Year 10 GCSE Coursework
Rocky Shore Investigation Ben Hickman

Null Hypothesis:
There is no pattern to the distribution of organisms over a rocky shore.

Variables:
Factors that affect the distribution of organisms over an area of shoreline are:

- The depth of water which may cover an organism at high tide.
- How resistant an organism in the littoral zone is to dessication.
- How efficiently an organism can conserve water.
- The proximity and availability of nutrition.

Stations
I think that stations 1 – 4 are in the sub-littoral zone of the rocky shore.
Stations 5 – 12 are in the mid-littoral zone.
Stations 13 – 15 are in the splash zone.
I know this through observation on the day, the amount of rock pools and their depth etc. Consequently the splash zone had no rock pools, the mid-littoral zone had some, but these were not very deep, the sub-littoral zone was very close to the sea and was almost all rock pools with lots of slippery seaweed. My results show that this was mainly *Fucus vesiculosus* (Bladdder Wrack).

Analysis of Results:

Animals

There are several clear trends in my results, the clearest of these being the limpet (*Patella vulgata*). The majority of limpets were situated mainly in the mid-littoral zone and splash zone. They had a peak at station 12 of 31 limpets. Their number slowly built up to this peak from 1 limpet at station 4 to 33 limpets at station 12. The limpets also petered out in numbers after station 12, to go 13 to 6 to 0. This tells me that they do not want to be exposed for that long between tides. However, station 12 still has a long exposure time which means that limpets must be very resistant to dessication because they are exposed to the sun for a long time. Also they may not inhabit zones 13, 14 and 15 because there is nothing for them to feed on there. Limpets were most common in stations 9 – 12, therefore we can deduce that the predominate seaweeds here are what they mainly feed on. The species of seaweeds in these stations were mainly *Fucus vesiculosus*, *Ceramium* and *Lithothamnion*. My research tells me that juvenile limpets are brought up in the *Lithothamnion*, therefore we can presume that this is where they like to graze. Out of *Lithothamnion*, *Fucus vesiculosus* and *Ceramium* the limpet population follows *Lithothamnion* availability the best. Also, the limpets are perhaps the most well-adapted of all the marine snails for a life on the exposed rock surfaces. Each limpet has its own 'home' – an exact spot on the rock where it stays when the tide is out. On soft rock, the limpet grinds it wit h its shell to make an exact fit; on hard rock, the shell is ground down to fit the rock's shape. This tight fit allows the limpet to trap a spoonful of water inside to stop it drying up. A strong foot muscle gets a firm grip on the rock, making it difficult for birds to prise off the limpet.

The periwinkles (*Melarhaphe neritoides*) on the shore are much more spaced out and were found in every quadrat bar one. They were also in abundance in the mid-littoral zone in quadrat 9 with a number of 25. Periwinkles, when out of water, can close off it's branchial (gill) chamber with a horny plate, called the operculim. This means thay can attach themselves securely to the rock and trap a bit of water. This allows for a long period of exposure to the sun. They are spaced out because they can live in all parts of the sea-shore, however, it feeds primarily on black lichens and detritus, which were not part of our investigation. Therefore we can presume that they are adapted to live on all parts of the sea shore.

Seaweeds

The seaweeds were split into three types; red, green and brown. The red seaweeds showed a clear trend by being mainly in the sub-littoral zone and partially in the mid-littoral zone. This tells us that they can photosynthesise effectively when deep under the water, because this is the condition of this zone at high tide. They were not as common as the brown seaweeds with their most commen species – *Laurencia* had a highest coverage of 37%. The red seaweeds did not go past zone 11.

The green seaweeds were very rare and were spaced randomly up the shore, there is a lot, however, in the splash zone when compared with it's results for the other zones, but not by much. For *Enteromorpha* it's last three results were 7%, 10% and 7% coverage and the average of all the other results was 5.2%. This shows that there was more green seaweed in the splash zone than the other zones.

The brown seaweeds were mostly found in the sub-littoral zone and partially in the mid-littoral zone. *Fucus vesiculosus* was extremely common and in quadrat 4 covered 95% of the area. *Fucus serratus* was rarer when compared with *Fucus vesiculosus* but still had a quadrat with 33% coverage, which was a lot when compared with other seaweeds. *Fucus vesiculosus* can tolerate desiccation until the water content is reduced to 30%. If desiccation occurs beyond this level, irreversible damage occurs. The plants nearer the splash zone probably live at the upper limit of their physiological tolerance and therefore are likely to be unable to tolerate increased desiccation and would be displaced by more physiologically tolerant species. This point is probably in station 9 and 10 which is in the mid-littoral zone.

These trends are because the availability of light changes drastically the deeper you get. Also, the spectral composition of light changes the deeper you get. This is because seawater itself absorbs light, largely at the red end of the spectrum. All seaweeds have the chlorophyll and carotene pigments that occur in green plants, which trap light energy for photosynthesis. On the upper shore the green seaweeds predominate, giving way to browns and reds further down the shore. Brown and red seaweeds, anchored at depth, survive and photosynthesise because they have additional pigments which are capable of absorbing the predominant incident light here. Brown seaweed has additional brown pigment which absorbs yellow-orange light and red seaweeds have additional red pigment which absorbs blue green light, these are the strongest spectral colours at their depths at high tide. The green seaweeds have normal photosynthetic pigments – chlorophyll.

Also, the seaweeds must be resistant to dessication. The seaweeds are covered in a mucilage, which acts as a reservoir for water. The seaweeds of the mid-littoral and splash zone are better able than others to withstand dessication because they contain more water when fully hydrated and they lose it more slowly when exposed. Seaweeds of the sub-littoral zones were mainly in shallow pools and do not have a high exposure time therefore they do not need to be too resistant to dessication.

Therefore we can reject our null hypothesis because there was clear zoning of the different species of seaweed and animals up the shore for the explained reasons.

<u>Evaluation of Practical</u>

These are problems that we had with the investigation.

- Firstly, we measured the percentages by eye and they were obviously never really exact.
- Also, because we were doing it by eye we could have missed out certain species. This was clear for the periwinkles and limpets because they were sometimes very small and were under rocks.
- A couple of our quadrats lay over very deep rock pools and it was hard to judge what was on the bottom.
- We also had problems identifying some of the rarer seaweeds and the differences between some of them.

There were some anomalies, for example for the brown seaweeds there was a long belt of washed up *Fucus vesiculosus* in the thirteenth, fourteenth and fifthteenth quadrats. This showed a result of 30% coverage of *Fucus vesiculosus* and a 17% coverage of *Fucus serratus* in the fourteenth quadrat. I think that this was washed up seaweed that had detached from the rock and subsequently died. It had been left there when the tide went out.

We could have improved these by using a quadrat that was split into 100 squares this would have given us a more accurate percentage.

Also if we had recorded height above sea level instead of just doing regular intervals up the beach we could have known exactly how deep seaweeds would be at high tide. This would have made a profile transect of the rocky shore. We could have done this by placing two measuring poles at the required points on the beach and then using a field level device, such as an Abney level, which consists of a sighting device and a spirit level. This would have produced two heights which when subtracted from eachother would have produced height increase.

We could also have improved the investigation by checking more thoroughly in the quadrats and by spending more time learning what the species subtle differences were.

We could have ensured that the groups we took data from for the averages had spent a decent amount of time on the investigation and had not rushed it.

There were many aspects of the investigation that could have flawed the results however overall I think that the practical still reliably rejected my null hypothesis.