



Establishing a monitoring programme for the Allt a'Mharcaidh river restoration project: Monitoring sites and initial surveys

ECRC Research Report Number 181

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UCL MSc Aquatic Science participants**

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Cover photo: Neil Rose

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1. Introduction

The Allt a'Mharcaidh is a stream located on the western side of the Cairngorm Mountains, Scotland. The catchment rises to 1111m above sea level (ECN, 2015) and drains via the River Feshie to the River Spey. Although originally naturally meandering, a stream section of approximately 1150m was artificially straightened in the early-1800s (Henderson, 2014) to power saw-mills on the River Feshie and to ease the floating of timber downstream. Despite changes in ownership and catchment land-use over the intervening two centuries, this section of the Mharcaidh has remained straightened.

In 2014, a restoration programme for the site was initiated with several objectives (Henderson, 2014) including:

- enhancing sediment transport to improve the morphology of the straightened channel;
- improving the stream's connection with the flood plain;
- creating erosion and deposition features to improve stream habitat.

This was implemented through the addition of woody debris along the stream and the (re-)opening of sediment sources to allow for gravel injection. In addition, riparian tree planting has been undertaken along the course of the straightened section (Spey Fishery Board, 2014).

In October 2015, a programme of monitoring at the Allt a'Mharcaidh was established by UCL MSc Aquatic Science students to ascertain changes in stream morphology and substrate at a location where woody debris had recently been introduced. A second 'control' section, with no added debris, was later established a few hundred metres upstream. The aim of this monitoring programme is to develop a long-term data-set of morphological changes during MSc field classes undertaken annually in October. This document describes the initial condition of the 'experimental' and 'control' sampling stretches of the Mharcaidh at the start of this programme as a base-line against which to assess any future change.

2. Methods

2.1. Substrate and morphology

At each location (control and experimental) a 50m stream reach was selected. Start and end points were fixed using a global positioning system (GPS) and each marked with a wooden post. Substrate assessment followed standard protocols employed by the Upland Waters Monitoring Network (Patrick et al 1991)

A 50m tape was laid along the southern bank and a flag placed at each 5m along the stretch. At each 5m point, wetted stream width was measured. At 25%, 50% and 75% of this stream width water depth, bed substrate (Table 1); and macrophyte presence or absence was recorded. If present, the macrophytes were identified in the field or

collected for later identification. In addition, within each 5m section, the overall percentage cover of each substrate-type was recorded, along with the overall percentage macrophyte cover and the percentage of the 5m stretch shaded by overhanging plants and/or banks.

Table 1. Size classes for substrate monitoring

Classification	Size range (mm)
Bedrock (Be)	N/A
Boulders (B)	>256
Cobbles (C)	64 - 256
Pebbles (P)	32 – 64
Gravel (G)	4 – 32
Sand (S)	0.125 – 4
Silt/Mud (Si/M)	<0.125
Woody debris (WD)	N/A
Earth / Soil (E) (above water level)	N/A

2.2. Aquatic macrophytes

When identification expertise permits, the percentage of different aquatic macrophyte species are also recorded within each 5m section. However, macrophyte cover may vary considerably depending on flow preceding the survey period. Therefore, this does not form part of the annual programme but will be undertaken when possible.

2.3. Stream temperature

A 'Tinytag Plus 2' temperature data logger was deployed just above the stream bed at the upstream end of the experimental section. This logger is fixed to the bank using dexion galvanised angle-sections and protected from direct sunlight by an open plastic tube which allows water to pass over the logger. Water temperature is recorded at 30 minute intervals.

2.4. Stream photographs and sketches

A series of overlapping photographs was taken for each stream section along the whole stretch from the opposing bank. This provides a record of bank morphology and allows major changes (e.g. bank collapse) to be determined over the monitoring period. The stream width and morphology data in combination with these photographs were used to compose a sketch of the section. Major changes can then be recorded each year by amending these sketches in the field.

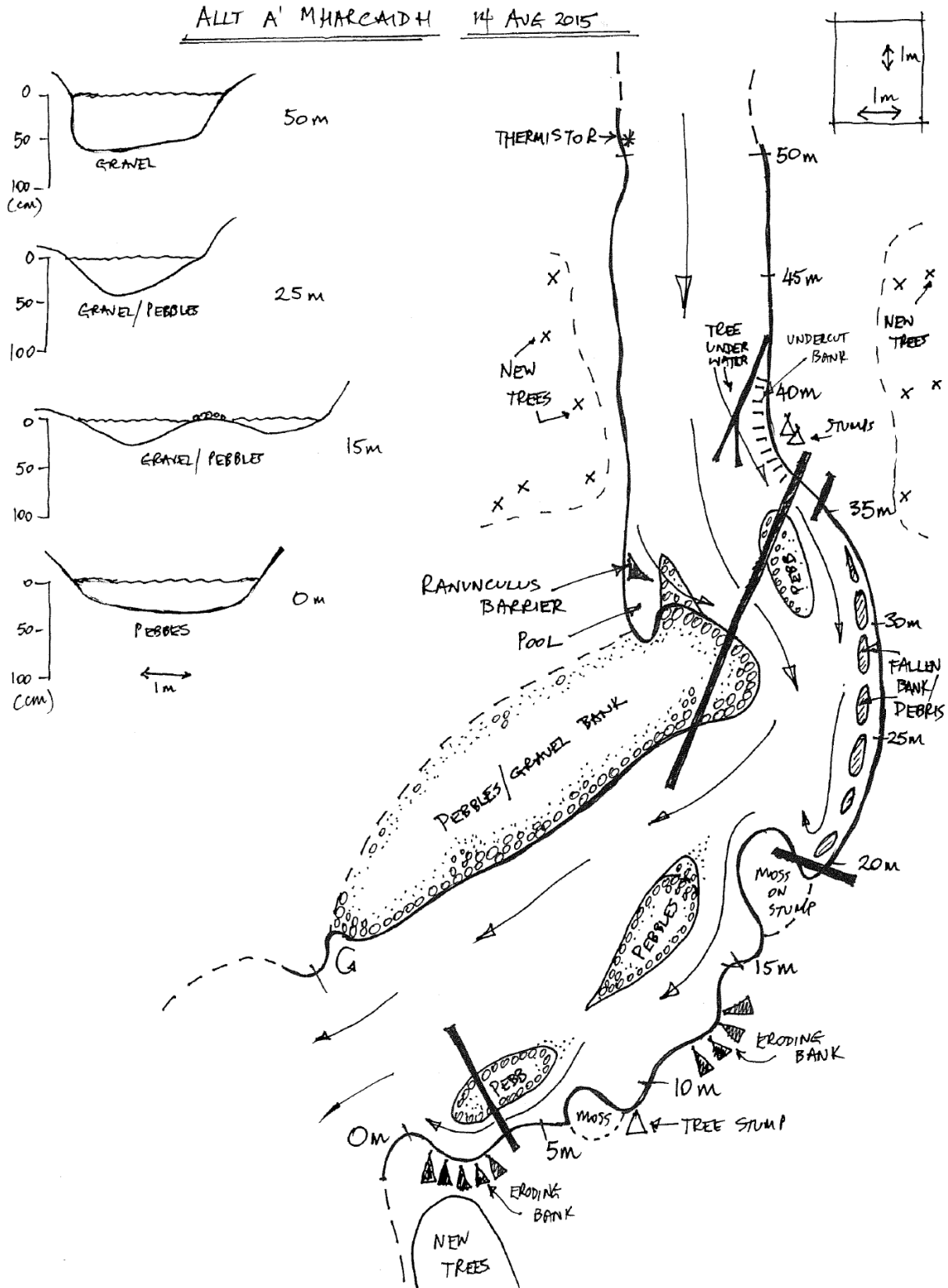


Monitoring of the experimental (top) and control (bottom) sections of the Allt a'Mharcaidh by UCL MSc Aquatic Science students (October 2015)

3. Monitoring sites: Experimental section

Start location: NH 86326 04168
 End location: NH 86345 04202

3.1. Experimental section initial survey sketch



3.3. Experimental section initial macrophyte data

ALLT A' MHARCAIDH		DATE	14/08/2015	TIME	1400	WEATHER		8/8 cloud	POLARISING GLASSES?			
SURVEYED BY		FLOW		CLARITY		COLOUR						
NR; ES, MvdZ		Normal		Good		Light Brown						
CROSS-SECTION	A	B	C	D	E	F	G	H	J	K	L	
	0m	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m	
WIDTH (m)	4.0	5.4	6.1	5.5	4.2	3.0	5.5	5.0	3.4	3.5	3.2	
DEPTH (cm)	28	32	30	5	13	8	32	3	7	27	1	16
SUBSTRATE	SI/M	P	P/G	P	P	P	G	P	P	G/P	P	S/G
	X	X	X	X	X	X	X	X	X	X	X	X
MACROPHYTE at point					Sp	X	X	X	X	X	X	X
COVER % (5m section)	15	2	0	<1	0	2	10	10	15	2		
SHADE % (5m section)	1	1	1	2	1	2	2	<1	<1	<1		
	A	B	C	D	E	F	G	H	J	K	L	
Myriophyllum	85	95		40		20	40	75	65	90		
Filamentous green algae	2	2	2		1	1	2	2	3			
Batrachospermum sp.	+	+			+			+				
Juncus bulbosus var. fluitans	5					20	20					
Carex nigra									+	+		
Glyceria fluitans	5			+	+		15	15	15	+		
Fontinalis antipyretica					+		1					
Viola palustris					+	+		+	+			
Carex rostrata									2			
Sphagnum	+	+		+	+	+		10	5	10		
Juncus articulatus					+	+						
Scapania undulata	3						1	1				
Galium palustre						35	10	+	2	+		
Hydrohyppnum	1											
Juncus effusus								+	+	+		
Brachythecium	+											
Ranunculus flammula						25		+	+			
Lemanea sp.	1											
Nitella flexilis				50								
REMARKS				50								

3.4. Experimental section bank photographs I: Looking south-east



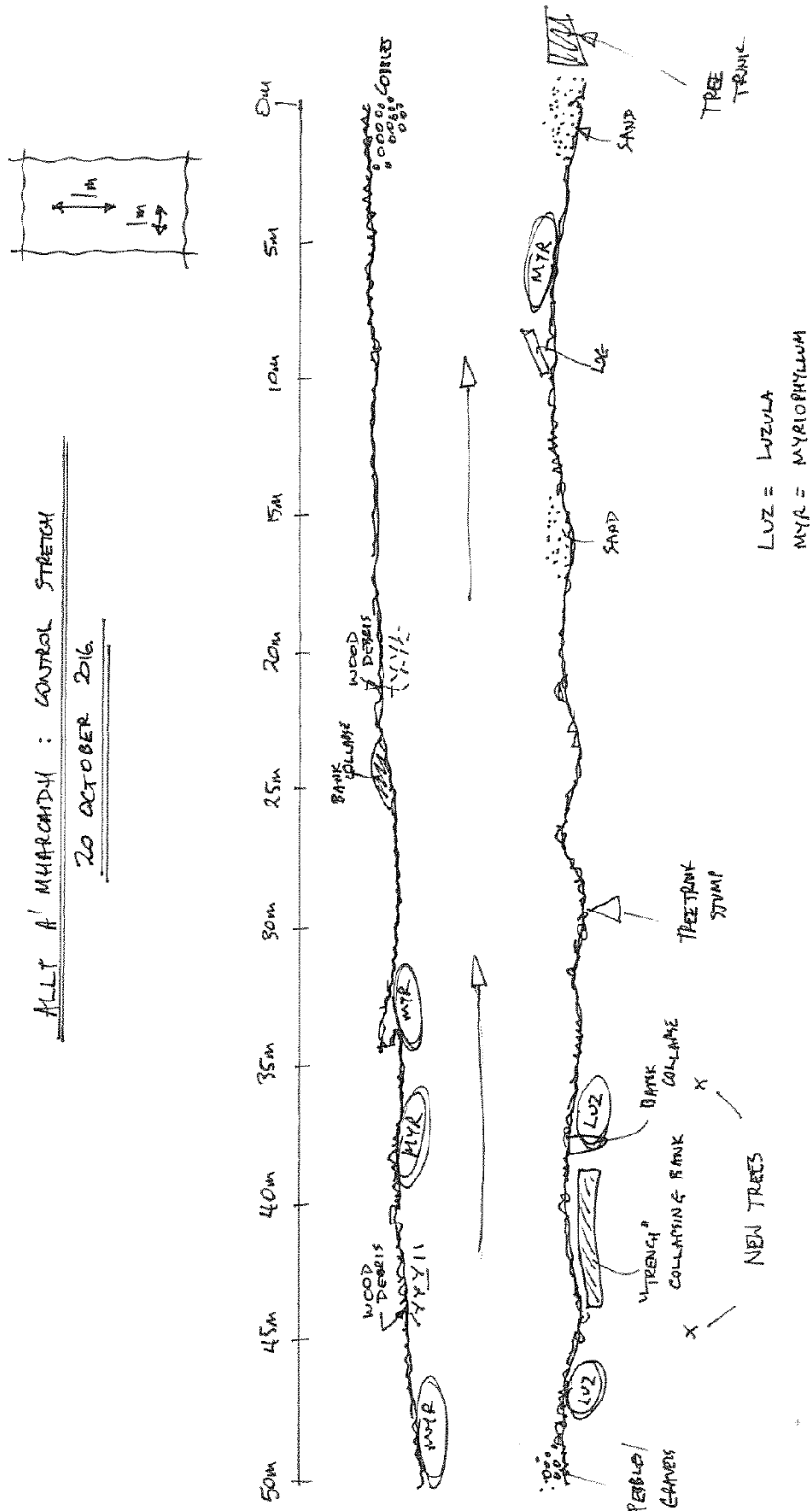
3.5. Experimental section bank photographs II: Looking north-west



4. Monitoring sites: Control section

Start location: NH 86394 04261
 End location: NH 86430 04296

4.1. Control section initial survey sketch



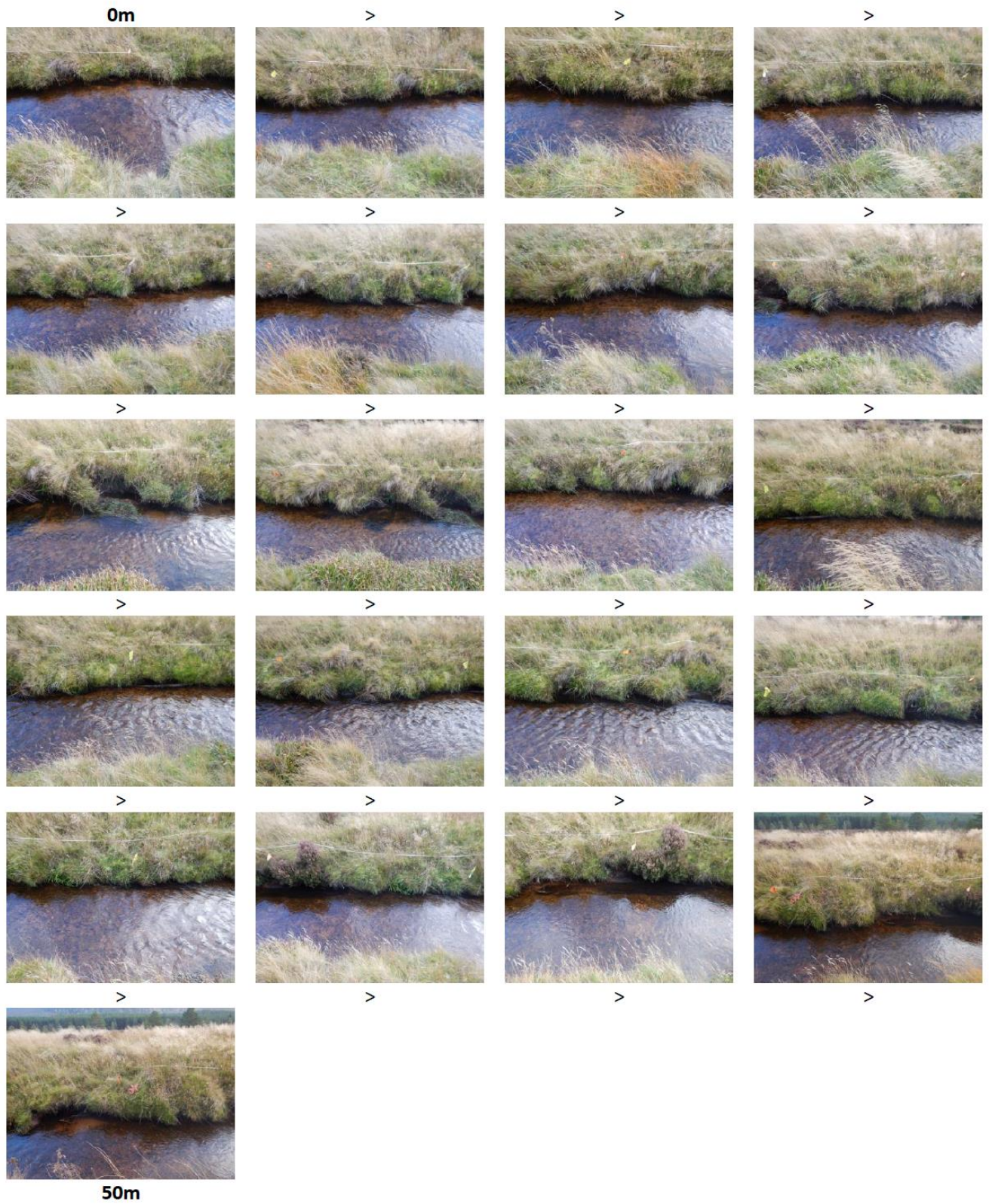
4.2. Control section initial substrate data
 Plant abbreviations: FA = Filamentous algae

ALLT A'MHARCAIDH CONTROL	DATE	22/10/2015	TIME	1445			WEATHER	Windy/ cloudy/ 7/8ths	POLARISING GLASSES?																	
				A	B	C			D	E	F	G	H	I	J	K	L									
SURVEYED BY Tim, Will, Kes, Ewan	FLOW	Medium	CLARITY	Good			COLOUR	Light Brown (whisky)																		
CROSS-SECTION	A	0m	B	5m	C	10m	D	15m	E	20m	F	25m	G	30m	H	35m	I	40m	J	45m	K	50m	L			
WIDTH (m)		3.4		2.6		3.2		3.2		3.2		3.0		3.2		2.4		2.6		3.0		3.0				
DEPTH (cm)		26	30	25	32	35	16	21	17	18	20	17	15	17	20	17	24	24	19	16	15	12	18	21	20	19
SUBSTRATE	G	G	P	G	G	G	G	P	G	G	G	P	G	G	P	G	G	P	P	P	G	P	P	G	P	G
MACROPHYTE at point	X	X	X	X	X	X	FA	FA	FA	X	X	FA	X	FA	X	FA	X	FA	X	FA	X	X	X	FA	X	FA
COVER % (5m section)	<1			5		3		1		2		2		10		4		4		4		2				
SHADE % (5m section)	5			3		3		3		3		3		3		3		3		3		3				
BEDROCK (Be)	A			B				D		E		F		G		H		J		K		L				
BOULDERS (B)																										
COBBLES (C')	+			10		5		5		15		+						+			+					
PEBBLES (P)	40			20		25		35		20		15		50		20		50		60						
GRAVEL (G)	55			60		60		50		60		80		50		70		40		35						
SAND (S)	5			10		10		10		5		5		+		10		20		5						
SILT/MUD (Si/M)																										
CLAY (Cl)																										
PEAT (Pe)																										
WOODY DEBRIS (WD)												+														

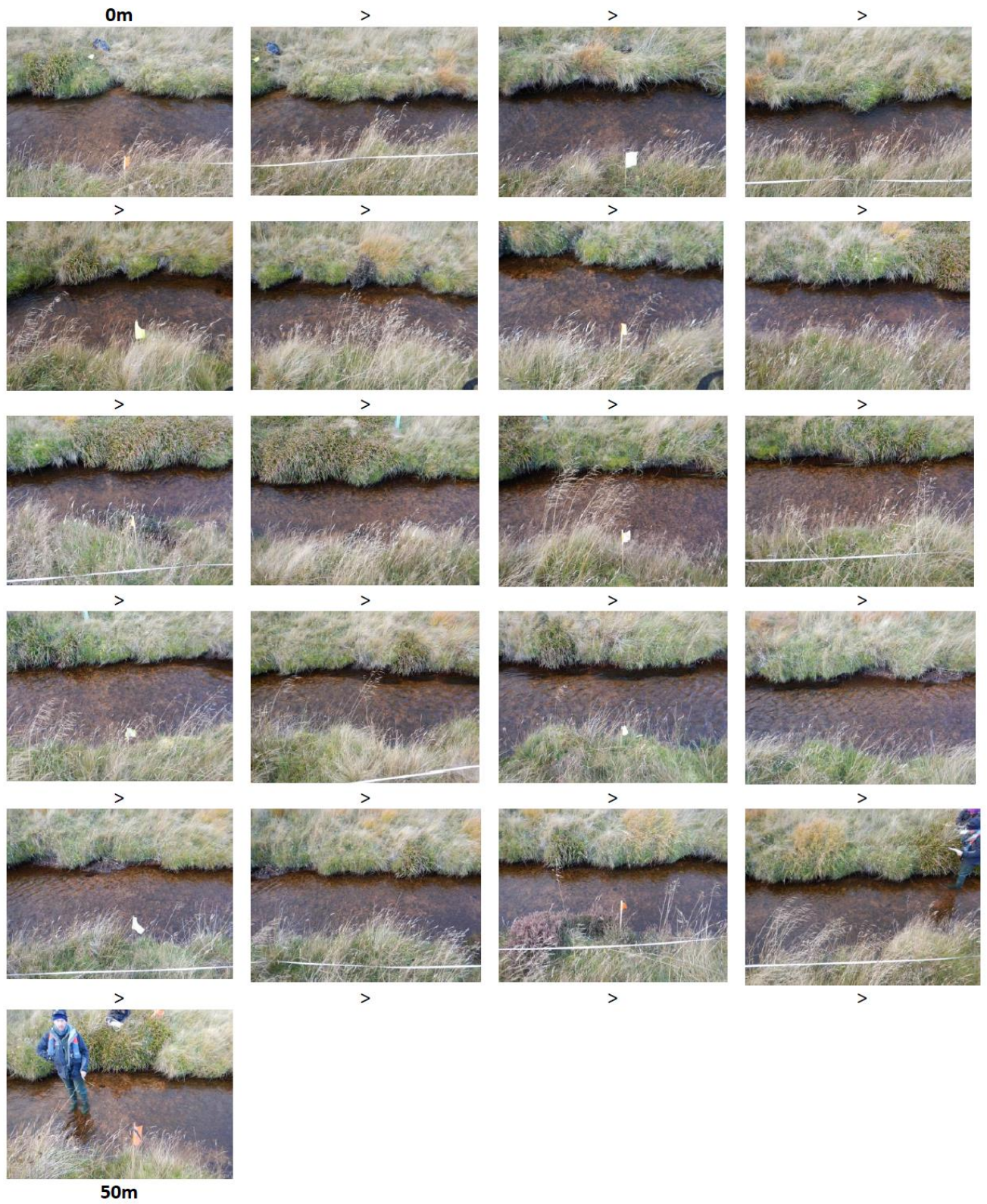
4.3. Control section initial macrophyte data

ALLT A'MHARCAIDH CONTROL	DATE	22/10/2015	TIME	1445	WEATHER	Windy/ cloudy/ 7/8ths	POLARISING GLASSES?		Yes		
SURVEYED BY Tim, Will, Kes, Ewan	FLOW	Medium	CLARITY	Good	COLOUR	Light Brown (whisky)					
CROSS-SECTION	A	0m	C	D	E	F	G	H	J	K	L
			10m	15m	20m	25m	30m	35m	40m	45m	50m
WIDTH (m)	3.4	2.6	3.2	3.2	3.2	3.0	3.2	2.4	2.6	3.0	3.0
DEPTH (cm)	26	30	32	35	16	17	17	17	15	17	17
SUBSTRATE	G	G	P	G	G	G	G	G	P	G	P
	X	X	X	X	X	X	X	X	X	X	X
MACROPHYTE at point	<1	5	3	1	2	2	10	4	4	2	
	5	3	3	3	3	3	3	3	3	3	
COVER % (5m section)											
SHADE % (5m section)											
Myriophyllum	A	B	C	D	E	F	G	H	J	K	L
Filamentous green algae	50	50	80		30	85	97	95	95	90	
Batrachospermum sp.	+	+	+	+	+	+	+	+	+	+	
Juncus bulbosus var. fluitans		40	10					+			
Carex nigra											
Glyceria fluitans											
Fontinalis antipyretica							1		5	10	
Viola palustris		+					+	+			
Carex rostrata					+	10					
Sphagnum		+	+	+	+	+	+	+	+	+	
Juncus articulatus											
Scapania undulata	30	10	10	100	70	5	1	5	+	+	
Galium palustre					+						
Hydrohyprum											
Juncus effusus		+		+			+	+	+		
Brachythecium											
Ranunculus flammula							+				
Le manaea sp.							1	+			
Nitella flexilis											
Liverwort A	10										
Lazula		+			+						
Hard Fern						+		+			
Hyocomium											+
											Bank falling

4.4. Control section bank photographs I: Looking south-east

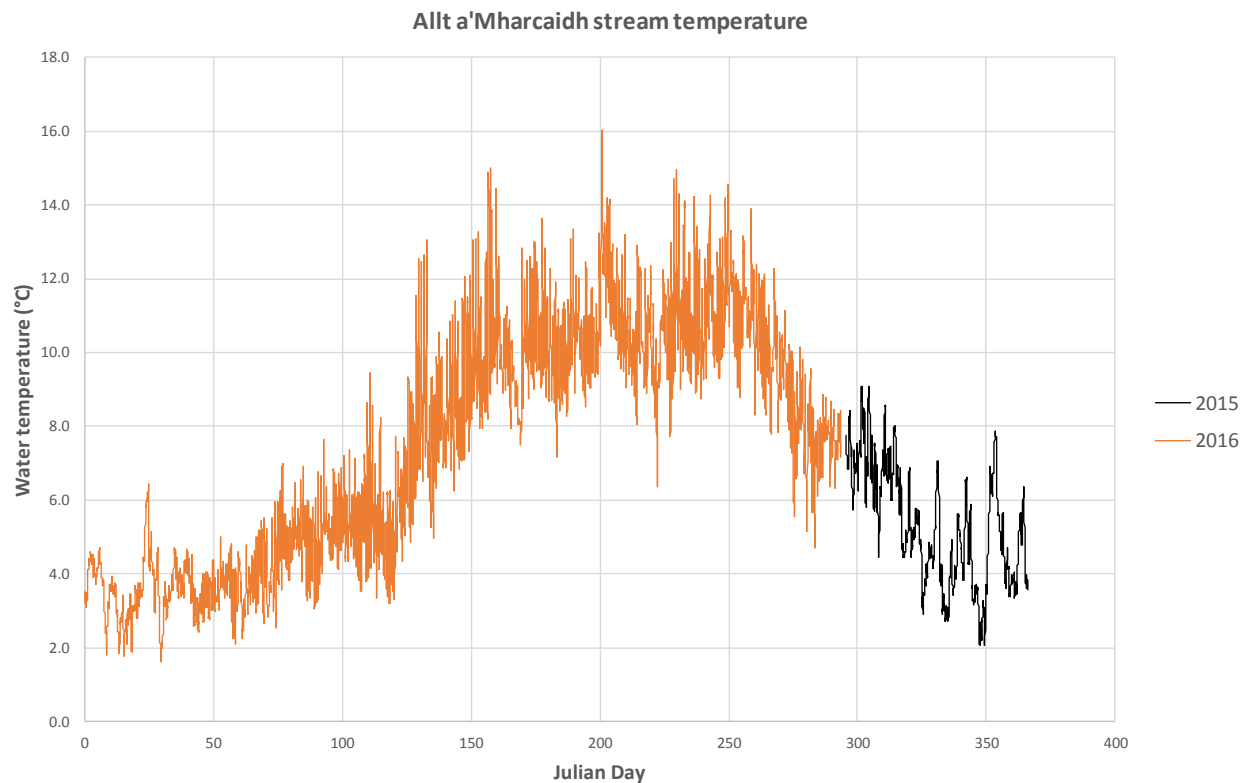


4.5. Control section bank photographs II: Looking north-west



5. Stream thermistor data

The thermistor was deployed at approximately 0.5m depth at the upstream end of the experimental section. While this provides a reasonably high resolution record of contemporary water temperatures, with sufficient longevity, it could also provide a base-line against which to compare future water temperature monitoring of the stream with respect to (i) increasing air temperatures as a result of climate change and / or (ii) the mitigating effects of riparian tree planting at the site. The first year of data October 2015 – October 2016 are presented below.



6. References

- Environmental Change Network (ECN) *Allt a'Mharcaidh*. (2017)
<http://www.ecn.ac.uk/sites/site/rivers/allt-a-mharcaidh>. Accessed 6th Feb 2017.
- Henderson, L. (2014). *Allt a'Mharcaidh river restoration proposal*. Prepared by the Spey catchment initiative.
- Patrick, S.T., Waters, D., Juggins, S. and Jenkins, A. (1991) *The United Kingdom Acid Waters Monitoring Network. Site descriptions and methodology report*. 1-63. ENSIS Ltd, London.
- Spey Fishery Board (2014) *Allt a'Mharcaidh river restoration*.
http://www.speyfisheryboard.com/wp-content/uploads/2014/12/Allt-Mharcaidh_general-article-Nov-14.pdf. Accessed 6th Feb 2017.

7. Additional information

Allt a'Mharcaidh site bibliography can be found here:
http://uwmn.defra.gov.uk/sites/site_02bib.php