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**Fisheries electrofishing survey for  
Kilgallioch Windfarm Extension**

**For ITP Energised**

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# Summary

## Fisheries electrofishing survey for Kilgallioch Windfarm Extension

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### **Keywords**

Electrofishing; Kilgallioch; windfarm; salmonids; juvenile surveys; baseline.

### **Background**

An electrofishing survey was undertaken in July 2019 on watercourses within the vicinity of the proposed Kilgallioch Windfarm Extension site. This work was completed to inform ITP Energised of the status of fish populations in the vicinity of the development in the pre-construction phase.

### **Main findings of the 2019 electrofishing survey**

- A total of five sites were surveyed using electrofishing techniques for this study. All sites were located within the River Bladnoch catchment.
- In general, good and moderate quality instream habitats were found throughout the electrofishing survey. On the whole this was not necessarily reflected in the densities of fish recorded across the survey due to potential water quality issues (acidification).
- Four sites held fish and one site was found to contain no fish. Juvenile salmon were only recorded at one site on Tarf Water. This was not altogether unexpected as salmon are only periodically recorded in the Upper Tarf catchment, most likely because of water quality issues (acidification). Headwater watercourses are also often narrow and are therefore less likely to hold populations of juvenile salmon.
- Juvenile trout across the survey were recorded in very low to moderate densities.
- Eels and pike were the only non-salmonid fish species encountered during the survey and were present in three of the five sites.

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## 1 INTRODUCTION

Galloway Fisheries Trust (GFT) was commissioned by ITP Energised to undertake pre-construction electrofishing surveys for the proposed Kilgallioch Windfarm Extension.

Electrofishing surveys were carried out in 2019 with the aim of providing baseline data and an overview of the fish populations present in the area of the proposed development and prior to its construction.

The development is within the River Bladnoch catchment in the South West of Scotland. The River Bladnoch is managed by the Bladnoch District Salmon Fishery Board and is covered by GFT.

The possible impacts that any land-based windfarm development and its associated infrastructure could have on surrounding fish populations are well known. The potential for fish species and their habitats to be affected by the development mainly occurs during the construction and decommissioning phases of the development. During the construction phase potential impacts include siltation from ground disturbance, accelerated or exacerbated erosion of watercourse banksides, hydrological changes to watercourses and surface water run-off, pollution of watercourses, 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 issues through watercourse crossings such as culverts, and the maintenance of silt traps and watercourse crossings. Potential risks to fish populations and their habitats during the decommissioning phase are broadly similar to those in the construction phase. These potential effects could all impact fish populations by causing direct mortality of juveniles and adults, causing changes in food availability, creating avoidance behaviour resulting in unused habitat, blocking fish migration routes to spawning grounds or causing damage to instream and riparian habitats.

There is a variety of legislation, regulations and guidance in place relating to fish species that may be present in watercourses within the River Bladnoch 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 a species of conservation concern on a UK level. Brown trout/sea trout is also a UK Biodiversity Action Plan (UKBAP) species.

There have been concerns around Europe over low eel stocks. It remains unknown why there was such a rapid decline but it was possibly linked to over-exploitation, inland habitat loss, climate and ocean current changes, disease and pollution. European Eel Regulations (EC) No 1100/2007 aim to establish measures to recover stocks of European eel. One such measure was the production of Eel Management Plans for the Solway Tweed River Basin District<sup>1</sup> (which covers the River Bladnoch). Fishing or taking eels is illegal (unless licensed) under The Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008. Eels are also a UKBAP priority species.

Both River and Brook lampreys are protected under Annex IIa and III of the EC Habitats and Species Directive 1992, with River lamprey also being protected under Appendix III the Bern Convention 1979. Both Sea lamprey and River lamprey are species of Conservation Concern on a UK level. Sea lamprey is listed in Annexes IIa and Va of the Habitats Directive, Appendix III of the Bern Convention and as a long list Species in the UK Biodiversity Action Plan.

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<sup>1</sup> Defra (2010), Eel Management Plans for the United Kingdom, Solway Tweed River Basin District <http://webarchive.nationalarchives.gov.uk/20130402151656/http://archive.defra.gov.uk/foodfarm/fisheries/documents/fisheries/emp/solway.pdf>

The upper River Bladnoch, and the Tarf Water, its main tributary, are areas that are recovering from acidification and as such fish numbers have been depressed for many years, especially populations of salmon. GFT has found some signs of recovery in recent years however, and low numbers of salmon are now coming back to the upper river to spawn, with some areas of the upper river now able to support young salmon. Salmon are known to be more sensitive to acidification than trout and so it is unfortunately quite usual that only trout are found in many areas across the upper Bladnoch and Tarf Water catchments, with juvenile salmon being absent. Acidification affects the egg stage of fish, particularly during the hatching period. If the pH of the water drops to a critical level during the egg or hatching stage, eggs can die. Salmon have been found to be recovering across some areas of the upper Tarf catchment and GFT has recorded low numbers of salmon fry and parr in some areas. There are still some areas that appear affected by acidification to such a degree that no trout, or very few trout are present.

## **2 AIMS**

The aims of this work were as follows:

- 2.1** To undertake electrofishing surveys within and downstream of the boundary of the Kilgallioch Windfarm Extension Development, on the Bladnoch catchment.
- 2.2** Undertake a detailed bankside and habitat survey at each electrofishing survey site.
- 2.3** To analyse and present results from the surveys in report form, briefly discussing any particular sensitivities and/or issues relating to juvenile salmonids found within the surveys.

### 3 METHODOLOGY

#### 3.1 Data recording

The GFT is a partner in the Scottish Fisheries Co-ordination Centre<sup>2</sup> (SFCC), an initiative involving twenty six Scottish Fishery Trusts and others, including Marine Scotland Science (Scottish Government), the Tweed Foundation, the Spey Research Trust, 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 juvenile salmonid population is through employing the use of electrofishing equipment.

This technique of electrofishing involves the 'stunning' of fish using an electric current which overpowers the nervous system of the fish and enables the operator to remove them 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 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 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 thoroughly fishing all the water in the chosen survey area.

To obtain fully quantitative information on the fish populations (primarily juvenile salmonids – see Section 3.2.1), 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 estimation<sup>3</sup> 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 m<sup>2</sup> of water, including the 95% confidence limits (information pertaining to the 2018 electrofishing survey is presented in Table 4). 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. Results from 2019 are provided in Section 4.1.3.

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

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<sup>2</sup> <http://www.sfcc.co.uk/>

<sup>3</sup> Zippin, C. (1958). The Removal Method of Population Estimation *Journal of Wildlife Management*, 22. Pp 82-90.

### 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 (eels only) but no population estimate is made (see Table 4 for the results of the 2019 electrofishing survey).

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 of the juvenile salmonid population residing within the site has been presented (see Section 4.1.2, 4.1.3 and Table 4). The absence of fish cannot be ascertained with certainty using electrofishing techniques so a density of zero does not always guarantee fish are altogether absent from the surveyed 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 location of all of the electrofishing survey sites selected for this study required the use of a mobile backpack electrofishing kit. The battery powered E-fish backpack electrofishing kit consists of an electronic controller unit with a linked cathode of braided copper (placed instream) and a linked, mobile, single anode, consisting of a pole-mounted stainless steel ring and trigger switch which 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 study juvenile salmonids are differentiated into fry (age 0+) and parr (age 1++) age groups (see Table 1).

### 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 (see Section 3.2.1) but numbers of individuals are counted. In the case of any eels that are captured, a measurement to the nearest 5 mm is taken.

### 3.2.5 *Site measurement*

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

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 the final width is noted at the 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 instream 'cover' available to salmonids 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 for individuals.

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. For more detailed SFCC habitat survey methodology.

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

### *3.2.7 Survey areas and site selection*

Sites were selected by GFT as agreed with ITP Energised. Sites were selected after reviewing previous surveys completed in this area.

Survey work was carried out between the 15<sup>th</sup> and 22<sup>nd</sup> of July 2019 which is within the optimal time for surveying for juvenile salmonids.

## 4 RESULTS

### 4.1 Electrofishing survey

The results of the electrofishing survey are outlined in this section and presented in detail in Table 4, 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, non-salmonid species and area fished (m<sup>2</sup>) are also 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, 2006<sup>4</sup>). 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 River Bladnoch catchment lies.

*Table 2: Quintile ranges for juvenile salmonids (per 100 m<sup>2</sup> 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 <sup>th</sup> Percentile (Low)	5.21	2.86	4.14	2.27
40 <sup>th</sup> Percentile (Moderate)	12.68	5.87	12.09	4.71
60 <sup>th</sup> Percentile (High)	25.28	9.12	26.63	8.25
80 <sup>th</sup> Percentile (Very High)	46.53	15.03	56.49	16.28

<sup>4</sup> 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>

Electrofishing and habitat information for all electrofishing survey sites surveyed is discussed in Section 4.1.4.

#### 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 water 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 or Red sensitivity rating should be monitored during construction and post construction phases.

#### 4.1.3 Electrofishing results (see Table 4 for tabulated results)

- Site 1 Ha' Hill Burn : Grid ref: 222867 570071

Juvenile salmon were absent from this site. Trout fry were also absent. Trout parr were recorded in a low density. One pike and one eel were also caught within the site.

- Site 2: Monandie Burn Grid ref: 224085 569224

Juvenile salmon were absent from this site. Trout fry were also absent. Trout parr were recorded in a moderate density. No non-salmonid fish species were recorded.

- Site 3: Tarf Water Grid ref: 224018 568844

Salmon fry were present in very low densities alongside very low densities of salmon parr. Trout fry were recorded in a very low density and parr were recorded in a low density. No non-salmonid fish species were recorded.

- Site 4: Loch Eldrig outflow

Grid ref: 225014 569397

No fish were present within this site.

- Site 5b: Loch Strand Burn

Grid ref: 224706 569198

Juvenile salmon were absent from this site. Trout fry were recorded in a moderate density together with a low density of trout parr. One eel was also recorded.

#### 4.1.4 Electrofishing results

- Site 1, Ha' Hill Burn

Site 1 is situated on Ha' Hill Burn, upstream of the confluence with the River Tarf.

Instream cover for parr size fish was recorded as being of a good standard. Wetted width averaged 0.86 m wide with an area of 42.5 m<sup>2</sup> being fished during the survey. Water depths were recorded up to 30 cm deep, with most water (80%) being between 11 and 30 cm deep. Water flows were characterised by run (40%), shallow glide (30%), riffle (20%) and some small areas of shallow pool (10%). The substrates within the site were dominated by cobble (70%) with a few large boulders (20%) and sparse patches of pebble (10%). A good level of bankside cover was available in the form of undercut banks and draped vegetation. Some rock cover was evident along the banksides which provided additional cover for fish. No canopy cover was shading the site.



Figure 1: Site 1 on Ha' Hill Burn, looking upstream

Salmon fry and parr were absent from this site. This is not unexpected as salmon have not been present this far up the catchment since GFT began surveying in 1988. As the water quality in the upper Tarf catchment improves and salmon are able to survive further up the system, GFT believes some areas of the Ha' Hill Burn could potentially provide habitat for juvenile salmon.

Trout fry were also absent from this site. Trout parr were recorded in a low density (>2.35 per 100 m<sup>2</sup> of water).

One eel was recorded at 30 cm and one juvenile pike was also present within the site.



*Figure 2: One trout parr caught within site 1 on the Ha' Hill Burn*

- *Site 2, Monandie Burn*

Site 2 is located on the Monandie Burn, a tributary of Tarf Water.

Instream habitat at this site was considered to be of a moderate standard. Wetted width averaged 0.72 m with 31 m<sup>2</sup> of water being fished in the survey. Cobbles and pebbles together dominated substrates (80% combined), with boulders and gravel also recorded. Flows within the site were dominated by deep glide and deep pool (65%) however the remainder of the site had a good mix of flow types including run (25%), shallow glide (5%) and some areas of riffle (5%). Recorded water depths were up to and over 50 cm deep with 40% of the site between 41 and >50 cm deep. There was limited shallow areas within the site with 5% lying under 10 cm, 5% between 11 and 20 cm, 15% between 21 and 30 cm deep and the remaining 35% between 31 and 40 cm. This corresponds with the range of flow types within the site. A good level of bankside cover was available for fish in the form of draped vegetation, undercut banksides and some marginal vegetation on both banks. No canopy cover shaded the site.



*Figure 3: Site 2 on the Monandie Burn, looking upstream*

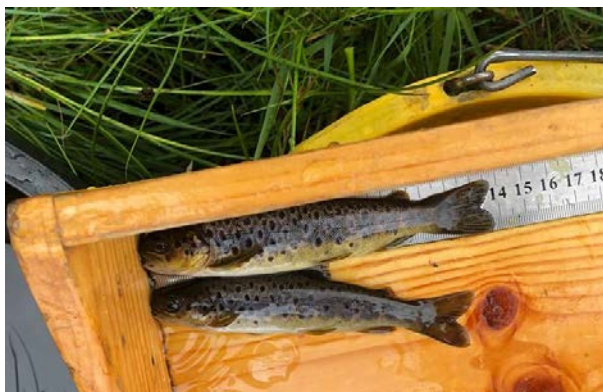


Figure 4: Two trout parr from site 2 on the Monandie Burn

Juvenile salmon were absent from this site.

Trout fry were also absent. Trout parr were found in a moderate density ( $>6.46$  per  $100\text{ m}^2$  of water).

No non-salmonid fish species were encountered during the survey.

- *Site 3, Tarf Water*

Tarf Water was surveyed at site 3. The site was situated above a corner pool with a conifer plantation on the right bank approximately 10 m away.

Instream cover was at a moderate standard. The wetted width averaged 6 m and an area of  $117.6\text{ m}^2$  was surveyed. Flows in the site were dominated by run (60%) and riffle (20%). Areas of shallow and deep glide were also recorded. Depths of up to 40 cm deep were recorded with most water lying between 21 and 30 cm deep (60%). The substrate was dominated by cobble (60%), with some gravel and sporadic pebbles. Boulders were also recorded within the site. There was a moderate level of bankside cover available for fish on each bank in the form of draped bankside vegetation and undercut banksides.

Salmon fry were present in very low densities within the site ( $>0.85$  per  $100\text{ m}^2$  of water) and salmon parr were also found in very low densities ( $>2.55$  per  $100\text{ m}^2$  of water). The presence of salmon in this site, however low the densities, is a very good sign and is furthest up the catchment that GFT have recorded salmon since surveys began in 1988. It indicates the recovery of the Tarf in its upper reaches and it will be important to monitor this site closely over the next few years.

A very low density of trout fry ( $>2.55$  per  $100\text{ m}^2$  of water) was recorded. Trout parr were recorded in a low density ( $>3.40$  per  $100\text{ m}^2$  of water).

No other fish species was recorded within this site.



*Figure 5: Site 3, Tarf water, looking upstream*



*Figure 6: Trout and salmon parr captured from within site 3 on the Tarf Water*

- *Site 4, Loch Eldrig Outflow*

Loch Eldrig outflow was surveyed at site 4, a short distance upstream of High Eldrig.

Instream habitats at this site were considered to be of a moderate standard. Wetted width averaged 0.93 m and an area of 50.5 m<sup>2</sup> was surveyed. Substrates within this site were dominated by a cobble/pebble mix (together 88%) with a few boulders and some gravel and silty areas comprising the remainder of substrates. Water depths were recorded up to 20 cm deep, with the majority of water (90%) lying under 10 cm deep. Flow was predominantly a shallow glide/run regime (together 80%) with some shallow pool and shallow marginal areas. There was very little in the way of bankside cover, with only 30% of both banks having thin marginal vegetation. No canopy cover shaded the site. At the time of fishing, water levels were very low and it is probable that this outflow runs dry on occasion.

No fish were present within the site.



*Figure 7: Site 4, Loch Eldrig Outflow, looking upstream*

- *Site 5, Loch Strand Burn*

Loch Strand Burn was surveyed at High Eldrig.

Instream habitats in this site were considered to be of a good standard. The wet width within the site averaged 1.36 m and the survey covered an area of 39.9 m<sup>2</sup> of water. Substrates were jointly dominated by cobbles and pebbles (together 70%), with boulders (20%), gravel and bedrock comprising the remainder of substrates. The site provided a wide range of flow types primarily dominated by riffle (35%) and run (25%). Two deep pools were present within the site (20%) and the remainder was an equal mix of shallow pool, deep and shallow glide. Water depths were recorded up to 40 cm deep, with an equal mix of water depths throughout the site. A moderate level of bankside cover was available for fish in the form of undercut banks and rocks. It was noted at the time of survey that this site held good quality juvenile trout habitat however spawning substrates were very limited. No canopy cover shaded this site.

Juvenile salmon were absent from the site.

Trout fry were recorded in a moderate density (>15.06 per 100 m<sup>2</sup> of water), alongside a low density of trout parr (>2.51 per 100 m<sup>2</sup> of water).

One eel was recorded here, 155 mm in length.



*Figure 8: Site 5 on Loch Strand Burn, looking upstream*





*Figure 9: Two trout fry from site 5 on Loch Strand Burn*

Table 4: Results from the 2019 electrofishing survey for Kilgallioch Windfarm Extension (\*Where a Zippin (1958) calculation could be carried out, 95% confidence limits are shown. 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 m<sup>2</sup>). 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/River Order	Site Location	Grid Ref	Survey Date	Presence Of Other Species	Area Fished (m <sup>2</sup> )	Density per 100 m <sup>2</sup> *				Sensitivity
							Salmon Fry (0+)	Salmon Parr (1+ and older)	Trout Fry (0+)	Trout Parr (1+ and older)	
1	Tarf Water Ha' Hill Burn	Above rocky shallows to break upstream boulder right bank	222867 570071	15/07/2019	Pike x 1 Eel x 1	42.5	0	0	0	>2.35	Fish
2	Tarf Water, Monandie Burn	Upstream confluence with Tarf Water	224085 569224	18/07/2019	None	31	0	0	0	>6.46	Fish
3	Tarf Water	From two boulders instream up to riffle	224018 568844	18/07/2019	None	117.6	>0.85	> 2.55	>2.551	>3.40	Fish
4	Tarf Water, Loch Eldrig Outflow	Downstream dyke wall at High Eldrig	225014 569397	15/07/2019	None	50.5	0	0	0	0	No Fish
5	Tarf Water, Loch Strand Burn	20 m downstream of corner pool up to second corner pool	224706 569198	19/07/2019	Eel x 1	39.9	0	0	>15.06	>2.51	Fish

## 5 DISCUSSION

Five sites were surveyed within the Upper Tarf catchment to gather baseline data for the proposed Kilgallioch Windfarm Extension. Juvenile salmon were present in one of the survey sites and four of the sites contained juvenile trout. One site held no juvenile salmonids. Eels and pike were the only non-salmonid fish species recorded during the survey.

The Tarf Water is the largest tributary of the River Bladnoch. The Tarf catchment appears to be starting to recover from acidification in the mid and upper reaches and so although low numbers of juvenile salmonids were recorded, it should still be considered very sensitive. Since GFT began surveying, this is the highest known location of salmon within the catchment. Trout parr and fry were found to be utilising three of the tributaries surveyed, along with Tarf Water itself. It is likely that these trout originate from resident brown trout as sea trout are not that common in the Bladnoch system. Therefore these burns should be considered sensitive.

The River Bladnoch is a SAC for Atlantic Salmon and the sensitivities of its watercourses should be acknowledged accordingly. The sensitivities of all the watercourses draining the proposed windfarm site and potentially affected by the development should be taken into account in the planning, construction and operational phases. This includes areas downstream of the site where pollution, silt input and changes in run-off could impact watercourses and fish populations.

Brown trout and sea trout are protected by various legislation and are a UK Biodiversity Action Plan species.

Instream habitat quality encountered throughout the survey sites ranged from moderate to good standard however the fish densities within most of these sites did not reflect this.