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## **Conclusions**

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|  | The research and data that I have collected for the most part, supports my hypothesis. Although in an ecological system there are many factors that influence a species, not just salinity and temperature. Because there are so many possible reasons and links in an ecosystem I can only give possible reasons why there is a significant difference in populations numbers between the two groups. However it is suggested that the temperature and salinity combined, effect the ecological system the most. Below are all of the factors that I feel influence the location preference of the sea urchin. |

**Temperature and Salinity**

Although these organisms are capable of withstanding such harsh environmental conditions, there are factors that are essential to their survival. The two that probably have the most impact are the temperature and salinity of the water. Without the correct balance of either, death would result rather quickly. The typical water temperature of a tide pool or water along the pacific coast averages from 52.4° F - 56.3° F from April through September. Temperature is a critical factor in the existence of any organisms. Virtually all bodily processes are affected by changes in temperature. Metabolic processes may shut down as temperatures rise, due to the denaturing of enzymes (proteins) necessary to carry out specific processes. Temperature is mostly affected by the nature of tide pools. Those pools that are higher in the intertidal region are more likely to become isolated and inaccessible to fresh sea water-which is cooler. The pool that the sea urchins were in (group 2) were in a more isolated area - exposed to the heat and sun for the majority of the day. Therefore, the water will slowly be hearted to a temperature that may cause the organisms to become in danger or die.

This endangering of the tide pool life is not all attributed to the heat alone. It directly affects the salinity of the pool. As the temperature increases, more and more water evaporates into the air leaving behind a solution that is increasingly salty. A normal level of slat is critical for the survival of all tide pool organism. This normal level is on average about 32-38 ppm. In this level, the organisms are with in an appropriate osmotic pressure with their environment. If too much evaporation occurs (too much salt in the water), the cells of the organisms are in a hypertonic environment in which they need to release water to compensate for the new osmotic pressure.

Although the data that I collected doesn't seem to be too significant of a change between group 1 and group 2, there could be reason to believe that it might affect the sea urchins. The temperature and salinity in group 1 were average, falling at 52° F and 38 ppm. Giving reason to believe that for these reasons, the lower intertidal environment is well suited for their needs.

In group 2, it had slightly above average results. Temperature was 55° F and salinity at 41 ppm. This might be related to the small number of urchins there.

In group number 1, their sizes averaged from about 3 cm high and 6 cm wide suggesting that they are fairly young. Whereas, the urchins in group 2 were slightly larger averaging at about 5 cm high and 7 cm wide. Thus suggesting that they are older. This may mean that the urchins in group two have adapted to the slightly higher levels of salinity and temperature, therefore allowing them to grow older and larger. But few are adapted to this environment. Unlike group 2, that are fairly young, but more numerous, suggesting that they are more adapted and more successful in that environment.

**Tidal Position**

An organisms height on the shore determines the total percentage of time it will spend submerged in water or exposed to air. The basic circumstances in all cases, is that most inhabitants of the interidal are primarily marine organisms periodically exposed to air, rather than terrestrial organisms periodically exposed to oceanic conditions. As such, they encounter more and more stressful conditions, more terrestrial, the higher they occur on shore. The closest information I have about the sea urchins' exposure is, about 3-6 hundred hours every six months, dividing that up, it equals about 1.7-3.3 hours a day. Thus suggesting that the sea urchin can only survive extended periods of exposure when there are low tides. This is particularly true of the recently settled larval and post-larval stages. Therefore the location near the low tide line, might be a more suitable environment due to the constant ocean spray, and shorter hours in the sun. Also linking back to the salinity and temperature, where group 1 lived in a more cooler and less salted area, suitable for their needs.

**Wave Shock**

One thing I read about quite often was that the purple sea urchin loves the violent surf along the low tide line. Although, the books always mentioned it, they never went into much detail. I have explored the idea on my own a bit, and with the help of a few books, I have come to a conclusion on why the purple sea urchin prefers the rocky shore, versus pools in a more higher intertidal zone.

Many of the plants and animals that are abundant in relatively protected locations (a higher intertidal zone) are simply not equipped to take the battering and the shearing force of heavy surf, and as a direct result, fewer species are often found on the open coast than in more-protected regions. Therefore, less predators are found near the surf. Because the sea urchins are able to withstand the battering surf they may choose to live there to escape from their predators.

Now you may be asking, other animals live in more protected areas because their food source is there, what about the sea urchins? Well, sea urchins, as said in the introduction, are herbivores that feed on algae. Purple sea urchins in particular, are also scavengers. In the rough surf, I didn't notice and abundance of algae on the rocks or near by, thus eluding to the idea that the surf brings in enough algae, and particles of fish, etc., for the sea urchin to live on successfully.

As for the few sea urchins in the more protected area. There may be less of them located there due to the fact that one of their main predators, the seastar, is found feeding on mussels nearby, thus eating the sea urchins also, and thereby depleting their population. They may be able to live there because algae is more abundant in the pools-giving them an adequate amount of food to survive on-assuming that they aren't killed by the change in salinity, temperature, and if they aren't eaten along the way.