Charlotte Loizou 13PTS
Biology Coursework Investigation

The frequency of Corralina sp. varies as the distance of growth from the sea increases

Corralina sp. Is a whitish-pink calcified seaweed. It has articulated fronds 60-70mm high. It grows on rock surfaces at low tide level and is especially abundant on exposed coasts.

I carried out my investigation on an exposed coast in the Isle of Wight. It has a rocky shore and when the tide is out small rock pools are present. It is a 'holiday' coast which many people visit, there are a number of cafes, restaurants and souvenir shops and also a road runs along the top of the shore.

Other affecting abiotic factors may be temperature, which when not at optimum may slow down enzyme action and chemical reactions within the plant. Oxygen saturation of the water, the equation for respiration is

$$\text{glucose + oxygen} \longrightarrow \text{carbon dioxide + water}$$

and so if oxygen saturation is low the rate of respiration will be too and vice versa when oxygen saturation is high.
Ion concentration of the water will also affect my species. It will affect vital processes such as the uptake of minerals by diffusion and osmosis of water molecules into to the seaweed.
In my pilot study I took readings for how the frequency of various organisms changed along a transect toward the sea. These organisms included a number of varieties of seaweed and limpets and crabs. From this data and observation I saw that there seemed to be a trend in the abundance of Corralina sp. I observed that the closer to the sea the Corralina was growing, the more abundant it seemed to be.

Repeats are an essential part of my investigation to improve the reliability of my results. It also makes it easier to locate anomalies. I will carry out this control by setting up a transect line perpendicular to the 1 I will use for my investigation running parallel to the sea so that the distance form it is constant.

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I will complete a table similar to the one shown below;

Site	Distance from sea (m)	Rank R1	Frequency Corralina per quadrat Left	Middle	Right	Mean	Rank R2	D (R1-R2)	D^2
1	22	12							
2	20	11							
3	18	10							
4	16	9							
5	14	8							
6	12	7							
7	10	6							
8	8	5							
9	6	4							
10	4	3							
11	2	2							
12	0	1							

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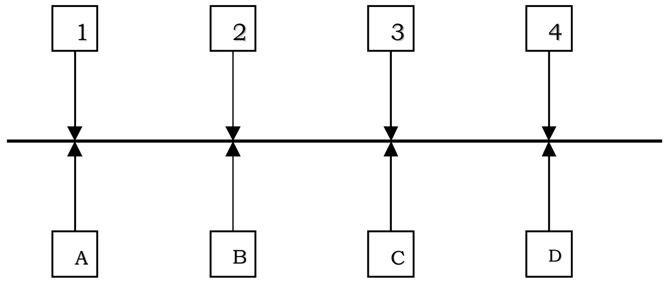
The most appropriate statistical test for my data in the Spearman's Rank Correlation Coefficient. This is because I am testing for a relationship between two variables and also because my data exists in matched pairs.



Where sample 1 (10 m from sea) is taken, sample A (frequency Corralina) is also taken.

Method;
Mark out transect line
In 2m intervals move along transect taking readings for frequency Corralina sp. using random sampling with a quadrat along the transect will allow me to obtain quantitative data.
Data for shore profile and for other variables using appropriate probes or a meter rule or for competition a quadrant measuring %cover competition (see above for what these are) and recording data in a table, even though the data obtained in my pilot study showed there was no significant variation in the variables I tested I will still collect data along my transect.

Experimental Hypothesis: The frequency of Corralina sp. varies as distance of growth from the sea increases.

Null Hypothesis: There is no change in the frequency of Corralina sp. as distance from the sea increases and any difference is due to chance.

Results:

Site	Distance from sea (m)	Rank R1	% cover Corralina sp. 1	% cover Corralina sp. 2	% cover Corralina sp. mean	Rank R2	D (R1-R2)	D^2	Shore profile data
1	30	1	0	0	0	13	-12	144	22
2	28	2	0	0	0	13	-11	121	59
3	26	3	0	0	0	13	-10	100	18
4	24	4	0	0	0	13	-9	81	11
5	22	5	0	0	0	13	-8	64	38
6	20	6	0	2	1	9	-3	9	26

7	18	7	0	0	0	13	-6	36	67
8	16	8	0	0	0	13	-5	25	12
9	14	9	6	4	5	8	1	1	0
10	12	10	11	11	11	7	3	9	8
11	10	11	25	23	24	6	5	25	5
12	8	12	27	21	24	5	7	49	1
13	6	13	28	24	26	4	9	81	10
14	4	14	34	24	29	3	11	121	12
15	2	15	35	39	37	2	13	169	8
16	0	16	45	35	40	1	15	225	3

I carried out S.R.C.C. test on my data.

The formula for Spearman's Rank Correlation Coefficient and my working:

$$r_s = \frac{1- 6\Sigma D^2}{n(n^2 - 1)}$$

$$= \frac{1- 6 * 1260}{16(16^2 - 1)}$$

$$= 1 - 1.85294\ldots$$

$$= - 0.85 \text{ to 2 d.p.}$$

Before setting out my work long-hand above I used a package supplied by Little Canada field studies centre. It is a programme for excel.

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By looking at my graph and results table I can deduce that there is a negative correlation between my 2 variables. This tells me that as the distance at which the Corralina is growing from the sea increases, the % cover of it decreases and therefore it becomes less abundant.

For distances between 0 and 12 metres the values for the % cover decrease at a fairly steady rate and my curve for this part of the graph is a fairly straight line with a steady –ve gradient and the % cover Corralina decreasing from 40 to 11. The gradient of my curve then begins to decrease and the rate at which % is decreasing slows down. For distances of 16 metres onwards the % cover is very low, all except the result for 20 which is 1% show that for distances between 16 and 30 metres the % cover is 0 and my graph curves off to a constant horizontal line.

If a Corralina 'plant' is taking substances up more rapidly, it may grow quicker, increasing the number of cells available to photosynthesise and take up vital substances, thus further increasing its potential growing speed (up to a certain point). The cells of those submerged for longest also have a longer period of time in which they can take up water my osmosis, this will reduce the chance of the cells losing too much evaporation over the period of the day causing them to become flaccid and the Corralina to die. The depth of water tends to increase closer to sea, and I have assumed that this will affect the Corralina, however to an extent the Corralina could affect the depth of the water. The equation for photosynthesis as I stated earlier is

$$\text{glucose + oxygen} \longrightarrow \text{carbon dioxide + water}$$

and so as the % cover Corralina increases more photosynthesis would be taking place and therefore to some degree more water would be produced.

After starting my investigation I found it too difficult to measure the frequency of because it became difficult to tell where 1 plant ended and the next began so I investigated the % cover instead. To make my data more accurate I could have used a smaller quadrat but I found in my pilot study that a $0.25m^2$ quadrat was the most appropriate size for my investigation.

Errors may have occurred when measuring the depth of water to improve this by taking measurements to mm however these 2 measurements were not linked to my independent or dependent variables and so will not have caused any error that will directly affect my investigation.

The limitations affecting my investigation were competition, the depth of the water and the profile of the shore.
Competition may affect the growth and abundance, therefore the % cover of Corralina sp. by causing it to compete for factors vital for its survival; sunlight, rock surfaces etc. I could not avoid competition and there was not one transect line along the whole shore where no competition was present.
Although the competition did change along my 30m transect, it was present in fairly equal quantities (i.e. the index of diversity did not vary considerably along the transect). Because the level of competition was fairly equal along my transect the affect it has on the growth of Corralina should be constant and so even though a limitation, competition is unlikely to have a significant impact on my results.

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In my research I discovered that Corralina grows best on rock surfaces in low tide areas and so as the depth of the water may have had an affect on the abundance of Corralina sp. I entered the data for depth of water and % cover Corralina into my S.R.C.C. programme and saw that it gave an rs value of 0.39 showing that there was not a significant correlation between these 2 variables. Also this was a tidal shore and so the whole shore would be immersed in water when the tide was in, this could result in changing water depths each time the tide came in and out. And so although the depth of water seems to affect the % cover Corralina there is not a significant correlation and so I can say that my conclusion that 'The % cover of Corralina sp. varies as distance of growth from the sea increases' is still valid.

I repeated S.R.C.C. test for the data I collected for my shore profile and obtained an rs value of 0.61 showing that there is a significant relationship between these 2 factors at a level of 95% confidence. This correlation is not as strong as the 1 between the distance of growth from the sea and the % cover Corralina. I looked at the data from my control and saw that although the profile across the shore, perpendicular to my investigation transect line was not flat, there was little variation in the data I obtained for the % cover. The distance from the sea remained constant and although the 'height' of the land differed the % cover Corralina was stable. This indicates to me that it is probably due to chance that there seemed to be a significant correlation between the % cover Corralina and the 'height' of the land.

I set out to investigate how the frequency of Corralina sp. varied with the distance of growth from the sea, I did not investigate this, I do think however that I succeeded in investigating how the % cover Corralina varied with the distance of growth from the sea (which is what I changed my investigation to), although other factors may have affected my result I don not think that this affect was significant enough to affect the validity of my results.