

National data collection protocols

National electrofishing sampling protocols

A new national electrofishing programme has been developed to assess and monitor the status of juvenile Atlantic salmon in Scottish rivers using a common set of standards. The protocols have been designed to collect as much information as possible to (1) explore opportunities for assessing the status of regions and rivers (2) improve existing fish density models (3) explore alternative measures of population health (e.g. biomass) (4) ensure that the collected data can support future developments in other areas e.g. National Eel Plan and Water Framework Directive.

Collection of genetic samples for a sub-set of locations will inform studies of genetic introgression. Water sampling will be used to assess the importance of water quality in controlling within and between catchment variability in fish abundance. Data on substrate and flow types will be used to improve characterisation of habitat using landscape proxies.

For queries on these protocols or in the case of a requirement for over-samples please contact neps@marlab.ac.uk or the MSS-FFL main office (FL_Admin@gov.scot, 0131 244 2900).

Protocol: Timing

Electrofishing should be undertaken between 1st July and 30th September.

Protocol: National multi-pass electrofishing

The national electrofishing programme uses a generalised random-tessellation stratified (GRTS) sample to ensure a representative, spatially balanced, unbiased, quantitative sample of juvenile numbers. To avoid the introduction of bias, it is important not to deviate from the electrofishing site locations provided. If sites are not 'fishable' (due to health and safety considerations) an oversample should be requested. Consistent recording of information on equipment and teams provides an opportunity to further develop capture probability models and thus should always be recorded.

- Sites should cover a minimum area of 100 m² or be 50m in length (for very narrow streams), whichever results in the shorter reach length.
- Proceed to the coordinates provided (**or river location nearest to coordinates**). This should be the bottom of the electrofishing site. If the electrofishing site is different from the provided location i.e. location does not fall exactly on the river, then record the adjusted location using GPS.
 - In the case of annual sites this should be as close to the previous year's start point as possible
- If the sampling location falls in the middle of a pool then move the shortest possible distance upstream to the nearest location where it is possible to wade. However, do not move more than 50m up or downstream from the specified GPS coordinates.
- If the sampling location falls on a braided section of river fish all channels
- If the reach is too deep to fish and moving <50m does not allow access, then do not fish the site. Instead obtain an over-sample location. This is to avoid biasing sampling towards

shallow habitats that are easier to sample and potentially associated with greater salmon fry densities.

- Where possible set the upstream extent of the site to coincide with a natural constriction (e.g. shallow area). Do not finish sections in the middle of a pool.
- Record the site length, if on a bend record site length on both banks. Record 5 equally distributed wetted, bed and bankfull widths (in metres). Note the distance along the length that each width measurement is taken. See Appendix 1 for further details and illustrations of width measurement protocols.
- When fishing sites on a braid, record the site length for each channel, if on a bend record site length on all banks. Record 5 equally distributed wetted, bed and bankfull widths (in metres) for each channel. Next sum these to ensure only 5 overall equally distributed widths which reflect the widths of all channels. Note the distance along the length that each width measurement is taken. See Appendix 2 for further details and illustrations of measurement protocols for braided channels.
- Fish with a minimum team size of two people. Note that the person using the EF equipment must hold a valid electrofishing license.
- For sites $\leq 10\text{m}$ wide stop nets should be used
- For sites $>10\text{m}$ wide aim to start and stop the site at physical barriers (e.g. shallow water) where possible
- Always conduct three electrofishing passes
- Record team members, specify who is on the anode, record equipment (make, model, bank-based / backpack), presence of stop nets and use of banner net if applicable. If possible also record electrical conductivity at the site and equipment settings.
- Use the same effort for each pass and systematically fish the entire river width working from downstream to upstream
- Record the total time taken for each pass and where possible (as equipment allows) the time the electrode was active (button depressed).

Protocol: National single-pass electrofishing

Where one pass electrofishing data is collected according to the same standards as the first pass of three pass data, in the same year of sampling, it is possible to get a quantitative estimate of density using the capture probability model.

- Follow the above protocol, with the following modifications
- The use of stop-nets is not compulsory but information on which (if any) stop nets are used **must** be recorded. The use of stop nets is recommended for simple habitats (e.g. canalised rivers with sand or fine gravel beds). These may be identifiable, prior to electrofishing, by inspecting satellite images of the site from Zoom Earth, Google Earth or Bing.

Protocol: fish processing

It is important to record the pass on which **all** fish were caught to inform the capture probability model for different species and life stages. Measuring and scaling all parr will allow for an accurate assessment of population demographics, size at age and of age at smolting. Consequently, it is very

important to record information that allows individual salmonids to be linked to associated scale packets and samples.

- If zero salmon (of any lifestage) are caught at a site on the first pass then do not undertake passes 2 and 3. Instead carry out 3–pass fishing at the next 1-pass site that is fished where salmon are present. This maintains the balance of 3:1 pass fishings. If the number of 3-pass sites remaining to be fished equals the number of sites remaining, then fish all as 3-pass regardless of numbers of fish caught. I.e. every region should have a minimum of 10 3-pass sites.
 - Note that in regions where there are multiple data collection organisations it should be ensured that the number of 3-pass sites fished equals the number of 3-pass sites provided.
- Process fish at the end of each run and be sure to record the run number on which fish were caught.
- For salmonids, assign all fish as “fry (0+)” or “parr (>0+)” at the time of sampling based on size observations.
- Measure the fork length of **all** “parr” to the nearest mm.
- Where there are ≤50 fry per run, measure all fry
- Where there > 50 fry per run measure **at least** a sample of 50, again to nearest mm and then record a count of the remaining fry that have NOT been measured. Alternatively, you can measure all fry.
- Size based aging of lifestage (i.e. fry versus parr) is normally fairly reliable, but there can be large overlaps in the sizes of different parr age classes. Therefore scale samples should be taken from **the first 50** salmon parr and **the first 50** trout parr in each run. Where there is any uncertainty over lifestage, scale samples should also be taken. Scales should be stored in provided Salmon (white) / Trout (brown) scale packets including **information on Sample Site, Date, length and day processing number** (from DPU OR the row number in the field data sheet which will correspond to the day processing number when entered into DPU) on **all** scale packets, thereby allowing scale ages to be related back to individual fish records. Use an elastic band to group together the labelled scale packets for each electrofishing event (site visit).
 - You may wish to consider the use of stamps with waterproof ink for rapidly filling out scale packets. Appendix 3 shows some examples of scale packet completion.
- For eels process as per salmonids (individuals with length), recording sizes of up to 50 fish per run. You may wish to use eel bag measuring, see page 23 of the following report: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/297344/geho0411btqf-e-e.pdf
- For all other species, obtain a count of individuals **per pass**
- Take at least one photograph of the electrofishing site that incorporates landscape context.
- Place fish in a holding box if further runs are to be undertaken
- Release all fish back into the bottom of the reach after recovering from anaesthetic
- Once all NEPS sites have been fished **all** scale packets (grouped with elastic bands by electrofishing site visit) should be returned to MSS-FFL, in the scale boxes provided, even if they do not contain samples.

Protocol: genetics samples

Genetics samples will be utilised as part of a Scottish Government funded three year study that seeks to quantify levels of introgression of genetic material of fish of non-native origin into wild Scottish Atlantic salmon populations. The samples collected will be genetically screened and levels of introgression determined at an individual/site/river and regional level. An additional £20 per site will be provided for collecting these samples.

- Tissue samples should only be taken from up to 30 salmon parr for the sites sampled using multi-pass electrofishing.
- Using scissors take a ~2mm² clip of the caudal fin while the fish is under anaesthetic and place into a numbered ethanol filled tube.
- Work sequentially through the sample tube box so that the genetics sample tube numbers follow on from each other, starting with the lowest number
 - Note that if you are using the DPU NEPS template, the genetic sample tube number will increment automatically once 'Tissue Sample Link' has been clicked. If samples are not collected in order this **must** be corrected in the Tissue Sample tab.
- Clean scissors by wiping with a damp rag/towel between each sample collection.
- **Note the genetics sample tube number**, so that genetics samples can be related back to individual fish records.
- Collect tissue samples from all salmon parr until either 30 samples have been obtained or all salmon parr available have been sampled.
- Once all NEPS sites have been fished **all** genetics sample tubes should be returned to MSS-FFL, even if they do not contain samples.

Protocol: habitat

Consistent recording of habitat provides the opportunity to improve the representation of habitat using landscape covariates.

- Record the percentage cover of each substrate class in the electrofishing reach (Wentworth scale)
- Record the percentage flow type in each reach (based on simplified SFCC descriptions)

Protocol: water quality

Water samples are required to assess whether broad scale patterns of hydrochemical variability can substantially improve predictions of fish abundance. The samples will be analysed and the resulting data included in future iterations of the juvenile density modelling. MSS has a system in place to return these samples to MSS-FFL. The following describes the protocols for sample collection and postage.

- Take a water sample at all electrofishing sites.
- Rinse the bottle and cap provided 3 times in the river.
- Facing upstream submerge the bottle completely until filled – ensure there is no air space within the bottle.
- Replace lid and note the bottle number on your datasheet.

- Complete the water sample datasheet provided.
- Refrigerate the sample until returned, if possible.
- On accumulating 2 samples please return these as soon as possible.

Sample Return

- Sample return will be by Royal Mail.
- Labelled jiffy bags for samples are provided which will hold up to 2 samples.
- Ensure the bottle is dry and use the tape provided to seal round the lid. See Appendix 4 Figure 4.1a.
- Place each of the samples in a polythene bag as provided and tie a knot. See Appendix 4 Figure 4.1b.
- Place the bottles upright in the jiffy bag provided and add message to keep upright. See Appendix 4 Figure 4.1c.
- Include the correct, completed sample record sheet with the samples in the jiffy bag.
- Seal down the jiffy bag and attach stamps (provided) to the value of **£3 only**.
- Take samples to post office ASAP.

Required Equipment

Essential equipment for data providers:

- GPS (or smart phone with app to collect location information)
- Maps (or smart phone with mapping app)
- Camera (or smart phone with camera)
- Stop watch
- Waders
- Electrofishing equipment
- Field laptop with DPU installed **or** field data sheets and pencil
- Tape measure
- Measuring board
- Anaesthetic
- Knife for taking scales
- Buckets
- Hand nets / dip nets / banner nets (if applicable)
- Stop nets (for multi-pass electrofishing <10m wide)
- Sediment size guide and flow type guide
- Holding box (for multi-pass electrofishing)
- Battery powered aerator
- Stamps for entering information onto scale packets (if used)

Essential equipment provided by MSS

- Scissors for taking fin clips (multi-pass sites)
- Tweezers
- J-cloth (for wiping scissors between samples)

- Labelled tubes of ethanol for genetic sampling (multi-pass sites)
- Scale packets (salmon and trout) and storage box
- Labelled water sample bottles
- Water sample datasheet
- Habitat substrate definitions
- Tape for water bottle lid and plastic bag
- Jiffy bags and stamps for postage
- Copies of standard operating procedures

Optional equipment provided by data providers and potentially useful resources:

- Electrical conductivity meter (if available)
- Mapping and satellite image webpages: Zoom Earth (<https://zoom.earth/>) Google Earth or Bing
- Smart phone apps for mapping: OS Maps, GB Outdoors, Backcountry navigator
 - Note that these can be associated with a cost if you want to use certain OS Maps offline
- Smart phone apps for grid references: Locate (from OS), OS Maps, UK Grid Reference Finder, Grid Reference

Appendix 1 – Measuring electrofishing site widths

Record 5 equally distributed wetted widths (in metres). This is the wetted part of the river channel, including wetted areas beneath visibly overhanging banks and excluding exposed river beds or bars. Note the distance along the length that each width measurement is taken.



Figure A1.1 Width measurements where blue denotes wetted width, yellow denotes bed width (active channel) and red denotes bank full width

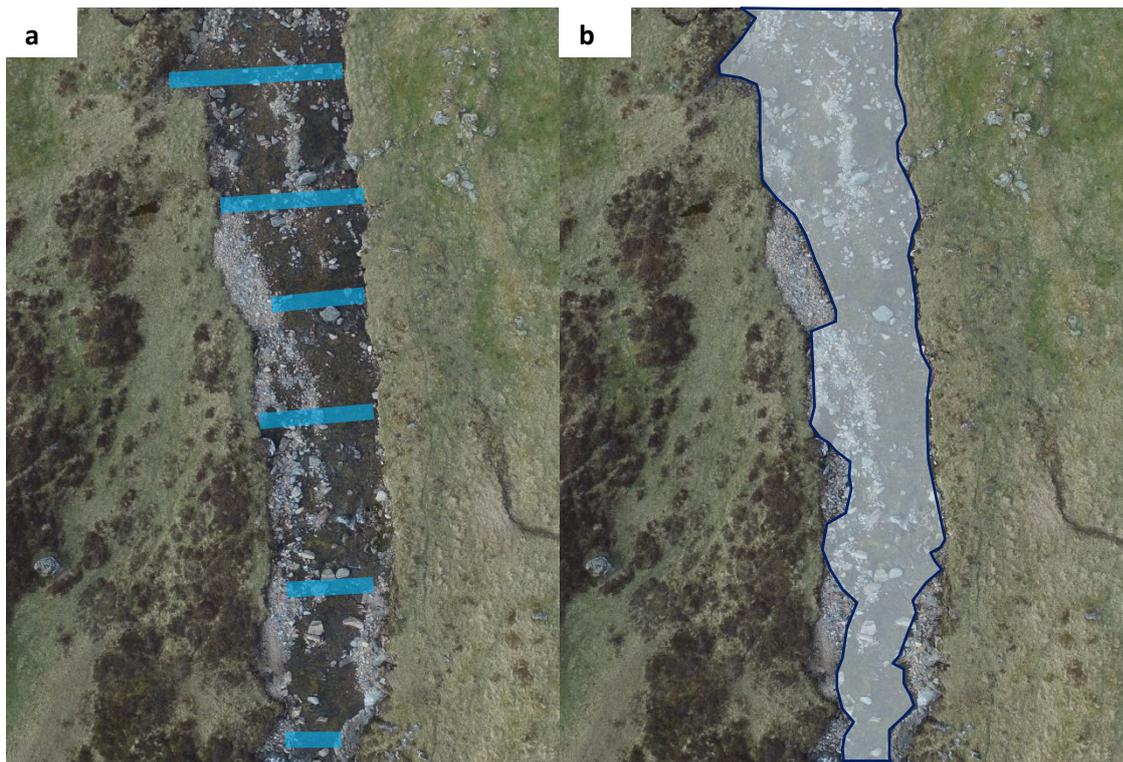


Figure A1.2 a) more complex example of wetted width measurements (blue lines) and b) associated fished area

Appendix 2 Measuring electrofishing sites on braided channels

When a sampling location falls on a braid all channels should be fished. Site length, wetted, bed and bankfull width measurements should also be taken for each channel fished (Figure A2.1). Widths, for each width metric, should be summed to provide a single width at each measurement interval, which reflects the width of all widths (see example below). Ensure that you measure and fish the same length of river in all channels.

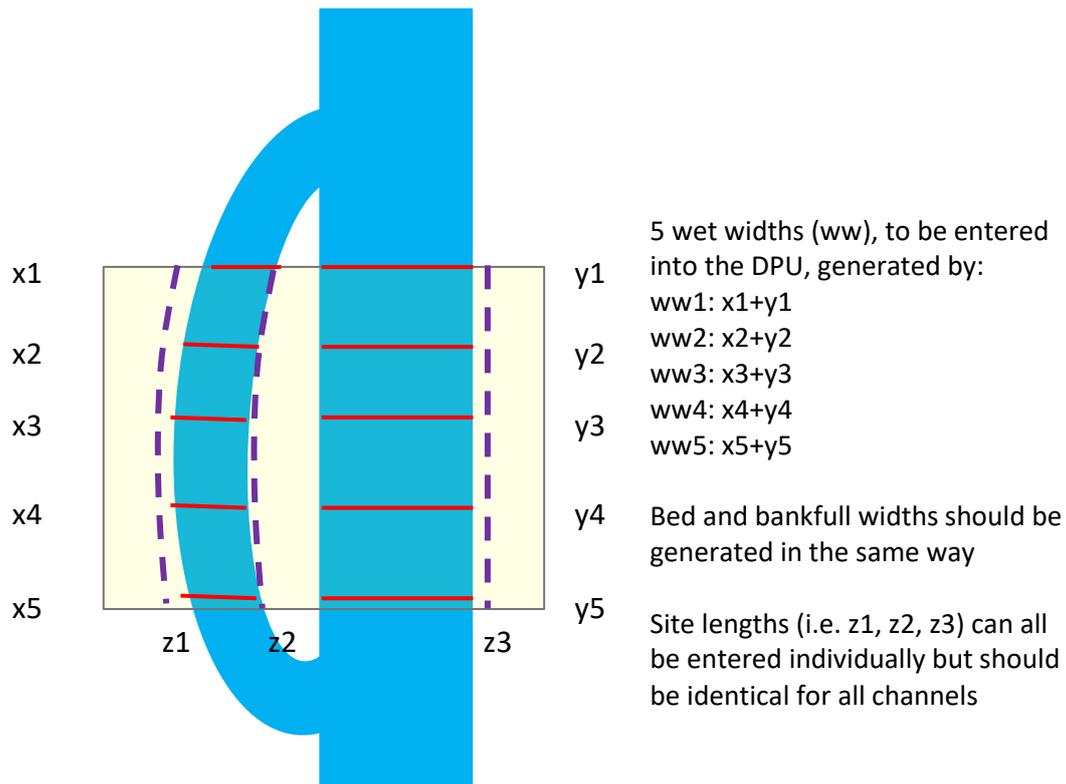


Figure A2.1 Example of width and length measurements for braided electrofishing sites, where $x1:5$ denote the 5 width locations on one channel, $y1:5$ denote the 5 width locations on the second channel. These should be summed at each interval to generate an overall channel width representative of both channels. Note that bed and bankfull widths would also be taken. $z1:3$ denote the site lengths, which can all be added individually to the DPU. Ensure that you measure and fish the same length of river in all channels.

Appendix 3 – Scale packet completion

Data providers need to ensure that relevant information is included on all scale packets including Site, Date, Day Processing Number and fish length to allow ages to be assigned to fish in the database at a later date

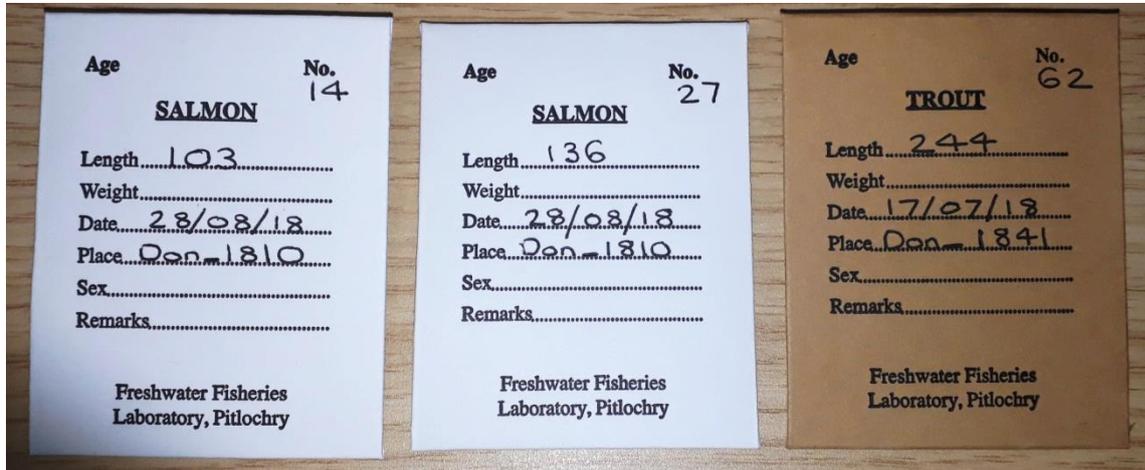


Figure A3.1 Example of minimum scale packet requirements, where 'No.' is the day processing number ('DayProcNo' from DPU OR the row number in the field data sheet which will correspond to the day processing number when entered into DPU), 'Length' is the fish length (mm), 'Date' date the electrofishing was undertaken, 'Place' is the site name provided by MSS.

Appendix 4 - Water sample return

Data providers need to ensure that water samples and associated sample record sheets are returned as soon as possible (once 2 samples are available) to MSS-FFL using Royal Mail.

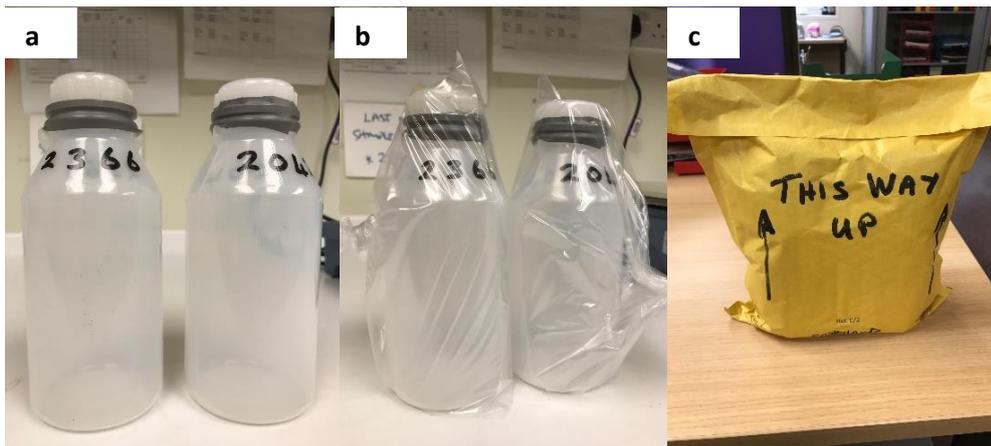


Figure A4.1 a) taped samples b) bagged samples c) jiffy bag labelling ready for postage