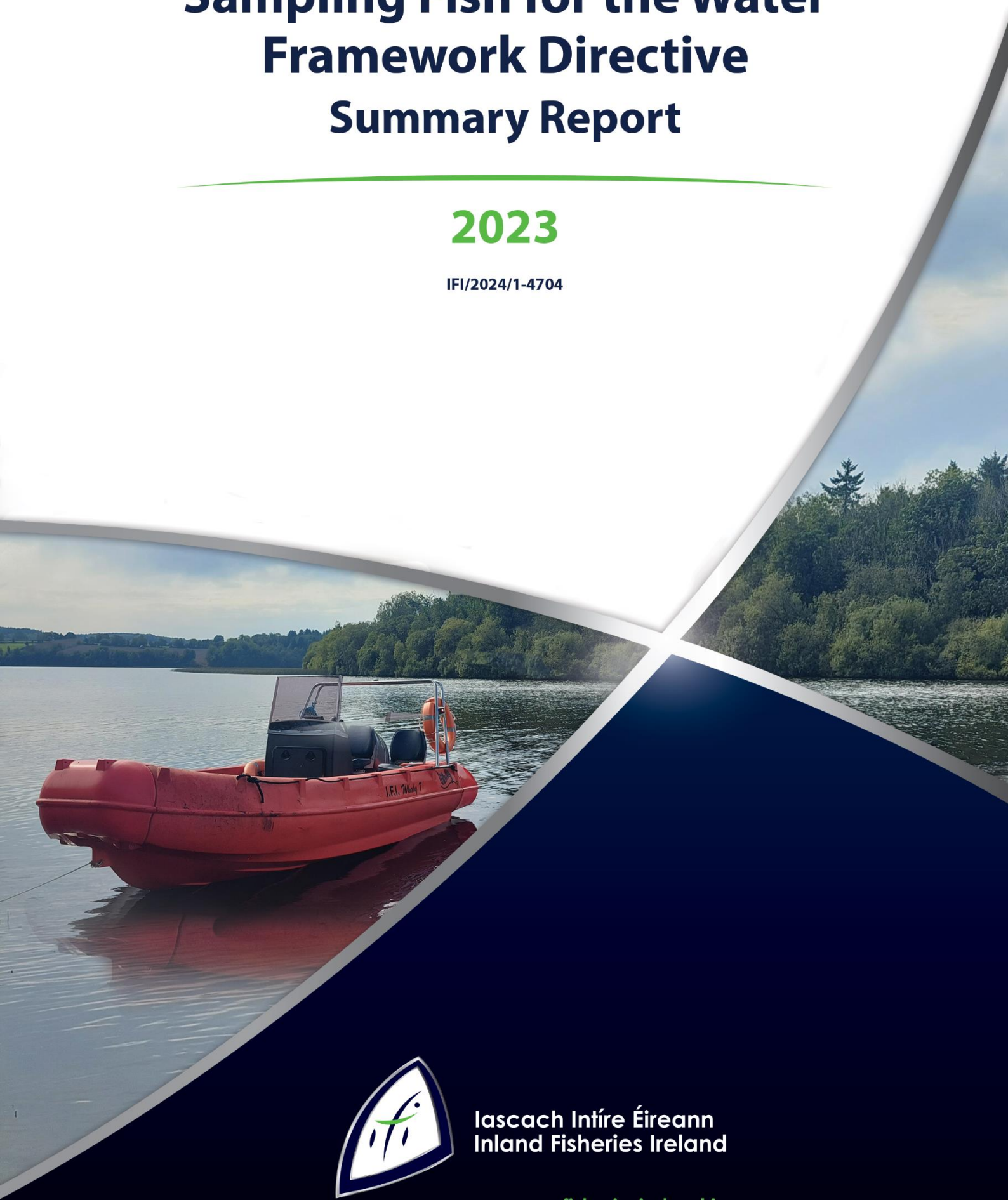
Sampling Fish for the Water Framework Directive

Summary Report

2023

IFI/2024/1-4704



Iascach Intíre Éireann
Inland Fisheries Ireland

fisheriesireland.ie

Sampling Fish for the Water Framework Directive -

Summary Report 2023

Iascach Intíre Éireann
Inland Fisheries Ireland

Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

CITATION: Corcoran, W., Matson, R., McLoone, P., Cierpial, D., Gordon, P., McCarthy, E., Robson, S., Wightman, G., Twomey, C., Roche, W. and Kelly, F.L (2024) Sampling Fish for the Water Framework Directive - Summary Report 2023. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

Cover photo: IFI survey boat on Lough Allua © Inland Fisheries Ireland

Project Personnel

This report was written and researched by Mr. William Corcoran, Dr. Ronan Matson, Mr. Daniel Cierpial, Mr. Paul Gordon, Mr. Paul McLoone, Mr. Elliot McCarthy, Dr. Stephen Robson, Dr. Willie Roche, Mr. Ciaran Twomey, Mr. Glen Wightman and Dr. Fiona Kelly, Inland Fisheries Ireland (IFI), as part of the National Water Framework Directive (WFD) Fish Monitoring Programme. Ms. Yani Cornthwaite, Mr. Brian Heagney and Mr. John Hyland assisted with fieldwork and data entry.

Acknowledgements

The authors wish to gratefully acknowledge the help and co-operation of the Directors and staff from the six IFI River Basin Districts. The authors would also like to thank their colleagues in IFI Citywest.

The authors also wish to acknowledge the funding provided for the programme by the Department of Housing, Local Government and Heritage (DHLGH) and Department of the Environment Climate and Communications (DECC).

TABLE OF CONTENTS

Executive summary

Inland Fisheries Ireland has been assigned the responsibility of delivering the fish monitoring requirements for the Water Framework Directive (WFD) in Ireland by the Environmental Protection Agency. In 2023, 27 lakes, 179 river sites and five transitional water bodies were surveyed as part of the national IFI fish WFD monitoring programme.

All surveys were conducted using a suite of European standard methods, including a range of different net types to sample lakes and transitional waters, and electrofishing methods to sample rivers.

A total of 14 species (sea trout are included as a separate "variety" of trout) and two cyprinid hybrids were captured across the lakes surveyed in 2023. European eel had the widest distribution, with perch the most abundant species. Five (18.5%) lakes were assigned a status of High, ten (37%) as Good, five (18.5%) as Moderate, three (11.1%) as Poor and four (14.8%) as Bad. All lakes had been surveyed previously, and when compared to previous results, 12 (44.4%) lakes showed no change in fish ecological status, eight (29.6%) improved and seven (25.9%) lakes deteriorated. There was no significant improvement in overall fish ecological status of lakes surveyed in 2023. Lakes falling below the required standard of Good status were located mainly in the north midlands with the exception of one lake in County Donegal (Lough Fern), one in County Cork (Lough Allua) and one in County Sligo (Lough Gill).

Fourteen fish species (sea trout are counted as a separate "variety" of trout) and one cyprinid hybrid were recorded across 179 river sites surveyed in 2023, with brown trout the most frequently encountered species, occurring in 166 out of 179 sites. A total of 170 sites were assigned a fish ecological status score. Seventeen (10.0%) sites were classified as High status, 53 (31.2%) as Good, 73 (42.9%) as Moderate, 23 (13.5%) as Poor and four (2.4%) as Bad. A total of 41 sites had previously been surveyed and classified. Of these, the status of 20 (48.8%) sites remained unchanged between surveys, while 17 (41.5%) sites deteriorated and four (9.8%) showed an improved status. There was no overall improvement in fish ecological status of river sites that were previously surveyed. Failures in fish ecological status were spread across the catchments surveyed in 2023 but were common in the north midlands (e.g. Cullies and Swanlinbar) and southeast (e.g. Slaney and Colligan) where the EPA has indicated that there are nutrient pollution pressures from agriculture, wastewater and hydromorphological pressures.

A total of 36 species of fish were captured in the five transitional waterbodies surveyed in 2023. Four species, sand goby, thick lipped mullet, three-spined stickleback and European eel were the most widely distributed species, recorded in four of the five waterbodies. All transitional waterbodies

surveyed were assigned a fish ecological status rating. One transitional waterbody was classified as Good status, three as Moderate status and one as Bad. All five waterbodies had previously been surveyed and classified. One waterbody, Kinvarra Bay improved in status and four waterbodies deteriorated, therefore no overall improvement in fish ecological status was observed.

1. INTRODUCTION

In December 2000, the European Union introduced the Water Framework Directive (WFD) (2000/60/EC) as part of a new standardised approach for all Member States to manage their water resources and protect aquatic ecosystems. The WFD was transposed into Irish Law in December 2003 (Water Regulations S.I. No. 722 of 2003).

The fundamental objective of the WFD is to protect and maintain the status of waters that are already of good or high quality, to prevent any further deterioration, to restore all waters that are impaired so that they achieve at least good ecological status, and to ensure long term sustainable use.

River Basin Management Plans (RBMPs) are required under the WFD and set out the government's approach to protect national waters through *Programmes of Measures* for each six-year cycle of the directive. The first RBMP cycle ran from 2009-2014, and the second from 2015-2021. Ireland is currently into its third RBMP cycle, which began in 2022 and will end in 2027.

A key step in the WFD process is for EU Member States to assess the health of their surface waters through national monitoring programmes. Classification tools are the main instruments used to assess status in five discrete bands (High, Good, Moderate, Poor or Bad) for each waterbody (a predefined section in a river, or other surface water). Once each country has determined the current status of their waterbodies, ongoing monitoring helps to track the effectiveness of measures needed to improve them and achieve at least good status. The responsibility for monitoring fish has been assigned to Inland Fisheries Ireland (IFI) by the Environmental Protection Agency (EPA) (EPA, 2006 and 2021a). A national fish stock surveillance monitoring programme has been conducted since 2007 at specified locations. This surveillance monitoring programme encompasses lakes, rivers and transitional waters (freshwater tidal river reaches, estuaries and lagoons) and provides information on species composition, abundance and age structure (e.g., growth patterns, and population demographics). The river fish monitoring programme has also been updated recently to follow an index catchment approach that will provide a more comprehensive overview of the health of fish stocks in each catchment for IFI, the EPA and other stakeholders (Matson *et al*., 2021). For transitional waters the programme will be similarly updated to rationalise monitoring activity and to include waterbodies with substantive deterioration in status.

A team from IFI carried out the 2023 monitoring programme using a suite of European standard methods. Electrofishing was the main survey method used in rivers, with various netting techniques used for both lakes and transitional waters. Field survey work was carried out between June and October (inclusive), the optimum timeframe for sampling fish in Ireland. This included lake surveys

between June and September, rivers between July and September and transitional waters between September and October.

This report summarises the main findings of these surveys and reports on the current ecological status and fish stocks in each. Detailed reports on all waterbodies surveyed are available to download from the *Research* section of the IFI corporate website (https://www.fisheriesireland.ie/what-we-do/research/water-framework-directive-fish-monitoring-programme) or from the dedicated WFD fish website (www.wfdfish.ie).

Plate 1.1. Glenbeg Lough, Co. Cork.

2. STUDY AREA

Inland Fisheries Ireland is organised into six River Basin Districts (RBDs), the Northwestern (NWRBD), the Western (WRBD), the Shannon (ShRBD), the Southwestern (SWRBD), the Southeastern (SERBD) and the Eastern (ERBD). Surveys were carried out in all six RBDs during 2023 (Figure. 2.4).

For ease of navigation through this report, results are presented under three survey types.

- Surveillance monitoring (SM) surveys - normally carried out on a three-year rolling-cycle as part of the WFD programme. Some exceptions/changes have been agreed with the Environmental Protection Agency.

- Additional value (AV) surveys - surveys carried out by IFI's National Research Survey Programme (NRSP) for various reasons, including lake surveys for the National Coarse Fish Research Programme and baseline river catchment surveys. These results have been included in this report to provide a more comprehensive overview of fish ecological status in each waterbody or catchment.

- Additional value/surveillance monitoring waterbody (AV/SM) - a survey done within a surveillance monitoring waterbody but not at the original surveillance monitoring station. Such surveys are intended to provide additional information on the SM waterbody, but are not intended to replace the SM site.

2.1 Lakes

Twenty-seven lakes were surveyed between the 7th of June and the 5th of October 2023 (Figure 2.1). In total, 22 lakes surveyed were surveillance monitoring sites (SM) (Table 4.2, Figure. 2.4). Five lakes were surveyed as part of IFI's Operational Monitoring Programme, with three of these surveyed for IFI's ongoing Coarse Fish Programme. These five lakes are presented as additional value (AV) sites (Table 4.2, Figure. 2.4).

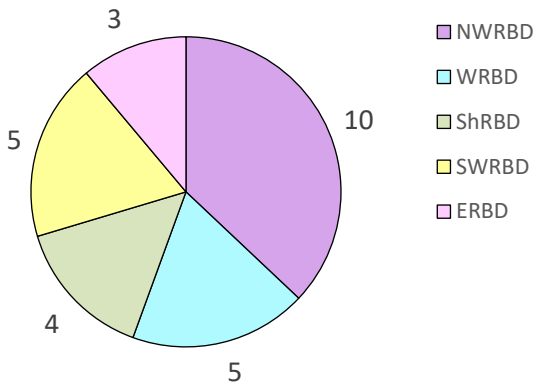


Figure 2.1. The number of lakes surveyed in each IFI RBD in 2023.

2.2 Rivers

A total of 179 river sites were surveyed between the 4th of July and the 30th of September 2023 (Figures 2.2 and 2.4). Thirty five were SM sites, 119 were added value and 25 were AV/SM (Figure 2.3). Of the completed river surveys, two sites were surveyed using boat-based electrofishing and 177 sites by wadeable electrofishing (Table 4.5).

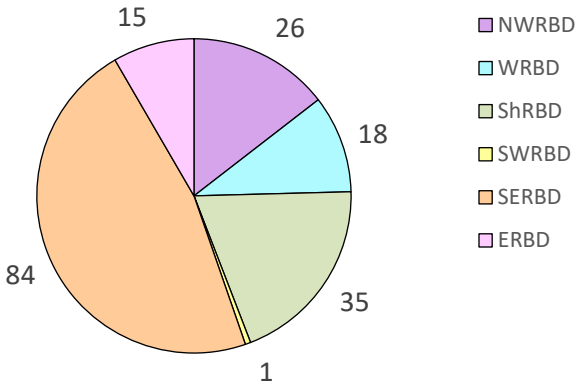


Figure 2.2. The number of rivers surveyed in each IFI RBD in 2023.

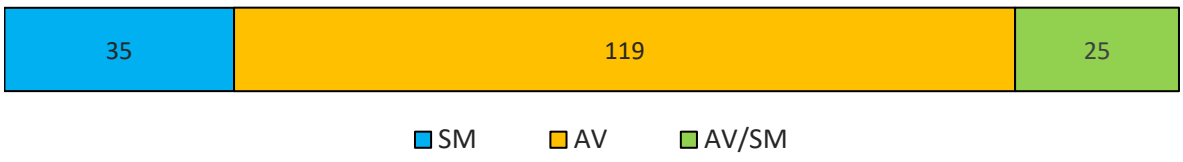


Figure 2.3. The number of survey types carried out in rivers in 2023.

2.3 Transitional waters

Five transitional water bodies were surveyed between the 28th of September and the 19th of October 2023. One waterbody was in the NWRBD, three waterbodies in the WRBD and one waterbody in the ERBD. All five transitional water bodies were SM waterbodies (Figure. 2.4).

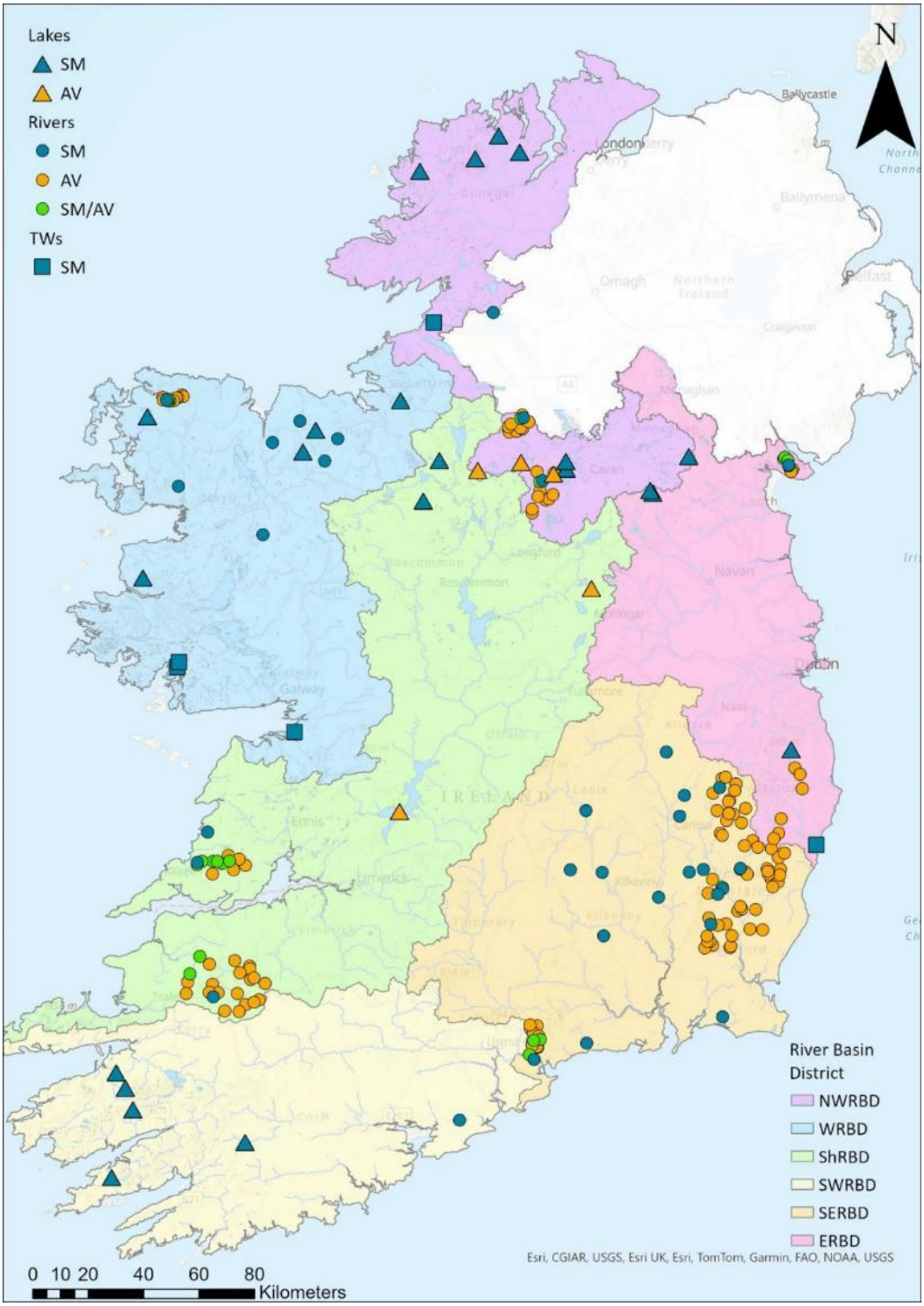


Figure. 2.4. Location of SM, AV and AV/SM surveys carried out on lakes, rivers and transitional waters from June to October 2023.

3. METHODS

All surveys were conducted using a suite of European standard methods (CEN, 2003; CEN, 2005a; CEN, 2015) and IFI standard operating protocols. Electrofishing is the main survey method used in rivers, while a multi-method netting approach is used in both lakes and transitional waters.

Procedures are required for disinfection of equipment to prevent dispersal and introduction of invasive aquatic species and other organisms to unimpacted waters. A standard operating procedure was compiled by Inland Fisheries Ireland for this purpose (Caffrey, 2010) and is followed by staff when moving between water bodies.

Plate 3.1. Setting a fyke net on Lough Derg in the ShRBD.

3.1 Lakes

Lake water bodies were surveyed using a netting method developed and tested during the NSSHARE Fish in Lakes Project 2005-2006 (Kelly *et al*., 2007 a and b; Kelly *et al*., 2008) and updated during an IFI intercalibration exercise (Connor *et al.,* 2017). The method is based on the European CEN standard for sampling fish with multi-mesh monofilament survey gill nets (12 panel, 5-55mm mesh size) using a stratified random sampling design (CEN, 2015). However, the netting effort has been reduced (approximately 50%) for Irish lakes to minimise damage to fish stocks (Kelly *et al*., 2008). Each lake is divided into depth strata (0-2.9m, 3-5.9m, 6-11.9m, 12-19.9m, 20-34.9m, 35-49.9m, 50-75m, >75m), where appropriate, and random sampling conducted within each of these (CEN, 2015). Floating multi-

mesh monofilament gill nets, fyke nets (one unit comprised of three fyke nets; leader size 8m x 0.5m) and single panel large mesh multifilament braided gill nets are also used to supplement the CEN standard gill netting effort.

All fish except for perch were measured and weighed on-site, and scales were removed from all brown trout, salmon, pike, roach, bream and roach x bream hybrids. Live fish were returned to the water whenever possible (i.e. when the likelihood of their survival was considered good). Samples of fish were retained for further analysis.

3.2 Rivers

Electrofishing is the method of choice to obtain a representative sample of fish in rivers. It is a well-established technique used by fishery biologists globally for sampling and is generally one of the most non-destructive, effective and cost-efficient methods. This technique complies with European Committee for Standardisation (CEN) guidelines for fish stock assessment in rivers (CEN, 2003). In 2022 both wadable electrofishing and non wadeable boat-based electrofishing were used.

3.2.1 Wadeable electrofishing

Two methods of electrofishing were used to sample small wadeable channels (<0.5-0.7m in depth) in 2023. These were Area Delineated Electrofishing (ADEF) and Ten-minute timed electrofishing (TEF_{10}).

ADEF is the primary quantitative method used to sample surveillance monitoring sites. A wadeable electrofishing set consists of one portable generator (220/240V) or electrofishing backpack with an appropriate control unit (DC converter), a cathode and an anode. The number of sets used on each site is determined by the width of the site and varied between one and three sets. ADEF electrofishing involves between two and six operators depending on the number of sets used. Fishing is carried out by wading in an upstream direction, ensuring that the electrical field covers the entire width of the river. A representative sample of the pool-riffle-glide river continuum is desirable; however, at some locations, this habitat breakdown may not be available. Three fishing passes are typically conducted using this method, with stop-nets deployed upstream and downstream of the survey stretch to prevent loss or recruitment of fish between each pass.

The TEF_{10} electrofishing method is a qualitative procedure that supplements the ADEF method. TEF_{10} electrofishing generally involves two operators and is used to sample added value (AV) sites where the wetted width of the survey site is <9 metres. This rapid assessment method is quicker and less resource demanding than ADEF fishing and allows for a more comprehensive catchment-wide survey. The equipment used consists of one portable generator (220/240V) or electrofishing backpack with

an appropriate control unit (DC converter), a cathode and an anode. No stop-nets are deployed. Electrofishing took place by wading upstream in a zigzag manner for exactly ten minutes at a steady pace (Matson *et al.,* 2018).

Plate 3.2. Electrofishing on the Gowran River in the SERBD.

3.2.2 Non wadeable boat-based electrofishing

ADEF using boat-based electrofishing is carried out on larger, deeper channels (>0.5-1.5m). Typically, boat-based electrofishing is carried out from a flat-bottomed boat(s) fishing in a downstream direction using a generator, control box, a pair of anodes and a cathode. The width of the channel determines how many boats should be used to sufficiently sample the site. Where a river is too wide for the number of boats or resources available are limited to cover the entire channel width, a partial survey may be undertaken along one bank in a parallel or staggered formation.

For the above methods, all fish were counted and measured on site.

An evaluation of river habitat quality is critical to any bioassessment survey; therefore, a simple habitat assessment was carried out at each site. General physical characteristics of the site were recorded, alongside parameters including river typology, land use, fish pressures, riparian and bank

vegetation, instream features, habitat breakdown, flow type, and substrate. Wetted width and depth were typically measured using five transects across each site, with five depth intervals along each. Other physico-chemical parameters recorded, included water temperature (°C) and conductivity (µS/cm).

Plate 3.3. A TEF_{10} electrofishing site on the Cullies River in the NWRBD.

3.3 Transitional waters

Transitional waters (freshwater tidal river reaches, estuaries and lagoons) are an interface habitat, where freshwater flows from rivers and mixes with the tide and salinity of the sea. As such, they provide a challenging habitat to survey due to their constantly changing environmental conditions. In every 25-hour period (approximately), the tidal level rises and falls twice, subjecting extensive areas to inundation and exposure.

Wightman *et al.* (2023a), describes the multi-method approach, including the use of beach-seine netting, beam trawling and fykes netting, utilised by IFI staff to survey transitional waters in 2023.

Plate 3.4. Cathaleen's Fall hydro generation power station on the Erne Estuary in the NWRBD.

3.4 Fish ecological status

An essential step in the WFD monitoring process is the classification of the ecological status of lakes, rivers and transitional waters. These assist in identifying the objectives that must be met in the individual River Basin Management Plans (RBMPs).

Three fish ecological classification tools have been developed to assign status to fish stocks in Irish lakes, rivers and transitional waters for WFD purposes. The Fish in Lakes (FIL2) ecological classification tool (Kelly *et al.,* 2012) was used to assign ecological status to lakes surveyed in 2023. An ecological classification tool for fish in rivers (Fisheries Classification Scheme 2 (FCS2-Ireland)) (SNIFFER, 2011) was used to assign ecological status to fish in rivers. The Estuarine Multi-Metric Fish Index (EMFI) (Harrison and Kelly, 2013) developed in 2013 was used to assign fish ecological status to transitional water bodies.

Plate 3.5. A pike being released on Lough Garadice in the NWRBD.

4. RESULTS

4.1 Lakes

4.1.1 Fish species distribution and abundance

A total of 14 fish species (sea trout are counted as a separate "variety" of trout) and two cyprinid hybrids were recorded across the 27 lakes surveyed in 2023 (Table 4.1). Eels had the widest distribution, occurring in 25 lakes (92.6%) (Figure 4.7). Brown trout had the second widest distribution, occurring in 18 lakes (66.6%). Perch (18 lakes) and roach (14 lakes) were the only other species to occur in more than 50% of the surveyed lakes (Table 4.1).

Table 4.1. Fish species recorded in lakes surveyed in 2023.

	Scientific name	Common name	Number of lakes	% of lakes
1	*Anguilla anguilla*	European eel	25	92.6
2	*Salmo trutta*	Brown trout	18	66.6
3	*Perca fluviatilis*	Perch	17	63.0
4	*Rutilus rutilus*	Roach	14	51.9
5	*Esox lucius*	Pike	13	48.1
6	*Rutilus rutilus* x *Abramis brama*	Roach X bream	13	48.1
7	*Abramis brama*	Bream	12	44.4
8	*Salmo salar*	Atlantic salmon	7	25.9
9	Phoxinus phoxinus	Minnow	7	25.9
10	*Tinca tinca*	Tench	6	22.2
11	*Gasterosteus aculeatus*	Three-spined stickleback	5	18.5
12	*Salmo trutta*	Sea trout*	5	18.5
13	*Salvelinus alpinus*	Arctic char	4	14.8
14	*Scardinius erythrophthalmus*	Rudd	4	14.8
15	*Gobio gobio*	Gudgeon	2	13.7
16	*Scardinius erythrophthalmus* x *Abramis brama*	Rudd X bream	1	3.7
17	*Coregonus pollan*	Pollan	1	3.7

*Note: *sea trout are counted as a separate "variety" of trout and not a species*.

Species abundance was recorded as Catch-Per-Unit-Effort (CPUE), which is the number of fish captured per metre of survey net (fish/m). Although a species may have been recorded in a lake, it might not have been in high abundance or dominant. The distribution and abundance of the most common fish species captured amongst all lakes surveyed in 2023 is shown in Figures 4.4 to 4.16. In addition to the species displayed in the figures, rudd were captured in Loughs Allua (SWRBD), Caragh (SWRBD), Cavetown (ShRBD) and Derrybrick (NWRBD). Gudgeon were captures in two lakes Lough

Allua (SWRBD) and Lough Garadice (ShRBD). Rudd x bream hybrids were captured in Cavetown Lough (ShRBD). Pollan were captured in Lough Derg (ShRBD).

Perch was the most abundant species captured during the 2023 survey season and the dominant species in 13 of the 27 lakes surveyed. The highest CPUE of perch was recorded in Lough Egish (2.842 fish/m of net) (Figure 4.9).

Brown trout was the next most abundant species recorded, being dominant in ten of the 27 lakes surveyed. The highest CPUE for trout (1.098 fish/m of net) was recorded in Lough Acoose (Figure 4.5).

Roach was the dominant species in three lakes, although the highest CPUE recorded for roach (1.083 fish/m of net), was in Lough Egish, where perch was the most abundant species (Figure 4.10).

Three-spined stickleback were the dominant species in one lake, Lough Carrowmore with a CPUE of 1.076 fish/m of net (Figure 4.11).

4.1.2 Fish ecological status classification in lakes

All 27 lakes surveyed in 2023 were assigned a draft fish ecological status using the FIL2 ecological classification tool, together with expert opinion. Five lakes (18.52%) were classified as High ecological status, ten (37.03%) as Good, five (18.52%) as Moderate, three (11.11%) as Poor and four (14.82%) as Bad (Table 4.2, Figures. 4.1 and 4.3).

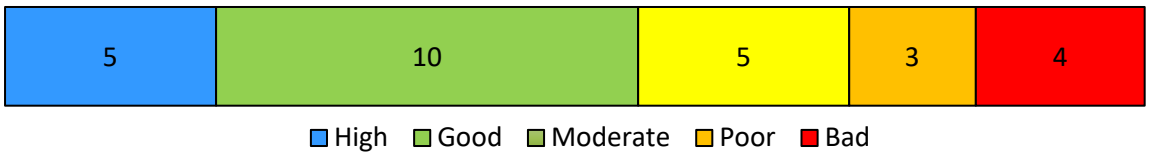


Figure 4.1 Fish ecological status for lakes surveyed in 2023.

Of the 27 lakes surveyed in 2023, all 27 had previously been sampled and assigned a fish ecological status. Twelve lakes (44.44%) had an unchanged ecological status, eight (29.63%) showed an improvement in status, while the remaining seven (25.93%) had deteriorated (Figures 4.2 and 4.3).

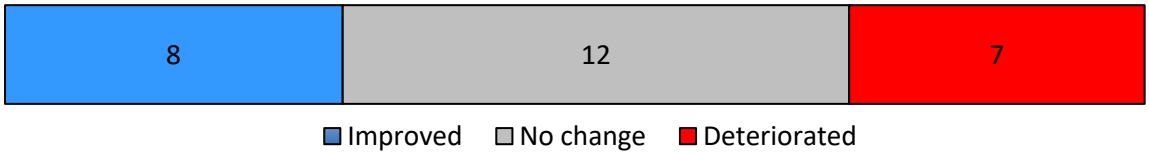


Figure 4.2 Change in fish ecological status for lakes surveyed in 2023.

Table 4.2 Summary details and fish ecological status of lakes surveyed for the WFD fish monitoring programme.

Lake name	WFD Code	Survey type	Catchment	FIL2 Typology	Area (ha)	Previous Status	2023 status
			NWRBD				
Anure	NW_38_83	SM	Gweedore	1	133.1	G (2020)	Good
Bawn	NW_36_573	OM	Erne	3	30.5	M (2018)	Bad
Beagh	NW_36_554	SM	Lackagh	2	11.6	H (2020)	High
Corglass	NW_36_655	SM	Erne	3	34.4	B (2017)	Poor
Derrybrick	NW_36_400	SM	Erne	3	36.3	G (2017)	Moderate
Egish	NW_36_671	SM	Erne	3	111.8	B (2011)	Bad
Fern	NW_39_13	SM	Leannan	1	181.0	B (2020)	Poor
Garadice	NW_36_648	OM	Erne	2	389.1	M (2018)	Good
Glen	NW_38_22	SM	Lackagh	1	167.7	H (2020)	Good
Scur	NW_36_665	OM	Erne	1	113.7	P (2018)	Poor
			WRBD				
Carrowmore	WE_33_1914	SM	Owenmore	1	915.2	G (2017)	Good
Easky	WE_35_136	SM	Easky	1	119.1	G (2020)	Good
Gill	WE_35_158	SM	Garvogue	4	1381.1	G (2017)	Moderate
Glencullin	WE_32_487	SM	Bundorragh	1	34.2	H (2017)	High
Talt	WE_34_405	SM	Moy	4	97.3	H (2020)	High
			ShRBD				
Cavetown	SH_26_705	SM	Shannon Upr	4	64.2	M (2014)	Good
Derg	SH_25_191	OM	Shannon Lwr	4	11650.5	M (2016)	Good
Derravaragh	SH_26_708	OM	Inny	4	914.1	P (2017)	Moderate
Meelagh	SH_26_711	SM	Shannon Upr	3	116.1	P (2014)	Bad
			SWRBD				
Acoose	SW_22_208	SM	Caragh	2	66.5	G (2020)	Good
Allua	SW_19_4	SM	Lee	2	136.4	P (2017)	Moderate
Brin	SW_21_402	SM	Blackwater	1	24.63	G (2017)	High
Caragh	SW_22_207	SM	Caragh	2	490.75	H (2017)	Good
Glenbeg	SW_21_444	SM	Coastal	2	66.43	G (2020)	Good
			ERBD				
Drumkeery	EA_07_268	SM	Boyne	1	13.0	M (2018)	Moderate
Skeagh (Upper)	EA_07_267	SM	Boyne	1	61.2	P (2017)	Bad
Tay	EA_10_25	SM	Boyne	2	50.0	H (2016)	High

Figure 4.3. Fish ecological status for lakes surveyed in 2023. (Note: Arrows indicate change in fish ecological status since previous survey).

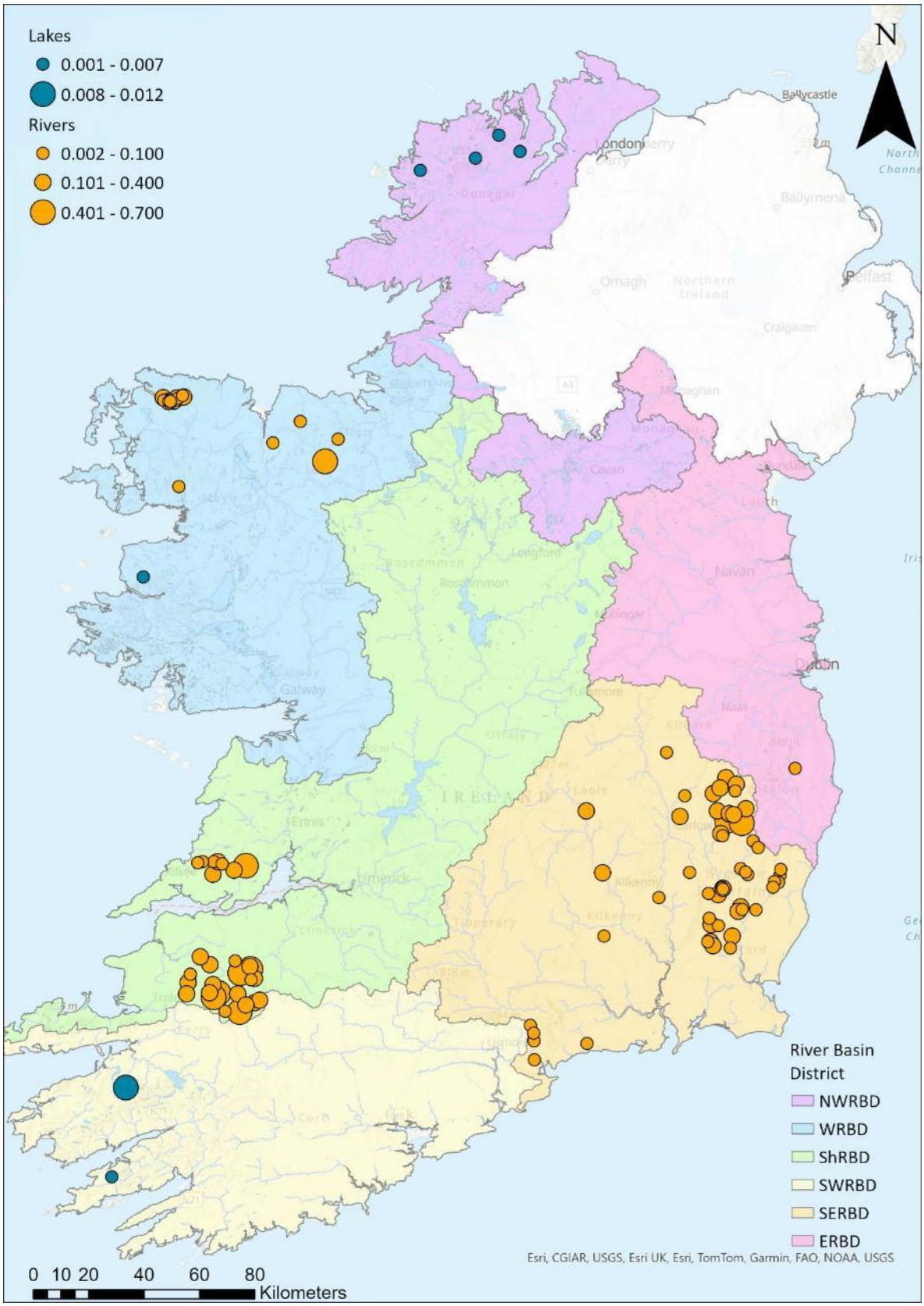


Figure 4.4. Atlantic salmon distribution and abundance in lakes (CPUE (no. fish/m net)) and rivers (density (no. fish/m^2)) surveyed in 2023 (CPUE and density are not comparable).

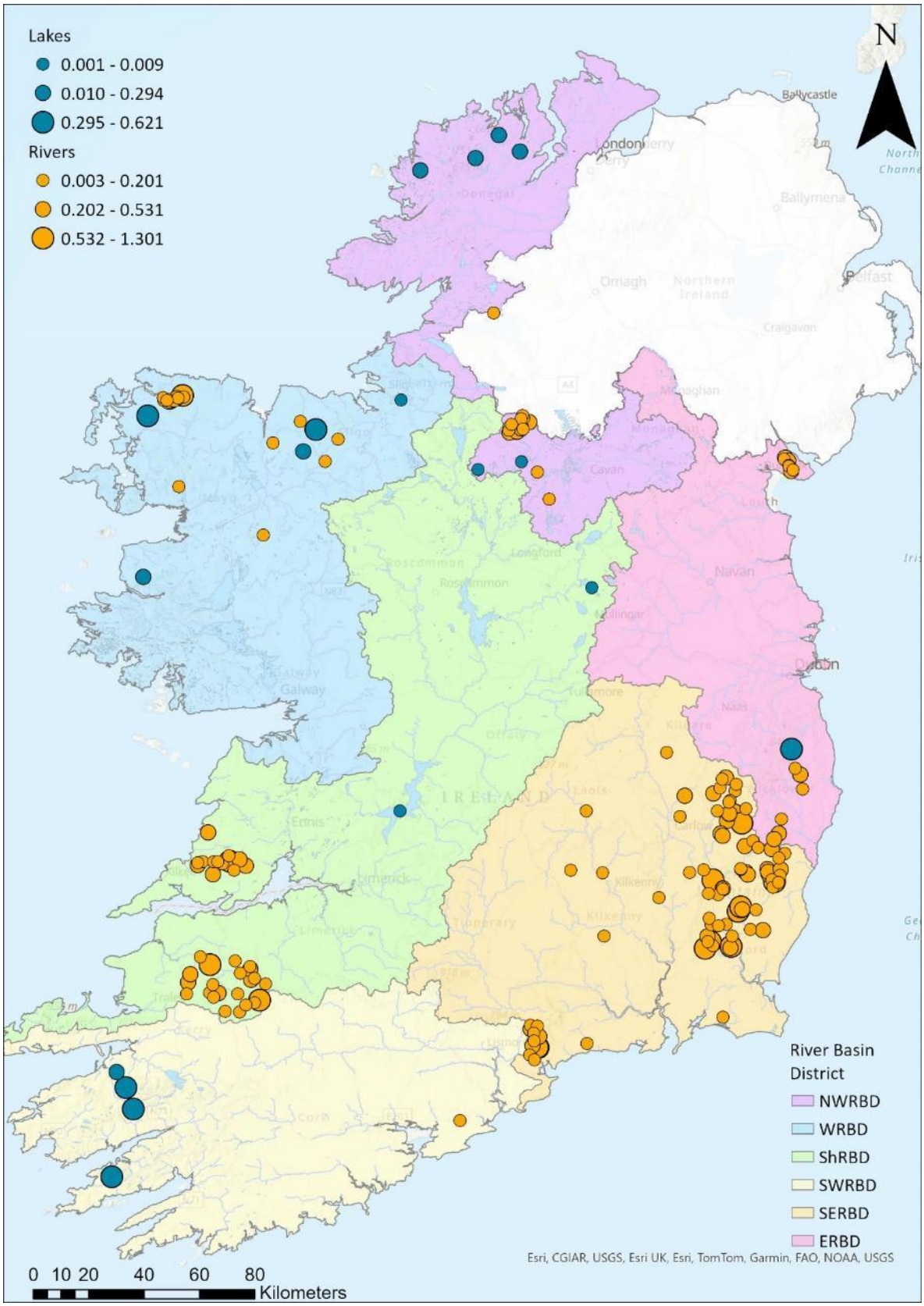


Figure 4.5. Brown trout distribution and abundance in lakes (CPUE (no. fish/m net)) and rivers (density (no. fish/m^2)) surveyed in 2023 (CPUE and density are not comparable).

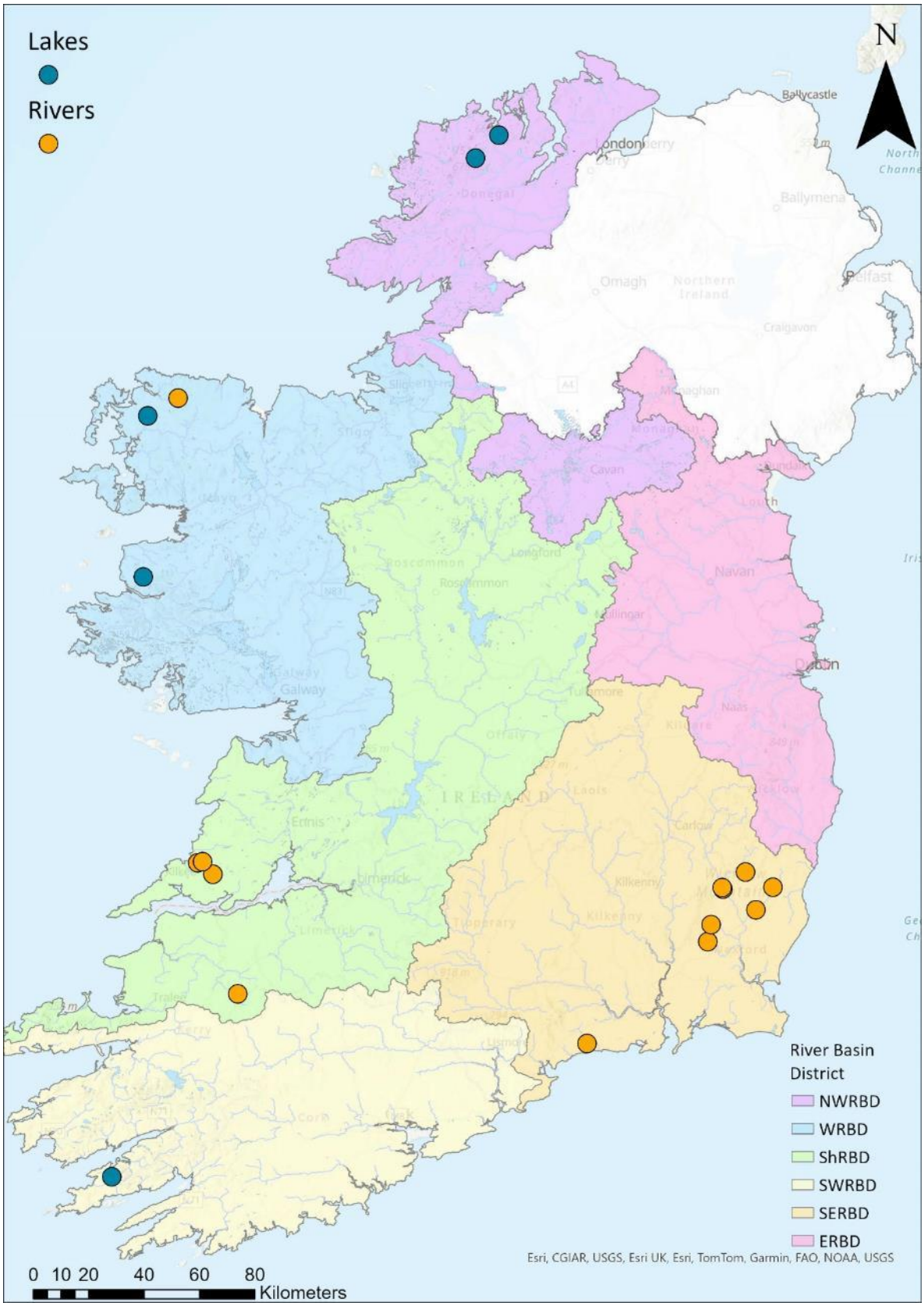


Figure 4.6. Sea trout distribution (please note species abundance is not displayed) in lakes and rivers surveyed in 2023.

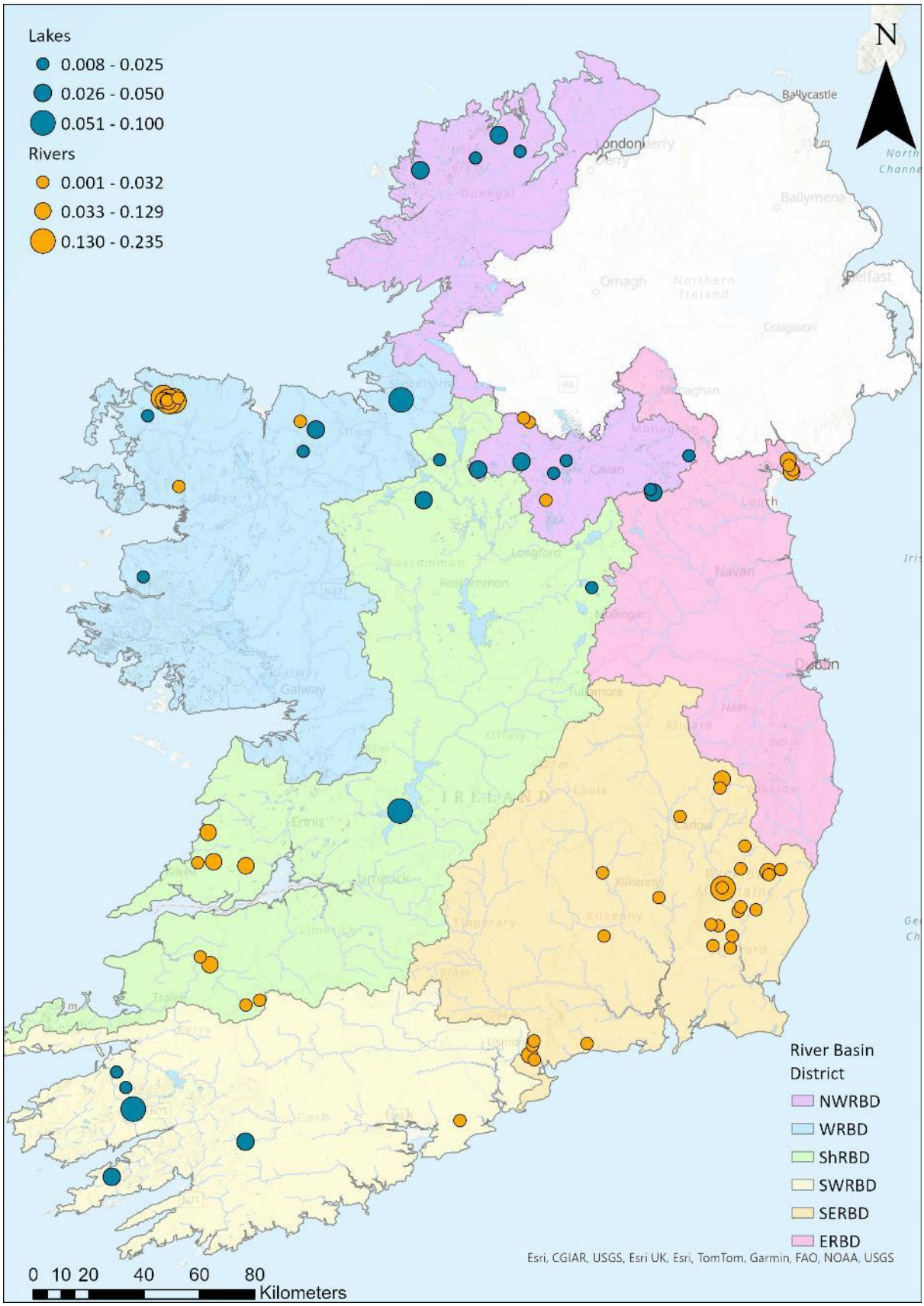


Figure 4.7. European eel distribution and abundance in lakes (CPUE (no. fish/m net)) and rivers (density (no. fish/m^2)) surveyed in 2023 (CPUE and density are not comparable).

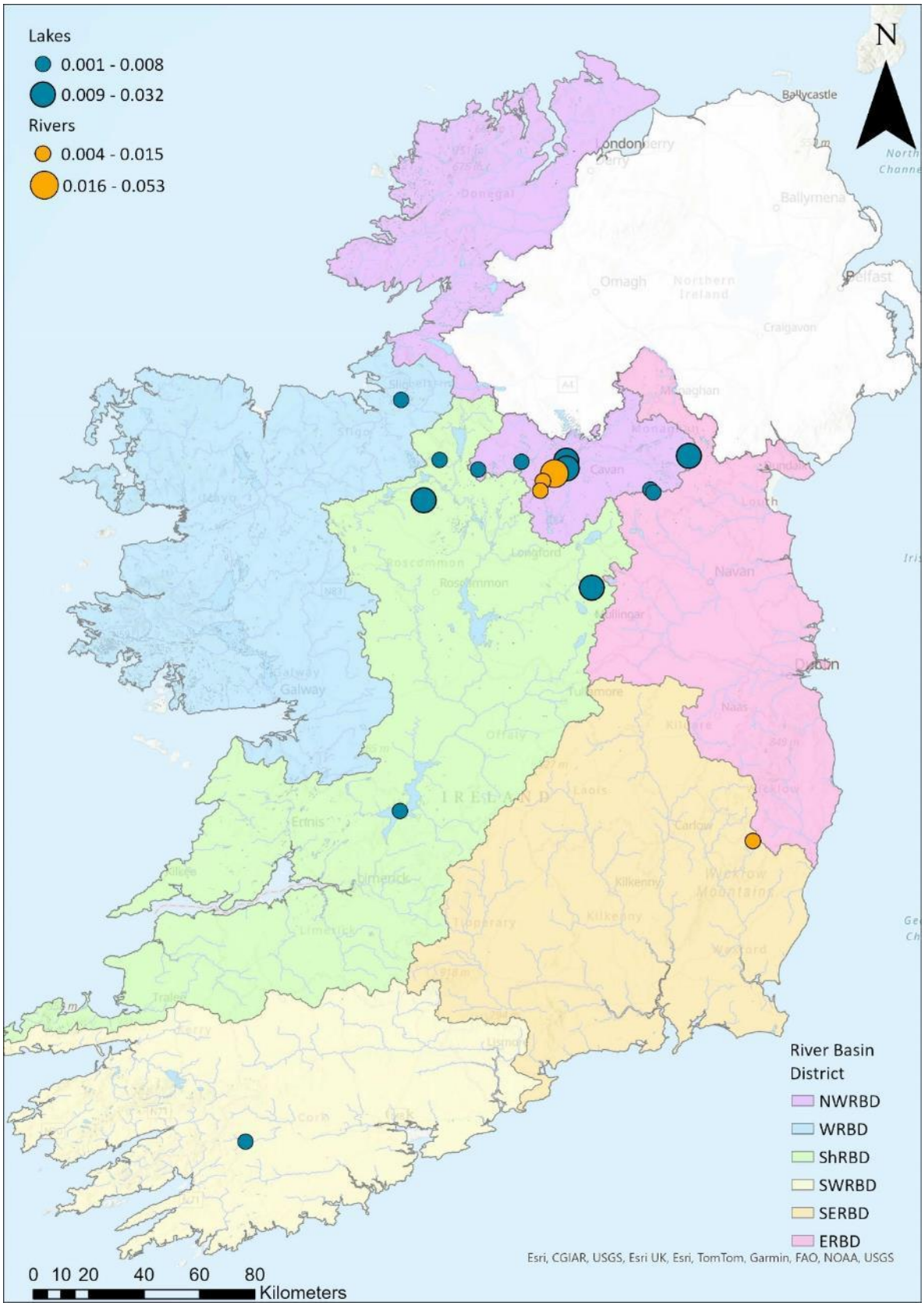


Figure 4.8. Pike distribution and abundance in lakes (CPUE (no. fish/m net)) and rivers (density (no. fish/m^2)) 2023 (CPUE and density are not comparable).

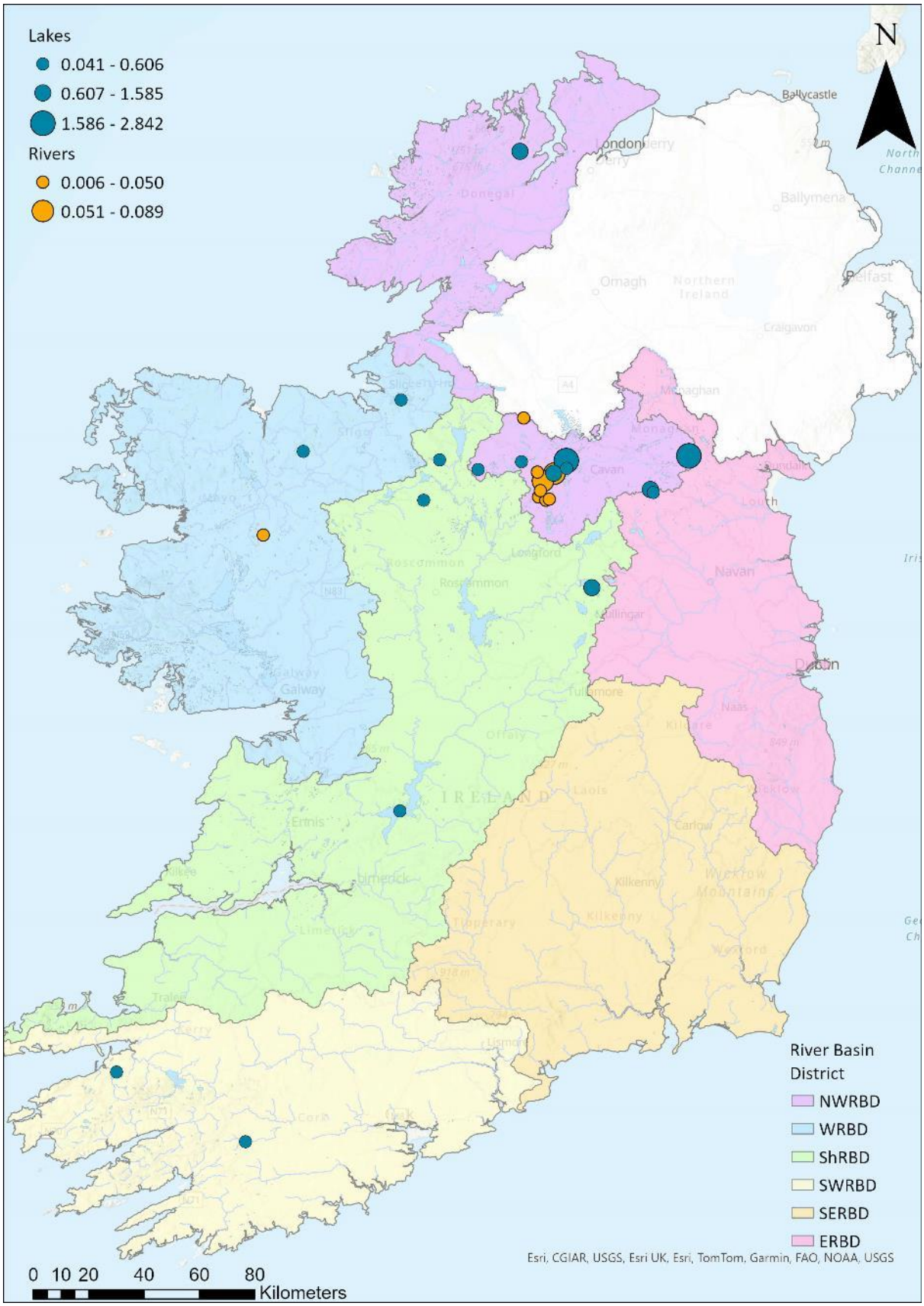


Figure 4.9. Perch distribution and abundance in lakes (CPUE (no. fish/m net)) and rivers (density (no. fish/m^2)) surveyed in 2023 (CPUE and density are not comparable).

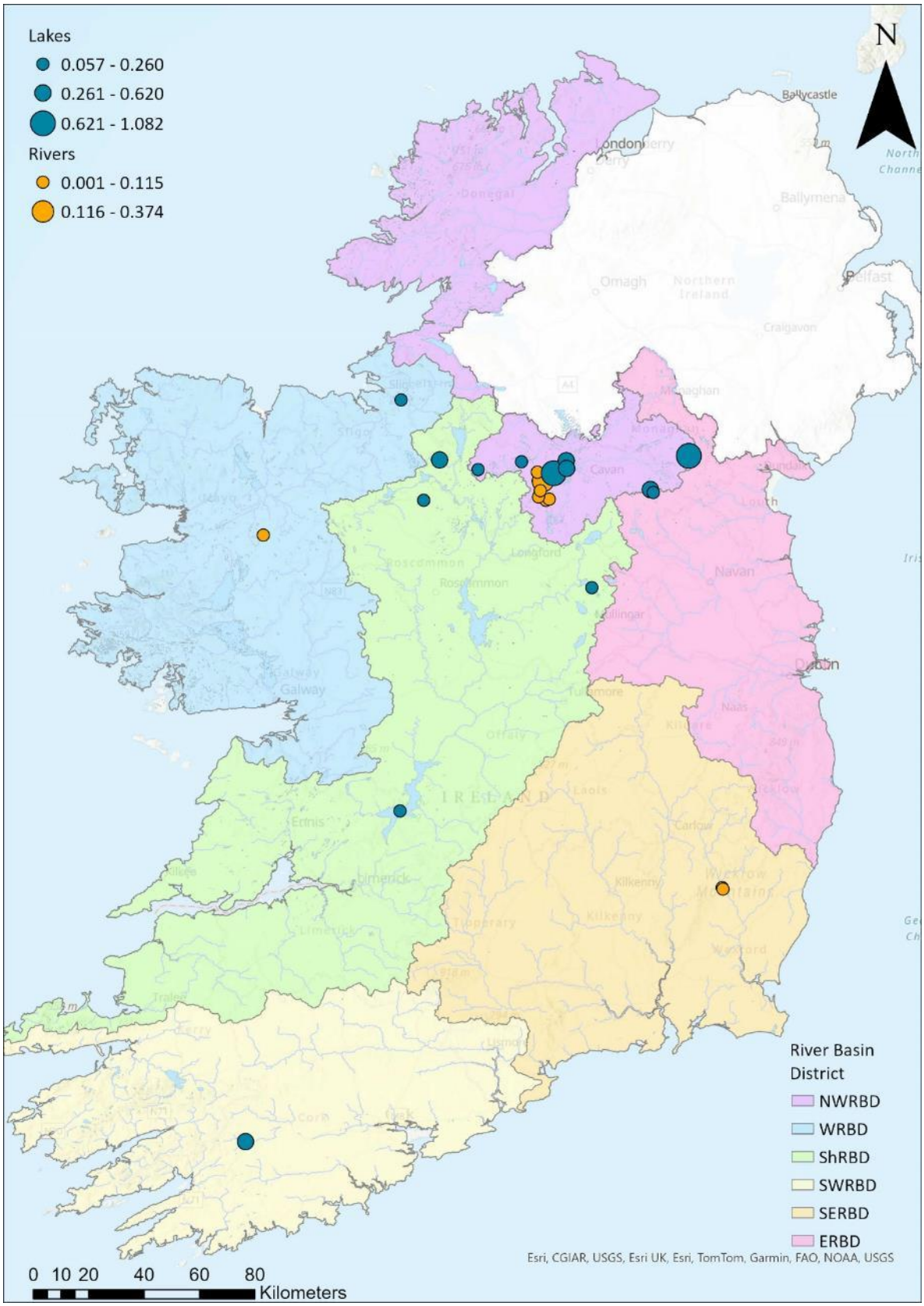


Figure 4.10. Roach distribution and abundance in lakes (CPUE (no. fish/m net)) and rivers (density (no. fish/m^2)) surveyed in 2023 (CPUE and density are not comparable).

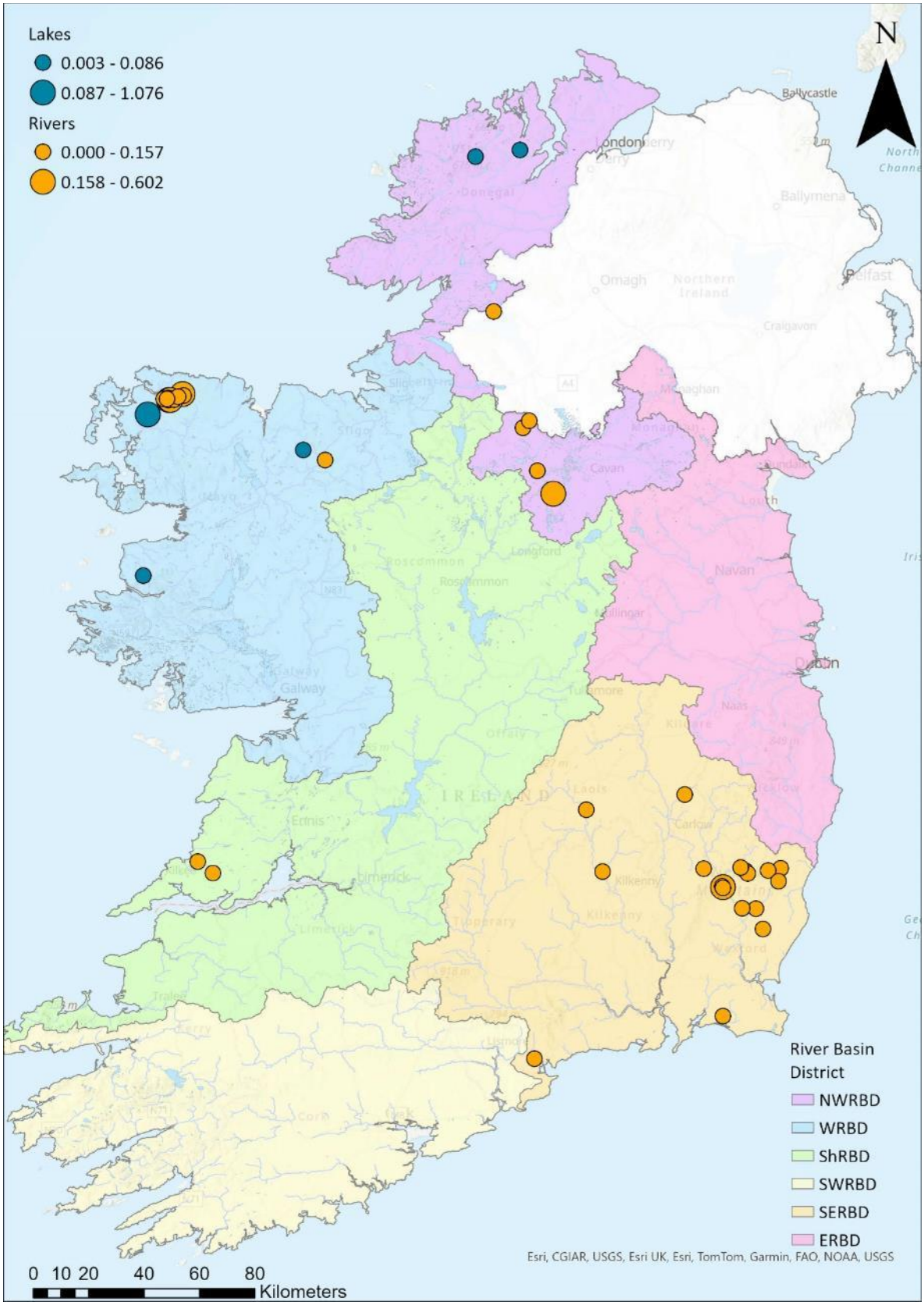


Figure 4.11. Three-spined stickleback distribution and abundance in lakes (CPUE (no. fish/m net)) and rivers (density (no. fish/m^2)) surveyed in 2023 (CPUE and density are not comparable).

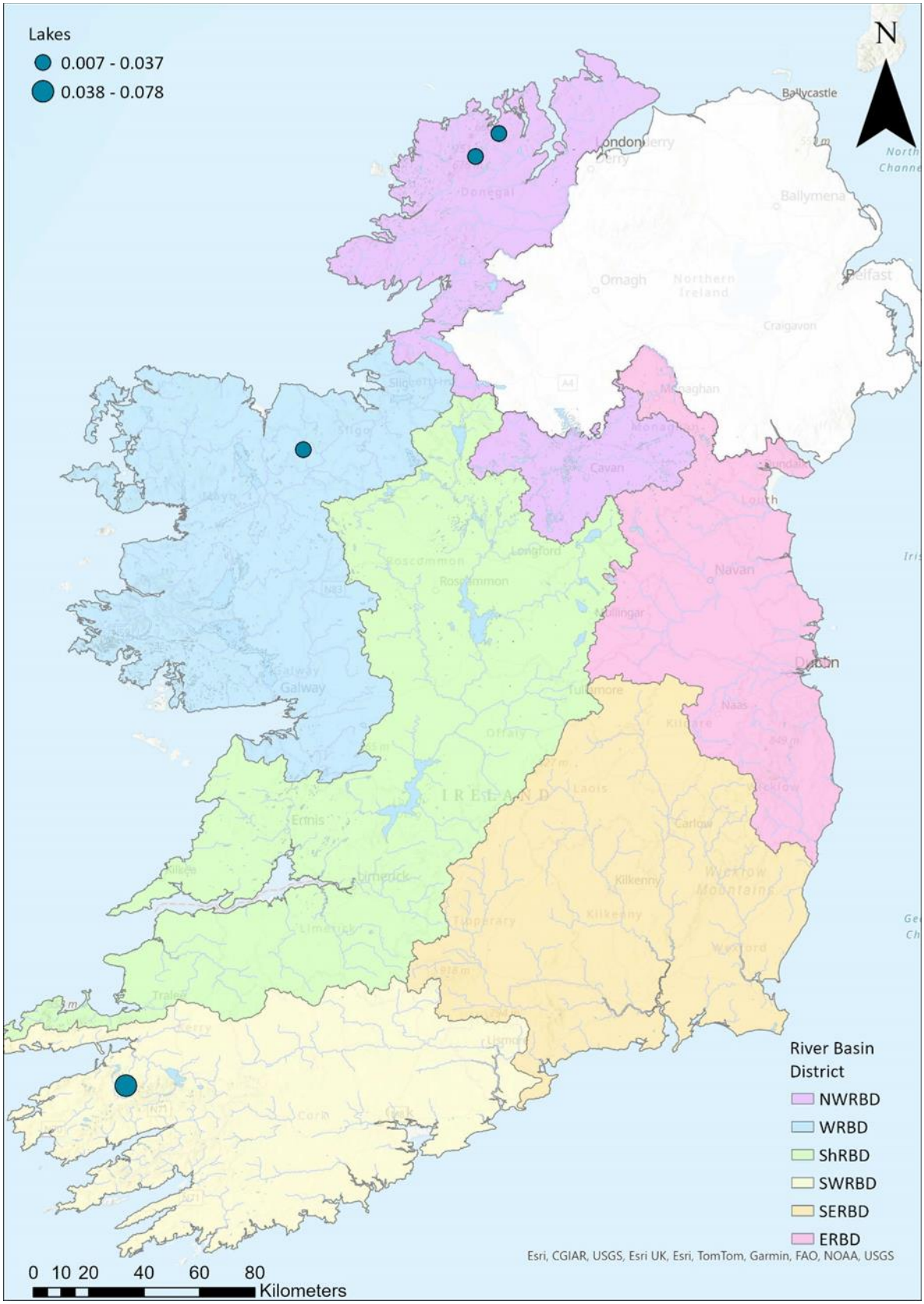


Figure 4.12. Arctic char distribution and abundance in lakes (CPUE (no. fish/m net)) surveyed in 2023.

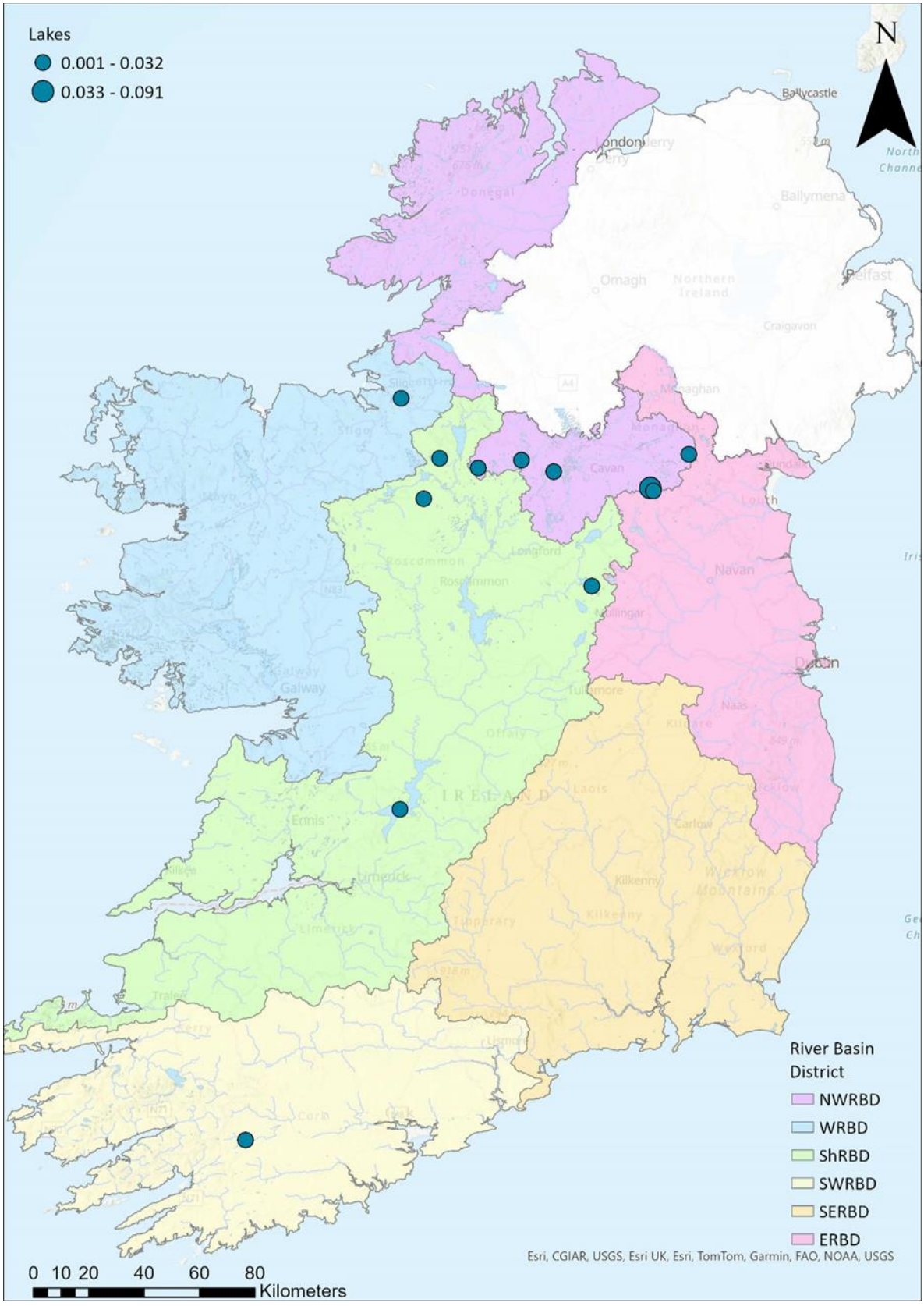


Figure 4.13. Bream distribution and abundance in lakes (CPUE (no. fish/m net)) surveyed in 2023.

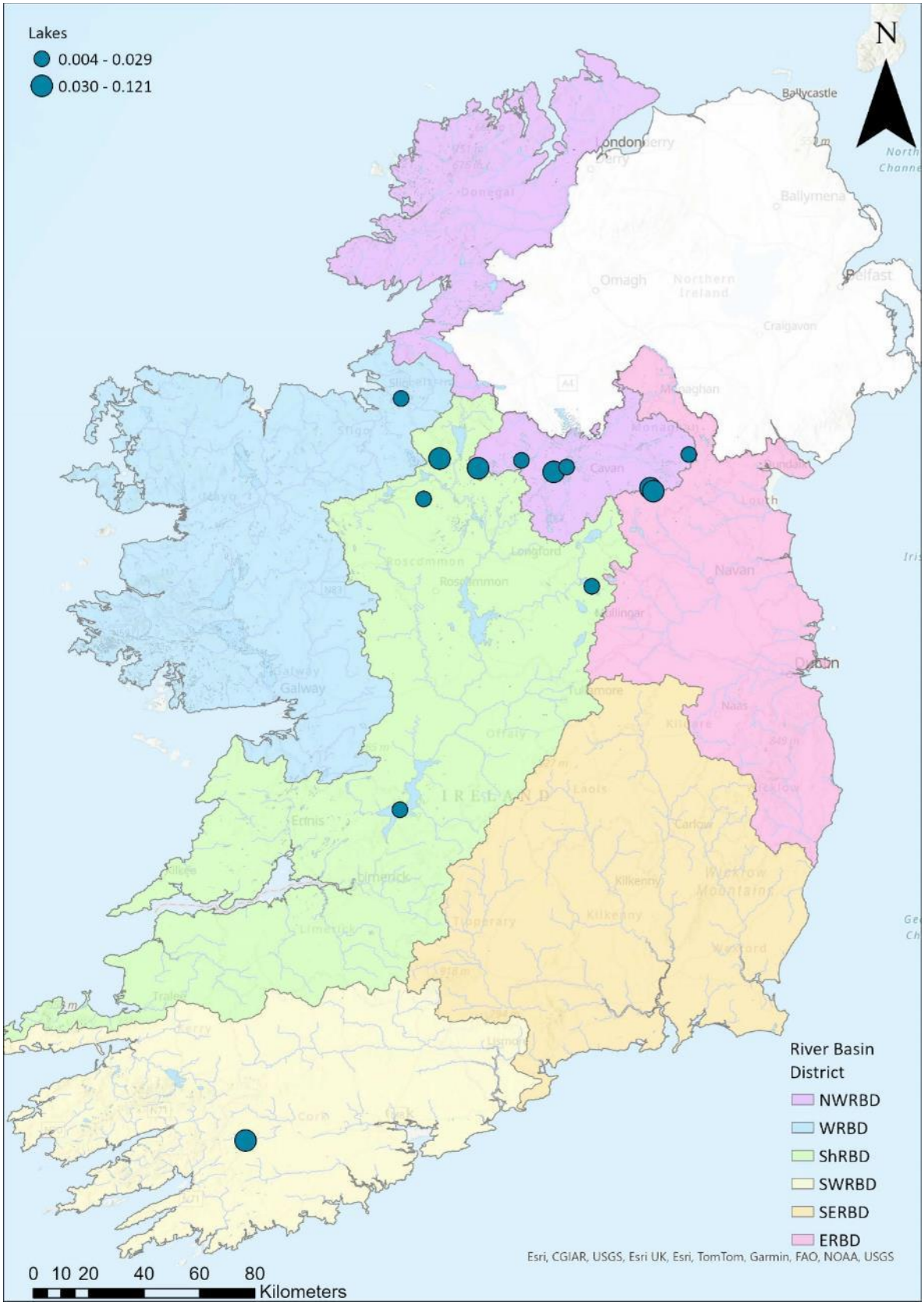


Figure 4.14. Roach X bream hybrid distribution and abundance in lakes (CPUE (no. fish/m net)) surveyed in 2023.

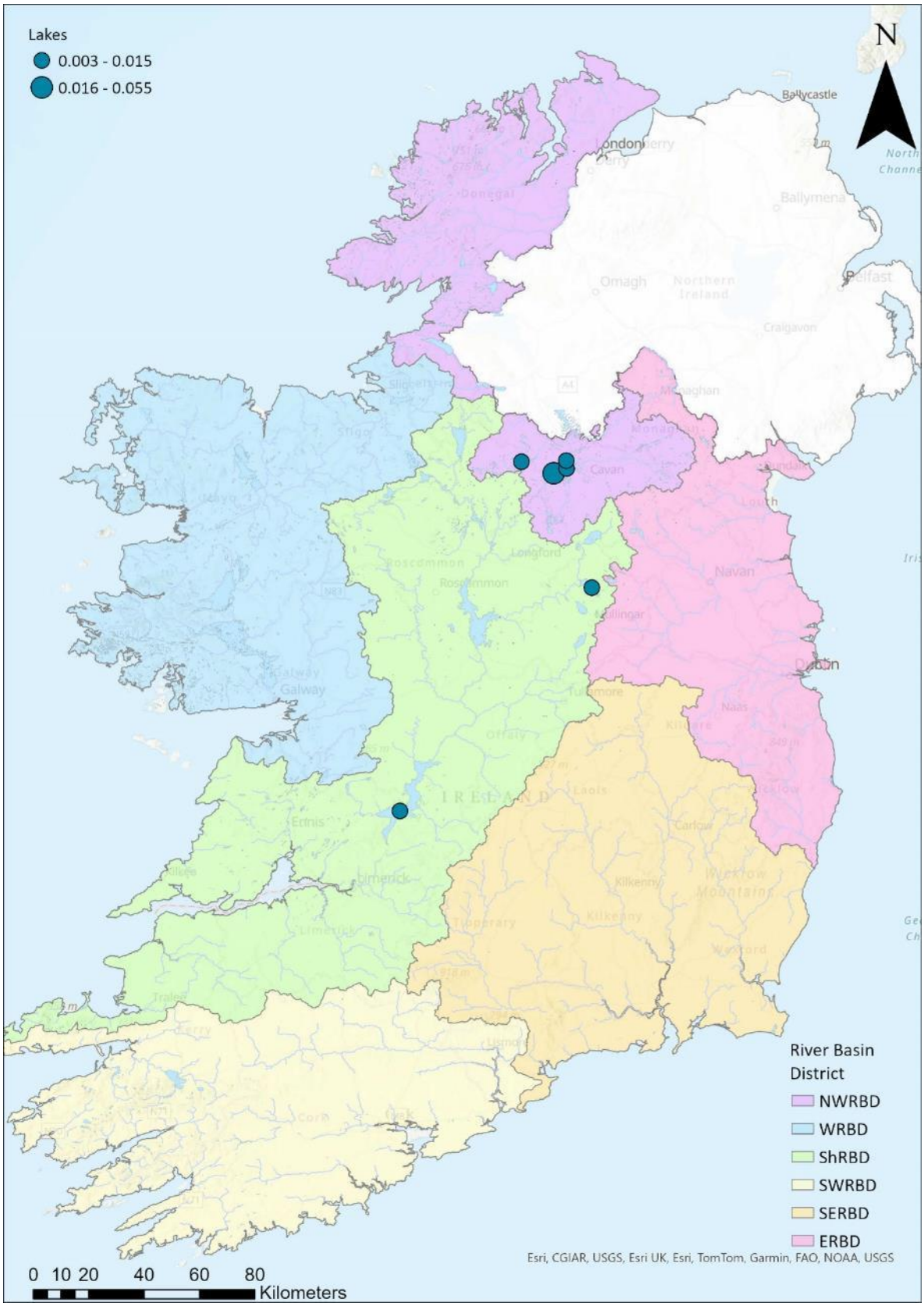


Figure 4.15. Tench distribution and abundance in lakes (CPUE (No. fish/m net)) surveyed in 2023.

4.2 Rivers

4.2.1 Fish species distribution and abundance

A total of 14 fish species (sea trout are counted as a separate "variety" of trout) and one cyprinid hybrid were recorded across the river sites surveyed in 2023 (Table 4.3). Brown trout had the widest distribution, occurring in 166 out of the 179 sites surveyed (92.7%), while salmon were recorded at 102 sites (57.0%) (Table 4.3).

Brown trout fry (0+) were recorded at 155 sites (86.6%), with 1+ and older individuals recorded at 154 sites (86.0%). Salmon fry (0+) were captured at 92 sites (51.4%) with 1+ and older individuals caught at 89 sites (49.7%).

Table 4.3. Fish species recorded in river sites surveyed in 2023 (age cohorts for brown trout and salmon are also shown).

	Scientific name	Common name	Number of river sites	% river sites
1	*Salmo trutta*	Brown trout (all age classes)	166	92.7
		Brown trout 0+	155	86.6
		Brown trout 1+ and older	154	86.0
2	*Salmo salar*	Salmon (all age classes)	102	57.0
		Salmon 0+	92	51.4
		Salmon 1+ and older	89	49.7
3	*Anguilla anguilla*	European eel	52	29.1
4	*Gasterosteus aculeatus*	Three-spined stickleback	36	20.1
5	*Barbatula barbatula*	Stone loach	30	16.8
6	*Phoxinus phoxinus*	Minnow	21	11.7
7	*Lampetra sp.*	Lamprey sp.	19	10.6
8	*Salmo trutta*	Sea trout*	13	7.3
9	*Rutilus rutilus*	Roach	10	5.6
10	*Perca fluviatillis*	Perch	9	5.0
11	*Gobio gobio*	Gudgeon	6	3.4
12	*Esox lucius*	Pike	4	2.2
13	*Platichthys flesus*	Flounder	2	1.1
14	*Leuciscus leuciscus*	Dace	2	1.1
15	*Rutilus rutilus* x *Abramis brama*	Roach X bream	1	0.6
16	*Tinca tinca*	Tench	1	0.6

*Note: *sea trout are counted as a separate "variety" of trout and not a species.*

The distribution and abundance of the most common fish species captured amongst all river sites surveyed in 2023 are shown in Figures 4.4 to 4.12 and 4.17 to 4.19. Abundance was recorded as minimum fish density (number of fish/m^2).

As well as being the widest ranging species, brown trout were also the most abundant captured in 2023 (Figure 4.5). Garraun bridge on the Boro River in the SERBD, had the highest density of trout recorded, with a density of 1.30 fish/m^2 recorded. This site also recorded the highest density of brown trout fry (0+) (1.01 fish/m^2). Bohadoon in the Colligan sub-catchment also in the SERBD, had the highest density of 1+ and older brown trout (0.78 fish/m^2).

Sea trout, a separate variety of brown trout, were recorded in low densities at 13 sites (Figure 4.6).

The highest density of salmon, 0.70 fish/m^2, was found at Knockbrack, on the River Feale in the ShRBD (Figure 4.4). This site also recorded the highest density of salmon fry (0+) (0.63 fish/m^2). The highest density of 1+ and older salmon (0.26 fish/m^2) was recorded at the Gortygeeheen site on the Doonbeg River in the ShRBD.

European eel were onserved in low abundances at 52 sites in 2023. The highest density recorded was 0.02 fish/m^2 at Glenamoy Village on the Glenamoy River in the WRBD (Figure 4.7).

Pollution tolerant species such as three-spined stickle back, stone loach and minnow, play a key role in identifying the status of water quality and fish ecological status. Three-spined stickleback recorded their highest density (0.60 fish/m^2) at Glencalry lower in the Glenamoy catchment in the WRBD (Figure 4.11). The highest density of stone loach, 0.21 fish/m^2 was found at Leggagh Southwest, on the Cullies River, in the NWRBD (Figure 4.17). The highest density of minnow, 0.21 fish/m^2 was found at the site Bridge Northeast of Blean House on the Greese River in the SERBD (Figure 4.16).

Lamprey (brook and river) are protected species under the EUs Habitats directive. The highest density for lamprey sp., was 0.02 fish/m^2, andfound at St Brendan's graveyard site on the Lask River in the Bann sub catchment, in the SERBD (Figure 4.18).

Roach (Figure 4.10), perch (Figure. 4.9) and pike (Figure 4.8) were captured at relatively few river sites. These species were captured predominantly at low gradient sites situated on the Cullies River in the NWRBD. Roach and perch were captured at seven sites on the Cullies River and pike were captured at three sites on this river. The highest density for all three species was recorded on the Cullies River at the site upstream of Bawn Lough. Roach had a highest density of 0.37 fish/m^2, perch a highest density of 0.09 fish/m^2 and pike a highest density of 0.05 fish/m^2.

In addition to the above, gudgeon were captured at six sites, with a highest density of (0.11 fish/m^2) recorded at the Bridge North of Kilbracken House on the Cullies River in the NWRBD. Dace were recorded in low numbers at two sites in SERBD. Flounder were captured at two sites, one in the SERBD and one in the ShRBD. One roach x bream hybrid was recorded at the bridge North of Kilbracken House on the Cullies River in the NWRBD. One tench was recorded at Fihoragh North on the Cullies River in the NWRBD.

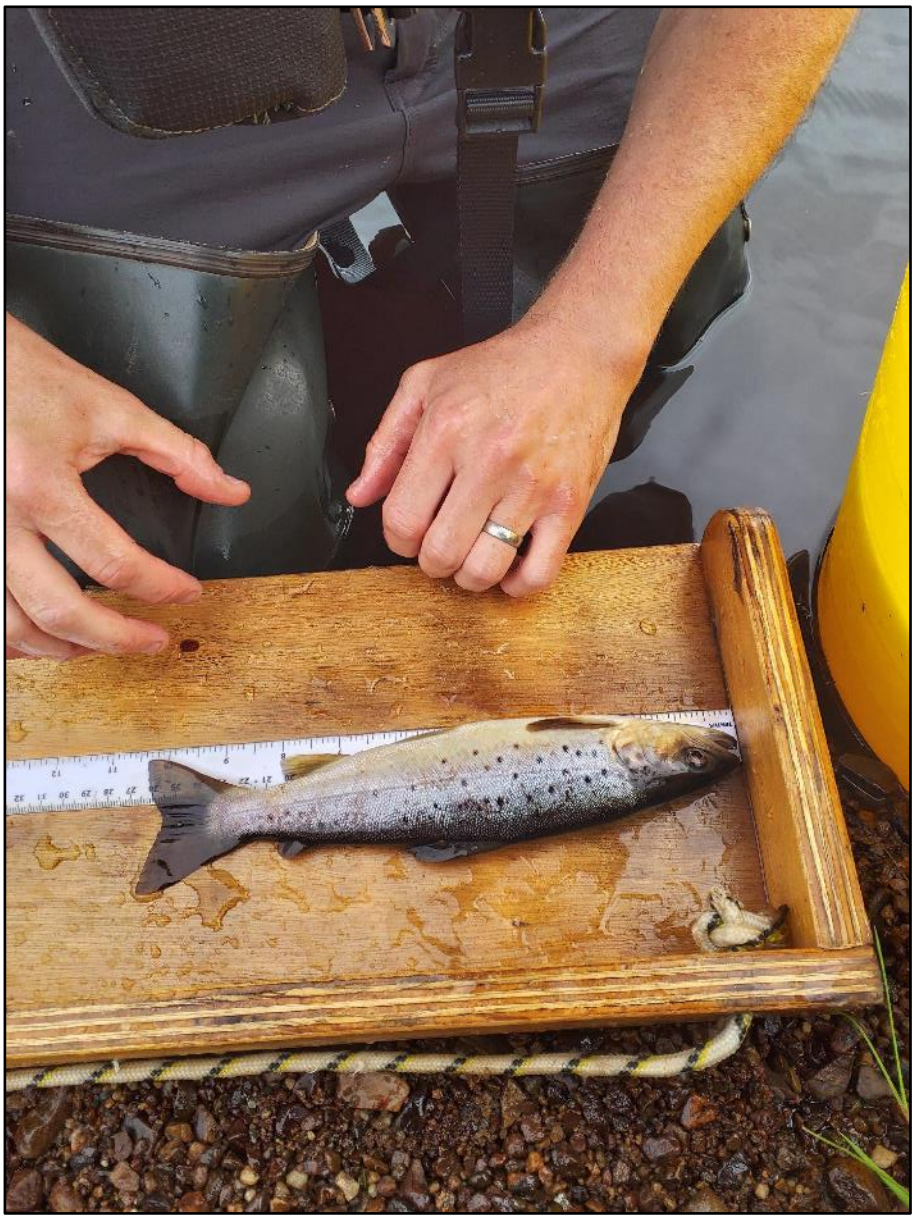


Plate 4.1. Measuring a brown trout prior to release into the Glenamoy River in Co. Mayo.

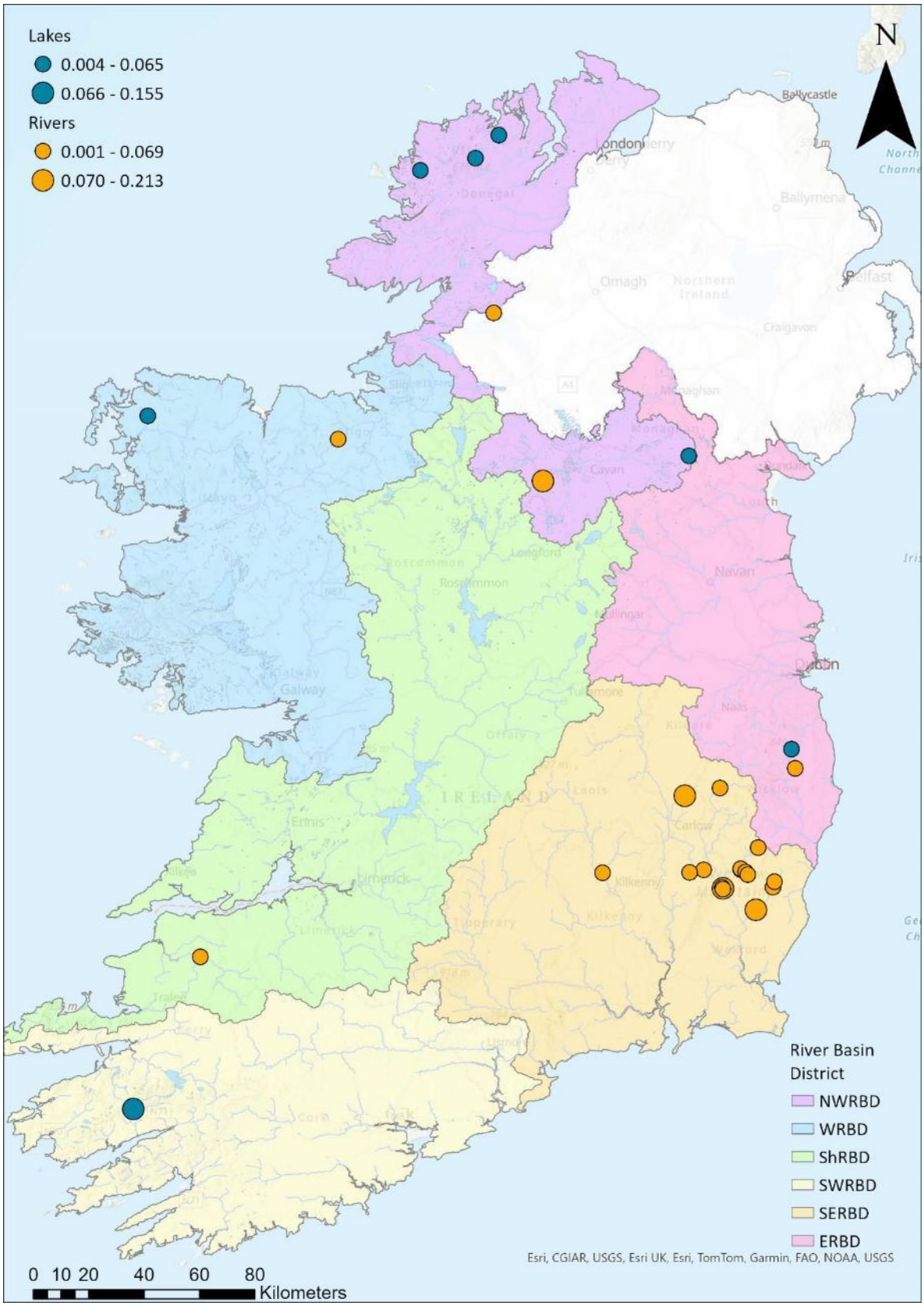


Figure 4.16. Minnow distribution and abundance in lakes (CPUE (no. fish/m net)) and rivers (density (no. fish/m2)) surveyed in 2023 (CPUE and density are not comparable).

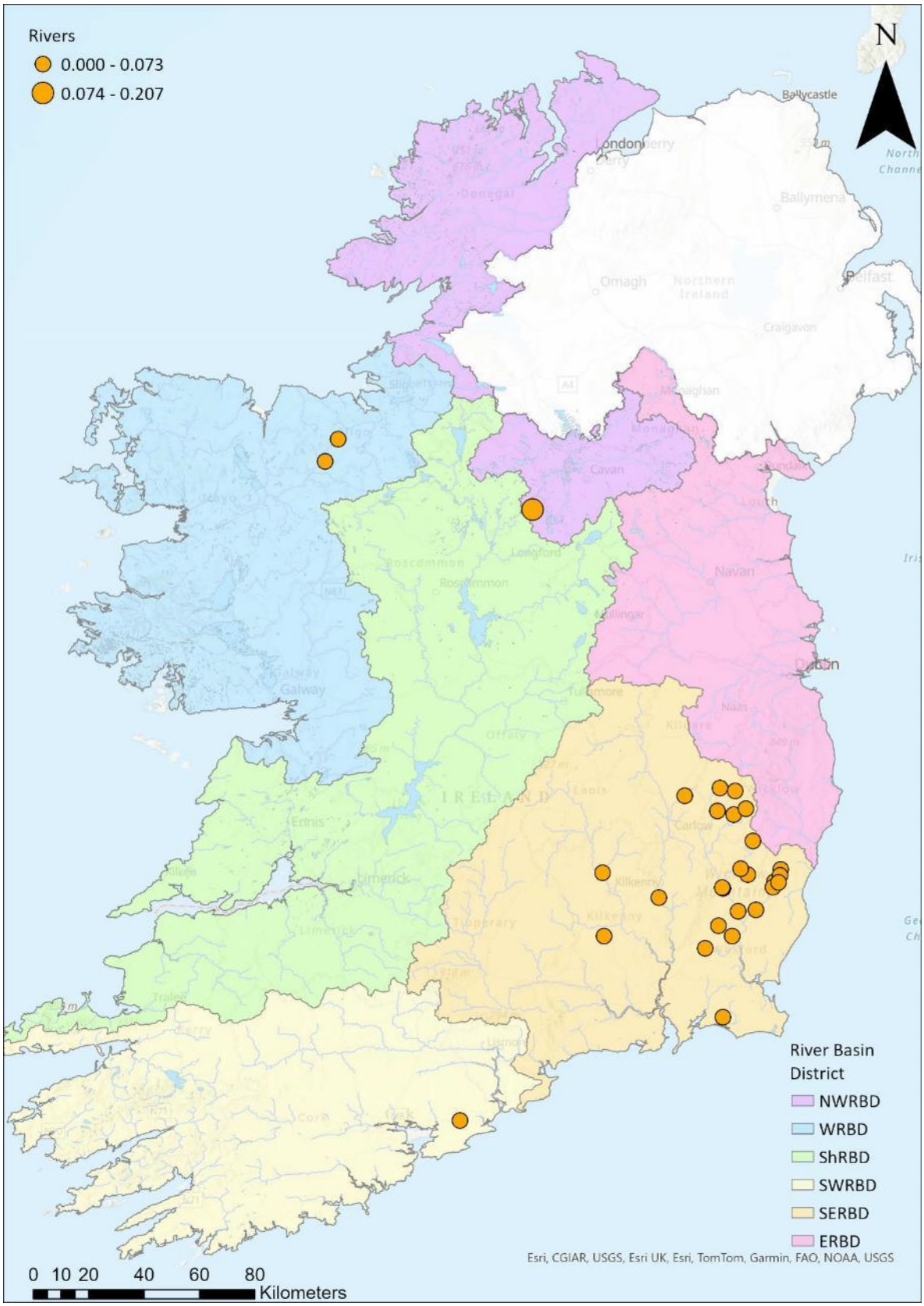


Figure 4.17. Stone loach distribution and abundance in rivers (density (no. fish/m^2)) surveyed in 2023.

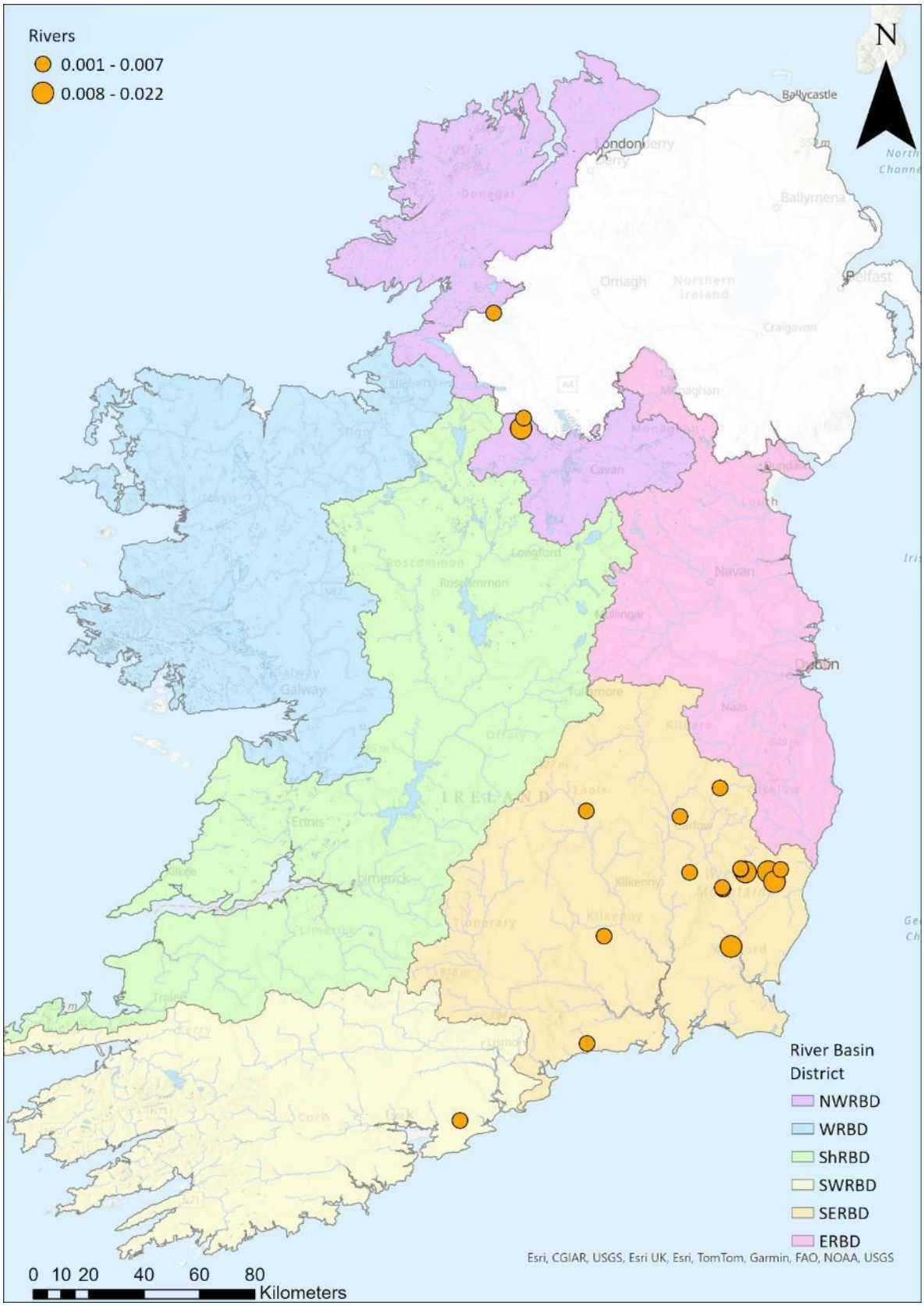


Figure 4.18. Lamprey sp. distribution and abundance in rivers (density (no. fish/m^2)) surveyed in 2023.

4.2.2 Fish ecological status in rivers

The FCS2-Ireland ecological classification tool was run on all 179 river sites surveyed in 2023, the results were then sense checked with expert opinion. In total, 170 sites were assigned a fish ecological status, while nine sites were unassigned. In total 17 river sites were classified as High ecological status, 53 as Good, 73 as Moderate, 23 as Poor and four as Bad (Table 4.4, Figures 4.19 and 4.23).

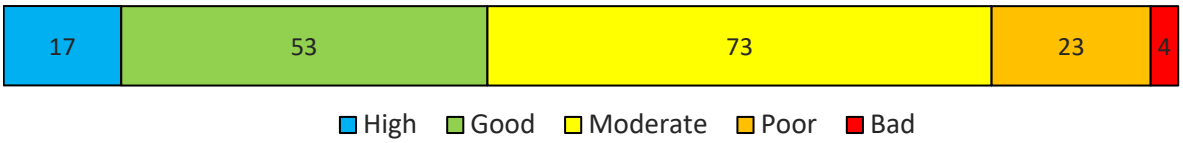


Figure 4.19. Fish ecological status for rivers surveyed in 2023.

Plate 4.2 Electrofishing on the Glenamong River Co. Mayo in the WRBD.

A total of 33 sites surveyed were surveillance monitoring (SM) sites. In total, 29 SM sites were assigned an ecological status and four sites were unassigned. Of the sites classified, seven were classified as having Good status (24.1%). The remaining 22 sites were classified as Moderate or Poor (75.9%). No SM sites were classified High or Bad in 2022 (Table 4.4; Figure 4.20).

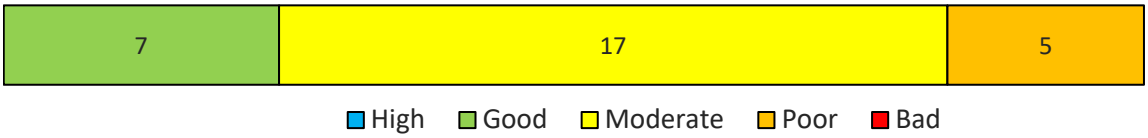


Figure 4.20. Fish ecological status for SM sites surveyed in 2023.

Of the 146 AV and SM/AV sites surveyed, 141 were assigned an ecological status with five sites left unassigned. In total 55 of the AV sites were assigned a status of High or Good (45.1%). The remaining 67 sites were assigned a status of Moderate or worse (54.9%) (Table 4.4; Figure 4.21).

Figure 4.21. Fish ecological status for AV and SM/AV sites surveyed in 2023.

Of the 170 sites assigned an ecological fish status in 2022, 41 sites had previously been surveyed and designated a status. Of these, the status of 20 (48.8%) sites remained the same between surveys, while 17 sites (41.5%) deteriorated, and four sites (9.7%) improved (Figure 4.22).

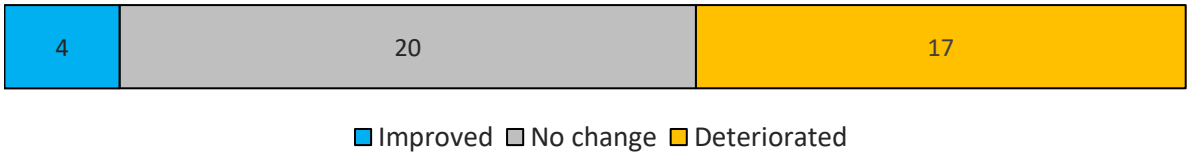


Figure 4.22. Trend in fish ecological status for river sites surveyed in 2023.

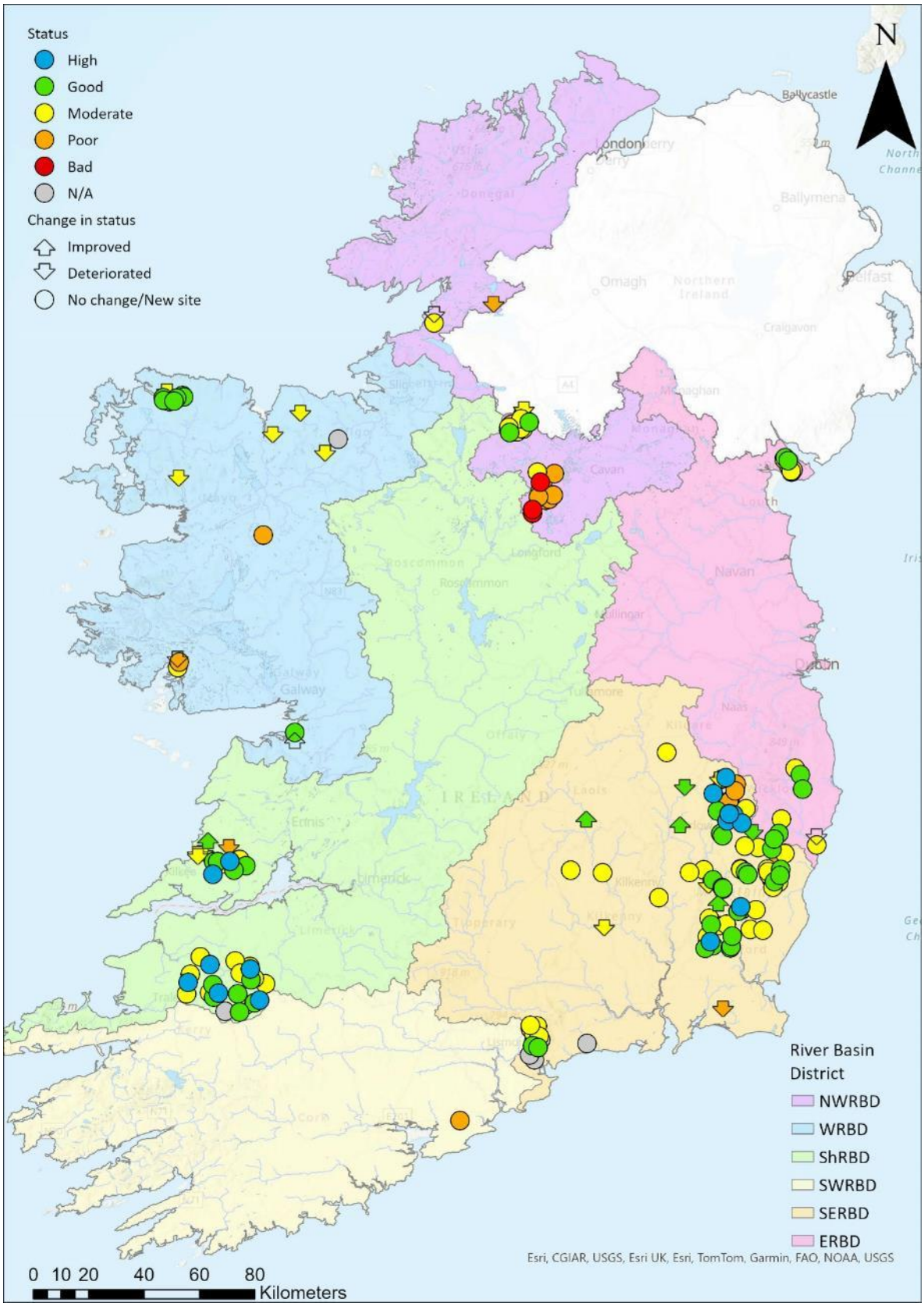


Figure 4.23 Ecological status of the 179 river sites surveyed during 2023 using the FCS2-Ireland ecological classification tool. (Note: Arrows indicate change in fish ecological status since previous survey).

Table 4.4. Summary details of rivers sites surveyed and fish ecological status 2023.

Sub Catchment	River	Site name	Survey type	Water body ID	Previous status	2023 Status
		ERBD				
Big (Louth)	Aghhameen	Killin	AV	NB_06_800	-	Moderate
	Big	Ballygoly Br.	SM	NB_06_642	M (2020)	Moderate
	Big	Ballygoly Southeast	SM/AV	NB_06_642	-	Moderate
	Big	Moneycrockroe_Northeast	SM/AV	NB_06_642	-	Good
	Big	Spellickanee	SM/AV	NB_06_642	-	Good
	Garden	Piedmont	AV	NB_06_818	-	Poor
	Moneycrockroe	Moneycrockroe	SM/AV	NB_06_642	-	Moderate
	Piedmont	Castletowncooley	AV	NB_06_697	-	Moderate
Avoca/Aughrim	Ballycreen	Macreddin Br.	AV	EA_10_131	-	Moderate
	Coolalug	Ballyday	AV	EA_10_1384	-	Good
	Derry	Kilpipe Br.	AV	EA_10_824	-	Good
	Derry	Mucklagh	AV	EA_10_1389	-	Good
Avoca/Avonmore	Ballinacorbeg	Ballinacorbeg	AV	EA_10_995	-	Moderate
	Garryduff	Montiagh East	AV	EA_10_1005	-	Good
	Moneystown	Castlekevin	AV	EA_10_492	-	Good
		SERBD				
Slaney & tributaries	Ballingale	Tombrack	AV	SE_12_955	-	High
	Douglas (Ballon)	Sragh Br.	SM	SE_12_789	M (2013)	Moderate
	Ballycarney	Ballycarney Br.	AV	SE_12_934	-	Good
	Ballycarney	Corah Br.	AV	SE_12_934	-	Moderate
	Boley Carrigeen	Colvinstown	AV	SE_12_1728	-	Poor
	Boley Carrigeen	Mountneill Br.	AV	SE_12_2200	-	Good
	Carrig	Carrig Mountain	AV	SE_12_1728	-	Poor
	Corbally	Ballincash Br.	AV	SE_12_2085	-	Moderate
	Drumderry	Carnew Rd.	AV	SE_12_924	-	Good
	Garryfelim	Annaghfinn North	AV	SE_12_2075	-	Moderate
	Kidavin	Ballyfinvalley	AV	SE_12_968	-	Good
	Slaney	Ballinclea Br	AV	SE_12_1524	-	Poor
	Carrigower	Ballylion Lower	AV	SE_12_1535	-	Poor
	Slaney	Bunclody Golf Course	SM/AV	SE_12_924	-	Good
	Slaney	Bunclody	SM	SE_12_2098	G (2014)	N/A
	Brook	Donard Lower	AV	SE_12_825	-	High
	Slaney	Waterloo Br.	SM	SE_12_1524	G (2013)	Moderate
	East Spinans	Tuckmill Lower	AV	SE_12_1728	-	High
Slaney/Little	Little Slaney	Rostyduff Br.	AV	SE_12_2506	-	Poor
Slaney/Bann	Lask	Ballinacoola	AV	SE_12_415	-	Good
	Lask	Crannford Br.	AV	SE_12_415	-	Moderate
	Lask	Knockbrandon Upper	AV	SE_12_415	-	Moderate
	Lask	Monaseed	AV	SE_12_415	-	Moderate
	Lask	St Brendan's Graveyard	AV	SE_12_415	-	Moderate
	Bann	Glandoran Upper	AV	SE_12_921	-	Moderate

Table 4.4 contd. Summary details of rivers sites surveyed and fish ecological status 2023.

Sub Catchment	River	Site name	Survey type	Water body ID	Previous status	2023 Status
		SERBD				
Slaney/Bann	Bann	Grovemill	AV	SE_12_921	-	Good
	Bann	Island Br.	AV	SE_12_921	-	Moderate
	Bann	Kilmichael Br.	AV	SE_12_921	-	Good
	Bann	Milltown Br.	AV	SE_12_921	-	Moderate
	Bann	Pallis Br.	AV	SE_12_332	-	Poor
	Bann	Tinnabaum	AV	SE_12_332	-	Moderate
Slaney/Boro	Aughathlappa	Cloughmills	AV	SE_12_183	-	Good
	Boro	Aughnappul Br.	AV	SE_12_2601	-	Good
	Boro	Garraun Lower	AV	SE_12_581	-	Poor
	Killeen	Garraun Br.	AV	SE_12_868	-	High
	Killeen	Killeen Br.	AV	SE_12_868	-	Moderate
	Templescoby	Garr Br.	AV	SE_12_2601	-	Good
	Townamulloge	Ballyboro	AV	SE_12_795	-	Good
Slaney/Clody	Clody	Ford (Br.) 3km u/s Bunclody	SM	SE_12_2098	M (2008)	Good
	Clody	Kelly's Quarter	AV	SE_12_2098	G (2020)	Moderate
Slaney/Derreen	Ballykillduff Upper	Carrarea	AV	SE_12_1814	-	Good
	Clonmore	Knockballystine Br.	AV	SE_12_1836	-	Good
	Derreen	Rathcoyle Br.	AV	SE_12_2405	-	Moderate
	Douglas (Kiltegan)	Crossnacole	AV	SE_12_1509	-	High
	Douglas (Kiltegan)	Tinnaclash	AV	SE_12_1509	-	High
	Douglas (Kiltegan)	Lucas Br.	AV	SE_12_1509	-	High
	Knockananna	Scotland Br.	AV	SE_12_1686	-	High
	Douglas (Kilteagan)	Borkillbeg	AV	SE_12_1509	-	High
	Douglas (Kiltegan)	St Teagan's Hall	AV	SE_12_1509	-	High
Slaney/Derry	Derry	Balisland Br.	SM	SE_12_2095	M (2014)	Moderate
	Derry	Curravanish	AV	SE_12_1442	H (2020)	Good
	Derry	Ballingate Br.	AV	SE_12_1567	-	Moderate
	Derry	Cronyhorn Br.	AV	SE_12_1567	-	Good
	Derry	Muskeagh	AV	SE_12_1230	-	Moderate
	Mine	Tombreane Br.	AV	SE_12_1817	-	Good
	Rosnastraw	Kilcommon Br.	AV	SE_12_781	M (2020)	Moderate
Slaney/Urrin	Urrin	Buck's Br.	SM	SE_12_2605	G (2020)	Good
	Urrin	Mangan Lane	AV	SE_12_2605	M (2017)	Moderate
	Urrin	Mocurry Br.	SM/AV	SE_12_2117	-	Moderate
	Urrin	Verona Br.	AV	SE_12_2605	-	Good
	Pullinstown	Ballinure	AV	SE_12_544	-	Moderate
Duncormick	Duncormick	(W) Br. nr Duncormick Rly St.	SM	SE_13_745	M (2014)	Poor
Barrow/Burren	Burren	Ullard Br.	SM	SE_14_1781	M (2015)	Moderate
Barrow/Gowran	Gowran	Br. N of Goresbridge (S Channel)	SM	SE_14_1879	M (2020)	Moderate
Barrow/Greese	Greese	Br. NE of Belan House	SM	SE_14_946	H (2015)	Good
Barrow/Lerr	Lerr	Prumplestown Br.	SM	SE_14_157	P (2020)	Good
Barrow/Tully	Tully Stream	Soomeragh Br.	SM	SE_14_842	M (2020)	Moderate

Table 4.4 contd. Summary details of rivers sites surveyed and fish ecological status 2023.

Sub Catchment	River	Site name	Survey type	Water body ID	Previous status	2023 Status
		SERBD				
Nore/Ballyroan	Ballyroan	Gloreen Br.	SM	SE_15_1938	M (2020)	Good
Nore/Dinin	Dinin	Dinin Br.	SM	SE_15_1955	M (2021)	Moderate
Nore/Glory	Glory	Br. E of Raheen	SM	SE_15_1870	G (2020)	Moderate
Nore/Nuenna	Nuenna	Br. d/s Clomantagh	SM	SE_15_1029	M (2020)	Moderate
Colligan	Araglin	Coumeraglin Mountain	SM/AV	SE_17_735	-	N/A
	Araglin	u/s Coum Br.	AV	SE_17_735	M (2017)	Moderate
	Colligan	Br. nr Killadangan	SM	SE_17_832	G (2017)	N/A
	Colligan	Colliganwood	SM/AV	SE_17_832	G (2017)	N/A
	Colligan	Glennaneane	AV	SE_17_479	M (2017)	Moderate
	Colligan	Lackandara Br.	SM	SE_17_832	H (2017)	N/A
	Glendermot	Bohadoon	AV	SE_17_446	-	Good
	Glendermot	Coolnasmear Upper	AV	SE_17_446	-	Moderate
	Knockanpower	Knockanpower Lower	AV	SE_17_832	G (2017)	Good
	Reandampaun	Lagg Br.	AV	SE_17_697	M (2017)	Moderate
	Reandampaun	Scart Br.	AV	SE_17_697	M (2017)	Moderate
	Skeheens	Skeehans Br.	AV	SE_17_696	-	Moderate
Mahon	Mahon	Seafield House	SM	SE_17_825	G (2014)	N/A
		SWRBD				
Womanagh	Womanagh	Br. u/s of Castlemartyr	SM	SW_19_1909	-	Poor
		ShRBD				
Feale/Allaghaun	Eeghaun	Ballymurragh West	AV	SH_23_1984	-	Moderate
	Allaghaun	Cleanglass East	AV	SH_23_995	-	Moderate
	Allaghaun trib.	Knocknadiha	AV	SH_23_1729	-	Good
	Ballymurragh East	Rathcahill West	AV	SH_23_1590	-	High
	Allaghaun	Tour Br.	AV	SH_23_1729	-	Moderate
	Eeghaun	Tulligoline	AV	SH_23_2055	-	Moderate
Feale & tributaries	Feale	Barrys Br.	AV	SH_23_1828	-	High
	Islandboy	Glashamore Br.	AV	SH_23_2130	-	High
	Feale	Knockaclarig Br.	AV	SH_23_510	-	Moderate
	Glashacooncore	Knockbrack	AV	SH_23_1010	-	High
	Caher	Mountcollins	AV	SH_23_2012	-	Good
	Glenfariff	Mount Eagle	AV	SH_23_1769	-	N/A
	Knockahorrea East	Rockchapel	AV	SH_23_111	-	Good
	Breanagh	Tooreenfineen	AV	SH_23_166	-	Good
	Oolagh	Crataloe	AV	SH_23_114	-	Moderate
Feale/Owveg	Cloghboola	Glena Br.	AV	SH_23_131	-	Good
	Owveg	Owveg Br.	SM	SH_23_1743	G (2012)	Good
	Tullaleague	Talbots Br.	AV	SH_23_2107	-	Moderate
Feale/Smearlagh	Patch	Glanaderhig	SM/AV	SH_23_2280	-	Moderate
	Smearlagh	Kennellys Br.	SM/AV	SH_23_373	-	Moderate
	Lyracrumpane	Lyracrumpane	AV	SH_23_2832	-	High
	Smearlagh	Reanagowan	AV	SH_23_1718	-	Moderate

Table 4.4 contd. Summary details of rivers sites surveyed and fish ecological status 2023.

Sub catchment	River	Site name	Survey type	Water body ID	Previous status	2023 Status
		ShRBD				
Annagh	Glendine	Knockloskeraun Br. S of M	SM	SH_28_231	M (2020)	Good
Creegh	Glenmore	Clonigulane	SM/AV	SH_28_709	-	High
	Kiltumper	Cahermurphy Br.	SM/AV	SH_28_709	-	Moderate
	Creegh	Clooneenagh	SM/AV	SH_28_709	G (2017)	Good
	Creegh	Cloonwhite Mound	SM/AV	SH_28_709	G (2017)	Good
	Creegh	Cragnashingaun	AV	SH_28_709	M (2017)	Poor
	Creegh	Creegh Br.	SM	SH_28_709	G (2017)	Moderate
	Creegh	Drumellihy Br.	SM	SH_28_709	G (2017)	Moderate
	Ballynagun West	Drumellihy North	SM/AV	SH_28_709	G (2017)	Moderate
Doonbeg	Kilmihil	Clooncullin	AV	SH_28_718	-	High
	Greygrove	Gortygeeheen	AV	SH_28_733	-	Good
	Doonbeg	Knockalough Br	AV	SH_28_733	-	Good
	Doonbeg	Sorrel Island Br.	AV	SH_28_709	-	Moderate
		WRBD				
Glennamong	Glennamong River	Br. u/s Lough Feeagh	SM	WE_32_2441	G (2015)	Moderate
Glenamoy	Barooskey	Sharanaploge	AV	WE_33_1882	-	Good
	Bellagelly North	Bunowna	SM/AV	WE_33_3238	-	Good
	Bellagelly South	Milltown West	SM/AV	WE_33_431	-	Good
	Gortleatilla	Gorthlettilaun	AV	WE_33_2798	-	Good
	Leanrevagh east	Bunalty	SM/AV	WE_33_3238	-	Good
	Leanrevagh West	Glenamoy Br. Field	SM/AV	WE_33_1894	-	Moderate
	Leanrevagh West	Milltown Field	SM/AV	WE_33_431	-	Good
	Pollboy	Pollboy	SM/AV	WE_33_1246	-	Poor
	Rathavisteen	Glencalry Lower	AV	WE_33_419	-	Good
	Glenamoy	Glenamoy Village	SM	WE_33_3238	G (2012)	Moderate
	Glenamoy	Glencalry Upper Schoolhouse	AV	WE_33_2146	-	Good
	Glenamoy	Gorthlettilaun East	AV	WE_33_1880	-	Moderate
Moy/Glenree	Black	Behy Br.	SM	WE_34_3999	G (2020)	Moderate
Moy/Loughnaminoo	Loughnaminoo	Balla Br. on Castlebar Road	SM	WE_34_1731	-	Poor
Moy	Moy	Cloonbaniff Br.	SM	WE_34_3035	G (2016)	N/A
Moy/Tobercurry	Tobercurry	Br. just u/s Moy River	SM	WE_34_2633	G (2020)	Moderate
Gowlan	Gowlan	Track west of Lough Black	SM	WE_35_1187	G (2012)	Moderate
		NWRBD				
Erne/Cullies	Cullies	Br. nr Kilbrackan House	SM	NW_36_2032	P (2016)	Poor
	Cullies	D/s of Garty Lough	AV	NW_36_477	-	Poor
	Cullies	D/s of Gulladoo Lough	AV	NW_36_2032	-	Poor
	Laheen	Drumleevan	AV	NW_36_268	-	Moderate
	Cullies	Drumshinny	AV	NW_36_149	-	Poor
	Cullies	Drumyouth Mass Rock	AV	NW_36_149	-	Poor
	Cullies	Fihoragh North	AV	NW_36_1455	-	Poor
	Leggagh	Leggagh Southwest	AV	NW_36_1978	-	Bad

Table 4.4 contd. Summary details of rivers sites surveyed and fish ecological status 2023.

Sub catchment	River	Site name	Survey type	Water body ID	Previous status	2023 Status
		NWRBD				
	Killytawny	U/s of Bawn Lough	AV	NW_36_188	-	Poor
	Aghamore Lower	Aghamore Lower	AV	NW_36_1978	-	Bad
	Drumsillagh	Drumsillagh Lane	SM/AV	NW_36_2032	-	Bad
	Drumsillagh	Drumsillagh Gate	SM/AV	NW_36_2032	-	Bad
Erne/Swanlinbar	Altateskin	Altateskin	AV	NW_36_1161	-	Good
	Alteen	Gorteennaglogh	SM/AV	NW_36_18	-	Moderate
	Claddagh	Tullydermot West	AV	NW_36_18	-	Poor
	Gortacashel	Drumersee	AV	GBNI1NW363602015	-	Good
	Gortmore	Derrynacreeve	AV	NW_36_1161	-	Moderate
	Hawkswood	Corranearty	AV	GBNI1NW363602015	-	Poor
	Legnadirk	Legnadirk	AV	NW_36_1438	-	Moderate
	Owensallagh	Altachullion Upper	AV	NW_36_1438	-	Moderate
	Owensallagh	Corraclassy New Br.	AV	NW_36_1161	-	Moderate
	Owensallagh	Drumcar East	AV	NW_36_1161	-	Moderate
	Swanlinbar	Furnaceland	SM/AV	NW_36_18	-	Moderate
	Swanlinbar	Swanlinbar Br. (Carpark)	SM	NW_36_18	G (2014)	Moderate
	Blackwater	Altbrean	AV	NW_36_1438	-	N/A
Erne/Waterfoot	Waterfoot	Letter Br.	SM	NW_36_2415	G (2016)	Poor

4.3 Transitional waters

4.3.1 Fish species richness and distribution

Species richness, the number of species captured, is often used as an indicator of the health of transitional water bodies. A total of 36 different species were captured across the five transitional waterbodies surveyed in 2023 (Table 4.5). Species richness ranged from five species in Loch an tSáile Lagoon to 22 species in Kinvara Bay (Figure 4.24).

Four species, sand goby, thick lipped mullet, three-spined stickleback and European eel were the most widely distributed species, recorded in four of the five waterbodies. Table 4.5 shows the most abundant species in each waterbody.

4.3.2 Transitional water ecological status classification

All five transitional waters surveyed during 2023 were assigned a fish ecological status class using the Estuarine Multimetric Fish Index (EMFI) ecological classification tool (Harrison and Kelly, 2013), together with expert opinion.

One site was assigned a fish ecological status of Good, three sites surveyed in were assigned a status of Moderate and one site assigned Poor (Table 4.5, Figures 4.25 and 4.27).

All five sites had previously been surveyed and assigned a fish ecological status. Four of the sites deteriorated in status between surveys, one site Kinvarra Bay, increased in status (Table 4.5, Figures 4.26 and 4.27).

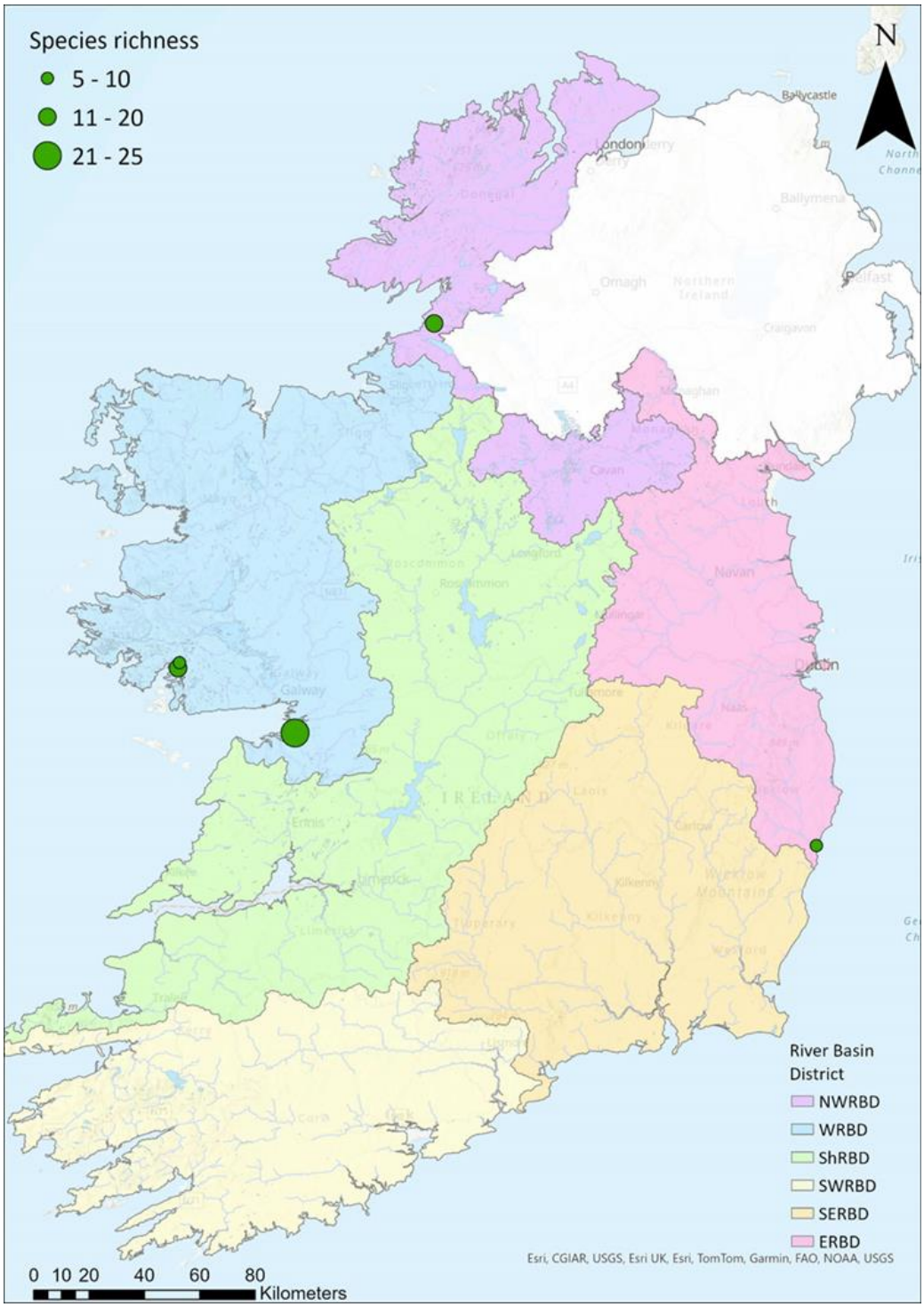


Figure 4.24. Species richness recorded at the five transitional waterbodies surveyed in 2023.

Table 4.5 Species richness and fish ecological status of transitional waters surveyed in 2023.

Water body	WFD Code	Survey type	SR	Dominant species		Previous Status	2022 status
				Scientific name	Common name		
WRBD							
Kinvarra Bay	WE 160 0100	SM	22	*Chelon labrosus*	Thick lipped grey mullet	M (2018)	Good
Camus bay	WE200 0200	SM	18	*Atherina presbyter*	Sand smelt	G (2015)	Moderate
Loch an tSaile	WE 200 1100	SM	5	*Gasterosteus aculeatus*	Three-spined stickleback	M (2008)	Poor
NWRBD							
Erne Estuary	NW 030 0100	SM	12	*Pomatoschistus minutus*	Sand goby	G (2018)	Moderate
ERBD							
Avoca Estuary	EA 150 0100	SM	8	*Chelon labrosus*	Thick-lipped grey mullet	G (2020)	Moderate

***Note**: *In 2008, The Transitional Fish Classification Index or TFCI, was used to calculate and report fish ecological status for transitional waters.*

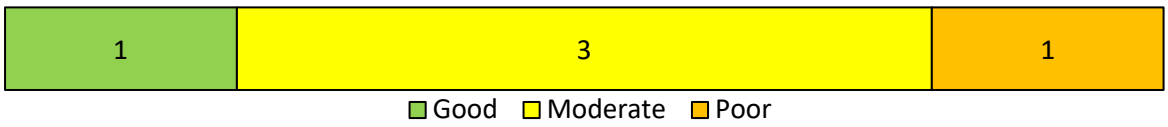


Figure 4.25. Fish ecological status for transitional waters surveyed in 2023.

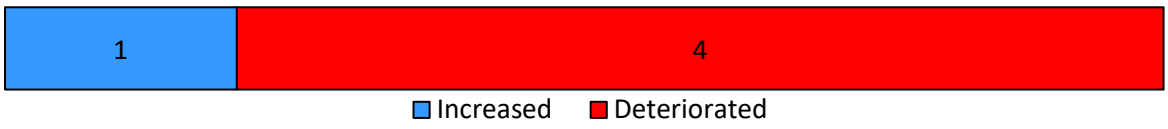


Figure 4.26. Change in fish ecological status for transitional waters surveyed in 2023.

Figure 4.27. Ecological status of the five transitional waterbodies surveyed in 2023.

5. DISCUSSION

5.1 Lakes

A total of 14 fish species and two cyprinid hybrids were recorded across the lakes surveyed during 2023. European eel was the most widely distributed species recorded, occurring in 25 lakes. Perch was the most abundant species, dominating catches in 13 of the 17 lakes where they were recorded.

Fifteen lakes (56%) were assigned a fish ecological status of High or Good in 2023. Twelve (44%) were assigned a status of Moderate or worse. Of the 12 lakes with a status of Moderate or worse, the most likely reason for this failure, was either a low abundance of type specific indicator species (species intolerant to pollution) such as brown trout, or a relatively high abundance and biomass of pollution tolerant fish species such as roach. Perch, roach and related cyprinids are more tolerant of low water quality and increased temperatures to varying degrees compared to type specific indicator species, such as brown trout and Arctic char and can proliferate when water conditions deteriorate.

When compared to previous surveys, the ecological status of 12 lakes showed no change, while eight lakes improved, and seven lakes deteriorated. Therefore there was no significant improvement in fish ecological status of lakes surveyed in 2023. Similar to the EPA findings, any improvements were largely negated by the deteriorations (EPA, 2024). Lakes falling below the required standard of Good status were mainly located in the north midlands, i.e. Loughs Bawn, Corglass, Derravaragh, Derrybrick, Drumkeery, Meelagh, Scur and Skeagh Upper), with the exception of one lake in County Donegal (Lough Fern), one in County Cork (Lough Allua) and one in County Sligo (Lough Gill).

The EPA (2021b) reported on a range of other ecological indicators in lakes, including phytoplankton, macrophyte and phytobenthos. For all 12 lakes assigned a Moderate or worse fish ecological status in 2023, the three ecological indicators assessed by the EPA were examined. In four lakes, Loughs Meelagh, Derravaragh, Allua and Derrybrick Lough, fish was the only biological element causing the failure, as all other ecological indicators were assigned a status of Good or higher. In addition to fish, two lakes, Lough Bawn and Corglass Lough failed macrophyte status. Four lakes failed three ecological indicators including fish status. Lough Scur and Drumkeery were assigned Moderate or worse for phytoplankton and macrophyte status and were assigned Poor and Moderate fish ecological status respectively. Lough Fern and Lough Gill were assigned Moderate or worse for macrophyte and phytobenthos status and achieved a fish ecological status of poor and moderate respectively. Two lakes Loughs Skeagh and Egish were assigned moderate or worse status for three indicators (phytoplankton, macrophyte and macrobenthos), while the assigned fish status was Bad for both (EPA 2021b).

The fish ecological status of Lough Brin improved from Good to High; this was likely due an increase in type specific indicator species, i.e. brown trout. Lough Derg improved from Moderate to Good status. This was probably due to a decreased abundance of pollution tolerant fish species (i.e. cyprinids) and an increased abundance of type specific indicator species i.e. brown trout. Fish ecological status in Lough Derravaragh (Poor to Moderate), Lough Garadice (Moderate to Good), Cavetown Lough (Moderate to Good) and Corglass Lough (Bad to Poor) improved between surveys. There was a decrease in pollution and warm water tolerant, cyprinid species in all four lakes, which likely accounted for this improvement. Lough Fern improved in status from Bad to Poor. This slight improvement was driven by a reduction in the perch population in this lake. These changes in fish ecological status may be an indication that water quality is improving in these lakes.

In Lough Bawn, Lough Meelagh, Lough Gill and Derrybrick Lough, the observed deterioration in fish ecological status is likely to be driven by an increase in the biomass of pollution and warm water tolerant fish species (i.e. cyprinids, particularly roach, tench and bream). Lough Skeagh decreased from Poor status to Bad status. This continued deterioration in status was facilitated by a further decrease in the biomass of type specific indicator species, with the endangered European eel abundance and biomass having dropped since the previous survey. Lough Caragh, which had previously been assigned High status dropped to Good status. The presence of rudd, which was recorded by IFI for the first time in this lake in 2023 (McLoone *et al*., 2024), was a likely factor contributing to this deterioration.

5.2 Rivers

A total of 14 fish species and one cyprinid hybrid variety were recorded across the river sites surveyed during 2023. Brown trout was the most widely distributed species, occurring at 92.7% of all sites surveyed. Salmon were less widely distributed, occurring at 57.0 % of sites.

Overall, 170 of the 179 river sites that were surveyed during 2023 were assigned a fish ecological status. Of the 170 sites classified, 70 sites (41%) were classified as having High or Good fish ecological status and the remaining 100 (59%) sites failed to meet this standard. Failures in fish ecological status were spread across the catchments surveyed in 2023 but were common in the north midlands and southeast where the EPA has indicated that there are nutrient pollution pressures from agriculture and wastewater and also hydromorphological pressures (EPA, 2024).

Only 25% of sites achieved a fish ecological status of high or good in the Big River, County Louth (ERBD) and the remaining 75% failed to meet the required standard of Good (Matson *et al*., 2024a). In the Creegh (Matson *et al*., 2024b.) and Doonbeg (Matson et al., 2024c) catchments in the ShRBD, 38% and

75% respectively of sites surveyed were assigned high or Good fish ecological status. No sites surveyed in the Cullies Catchment (NWRBD) achieved the required standard of Good fish ecological status and no improvements were observed (Matson *et al*., 2024d). The Swanlinbar Catchment, also in the NWRBD performed slightly better, 17% of sites achieved the required standard of Good status, but 83% failed to meet this standard. In addition one site deteriorated from Good to Moderate status (Matson *et al*., 2024e). In the SERBD, 50% of sites in the Slaney Catchment achieved the required standard of Good or high status and the remaining 50% failed to meet this standard. Five sites deteriorated in this catchment, one site improved and four were unchanged when compared to the previous survey (Matson *et al*., 2024f). While in the Colligan Catchment 25% sites achieved Good fish ecological status and 75% were assigned Moderate. No improvements were observed in the Colligan Catchment (Matson *et al*., 2024g). In the SHRBD, 52% of sites in the Feale were assigned High or Good status and the remaining 48% were moderate (Matson *et al*., 2024h). In the WRBD 67% of sites in the Glenamoy were assigned the required Good status, 33% of sites failed to meet this requirement ((Matson e*t al*., 2024i).

A total of 33 sites surveyed were long-term surveillance monitoring sites and 29 of these were assigned a fish ecological status. Of the sites classified, seven (24.1%) were assigned as Good, 17 (58.6%) as Moderate and five (17.3%) as Poor. No long-term surveillance monitoring sites were classified as High or Bad.

A total of 41 sites had previously been surveyed and classified. Of these, the status of 20 (48.8%) sites remained unchanged between surveys, while 17 (41.5%) sites deteriorated and four (9.7%) showed an improved status. Therefore there was no overall improvement in fish ecological status of river sites that were previously surveyed.

Where a site was assigned a High or Good ecological status, or where a site showed an improvement in ecological status between surveys, the reason was generally due to the presence and/or increase in abundance of the required type specific fish species (e.g. salmon and trout), or the presence and/or increase of all age cohorts. The site Prumplestown Bridge on the Lerr River (Barrow Catchment) in the SERBD, improved from Moderate status to Good status. This was in part due to the presence of 1+ brown trout, which were absent from the previous survey in 2020. The site Gloreen Bridge on the Ballyroan River in the SERBD, improved from Moderate status to Good status. This improved status was driven by an increased abundance of 0+ salmon and brown trout captured in the survey.

The most common reasons for a site failing to achieve the required standard of Good fish ecological status or for deteriorating between surveys was a decrease in the abundance of type specific fish species and missing age cohorts. This was probably caused by various pressures such as a decline in

water quality and modification of the natural hydromorphology of a river (including presence of barriers to fish migration). In some cases, an age cohort previously recorded at the site was not captured during the most recent survey, indicating a failure in recruitment. This suggests either the presence of water quality issues, physical habit degradation (or a combination of both) and other pressures that affect fish species recruitment and persistence.

In 2023 100 (59%) sites were classified as Moderate or worse. At least 35 sites were identified as having hydromorphology issues, mainly artificial barriers affecting fish movement and arterial drainage. Mathers *et al.,* 2002 describe the negative effect hydro-electric dams have on migratory fish species in Ireland. The Cathaleen falls hydro-electric dam in Ballyshannon, acts as a significant barrier to fish migration in the Erne Catchment and therefore has a negative impact on fish movements in the Swanlinbar and Cullies catchments. The dam restricts the migration of diadromous fish species (e.g. Atlantic salmon and European eel) and is the likely one of the main drivers of the Moderate or lower status assigned in these catchments. A large bridge apron, acting as a barrier to salmon migration, has been recorded on the Lask river in the Bann (Slaney) catchment. Four survey sites upstream of this barrier were assigned a Moderate status due to the absence of salmon.

A large number of sites had water quality issues. Fish species such as minnow, 3-spined stickleback and stone loach show a high level of pollution tolerance. These species proliferate in the absence of salmonids, which are more sensitive to deteriorations in water quality and habitat. A high abundance of these species, or an absence of salmonids, is a good indication that a site has water quality issues (Kelly *et al*., 2007b).

In the Slaney catchment 12 sites were assigned a status of Moderate or lower. A complete absence or low abundance of salmon and brown trout was the main driver behind these results. Data from the 2016-2021 WFD survey period show that several sub-catchments in the Slaney catchment had nutrient enrichment issues (EPA, 2021b).

As well as the presence and absence of tolerant and sensitive fish species, physical observations recorded on site can highlight water quality issues. At several sites, such as Sorrel Island Bridge on the Doonbeg river in the ShRBD, IFI staff noted excessive algal growth in the area. Excess algal growth can be an indicator of nutrient enrichment in the area (Canning and Death, 2020). Other issues noted included cattle poaching, sediment, absence of essential habitat types, domestic and agricultural waste dumping and invasive species.

5.3 Transitional waters

Five transitional waterbodies were surveyed by IFI in 2023. Three waterbodies, Kinvarra Bay, Camus Bay and Loch tSáile Lagoon, which together make up the Greater Camus Complex, were in the WRBD,

Erne Estuary is situated in the NWRBD, and the Avoca Estuary is in the ERBD. A total of 36 fish species were captured across the five transitional waterbodies. Species richness ranged from five species in Loch an tSáile Lagoon to 22 species in Kinvara Bay.

Four (80%) waterbodies were assigned a fish ecological status of Moderate or worse. Kinvarra Bay was the only waterbody to achieve Good status in 2023. The reasons for failure can be complex. In many cases where a site achieves a status of Moderate or worse, the reason is either low species richness or an overabundance of one or two dominant species. This can be a natural occurrence, particularly in smaller estuaries or waterbodies where habitat variation is low or can be an indicator of a change in water quality. As many transitional waters are close to large urban centres, there can also be anthropogenic pressures in place. Urban run-off, development works and hydromorphological issues, such as dredging, are among the reasons for declining ecological status in transitional waterbodies. Agricultural run-off, resulting in high influxes of nitrogen and phosphates can also negatively affect transitional waters (EPA, 2024).

Camus Bay and Loch tSáile Lagoon were assigned a status of Moderate and Poor respectively in 2023. Both waterbodies are situated within a sparsely populated area of Connemara, with no large towns nearby, so it is assumed that human impacts are minimal (Wightman *et al.,* 2023a). Camus Bay had been assigned a status of Good in previous surveys (2008 and 2015). In both these surveys flatfish species such as plaice and flounder had been recorded. These species were absent from 2023 survey, leading to a decreased species richness value. It is this decrease in species richness that is likely driving the Moderate status for Camus Bay.

Loch tSáile Lagoon has limited habitat types available for fish species. This limited habitat availability reduces the natural species richness of the lagoon. Just five species were recorded in Loch tSáile Lagoon. Three-spined stickleback were over abundant in the lagoon, making up over 45% of the fish population. This reduction in species richness and an overabundance of one species are the likely drivers of the Poor status result. Loch tSáile Lagoon was assigned a Moderate status in 2008.

The Avoca Estuary has declined in fish ecological status since 2020, deteriorating from Good in 2020 to Moderate in 2023. In 2020 13 species were recorded in the Avoca Estuary but this dropped to just eight in 2023. This reduction in species richness, likely caused by anthropogenic factors, is the key driver in the reduction in status. The Avoca Estuary is located close to the large urban centre of Arklow, Co. Wiclow and has a large catchment area encompassing many pressures (agriculture, hydromorphology, forestry, etc.). Pollution events such as agricultural and urban run-off, together with urban development, are likely to negatively impact the Avoca Estuary. Discharges from the Avoca Mines have previously been described as having a negative effect on the Avoca catchment (ERBD,

2009). The EPA (2023) described how the Avoca Estuary showed a significant increase in winter median phosphate concentrations between 2012-2022. Data from the 2016-2021 WFD survey period, shows that several river catchments, such as the Glenealo and the Avonbeg, upstream of the estuary, have issues with specific pollutant conditions, particularly zinc and copper (EPA, 2021b). These upstream pressures have the potential to reduce the presence of fish species across affected estuarine habitats.

The Erne Estuary was assigned a fish ecological status of Moderate in 2023, deteriorating from Good in 2018. The estuary had also been assigned a Moderate status in 2009, 2012 and 2015. The Erne Estuary recorded a species richness of 12 species in 2023, this is a reduction from 19 in the 2018 survey. As species richness is a key metric for fish ecological status in transitional waters, it's likely this reduction is the driver of the reduced status. Like most estuaries the Erne Estuary is situated near a large urban centre, in this case Ballyshannon. A large catchment area, encompassing the usual anthropogenic pressures (agriculture, urban runoff, etc.), flows into the estuary. Data from the 2016-2021 WFD survey period, show that several rivers in the catchment, such as the Annalee and Finn, have Moderate assigned phosphorus conditions (EPA, 2021b). The cumulative effect of these phosphorus levels could have the potential to negatively affect fish species in the estuary. As well as upstream water quality issues, the Erne estuary also faces anthropogenic pressures. The most obvious anthropogenic pressure is the large dam at the Cathaleen's Fall hydroelectric power station. This dam has the potential to disrupt natural flows of both freshwater and sediment into the estuary and migration of fish species. Large volumes of freshwater released into the estuary can disrupt delicate salinity balances. This potential change in salinity could adversely affect the survival and recruitment of estuarine species. The large dam also traps sediment and prevents it reaching the estuary. This natural sediment flow is crucial for maintaining estuarine ecosystems and providing habitat for many species (Wightman *et al.,* 2023b). It is likely this dam and associated freshwater and sediment flow disruptions and interference with fish migration has had a negative affect species diversity in the Erne Estuary.

6. REFERENCES

Caffrey, J. (2010) *IFI Biosecurity Protocol for Field Survey Work*. Inland Fisheries Ireland.

Canning A.D. and Death RG. (2020) The influence of nutrient enrichment on riverine food web function and stability. *Ecological Evolution*, **(2)**, 942-954

CEN (2003) *Water Quality - Sampling of Fish with Electricity*. CEN EN 14011:2000.

CEN (2005a) *Water Quality - Guidance on the Scope and Selection of Fish Sampling Methods*. CEN EN 14962.

CEN (2015) *Water quality - Sampling of fish with multi-mesh gillnets*. CEN EN 14757:2015

Connor, L., Kelly, F.L., Corcoran W., Coyne, J., Delanty K., McLoone P., Morrissey, E., Cierpial D., Matson, R., Gordon P., O'Briain R. and Rocks, K. (2017) *National Research Survey Programme Intercalibration of Lake Sampling Methods*. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

EPA (2006) *Water Framework Directive Monitoring Programme*. Published by the Environmental Protection Agency, Ireland. Version 1.0. 22 October 2006.

EPA (2021a) *Ireland's National Water Framework Directive Monitoring Programme 2019-2021*. Published by the Environmental Protection Agency.

EPA (2021b) https://gis.epa.ie/EPAMaps/ Data - Catchments.ie - Catchments.ie. Accessed in May/June 2024.

EPA (2023) *Water Quality in 2022 An Indicators report.* Published by the Environmental Protection Agency 2023.

EPA (2024) *Water Quality in 2023: An Indicators Report*. Environmental Protection Agency.

ERBD, 2009.Eastern River Basin District. River Basin Management Plan 2009 - 2015.

Harrison, T.D. and Kelly, F.L. (2013) Development of an estuarine multi-metric fish index and its application to Irish transitional waters. *Ecological Indicators*, **34**, 494-506.

Kelly, F.L., Champ, W.S.T, Connor, L., Rosell, R. and Harrison, A. (2007a) *Task 6.2: Sampling Procedures for Fish in Lakes (PART B). Testing of Various Fish Sampling Gear Types (Fyke Nets, Monofilament Multi-Mesh Gillnets, Braided Gill Nets, Seine Nets and Electrofishing) on Selected Lakes in the NS Share Area. Preliminary analysis*. NS Share report.

Kelly, F.L., Champ, W.S.T., Rosell, R. and Harrison, A. (2007b) Methods Manual. IV Fish. NS SHARE Lakes Project. NS Share report.

Kelly, F.L., Champ, W.S.T., McDonnell, N., Kelly-Quinn, M., Harrison, S., Arbuthnott, A., Giller, P., Joy, M., McCarthy, T.K., Cullen, P., Harrod, C., Jordan, P., Griffiths, D. and Rosell, R. (2007c) *Investigation of the Relationship between Fish Stocks, Ecological Quality ratings (Q-values), Environmental Factors and Degree of Eutrophication*. EPA Environmental RTDI Programme 2000-2006. Project 2000-MS-4-M1. Synthesis report.

Kelly, F.L., Champ, W.S.T., Harrison, A., Connor, L. and Rosell, R. (2008) A lake fish stock survey method for the Water Framework Directive. In: Moriarty, C., Rosell, R. and Gargan, P. (Eds) Proceedings of the 38th Annual IFM Conference – *Fish Stocks and their Environment*, held in Westport, County Mayo Ireland, 16th to 18th of October 2007.

Kelly, F.L., Harrison, A.J., Allen, M., Connor, L. and Rosell, R. (2012) Development and application of an ecological classification tool for fish in lakes in Ireland. *Ecological Indicators*, **18**, 608-619.

Mathers, R.G., De Carlos, M., Crowley, K. and Ó Teangana, D. (2002) A review of the potential effect of Irish hydroelectric installations on Atlantic Salmon (*Salmo salar* L.) populations, with particular reference to the River Erne. *Biology and Environment: Proceedings of the Royal Irish Academy*, **102B (2)**, 69-79.

Matson, R., Delanty, K., Shephard, S., Coghlan, B. and Kelly, F. (2018) Moving from multiple pass depletion to single pass timed electrofishing for fish community assessment in wadeable streams. *Fisheries Research*, **198**, 99-108.

Matson, R., Duffy, P., Donovan, R., Corcoran, W., Gordon, P., McCarthy, E. and Kelly, F.L (2021) *National Water Framework Directive Fish Monitoring Programme - Using the Balanced Acceptance Sampling Approach for Site Selection in Index Catchments*. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024a) *Sampling Fish in Rivers 2023 – Big River (Louth) Catchment.* Factsheet No. 2023/01. National Research Survey Programme. Inland Fisheries Ireland.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024b) *Sampling Fish in Rivers 2023 – Creegh Catchment*. Factsheet No. 2023/03. National Research Survey Programme. Inland Fisheries Ireland.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024b) *Sampling Fish in Rivers 2023 – Doonbeg Catchment*. Factsheet No. 2023/05. National Research Survey Programme. Inland Fisheries Ireland.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024d) *Sampling Fish in Rivers 2023 – Cullies Catchment*. Factsheet No. 2023/04. National Research Survey Programme. Inland Fisheries Ireland.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024e) *Sampling Fish in Rivers 2023 – Swanlinbar Catchment*. Factsheet No. 2023/08. National Research Survey Programme. Inland Fisheries Ireland.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024f) *Sampling Fish in Rivers 2023 – Slaney Catchment*. Factsheet No. 2023/09. National Research Survey Programme. Inland Fisheries Ireland.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024g) *Sampling Fish in Rivers 2023 – Colligan Catchment*. Factsheet No. 2023/02. National Research Survey Programme. Inland Fisheries Ireland.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024h) *Sampling Fish in Rivers 2023 – Feale Catchment*. Factsheet No. 2023/06. National Research Survey Programme. Inland Fisheries Ireland.

Matson, R., Gordon, P., Kelly, K., Corcoran, W., McCarthy, E., Cornthwaite, Y., Hyland, J. and Kelly, F.L. (2024i) *Sampling Fish in Rivers 2023 – Glenamoy Catchment*. Factsheet No. 2023/07. National Research Survey Programme. Inland Fisheries Ireland.

McLoone, P., Corcoran, W., Bateman, A., Cierpial, D., Gordon, P., McCarthy, E., Heagney, B., Hyland, J., Cornthwaite, Y., Robson, S., Twomey, C., O'Keeffe, K., Kelly, K., and Kelly, F.L. (2024) *Fish Stock Survey of Lough Caragh, August 2023*. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

SNIFFER (2011) *River Fish Classification Tool: Science Work*. WFD68c, Phase 3, Final Report. Scotland and Northern Ireland Forum for Environmental Research.

Wightman, G., Robson, S., Heagney, B., O' Neill, M. and Roche, W. (2023a) *Fish Stock Survey of Transitional Waters in the Western River Basin District 2023 – Camus Bay / Loch an tSáile*. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

Wightman, G., Robson, S., Heagney, B., O' Neill, M. and Roche, W. (2023b) *Fish Stock Survey of Transitional Waters in the North-Western River Basin District 2023 – Erne Estuary*. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.
D24 Y265

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600