How juvenile habitat mapping can be used to assess the sustainability of a *Margaritifera* population

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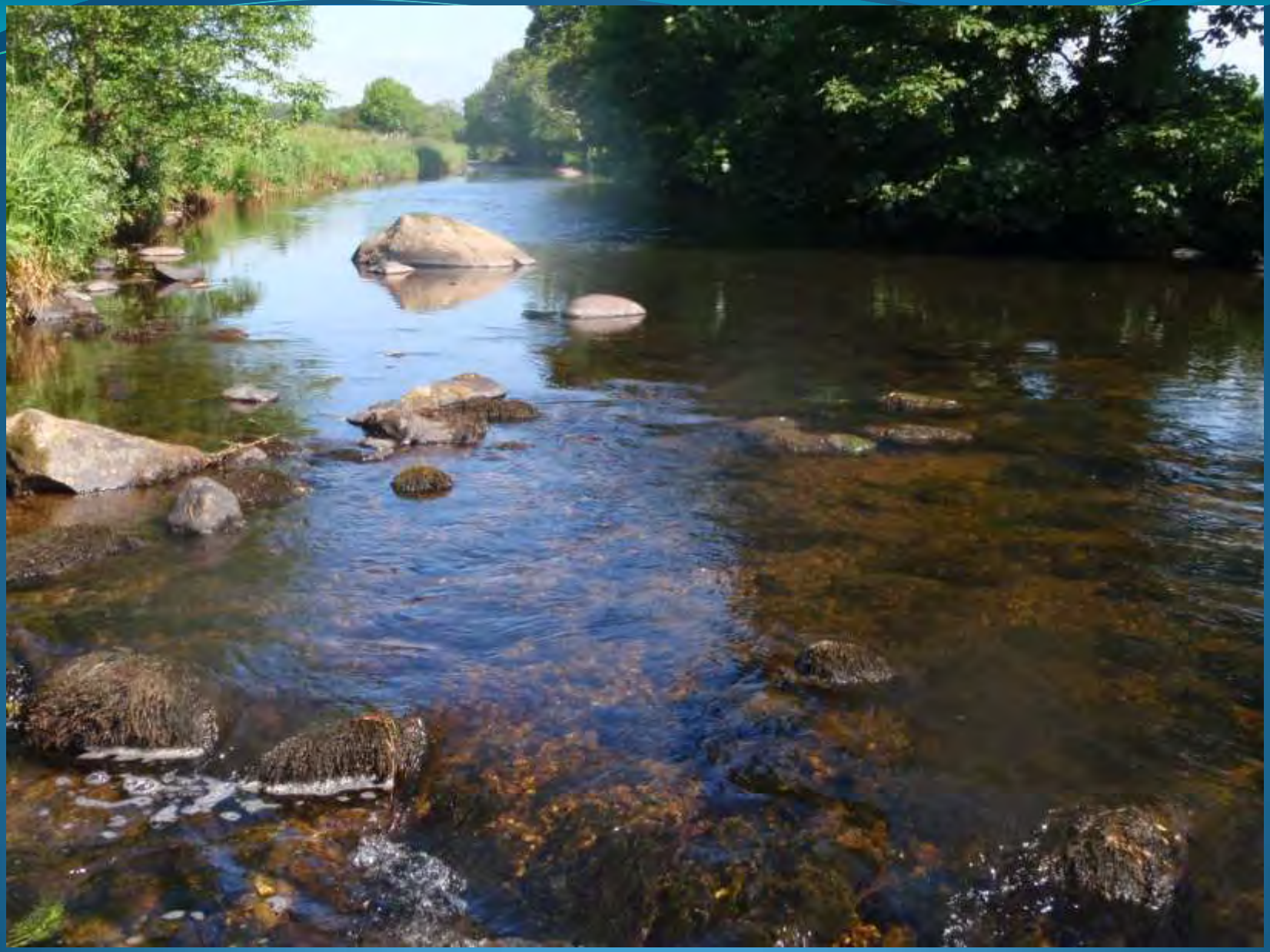


- The River Ehen holds the largest and most important pearl mussel population in England
- It has a population of around 500, 000 individuals, 95% of which live in the 3.5 km immediately downstream of the lake
- It is amongst the top 5 rivers in Britain in terms of population numbers
- There is some recruitment
- The river is not yet in favourable condition but it is recovering

Detailed substrate mapping of juvenile FPM habitat in the River Ehen, England

This 4 year project formed part of an agreed package of compensatory measures, the aim of which is to restore the habitat which enables the sustainable recruitment of freshwater mussels and salmon, primarily in the River Ehen SAC, and to undertake research and monitoring to understand how this outcome would best be achieved.

The objective of this research has been to determine the extent of potential habitat for juvenile freshwater mussels (the primary interest feature of the SAC, and the feature that is currently in unfavourable condition) in the River Ehen.



Parameter assessment categories

Parameter	Habitat suitability	Habitat Condition
Water depth (cm)	X	
Wide clast size range?	X	
Dominant clast size(s)	X	
Sand to fine gravel?	X	
In lee of boulders?	X	
Compaction	X	X
Silt cover	X	X
Silt infiltration	X	X
Detritus	X	X
Algae		X
Floc		X
Macrophytes		X
Flow	X	X
Mussels	X	
Scour	X	
Habitat suitability	X	
Habitat condition		X

Information should be collected from 1 m x 1 m quadrats within transverse transects
To obtain sufficiently high resolution, transects need to be closely spaced (10 m), and every 1 m quadrat on the transect should be recorded

Habitat suitability was assessed as having “no potential”, “potential” and “good” juvenile habitat

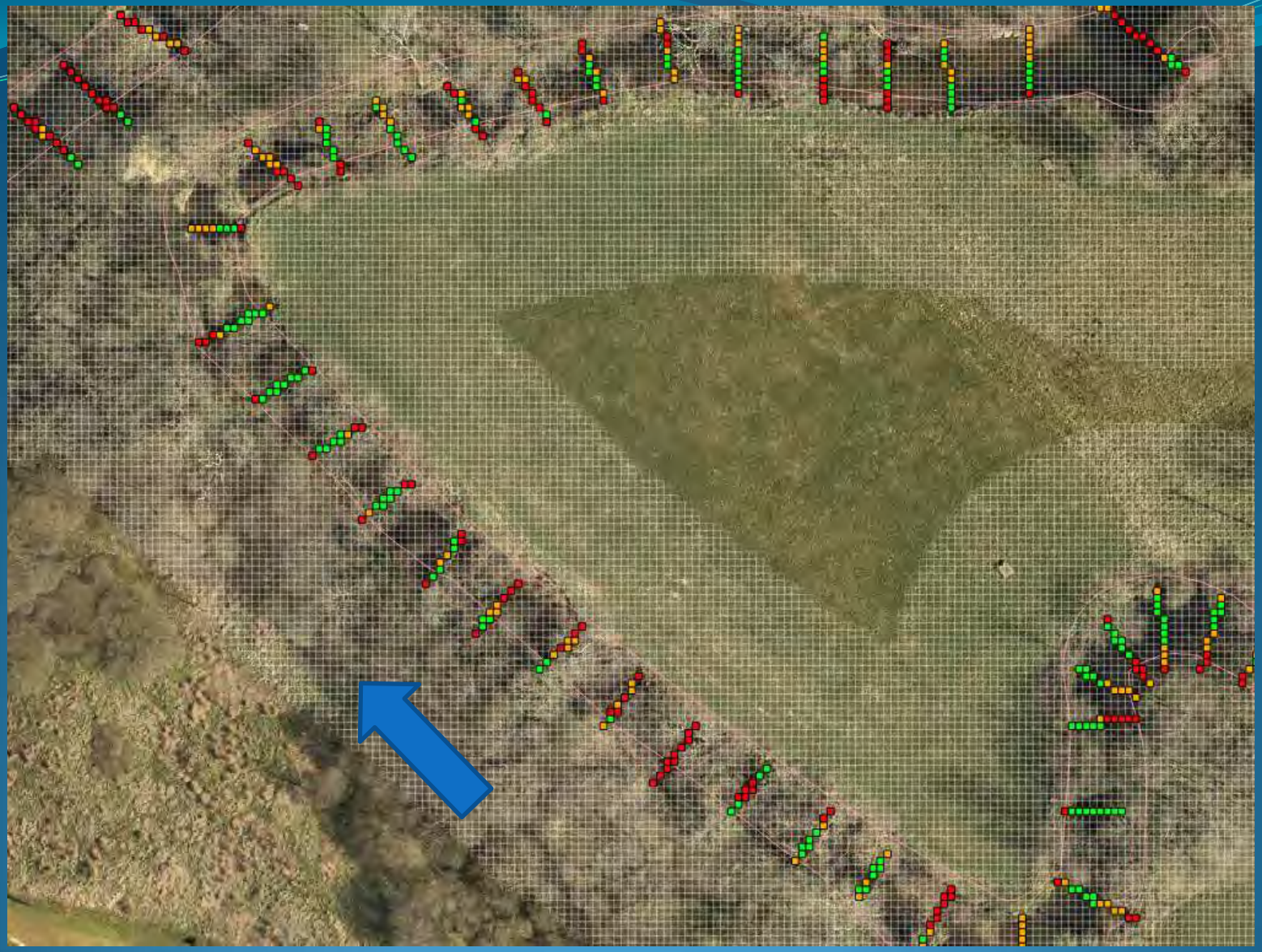
Habitat condition was assessed as being good, moderate or poor.

These were best expert judgements based on the ecological interpretation of the combination of parameters surveyed in the detailed transects, and observed in the intermediate transects.

- **The upper section of the river was surveyed continuously at 10 m intervals over a distance of 3 km**
- **A total of 3, 347 quadrats within 297 transects were surveyed**



Example of a section with transects and quadrats on a 1 metre grid



Example of a section with transects colour coded according to juvenile habitat

Good | Potential | None

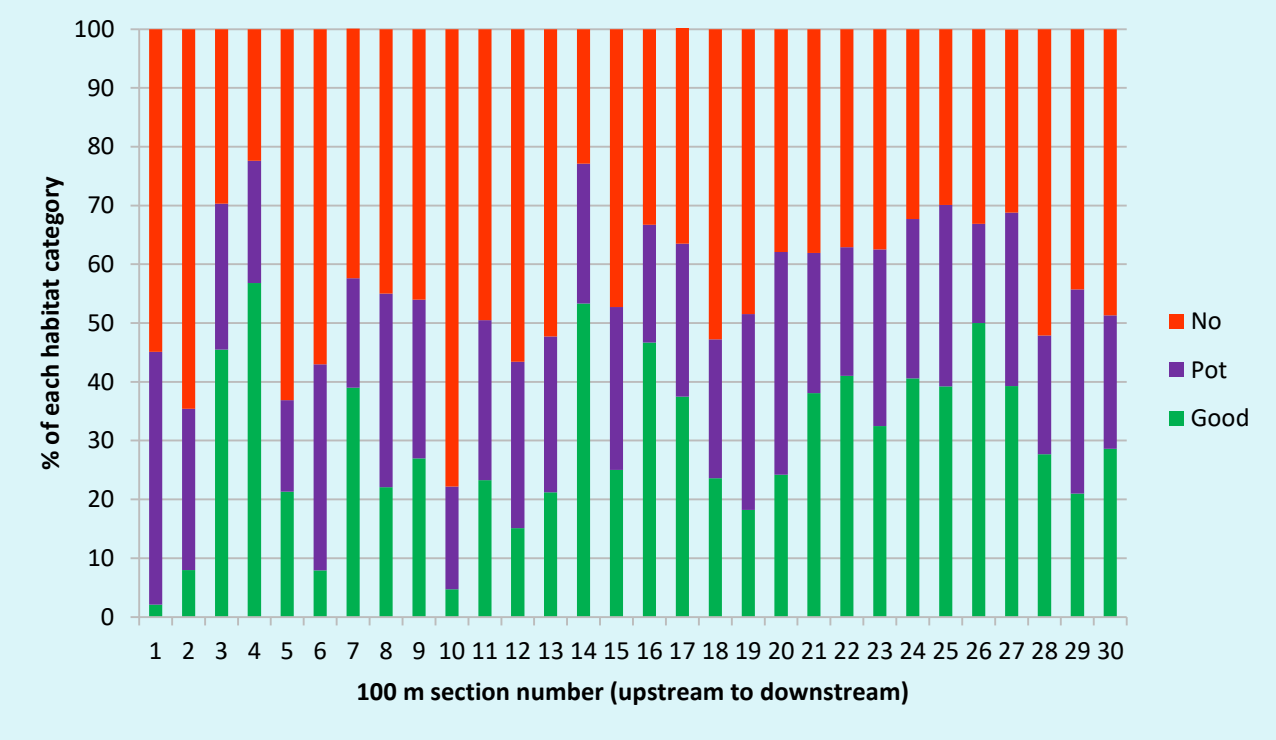


Example of section with interpreted habitat between the transects colour coded

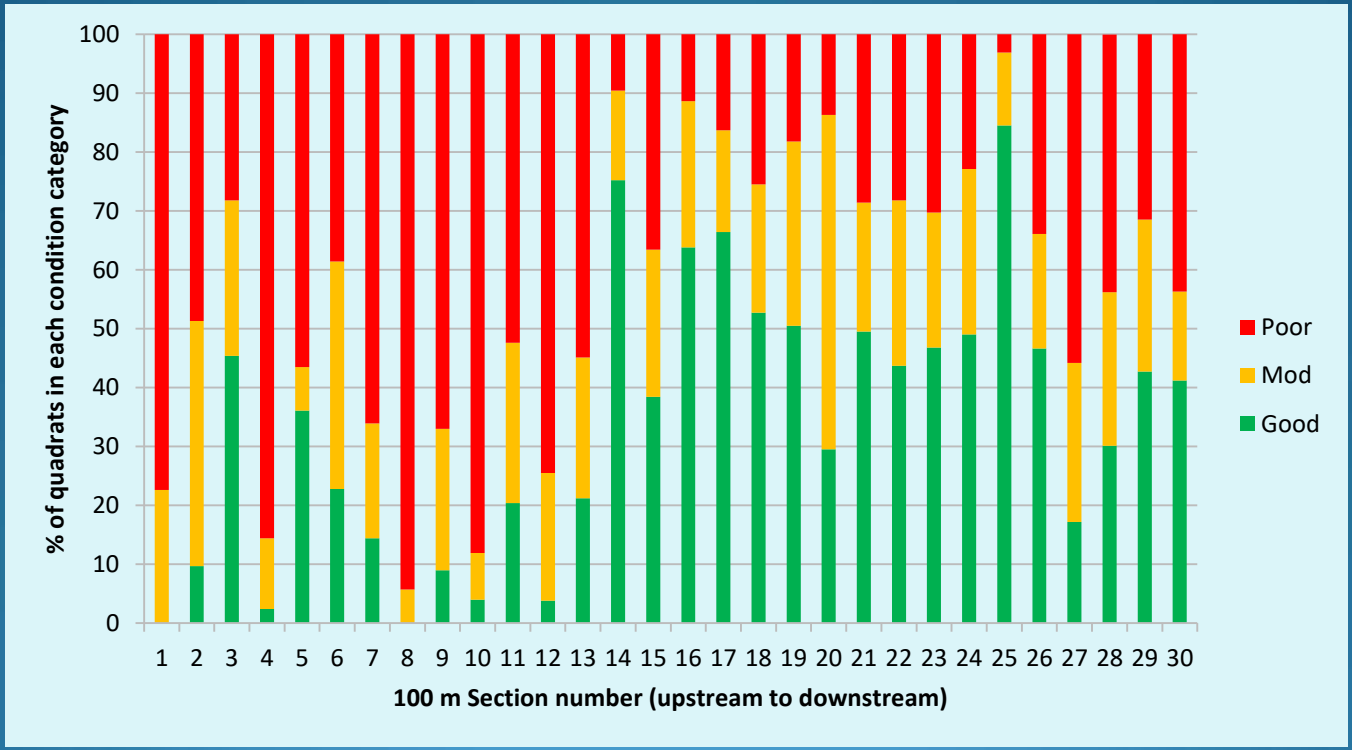
Juvenile habitat category results

	Entire 3 km		500 m example	100 m example
Habitat category	% based on transects alone	% based on transects plus interpreted areas	% based on transects plus interpreted areas	% based on transects plus interpreted areas
Good Juvenile Habitat	29.4	34.2	40.3	43.5
Potential Juvenile Habitat	26.3	33.0	36.5	38.6
No juvenile habitat (unsuitable)	44.3	32.8	23.2	17.9

Distribution of habitat by 100 m section



Habitat Condition in each 100 m section





Results from a selected section: Transects with quadrats colour coded



Results from a selected section: Interpreted habitat colour coded



Results from a selected section: 100 m example

Mussels

0 | 1-10 | 11-20 | 21-50 | >50 | direction of flow

Transect	Quadrat number (Left bank to right bank)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
EA74.2	0	19	46	49	18	17	16	5	4	0			
EA74.1	2	42	17	48	28	23	6	1	4				
EA73.2	0	0	11	15	31	53	24	18	14	2	0		
EA73.1	0	0	30	73	53	17	29	1	26	0			
EA72.1	0	0	1	0	16	44	35	27	7	0	0		
EA71.1	0	0	1	87	101	80	110	75	10				
EA70.1	0	0	6	45	52	107	75	5	0	0	2	2	4
EA69.2	0	12	24	4	11	44	41	105	95	110	30	9	
EA69.1	0	3	26	18	5	22	41	50	47	36			
EA68	0	29	29	38	57	5	6	3	0	0	0		
EA67.1	0	20	67	44	72	39	82	53	20				

Flow

Standing | Slow | Moderate | Swift | Fast | direction of flow

Transect	Quadrat number (Left bank to right bank)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
EA74.2													
EA74.1													
EA73.2													
EA73.1													
EA72.1													
EA71.1													
EA70.1													
EA69.2													
EA69.1													
EA68													
EA67.1													

Depth

0-20 | 21-40 | 41-60 | >60 | direction of flow

Transect	Quadrat number (Left bank to right bank)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
EA74.2													
EA74.1													
EA73.2													
EA73.1													
EA72.1													
EA71.1													
EA70.1													
EA69.2													
EA69.1													
EA68													
EA67.1													

Habitat

Good | Potential | None | direction of flow

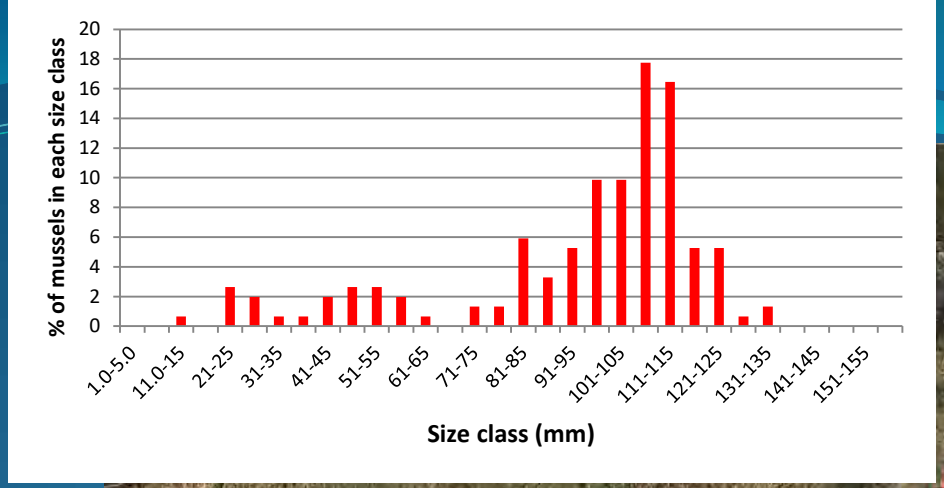
Transect	Quadrat number (Left bank to right bank)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
EA74.2													
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EA72.1													
EA71.1													
EA70.1													
EA69.2													
EA69.1													
EA68													
EA67.1													

Condition

Good | Moderate | Poor | direction of flow

Transect	Quadrat number (Left bank to right bank)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
EA74.2													
EA74.1													
EA73.2													
EA73.1													
EA72.1													
EA71.1													
EA70.1													
EA69.2													
EA69.1													
EA68													
EA67.1													

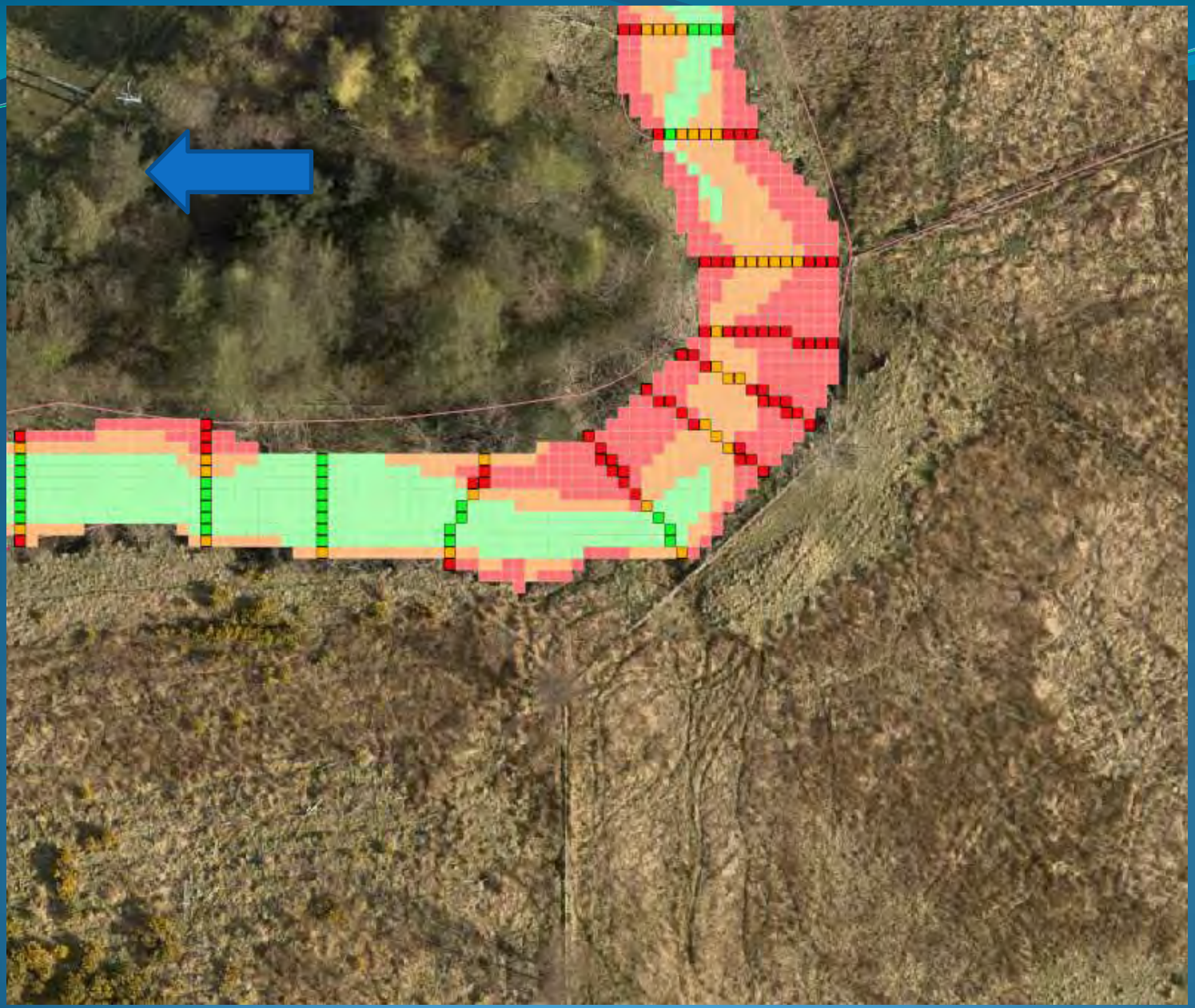
Results from a selected section: 100 m example



16.3% < 65 mm
5.2% < 30 mm

Size profile

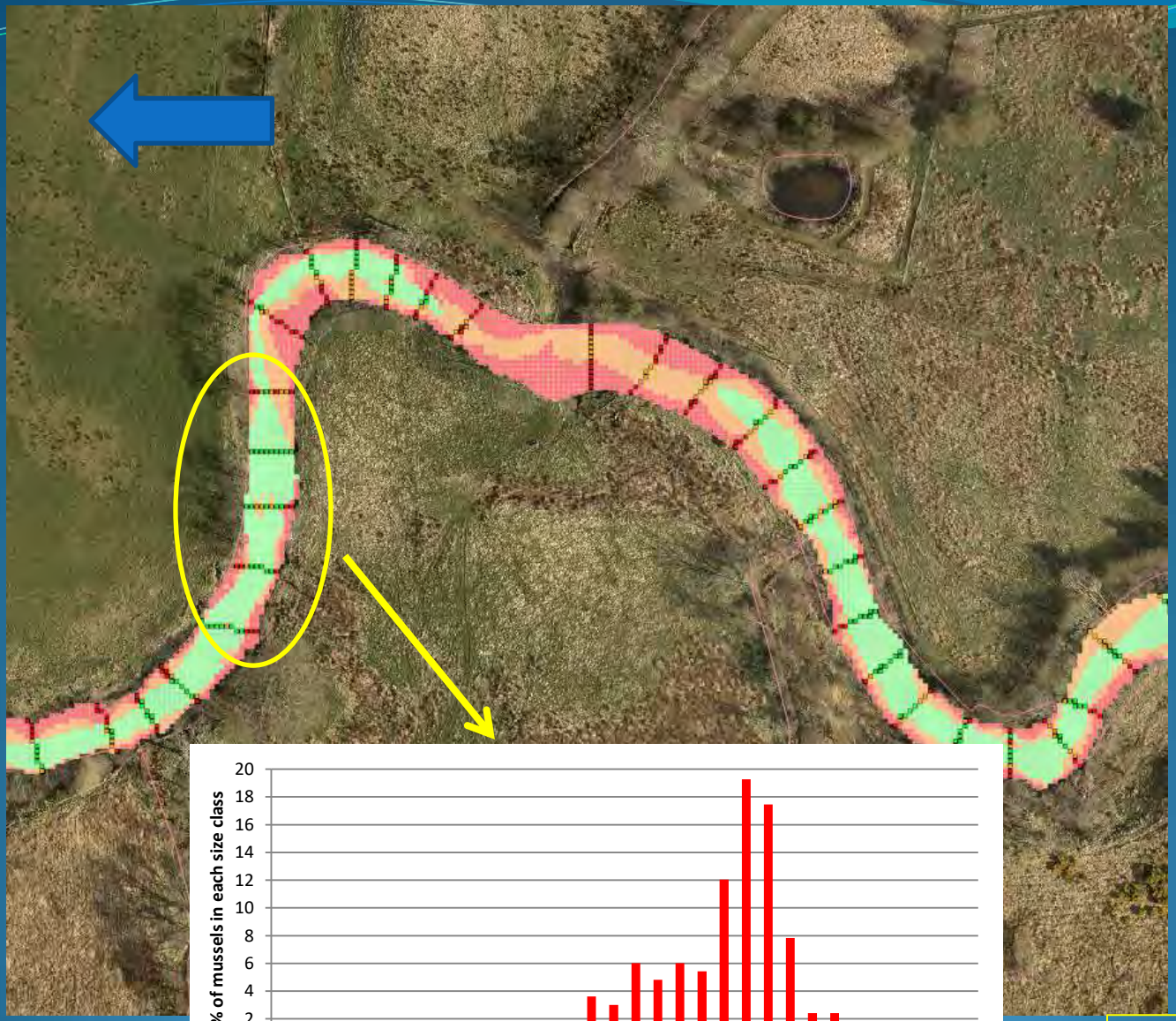
(from the 9 habitat/condition combinations in duplicate = 18 quadrats)







B) Results from a 2nd selected section: 100 m example



Size profile

7.8% < 65 mm
2.4% < 30 mm

Habitat Condition



Transect	Quadrat number (Left bank to right bank)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
B102													



Seepages

2018





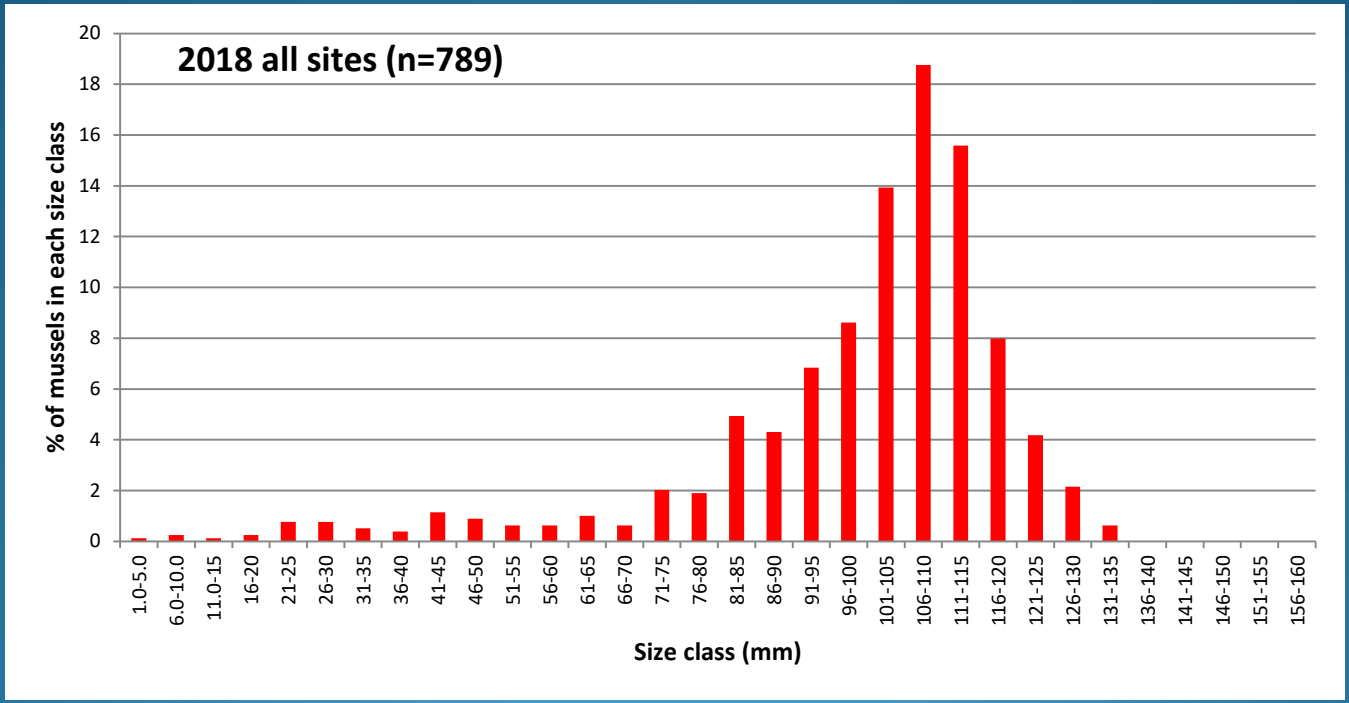


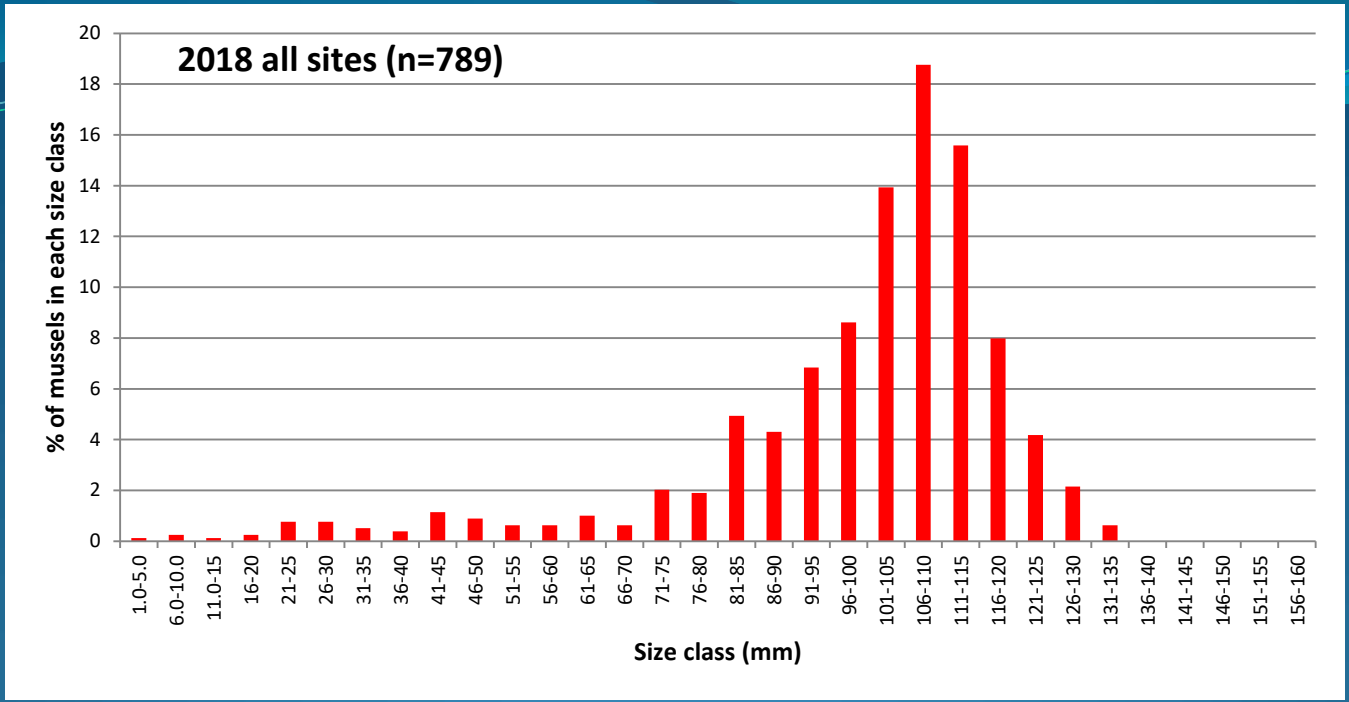
2012

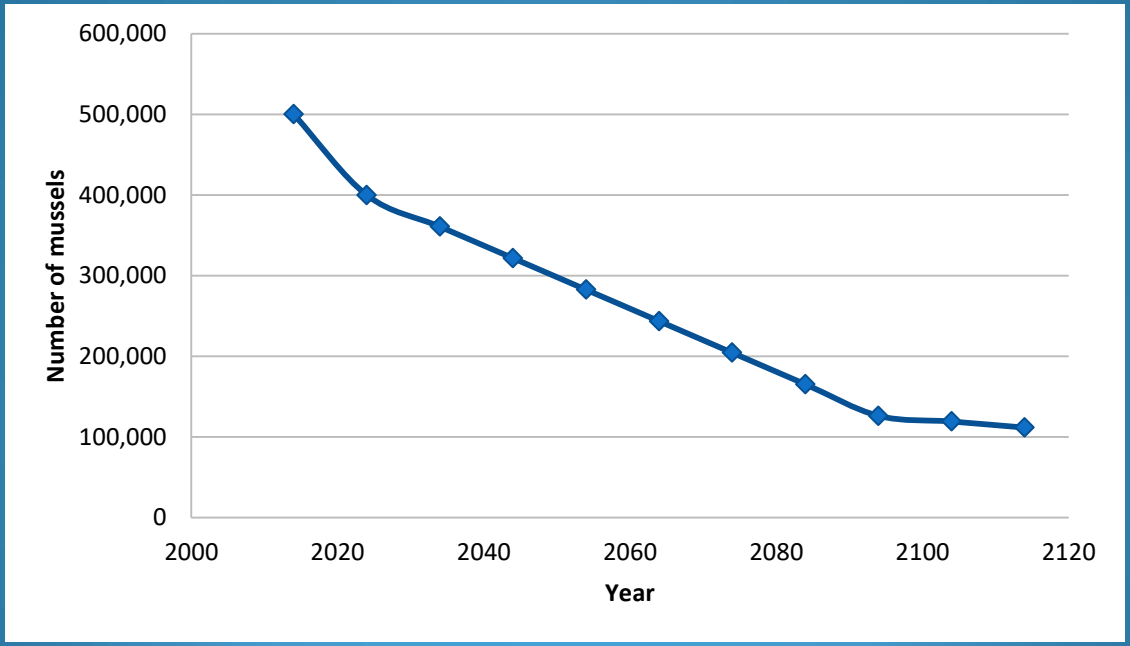







2018 all sites (n=789)
% of mussels in each size class
0
2
4
6
8
10
12
14
16
18
20
1.0-5.0
6.0-10.0
11.0-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
81-85
86-90
91-95
96-100
101-105
106-110
111-115
116-120
121-125
126-130
131-135
136-140
141-145
146-150
151-155
156-160
Size class (mm)


2018 all sites (n=789)
% of mussels in each size class
Size class (mm)
0
2
4
6
8
10
12
14
16
18
20
1.0-5.0
6.0-10.0
11.0-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
81-85
86-90
91-95
96-100
101-105
106-110
111-115
116-120
121-125
126-130
131-135
136-140
141-145
146-150
151-155
156-160


Number of mussels
Year
0
100,000
200,000
300,000
400,000
500,000
600,000
2000
2020
2040
2060
2080
2100
2120

This is probably the most detailed study of *Margaritifera* ever undertaken. It has provided high resolution information on the species' habitat and distribution and the parameters that control them.

Because it assesses physical juvenile habitat occurrence and its condition separately, it provides an insight into how juvenile habitat deteriorates, and a method of monitoring its recovery (or decline).

This method has been used successfully in Ireland in 100 m stretches to assist with condition assessments. It can be used across the range of *Margaritifera* populations and for other unionoid species in need of conservation management.

The use of this methodology is recommended across a range of *Margaritifera* populations in order to provide an accurate means of comparison of juvenile habitat extent as well as quality, expected and actual juvenile recruitment levels, and population size.

This method has been used to assist in the choice of juvenile receptor sites.

Acknowledgements

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