



Technical Appendix 8.5

Fish & Fresh Water Pearl Surveys

Table of contents

Fish & Fresh Water Pearl Surveys



A Scottish Registered Charity
No. SC 020751

Commissioned Report No. JRAD1909

Fish and Fresh Water Pearl Mussel surveys for Proposed Clauchrie Wind Farm

For ITPEnegised

For further information on this report please contact:

Name of GFT Project Manager – J Ribbens
Galloway Fisheries Trust
Fisheries House
Station Industrial Estate
Newton Stewart
DG8 6ND
Telephone: 01671 403011
E-mail: jamie@gallowayfisheriestrust.org

This report should be quoted as:

Galloway Fisheries Trust. September 2019. Fish and Fresh Water Pearl Mussel surveys for
Proposed Clauchrie Wind Farm.
Galloway Fisheries Trust Report No. – JRAD1909

This report, or any part of it, should not be reproduced without the permission of Galloway Fisheries Trust. This permission will not be withheld unreasonably.

© Galloway Fisheries Trust Year – 2019



Summary

Fish and Fresh Water Pearl Mussel surveys for Proposed Clauchrie Wind Farm

Commissioned Report No.: JRAD1909
Contractor: ITPEnegised
Year of publication: September 2019

Keywords

Electrofishing; Clauchrie; Freshwater Pearl Mussel; Wind farm; salmonids; juvenile surveys.

Background

Electrofishing and Freshwater Pearl Mussel surveys were undertaken in July and August 2019 in watercourses which could potentially support fish and mussels, within the development area and access routes for the proposed Clauchrie Wind Farm. The surveys were carried out with the aim of providing baseline data to inform the EIA phase of the wind farm development.

Main findings

- 16 survey locations were identified for the fish surveys (following site visits one site was found to be too small and unsuitable to support fish and was not surveyed).
- Three water courses were identified as potentially supporting Freshwater pearl mussels and requiring surveys.
- Two of the electrofishing sites contained juvenile salmon. These juvenile salmon have been stocked.
- Ten of the sites contained juvenile trout. Five of the sites had trout fry and all 10 contained trout parr.
- No non-salmonid fish were caught during the electrofishing surveys.
- On sensitive watercourses (with fish) great care must be taken to ensure there is no impact to fish populations either at crossing points or further downstream. Any works being carried out instream must allow for free movement of fish both upstream / downstream and silt control must be put in place to stop any silt entering the water both at the work area and downstream. Instream habitat disturbance should be kept to a minimum. Any specific areas of these sensitive watercourses that need to be crossed or disturbed during construction should be reconsidered to allow for the most suitable crossing system to be established. Fish rescues may be required at these watercourses if instream works take place during the construction works.
- On watercourses of lower Sensitivity (without fish), it should be considered that although the specific watercourse may not support fish, the downstream waters into which it flows will at some point. Pollution prevention measures are still required to

protect downstream waters. Localised disturbance within the work area is not as detrimental on these watercourses.

- No Freshwater pearl mussels were found during the surveys.

Table of Contents		Page
1	INTRODUCTION	4
2	AIMS	5
	2.1	5
	2.2	5
	2.3	5
	2.4	5
3	METHODOLOGY	6
	3.1 Data recording	6
	3.2 Electrofishing surveys	6
	3.2.1 Limitations of electrofishing surveys	7
	3.2.2 Electrofishing equipment	7
	3.2.3 Age determination	7
	3.2.4 Non-salmonid fish species	7
	3.2.5 Site measurement	7
	3.2.6 Bankside/instream electrofishing site habitat assessment	8
	3.2.7 Survey areas and site selection	8
	3.3 Fresh Water Pearl Mussel surveys	8
4	RESULTS	10
	4.1 Electrofishing survey	10
	4.1.1 Survey limitations	10
	4.1.2 Site sensitivity	11
	4.1.3 Electrofishing results (see Table 4 for tabulated results)	12
	4.1.4 Electrofishing results	13
	4.2 FWPM survey	26
5	DISCUSSION	28
	5.1 Electrofishing survey	28

For further information on this project contact:
 Name of Project Manager – J Ribbens
 Telephone No. of Project Manager – 01671 403011

1 INTRODUCTION

Galloway Fisheries Trust (GFT) was commissioned by ITP Energised to carry out electrofishing surveys in watercourses which could potentially support fish, within the development area (including the access routes) for the proposed Clauchrie Wind Farm. Fresh Water Pearl Mussel (FWPM) surveys were also required in watercourses with suitable habitats to potentially support this rare mollusc. GFT identified 16 sites for electrofishing and three sites for FWPM surveys. The electrofishing surveys were carried out with the aim of providing a baseline overview of fish population data (distribution and abundance), to inform the EIA phase of the development.

The proposed survey locations were all within the River Cree catchment.

There is a variety of legislation, regulations and guidance in place relating to fish species that may be present in watercourses within the Cree catchment. Atlantic salmon is an internationally important fish species which is listed under Annex II and V of the European Habitats Directive (1992) (only in freshwater), Appendix III of the Bern Convention (1979) (only in freshwater) and is a local priority species in the Dumfries and Galloway Local Biodiversity Action Plan. Atlantic salmon is also a species of conservation concern on a UK level. Atlantic salmon and sea trout are also on the Scottish Biodiversity List. Salmon and migratory Sea trout within the Cree Catchment are managed by the River Cree District Salmon Fishery Board.

Freshwater Pearl mussels (*Margaritifera margaritifera*) are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), are listed on the EU Habitats and Species Directive (Annexes II and V) and Appendix III of the Bern Convention 1979. They are included on the IUCN Invertebrate Red List, where their status is described as Vulnerable. Freshwater Pearl mussels are also classified on the Scottish Biodiversity List.

The potential for fish species and their habitats to be affected by this development mainly occurs during the construction phase of the development. During the construction phase potential impacts include siltation from ground disturbance, accelerated or exacerbated erosion, hydrological changes, pollution, and the blocking or hindering of the upstream/downstream migration of fish. During the operational phase, concerns include the effects of poor road drainage, accelerated levels of erosion, fish access, and the maintenance of silt traps and road crossings. These potential effects could all impact on the surrounding fish populations by causing direct mortality of juveniles and adults, changes in food availability, avoidance behaviour resulting in unused habitat, blocking of migration routes to spawning beds or the damage of instream and riparian habitats.

This report will detail the fish species present and their densities at each site (standardised to 100 m² of water), describe the instream and riparian habitats at each survey site, rank watercourses on its fisheries sensitivity and highlight potential risks to the fish populations from the planned construction works. This will allow the project design to consider any sensitive fish issue and how to mitigate to protect them e.g. avoid instream works during key fish spawning periods. This data will also provide the baseline surveys which future surveys will be compared to.

The surveys will also identify whether FWPM are present in the main watercourses within the development area (including access tracks) of the wind farm.

2 AIMS

The aims of this work were as follows:

- 2.1 To undertake electrofishing surveys at the proposed Clauchrie Wind Farm site and main access route to provide a baseline overview of fish population data.
- 2.2 Undertake a detailed bankside and habitat survey at each electrofishing site.
- 2.3 Undertake a Fresh Water Pearl Mussel (FWPM) survey at watercourses where suitable habitat is present to support this species
- 2.4 To analyse and present results from the surveys (as detailed above 2.1, 2.2, 2.3) in report form, briefly discussing any particular sensitivities and / or issues relating to juvenile salmonids / pearl mussels found within the surveys.

3 METHODOLOGY

3.1 Data recording

The GFT is a partner in the Scottish Fisheries Co-ordination Centre¹ (SFCC), an initiative involving Scottish Fishery Trusts and others, including the Marine Scotland Science (Scottish Government), The Tweed Foundation, the Tay Foundation and the Cromarty Firth Fisheries Trust.

This group has, in partnership, developed a set of agreed survey and data collection methodologies for electrofishing surveys and an associated database in which to record information gathered from such surveys.

The electrofishing surveys undertaken by GFT for this study have been completed to the high standards that are required by the SFCC and recorded using the agreed methodologies.

3.2 Electrofishing surveys

To assess the fish population present within a section of river various techniques have been developed in the recent decades. The main method of determining the status of a fish population is through employing the use of electrofishing equipment.

This technique of electrofishing involves the 'stunning' of fish using an electric current which enables the operator to remove the fish from the water. Once captured, the fish recover in a holding container. They are then anaesthetised using a specific fish anaesthetic, identified to species, measured and recorded, and once fully recovered, returned unharmed to the area from which they were captured.

The method of fishing involves the anode operator drawing stunned fish downstream to a banner net held against the current by an assistant. A hand net operator completes the three-man team. Captured fish are then transferred to a water-filled recovery container. The fishing team works its way across the survey section and upstream, thereby fishing thoroughly all the water in the chosen survey area.

To obtain fully quantitative information on the fish, primarily juvenile salmonid, populations within an area of interest, each survey site is fished through up to four times consecutively to allow the calculation of a more accurate estimate of the fish population present. A Zippin estimation² of a fish population is a common calculation carried out using data derived from the depletion method of fishing (multiple run fishing). The result provides an estimate of the fish population density per 100 m² of water, including the 95% confidence limits. When the calculation of a Zippin estimate of the population is not possible, a minimum estimate of the fish population is calculated for that section of river.

After the electrofishing exercise has been completed, a targeted and detailed SFCC habitat survey is completed of the actual fishing site.

For this study, electrofishing was undertaken by three SFCC accredited GFT staff at all survey sites.

It is the policy of GFT to disinfect all relevant equipment both prior to and following work in each river catchment to ensure that there is no transfer of disease organisms.

3.2.1 Limitations of electrofishing surveys

The SFCC method of electrofishing was primarily developed to survey juvenile salmonids in relatively shallow running water. Non-salmonid fish species may be present and caught during these surveys but their populations may not be properly determined using this method of electrofishing. Any non-salmonid fish species are therefore counted and measured but no population estimate is made.

Electrofishing will never capture all the fish in a survey site so densities presented in this report are an estimate (either a minimum estimate, or where possible the calculation of a Zippin estimate, has been presented, of the juvenile salmonid population residing within the site. The absence of fish cannot be ascertained with certainty using electrofishing techniques so a density of zero does not always guarantee these fish are altogether absent from this section of watercourse.

A low density of fish can be assessed with electrofishing techniques however it is harder to fully assess the actual population density of the watercourse or the representative site. If there is a low and patchy distribution of fish it may be harder to draw conclusions from the data.

3.2.2 Electrofishing equipment

The bankside generator apparatus which is employed during GFT electrofishing surveys is powered by a 2.2 kW petrol generator (5 horse power) with a variable voltage output (200 – 400 volts) linked to an Electracatch controller unit (model WFC7 – 1a). GFT endeavors to use a bankside generator kit wherever possible. Where distance prevents the use of the bankside kit, a mobile, battery powered backpack electrofishing kit is used to undertake the survey. GFT employs the use of an E-Fish backpack electrofishing kit. Both the bankside and backpack controller units are linked to a cathode of braided copper (negative electrode) and a mobile, single anode, consisting of a pole-mounted stainless steel ring (positive electrode) and trigger switch is used instream to capture the fish.

Smooth direct current was used in all survey sites.

3.2.3 Age determination

For this study the electrofishing survey concentrated on assessing the status of juvenile salmonid species, namely salmon (*Salmo salar*) and trout (*Salmo trutta*). In the majority of cases age determination can be made by assessment of the length of fish present. However, with older fish it is often more difficult to clarify age classes. In these cases a small number of scale samples can be taken from fish, in addition to taking length assessments, to verify the ages of fish whose age cannot be determined with certainty from the length.

In this survey juvenile salmonids are differentiated into fry (age 0+) and parr (age 1++) age groups.

3.2.4 Non-salmonid fish species

At each survey site the presence of non-salmonid fish species is noted. Population densities for these species are not calculated.

3.2.5 Site measurement

At each survey site a total site length was recorded and average wet and dry widths calculated.

¹ <http://www.sfcc.co.uk/>

² Zippin, C. (1958). The Removal Method of Population Estimation Journal of Wildlife Management, 22. Pp 82-90.

The average wet width is calculated from five or more individual widths recorded at equidistant intervals from the bottom of the site (0 m) to the top. At each site a final width is noted at the absolute upper limit of the surveyed water. From these site measurements the total area fished can be calculated.

3.2.6 *Bankside/instream electrofishing site habitat assessment*

At each electrofishing site a detailed habitat assessment using SFCC protocol is made of the instream habitat available for older (parr (1++) aged) fish. This assessment grades the cover available to salmonids instream as none, poor, moderate, good or excellent. This grading provides an index of instream cover where diverse substrate compositions will score more favorably than areas of uniform substrate which provides lower levels of cover.

In accordance with SFCC protocols, percentage estimates of depths, substrate type and flow type are made at each electrofishing site. Additionally, percentage estimates of the quantity of the bankside cover features such as undercut banks, draped vegetation, bare banks and marginal vegetation are made.

When reference to left or right bank is made, it is always left and right bank when facing downstream.

3.2.7 *Survey areas and site selection*

The specific electrofishing sites to be surveyed were identified from Ordinance Survey maps (1:25,000) and maps provided to GFT showing the extent of the proposed development and main access route. A total of 16 sites were agreed to be surveyed.

3.3 *Fresh Water Pearl Mussel surveys*

GFT holds no information relating to the presence of FWPM on the High Cree catchment apart from finding previously the remains of a shell in the main river. Therefore a general survey of mussel distribution within suitable habitat units was undertaken as described by Young et al (2003)³ in the Conserving Natura 2000 Rivers FWPM monitoring guide. Scottish Natural Heritage, who issue FWPM licenses to trained and approved surveyors, recommends this method of surveying for FWPM in Scotland.

Watercourses were surveyed by two licensed and trained GFT surveyors between two predetermined points. If the presence of mussels is unknown then an initial general mussel survey is carried out in the most likely habitat units using a bathyscope. Optimal mussel substrates (clean, coarse sand, usually found in pockets behind stable cobbles or boulders) were targeted in areas most likely to sustain mussels, such as substrates near the banks and under canopy cover. If mussels are found (live mussels or dead shells) then they are identified to confirm species and then a more detailed survey is undertaken using 50 m transect samples, selecting where clumps of mussels are located. A detailed methodology is described in Young *et al.* (2003). If no live mussels or dead shells are found during the initial general survey and in optimal mussel areas then mussels are recorded as absent.

Other variables recorded during the mussel surveys was an assessment of instream substrates (sizes based on the Wentworth scale), algal cover of instream substrates, nature of bankside vegetation and instream flow types and characteristics, sources of pollution or other factors which might affect populations of mussels.

Three watercourses associated with the proposed development were considered large

enough and containing suitable habitat to potentially support a mussel population; Fardin Burn, High Cree and Cairnfore Burn. These three watercourses were surveyed for mussels.

³ Young, M.R., Hastie, L.C. & Cooksley, S.L. (2003). Monitoring the Freshwater Pearl Mussel, *Margaritifera margaritifera*. Conserving Natura 2000 Rivers Monitoring Series No.2, English Nature, Peterborough.

4 RESULTS

4.1 Electrofishing survey

The results of the electrofishing survey are outlined in this section and presented in detail in Table 3, which provides information on the population densities of juvenile salmonids at each survey site. Ages of fish were determined from length frequency distributions. Site code, watercourse, site location, O.S. Grid reference, survey date and non-salmonid species are shown in Table 4.

With regard to the juvenile salmonid age classes, these are separated into four categories, which are defined in Table 1 below.

Table 1: Salmonid age classifications referred to in this report

Salmon Fry (0+):	Young fish less than one year old resulting from spawning at the end of 2018
Trout Fry (0+):	Young fish less than one year old resulting from spawning at the end of 2018
Salmon Parr (1+ and older (1++)):	Young fish of greater than one year and greater than two years old (where present) from spawning in 2017 or previously
Trout Parr (1+ and older (1++)):	Young fish of greater than one year and greater than two years old (where present) from spawning in 2017 or previously. Trout of up to three or four years old are also included in this category

Along with classifying salmonids into age brackets within the electrofishing results, juvenile salmonid numbers recorded have also been classified into several 'density' categories. A classification scheme for densities of salmonids was previously generated by the SFCC using data collected from 1,638 Scottish electrofishing survey sites covering the period 1997 to 2002 (SFCC, 2006⁴). From this, regional figures were created to allow more accurate local 'density ranges'. The categories referred to in this report are based on quintile ranges for one-run electrofishing events in the Solway region (Solway Salmon Fishery Statistical Region).

4.1.1 Survey limitations

The juvenile salmonid density classification scheme (SFCC, 2006) is based solely on data from surveyed sites containing fish in 1997 to 2002 and refers to regional conditions at that time; it must only be used as a very relative guide and not be used to draw conclusions. Moreover, the figures for juvenile trout are less reliable for various reasons (e.g. some surveyed populations of trout are isolated; sea trout contributing to stock in some areas etc.) and so can only be used as a relative indication of numbers. Table 2 shows these quintile ranges for the Solway region, within which the Cree lies.

Table 2: Quintile ranges for juvenile salmonids (per 100 m² of water) based on one-run electrofishing events, calculated on densities >0 over 291 sites in the Solway Statistical Region

	Salmon 0+	Salmon 1++	Trout 0+	Trout 1++
Minimum (Very Low)	0.22	0.38	0.38	0.35
20 th Percentile (Low)	5.21	2.86	4.14	2.27
40 th Percentile (Moderate)	12.68	5.87	12.09	4.71
60 th Percentile (High)	25.28	9.12	26.63	8.25
80 th Percentile (Very High)	46.53	15.03	56.49	16.28

4.1.2 Site sensitivity

Data from across the survey was analysed and a traffic light sensitivity rating was added to Table 4.

Table 3: Showing traffic light rating of sensitivity based on densities of juvenile salmonids found at each location

Traffic Light Rating	Description
Green	Not sensitive for fish at the survey location and unlikely to cause a localised effect. Works could still potentially cause downstream impact so mitigations still need to be in place. No fish rescue required for any instream works.
Amber	Moderately sensitive for fish at the survey location as non-salmonid fish species are present. Fish rescue will be required prior to any instream work such as culvert placement. May cause a localised and downstream impact so strict pollution requirements still stand.
Red	Very sensitive for fish at the survey location and work could potentially cause a localised and downstream impact on fish populations. Fish rescue required prior to any instream works.

Several areas across the electrofishing survey can be classed as sensitive.

For a water to be classified as having a Green sensitivity rating (Low Sensitivity) it was found to contain any of the following: no fish present, site is a field ditch/drain, has unsuitable habitat to support fish, no watercourse visible during the surveys.

For a water to be classified as having an Amber sensitivity rating (Moderately Sensitive) it was found to contain any of the following: only non-salmonid species of fish. In general, the habitat was not suitable to support salmon or trout populations.

For a crossing point to be classified as having a Red sensitivity rating (Very Sensitive) it was found to contain any of the following: presence of salmonids in any density or display habitats of particular significance.

All watercourses which have an Amber and Red sensitivity rating should be monitored during construction and post construction phases.

⁴ Godfrey, J. D. (2006), Site Condition Monitoring of Atlantic Salmon SACs: Report by the SFCC to Scottish Natural Heritage, Contract F02AC608 <http://www.gov.scot/resource/doc/295194/0096508.pdf>

4.1.3 Electrofishing results (see Table 4 for tabulated results)

- Site 1AR (Goat Burn) Grid reference: 231566 580177

No fish were found at this site.

- Site 2AR (Sprit Strand) Grid reference: 231660 581781

No fish were found at this site.

- Site 3AR (Laniwee Burn) Grid reference: 231604 582313

Salmon fry and parr were absent at this site. Trout fry were recorded in very low densities (>2.5 per 100 m² of water), whereas trout parr were found at high densities (>9.8 per 100 m² of water). No other fish species were found.

- Site 4AR (Plumbjordon Burn) Grid reference: 232100 583962

No fish were found at this site.

- Site 5AR (High Cree) Grid reference: 233440 586141

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at very low densities (<1.4 per 100 m² of water). No non-salmonid fish species were recorded.

- Site 6AR (Fardin Burn tributary) Grid reference: 232526 588179

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at very low densities (<3.1 per 100 m² of water). No non-salmonid fish species were recorded.

- Site 7AR (Cairnfore Burn) Grid reference: 234484 586943

Salmon fry and parr were absent from this site. Trout fry were present in a very low density (>1.6 fry per 100 m² of water) and trout parr were recorded in high density (11.6 ± 2.1 per 100 m² of water).

- Site 8AR (Cairnfore Burn tributary) Grid reference: 234723 588184

No fish were found at this site.

- Site 9AR (Cairnfore Burn (upper)) Grid reference: 233683 589974

Salmon fry and parr were absent from this site. Trout fry were present in a very low density (>4.0 fry per 100 m² of water) and trout parr were recorded in high density (>16.0 per 100 m² of water).

- Site 1DA (Polmaddie Burn) Grid reference: 232380 589722

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at high densities (<10.2 per 100 m² of water). No non-salmonid fish species were recorded.

- Site 2DA (Fardin Burn (upper)) Grid reference: 231420 589665

No fish were caught within this site.

- Site 3DA (Fardin Burn) Grid reference: 232171 587887

Salmon fry were present in low densities (>5.2 per 100 m² of water) and parr were present in high densities (9.4 ± 1.7 per 100 m² of water). Trout fry were present in a low density ($9.4 \pm$

1.7 per 100 m² of water) and trout parr were recorded in a moderate density (>5.2 per 100 m² of water).

- Site 4DA (Clauchrie Burn (upper)) Grid reference: 230074 587951

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at high densities (>14.3 per 100 m² of water). No non-salmonid fish species were recorded.

- Site 5DA (Scalloch Burn) Grid reference: 228959 587321

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at very high densities (>19 per 100 m² of water). No non-salmonid fish species were recorded.

- Site 6DA (Loch Scalloch inflow) Grid reference: 228600 589100

No suitable watercourse to survey or support fish was found.

- Site 7DA (Clauchrie Burn) Grid reference: 228811 584440

Salmon fry were present in high densities (>35.1 per 100 m² of water) and parr were present in very low densities (>1.4 per 100 m² of water). Trout fry were present in a low density ($>5.5 \pm 0.7$ per 100 m² of water) and trout parr were recorded in a high density (>14.9 per 100 m² of water).

4.1.4 Electrofishing results

- Site 1AR Goat Burn

Instream habitats in this site were considered to be of moderate standard. Wet width within the site ranged from 50 cm to 1.15 m. Instream substrates were dominated by a pebble and gravel mix (80% combined). Flows were characterised by predominantly run (65%) with 10% of the site considered riffle and the rest shallow glide. Water depths were recorded up to 40 cm deep. Plenty of bankside cover was available for fish.



Figure 1: Site 1, looking upstream

No fish were found.

- *Site 2AR Sprit Strand*

Site 2 is located upstream of the forestry road bridge.

The instream habitat (for parr aged fish) was considered 'moderate'. The depth of the water ranged from 0 cm to 30 cm. Instream substrates were dominated by pebbles (40%) and cobbles (30%), gravel and boulders were also recorded. Substrates were noted as being stable, un-compacted and not silted. Wetted width ranged from 65 cm to 1.4 m. The flow type was predominantly faster run (50 %) and some riffle (25 %) with small areas of shallow glide and torrent.

No fish species were present within this site.



Figure 2: Site 2, looking upstream

- *Site 3AR, Laniwee Burn*

Site 3 is situated a short distance upstream of the forestry road bridge.

Instream habitats in this site were considered to be of good standard (for parr aged fish). The wet width within the site ranged from 1.4 m to 2.6 m. Substrates were dominated by boulders and cobbles (70% combined) with some pebbles and gravel present. It was noted that very little spawning habitat was present. The main flowtype present was run. Water depths were recorded up to 50 cm deep, with the majority of water (60%) lying between 20 and 40 cm deep.



Figure 3: Site 3 looking upstream

No juvenile salmon were present. Trout fry were recorded in very low densities (>2.5 per 100 m^2 of water), whereas trout parr were found at high densities (>9.8 per 100 m^2 of water). No other fish species were found.



Figure 4: A trout fry and trout parr found within site 3

- *Site 4AR: Plumbjordon Burn*

Site 4 was located upstream of the forestry road bridge. The wetted width ranged from 60 cm to 1 m. Instream cover was recorded as being moderate with the majority of the substrate being made up of gravel (50%) and pebbles (30%) and some areas of cobbles. All water depths were below 30 cm. There was no instream vegetation and the substrate was stable and un-compacted.



Figure 5: Plumbjordon Burn, looking upstream

No fish were present.

- Site 5AR: High Cree

This site was located immediately upstream of the forestry road bridge. The wetted widths were between 4.5 m and 5.1 m. Instream cover was classified as 'good' standard. Water depths ranged between 10 cm and 50 cm. Substrates were large and mainly a mixture of boulders (40%) and cobbles (40%). Flow types recorded were also varied; 40% glide, 40% run and the rest riffle. Decent bankside cover was available on both banks consisting of mostly draped vegetation and some undercut areas. There was very little canopy cover.

The only fish population found was a very low density of trout parr.



Figure 6: High Cree at site 5, looking upstream



Figure 7: Brown trout parr at site 5

- Site 6AR: Fardin Burn tributary

Instream habitat of this burn was considered good for parr sized fish. The wet widths of the site ranged from 1.0 m to 2.6 m. Under the medium flow conditions, most depths ranged from 20 cm to 40cm (70%). Instream substrate were mostly cobbles (65%) and boulders (30%), the rest was bedrock. Substrates were noted as being stable, uncompacted and not silted. The flow was noted as predominantly run (60%) with a small area of torrent, glide and riffle. at the top of the site. Bankside fish cover was abundant from rocks, draped cover and undercut banks.



Figure 8, site 6AR, looking upstream

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at very low densities (<3.1 per 100 m² of water). No non-salmonid fish species were recorded.

- Site 7AR: Cairnfore Burn

Site 7 is situated on the Cairnfore Burn, just upstream of the road bridge.

Instream cover for fish was recorded as being of 'good' standard. Wetted width ranged from 3.6 m to 4.4 m. Water depths were recorded as mostly between 20 cm and 40 cm (60%). Water flows were characterised glide (40%), riffle (20%) and run (40%). The majority of substrates were recorded as boulders and cobble (70%), with some gravel (10%) and pebbles (20%) also present within the site. Reasonable levels of bankside cover were present.



Site 9: Cairnfore Burn, looking upstream

Salmon fry and parr were absent from this site. Trout fry were present in a very low density (>1.6 fry per 100 m^2 of water) and trout parr were recorded in high density (11.6 ± 2.1 per 100 m^2 of water).

- Site 8AR: Tributary of Cairnfore Burn

Site 8 is situated just downstream of culvert under forestry road.

Instream cover was of a good standard. The wetted width ranged from 50 cm to 1.1 m. Flows within the site were varied; run (30%), riffle (20%), pool (5%) and 45% glide. Depths of up to 40 cm deep were recorded with most water lying between 11 and 30 cm deep (90%). A good range of substrate sizes were present within the site; the majority being cobbles and pebbles (together 60%), with some gravel and peat also recorded. A high level of bankside cover was available for fish in the form of draped bankside vegetation and undercut banksides along both banks.



Figure 10: Site 8AR, looking upstream

No fish were found in this site.

- Site 9AR: Tributary of Cairnfore Burn (upper)

Instream habitats at site 9 were considered to be of good standard. Wetted width ranged from 80 cm to 1.8 m. Instream substrates at this site were dominated by cobbles (60%), with boulders (20%) and pebbles (20%) also recorded. Flows were dominated by run (50%) with some shallow glide and riffle also recorded. All water depths were under 30 cm deep. There is a moderate level of bankside cover available on both banks. This was in the form of draped bankside vegetation (bog myrtle) and undercut banksides along both banks. No canopy cover was present shading the site.

Salmon fry and parr were absent from this site. Trout fry were present in a very low density (>4.0 fry per 100 m^2 of water) and trout parr were recorded in high density (>16.0 per 100 m^2 of water).



Figure 14: Site 9AR, looking upstream

- Site 1DA: Polmaddie Burn

Site 10 is situated just downstream of the falls below the road bridge.

Instream habitats in this site were considered to be of a moderate standard for parr sized fish. Wet width ranged from 1.0 m to 2.2 m. Instream substrates were very varied with roughly an equal mix of gravel, pebbles, cobbles, boulders and bed rock. Flows were dominated by run and glide (both 40%) but had some areas of riffle (20%) and torrent (10%). Water depths were recorded up to 40 cm deep, with the majority of water lying between 21 and 40 cm deep (75%). A low percentage of bankside cover was available for fish on the left bank but more was present on the right bank (70%) in the form of mostly undercut banksides. No canopy cover shaded the site.



Figure 15: Site 1DA, looking upstream

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at high densities (<10.2 per 100 m^2 of water). No non-salmonid fish species were recorded.

- Site 2DA: Fardin Burn (upper)

Instream habitats in this site were considered to be of a moderate standard. The wet widths range was from 80 cm to 1.7 m. Substrates were dominated by pebbles and cobbles (90% combined) with a few gravel and boulders present. Shallow glide (15%), run (65%), shallow pool (5%) and riffle (15%). Water depths were recorded up to 30 cm deep, with the majority of water (65%) lying between 11 and 20 cm deep. Good bankside cover was available for fish.

No fish were caught within this site.



Figure 16: Site 2DA looking upstream

- Site 3DA: Fardin Burn

Instream habitats in this site were considered to be of a 'poor' standard for parr aged salmonids. Wetted width ranged between 3.2 m and 3.7 m. Substrates were dominated by a mix of gravel and pebbles (70%), with the remainder of substrates comprising of cobbles and boulders. Water depths were recorded up to 40 cm deep, with the majority of water (80%) lying under 30 cm deep. The site had a good mix of flows with run covering 40% of

the site, glide (40%) and riffle (20%). Both banksides provided low levels of fish cover.



Figure 17: Site 3DA, looking upstream

Salmon fry were present in low densities (>5.2 per 100 m^2 of water) and parr were present in high densities (9.4 ± 1.7 per 100 m^2 of water). Trout fry were present in a low density (9.4 ± 1.7 per 100 m^2 of water) and trout parr were recorded in a moderate density (>5.2 per 100 m^2 of water).

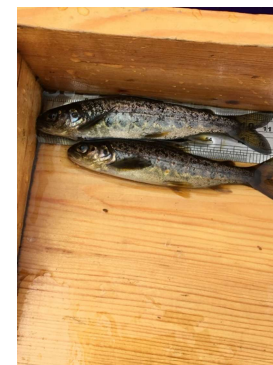


Figure 18: salmon parr caught at site 3DA

- Site 4DA: Clauchrie Burn (upper)

Site 13 is situated at the bottom of a forestry ride.

Instream habitats at this site were considered to be of a 'good' standard. Wetted width ranged from 1.7 to 2.7 m. Substrates within this site were dominated by a pebble cobble mix (together 65%), with the rest gravel and boulders. Water depths were recorded up to 40 cm deep. Flows within the site were dominated by run (55%) with some riffle (25%) and glide (20%). Decent levels of bankside cover was available for fish in the form of undercut banksides and draped bankside vegetation. No canopy cover shaded the site.

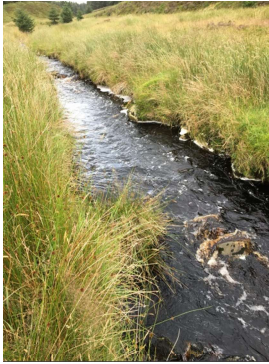


Figure 19: Site 4DA, looking upstream

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at high densities (>14.3 per 100 m² of water). No non-salmonid fish species were recorded.

- Site 5DA: Scalloch Burn

Site 5DA is on the Scalloch Burn, a tributary of the Clauchrie Burn.

Instream habitats in this site were considered to be of a 'good' standard for parr aged salmonids. Wetted width ranged between 2.0 m and 3.2 m. Substrates were dominated by a mix of cobbles and boulders (85%), with the remainder of substrates comprising of gravel and pebbles. Water depths were recorded up to 50 cm deep, with the majority of water (55%) lying under 30 cm deep. The site had a good mix of flows with run covering 45% of the site, glide (30%), torrent (10%) and riffle (15%). Both banksides provided only low levels of fish cover.



Figure 20: Site 5DA, looking upstream

Salmon fry and parr were absent at this site. Trout fry were also absent. Trout parr were present at very high densities (>19 per 100 m² of water). No non-salmonid fish species were recorded.

- Site 6DA: Loch Scalloch inflow

Site 6DA was located on the inflow to Loch Scalloch. This watercourse was very small and did not contain habitat suitable to support a fish population. It was too small to survey.

No fish were present within this site.



Figure 21: Site 6DA

- Site 7DA: Clauchrie Burn

Site 7DA is on the Clauchrie Burn downstream of a forestry Irish pipe bridge. The instream habitat here was considered to be 'good'. The wetted widths ranged from 4.7 m to 6.4 m. Water depths were relatively deep and ranged from 11 cm to just over 50 cm. The substrate was large and was dominated by a cobble / boulder mix (90%) with the rest gravel and pebbles. Flows were dominated by run (60%) and the rest was glide. The site did not offer any bankside cover for fish.



Figure 22: Site 7DA, looking downstream

Salmon fry were present in high densities (>35.1 per 100 m² of water) and parr were present in very low densities (>1.4 per 100 m² of water). Trout fry were present in a low density (>5.5 ± 0.7 per 100 m² of water) and trout parr were recorded in a high density (>14.9 per 100 m² of water).

Table 4: Results from the 2019 electrofishing survey for Clauchrie Wind Farm Project - *where only the number appears, a Zippin estimation could not be carried out. In these cases the number represents a minimum estimate of fish density per 100 m². Traffic light colour coding represents sensitivity of sites with regards to fish, with red indicating very sensitive, amber moderately sensitive and green not sensitive).

Site Code	Watercourse	Site Location	Grid Ref	Survey Date	Presence Of Other Species	Density per 100m ² *				Sensitivity
						Salmon Fry (0+)	Salmon Parr (1+ and older)	Trout Fry (0+)	Trout Parr (1+ and older)	
1AR	Goat Burn	Close to forestry road	231566 580177	30/07	None	0	0	0	0	No Fish
2AR	Sprit Strand	Upstream of forestry bridge	231660 581781	30/07	None	0	0	0	0	No Fish
3AR	Laniwee Burn	Upstream of forestry bridge	231604 582313	30/07	None	0	0	>2.5	>9.8	Fish
4AR	Plumbjordon Burn	Upstream of forestry bridge	232100 583962	30/07	None	0	0	0	0	No Fish
5AR	High Cree	Upstream of forestry bridge	233440 586141	30/07	None	0	0	0	>1.4	Fish
6AR	Fardin Burn tributary	Downstream of road bridge	232526 588179	30/07	None	0	0	0	>3.1	Fish
7AR	Caimfore Burn	Upstream of road bridge	234484 586943	06/08	None	0	0	>1.6	11.6 ± 2.1	Fish
8AR	Tributary of Caimfore Burn	Downstream of road culvert	234723 588184	05/08	None	0	0	0	0	No Fish
9AR	Caimfore Burn (upper)	Downstream road bridge	233683 589974	30/07	None	0	0	>4.0	>16.0	Fish
1DA	Polmaddie Burn	Downstream of falls by road	232380 589722	30/07	None	0	0	0	>10.2	Fish
2DA	Fardin Burn (upper)	Along forest ride	231420 589665	30/07	None	0	0	0	0	No Fish
3DA	Fardin Burn	Walk down through forestry	232171 587887	06/08	None	>5.2	9.4 ± 1.7	9.4 ± 1.7	>5.2	Fish
4DA	Clauchrie Burn (upper)	At bottom of forest ride	230074 587951	05/08	None	0	0	0	>14.3	Fish
5DA	Scalloch Burn	At end of forest ride	2228959 587321	05/08	None	0	0	0	>19	Fish
6DA	Loch Scalloch inflow		228600 589100	02/08	None	NO	SUITABLE	HABITAT	PRESENT	No Fish
7DA	Clauchrie Burn	Downstream of forest road	228811 584440	02/08	None	>35.1	>1.4	5.5 ± 0.7	>14.9	Fish

4.2 FWPM survey

Three watercourses were identified as potentially being suitable to support FWPM populations due to their size and instream habitats present. Each water course was surveyed in the vicinity of where the access tracks are expected to cross or be located close to. At each crossing point, i.e. bridge, a survey was undertaken for 100 m downstream and 50 m upstream (where water depths were low enough to be able to use a bathyscope safely).

Surveys were completed on the 27/08/19 by two licensed FWPM surveyors; Jamie Ribbens and Victoria Semple.

4.2.1 FWPM results

- High Cree

The survey was undertaken upstream and downstream of the road bridge at GR: 233436 586145. Suitable habitat was present to support a mussel population with boulders, cobbles and pebbles present. No FWPM were found during the survey.



Figure 23: High Cree site

- Fardin Burn

The survey was undertaken upstream and downstream of the road bridge at GR: 232320 587041. Suitable habitat was present to support a mussel population with boulders, cobbles, pebbles and gravel present. No FWPM were found during the survey.



Figure 24: Fardin Burn site

- Cairnfore Burn

The survey was undertaken upstream and downstream of the road bridge at GR: 234504 586942. Suitable habitat was present to support a mussel population with boulders, cobbles and a few pebbles present. No FWPM were found during the survey.



Figure 25: Cairnfore Burn

5 DISCUSSION

5.1 Electrofishing survey

Sites 1AR – 9AR were selected to cover the main access route into the proposed wind farm development. Of these nine sites, five contained trout populations (sites 3AR, 5AR, 6AR, 7AR, 9AR). The most significant populations were in Laniwee Burn (3AR), Cairnfore Burn (7AR) and upper Cairnfore Burn (9AR). If water crossings are to be ungraded at these locations then it is essential that they are designed to ensure the free movement of fish past them. When using culverts there is a risk of creating a barrier to fish migration so it is essential to follow the recognised best practice. The timing of any instream works must also take account of sensitive times for trout spawning to ensure adult spawning fish can access easily past them, that no spawning redds are damaged. Newly hatched alevins in the early spring are particularly sensitive to pollution including silt. The sensitive times for trout are considered from October to May and instream works should avoid these times. Any instream works such as culvert laying or over pumping / use of dams to create dry working areas should avoid these sensitive times and also will require a fish rescue prior to works taking place in water courses known to support fish populations.

Sites 1DA – 7DA were selected to understand the fish populations within the main development area for the proposed windfarm. Of these seven sites, five contained trout populations (sites 1DA, 3DA, 4DA, 5DA, 7DA) and two contained salmon populations (3AD, 7DA). Two sites had no fish (2DA, 6DA). The Fardin Burn and Clauchrie Burn contained the healthiest fish populations with good numbers of wild trout present. Both of these water courses are also stocked with juvenile salmon annually by the Cree District Salmon Fishery Board. Although wild salmon could potentially access these areas, GFT considers that all of the juvenile salmon found in these burns will be stocked fish. The Fardin Burn and Clauchrie Burn should be considered particularly sensitive and any new water crossings over these burns would need to be designed to ensure fish access is not impeded. Again any proposed instream works would require a fish rescue.

There are many water courses crossing the proposed development area and access routes. It is important to ensure that pollution does not reach enter these watercourses particularly silt. A carefully designed pollution prevention plan will be required. The existing drainage network for the forestry will need to be carefully considered and where necessary blocked up to ensure any pollution from work sites, including from forestry felling, cannot contaminate the surrounding water courses.

5.2 FWPM survey

The surveys completed in the three main watercourses within the development area found no FWPM at the survey sites so no additional works are required to protect this species.

Clauchrie Windfarm Project Team

ScottishPower Renewables
9th Floor Scottish Power Headquarters
320 St Vincent Street
Glasgow
G2 5AD

clauchriewindfarm@scottishpower.com



www.scottishpowerrenewables.com