

Sampling Fish for the Water Framework Directive

A summary of Inland Fisheries Ireland's Water Framework Directive Monitoring Programme for Fish in Lakes, Rivers and Transitional Waters, 2007 - 2009

WFD Summary Report 2007 - 2009

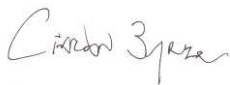
Inland Fisheries Ireland CEO's Statement

The Water Framework Directive (WFD) was introduced in December 2000 with the broad aims of providing a standardised approach to water resource management throughout Europe and promoting the protection and enhancement of healthy aquatic ecosystems. The Directive, transposed into Irish Law in December 2003, requires Member States to protect those water bodies that are already of Good or High ecological status and to restore all water bodies that are degraded in order that they achieve at least Good ecological status by 2015.

Since 2007 a WFD team based in the Research and Development Division have worked closely with colleagues within Inland Fisheries Ireland (previously the Central and Regional Fisheries Boards) and with staff from other national agencies, academic institutions and our parent Department, the Department of Communication, Energy and Natural Resources to complete the key objectives of the fish monitoring programme.

I am delighted to have such an experienced, dedicated and talented team of scientists working within the WFD team in IFI, Swords. However, without the support and commitment of the management and staff in the Regional Fisheries Boards between 2007 and 2009 (now River Basin Districts), it would not have been possible to complete the key objectives reported in this document. The regional based staff were integral to the successful delivery of this programme. With the amalgamation of the Central and Regional Fisheries Boards in July 2010 into the newly formed entity, IFI, we are pleased to be able to further the WFD work programme at a national inland fisheries level.

I would like to congratulate all who have contributed to the significant level of work which was undertaken over the three year period (2007 – 2009) under the Water Framework Directive fish surveillance monitoring programme, the key elements of which are reported in this document, and wish them continued success in 2010.



Dr Ciaran Byrne
CEO, Inland Fisheries Ireland

August 2010

Foreword

Welcome to Inland Fisheries Ireland's summary report on the first three years (2007 – 2009) of fish sampling for the Water Framework Directive Summary (WFD).

Inland Fisheries Ireland (IFI) has been assigned the responsibility by the Environmental Protection Agency (EPA) for delivering the fish monitoring element of the WFD in Ireland. Monitoring takes place over a three year rolling period, with the first three year monitoring cycle completed in 2009. Monitoring sites are set out in the WFD Monitoring Programme published by the EPA in 2006 and the fish monitoring requirements include over 300 water bodies. Although the surveillance monitoring programme for rivers and transitional waters was delayed by one year, the two subsequent years have seen a huge effort by the team of IFI scientists to achieve the three year goals, and I'm delighted to report a total of 70 lakes, 72 transitional waters and 134 river sites have been surveyed in the first surveillance monitoring cycle.

The 2007 - 2009 fish surveillance monitoring programme has been extensive, with over 70 fish species (plus hybrids and four brown trout varieties) being recorded and over 150,000 fish captured and examined. All fish have been identified, counted and a representative sub-sample has been measured, weighed and aged. A further sub-sample of fish was retained for laboratory analysis of stomach contents, sex and parasitism. This large volume of data has been processed and entered into a new GIS database, with interactive species distribution maps available on the WFD fish website (www.wfdfish.ie).

All water bodies surveyed have been assigned an interim ecological status class (High, Good, Moderate, Poor or Bad) and these results have been submitted to the EPA for inclusion in River Basin Management Plans (RBMPs). Future information from ongoing monitoring programmes will evaluate the effectiveness of programmes of measures set out in these RBMPs.

The data collected to date in this first cycle of surveillance monitoring for the WFD not only fulfils legislative requirements, but provides an invaluable source of information on fish species distribution and abundance for decision makers, angling clubs, fishery owners and other interested parties. Preliminary reports for each water body are available on the WFD fish website (www.wfdfish.ie) and these will be replaced by more detailed reports on each water body in 2010 and 2011.

It is important that I acknowledge the support and expertise received from our colleagues in the former Regional Fisheries Boards (RFBs) during the 2007 - 2009 monitoring seasons. It is only with a coordinated effort between the R&D and regional based staff that delivery of such a comprehensive monitoring programme is possible.

2010 has seen the merger of the Central and Regional Fisheries Boards into a national fishery research and management organisation called Inland Fisheries Ireland. This organisational change, within a

challenging economic climate, will necessitate a strong business focus on project management to ensure that Inland Fisheries Ireland continues to deliver against the requirements of the WFD fish monitoring programme. We also continue to see rapid changes in our aquatic environment; conservation and protection of this resource is of the highest priority.

Lastly I would like to thank all those that contributed to this report and I wish the IFI WFD team every success for the year ahead.



Dr Cathal Gallagher,
Head of Function, Research & Development

Inland Fisheries Ireland,
August 2010

Executive Summary

The Water Framework Directive (WFD) (2000/60/EC) was introduced in 2000 and subsequently transposed into Irish law in 2003 (S.I. No. 722 of 2003), establishing a new framework for the protection and management of water resources from “source to sea” throughout the EU. The principal aim of the WFD is to preserve those water bodies that are currently of ‘High’ or ‘Good’ ecological status, and to restore those water bodies that are currently impaired in order that they achieve at least ‘Good’ ecological status by 2015.

One of the key steps in this process is for Member States to assess the current ecological status of surface waters (rivers, lakes and transitional waters) by monitoring a range of biotic and abiotic elements, including phytoplankton, macrophytes, phytobenthos, benthic invertebrates, fish, water chemistry and hydromorphology. Ongoing monitoring of these elements can then be used to assess the effectiveness or otherwise of programmes of measures designed to restore those water bodies that fail to meet the minimum WFD requirement of ‘Good’ ecological status.

Over 300 surveillance monitoring water bodies, encompassing rivers, lakes and transitional waters, have been set out by the Environmental Protection Agency in the WFD Water Monitoring Programme (EPA, 2006) and are completed on a three year rolling cycle for all biological quality elements. Inland Fisheries Ireland (IFI) has been assigned the task of monitoring fish for the WFD.

The first three year WFD fish monitoring cycle (2007 – 2009) has been extensive, with a total of 275 water bodies being surveyed (133 river water bodies (134 sites), 70 lakes and 72 transitional water bodies). Delays in the start-up of the fish surveillance monitoring programme in 2007 resulted in only 15 lakes and eight transitional water bodies being surveyed during this year; however, concerted efforts by the dedicated WFD team in IFI during 2008 and 2009 has seen the successful completion of surveys in the majority of surveillance monitoring sites, with a resulting vast amount of new information on fish species distribution and abundance being collected.

This report highlights the current draft ecological status, based on the fish populations present, of each water body surveyed during the first three year WFD fish monitoring cycle from 2007 – 2009.

Out of a total of 134 river sites surveyed, 10 (7.5%) were classified as ‘High’, 66 (49.3%) as ‘Good’, 54 (40.3%) as ‘Moderate’, 3 (2.2%) as ‘Poor’ and 1 (0.7%) as ‘Bad’ ecological status, based on the fish populations present.

Out of a total of 70 lakes surveyed, 10 (14%) were classified as ‘High’, 21 (30%) as ‘Good’, 34 (49%) as ‘moderate’, 4 (6%) as ‘Poor’ and 1 (1%) as ‘Bad’ ecological status, based on the fish populations present.

Out of a total of 72 transitional waters surveyed, 1 (1.4%) were classified as ‘High’, 37 (51.4%) as ‘Good’, 23 (31.9%) as ‘Moderate’, 9 (12.5%) as ‘Poor’ and 2 (2.8%) as ‘Bad’ ecological status, based on the fish populations present.

In addition to the new data collected from 2007 – 2009, archival data from 66 lakes (2005 – 2006, ROI and NI), 416 river sites (1998 – 2003, ROI and NI) and 12 transitional water bodies (2000 – 2006, ROI and NI) have been used to develop the ecological classification tools and these water bodies have also been assigned an ecological status class.

The fundamental WFD requirement of reporting the ecological status of each water body has been addressed; however, a considerable amount of new information on fish species distribution and abundance has also been collected, a selection of which is presented. More comprehensive information on the distribution and abundance of each species can be found in the 2007, 2008 and 2009 WFD summary reports (Kelly and Champ, 2008b; Kelly *et al.*, 2009; Kelly *et al.*, 2010). Individual reports on each water body are also available to download on the dedicated WFD fish website (www.wfdfish.ie).

Project Personnel

This report was written and researched by Dr. Fiona Kelly, Dr. Andrew Harrison, Ms. Lynda Connor, Dr. Ronan Matson, Ms. Emma Morrissey, Ms. Roisin O’Callaghan, Mr. Rory Feeney, Ms. Grainne Hanna, Ms. Ciara Wogerbauer, Mr Glen Wightman, Mr. Kieran Rocks, Mr Trevor Stafford and Mr Brian Hayden, Inland Fisheries Ireland (IFI), under the direction of Dr. Cathal Gallagher, Head of Research and Development as part of the Water Framework Directive (WFD) Fish Surveillance Monitoring Programme, 2007 to 2009.

Acknowledgements

In July 2010, the Central and Regional Fisheries Boards amalgamated to form the new entity – Inland Fisheries Ireland (IFI). However, throughout the 2007 – 2009 surveillance monitoring cycle, the authors received a significant amount of help and co-operation from the CEOs, ACEOs and their staff from the seven Regional Fisheries Boards, and from their colleagues within the Central Fisheries Board. This help and co-operation is gratefully acknowledged.

The many angling clubs, fishery owners and land owners who granted permission and access for fish surveys are also gratefully acknowledged.

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1. INTRODUCTION

In December 2000 the European Union introduced the Water Framework Directive (WFD) (2000/60/EC), the most significant piece of water quality legislation to come from the EU in recent years, with the aim of establishing a new framework for the management of water resources and the protection of aquatic ecosystems. The WFD is different from other water quality legislation in that it moves the focus away from the concept of ‘water quality’ based mainly on chemical analysis to a more holistic approach to water management, introducing the concept of ‘ecological status’.

In Ireland, water quality has been assessed for many years by the Environmental Protection Agency (EPA), principally on the basis of benthic invertebrates and water chemistry in rivers. In contrast, the WFD now requires monitoring of phytoplankton, macrophytes, phytobenthos, benthic invertebrates, fish, water chemistry and hydromorphology.

EU Member States are required to conduct monitoring programmes to initially assess the health of their surface waters (rivers, lakes and transitional waters), and subsequently to assess the effectiveness of measures put in place to restore ecologically impaired waters. Each water body (section of a river or other surface water) is assigned an ‘ecological status’ class (High, Good, Moderate, Poor or Bad), with the fundamental objective of the WFD being to achieve at least ‘Good’ ecological status in all surface waters by 2015.

The WFD is administered at a local level through River Basin Districts (RBDs), with the EPA responsible for co-ordinating the activities of the RBDs, Local Authorities and State Agencies. The EPA also has the responsibility of reporting to the European Commission, developing classification systems, setting standards and devising the monitoring programme. The result of this co-ordinated work within each River Basin District is the development of River Basin Management Plans, which outline programmes of measures designed to restore water bodies that are currently falling below the WFD requirement of ‘Good’ ecological status. Ongoing monitoring of surface waters will help to track the effectiveness or otherwise of these measures in achieving the objectives of the WFD.

The responsibility of monitoring fish for the WFD has been assigned to Inland Fisheries Ireland (previously the Central and Regional Fisheries Boards), with over 300 water bodies encompassing rivers, lakes and transitional waters included in a three year rolling monitoring programme.

The first three year fish monitoring cycle from 2007 – 2009 has seen the completion of surveys on 70 lakes, 133 river water bodies (134 river sites) and 72 transitional water bodies. This report highlights some of the key findings from these surveys and the draft fish ecological status class of each water body are presented.

Detailed reports on all water bodies surveyed are available to download on the dedicated WFD fish website (www.wfdfish.ie).

2. DETAILS OF WFD FISH MONITORING SITES

A total of 70 lake water bodies, 133 river water bodies (134 river sites) and 72 transitional water bodies were surveyed from 2007 to 2009. Details of all sites surveyed are shown in Tables 2.1 to 2.3 and Figures 2.1 to 2.4.

Table 2.1. Details of lakes surveyed for WFD fish monitoring, 2007 - 2009

Lake name	Water body code	Year	Easting	Northing	Area (ha)	Mean depth (m)	Max depth (m)	Ecological status (fish)
ERBD								
Annagh (White)	EA_07_258	2007	251154	273108	25.1	>4.0	18.0	Moderate
Bane	EA_07_270	2007	254766	271293	75.4	>4.0	16.0	Moderate
Dan	EA_10_29	2009	315394	203430	102.9	13.5	40.0	Good
Lene	EA-07_274	2007	251073	268421	416.2	>4.0	20.0	Good
Skeagh, Upper	EA_07_267	2008	265083	301342	61.0	2.2	4.9	Moderate
Tay	EA_10_25	2009	316085	207508	50.0	10.1	35.0	Good
ShIRBD								
Alewnaghta	SH_25_189	2009	176089	191267	54.6	<4.0	4.5	Moderate
Annaghmore	SH_26_669	2008	189942	283670	52.9	<4.0	16.0	Moderate
Ateduan	SH_27_108	2007	129670	188457	38.0	2.3	7.0	Moderate
Cam	SH_23_74	2009	59744	107907	8.0	2.7	15.0	Good
Cavetown	SH_26_705	2008	183228	297430	64.0	<4.0	20.0	Poor
Cullaun	SH_27_115	2009	131594	190644	49.7	6.7	21.0	Moderate
Derg	SH_25_191a	2009	177812	185798	11650.5	6.0	36.0	Poor
Dromore	SH_27_82	2009	134517	185851	49.1	5.9	20.0	Poor
Gur	SH_24_99	2009	163885	140815	78.9	2.4	5.0	Moderate
Inchicronan	SH_27_126	2009	139500	185948	116.7	<4.0	18.8	Moderate
Lickeen	SH_28_85	2007	117575	190916	84.2	>4.0	20.0	Good
Meelagh	SH_26_711	2008	189093	312025	115.7	<4.0	14.0	Moderate
Nanoge	SH_26_580	2008	150461	290247	45.9	4.5	11.0	Moderate
O' Flynn	SH_26_693	2008	158361	279690	136.9	4.5	14.5	Moderate
Owel	SH_26_703	2008	240155	258633	1017.6	>4.0	22.0	Moderate
Sheelin	SH_26_709	2008	244291	283941	1808.2	4.4	15.0	Moderate
NBIRBD								
Muckno	NB_06_56	2009	285627	318883	316.0	5.9	20.0	Poor
NWIRBD								
Anure	NW_38_83	2009	181476	414670	156.0	2.0	11.9	High
Barra	NW_38_84	2008	193447	411876	62.3	4.4	12.0	High
Beagh	NW_38_80	2008	202074	421485	259.0	9.2	46.5	High
Corglass	NW_36_655	2008	234842	308823	34.3	1.6	6.0	Moderate
Derrybrick	NW_36_400	2008	234514	312044	36.2	2.1	5.0	Moderate
Dungloe	NW_38_692	2009	177887	411252	61.0	1.3	7.5	Good
Egish	NW_36_671	2008	277884	312744	117.0	3.3	10.0	Bad
Fern	NW_39_13	2008	218292	424349	181.0	2.0	3.0	Good
Kiltooris	NW_38_47	2008	167183	396339	43.3	<4.0	14.0	Good
Kindrum	NW_38_670	2009	217786	442631	61.0	6.6	15.0	Good
Melvin	NW_35_160	2008	189530	353752	2197.0	7.8	40.0	Good
Muckanagh	SH_27_100	2009	137228	192888	96.1	3.0	19.0	Moderate
Nasnahida	NW_38_67	2009	185231	407764	15.2	<4.0	11.0	Good
Sessiagh	NW_38_61	2009	203933	435931	24.0	4.0	20.9	Good
White	NW_36_647	2009	267964	319078	54.0	<4.0	6.0	Moderate

Table 2.1 contd. Details of lakes surveyed for WFD fish monitoring, 2007 - 2009

Lake name	Water body code	Year	Easting	Northing	Area (ha)	Mean depth (m)	Max depth (m)	Ecological status (fish)
SWRBD								
Acoose	SW_22_208	2008	75602	85287	66.3	>4.0	19.0	Good
Allua	SW_19_4	2008	118989	65591	135.9	4.0	28.4	Moderate
Brin	SW_21_402	2008	78334	77451	24.5	5.9	13.0	High
Caragh	SW_22_207	2008	71986	90432	488.7	11.0	39.0	Good
Glenbeg	SW_21_444	2008	70632	53003	66.2		32.0	Good
Inniscarra	SW_19_138	2008	147703	279690	489.0	7.4	35.4	Moderate
Leane	SW_22_185	2008	93171	88660	1944.3	13.0	60.0	Good
Upper Lake	SW_22_186	2008	90931	82113	166.7	14.5	36.0	Good
WRBD								
Ardderry	WE_31_76	2007	98397	245804	81.1	>4.0	12.0	Moderate
Arrow	WE_35_159	2009	179161	312139	1247.0	9.0	33.0	Moderate
Aughrusbeg	WE_32_436	2007	55792	258173	50.2	<4.0	14.0	Moderate
Bunny	WE_27_114	2009	137409	196784	102.9	2.7	14.0	Moderate
Carra	WE_30_347	2009	118998	272737	1564.5	1.8	19.0	Good
Carrowmore	WE_33_1914	2008	83597	327913	911.2	<4.0	2.5	Good
Corrib, Lower	WE_30_666a	2008	113819	248676	11519.0	<4.0	6.8	Moderate
Corrib, Upper	WE_30_666b	2008	127105	236016	5042.0	>4.0	42.0	Moderate
Cullin	WE_34_406a	2009	122875	302769	1023.6	<4.0	3.0	Moderate
Doo	WE_32_463	2009	83461	268222	16.2	>4.0	46.0	High
Easky	WE_35_136	2008	144396	323036	118.7	3.0	10.5	Good
Gill	WE_35_158	2008	175363	333545	1375.3	>4.0	31.0	Moderate
Glenade	WE_35_156	2007	182429	346230	73.6	<4.0	11.5	Moderate
Glencar	WE_35_139	2007	174919	343333	114.6	>4.0	19.0	High
Glencullin	WE_32_487	2008	81952	269647	34.1	<4.0	13.0	High
Kylemore	WE_32_509b	2007	77268	258266	134.1	>4.0	30.0	High
Lettercraffroe	WE_30_344	2007	105625	237701	82.4	2.8	17.8	Moderate
Mask	WE_30_665	2009	110027	264594	8217.8	5.0	57.0	Moderate
Maumwee	WE_30_343	2007	97708	248533	27.6	2.1	8.8	High
Nambrackmore	WE_32_500	2007	71689	245439	10.4	2.1	10.0	Moderate
Ross (Corrib)	WE_30_345	2007	119229	236521	139.2	>4.0	14.0	Moderate
Shindilla	WE_31_171	2007	95812	246068	65.6	>4.0	22.0	High
Talt	WE_34_405	2008	139683	315172	96.9	>4.0	40.0	Good
Templehouse	WE_35_157	2008	161565	317148	118.6	2.6	5.3	Moderate

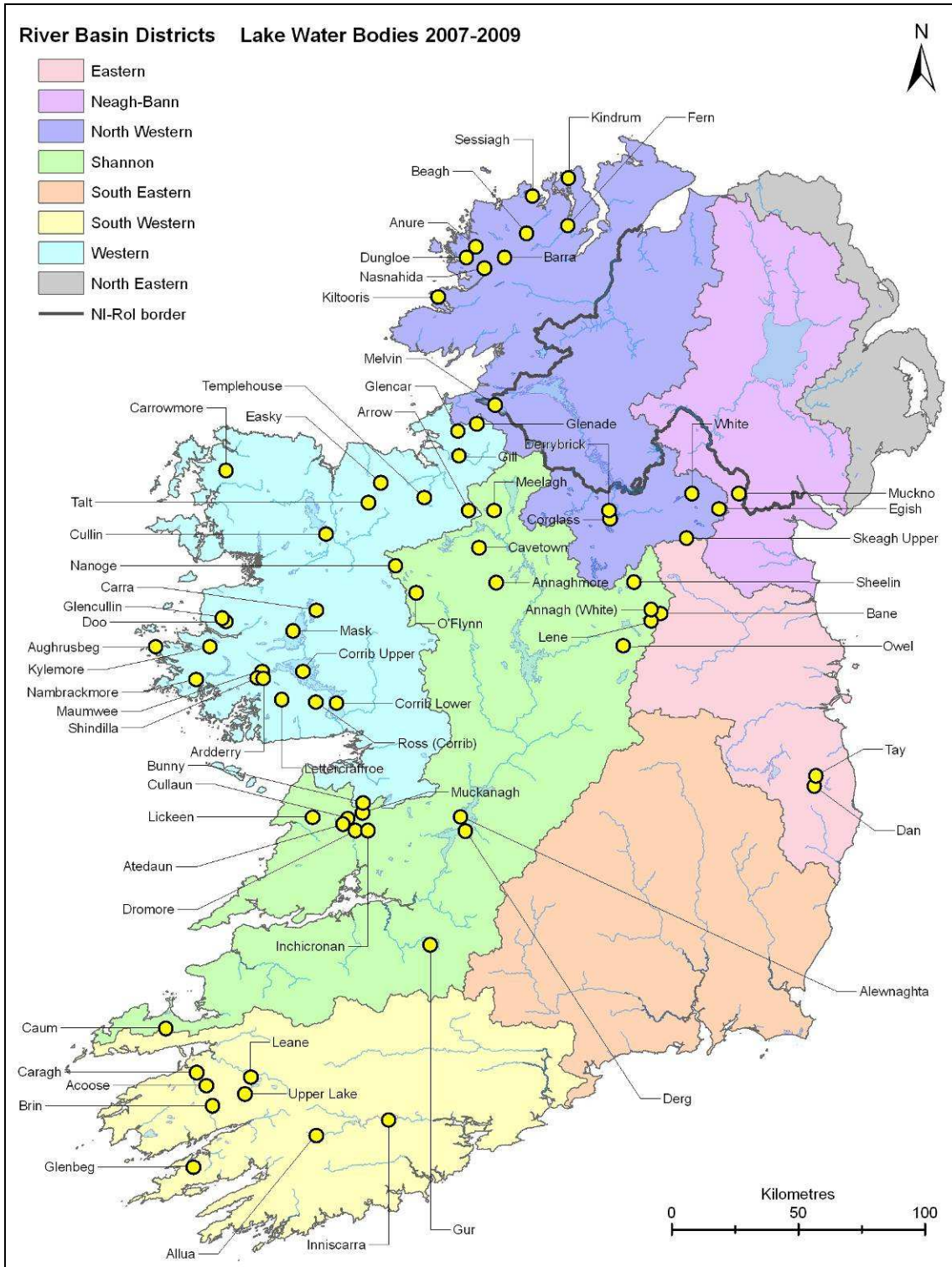


Fig. 2.1. Location of WFD fish monitoring lake water bodies, 2007 - 2009

Table 2.2. Details of river sites surveyed for WFD fish monitoring, 2008 - 2009

River	Site name	Year	Site Code	Water body code	Ecological status (fish)
ERBD Hand-set sites					
Athboy	Bridge at Clonleasan House	2009	IE07A010100	EA_07_971	Good
Blackwater	Just u/s of Lough Ramor	2009	IE07B010800	EA_07_1035	Moderate
Dargle	1km u/s of Bray Br.	2009	IE10D010250	EA_10_1275	Good
Dodder	Footbridge (Beaver Row)	2008	IE09D010900	EA_09_587	Good
Glencree	Bridge u/s of Dargle R. confl.	2009	IE10G010200	EA_10_367	Good
Glenealo	Bridge d/s of Upper Lake	2009	IE10G050200	EA_10_793	Good
Nanny	Bridge at Julianstown	2009	IE08N010700	EA_08_814	Moderate
Rye Water	Kildare Br	2008	IE09R010400	EA_09_246	Moderate
ERBD Boat sites					
Boyne	Boyne Br.	2009	IE07B040200	EA_07_990	Good
Liffey	Kilcullen Br	2008	IE09L010700	EA_09_1870_2	Good
Liffey	d/s of Ballyward Br.	2009	IE09L010250	EA_09_1175	Moderate
Liffey	Lucan Br.	2009	IE09L012100	EA_09_1870_5	Good
Vartry	Newrath Br	2008	IE10V010300	EA_10_1601	Good
NBIRBD Hand-set sites					
Big	Ballygoly Br.	2009	IE06B010100	NB_06_642	Good
White	Coneyburrow Br.	2009	IE06W010500	NB_06_550	Moderate
NBIRBD Boat sites					
Blackwater (Monaghan)	Newmills Br	2008	IE03B010800	XB_03_5	Moderate
Dee	Burley Br.	2009	IE06D010600	NB_06_50	Moderate
NWIRBD Hand-set sites					
Ballyhallan	Bridge u/s Clonmany River	2008	IE40B010200	NW_40_1082	Good
Burnfoot	Bridge in Burnfoot	2008	IE39B020600	NW_39_1105	Moderate
Clady	Bridge u/s of Bunbeg	2009	IE38C040300	NW_38_4124	Good
Cronaniv Burn	Bridge u/s Dunlewy Lough	2008	IE38C060100	NW_38_800	High
Gliskeelan	Bridge W. of Roshin (Lough Gartan)	2008	IE39G050100	NW_39_1136	Good
Owentocker	500m d/s Bridge in Ardara	2008	IE38O060300	NW_38_3037	High
Swanlinbar	0.6km d/s Swanlinbar Br	2008	IE36S010300	NW_36_18	Good
Swilly	Swilly Br (near Breenagh)	2008	IE39S020050	NW_39_1508	Good
Waterfoot	Letter Br	2008	IE36W030700	XB_36_west_5	Good
NWIRBD Boat sites					
Annalee	0.2km d/s Cavan R confl	2008	IE36A021400	NW_36_2417	Moderate
Dromore	Br in Ballybay	2008	IE36D020150	NW_36_30	Moderate
Eany Water	Just u/s Eany Beg/More confl	2008	IE37E030300	NW_37_3646	Good
Erne	Kilconny Belturbet (RHS)	2008	IE36E011400	XB_36_east_4	Moderate
Erne	Bellahillan Br.	2009	IE36E011100	NW_36_1746	Moderate
Finn	Cumber Br.	2009	IE36F010500	XB_36_east_3	Moderate
SERBD Hand-set sites					
Ballyroan	Gloreen Br	2008	IE15B010200	SE_15_1938	Moderate
Banoge	Br u/s Owenavorrhagh R confl.	2008	IE11B020300	SE_11_257	Moderate
Burren	Ullard Br.	2009	IE14B050100	SE_14_1781	Moderate
Clody	Ford (Br) 3km u/s Bunclody	2008	IE12C030200	SE_12_2098	Good
Douglas (Ballon)	Sragh Br	2008	IE12D030200	SE_12_789	Moderate
Duag	Br u/s Ballyporeen	2008	IE16D030100	SE_16_639	Good
Duncormick	(W) Br nr Duncormick Rly St	2008	IE13D010350	SE_13_745	Moderate
Glory	Br E of Raheen	2008	IE15G010200	SE_15_1870	Good
Greese	Bridge NE of Belan House	2009	IE14G040350	SE_14_946	Moderate
Nier	Br ENE of Ballymacarby	2008	IE16N010100	SE_16_1059	High
Nuenna	Br d/s Clomantagh	2008	IE15N020100	SE_15_1029	Moderate
Tully Stream	Soomeragh Br.	2009	IE14T020390	SE_14_842	Moderate
Urrin	Buck's Br	2008	IE12U010200	SE_12_2605	Good
SERBD Boat sites					
Anner	Drummon Br	2008	IE16A020600	SE_16_2342	Good
Barrow	Pass Br.	2009	IE14B011000	SE_14_196_1	Moderate
Colligan	Br nr Killadangan	2008	IE17C010250	SE_17_832	Good
Dinin	Dinin Br.	2009	IE15D020800	SE_15_1955	Good
King's	Kells Br.	2009	IE15K020800	SE_15_1819	Good
Mahon	ENE of Seafield Ho	2008	IE17M010350	SE_17_825	Good
Multeen	Ballygriffin Br	2008	IE16M021100	SE_16_3825	Good
Nore	Quaker's Bridge	2008	IE15N010300	SE_15_1018	Moderate
Owenavorrhagh	Br N of Ballinamona	2008	IE11O10500	SE_11_251	Moderate
Slaney	Waterloo Br.	2009	IE12S020400	SE_12_1524	Good
Suir	Knocknageragh Br	2008	IE16S020200	SE_16_3997	Moderate

Table 2.2 contd. Details of river sites surveyed for WFD fish monitoring, 2008 - 2009

River	Site name	Year	Site Code	Water body code	Ecological status (fish)
ShIRBD Hand-set sites					
Ballyfinboy	Bridge u/s Lough Derg	2009	IE25B020800	SH_25_1853	Moderate
Bilboa	Bilboa Br.	2009	IE25B030080	SH_25_486	High
Boor	Br NW of Kilbillaghan	2008	IE26B071100	SH_26_3921	Moderate
Bow	Bow River Br	2008	IE25B100100	SH_25_2145	Good
Broadford	Just u/s South Branch confl.	2008	IE27B020300	SH_27_287	Good
Broadford	Bridge u/s of Doon Lough	2009	IE27B020800	SH_27_287	Good
Caher	Bridge 2 km d/s of Formoyle	2009	IE28C010200	SH_28_106	Good
Dead	Pope's Br.	2009	IE25D010100	SH_25_1893	Moderate
Glenafelly	Br 3km E of Longford	2008	IE25G210010	SH_25_2084	Good
Glendine	Knockloskeraun Br.	2009	IE28G020200	SH_28_231	Good
Gourna	Br u/s Owenogarney R confl.	2008	IE27G020600	SH_27_885	Good
Graney	Caher Br, S of L. Graney	2008	IE25G040025	SH_25_2081	Good
Inny	Br 1km S of Oldcastle	2008	IE26I010100	SH_26_3091	Good
Little	Br 2km SW of Cloghan	2008	IE25L010200	SH_25_3014	Moderate
Moyree	Bridge u/s Fergus River	2009	IE27M020700	SH_27_1178	Moderate
Newport	Rockvale Br.	2009	IE25N020200	SH_25_320	Good
Owvane	Bridge u/s of Loughill	2009	IE24O020200	SH_24_878	Good
Owveg	Owveg Br.	2009	IE23O050200	SH_23_1743	Good
Tyshe	Br nr Banna House	2008	IE23T020500	SH_23_427	Bad
Tyshe	West of Ardfert Friary	2009	IE23T020400	SH_23_427	Poor
ShIRBD Boat sites					
Brosna	Clonony Br (NW of canal)	2008	IE25B091100	SH_25_681	Moderate
Brosna	0.5km NW of Pollagh	2008	IE25B090760	SH_25_681	Moderate
Camlin	Bridge W of Lisnabo	2008	IE26C011000	SH_26_3927_2	Moderate
Clodiagh	Br at Raham	2008	IE25C060500	SH_25_2952	Good
Creegh	Drumellihy Br.	2009	IE28C021400	SH_28_709	Good
Cross	Bridge u/s Shannon River	2008	IE26C100400	SH_26_1448_2	Moderate
Deel (Newcastlewest)	Bridge near Ballinaska	2008	IE24D020400	SH_24_863	Moderate
Feale	Br ENE of Duagh Ho	2008	IE23F010500	SH_23_2941	High
Feorish	Bridge 1.5km SW of Keadue	2009	IE26F020400	SH_26_234	Poor
Fergus	Bridge near Clonroad House	2008	IE27F010700	SH_27_1245	Moderate
Fergus	Poplar Br.	2009	IE27F010100	SH_27_181	Good*
Inny	Shrute Br	2008	IE26I011350	SH_26_883	Moderate
Kilcrow	Ballyshrute Bridge	2008	IE25K010700	SH_25_334	Moderate
Little Brosna	Riverstown Br	2008	IE25L020700	SH_25_633	Good
Maigue	at Castleroberts_Br	2008	IE24M010900	SH_24_1675	Moderate
Mountnugent	Mountnugent Br	2008	IE26M020500	SH_26_2742	Good
Nenagh	Ballysoilshaun Br.	2009	IE25N010300	SH_25_335	Good
Scramoge	Bridge N.E. of Riverdale	2008	IE26S010300	SH_26_3801	Moderate
Shannon	Battle Br	2008	IE26S020500	SH_26_3090	Moderate
Shannon	Ballyleague Br.	2009	IE26S021600	SH_26_4162	Moderate*
Silver	Lumcloon Br	2008	IE25S020700	SH_25_3701	Good
Smearlagh	Ford u/s Feale R confl (LHS)	2008	IE23S020700	SH_23_373	Good
Suck	Ballyforan Bridge	2008	IE26S071100	SH_26_1447_4	Moderate
Suck	Cloondacarra Bridge	2008	IE26S070300	SH_26_1447_1	Moderate
Tullamore	Bridge SW of Ballycowen Br.	2008	IE25T030400	SH_25_3798	Moderate
SWRBD Hand-set sites					
Argideen	Ford S of Reengarigeen	2009	IE20A020200	SW_20_2251	Good
Funshion	Brackbaun Br.	2009	IE18F050030	SW_18_11	Good
Glashaboy	Ballyvorisheen Br	2008	IE19G010200	SW_19_755	Good
Martin	Bawnafinny Br	2008	IE19M010600	SW_19_191	Good
Shanowen	Ford (Br) u/s Maine R confl.	2008	IE22S010100	SW_22_3452	High
SWRBD Boat sites					
Awbeg	Kilcummer Br.	2009	IE18A051300	SW_18_2677	Good
Bandon	Bridge near Desert Station	2009	IE20B020600	SW_20_2230_1	Moderate*
Blackwater	Killavullen Br.	2009	IE18B021900	SW_18_2292_5	Moderate*
Blackwater	Nohaval Br.	2009	IE18B020200	SW_18_450	Good
Bride	Bridge N of Ballynella	2009	IE18B050500	SW_18_2778	Good
Flesk*	Flesk Br, S of Killarney LHS	2008	IE22F020300	SW_22_3372	Good
Gweestin	Gweestin Br	2008	IE22G061200	SW_22_2207	Moderate
Lee	Inchinossig Br	2008	IE19L030100	SW_19_928	Good
Maine	Maine Br (Lower)	2008	IE22M010700	SW_22_3960	Moderate
Owenreagh*	Br u/s Upper Lake	2008	IE22O030400	SW_22_2703	Good
Womanagh	S of Ballyhonock Lough	2008	IE19W011300	SW_19_1909	Moderate

Table 2.2 cont. Details of river sites surveyed for WFD fish monitoring, 2008 - 2009

River	Site name	Year	Site Code	Water body code	Ecological status (fish)
WRBD Hand-set sites					
Ballinglen	Ballinglen Bridge	2008	IE33B010100	WE_33_2091	High
Black	Bridge at Kilshanvy	2009	IE30B020100	WE_30_2928	Good
Clydagh	Br NW Ardvarney	2008	IE34C050030	WE_34_314	High
Dunneill	Donaghintraine Br.	2009	IE35D060200	WE_35_1430	Moderate
Glenamong	Bridge u/s Lough Feeagh	2008	IE32G030100	WE_32_2441	Good
Gowlan	Ford u/s of Easky River confl.	2009	IE35G030100	WE_35_1187	Good
Moy	Cloonbaniff Br	2008	IE34M020050	WE_34_3035	High
Owenbrin	Bridge u/s of Lough Mask	2009	IE30O010200	WE_30_1063	Good
Owendalulleegh	Bridge SE of Killafeen	2009	IE29O011000	WE_29_150	Moderate
Tobercurry	Br just u/s Moy River	2008	IE34T020200	WE_34_2633	High
Unshin	d/s of Riverstown Br.	2009	IE35U010200	WE_35_2178	Good
WRBD Boat sites					
Behy	Behy Bridge	2008	IE34B080400	WE_34_3999	Good
Bunowen*	Tully Bridge	2008	IE32B030100	WE_32_3740	Good
Castlebar	Br 2.5km d/s Castlebar	2008	IE34C010200	WE_34_3953	Poor
Deel (Crossmolina)	Bridge at Castle Gore	2008	IE34D010400	WE_34_3896_3	Moderate
Glenamoy	Glenamoy Bridge	2008	IE33G010100	WE_33_3238	Good
Nanny	u/s of Weir Br.	2009	IE30N010300	WE_30_1128	Moderate

*surveys completed in unfavourable flood conditions and will be repeated in the second surveillance monitoring cycle (2010 – 2012)

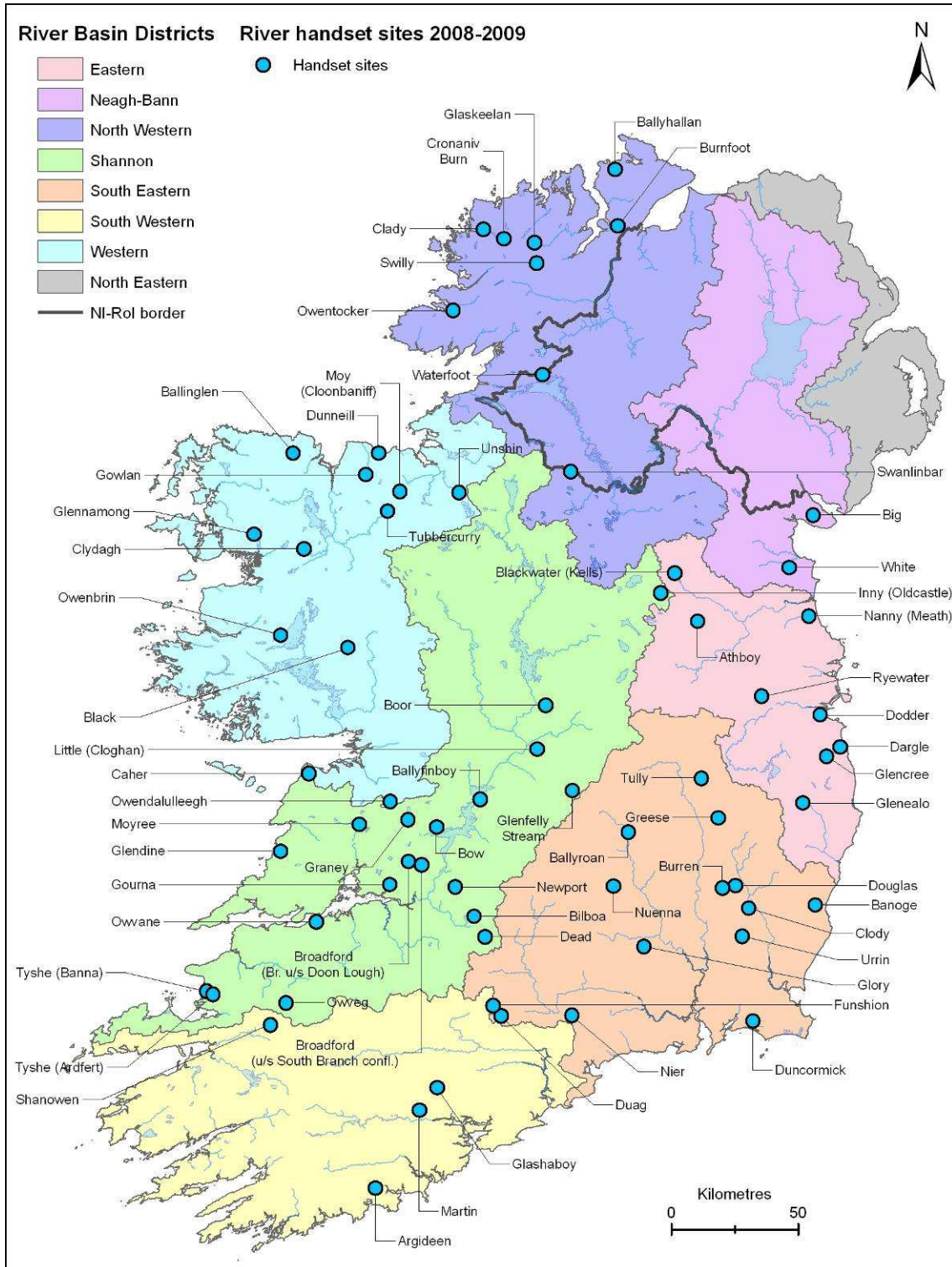


Fig. 2.2. Location of WFD fish monitoring river sites (hand-set), 2008 - 2009

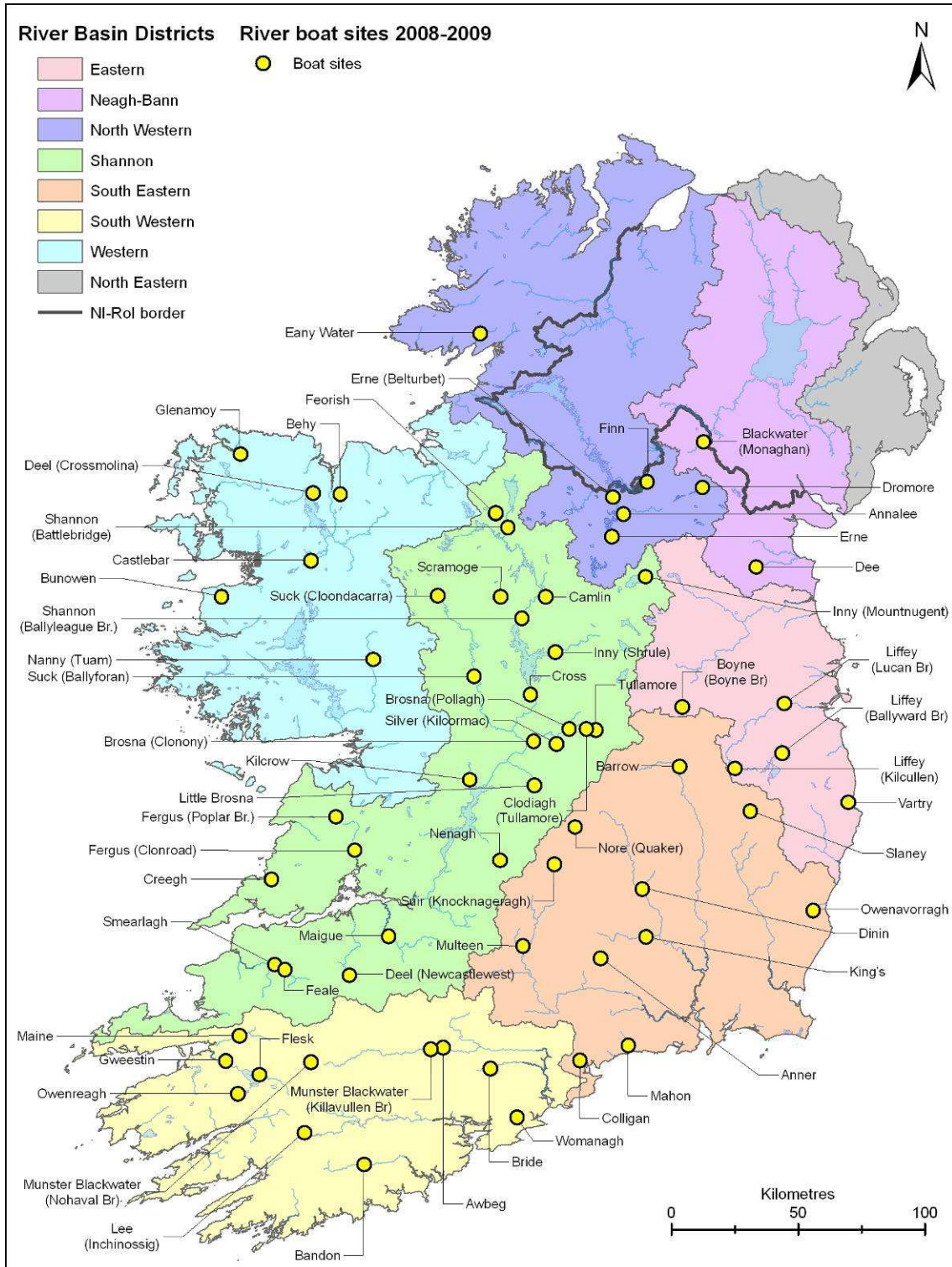


Fig. 2.3. Location of WFD fish monitoring river sites (boat), 2008 - 2009

Table 2.3. Details of transitional waters surveyed for WFD fish monitoring, 2007 – 2009. TW = Transitional Water, FT = Freshwater Tidal, L = Lagoon

Transitional Water body	Water body Code	Year	Easting	Northing	Type	Area (km ²)	Ecological status (fish)
ERBD							
Avoca Estuary	EA_150_0100	2008	324953	173295	TW	0.17	Moderate
Boyne Estuary	EA_010_0100	2009	313778	276399	TW	3.16	Good
Broad Lough	EA_130_0100	2008	330594	195959	TW	0.80	Good
Broadmeadow Water	EA_060_0100	2008	320835	247207	L	3.33	Good
Liffey Estuary, Lower	EA_090_0300	2008	322144	234429	TW	4.80	Good
Liffey Estuary, Upper	EA_090_0400	2008	314071	234314	TW	0.19	Poor
Rogerstown Estuary	EA_050_0100	2008	322928	252252	TW	3.05	Moderate
Tolka Estuary	EA_090_0200	2008	321433	234429	TW	3.58	Moderate
NBIRBD							
Castletown Estuary	NB_040_0200	2009	307493	308320	TW	1.88	Moderate
Dundalk Bay, Inner	NB_040_0100	2009	311060	304506	TW	33.35	Moderate
WRBD							
Ballysadare Estuary	WE_460_0300	2008	163808	330609	TW	8.72	Moderate
Bridge Lough, Knockakilleen	WE_160_0200	2009	133901	213038	L	0.08	Poor
Camus Bay	WE_200_0200	2009	94485	233785	TW	10.75	Good
Corrib Estuary	WE_170_0700	2008	130733	224168	TW	9.70	Good
Erriff Estuary	WE_310_0100	2008	89005	263718	TW	0.41	Good
Garavoge Estuary	WE_470_0100	2008	166769	337869	TW	8.83	Good*
Kinvarra Bay	WE_160_0100	2009	136233	212338	TW	5.72	Good
Loch an Aibhinn	WE_200_0700	2009	94702	231553	L	0.54	Moderate*
Loch an tSáile	WE_200_1100	2008	95117	238938	L	0.90	Moderate*
Loch Tanaf	WE_200_0600	2008	95017	230456	L	0.10	Moderate*
Lough Athola	WE_260_0100	2009	62586	248410	L	0.11	Good
Moy Estuary	WE_420_0300	2008	125934	323839	TW	7.42	Good
Murree, Lough	WE_120_0100	2009	125455	211937	L	0.13	Bad
Newport Bay	WE_350_0200	2008	95723	293895	TW	9.35	Good
Sruwaddacon Bay	WE_400_0200	2008	82999	337409	TW	8.39	Good
Tullaghan Bay	WE_390_0100	2008	77396	317351	TW	17.25	Good
Westport Bay	WE_350_0100	2008	94402	284134	TW	5.32	Good
NWRBD							
Donegal Bay, Inner	NW_050_0100	2009	191394	375542	TW	8.12	Good
Durnesh Lough	NW_040_0100	2009	311060	304506	L	0.70	Moderate
Erne Estuary	NW_030_0100	2009	187760	369317	TW	2.58	Good
Gweebarra Estuary	NW_120_0100	2009	185343	361866	TW	8.26	Good
Inch Lough	NW_220_0300	2009	183113	402412	L	1.62	Good
Swilly Estuary	NW_220_0100	2009	297785	135653	TW	59.36	Good
SHIRBD							
Cashen Estuary	SH_060_0100	2008	89059	136019	TW	2.67	Good
Deel Estuary	SH_060_0600	2008	131801	152431	TW	3.02	Moderate
Feale Estuary, Upper	SH_060_0200	2008	94987	132099	FT	0.38	Good
Fergus Estuary	SH_060_1100	2008	132035	165677	TW	64.75	Moderate
Lee (Tralee) Estuary	SH_050_0100	2008	80583	113393	TW	3.06	Bad*
Limerick Docks	SH_060_0900	2008	157383	157267	FT	2.49	Good
Maigue Estuary	SH_060_0700	2008	148098	152519	TW	3.21	Moderate
Shannon Estuary, Lower	SH_060_0300	2008	116583	152260	TW	123.08	Good
Shannon Estuary, Upper	SH_060_0800	2008	143538	159394	TW	39.51	Good

*Indicates a low confidence of classification due to sampling problems. These sites will be repeated and re-classified

Table 2.3 contd. Details of transitional waters surveyed for WFD fish monitoring, 2007 – 2009.
TW = Transitional Water, FT = Freshwater Tidal, L = Lagoon

Transitional Water body	MS Code	Year	Easting	Northing	Type	Area (km ²)	Ecological status (fish)
SERBD							
Barrow Estuary, Upper	SE_100_0300	2007	273066	137640	TW	1.15	Moderate
Barrow Nore Estuary Upper	SE_100_0250	2007	272129	128644	TW	0.64	Poor
Barrow Suir Nore Estuary	SE_100_0100	2007	271527	107512	TW	28.21	Good
Bridgetown Estuary	SE_080_0100	2009	291841	107934	TW	2.03	Good
Colligan Estuary	SE_140_0100	2008	226938	92488	TW	10.03	Good
Lady's Island Lake	SE_060_0100	2009	309650	106515	L	2.96	Moderate
New Ross Port	SE_100_0200	2007	267862	117105	TW	6.71	Moderate
Nore Estuary	SE_100_0400	2007	265312	135294	TW	1.26	Good
North Slob Channels	SE_040_0100	2009	307472	124835	L	0.37	Moderate
Slaney Estuary, Lower	SE_040_0200	2009	303790	124978	TW	18.35	Good
Slaney Estuary, Upper	SE_040_0300	2009	297785	135653	FT	0.80	Good
Suir, Lower	SE_100_0500	2007	266073	112602	TW	3.52	Moderate
Suir, Middle	SE_100_0550	2007	249824	114070	TW	7.03	Good
Suir, Upper	SE_100_0600	2007	243887	121066	TW	1.09	Moderate
Tacumshin Lake	SE_070_0100	2009	305135	106528	L	3.11	Moderate
SWRBD							
Argideen Estuary	SW_090_0200	2008	151698	44138	TW	4.92	Moderate
Bandon Estuary, Lower	SW_080_0100	2009	158029	51623	TW	6.79	High
Bandon Estuary, Upper	SW_080_0300	2009	155716	55871	FT	0.35	Moderate
Blackwater Estuary, Lower	SW_020_0100	2008	210190	86691	TW	12.07	Good
Blackwater Estuary, Upper	SW_020_0500	2008	210068	98339	FT	0.70	Good
Glashaboy Estuary	SW_060_0800	2008	172449	73470	TW	0.12	Poor*
Ilen Estuary	SW_130_0100	2008	105212	29954	TW	9.66	Good
Kilkeran Lake	SW_110_0100	2008	133844	34429	L	0.18	Poor
Kilmakilloge Harbour	SW_190_0200	2008	73974	58927	TW	5.85	Good
Lee (Cork) Estuary, Lower	SW_060_0900	2008	172082	72051	TW	0.88	Poor*
Lee (Cork) Estuary, Upper	SW_060_0950	2008	165903	71693	TW	0.25	Poor*
Mahon, Lough	SW_060_0750	2008	177107	69092	TW	12.23	Moderate*
Mahon, Lough (Harper's Island)	SW_060_0700	2008	180271	72382	TW	2.06	Poor*
North Channel Great Island	SW_060_0300	2008	183669	69611	TW	7.96	Good*
Owenacurra Estuary	SW_060_0400	2008	188010	71718	TW	1.12	Poor*

*Indicates a low confidence of classification due to sampling problems. These sites will be repeated and re-classified

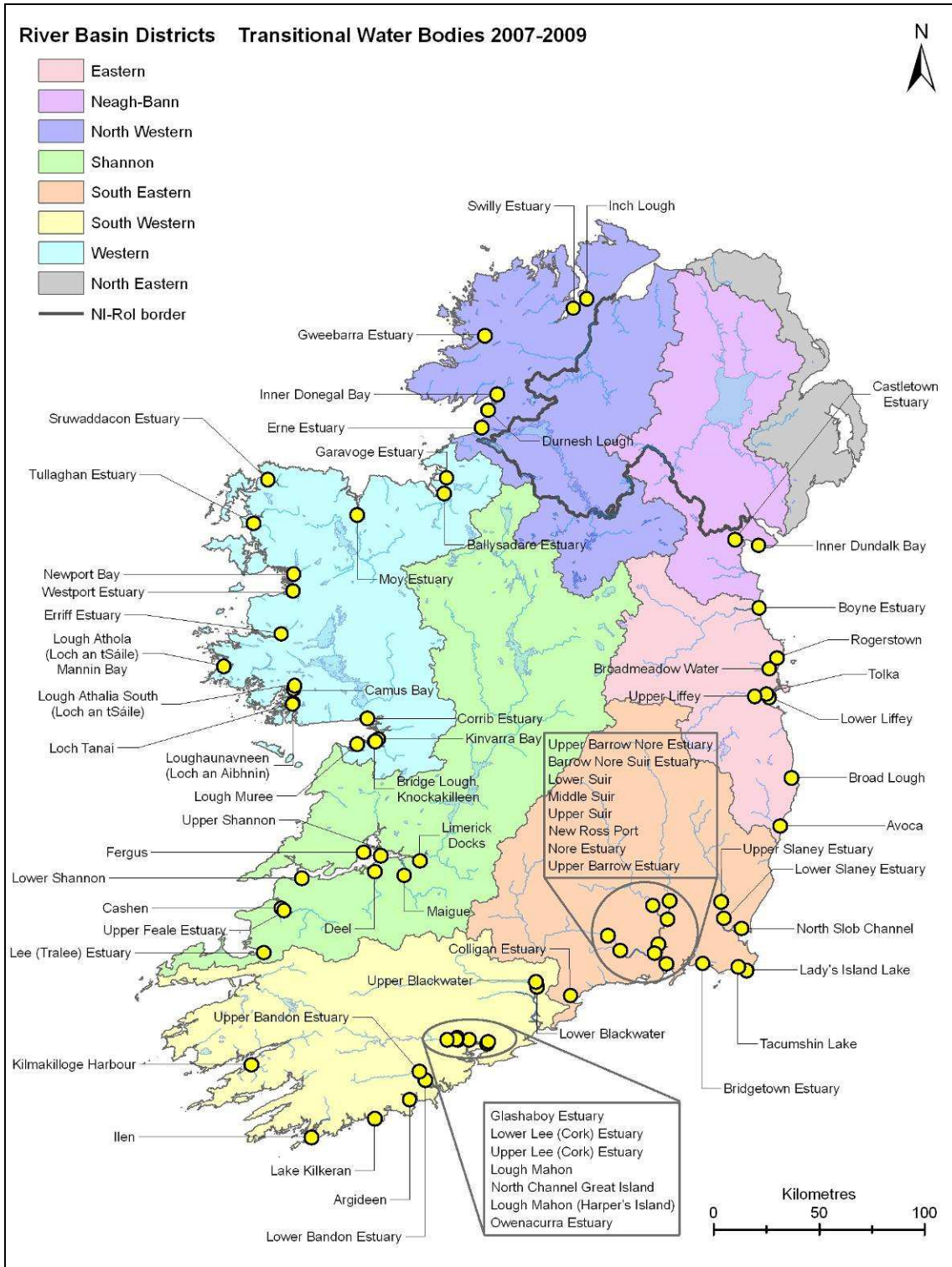


Fig. 2.4. Location of WFD fish monitoring transitional water bodies, 2007 - 2009

3. SURVEY METHODOLOGY

Sampling fish for the WFD requires the use of a broad range of survey techniques, developed in accordance with European standards (CEN, 2005a) to provide comprehensive information on the composition, abundance and age structure of all fish species present within each water body. Detailed information on the survey procedures and sample processing techniques for lakes, rivers and transitional waters can be found in the WFD summary reports for 2008 and 2009 (Kelly *et al.*, 2009; Kelly *et al.*, 2010).

Lakes are surveyed using a ‘multi-method’ approach, involving the use of monofilament multi-mesh survey gill nets (Fig. 3.1), large mesh braided, single panel survey gill nets and fyke nets. The netting procedure is carried out in accordance with the European standard for sampling of fish with multi-mesh gill nets (CEN, 2005b), which adopts a ‘stratified random sampling’ survey design, structured to effectively survey a representative sample of all habitat types and depth zones within the lake.



Fig. 3.1. Setting a benthic monofilament multi-mesh gillnet on Lough Allen

Rivers are surveyed using electric-fishing, in accordance with the European standard for sampling of fish with electricity (CEN, 2003). Small, wadeable streams are surveyed using ‘hand-set’ electric-fishing equipment with either backpacks or bank side generators using standard protocols developed by IFI (CFB, 2008a), whilst larger rivers are surveyed using ‘boat-based’ electric-fishing equipment (Fig. 3.2). Very large rivers (>2m deep, >30m wide) are surveyed using boat-based high-voltage electric-fishing equipment.



Fig. 3.2. Boat-based electric-fishing

Transitional waters (estuaries and lagoons) are surveyed using a ‘multi-method’ approach, developed by IFI for the purposes of the Water Framework Directive in accordance with methods used in the UK and other European countries (CFB, 2008b). This involves the use of fyke nets, beach seine nets (Fig. 3.3) and beam trawling using a small custom built beam trawl that can be deployed from a small boat.



Fig. 3.3. Setting a beach seine net

4. KEY FINDINGS

A large amount of new data has been collected during the first three year WFD fish monitoring cycle, with 79 species (plus hybrids and four brown trout ‘varieties’) and over 150,000 fish being recorded. This huge volume of data has been processed and entered into a new GIS database, with interactive species distribution maps available on the WFD fish website (www.wfdfish.ie).

4.1 Native versus non-native fish species richness

Figures 4.1 and 4.2 show fish species richness for lakes and river sites respectively. In general, sites in the ShIRBD and southern end of the NWIRBD and NBIRBD exhibited much higher fish species richness due to the presence of many non-native species such as roach, perch and pike. The north-western end of the NWIRBD is one of the few remaining locations with only native fish species present.

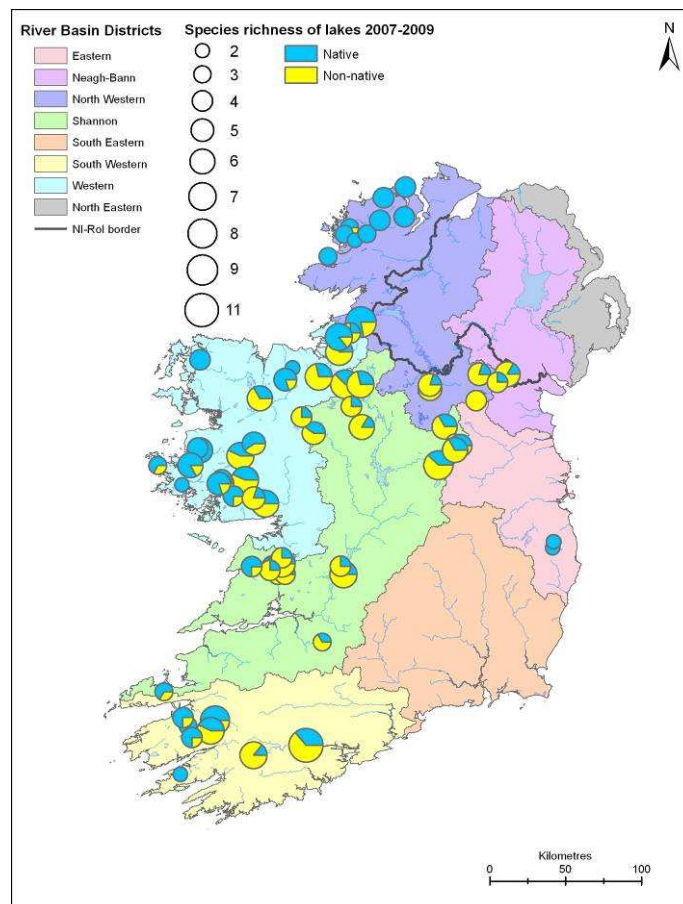


Fig. 4.1 Native versus non-native fish species richness in lakes surveyed for the WFD, 2007 – 2009

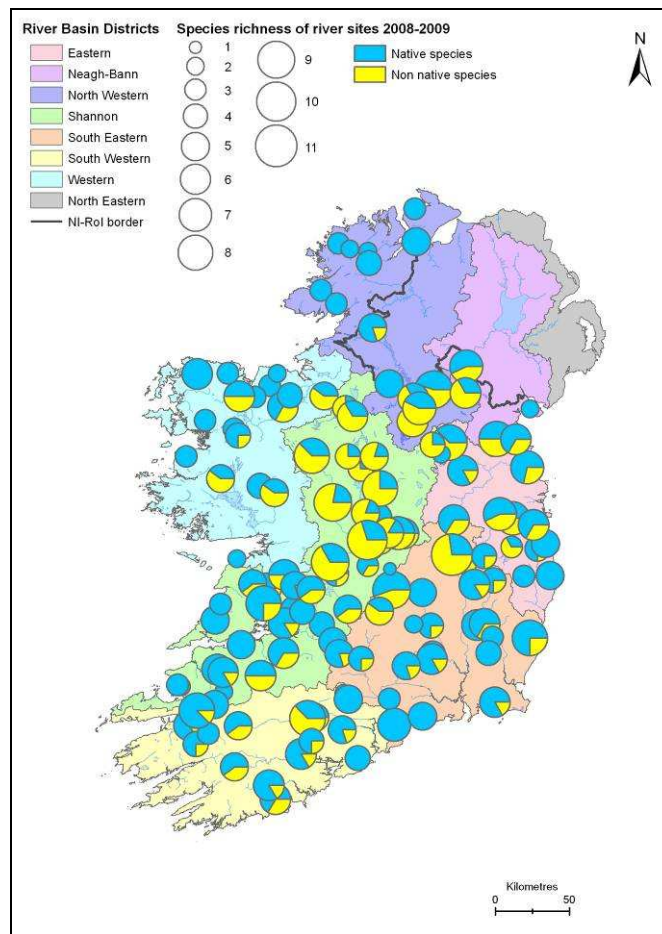


Fig. 4.2 Native versus non-native fish species richness in rivers surveyed for the WFD, 2008 - 2009

4.2 Species distribution and abundance

Species distribution and abundance (Catch Per Unit Effort – CPUE) maps for each year and for all waterbodies have been collated for the dominant fish species and are available in the 2008 and 2009 summary reports (Kelly *et al.*, 2009; Kelly *et al.*, 2010). The distribution and abundance of selected key species recorded from 2007 - 2009 in lakes, rivers and transitional waters are shown in Figures 4.3 to 4.14.

Among the lakes surveyed from 2007 - 2009, brown trout and Arctic char were distributed mainly in the north and west of the country, while many of the non-native fish were recorded in the midlands (Figs. 4.3 and 4.4). The highest density of brown trout was recorded in Lough Barra, with 0.47 fish per metre of net being captured. The highest density of Arctic char was recorded in Lough Shindilla (0.11 fish per metre of net). The two most abundant non-native fish species recorded in lakes surveyed from 2007 – 2009 were roach and perch. These species were mainly distributed throughout

the ShIRBD and the southern ends of the NWIRBD and NBIRBD; however, high numbers of both roach and perch were also recorded in the eastern half of the WRBD (Figs. 4.5 and 4.6). The highest density of roach was recorded in Lough Cullin, with 0.60 fish per metre of net being captured. The highest density of perch was recorded in Lough Alewnaghta (1.06 fish per metre of net).

Both brown trout and salmon in rivers surveyed from 2007 – 2009 were well distributed throughout the country; however, there was a notable absence of salmon in the upper Shannon catchment (Figs. 4.7 to 4.10). The highest density of 0+ brown trout was recorded in the Glendine River, with 0.40 fish per m² being captured. The highest density of 0+ salmon was recorded in the Tobercurry Stream (0.57 fish per m²). The highest density of 1+ and older brown trout and salmon were recorded in two rivers in Co. Donegal (Burnfoot river - 0.44 fish per m² and Owentocker river - 0.43 fish per m² respectively). Similar to the distribution in lakes, roach were mainly recorded in the ShIRBD and the southern ends of the NWIRBD and NBIRBD. The highest density of roach was recorded in the River Blackwater (Kells), with 0.21 fish per m² being recorded. Dace, an invasive fish species in Ireland, was recorded in four river sites; the River Barrow (Pass Bridge), Awbeg River, Munster Blackwater at Killavullen Bridge, and Tully Stream, with the highest density being recorded in the Tully Stream (0.006 fish per m²).

A total of 71 fish species were recorded among the transitional waters surveyed from 2007 – 2009. Many of these species, such as European eel and pollack (Figs. 4.13 and 4.14) were widely distributed around the country, however many other species had much more restricted distributions. Sea bass were not recorded in the NWIRBD or WRBD. They were recorded in several water bodies within the Shannon and the Barrow/Suir/Nore Estuaries, as well as the Lower Munster Blackwater Estuary and four small estuaries on the east coast (Broad Lough, Tolka Estuary, Broadmeadow Water and Rogerstown Estuary) (Fig. 4.15). Smelt, a species considered an indicator of good water quality and listed in the Irish Red Data Book as threatened in Ireland (Whilde, 1993), were recorded in five water bodies within the Barrow/Suir/Nore Estuary, three water bodies within the Shannon Estuary, and the Lower Munster Blackwater Estuary (Fig. 4.16).

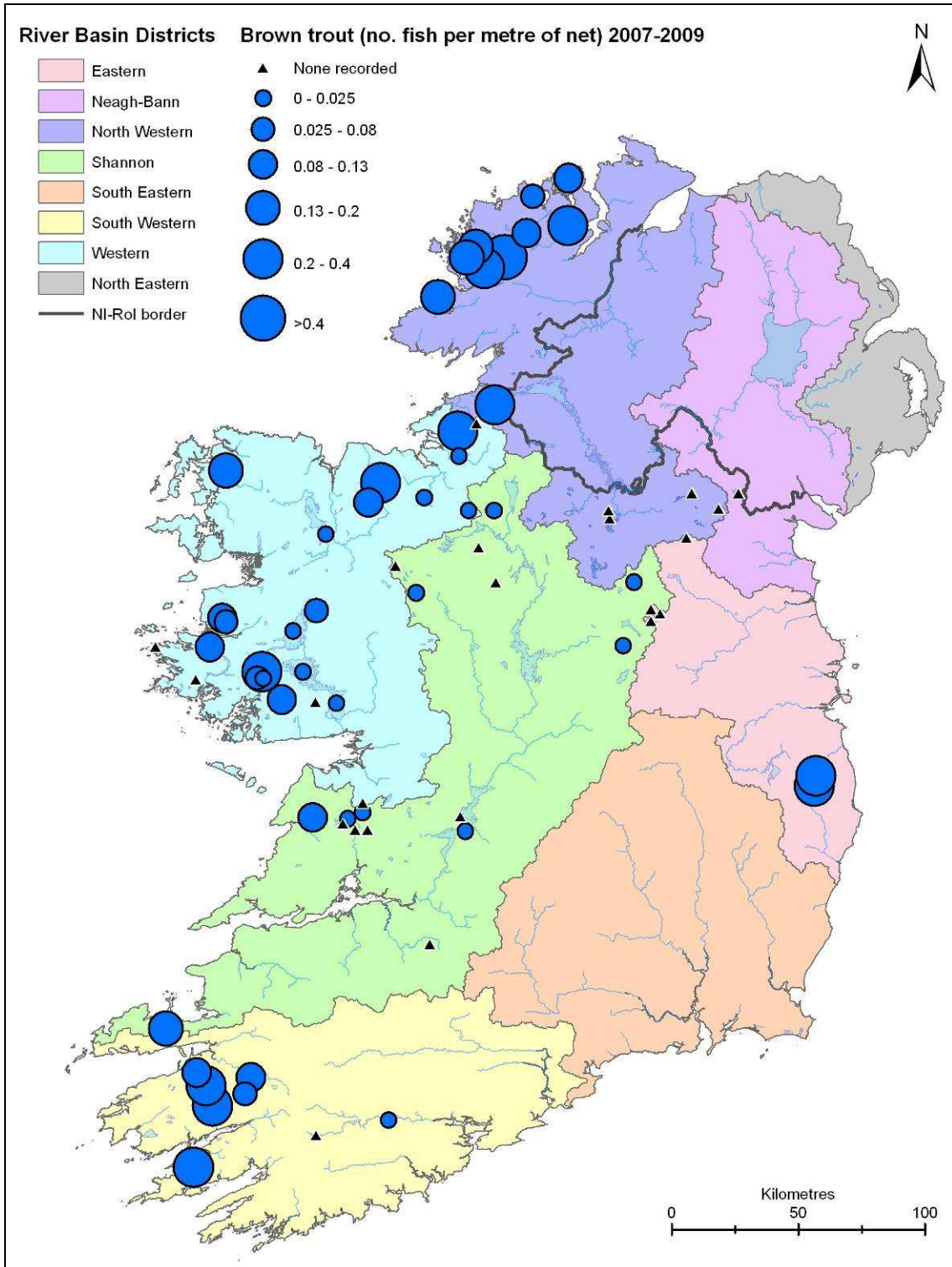


Fig. 4.3. Distribution and abundance of brown trout in lakes surveyed for WFD fish monitoring 2007 – 2009

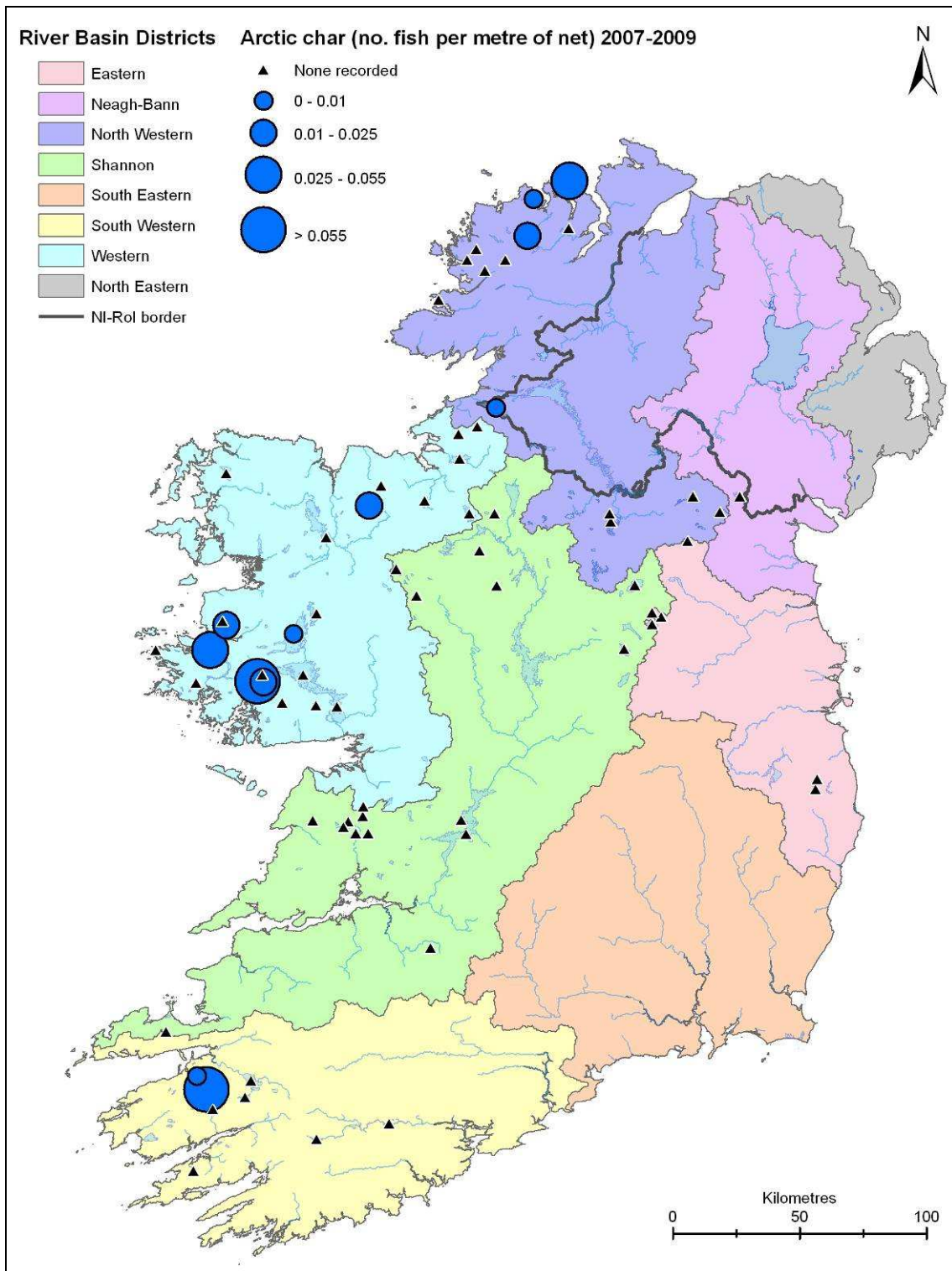


Fig. 4.4. Distribution and abundance of Arctic char in lakes surveyed for WFD fish monitoring 2007 – 2009

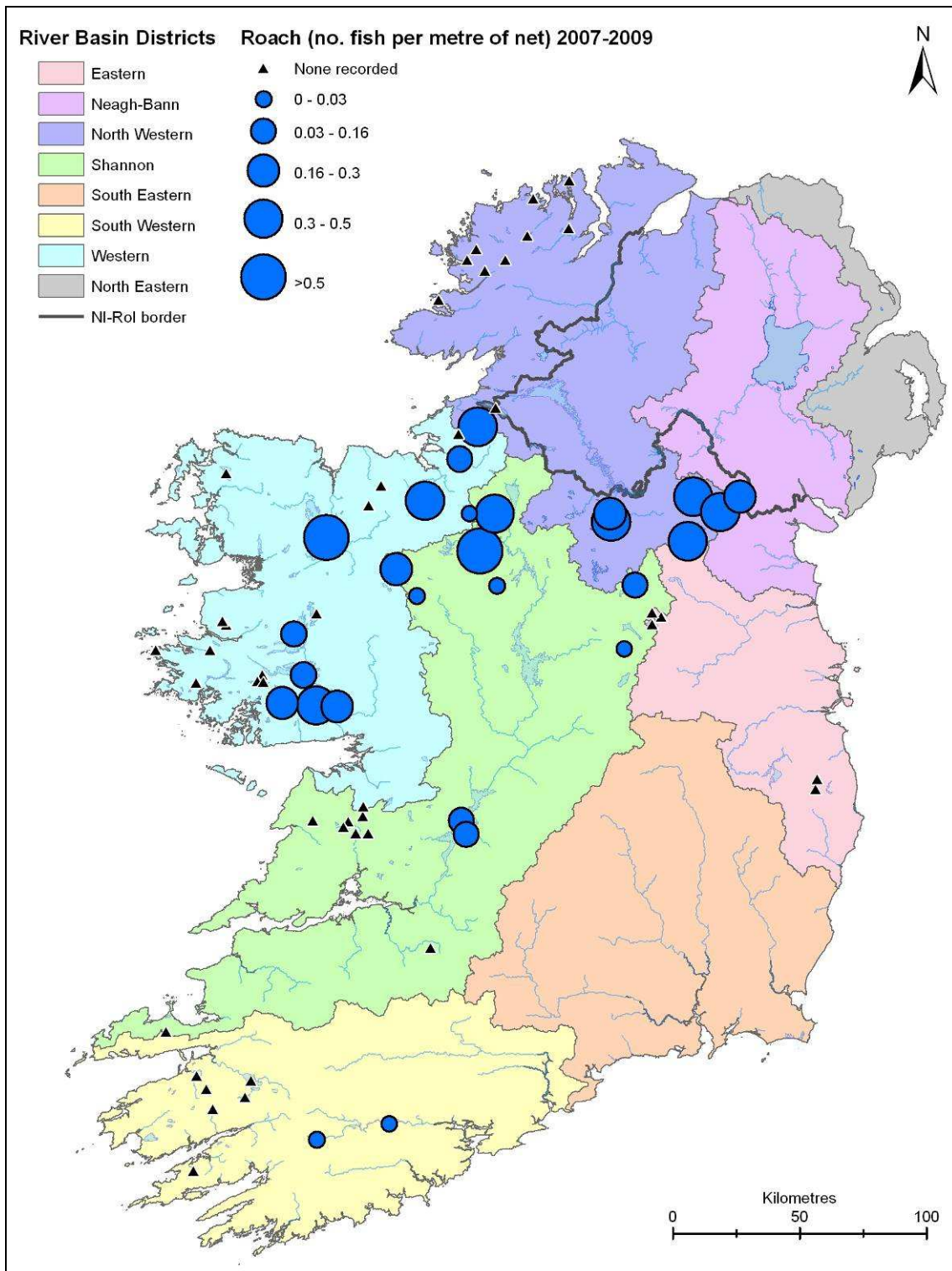


Fig. 4.5. Distribution and abundance of roach in lakes surveyed for WFD fish monitoring 2007 - 2009

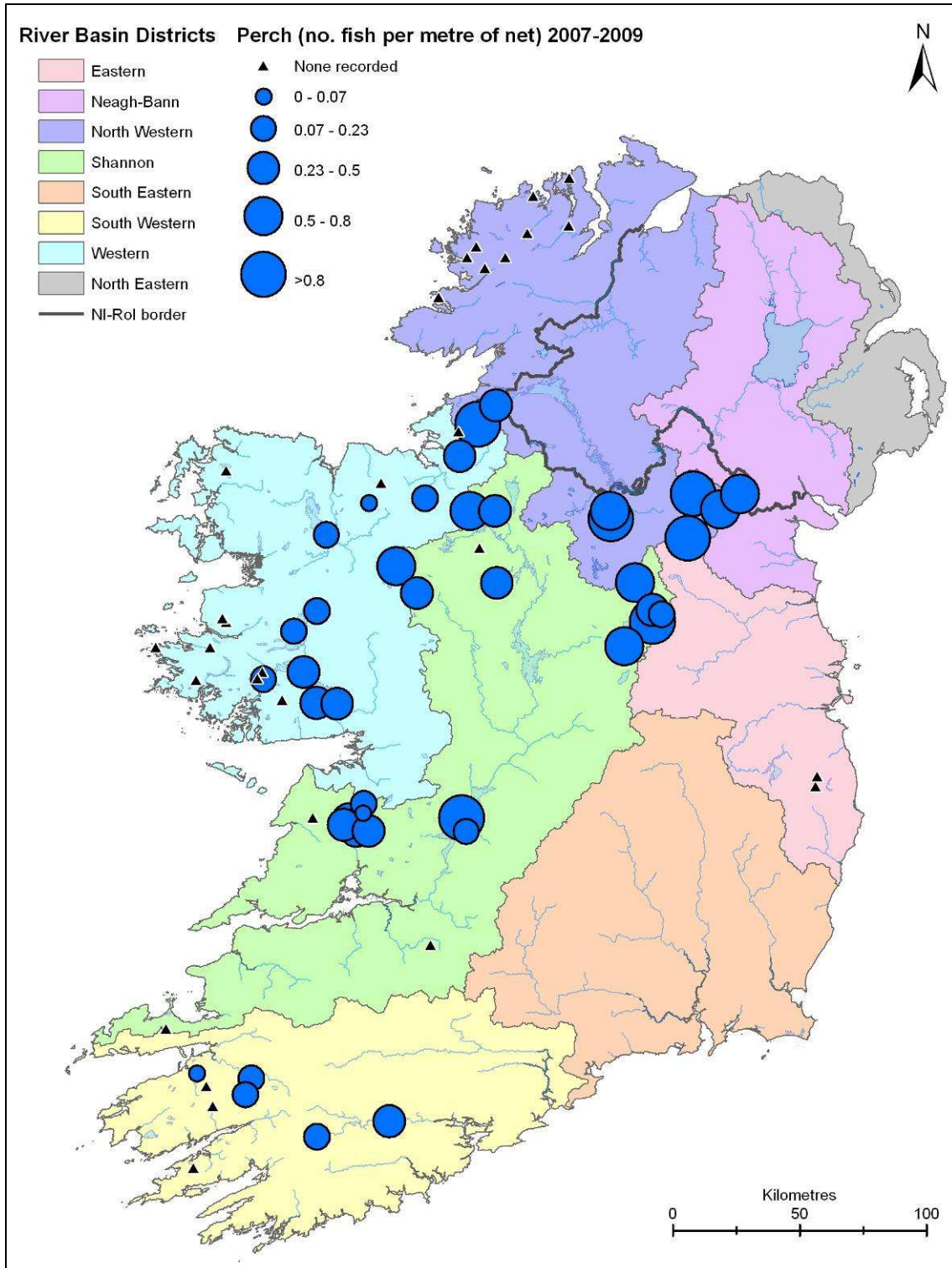


Fig. 4.6. Distribution and abundance of perch in lakes surveyed for WFD fish monitoring 2007 – 2009

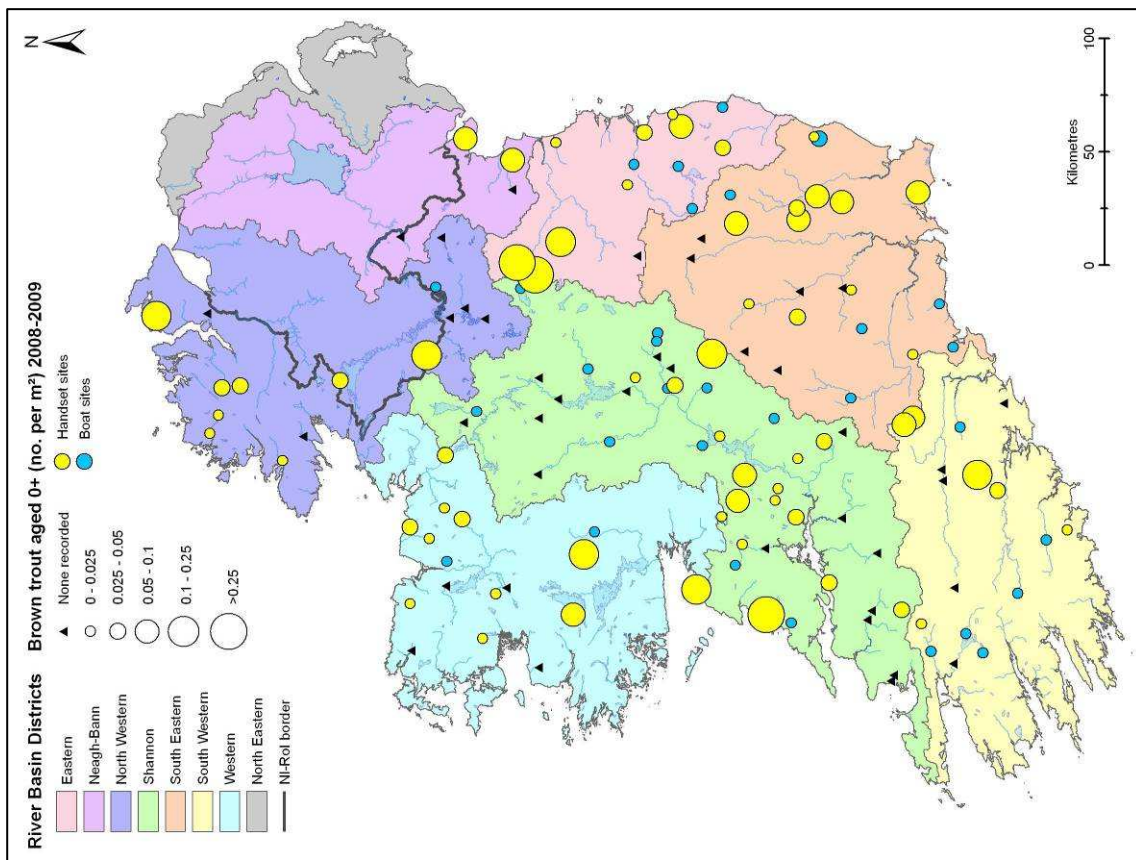


Fig. 4.7. Distribution and abundance of 0+ brown trout in rivers surveyed for WFD fish monitoring 2008 – 2009

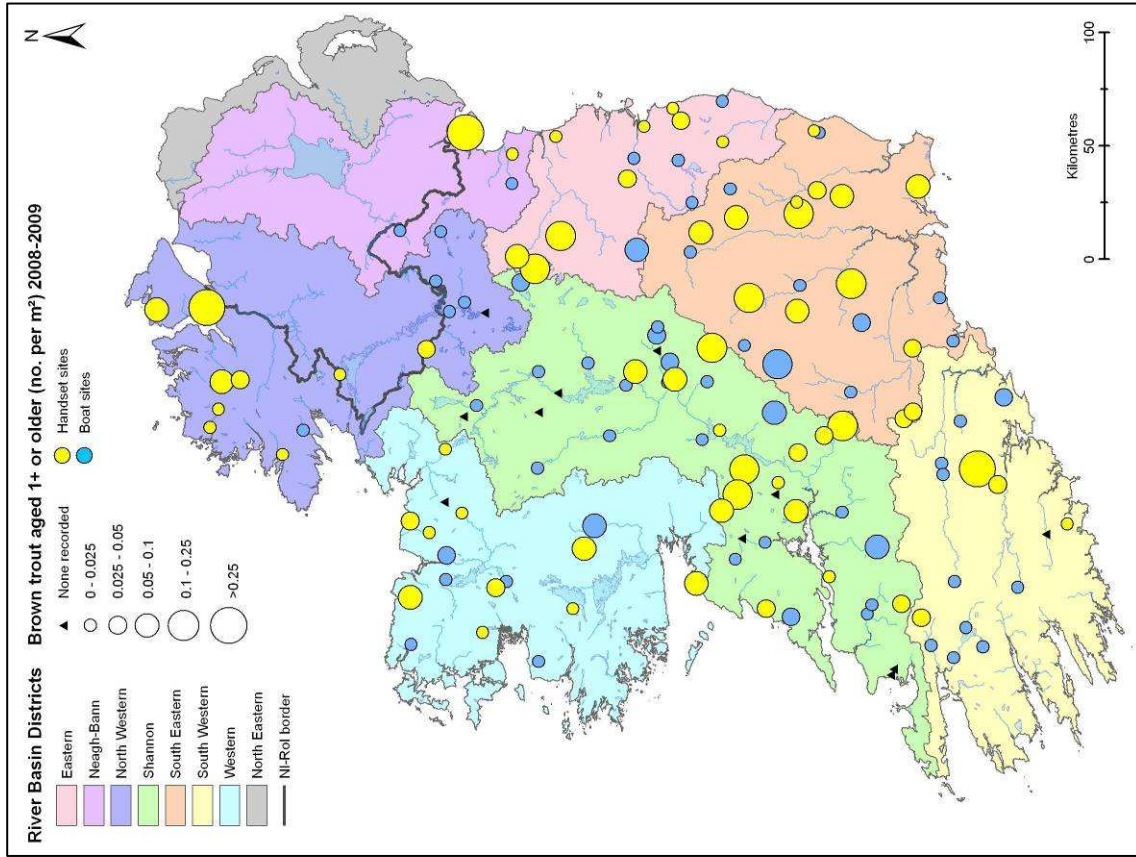


Fig. 4.8. Distribution and abundance of 1+ older brown trout in rivers surveyed for WFD fish monitoring 2008 – 2009

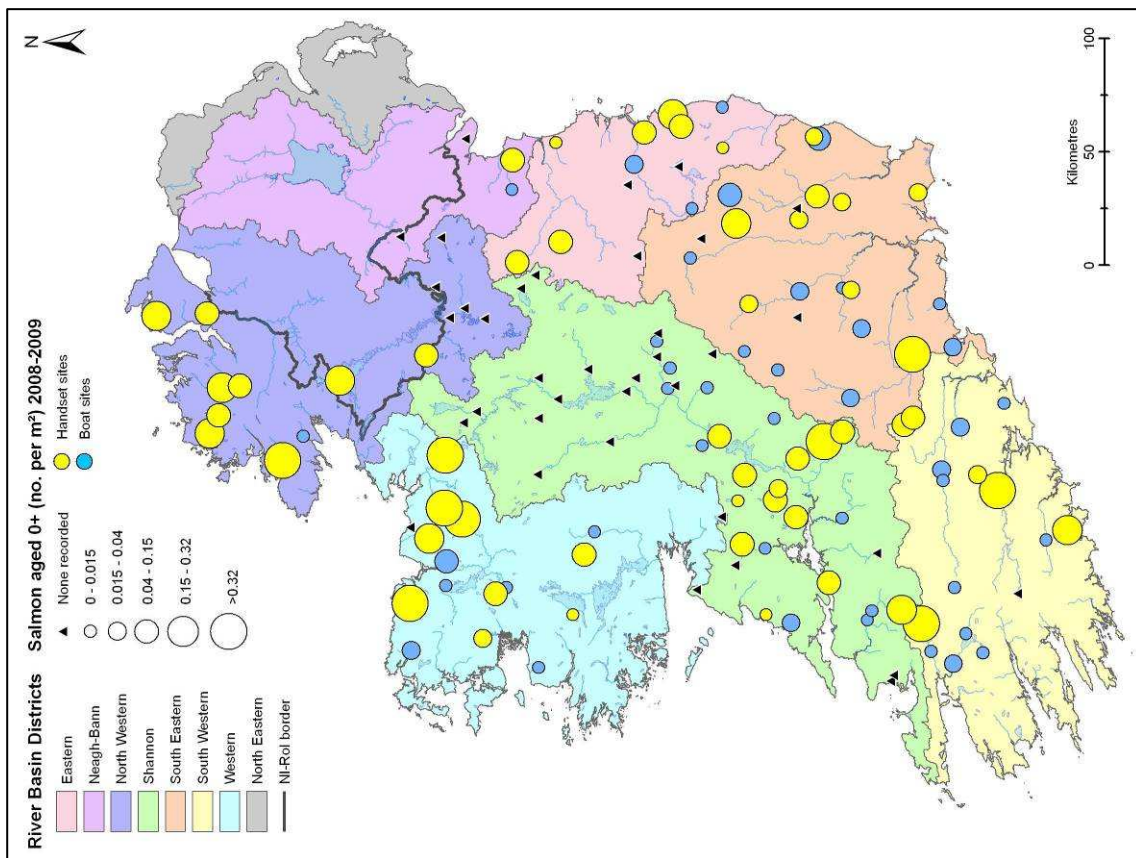


Fig. 4.9. Distribution and abundance of 0+ salmon in rivers surveyed for WFD fish monitoring 2008 – 2009

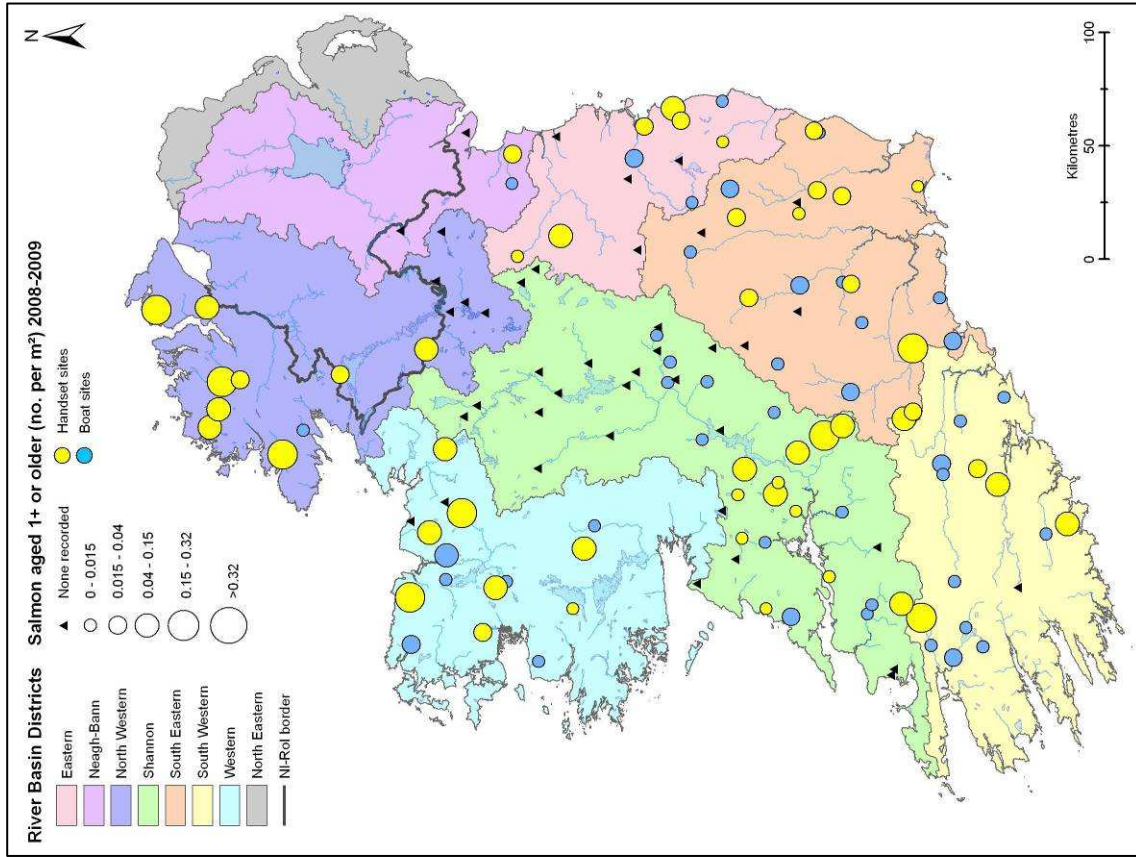


Fig. 4.10. Distribution and abundance of 1+ older salmon in rivers surveyed for WFD fish monitoring 2008 – 2009

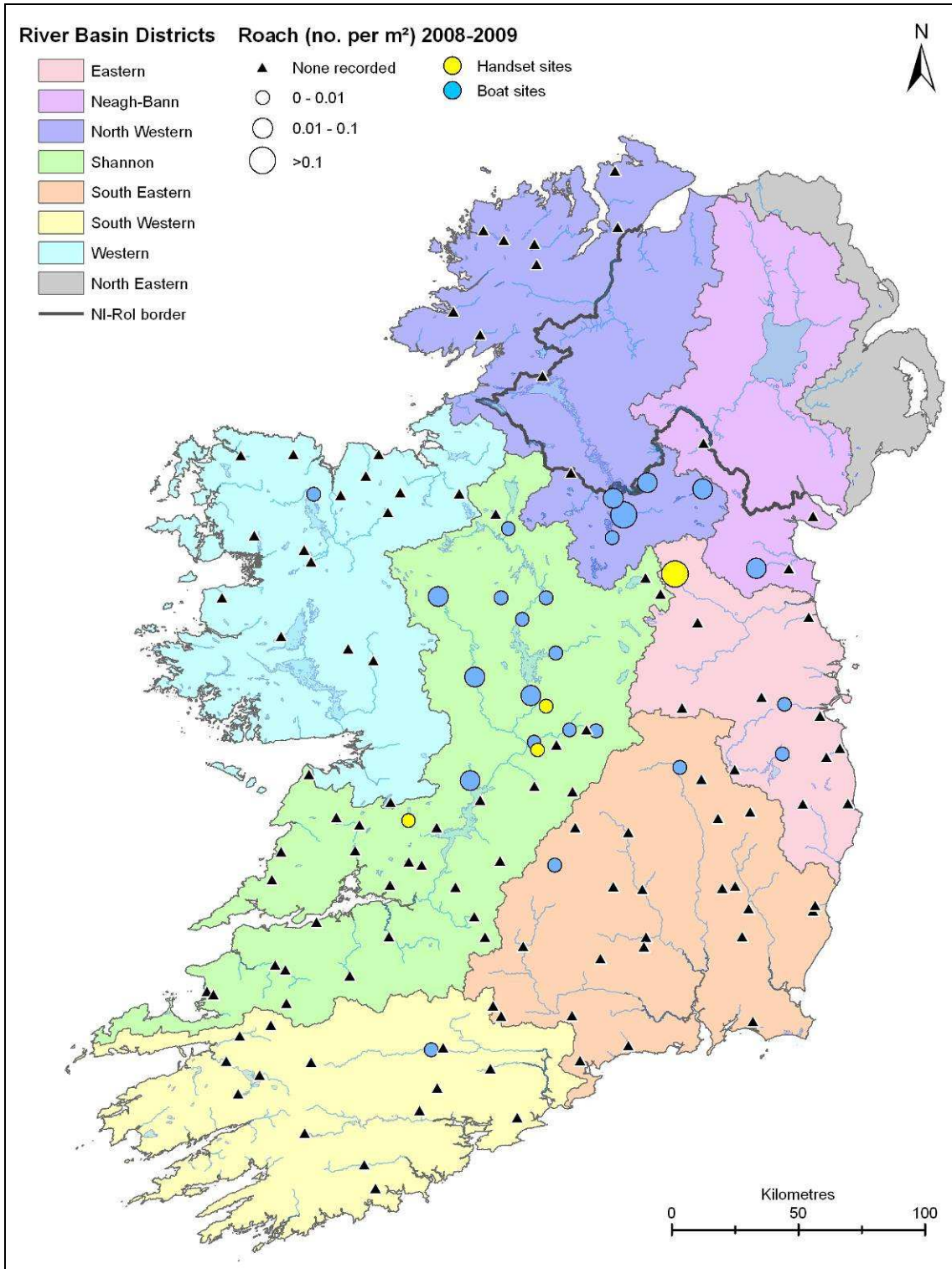


Fig. 4.11. Distribution and abundance of roach in rivers surveyed for WFD fish monitoring 2008 – 2009

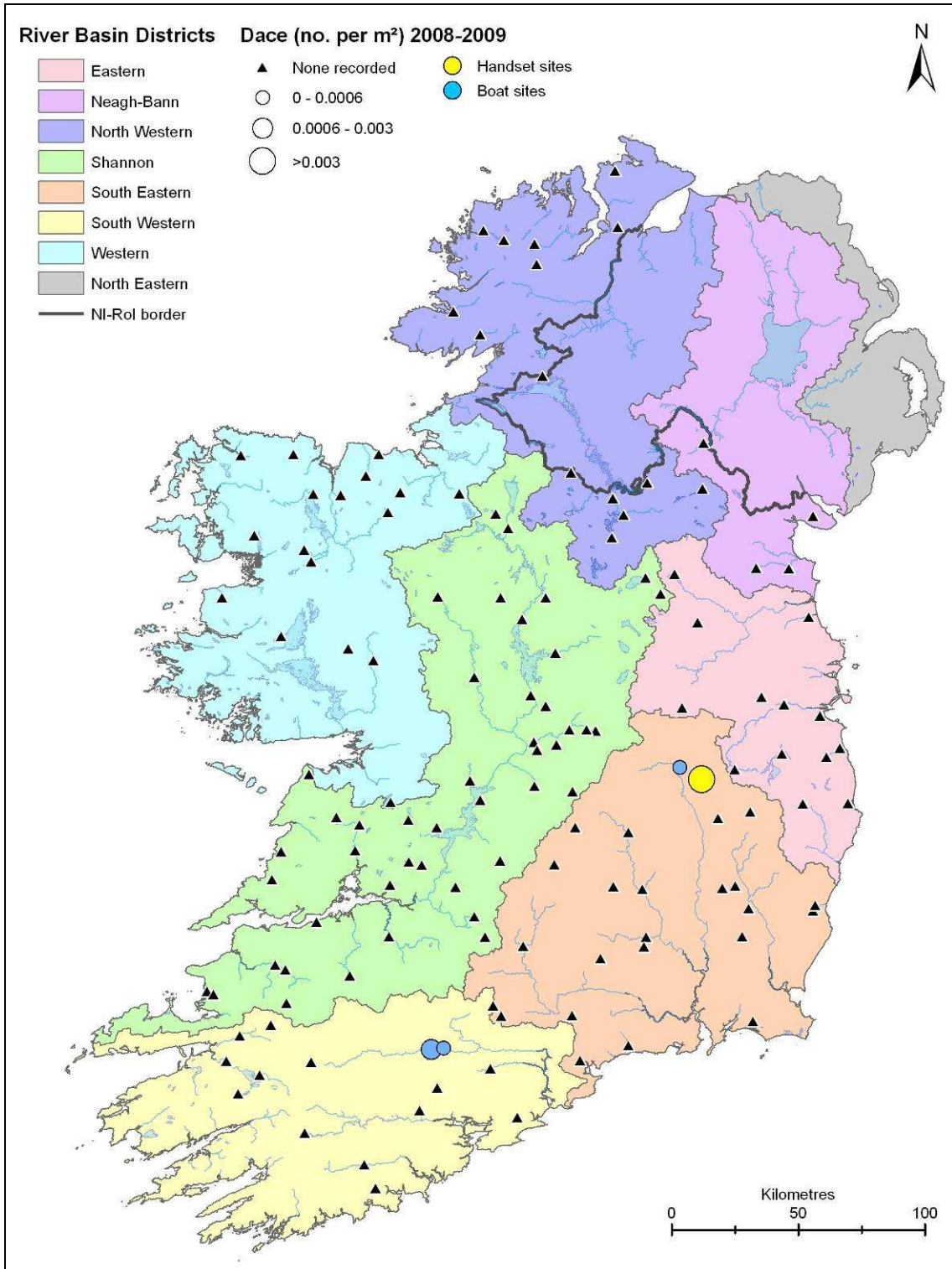


Fig. 4.12. Distribution and abundance of dace in rivers surveyed for WFD fish monitoring 2008 – 2009

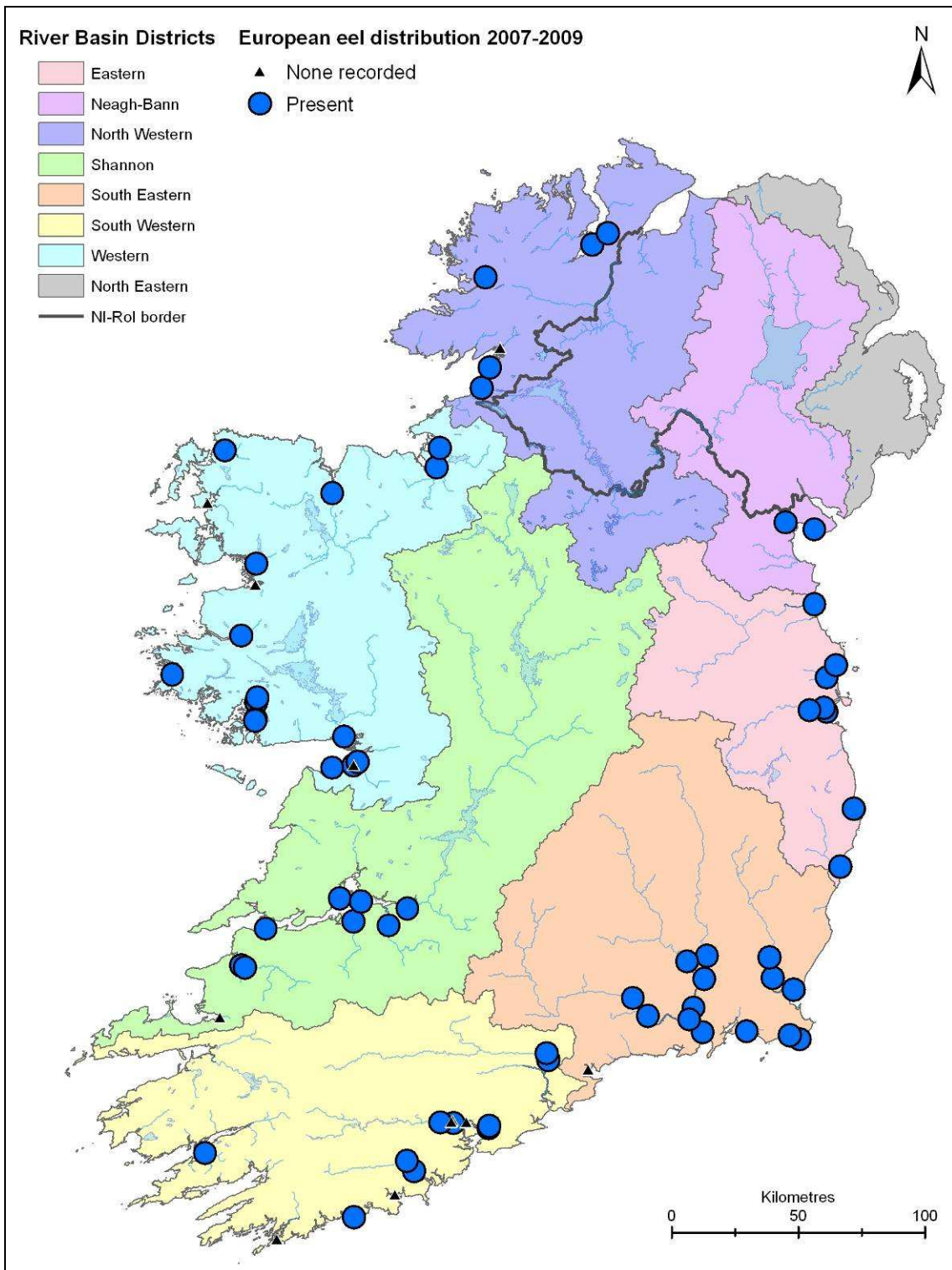


Fig. 4.13. Distribution of European eel in transitional waters surveyed for WFD fish monitoring 2007 – 2009

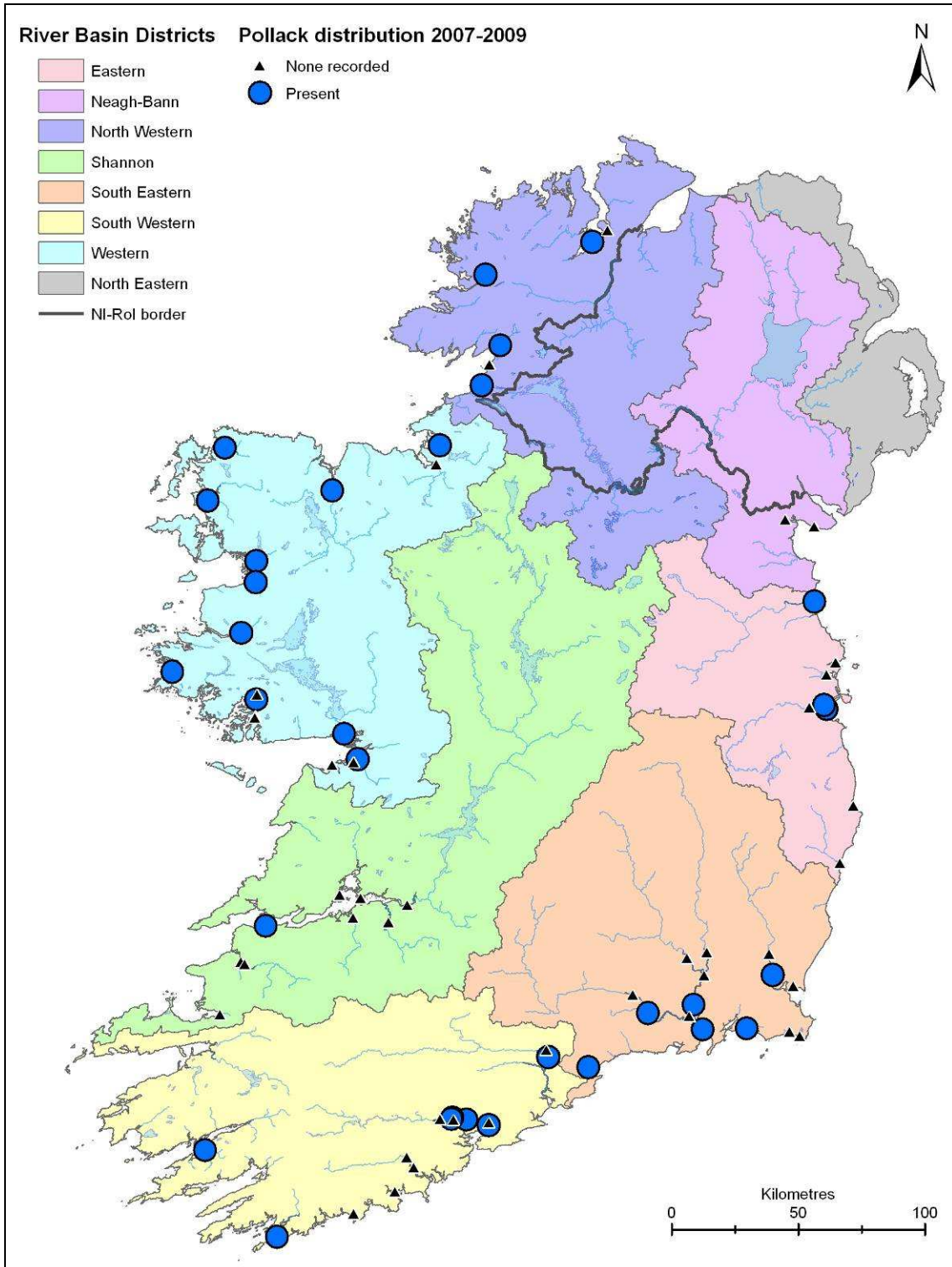


Fig. 4.14. Distribution of pollack in transitional waters surveyed for WFD fish monitoring 2007 – 2009

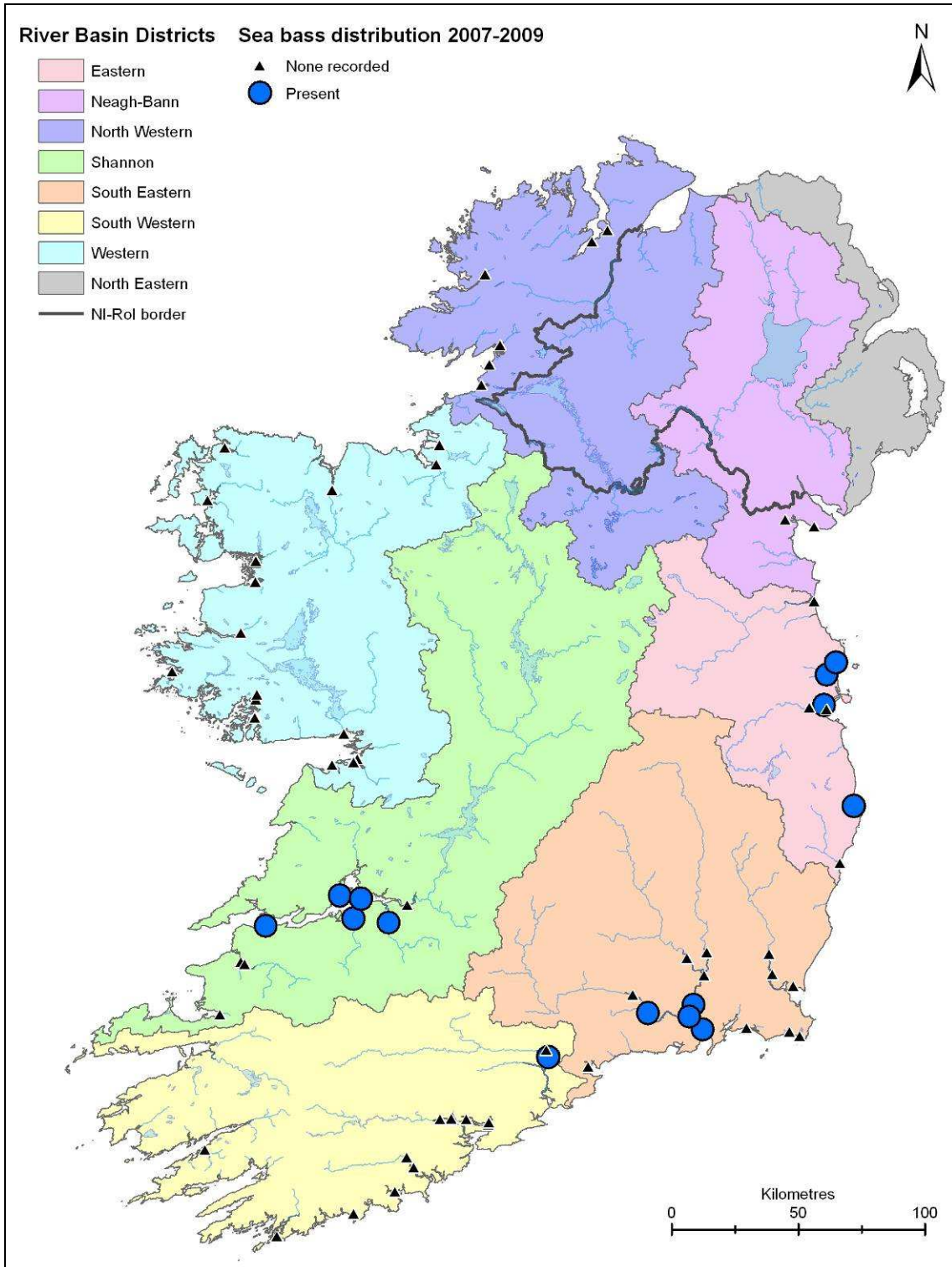


Fig. 4.15. Distribution of European sea bass in transitional waters surveyed for WFD fish monitoring 2007 – 2009

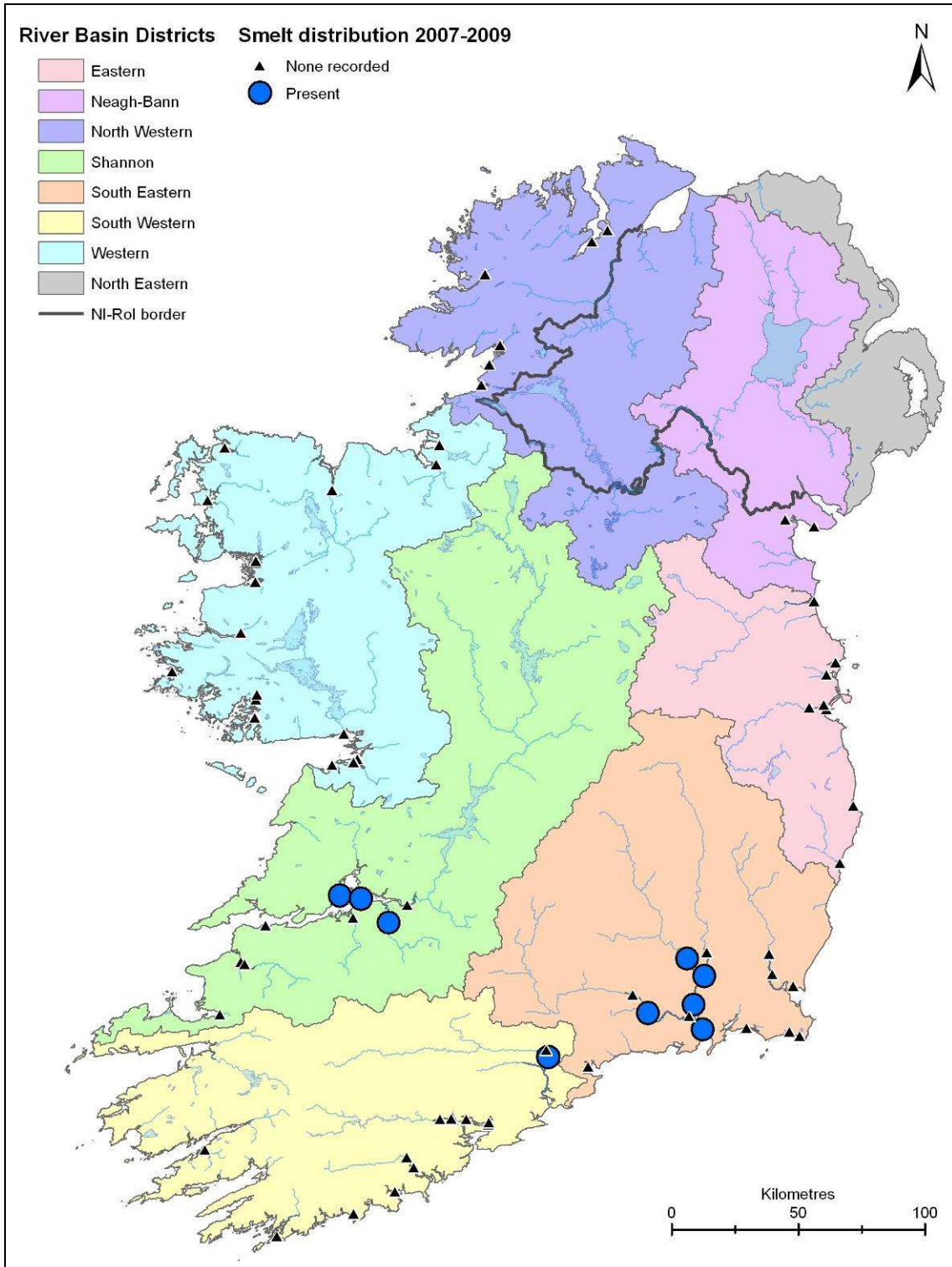


Fig. 4.16. Distribution of smelt in transitional waters surveyed for WFD fish monitoring 2007 – 2009

5. ECOLOGICAL CLASSIFICATION TOOL DEVELOPMENT

An essential step in the WFD process is the classification of water bodies into ecological status classes (High, Good, Moderate, Poor or Bad), based on the various biological and physico-chemical elements monitored. These status classes are used to identify the objectives that must be set in River Basin Management Plans, and in turn help to track the effectiveness of programmes of measures designed to restore those water bodies that fail to meet the current minimum WFD requirement of Good ecological status.

Ecological classification tools for the various biological quality elements (phytoplankton, macrophytes, phytobenthos, benthic invertebrates and fish) are being developed by various organisations. Inland Fisheries Ireland is responsible for the development of classification tools for fish in Irish lakes, rivers and transitional waters. Progress in the development of these three separate tools, along with the resultant ecological status classifications are highlighted below.

5.1 Lakes

A preliminary ecological classification tool for fish in lakes was developed for the island of Ireland (Ecoregion 17) using Central Fisheries Board (now IFI) and Agri-Food and Biosciences Institute Northern Ireland (AFBINI) data generated during the NSSHARE Fish in Lakes (FIL) project. This classification tool (FIL) is used to objectively assign lakes to ecological status classes based on fish species composition, abundance and age structure (Kelly *et al.*, 2008a). Expert opinion is also used on some occasions where known pressures, such as non-native species introductions, serve to downgrade the status of a lake. For example, a high status lake cannot contain any non-native fish species.

Data collected from the 70 lakes surveyed during the 2007 – 2009 surveillance monitoring period are being used to further refine the Fish in Lakes Classification tool (FIL2) in order to make it fully WFD compliant and compatible for use in the EU Intercalibration process, which is expected to be completed during 2011.

Four lake ‘types’, based on alkalinity and maximum depth, have been identified for use in the FIL2 classification tool (Low Alkalinity/Shallow, Low Alkalinity/Deep, High Alkalinity/Shallow and High Alkalinity/Deep). Each lake is assigned an ecological status or ‘impact class’ based on an anthropogenic pressure gradient using total phosphorous and chlorophyll as stressors. The FIL2 classification tool then uses discriminant analysis to develop classification rules for each lake typology based on selected key fish metrics, including the total BPUE (Biomass Per Unit Effort) of all fish species, BPUE of native fish species and the percentage biomass of perch. A separate statistical model is then used to generate Ecological Quality Ratios (EQRs) between 0 and 1 for each lake.

The FIL2 classification tool is due to be completed in December 2010; however, the original FIL classification tool has been used, along with expert opinion, to assign all lakes surveyed to date into

draft ecological status classes based on the fish populations present in each (Fig. 5.1). Final ecological classifications will be reported in March 2011 once the FIL2 classification tool has been completed.

A total of 136 lakes (RoI and NI), including the 70 lakes surveyed during the 2007 – 2009 surveillance monitoring period, have been used in classification tool development and assigned draft ecological status classes. The spatial distribution of ecological status classes in the 105 lakes situated within RoI is shown in Figure 5.1. The distribution of high and good status sites in the north-west and west of the country, situated in remote areas with low levels of anthropogenic pressures, reflects the absence of non-native fish species and the presence of sensitive species such as Arctic char in these water bodies. Details of the ecological status classes assigned to each of the 70 lakes surveyed during the 2007 – 2009 surveillance monitoring period in particular are given in Table 2.1.

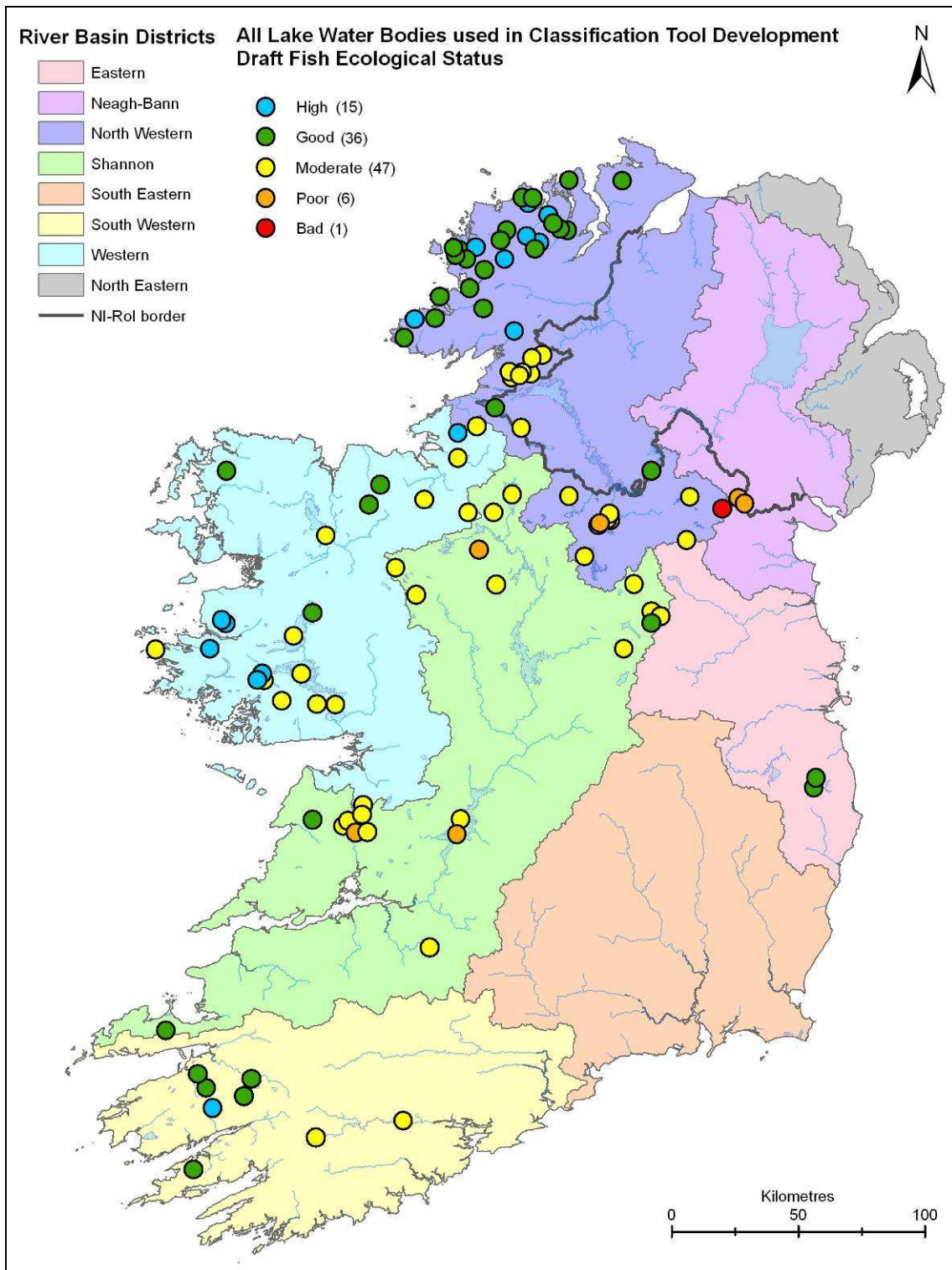


Fig. 5.1. Draft fish ecological status in the 105 lakes used to develop the FIL ecological classification tool

5.2 Rivers

A new ecological classification tool for fish in rivers (Fish Classification System - FCS2) has recently been completed for the island of Ireland, along with a separate version for Scotland, under the management of the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER). The tool was originally developed by the Environment Agency of England and Wales and has been adapted and extended for application to Irish and Scottish fish data. The tool was developed using Irish data (675 sampling occasions) collected during the 2007 – 2009 surveillance monitoring period (Republic of Ireland and Northern Ireland), along with CFB archival data (various projects, 1998 to 2001) and data generated during the EPA ERTDI 2000-MS-4-M1 Q-values and fish project from 2001 to 2003.

FCS2 works by comparing fish species metrics (abundance and prevalence) within a given site (observed) to those predicted (expected) for that site under reference (or unimpaired) conditions using a geo-statistical model based on Bayesian statistics. The tool predicts the expected catch of a species at reference conditions by using a range of environmental variables (e.g. altitude, river width) and pressure variables (e.g. molybdate reactive phosphate). FCS2 also takes into account the geographical location of a site because different fish species can predominate in different parts of the country. FCS2 generates an Ecological Quality Ratio (EQR) (more correctly, probability) estimate of abundance and prevalence for each of 16 fish species models. Species probabilities are then combined to produce an EQR for each site. Site EQRs are then combined to produce an EQR for each water body which is used to classify the water body. Class boundaries are defined along a range between 1 and 0 for High, Good, Moderate, Poor and Bad ecological status.

This recently completed classification tool for fish in rivers has been used to assign all river sites surveyed to date into draft ecological status classes based on the fish populations present in each. Final ecological classifications will be given once the classification tool has completed the EU Intercalibration process.

A total of 550 river sites (565 sampling occasions) from the Republic of Ireland, including the 134 river sites surveyed during the 2007 – 2009 surveillance monitoring period, have been assigned draft ecological status classes using this new river fish classification tool (FCS2). The spatial distribution of ecological status classes in these 550 river sites is shown in Figure 5.2. Details of the ecological status classes assigned to each of the 134 river sites surveyed during the 2007 – 2009 surveillance monitoring period in particular are also given in Table 2.2.

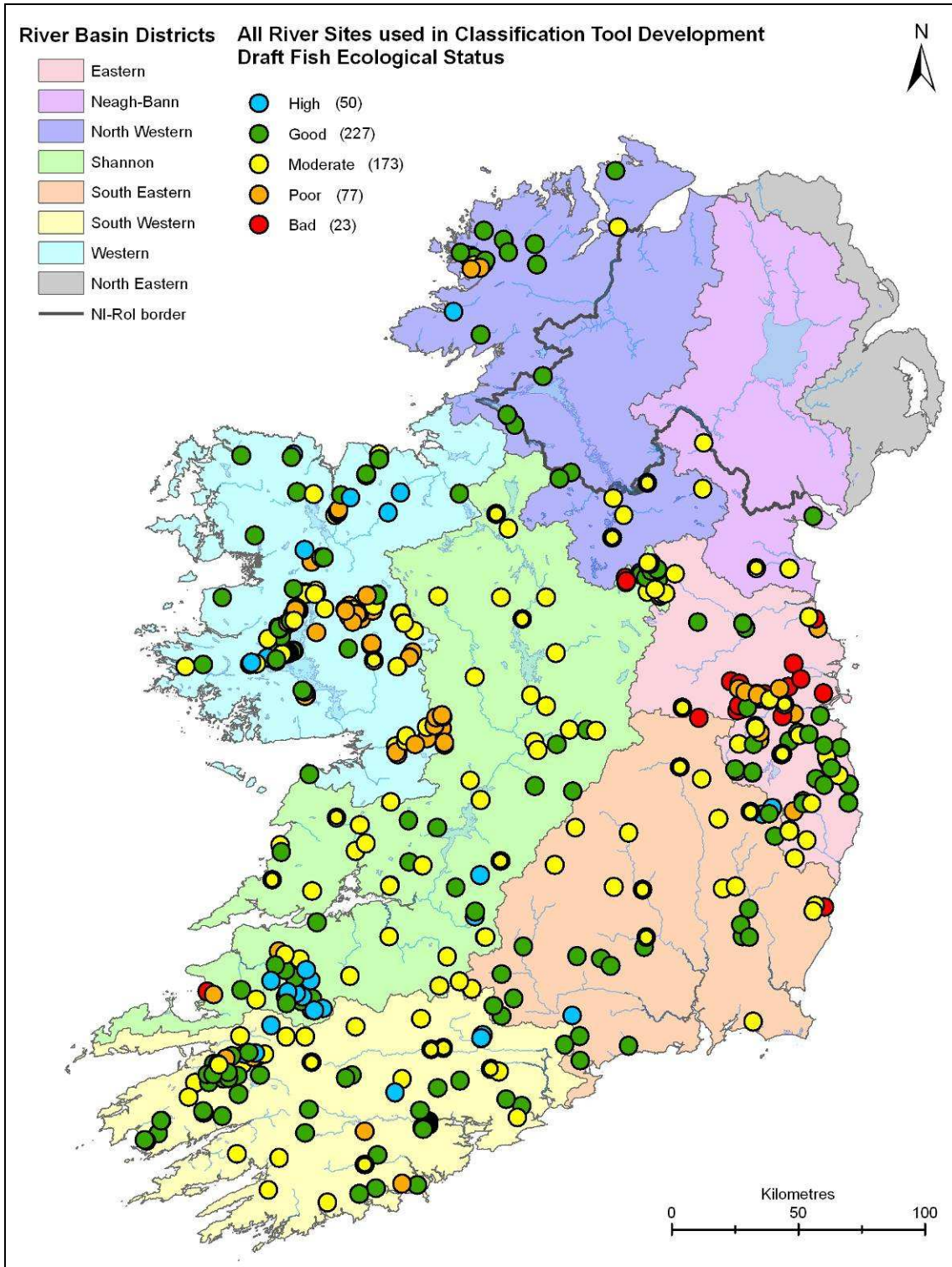


Fig. 5.2. Draft fish ecological status in all 550 river sites (RoI) used to develop the rivers fish ecological classification tool

5.3 Transitional Waters

A new preliminary ecological classification tool for fish in transitional waters, the Transitional Fish Classification Index (TFCI), has been developed for the island of Ireland (Ecoregion 1) using Northern Ireland Environment Agency (NIEA) and IFI data. It is a multi-metric index based on similar tools developed for transitional waters in South Africa and the UK (Harrison and Whitfield, 2004; Coates et al., 2007), using 10 different fish metrics based on species composition, abundance, functional guilds and indicator species to assign an ecological status class to each transitional water body.

The TFCI is still undergoing some development, particularly in relation to classifying small lagoons and freshwater tidal zones. Currently, the WFD classifies all transitional waters in Ireland into one ‘typology’; however, this proves problematic for developing a robust classification tool for all estuaries. For example, lagoons do not have a strong, continuous connection to the sea and thus are expected to contain a different species composition and lower species richness than larger estuaries. Similarly, freshwater tidal zones and small estuaries also tend to have lower species richness than larger estuaries and hence it is difficult to compare all estuary types together.

Currently, the TFCI is run separately for two distinct categories; ‘Transitional Waters’ and ‘Lagoons and Freshwater Tidal’ water bodies. This helps in overcoming the problem of comparing different types of estuaries; however, we can see from the classifications that lagoons and freshwater tidal water bodies still tend to score lower than larger/complete estuary systems, mainly due to a lower species richness and abundance, particularly in relation to certain functional guilds and indicator species.

The TFCI is currently undergoing further development in an attempt to address these problems, particularly with regards setting different ‘type specific’ reference conditions for each of the water body types identified. This, in effect, will help to ensure that we are only comparing ‘like with like’ and are not downgrading smaller, naturally less species diverse water bodies by comparing them with larger, species rich systems.

All 72 transitional water bodies surveyed during the 2007 – 2009 surveillance monitoring cycle have been assigned draft ecological status classes using the current TFCI, with the aid of expert opinion. Final ecological classifications will be assigned to each water body once the TFCI has been revised and the EU Intercalibration process has been completed.

The spatial distribution of transitional water ecological status classes is shown in Figure 5.3. Similar to trends in lakes and rivers, there are a greater proportion of good status sites in the north and west of the country than in the south and east. Details of the ecological status classes assigned to each water body are also given in Table 2.3.

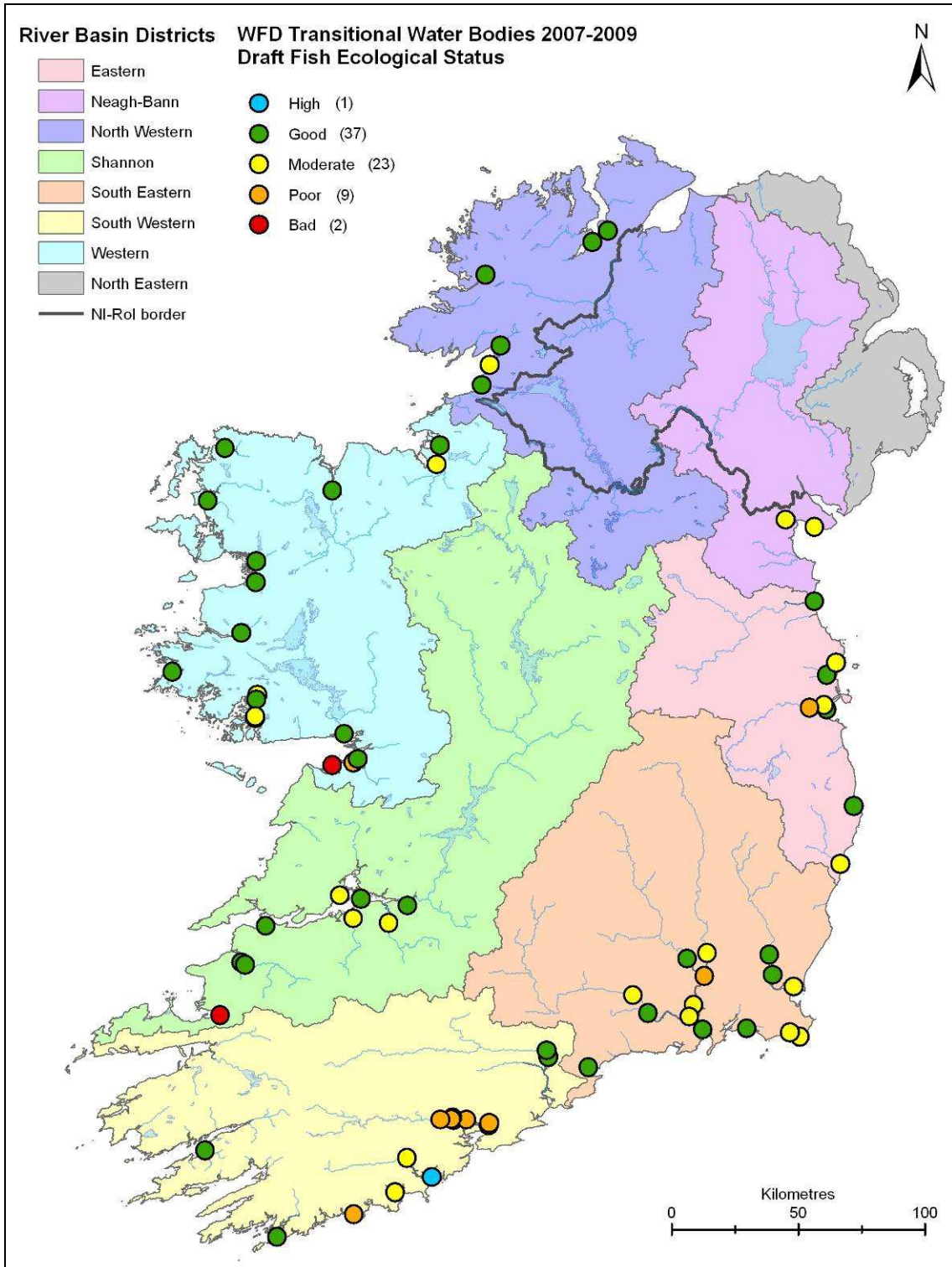


Fig. 5.3. Draft fish ecological status in all 72 transitional water bodies surveyed for WFD fish monitoring 2007 - 2009

6. SUMMARY

The first three year WFD fish monitoring cycle, from 2007 – 2009, has been extensive. A large amount of work has been completed, both in terms of a comprehensive fish monitoring programme and in the development of ecological classification tools for fish in lakes, rivers and transitional waters. Field sampling over the three year period was hampered by several factors, including project start-up (funding issues) delays, an embargo on staff recruitment and very high rainfall levels in 2008 and 2009; however, despite this, approximately 90% of all scheduled surveys were completed.

The paucity of WFD compliant fish population data, particularly in relation to lakes and transitional waters, has necessitated the concurrent development of the ecological classification tools that have been reliant on the input of this new data as it became available. These classification tools continue to be refined as more data is collected, and the process of intercalibration with other EU Member States will ensure that they are fully WFD compliant.

Although the EU intercalibration process has yet to be completed for the fish ecological classification tools (both the lakes tool and rivers tool are expected to complete the intercalibration process during 2011), all lake, river and transitional water bodies surveyed to date have been assigned draft ecological status classes using the classification tools along with expert opinion.

Whilst the main emphasis of WFD surveillance monitoring is to assign ecological status classes to all water bodies, the fish monitoring element of the WFD has also generated a vast amount of invaluable new data on fish distribution and abundance throughout Ireland. No such comprehensive lake or transitional water fish monitoring programmes have been attempted in the past, and most historical monitoring of fish in rivers has tended to focus on salmon and trout in particular catchments. In contrast, during the WFD surveillance monitoring programme from 2007 – 2009, more than 150,000 fish encompassing 79 different species have been recorded.

This large amount of data has been collated into a new GIS database from which fish species distribution and abundance maps for rivers, lakes and transitional waters throughout Ireland can be generated. Distribution patterns of native versus non-native fish can be studied, along with the distribution and abundance of individual species of interest such as Arctic char or salmon. Fish ecological status maps for all water bodies surveyed to date are also available. Interactive GIS maps can be accessed on the dedicated WFD fish website (www.wfdfish.ie), along with individual reports on each water body surveyed.

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