Ayrshire Rivers Trust

Arecleoch East Windfarm

Electrofishing Fish Survey

2017

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Summary

Ayrshire Rivers Trust (ART) undertook electrofishing surveys on a number of watercourses within the Duisk Water catchment near Barrhill in South Ayrshire. Eight of these sites are situated within or downstream of the proposed Arecleoch East windfarm development. A control site out with and unaffected by the construction works was also surveyed on the Muck Water. The data recorded from the surveys can be used to inform the planning process and future monitoring programmes for this site.

- Both age classes of salmon and trout were recorded in the survey sites
- Salmon were recorded in six out of nine sites whilst brown trout were recorded in all sites
- Other fish species recorded included European eel and lamprey spp.
- Substrates and gravels were clean with no excessive silt present

CONTENTS

List of Figures

List of Tables

1. Introduction

Ayrshire Rivers Trust (ART) was commissioned by Scottish Power Renewables (SPR) to survey watercourses for freshwater fish within the proposed Arecleoch East windfarm prior to construction work commencing. The proposed development is situated in South Ayrshire near to the town of Barrhill in the River Stinchar catchment.

No detail was available on the number of turbines to be built or their locations. However, a site boundary plan detailing the development area (Appendix B) was available and was used to select the appropriate watercourses which may be affected by the construction work. The proposed site is to the immediate east of the existing SPR Arecleoch Windfarm.

The development has the potential to impact on the water environment due to its close proximity to the Duisk Water and several important tributaries. The Duisk Water and upper Stinchar catchment is an important area for salmonid production and is also host to a number of other protected species. .

The River Stinchar salmon population falls under the management and control of the River Stinchar District Salmon Fishery Board (RSDSFB) who have statutory powers in relation to all matters and activities surrounding and affecting salmon within the catchment. The RSDSFB grants permission to ART to perform electrofishing surveys within the River Stinchar catchment. ART provide professional management and ecological advice to the RSDSFB in relation to all matters affecting the habitat and fishery.

Nine electrofishing sites were selected that were located downstream or within the site boundary of the construction, whilst a control site was surveyed in the same catchment but out with the influence of proposed site construction.

The aims of these surveys were to assess both the fish habitat and species present by calculating the number of fish present per 100m^2 in the watercourses surrounding the proposed development area. These surveys will provide pre-construction fisheries data which can be used to inform the environmental statement should a planning application be submitted.

1.1 Salmonid fish and fisheries

Migratory salmonids; Atlantic salmon (*Salmo salar*) and brown/sea trout (*Salmo trutta*) and other native fish populations commonly use freshwater habitats for breeding and development of early life-stages. Typically, juvenile salmon and trout spend between one and three years in freshwater before migrating to sea as smolts. Salmon may spend between one and three years in the Atlantic Ocean before returning as mature fish to spawn within their natal river, at or close to their original hatching site. Sea trout differ from salmon in that they are part of a resident brown trout population and may spend less time at sea and, unlike salmon, remain in nearby inshore marine waters to feed. The use of both marine and freshwater habitats during their life-cycle makes migratory salmonids vulnerable to deterioration or loss of accessibility in a wide range of habitats.

Isolated resident brown trout populations are potentially present upstream of waterfall barriers that prevent access from the sea. Although an important part of biodiversity, it is likely such isolated brown trout populations are present in most catchments and may contribute to downstream populations through downstream migration.

1.2 Biodiversity

Other than Atlantic salmon and brown trout, native fish such as lamprey (*Lampetra spp*.), stickleback (*Gasterosteus aculeatus*) and European eel (*Anguilla anguilla*) may also utilise freshwater habitats. Fish and freshwater habitats also support a range of other native flora and fauna and consequently mitigation to protect water resources for such species is likely to benefit a range of other biodiversity and conservation objectives.

2. Methods

2.1 Background

ART is a full member of the Scottish Fisheries Coordination Centre (SFCC), which is an association of Scottish fisheries management organisations including the Fisheries Management Scotland (FMS), the Marine Scotland Science (MSS), and the local District Salmon Fishery Boards. The electrofishing surveys carried out for this report were completed following the SFCC's protocols for this technique using SFCC accredited surveyors. The SFCC also provides electrofishing training to its members, and ART staff are qualified to lead and design electrofishing surveys to SFCC protocols. Wherever possible ART surveys are therefore carried out to the standards required by the SFCC and data are recorded using the agreed format.

2.2 Techniques

Fish populations at each site were assessed using electrofishing. This is a widely used technique to examine freshwater fish communities. The method uses electricity to attract and stun fish, which allows operators to remove them from the water. The fish are transferred to a holding container until they have recovered and then anaesthetised using a mild solution of MS222 (Tricaine Methane Sulphonate). Each individual is then identified, measured and returned unharmed to the area from where they were captured.

Battery powered backpack equipment (Hans Grassl model # IG600) was used to carry out each survey. Smooth DC was used at all sites, to maximise catch efficiency, while minimising potential damage to fish and other wildlife. A minimum voltage of 200V was used, to ensure efficient fish capture.

In small watercourses, it is possible to cover the entire survey area accurately, and the number of fish captured can therefore be related to the wetted area of the site. All survey protocols were followed to SFCC standards.

2.3 Quantitative sites

All of the sites surveyed were density surveys; the survey sweep began at the downstream end of the section and moved back and forth across the channel so that every part of the bed was covered. The type of net used depended on the specific site - at fast flowing sites with small substrate a banner net was used to ensure no stunned fish were carried downstream past the operator. However in slower flowing water, or where the substrate was made up of many large boulders, a hand net was generally found to be more effective. Salmon and trout were separated into year classes on the basis of length frequency histograms. As fish grow at very different rates between sites, this was repeated for each site individually. Age classifications were also checked by examining the number of annual rings on scales taken from fish of a range of sizes. Fish densities were then separated into fry and parr for the presentation of results. Other fish species were counted and recorded.

All sites were sampled using an area-delimited survey, thus allowing fish densities to be calculated. A fully quantitative 3-run depletion technique, using upstream and downstream stop nets was used at all sites. If there were sufficient fish present, absolute fish densities were calculated, together with a measure of statistical confidence, otherwise a minimum density estimate was used. Thus, data from all the sites can be compared, regardless of whether catch efficiency changes.

Throughout this report the following notation has been used to distinguish fish year classes: salmonid fish less than one year old are recorded as 0+ year class or fry, whilst fish one year or older are recorded as 1+ or parr.

3. Results

3.1 Results classification

The results from surveys where fish densities are obtained are now classified according to the SFCC Scottish national classification scheme which was derived using data from over 1600 Scottish sites covering the period 1997-2002, Godfrey (2005). This allows ART and the reader to interpret local fish populations in a Scotland-wide context. The national classes should be periodically revised as fish populations will inevitably change over time, even on a national scale. It should be noted that the results were based on single run, or the first run of multiple pass, surveys.

Table 1: SFCC classification salmon fry and parr breakpoints

Salmon fry (no/100m²)	Classification	Salmon parr (no/100m²)
0.0	Absent	**0.0**
<4.7	E – Very poor	**<2.6**
4.7 -<10.3	D - Poor	**2.6 -<5.1**
10.3 - <20.3	C - Moderate	**5.1 - <9.1**
20.3 - <42.1	B - Good	**9.1 - <15.8**
>42.1	A - Excellent	**>15.8**

Table 2: SFCC classification trout fry and parr density breakpoints

Trout fry (no/100m²)	Classification	Trout parr (no/100m²)
0.0	Absent	**0.0**
<2.5	E – Very poor	**<1.6**
2.5 -<5.3	D - Poor	**1.6 -<3.1**
5.3 - <12.4	C - Moderate	**3.1 - <5.6**
12.4 - <30.3	B - Good	**5.6 - <10.4**
>30.3	A - Excellent	**>10.4**

3.2 Electrofishing survey limitations

Electrofishing is a common means of obtaining data on fish populations (SEERAD, 2007). The electrofishing techniques used by ART are specifically designed for assessing juvenile salmonid populations therefore fish from other groups may not be quantified effectively.

The survey sites chosen were selected to be representative of the general habitat type present within each sub-catchment and to include a range of flow and substrate types. The SFCC protocol recommends that the minimum survey length is six times the mean channel width at the site, with a minimum of 20m length (where practical) (Godfrey 2005). If the site selected is representative of the local habitat the survey should provide a robust estimate of local fish populations. However it is possible that if fish populations are low or have a clumped distribution, the survey data may not sample the full fish population in that area.

It is considered impossible to prove the absence of a fish species by electrofishing, therefore, whilst the failure to capture fish at a site may indicate that the population is absent, it cannot be assumed that they are not present elsewhere in the watercourse. For the purposes of this report and the classifications tables 1 and 2, where a fish species has not been recorded at an electrofishing site, they will be classified as absent.

3.3 Fish survey

Electrofishing allowed the two main tributaries located within the site boundary, the Water of Tig and the Cross Water, to be surveyed along with two smaller watercourses the Laggish and Haw Burns also within the boundary. Sites on the Duisk Water and Pollgowan Burn are located immediately downstream of the boundary and the fish species within these areas will also be receptors to any potential impact. A site on the Muck Water was selected as a control site due to the similar ecological and habitat characteristics found in the monitoring sites.

If any pollution incidents occur during the construction phase, baseline data confirms which species were present and the density per unit area of those species. Should densities remain at a similar level to the previous year at the control site, but reduce at those sites that could be potentially impacted by the remedial works when surveys are repeated, then this may indicate that the works had a negative impact on the watercourses present within the viaduct works area.

Details of the electrofishing sites are shown below in Table 3. Surveys were completed in low-medium water conditions during daylight hours. Summary results are presented in Tables 4 and 5.

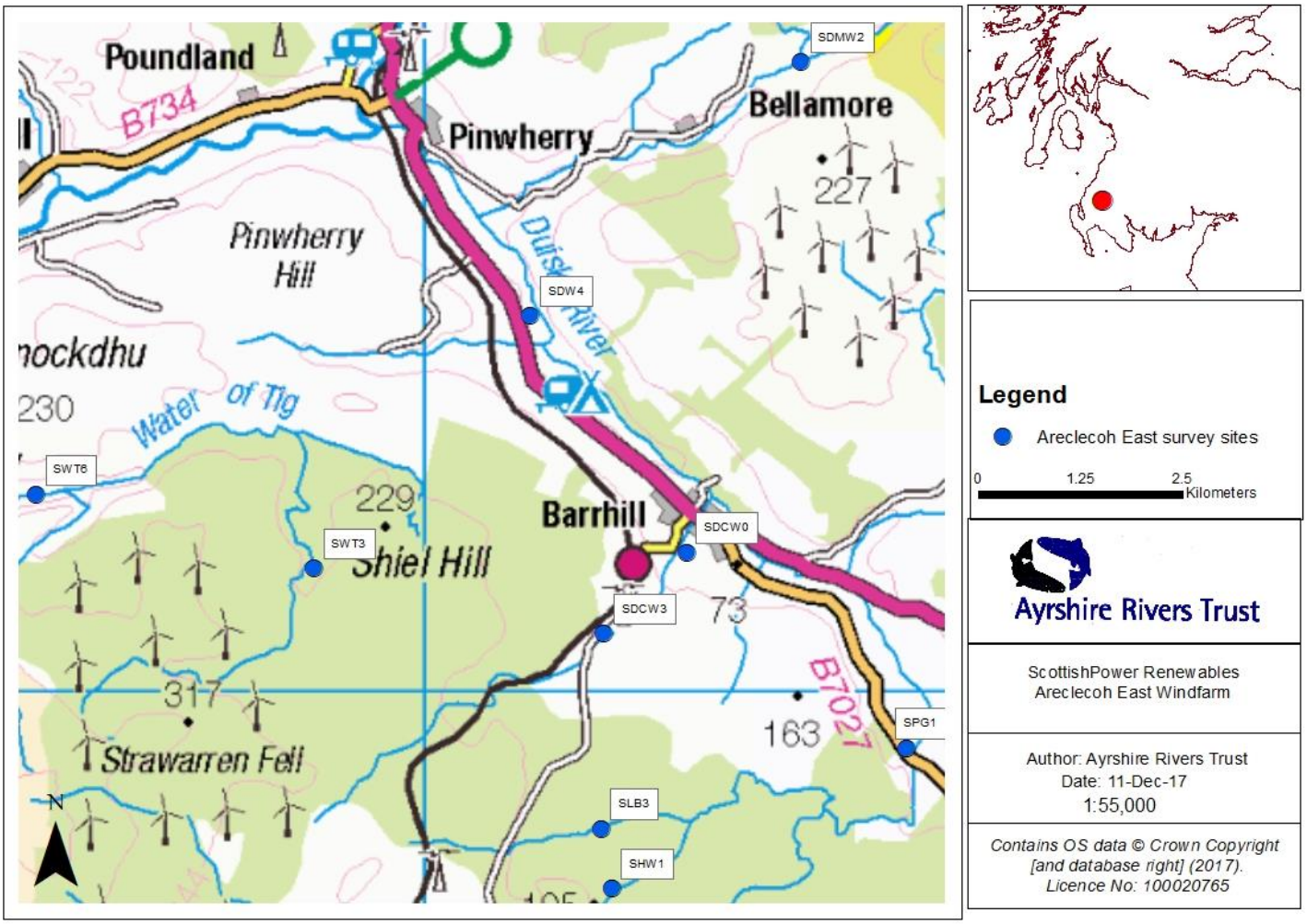

Figure 1 Catchment overview with the electrofishing sites shown

Table 3: Details of the electrofishing survey sites selected

Site code	Watercourse	Purpose	Location	Grid ref (Easting/ Northing)	Average width (m)	Site length (m)	Area fished (m^2)
SPG1	Pollgowan Burn	Monitoring	Lochton Mill	225900 579300	7.30	15.30	111.70
SLB3	Laggish Burn	Monitoring	Downstream of New Luce-Barrhill road bridge	222160 578310	1.78	26.50	47.17
SHW1	Haw Burn	Monitoring	u/s forestry track bridge	222290 577570	1.77	28.30	50.10
SDCW0	Cross Water	Monitoring	Martyrs Tomb	223212 581796	4.56	25.60	116.74
SDCW3	Cross Water	Monitoring	Upstream site below roadbridge	222200 580700	3.36	33.80	113.60
SDW4	Duisk Water	Monitoring	Ballochmorrie House	221300 584600	11.20	11.50	128.80
SWT3	Water of Tig	Monitoring	Upper Site downstream of Old Shielings	218650 581500	3.36	33	110.90
SWT6	Water of Tig	Monitoring	Lower Site at Balkissock	215240 582410	7.18	16.50	118.50
SDMW2	Muck Water	Control	u/s of Bellamore Farm	224616 587718	4.42	31.30	138.35

Table 4: Results from the 2017 electrofishing survey. Where available, calculations of absolute densities are given, along with confidence limits, otherwise minimum densities are supplied.

*Codes for salmon and trout 0+ = fry (less than one year old), 1++ = parr (one year older fish and older)

**Codes for other species are, E = Eel, L=Lamprey, numbers in brackets indicate number category for each species.

* Minimum density (per 100m2) estimates

Site code	Watercourse	Fish densities (Number/100m²)				Other fish species**
		Salmon*		Trout*		
		0+	1++	0+	1++	
SPG1	Pollgowan Burn	7.20	6.30	8.06±2.6	1.79*	E (10)
SLB3	Laggish Burn	0	0	53	2.12*	E (7)
SHW1	Haw Burn	0	0	0	4±2.12	-
SDCW0	Cross Water	5.14	6.90	4.30	8.57±0.47	E(1)
SDCW3	Cross Water	0	0	1.76*	0.88*	E(2)
SDW4	Duisk Water	93.33±(6.23)	6.22	2.33*	0	L(1)
SWT3	Water of Tig	0	0.90*	11.72	3.61	-
SWT6	Water of Tig	50.65	3.38	3.38*	0	E(3)
SDMW2	Muck Water	7.23	2.89	6.51	2.17	E(6)

Table 5: SFCC classification for each site 2017

	Salmon fry	Salmon parr	Trout fry	Trout parr
SPG1	D	C	C	E
SLB3	Absent	Absent	A	D
SHW1	Absent	Absent	Absent	C
SDCW0	D	C	D	B
SDCW3	Absent	Absent	E	E
SDW4	A	C	E	Absent
SWT3	Absent	E	C	C
SWT6	A	D	D	Absent
SDMW2	D	D	C	D

Juvenile salmon were present in six out of the nine sites including the control site whilst trout were recorded in all sites. Salmon fry were in the 'excellent' category at the Duisk Water site where 93.3/100m² were recorded and also the lowermost Water of Tig site at Balkissock which produced 50.6/100m². Where salmon parr were recorded they were mostly in the 'moderate' or 'poor' category.

Trout fry densities were variable between sites. Notably, the highest trout fry densities were recorded in the Laggish Burn where they were in the 'excellent' category. Trout parr densities were also variable between sites but the highest densities were recorded in those sites where salmon fry or parr were absent or low.

Eels were present in all sites with the exception of the Haw Burn and the upper Water of Tig site. One lamprey spp. was recorded on the Duisk Water site.

Habitat observations noted substrates were stable and un-compacted with no high organic matter or excess silt recorded in any of the survey sites. Spawning gravels were clean and the water conductivity had a range of 35-50µScm^{-1}. It was also noted the water in the Haw Burn had a dark peaty appearance to it.

4. Discussion

Electrofishing surveys undertaken by ART show salmon and trout use this sub-catchment as a juvenile nursery area. Of particular importance are the main Duisk Water and Cross Water where salmon fry densities were excellent. Although juvenile salmon were not recorded in every watercourse, juvenile brown trout were present in their absence. This indicates that the habitat and the water quality at these sites is very good.

The presence of the European eel at most of the survey sites also highlights the importance of these watercourses to all migratory fish species. The European eel is a protected species, an IUCN Red List species and is listed as critically endangered (Jacoby and Gollock, 2014). Furthermore, Atlantic salmon are also listed as a European species of importance under the EC Habitats & Species Directive, in addition to the extensive UK legislation intended to protect the species (Hendry and Cragg-Hine, 2003). Given the conservation status of these fish and the historical significance of these watercourses as productive juvenile salmon areas of the River Stinchar, it is important to monitor the impact that the proposed Windfarm construction may have on these species.

ART recommends these sites should be re-surveyed prior to any construction works commencing including the provision of access roads for site traffic. The ecological monitoring programme should also include a fisheries audit during and after construction which can be used to monitor changes within the aquatic communities. As ART advise the RSDSFB on all fishery matters, early consultation should be initiated with us and the Board should any temporary or permanent road crossing involving watercourses within the proposed development be planned. The installation of culverts may involve the removal and translocation of fish to safer locations, a procedure which ART can assist with. Furthermore, badly positioned or designed culverts can also have a detrimental impact on fish migration. It is therefore crucial that measures are in place early to minimise the negative impact they may have on the fishery.

5. References

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Appendix A Site photographs

Pollgowan Burn (SPG1)

Laggish Burn (SLB3)

Haw Burn (SHW1)

Cross Water (SDCWO)

Water of Tig (SWT3)

Water of Tig (SWT6)

Duisk Water (SDW4)

Control site on the Muck Water

Appendix B Arecleoch East Site Boundary Plan