Baleen Force Measurement Observational Study

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Climates around the earth are experiencing changes in recent history. The ecosystems of the earth’s surface are known to be threatened by burning fossil fuels, but climate change is occurring in the earth’s oceans due to emissions as well. As carbon dioxide in the atmosphere enters the oceans, it reacts with the water in the sea to become carbonic acid. Due to this, the acidity of the ocean is rising. The ocean has a pH of 8.1, which has decreased from 8.2 in the past 200 years. The increasing acidity has relatively unknown consequences, which prompted the goal of the Baleen Force Measurement Observational Study. Whales have baleen in their mouths, which filter the nutrients they consume, and the baleen is composed of keratin fibers. Keratin was decomposed by formic acid, causing the keratin to release proteins (Barone, Schmidt, 239). The effects of formic acid on poultry keratin led us to investigate whether or not the increasing ocean acidity would have any effect on the whale baleen.

The four-week experiment began on May 21st, 2018. The first few days consisted of becoming familiar with the resources in the lab. On May 23rd, 3 aquarium tanks were prepared for the experiment. Each tank had 2 gallons of water, which were mixed with 1 cup of Instant Ocean Sea Salt Mixture. Once the salt water was prepared, fans were placed in the tanks to simulate a current, which kept the water from becoming stagnant. 5 baleen samples were placed into each tank. A pH meter was used while the pH of each tank was adjusted. The first tank had a pH of 7.61, the second tank had a pH of 6.60, and the third tank had a pH of 8.05. The samples remained submerged for a week in their tanks, and were tested on May 30th. The samples were tested using a Mark-10 Force and Torque Measurement device. A drill tip shaped like a right cone was driven into each sample, and the amount of Newton’s before cracking was observed and recorded. Data was recorded into a spreadsheet with each individual sample’s measured newton’s as well as each tank’s average recorded newton’s. The same experiment was prepared again, and each tank was set to the same pH as it had been, but the samples inside were given 2 weeks of submersion in the tanks rather than 1 week. The newton’s of force needed to crack the samples were measured once the samples had spent their two weeks in the tanks, and data was recorded in the same spreadsheet as the previous test results. The fourth week and final week was spent compiling data as well as preparing for my research seminar presentation.

The Mark-10 Force and Torque Measurement device allowed for a careful recording and observation of the necessary amount of force needed to break each baleen sample. The results from the tank with a pH of 7.61 showed that the samples required on average 60.12 newton’s of force to break them. The tank at pH 6.60 required on average 59.5 newton’s before the samples broke, and the samples in the tank with a pH of 8.05 needed on average 69.36 newton’s before the samples snapped in half. The two samples that were far from the Ocean’s average pH of 8.1, tanks 1 and 2, showed the lowest amount of ability to withstand force, seeing as how they could only withstand 60.12 newton’s and 59.5 newton’s.

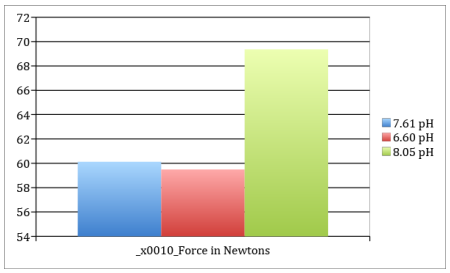

Fig. 1: This figure depicts the average amount of newton’s each tank’s samples were able to withstand before breaking.

While there is approximately 10 newtons more force that was withstood by the samples in the 8.05 pH tank, there is not a large enough difference in the data to say that there is any direct effect on the baleen from the exposure to increased acidity. More research could be conducted in a larger time frame in order to better understand the consequences of increasing ocean acidity on baleen. The poultry keratin study observed the feather for 39 weeks, which allowed for the keratin to breakdown properly, and if there were more time to conduct the study, perhaps more significant results would have been discovered. This project has the potential to discover the true effect of acidic water on baleen, if we revisit the observational study in the future.

REFERENCES

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