

# Environmental Impact Assessment Report

Beinneun 2 Wind Farm

Volume 3

Technical Appendix A6.5: Fish

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# Beinneun 2 Windfarm Habitat and Fish Population Survey



Ness District Salmon Fishery Board

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# Beinneun 2 Wind Farm Habitat and Fish Population Surveys

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### Non-Technical Summary

Habitat within all watercourses provided suitable habitat for salmonids, however there were a number of limiting factors that may prevent viability of fish populations found therein. Gradients were high in all tributaries with waterfalls present, some of which were clearly impassable. One unnamed tributary, and Allt Garbh Doire, were inaccessible due to a waterfall and manmade structure respectively and this was reflected in the absence of any fish populations. It is likely that these tributaries dry in the summer months with the exception of Allt Bealach Odhar and Allt Garbh Doire further impacting on fish populations.

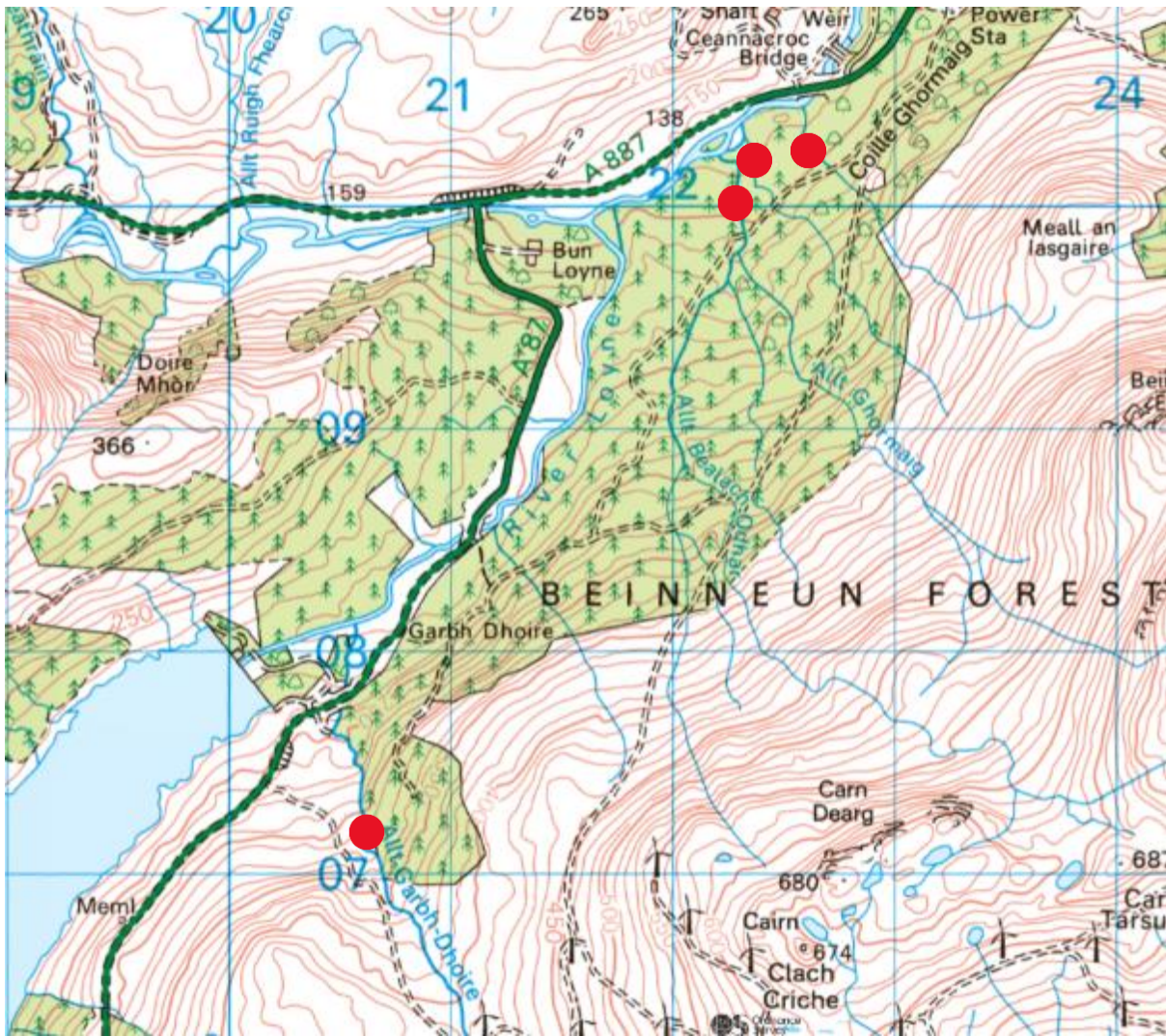
Salmon and trout were recorded at four of the six sites surveyed. Two of these sites were on the main river Moriston which included both fry and parr. Salmon parr were recorded on Allt Bealach Odhar in moderate densities with fry absent, suggesting that the tributary is utilised intermittently, or by juveniles migrating into the river from the mainstem. A solitary parr was found in an unnamed tributary again suggesting the same however, the nature of the tributary suggests it may dry.

Freshwater Pearl Mussels are present throughout the river Moriston; however, none were observed during the surveys. This does not necessarily mean that the species is absent within the area. This should be a major consideration going forward.

The key areas of concern are the mainstem river Moriston and Allt Bealach Odhar, both containing juvenile salmonids in reasonable densities. Mainstem densities also show a marked improvement when compared to historical data with an increase in both parr and fry. In addition, the main river also contains Freshwater pearl mussels although none were observed during surveys. It is therefore important that mitigation is in place during any works to protect these species. Salmon are also an important species with regard to freshwater pearl mussels, acting as a host species for larvae.



## Beinneun 2 Wind Farm Habitat and Fish Population Surveys



*Figure 2 Habitat survey site locations*

Semi-quantitative fish population surveys were also carried out on each of the four tributaries, along with a timed survey directly below the track on Allt Bealach Odhar. This survey was to ascertain the passability of a series of bedrock cascades in the lower reaches. In addition, a further two fish population surveys were carried out on the River Moriston mainstem where these tributaries join the main river. These surveys were carried out in accordance with SFCC protocols.

Four freshwater pearl mussel surveys were also carried in the same area. These took the form of 50mx1m transects at locations in the vicinity of the confluences of the tributaries. All staff were fully licenced through NatureScot to carry out these surveys.

### Key Species of Interest

#### Atlantic Salmon *Salmo salar*

Atlantic salmon in the UK are now listed as “Endangered” by the IUCN (IUCN, 2024) and are listed in Appendix III of the Bern Convention and Annex II and V of the EC Habitats & Species Directive (OSPAR Convention, 2010). The multi-sea-winter component of the Atlantic salmon population is included in the UK Biodiversity Action Plan (UKBAP) Priority Species List (UKBAP, 2007). While the River Ness itself is not a statutory designated site, the River Moriston is designated as a Special Area of Conservation (SAC) due to its importance for Atlantic salmon and Freshwater pearl mussels (*Margaritifera margaritifera*) (NatureScot Sitelink).

#### Brown Trout *Salmo trutta*

Brown trout are a UKBAP species and therefore deemed to be of national importance (UKBAP, 2007a). Sea trout are the sea-running form of the brown trout. Neither form of trout receives extensive protection within conservation legislation. Some protection in terms of exploitation controls exist within fisheries legislation and sea trout are further protected within Scottish fisheries acts relating to the protection of 'salmon.

#### European Eel *Anguilla anguilla*

The European eel is listed as ‘critically endangered’ on the International Union for Conservation of Nature (IUCN) Red List (IUCN, a.). A widespread decline has led the European Commission to develop an Eel Recovery Plan (Council Regulation No 1100/2007). This aims to return European eel stocks to sustainable levels. Each Member State is required to establish national Eel Management Plans, with an Eel Management Plan for Scotland developed by Marine Scotland Science in 2008 (Scottish Government, 2008). The European eel was also added to the UKBAP Priority Species List in 2007 (UKBAP, 2007).

#### Lamprey Species

There are three lamprey species present in UK; brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*). All three species are afforded protection within conservation legislation:

- Brook Lamprey Annex II of the EU Habitats Directive Appendix III of the Bern Convention;
- River Lamprey Annexes II and V of the EU Habitats Directive Appendix III of the Bern Convention and are on the UKBAP Priority List; and
- Sea Lamprey Annex II of the EU Habitats Directive Appendix III of the Bern Convention and are on the UKBAP Priority List.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

### Freshwater Pearl Mussel *Margaritifera margaritifera*

The Freshwater pearl mussel in Europe are now listed as “Critically Endangered” by the IUCN (*IUCN, 2024*). *Margaritifera margaritifera* is an Annex II species and is the primary reason for the selection of the River Moriston as an SAC (JNCC, 2007 b).

### Methodology

#### Habitat Survey protocol

The fish habitat survey utilised Scottish Fisheries Coordination Centre (SFCC) protocols during data collection. In order to assess the suitability of habitat for salmonids and other fish species, a number of features were recorded which may broadly be categorised as follows:

- Water depth;
- Water flow type;
- Instream characteristics;
- Bankside characteristics;
- Riparian vegetation;
- Surrounding land uses;
- Bankside fencing and grazing;
- Erosion and bankside collapse;
- Pollution sources; and
- Bankside and channel modifications.

Each watercourse was split into transects, the length of which depended on the width of the river and the presence of natural or manmade 'break-points', such as where two rivers merge, fence lines marked on Ordnance Survey maps or distinct changes in habitat. The surveyor recorded the location of each transect line using a handheld GPS device and recorded its habitat details on printed sheets. Typically, these were recorded in terms of percentages of the survey stretch as a whole. Photographs were taken of key features of interest.

#### Electrofishing protocol

Fishing with electricity is the most common method employed to survey a river dwelling fish species. Back-pack electro-fishing equipment was utilized during these electro-fishing surveys. Semi quantitative surveys and the time Delineated survey and were carried out and recorded in accordance with the protocols established by the Scottish Fisheries Co-ordination Centre.

#### Area delineated – Semi-quantitative surveys

During each survey, where possible areas of river/burn (approximately 50-100m<sup>2</sup>) were identified. The area was fished through in a methodical and thorough manner with fish being retained in buckets.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

Captured fish were lightly anaesthetized in order to facilitate accurate length measurements (mm) and species identification. Scale samples were taken when required. The sites were fished through once only and densities recorded as a minimum density estimate – number of fish per 100m<sup>2</sup> Instream habitat of each site was also recorded

### Time-Delineated Surveys

Timed fishing relies on the assumption that the catch per standardised unit of effort (CPUE) is proportional to population size. To meet this assumption and attempt to produce consistent catch efficiency, effort is standardised with regard to the time fished, the equipment and its electrical output characteristics, training of the operatives and the prevailing biotic and abiotic factors. The catch efficiency will also vary with fish species, fish size and habitat, and the similarity of these factors between sites has to be taken into account when studying community structure or comparing populations or sub-populations.

The equipment used incorporates a timer when the anode is live allowing for an accurate measure of time actually fished. This is preset to three minutes. Staff worked in an upstream direction fishing mainly run and riffle habitat. Any eels seen were counted. All fish were lightly anaesthetised using a solution of MS222, species identified and a length measurement taken. A range of instream habitat parameters were also recorded.

### Data Analysis

In the absence of a national classification scheme the data obtained from time delineated surveys was compared to the Spey Classification and River ranking system (*Spey Fishery Board, 2016*). This enabled staff to obtain a comparable data set and give an indication of the status of fish populations within the survey areas.

Table 1: Timed electrofishing survey breakpoints for number of salmon fry and parr caught per minute live anode time.

Breakpoint (salmon fry/min)	Class	Breakpoint (salmon parr/min)
0	Absent	0
<5.00	Very low	<1.0
5.1 to <11.0	Low	>1.0 to 2.0
11.0 to <17.3	Moderate	>2.0 to 3.9
17.4 to 28.0	Good	4.0 to 6.9
>28.1	Excellent	>7.0

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

Area Delineated surveys were classified under the SFCC Moray Firth region and corrected for stream width.

*Table 2: SFCC Moray Firth Region salmon and trout densities, corrected for stream width.*

Width Class	Salmon fry density/100m <sup>2</sup>				Salmon parr density/100m <sup>2</sup>			
	< 4m	4-6m	6-9m	>9m	< 4m	4-6m	6-9m	>9m
<b>A - Excellent</b>	86.8+	77.3+	40.4+	32.3+	30.9+	25.3+	22.8+	16.0+
<b>B - Good</b>	<86.8 - 35.8	<77.3 - 42.6	<40.4 - 26.8	<32.3 - 15.1	<30.9 - 18.9	<25.3 - 18.4	<22.8 - 12.4	<16.0 - 12.1
<b>C - Moderate</b>	<35.8 - 22.6	<42.6 - 27.5	<26.8 - 18.7	<15.1 - 9.9	<18.9 - 11.7	<18.4 - 10.8	<12.4 - 9.2	<12.1 - 6.7
<b>D - Low</b>	<22.6 - 8.6	<27.5 - 7.7	<18.7 - 11.2	<9.9 - 4.0	<11.7 - 5.3	<10.8 - 3.7	<9.2 - 4.9	<6.7 - 3.0
<b>E - Very Low</b>	<8.6 - 1.5	<7.7 - 1.0	<11.2 - 0.7	<4.0 - 0.9	<5.3 - 1.2	<3.7 - 1.0	<4.9 - 0.7	<3.0 - 0.9
<b>Absent</b>	0.0	0.0	0.0	0.0	0	0	0	0
Width Class	Trout fry density/100m <sup>2</sup>				Trout parr density/100m <sup>2</sup>			
	< 4m	4-6m	6-9m	>9m	< 4m	4-6m	6-9m	>9m
<b>A - Excellent</b>	39.0+	26.4+	9.3+	5.4+	18.1+	13.3+	6.1+	2.7+
<b>B - Good</b>	<39.0 - 21.0	<26.4 - 10.4	<9.3 - 6.0	<5.4 - 3.3	<18.1 - 13.7	<13.3 - 7.2	<6.1 - 4.0	<2.7 - 1.9
<b>C - Moderate</b>	<21.0 - 14.3	<10.4 - 7.0	<6.0 - 4.5	<3.3 - 1.6	<13.7 - 9.1	<7.2 - 5.2	<4.0 - 2.3	<1.9 - 1.7
<b>D - Low</b>	<14.3 - 5.9	<7.0 - 2.9	<4.5 - 3.1	<1.6 - 1.2	<9.1 - 3.9	<5.2 - 2.3	<2.3 - 1.3	<1.7 - 1.0
<b>E - Very Low</b>	<5.9 - 1.1	<2.9 - 0.5	<3.1 - 0.8	<1.2 - 0.3	<3.9 - 1.4	<2.3 - 1.0	<1.3 - 0.6	<1.0 - 0.6
<b>Absent</b>	0.0	0.0	0.0	0.0	0	0	0	0

## Beinneun Windfarm Habitat Survey

### Allt Bealach Odhar

Allt Bealach Odhar is a small tributary of the River Moriston with its confluence at grid reference **222204 – 810259**. This tributary was surveyed on 27/06/2024. For the purpose of the survey the river was split into three transects covering a total distance of approximately 520m. The location of the river and transects is shown below in **Figure 3**

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys



**Figure 3 Map showing Transect Locations and Upstream limit of survey**

At the time of survey water levels were recorded as ‘Low’ and bed visibility was 100%. The details for each transect are shown in **Table 1** below.

**Table 3 Site Codes, Grid references, site lengths and altitude for all transects**

Transect	Downstream Easting	Downstream Northing	Upstream Easting	Upstream Northing	Length (m)	Altitude (m)
AB1	222204	810259	222288	810075	200	135
AB2	222288	810075	222320	809882	220	148
AB3	222320	809882	222286	809802	100	162

### Transect AB1

Transect AB1 was approximately 200m in length, wet widths were variable ranging from 2m at its confluence to 5m further upstream before narrowing again giving an average wet width of 4m. Bed widths were also variable ranging from 4m – 10m. At the downstream end of the transect a large gravel cone was observed on the right bank at the confluence with the river Moriston. This suggests that Allt

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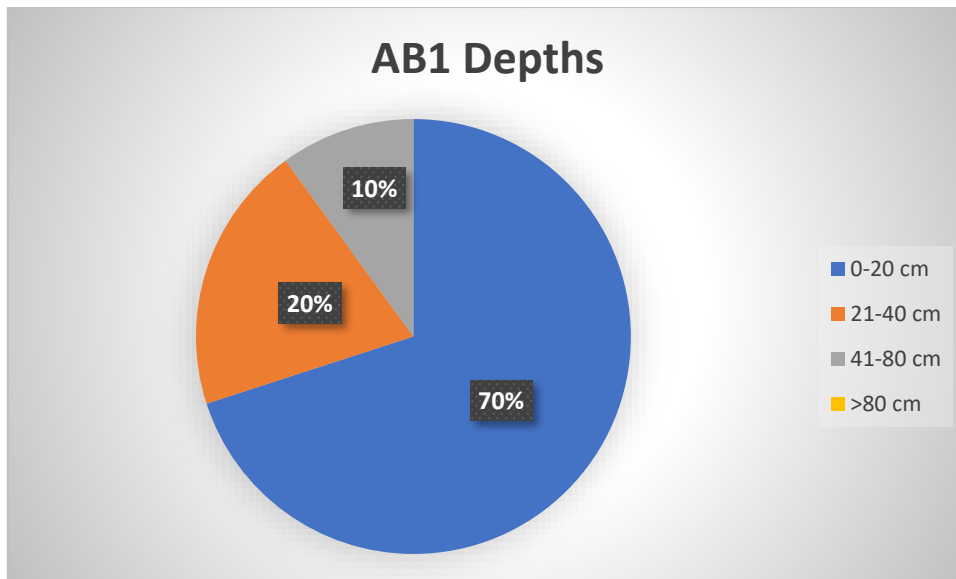
Bealach Odhar is an important tributary in terms of the addition of sediments within the River Moriston. A photograph of this feature is shown below in **Figure 4**.



*Figure 4: Gravel Cone at the confluence with River Moriston*

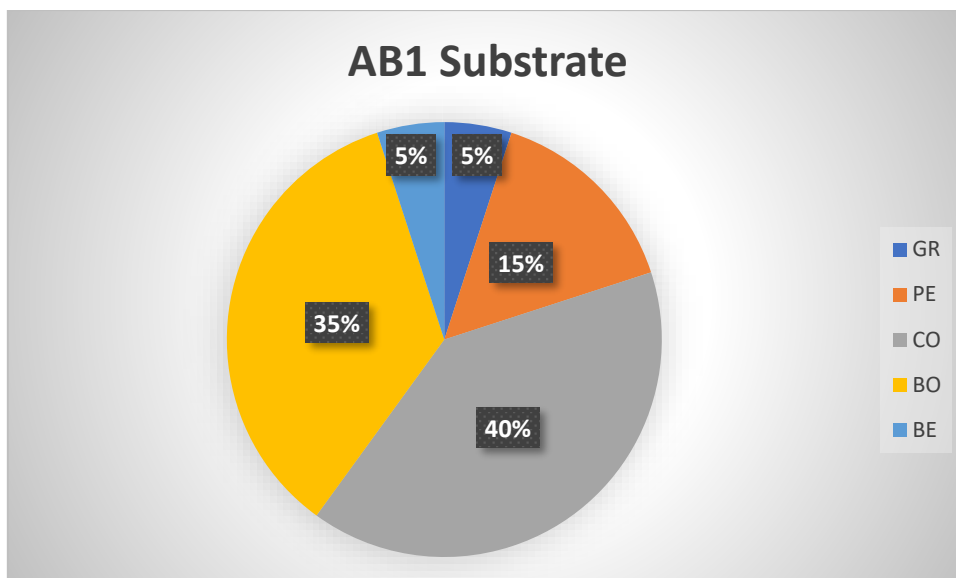
Depths throughout the transect length were relatively shallow with the majority being in the <20cm and 21cm-40cm range although occasional pockets of slightly deeper areas were observed both at the start and at the upstream extremity. These depths were recorded as a percentage of the whole transect and are shown below in **Figure 5**.

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**Figure 5: Depths recorded as a percentage for Transect AB1**

Substrate was predominantly cobble and boulder with intermittent and small areas of pebble and gravel. This provides good mixed juvenile habitat for salmonids offering ample cover for both parr and fry due to the larger substrate size. Useable spawning substrate was patchy and spread throughout the site, an area of approximately 100m<sup>2</sup> was recorded and this was observed towards the lower end of the transect. A small area of bedrock was evident at the top of the transect.



**Figure 6: Substrate types recorded as a percentage for Transect AB1.**

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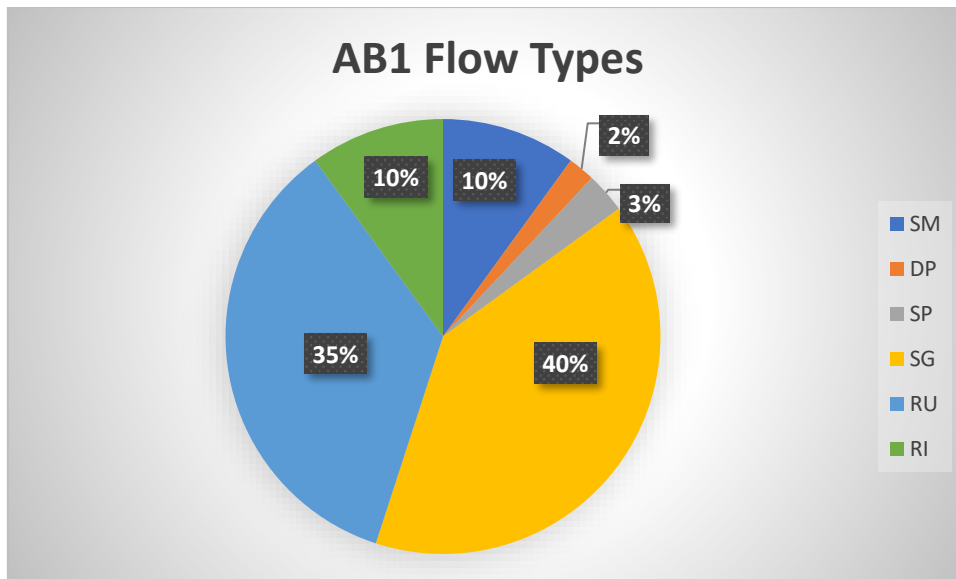
It was noted that instream substrate has historically been utilised for bank reinforcement/flood prevention on the right bank. The photograph below in **Figure 7** shows a downstream view of the transect with the flood bank and instream habitat shown.



*Figure 7: Downstream view of transect AB1 showing instream habitat and flood bank.*

Flow types within the stretch were mainly shallow glide and run with small areas of riffle. In addition, shallow, and deep pool habitats were observed at the top of the stretch forming small plunge pools below a waterfall/cascade. These flows are shown below in **Figure 8**.

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*Figure 8 Flow Types recorded as a percentage for Transect AB1*

Both banks offered very little in the way of fish cover with rocks being the main feature accounting for 5% of the stretch overall. The riparian zone was made up of mainly tall herbs and conifer plantation (age approximately 40 years +) with sporadic deciduous trees although neither provided any shade or canopy cover. There was some evidence of light grazing and trampling mainly from the local deer population. Deer were observed further upstream on the day of the survey. No exclusion features were present on either bank.

Two obstacles were recorded in transect AB1. A water gate was recorded at grid reference **222212 – 810219** and was recorded as passable. A waterfall/series of cascades was recorded at grid reference **222266 – 810077** this cascade continued to the end of the transect. It was unclear as to whether this was accessible as the river begins to steepen here, it may be passable under higher flows. **Figure 9** shows the start of this series of cascades marking the end of the transect AB1.

Overall Transect AB1 offered good to excellent juvenile salmonid habitat with a good mixture of substrates providing plenty of cover for juvenile salmonids. Spawning areas were patchy but likely to be utilised by salmon with access unhindered to this area. Juvenile salmonids were observed during the survey although it was difficult to ascertain species. The area where dredging had occurred presents a potential restoration opportunity.



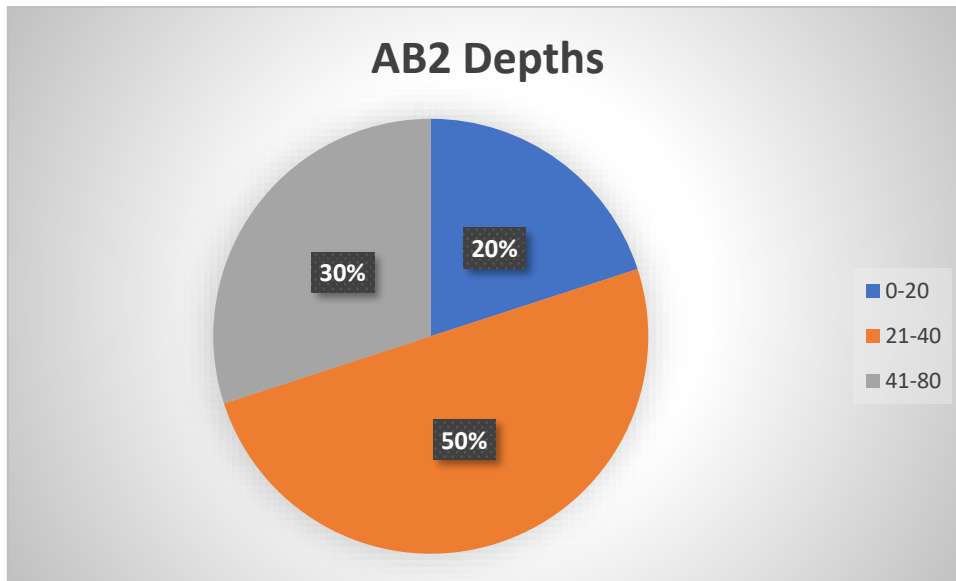
*Figure 9 The start of a series of waterfalls/cascades at the upper limit of Transect AB1*

### Transect AB2

AB2 was 220m in length. Wet widths in Transect AB2 were narrower overall with an average of 3m. Bed widths remained constant at 8m. The river showed a marked increase in gradient with a series of stepped falls and bedrock present. In between these falls habitat was good with areas of good mixed juvenile habitat.

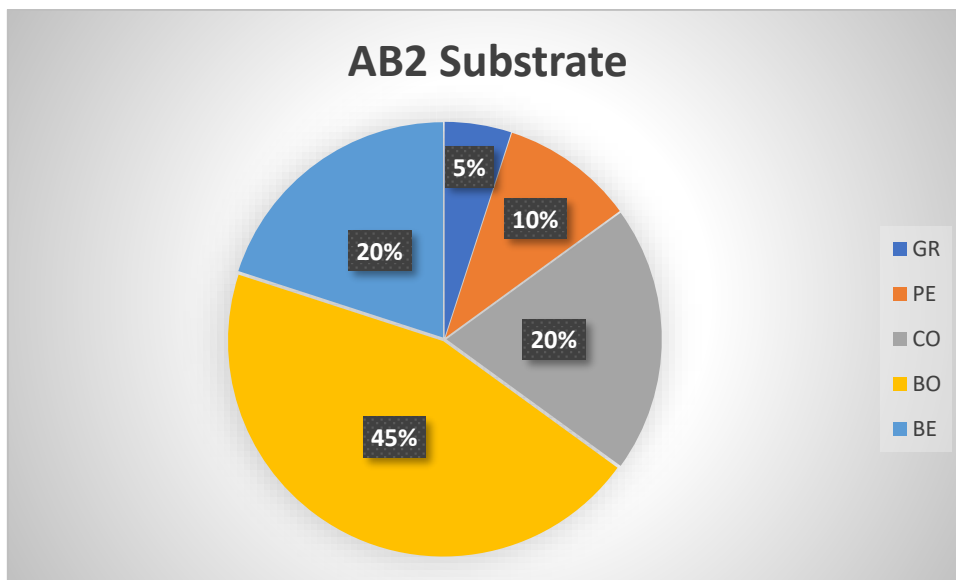
Depths were slightly more variable than those recorded in AB1 with the majority of the stretch within the 21cm-40cm range with small pockets of deeper water forming small plunge pools below any steps. A breakdown of depths is shown below in **Figure 10**.

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*Figure 10 Depths recorded as a percentage for AB2*

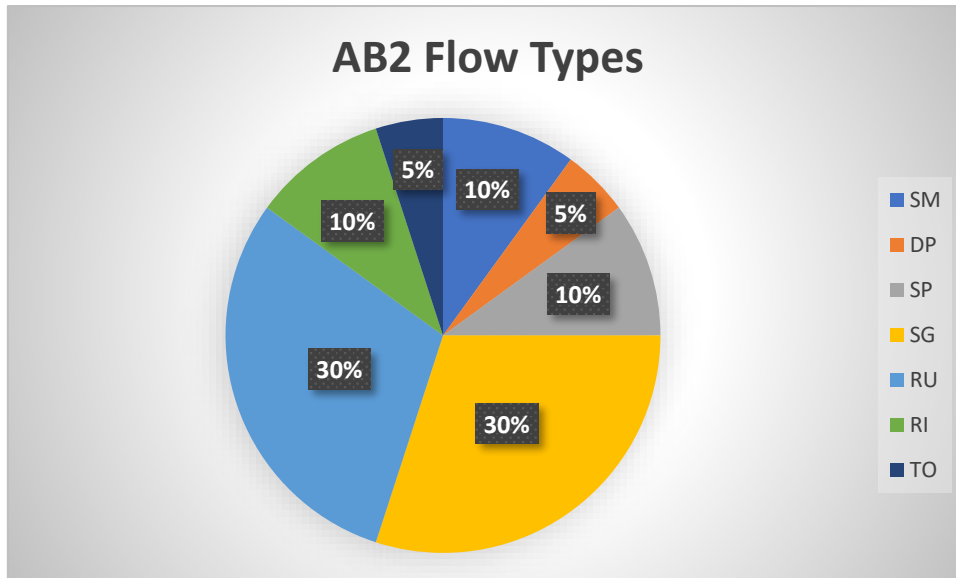
Substrate was much larger overall in transect AB2. Bedrock dominated with boulder and was minimal throughout the transect length. Transect AB2 offered very little spawning with approximately 80m<sup>2</sup> recorded, this was again spread throughout the transect with the majority found below the bridge at the top of the site. Substrate types are shown below in **Figure 11**.



*Figure 11: Substrate types shown as a percentage for Transect AB2*

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Flows within AB2 were faster overall and was reflected by the gradient and substrate. Flows were mainly run and glide with small areas of torrent where cascades were present, immediately below these cascades were small areas of deeper pool. Flow types are shown below in **Figure 12**.



**Figure 12: Flow Types shown as a percentage for Transect AB2**

There was no fish cover on both banks throughout the transect. The Riparian zone was predominantly ageing conifer with sporadic deciduous trees. The bank face vegetation on both banks was uniform in nature and both bank tops were complex. Canopy cover was recorded as 60% providing good shading.



**Figure 13: Upstream view at the start of Transect AB2.**

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

There was evidence of light grazing within the transect and this is likely due to the resident Deer population.

A series of stepped falls were present at Grid reference **222313 – 810003**. It is likely that these falls are impassable to upstream migration although this may be possible dependant on flow. Electrofishing above this area was deemed necessary to ascertain whether salmon are present upstream.

A small side bar was also present on the left bank and accounted for approximately 2% of the overall bank length.



*Figure 14: Series of stepped falls/cascades in survey stretch AB2.*

At the top of the transect there was a small area of possible spawning habitat directly downstream from the track bridge. This accounted for approximately 20m<sup>2</sup>. There were further patchy areas throughout the transect accounting for a further 60m<sup>2</sup> overall.

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Overall, this transect does provided some areas of good salmonid habitat and this situated between the falls and cascades and in the upper areas of the transect below the bridge. The river here has a steep gradient than the previous transect and this is reflected in the habitat found therein.

A photo of the bridge at the top of the transect is shown below in **Figure 15**.



*Figure 15: The bridge and culvert at the upper limit of Transect AB2. There was good mixed juvenile habitat in this part of the transect.*

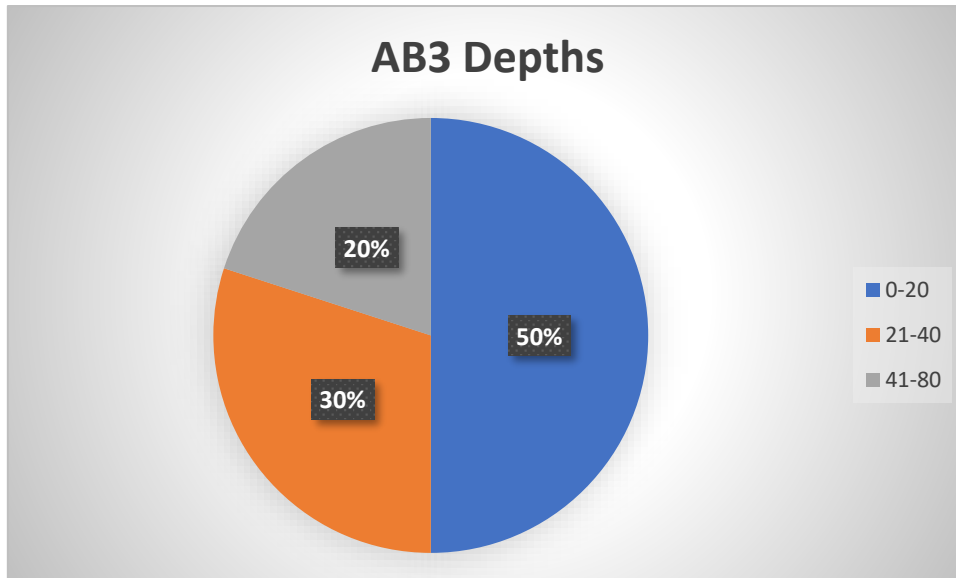
### Transect AB3

AB3 was 100m in length and ended at a waterfall where the river splits upstream from the bridge/track. Wet widths in Transect AB3 had an average of 3m. Bed widths remained constant at 8m.

At the start of the Transect habitat was excellent with regard to juvenile salmonids with a good mixture of substrate types. This changed after approximately 20m where bedrock and cascades dominated leading up to the split and the top of the transect.

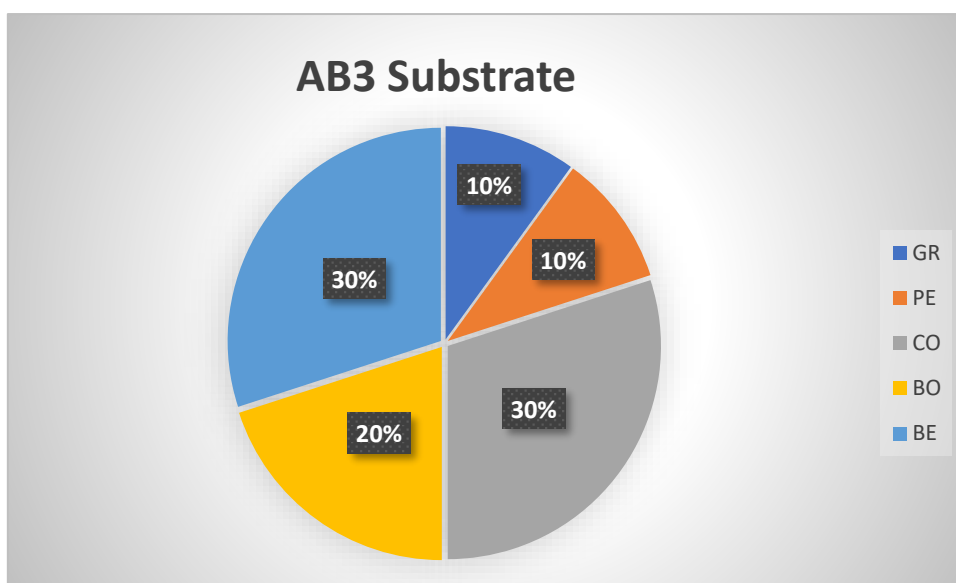
## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

Depths, again, were relatively shallow, with majority falling into the 0-20cm and 21-40cm range with small pockets of slightly deeper water below falls. **Figure 16** provides a breakdown of these depths for the transect.



**Figure 16: Depths shown as a percentage for Transect AB3**

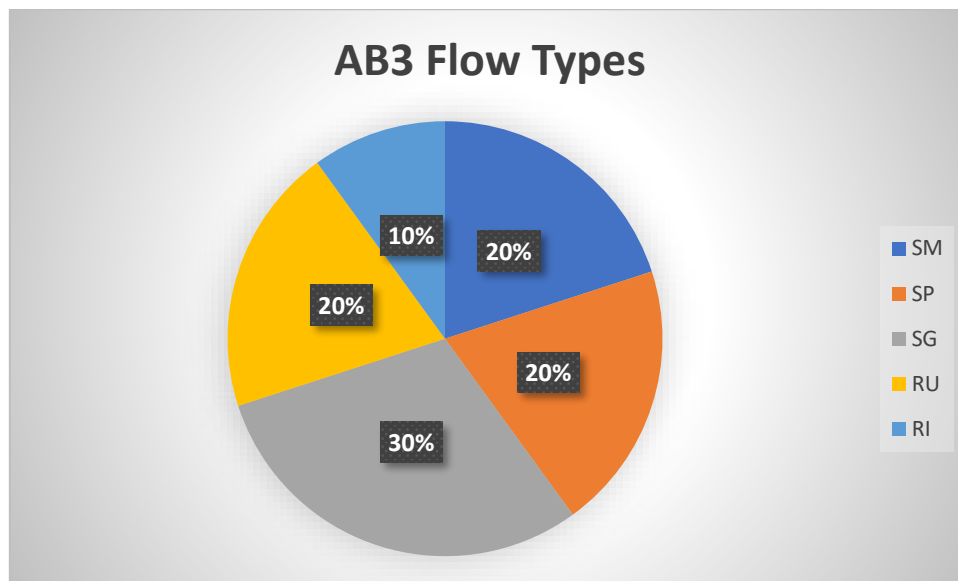
Substrate types at the start of Transect AB3 provided excellent instream habitat for juvenile salmonids and was made up of mainly cobble and boulder with some pebble and gravel. This changed markedly after approximately 20m where the river gradient steepened and bedrock dominated with a series of falls and cascades. The substrate breakdown is provided below in **Figure 17**.



**Figure 17: Substrate types shown as a percentage for Transect AB3**

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Flow was mainly shallow glide, especially at the lower limits of the transect. Run and riffle was present as the river steepened with pockets of shallow pool below the falls. The breakdown of flows is shown below in **Figure 18**.



**Figure 18: Flow types shown as a percentage for Transect AB3.**

Fish cover on both banks was minimal accounting for approximately 10% overall and was provided by rocks at the margins. The riparian zone was mainly tall herb and deciduous trees although conifer plantation was also present within 50m from the bank top. Vegetation types on both bank faces and bank tops was recorded as complex. There was evidence of light grazing on both banks with Deer observed towards the top of the stretch.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys



*Figure 19 Good habitat at the start of Transect AB3*

Spawning was limited to the downstream limits of the transect and spread throughout this area resulting in an area of approximately 50m<sup>2</sup>, however it is unlikely that this would be utilised by salmon due to the waterfalls downstream.

A number of waterfalls/cascades were recorded starting at Grid Reference **222308-809915** and extending to the end of the transect at Grid Reference **222286-809802** which was also marked by a waterfall. It is unlikely that these waterfalls are impassable to upstream migrations with downstream access highly likely.



*Figure 20: The start of a series of waterfalls at Transect AB3*

Overall, this transect offers good salmonid habitat initially before changing to a less productive areas dominated by bedrock and cascades.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

### Unnamed Tributary 1

This unnamed tributary was surveyed on 27/06/2024. For the purpose of the survey the river was split into three transects covering a total distance of approximately 620m. The location of the river and transects is shown below in **Figure 21**



**Figure 21** Map showing Transect locations and Downstream Limit

At the time of survey water levels were recorded as 'Low' and bed visibility was 100%. Transect details are shown in **Table 4** below.

**Table 4:** Un-named tributary site details.

Transect	Downstream Easting	Downstream Northing	Upstream Easting	Upstream Northing	Length (m)	Altitude (m)
ACA1	222371	810085	222385	809937	150	150
ACB1	222371	810085	222465	810013	120	150
ACB2	222355	8010426	222371	810085	340	135

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This tributary is formed when two small tributaries join at Grid Reference **222371-810085**. The upper parts of the river above this split were both surveyed and given site codes ACA1 and ACB1 respectively, ACB2 represents the tributary from the confluence with the Moriston junction of the two tributaries.

### Transect ACA1

ACA1 was 149m in length and is the west tributary of the two streams that merge at grid reference **222371-810085**. The start of the survey stretch was marked by a culvert under the forest/wind farm track. This stream was small in nature with an average width of 0.6m and a bed width of 1.5m. At the time of survey water levels were very low with ponding occurring, suggesting this stream is likely to dry out during drought conditions. The culvert was considered impassable on the day of the survey due to low flows but it may be passable during higher flow conditions.

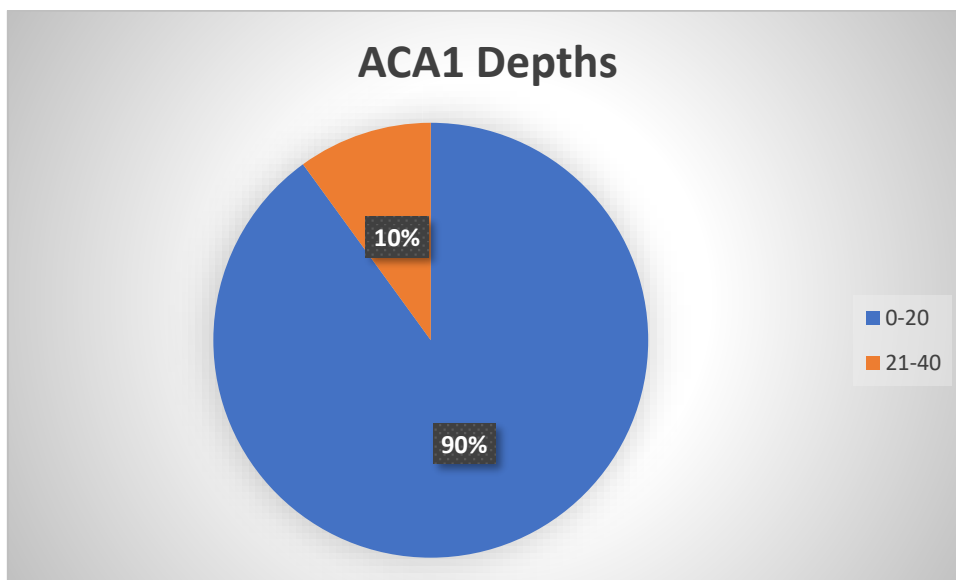


*Figure 22: Impassable Culvert (on the day of the survey) at the upper end of the survey stretch.*



*Figure 23: Photo showing very low levels and ponded flow conditions.*

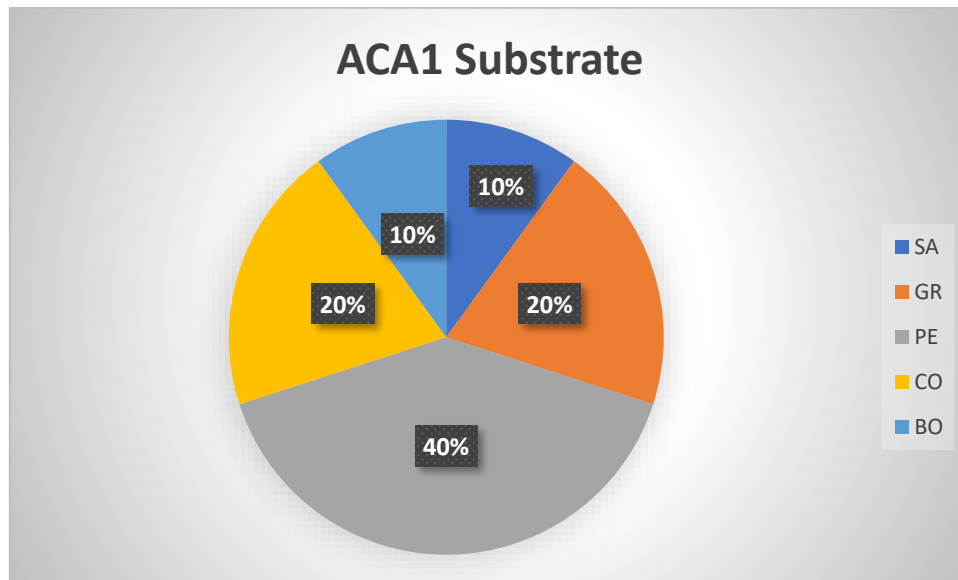
Depths were shallow with the 90% falling within the 0-20cm range with slightly deeper pockets in the 21-40cm range. **Figure 24** shows the breakdown of depths as percentage.



*Figure 24: Depths shown as a percentage for Transect ACA1*

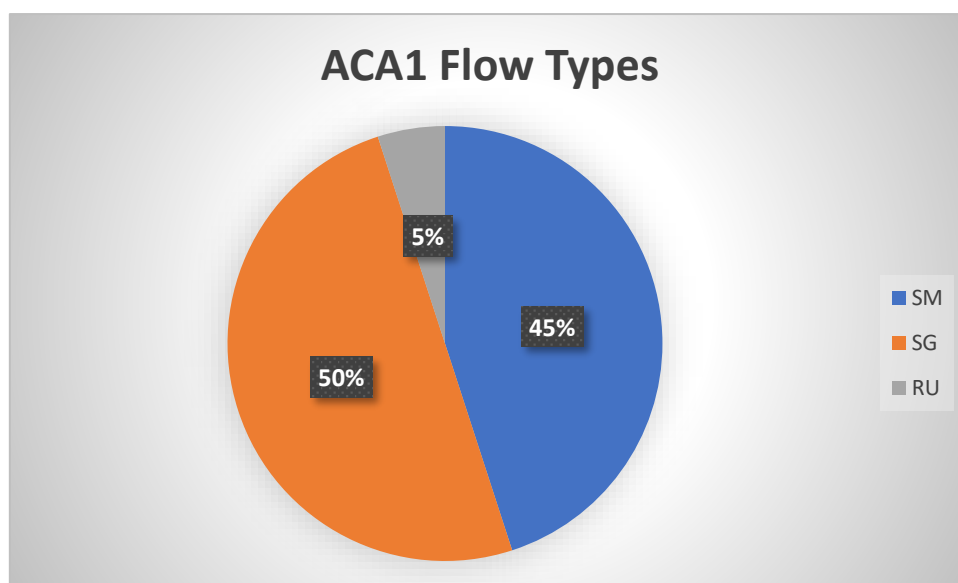
## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

The substrate matrix was predominantly pebble and cobble although boulder and gravel were present along with pockets of sand. This instream habitat would offer good mixed juvenile habitat; however, the lack of flow was a limiting factor. **Figure 25** shows the breakdown of substrate types as a percentage.



*Figure 25: Substrate types shown as a percentage for Transect ACA1.*

Greater flows were present towards the downstream limit where shallow glide and small areas of run dominated. Large areas of still marginal habitat occurred in the upper reaches. These areas took the form of isolated pockets of still, very shallow water in between areas of dried out substrate. A breakdown of these flow types is shown as a percentage in **Figure 26**.



*Figure 26: Flow Types shown as a percentage for Transect ACA1*

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

Bankside fish cover was absent on both banks, however there was a number of fallen trees and branches within the stream. There was no evidence of grazing although Deer are likely to be present in this area. The stream flows through dense conifer plantation creating areas of heavy shading for most of the stretch. No spawning areas were recorded within this stretch.

Overall, this transect was deemed unsuitable for salmonids due to low water levels, it is highly likely that this stream dries out completely in dry years. In spite of this the instream habitat is excellent with lots of instream cover where water levels are sufficient. This was found at the downstream limits. The only obstacle was the culvert at the upper end of the transect.



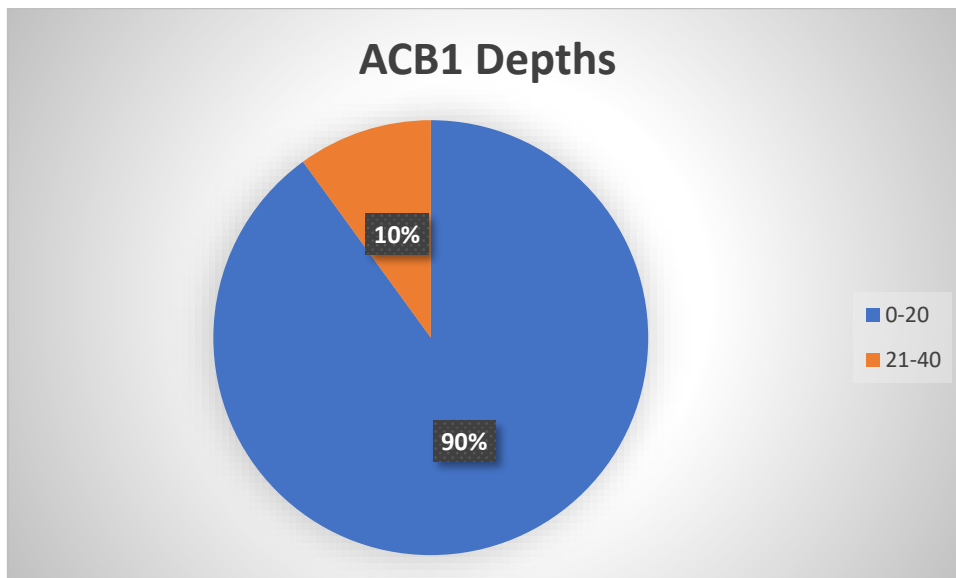
*Figure 27: Area of excellent habitat at the downstream limit of Transect ACA1*

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

### Transect ACB1

Transect ACB1 was 120m in length and it merges with ACA1 at grid reference **222371-810085**. The upper limit was the culvert, under the track, which was recorded as passable. The average width was 1m with a bed width of 2m. At the time of survey river levels were low, with very little flow and in some areas, water flowed sub-substrate. This stream is likely to dry out under drought conditions.

Depths were very shallow, with the majority falling into the 0-20cm range with small pockets of slightly deeper water, although this was still shallow. A breakdown of depths recorded as a percentage are shown in **Figure 28**.



*Figure 28: Depths shown as a percentage for Transect ACB1*

The substrate was a good mixture of pebble, cobble and boulder with smaller pockets of sand and gravel. This provided good instream cover for juvenile salmonids; however, river levels and low flows are likely to be a limiting factor. The substrate matrix was uncompacted and recorded as stable. The instream habitat improved as the downstream limit was reached. The channel itself created cuts through peat overlaid with pebble, cobble and boulder. A breakdown of the substrate recorded as a percentage is shown below in **Figure 29**.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

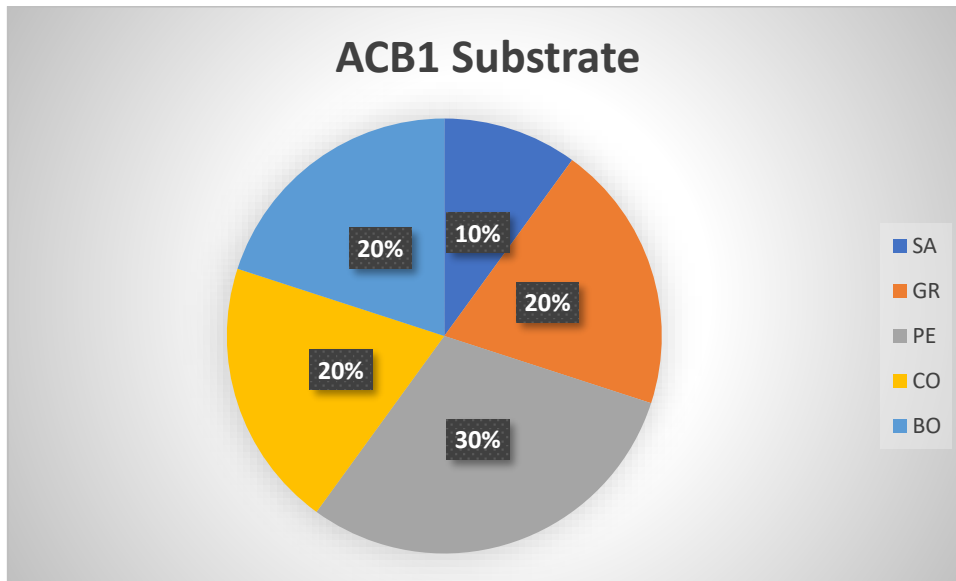


Figure 29: Substrate shown as a percentage for Transect ACB1.

Flows within the transect were minimal, with large areas of still marginal and shallow glide. There was a slight increase in flows towards the downstream limit with run and riffle more apparent. In some areas water flowed sub-substrate which caused fragmentation and was a potential barrier to any fish movements. A breakdown of flow types recorded as a percentage is shown in **Figure 30**.

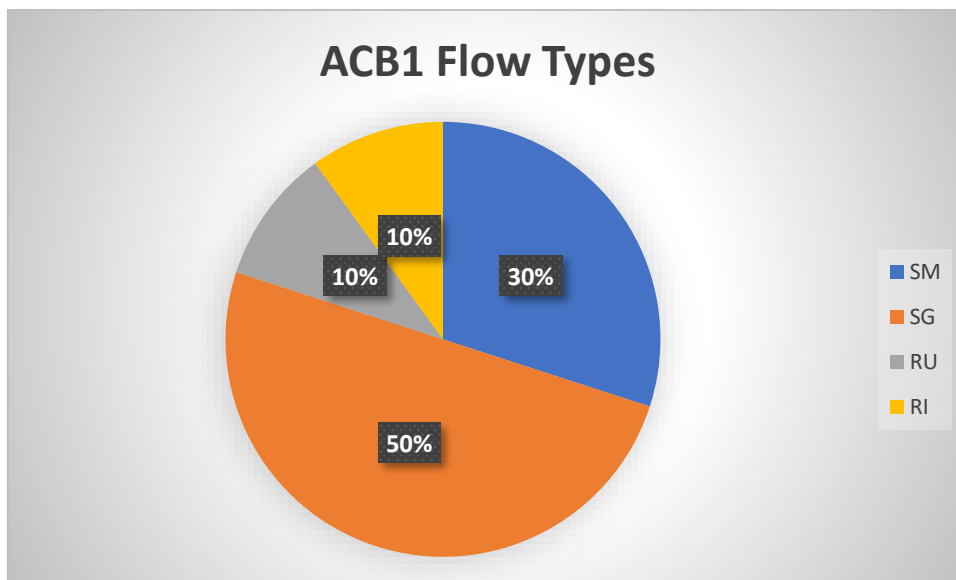


Figure 30: Flow types recorded as a percentage for Transect ACB1.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

Levels of bankside cover were low, accounting for 10% on both banks. This took the form of tree roots. There was evidence of light grazing from the local deer population. The stream flows through commercial conifer plantation creating heavy shading. Both banks were populated by dense conifers.

Spawning areas were limited and sporadically spread throughout the transect amounting to approximately 60m<sup>2</sup>. These areas were probably more suited to trout due to the nature of the smaller substrate size although it could also be utilised by salmon.



*Figure 31: Area of excellent habitat at the downstream limits of Transect ACB1. Note the heavy conifer shading and the lack of any ground cover*

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

Transect ACB1 offered good instream habitat for juvenile salmonids where flows were sufficient, however it is possible that this stream may dry completely during periods of dry weather. There was a single potential obstacle at the upper end of the transect and this was recorded as passable, however this may be restricted in periods of extreme low flows.



*Figure 32: Passable culvert at the upper end of Transect ACB1*

### Transect ACB2

Transect ACB2 starts where ACA1 and ACB1 join at grid reference **222371-810085**. It flows downstream from here joining the river Moriston at grid reference **222355-810246**. This transect had an average width of 2m with a bed width of 3m. A large mature island was present towards the lower limit of the transect, however only the right channel was wetted, the left channel being dry during low flow conditions. A photo of the dry channel is shown below in **Figure 33**. Flows and water levels were low with the potential for drying in drought conditions.



*Figure 33: Dry left channel at island.*

Depths within the transect varied, however the majority was within the 0-20cm range with deeper areas also present including small pockets of deep pool within the 41-80cm range. A breakdown of depths is shown below in **Figure 34**.

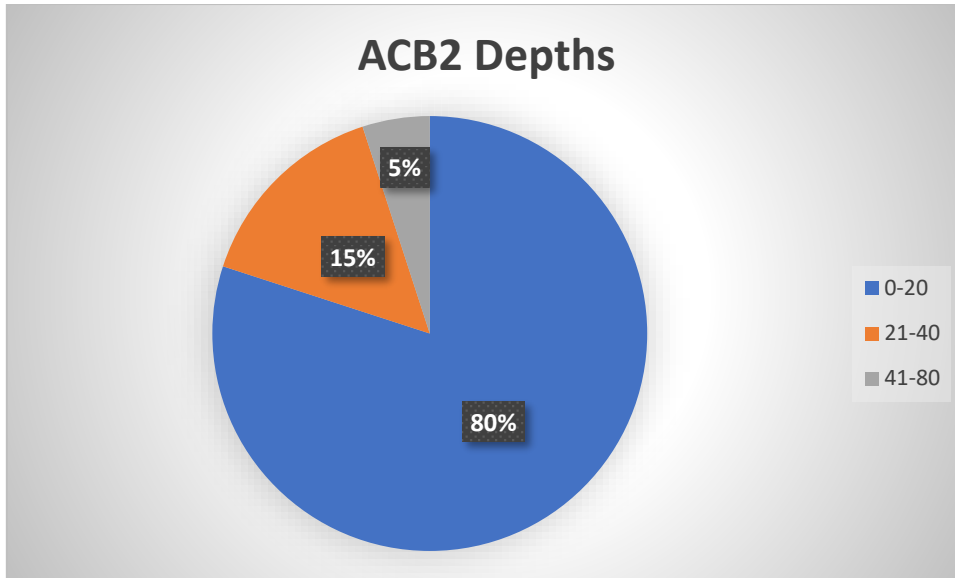


Figure 34: Depths recorded as a percentage for Transect ACB2.

Transect ACB2 provided excellent instream cover for the majority of its length with a variety of substrate types. Pockets of silt were present at the downstream limit where the transect joins the river Moriston. This has the potential to provide habitat for Lamprey species. The majority of the substrate matrix consisted of gravel, pebble, cobble and boulder. A small outcrop of bedrock was also present. A breakdown of the substrate types is shown below in **Figure 35**.

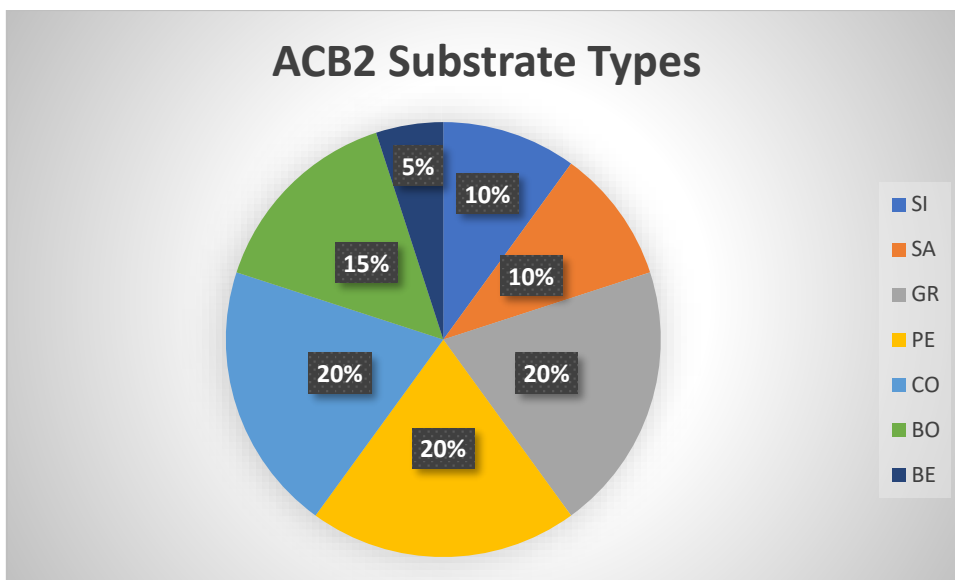
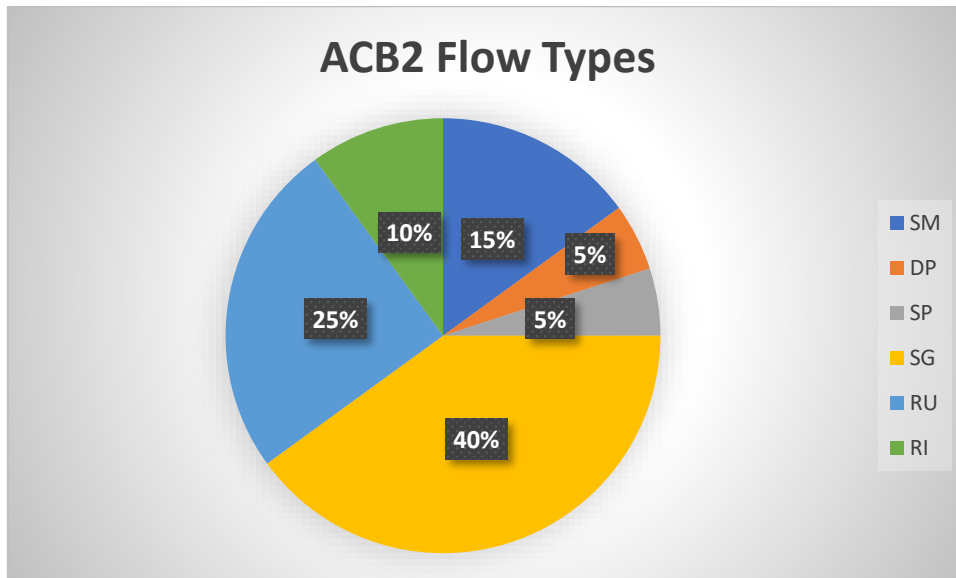


Figure 35: Substrate types recorded as a percentage for Transect ACB2.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

Flows were variable within the transect with more shallower glide and run compared to other transects within this system. Small areas of deep pool and shallow pool were present with less still marginal. A breakdown of flow types is shown in **Figure 36**.



**Figure 36:** Flow types recorded as a percentage for Transect ACB2.

The majority of the stream flows through dense conifer plantation resulting in heavy shading throughout. Bankside fish cover was provided by tree roots and accounted for 10% of both banks. Evidence of grazing by deer was recorded as light with small areas of light erosion.

Spawning areas were again, limited and spread throughout the transect with a total area of approximately 50m<sup>2</sup> recorded. These areas were more suited to trout however salmon are likely to also utilise it.

Overall, this transect provided excellent habitat for juvenile salmonids. There were no obstacles to migration and it is likely to be utilised by juvenile fish moving in from the river Moriston, as well as fish spawning within. This entire tributary is likely to dry out during extended periods of dry weather, in particular during the summer months. Numerous fallen trees and branches (mainly conifer) were present further providing additional instream cover.

A photograph of excellent instream habitat towards the downstream limit is shown below in **Figure 37**.



*Figure 37: Excellent instream habitat at ACB2*

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

### Unnamed Tributary 2

This unnamed tributary was surveyed on 27/06/2024. For the purpose of the survey the river was split into two transects covering a total distance of approximately 361m. The location of the river and transects is shown below in **Figure 38**.



**Figure 38: Map showing ACC Transect locations and upstream limit.**

**Table 5: Un-named tributary 2, transect details.**

Transect	Downstream Easting	Downstream Northing	Upstream Easting	Upstream Northing	Length (m)	Altitude (m)
ACC1	222532	810466	222662	810214	280	133
ACC2	222662	810214	222734	810166	90	151

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

### Transect ACC1

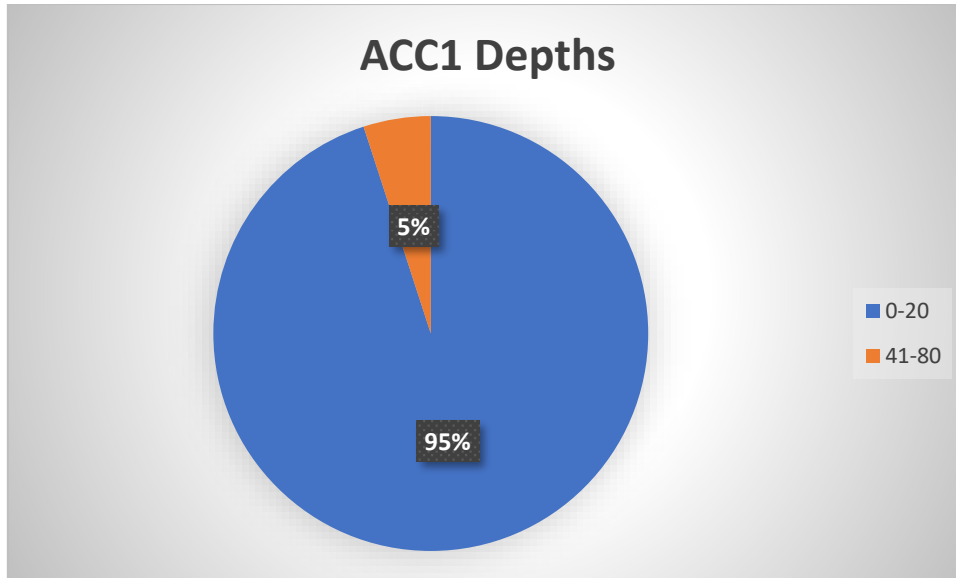
Transect ACC1 starts at the confluence with the river Moriston at grid reference **222532-810466**. This point was marked by a steep bedrock outcrop forming a waterfall. This waterfall was recorded as impassable to upstream migration of salmonids.



*Figure 39: Impassable waterfall at the confluence with the river Moriston.*

The transect was 280m in length with an average width of 1.5m. At the time of survey, water levels were low with some areas almost dry, it is likely that the river does dry in periods of dry weather.

Depths fell within the 0-20cm range for the majority of the survey length with a pocket below the falls ranging from 41-80cm deep. These depths are shown below in **Figure 40** as a percentage of the whole stretch.



*Figure 40: Depths recorded as a percentage for Transect ACB2.*

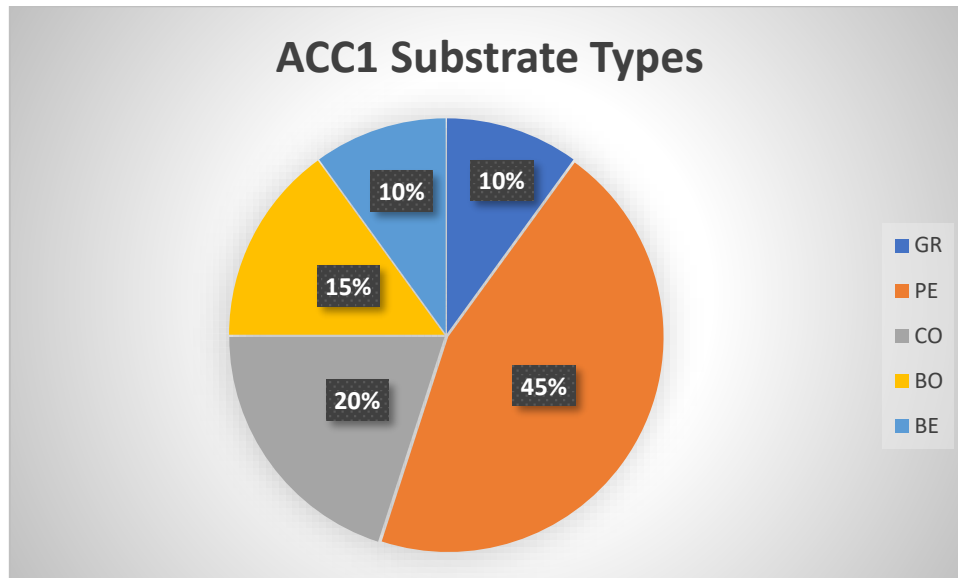


*Figure 41: Area of exposed bed and drying channel.*

Despite a significant lack of water, the instream habitat within the transect offered a good mixture of substrates with pebble and cobble featuring heavily. Boulder and the occasional crop of bedrock was also present. This smaller substrate is likely to provide a good spawning medium, however water levels

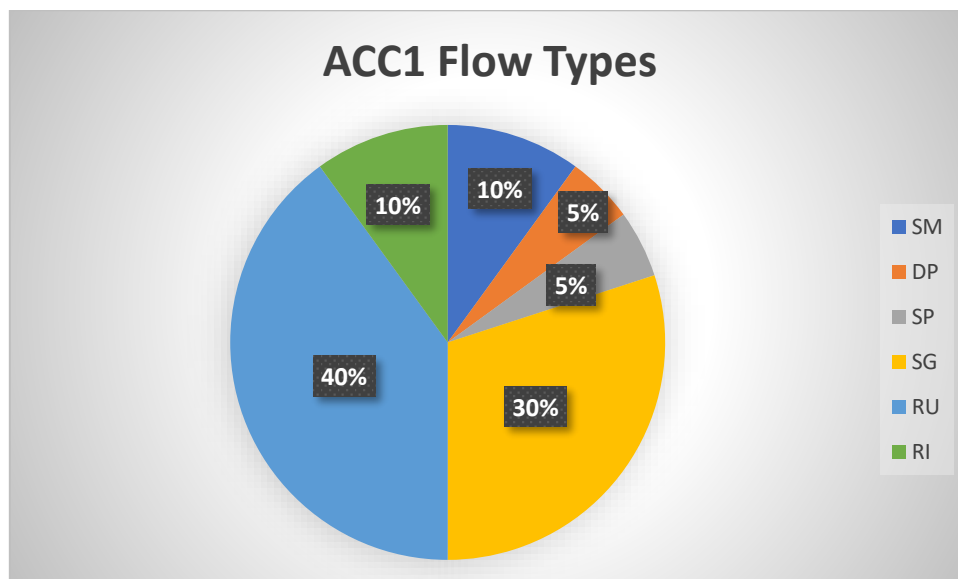
## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

are likely to be a limiting factor along with accessibility. A breakdown of the substrate types is shown below in **Figure 42**.



**Figure 42:** Substrate types shown as a percentage for transect ACC1.

Flows within the transect were variable with many areas dry or drying. Water was often limited to ponding. The lower extremities were limited to shallow glide, pool and still marginal areas, however, as the gradient increased slightly flow speeds increased exhibiting sporadic areas of run and riffle. These areas were shallow and, in some cases, flowed through the substrate rather than over it. A breakdown of flow types for ACC1 is shown below in **Figure 43**.



**Figure 43:** Flow types shown as a percentage for Transect ACC1.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

The photo below shows the typical habitat found within transect ACC1.



**Figure 44: Representative habitat within Transect ACC1.**

Bankside fish cover was minimal with approximately 10% on both banks represented by roots and rocks, again water levels were a limiting factor. Groundcover was minimal in places due to the heavy conifer shading. Where there was ground cover there was some evidence of light grazing from the local deer population. The predominant bank face vegetation was classed as uniform with the bank tops being complex in nature. This vegetation was predominantly conifer with sporadic deciduous further upstream.

The substrate matrix provides good spawning material, especially for trout due to the smaller size, however flows and water levels will limit this. At the time of survey an area of approximately 70m<sup>2</sup> was available and this was spread throughout the whole transect.

### Transect ACC2

Transect ACC2 began at grid reference **222662-810214** and ended at grid reference **222734-810166** at a culvert where the track crosses the stream. It is likely that this culvert is passable during higher flows.



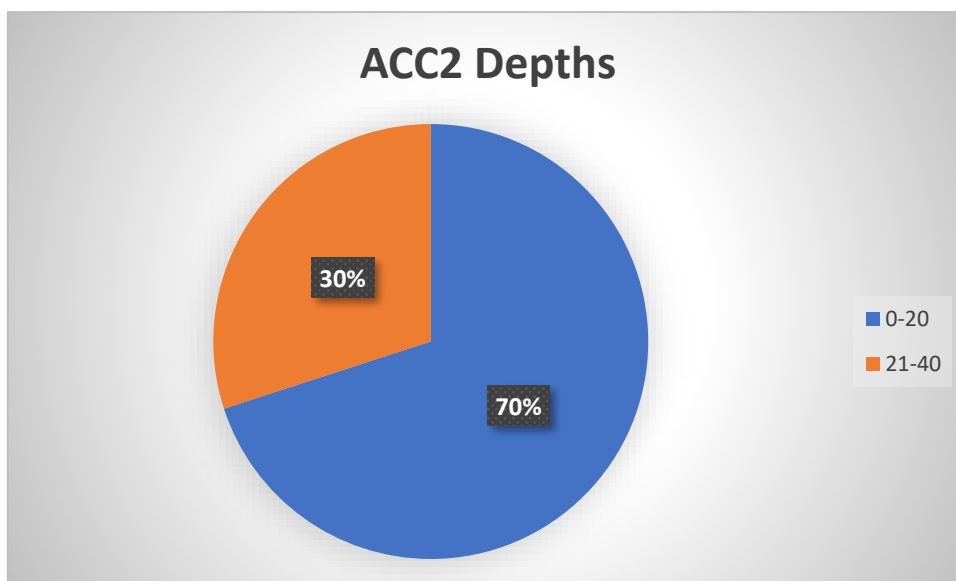
*Figure 45: Culvert at the upper end of Transect ACC2.*

The Transect was approximately 90m in length with an average width of 2m. Excellent habitat was present for approximately 40m at the start of the transect, although water levels were low, before the gradient increases and substrate types change to boulder and bedrock with a series of cascades/falls towards the upstream limits. This steep, 50m stretch offers very little usable habitat for fish species due to the steep gradient and low water levels.



*Figure 46: Excellent instream habitat at the lower limits of transect ACC2.*

Depths within this transect were shallow overall with the majority being less than 20cm with nothing over 40cm. in some areas water flowed through rather than over the substrate indicating the potential for drying out completely. A breakdown of the depths is shown below in **Figure 47**.



*Figure 47: Depths shown as a percentage for Transect ACC2.*

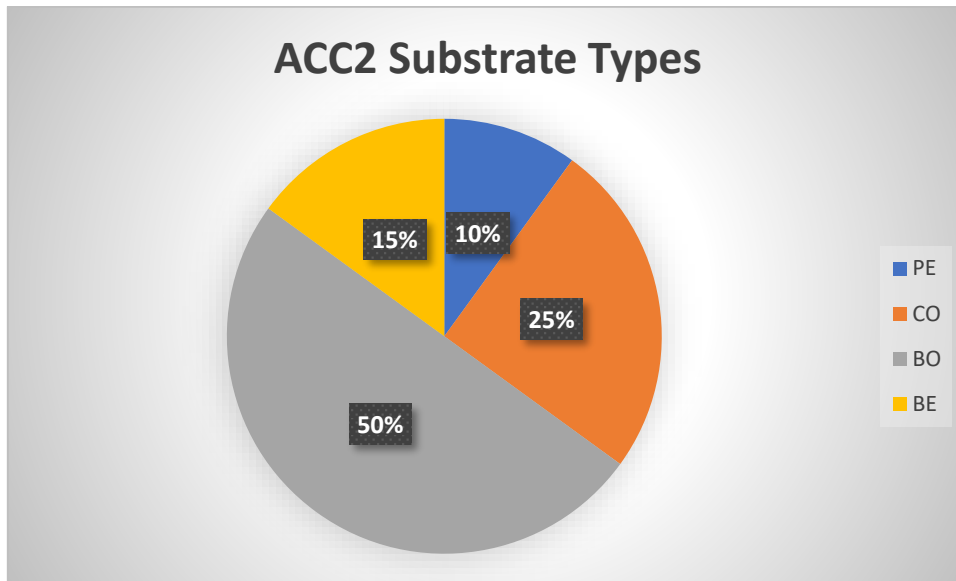
## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

For the first 40m substrate was dominated by cobble and pebble offering excellent habitat for juvenile salmonids, however, low water levels were a limiting factor. The gradient then increased for the remainder of the stretch with a significant change in substrate size. Boulder and bedrock dominated creating a series of cascades and falls with low flows creating an impassable barrier to migrating salmonids.



*Figure 48: The start of the boulder/bedrock section in transect ACC2.*

A breakdown of the substrate types found in Transect ACC2 is shown below in **Figure 49**.



*Figure 49: Substrate types shown as a percentage for Transect ACC2.*

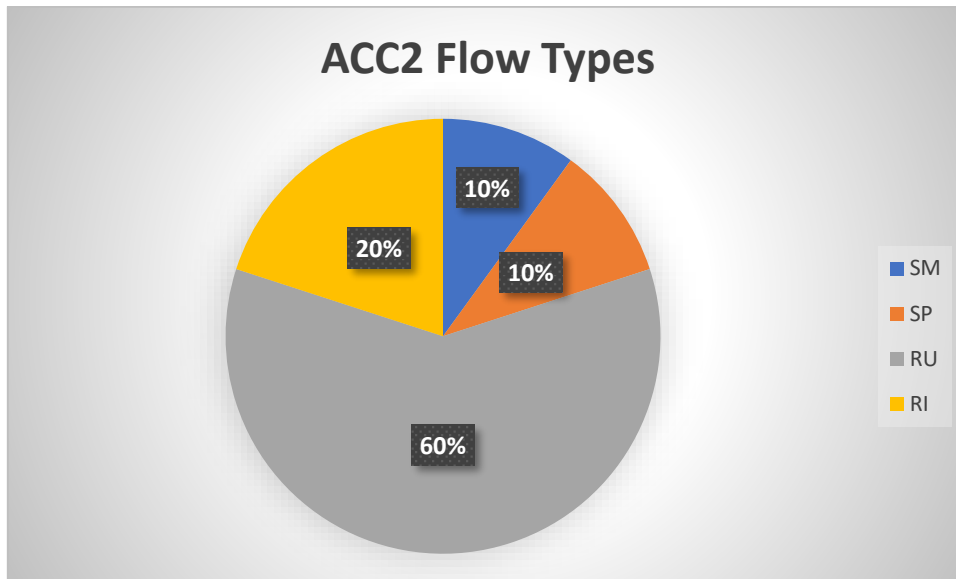
Flow types changed compared to the previous section due to the nature of the gradient with run and riffle dominating. Slower areas at the lower extremities consisted of mainly still marginal and shallow pool, due to low water levels as shown in **Figure 50** below.



*Figure 50: Shallow pool and still marginal flows.*

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A breakdown of flow types is shown in **Figure 51**.



**Figure 51: Flow types shown as a percentage for transect ACC2**

Bankside fish cover was absent on both banks throughout the transect. There was evidence of light grazing from deer on both banks with a number of deer present at the time of the survey. Right and left bank faces were uniform in nature, as were bank tops with both recorded as complex due to the presence of deciduous trees and some conifer.

The substrate offered no suitable spawning habitat. The instream habitat was excellent initially, but this soon declined as the gradient increased. It is likely that this stream dries, or at least partially dries with evidence of ponding between the substrate and in some areas, water flowed sub-substrate.

The steep gradient began at grid reference **222680-810194** forming a series of stepped falls and cascades, with the addition of very low flows making this area impassable to salmonids. This continued upstream to the culvert at the track.

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### Allt Garbh Doire

Allt Garbh Doire is a small tributary of the River Loyne with its confluence at Grid reference **220557-808136**. Approximately 500m upstream from here there is a large impassable weir/offtake structure belonging to SSE. This intake effectively de-waters the lower 500m of this burn, isolating the upper wetted section from the Allt Loyne.



*Figure 52: Allt Garbh Doire hydro intake and dewatered section downstream.*

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The survey was carried out on 27/04/2024 in the area above this structure. A map showing the survey transects is shown below in **Figure 53** below.



**Figure 53: Map showing AGD transect locations.**

The river was split into two transects covering a distance of approximately 270m. This whole area is effectively a gorge with steep gradients and numerous cascades and falls throughout. Transect information is shown below in **Table 6**.

**Table 6: Allt Garbh Doire transect details.**

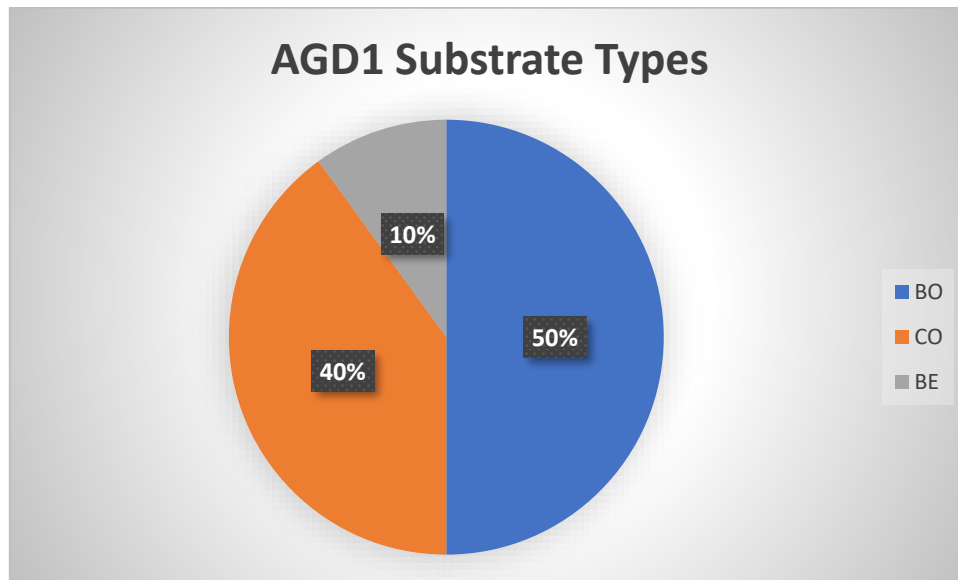
Transect	Downstream Easting	Downstream Northing	Upstream Easting	Upstream Northing	Length (m)	Altitude (m)
AGD1	220466	807632	220530	807614	70	150
AGD2	220530	807614	220591	807412	200	170

### Transect AGD1

Transect AGD1 contained the best habitat and was dominated by boulder and cobble with bedrock present toward the top of the stretch. This offered good instream cover for salmonids, however the

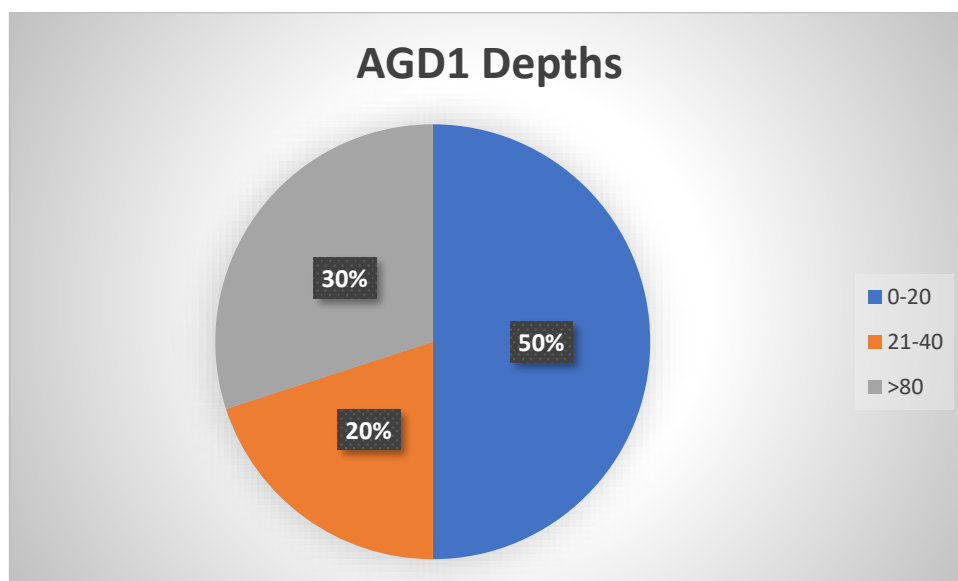
## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

presence of the offtake structure downstream combined with the high gradient and a lack of spawning substrate means it is unlikely that any fish species were likely be present. This was confirmed during the electrofishing survey. A breakdown of substrate types is shown below as a percentage.



*Figure 54: Substrate types shown as a percentage for transect AGD1.*

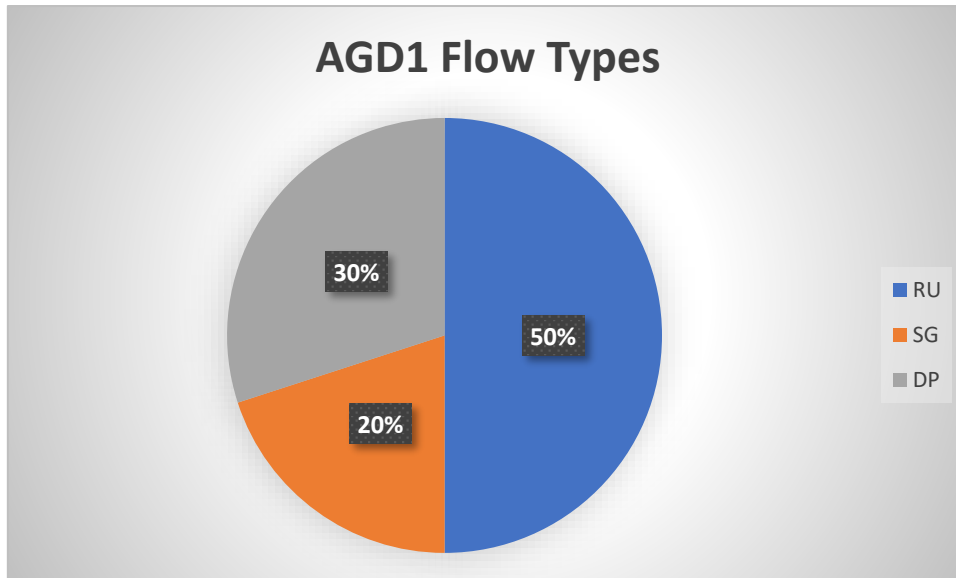
Depths varied throughout the transect with an area at the start, directly above the dam being too deep to assess safely, this area was >80cm. The majority of the transect fell within the 0-20cm range. A breakdown of depths is shown below in **Figure 55**.



*Figure 55: Allt Garbh Doire depths shown as a percentage for Transect AGD1*

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Flow within transect AGD1 were dominated by run with small areas of glide and the deep pool at the start of the stretch. It was observed in the days prior to the survey that this river can have high velocities during spells of heavy rain. A breakdown of flow types is shown below in **Figure 56**.



*Figure 56: Flow types shown as a percentage for transect AGD1*

Vegetation on both banks was complex with good canopy cover from deciduous trees, this provided good shading. A photo of transect AGD1 is shown below.



*Figure 57: Typical habitat at Transect AGD1.*

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A small waterfall/cascade marked the upstream limit of this transect as the river steepened. No areas of suitable spawning for salmonids were observed.



*Figure 58: Waterfall/cascade at the upper limit of Transect AGD1.*

### Transect AGD2

Transect AGD2 was significantly steeper with bedrock dominating. The whole stretch was a series of cascades and falls with most being impassable. The habitat within offered very little with regard to salmonids.

The river here flowed through a steep gorge section which was heavily wooded. It is unlikely that this area would support salmonids and again was reflected in the electrofishing results.

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Photographs of this transect are shown below.



*Figure 59: Typical habitat in Transect AGD2*



*Figure 60: Allt Garbh Doire transect AGD2 showing waterfall at upper limit.*

Overall, Allt Garbh Doire offers very little suitable habitat for salmonids. Access to the wetted area is denied due to the dam/structure. Above here the gradient is high with turbulent velocities during

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spates. The substrate was dominated by bedrock apart from a small section in AGD1. However, this substrate is large and offers no areas for spawning.



*Figure 61: SSE Hydro intake structure at the lower end of the survey area.*



BWF1-Allt Bealach Odhar



Figure 64 BWF1 Site Photograph

The survey was carried out on 06/08/2024. A wetted area of 102m was fished. A total of 17 salmon parr was recorded generating a density of 16.5 per 100m<sup>2</sup>. This can be classified as 'Moderate' under the SFCC classification scheme. A length frequency histogram is shown below.

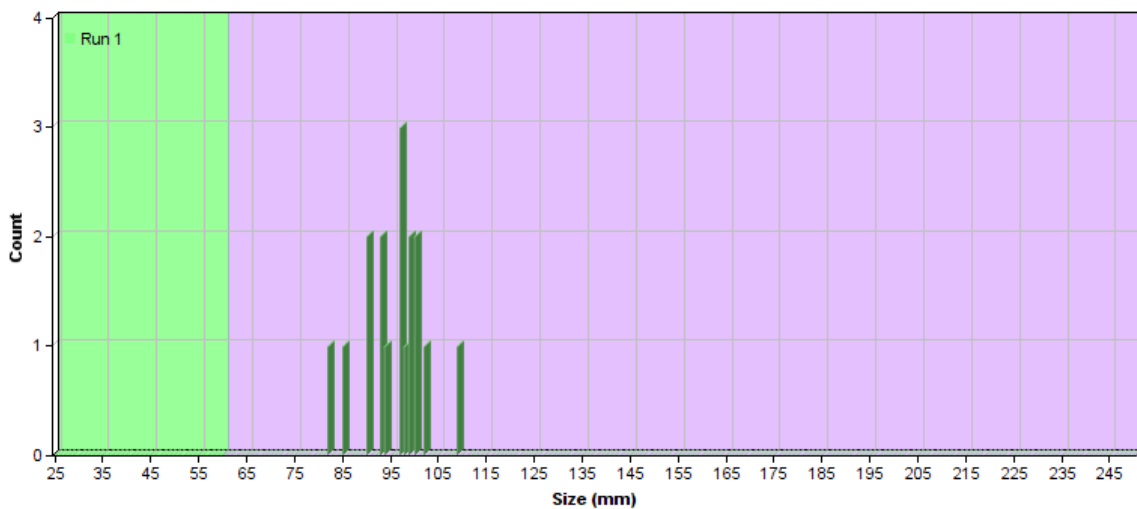
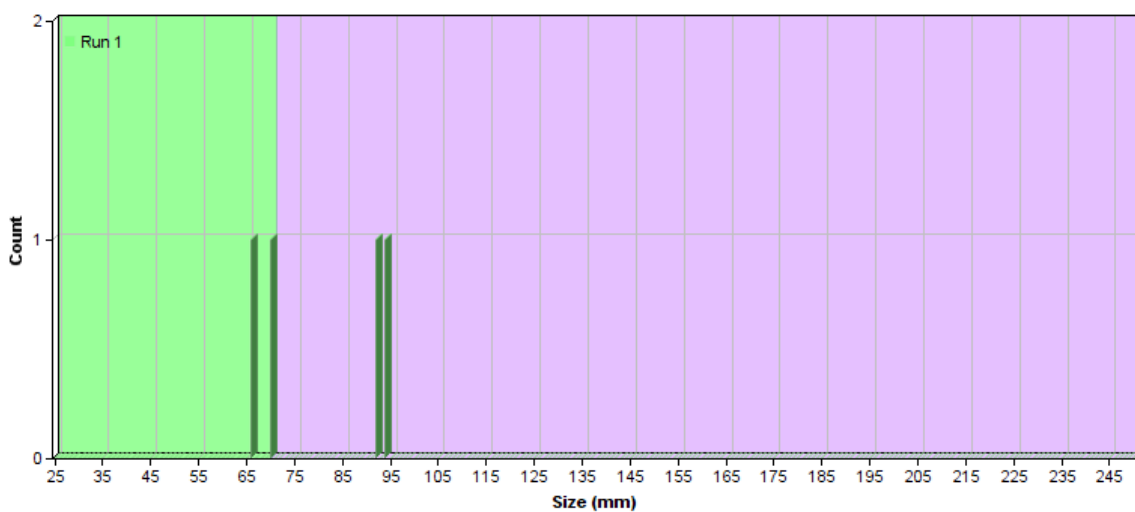


Figure 65: Length frequency histogram for salmon captured at BWF1.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

It can be seen that a single year class of salmon is present within the survey site. Salmon fry were absent suggesting that little or no spawning had occurred the previous winter. However, it is possible that the presence of salmon parr is a result of these emigrating into the river from the main river Moriston.

Two trout fry and two trout parr were recorded giving densities of 1.94 per 100m<sup>2</sup> for both year classes. These densities can be classified as 'Very Low' under the SFCC classification scheme. Three minnows were also recorded. Minnows are not native to the highlands and have likely to have been historically introduced by anglers for bait. A length frequency histogram for trout is shown below in **Figure 64**.



**Figure 66: Length frequency histogram for trout at BWF1.**

The results of this survey suggest that this tributary is utilised by juvenile salmonids albeit in relatively low numbers. It is likely that juveniles migrate in and out of the river from the mainstem river Moriston. Spawning areas were limited which may restrict utilisation by salmon, however it provides nursery habitat which may be lacking in areas on the main river.

In addition to the semi-quantitative site, an investigative timed survey (BW7) was carried out above the series of falls and cascades. The location was immediately below the track bridge in an area with good to excellent juvenile habitat. The purpose of this survey was to see if salmon were present above the aforementioned falls.

Salmon of all age classes were absent. It is likely that the falls/cascades are impassable to salmon.

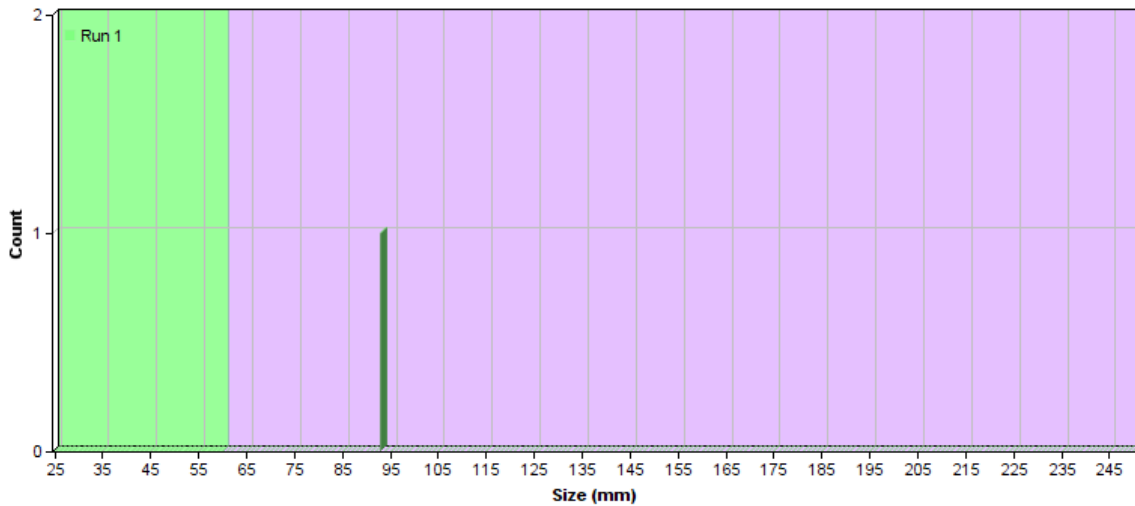
BWF2-Unnamed Tributary



*Figure 67 BWF2 Site Photograph*

The survey was carried out on 06/08/2024. A wetted area of 74m was fished. A total of one salmon parr was recorded generating a density of 1.35 per 100m<sup>2</sup>. This can be classified as 'Very Low' under the SFCC classification scheme. A length frequency histogram is shown below.

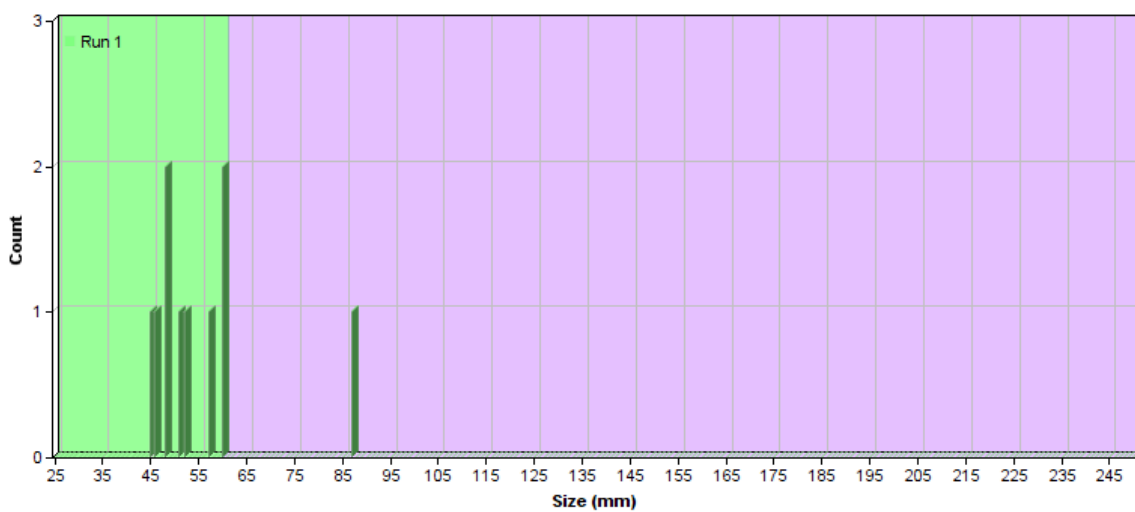
## Beinneun 2 Wind Farm Habitat and Fish Population Surveys



*Figure 68: Length Frequency Histogram for salmon at BWF2.*

Salmon fry were absent. This suggests that no salmon spawning had taken place and that the river is unlikely to support a self-sustaining salmon population. This solitary parr record may be an upstream migrant from the mainstem river Moriston.

A total of nine trout fry and one trout parr was recorded generating densities of 12.1 per 100m<sup>2</sup> and 1.3 per 100m<sup>2</sup> respectively. These densities can be classified as 'Low' for fry and 'Very Low' for parr. Small tributaries of this size in the Moriston catchment are prone to drying out under drought conditions. However, it may remain wetted over the winter and early spring sufficiently long for trout to spawn and for the resulting fry to emigrate downstream to the main river. A length frequency histogram for trout is shown below.



*Figure 69 Length Frequency Histogram for trout at BWF2*

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Trout are present in very low numbers suggesting limited spawning and production by a trout population utilising burn and mainstem habitat.

### BWF3-Unnamed Tributary



*Figure 70: BWF3 electrofishing site photograph*

The survey was carried out on 06/08/2024. A wetted area of 80m<sup>2</sup> was fished. All fish species were absent. A large impassable waterfall at the confluence with the mainstem river Moriston accounts for the lack of fish species making any migration into the river impossible. The high likelihood of drying out during extended dry period precludes the presence of fish of any species.

### BWF4-Allt Garbh Doire

The survey was carried out on 06/08/2024. A wetted area of 138.6m<sup>2</sup> was fished. All fish species were absent. This is likely to be due to a large dam/structure downstream of the site. Below this, the river is permanently dry therefore making any access impossible. A site photograph is shown below.



*Figure 71: BWF4 electrofishing site photograph*

#### **BWF5- River Moriston**

This survey was carried out on 08/08/2024 in area immediately downstream of the tributary Allt Bealach Odhar. A wetted area of 132.6m<sup>2</sup> was fished. A total of 15 salmon parr were recorded generating a density of 11.3 per 100m<sup>2</sup>. This density can be classified as ‘Moderate’ under the SFCC classification scheme. Salmon fry were absent and this is reflected in the habitat in the area with very little spawning substrate available. However, the substrate here does provide excellent parr habitat with boulder and cobble dominating.

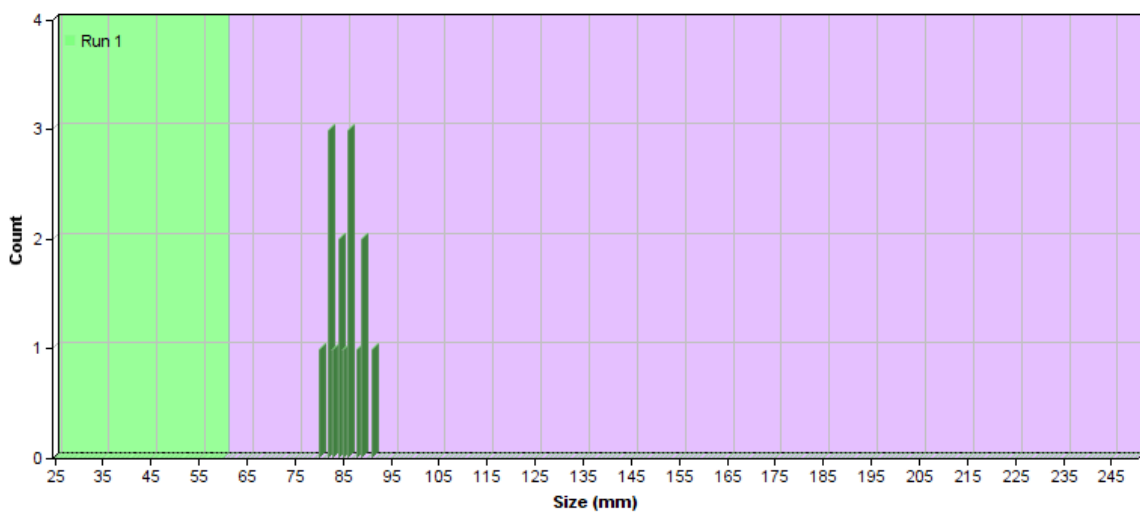
A site photograph is shown below in **Figure 70**.

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*Figure 72: River Moriston electrofishing site BWF5 photograph*

A length frequency histogram for salmon is shown below.

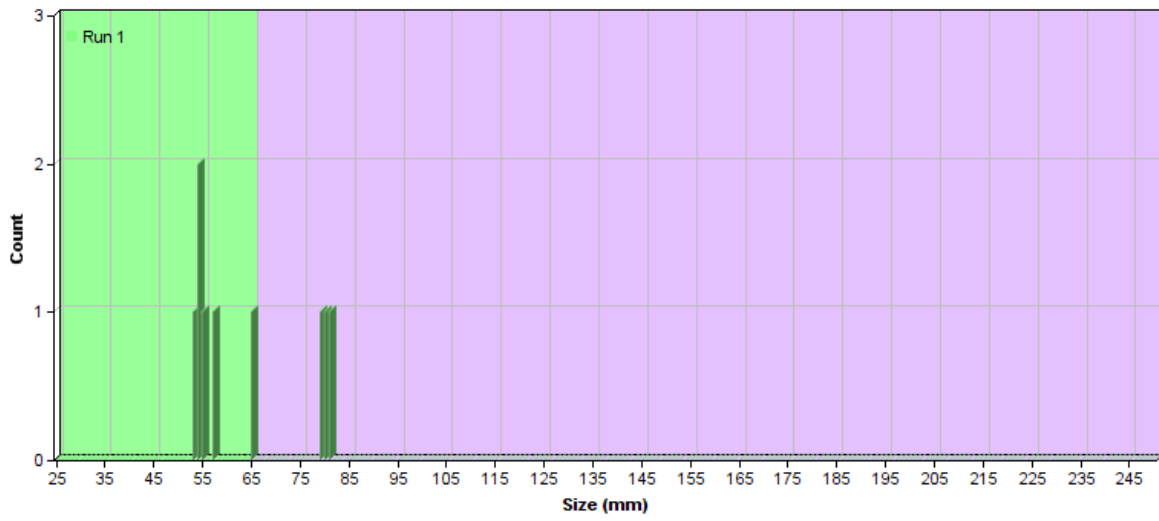


*Figure 73 Length Frequency Histogram for salmon at BWF5*

A total of six trout fry and 3 trout parr were recorded generating densities of 4.5 per 100m<sup>2</sup> and 2.2 per 100m<sup>2</sup> respectively. These densities can be classified as 'Low' for both age classes. It is clear that some trout spawning had occurred and this may occur in the adjacent tributary, the Allt Bealach

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

Odhar, with fry dropping out into the mainstem. A length frequency histogram for trout is shown below.



**Figure 74: Length Frequency Histogram for trout at BWF5**

### BWF6-River Moriston

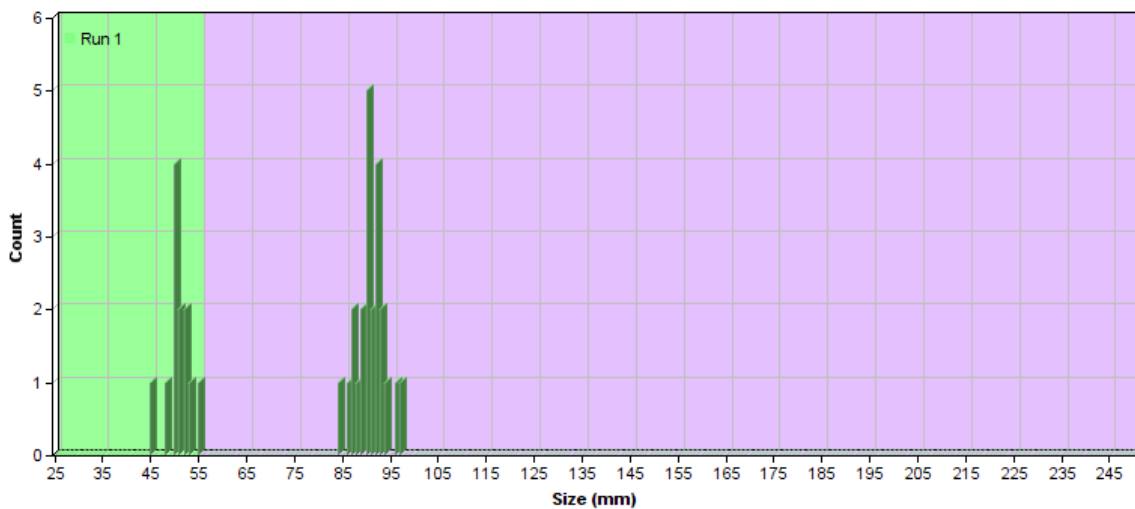


**Figure 75 BWF6 Site Photograph**

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

This survey was carried out on 08/08/2024 in area immediately downstream of BWF5 at the tip of an island. A wetted area of 140.8m<sup>2</sup> was fished.

A total of 12 salmon fry were recorded generating a density of 8.52 per 100m<sup>2</sup>. This density can be classified as 'Low' under the SFCC classification scheme. The presence of salmon fry suggests that spawning had taken place within the vicinity. A total of 23 salmon parr were captured generating a density of 16.3 per 100m<sup>2</sup>. This can be classified as 'Excellent' under the SFCC classification scheme. A length frequency histogram for salmon is shown below.

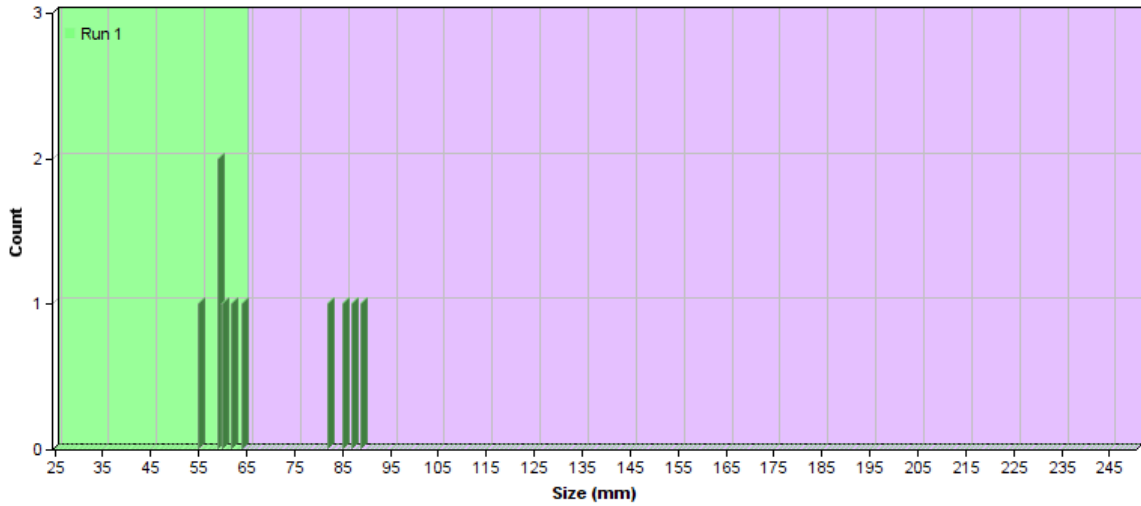


**Figure 76 Length Frequency Histogram for salmon at BWF6**

These densities reflect the excellent habitat found within the site and also a marked improvement when compared to previous surveys at the same location carried out by NDSFB. The localised distribution of salmon fry in the Moriston is interesting. Sites BWF5 & BWF6 are separated by little over 100m, yet salmon fry were absent in one of the sites. It is possible that salmon spawn in the channel to the north of the island at the Allt Belach Odhair confluence, and that fry from there have migrated downstream into site BWF6.

A total of six trout fry and 4 trout parr were recorded generating densities of 4.2 per 100m<sup>2</sup> and 2.8 per 100m<sup>2</sup> respectively. These densities can be classified as 'Low' for both age classes. It is clear that some trout spawning had occurred and this may have occurred in the nearby tributary, the Allt Bealach Odhar with fry dropping out into the mainstem. A length frequency histogram for trout is shown below.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys



*Figure 77: Length Frequency Histogram for Trout at BWF6.*



*Figure 78: Salmon and trout parr from fish population surveys at site BWF6.*

## Freshwater Pearl Mussel Surveys

Surveys were carried out on the river Moriston by NatureScot licensed NDSFB staff on 08/08/2024. A total of four 50m x 1m transects were identified and surveyed with glass bottomed buckets. Each transect length was viewed and a count of all mussels observed was recorded. A map showing all transects is shown below.



*Figure 79 Map showing transect locations*

No mussels were found in the transects. Further spot checks and random searches were also carried in the immediate area with no mussels found.

The river Moriston is an important river with regard to the species with an estimated population of circa 500,000 with 95% being present below Dundreggan dam. Populations in the upper river have declined dramatically through illegal pearl fishing, a decline in host species and hydroelectric operations. NDSFB are currently running a restoration project in the upper river.

## Beinneun 2 Wind Farm Habitat and Fish Population Surveys

The absence of mussels during these surveys suggests that mussels may not be present within the survey area, however, these surveys are a mere snapshot and does not prove that mussels are not present locally. It is known that mussels are present throughout the whole river up to Cluanie Dam, albeit in low numbers.



*Figure 80: NDSFB staff carrying out freshwater pearl mussel survey.*

### Discussion/Recommendations

The river Moriston is an SAC for Atlantic salmon and Freshwater pearl mussels. Historically, juvenile densities in the upper Moriston have been highly variable, possibly due to hydroelectric operations and the passability of a fish pass at Ceannocroc. However, recent surveys carried out by NDSFB suggest that the salmon population upstream of the redundant Ceaanacroc Heck are improving, with densities increasing.

Historically, the river Moriston and its tributaries are heavily impacted by numerous energy schemes with a number of hydro-electric schemes and windfarms already present. Further developments should therefore consider effective mitigation, or restoration opportunities can be delivered to remove any further impacts on the sensitive species found therein. Both salmon and Freshwater pearl mussels are present within the catchment and it is therefore vital that any developments do not impact on them.

Surveys have shown that the tributaries are mainly utilised by limited trout populations with the exception of Allt Bealach Odhar. The single year-class of salmon present in the lower site in transect AB1 of the Allt Bealach Odhar could have been derived from spawning within the lower reaches of the tributary, or by upstream migration from the Moriston Mainstem.

The remaining tributaries are much smaller and it is likely that dry out during drier spells. The summer of 2024 has been wet in the west of the Ness catchment resulting in a constant flow (albeit small) within these tributaries. It is unlikely that these tributaries would support a self-sustaining salmon population. Access to one unnamed tributary, and the Allt Garbh Doire, is impossible due to a waterfall and a manmade structure respectively. All fish species were absent in these tributaries.

Any works carried out should ensure that mitigation is in place to halt any sediment input as this is likely to enter the main river Moriston and is likely to impact on spawning areas and also Freshwater Pearl Mussels.

In addition, any works carried out on tributaries with salmonids should be implemented out with the spawning, incubation and emergence season. Spawning usually takes place in November and emergence occurs usually in March/April.

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