North Western International River Basin District Rivers

Sampling Fish for the Water Framework Directive - Rivers 2009

The Central and Regional Fisheries Boards

ACKNOWLEDGEMENTS

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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). Three of the 54 surveys were carried out at river sites in the North Western International River Basin District between September and October 2009 by staff from the Central Fisheries Board and Northern 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 Northern Regional Fisheries Board (NRFB) occupied most of Co. Donegal and parts of Co. Leitrim, Co. Longford, Co. Cavan and Co. Monaghan. The North Western International River Basin District (NWIRBD) covers most of this area but also includes the Finn/Foyle Catchment in Co. Donegal and parts of Co. Fermanagh, Co. Derry and Co. Tyrone.

The NWIRBD (Fig. 2.1) is the largest of three cross-border RBDs, shared with Northern Ireland. It encompasses all of Co. Donegal and parts of counties Derry, Tyrone, Fermanagh, Sligo, Leitrim, Longford, Monaghan and Cavan. It has a land surface area of approximately 12,300km^2 and a marine area (most of which belongs to Co. Donegal) of approximately 2,500km^2. The region has a relatively low population, less than 0.5 million, with most people living in the larger towns such as Derry/Londonderry, Enniskillen, Omagh, Letterkenny and Cavan. The NWIRBD covers a number of different landscape types, ranging from scenic mountains and coastline in the west to rich fertile farmland in the east. Some of the most important anthropogenic activities affecting water quality

include agriculture, forestry and tourism. The Erne and Foyle are two of the largest river systems within this district (NWIRBD, 2009).

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

2. STUDY AREA

Three river sites were surveyed in two river catchments; the Clady and the Erne. The sites ranged in surface area from 417m^2 in the Clady River to 3,615m^2 in the River Erne 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 NWIRBD 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
NWIRBD Hand-set sites				
Clady	Bridge u/s of Bunbeg	Clady	IE38C040300	NW_38_4124
NWIRBD Boat sites				
Erne	Bellahillan Br.	Erne	IE36E011100	NW_36_1746
Finn	Cumber Br.	Erne	IE36F010500	XB_36_east_3

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)
NWIRBD Hand-set sites					
Clady	78.63	10.42	417	0.23	0.68
NWIRBD Boat sites					
Erne	336.37	15.00	3615	1.50	2.50
Finn	121.61	11.25	2835	1.75	3.00

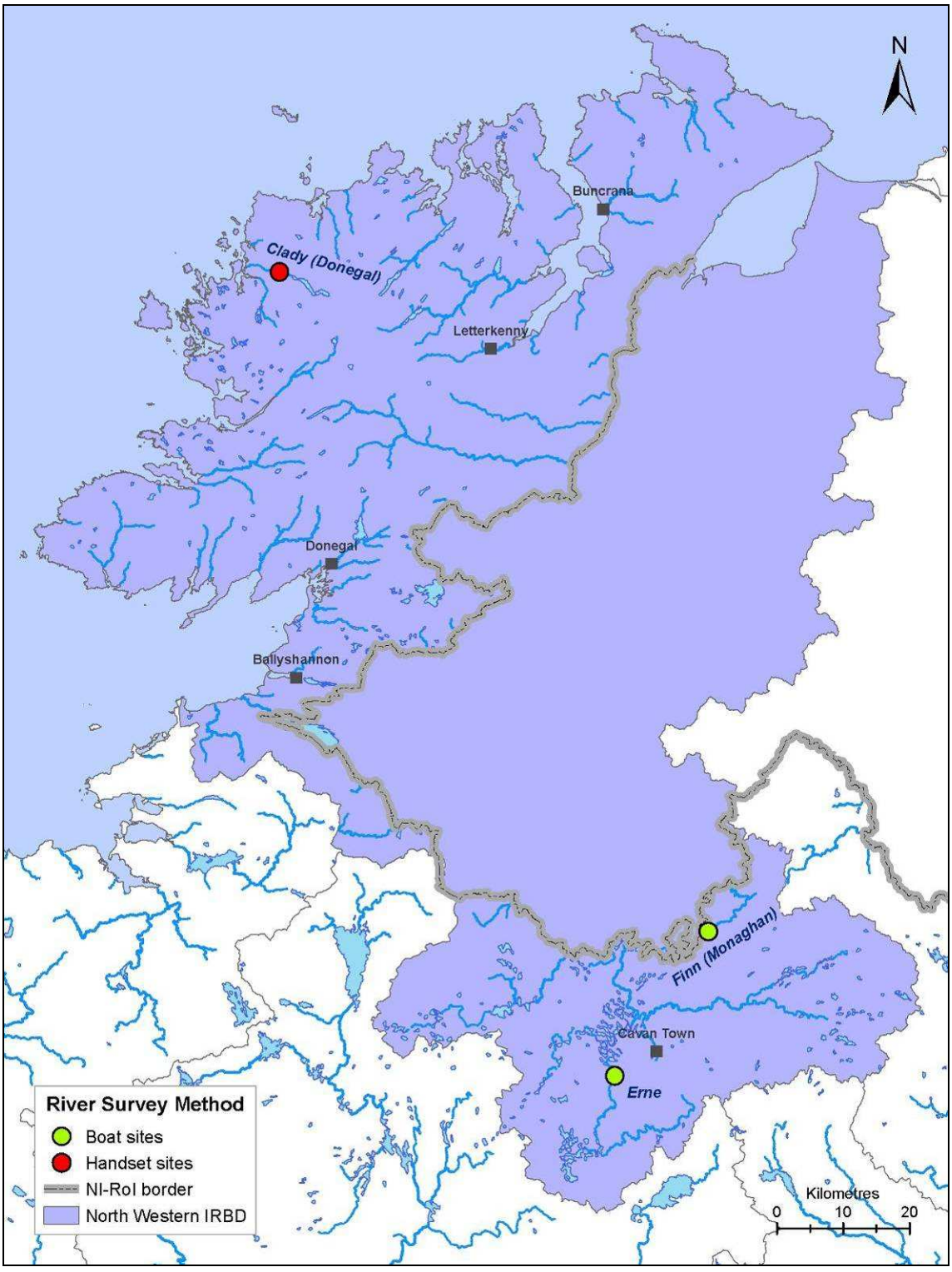

Fig. 2.1. Location map of river sites surveyed throughout the NWIRBD for WFD fish surveillance monitoring 2009

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 River Erne (Bellahillan Bridge)

4. RESULTS

4.1 Wadeable hand-set sites

4.1.1 The Clady River (Donegal)

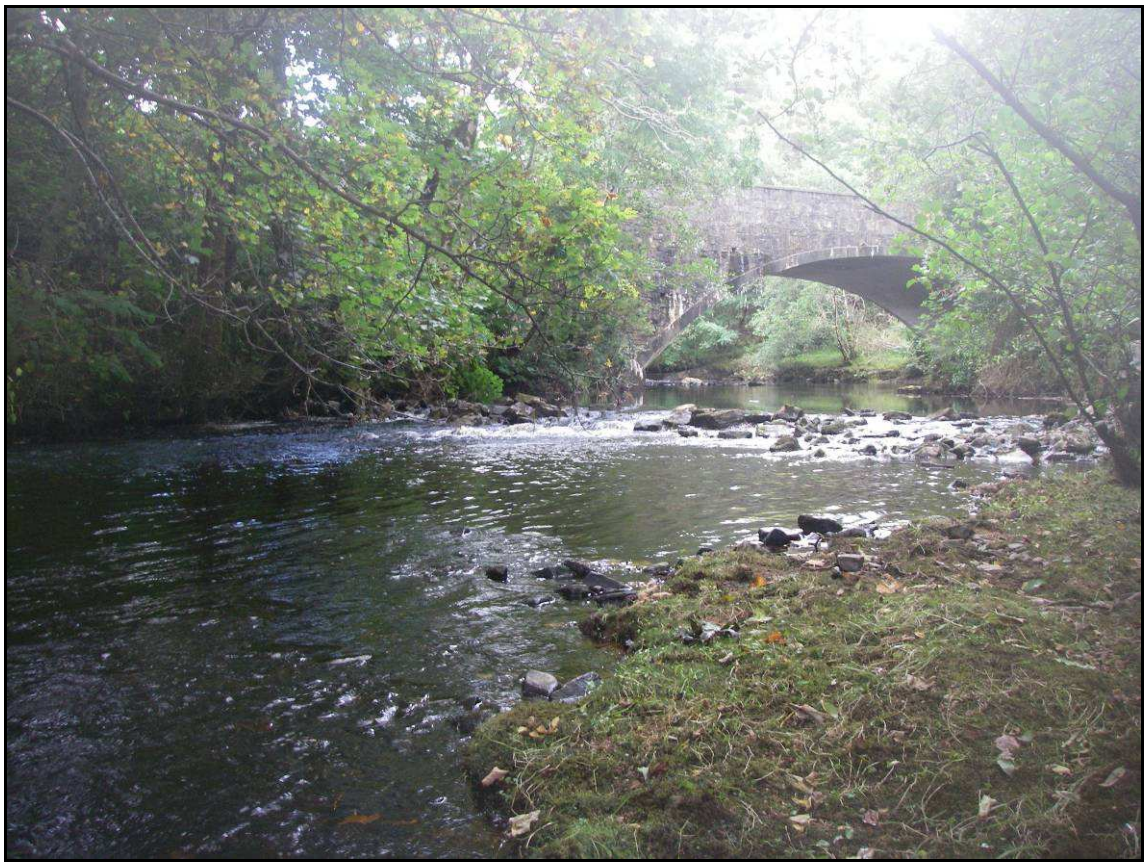

Plate 4.1. The Clady River downstream of the N56 road bridge in Gweedore, Co. Donegal

The Clady River (Plate 4.1) flows out of Lough Nacung, which is fed by a number of small streams flowing into it from the surrounding mountains of north Donegal (Fig. 4.1). It flows north-westwards, eventually joining the Gweedore Estuary near Bunbeg. A canal used by the local hydroelectric power station connects the Clady to the nearby Crolly River. As a result, water discharged through the canal confuses the migration of fish and draws Clady River fish up the Crolly River (O'Reilly, 2009). Controlled discharges throughout the year are required to assist the passage of fish up through the power station fish pass. Despite these factors, however, both the Clady and its connected neighbour are known as excellent salmon and sea trout rivers (O'Reilly, 2009).

The Clady River passes through a number of different areas assigned with conservation status. The source of the river is located within Glenveagh National Park SPA and flows down from the mountains through Cloghernagore Bog and Glenveagh National Park SAC, designated for salmon. It

then enters Fawnboy/Lough Nacung SAC where the survey site is located. This SAC is important for both blanket bog and wet heath, two habitats listed in Annex I of the EU Habitats Directive (NPWS, 1997). A number of important species also occur in the area, most notably pearl mussels, listed in Annex II of the EU Habitats Directive and two species of bird, the red-throated diver and Greenland white-fronted goose, both protected under Annex I of the EU Birds Directive (NPWS, 1997). Finally, as the Clady River completes its journey to the sea, it enters the West Donegal Coast SPA and Gweedore Bay and Islands SAC.

The survey site was located in Gweedore, downstream of the N56 bridge (Fig. 4.1). Three electric-fishing passes were conducted using three bank-based electric-fishing units on the 9th of September 2009 along a 40m length of channel. The mean wetted width of the surveyed stretch was 10.4m and the mean depth was 23.0cm. A mixture of habitats was present, with riffle the most prominent type. The substrate consisted mainly of cobble. A total wetted area of 417m^2 was surveyed.

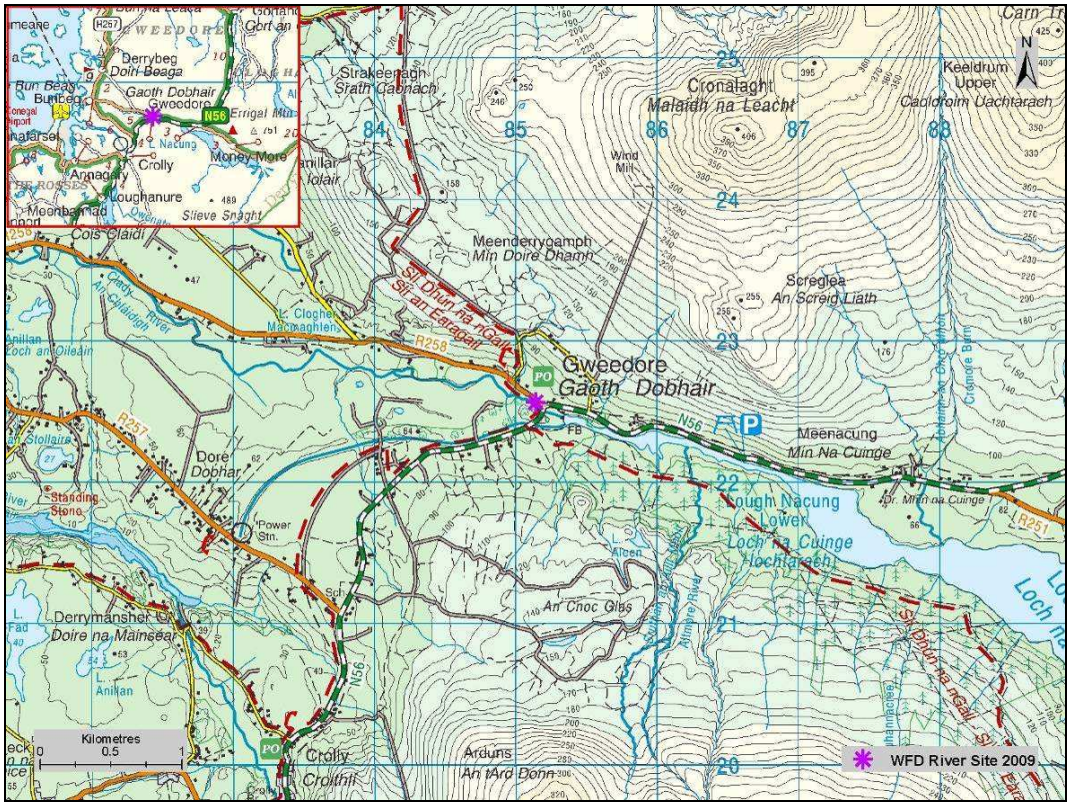

Fig. 4.1. Location of the Clady River surveillance monitoring site

A total of three fish species were recorded in the Cady River site. Salmon was the most abundant species, followed by brown trout and European eel (Table 4.1).

Table 4.1. Density of fish (no./m^2), Clady 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	0.0888	0.1320	0.2208
Salmo trutta	Brown trout	0.0120	0.0216	0.0336
Anguilla anguilla	European eel	-	-	0.0048
All fish	All fish	-	-	0.2592

Salmon ranged in length from 4.2cm to 13.3cm (Fig. 4.2). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 48%, 46% and 7% of the total salmon catch respectively. Mean salmon L1 and L2 were 4.2cm and 7.9cm respectively (Appendix 2).

Brown trout ranged in length from 6.0cm to 27.9cm (Fig. 4.3). Four age classes (0+, 1+, 2+ and 3+) were present, accounting for approximately 33%, 27%, 23% and 17% of the total brown trout catch respectively. Mean brown trout L1, L2 and L3 were 6.0cm, 13.1cm and 17.8cm respectively (Appendix 1). This indicates 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 15.0cm to 36.6cm.

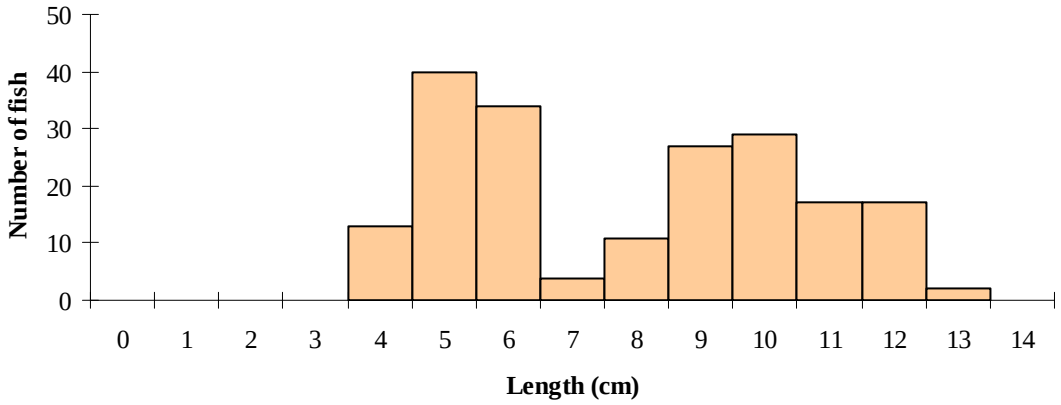

Fig. 4.2. Length frequency distribution of salmon in the Clady River site, September 2009 (n = 194)

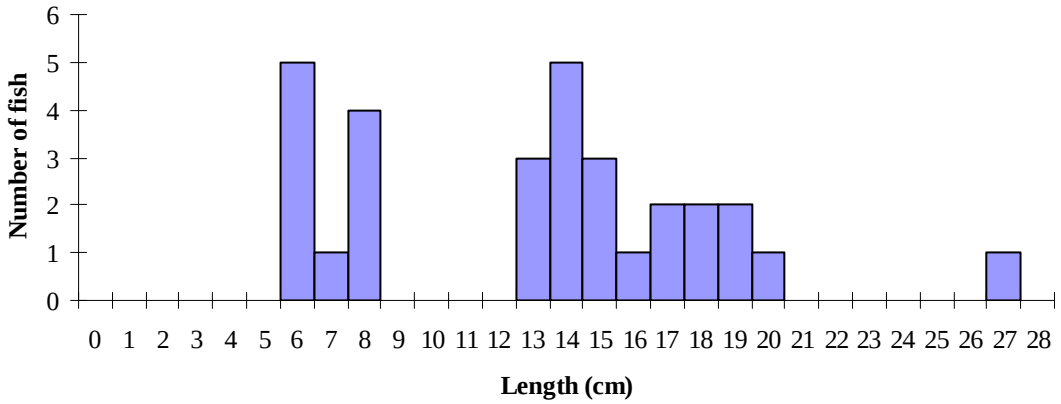

Fig. 4.3. Length frequency distribution of brown trout in the Clady River site, September 2009 (n = 30)

4.2 Boat sites

4.2.1 The River Erne (Bellahillan Bridge)

Plate 4.2. The River Erne at Bellahillan Bridge near Bellanagh, Co. Cavan

The River Erne (Plate 4.2) rises just south of the village of Stradone near Cootehill in Co. Cavan. It has a very large catchment draining many lakes, including Upper and Lower Lough Erne. The river travels for approximately 100 kilometres, eventually reaching Donegal Bay near Ballyshannon. The Erne Estuary provides ample supplies of food for sea trout, making this an important sea trout river. The Middle Erne, between Bellahillan Bridge and Sallaghan Bridge, Co. Cavan is considered good for brown trout, albeit a difficult stretch to access (O'Reilly, 2009).

The survey site was located upstream of Bellahillan Bridge, approximately 7km south-west of Cavan town (Fig.4.4). Three electric-fishing passes were conducted using two boat-based electric-fishing units on the 5th of October 2009 along a 241m length of channel. This was a relatively slow flowing stretch of river and contained various bank-side grasses and reeds commonly found along the muddy margins of deep rivers such as this. The mean wetted width of the surveyed stretch was 15.0m and the mean depth was 150cm. Glide was the only distinguishable habitat present and due to the depth of

the water, it was not possible to ascertain substrate composition. A total wetted area of 3,615m^2 was surveyed.

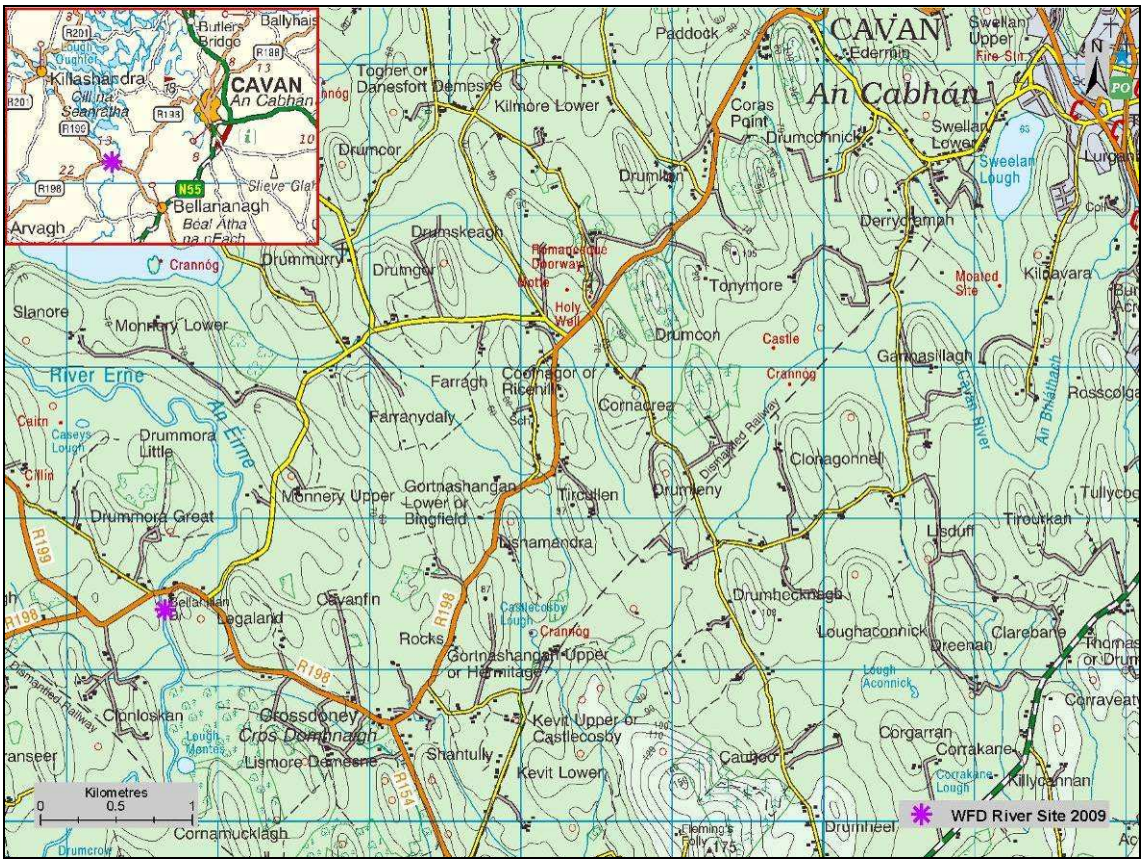

Fig. 4.4. Location of the River Erne surveillance monitoring site

A total of six fish species were recorded in the River Erne (Bellahillan Bridge) site. Perch was the most abundant species, followed by pike, gudgeon, roach, European eel and juvenile lamprey (Table 4.2).

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

Scientific name	Common name	0+	1+ & older	Total minimum density
Perca fluviatilis	Perch	-	-	0.0011
Esox lucius	Pike	-	-	0.0008
Gobio gobio	Gudgeon	-	-	0.0006
Rutilus rutilus	Roach	-	-	0.0006
Anguilla anguilla	European eel	-	-	0.0003
	Lamprey sp.	-	-	0.0003
All fish	All fish	-	-	0.0036

Perch ranged in length from 10.1cm to 19.1cm (Fig. 4.5). Pike ranged in length from 18.8cm to 69.0cm, with four age classes (1+, 3+, 5+ and 6+) being present. Roach ranged in length from 11.7cm to 14.8cm, with two age classes (3+ and 4+) being present. Gudgeon ranged in length from 10.1cm to 12.6cm. A single juvenile lamprey measuring 11.8cm and a single European eel measuring 28.5cm were also recorded.

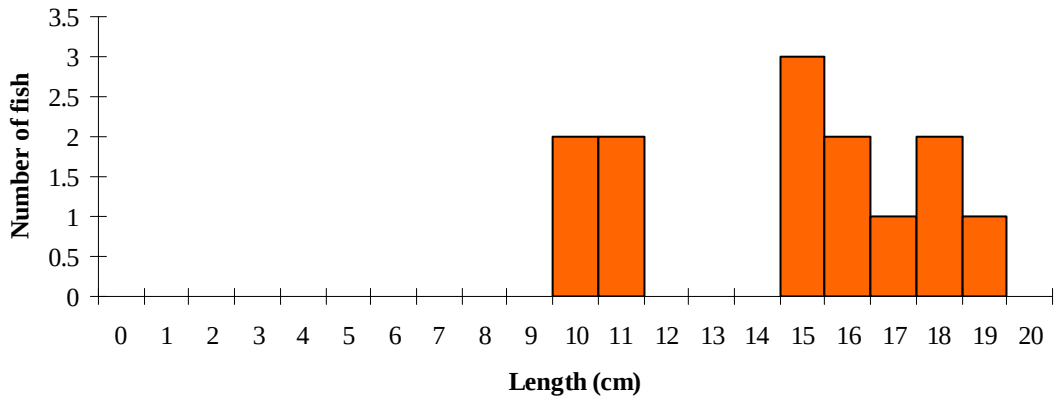

Fig. 4.5. Length frequency distribution of perch in the Erne River, October 2009 (n = 13)

4.2.2 The Finn River (Monaghan)

Plate 4.3. The Finn River at Cumber Bridge near Clones, Co. Monaghan

The Finn River is a tributary of the River Erne, rising on the border of Co. Tyrone and Co. Fermanagh. It flows south-westwards through Co. Monaghan before eventually joining the River Erne on the Fermanagh/Cavan Border. The Finn was once considered to be one of the best brown trout fisheries in Ulster. Chronic pollution over the years, however, has destroyed this status (O'Reilly, 2009).

The survey site was located downstream of Cumber Bridge, approximately 3km south of Clones in Co. Monaghan (Fig. 4.6). Three electric-fishing passes were conducted using two boat-based electric-fishing units on the 6th of October 2009 along a 252m length of channel. The channel had a mean wetted width of 11.3m and a mean depth of 175cm. Both glide and pool habitat types were abundant throughout the channel. Shallow sections enabled an estimation of substrate composition to be made, which consisted of mainly cobble and gravel. The macrophyte vegetation present was composed of mostly tall riparian grasses, anchored along the deep muddy banks. A total wetted area of 2,835m^2 was surveyed.

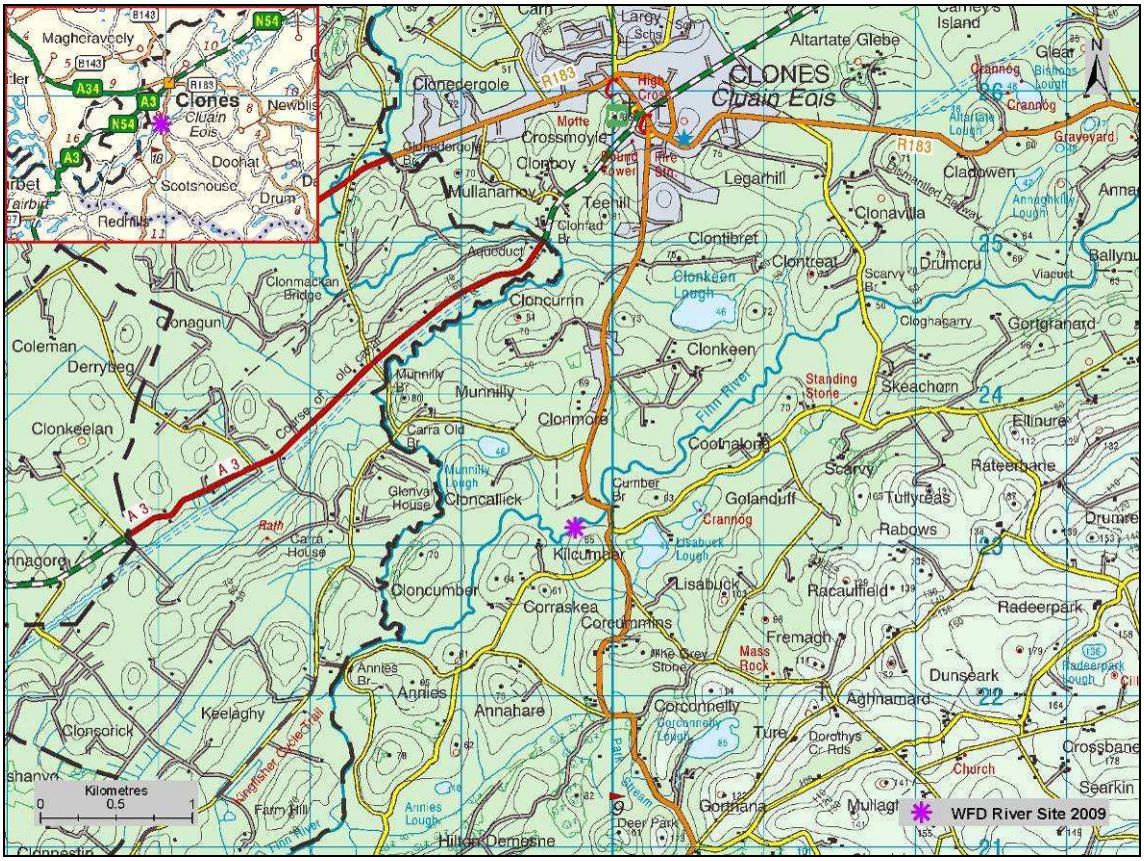

Fig. 4.6. Location of the Finn River (Cumber Bridge) WFD surveillance monitoring site

A total of nine fish species were recorded in the Finn River (Monaghan) site. Gudgeon was the most abundant species, followed by roach, brown trout, perch, pike, European eel, stone loach, three-spined stickleback, and juvenile lamprey (Table 4.3).

Table 4.3. Density of fish (no./m^2), Finn 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
Gobio gobio	Gudgeon	-	-	0.0317
Rutilus rutilus	Roach	-	-	0.0166
Salmo trutta	Brown trout	0.0046	0.0078	0.0123
Perca fluviatilis	Perch	-	-	0.0014
Esox lucius	Pike	-	-	0.0007
Anguilla anguilla	European eel	-	-	0.0004
Barbatula barbatula	Stone loach	-	-	0.0004
Gasterosteus aculeatus	Three-spined stickleback	-	-	0.0004
	Lamprey sp.	-	-	0.0004
All fish	All fish	-	-	0.0642

Gudgeon ranged in length from 6.2cm to 13.5cm (Fig. 4.7). Roach ranged in length from 3.1cm to 18.6cm (Fig. 4.8). Six age classes (0+, 1+, 2+, 3+, 4+ and 5+) were present, accounting for approximately 40%, 38%, 3%, 12%, 7% and 1% of the total roach catch respectively.

Brown trout ranged in length from 6.4cm to 26.9cm (Fig. 4.9). Three age classes (0+, 1+ and 2+) were present, accounting for approximately 49%, 42% and 9% of the total brown trout catch respectively. Mean brown trout L1 and L2 were 8.8cm and 16.4cm 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).

Two pike were recorded, measuring 13.9cm (aged 1+) and 56.1cm (aged 5+).

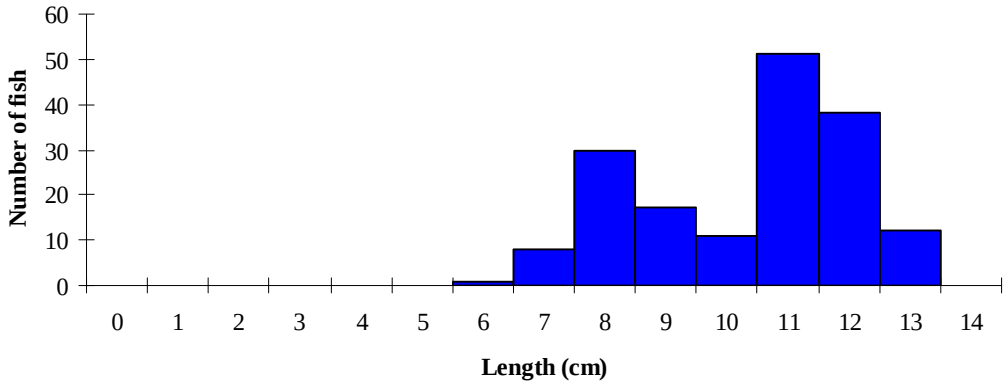

Fig. 4.7. Length frequency distribution of gudgeon in the Finn River, October 2009 (n = 168)

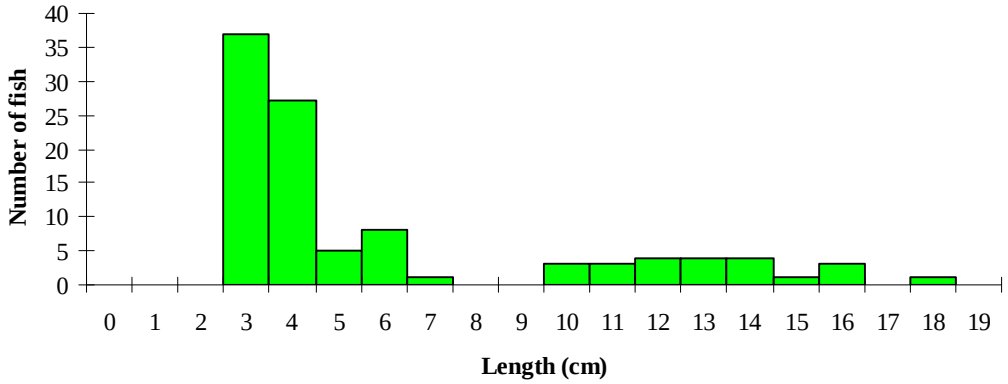

Fig. 4.8. Length frequency distribution of roach in the Finn River, October 2009 (n = 101)

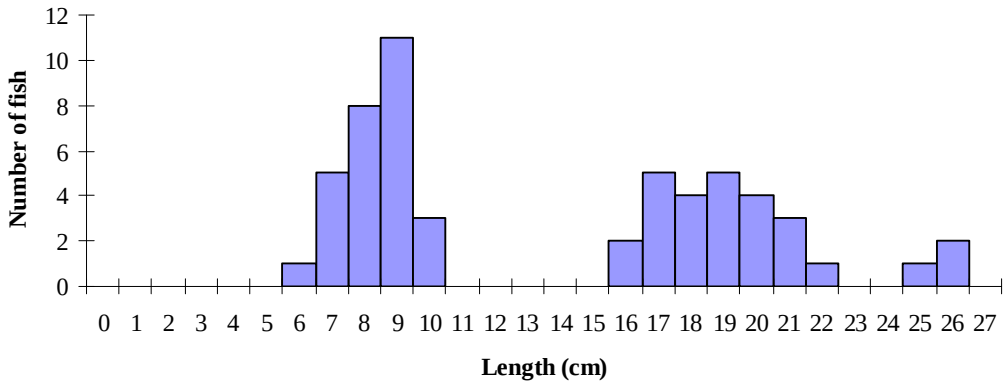

Fig. 4.9. Length frequency distribution of brown trout in the Finn River, October 2009 (n = 55)

4.3 Community structure

4.3.1 Species richness and composition

A total of 10 fish species were recorded within the three NWIRBD sites surveyed (Fig.4.10). European eel was the most common species, occurring at all sites surveyed. This was followed by brown trout (67%), gudgeon (67%), Lamprey (67%), perch (67%), pike (67%) and roach (67%). Salmon, three-spined stickleback and stone loach were only recorded at one site each.

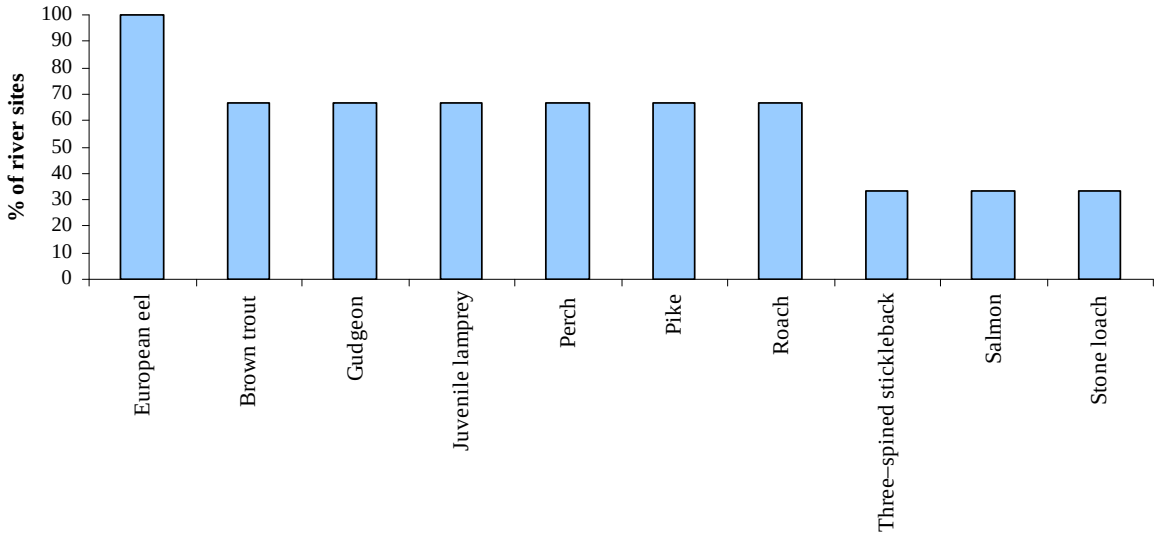

Fig. 4.10. Percentage of sites where each fish species was recorded in the NWIRBD for WFD SM monitoring 2009

Species richness ranged from three species recorded in the Clady River to a maximum of nine species recorded in the Finn River (Table 4.4). 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 in all sites surveyed. Group 2 – non-native species that influence ecology (e.g. pike, perch, roach and stoneloach) were recorded in two of the sites surveyed, and Group 3 – non-native species that generally don't influence ecology (e.g. gudgeon) were recorded in two sites.

Table 4.4. Species richness at each river site surveyed in the NWIRBD, 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		
Clady River	3	3	0	0
		BOAT SITES		
Finn River	9	4	4	1
River Erne	6	2	3	1

4.3.2 Species abundance and distribution

Abundance (minimum population density) and distribution maps for the most common fish species recorded within the NWIRBD are shown in Figures 4.11 to 4.32. 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.

Of the two boat-sites, brown trout fry and parr were recorded in only one, the Finn River in Monaghan. Here the densities were low, both less than 0.01 fish/m^2 (Fig. 4.11 & Fig 4.13). In the only hand-set site surveyed, the Clady River, the densities of brown trout fry (0+) and brown trout aged 1+ and older (Fig. 4.12 and Fig. 4.14) were 0.01 fish/m^2 and 0.02 fish/m^2 respectively.

Salmon were only recorded in the Clady River, where the density of 0+ fry (Fig. 4.16) was 0.09 fish/m^2 and parr aged 1+ or older (Fig. 4.18) was 0.13 fish/m^2. These were among the highest densities recorded for salmon amongst all river sites surveyed throughout the country during 2009 (Kelly *et al*., 2010).

European eel was the only species present in all three of the rivers surveyed (Fig. 4.19 and Fig. 4.20), with their highest density recorded in the Clady River (0.01 fish/m^2). Lamprey (Fig. 4.21 and Fig. 4.22), perch (Fig. 4.23 and Fig. 4.24), pike (Fig. 4.25 and Fig. 4.26), gudgeon (Fig. 4.27 and Fig. 4.28) and roach (Fig. 4.29 and Fig. 4.30) were all present in the River Erne and Finn River but absent from the Clady River. Three-spined stickleback (Fig. 4.31 and Fig. 4.32) and stone loach were only recorded in the Finn River.

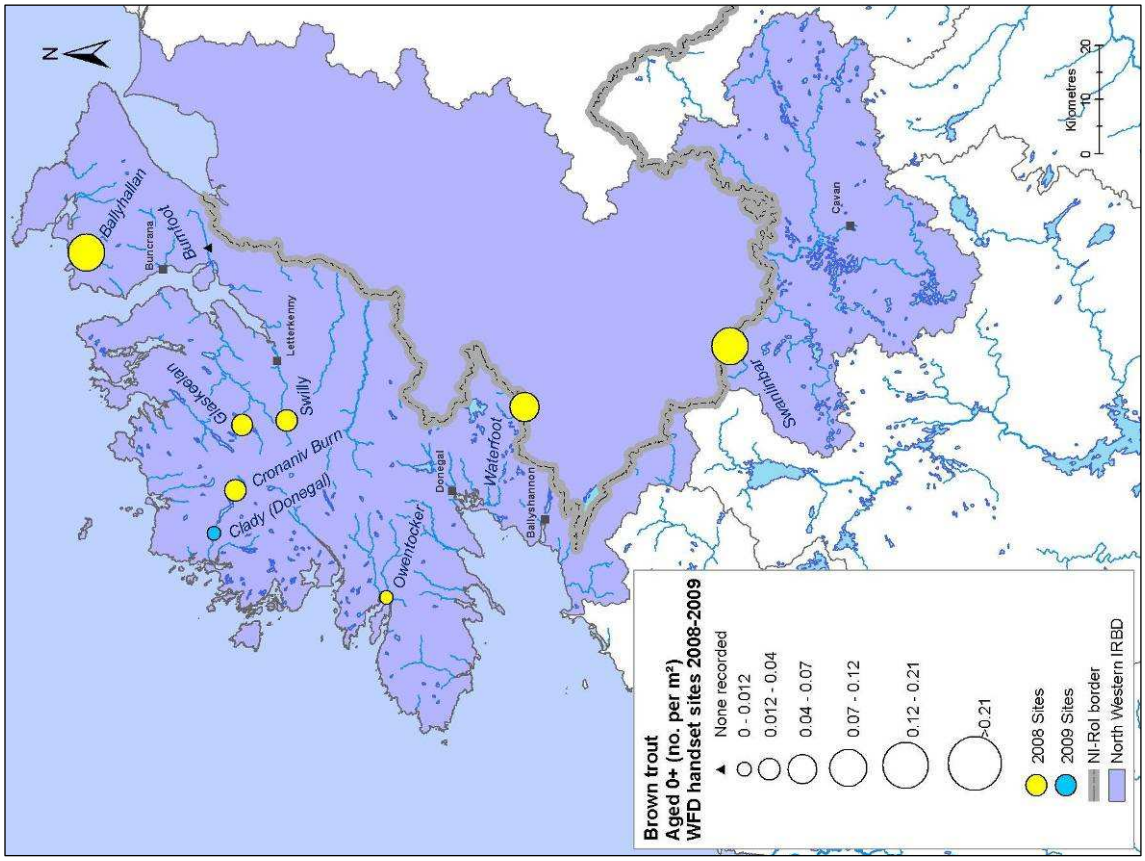

Fig. 4.12. Distribution map of 0+ brown trout in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

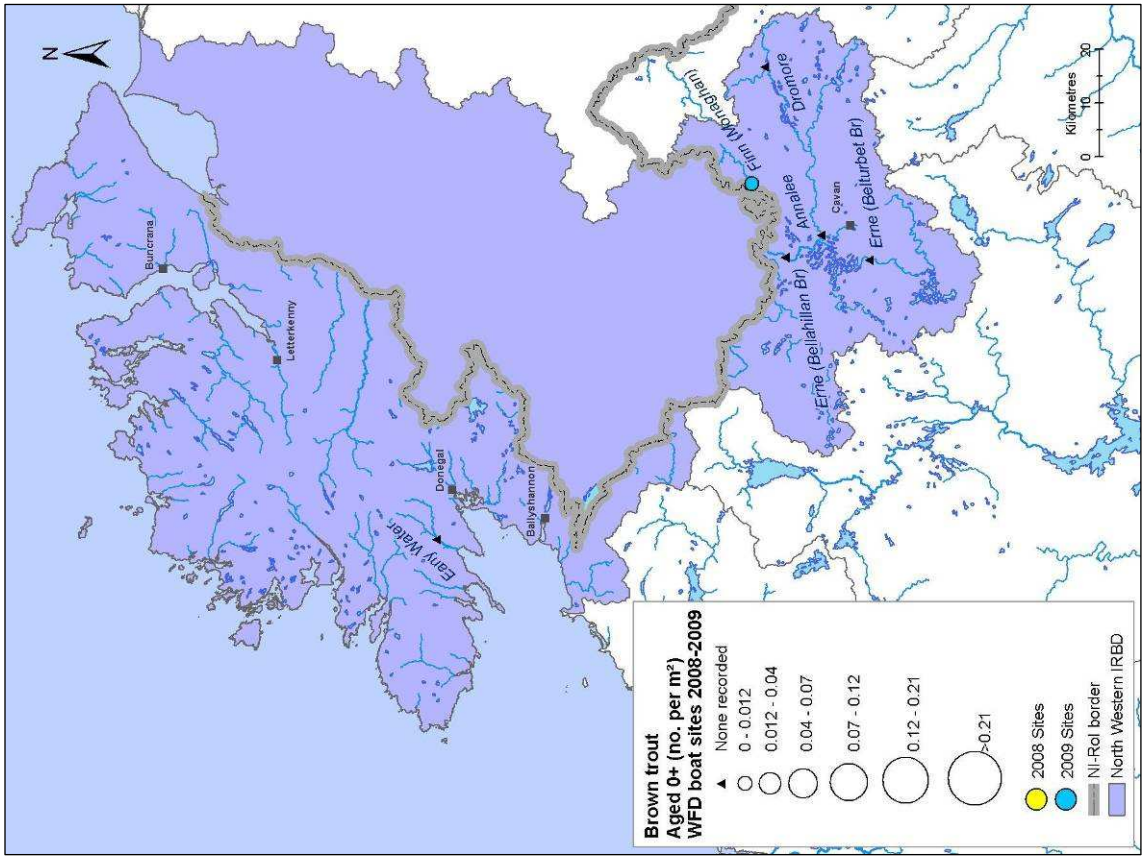

Fig. 4.11. Distribution map of 0+ brown trout in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

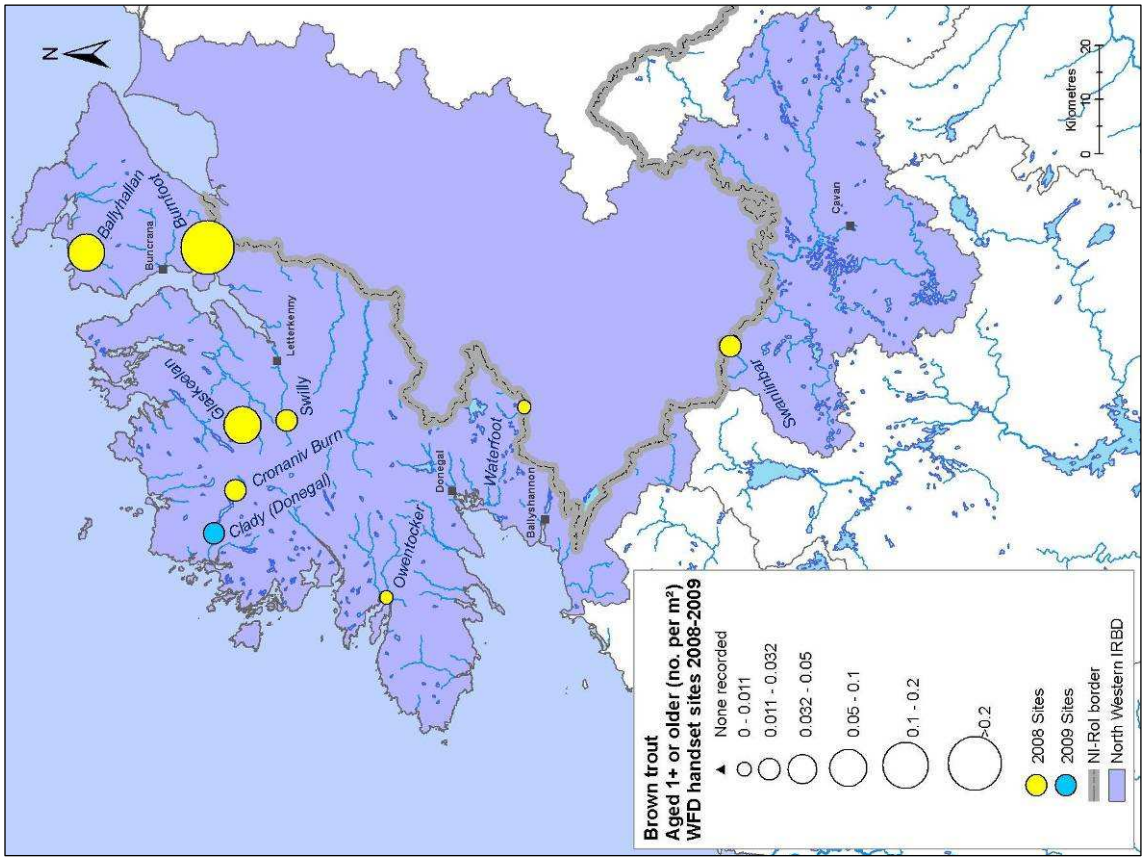

Fig. 4.14. Distribution map of 1+ or older brown trout in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

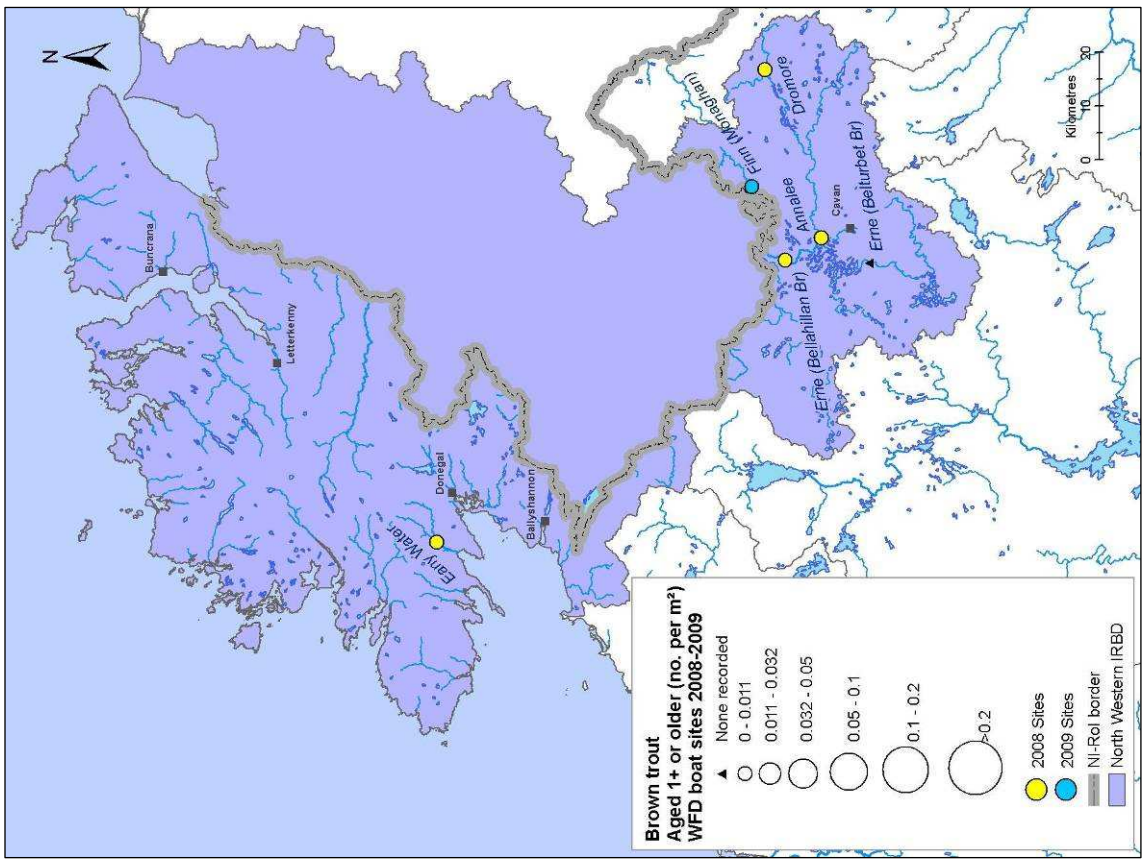

Fig. 4.13. Distribution map of 1+ or older brown trout in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

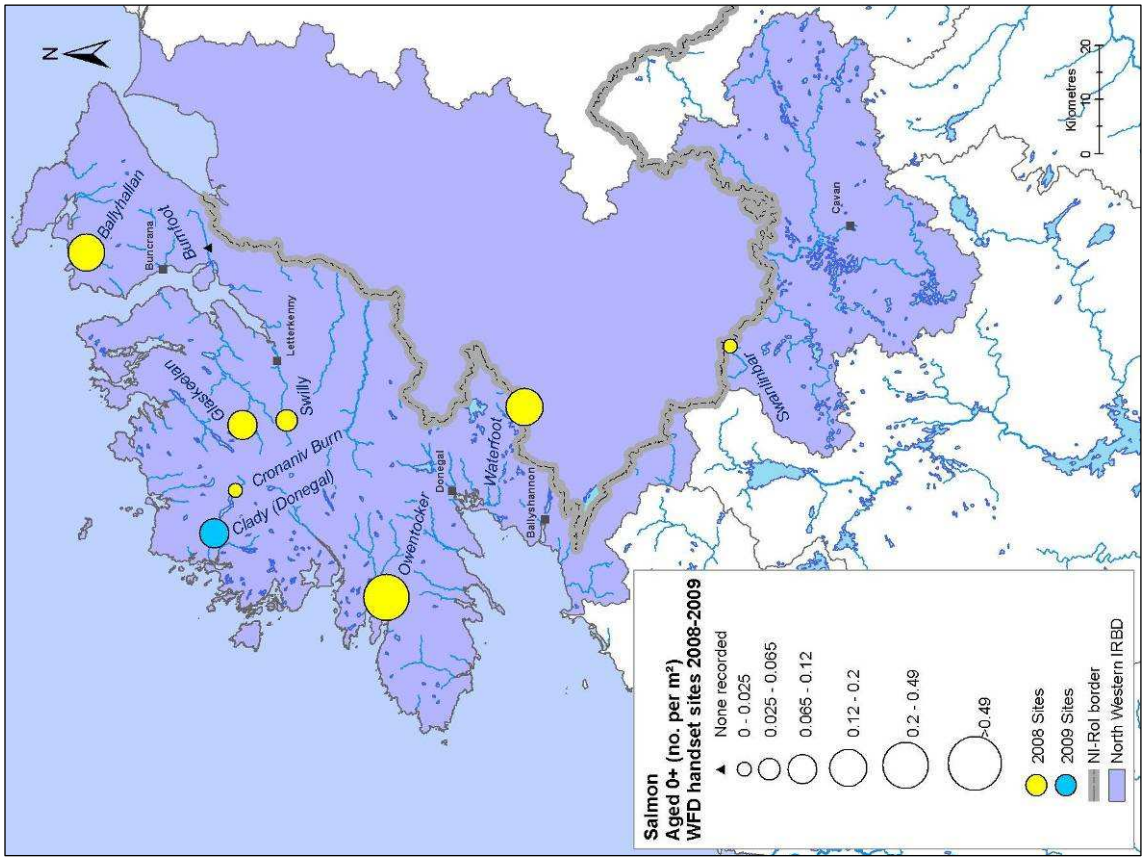

Fig. 4.16. Distribution map of 0+ salmon in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

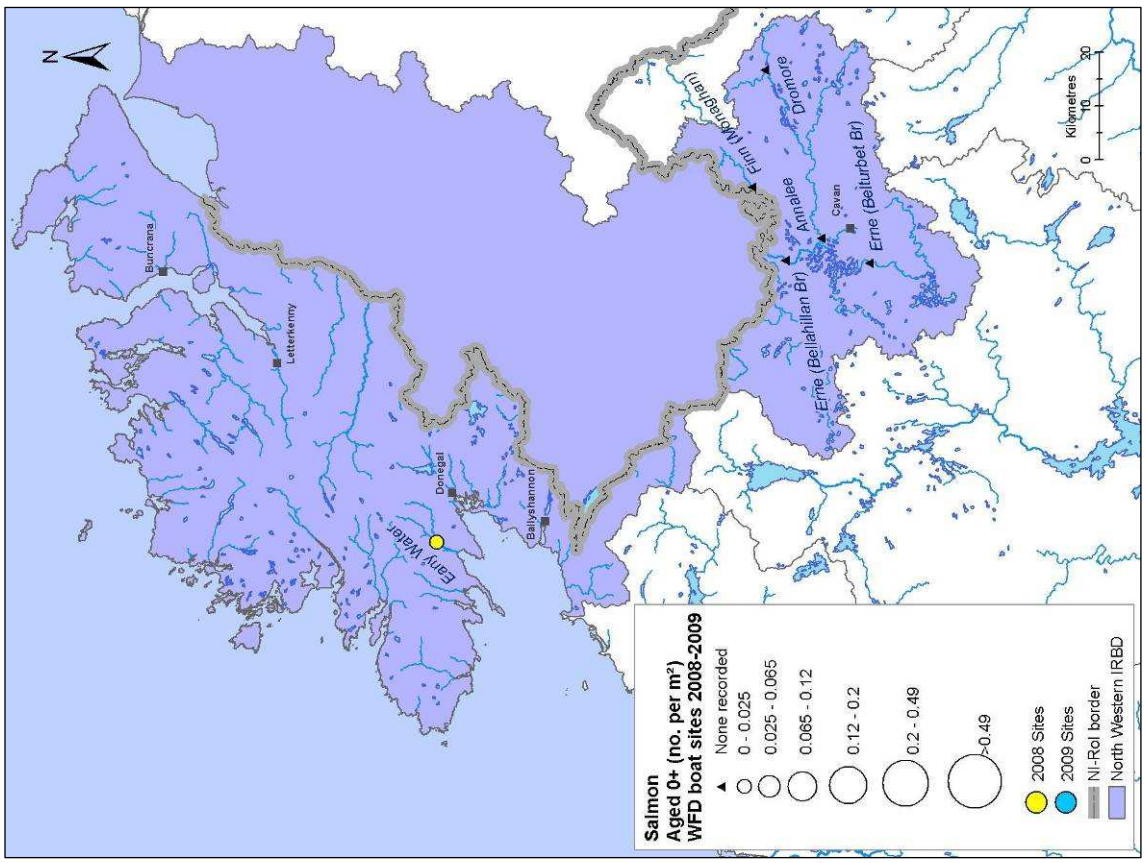

Fig. 4.15. Distribution map of 0+ salmon in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

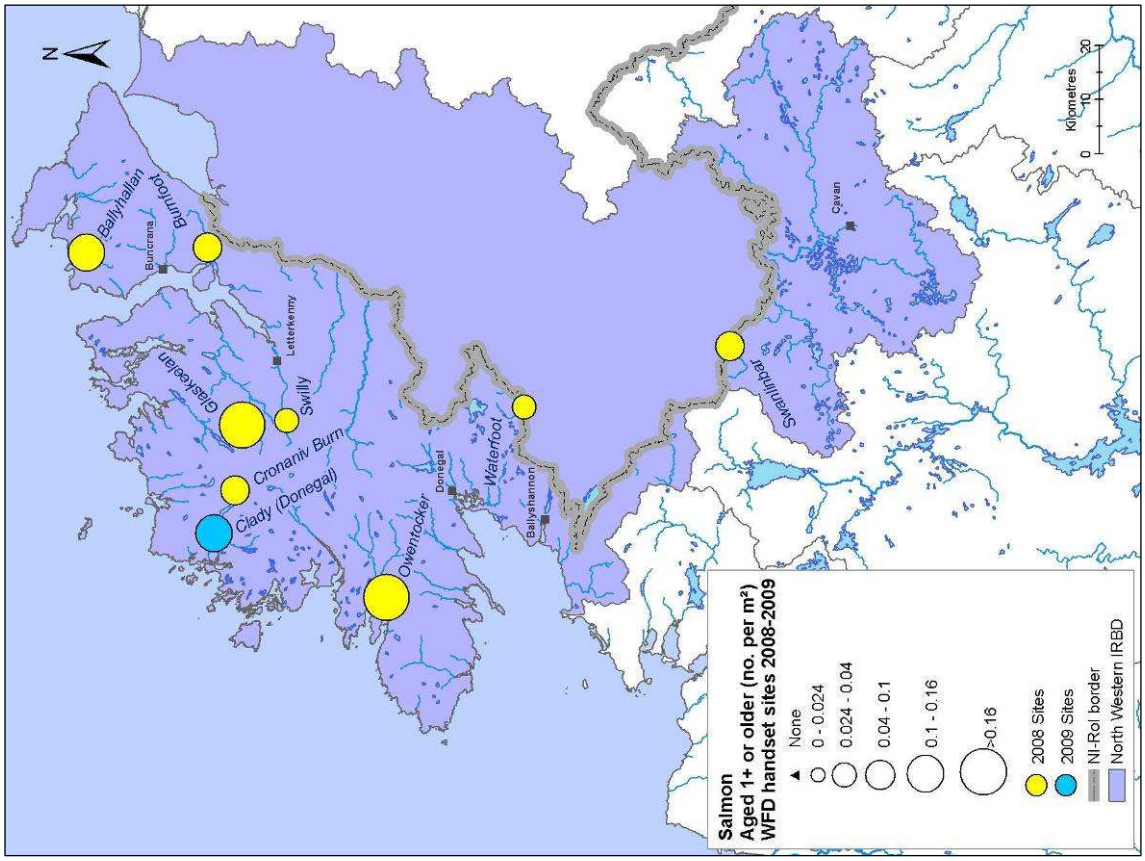

Fig. 4.18. Distribution map of 1+ or older salmon in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

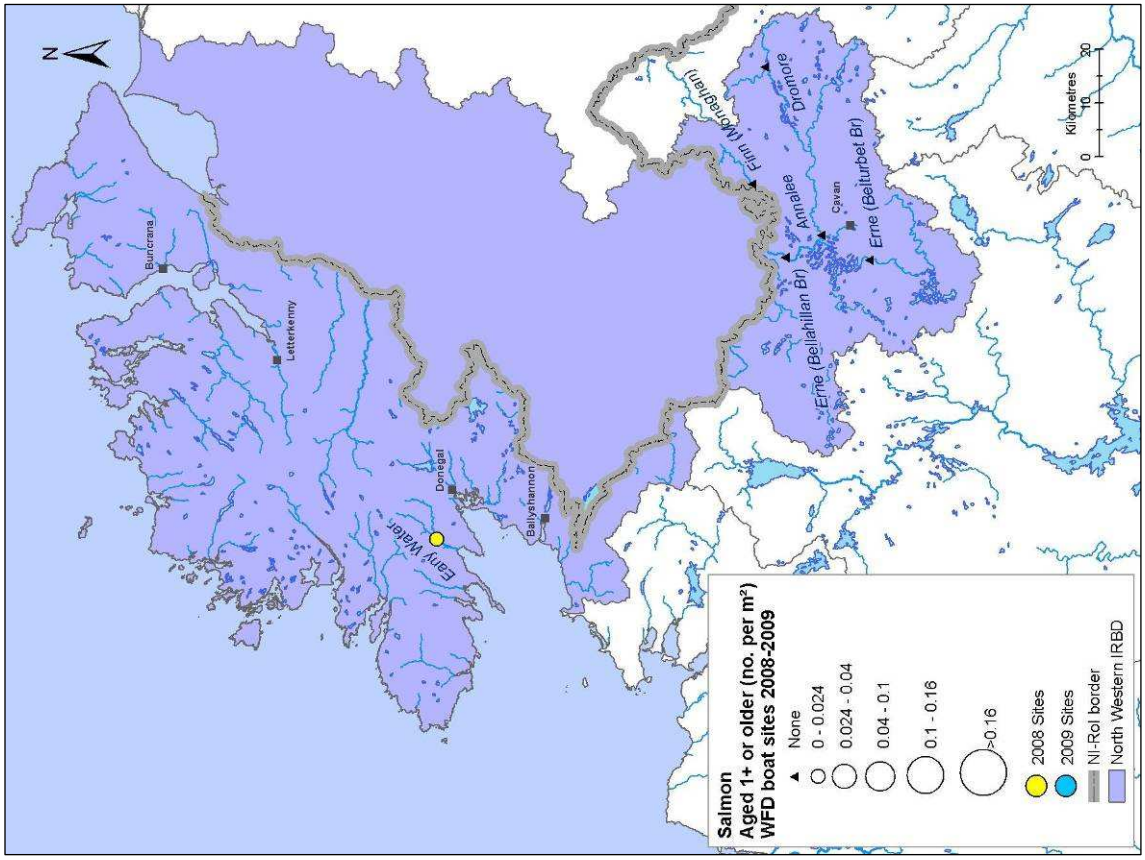

Fig. 4.17. Distribution map of 1+ or older salmon in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

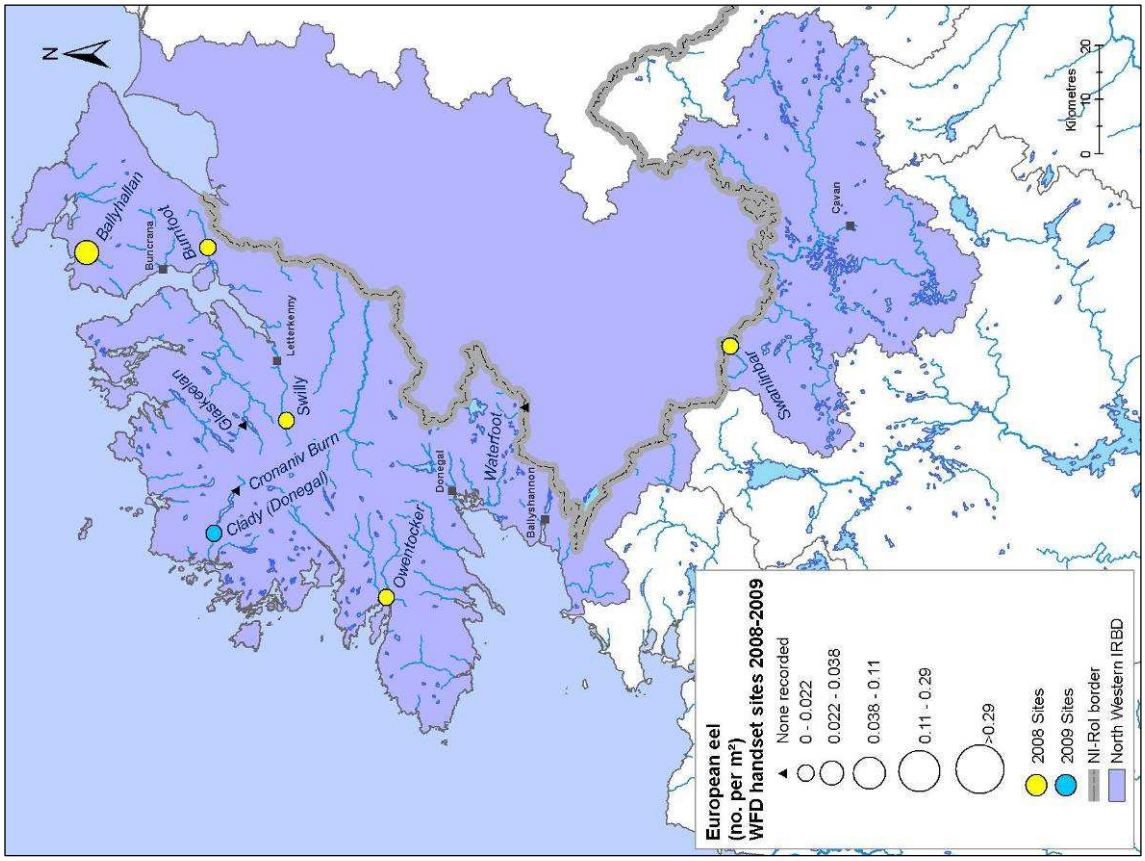

Fig. 4.20. Distribution map of European eel in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

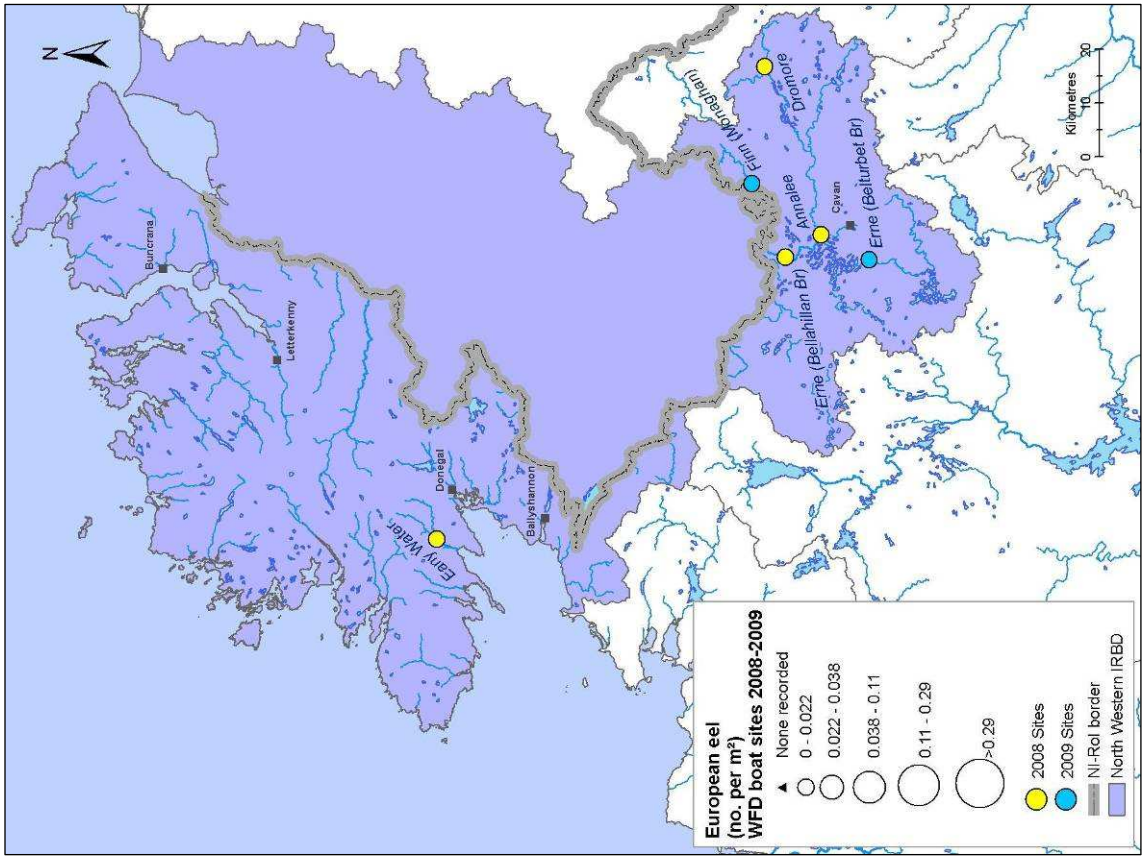

Fig. 4.19. Distribution map of European eel in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

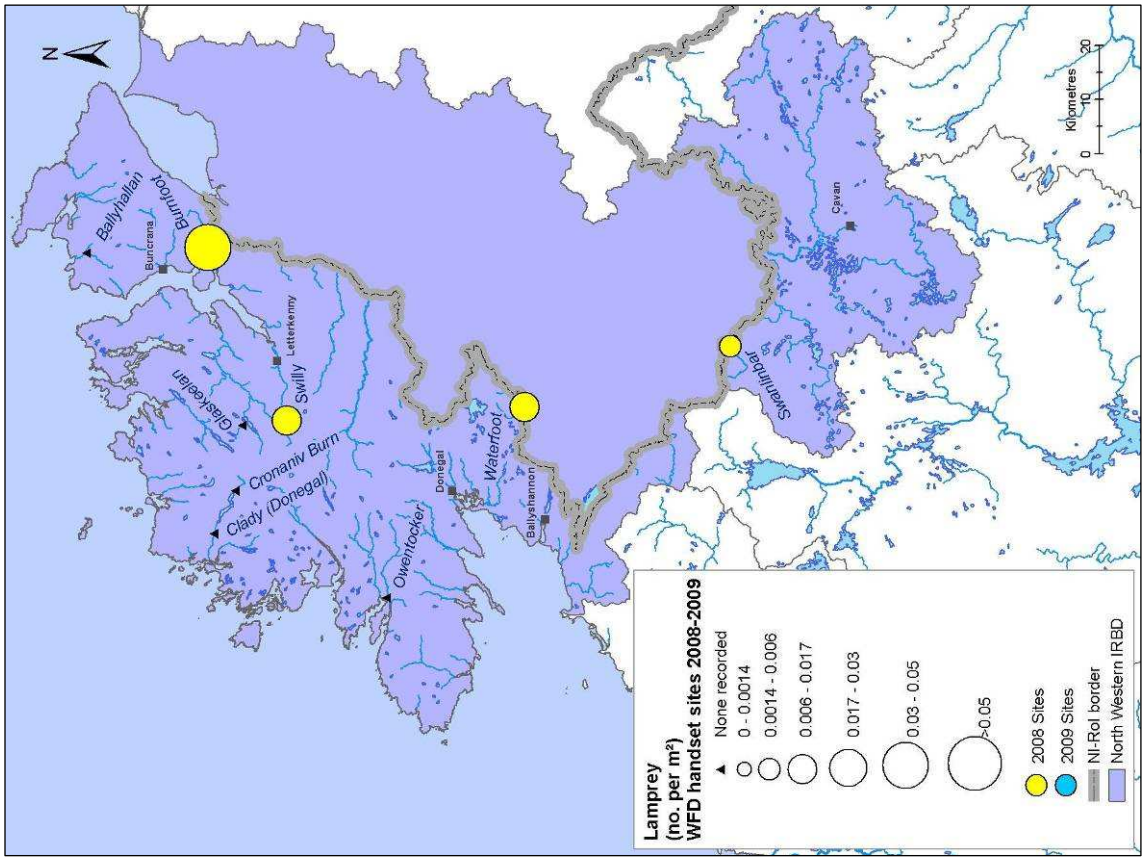

Fig. 4.22. Distribution map of lamprey in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

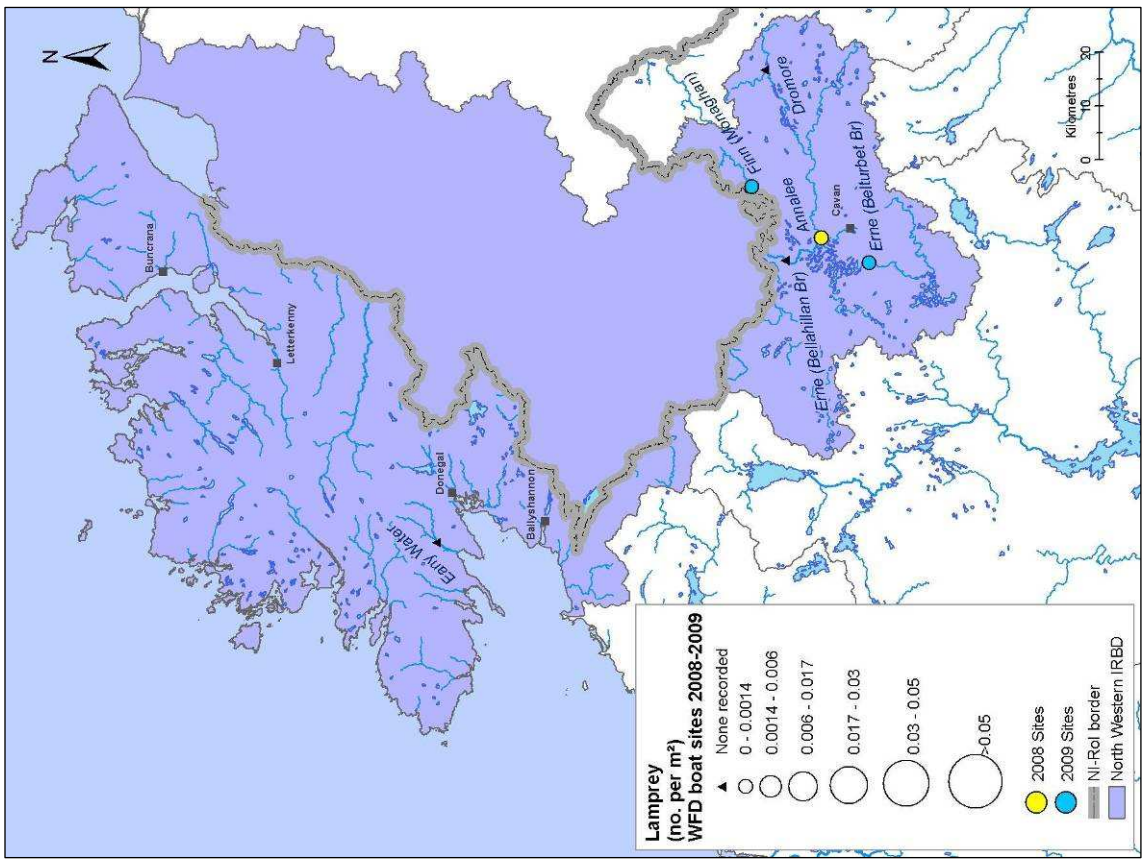

Fig. 4.21. Distribution map of lamprey in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

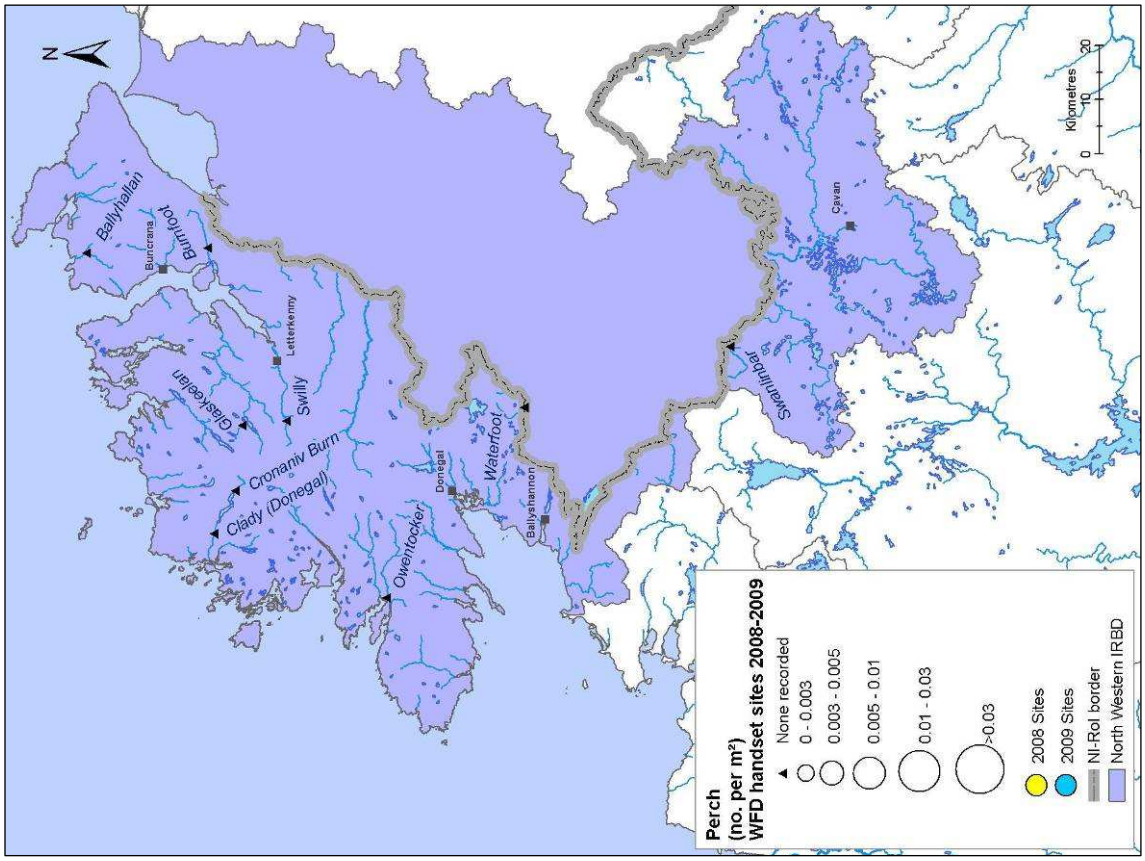

Fig. 4.24. Distribution map of perch in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

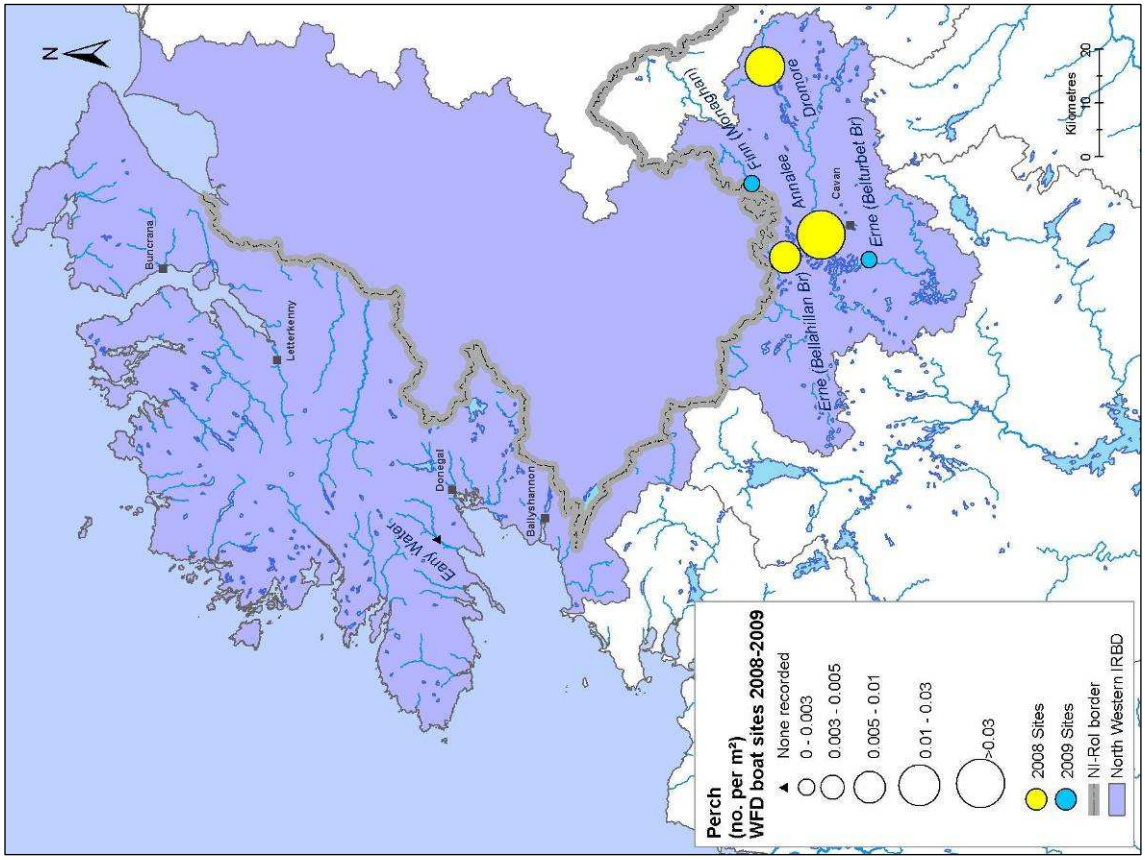

Fig. 4.23. Distribution map of perch in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

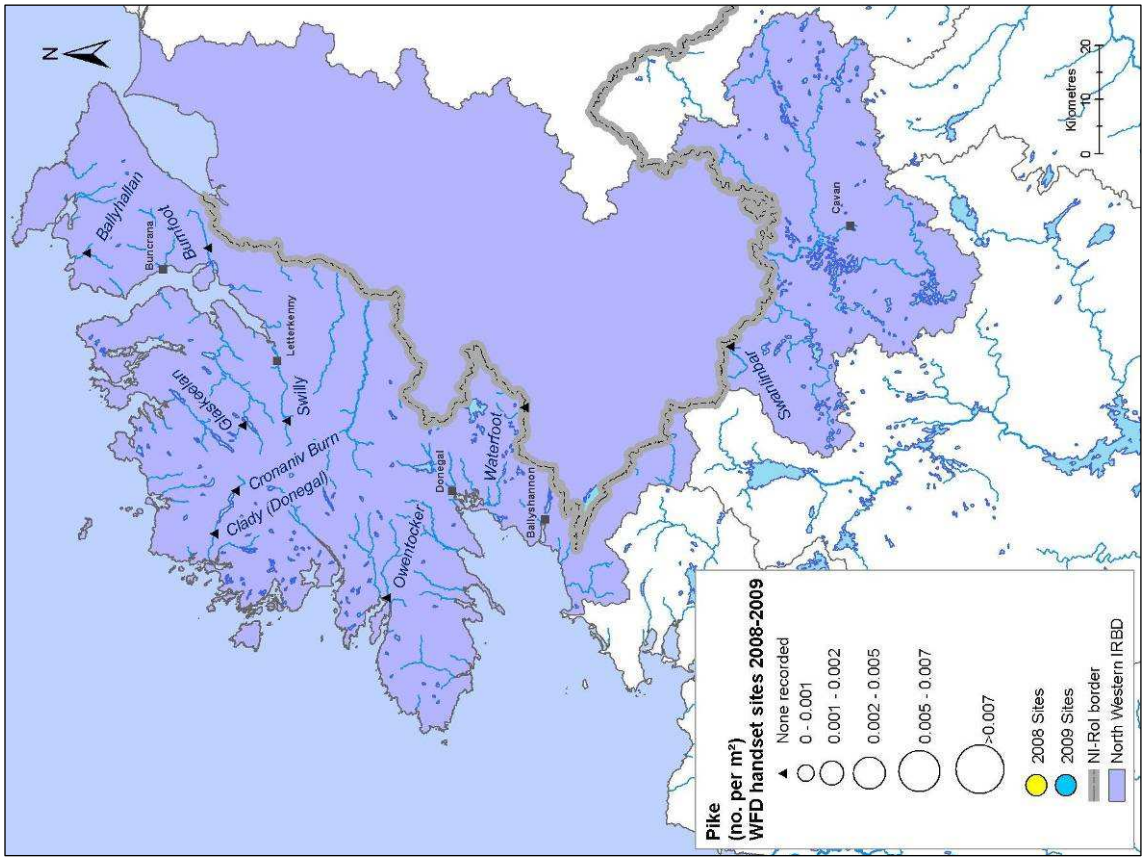

Fig. 4.26. Distribution map of pike in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

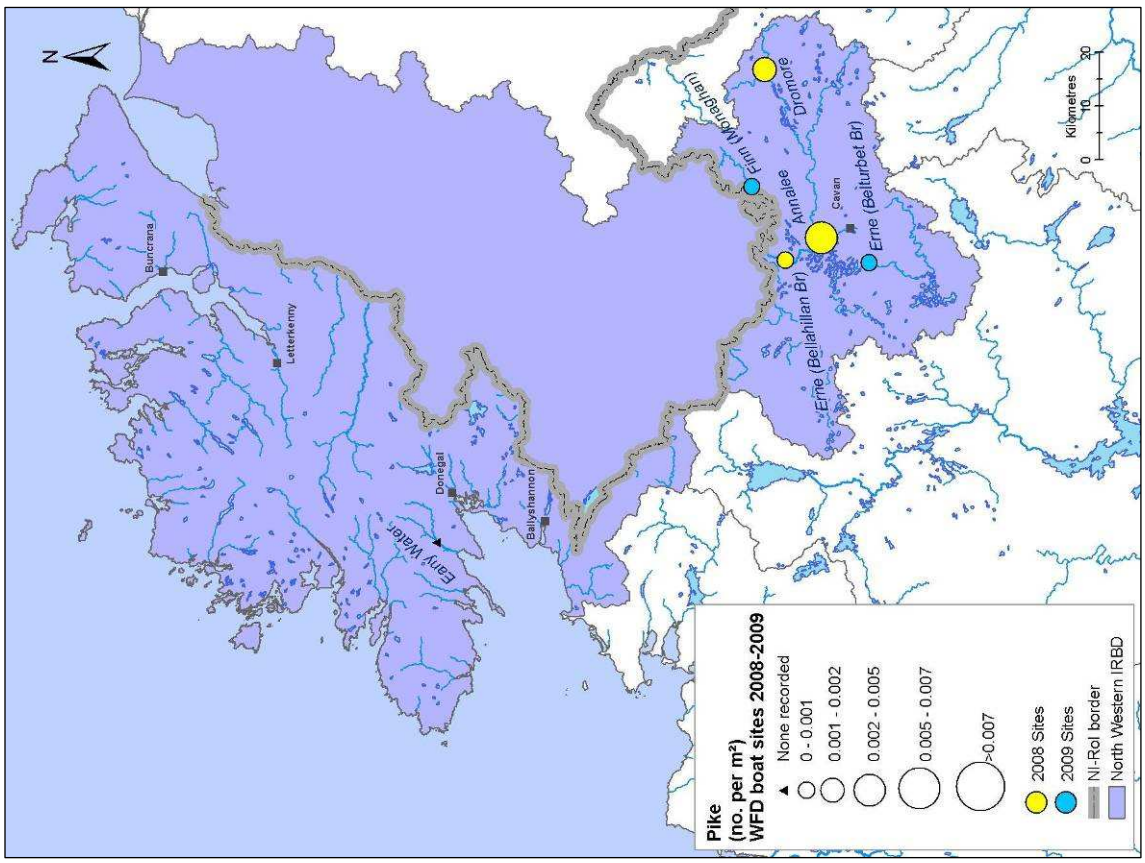

Fig. 4.25. Distribution map of pike in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

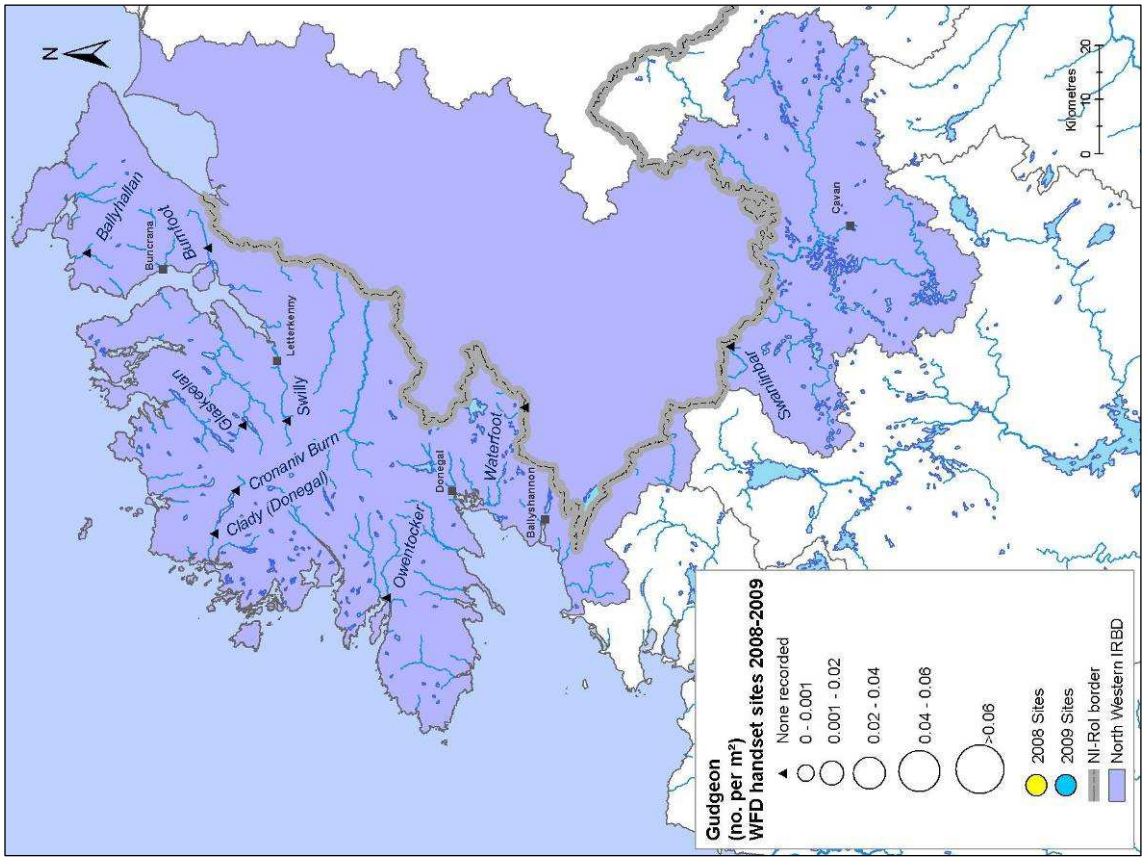

Fig. 4.28. Distribution map of gudgeon in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

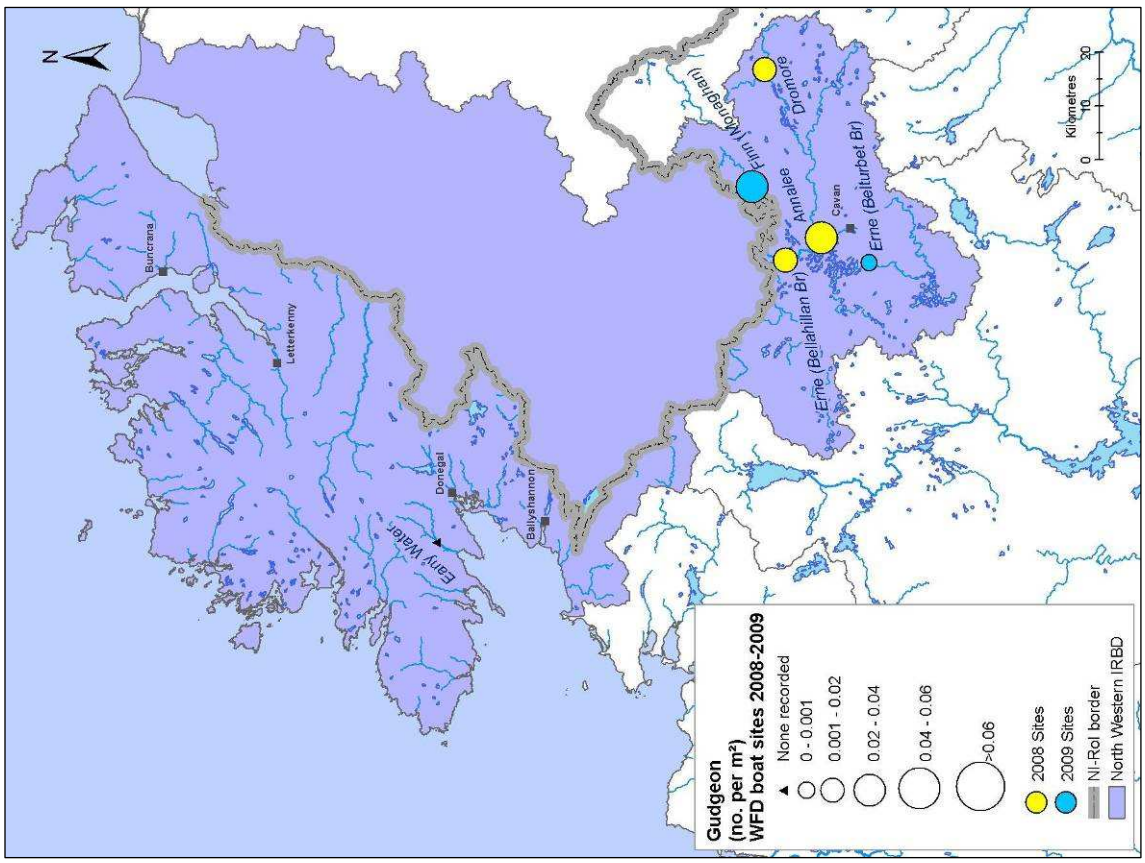

Fig. 4.27. Distribution map of gudgeon in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

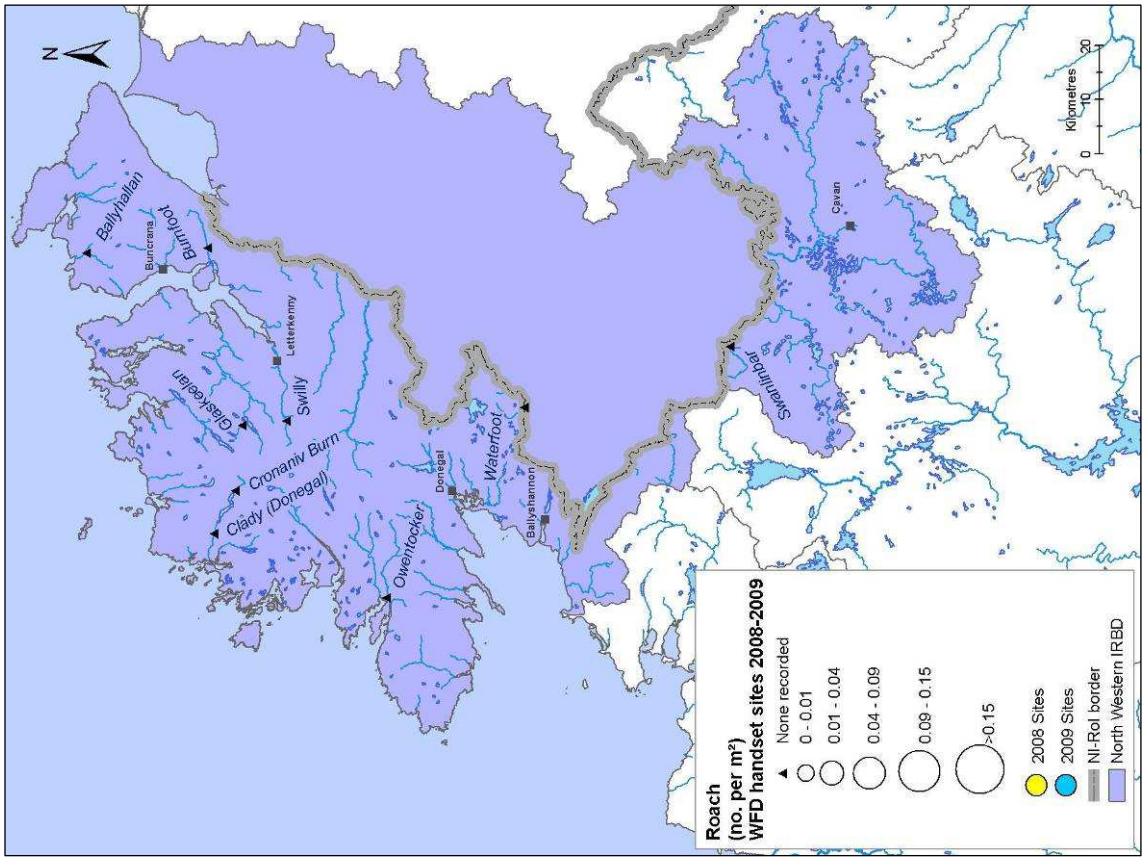

Fig. 4.30. Distribution map of roach in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

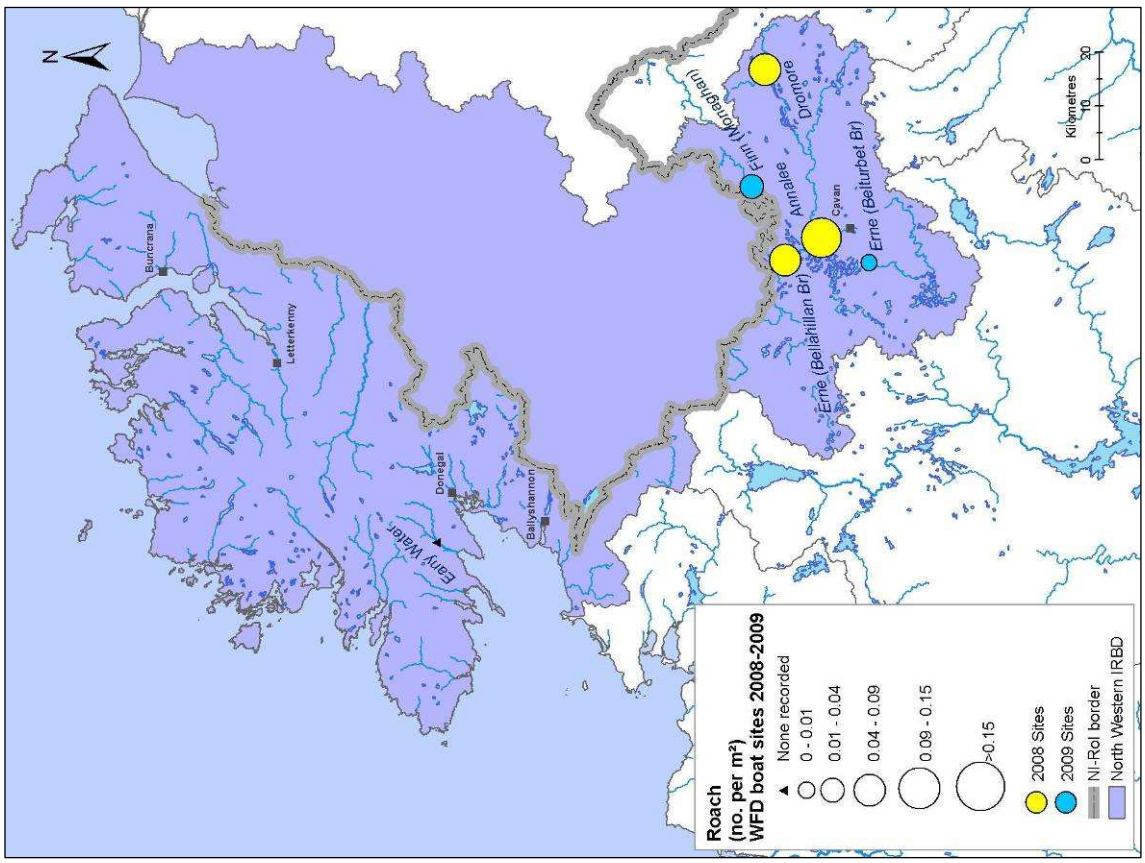

Fig. 4.29. Distribution map of roach in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

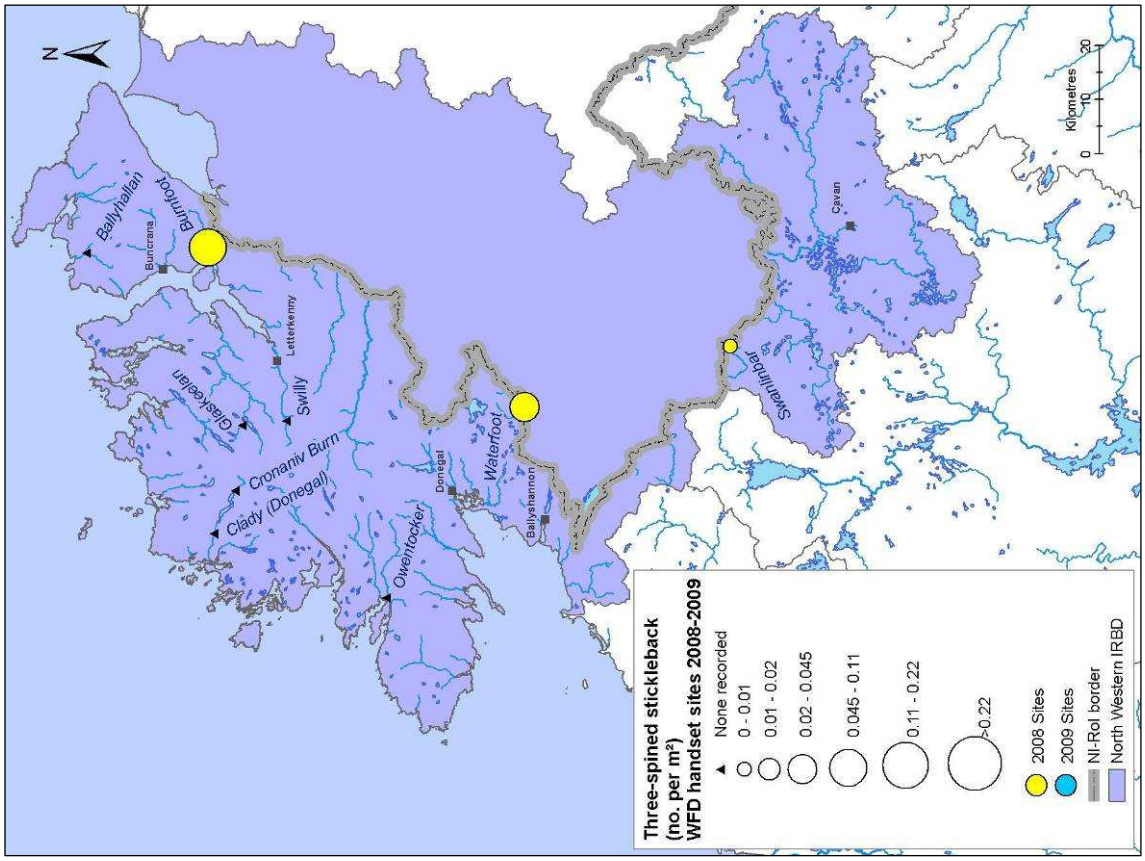

Fig. 4.32. Distribution map of three-spined stickleback in the NWIRBD hand-set sites surveyed for WFD monitoring 2008–2009

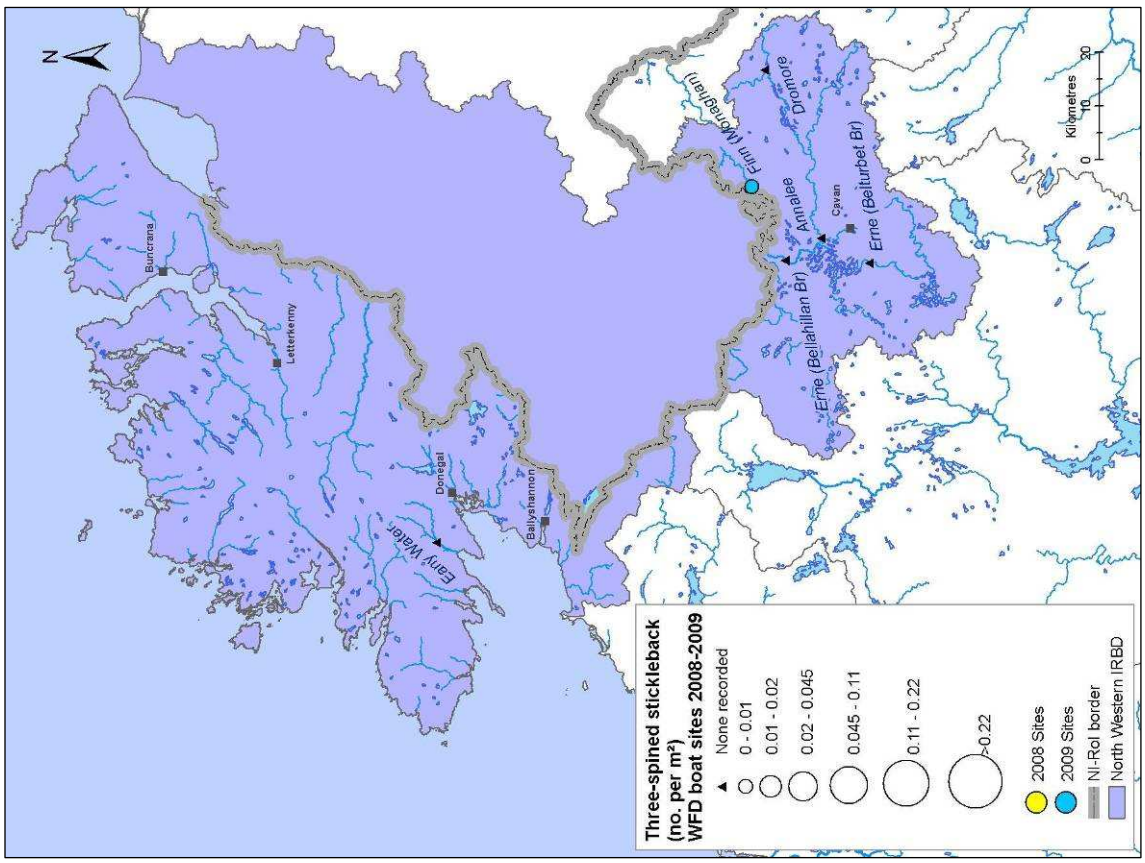

Fig. 4.31. Distribution map of three-spined stickleback in the NWIRBD boat sites surveyed for WFD monitoring 2008–2009

4.3.3 Age and growth of brown trout and salmon

Age and growth were determined for brown trout and salmon (where present) in each river site. Brown trout ages ranged from 0+ to 3+, with 0+ and 1+ being the dominant age classes in both sites where they were present. The largest brown trout (length = 27.9cm and weight = 0.24kg) recorded was captured in the Clady River. Juvenile salmon were only recorded in the Clady River, the largest of which measured 13.3cm and weighed 33.5g.

Length at age analyses and growth curves are presented for brown trout (Fig. 4.33 and Appendix 1). The brown trout in both river sites were assigned growth categories described by Kennedy and Fitzmaurice (1971), who examined the relationship between alkalinity and brown trout growth in Irish streams and rivers. Growth was classified as slow in the Clady River and fast in the Finn River. The Clady River site was the only site to contain salmon within the NWIRBD sites surveyed during 2009, therefore comparisons of growth rates was not possible. A comparison, however, with results from surveys conducted in 2008 (Kelly *et al*., 2009) shows similar salmon growth rates for other rivers within the NWIRBD.

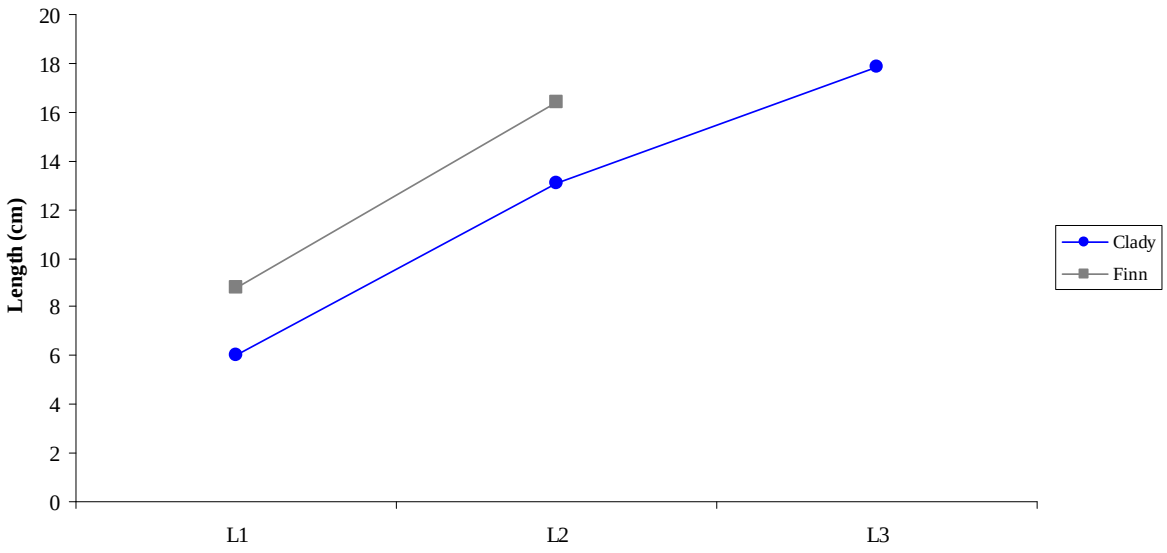

Fig. 4.33. Back calculated lengths for brown trout in each river, 2009

5. DISCUSSION

A total of ten fish species were recorded in the NWIRBD during 2009. This was comparable with the numbers captured in other River Basin Districts; the SERBD had the highest species richness of 14 species. The main summary report for 2009 (Kelly *et al*., 2010) provides information on species composition, richness and distribution for the whole country.

The NWIRBD can be divided into two halves in terms of fish species composition. Results from this year combined with 2008 (Kelly *et al*., 2009) demonstrate that rivers in the north of the region generally contain only native species (excluding minnow), while those in the southern end (e.g. Co. Cavan and Co. Monaghan) have more non-native fish species present.

The Finn River was the most diverse site in terms of fish species richness, with nine 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 a high number of non-native fish were present. The Clady River had the lowest species diversity in the NWIRBD, with only three species present. Such a low diversity is common in small wadeable streams throughout Ireland that contain only native fish species (Kelly *et al*., 2009).

Of the three rivers surveyed, European eels exhibited their highest density in the Clady River. Brown trout were recorded in both the Clady and Finn Rivers, while salmon were encountered only in the Clady River. Sea trout were absent from all sites. Lamprey, as well four non-native fish species, perch, pike, gudgeon and roach were all present in the River Erne and Finn River (south end of the district) but absent from the Clady River (north end of the district), a trend similar to that observed in 2008 (Kelly *et al*., 2009). Stone loach were only recorded in the Finn River.

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

Non-native fish species were recorded in two of the three rivers surveyed in the NWIRBD. 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 Clady River in Co. Donegal. 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 in the NWIRBD region.

Following the methods of Kennedy and Fitzmaurice (1971), brown trout growth was classified as slow in the Clady River and fast in the Finn River. Of the three NWIRBD sites surveyed in 2009, only the Clady River contained salmon; thus it was not possible to draw any conclusions on their growth rate. A comparison, however, with sites from 2008 (Kelly *et al*., 2009) shows that salmon in the Clady River have similar growth rates between L1 and L2 to other rivers in the region.

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 etc.)

River		L1	L2	L3	Growth category
Clady	Mean	6.0	13.1	17.8	Slow
	S.D.	1.3	2.2	3.1	
	S.E.	0.3	0.8	1.8	
	n	16	8	3	
	Range min.	4.0	9.6	14.7	
	Range max.	8.2	16.1	20.9	
Finn	Mean	8.8	16.4		Fast
	S.D.	2	4		
	S.E.	0.4	1.9		
	n	28.0	5.0		
	Range min.	5.6	11.6		
	Range max.	12.9	22.1		

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
Clady	Mean	4.2	7.9
	S.D.	1.0	0.5
	S.E.	0.2	0.2
	n	25	5
	Range min.	2.7	7.3
	Range max.	7.7	8.5

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