



Sampling Fish for the Water Framework Directive

Rivers 2010

Neagh-Bann International
River Basin District



Iascach Intíre Éireann
Inland Fisheries Ireland

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1. INTRODUCTION

Fish stock surveys were undertaken in 43 river sites throughout Ireland during the summer of 2010 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). One of the 43 surveys was conducted on a river site in the Neagh-Bann International River Basin District (NBIRBD) in June 2010 by staff from Inland Fisheries Ireland (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 (RBD) managers to compile and implement programmes of measures to improve degraded water bodies.

The NBIRBD is one of three international river basin districts on the island of Ireland (Fig. 2.1). Most of its area (approximately 6,000km²) is situated within Northern Ireland, whilst the remainder (approximately 2,000km²) is situated within the Republic of Ireland. The NBIRBD has the smallest stretch of coastline among all eight RBDs throughout Ireland (north and south). This includes the Bann Estuary at Port Stewart to the north and Carlingford Lough to the south. Only 200km² of marine waters belong to this RBD; however it does contain Ireland's largest lake, Lough Neagh. All of County Armagh is contained within the NBIRBD, along with parts of Derry, Antrim, Down, Tyrone, Fermanagh, Monaghan, Cavan, Louth and Meath. In the Bann Valley to the north, there is rich agricultural land which is used mainly for livestock grazing, while the south contains the drumlin counties of Cavan and Monaghan. Over half a million people live within this RBD, with most living in the major towns, including Armagh, Ballymena, Dundalk, Monaghan and Newry. The NBIRBD shares similar pressures to most other RBDs, including drinking water supply and wastewater treatment, but also contains some very heavily modified surface waters. These have been altered for various activities such as, navigation, flood defence and land drainage (NBIRBD, 2009).

This report summarises the main findings of the single fish stock survey conducted in the NBIRBD during 2010 and reports on the current status of the fish stocks present.

2. STUDY AREA

One site within the NBIRBD, on the Fane River, was surveyed during 2010. This was a wadeable site and was surveyed using bank-based electric-fishing units. Summary details of the site's location and physical characteristics are given in Tables 2.1 and 2.2, and the location of the site within the NBIRBD is shown in Figure 2.1.

Table 2.1. Location and code of the river site surveyed for WFD surveillance monitoring, 2010

River	Site name	Catchment	Site Code	Waterbody code
NBIRBD Wadeable sites				
Fane	Br d/s of Inniskeen	Fane	06F010650F	XB_06_8

Table 2.2. Details of the river site surveyed for WFD surveillance monitoring, 2010

River	Upstream catchment (km ²)	Wetted width (m)	Surface area (m ²)	Mean depth (m)	Max depth (m)
NBIRBD Wadeable sites					
Fane	234.3	7.98	375	0.23	0.82

The Fane River begins as a series of small streams which rise in Co. Armagh and Co. Monaghan (Plate 2.1). It flows into Lough Muckno and Lough Ross before twisting its way in a south easterly direction through Inniskeen village. It continues downstream to join the sea at Dundalk Bay, just a few kilometres south of Dundalk. The Fane River is a popular angling river for salmon, brown trout and sea trout (O' Reilly, 2002).

The survey site was located just downstream of Inniskeen Village (Fig. 2.2). Three electric-fishing passes were conducted using three bank-based electric-fishing units on the 29th of June 2010 along a 47m length of channel. The mean wetted width of channel surveyed was 8.0m and the mean depth was 23.0cm. A total wetted area of 375m² was surveyed. Riffle and glide were the most dominant habitats present, with a substrate of mainly cobble. The macrophyte vegetation present consisted of mosses and common riparian and bank-side species.

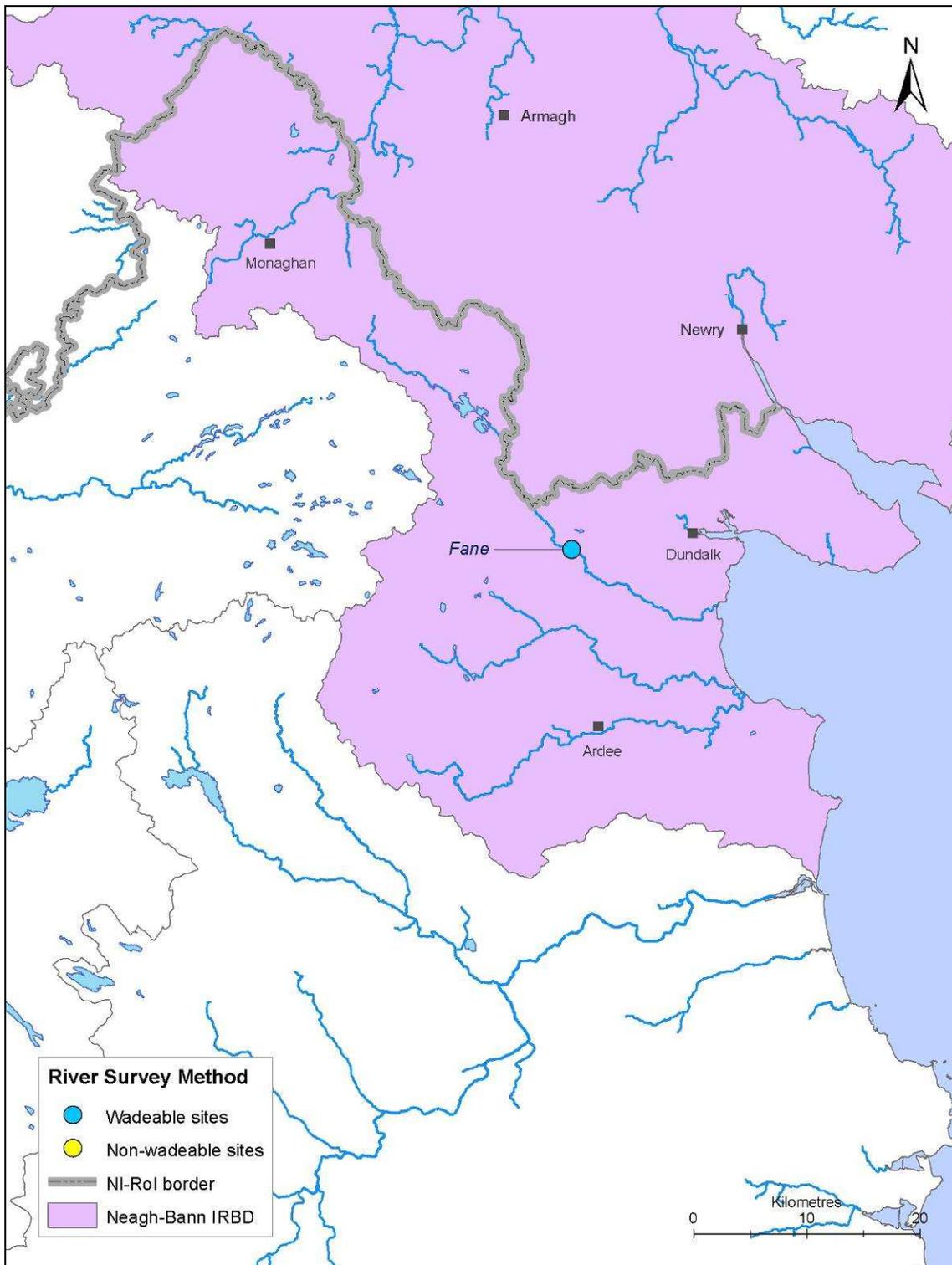


Fig. 2.1. Location map of river sites surveyed throughout the NBIRBD for WFD fish surveillance monitoring 2010



Plate 2.1. The Fane River site downstream of Inniskeen, Co. Louth

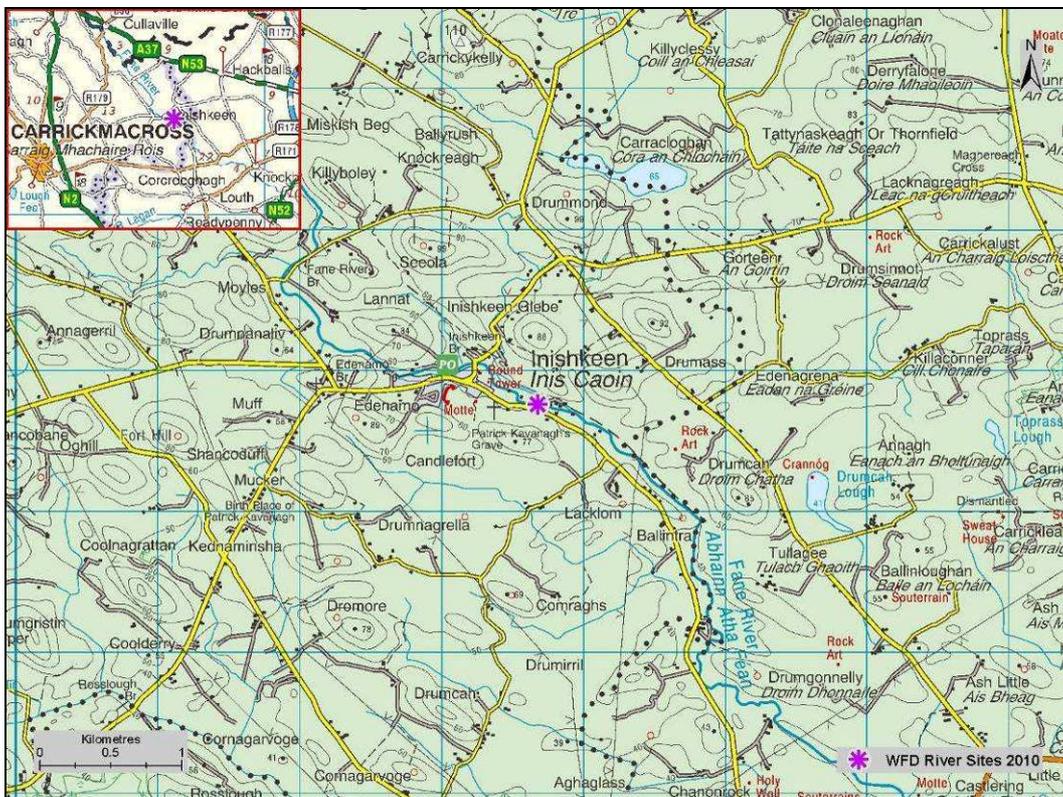


Fig. 2.2. Location of the Fane River surveillance monitoring site

3. METHODS

Electric-fishing 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 (Plates 3.1 and 3.2). This technique complies with European Committee for Standardisation (CEN) guidelines for fish stock assessment in wadeable rivers (CEN, 2003). At each site, where possible, the stretch sampled was isolated using stop nets and one to three fishing passes were conducted using bank-based electric fishing units or boat-based electric fishing units. Each survey encompassed all habitat types: riffle, glide and pool. A number of physical habitat variables were measured at each site. Water samples for chemical analyses were also taken, along with a multi-habitat kick-sample of macroinvertebrates. Macrophyte surveys were conducted on a selected number of wadeable streams.

Fish from each pass were sorted and processed separately. Fish were identified and lengths and weights were recorded; sub-samples were measured when large numbers of fish were present. For the purpose of species identification, where recorded, 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 recorded separately. For aging analyses, scales were taken from salmonids and most non-native fish species greater than 8.0cm in length. These fish were held in a large bin of oxygenated water after processing until they were fully recovered before being returned to the water. When present in a survey, a sub-sample of perch were retained for aging using opercular bones.

Three fishing passes were not possible or practical at all sites. Therefore in order to standardise abundance estimates across all sites, fish densities were calculated using data from the first fishing pass only. The number captured in the first fishing pass was divided by the total area surveyed to give a minimum population density for each species.

A sub-sample 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 bank-based units on the Owenriff River (WRBD)



Plate 3.2. Electric-fishing using boat-based units on the River Shannon (Clonmacnoise)

4. RESULTS

4.1 Species composition, abundance and age structure

A total of five fish species were recorded in the Fane River site. Salmon was the most abundant species, followed by brown trout, eels, stone loach and lamprey (Table 4.1).

Table 4.1. Minimum density of each fish species (no./m²) captured on the Fane River site, June 2010

Scientific name	Common name	0+	1+ & older	Total minimum density
<i>Salmo salar</i>	Salmon	0.362	0.275	0.637
<i>Salmo trutta fario</i>	Brown trout	0.013	0.096	0.109
<i>Anguilla anguilla</i>	Eel	-	-	0.037
<i>Barbatula barbatula</i>	Stone loach	-	-	0.024
<i>Lampetra</i> sp.	Lamprey sp.	-	-	0.0027
All Fish	All Fish	-	-	0.810

Salmon ranged in length from 3.6cm to 14.3cm (Fig. 4.2). Three age classes (0+ and 1+ and 2+) were present, accounting for approximately 62%, 32% and 6% of the total salmon catch respectively (Fig. 4.2). The mean salmon L1 and L2 were 4.2cm and 8.1cm respectively (Appendix 2).

Brown trout ranged in length from 5.4cm to 29.9cm (Fig. 4.3). Five age classes (0+, 1+, 2+, 3+ and 4+) were present, accounting for approximately 11%, 38%, 33%, 15% and 3% of the total brown trout catch respectively. The mean brown trout L1, L2, L3 and L4 were 7.3cm, 16.2cm, 22.5cm and 26.7cm respectively (Appendix 1). This indicates that growth of brown trout in this river site was 'fast' according to the classification scheme of Kennedy and Fitzmaurice (1971).

Other species recorded included, eels ranging in length from 13.4cm to 54.6cm (Fig. 4.4), stone loach ranging in length from 8.1cm to 10.8cm and lamprey ranging in length from 9.9cm to 12.4cm.

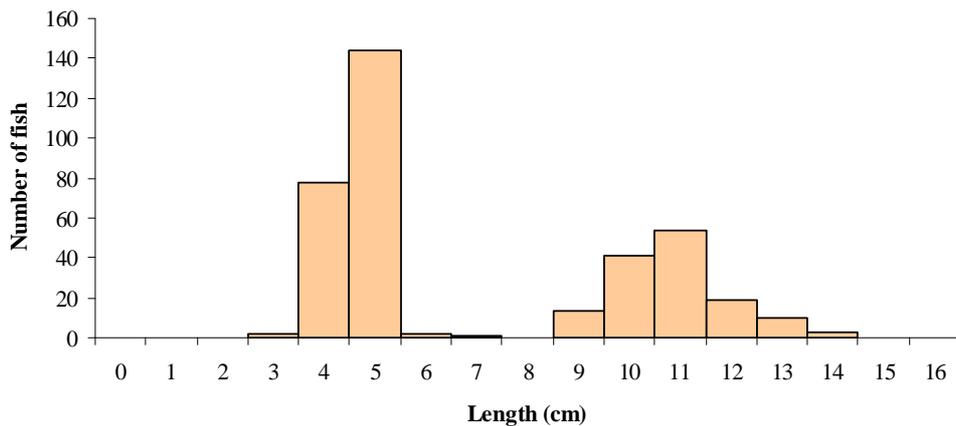


Fig. 4.2. Length frequency distribution of salmon in the Fane River site, June 2010 (n = 367)

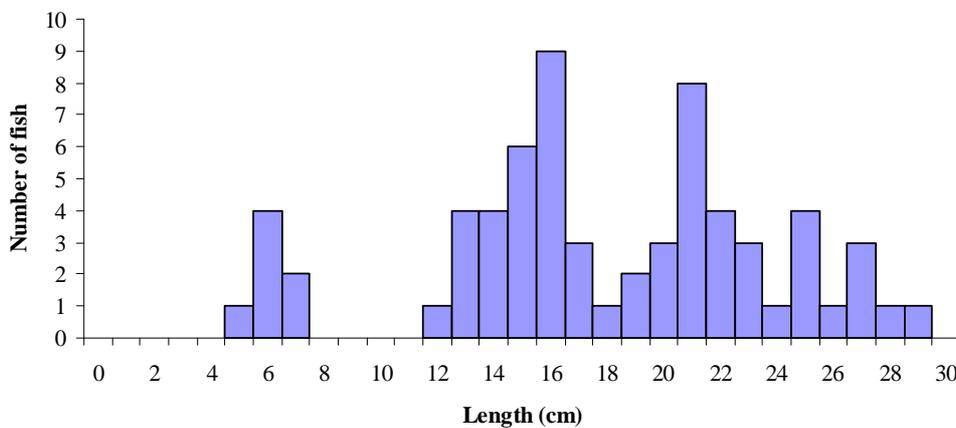


Fig. 4.3. Length frequency distribution of brown trout in the Fane River site, June 2010 (n = 66)

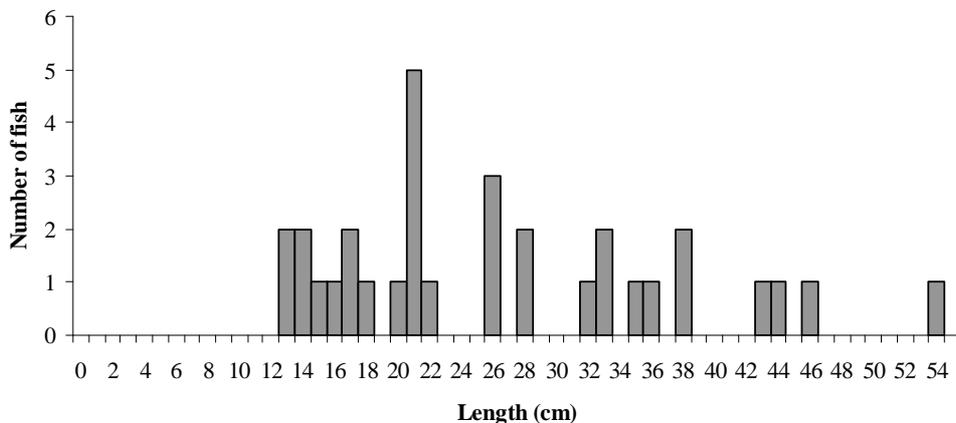


Fig. 4.4. Length frequency distribution of eels in the Fane River site, June 2010 (n = 32)

4.2 Age and growth of brown trout and salmon

Growth rates based on back-calculated length-at-age data were analysed for brown trout and salmon in the Fane River site.

Brown trout ages ranged from 0+ to 4+, with fish aged 1+ and 2+ comprising the most abundant age classes. The largest brown trout recorded measured 29.9cm in length, weighed 336g and was aged 4+. Brown trout in the Fane River were assigned a growth category described by Kennedy and Fitzmaurice (1971), who examined the relationship between alkalinity and growth of brown trout in Irish streams and rivers. Brown trout growth was classified as 'fast' (Fig. 4.5, Appendix 1).

Three age classes of salmon were recorded in the Fane River site: 0+, 1+ and 2+, with 1+ fish being the most abundant age class.

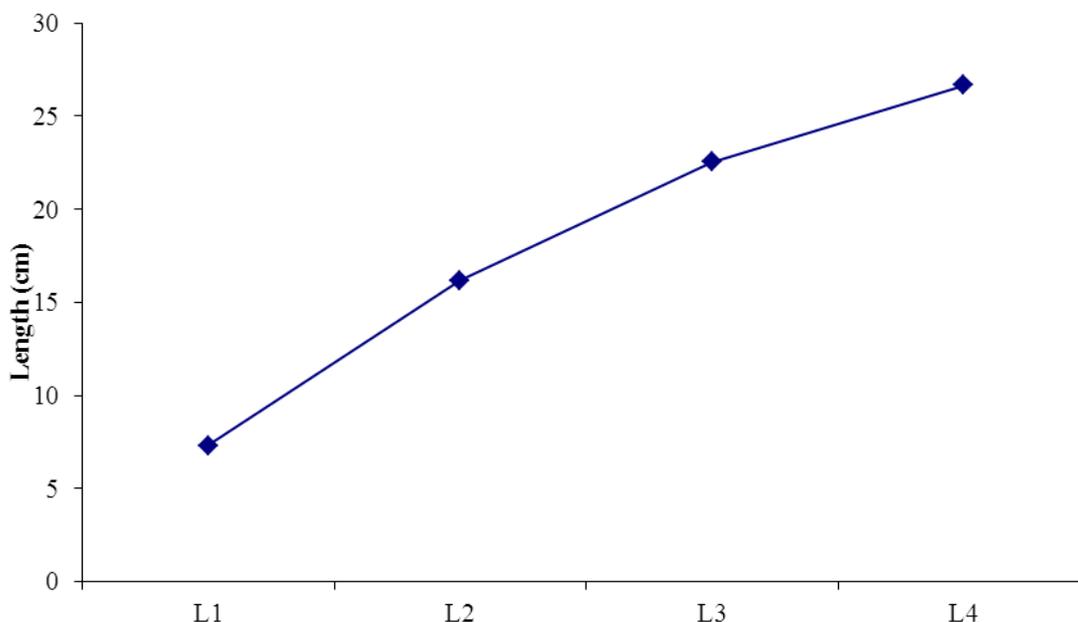


Fig. 4.5. Mean back calculated length-at-age data for brown trout in the Fane River, WFD surveillance monitoring 2010

4.3 Ecological status

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 Management Plans.

An ecological classification tool for fish in rivers has recently been developed for Ecoregion 17 (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 which was used in the model development. 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 (Fisheries Classification Scheme 2, or ‘FCS2’) be used. This approach has broadly been followed and improved to develop the new classification tool – ‘FCS2 Ireland’. The tool 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 resultant output is an Ecological Quality Ratio (EQR) between 1 and 0, with five class boundaries defined along this range corresponding with the five ecological status classes of High, Good, Moderate, Poor and Bad. Confidence levels are assigned to each class and represented as probabilities.

Using FCS2 Ireland, along with expert opinion, the Fane river site surveyed during 2010 has been assigned a draft fish ecological status class of Good (Table 4.2).

Table 4.2. Ecological status, based on the fish populations present, of sites surveyed in the NBIRBD for WFD surveillance monitoring 2010

River	Site code	Site name	Ecological status
NBIRBD Wadeable sites			
Fane	06F010650F	Br d/s of Inniskeen	Good

5. DISCUSSION

A total of five fish species were recorded in the Fane River site within the NBIRBD during the 2010 monitoring program. The highest species diversity recorded in any site throughout the country during 2010 was ten species in the River Blackwater (Lismore) where there was a high number of non-native fish species present. Information on fish species richness, composition, distribution and abundance throughout the whole country can be found in the WFD summary report for 2010 (Kelly *et al.*, 2011).

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). 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. Stone loach was the only non-native species recorded in the Fane River site during 2010.

Following the methods of Kennedy and Fitzmaurice (1971), the growth of brown trout was classified as 'fast' in the Fane River site (Appendix 1). Furthermore, brown trout in the Fane River site exhibited the second fastest growth rate from L1 to L4 among all river sites surveyed throughout Ireland during 2010 (Kelly *et al.*, 2011).

Using the recently completed ecological classification tool for fish in rivers (FCS2 Ireland), along with expert opinion, each river site surveyed during 2010 has been assigned a draft ecological status classification based on the fish populations present. The Fane River site has been assigned an ecological status of Good.

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APPENDIX 1

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

River		L1	L2	L3	L4	Growth category
Fane	Mean	7.3	16.2	22.5	26.7	Fast
	S.D.	1.2	3.2	1.2	0.1	
	S.E.	0.2	0.6	0.4	0.1	
	n	49	30	9	2	
	Min	4.6	10.3	20.8	26.6	
	Max	10.0	20.9	24.5	26.7	

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
Fane	Mean	4.2	8.1
	S.D.	0.8	0.7
	S.E.	0.1	0.2
	n	28	10
	Min	3.3	7.3
	Max	5.9	9.3

A dark blue abstract shape, resembling a stylized wave or a folded piece of paper, occupies the lower-left portion of the page. It features several white dashed lines that curve across its surface and extend into the white background to the right.

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