An investigation into whether the height of sea wrack changes as the depth of seawater increases down the seashore.

Introduction

(1)The wrack family has the most common type of brown seaweed found on the British shore. (1)"Wracks are still widely used as manure" and farmers cut the wrack form shores. My investigation explores how the average height of the wrack family combined changes as I descend the seashore, presuming that the depth of water is proportional to the distance moved down. In the experime nt a transect line is run down the shore measuring from 0 metres. At similar intervals, a 30 metre sample line is drawn across perpendicular to the left of the transect line. (Due to the length of shore, the sample line intervals of 40m stated in the plan were altered to intervals of 20m, with the last 2 results being at 10m intervals.) A random number table is then used to select 30 random points along each sample line so that the results are not bias. At each point the nearest plant perpendicular to the s ample line is measured and its species recorded. At each sample line, 3 at 3 randomly selected points the pH and temperature are recorded and an average calculated for each to prevent bias.

There are a number of variables in my experiment that cannot be c ontrolled and may affect my obtained results. (6)Sunlight is an important ecological factor. Light intensity affects the rate of photosynthesis and the temperature of the surrounding environment. (4)Optimising the sun's radiant energy maximises the rate of photosynthesis and temperature. This allows the wrack to grow larger, as food is being supplied quicker due to photosynthesis being an enzyme controlled reaction. Enzymes generally work better at higher temperatures although at a lower temperature the enzyme is still active but works slower. The differing pH in different areas affects the type of wrack that can grow there. For example a more alkaline pH will be preferred by a certain species. Therefore in this area there will be an abundance of that specie s of wrack which will flourish, whereas other wracks although present may not be able to photosynthesise efficiently, as the pH is too high for the enzymes. This resulting in stunted growth and insufficient minerals being synthesises for use within the pla nt. Desiccation due to stormy weather, high tides and mechanical damage will lower the average height of wrack in my experiment. If there has been a particularly violent storm over the winter, whole areas of sea wrack may have been destroyed in which case all the wracks present will be smaller younger plants. Zonation occurs all the way down the shore, in different zones there are bands of different species. There is a lot of competition for space to grow with sufficient exposure to light. Salinity decrease s down the shore where it is most stable at the bottom. This promotes the growth of more saline tolerant plants at the top. Genetic factors play a large part in determining the population of a species. In a more elemental extreme area a wrack with long and stronger roots with a short height is adapted to cope better in which case will have the greatest population in that area. The physical characteristics of wracks differ from species to species.

(1)*Fucus serratus*- serrated wrack is a robust with short oli ve brown fronds and a serrated edge stalk with forward pointing teeth. (1)It is found in greatest number on the lower shore reaching 4 to 5 feet in favourable conditions bearing reproductive fruit spores all year round.

(1)Fucus vesiculosus- bladder wrac k shows much more variation in species than serrated wrack. (1)Its characteristics include air vesicles on the frond leaves allowing it to float above water during high tides. (1)These pea -sized bladders are round occurring in pairs, one either side of the midrib. (1)The species has great variation in height varying from 1 to 5 feet in length and varies in diameter from narrow to broad. (1)Its adaptability allows it to grow in many conditions. (1)Its ability to float allows it to flourish in areas of strong wave action where other species struggle.

(1)*Fucus spiralis*- flat wrack is a smaller species of 6 to 16 inches long with a flat leafy stem, ellipsoidal receptacles and olive brown fronds with cryptostomata. (1)This species grows on the upper part of the b each. (1)The fronds often twist spirally. (1)It is adapted to cope with the dryer, more saline conditions found at the top of the shore; i.e. it is short to prevent water loss.

(1)*Fucus ceranoides*- horned wrack is different to other species in that it doesn't occupy any specific fucus zones, it forms a sequence along runs of fresh water mixing with the salt water. This shows that the saline requirements of this plant are of a lower salt content. (1)Therefore this plant only flourishes near estuaries or in land-locked bays. (1)Like flat wrack it is a smaller species of 10 to 18 inches long with a narrow midrib and short narrow leafy branches with horned fruiting receptacles.

(1)*Ascophyllum nodosum*- egg wrack differs from fucus as it has no midrib or crptostomata, its fronds are long and every couple of inches a large ellipsoidal bladder occurs. (1)There are notches along each frond and narrow branches, which terminate at a receptacle. Its growth takes longer and it has a longer life span, it also likes to be firmly anchored on rocks, which prevent it from being swept to sea and it occupies the middle region of the shore.

(1)*Pelvetia canaliculata*- channel wrack also differs from fucus having no midrib or crypyostomata, neither does it have bladders. (1)It is small being 2 to 6 inches and forms dense tufts at the up most point of the shore at high water level. (1)It has narrow fronds with fork ended branches and its receptacle fruits are fork -like usually having a double forked end.

Diagram of zones

TOP of shore--------------------------→

Channel Wrack

Flat wrack

Serrated wrack

Bladder wrack
(Horned wrack)

MIDDLE of shore----------------------→

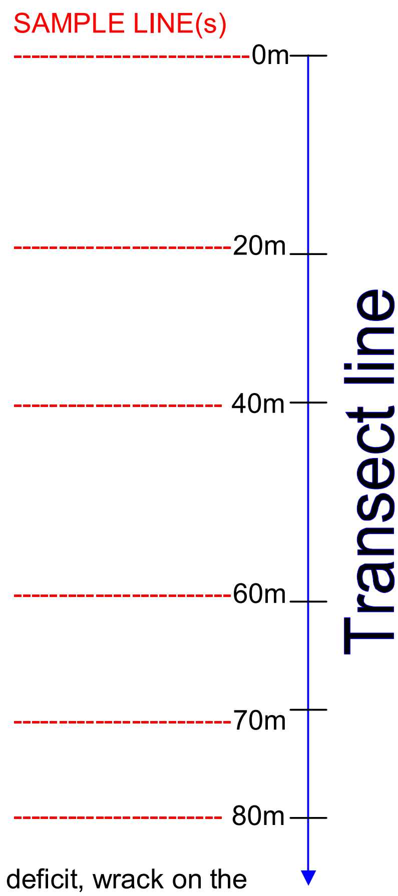
Egg wrack

Serrated wrack

Bladder wrack

Horned wrack

BOTTOM of shore--------------------→



(4)Another factor to take into consideration is water deficit, wrack on the upper shore has to endure long periods without a lot of water whereas other species at the bottom live in a much different environment where they fully submerged for the majority of the time. Only plants that are genetically adapted to live in these extremities will flourish, so we get more obvious Zonation patterns. The geographic features of the shore may also affect the wrack, for example bladder wrack does not grow on a slope, are any of my r esults situated in the middle of a rock pool in which case that environment is different. My prediction was that as you move down the shore, the height of wrack would increase. This is mostly based on the factors affecting water loss. The larger the plant , the more surface area it has to respire from, therefore a larger plant will loose more water. This is fine if the wrack happens to be submerged in water where water can be reabsorbed in photosynthesis, i.e. at the bottom of the shore. But at the top of t he shore, water is in short supply so wracks will be smaller so that they respire less and keep hold of moisture.

Use Of Statistical Techniques

(See Results Tables)
My null hypothesis is that as you go down the shore there is no change in the height of sea wrack, any change is due to chance.
I have used 30 samples in my results so my degrees of freedom are infinite.

After finding my critical values, only my 1st t-test had a significant difference between 40m and 60m down the shore. The probability of the mean being due to chance is 0.05. I can reject the null hypothesis for this section of the shore. There is a significant difference between heights of wrack to 60m down the shore, which is not due to chance. The average height of sea wrack increases as yo u go down the shore from 0m to 60m. After 60m the null hypothesis has to be accepted, there is no significant difference between heights of wrack from 60m to 80m and any increase in height is due to chance.

Interpretation of results

The general trend of my results indicated that as you move down the shore, the average height of wrack increases. This is also shown on the graph as a curve on which the end results have a lesser gradient. The confidence limits calculated and plotted show that all means are c onfident to 10.02 cm either side of the mean. The confidence limits actually start quite low at 1.79cm, which indicates that the later means were not as confident as the means at the top of the shore. On further statistical analysis of my results using t -tests it was established that for these end results from 60m to 80m the null hypothesis had to be accepted and those results were due to chance. I conclude that because the null hypothesis could be rejected for 0m to 60m I think that if id been able to go b eyond 80m and obtain a further set of results, it would have shown that there was a significant difference in the means.

Evaluating evidence and procedures

My observations during the experiment showed that there was quite a lot of new growth, probably d ue to desiccation or a winter storm. This may account for the confidence limits being higher at the bottom because there was greater variation in height. The pH fell a little towards the bottom too which was a little unexpected. Perhaps the equipment used wasn't accurate enough to +/- 0.01 decimal place. Each result was taken from a completely random point along the sample line to avoid bias. Perhaps the ruler wasn't accurate enough. It was not possible to get the tape ruler completely strait due to physica l features like contours and rocks. The shore was on a gentle slope with a slight ridge in the middle, which may be a significant affecting factor. (1)Wracks generally fruit during the winter, would this stop growth. The main sources of error in my experim ent came from the accuracy of the tape measures and the site chosen to investigate which I had no control over. There would have been little , if any human error due to the random number table, averages made and quantity of results recorded. The limitation s in my results were not being able to conduct another experiment in another area to compare results. Also, my experiment would have been more successful if I'd been able to go and record results at a greater distance down the shore, which I also think cau sed error because of new growth present at 60 to 80 metres.