Report on the field sampling activities in 2024 for the GeneFlow project

IFI/2025/1-4754

Iascach Intíre Éireann
Inland Fisheries Ireland

fisheriesireland.ie

Report on the field sampling activities in 2024 for the GeneFlow project

Inland Fisheries Ireland

11 April 2025

DOCUMENT CONTROL SHEET

Name of document:	Report on the field sampling activities in 2024 for the GeneFlow project				
Author(s):	John Coyne Darragh Creedon Michael Wilson Alastair Dudman Finbar McGroarty Michael Millane				
Authorised Officer:	Michael Millane				
Description of content:	Report on the field sampling activities in 2024 for the GeneFlow project				
Approved by:	Cathal Gallagher				
Date of Approval:	11/04/2025				
Assigned review period:	NA				
Date of next review:	NA				
Document code:	IFI/2025/1-4754				
This documents comprises	TOC	Text	List of tables	List of Figures	No. Appendices
	Yes	Yes	No	No	3

Version Control Table

Version No.	Status	Authors(s)	Reviewed by	Approved by	Date of issue
1.0	Draft issued	John Coyne Darragh Creedon Michael Wilson Alastair Dudman Finbar McGroarty Michael Millane	M Millane		27/11/2024
2.0	FINAL	John Coyne Darragh Creedon Michael Wilson Alastair Dudman Finbar McGroarty Michael Millane	M Millane	C Gallagher	11/04/2025

1. Executive summary

There is increasing international and national concern for the conservation status of wild Atlantic salmon due to the threat of genetic introgression (i.e. harmful gene flow) from farm escaped fish into recipient wild populations. High levels of such gene flow into wild populations of Atlantic salmon may result in the disruption of their genetic and biological integrity, resulting in life history changes, reduced productivity and ultimately the loss of locally adapted populations. Ireland does not currently monitor the genetic status of its wild Atlantic salmon populations even though salmon farming is a significant endeavor along its Atlantic coast.

To address this deficit, University College Cork (UCC), Inland Fisheries Ireland (IFI) and Teagasc formed a partnership for the tender by the Marine Institute to undertake the project, "provision of the services to determine the level of genetic introgression in Irish wild salmon stocks from farmed escape salmon" (RFT ITT23-015). The project aims to establish a genetic baseline, deploying recently developed state-of-the-art genomics, by which the current and future status of wild Irish salmon populations with regard to genetic introgression from farmed escaped salmon can be assessed and reported.

The project aims to sample 200 salmon stocks from 144 salmon designed rivers in Ireland in the period 2023 to 2026. Following the collection of samples from 88 total catchments in 2023, a further 55 catchments were sampled between July 10th and September 24th 2024. From this effort, 44 full genetic collections were obtained comprising a total number of 1,411 samples. The GeneFlow project is supported by funding provided by Inland Fisheries Ireland and the European Maritime, Fisheries and Aquaculture Fund.

2. Introduction

Inland Fisheries Ireland (IFI) is the State agency responsible for the protection, management and conservation of Ireland's inland fisheries and sea angling resources and is the competent authority in relation to “fish” elements of the EU Habitats Directive (European Commission 2000). Ireland has over 74,000 kilometres of rivers and streams and 128,000 hectares of lakes all of which fall under the jurisdiction of IFI. Wild salmon in Ireland are managed on a river-specific basis and comprise 144 salmon designated stocks in addition to *c*. 30 more minor systems with small populations of salmon present. The salmon farming sector in Ireland is principally active in the south-west, west and north-west of the country with *c*. 20 farms currently in operation. This sector has averaged approx. 13,000 tonnes of farmed salmon annually in the last decade with 9,289 tonnes produced in 2023 (Dennis *et al*., 2024).

There is increasing international and national concern for the conservation status of wild Atlantic salmon due to the threat of genetic introgression (i.e. harmful gene flow) from farm escaped fish into recipient wild populations. The most recent high profile farm escape event occurred at Killary Harbour, located between counties Galway and Mayo on 11th August 2024. Subsequent to this, captures of adult farmed salmon were recorded in several rivers on the western seaboard between mid-August and September 2024 (Kelly *et al*., 2025). High levels of such gene flow into wild populations of Atlantic salmon may result in the disruption of their genetic and biological integrity, resulting in life history changes, reduced productivity and ultimately the loss of locally adapted populations. Ireland has not routinely monitored the genetic status of its wild Atlantic salmon populations to date in this regard even though salmon farming is a significant endeavor along its Atlantic coast.

To address this deficit, University College Cork, Inland Fisheries Ireland and Teagasc formed a partnership for the tender issued by the Marine Institute to undertake the project “provision of the services to determine the level of genetic introgression in Irish wild salmon stocks from farmed escape salmon” (RFT ITT23-015) (GeneFlow). The project aims to establish a genetic baseline, deploying recently developed state-of-the-art genomics, by which the current and future status of wild Irish salmon populations with regard to genetic introgression from farmed escaped salmon can be assessed and reported.

The GeneFlow project is intended to run over a three-year period from 2023 to 2026 with up to 200 salmon stocks in Ireland designated for sampling and characterisation in regard to genetic introgression. IFI were tasked with collecting the field samples for the project. This document reports on the field sampling work undertaken in order to collect samples for the

second year of the project. In the first year of the project in 2023, salmon populations in 88 catchments were sampled. The field sampling element of the GeneFlow project is jointly funded by IFI and the European Maritime, Fisheries and Aquaculture Fund.

The IFI project team comprised:

- Dr Michael Millane (IFI, Senior Research Officer)
- Michael Wilson (IFI, Fisheries Inspector)
- Alastair Dudman (IFI Fisheries Officer)
- Finbar McGroarty (IFI Fisheries Officer)
- Local IFI River Basin District staff throughout the country
- John Coyne (IFI Research Officer) GeneFlow Funded
- Darragh Creedon (IFI Fisheries Assistant) GeneFlow Funded

Project supervision was provided by Michael Millane (Senior Research Officer, IFI) and Michael Wilson (Fisheries Inspector, IFI). The project team was supported by IFI River Basin District (RBD) staff and local expert knowledge throughout the country. The sample collection programme was conducted under the guidance of the GeneFlow project leader Prof. Phil McGinnity (UCC).

As part of the GeneFlow project extensive preparatory work was resourced, funded and undertaken by IFI in advance of the field sample collection. These included:

- submission of the project to the IFI Ethics Review Committee;
- submission of a Section 14 to undertake field sampling;
- preparation of a screening Appropriate Assessment;
- development of a Standard Operating Procedure (Appendix 1);
- hiring and induction of a Research Officer, a Fisheries Assistant and two Fisheries Officers and provision of PPE (Personal Protective Equipment);
- hosting of a training programme at the National Salmonid Index Catchment which included provision of training to field personnel in the sampling techniques (fish identification, sampling processing, regulatory obligations; and electrofishing);
- provision of GIS data and expert resources to support sampling site identification;
- provision of a vehicle for one of the field teams; and
- provision of two sets of electrofishing equipment.

In addition, IFI provided funding to cover the operations of the additional field sample collection team including salaries, and travel and subsistence costs; as well as allocating, in-kind, the project management and supervisory resources of their permanent staff, which were significant, particularly during the preparatory and reporting phases of the project in both year 1 and year 2.

3. Methods

3.1. Sampling design

The key criteria of the sampling design to collect samples in the field were:

1. To provide sufficient national coverage as it is important to sample potentially affected and unaffected rivers to garner some determination of deviations from background levels of genetic variation;
2. To collect at least one sample from each of the principal identified salmon rivers (n=144);
3. To collect samples from a range of rivers with different population sizes on basis that small rivers are likely to be impacted proportionally more than larger ones, while impacted larger ones will likely produce more hybridised offspring;
4. To sample populations from two putative Irish phylogeographic lineages, namely Celtic and Boreal phylogeographic groups (Payne *et al.* 1971);
5. To identify and sample rivers substantially below conservation limits as demographically compromised populations are more susceptible to hybridisation than demographically strong populations (Hansen & Youngson, 1998, TEGOS 2023);
6. To prioritise areas where salmon farming is practiced or has previously been practiced https://www.marine.ie/site-area/areas-activity/aquaculture/locations-salmonid-farms;
7. To prioritise rivers and river samples where sampling has occurred previously i.e. the sampling carried out in 2006/2007 as part of the National Stock identification Project;
8. To utilise contemporary and historical spawning area distribution nationally based on field information mapped onto GIS in 2006 and supplemented by interrogation of the full national geo-rectified 1m resolution aerial photography database held by the Department of Environment, Climate and Communications.
9. To prioritise spawning sites on the lower sections of individual river systems as most likely locations for spawning of farmed salmon (Clifford *et al.* 1998);
10. In the larger river systems with high potential for genetic structuring (usually associated with lakes) to ensure sampling of multiple populations e.g. the Moy river system (Dillane *et al.* 2008).
11. In rivers where significant genetic introgression is detected in year 1 and year 2 to re-sample the same sites in years 2 or year 3.
12. To include in site selection GIS calculated route planning to determine the most time and energy efficient sampling programme.

3.2. Preparations for field sampling

The following work was done in preparation for the field sampling:

- the project proposal was submitted to and approved by the IFI Ethics Review Committee (year 1);
- a Section 14 approval was secured to undertake field sampling;
- a screening Appropriate Assessment was produced and approved;
- a Standard Operating Procedure was finalised (Appendix 1);
- A Research Officer, a Fisheries Assistant and two Fisheries Officers were hired to comprise two sampling teams; and
- training was provided in the sampling techniques (fish identification, sampling processing, regulatory obligations; and electrofishing (Electric Fishing Technical Services).

3.3. Field sampling

Full details on the field sampling are contained in the SOP (Appendix 1). Sampling was undertaken between July 10th and September 26th 2024.

Figure 1 Sampling for the Geneflow project – Owenboliska River (WRBD).

The two field sampling teams (IFI and GeneFlow funded) each consisted of two staff sometimes supported by local colleagues from IFI Operations. IFI provided each team with a single electrofishing backpack with an appropriate control unit (DC converter), a cathode and

an anode used per team to capture candidate juvenile salmon for genetic sampling. The prime goal of this qualitative sampling method was to cover a sufficient length of river in order to minimise sibling bias and represent the overall genetic composition of the fry year class as much as possible. Fishing was carried out by walking in an upstream direction and point source sampling at two to three second bursts every 15-20m of suitable habitat, retaining one to two individuals per effort.

The sample target per catchment was forty 0+ Atlantic salmon fry. However, when numbers were low, this was complemented by the collection of samples from 1+ parr. Individual 0+ fry for sample retention were euthanised by MS222 anaesthetic (Appendix 1). Retained salmon were then measured (fork length to the nearest mm) and weighed (to two decimal places) where possible in 2024. Samples were preserved in ethanol for later DNA extraction. A subset of 15 samples were preserved in RNAlater to facilitate profiling for transcriptional genetic markers. In order to minimise the inadvertent risk of spreading invasive species, standard IFI biosecurity measures were implemented by the field teams when moving between sampling sites (Appendix 1).

3.4. Identification

The identification Atlantic salmon fry is a critical component of the project. The primary error potentially occurs in the form of misidentifying salmon as brown trout (*Salmo trutta*) fry. All staff were providing with training to aid correct identification which involved instruction on the visual and morphological differences between both species at 0+ and 1+ year classes (Table 1 and Figure 2).

Table 1 Characteristics of juvenile Atlantic salmon and brown trout (adapted from Bremset and Berg, 1999).

No.	Features	Atlantic salmon	Brown trout
1	Pectoral fin	Very long, broad with sharp lobes, reach beneath the anterior of the dorsal fin (white dashed line)	Short, relatively narrow and rounded, do not reach the anterior of the dorsal fin
2	Adipose fin	Brownish	Dark red
3	Tail fin	Forked with sharp lobes	Not forked, lobes are rounded
4	Anal fin	Brownish	White at apex
5	Maxilla	Reaches the posterior of iris. Does not extend past eye (white dashed line)	Reaches the posterior of eye (black dashed line)
6	Body shape	Slim, cylindrical body	Relatively deep body
7	Body pigmentation	Few red spots concentrated around the lateral line (white circles)	Several red spots all over the flanks (black circles)

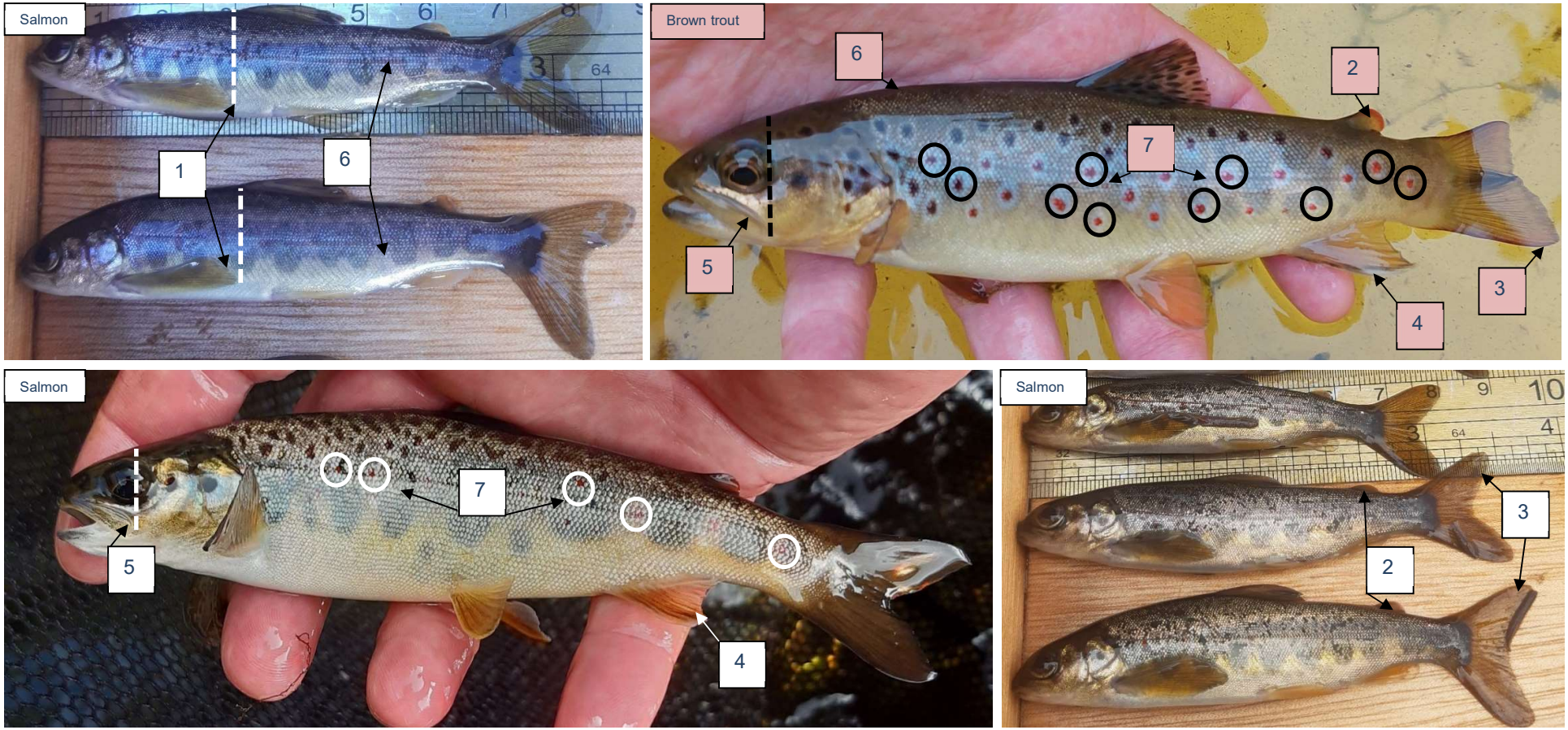


Figure 2 Key characteristics of Atlantic salmon vs brown trout juveniles as described in Table 1. Marks 1-7 in white indicate key features for salmon. Marks 2-7 in coral indicate key features for brown trout.

3.5. Additional species

Another requirement of the sampling programme was to record the presence of other fish and invasive species in addition to salmon fry at each sampling site to fulfil the obligations of the Section 14 authorisation. This was done by each of the sampling teams at each survey location in a presence-absence format.

3.6. Assessment of fishing and wading difficulty

In order to inform future sampling at these locations and improve the time management and performance of the field sampling process, a per site qualitative metric of both wading and sample collection difficulty was recorded by each of the sampling teams. Both metrics were calculated by a score of 1-5. Wading difficulty was rated as:1 – easy; 2 – easy to moderate; 3 – moderate; 4 moderate to difficult; and 5 – difficult. Sample collection difficulty was recorded using the same scoring system.

3.7. Site details and dimensions

GPS coordinates were recorded in the field at the start and finish of each individual site sampled. GIS was then used to calculate the average wetted width (m) and additionally the approximate wetted area covered (m^2) between these points. In addition, the latitudinal position of each sampling site was also recorded. Maintaining a record of the area used to collect the samples was deemed important in the context of any family bias later becoming apparent in the subsequent sample analyses. This can inform whether the collection of samples may have influenced this or indeed indicate underlying issues with recruitment in a particular sampling area, if the sample collection was well distributed.

4. Results

4.1. National sampling effort 2024

A total of 55 catchments were surveyed between July 10th and September 26th 2024 (Figure 3). This comprised:

- complete genetic collections of juvenile salmon were obtained from 44 catchments; and
- 11 rivers where no samples were available for collection due to a paucity of salmon (Figure 3).

An average distance per site of 574m (range: 189-1023m) was covered, with a total distance of *c*. 26 km (Appendix 2). Wetted width (m) and distance calculations recorded an average site area of 4,141m^2 (range: 637–14,229 m^2) (Appendix 2). In total, 67 individual sampling efforts were undertaken during this period, with 13 rivers requiring multiple efforts to acquire the requisite pool of genetic samples. The collection of complete genetic samples from 44 rivers in 2024 was lower than the previous year (n=88). This was because a notable number of the rivers targeted in 2024 had relatively less abundant salmon stocks thereby requiring more effort to acquire the requisite number of samples.

4.2. Results – National scale

A total of 1,411 individual samples of juvenile salmon were recorded during the twelve week sampling window in 2024 (Figure 4). A mean fork length of 64.6 mm ± 15.4 SD (range: 33–153 mm) was recorded for juvenile salmon samples collected in the 44 catchments in 2024 (Figure 4). Length frequency data per RBD of salmon juveniles collected are presented in Figure 5. Within this dataset, a total of 986 individuals ranging from 33-100mm were weighed (0.33g – 9.8g). Length weight data for all RBDs and individual population relationships are presented in Figure 6.

4.3. Assessment of fishing and wading difficulty

Details of assessment of fishing and wading difficulty metrics recorded at each survey site are presented in Appendix 2.

4.4. Site details and dimensions

Details of each survey site and their dimensions are presented in Appendix 2.

4.5. Additional species presence and absence

Additional species were recorded by each of the sampling teams at each individual survey location. Given the qualitative nature of the methodology used in the project, the data is provided in a presence-absence format (Appendix 2).

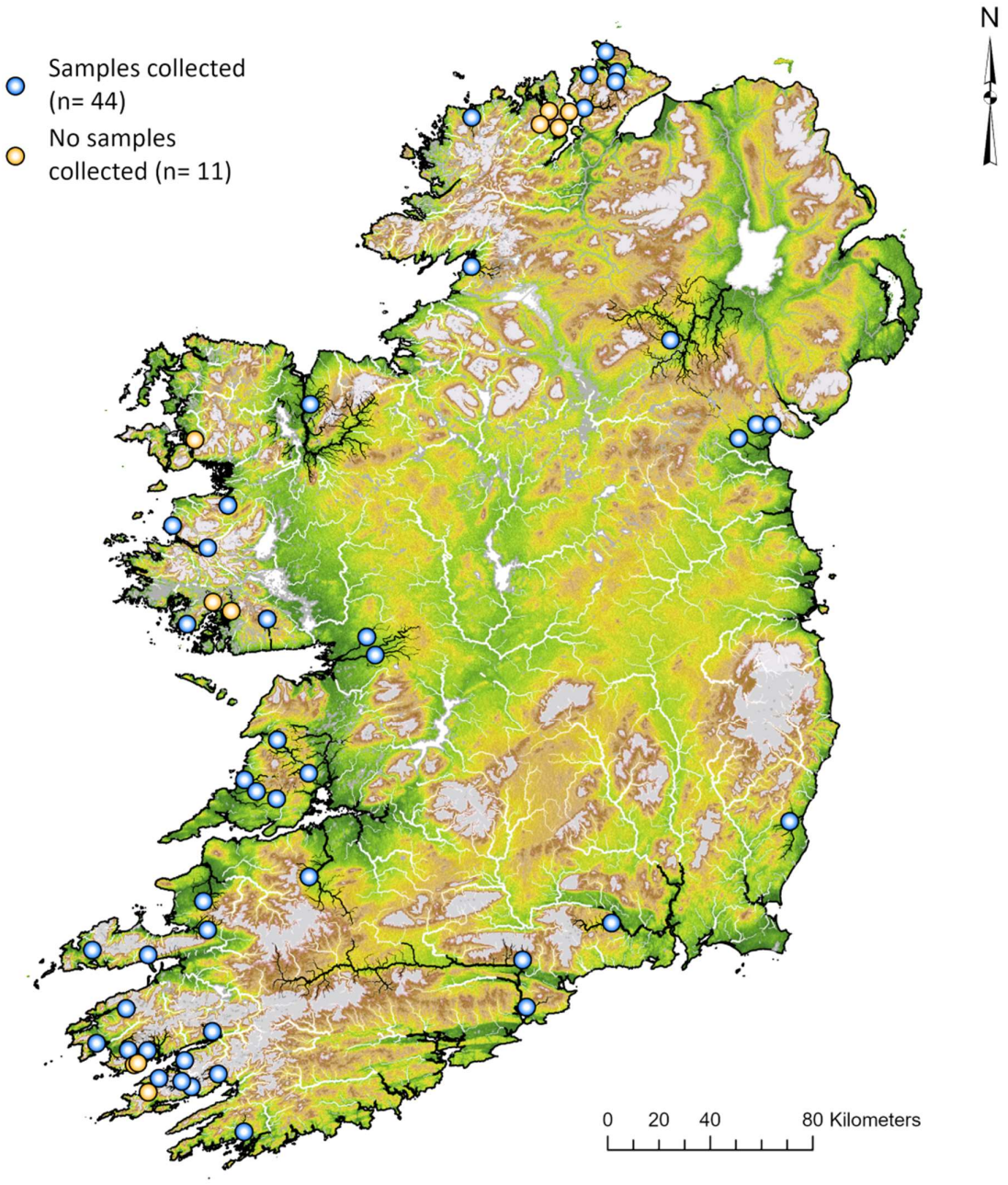


Figure 3 Sites sampled for the GeneFlow project in 2024.

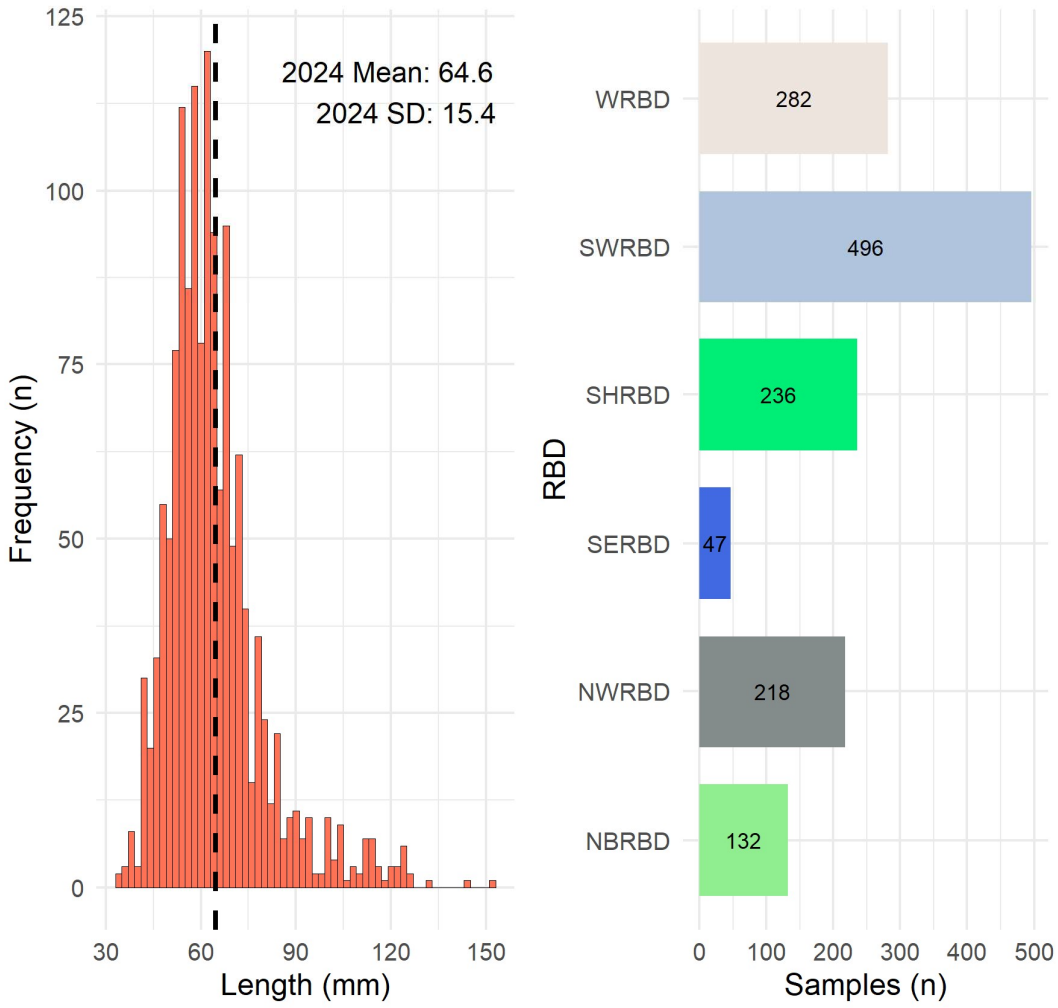


Figure 4 Salmon juvenile length frequency (left panel) and number of samples collected per River Basin District (right panel) during year 2 of the GeneFlow project. A total of 1,411 samples (range: 33–153 mm) were recorded from 44 catchments where samples were obtained in 2024. The mean length of juvenile salmon collected (64.6mm ± 15.4 SD) is indicated by the black dashed vertical line.

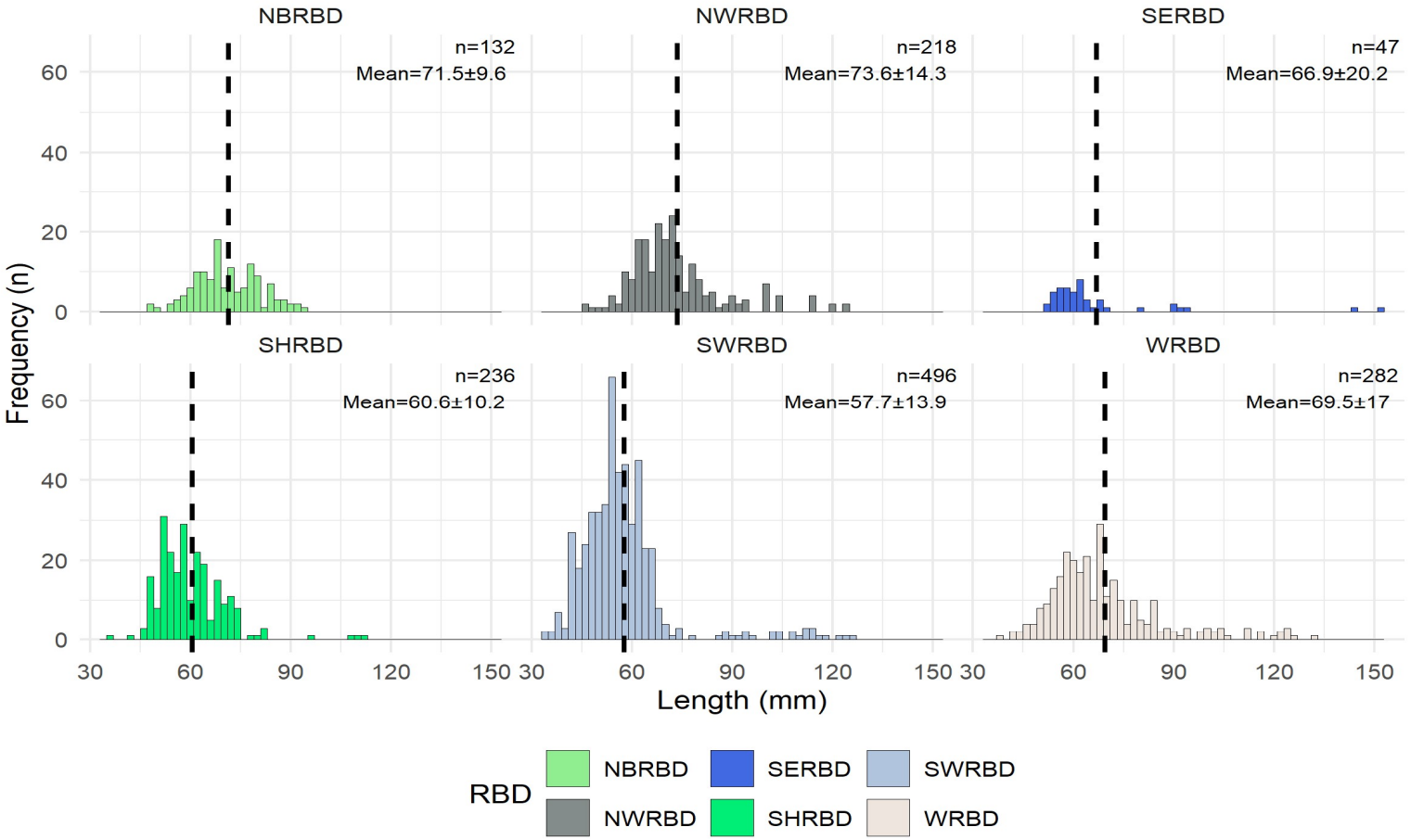


Figure 5 Length frequency data per River Basin District (RBD) of salmon juveniles collected during the GeneFlow project in 2024. The dashed black line indicates mean length of salmon (mm) from each RDB. Associated standard deviations (SD) and number of replicates (n) are also displayed.

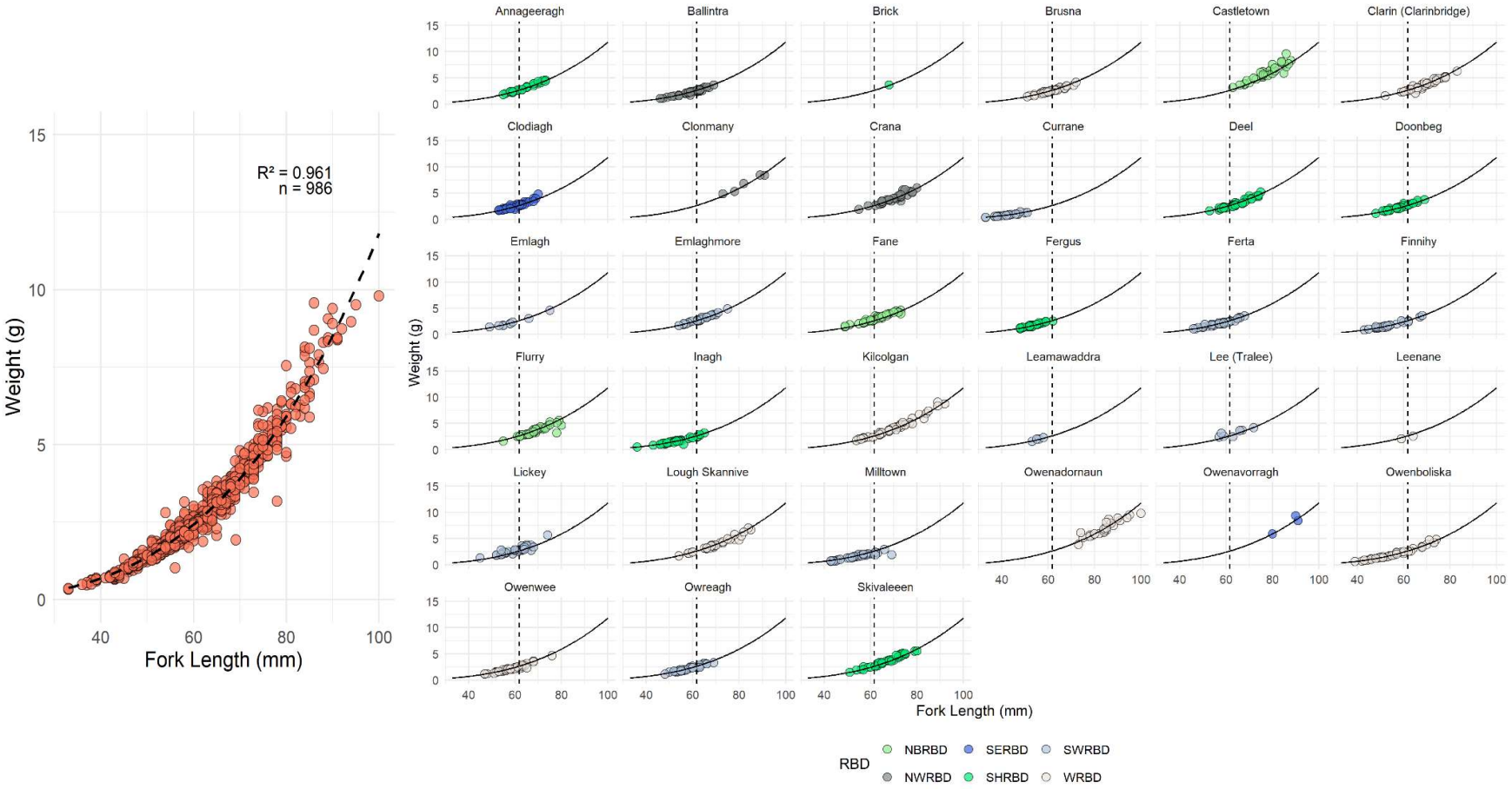


Figure 6 Length weight relationship data per River Basin District (RBD) of salmon juveniles (n=986) collected during the GeneFlow project in 2024. A power curve has been fitted (R^2 = 0.961). The dashed vertical black line indicates national mean length of salmon (mm) from 2024.

5. Discussion

The GeneFlow project work in year 1 and year 2 originally aimed to collect samples from as many of the 144 designated salmon rivers and minor salmon rivers as possible, with further refinements to the field sampling approach envisaged based on these results. Between 2023-2024, 122 of the 144 rivers have generated samples along with 9 further samples from rivers outside the 144 list. In order to achieve the required sample sizes, greater field sampling effort was required in 2024 in systems where salmon stocks had low apparent abundance, notably in certain catchments in the north west in 2024. There were 13 systems where multiple locations had to be sampled in order to acquire the required samples size. In 11 catchments no samples were obtained despite significant sampling effort. From a project management perspective, the recording of metrics such as wading difficulty can help inform future field collection planning if further attempts are made to re-sample such sites for this or related projects. It was also considered valuable to have collected information on the wetted area covered to both document sampling effort as well have a metric to potentially evaluate if the sampling area size was a factor in any family bias later evident in the samples taken.

In advance of year 3, a recruitment process will again have to be undertaken to establish the field teams, along with similar training provided in advance of the fieldwork. The field team should be fully prepared to commence field work by the 1 July 2025 to maximise the sampling that can be achieved by the deadline of 30 September.

6. References

Bremset, G., & Berg, O. K. (1999). Three-dimensional microhabitat use by young pool-dwelling Atlantic salmon and brown trout. Animal behaviour, 58(5), 1047–1059.

Clifford, S.L., McGinnity, P. and Ferguson, A. (1998). Genetic changes in Atlantic salmon, *Salmo salar* populations of NW Irish rivers resulting from escapes of adult farm salmon. *Can. J. Fish. Aquat. Sci.* 55: 358-363.

Dennis, J., Jackson, E., & Perry, S. (2024). Annual Aquaculture Report: Findings of the National Seafood Survey 2024: Bord Iascaigh Mhara (BIM).

Dillane E, McGinnity P., Coughlan J, Cross M, de Eyto, E., Prodohl, P., Kenchington, E., and Cross T. (2008). Landscape features influence intra-river population genetic structure in Atlantic salmon (*Salmo salar* L.). *Molecular Ecology* 17: 4786-4800.

Hansen L.P. & Youngson A.F. (1998) Interactions between farmed and wild salmon and options for reducing their impact. In: A.F. Youngson, L.P. Hansen & M. Windsor (eds) Interactions Between Salmon Culture and Wild Stocks of Atlantic Salmon: The Scientific and Management Issues. Report of the ICES/NASCO Symposium, Bath, England, April 1997. Trondheim, Norway: Norwegian Institute for Nature Research, pp. 80–89.

Payne, R.H., Child, A.R, Forrest, A. (1971). Geographical variation in the Atlantic salmon. *Nature*. 231:250–252.

TEGOS (2023). The Status of Irish Salmon Stocks in 2022 with Catch Advice for 2023. Report of the Technical Expert Group on Salmon (TEGOS) to the North-South Standing Scientific Committee for Inland Fisheries. 55 pp.

7. Appendices

7.1. Appendix 1: Standard Operating Procedures

Standard Operating Procedure for GeneFlow field sampling activities

Inland Fisheries Ireland

2023

Name of Document:	Standard Operating Procedure for GeneFlow field sampling activities				
Author (s):	Michael Millane / Tony Holmes / Phil McGinnity/ John Coyne				
Authorised Officer:	Michael Millane				
Description of Content:	This SOP details the electric fishing, fish processing methods and safety procedures to be followed by Inland Fisheries Ireland.				
Approved by:	Michael Millane				
Date of Approval:	04.08.2023				
Assigned review period:	3 years				
Date of next review:	04.08.2026				
Document Code					
This document comprises	TOC	Text	List of tables	List of Figures	No. Appendices
	-	Yes	-	-	4

Version Control Table

Version No.	Status	Authors(s)	Reviewed by	Approved by	Date of issue
V0.1	Issued	Michael Millane Tony Holmes Phil McGinnity			11.07.2023
V0.2	issued	Michael Millane Tony Holmes Phil McGinnity			21.07.2023
V0.3	Issued	Michael Millane Tony Holmes Phil McGinnity			28.07.2023
V0.4	Issued	John Coyne Michael Millane Tony Holmes Phil McGinnity	Michael Millane	Michael Millane	04.08.2023

1. INTRODUCTION

All fish sampling techniques are generally considered to be selective to some degree; however, electric fishing has proven to be the single most comprehensive and effective method for collecting stream fish (Barbour *et al*., 1999). It is a well-established technique used by fishery biologists all over the world for sampling fish in freshwaters. It is generally the most non-destructive, effective and cost efficient means of sampling freshwater fish, particularly in rivers. The use of electric fishing for sampling fish populations was first described over 70 years ago (Schiemenz & Schonfelder, 1927). Moore (1968) proposed the use of a portable light-weight fish shocker which induces 'galvanotosis', causing the fish to move towards the electrode (anode) where they are captured using a hand net (Lippet, 1978). Electric fishing uses the physiological effect of an electric field in water produced by immersed electrodes to stimulate a fish's nervous system so that it swims towards the positive electrode (anode) and can be easily netted. In best practice, the goal is to attract, rather than stun the fish and prevent any harm to them.

1.2. Scope and Application

The purpose of this document is to define the electric fishing and collection methods for sampling juvenile salmon for the GeneFlow project. The electrofishing element of this SOP is based on the catchment-wide national sampling programme to assess salmon fry abundance in river catchments.

1.3 Site selection

There are 237 named discrete river basins on the island of Ireland, 208 in Ireland and 29 in Northern Ireland (Ordnance Survey of Ireland, 1958). There are 261 recognised salmonid 'Fishery' river systems with Atlantic salmon and or sea trout identified in Ireland (excluding Northern Ireland) of which 173 are known to have salmon and trout present with 88 having sea trout only (McGinnity *et al.* 2005). Of the 173 rivers with salmon, catch advice is provided for 144 of these annually (TEGOS, 2003). Each river has a genetically distinct salmon population. Many of the larger river systems will have two of more genetically discrete populations (Dillane *et al.* 2008).

The goal of Task 1 will be to design and communicate a sampling plan to establish a comprehensive and accurate genetic baseline upon which a fair and accurate assessment of the levels of gene flow from farmed escaped salmon can be provided for Irish salmon populations on an individual river basis. The tender call proposes the sampling of approximately 200 potential populations. It is proposed here to sample at least 200 sites

encompassing the collection of some 6,000 individuals and is deemed sufficient to capture the majority of the genetic variability present. The tender also envisages the profiling of up to 10,000 samples, thus providing scope for the analysis of additional material. In addition to the resampling of samples of interest subsequent to year one or year two analysis it is envisaged that a proportion of the juvenile salmon collected as parr for the National Genetic Stock Identification genetic baseline established in 2006/2007 will be re-characterised using selected diagnostic SNP markers in order to compare present status with regard to introgression to that which existed 18 years previously.

The key criteria of the sampling design are:

1. To provide sufficient national coverage as it is important to sample potentially affected and unaffected rivers to garner some determination of deviations from background levels of genetic variation;
2. To collect at least one sample from each of the principal identified salmon rivers (n=144);
3. To collect samples from a range of rivers with different population sizes on basis that small rivers are likely to be impacted proportionally more than larger ones, while impacted larger ones will likely produce more hybridised offspring;
4. To sample populations from two putative Irish phylogeographic lineages, namely Celtic and Boreal phylogeographic groups (Payne *et al.* 1971);
5. To identify and sample rivers substantially below conservation limits as demographically compromised populations are more susceptible to hybridisation than demographically strong populations (Hansen & Youngson, 1998, TEGOS 2023);
6. To prioritise areas where salmon farming is practiced or has previously been practiced https://www.marine.ie/site-area/areas-activity/aquaculture/locations-salmonid-farms;
7. To prioritise rivers and river samples where sampling has occurred previously i.e. the sampling carried out in 2006/2007 as part of the National Stock identification Project;
8. To utilise contemporary and historical spawning area distribution nationally based on field information mapped onto GIS in 2006 and supplemented by interrogation of the full national geo-rectified 1m resolution aerial photography database held by the Department of Communications, Marine, and Natural Resources.
9. To prioritise spawning sites on the lower sections of individual river systems as most likely locations for spawning of farmed salmon (Clifford *et al.* 1998);
10. In the larger river systems with high potential for genetic structuring (usually associated with lakes) to ensure sampling of multiple populations e.g. the Moy river system (Dillane *et al.* 2008).
11. In rivers where significant genetic introgression is detected in year 1 and year 2 to re-sample the same sites in years 2 or year 3.
12. To include in site selection GIS calculated route planning to determine the most time and energy efficient sampling programme.

1.4 Sample collection

Sample collection will be undertaken by IFI. IFI will deploy a sampling team who will carry out the sampling according to the design proposed and outlined in Task 1. The target number of sample sites (populations over the period of the project) is 200. The sampling will be undertaken in the summer period from July until the end of September. Conservatively, it is

proposed that the IFI team will sample six sites per week. IFI will endeavour to sample as many populations in as short a period as possible. However, we are cognisant that weather conditions either due to elevated temperatures or high flow conditions can preclude fishing. No fishing will take place where temperatures exceed 20^{O}C in order to minimise inadvertent mortalities to non-target, non-retained fish. Fishing and fish handling will be undertaken with regard to conforming with highest standards consistent with best practice for animal welfare, hygiene and protection of the environment. At an identified river reach (expected one to two km in length) 40 0+ individuals will be collected by electrofishing. The sample will be collected over a sufficient length of river in order to minimise the number of siblings sampled. The individual fish will be euthanized by overdose of anaesthetic. The fish will be measured for length and preserved in ethanol for later DNA extraction. A subset of samples will be preserved in RNAlater to facilitate profiling for transcriptional genetic markers at some later date. Non-target fish will be released after recovery from stunning. Training will be provided to the IFI teams by UCC in respect of site identification, site recording, sampling methodology, sample recording, sample preservation and sample storage. Electrofishing and fish handling training will also be provided to the teams.

2. Health and Safety

The primary responsibility of all staff engaged in field work is the health and safety of themselves and their colleagues. It must be recognised that any electric fishing equipment producing an effect of this type is potentially dangerous. The fishing efficiency is closely related to the experience of the electric fishing team and fishing should only be carried out by qualified personnel.

ELECTRIC FISHING CREWS MUST ADHERE TO THE INSTRUCTION OF THEIR SUPERVISOR. BEHAVIOUR WHICH COULD ENDANGER LIFE OR CAUSE INJURY WILL NOT BE TOLERATED.

2.1 Electrofishing training

One field team member should be trained in electric fishing safety precautions and operational procedures. Crew members are advised to familiarise themselves with the following manual: *Electric Fishing: Training Course Manual. Inland Fisheries Ireland WRC Beaumont 2012.* First aid certificates should be held by the field staff and training given if required.

2.2 Number of crew

A two-person crew is required for the electro-fishing. One member of the team should act as supervisor.

2.3 PPE

Each crew member should wear rubber soled waders and life jackets and insulation gloves. The collection bucket should be free of exposed metal and have a plastic / insulated handle.

2.4 Weather conditions

Electric fishing is not recommended in spate conditions and is strictly forbidden in wet weather (including mist) or when there is a risk of thunder and lightning. If it starts to rain, stop fishing immediately; turn off the power and cover electrical equipment appropriately, e.g., with a layer of tarpaulin.

2.5 Operations – Electrofishing Survey Method

- Provisional arrangements of the fieldwork schedule to be made (between Owen Kelly and John Coyne) a week prior to sampling with notification given to the relevant Fisheries Inspectors and/or Environmental Officers in the River Basin District (RBD) region where sampling is planned. Further adaptions to the planned schedule may be necessary in the event of adverse weather at shorter-notice and this should be done in consultation with the relevant RBD regional contact or their designate.
- Sampling is conducted by two operators.
- Locate identified (planned) fishing site using logbook provided. Directions can be supplemented using Google maps on phone or *via* in-vehicle GPS.
- Record fishing starting point using GPS or estimate extent of fishing site by pacing along river bank from river entry point.
- Note fishing start time.
- Electro-fishing to be conducted in an upstream direction in a riffle area away from sensitive habitats and non-target species.
- Forty 0+ salmon fry should be collected per catchment (or in designated large catchments it may be thirty-fvie 0+ salmon fry per sub-catchment as advised in the sampling plan).
- Sites in a catchment should be geographically dispersed when attempting the collection of the requisite number of fish to minimise the risk of siblings being sampled.
- The electrode needs to be dragged quickly back above the substrate towards the operator in order to disturb fry which are then captured in the net which is held firmly

to the substrate. Fry will be trapped in the net for transfer to the bucket. The technique is designed to capture salmon fry and capture of larger parr should be avoided.

- Preferably collect all samples in one fishing as this will ensure adequate mixing of samples in bucket and enable randomized selection of the first 15 individuals for RNAlater preservation. However, if a number of fishings are required, either because two or more distant locations within a site are required, or the site has to be fished over an extended period, or a site has to be fished over a two different days, these should be processed on their own merit and individuals selected for RNAlater preservation in proportion to the number of individuals collected.
- The presence and / or numbers of all fish captured during each survey by species at each site and sub-section fished should be recorded in the field sheets and this information provided to IFI in the Section 14 template.
- Time of fishing at each site and sub-section should be recorded and an estimate made of the length of the site / sub-section.

2.6 Operations – euthanasia and laboratory setup

The individual fish to be retained for genetic analyses will be euthanized by overdose of anaesthetic of MS222 (400mg/l). During the induction training, field operatives will be trained in this method of euthanasia.

- Ensure a clear area for fish processing in the back of vehicle is provided.
- Set up measuring board.
- Sequentially number 15 RNAlater tubes using indelible marker identifying site number and individual sample number.
- Select appropriate sample site ethanol tubes.
- Enter log book site data – site number; date; sampling team; distance fished; time fished; species encountered summary; any other comments .
- Allocate sampling tasks among sampling team: 1. person dissecting the fish; 2. data recorder/RNAlater tube management; and 3. ethanol tube manager/quality control/ procedure management.
- Prepare anesthesia.
- Protective latex or nitrile gloves and safety glasses should be worn during this procedure.
- Stock bottles of MS222 solution for the field sampling will be prepared before use by UCC (according to their safety protocols).

- The MSS222 solution will be mixed in a bucket of 1 litre of river water at a rate of 8-10ml/litre. Use a pipette to administer dosage.
- Add a proportional amount of baking powder to nullify the acidification effects of MS222 (Example – 0.5g of Baking Powder per litre, based on 10ml of stock solution (@400mg/l).
- Place small batches of fish (e.g. 10) in the anaesthetic solution and let them remain there until mortality is confirmed and proceed with sample processing thereafter. This reduces the time between mortality and sampling for the whole sample taken.
- The mortality point will be where there is no swimming / voluntary locomotor activity, buoyancy equilibrium is lost present, the opercular (gill) movements have ceased and no reflex response is evident after a tail-fin pinch stimulus.
- A Safety Data Sheet for MS222 is provided in Appendix 2 for reference.
- Measure individual fish fork length to one decimal point (e.g., 5.1, 5.2 etc.) and record in field sheet (Appendix 3).
- Once mortality point has been reached, a portion of the sample (from tail to just behind anus) is inserted into an ethanol tube. This is conducted for all samples.
- 15 samples are to be retained in vials of RNAlater. Open body cavity of remaining section of fish *via* anus up to and through to the jaw (mouth) using fine-pointed surgical scissors so as to expose internal organs to RNAlater. Care is taken to maintain the integrity of key organs and digestive system of the sample.
- The data recorder should identify on the datasheet samples retained in ethanol and RNAlater tubes.
- After 15 samples have been processed for RNAlater, the additional second section of fish bodies (no need to open up organ cavity) should be collected in individual zip lock bags for later freezing. A waterproof paper identification label recorded with pencil should be included in each bag; details should include site number, river name, date, number of 0+ salmon and numbers of any trout that may have been sampled inadvertently.
- The Unalter samples should be bagged individually (ziplock bag) and secured. The waterproof paper pencil recorded identification label detailing sample site, river and date should be placed in the bag.
- Return any excess live fish to the river.
- Disinfection of all equipment and PPE is obligatory before leaving site (See section 2.7).

2.7 Operations – General

Equipment: Backpack units should be used for sampling by all teams to provide a consistent sampling effort and approach. Ensure that all connections are securely fastened, and that anode and cathode are attached to the backpack frame with the metal clip. Fry will escape through any holes in the net so ensure that any holes that may develop are repaired.

Backpack Settings: Note all IFI safety procedures and safety features on the backpack before commencing operations.

- For SAFARI EF unit: Pulsed DC to be used. Backpack should be set to deliver approx. 200v at low amps. The recommended power setting (switch located on the left of the backpack) is approximately 45% of available power.
- For Hans Grassl EF unit: Use Pulse electrofishing with initial setting of 60 pulses per seconds and a pulse width of 5 m/s, and minimum required voltage to effectively catch fish. Voltage output is the sum of the coarse and fine settings. When fishing for salmonids stay within 40-60 p/s – lower frequencies will attract but not stun, higher frequencies may be injurious; pulse widths of 4-6 m/s should prove effective - lower pulse widths use less power and cause less damage to fish. Never adjust settings when electrical current is flowing.

If any fish mortalities are observed reduce the power setting appropriately.

Batteries: the backpack equipment is very effective when used with fully charged batteries. Two sets of fully charged batteries will be required each day. It is recommended to change the batteries midway through the sampling day or when the audible “whine” from the backpack begins to weaken. Batteries will require overnight re-charging to be fully charged for activity the following day. It is recommended that the date of first use and a relevant number is written on each battery or double battery pack. This allows tracking of battery life and will ensure batteries can be replaced after fulfilling their natural usefulness/life span.

Survey Sheets: Special survey sheets will be provided and these are required to be completed for all sites fished (Appendix 3). All sheets should be scanned and paper copies retained.

Section 14 Authorisation & annual schedule of rivers to be fished

Each year an application is made for a Section 14 Authorisation for all staff undertaking the field work. A schedule of the proposed rivers to be fished is also included.

Sampling in SACs: NPWS should be notified in respect of any Natura 2000 catchments where relevant instream qualifying interest species are present (i.e. pearl mussel *Margaritifera* spp. and white-clawed crayfish *Austropotamobius pallipes*). IFI are aware of the precautions necessary regarding lamprey and other species which are qualifying interests in SACs and all staff are aware that particular care is required in pearl mussel SACs to ensure that these animals are not disturbed.

GPS: Readings should be taken using the Irish Transverse Mercator **ITM Grid system.** Calibrate GPS instrument by holding it upright and walking around in a 10 m circle on site. This is important if moving substantial distances > 50 miles between sites. GPS instrument **should be held and read upright** when capturing a location. The reading should be taken at the electrofishing starting point at the bottom of the riffle. Fill in all details from location to survey sheet when the GPS stabilises. Accuracy in most handheld units is about 5 m or so - when this is achieved it can be assumed that this is the best reading.

Reading format: ITM coordinates are based on 2 groups of six figures. Eastings (always 1st) and Northings (2nd). Example: 123456 125467.

If for any reason location cannot be obtained as ITM then a Lat/ Long is acceptable. Please make sure to write down the whole of the co-ordinates available. Lat longs are available from the TETRA radios by selecting 'Location' and 'Position' from the main menu.

Biosecurity/Disinfection: use IFI's standard operating procedure to prevent transfer of algae, higher plants, invasives etc. between systems. Sampling should be conducted starting at the uppermost site in the catchment to prevent transfer of invasives from the lower reaches. Extreme vigilance is essential if moving between catchments to avoid any possibility of transfer. All teams to strictly observe IFI's field survey biosecurity protocol. Download from http://www.fisheriesireland.ie/Research/invasive-species.html

https://www.fisheriesireland.ie/sites/default/files/migrated/docman/biosecurityforfieldsurveys2010.pdf

2.7 Equipment

Checklist of equipment:

- Electrofishing PPE (lifejackets, wades, jackets, sunhats, insulation gloves, polaroid glasses etc)
- MS222 PPE (gloves and safety glasses)
- Pipette for dispensing MS222
- GPS - Smartphone with appropriate app or Tetra radio can be used.
- Discovery map – locations on google maps
- Catchment map (from IFI /UCC) with sampling channels marked
- Biosecurity kit – including virkon tablets
- Electrofishing gear and spares – anode, cathode, (two fully charged battery packs)
- chargers
- Buckets (3 for sampling/collecting/euthanising) plus 1 large 42L bucket for disinfection
- Survey sheets packs
- Measuring board
- Weighing scales –accuracy to 0.001g (10g limit)
- Measuring tape
- Camera
- Stopwatch
- Sampling containers – genetics (36 per site) and RnaLater tubes
- Scale envelopes
- Blue roll
- Ziplock bags for sample collection and storage
- Penknife for collecting scales
- Aquarium net (for catching fry in bucket)
- Prepared stock bottles of MS222
- Baking powder – in conjunction with MS222
- Stock bottle and funnels for disinfectant – repeat usage
- Stock bottles (covered to avoid light) for MS222 solution – maximum use: 4 occasions
- Rubber bands
- Surgical gloves
- Waterproof notebook – for labels

3. References

Barbour, M.T., Gerritsen, J., Synder, B.D. & Stribling, J.B. (1999). Rapid Bioassessment Protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish. 2nd Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Washington D.C.

CEN (2001) Water quality – Sampling of fish with electricity. (European community for standardization).

Clifford, S.L., McGinnity, P. and Ferguson, A. (1998). Genetic changes in Atlantic salmon, Salmo salar populations of NW Irish rivers resulting from escapes of adult farm salmon. Can. *J. Fish. Aquat. Sci*. 55: 358-363.

Dennis, J., Jackson, E. & Perry, S. (2024). Annual Aquaculture Report: Findings of the National Seafood Survey 2024: Bord Iascaigh Mhara (BIM).

Dillane E, McGinnity P., Coughlan J, Cross M, de Eyto, E., Prodohl, P., Kenchington, E., and Cross T. (2008). Landscape features influence intra-river population genetic structure in Atlantic salmon (*Salmo salar* L.). Molecular Ecology 17: 4786-4800.

Hansen L.P. and Youngson A.F. (1998). Interactions between farmed and wild salmon and options for reducing their impact. In: A.F. Youngson, L.P. Hansen & M. Windsor (eds) Interactions Between Salmon Culture and Wild Stocks of Atlantic Salmon: The Scientific and Management Issues. Report of the ICES/NASCO Symposium, Bath, England, April 1997. Trondheim, Norway: Norwegian Institute for Nature Research, pp. 80–89.

IG600 / IG600T Operating Manual from building date 01.6.2007, Hans Grassl, Pdf: [http://www.hans-grassl.com/Bilder_DB/IG600_ds_E030314w.PDF] accessed 27/7/2023.

Hansen L.P. and Youngson A.F. (1998). Interactions between farmed and wild salmon and options for reducing their impact. In: A.F. Youngson, L.P. Hansen & M. Windsor (eds) Interactions Between Salmon Culture and Wild Stocks of Atlantic Salmon: The Scientific and Management Issues. Report of the ICES/NASCO Symposium, Bath, England, April 1997. Trondheim, Norway: Norwegian Institute for Nature Research, pp. 80–89.

IG600 / IG600T Operating Manual from building date 01.6.2007, Hans Grassl, Pdf: [http://www.hans-grassl.com/Bilder_DB/IG600_ds_E030314w.PDF] accessed 27/7/2023.

Kelly, S., Adons, H., Nunez, J., O'Brien, E., O'Malley, P. & Millane, M. (2025). Occurrence of Farmed Atlantic Salmon in Western River Basin Districts during August & September 2024. Inland Fisheries Ireland, River Erriff National Salmonid Index Catchment, Aasleagh, Leenane, Co. Mayo.

Lippet, D.A. (1978). Electric fishing - the practical approach. *Fisheries Management*, **9:** 83-88.

McGinnity, P., Gargan, P., Roche, W.P, Mills, P. and McGarrigle, M. (2005). *Quantifying the freshwater habitat resource as a basis for the management of Irelands Atlantic salmon (Salmo salar L.) fisheries*. In The Proceedings of the Institute of Fisheries Management Annual Study Course 2005.

Moore, D.C. (1968). A light weight pulsed DC fish shocker. *Journal of Applied Ecology*. **5:** 205-208.

Payne, R.H., Child, A.R, Forrest, A. (1971). Geographical variation in the Atlantic salmon. Nature. 231:250–252.

Schiemenz, F. & Schonfelder, A. (1927). Fischfang Mit Elektrizitat. *Zeitchrift Fischerei* **25**: 161-187.

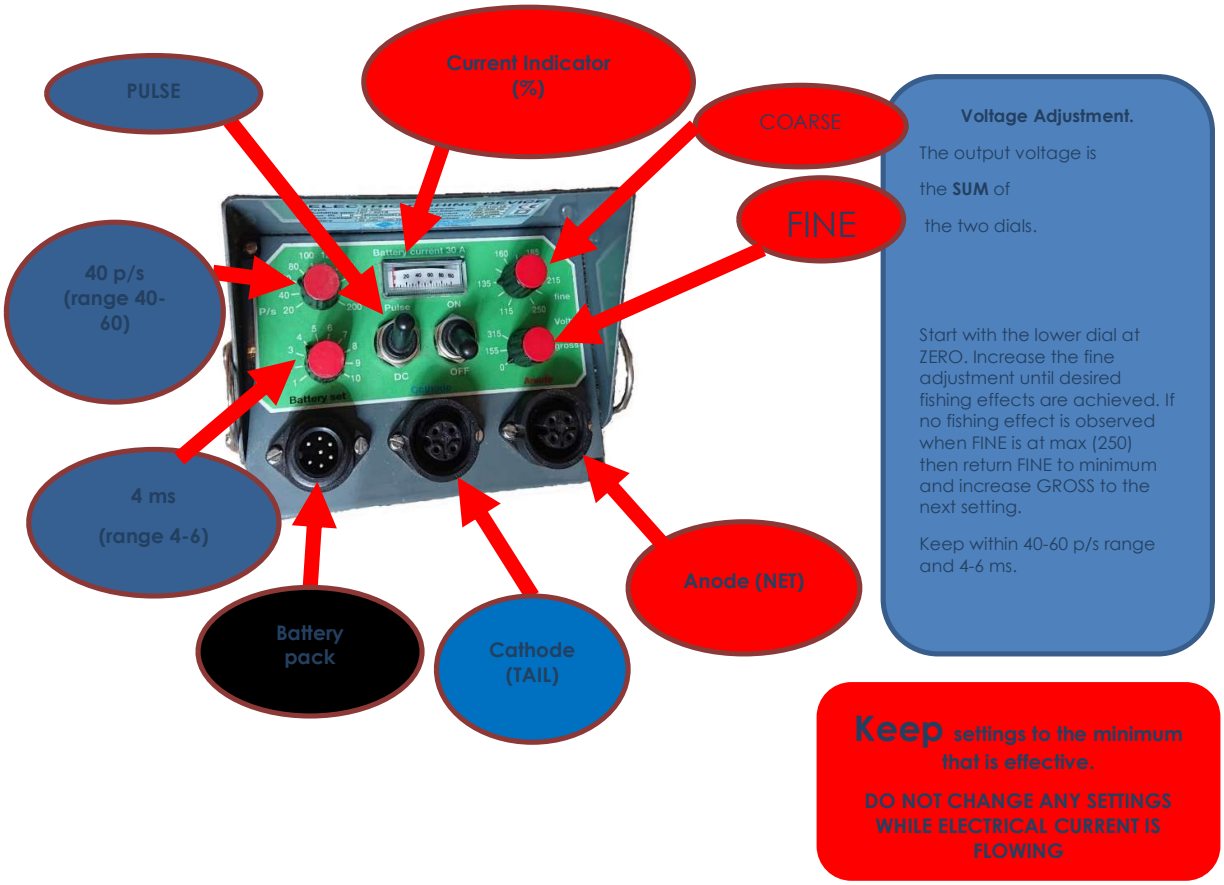
TEGOS (2023). Report of the Technical Expert Group on Salmon to the North-South Standing Scientific Committee for Inland Fisheries The Status of Irish Salmon Stocks in 2022 with Catch Advice for 2023. 55 pp.

SOP Appendix 1

Recommended initial settings for Hans Grassl for CWEF programme

The device will be ready for operation a few seconds after switching on. The first actuation of the anode switch (Dead-man's Switch) (DMS) is ignored by the device. After the second activation of the DMS an audible tone and deflection of the current indicator needle indicates when electrical current is flowing.

The Device should only be used by trained personnel and this guide should be used in conjunction with the operating manual: [http://www.hans-grassl.com/Bilder_DB/IG600_ds_E030314w.PDF]



SOP Appendix 2

Safety Data Sheet for MS222

Supelco®

www.sigmaaldrich.com

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Version 6.1
Revision Date 06.09.2022
Print Date 25.07.2023

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name	:	Ethyl 3-aminobenzoate methanesulfonate salt Ethyl 3-aminobenzoate methanesulfonate salt
Product Number	:	A5040
Brand	:	Sigma-Aldrich
REACH No.	:	A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.
CAS-No.	:	886-86-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Merck Life Science Limited Vale Road Arklow CO WICKLOW Y14 EK18 IRELAND
Telephone	:	+353 402-20300
E-mail address	:	TechnicalService@merckgroup.com

1.4 Emergency telephone

Emergency Phone #	:	+(353)-19014670 (CHEMTREC)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Skin irritation (Category 2), H315
Eye irritation (Category 2), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Long-term (chronic) aquatic hazard (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008
Pictogram

Signal Word	Warning
Hazard statement(s)	
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H412	Harmful to aquatic life with long lasting effects.
Precautionary statement(s)	
P261	Avoid breathing dust.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P302 + P352	IF ON SKIN: Wash with plenty of water.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Supplemental Hazard Statements	none

Reduced Labeling (<= 125 ml)

Pictogram

Signal Word	Warning
Hazard statement(s)	
H412	Harmful to aquatic life with long lasting effects.
Precautionary statement(s)	none
Supplemental Hazard Statements	none

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : MS-222
Tricaine

Formula : $C_9H_{11}NO_2 \cdot CH_4SO_3$
Molecular weight : 261.29 g/mol
CAS-No. : 886-86-2
EC-No. : 212-956-8

Component		Classification	Concentration
3-Ethoxycarbonylanilinium methanesulphonate			
CAS-No. EC-No.	886-86-2 212-956-8	Skin Irrit. 2; Eye Irrit. 2; STOT SE 3; Aquatic Chronic 3; H315, H319,	<= 100 %

	H335, H412	

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Nitrogen oxides (NOx)
Sulfur oxides
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry.

Storage class
Storage class (TRGS 510): 11: Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

The selected protective gloves have to satisfy the specifications of Regulation (EU) 2016/425 and the standard EN 374 derived from it.

Full contact
Material: Nitrile rubber

Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
protective clothing

Respiratory protection
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.
Recommended Filter type: Filter type P2

The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Physical state	powder
b)	Color	light gray
c)	Odor	No data available
d)	Melting point/freezing point	Melting point/range: 148 °C
e)	Initial boiling point and boiling range	No data available
f)	Flammability (solid, gas)	No data available
g)	Upper/lower flammability or explosive limits	No data available
h)	Flash point	No data available
i)	Autoignition	No data available

	temperature	
j)	Decomposition temperature	No data available
k)	pH	No data available
l)	Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: No data available
m)	Water solubility	No data available
n)	Partition coefficient: n-octanol/water	No data available
o)	Vapor pressure	No data available
p)	Density	No data available
	Relative density	No data available
q)	Relative vapor density	No data available
r)	Particle characteristics	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available

Inhalation: No data available
Dermal: No data available
LD50 Intravenous - Mouse - 180 mg/kg

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

Endocrine disrupting properties

Product:

Assessment	The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

RTECS: DG2455000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 40.9 mg/l - 96 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Endocrine disrupting properties

Product:

Assessment : The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. Notice Directive on waste 2008/98/EC.

SECTION 14: Transport information

14.1 UN number

ADR/RID: - IMDG: - IATA: -

14.2 UN proper shipping name

ADR/RID: Not dangerous goods
IMDG: Not dangerous goods
IATA: Not dangerous goods

14.3 Transport hazard class(es)

ADR/RID: - IMDG: - IATA: -

14.4 Packaging group

ADR/RID: - IMDG: - IATA: -

14.5 Environmental hazards

ADR/RID: no IMDG Marine pollutant: no IATA: no

14.6 Special precautions for user

Further information

Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

This material safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006.

Other regulations
Take note of Dir 94/33/EC on the protection of young people at work.

15.2 Chemical Safety Assessment
For this product a chemical safety assessment was not carried out

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

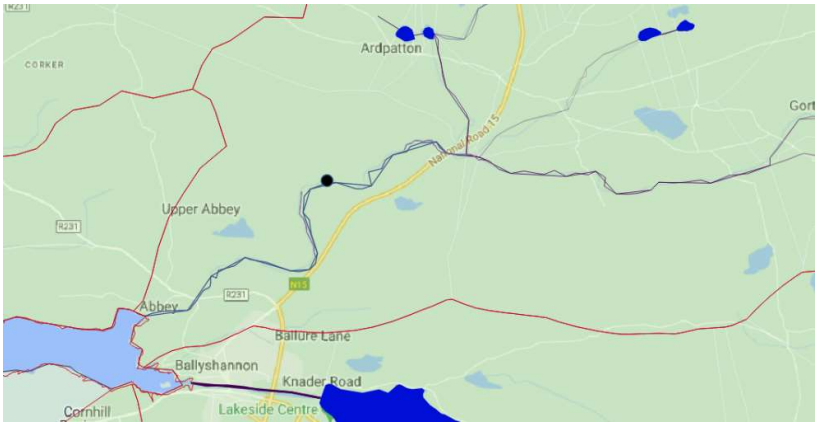
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H412	Harmful to aquatic life with long lasting effects.

Further information
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

SOP Appendix 3

Field sheet templates



District: Ballyshannon
River: Abbey
Site: Parkhill
OS Co-ordinates: 188839, 363686
Directions: Travelling north from Ballyshannon turn left off N15 approx. 1.3Km after Morning Star roundabout, continue for 700m to bridge crossing river at site.
Date sampled:
Team:

General Comments

No.	Length (mm)	Ethanol	RNAlater	Comments
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				

INLAND FISHERIES IRELAND

Introgression Project 2023

System name:	Date:	Site time arrival:	Site time finish:

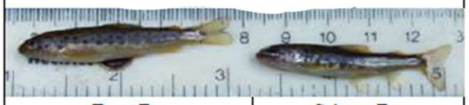
ITM GPS (at starting point) (include letter also):												Water level: (Circle)					
												1. V.Low	2. Low	3. Med/Low	4. Med	5. Med/High	6. High

Elevation from GPS:	m

Site Details / Location accessed at:

Conductivity (low water only):	µS	Photographs: (photo site & include upstream finish point)	Y	N
Water Temperature:	°C	Known spawning location:	Y	N	Unknown
E/F gear used:				
Backpack Output:	volts	amps		

Additional species/cohorts recorded	n	Total length of sample area:	m
Salmon parr (1+)			
Brown trout fry (0+)			
Brown trout parr (1+)			
Eels			
Lamprey			
Other species:			



Trout Fry

Salmon Fry

7.2. Appendix 2: Site details

7.2.1. NWRBD

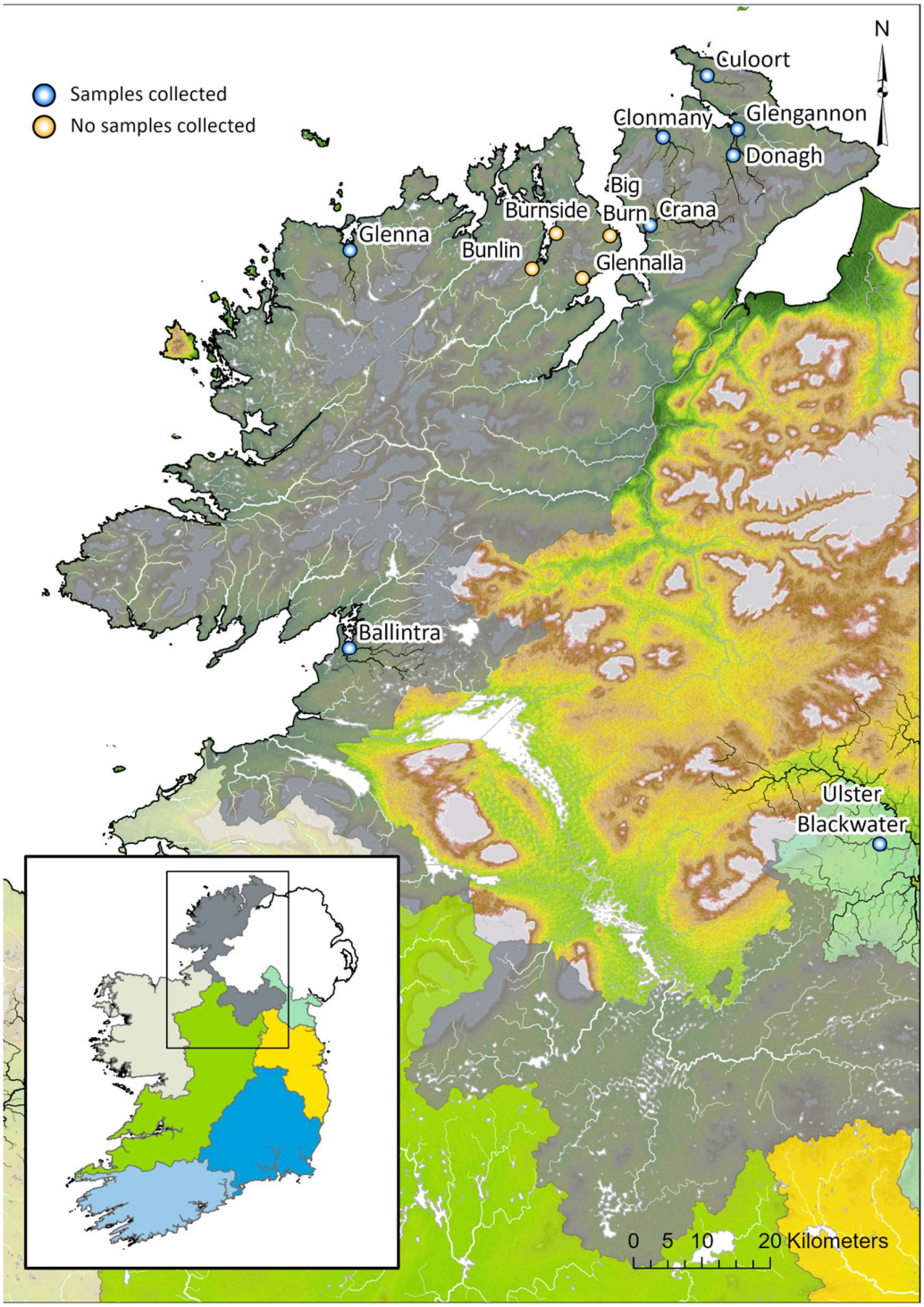


Figure 6 Rivers surveyed for the Geneflow project in 2024 within the NWRBD (n = 7). Blue dots indicate successful sample collections. Orange dots indicate catchments where no salmon were recorded in 2024.

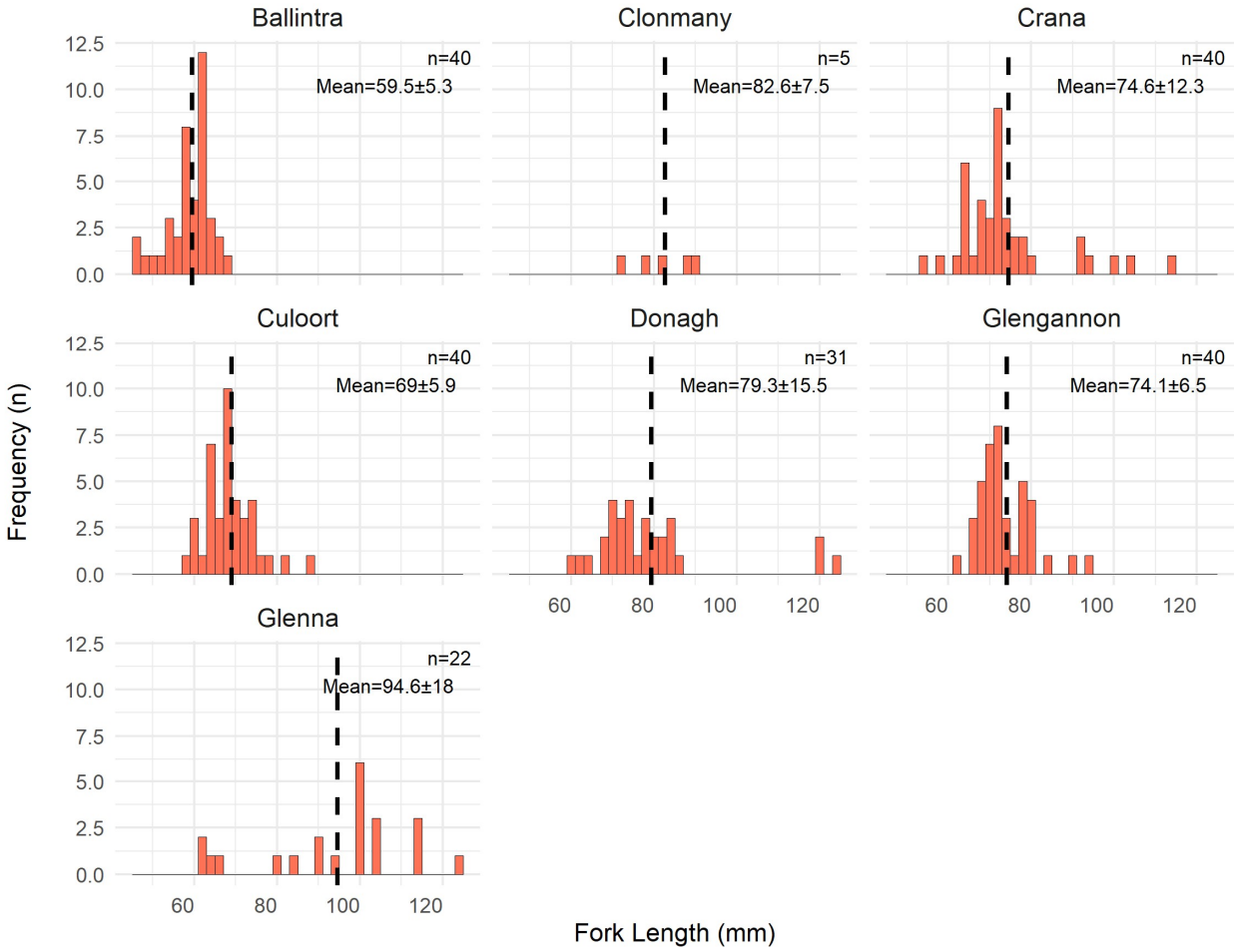


Figure 7 Length frequencies of juvenile salmon collected for the Geneflow project in 2024 in rivers sampled within the NWRBD (n = 7). Individual means are indicated in each of the histograms.

Table 2 Site details, additional information, and site segment dimensions for NWRBD rivers where samples were collected in 2024.

NWRFB																
Site code	Catchment	Date	Start location eastings (ITM)	Start location northings (ITM)	Finish location eastings (ITM)	Finish location northings (ITM)	Wading difficulty rating	Sample difficulty rating	Size Range (mm)	Mean length (mm) ± SD	Stream order	Survey sections (n)	Latitude	Average wetted with (m)	Distance covered (m)	Average wetted area (m^2)
147	Ballintra	02/09/2024	590889	871762	591057	871800	3	2	46-69	59.5±5.3	4	1	54.6	8.2	189	1550
129	Clonmany	03/09/2024	636805	946499	637076	946356	3	5	73-91	82.6±7.5	4	4	55.2	8.5	407	3460
148	Crana	03/09/2024	634940	933622	635469	933849	4	4	55-114	74.6±12.3	5	1	55.1	15.1	632	9543
123	Culoort	12/08/2024	643274	955529	643278	954940	3	3	59-88	69.0±5.9	2	1	55.4	4.5	850	3825
125	Donagh	19/08/2024	647087	943863	646422	943971	3	3	60-125	79.3±15.5	4	1	55.3	7.9	574	4535
124	Glengannon	14/08/2024	647711	947661	647901	947213	3	3	63-95	74.1±6.5	4	1	55.3	7.9	489	3863
126	Glenna	30/08/2024	590983	929953	590971	929543	3	3	62-125	94.6±18.0	4	1	55.1	7	403	2821

Table 3 Species presence and absence of each species recorded (except salmon fry) in NWRBD rivers sampled for the Geneflow programme in 2024. Approximate numbers encountered are also noted where applicable.

NWRBD									
River	Salmon	Trout		Eel	Lamprey	Stickleback	Stone loach	Minnow	Other species
	Parr	Parr	Fry						
Ballintra	Y (9)	Y(4)	Y (9)	N	N	N	N	N	Flounder, Sea trout
Big Burn	N	Y (50+)	Y (30+)	2	N	N	N	N	N
Bunlin	N	Y (25)	Y (20)	3	N	N	N	N	Flounder
Burnside	N	Y	Y	N	N	N	N	N	N
Clonmany	Y	Y (15)	Y (8)	Y	N	N	N	N	N
Crana	Y (A)	Y (20)	Y (3)	N	N	N	N	N	N
Culoort	Y (2)	Y (20)	Y (20)	Y (15)	N	N	N	N	Flounder
Donagh	Y (3)	Y (50)	Y (50)	Y (11)	N	N	N	N	N
Glengannon	Y (7)	Y (30)	Y(30)	Y (20)	N	N	N	N	Flounder
Glenna	Y	Y (12)	Y (16)	Y (2)	N	N	N	N	Flounder
Glennalla	N	(50+)	(20+)	1	N	N	N	N	N

7.2.2. WRBD

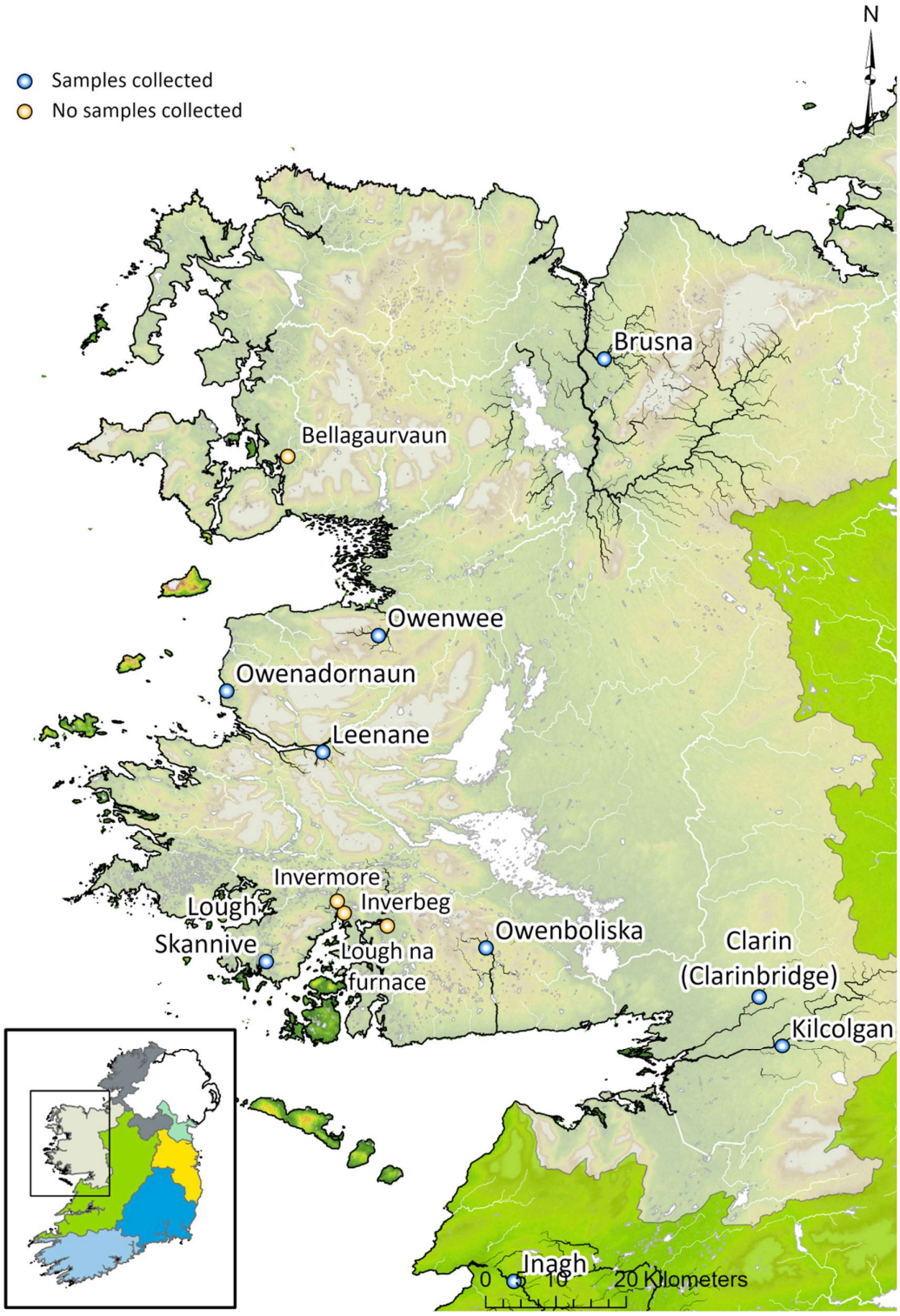


Figure 8 Rivers surveyed for the Geneflow project in 2024 within the WRBD (n = 8). Blue dots indicate successful sample collections. Orange dots indicate catchments where no salmon were recorded in 2024.

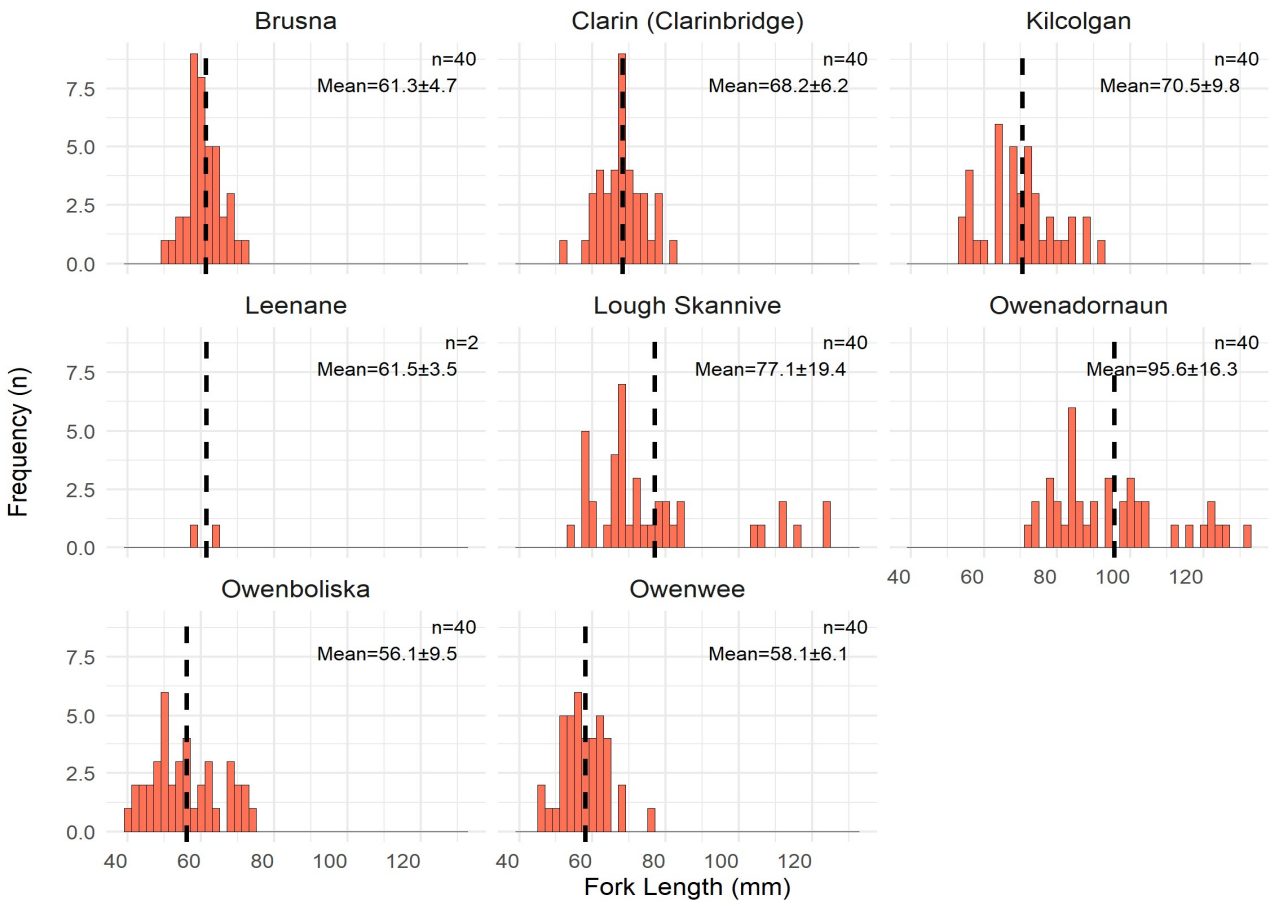


Figure 9 Length frequencies of juvenile salmon collected for the Geneflow project in 2024 in rivers sampled within the WRBD (n = 8). Black vertical segmented line indicates sample mean length (mm).

Table 4 Site details, additional information, and site segment dimensions for WRBD rivers where samples were collected in 2024.

WRFB																
Site code	Catchment	Date	Start location eastings (ITM)	Start location northings (ITM)	Finish location eastings (ITM)	Finish location northings (ITM)	Wading difficulty rating	Sample difficulty rating	Size Range (mm)	Mean length (mm) ± SD	Stream order	Survey sections (n)	Latitude	Average wetted with (m)	Distance covered (m)	Average wetted area (m^2)
130	Brusna	04/09/2024	528015	818016	528327	818147	2	2	51-72	61.3+/-4.7	5	1	54.1	12.5	360	4500
116	Clarin	19/08/2024	550050	727191	550285	727581	2	2	52-83	68.2+/-6.2	3	1	53.3	6.1	560	3416
158	Kilcolgan	18/09/2024	553337	720179	555528	720004	2	2	54-92	70.5+/-9.8	3	1	53.2	5.9	300	1770
137	Leenane	24/09/2024	487957	761997	488289	761268	4	5	59-64	61.5+/-3.5	3	2	53.6	3.5	922	3227
135	Lough Skannive	23/09/2024	479910	732223	480240	732188	2	3	54-125	77.1+/-19.4	3	2	53.3	5	457	2285
136	Owenadornaun	24/09/2024	474281	770686	475315	770515	2	2	73-132	95.6+/-16.3	4	1	53.6	5.5	780	4290
151	Owenboliska	19/09/2024	511183	734163	510781	734323	3	4	39-74	56.7+/-9.7	3	3	53.3	5.2	682	3547
152	Owenwee	20/09/2024	495871	778564	495520	778633	2	2	47-76	58.1+/-6.1	4	1	53.7	6.2	783	4855

Table 5 Species presence and absence of each species recorded (except salmon fry) in WRBD rivers sampled for the Geneflow programme in 2024. Approximate numbers encountered are also noted where applicable.

WRBD									
River	Salmon	Trout		Eel	Lamprey	Stickleback	Stone loach	Minnow	Other species
	Parr	Parr	Fry						
Bellagaurvaun	N	Y (50)	Y (50)	N	N	N	N	N	N
Brusna	Y (7)	N	N	N	N	N	N	N	N
Clarin	Y (15)	Y (15)	Y (40)	Y	N	Y	N	N	N
Inverbeg	N	N	Y	Y	N	N	N	N	N
Invermore	N	N	Y	N	N	N	N	N	N
Kilcolgan	Y (50)	Y (1)	Y (12)	Y	N	Y	N	Y	N
Leenane	N	Y (50+)	Y (50+)	Y (15)	N	N	N	N	Flounder, Goby
Lough na Furnace	N	Y (4)	N	Y (30)	N	N	N	N	Flounder
Lough Skannive	Y (20)	Y (10)	Y (12)	Y	N	N	N	Y	N
Owenboliska	Y (10)	Y	Y	N	N	N	N	N	N
Owennadornaun	Y (30)	Y (50+)	Y (50+)	Y (50+)	N	N	N	N	Flounder
Owenwee	Y (20)	Y (4)	Y (10)	N	N	N	N	N	N

7.2.3. SHRBD

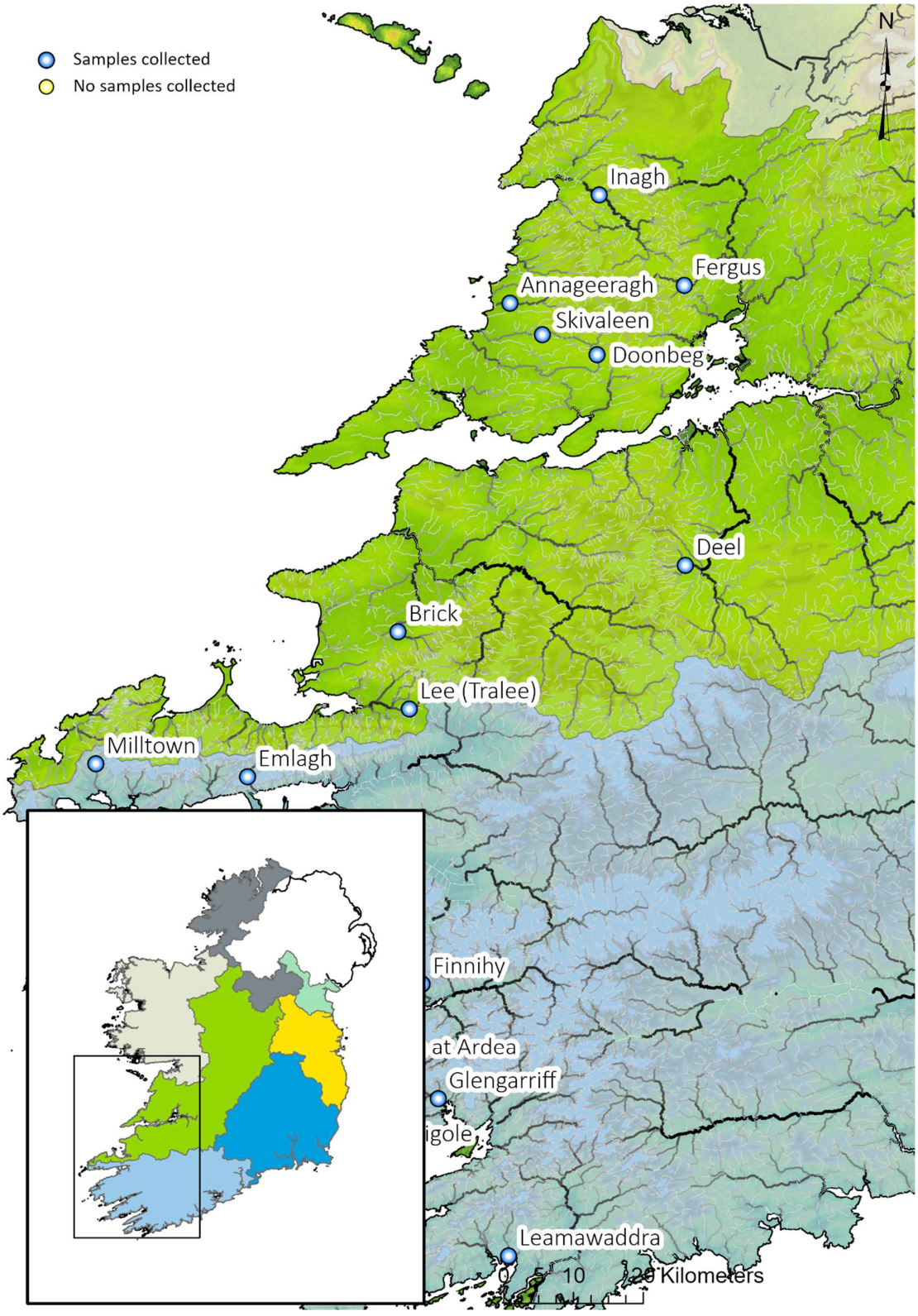


Figure 10 Rivers surveyed for the Geneflow project in 2024 within the SHRBD (n = 7). Blue dots indicate successful sample collections.

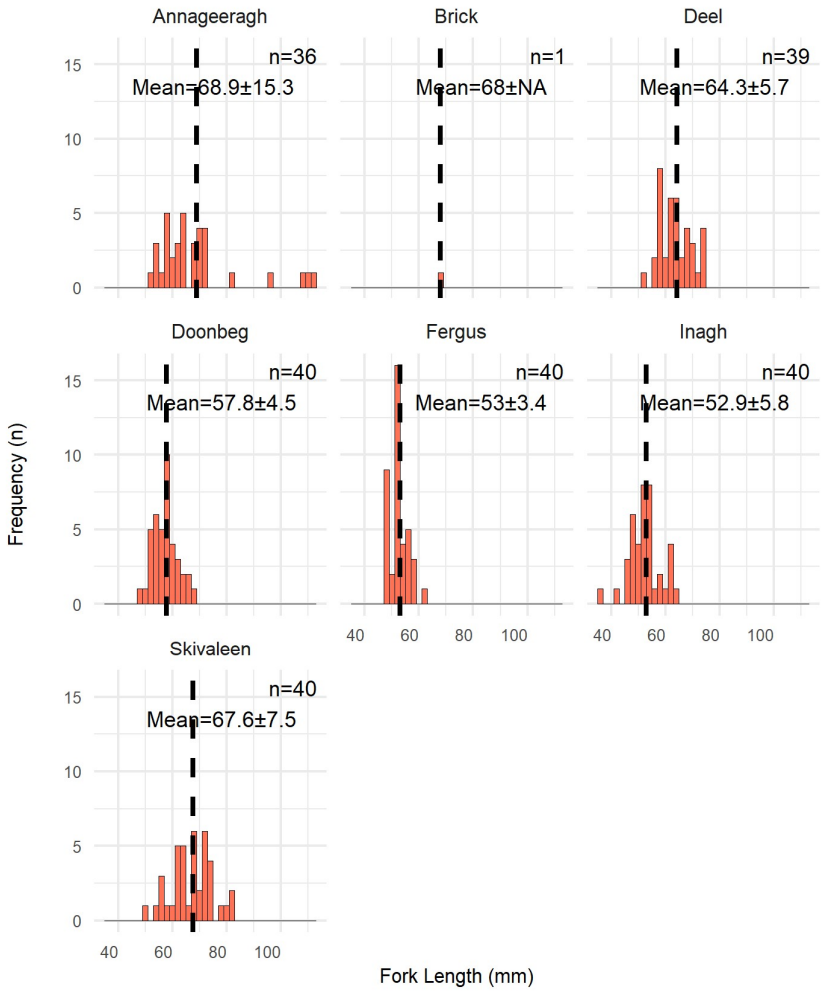


Figure 11 Length frequencies of juvenile salmon collected for the Geneflow project in 2024 in rivers sampled within the SHRBD (n = 7). Black vertical segmented line indicates sample mean length (mm).

Table 6 Site details, additional information, and site segment dimensions for SHRBD rivers where samples were collected in 2024.

SHRFB																
Site code	Catchment	Date	Start location eastings (ITM)	Start location northings (ITM)	Finish location eastings (ITM)	Finish location northings (ITM)	Wading difficulty rating	Sample difficulty rating	Size Range (mm)	Mean length (mm) ± SD	Stream order	Survey sections (n)	Latitude	Average wetted with (m)	Distance covered (m)	Average wetted area (m^2)
155	Annageeragh	06/08/2024	502355	671197	502850	671127	3	3	52-113	68.9+/-15.3	4	1	52.7	8.6	559	4807
113	Brick	24/07/2024	486306	623953	486387	623671	2	5	68-68	68+/-NA	4	3	52.3	7.9	380	3002
156	Skivaleen	07/08/2024	507006	666683	507662	666873	3	3	51-82	67.6+/-7.5	3	2	52.7	7.8	800	6240
134	Deel	23/07/2024	527509	633500	527193	633801	2	2	53-75	64.3+/-5.7	4	1	52.4	4.8	572	2746
140	Doonbeg	01/08/2024	514847	663813	514538	663876	2	2	48-69	57.8+/-4.5	3	1	52.7	4	310	1240
142	Fergus	30/07/2024	527354	673747	527083	673948	3	3	48-62	53+/-3.4	4	1	52.8	8.9	428	3809
139	Inagh	31/07/2024	515155	686720	515640	687020	4	3	36-65	52.9+/-5.8	3	1	52.9	7	856	5992

Table 7 Species presence and absence of each species recorded (except salmon fry) in SHRBD rivers sampled for the Geneflow programme in 2024. Approximate numbers encountered are also noted where applicable.

SHRBD									
River	Salmon	Trout		Eel	Lamprey	Stickleback	Stone loach	Minnow	Other species
	Parr	Parr	Fry						
Annageeragh	Y (10)	Y (10)	Y (10)	Y (10)	N	N	N	N	N
Brick	N	Y (5)	Y(3)	Y (30)	N	Y	N	Y	Flounder
Skivaleen	Y (50)	Y (50)	Y (50)	Y	N	N	Y	N	N
Deel	N	N	N	N	N	Y	N	N	N
Doonbeg	Y (30)	N	N	N	N	N	N	N	N
Fergus	Y (30)	N	Y (1)	N	N	N	N	N	N
Inagh	Y (5)	Y (10)	Y (3)	Y	Y	Y	Y	Y	N

7.2.4. SWRBD

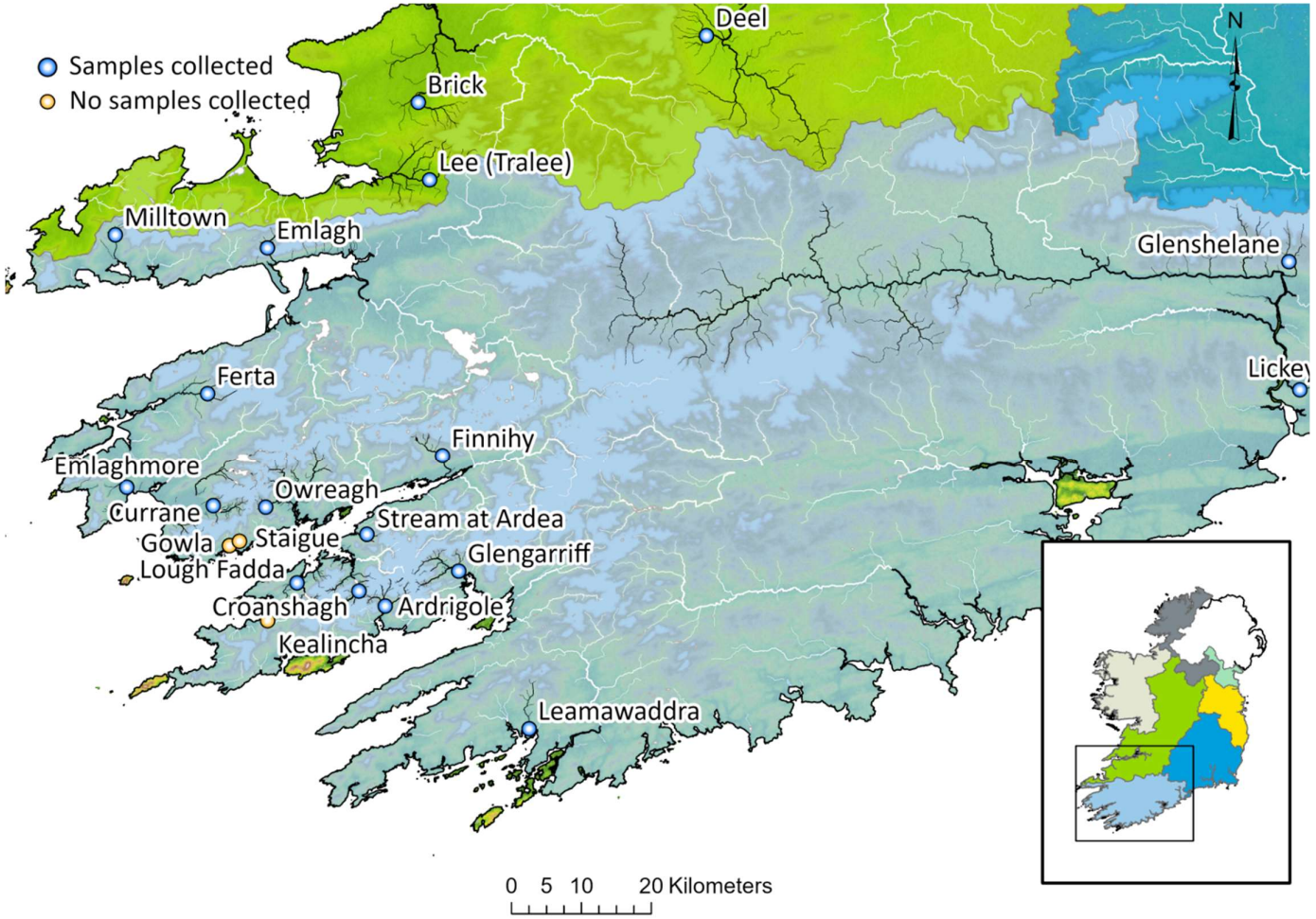


Figure 12 Rivers surveyed for the Geneflow project in 2024 within the SWRBD (n = 21). Blue dots indicate successful sample collections. Orange dots indicate **catchments where** no **salmon were recorded in** 202**4.**

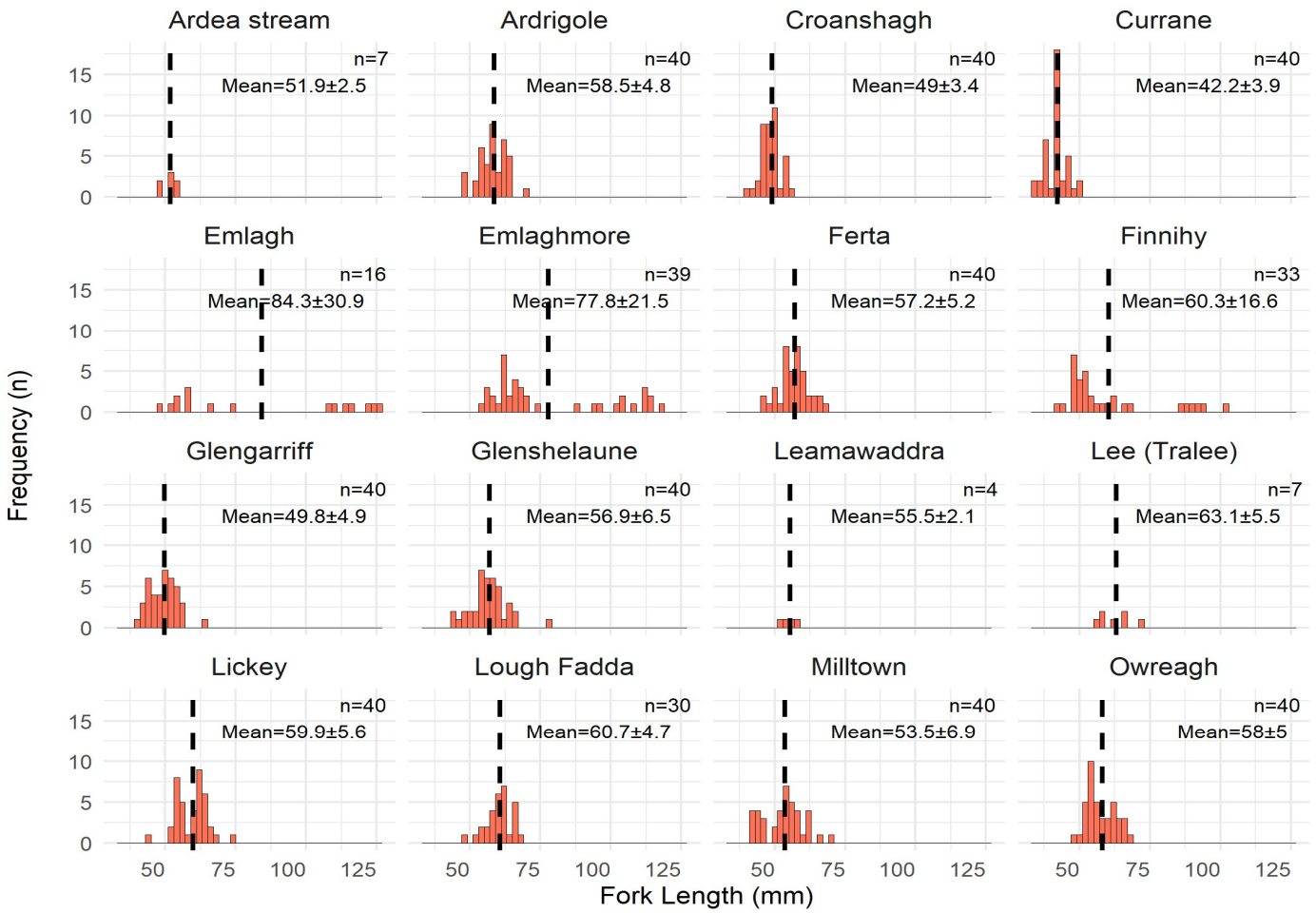


Figure 13 Length frequencies of juvenile salmon collected for the Geneflow project in 2024 in rivers sampled within the SWRBD (n = 16). Black vertical segmented line indicates sample mean length (mm).

Table 8 Site details, additional information, and site segment dimensions in SWRBD rivers where samples were collected in 2024.

SWRFB																	
Site code	Catchment	Date	Start location eastings (ITM)	Start location northings (ITM)	Finish location eastings (ITM)	Finish location northings (ITM)	Wading difficulty rating	Sample difficulty rating	Size Range (mm)	Mean length (mm) ± SD	Stream order	Survey sections (n)	Latitude	Average wetted with (m)	Distance covered (m)	Average wetted area (m^2)
117	Ardea stream	18/07/2024	478955	562102	478617	562388	2	5	48-55	51.9+/-2.5	2	1	51.8	1	637	637
118	Ardigole	23/07/2024	481577	551883	481454	552342	3	2	48-70	58.5+/-4.8	5	1	51.4	8.9	510	4539
122	Croanshagh	25/07/2024	477819	554012	477449	553739	1	4	40-56	49+/-3.4	5	1	51.7	10.2	513	5233
133	Currane (Rock Lodge)	19/07/2024	456981	566194	456834	566500	3	3	33-51	42.2+/-3.9	3	1	51.8	2.7	348	940
154	Emlagh	10/07/2024	464729	603152	464826	603482	4	4	49-127	84.3+/-30.9	4	2	52.2	5.6	747	4183
119	Emlaghmore	15/07/2024	444617	568812	444105	569210	2	3	54-119	77.8+/-21.5	4	1	51.9	8.1	420	3402
112	Ferta	12/07/2024	456165	582298	456255	582186	3	4	46-68	57.2+/-5.2	3	2	52	3.9	500	1950
120	Finnihy	17/07/2024	489760	573387	489980	573435	4	4	43-102	60.3+/-16.6	4	2	51.9	6.9	738	5092
108	Glengarriff	17/07/2024	492081	556852	491605	556985	3	3	40-64	49.8+/-4.9	3	1	51.8	5	500	2500
107	Glenshelane	16/07/2024	610814	601173	610487	601429	2	2	45-79	56.9+/-6.4	3	1	52.2	5.7	475	2708
109	Leamawaddra	10/07/2024	502152	534400	502719	534841	3	5	53-58	55.5+/-2.1	2	3	51.6	0.8	802	642
111	Lee (Tralee)	11/07/2024	487923	612876	488636	612755	2	5	57-72	63.1+/-5.5	4	3	52.3	7.9	782	6178
110	Lickey	16/07/2024	612374	582854	613117	582815	2	2	45-74	59.9+/-5.6	3	1	52	6.5	798	5187
121	Lough Fadda	24/07/2024	468951	555180	469169	554901	2	4	48-69	60.7+/-4.7	5	1	51.7	7	581	4067
153	Milltown	10/07/2024	442974	605012	443048	604585	1	1	43-69.1	53.5+/-6.9	3	1	52.2	4.9	624	3058
114	Owreagh	25/07/2024	464487	565978	463920	565862	3	3	48-69	58+/-5	3	1	51.8	4.9	624	3058

Table 9 Species presence and absence of each species recorded (except salmon fry) in SWRBD rivers sampled for the Geneflow programme in 2024. Approximate numbers encountered are also noted where applicable.

SWRBD									
River	Salmon	Trout		Eel	Lamprey	Stickleback	Stone loach	Minnow	Other species
	Parr	Parr	Fry						
Ardea stream	Y (2)	Y (50)	Y (50)	Y	N	N	N	N	N
Ardigole	Y (2)	Y (15)	Y (1)	Y (1)	N	N	N	N	N
Croanshagh	Y (11)	Y(7)	Y(3)	Y(9)	N	N	N	N	N
Currane (Rock Lodge)	Y (20)	Y (50)	Y (10)	N	N	N	N	N	N
Emlagh	Y (4)	Y (14)	Y (10)	N	N	N	N	N	N
Emlaghmore	Y (A)	Y (A)	Y (A)	Y	N	N	N	N	N
Ferta	Y (A)	Y (10)	y (4)	Y	N	N	N	N	N
Finnihy	Y(50)	Y(50)	Y(50)	N	N	N	N	N	N
Glengarriff	Y 10	Y 7	Y 4	Y 10	N	N	N	N	N
Glenshelane	Y30	Y 6	Y 15	Y	7	N	N	N	N
Gowla	N	Y (50)	Y (50)	Y (50)	N	N	N	N	N
Kealincha	N	Y	Y	N	N	N	N	N	N
Leamawaddra	N	Y 50	Y	N	N	N	N	N	N
Lee (Tralee)	N	Y (50)	Y (50)	Y	N	Y	N	N	N
Lickey	Y (17)	Y (3)	Y (6)	Y (5)	N	N	N	N	N
Lough Fadda	N	Y (50)	Y(40)	Y(3)	N	N	N	N	N
Milltown	Y (10)	y (1)	y (15)	N	N	N	N	N	N
Owreagh	N	Y (50)	Y (50)	N	N	N	N	N	N
Staigue	N	Y (50)	Y (50)	Y (50)	N	N	N	N	N

7.2.5. SERBD

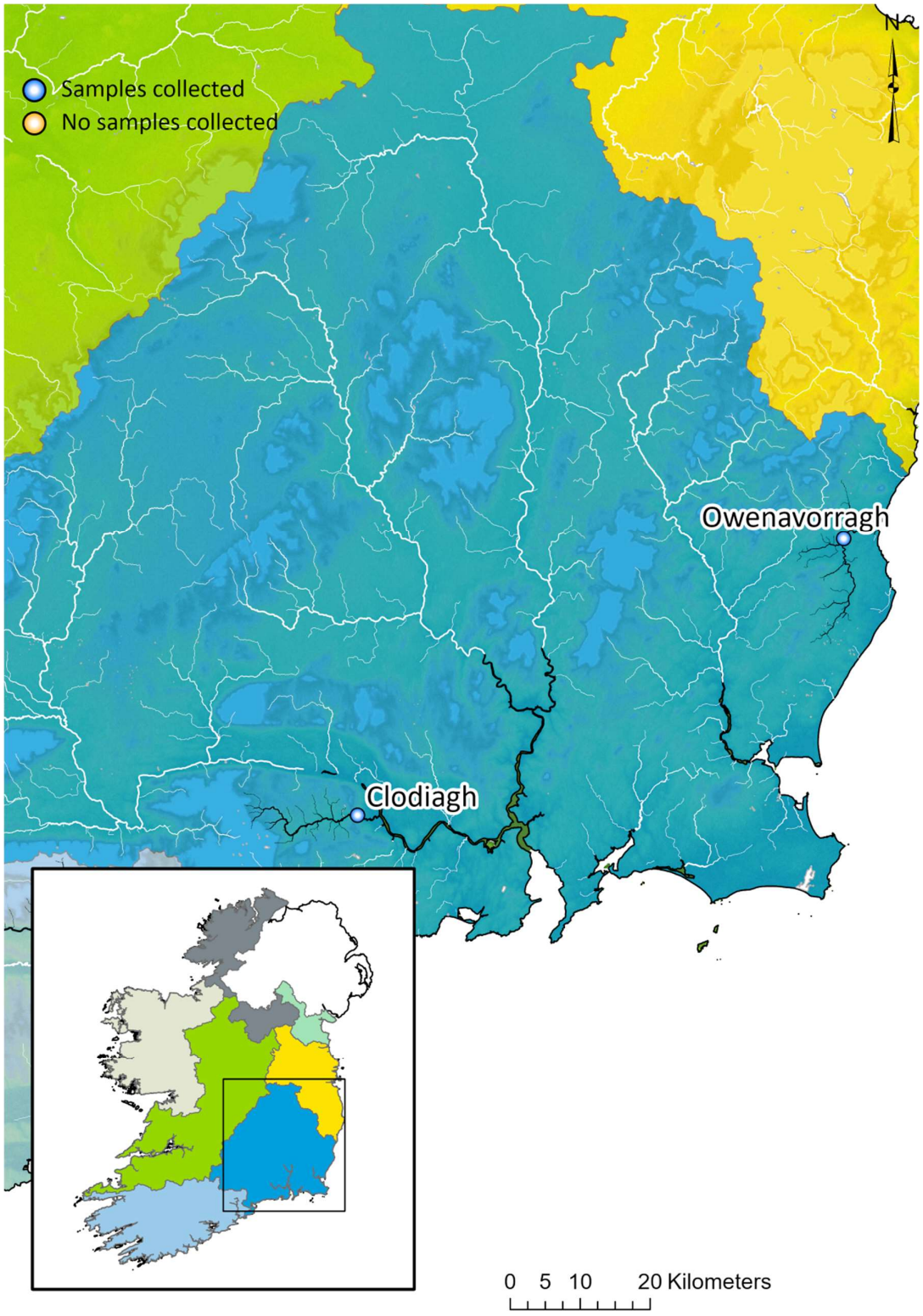


Figure 14 Rivers surveyed for the Geneflow project in 2024 within the SERBD (n = 2). Blue dots indicate successful sample collections.

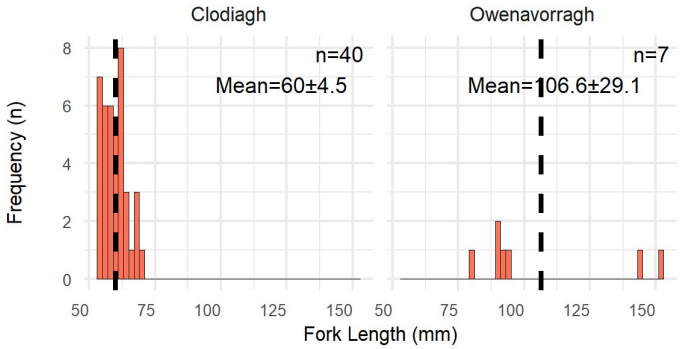


Figure 15 Length frequencies of juvenile salmon collected for the Geneflow project in 2024 in rivers sampled within the SERBD (n = 2). Black vertical segmented line indicates sample mean length (mm).

Table 10 Site details, additional information, and site segment dimensions in SERBD rivers where samples were collected in 2024.

SERFB																	
Site code	Catchment	Date	Start location eastings (ITM)	Start location northings (ITM)	Finish location eastings (ITM)	Finish location northings (ITM)	Wading difficulty rating	Sample difficulty rating	Size Range (mm)	Mean length (mm) ± SD	Stream order	Survey sections (n)	Latitude	Average wetted with (m)	Distance covered (m)	Average wetted area (m^2)
141	Clodiagh	26/07/2024	645537	615569	644518	615532	3	2	53-70	60+/-4.5	5	1	52.3	13.9	1023	14220
143	Owenavorragh	13/08/2024	715022	655034	714983	615532	3	2	90-153	111+/-29.2	5	3	52.6	12.6	551	6943

Table 11 Species presence and absence of each species recorded (except salmon fry) in SERBD rivers sampled for the Geneflow programme in 2024. Approximate numbers encountered are also noted where applicable.

SERBD									
River	Salmon	Trout		Eel	Lamprey	Stickleback	Stone loach	Minnow	Other species
	Parr	Parr	Fry						
Clodiagh	Y (a)	N	Y (3)	N	N	N	N	N	
Owenavorragh	Y 5	Y (2)	Y (50)	Y	N	Y	Y	Y	

7.2.6. NBRBD

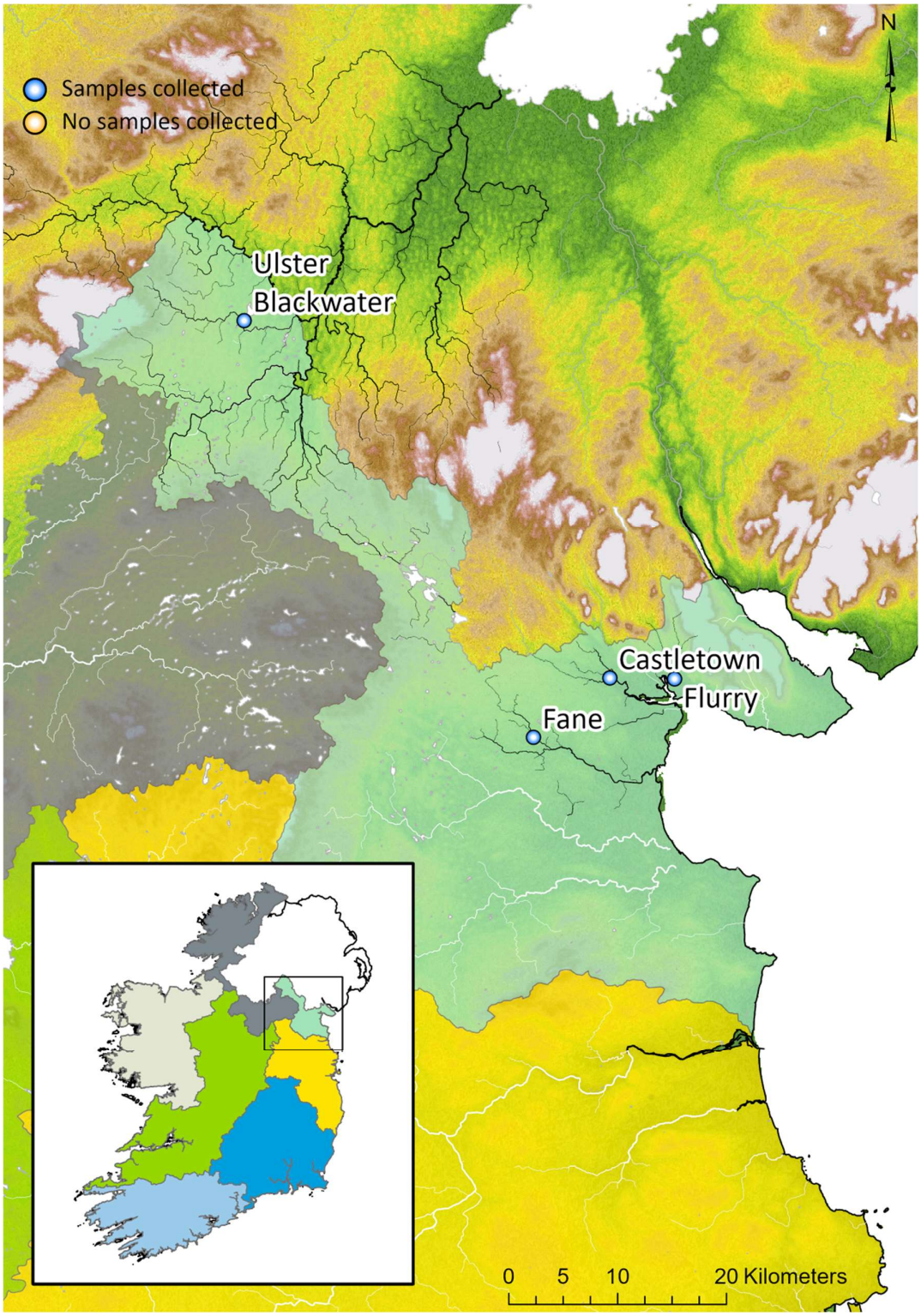


Figure 18 Rivers surveyed for the Geneflow project in 2024 within the NBRBD (n = 3). Blue dots indicate successful sample collections.

Table 14 Site details, additional information, and site segment dimensions in NBRBD rivers where samples were collected in 2024.

NBRFB																
Site code	Catchment	Date	Start location eastings (ITM)	Start location northings (ITM)	Finish location eastings (ITM)	Finish location northings (ITM)	Wading difficulty rating	Sample difficulty rating	Size Range (mm)	Mean length (mm) ± SD	Stream order	Survey sections (n)	Latitude	Average wetted with (m)	Distance covered (m)	Average wetted area (m^2)
144	Castletown	14/08/2024	702129	810112	701808	809870	2	3	49-85	63.1+/-7	3	1	54	7.4	915	6771
155	Fane	15/08/2024	695109	804654	694751	804817	2	1	63-94	79+/-7.1	3	1	53	13.1	379	4965
157	Flurry	17/09/2024	708071	810025	708172	810282	2	2	55-80	69+/-5.2	3	1	54	7.1	331	2350
na	Ulster Blackwater	24/09/2024	671936	842196	670992	842372	3	4	72-93	82.4+/-5.8	4	3	54.2	8.5	976	8296

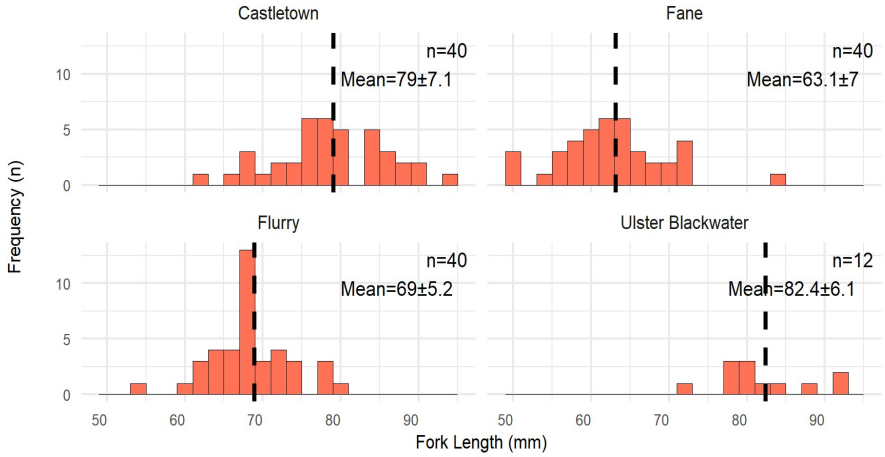


Figure 19 Length frequencies of juvenile salmon collected for the Geneflow project in 2024 in rivers sampled within the NBRBD (n = 4). Black vertical segmented line indicates sample mean length (mm).

Table 15 Species presence and absence of each species (except salmon fry) recorded in NBRBD rivers for the Geneflow programme in 2024. Approximate numbers encountered are also noted where applicable.

NBRBD									
River	Salmon	Trout		Eel	Lamprey	Stickleback	Stone loach	Minnow	Other species
	Parr	Parr	Fry						
Castletown	Y (a)	Y (4)	Y (3)	Y	N	Y	N	Y	N
Fane	Y 10	Y 6	Y 2	Y 10	N	Y	N	N	N
Flurry	Y (2)	N	Y (50)	Y (5)	N	N	N	N	N
Ulster Blackwater	N	Y	Y	N	N	N	N	N	N

7.2.7. Length frequencies of all rivers sampled

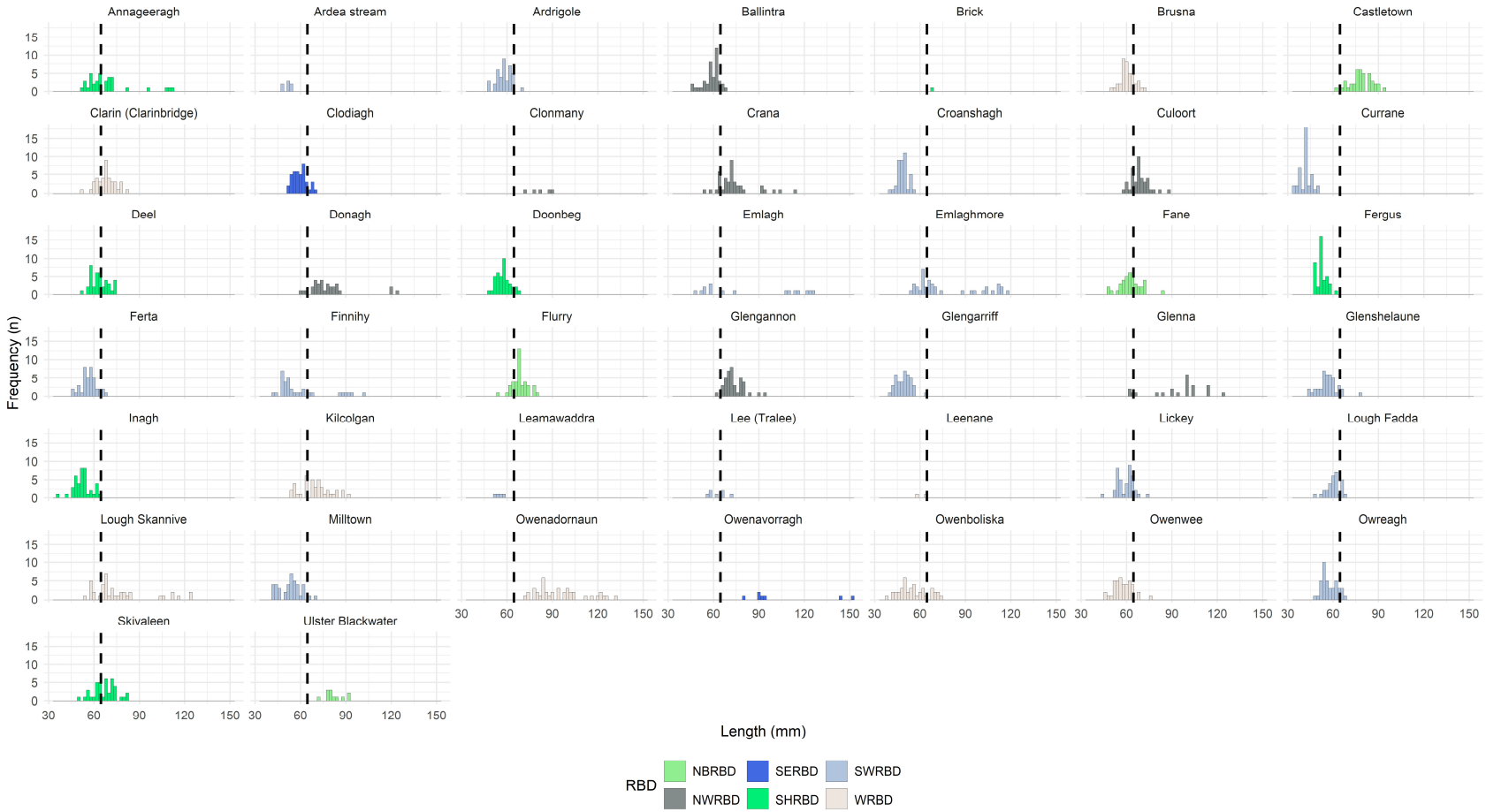


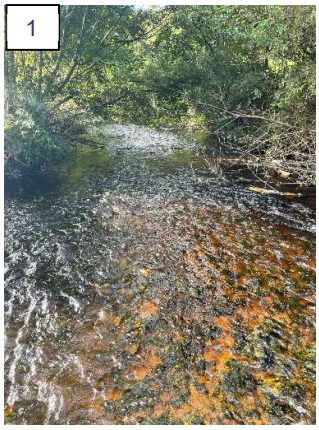
Figure 20 Length frequencies of juvenile salmon collected (n = 44) for the Geneflow project in 2024. Rivers are in alphabetical order and split by RBD in colour. Black dashed line indicates sample national average mean length (64.6mm)

7.3. Appendix 3: Photos of rivers sampled per RBD

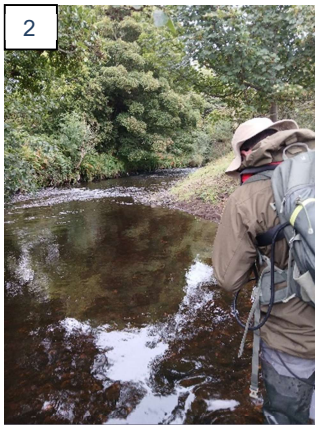
7.3.1. NWRBD

NWRBD		
1. Ballintra	2. Clonmany	3. Culoort
4. Crana (Cockhill)	5. Donagh	6. Glenna
7. Glengannon		

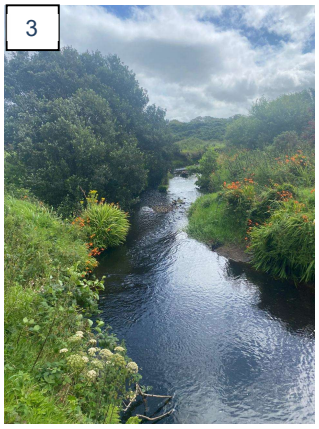
1



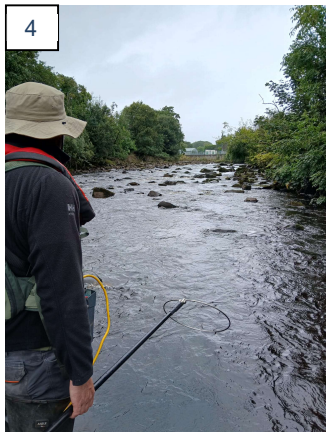
2



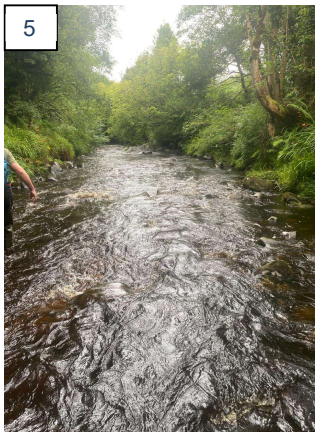
3



4



5

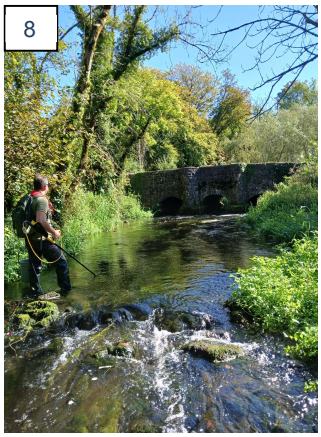


6

7

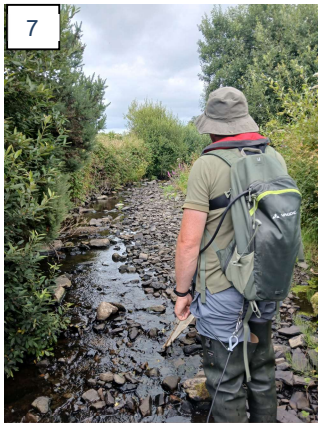
7.3.2. WRBD

WRBD		
1. Brusna	2. Clarin	3. Leenane
4. Lough Skannive	5. Owenadournan	6. Owenwee
7. Owenboliska	8. Kilcolgan	



7.3.3. SHRBD

WRBD		
1. Annageeragh	2. Brick	3. Skivaleen
4. Deel	5. Doonbeg	6. Fergus
7. Inagh		

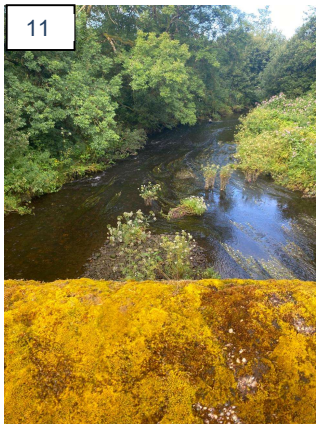


7.3.4. SWRBD

SWRBD		
1. Ardea stream	2. Ardrigole	3. Croanshagh
4. Currane	5. Emlagh	6. Emlaghmore
7. Ferta	8. Finnihy	9. Glengarriff

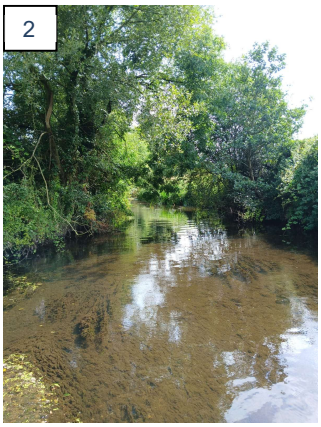
7.3.5. SWRBD

SWRBD		
n/a Glenshelaune	n/a Leamawaddra	10. Lee (Tralee)
11. Lickey	12. Lough Fadda	13. Milltown
14. Owreagh		



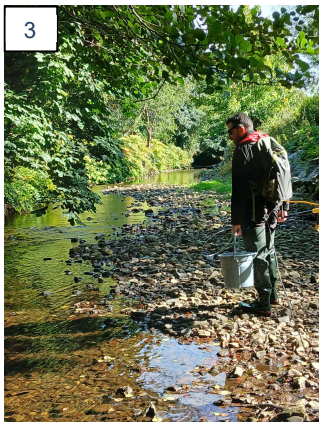
7.3.6. SERBD

SERBD		
1. Clodiagh	2. Owenavorragh	



7.3.7. NBRBD

NBRBD		
1. Castletown	2. Fane	3. Flurry
n/a Ulster Blackwater		



Inland Fisheries Ireland
3044 Lake Drive,
Citywest Business Campus,
Dublin 24,
Ireland.
D24 CK66

www.fisheriesireland.ie
info@fisheriesireland.ie

+353 1 8842 600