

The Effect of the Oxygen Concentration in the River on Gammarus Pulex

Rationale: Whilst doing a group study on the biodiversity of life in different parts of the river, I noticed a difference in the number of Gammarus Pulex. I thought this might be due to the difference in abiotic factors such as pH and flow rate. After doing some research on this species I discovered that they are particularly fond of more oxygenated water, thus I constructed my hypothesis to investigate this.

Gammarus Pulex: This species is more commonly known as the fresh water shrimp. It is generally found in shallow fresh water rivers, although they have been known to tolerate lakes with a stream running into it for example. This is probably due to the higher oxygen levels in the water. They spend most of their time under stones in the bed of the river and feed on decomposing plant and animal material. They range from being only a couple of millimetres to up to three centimetres and can be any colour from pale orange to grey and brown. They are easy to spot by their arc shaped bodies and their distinctive movement. They propel themselves through the water by a series of contractions and relaxations and travel on their side. Although it is very difficult to see they are also constantly vibrating. This produces a constant current of water over their gills at the base of their thoracic legs. When the females are carrying eggs or young in their pouches they are carried around by the males.

Hypothesis: There will be a greater abundance of gammarus pulex in the more oxygenated sites of the river.

Null Hypothesis: There will be no association between the abundance of gammarus pulex and the oxygenation of the river sites

Planning

I have chosen two sites where I think that the oxygen levels will be different:

The first site is on ~~The Farm~~ which is privately owned. The owners often use the land for grazing animals and it is possible that the soil may have been treated before for agricultural purposes so it is important that I measure the pH and nutrient levels of the water. As few people are allowed access to this site it is pretty much undisturbed. However only about ten metres upstream from site I am using is a small weir. This is likely to incorporate more oxygen into the water. The area is clear from trees and crops and is surrounded by meadow type land. There are reeds and other greenery on the banks. The riverbed itself is mainly made up of shingle and the water is very clear. It was 1 m deep

The second site is at ~~Lettingsett Ford~~ It is situated alongside a single-track country road and just about ten metres upstream there is a small ford that leads to a couple of residential properties. It is surrounded by agricultural land used for arable farming. Again the land may have been treated for this purpose so it is important I measure the pH and nutrient levels in the water. The riverbed itself is made up of larger stones. There were some ash trees on one of the banks and grass on

Temperature of Water	Measure using a thermometer
Ammonia, Phosphate and Nitrate Levels in Water	Measure with testing kits
Light Intensity	I will try to do the experiments at both sites quickly one after the other on the same day to reduce variation

~~Abiotic and Anthropogenic~~

- Distance away from fords, animal crossings etc
- Pollution of water and riverbed

I will have to observe and consider these anthropogenic factors and consider their importance at both sites.

All these abiotic and anthropogenic factors can cause variation in the favorability of the habitat for certain species. Even if a factor does not specifically affect the Gammarus Pulex, if they make the conditions better for a predator or competitive species then the number of Gammarus Pulex will decrease. In another way if the conditions should favour some of the smaller organisms that they feed on then there will be an increase in the number of Gammarus Pulex.

~~Accuracy and Reliability~~

The other factors that I must be careful to control involve my procedure. For example my method of sampling must be kept constant and systematic. I must make sure that I do not allow any oxygen into my samples of water for oxygen testing as this could make my results inaccurate. To maintain reliability I will kick sample for the same amount of time every time. I will also take several sets of abiotic data to ensure that the results are reliable. I will ensure that my measuring technique in the identification and counting of the Gammarus Pulex is constant, again so as not to make my results inaccurate.

When performing the Winkler Test in the laboratory I will take care to avoid contamination of other chemicals. I will rinse out my volumetric flask each time with distilled water. I will take care to read the pipette and burette to the bottom of the meniscus. I will run the liquid through the burette for a while into a waste beaker to make sure the jet is full and there are no air bubbles. All these precautions should improve the accuracy and reliability of the results. I will repeat the titrations to check that they are reliable. I have also taken care choosing my apparatus. I have used the largest amounts possible so as to improve accuracy.

Apparatus

- Net
- Deep white tray
- Tape measure
- Sample bottles
- Manganese chloride

- Potassium iodide
- Sodium hydroxide
- Thermometer
- Speed measuring apparatus
- Safety glasses
- Magnifying pot
- Plastic spoon
- Potassium, ammonia and nitrate testing kits
- pH testing kit

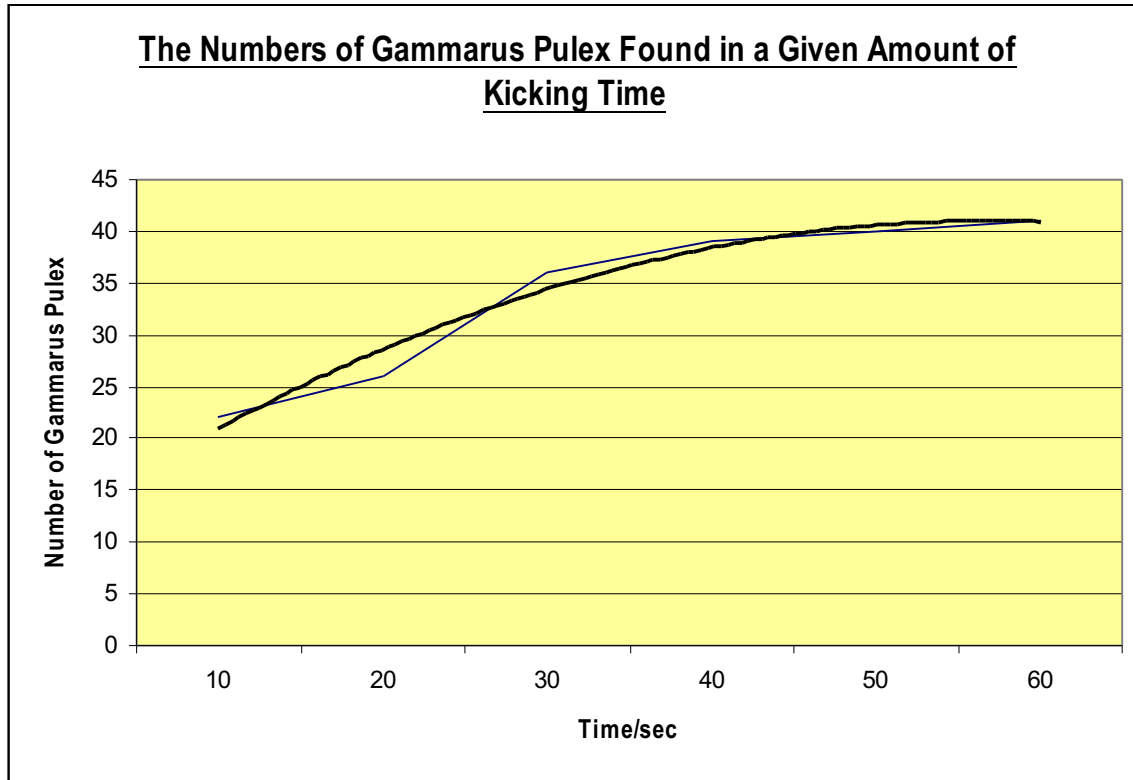
Risk Assessment

- Harmful chemicals – safety goggles
- Bacteria from water – wash hands, no eating
- Tripping – glass
- Care of water levels
- No lone working
- Stranger danger

Preliminary investigation

- Length of time of kicks

Kicking Time/sec	Number of Shrimps
10	22
20	26
30	36
40	39
50	40
60	41



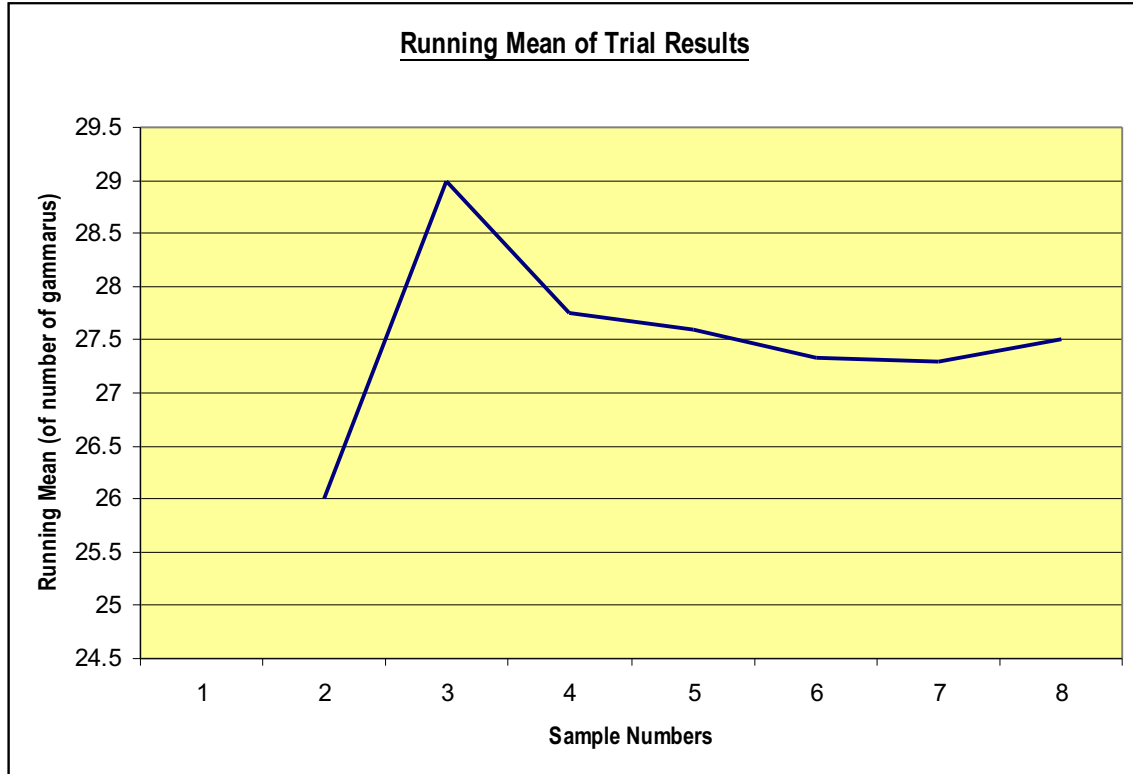
Trial Method

- Kick sample for 30 seconds
- 2 kicks per second
- Six sample areas
- Upstream each time to prevent debris from previous samples
- Empty net into tray of clean water
- Empty one at a time into magnifying pot and keep a tally score
- Release back into river downstream of sampling

	5	1	
	6	2	
	7	3	
	8	4	

Trial Results

Sample Area	Number of Shrimps	Running Mean
1	27	
2	31	26.00
3	29	29.00
4	24	27.75
5	27	27.60
6	26	27.33
7	27	27.29
8	29	27.50
Total	224	



I have plotted a graph of the running mean to ensure that I have used enough sample areas to make sure my investigation is reliable. As you can see from the graph, my running mean does become more stable. I think I have used enough sample areas although it is not as constant as I expected so I will endeavor to take more sample areas.

Changes to the method

As a result of my preliminary and trial experiments I have chosen to change a few parts of my method. Firstly as soon as I started to kick sample I discovered a considerable variable in the speed at which I kicked at and the strength of my kicking. A variation in either of these could mean that I would produce different amount of disturbance to the riverbed and therefore would have a not very reliable number of gammarus pulex. The speed of my kicking I can easily solve by using a stopwatch to measure the amount of kicks I do per second. I decided that a suitable rate would be two kicks a second. As for the strength of the kick, I cannot think of a way of measuring, therefore I will have to monitor this with my own judgment and try and keep it the same. In my preliminary work on the length of kicking time I decided that I would use a kicking period of forty seconds.

I have decided to change the amount of samples I take to twelve samples but use the same sampling method, see plan below:

	9	5	1	
	10	6	2	
	11	7	3	
	12	8	4	

Otherwise I found that the general method worked well. Whilst working on the river I attempted to keep upstream of anyone else on the river so that their trampling did not disturb the conditions for my investigation. I also tried to keep out of their way so I did not affect their experiment, I therefore emptied my gammarus pulex downstream of them.

References

http://www.csir.co.za/rhp/newsletters/news7_kick.html

17/10/06

South African River Health Programme

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