Candidate 1

<u>Title: the effect of water velocity on freshwater invertebrates</u>

<u>Aim:</u> to investigate the effect of water velocity on the number of freshwater invertebrate species.

<u>Underlying environmental science:</u>

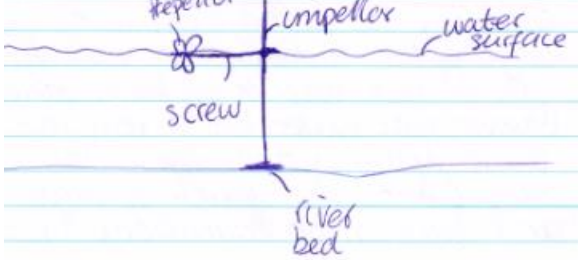
Biological oxygen demand plays a huge part in indicating whether or not freshwater invertebrates have a plentiful supply of oxygen. Levels of pollution will influence the presence or absence of different invertebrates or organisms known as indicator species. Stonefly nymph and mayfly larva would be present in clean water but not polluted water. If the water was slightly polluted there would be freshwater shrimp and caddis fly larva. If it was moderately polluted bloodworm and water louse would be present. If it was highly polluted sludgeworm and red tailed maggot would be seen. If the water was very polluted there would be no aquatic invertebrates present.

Eutrophication affects the number of species in freshwater because it increases the nutrient levels in the water. Most of the nutrients have either run off farm land with the rainwater or have leached from soil. However, most water has a very low level of these nutrients, and these low concentration rates limit the growth of algae, cyanobacteria and bacteria.

Bioaccumulation affects the number of species because organisms are unable to metabolise the chemicals that enter the water. Therefore the chemicals build up in the living tissue and the accumulation of harmful substances becomes toxic and causes the death of the organism.

The velocity of a river is the speed at which water flows along it. The velocity will change along the course of any river and is determined by factors such as the gradient (how steeply the river is losing height), the volume of water, the shape of the river channel, and the amount of friction created by the bed, rocks and plants. Velocity is calculated using the equation 0.0277 + (3.281 ÷ mean time).

<u>Method:</u>



We measured the velocity of a local stream using a hydro prop. We wound the propeller to the end of the screw, and then placed the hydro prop in the water so the propeller was just under the surface. Then we started a stopwatch and timed how long it took for the propeller to get back to the start of the screw. We measured the velocity every 10 metres. This meant it was stratified random sampling.

Then we started kick sampling to find out the type and number of species in the river. We did this at the same sampling points where the velocity was measured and on the same day. To avoid contaminating water downstream with dislodged sediments, we started at the furthest point downstream (sampling site 10) and then worked our way upstream.

We placed a net with the opening facing upstream. We then took 3 steps upstream away from the net. The timer was set for 30 seconds and we kicked the riverbed to dislodge the rocks. After 30 seconds we took a step closer to the net and kicked for another 30 seconds. We did this again standing right beside the net. The kicking loosened organisms that were on the river bed and the current then carried them downstream and into the net. We emptied the net into a white tray and identified and counted all the organisms.

Raw data:

Velocity:

Site no	1	2	3	4	5	6	7	8	9	10
Velocity	0.3	0.3	0.03	0.08	0.39	0.26	0.16	0.21	0.28	0.33

Species present:

Common name	Site no									
	1	2	3	4	5	6	7	8	9	10
Flatworm			1							1
Leech small < 3cm	1	1			2		1			
True worm			2	1		1	3			
Water mite		4	3			4	2	4		
Freshwater shrimp	3	4	3	15	2	14	10	3		3
Swimming mayfly		1	4	1	2			1		
Flat mayfly	1	7	2							
Blackfly		1				3	1			
Cranefly	1	1								
Diving beetle	4	3	3	1						

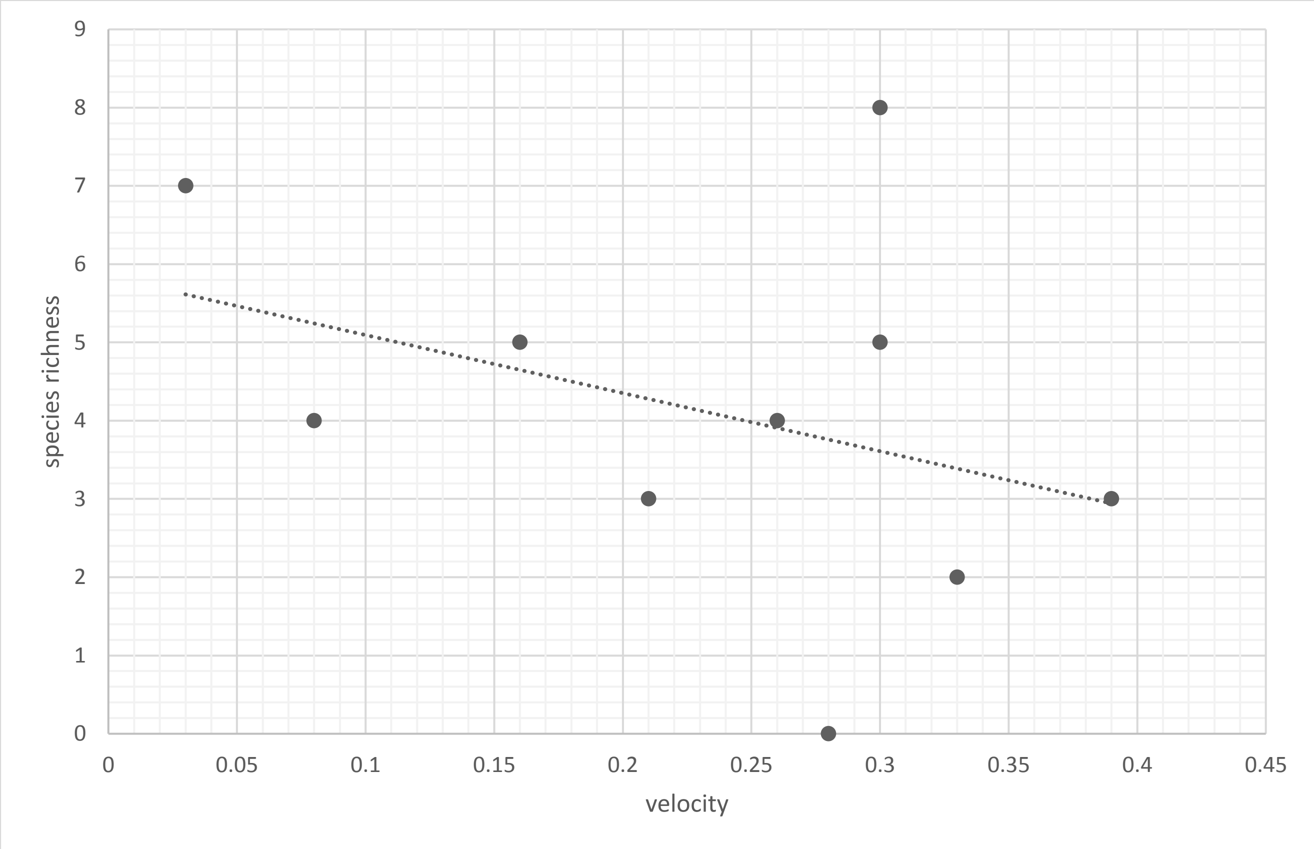
Species richness calculation:

Site no	1	2	3	4	5	6	7	8	9	10
Species richness	5	8	7	4	3	4	5	3	0	2

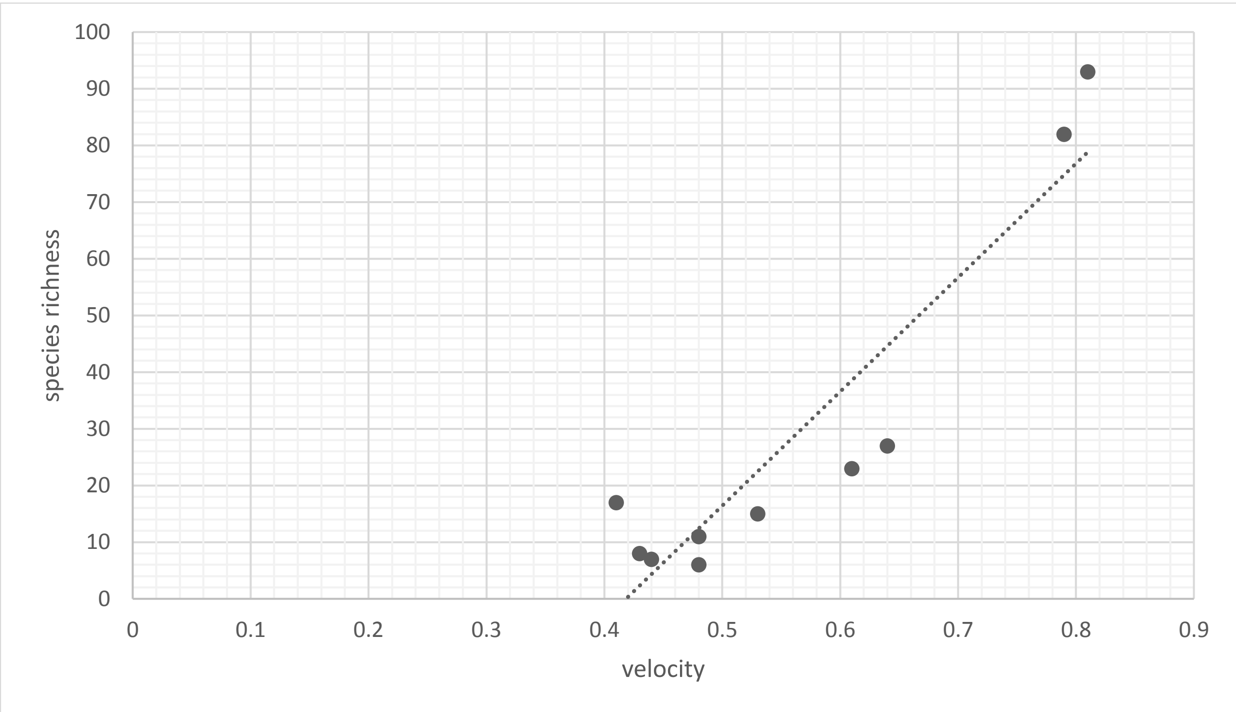
Source 2 data (from a Field Studies Council fieldwork handout)

Common name	1	2	3	4	5	6	7	8	9	10	
Flatworm									1		1
Leech large >3cm		2	1								3
Leech small <3cm		3	1			1					5
Trueworm					1	3					4
Tubifex worm											
Pond snail		1	2	4					1		8
Rams-horn snail						6					6
River limpet											
Other freshwater mussels											
Water mite	3			6	4	2	4			3	22
Ostracod											
Water flea											
Cyclops											
Water hoglouse											
Freshwater shrimp		18	1	2	14	10	3		3	14	65
Swimming mayfly		4	5	1			1			9	20
Flat mayfly large >1cm				1							1
Flat mayfly small <1cm	2				3	1					6
Drifter stonefly											
Long-thin stonefly		4									4
Long-bodied stonefly											
Cased caddis (veg) <1cm	1										1
Cased caddis (veg) >1cm							2		1		3
Brown caseless caddis											
Green caseless caddis											
Yellow caseless caddis					2					1	3
Pink caseless caddis											
Lesser waterboatman											
Greater waterboatman											
Pond skater											
Biting midge											
Phantom midge											
Non-biting midge											
Blackfly				1							1
Rat-tailed maggot											
Cranefly											
Diving beetle (S)	2									1	3
Diving beetle (P)											
Diving beetle larvae							1				1
Riffle beetle											
Whirligig beetle		50			2		6	7		55	130
Other adult beetles											
Other beetle larvae											
Dragonfly large >1cm											
Dragonfly small <1cm											
Damselfly large >1cm											
Damselfly small <1cm					1						1
Alderfly											
Species richness	**8**	**82**	**11**	**15**	**27**	**23**	**17**	**7**	**6**	**93**	**289**
Velocity (m/s)	0.43	0.79	0.48	0.53	0.64	0.61	0.41	0.44	0.48	0.81	

Scatter graph of fieldwork data:



Scatter graph of data from Source 2:



Analysis:

The scatter graph for my site shows a slight negative correlation, suggesting there is no relationship between river velocity and species richness. The scatter graph for source 2 shows the opposite and that at this river there is a positive relationship between river velocity and species richness.

Conclusion:

The data collected from my fieldwork suggests that river velocity does affect the number of freshwater species present because the scatter graph suggests that the higher the velocity the lower the number of species. The scatter graph for the field centre does not show the same results as they found that the species richness increased as velocity increased. However, lots of factors can affect river velocity and this might explain why they got different results.

Evaluation

We only kick sampled at one point every 10 metres. Kick sampling at three points across the stream at each 10 metre stage would have allowed us to calculate an average for that sampling point. This would have improved the reliability of our data.

Species richness seems to decrease as you move downstream. We took care not to contaminate sampling points and affect species present by starting kick sampling downstream and working upstream. Some other factor might have caused the difference in species richness, so we could also have measured things like dissolved oxygen, pH or total dissolved solids at each sampling point

References

Source 2 data was obtained from a handout given to pupils visiting a Field Studies Council centre a few years ago.