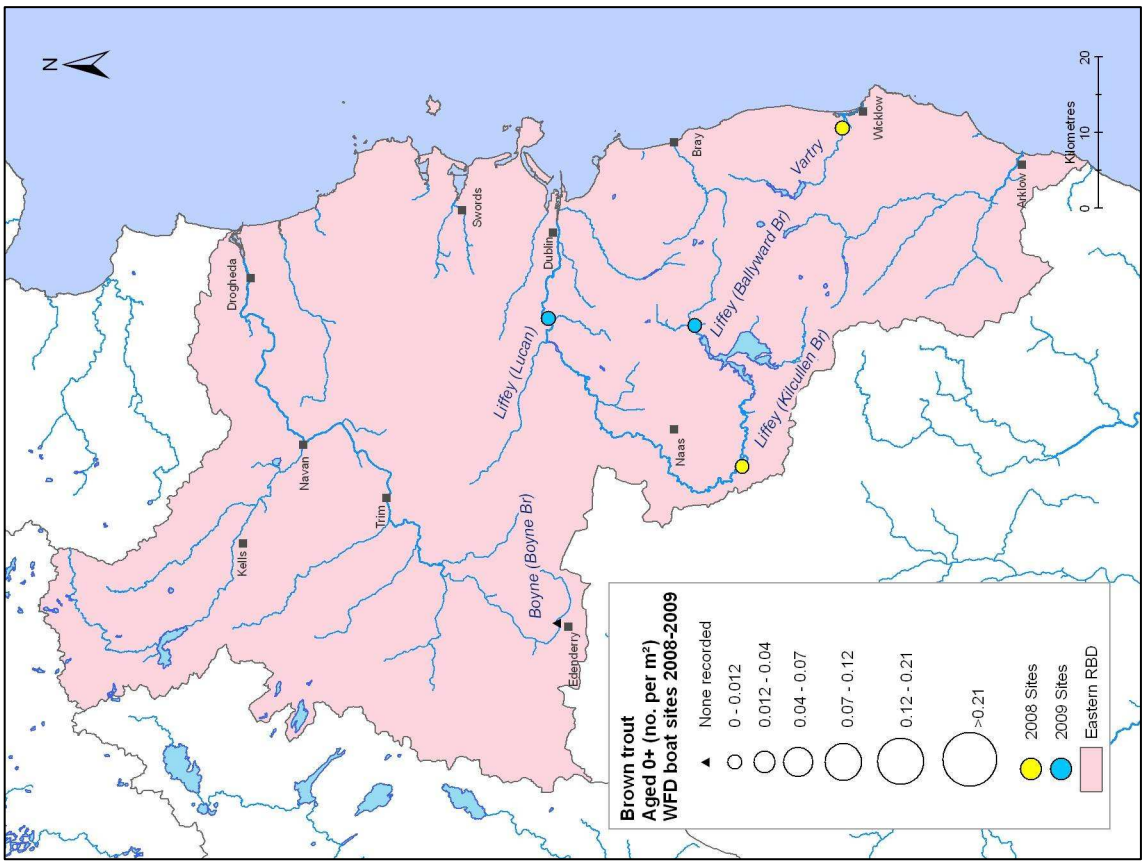

Fig. 4.29. Distribution map of 0+ brown trout in the ERBD boat sites surveyed for WFD monitoring 2008–2009

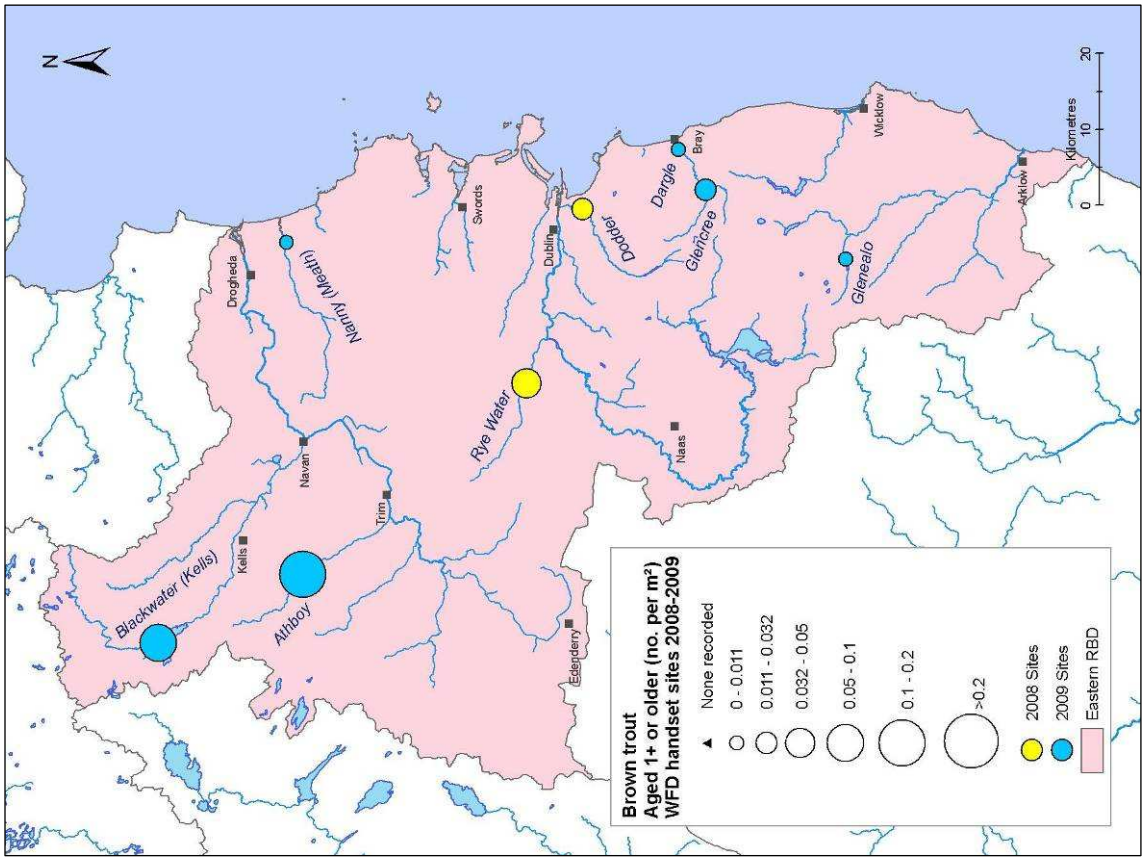

Fig. 4.32. Distribution map of 1+ or older brown trout in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

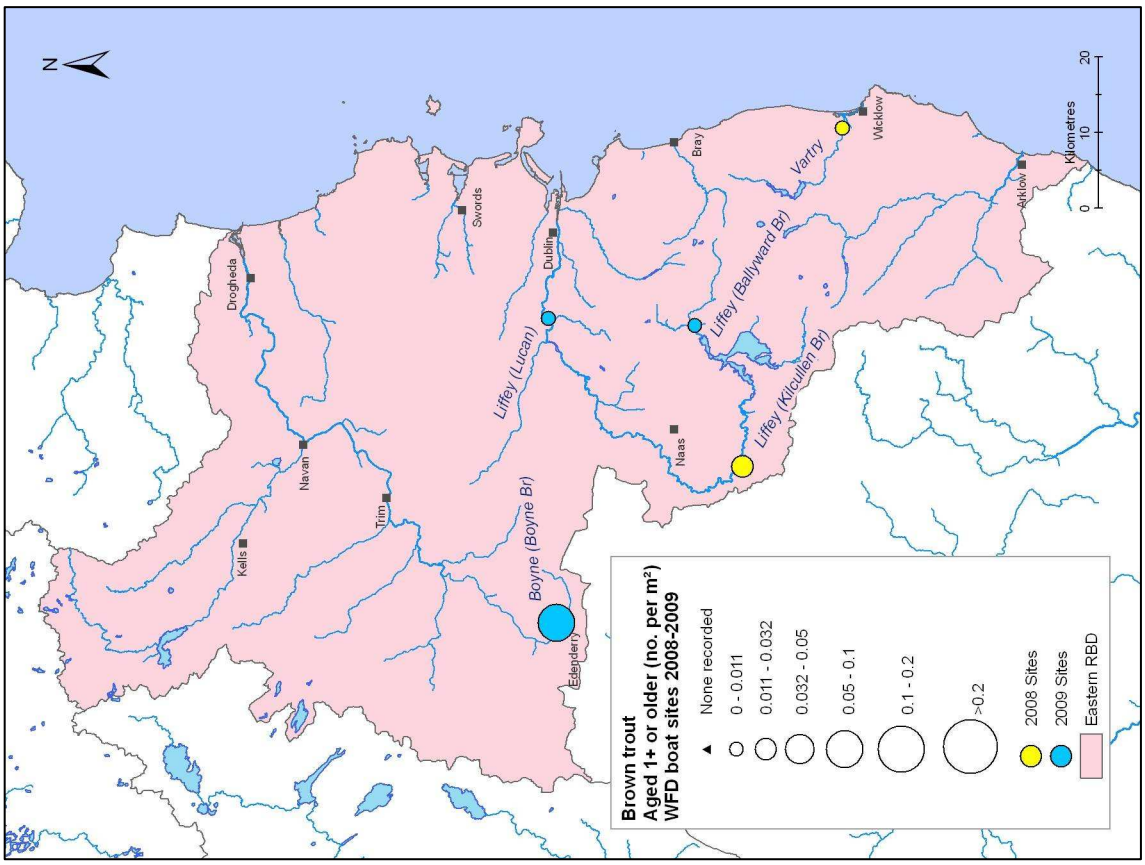

Fig. 4.31. Distribution map of 1+ or older brown trout in the ERBD boat sites surveyed for WFD monitoring 2008–2009

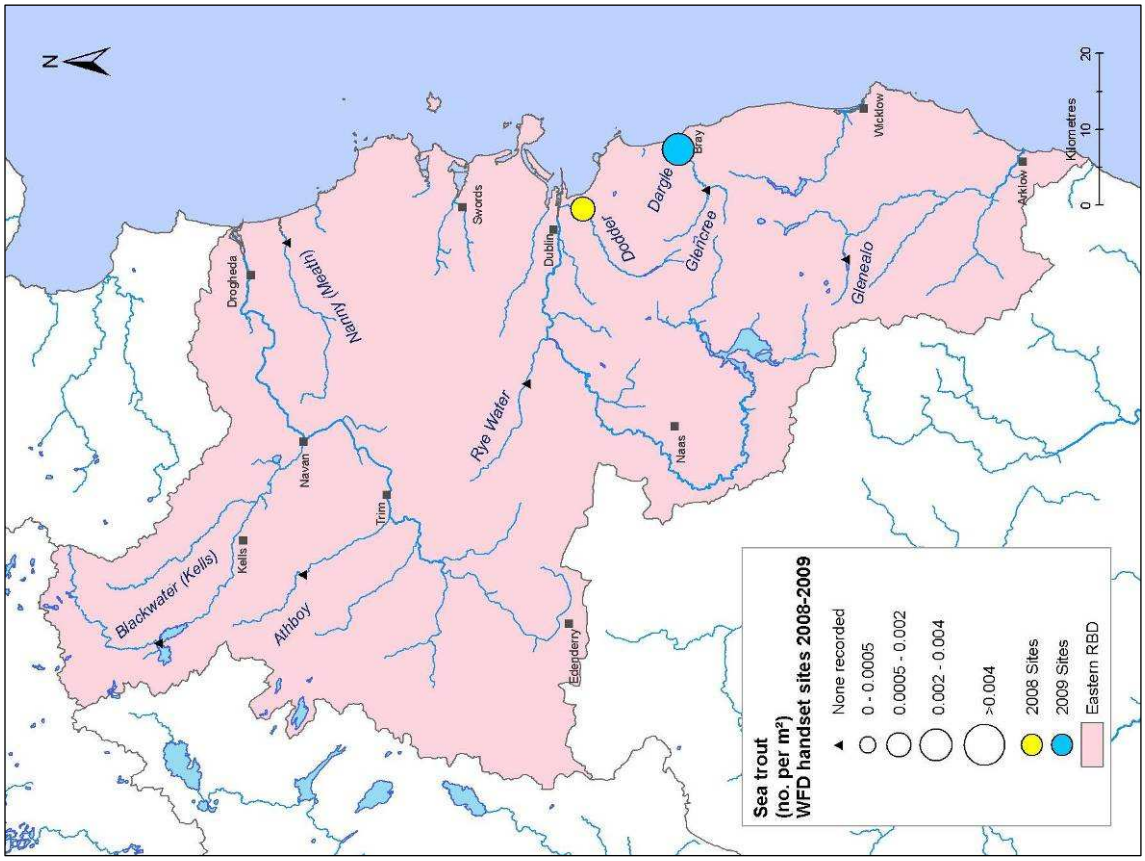

Fig. 4.34. Distribution map of sea trout in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

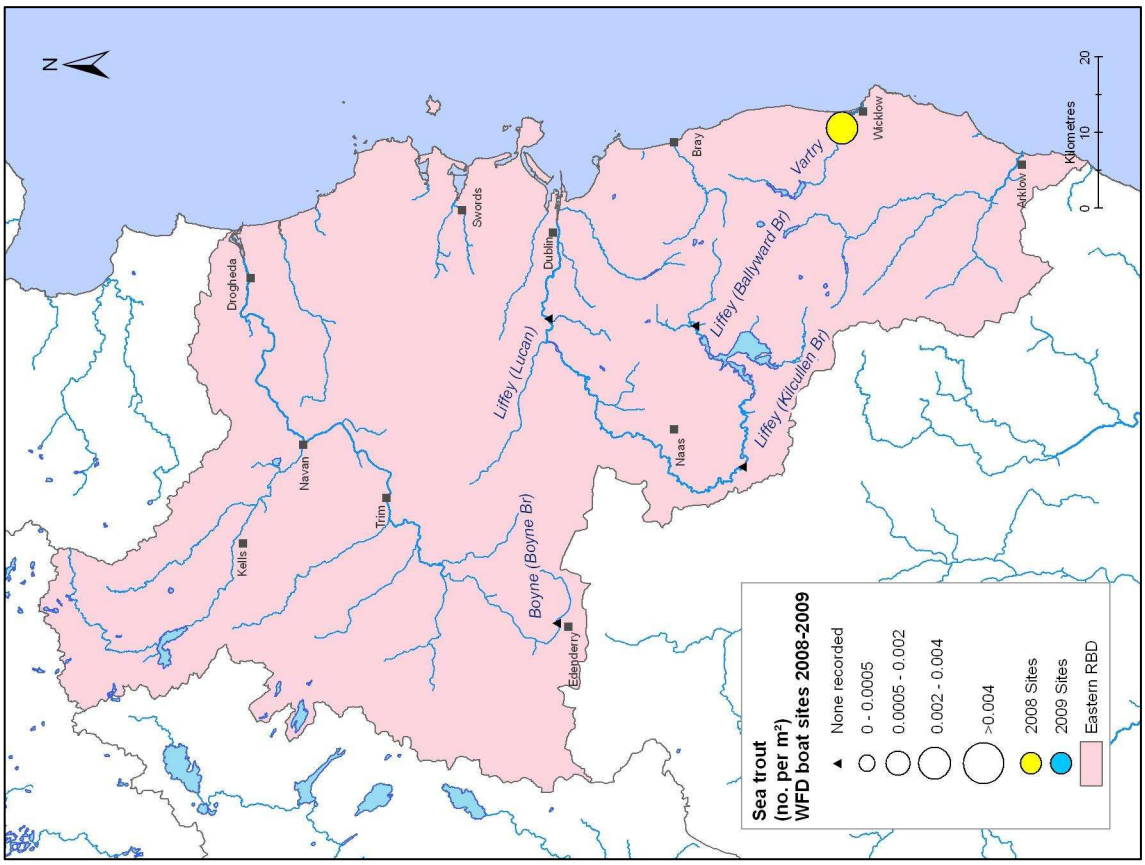

Fig. 4.33 Distribution map of sea trout in the ERBD boat sites surveyed for WFD monitoring 2008–2009

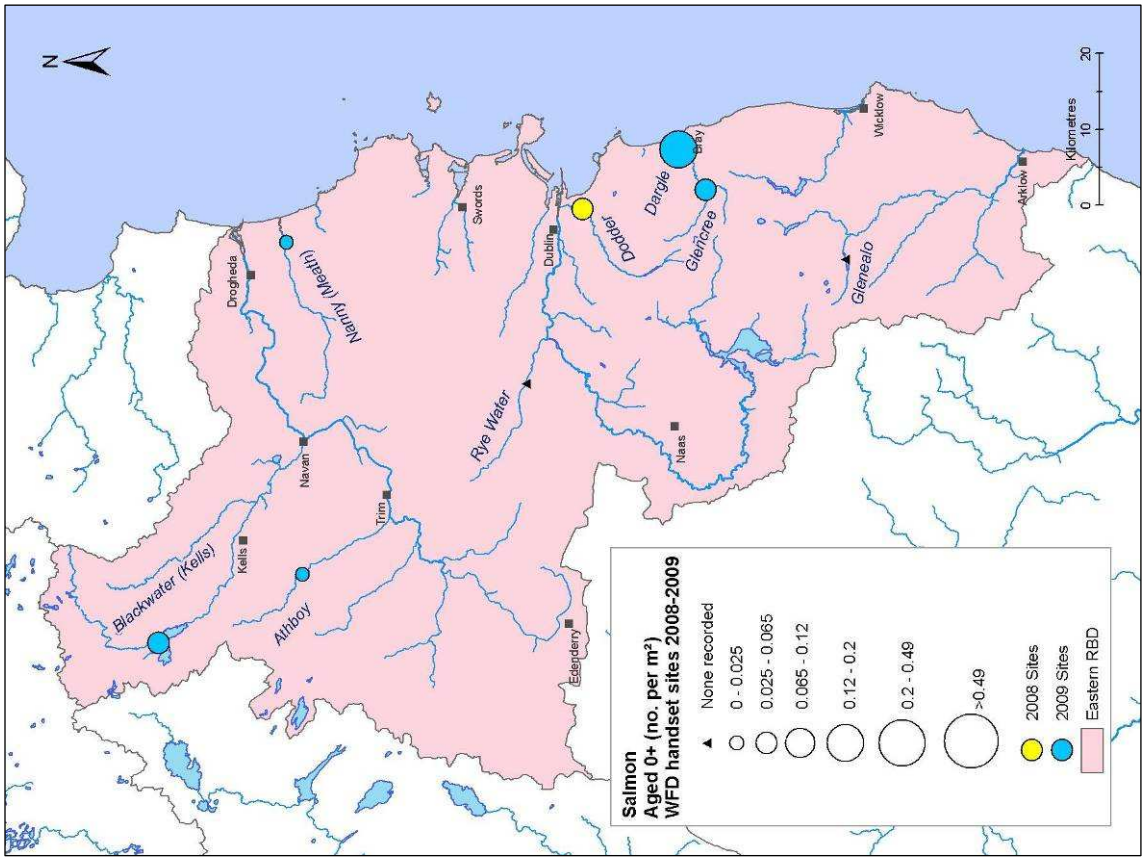

Fig. 4.36. Distribution map of 0+ salmon in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

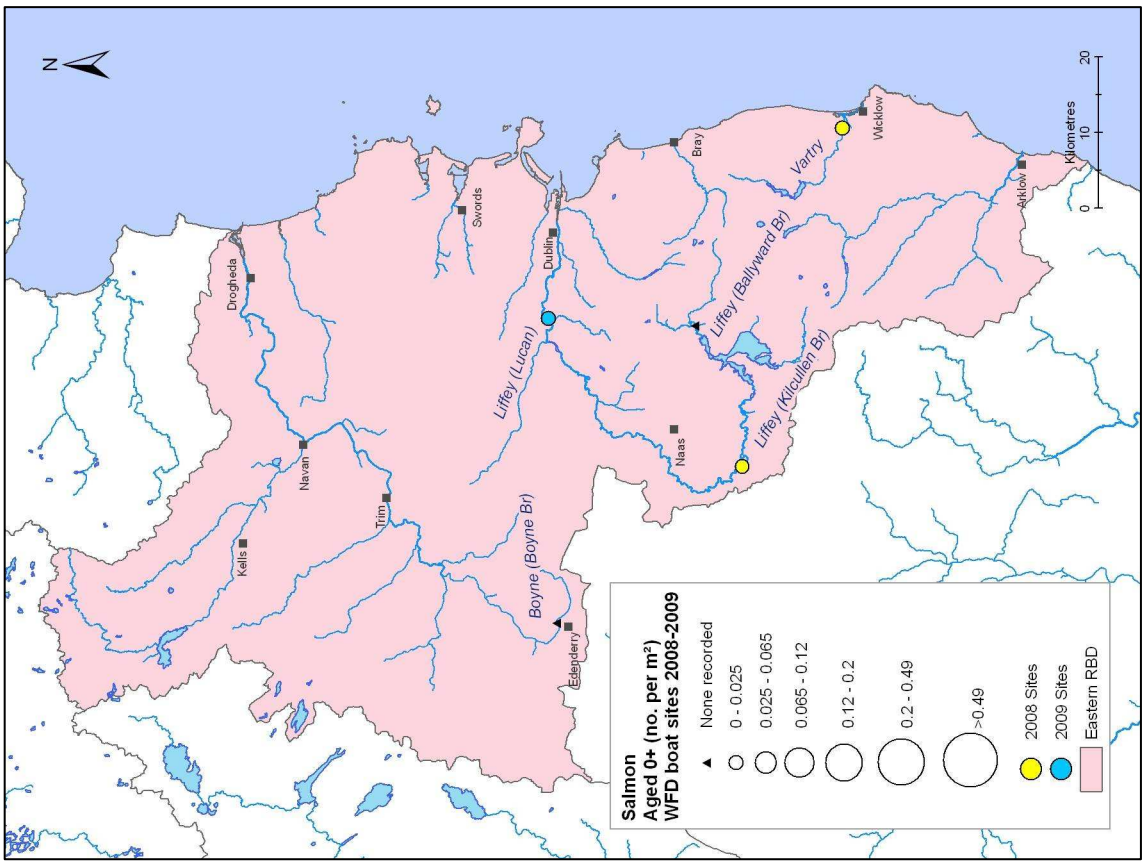

Fig. 4.35. Distribution map of 0+ salmon in the ERBD boat sites surveyed for WFD monitoring 2008–2009

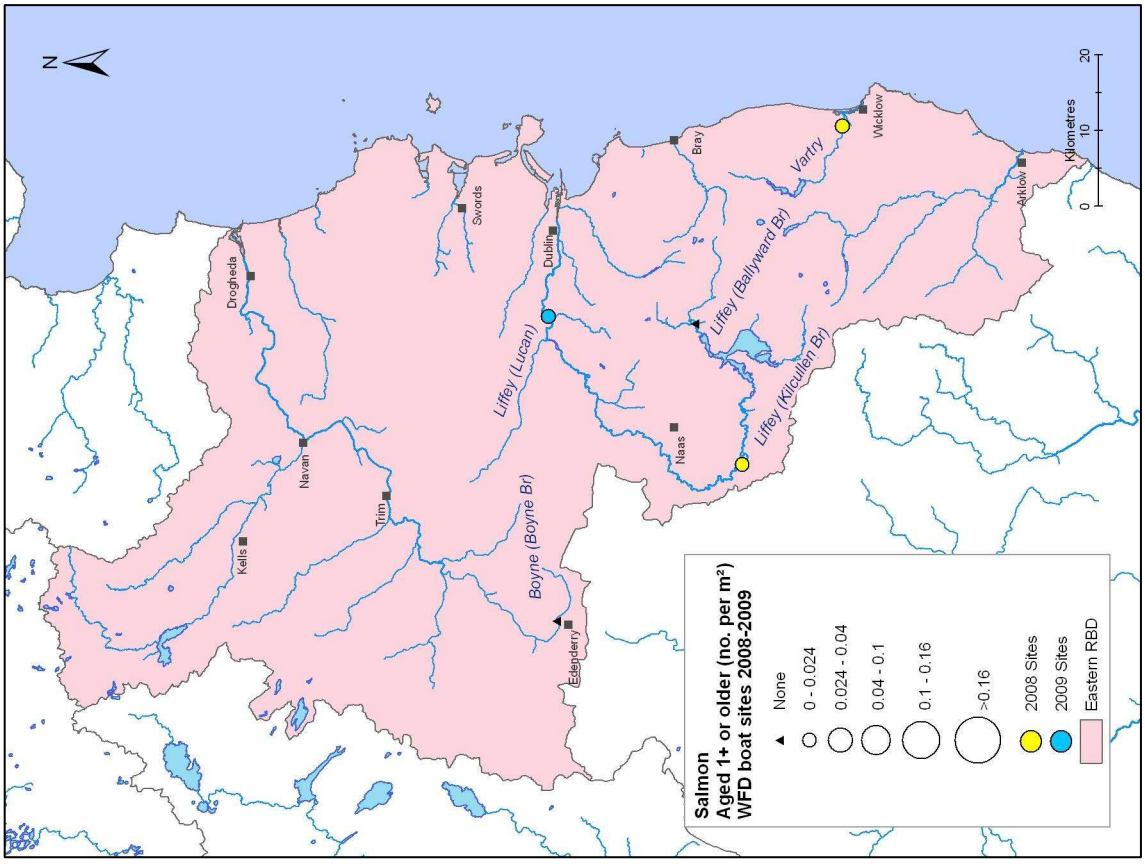

Fig. 4.37. Distribution map of 1+ or older salmon in the ERBD boat sites surveyed for WFD monitoring 2008–2009

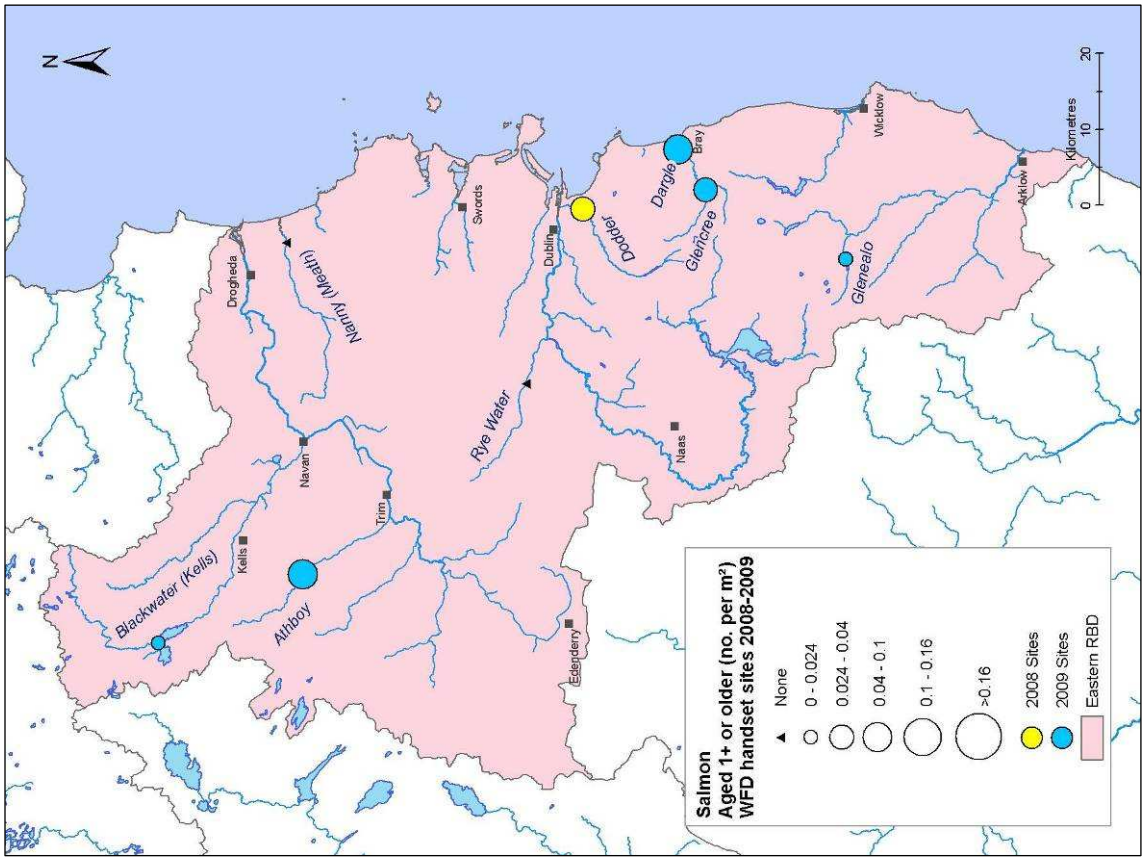

Fig. 4.38. Distribution map of 1+ or older salmon in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

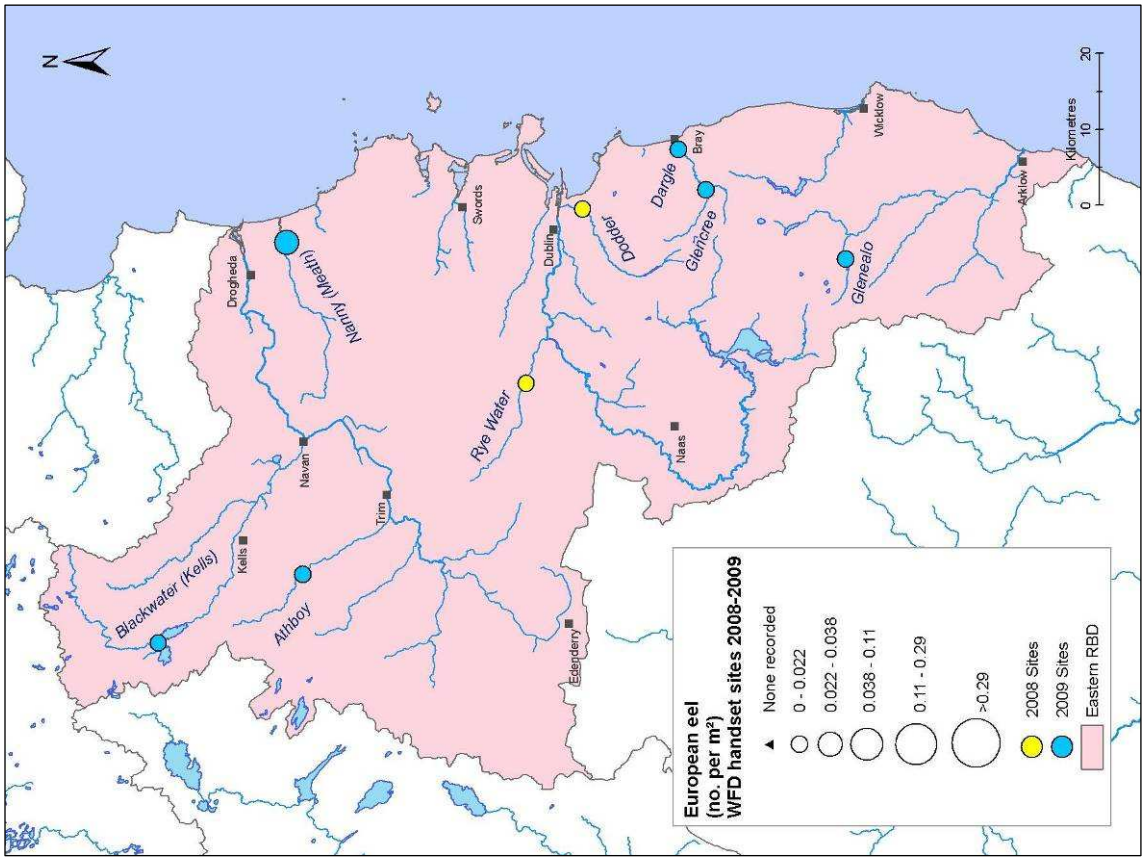

Fig. 4.40. Distribution map of European eel in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

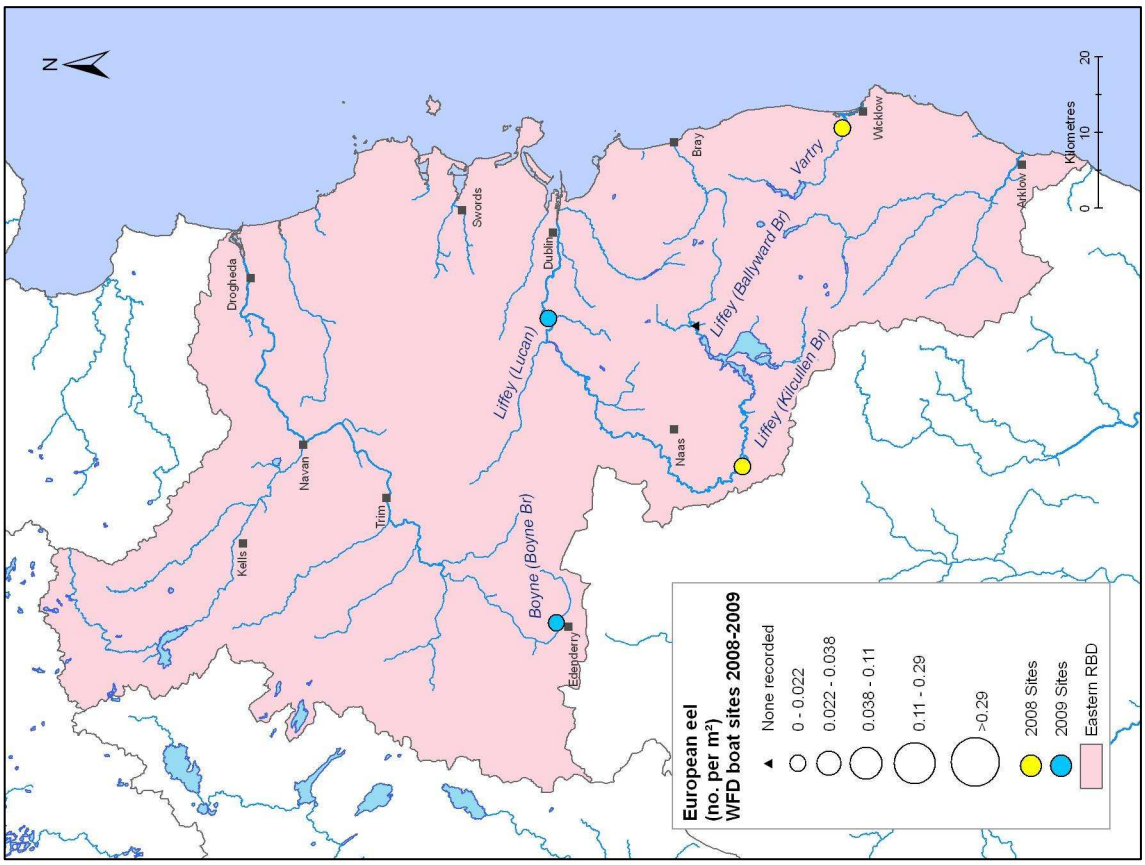

Fig. 4.39. Distribution map of European eel in the ERBD boat sites surveyed for WFD monitoring 2008–2009

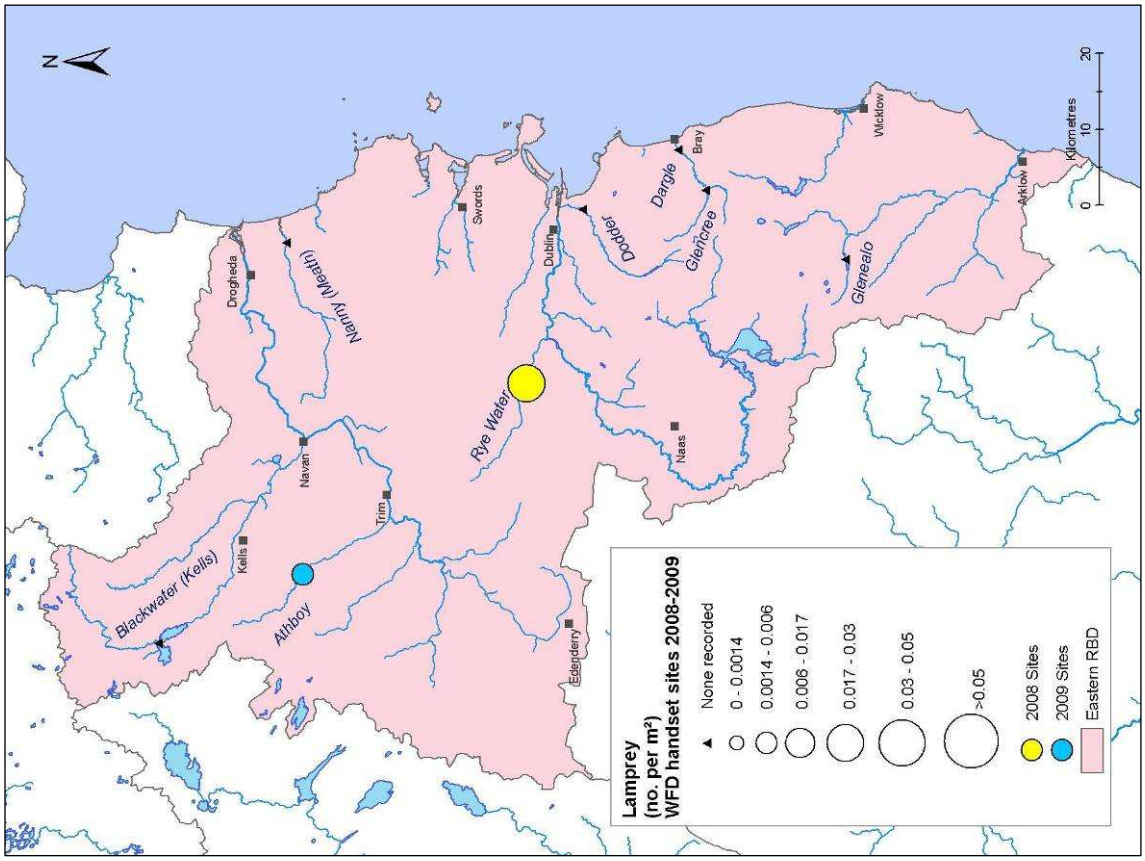

Fig. 4.42. Distribution map of lamprey in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

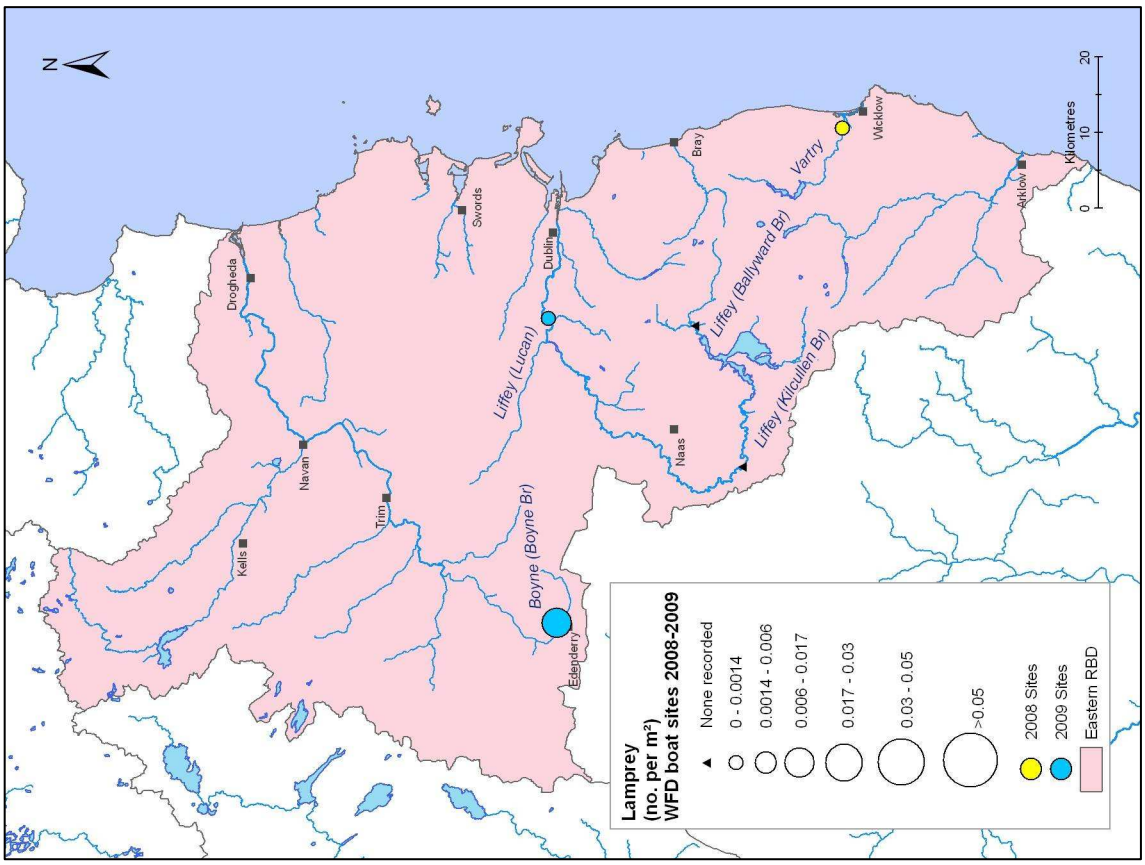

Fig. 4.41. Distribution map of lamprey in the ERBD boat sites surveyed for WFD monitoring 2008–2009

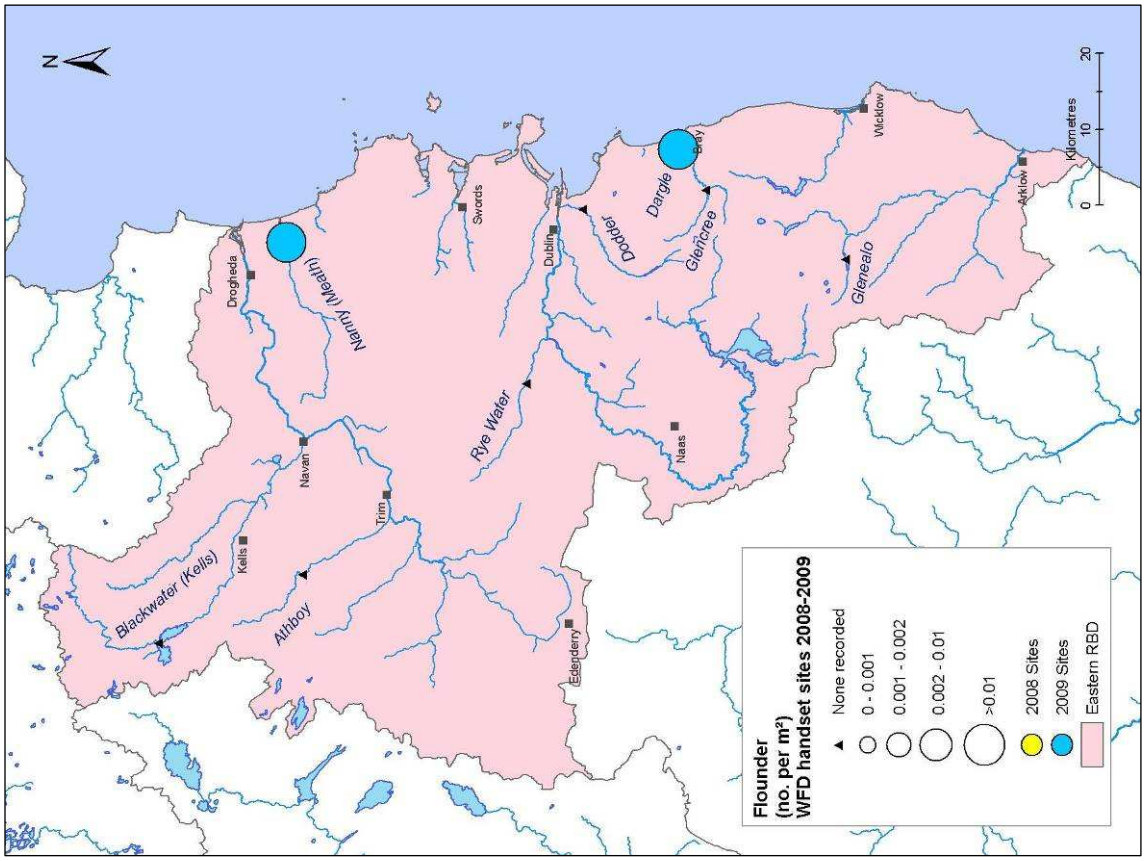

Fig. 4.44. Distribution map of flounder in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

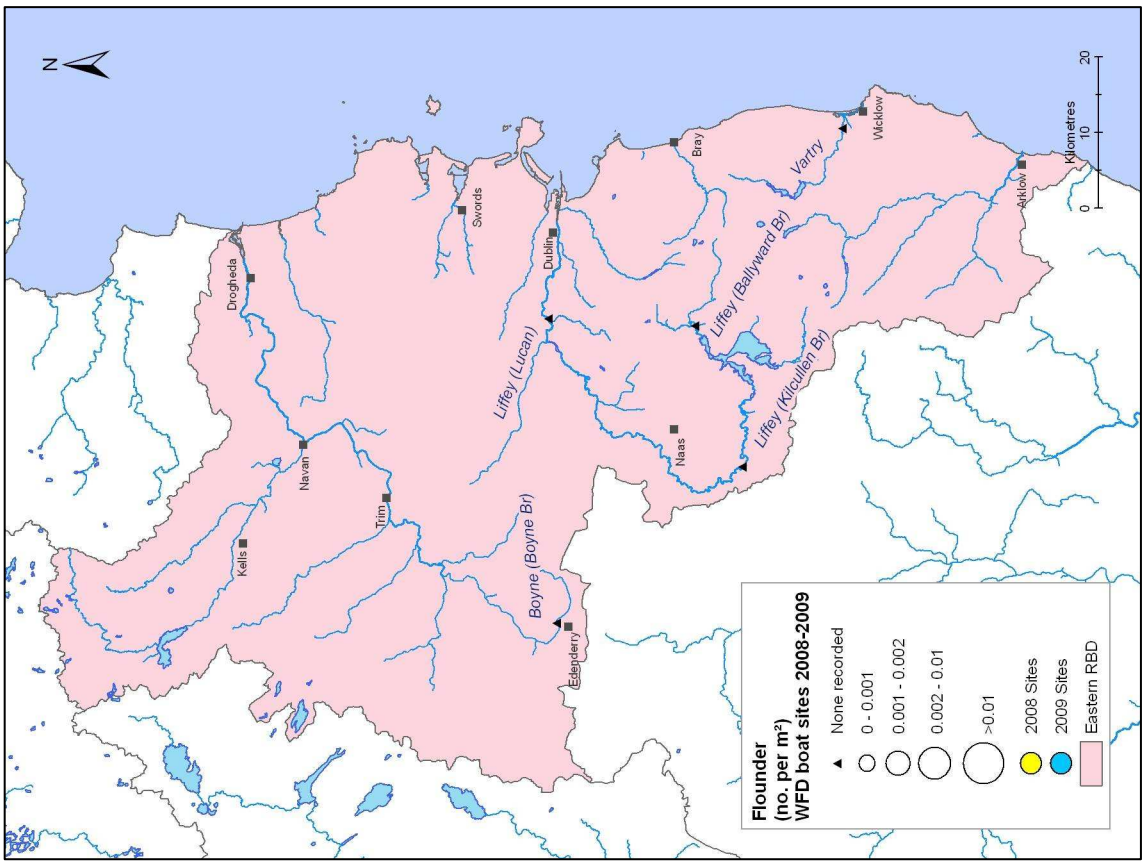

Fig. 4.43. Distribution map of flounder in the ERBD boat sites surveyed for WFD monitoring 2008–2009

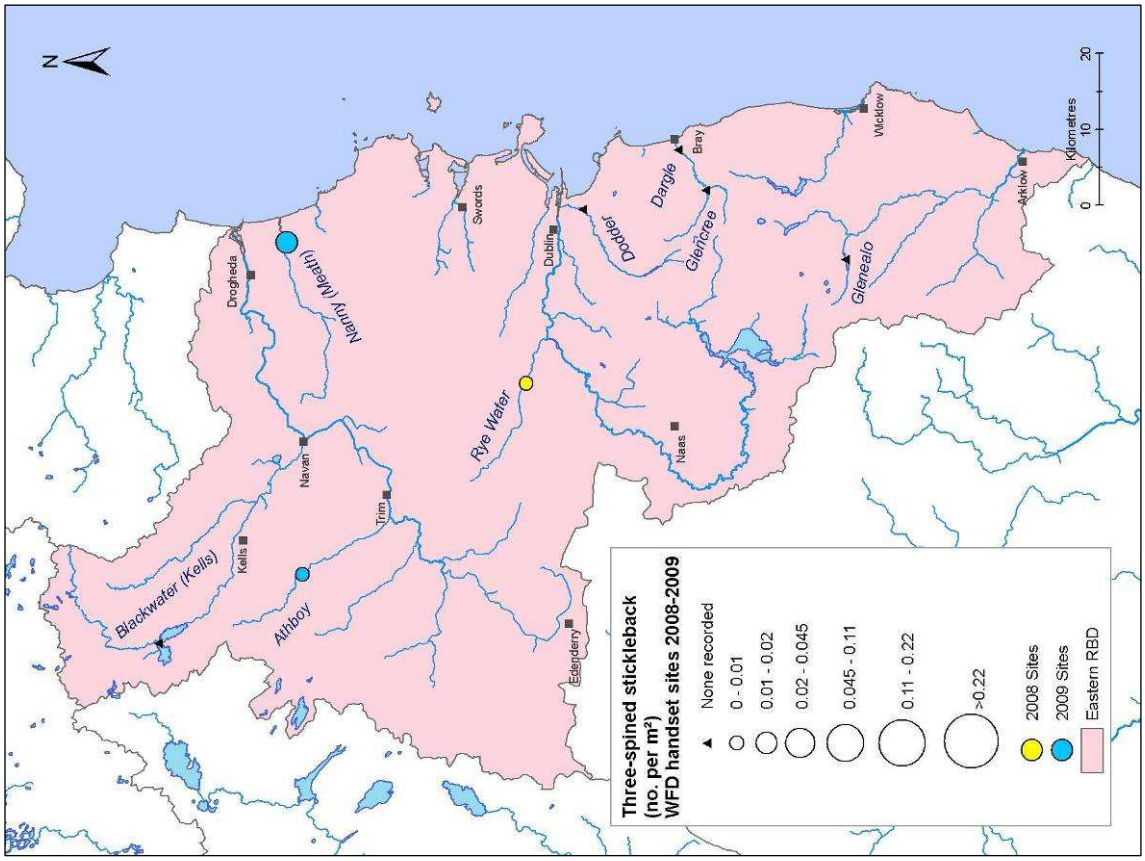

Fig. 4.46. Distribution map of three-spined stickleback in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

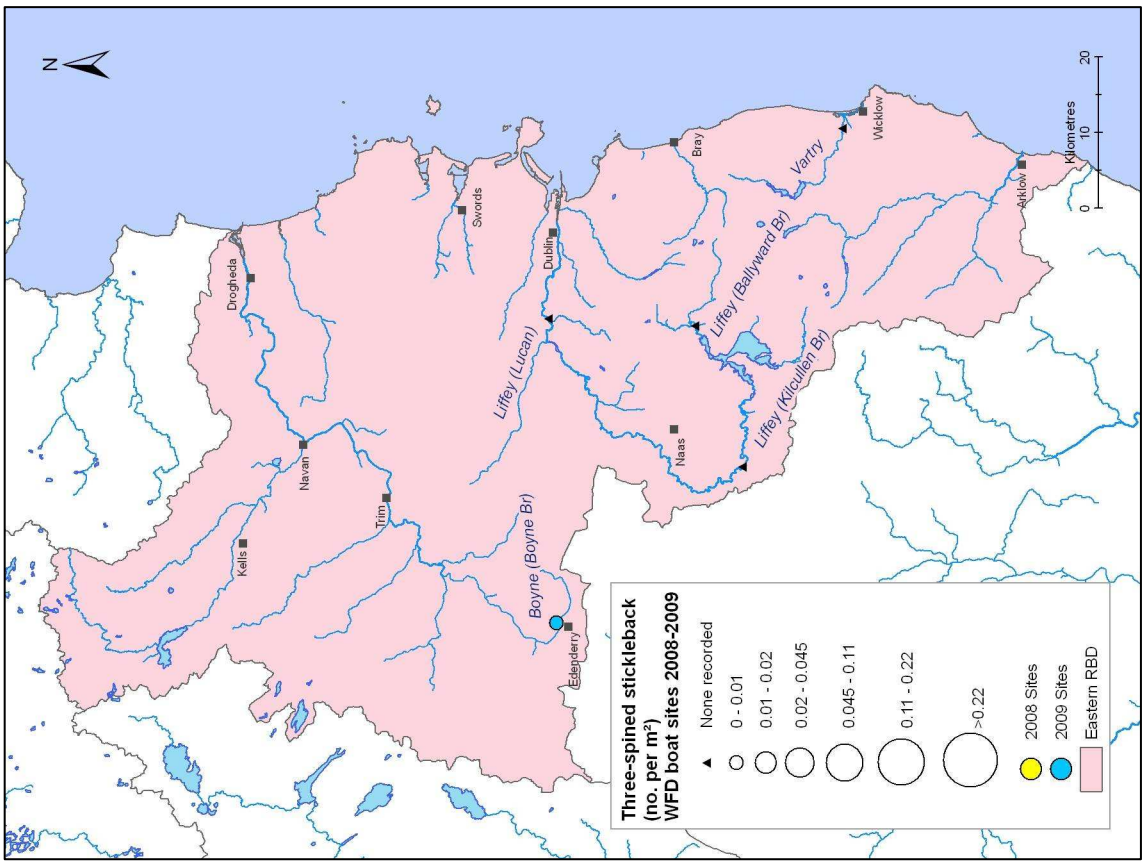

Fig. 4.45. Distribution map of three-spined stickleback in the ERBD boat sites surveyed for WFD monitoring 2008–2009

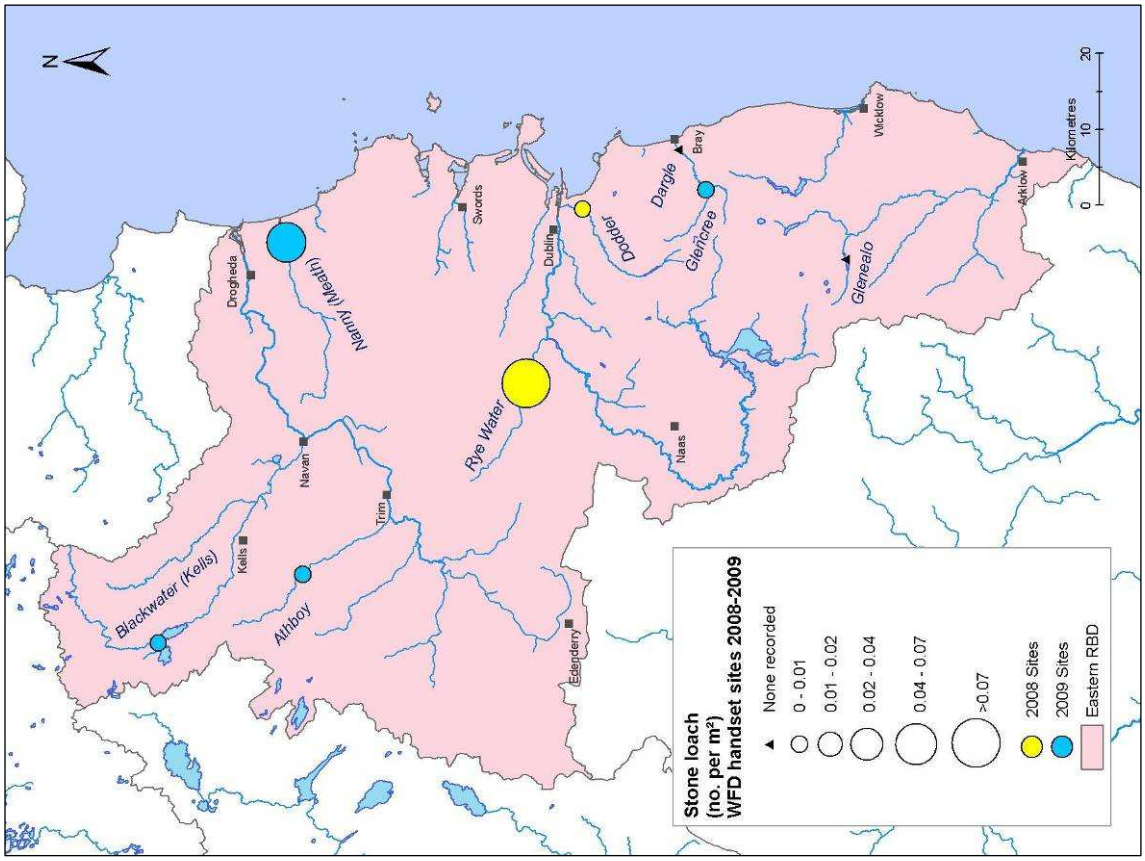

Fig. 448. Distribution map of stone loach in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

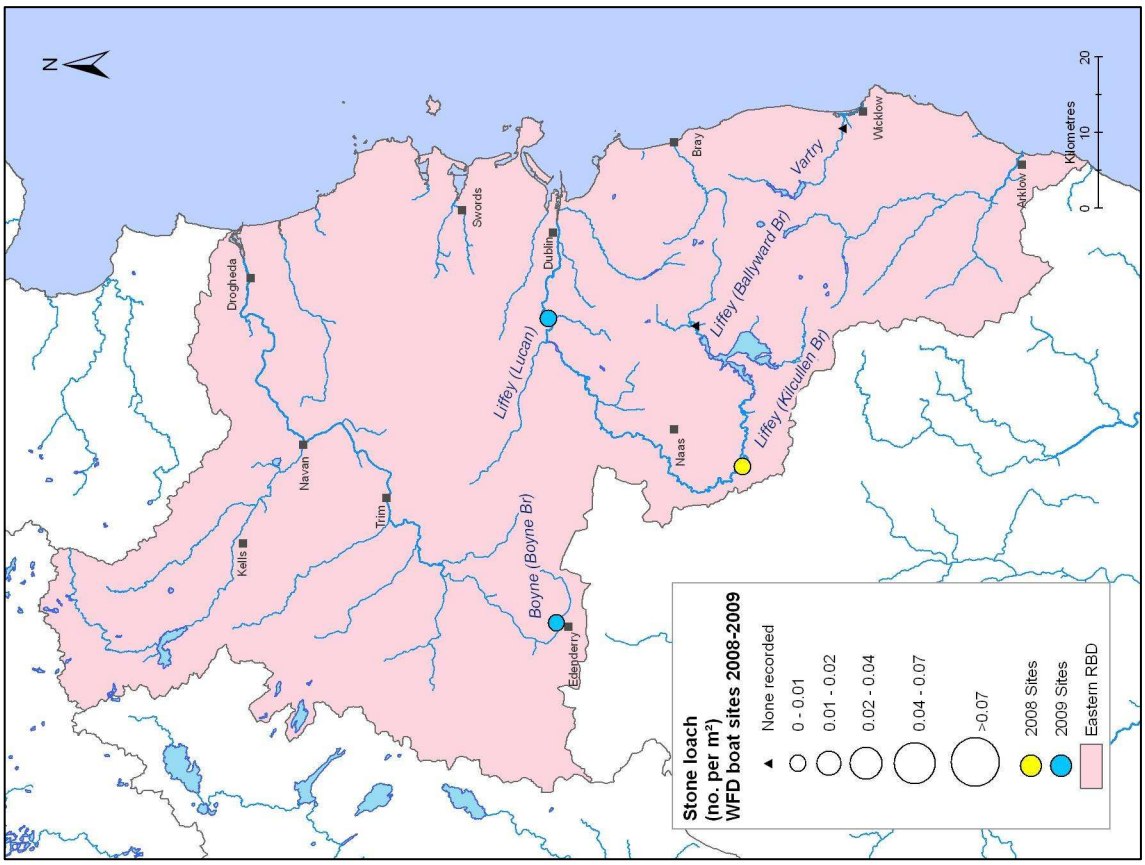

Fig. 4.47. Distribution map of stone loach in the ERBD boat sites surveyed for WFD monitoring 2008–2009

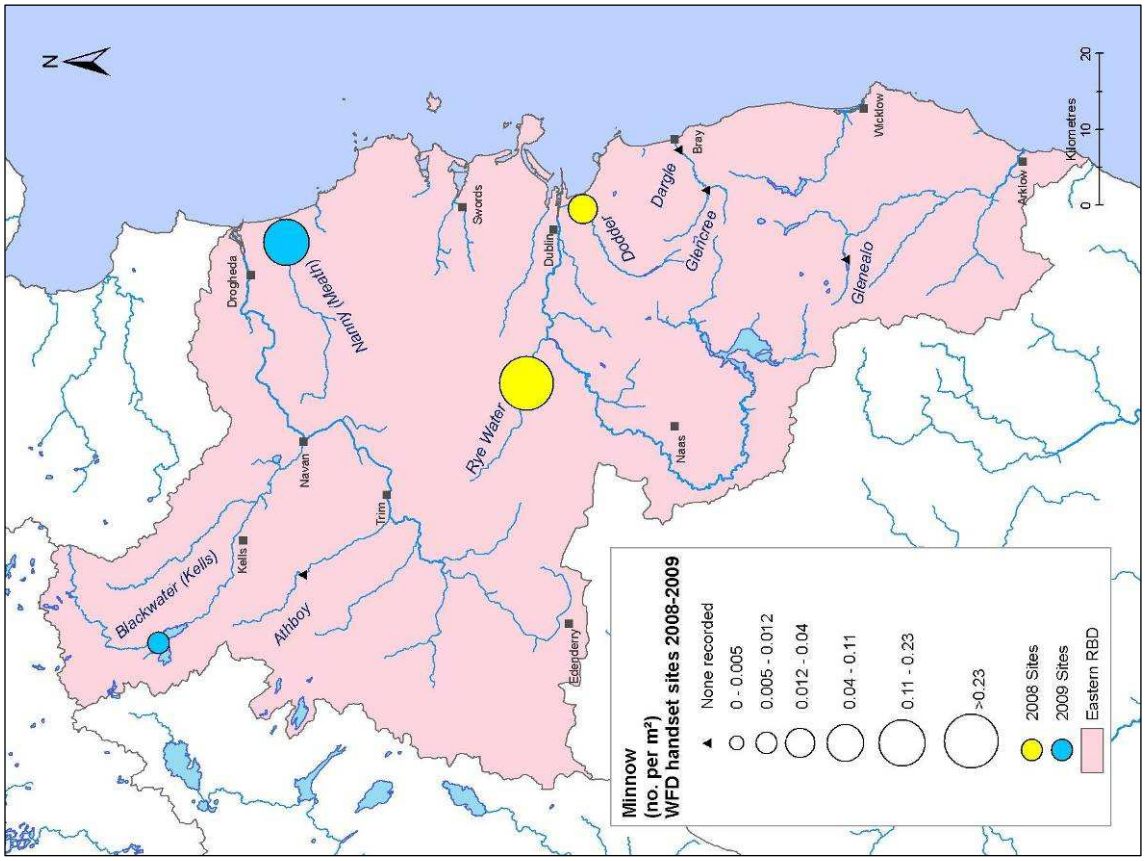

Fig. 4.50. Distribution map of minnow in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

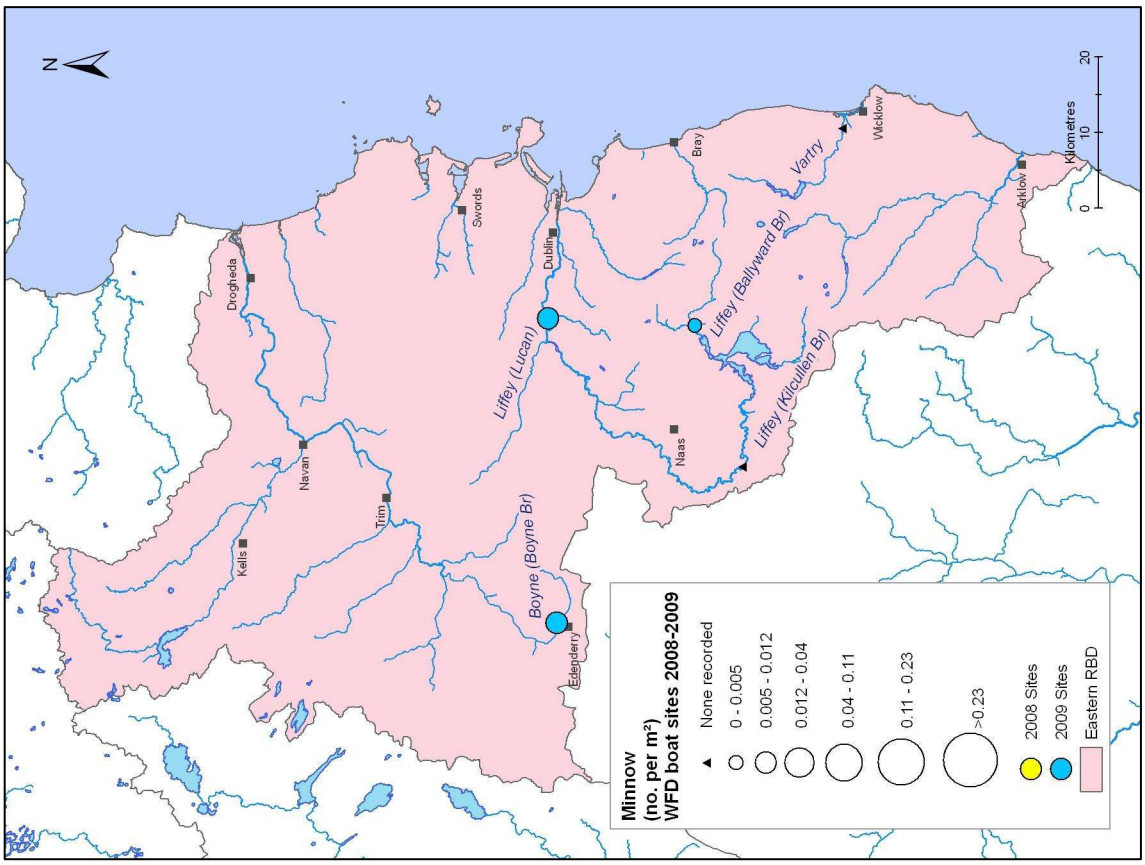

Fig. 4.49. Distribution map of minnow in the ERBD boat sites surveyed for WFD monitoring 2008–2009

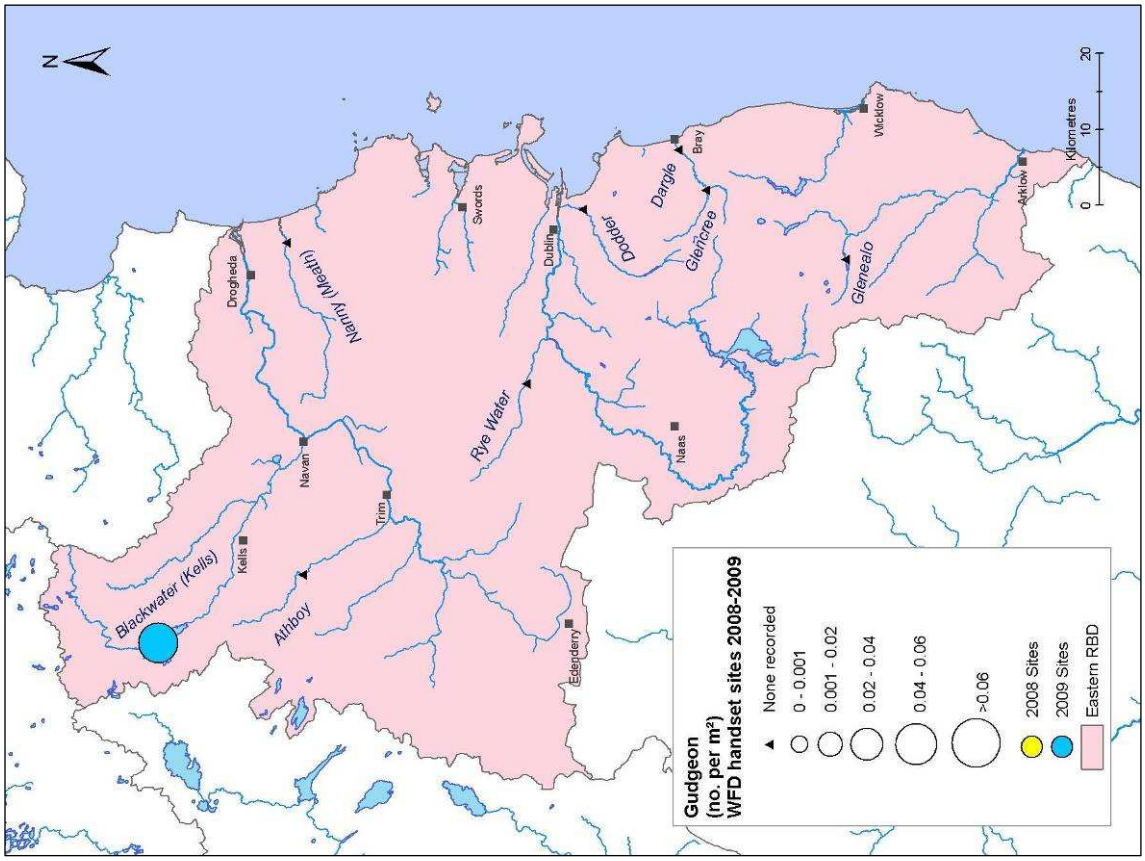

Fig. 4.52. Distribution map of gudgeon in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

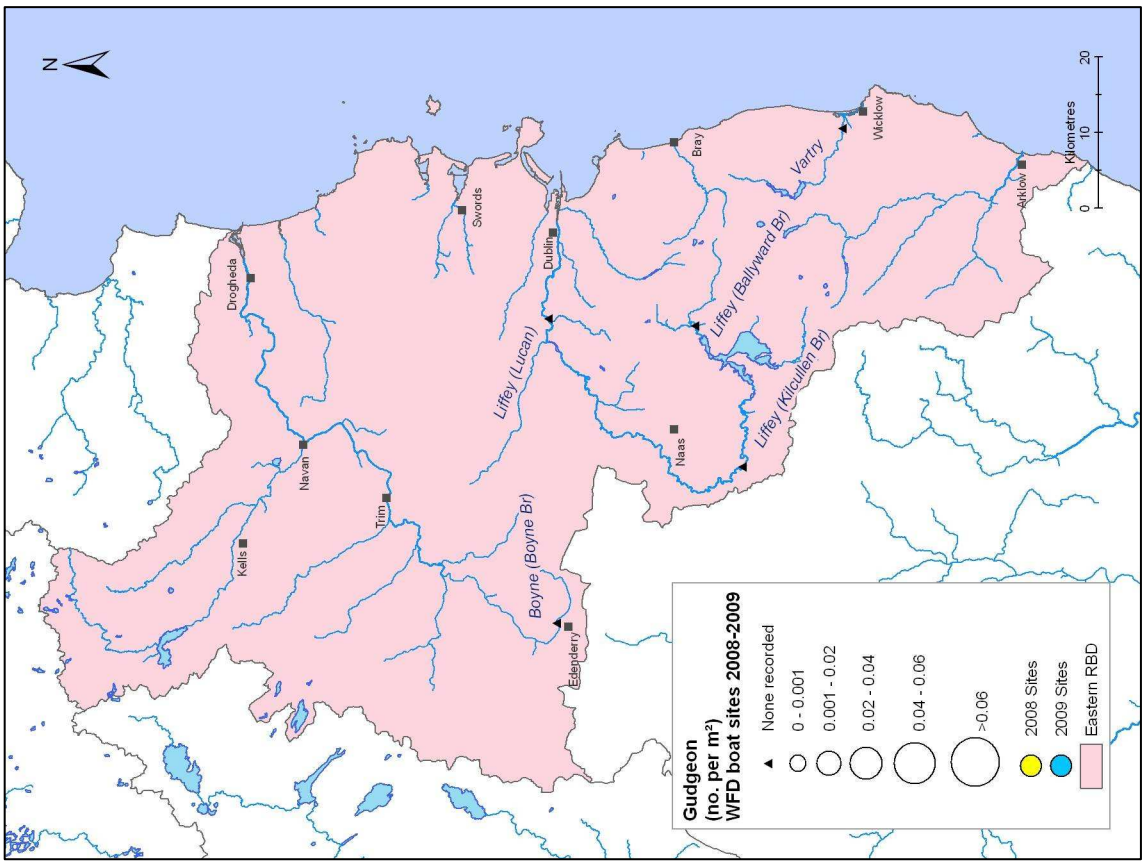

Fig. 4.51. Distribution map of gudgeon in the ERBD boat sites surveyed for WFD monitoring 2008–2009

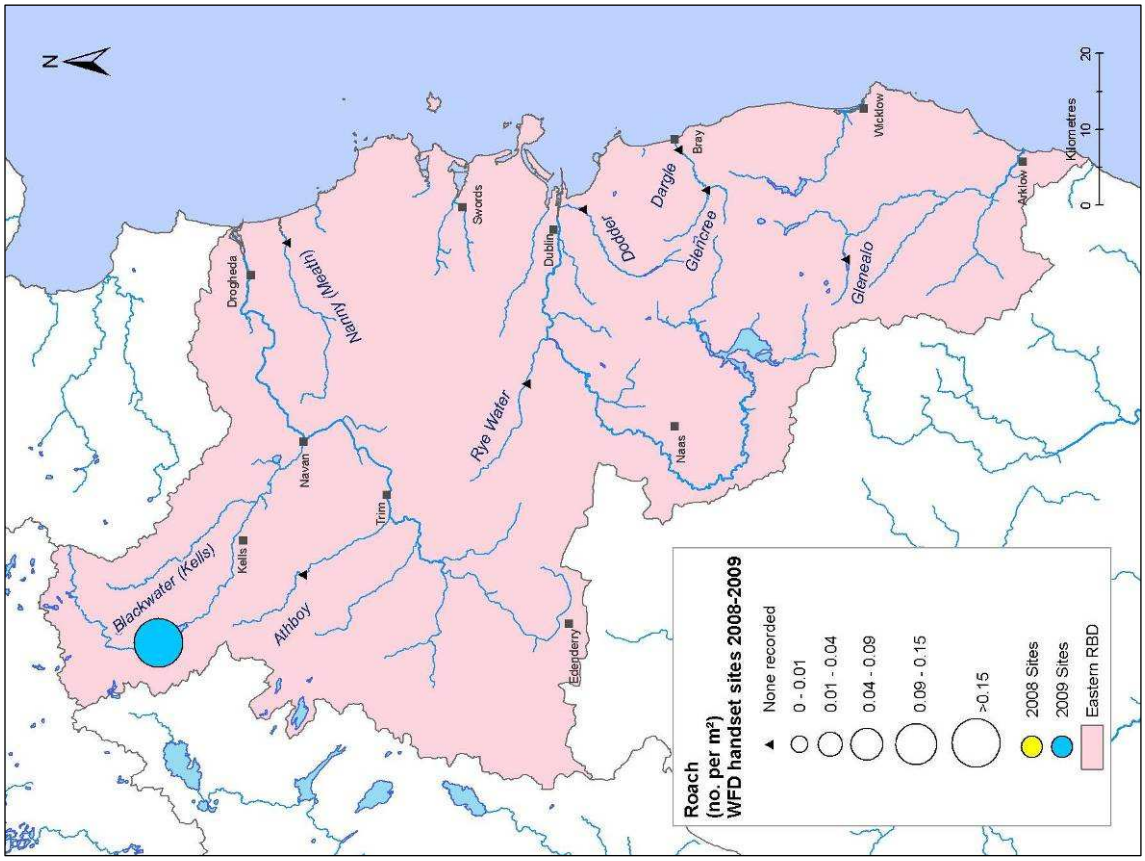

Fig. 4.54. Distribution map of roach in the ERBD hand-set sites surveyed for WFD monitoring 2008–2009

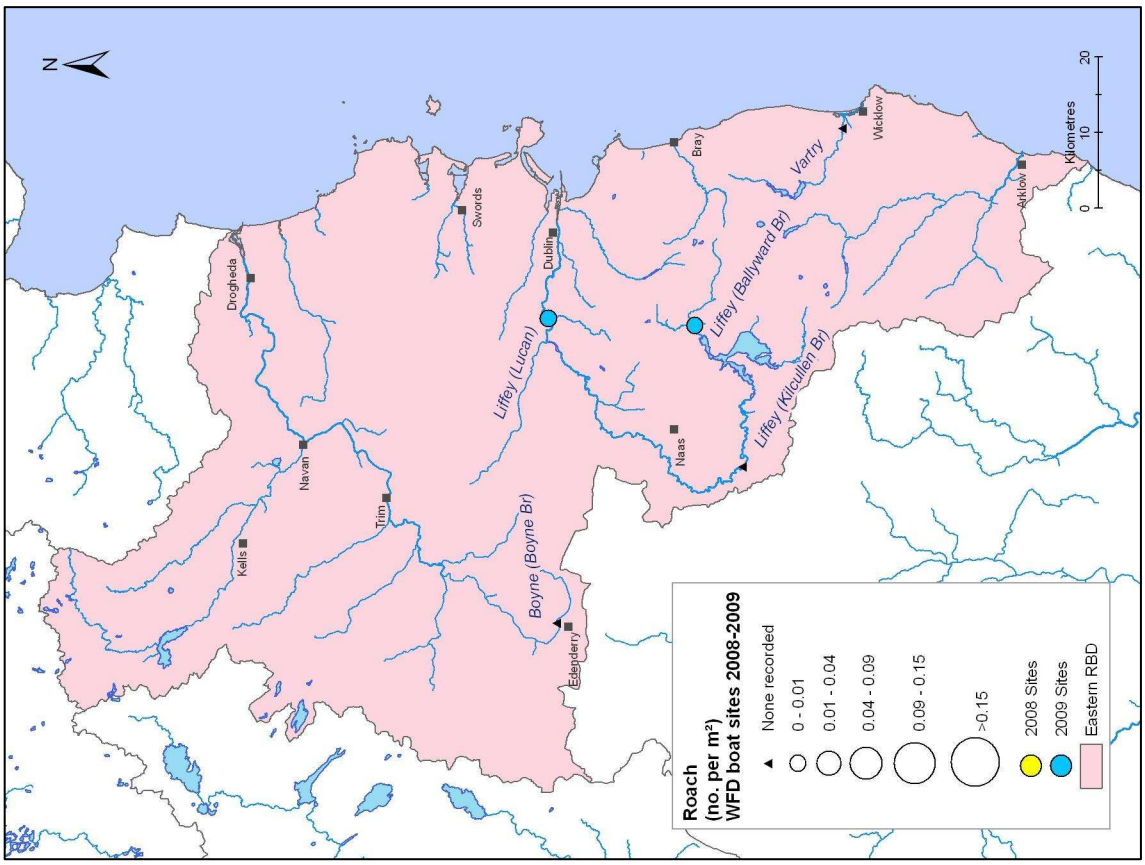

Fig. 4.53. Distribution map of roach in the ERBD boat sites surveyed for WFD monitoring 2008–2009

4.3.3 Age and growth of brown trout and salmon

Age and growth of fish were determined for brown trout and salmon (where present) in each river site. Brown trout ages ranged from 0+ to 5+, with 0+ and 1+ being the dominant age classes at most sites. The largest brown trout (length 46.5cm and weight 1.18kg) recorded during the survey was captured in the River Liffey at Lucan. Three age classes of salmon were recorded; 0+, 1+ and 2+, with those in the 1+ age class the most abundant. The largest juvenile salmon recorded in the ERBD was captured in the River Liffey (Lucan), measuring 18.2cm and weighing 91g.

Length-at-age analyses and growth curves are presented for brown trout (Fig. 4.55, Appendix 1) and salmon (Fig. 4.56, Appendix 2) recorded in the nine river sites surveyed within the ERBD during 2009. 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 brown trout in Irish streams and rivers. Growth was classified as very slow in the Blackwater (Kells), Glencree and Glenealo, slow in the Athboy, Dargle and Liffey (Ballyward), fast in the Boyne (Boyne Br.) and very fast in the Liffey (Lucan) sites.

The River Blackwater (Kells) and River Liffey (Lucan) appeared to have the fastest growth rates for salmon relative to the other rivers where salmon were recorded (Fig. 4.56, Appendix 2); however this is based on limited data for L1 and L2 only.

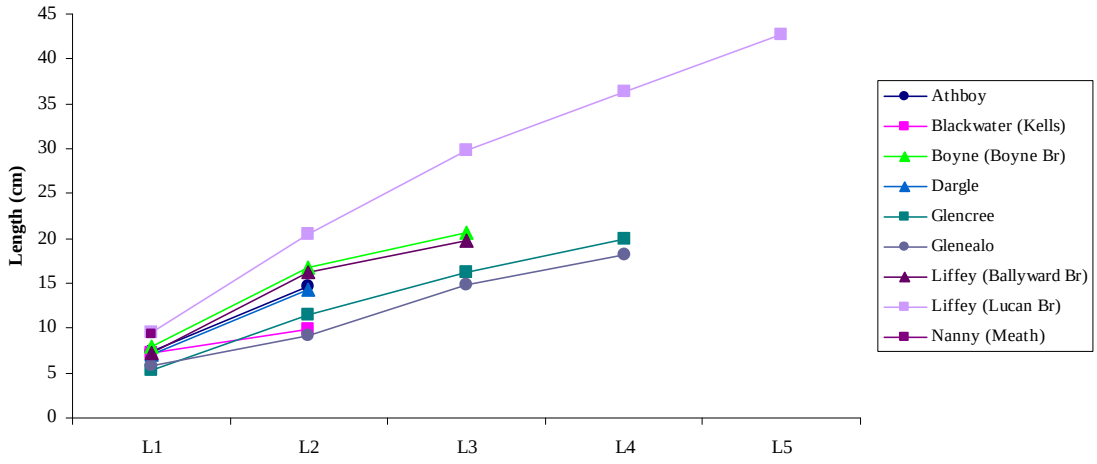

Fig. 4.55. Back calculated length-at-age for brown trout in each river, WFD surveillance monitoring 2009

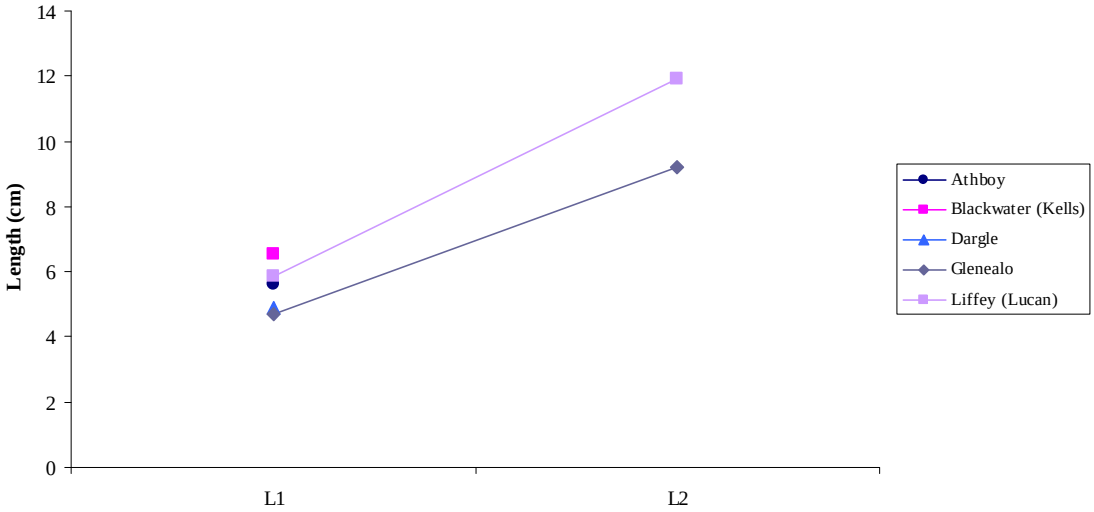

Fig. 4.56. Back calculated length-at-age for salmon in each river, WFD surveillance monitoring 2009

5. DISCUSSION

A total of 11 fish species (sea trout are included as a separate variety of trout) were recorded during the 2009 sampling program within the ERBD. In comparison, the highest species diversity (14 species) throughout all regions was recorded in the SERBD. The main summary report for 2009 (Kelly *et al*., 2010) provides information on species composition, richness and distribution for the whole country.

The River Blackwater (Kells) was the most diverse site within the ERBD in terms of fish species richness, 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 South Eastern River Basin District (SERBD) where there was a high number of non-native fish present. The Glenealo River and River Liffey (Ballyward Bridge) sites had the lowest species diversity in the ERBD, with only three species present in each. Such a low diversity is common in rivers throughout Ireland that contain only native fish species (Kelly *et al*., 2009).

Brown trout were present in all the sites surveyed within the ERBD. The greatest abundance was recorded in the River Blackwater (Kells). The Dargle River was the only site in the ERBD to contain sea trout. Salmon were also well distributed throughout the region, being recorded in seven of the sites surveyed, with the highest densities recorded on the Dargle River. European eel and stone loach were also well distributed, occurring in eight and six sites respectively. Lamprey and three-spined stickleback appeared to be distributed towards the north of the region while flounder were only encountered in sites close to the coast. Non-native fish such as roach, perch and gudgeon were relatively rare throughout the region but were most prevalent in the River Blackwater (Kells), a site close to the NWIRBD and northern end of the SHIRBD where non-native fish are most abundant in Ireland.

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 seven of the nine river sites surveyed in the ERBD. Eno *et al*. (1997) differentiate between non-native and alien species, with the former being those that have established themselves and the latter being those that have not established themselves and cannot do so without some sort of human intervention. The two rivers containing only native fish species were the Dargle and Glenealo, both of which are located in Co. Wicklow. 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, perch, roach and stone loach) and one Group 3 species (gudgeon) were recorded within the ERBD. Minnow and stone loach appear to be quite common throughout the country, while pike and gudgeon are more confined to certain areas, including the SHIRBD and NWRBD (Kelly *et al*., 2008 & 2009). With the exception of minnow and stone loach, results suggest that the ERBD is still relatively free of non-native species but these may become more of a concern in the future if they gain access to neighbouring channels and new habitats. The low diversity of non-native fish species such as roach and perch may be attributed, to some extent, to the paucity of lakes within the region and lack of connectivity to systems within other regions where these fish are present, such as the SHIRBD and NWRBD.

In a similar trend to that observed in 2008 (Kelly *et al*., 2009), older brown trout with faster growth rates were recorded in the larger river sites such as the River Liffey (Lucan) and River Boyne (Boyne Bridge), while younger fish with slower rates of growth were recorded in smaller channels such as the Athboy, Glencree and Glenealo Rivers. Following the methods of Kennedy and Fitzmaurice (1971), brown trout growth was classified as very slow in the River Blackwater, Glencree and Glenealo Rivers, slow in the Athboy River, Dargle River and River Liffey (Ballyward), fast in the River Boyne (Boyne Bridge) and very fast in the River Liffey (Lucan). This corresponds to the work of Kennedy and Fitzmaurice (1971), where slow growth rates were assigned to low alkalinity sites on the Upper Liffey and Wicklow, while faster growth rates were assigned to more productive stretches on the Lower Liffey.

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 each site. 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.

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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, L2 = back calculated length at the end of the second winter, etc.)

River		L1	L2	L3	L4	L5	Growth category
Athboy	Mean	7.4	14.6				Slow
	S.D.	1.7	2.3				
	S.E.	0.3	0.7				
	n	38	13				
	Range min.	3.8	9.4				
	Range max.	10.7	17.0				
Blackwater (Kells)	Mean	7.3	9.9				Very slow
	S.D.	1.9	n/a				
	S.E.	0.3	n/a				
	n	29	1				
	Range min.	4.7	9.9				
	Range max.	11.3	9.9				
Boyne (Boyne Br.)	Mean	7.9	16.8	20.6			Fast
	S.D.	1.3	2.0	8.4			
	S.E.	0.2	0.4	3.2			
	n	40	24	7			
	Range min.	5.6	12.4	2.1			
	Range max.	10.9	20.8	26.5			
Dargle	Mean	7.1	14.3				Slow
	S.D.	1.1	0.8				
	S.E.	0.3	0.6				
	n	12	2				
	Range min.	4.8	13.7				
	Range max.	8.6	14.8				
Glencree	Mean	5.3	11.5	16.2	20.0		Very slow
	S.D.	0.6	1.3	0.7	2.0		
	S.E.	0.1	0.5	0.4	1.4		
	n	18	6	3	2		
	Range min.	4.4	8.8	15.7	18.6		
	Range max.	6.2	12.4	16.9	21.4		
Glenealo	Mean	5.8	9.1	14.9	18.2		Very slow
	S.D.	n/a	n/a	n/a	n/a		
	S.E.	n/a	n/a	n/a	n/a		
	n	1	1	1	1		
	Range min.	5.8	9.1	14.9	18.2		
	Range max.	5.8	9.1	14.9	18.2		

APPENDIX 1 continued

River		L1	L2	L3	L4	L5	Growth category
Liffey (Ballyward Br.)	Mean	7.2	16.3	19.8			Slow
	S.D.	1.2	0.3	n/a			
	S.E.	0.5	0.2	n/a			
	n	5	3	1			
	Range min.	5.6	16.0	19.8			
	Range max.	8.8	16.6	19.8			
Liffey (Lucan)	Mean	9.5	20.5	29.8	36.3	42.7	Very fast
	S.D.	1.8	3.8	3.4	n/a	n/a	
	S.E.	0.3	0.9	1.5	n/a	n/a	
	n	36	17	5	1	1	
	Range min.	4.4	12.7	24.5	36.3	42.7	
	Range max.	13.4	29.7	33.3	36.3	42.7	
Nanny (Meath)	Mean	9.4					n/a
	S.D.	0.4					
	S.E.	0.2					
	n	4					
	Range min.	9.1					
	Range max.	9.8					

APPENDIX 2

Summary of the growth of salmon in rivers (L1 = back calculated length at the end of the first winter, L2 = back calculated length at the end of the second winter, etc.)

River		L1	L2
Athboy	Mean	5.6	
	S.D.	1.3	
	S.E.	0.3	
	n	21	
	Range min.	3.6	
	Range max.	9.6	
Blackwater	Mean	6.5	
	S.D.	0.5	
	S.E.	0.2	
	n	4	
	Range min.	5.9	
	Range max.	6.9	
Dargle	Mean	4.9	
	S.D.	0.8	
	S.E.	0.2	
	n	22	
	Range min.	3.5	
	Range max.	6.2	
Glencree	Mean	4.8	9.2
	S.D.	0.4	n/a
	S.E.	0.1	n/a
	n	18	1
	Range min.	4.1	9.2
	Range max.	5.9	9.2
Glenealo	Mean	4.2	
	S.D.	0.4	
	S.E.	0.3	
	n	2	
	Range min.	3.9	
	Range max.	4.5	
Liffey (Lucan)	Mean	5.9	11.9
	S.D.	0.9	1.5
	S.E.	0.2	0.7
	n	26	4
	Range min.	4.6	10.7
	Range max.	7.8	13.7

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