River Ruel Fish Habitat Improvement Project - Progress Report (January 2023)

1. Background

The River Ruel is an important catchment for Atlantic salmon and sea-run brown trout on the Cowal Peninsular in Argyll and Bute (Figure 1.1). In addition to supporting local biodiversity, the river also provides a recreational fishery resource which benefit the local angling club and visitors to the area contributing to the local economy.

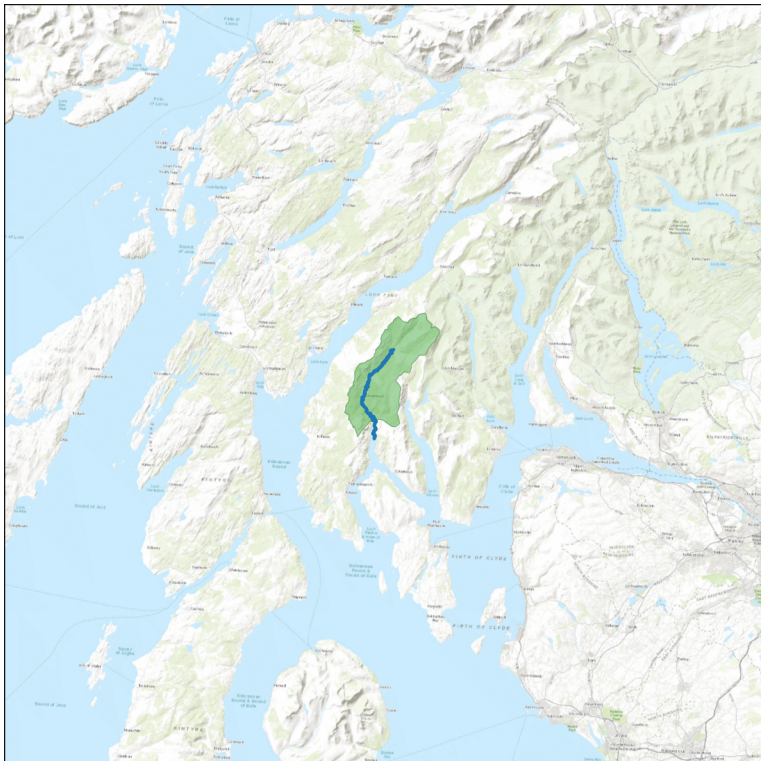

Figure 1.1 Location of the River Ruel

Since 1998, Argyll Fisheries Trust (AFT) have undertaken surveys of fish populations and fish habitat to inform management of the fishery. The fish surveys have found sub-optimal numbers of young salmon and trout in the River Ruel, which reflect the low numbers of adult salmon and trout returning to the river and the performance of the fishery. While there are significant factors affecting adult fish return rates in the marine environment, the fish habitat surveys found that the recruitment of young trout and salmon was being affected by the large amount of fine sediment in the river bed. Subsequently, a geomorphological survey (2017) found that the fine sediment in the riverbed was as a result of the amount of soil being eroded from riverbanks. The high rates of bank erosion identified by the survey is due to the loss of bankside trees which stabilise the banks and is exacerbated by trampling and poaching of the banks by livestock. In addition, this work identified that the abstraction of water from the River Garvie tributary at the head of the river was also likely to contribute to the problem of fine sediment accumulating on the river bed. The fine sediment reduces the survival of salmon and trout eggs and fills the gaps between larger coarse substrates that young fish and macroinvertebrates (which fish feed on) utilise for cover from floods and predators. To begin to restore the river habitat and to improve the recruitment of young fish, AFT prescribed habitat improvement works aimed at maximising the good habitat present in the short-term and begin the longer-term process of restoring the habitat that was more significantly affected. The

project has focused on two sections of habitat in the upper river (Figure 1.2) where different techniques have been employed:

- Section A - Protect and stabilise existing trees and improve bank cover for fish where the riverbed was in good condition.
- Section B – Restore the condition of the riverbed by reducing bank erosion and increase the stability of banks and diversity of the bank vegetation. The vegetation will form the foundation of the bank protection in the longer-term as the GBR works degrade over time.

Under a general concept of working in a downstream direction, these objectives have been progressed in the upper catchment between 2018 and 2022.

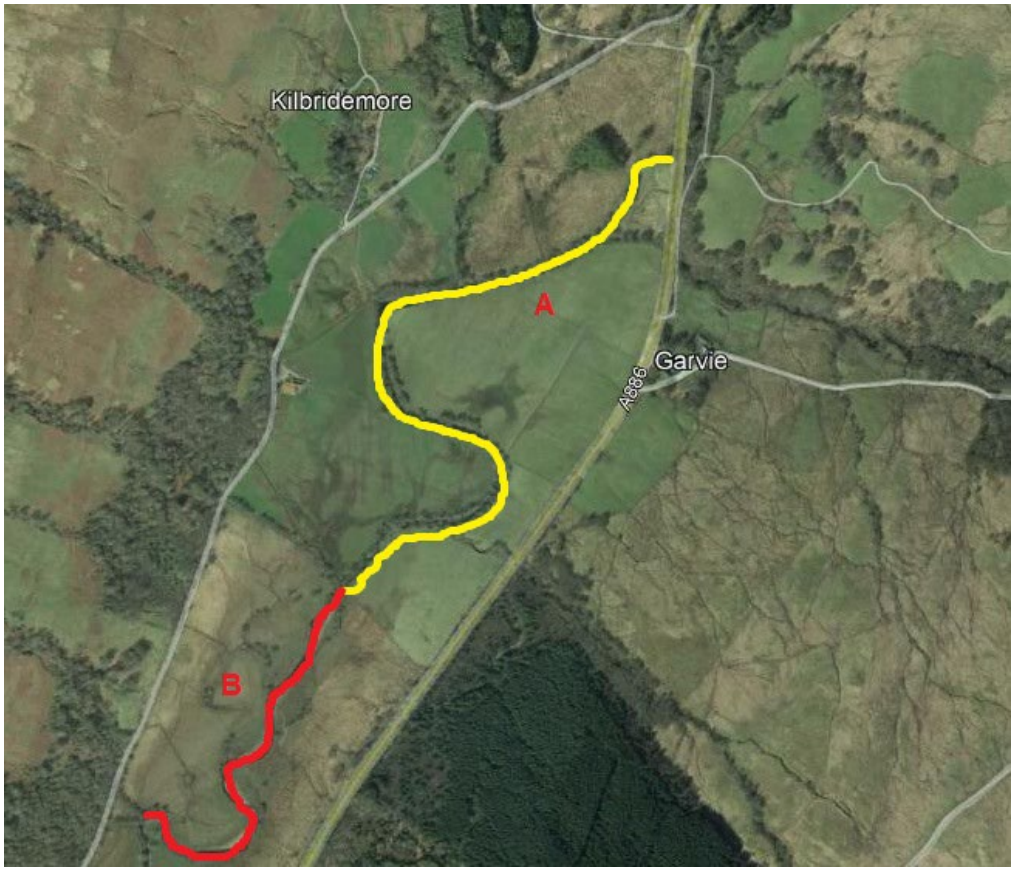

Figure 1.2 Upper River Ruel Habitat Works Sections

The technical aspects of this work have been derived from techniques demonstrates by the Wild Trout Trust (WTT) as part of a practical workshop held in Argyll in 2015. AFT have utilised and developed these techniques to suit the local conditions and management priorities. Since 2018, the annual work programme has been supported by the River Ruel Improvement Association (RRIA), Scottish and Southern Energy PLC (SSE), and grant funding from the Cruach Mor Wind Farm Trust (CMWFT). These contributions have supported much of the work carried out to date in section A. The work programme was interrupted in 2022 due to the Covid-19 pandemic. In 2021, additional funding was also granted by the Wild Salmonid Support Fund (WSSF) which has enabled the project partners to begin work on the bank erosion in section B.

2. Project Progress

The project has been focused on different techniques used to tackle specific outcomes on section A between 2018 and 2021 and section B in 2022. The locations of the worksites are given in Appendix I

Section A

In section A, some of the best remaining instream habitat was threatened by undermining of large mature trees and lack of regeneration of young trees. To maintain and improve some existing high-quality in-stream habitat for fish in section A, the work has mainly utilised three techniques to maintain the benefits provided by mature trees.

- Coppice larger trees to maintain bank stability (relieving strain on root plates) while retaining sufficient shading of the channel (Figure 2.1)
- Utilise coppiced large woody debris (LWD) to provide bankside cover for fish (Figures 2.2 and 2,3).
- Coppiced limbs of larger trees were also wired together and used for bank protection (Figure 2.4) and protect tree roots from livestock damage (Figure 2.5).

Fig. 2.1 Felling / coppicing overhung trees to maintain root system

Fig. 2.2 Felled trees were winched into the bank to provide cover for fish

Fig. 2.3 Felled trees secured into the bank

Fig. 2.4 Coppiced tree limes secured into an eroded bank

- Coppiced small woody debris (SWD) was also used in green revetment that trap fine sediment, assist the rebuilding of eroded sections of bank and prevent undermining of valuable trees (Figure 2,6).

Fig. 2.5 Coppiced tree limbs secured to protect roots from hoof-shear

Fig. 2.6 Installing green bank revetment to protect existing trees

The work progressed from 2018 to 2021 along the left bank of Section A (1.4 km length) as described below (Table 2.1).

Table 2.1 – Work completed in Section A (2018-2021)

Period	Site	Work	Bank Length (m)	No. Sites
2018	A1	Green Bank Revetment	15	1
2018	A1	Coppice & LWD cover	30	2
2018 total	A1	Total bank length	45	3
2019	A2	Coppice & LWD cover	55	2
2019 total	A2	Total bank length	55	4
2021	A3	Debris Dam cleared	8	1
2021	A3	Coppice & LWD cover	170	7
2021 total	A3	Total bank length	178	8

An increasing length of bank has been improved each year of the project (no work carried out in 2020 due to the covid-19 pandemic) as our experience has grown. In total, a 278 m length of bank has been repaired and numerous bankside trees have been stabilised.

Section B

Habitat surveys identified that there are fewer and smaller patches of high quality in-stream habitat for fish in section B, and there is a high proportion of fine sediment present in the riverbed substrates. This sediment impairs incubation of salmonid fish eggs and reduce cover for juvenile fish and invertebrate food sources for fish. The work carried out in 2022 was aimed at beginning to reduce the erosion of banks and inputs of soil into the river at Site B1. The two techniques were used to achieve this are:

- Install Green Bank Revetment (GBR) along eroding bank faces to reduce erosion.
- Re-establish riparian vegetation by fencing to reduce access of grazing livestock.

The work carried out in 2022 at Site B1 installed 125 meters of green bank revetment along an eroding face of the River Ruel (Figures 2.7) which contribute significant amounts of soil into the river (Figure 2.8).

Fig. 2.7 Eroding bank face at treatment site

Fig. 2.8 Bank collapse and soil deposits

To install the green bank revetment, a team of four staff from AFT and volunteers from the RRIA spent one week on the river in early August with a machine contractor, The work consisted of a sequence of several actions:

- Cutting and transporting willow brash to be installed into the revetment.
- Install a line of hardwood posts along the bank using a post driver on the excavator machine (Figure 2.9)
- Re-profiling of the eroding bank face (by excavator machine) to reduce the angle of the bank face and therefore the exposure of the bank to erosion
- Install a layer of willow brash between the submerged portion of the bank face and the posts (Figure 2.10)

Fig. 2.9 Installing posts along the reprofiled bank face

Fig. 2.10 Track machine securing the bank behind the brash to protect the new bank

- Protect the upper bank face with a layer of hessian material to assist soil retention (Figure 2.11).

- Install a layer of willow brash on top of the hessian to act as a source of willow regeneration (Figure 2.12).

Fig. 2.11 Hessian layer installed to aid bank recovery and securing posts driven into the top of the bank

Fig. 2.12 Willow brash and log laid onto the hessian layer

- A layer of turf (removed from the bank) was added on top of the brash and secured by fencing wire strung between the posts at the bottom and top of the bank (Figure 2.13).
- Existing trees were coppiced to prevent them from falling into the river and a woody debris dam was reduced in size to prevent erosion of the new bank work (Figure 2.14).

Fig. 2.13 The turf laid onto the willow secured by a fencing wire lattice.

Fig. 2.14 Reducing a woody debris dam

Further work is planned to take place in early spring 2023:

- Erect a livestock-proof fence along the new bank to allow the vegetation to regenerate.
- Plant willow cuttings into the new bank face to aid regeneration of the vegetation

The work completed at Site B1 in 2022 was revisited in January 2023 to assess the stability of the bank and reaction of the riverbed (see section 4).

3. Project Finances (2022-23)

Project finances are reported for financial year ending 31st of March 2023 (2022/23) are forecast below.

In 2022-23 a total of £17,657 in contributions to the project have been received from Scottish & Southern Energy Plc (SSE), Cruach Mhor Wind Farm Trust (CMWFT) and income from Argyll Fisheries Trust's (AFT) application to the Wild Salmonid support Fund (WSSF) (Table 3.1).

Table 3.1 Project income 2022-23

Project Partner	Income (£)
Scottish & Southern Energy (SSE)	3,500
Cruach Mor Wind Farm Trust (CMWFT)	2,500
River Ruel Improvement Association (RRIA)	1,500
Wild Salmonid Support Fund (WSSF)	10,157
Total Fund 2022-23	17,657

The total project expenditure for 2022-23 is £15,880 (Table 3.2) including a projected £1,834 required for fencing work before the end of March 2023. A project balance for 2022/23 is expected to be a surplus of £1,778. The projected surplus will be used to contribute to maintenance and new work required in 2023/24.

Table 3.2 Project expenditure 2022-23

Project contractor	Activity	Sum (£)
AFT staff & contract labour	Management & delivery	7,253
Machine contractor	Revetment installation	5,220
Materials	Posts, wire & consumables	1,572
Fencing (TBC)	Posts, wire & labour	1,834
Total Expenditure 2022/23		15,880
Total Income 2022/23		17,657
Project Balance 2022/23 (including funds carried forward)		16,259

4. Project Monitoring and Development (January 2023)

Inspection of the work carried out at site B1 in 2022 was undertaken during a site visit in January 2023 to assess the effectiveness of the GBR installation following several high flow events and inform the development of the project going forward. The inspection found that the treatment stretch had reacted positively to the GBR revetment in that the fine sediment had largely been scoured from the riverbed and substrates appear clean. The substrates also appear to have been redistributed with larger substrates appearing on the outside of the bend and fine sediment being deposited on the inside of the bend. The reappearance of larger substrates on the outside of the bend is a consequence of the riverbed being scoured of fine sediment and prevention of new fine sediment deposited into the river due to the stabilising effect of the new GBR. Reduction of fine sediment in the riverbed has meant that the pool habitats within the stretch have become much deeper and the spawning gravel much cleaner. The brash material installed onto the bank face has also started to accumulate fine sediment

(Figure 4.1) and the turfs placed on top of the brash have been retained and begun to stabilise the bank face vegetation (Figure 4.2).

Fig. 4.1 Upper portion of GBR, 17/01/23

Fig. 4.2 Lower portion of GBR, 17/01/23

The GBR work was found to be stable in the shallower glide and run flow habitat (Figure 4.3) but were less stable in the two deeper pool habitats where the riverbed in the lower portion of the work area had been soured. Several posts have become undermined by the scouring of the riverbed and had been thrown onto the bank (Figure 4.4). The scouring of the posts is evidence of the changes made in the riverbed profile created by the GBR. The loss of the 1.8-meter-long posts will require that they are replaced with 3-meter-long posts at the two spots affected. The loss of some of the brash behind the lost posts will also need replacement. The repair work will be required on an 18-meter length of the 125-meter-long treatment stretch (15 %).

Fig. 4.3 Stable GBR in shallow run habitat 17/01/23

Fig. 4.4 Scoured posts in deep pool habitat 17/01/23

5. Project Development and proposals (2023/24)

In addition to the repairs to the 2022/23 work at site B1, continued bank stabilisation work is proposed for 2023/24 further downstream at site B2. The work planned for 2023-34 include three activities. Firstly, tree coppicing and large woody debris management along a 25-meter length of bank (site B2a) where the root structures of existing trees are being undermined (Figure 5.1). Secondly, installation of a 96-meter length of GBR (at site B2b) on an eroding and collapsed bank (Figure 5.2) and thirdly, install stock fencing along a 150-meter length of bank to allow the vegetation on the newly treated bank to recover.

Fig. 5.1 Undermined trees (site B2a)

Fig. 5.2 Eroding / collapsed bank (site B2b)

Given the large amount of habitat in the River Ruel that require improvement work, AFT and RRIA will be seeking additional grant funding (as was the case in 2022/23) to expand the work programme. If additional funds are forthcoming from the Wild Fisheries Fund or other sources in 2023/24, the project partners will undertake further tree management work on unstable bank side trees (Figure 5.3) and GBR on the next section of eroding and collapsing bank (Figure 5.4) further downstream (Site B3).

Fig. 5.3 Unstable bankside trees (Site B3a)

Fig. 5.4 Bank erosion & collapse (site B3b)

The estimated cost of the work in 2023-24 is £33,750 (Table 5.1) which include additional costs for AFT staff and contract labour to source, gather and transport brash material to the site. The 2022/23 work was able to source materials from nearby trees, but the 2023/24 work will need to go further afield to gather the materials. Additionally, having the brash material on site prior to the installation will allow for better efficiency of the machine contractor time.

Table 5.1 Project expenditure forecast 2023-24

Project contractor	Activity	Sum (£)
AFT staff	Management & labour	15,000
Contract labour	GBR installation	3,300
Machine contractor	GBR installation	12,000
Consumables	Posts, wire & tools	1,950
Fencing	Materials & labour	1,500
Total Expenditure		33,750

In addition to the balance of funds carried forward from 2022-23 (£ 16,259), the RRIA have pledged to contribute £1,500 on completion of the work in 2023. SSE have confirmed their continued support of the work in 2023/24. A funding application (£2,500) will be made to CMWFT in spring 2023. An application to the Wild Fisheries Fund (WFS) is also being made in Spring 2023 (£10,000). The Total funds estimated for work in 2023/24 are outlined in the Table 5.2 below.

Table 5.2 Project income forecast 2023-24

Project Partner	Income
Project funds carried forward	£16,259
Scottish & Southern Energy (SSE)	£3,500
Cruach Mor Wind Farm Trust (CMWFT)	£2,500
Wild Fisheries Fund (WFS)	£10,000
River Ruel Improvement Association (RRIA)	£1,500
Total income forecast 2023-24	£33,759

6. Monitoring and review of progress

Monitoring of the tree management, bank stabilisation and the reaction of the fish population to the work will be required to ensure the work is effective and that the techniques utilised are long-lasting. The major focus of the monitoring will be on the stability of the GBR work and identify any repairs necessary as the river adjusts to the work in the short term. This should ensure that the GBR work is able to sustain the recovery of the bankside vegetation over time which will form the natural protection of the banks for the longer term as the GBR works degrade.

Indirect monitoring of the benefits of the work to the fish population will be undertaken by surveys of juvenile fish (electrofishing) and adult spawning sites (redd counts) within the work sites and for comparison, at untreated sites nearby. These surveys will provide feedback to the management of the project, although the results of such surveys may be affected by the number of migratory salmonids returning to the river each year. Such surveys, add to the costs of the project, but should be considered as a means of demonstrating the effectiveness of the work to current and future funding partners. Changes in bankside habitat, may also be tracked using fixed point photography that provide a time-series of images that allow review and improvement of the work programme.

In 2023/24 AFT will review the available fish and habitat data on the upper River Ruel to formalise a monitoring programme going forward. Further to this, AFT will seek independent advice on developing a strategic approach to prioritising sites for treatment that will maximise the benefits to the habitat and the fish population. Project partners will also need to be aware of changes to incentives for landowners that affect land use and farming practices. Opportunities may also arise through several sources where the scale of the work may be increased, and benefits maximised.

APPENDIX I – Work site locations

Year	Site	Treatment	Upstream		Downstream		Bank Length (m)
			Easting	Northing	Easting	Northing	
2018	A1a	LWD placement	203551	690585			5
2018	A1b	GBR	203502	690577	203490	690571	15
2018	A2	Coppicing & LWD	203490	690571	203236	690505	245
2019	A3	Coppicing & LWD	203236	690505	203330	690178	528
2021	A4	Coppicing & LWD	203330	690178	203035	689998	380
2022	B1	GBR & Coppicing	202911	689783	202838	689714	125
2023	B2a	Coppicing & LWD	202820	689724	202814	689702	25
2023	B2b	GBR	202814	689702	202851	689620	96
2024	B3a	Coppicing & LWD	202867	689619	202871	689596	25
2024	B3b	GBR	202871	689596	202767	689546	130