

**Statistics Coursework 2001**  
**Using Statistical Methods to Investigate the Seashore**  
**Habitat of Shellfish and Flora + Fauna**

**Introduction**

For my investigation I am going to visit the Northeast's seaside resort of Sunderland. The area of coastline that I will be analysing is called Whitburn Beach.

Before fully deciding upon a hypotheses and task for our investigation, we had to build up ideas in the classroom. We decided that the investigation would be based on seaside habitat(s). From then we brainstormed all of the variables that would be applicable to this seaside investigation. We had to work out the best time to visit the seaside, because the tides would affect how long we could spend there.

**Hypotheses**

Whitburn Beach is an ideal location for my investigation because it is mostly compiled of rocky surfaces and rock pools that are prime habitats for limpets, periwinkles and seaweed. The four main variables that I will be investigating are: -

- (1) Number of limpets
- (2) Number of periwinkles
- (3) Heights of limpets
- (4) Percentage area of seaweed.

From these variable I have decided upon using the hypotheses: -

**The limpets are larger with distance from the sea.**  
**Where there are large amounts of seaweed there will be many periwinkles.**  
**Where there are more periwinkles there will be fewer limpets.**

I used these hypotheses because they were the most relevant towards how much time we had to collect the data, and how we would write up the investigation afterwards. They are also quite interesting hypotheses to analyse, and it would be good to find out more about my local environment.

I decided to discard certain variables, mostly because of the time limit imposed to collect my data accurately, and they would also be irrelevant to my hypotheses: -

- (a) Depth and number of rock pools.
- (b) Distance the pools were from the sea
- (c) Different types of seaweed
- (d) Number of rocks in rock pools
- (e) Number of grains of sand on the beach

As you can see these variables are mostly irrelevant, especially (e) which would be practically impossible to commit to.

### **Data Collection and Sampling**

The data to be collected was quantitative data; this is basically just numerical data involving numbers. I collected my data using a piece of equipment called a quadrat. This is a 1-sq. metre frame consisting of 4 1-metre rulers attached together in a square shape. I would place the quadrat on a part of the beach and collect the data. To determine which parts of the beach I placed the quadrat on, I chose to use sampling. This would refrain me from biasing my results and leaving them inaccurate and incorrect. There were many different types of sampling to choose from, I had to decide which one would be the most relevant to my investigation and collection of data.

There was random sampling, which is where I would just randomly throw the quadrat on to a part of the beach. This method I discarded because I feared that I might be biased which direction I threw the quadrat.

Another method was stratified sampling. These involved measuring a whole area and then collect fractions of data from every part of the area. This would probably be the most accurate way to collect my data but it is extremely time consuming for a whole area of rocky beach. This method was discarded.

Out of the methods of collecting data that were available I chose systematic sampling. This is when you form a relevant pattern of collecting the data, like placing the quadrat every 10 metres until you reach the sea and collecting the data per quadrat. This sampling method most suited my task because it was not very time consuming and I could not be biased to where I would place the quadrat, I would also hopefully get results from quite a lot of different sources.

## **Methods**

Here is a simple diagram of the beach we visited; it shows my systematic sampling method and how I proceeded from the road to the seashore. Please note that this diagram is not to scale: -

By using systematic sampling I decided to place the quadrat every 10 metres in a straight line from the road to the sea. To accurately measure 10 metres each time I had a piece of string exactly 10 metres long that I had prepared previously. A partner and me stretched it from the centre of the quadrat to another area of beach. Once the quadrat was placed in its position, I had to collect up the data. I counted the number of limpets and periwinkles and charted them in my results table on a clipboard. I also used a steel ruler to measure the limpets' heights because the steel rulers are very accurately made and were durable for their use that day. To determine the percentage of seaweed in each quadrat we laid the seaweed out from one corner of the quadrat and approximated the percentage area of the quadrat that it took up, then we returned it to its natural positioning, so as not to harm the environment in any way.

My aim by collecting this data is to help to prove or disprove my hypotheses, or to give me a deeper understanding of the marine life that I am analysing. I will plot the heights of limpets by the distance from the sea on a graph and hopefully it will show positive correlation (heights increase with distance from sea) which would prove my hypothesis. To help prove this hypothesis I will also use Spearman's Rank Coefficient to statistically and numerically show if the correlation is strongly positive, weakly positive, or strongly and weakly negative. This method gives a more accurate insight into what correlation is shown by comparing the data.

My other hypothesis was that where there was more seaweed there were more periwinkles. To prove this I will compare the results of

Spearman's Rank Coefficient of percentage seaweed per quadrat and number of periwinkles per quadrat. If the correlation is vaguely the same then the hypothesis will be proven, if it differs then it will be disproved. Also I will use a bar chart with the two sets of data on to further prove this hypothesis.

My final hypothesis is that there are fewer limpets where more periwinkles are present, these will also be plotted on a bar chart and Spearman's rank will be compared once again.

### **Equipment**

Quadrat – This was placed on the  
Different parts of the  
Beach for collection  
Of data.

Steel Rule – Used to measure the  
Heights of limpets and  
Periwinkles.

Pencil/Pen – To plot my data with.

Clipboard – Carrying my results  
Table to plot my  
Results onto.

String – To measure 10 metres  
Between each quadrat.

The equipment that I used was chosen because it can all easily be handled on the rocky terrain we would be working on. All of the equipment is strong and durable and they were the only equipment needed to collect the data.

### **Safety**

Also to ensure safety whilst collecting data, we did not go into the sea itself or disturb any wildlife that was irrelevant to the task at hand. To further the safety we all wore sensible clothes for the occasion and ensured we were with a partner all of the time in case of an accident.

### **Additional Information**

I have personally researched the lifestyles and habitats of limpets, periwinkles and seaweed. Information that I have recovered entails facts only about limpets.

Courtesy of AOL Search: "Limpets" > <http://www.geocities.com/for/sealife>

"Limpets are included in a grouped species of sea snails that are present all over the world. You may find them clinging to rocks or pieces of timber. Their homes are usually a scraped out region of rock as large and as thick as their shells. During the day they search for food. They live on algae on the rocks. Limpets use their tongues on their underside to scrape algae from the rocks and into their feeding glands."

This gives a little more insight into the habitats of limpets. I daresay it has little to do with my hypotheses at this time, but it is relevant to the investigation and may prove a point linked into my hypotheses later in the investigation. Although I did try to find out some information on periwinkles' habitats and seaweed, my attempts were unsuccessful. But the information above could help to the understanding of sea life and habitats of the other data collected.

## **Evaluation**

My overall aim at the beginning of this investigation was to prove these hypotheses: -

**The limpets are larger with distance from the sea.**

**Where there are large amounts of seaweed there will be many periwinkles.**

**Where there are more periwinkles there will be fewer limpets.**

I began to use different methods of displaying data and finding more information from the data that I had collected, to find out the most accurate results from the amounts of data that I had obtained earlier.

I think that I have produced substantial amounts of evidential information to prove my hypotheses sufficiently. Although I have proved my hypotheses I still think there are ways I could have improved the accuracy of my displayed information.

One obvious way to make my results more accurate would be to collect more information. This would mean another sampling method would have to have been used or alterations made to my original method. This would have been done in the first place but time limits restricted me from doing this.

Another way to ensure more accurate results would be when I was measuring the limpets heights and counting the numbers of limpets and periwinkles. Although the rulers I used were extremely accurate I may have made slight mistakes whilst measuring and I may have been inaccurate by just a couple of millimetres. But this would still affect my results. Also there was no way that I could totally ensure that all of the limpets and periwinkles per quadrat were counted because some may have been in unreachable places.

Quite a inaccurate method that I used was for measuring the percentage of seaweed per quadrat. This was an approximation and could have been wrong from anything up to around 10% which is not very accurate at all.

In conclusion I am happy with the successful investigation I have put forward and I believe I have proved my hypotheses to quite an accurate extent. Although if I were to repeat the investigation I would almost certainly have changed things like measuring limpets, I would have used more accurate means of measuring, and used a measuring device suitable for measuring the area of seaweed per

quadrat. All in all it has turned out well and accurate enough to prove my hypotheses, and I am pleased with the overall outcome.