

**C. B. G. S.**

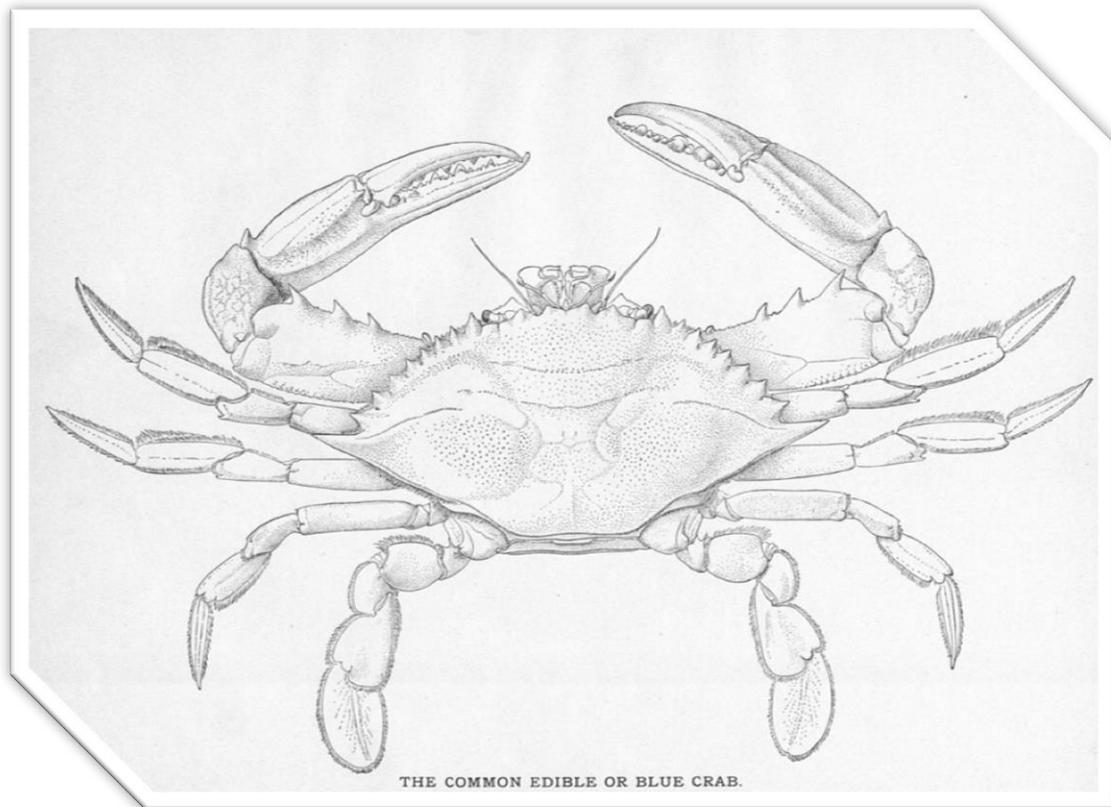
**R**esearch

**A**bstract

**B**ulletin



**Senior Research Project  
Abstracts from the  
Chesapeake Bay  
Governor's School  
Class of 2013**



**Volume 2**

**Spring 2013**

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## Abstract Symbol Legend

BG = Student from Bowling Green Campus

G = Student from Glens Campus

W = Student from Warsaw Campus

★ Exemplary Presentation Award at CBGS Science Symposium, March 2013

## Research Project Subject Legend

BOT = Botany

CON SCI = Consumer Science

EGR = Engineering

ENV = Environmental Science

MAR = Marine Science

MED = Medicine and Health

PHY = Physics

PSY = Psychology

ZOO = Zoology

# **Chesapeake Bay Governor's School**

## **Student Research Project Overview**

This bulletin contains the research of the Chesapeake Bay Governor's School Class of 2013. The student research project is an integral part of every CBGS student's experience. Starting officially in the Fall Semester of their junior year, each student delves into the scientific method through exploratory labs, collecting data on field trips, analyzing data graphically and interpreting results. At this time, students are also introduced to primary scientific literature that they read and discuss, and they learn how to do literature surveys themselves in online libraries and journals. By the end of their junior year students will put forth a written proposal with their research topic, hypotheses, plan of action and timeline for sampling.

Students work with a mentor, usually their Marine & Environmental Science teachers, but some can have multiple mentors, to set up their sampling and start collecting data. The student is responsible for maintaining their project, doing the sampling, analysis of samples and keeping records of this work. CBGS mentors facilitate this process, and help when needed, but the student is the principle investigator. Students also analyze their data and create graphs and generate statistics using Excel.

In the fall of their senior year, each senior will present their research and preliminary findings in a poster session for the underclassmen. During Spring Semester, papers are written, edited and revised. In March, all students convene at the Senior Research Symposium at Virginia Commonwealth University for oral research presentations in PowerPoint format by all CBGS seniors.

There are many goals of this project, the most basic are for students to learn how to create hypotheses and execute a plan using the scientific method and to generate and analyze data. Another very important facet of this process is that students learn effective communication both through genuine scientific writing and also by presenting their work to audiences at the poster session and in talks at the Science Symposium. Students learn to look at information with a critical eye, to discern reputable source material and analyze information more effectively. Students find out that science is a messy and creative process where the answers are not always what you would expect, perseverance pays off, and they stretch themselves farther than they thought they could go.

## **A Comparison Between Traditional and On-Line Classes**

Atiya Aiken <sup>W</sup>

### **Abstract**

Man has been learning since they learned to speak, you do not have to be in a classroom to learn something new. The first school was built in 1635, during that time students only knew of face to face learning. In 2012 there are still more students that take traditional classes than online because there are not that many online classes offered or students are not aware of them. Students should be well aware of their options but also need to know what they are up against. This study compares traditional face to face education and online learning to determine if online learning is better, worse, or just as good as traditional learning. This was determined by the preference of the students and grades from each course will be compared. Both groups were studied to determine the difference in preferred learning styles, grades, and subject matter knowledge. This was found by asking the students which they prefer and why also looking at their grades for the first nine weeks and creating a quiz that had information that both classes should know. Other studies found that the student population for distance learning has changed dramatically since the 1980s. Distance learning has been the main element of higher education. Today's college students are older, more diverse, and display varying degrees of academic readiness. This study can conclude that while distance education may be superior to or better than traditional face-to-face education, it is preferred more than a traditional education. It is clear what students prefer and do better in but all students do not have the same learning styles and that must be viewed to see if that could cause a problem for the data entered. A standard t-test was used to find the p value of 0.225616. Due to this P value the experiment cannot be significant due to the small sample size.

PSY

# **Going, Going, Gone: The Effect of Humidity on the Overall Distance Travelled by Softballs and Baseballs**

Ian Anderson <sup>BG</sup>

## **Abstract**

The relation between humidity and the distance traveled by a ball has been experimented by many sports teams. The most notable being the Colorado Rockies in 2002, who found that increased humidity decreased the amount of homeruns hit. This experiment sought to test the effects of humidity on baseballs and softballs. An optimal humidity range was found to be between 54 and 80 percent. It was hypothesized that the balls with increased humidity would travel less far. A spring loaded pitching machine shot baseballs and softballs 3 times each. They would remain outside to acclimate to the humidity of the day. It was found that balls acclimated to higher humidities travelled less far than those that were of less humidity. The change in distance is caused by the release of water vapor from the air into the material that compromises the core of the ball. This adds mass to the ball which in turn increases the amount of force needed to send a baseball or softball a certain distance. This was supported by the data collected as the graphic representation suggests, the increase in humidity was inversely proportional to the distance travelled. For both softballs and baseballs, there was a steady downward trend. P-values of  $2 \times 10^{-17}$  for baseballs and  $5.5 \times 10^{-18}$  for softballs were obtained suggesting that there were significant differences of humidity on overall distance travelled by a ball. This led to the rejection of my null hypothesis and the failure to reject my alternative hypothesis. Testing at lower humidity ranges would have made this experiment more accurate in conclusion, but it still has some far reaching implications like helping to lower aviation fuel costs. Overall, there was an effect of humidity on the distance travelled by baseballs and softballs.

PHY

# **The Effect of Water Quality and Habitat on Largemouth Bass Populations and Health**

Haley Balderson and Carrington Balderson <sup>W</sup>

## **Abstract**

The main objective of this research was to compare the effects of water quality parameters and habitats on Largemouth Bass health. The two ponds that were tested were similar in size and habitat but water level differed at times. There were a lot of barriers around the pond from trees to shrubbery but the Nursery pond is used for irrigation while Travis pond is not. The two ponds tested had similar parameters of D.O. and pH, while the Nursery pond had higher water clarity than Travis pond. When both ponds were compared, the t-test had a p-value of 0.3, which is not significant to 0.05, the range we want our p-value to fall in. Both ponds had three significant habitats of shallow, open water and a brushy edge near the banks of the ponds. A comparison of the relative weight of fish caught was formulated in a t-test and the mean of relative weight was higher in Travis pond which was 2.4 and lower in the Nursery pond which was 2.2. This can help specify that there were some larger Bass caught in Travis pond than the Nursery pond and the difference might occur from the largest bass caught in the study. The main conclusion that was obtained was that the shallow water of the ponds produced a higher amount of healthy, mature Largemouth Bass. However, the results were  $> 0.05$  and not statistically significant.

ENV

## **Is Territoriality a Behavior Trait of *Gobiosoma bosci* in Oyster Reef Habitat?**

Nancy Barnhardt<sup>G</sup>

### **Abstract**

Territorial behavior is a common trait of many animals. The reason for this trait is to improve prey capture, reduce predation on offspring, and enhance survivorship. This experiment determined whether fish in oyster reef environments exhibit a similar behavior to coral reef fish. The fish used in this experiment were Naked Gobies, *Gobiosoma bosci*, from Urbanna Creek, a tributary of the Rappahannock River. The fish were observed for 10 minute intervals and different behaviors toward each other were observed. Data were recorded as to how many times the fish demonstrated territorial behavior: flaring, nipping, and chasing. The types of behaviors were assigned a number based on how much aggression is involved in the behavior. Flaring was a one, nipping was a two, and chasing was a three. These numbers were multiplied by the mean of each type of behavior in each treatment and then totaled. After the total was found, it was divided by 10 since there were ten trials done. The study showed that the most aggression was shown in the tank with the small mound of oysters while the least amount was shown in the large mound of oysters. The statistics indicated that there had a lot of significance with  $p=4.6 \times 10^{-6}$ . It was concluded that oyster reef fish that oyster reef fish, like coral reef fish, have the trait of territorial aggression.

ZOO

## **3 + 2 = 6?: The Effect of Increased Education Level on Retention of Basic Arithmetic**

Allyson Beverly<sup>BG</sup>

### **Abstract**

Mathematics education in the United States today comes under much scrutiny. With the reports constantly explaining how far the country is behind other nations in advanced mathematics, it is often forgotten that most people only ever use the basics. This study aimed to understand whether high school students have retained the knowledge of basic arithmetical operations, what one might refer to as “everyday math”, instilled in them years prior. For the study, thirty-four (34) high school Algebra I and Geometry students, forty-three (43) fifth grade students, and thirty-nine (39) third grade students were given sets of basic addition, subtraction, multiplication, and division problems. These groups were chosen due to state educational standards. Due to the time of testing, third grade students had not yet learned division and were not scored on that portion of the test. Results suggest there to be no significant difference among the three groups in addition or subtraction. In multiplication, the third grade students scored significantly lower than the other two groups however third grade is the year this skill is taught. Division scores for fifth grade and high school students were not significantly different. The data for high school students did, however, show the smallest standard deviation on each operation while the fifth grade data had the highest standard deviation on addition and subtraction. To be brief, the research suggests students tend to know their basic operations at least as well as third and fifth graders even if they haven’t been tested on them in more than half a dozen years. That being said, further study on this topic would be beneficial to the educational system.

PSY

**Cloudy with a Chance of Jellyfish: Forecasting the Occurrence of *Chrysaora quinquecirrha* in the Potomac River and Cockrells Creek**

Lauren Brent <sup>w</sup> ★

**Abstract**

Many species in the Chesapeake Bay are influenced by temperature and seasonal changes. Especially, species like the sea nettle that does not live in the Bay all year long. Since they don't live here all year long there are forecasters, like The National Oceanic and Atmospheric Administration's (NOAA) sea nettle forecaster, which predicts when they will start showing up in the Bay. This study compared the occurrence of jellyfish in two different bodies of water and over the summer of 2012 (June-September). Water and jellyfish observations in Cockrell's Creek were compared with the Sea Nettle Predictor model data from the mouth of the Potomac River. The parameters that were collected were salinity (PPT) and temperature (C°). These parameters were put in a mathematical equation used by the model and compared the predicted model occurrence percent with actual sea nettle observations. A standard t-test, comparing salinity between the Potomac and Cockrell's Creek, resulted in an insignificant p-value. However, temperature was significantly different. Another standard t-test comparing the percentage occurrence of jellyfish in the Potomac River and Cockrell's Creek was significant with a p-value less than 0.05. The percentage occurrence was higher for Cockrell's Creek.

Models can be very helpful for scientists to collect data if they can't get to the actual site. However, it can be difficult for collecting data in smaller tributaries. These models can be placed all over so you don't even have to go anywhere to get the data; it's all available online. When dealing with these models, all variables must be accounted for, so they might need to be modified for better accuracy in smaller tributaries.

MAR

## **The effects of running distance on distance achieved from vault table**

Stephanee Brower<sup>BG</sup>

### **Abstract**

An experiment was conducted to decide if there was a correlation between the distance run by the gymnast down the vault runway and the length they were able to achieve off of the vault table. There were three different vault running distance that were each tested 15 times. There was only one test subject test during this experiment. The results from the experiment were evaluated using a linear regression. The data was tested against a 0.05 significance level; it was found that there was a correlation between the distance run and the distance a gymnast was able to reach from the table.

PHY

## **Are Broadleaf Weeds Developing a Resistance to Roundup in Mathews, VA?**

Amber Burruss<sup>G</sup>

### **Abstract**

Traditional tillage farming causes many negative effects on the water quality of surrounding bodies of water. Till farming leads to an increase of runoff and erosion and increases the nutrients, siltation, and pesticide levels. Nitrogen and Phosphorus are the two main nutrients that concern water quality. No-till farming is a new form of farming used to decrease the amount of runoff and erosion, however, this method leads farmers to become completely dependent on herbicide use. The chosen herbicide is Roundup, Glyphosate, in no-till genetically modified corn and soybean fields. Over time weeds build a resistance to the herbicide that farmers did not contemplate. Random transects of a soybean field in Mathews County, Virginia were observed on six different dates after the Roundup was sprayed on August 6<sup>th</sup>. Data was collected on six different sampling days in September and October. The results of the 3.5m transect observations show that the broadleaf weeds have not built a resistance to Roundup in Mathews County, Virginia.

BOT

## Small Nocturnal Animals' Reactions to Different Scents

Jaclyn Campbell<sup>BG</sup> ★

### Abstract

This paper shows the results of the study of small nocturnal animals' reactions to different scents. The animals that were recorded were skunks, opossums, and raccoons and the scents presented were shellfish essence, acorn oil, muscaro oil, cigarette butts, and a control. The purpose was to show that each nocturnal animal was attracted to a certain scent. This information could be used to create better hunting and trapping methods or to keep these possible rabies contracting animals away from pets and children. The null hypothesis was that the scents presented will have no effect on the reactions of the small nocturnal mammals. The alternative hypothesis was the acorn oil will attract the most animals and the cigarette butt would attract the least. The animals will be more attracted to the sweet acorn oil because it is their natural instinct to pollinate flowers, and flowers' scents are generally stronger at night to attract them to do so. Unfortunately, the One- Way ANOVAs did not suggest any significant data so the null hypothesis failed to be rejected. This experiment was successful because of the magnitude of animals that were attracted to the area. Shellfish attracted the most, then the control, acorn oil, muscaro oil, then the cigarette butts attracted the least. If this were to be attempted again, there would be more location, time, and scents.

ZOO

## **What a Drag: The Effect of Drag on Forward and Rear Swept Wings**

James Kenneth Campbell Jr. <sup>BG</sup>

### **Abstract**

This experiment tested the drag of forward swept wing design against the drag of the rear swept wing design. For this experiment the each wing had to be created using the design program AutoCAD then printed out using a 3D printer. With the layout of the planes was taken off the internet from the manufacturer. The planes used were the Boeing 737, Boeing 737, and the McDonald DC-8; these three were chosen based on popularity. The wings were created by first creating a wireframe then mirroring the frame over the x-axis for the forward swept wing version. They were then covered using a combination of meshes and surfaces for 3D printing purposes. The planes were then fed through another program to turn the surfaces and meshes into solid form; from there the designs were imported into a Makerbot 3D printer courteous of the University of Mary Washington. Each plane was then placed into a wind tunnel to test the drag of each plane against its counterpart in units of grams. The data was recorded then ran through a two-way ANOVA. The p-value between the forward swept wings and the rear swept wings suggest that there is not significance between them and the drag created.

EGR

## The Effect of Caffeine Levels on Fatigue over Time

Laira Carreon<sup>BG</sup> ★

### Abstract

Caffeine affects the brain by releasing dopamine and triggering neural receptors. By triggering too little or too many receptors, the brain can feel fatigued which has a direct correlation to reaction time. This study examined the effects of different levels of caffeine on fatigue. Using both a color-changing stimulus test and a moving-object stimulus test, reaction time was recorded over the span of five hours every 30 minutes. Reaction times were dispersed with an average of 273 milliseconds (ms)  $\pm$  46 ms with the color-changing stimulus test and 172 ms  $\pm$  20 ms for the moving-object stimulus test. After performing a multiple linear regression, a p-value of  $2.0 \times 10^{-16}$  was obtained suggesting significant differences in the color-changing stimulus reaction time at the levels of caffeine tested, but with a p-value of 0.2230, significant differences were not found in the color-changing stimulus reaction time at the time intervals tested. With a p-value of 0.01050 and 0.0000977, significant differences were found in the moving-object reaction times at the levels of caffeine as well at the different time intervals respectively. This study suggested that at the levels of caffeine tested, reaction times differed over time. However, no specific level of caffeine tested to have a definite lower reaction time than others. Judging by significant differences and experimental observations, caffeine did have effect on fatigue, but more testing is needed.

MED

## **The Effects of Pulp and Paper Mill Effluent on Blue Catfish of the Mattaponi River**

Anisha Carter<sup>G</sup>

### **Abstract**

The health and survival of organisms inhabiting tributaries of the York River, mainly the Pamunkey and Mattaponi tributaries, have been endangered by the pollution released from the paper and pulp mill owned by RockTenn, formerly Smurfit-Stone. Residents are potentially more negatively impacted due to bio-magnification and bio-accumulation of pollutants in river-caught fish. In a five year analysis report for West Point, there were significant chemicals released on and off-site from the plant including formaldehyde, mercury compounds, lead compounds, and naphthalene. The fish that live in the York River estuary are euryhaline, and can travel to and from the Pamunkey and the Mattaponi Rivers. People that fish in the Mattaponi may be catching and eating these catfish affected by the pulp mill effluent. Blue catfish, *Ictalurus furcatus*, were the fish chosen for this study because they are bottom feeders as well as carnivores. The catfish were collected between the months of June and October. After collecting catfish by bait-casting and trot lining, the fish were weighed on a scale, measured in length, and photographed for any lesions or damage visible on their bodies. Weights and lengths of each catfish were proportional to their average weight and length according to the Tidal James River, 2002-2008 Data. The results from the catfish data show that there were no obvious external signs of ill health on the catfish bodies.

ENV

## Music and Music Videos: Is there a Significant Difference in Human Response?

Rashauna Carter and Nia Jones <sup>w</sup> ★

### Abstract

This study was conducted to see if there was a difference in human responses between listening to music alone compared to watching a music video based on heart beat and blood pressure. In this study there were three genres of music; rap, country, and pop. Thirty people participated in the experiment by first, listening to music alone, and then secondly watching the music video for that song. The initial blood pressure and heartbeat were taken. Between listening to the song and watching the music video the blood pressure and heartbeat were taken again. The results were all different when it came to music with the three different genres. But when concentrating on one specific song the results were less spread out. The genre, pop caused blood pressure and heartbeat to go up the most compared to rap and country after the participants listened to the song and also when they actually watched the corresponding video. From receiving a P-value of 0.178447 it can be said that genre had nothing to do with the effect of heart beat on the participants. The P-value of 0.91925 shows that whether the participant listened to music alone or watched the music video also had no effect on their heart beat. From receiving a P-value of 0.097638 it can be said that genre had nothing to do with the effect of blood pressure on the participants. The P-value of 0.91925 which is also insignificant shows that music or music video is not the cause of a change in blood pressure. For one genre a P-value of 0.332533 proves that listening to music alone and watching a music video is not scientifically significant when it comes to having an effect on heartbeat. The results from the experiment caused the hypothesis to be neither rejected nor accepted, therefore further studies are needed. MED

## A Comparison of the Amount of Sedimentation at Different Marsh Locations

Jason Compton <sup>W</sup>

### Abstract

Salt marshes are found all along river banks and the Chesapeake Bay and these ecosystems shape the way the coasts look today. This occurs due to the miniscule amount of sediments that build up with the help of marsh cord grasses, particularly *Spartina alterniflora*. A sign of sediments depositing in the marshes could show signs of the marsh building up on itself which shows that the marshes are making a natural barrier against the rise of sea level. Twenty regular compact discs were used to measure the marsh change in height of the sediment over a four-month period from June 15 to October 20. The marsh had completely changed shape since the first time it was visited. Twelve discs were lost in the marsh and the other 8 were almost impossible to find. One possible reason could be a combination of tidal, precipitation, and/or wind. Only three discs were recovered at the 5 meter mark, one at the 10 meter, and one at the 15 meter mark. The sediments were collected off the discs, dried and weighed. The first row of discs on the waterline weighed 0.82, 0.71, and 0.87 grams. The second row had three measuring 1.27, 1.19, and 1.29 grams. The third row had only one disc found but it had 31.93 grams of sediment while the final row contained one disc with 0.55 grams. One finding that is unexplainable was the large amount of marsh sediment that was on the disc at the 10 meter mark. Due to the last two test sites having one disc, they were not used in finding the P-value of the test. After the statistical test was run, it came to be that it was statistically significant ( $p < 0.0007$ ) for the first two rows. The null hypothesis could be rejected but since the final two rows were not used, the alternative hypothesis was rejected as well.

ENV

**It's a Bug's Life: The effects of various habitats on biodiversity throughout waterways differing in size.**

Alexandra Conolly and Ashley Brooks<sup>BG</sup>

**Abstract**

This study was conducted to compare the diversity among macroinvertebrates within varying habitats differing in size and flow. Macroinvertebrates are key indicators of water quality throughout waterways. As indicators, they are used to suggest the overall health, area, and location of a waterway. In this experiment, the researchers assembled leaf packs to be placed in the Mattaponi River and a tributary of Maracossic Creek located in central Virginia. The leaf packs were placed in three different habitats (wooded area, sandy area, and leafy area) throughout each location and left for three weeks. After three weeks, all leaf packs were successfully retrieved, and organisms were classified into families. A Shannon-Weiner Diversity index, a percent EPT test, richness counts, and a Diversity index were used to sum up the data collected. Numbers produced from tests were then used in a one way ANOVA for comparison. The p-values found from the ANOVA suggest that habitats do not have an effect on diversity, but flow and size of a waterway do.

ENV

## Can My Oyster Farm Save the Bay?

Caitlyn Cralle <sup>W</sup>

### Abstract

Since the time of John Smith the oyster population of the Chesapeake Bay has been decimated to two percent of its original population as a result of overharvesting, and disease. This decline has directly resulted in loss of habitat as well as poor water quality due to less filtering of the water. Large-scale efforts to restore oyster populations have shown minimal results. However, many people have started farming oysters themselves, using a number of different methods from bottom cages to surface Taylor floats. These small farms could increase the amount of oysters in the Chesapeake Bay, provide important habitat and could potentially improve the entire health of the water. This project compared the different modes of oyster farming on oyster growth rates and their impact as a habitat. In this project 222 oysters were placed into 6 cages: 3 floating and 3 bottom cages. The amount and types of organisms were recorded every week for three months. Initially, 10 oysters from each cage were measured; after three months a final measurement of 10 oysters from each cage determined growth. This experiment showed the bottom devices attracting a significantly larger amount of organisms, through a t-test with a p-value of  $8.69E-11$ . In regards to the diversity of organisms that used the devices as a habitats the top cages had a more diverse population, this is supported by a diversity level of top devices organisms was 0.919 which is much higher than the diversity level 0.575 in the bottom cages. The growth rates of the organisms in the two types of cages are extremely different, with the oysters in the top cages growing much bigger, this is supported by a t-test that showed a p-value of  $2.39169E-09$ . Both types of devices are very important for the Chesapeake Bay for completely different reasons.

MAR

# **A Comparison of Radish and Lettuce Growth in Aquaponics Systems Subjected to Different Feeding Ratios**

Megan Daiger <sup>w</sup> ★

## **Abstract**

Aquaponics is the utilization of hydroponics and aquaculture in a re-circulating system. It is a form of sustainable agriculture that rears both fishes and plants in a tightly enclosed system. Aquaponics may soon be a dominant means of agricultural production, especially in third world countries, as it conserves water, space, and other resources. The experiment tested the effects of fish feed amount to nitrogen and phosphorous levels in the fish tanks which in turn was compared to growth rates of lettuce and radish seeds. It was hypothesized that more fish feed would yield a greater production of nitrogen and phosphorous yielding a greater growth rate in radish plants which are known for needing higher amounts of nitrogen. In turn, it was believed that less fish feed would result in greater lettuce growth rates as they normally need less amounts of nitrogen for healthy growth. The test showed no significant results with respect to lettuce and radish growth in systems with different feeding amounts, though the trends still followed the hypothesis. In addition, phosphorous levels were not found to be significant when compared to fish feed. However, one p-value was accepted which compared feeding ratio to nitrogen level. Conversely, interesting observations were made suggesting that perhaps with slight alteration of the experiment, a null hypothesis may be rejected. The perfection of the aquaponics method could be extremely vital in countries with diminished resources as well as largely developed countries that are slowly depleting their agricultural availabilities.

ENV

## Factors Attracting *Vespidae* to a Food Source

Emily Dawson <sup>BG</sup> ★

### Abstract

Tested here was the affect that color had on yellow jacket (*Vespidae*) feeding habits. The composition of the *Vespidae*'s compound eye revealed that the *Vespidae* could indeed see color. Based on the compound eye, the yellow jacket should be able to see in the blue-green spectrum the best. Multiple levels of nectar, sugar-water, solutions colored with food coloring were presented to the *Vespidae* at red, blue, yellow, and one with no color. The solutions were set up outside in a natural habitat. As a result, the red food colored sugar-water solution was consumed the most followed by the blue, yellow, then the control with no color added. This was backed up with a one-way anova statistical test that showed a significant p-value of  $1.7 \times 10^{-8}$ . The results are contrary to what was expected. During the experiment observations of ants in and around the nectar and *Vespidae* were made as well. This information was then used to explain the results and the relationship between the yellow jackets and ants was investigated. A significant relationship was exposed. Other variables including weather, evaporation, temperature, ultraviolet light, nectar amounts and contents, and availability were ruled out through secondary testing and further investigation. What was left to explain the results was based on the predator prey relationships between the yellow jackets and ants and food availability as well as the *Vespidae*'s diet. Therefore, in conclusion, the *Vespidae* would have ideally shown a color preference of blue; however, because the ants also had a color preference of blue, to avoid the ants and stick to their sugar-based summer diet, the *Vespidae* chose to consume the red nectar.

ZOO

## **Are You Scared Yet?: The Effect of Scary Movies on the Human Bodily Response**

Kennedy Deem <sup>BG</sup>

### **Abstract**

Scary movies are a large part of American culture, millions of dollars go into celebrations of horror and cinematic films every year. But is there a correlation between these film types and our unconscious human body response? For this test four categories were selected for comparison; humans gone wrong, paranormal, childhood derived fears, and blood and gore; these categories were used to compare and contrast to see which would cause the largest amount of human bodily response. Each category contained four clips of varying age and scariness. To compare the different categories and clips, the study used heart rate and systolic blood pressure (which measures the reflex of the heart muscle pressing blood into the chambers) to quantify the human bodily response to different horror film clips. To complete this effectively one hundred and sixty tests were completed using random selection. Tests measuring for the dependent and independent variables were run before and after each clip to see the change. After obtaining results the tests concluded that there was no significance in the varying levels of clips and categories in terms of the human bodily response. Due to a lack of significance it is then inferred that there is no significant difference in human bodily response among different types of horror.

PSY

## **The Prevalence of Three Invasive Species in Evergreen vs. Deciduous Forests**

Alexandra Dore <sup>G</sup>

### **Abstract**

Invasive species from all over the world frequently end up settling in areas they are not naturally occurring and bringing many chaotic effects down on the natural habitat: niche displacement, competitive exclusion, mutualisms and extinctions. As popular knowledge of invaders becomes more widespread, there are more preventative measures put up against invasion, though it happens daily. Though these factors play a large role in invasion, this study explores the idea that the establishment of a forest determines its risk of invasion. Four testing sites were chosen in James City County and New Kent County, Virginia, of which, two were deciduous based and two were hardwood based. Each coordinate was searched for *Hedera helix*, *Lonicera japonica*, and *Ligustrum sinense*. For every forest, a comparison was made between each plant's inner and outer coordinates. The total number of invaders per surveyed site, organized by the forest's establishment of being deciduous or evergreen, was broken down into its location within the forest. The results show that the outer edges of less established evergreen forests are more easily invaded than any part of a deciduous forest. These results support the idea of vertical as opposed to horizontal growth.

ENV

## **Kids Like Sugar: The Correlation of Nutritional Choices with Age and Level of Education**

Cassandra Drain <sup>G</sup> ★

### **Abstract**

Obesity is a pandemic all across the world with nearly 10% of men and 14% of women having the disease. In 2012, the American Heart Association found that about 17% of America's youth are obese, and around 34% of adults in America are obese. In youth, humans prefer intense sweet and salty flavors, and this preference does not begin to fade until close to the end of puberty. In a report to Congress, the Food and Nutrition Service showed that education on nutrition could change the obesity trends in America. This leads to the question of whether or not education in general has an effect on the nutritional choices that people make. A survey was given out assessing the subject's age, gender, and level of education. The two main comparisons made were the difference in results of adults and teens, and then the difference in results of adults with college degrees and adults without college degrees. In the comparison of adult and teen respondents, the adults made overall healthier choices than the teens. In the comparison of adult respondents with college degrees and the adult respondents without college degrees, the adults with college degrees made healthier choices than the adults without college degrees. Children prefer to consume more sugar than adults do. Implementing nutrition education into schools could change the way humans eat and their health outcomes in the future.

MED

## **An Experiment in the Removal of Bio-fouling Organisms from Oyster Aquaculture Cages**

Morgan Duke <sup>G</sup> ★

### **Abstract**

Bio-fouling is a major issue in the Chesapeake Bay and in world aquaculture today. Bio-fouling occurs when algae, barnacles, and other organisms attach and grow out in aquaculture farms. When organisms such as sea squirts, barnacles, and algae take over the cages, the oysters are not able to breathe and they cannot get the nutrients that they need because water cannot flow through the cage. Ten oyster cages were set out in the Rappahannock. Every week the cages were dipped, a 10 in. x 10 in. square was measured to see how much of the bio-fouling organisms were killed by the treatments. The ice water treatment was the most effective at removing the bio-fouling from the oyster cages. These treatment data were statistically analyzed using a single factor ANOVA, the p-value=5.1E-05 indicates that the treatments were significantly different. The null hypothesis can be rejected, because the data were significantly different than the control. When the amount of bio-fouling that was removed had been measured, the cages were not brushed off to see if any organisms were killed but did not fall off so that could make the data more accurate.

MAR

## **The Effects of Chlorine on the Growth Rate of *Hydrilla Verticillata* and *Ceratophyllum***

Jessica Flester<sup>BG</sup>

### **Abstract**

This paper explains a unique method of measuring the effects of chlorine on one native plant species and one invasive plant species. The purpose of this study was to test whether the dumping of pool water into natural bodies of water will have a positive effect on the takeover of invasive species. The idea concerning this experiment was that because invasive species are seen as superior to native species, the dumping of chlorinated pool water would affect native species negatively while have virtually no impact on the invasive species. The native species used in the experiment was *Ceratophyllum*, and the invasive species used was *Hydrilla Verticillata*. The plants were put into six bins, each assigned to a different parts per million of chlorine. The bins also had lights suspended above them to mimic the sun and tubes in the water which were connected to an air pump. This kept the water from becoming stagnant. Their masses were measured for eight days. The invasive species lost 85% of its original mass overall, while the native species only lost 5% overall. With a p-value of less than  $2e-16$ , the difference in species had the greatest impact on the growth of the two species, rather than the levels of chlorine. Results did not support the theory that invasive species are superior to native species, however the invasive species was in a worse condition going into the experiment. The results of this experiment may contribute to solving the problem of invasive species in the environment.

ENV

## The Effect of Ocean Acidification on Oyster Growth

Elizabeth Flynn <sup>w</sup> ★

### Abstract

One of the biggest environmental concerns today is global warming and carbon dioxide emissions into the atmosphere. More carbon dioxide has been released into the air, and it doesn't just disappear when it gets there. It enters the carbon cycle and gets stuck in carbon sinks. One of the biggest, and most important of these sinks is the ocean. With excessive amounts of carbon entering the oceans, the delicate chemical balance that the ocean naturally has is thrown off and the water becomes more acidic. These acidic conditions have been proven to affect some organisms, mostly corals, already. This experiment looked at how acidic conditions would affect the growth of another calcifying organism, the oyster. This experiment focused on how oysters would react when exposed to acidic conditions they might face in the near future if ocean acidity continues to lower the pH of ocean waters. This experiment was set up using tanks of different water pH; a control tank with pH 8.2, a more acidic tank with pH 7.2, and the most acidic tank had pH 6.2. This experiment found a highly significant p-value of 2.46E-08 when comparing the large and small oysters in terms of length. When comparing the length of the oysters in different water pH's, the p-value was not significant. When comparing the small and large oysters in terms of mass, the p-value was not significant. When comparing the length of the oysters in different water pH's, the p-value was significant with a value of 0.025424. The fact that small oysters were found to react more adversely than large oysters could come to damage the health and economy of the Chesapeake Bay area by potentially reducing future amounts of oysters in the Bay.

MAR

## **Hit Somebody: The Effect of Helmet Padding Styles on Impact Resistance Levels**

Cory Fox<sup>BG</sup> ★

### **Abstract**

This study looks at the effect of helmet padding styles on impact resistance levels. Concussions are a very common and dangerous injury to any sports player. Helmets are meant to protect, but some work better than others. The newest helmets are usually the most expensive, so most schools cannot afford them, instead opting for the less expensive and usually lower quality. The experiment was designed to answer the question "Which helmet used by high school football programs provides the best protection?" There are three main types of helmet that are used in the football program, each a different generation. The oldest that was tested is the Riddell, the middle was the Schutt, and the newest was the Revolution. Three helmets of each brand were tested for a total of nine helmets with five tests a piece. The experiment took a variation of the NOCSAE drop test and applied it to test impact resistance and compare to see which helmet brand gave the best protection. The data suggests that the newest, the Revolution, has the lowest impact force registered, and therefore affords the best protection available. A one-way ANOVA statistical test was run with a p-value of  $3.82 \times 10^{-13}$ . This suggests a highly significant difference in the type of padding and the impact force resistance level. A multiple comparison with a Bonferroni correction was run to see how individual helmets tested against each other. With this, the data suggests that the only truly significant difference was between the first and third generation of helmets. This experiment can have real-world applications by helping schools pick the correct helmet when starting a program or renewing equipment. And lessen injury rates in high school players as they choose to use the safer helmets.

PHY

**A Tag and Recapture Study of Blue Crabs, *Callinectes sapidus*, in the Rappahannock River, a Tributary of the Chesapeake Bay**

Chris France and Brandon Vidra

**Abstract**

The purpose of this research was to find out if male blue crabs exhibit site fidelity more than females. Site fidelity is when an organism repeatedly returns to a specific territory in order to spawn or feed. Site fidelity is important because it can show where crabs tend to return to feed or spawn. Knowledge of this can help watermen better understand the movement of crabs and where they will be. This also allows scientists to be able to better study crabs. Fifteen standard crab pots were placed in concentric lines in an area roughly the size of a football field. The crabs that were captured were then marked with green or blue nail polish for males or females, respectively. Data was recorded in a field notebook, and then was transferred to a computer to be further analyzed. This study will help watermen and scientists to better understand where crabs will be located throughout the year. The presence of blue crabs can help determine water quality for a particular area. Over the tested time, 287 crabs were caught in total (mostly male), and 35 of them were male recaptures. No females were recaptured. Because of the high number of males that were caught and recaptured, the p-value was very significant ( $7.6 \times 10^{-4}$ ).

MAR

## **Comparing the Effectiveness of Living Shorelines in Preventing Erosion**

Meghan Frere <sup>W</sup>

### **Abstract**

Wetlands are integral to the overall health of the Chesapeake Bay, one of the state's most vital ecosystems. The Bay's marshes provide a habitat for marine and terrestrial organisms, and can also serve as a buffer for pollution and erosion. Because of these vital functions performed by wetlands, their degradation has become an increasingly prevalent issue. Shoreline erosion, one cause of wetland degradation, has become a serious problem in the Chesapeake Bay due to increasing sea level rise. There are many different anthropogenic responses to shoreline erosion, including shoreline armoring and living shorelines, a relatively new technology. Living shorelines serve as an alternative to traditional shoreline armoring devices. The purpose of this study was to compare the effectiveness of different types of living shorelines and natural shorelines in preventing erosion and maintaining the coastal wetlands that they protect. The study also examined net erosion and deposition before and after a major storm event, Hurricane Sandy. The study was completed by measuring the sediment change at each site through a series of shoreline profiles. A living shoreline without weirs, or openings, was found to be effective at preventing erosion during a major storm event, Hurricane Sandy, and was significantly more effective at preventing erosion than a living shoreline with weirs and a natural shoreline at the same site. In a lower erosion environment, a living shoreline with weirs was found to be effective in preventing erosion as well. These results would indicate that a living shoreline, depending on the site and design, could serve as more ecological, yet still effective form of erosion control, protecting and benefiting one of the Bay's most critical ecosystems.

ENV

**The Effects of Global Warming on the Growth Rate of the  
Chesapeake Bay Oyster, *Crassostrea virginica***

Sam Friday and Nick Whay<sup>W</sup>

**Abstract**

The Chesapeake Bay oyster, *Crassostrea virginica*, is the primary filter for the Bay, removing impurities and improving clarity. They also provide shelter for smaller organisms. Over the last several decades the Chesapeake Bay oyster has been directly threatened by human activity, which has drastically reduced its population. Another threat to the oyster is global warming and ocean acidification. Ocean acidification is the continued decrease of Earth's oceans pH by anthropogenic carbon dioxide (CO<sub>2</sub>) from the atmosphere. Previous studies on the effects of global warming on shellfish show that increased water temperature slightly increases oyster growth rate while ocean acidification deteriorates their shells. This experiment tested the affects of increased temperature and decreased pH on the growth of Bay oyster spat. By manipulating the water conditions in a nine-week study, oysters were subjected to the projected Bay conditions (for temperature and pH) 50 years from now. The growth rates of four batches of oysters, each subjected to different conditions: A control group; A group with only increased temperature; A group with only decreased pH; A group that combined the changes in pH and temperature. They were tested over a period of nine weeks, but the growth recorded was still insignificant. However, the temperature group and the pH and temperature group both died before the experiment was over, suggesting that temperature can also be detrimental to oyster health. While the control group fared the best, the strictly pH group also survived the full trial time, suggesting that oysters are more resilient to a future pH decrease than a (relatively) quick temperature increase.

MAR

## **The Effect of Age on Thermoregulation during Exercise in Horses**

Ashleigh Gaylord<sup>BG</sup>

### **Abstract**

A challenge in defining what happens as horses age is the inconsistency in how they are treated and exercised. The inconsistency ranges from different feed types and routines and how much exercise the horse is getting. However, we can see that their ability to thermoregulate is decreased, which means that older horses reached higher body temperatures faster than young horses, and at lower intensities. Thermoregulation is a key term in this study, and can be defined as an animal's ability to maintain a stable body temperature. After initial temperature is taken directly before the test, the equine subjects run a half-mile at a full gallop. As soon as the horse is caught, temperature will be taken again. There will be no time to cool down. After running a linear regression on the data I collected, a p-value of  $9.811 \times 10^7$  was produced. The same test produced an r-squared value of .3218. As the horse's age rises, the change in temperature tends to rise.

ZOO

## **The Effect of Sunspot Frequency on Volcanic Activity**

Chad Glenn<sup>BG</sup>

### **Abstract**

Sunspots are a representation of the amount of solar wind that is coming to Earth at any given time. This solar wind effects weather patterns in many different ways; however, its effect on volcanoes is unclear. After retrieving data of volcanoes with VEI ratings of four or higher in the past 100 years as well as sunspot totals for the past 100 years, a correlation was run. A positive correlation coefficient would have shown that an increase in the number of sunspots would cause an increase in the number of explosive volcanoes, which was expected. However, there was no significance in the data, which came out with a slightly negative correlation coefficient.

# **The Effectiveness of Macrophyte and Bacterial Treatment on Sewage for Nitrate Removal**

Alexys Gray <sup>G</sup> ★

## **Abstract**

The health of the Chesapeake Bay has suffered considerably due to nutrient inputs from anthropogenic eutrophication. This leads to hypoxic and anoxic dead zones across the bottom of the Bay, virtual deserts, that cannot sustain organisms such as blue crabs, oysters, and rockfish. These organisms are vitally important to the Maryland and Virginia fishing industries as well as the livelihood of local watermen along the Bay. This study seeks to determine the relative effectiveness of nitrate removal from wastewater septic treatments by floating macrophytes and bacteria in biobaskets, respectively. Artificial drainage fields were created to mimic those of a conventional septic system. A control group consisting of a typical septic gravel drainage bed was used as a comparison. The wastewater used was a mixture of water and chicken manure that had a concentration of 1 ppm of nitrates. Over the entire three-hour treatment period, the control system removed an average of 45% of the total nitrates present in the wastewater. The biobasket system removed an average of 78% of the nitrates present. The floating macrophyte system removed an average of 82% of the nitrates present in the wastewater. This experiment determined that both the pond and the bio basket matrix were effective in nitrate removal.

ENV

## **The Effect of Conductors on Gaming Controller Buttons**

Brandon Hale <sup>W</sup>

### **Abstract**

Electronic buttons are used in almost all electronic devices including cell phones, keyboards, radios, and even coffee makers. An important use of electronic buttons is in video game controllers. Video game controllers are frequently dependent on electronic buttons and the buttons' responsiveness. One might wonder if the conductors used to complete the circuits of video game buttons would yield greater results for responsiveness and electronic button accountability. If video game buttons could be more responsive, then video game market and economy could be stimulated with faster and more exciting video games. Different conductors might also be more accountable and for longer periods of time. To determine this, three different controllers were tested with one of their electronic buttons in each. The conductor from the button in each controller was removed and tested with four other materials: Teflon, Steel, Aluminum, and Copper. The controller was tested with each conductor in the same button with a lagless cathode ray tube monitor and a camera. The button was completed ten times with each conductor and recorded with a 60 frames per second camera on both the controller and the monitor. A computer was used to power the controller, recognize button input, and display the controller's input. The experiment found the different conductors used in the electronic buttons did not have varying results. Teflon and Steel did not allow for the electronic button to have any response while Aluminum and Copper had responsiveness very close in number to zero frames. The silicon used in the controllers' original buttons were not statistically tested or recorded, but appear to be the best method of utilizing electronic buttons.

EGR

## **Physics of Baseball Bats**

Bradley Hudson and Nicholas Wind <sup>W</sup>

### **Abstract**

Baseball is a huge sport in America. Nothing in baseball has caused more arguments than the discussion of bats. Many new materials have been tested and used since the original bats made out of different types of wood were made. Although new materials like aluminum and composite were said to be better due to the enhanced physics of the bat, people were still skeptical. Studies done in the past of the different materials of the bat and their effects on the baseball when it was hit have been done, but results varied. The diversity of the results from the studies really inspired the experiment. Millions of people around the world play baseball and want to improve their game, however, they do not have a clear answer to a very important question of the game. This study tested the performance of composite, aluminum, and wooden bats. Baseballs were hit to find the average distance and speed of the ball off the bat. The data was compared to the theoretical range of projectile motion of the baseball with and without air resistance. This study found that in distance, composite was the best, followed by wood, and then aluminum. In speed off the bat, wood and composite average speed were almost identical, but wood came out on top. Without air resistance, theoretically distance when the ball is hit at a 45 degree angle proved to be the best. With air resistance, the distance of the ball was best at 30 degrees for both the aluminum and composite bat, but not the wooden bat. Once again, the aluminum bat was the worst in performance. Overall, the performance of the wooden bat was superior and statistically significant. Baseball players of all ages can you use this information to pick the bat they want to use for optimum performance.

PHY

## **Bacteria in Public Restrooms as Compared to Bacteria in Private Home**

Heather Hundley <sup>W</sup>

### **Abstract**

This study tested the percentages of bacteria on the sink handles in five public and five private locations. Due to the fact that many public locations have cleaning requirements and are typically required to be cleaned daily, it was hypothesized that public places would contain fewer bacteria than private locations. However, the results of this study showed nearly equal overall percentages and had an insignificant p-value. However, in the individual results, there was a wide range of differences in percentages between just the private locations and just the public locations. This could be due to differences in cleaning solutions used, the number of people in each location, or when the sinks were last cleaned. Also, all of the private locations showed similar types of bacteria, while all of the public locations showed different types of bacteria. This could be due to the fact that all of the public locations sold different types of products. Due to the different types of bacteria, it might be more likely for people to pick up harmful bacteria that they are not used to from public sink handles.

MED

## **The Effect of Salinity on the size of *Fundulus heteroclitus* scales**

Sarah Ipson <sup>w</sup>

### **Abstract**

There are many environmental factors that affect the size of fish, their scales, migration and eating habits. Fish have certain preferences to the temperature and salinity of the water and nutrient amounts that are in the water as well. What was looked at in this experiment was if salinity had an effect on the size of fish scales. Former studies have shown that the size of the scale is relative to the size of the fish and the scales grow as the body of the fish grows the scales grow in size but it does not gain a greater number of scales. In the experiment performed, the fish, mummichogs, *Fundulus heteroclitus*, were tested from multiple tributaries of the Rappahannock River. At each location multiple trials were tested. At each location a different number of mummichogs were caught depending on the method of catching and if the day was good or not. At each location after catching the fish they were scraped of a few scales and tested for size. They were also measured from the nose to the tail, and also measured from the dorsal fin to the lower widened part of the stomach. After having collected and recorded the data it showed that the fish scales grew directly with the size of the fish, but not necessarily with the salinity of the water, although this may have just been due to the sample size of mummichogs and the areas that were tested.

MAR

## **The Iron Noose: The Affect of Dissolved Iron on the Respiration of Fish**

Dakota Johnson and Jax Ross <sup>BG</sup> ★

### **Abstract**

Iron is a known toxic heavy metal. High concentrations of iron are polluted into marine ecosystems by anthropogenic activities like construction, but mainly through coal and metal mining techniques. Iron pollution can affect all organisms in the ecosystem because it is a dietary need for most fauna. Therefore, too much or too little can disrupt the ecosystem. This study conducts an experiment on the effect iron has on the gill rate, or respiration rate, of the model species *Pimephales promelas*. The experiment includes five levels of iron and five levels of dissolved oxygen that were tested in junction. The five levels of iron concentration ranged from 0 parts per million (ppm) to 450 ppm. The five levels of dissolved oxygen ranged from 0 ppm to fully saturated water at 12 ppm. Five replicates were done with 25 fish in each trial. Statistical testing of a multiple linear regression of the results determined a p value that suggested the iron affected the gill rates of the fish while oxygen levels did not show an affect. These results suggest iron has a physiological effect on the respiration of the fish that may trump the affect of oxygen availability in anoxic conditions. Iron is filtered out of the water through a fish's gills and can build up on the gills of a fish. Over time, a buildup of iron can cause necrosis of the cells in the gills of the fish; suggesting for the cause of the higher respiration rates and stress level on the fish involved.

ENV

## Analyzing Earthshine with a Ground-Based Telescope

Cullen Johnson<sup>G</sup>

### Abstract

Spectroscopy is the technique used to separate wavelengths of light that are emitted by a substance at different levels of energy to determine the characteristics of that substance such as chemical composition, temperature, and mass. Light reflected from Earth's surface to another object is known as *earthshine*. The spectrum of *earthshine* was measured in an effort to determine Earth's elemental composition by looking at it as if one was outside of Earth's atmosphere. Ground-based telescopes were hypothesized to be capable of measuring the absorption spectrum of *earthshine* that can be analyzed for the presence of biomarkers. The telescope at the University of Virginia's Fan Mountain Observatory and the Fan Observatory Bench Optical Spectrograph (FOBOS) were used in this study. The telescope and spectrograph successfully measured multiple spectra for the dark side of the Moon, the light side of the Moon, and the sky that surrounded the Moon. Earthshine spectra can ultimately be compared to the spectra of other planets to determine similarities and ultimately advance the search for other inhabitable planets.

## **Settlement of Juvenile Blue Crabs, *Callinectes sapidus*, in SAV vs. Non-SAV Areas**

Jacob Johnson<sup>G</sup>

### **Abstract**

Blue Crabs, *Callinectes sapidus*, go through a predictable series of developmental post-larval stages that occur as they enter settlement habitats. In order to go through these stages the larvae must find a safe environment. SAV beds are the most suitable environments for these larvae to start developing, they are full of nutrients and provide plenty of protection, but these once abundant grass beds are now being depleted. The depletion of the SAV beds has the potential to negatively affect the development of juvenile blue crabs. Every week from July 30<sup>th</sup> to October 8<sup>th</sup> collectors were deployed by kayak at two different locations in Mobjack Bay, one in an SAV area and another one in a non-SAV area to test for the correlation between crabs and SAV beds. Water samples were taken at the beginning of each week or after it rained to test for a change in salinity. The traps used were composed of filter material and PVC pipe. The results indicated that there was a strong correlation between juvenile blue crab settlement and SAV beds. So the hypothesis was accepted Juvenile Blue Crabs preferred to settle in SAV areas as opposed to non-SAV areas. SAV is crucial to the development and success of the blue crab population. Blue Crabs are a crucial part of the Chesapeake Bay ecosystem and without the SAV the this species could be at risk.

MAR

**A Comparison of the Filtration Abilities of the Chesapeake Bay Oyster,  
*Crassostrea virginica***

Megan Knight <sup>w</sup> ★

**Abstract**

The well known oyster of the Chesapeake Bay, *Crassostrea virginica*, has remained a vital source of filtration for the Bay throughout its extensive history. Previous studies have shown that oysters have one of the highest filtration abilities among other bivalves. They have been known to filter solid particles, which has historically cleaned the water of the Chesapeake Bay. This study tested the ability of oysters to filter the chemical components of the water. This study compared the filtration rates of oysters and a man-made filter. Four tanks compared a different method of filtration: a tank with eight oysters, a tank with four oysters, a tank with a man-made filter, and a tank without a form of filtration. Each tank contained eight to nine mummichogs. To compare the filtration abilities of oysters to the filtration abilities of man-made tanks a twelve day time period per trial (three total trials) was conducted; this study observed and recorded the pH, Dissolved Oxygen, and the levels of nitrates and phosphates of four tanks with fish filled with fifty quarts of water from the Rappahannock River. Results showed similar trends in D.O. between the non-filter and oyster tanks with the filter tank showing the greatest decrease in D.O., although statistical results were insignificant. The pH values for the filter and oyster tanks stayed steady throughout the test, while the non-filter showed a marked decrease in pH. Statistical tests comparing pH between tanks was also insignificant. With this new information pertaining to the amazing filtration skills of the Chesapeake Bay Oysters the opportunity for oysters, and other bivalves, to replace man-made filter that can consume a significant amount of energy and money.

MAR

## **The Effect of Turbidity on Fish Maturation**

Laura Koontz<sup>BG</sup>

### **Abstract**

This study looked at the effect of turbidity on the health of Ruby Red minnows. When conducting this experiment twenty fish were given identifying, different fin cuts and weighed. After being kept in either a turbid tank or control tank for two weeks the fish were weighed again. The null hypothesis in this experiment was that the fish weight would be the same tank to tank. The alternative hypothesis was that the fish kept in a turbid condition would have a decreased weight after two weeks. The thinking behind this was that the increased turbidity would have a negative effect on fish health due to decreased gill function and decreased visibility leading to feeding problems. Results of this study did not show any correlation between turbidity and weight change due largely in fact to the food that was given. Instead of receiving fish food flakes based on the number of fish surviving, as there was high mortality in the turbid tank, the fish were given a tablet that slowly dissolved releasing food. As a result, the remaining fish received increased food therefore gaining weight in spite of the conditions. This could possibly mean fish dealing with high turbidity and dead zones in the wild could undergo evolution. The fish that survive these conditions in the wild will give birth to babies who have the capability to withstand high turbidity, therefore, creating a new breed of fish that can survive the ever evolving Earth.

ENV

## **Do Shallow Water Habitats Serve as a Refuge for Prey Species in the York River Estuary?**

Simone La Guardia <sup>G</sup>

### **Abstract**

The Chesapeake Bay provides essential habitats and refuge for juvenile fish and small prey species. One of the most common refuge habitats is submerged aquatic vegetation, i.e. grass beds, unfortunately these habitats are endangered due to pollution, invasive species, disease, and turbidity. Another habitat is shallow water habitat, which provides essential habitat for many small and shallow juvenile fish. In order to collect samples for this research, seining nets were fished in shallow water environments during September. The sample sites varied from four different locations on the York River. During the seining trips the average length of the prey fish were 6.96 cm long, and the average length of predator fish were 8.92 cm. During these trips an average of 41 prey fish species were caught, and an average number of 4 predator fish species were caught. Out of the total seining trips 769 different prey and predator fish species were collected. The significance between the average length of prey species and predator species was not significant. The difference between prey fish species and predator fish species is significant though and that that utilize the shallow water habitat more than predator fish species. This allows my hypothesis to be accepted and my null hypothesis rejected.

MAR

## **The Effect of Stocking Density on Red Nile Tilapia Growth and Survival Rates**

Elijah Lewis <sup>W</sup>

### **Abstract**

This experiment was undertaken to explore the scientific relationship between the stocking density of the Red Nile Tilapia, and its effect on both the growth and survival of the fish. This experiment has its roots in aquaculture, a multi-million dollar industry comprised of raising seafood for human consumption and use. The tilapia is a very common fish to be raised, due to the ease of care, excellent taste, and high protein concentrations. The experiment focused on how to maximize the size of the fish the cheapest and easiest way. Four forty gallon tanks were set up, complete with heaters and filters, and fingerling tilapia were placed in each tank in increasing amounts of five, ten, fifteen and twenty fish per tank. Over the next seventeen weeks, measurements were taken of each fish in each tank, and they were averaged for each tank. At the end of the experiment, the tank that showed the largest growth was the tank with fifteen fish, followed respectively by the tank with ten fish, the tank with twenty fish, and the tank with five fish. There were no significant deaths in any of the tanks, with only two fish dying due to unrelated causes, one in the twenty fish tank, and one in the ten fish tank. The results of this experiment and the conclusions drawn led to the alternative hypothesis for growth being accepted, and the null hypothesis being rejected. The alternative hypothesis for survival was rejected, and the null hypothesis was accepted. The main purpose of this experiment was to find an optimal stocking density for Red Nile Tilapia, and this was achieved, finding that the best stocking density for them is a moderate density. The importance of this conclusion is that the aquaculture industry could cut down on waste by finding a midpoint for tank stocking to maximize the efficiency of growth, leading to more food available, at a cheaper cost. ZOO

# The Correlation Between Barometric Pressure and Lunar Phase on the Overall Catchability of the *Ictalurus Furcatus*

Travis Lipscomb <sup>BG</sup> ★

## Abstract

Throughout history fisherman, commercial and noncommercial, have been trying to determine the superlative conditions at which the catch-ability of their target species would be highest. Considering the amount of time and money acquired by this industry annually it is a very valuable question worth answering. In this experiment the reader will observe a study conducted in order to determine different lunar phases and barometric pressure and their correlation to the catch-ability of the *Ictalurus Furcatus* in the Mattaponi River. A team of 5 anglers used hook and line method with bait consisting of eel and squid, and had an average of 50 sink hours per day. The readers will inevitably find this experiment to not show a direct link in effects because of the wide range of unknown variables; however they will find an equation that can theoretically predict the amount of Blue Cats that will be caught with days away from a new moon. My hopes are to encourage others to do their own studies and discover their own equations to maximize the catchability rates for their own specific target species. I also hope to help commercial and recreational anglers know that it is more likely to hook their prize with days closer to the presence of a new moon and be able to better optimize the catchability of the Blue Catfish and have a more effective CPUE.

ZOO

## **PCB Concentrations Correlation to Parasite Infestation in the Rappahannock River**

Levi Lott<sup>G</sup> ★

### **Abstract**

Polychlorinated Biphenyls (PCBs) are compounds formed by the direct chlorination of biphenyl that have a tendency to bioaccumulate and biomagnify in both fresh and salt water ecosystems around the world. PCBs are a proven carcinogenic in marine organisms as well as an endocrine disruptor. While both freshwater and saltwater fish are exposed to PCBs, primarily through biomagnification, the North Atlantic Ocean contains 50 to 80% of all PCBs in the world environment. Considering that PCBs sink to the bottom and are stored in the sediment, and that annelids are deposit feeders, it is expected that Atlantic croaker will suffer from high exposure to PCBs. This study was designed to look for external signs of negative PCB effects in croaker and other bottom feeders, and also external parasites as an indicator of fish health. The croaker examined for parasite infestation were collected at depths from 5 to 10 meters in the Rappahannock River, ranging from the Urbanna Creek to the Route 3 Bridge during August and September of 2012. Data for average PCB concentrations in marine organism tissue in ppb was collected from the Virginia Department of Environmental Quality (DEQ). The data used for this study ranged along the Rappahannock River from Tarpley Point to the Route 3 Bridge. The parasite data from Urbanna Creek to the Route 3 Bridge were conclusive ( $1 \times 10^{-5} < p < 1 \times 10^{-4}$ ), while the PCB data from Tarpley Point to the Route 3 Bridge were inconclusive ( $p = 0.76$ ). This study can not determine the independence of parasite infestations and PCB concentrations due to resource limitations for analysis of PCB data.

ENV

## Comparing Open Pollinated and Hybrid Vegetables for Productivity and Quality

Sam Markwith<sup>G</sup>

### Abstract

It is important to plant open-pollinated seeds to preserve their growing qualities, unique flavors, and genetic diversity. By looking at the yield of vegetables produced from hybrid seeds, and also at the dwindling number of open-pollinated seeds available for purchase, it becomes apparent that hybrids are increasingly preferred by gardeners. Because of this, our seed bank supply is dwindling. In this experiment productivity and taste quality of both hybrid and open pollinated seeds was compared. The cucumbers were planted along a trellis with hybrid on one side and open-pollinated on the other; the tomatoes were planted in the box with hybrid on one side and open-pollinated on the other and with tomato cages around the plants. The tomatoes contracted early blight and were therefore replaced with radishes, planted in a similar manner. I found that in both vegetables the hybrid plants out produced the open pollinated, but the open pollinated performed better in taste tests. Preserving our seed bank is one of the most important things we need to be doing or else there will be no genetic diversity and therefore no backup plan in case something goes wrong, however, hybrid seeds are still needed to support our growing population.

BOT

## **Paper: Recycling, Landfills, How about Marshes?**

Andi Mayer<sup>w</sup> ★

### **Abstract**

Paper paper everywhere, nor any place to put it. Paper production is on the rise, landfills are overflowing, and recycling methods are messy. People have taken a toll on the environment, with little return. This study explains a possible solution. Wetlands are proven to harbor pollutants, protect the coastline, are an important habitat for marine and terrestrial organisms. They are threatened by developments and are being destroyed, then replaced by incompatible man-made marshes. These man-made marshes are lacking in nutrients and do not replicate the benefits of natural marshes. How could all of these problems be fixed? If paper was put into man-made marshes instead of landfills or recycling facilities, it could reduce the amount of waste and possibly increase the nutritional value of the soil in man-made marshes, therefore saving our important wetlands. This study added paper to a landfill simulation, man-made marsh simulation, and a natural marsh. The paper sat for four months to decompose. In conclusion the man-made marsh decomposed paper better than the landfill and the natural marsh. There was a p-value of 0.011489 comparing the amount of paper decomposed in the three sites. The second tests added paper to the man-made marsh for a month to see if it would enhance the soil quality. When paper was added to the man-made marsh soil, there was an increase in soil quality. Although this was not significant, it could easily become significant if the soil sits for longer periods of time. If paper was added to the depleted, man-made marshes it could, minimize the size of landfills, cut out messy recycling processes, increase the quality of the marshes, strengthening them and restoring the Chesapeake Bay.

ENV

## **The Efficiency of Green Roofs in Southeastern Virginia**

Madison McCann<sup>G</sup>

### **Abstract**

Environmental issues in Southeastern Virginia including high levels of energy consumption, urban heat island effect, storm water runoff/pollution, and carbon emissions have been exacerbated by the use of inefficient building materials and designs. The use of metal and tar roofing materials has increased the ambient air temperature around buildings and the internal air temperature within the buildings. This increase in temperature has increased the need for heating and cooling in buildings, resulting in high levels of carbon emissions and overall energy consumption. Green roofs optimize the energy efficiency of buildings by reducing the ambient air and internal temperatures of the buildings, therefore decreasing the need for high levels of energy consumption through heating and cooling. By employing green roof technology storm water runoff is absorbed by the layers of plants, soil, and drainage membranes; reducing the speed at which the water travels off the roof and into local waterways. The peak internal temperatures of three mock buildings with three different roofing materials were monitored in Mathews County. Green, Tin Sheet, and Tar Shingle (control) Roofs were compared throughout the months of August to January to monitor the temperature fluctuations of each building throughout different seasons. The objective of the study was to find whether the previously studied energy efficiency of green roofs was effective in the lower latitude and extreme climate of Southeastern Virginia. The results of this study were that the Green roof was significantly effective in the extreme climate seasons of summer and winter but did not have a significant effect in the months of fall. The Green roof was significantly more effective in reducing energy demand than the Tin Sheet and Tar Shingle (control) roofs.

ENV

## **The Effect of Chlorine on the Formation of Fecal Coliform Colonies in Common Water Sources**

John Archer Minor<sup>G</sup>

### **Abstract**

Fecal coliform and other bacteria have always been a problem when it comes to water that humans have direct contact with on a daily basis. We now realize that unclean water and cholera are the biggest killers in the world, causing the death of over 4000 people every day. In response to these bacteria, humans have developed a process of chlorination, which aims to neutralize the materials that are harmful to the health of human beings and other living organisms. To begin, testing locations needed to be found. Four locations were decided to be sufficient, stable, and different enough. The experiment outline was to use a special fecal coliform testing kit to determine which source contained the most coliform traces. In the end, the project did not turn any shocking results. Because all of the water sources were treated in some way, there were little to no fecal coliform colonies to be found. The results that were obtained did not support the Hypothesis, and it had to be rejected. The null hypothesis was instead accepted, as it turned out the treatment method did not affect the cleanliness of the water samples in this test. Clearly these methods work, and should be implemented around the world. Healthy water leads to a healthy economy, which leads to a better standard of living and lifestyle for the constituents of that country.

MED

## **Oh, Crap! The Effect of Fertilizer on Nitrogen and Phosphorous Runoff**

Ruth Misch <sup>BG</sup> ★

### **Abstract**

An overabundance of phosphorous and nitrogen in the Chesapeake Bay is contributing to lowering values of dissolved oxygen. While these nutrients are vital to plant growth, this experiment looked at how homeowners, farmers, and companies can lower runoff levels from yards, farms, and golf greens, respectively. Three different levels of commercial 9-9-9 fertilizer (half-dose, regular dose, and double dose) were tested along with two different agricultural fertilizers (chicken manure and cow manure) against a control (no fertilizer of any type). A spectrophotometer was used to quantify the data, and correlations, linear regressions, and multiple comparisons t-tests with Bonferroni corrections were run to determine statistical significance between the fertilizer type and nutrient runoff levels.

ENV

## **The Effect of Thermo Plastics on Force Absorption**

Chandler Moison<sup>BG</sup>

### **Abstract**

Concussions have been a growing problem with sports injuries throughout the past few decades. Mouth guards may hold the key to helping prevent concussions from occurring because of their rubbery quality. There are several types of mouth guards out there, and many of the companies are beginning to claim that the mouth guards will help protect against the athlete obtaining a concussion. This experiment is used in order to test to see if the thickness of rubber has any effect on the amount of force exerted when a marble is dropped. Latex rubber was chosen because it is one of the most common types of rubber found in mouth guards, and it is easy to obtain. Different sizes of latex rubber were carefully measured and cut into four different sizes. These experimental sizes included 10mm, 7.5mm, 5mm, and 2.5mm. a size of 0mm will also be used as a control. There will be three samples cut for each size, and each size will be used 15 times. This will ensure a total of 45 trials. The independent variable is the thickness of the latex rubber, and the dependent variable is the amount of force read by the force sensor. After performing a Linear Regression test a P- Value of 0.01 was obtained. This shows that there is a significant difference in the force read by the force sensor between the different sizes of latex rubber, and leads to the ability to reject the null hypothesis. A trend was developing as well. The data showed that the thinner pieces of rubber were absorbing more force than the thicker pieces. Yet when there was no rubber used at all the amount of force exerted was highest.

PHY

## **Diary of a Beekeeper: The Effect of Smoke Moisture Levels on Honeybees**

Duncan Mollner<sup>BG</sup> ★

### **Abstract**

Honeybees are the main pollination source for many crops around the world, but Colony Collapse Disorder, among other causes, is causing deep decreases in the honeybee population. Commercial and recreational beekeepers help support the waning honeybee population, and using smoke to control the hives and bees is essential for strong beekeeping. This study tested the effect of the moisture content in a smoker on the smoke's effect on honeybee flight time. Using orthodox smoker fuels of varying moisture levels, the independent variable was tested by measuring Italian Honeybee's flight times in a smoked tank with 30 trials per moisture level. The data was analyzed using a linear regression with an alpha-value of .05—there was a significant difference in the flight times of smoked bees versus control bees and in the flight times between moisture levels. Although there were significant differences among the smoke moisture levels, it was less than two seconds between the two opposite extremes of the moisture content, and the results are inconclusive on whether the difference is significant if applied to an actual hive. In conclusion, the study suggests smoke with less moisture decreases flight times significantly, but further testing is needed before it can be applied in the field.

ZOO

# **The Effect of Land use and Rainfall on Nitrate and Phosphate Levels in Tributaries of the Chesapeake Bay**

Kaitlyn Newman and Patrick Francis<sup>W</sup>

## **Abstract**

This study looked at the possible effect of different land usages at three different locations on the water quality in tributaries of the Chesapeake Bay. The different land uses were an agricultural facility, a developed area and a wooded area. This experiment also looked at the effect on nitrates and phosphates before and after a rainfall event. The experiment took place over a two-week period in November 2012. For this experiment water samples were collected every other day over this two-week period. The samples were then cooled and then tested within 24 hours. The tests used Chemetrics ampoule kits for nitrates and phosphates. From there the viles were run through a Spectrophotometer to measure transmittance of the samples and from there determine the amount of nitrates and phosphates in parts per million. After the all the data was collected it was analyzed for nitrate and phosphate levels at three different locations with different land uses as well as the effect on nitrates and phosphates before and after a rainfall event. After analyzing and looking at the data it was concluded that the test for nitrates at different locations with different land uses was the only significant p value that the data provided. Statistical tests for nitrates before and after a rainfall event, phosphates at different locations, and phosphates before and after a rainfall event were all insignificant.

ENV

## **Is Breakfast Really the Most Important Meal of the Day?**

Mark Noel Jr. <sup>G</sup>

### **Abstract**

Breakfast has been described as the most important meal of the day, contributing substantially to daily nutrient intake and energy needs. It is also said that sleep can play a vital role in academic performance. An experiment was designed to answer these questions. There were 4 groups involved in the experiment- the experimental group, which were the students who ate breakfast prior to taking the test, and the control group, which were the students who did not eat breakfast. Then there were the other 2 groups, students who slept for 7+ hours, and children who did not have 7 hours of sleep. There were not many materials used in these experiments, other than students and Microsoft Excel. The mean test scores for students who ate breakfast were 75.6, while students who didn't eat breakfast had a mean of 72.4. However, running a T-Test: Two-Sample Assuming Equal Variances showed that the data collected was not significant. The sleeping hours of the students ranged from a minimum of 0 hours to a maximum of 10 hours. The data showed that there was an increase in test scores with student who slept for 7+ hours. The results of this experiment are consistent with results from past experiments.

MED

## Escape Behaviors in Marsh Periwinkles, *Littoria, irrorata*

Megan Parker <sup>w</sup>★

### Abstract

In the circle of life, some animals are predators while others are prey. Marsh periwinkles (*Littoria irrorata*), are a common species of snail found in salt marshes along the East coast. These snails are most often preyed upon by crabs and large birds that also reside in the marsh. Because of their small size, marsh periwinkles must escape these predators in order to survive. Those periwinkles who have survived attacks from predators usually have scars present on their shells. Previous studies have shown that periwinkles retreat towards the land during high tide and often climb the grass stalks of marsh grasses, such as *Spartina alterniflora*. During low tide, periwinkles head back towards the water line. Other studies have also shown that marsh periwinkles rarely move more than two meters from their release point, with juvenile periwinkles travelling a shorter distance than the adult periwinkles. This caused less stress on the juvenile periwinkles. This study compared the distance scarred and non-scarred marsh periwinkles traveled in the presence and absence of a predator to determine if escape behaviors are learned in marsh periwinkles. In the absence of a predator, the t-test comparing distance traveled between non-scarred and scarred periwinkles was insignificant, yielding a p-value of 0.774; however, in the presence of a predator, the t-test comparing distance traveled by non-scarred and scarred periwinkles was significant yielding a p-value of 0.024. This study concluded that because of the strong relationship between presence of predator, distance traveled, and number of scars present on periwinkles, escape behaviors are likely learned in periwinkles, allowing them to avoid predators. If periwinkles were unable to escape predators, the periwinkle population would die out and a vital part of the marsh ecosystem would be lost.

MAR

## A Comparison of Water Quality Between Ponds With and Without *Castor canadensis*

Katie Parr <sup>W</sup>★

### Abstract

Beavers, *Castor canadensis*, have been called keystone organisms by a few scientists yet there is great debate whether beavers harm the ecosystems in which they call home or actually benefit it. They could increase levels of nitrates and sulfides that would decrease the pH and cause aquatic vegetation in an ecosystem to grow more abundantly due to better growing conditions (Cirimo et al, 1993). This study tested the levels of nitrates, sulfides, pH and dissolved oxygen saturation in an effort to see whether a beaver benefits an ecosystem more than a non-beaver inhabited ecosystem. This study used LaMotte dissolved oxygen and pH testing kits and Chemetrics ampoule kits and spectrometer to measure nitrates and sulfides; testing was conducted once a week for one and a half months. The results showed trends including: pH lower in beaver pond (BP), sulfides were more prevalent in BP on surface but not one meter deep, nitrates were less prevalent on surface of BP but more in one meter deep, dissolved oxygen on surface less in BP than the beaver free pond (BFP), but in one meter deep water the site closest to the beaver dam had more dissolved oxygen saturation compared to the BFP. The beaver pond had a decreased pH, and a greater amount of nitrates and sulfides in the water. This experiment found that *Castor canadensis* may actually affect the pH levels in its ecosystem. The nitrates and sulfide levels could have been affected by the presence of beavers but the results were not statistically sound enough to make that a very valid conclusion. This study hopefully will help catalyze more studies that will prove once and for all that *Castor canadensis* are keystone organisms and should be protected.

ENV

## **A Study of Pollination: Native Pollinators vs. the European Honey Bee, *Apis mellifera***

Leah Procopi<sup>G</sup>

### **Abstract**

In recent years the population of *Apis mellifera*, European Honey Bees, has been in drastic decline. These bees are essential for pollinating commercial agricultural crops all over the globe. Neonicotinoids are the only non-natural cause known for bee population decline and neonicotinoid insecticides are highly effective at killing the insects that damage produce crops. They are used globally on plants such as: corn, sunflowers, and cotton. Cucumbers and squash plants were observed at one location in Gloucester, VA that is not located near an *Apis mellifera* bee hive. In order to be able to accurately assess the types of insects which were pollinating each plant, the insects were grouped as: honey bees (*Apis mellifera*), wasps and sawflies, bumble and carpenter bees, leaf cutters, mason and sweat bees, butterflies, and moths. Over all of the data, the average number of visits to a plant by a honey bee was approximately 3 while the average of native pollinators was 70. This t-test analysis yielded a p-value= $1.1 \times 10^{-5}$ , which indicates a significant difference in pollination visits between *Apis mellifera* and native pollinators. The Shannon-Weiner Diversity Index gave a value of 0.66 which means that the distribution of organisms in the environment is not very even and the community of pollinators is fairly diverse. Additionally, some groups of native pollinators were highly abundant. Therefore, although the *Apis mellifera* population is in drastic decline, native pollinators have shown promise that they can handle pollination demands in this area.

ZOO

## **The Physical and Emotional Effects that Horror Movies have on Humans**

Allie Reaves<sup>G</sup>

### **Abstract**

Millions of people each day watch scary movies. They enjoy the excitement that these movies bring them, and they love to watch others suffer within these movies. Within this experiment anonymous people have watched scary movies and paid attention to how they felt toward the movie before, during, and after they watched it. They also paid attention to their heartbeat which they recorded before, during, and after the movie. They recorded their results on a survey. A total of 24% of the surveys were returned from seventeen women and seven men. They were divided by age. The participants within the age range of 0-20 years old had an average heartbeat of 92.5 bpm before the movie, 87.4 bpm during the movie, and 86.8 bpm after the movie. The participants within the age range of 21 years old and up had an average heartbeat of 88.0 bpm before the movie, 88.3 bpm during the movie, and 85.7 bpm after the movie. The survey results have proven that as people watch scary movies, depending on their mood, their heart rate will either decrease or increase.

## Comparing Baits and Location to Yield the Most *Fundulus heteroclitus*

Evan Robertson and Greg Shoukas<sup>W</sup>

### Abstract

Organisms have been used as bait for larger organisms throughout time. Small fish are commonly used as bait to attract larger fish. Many different techniques to catching these fish have been developed. Various types of baits have been used and tested to try and capture mummichogs. Baits that move on their own or give off a scent generally attract the greatest amount of fish. Artificial baits are generally effective bait when catching bull minnows because they can be manufactured to reflect sunlight and can have chemical scents. This study focused on what type of bait and creek location was preferred by *Fundulus heteroclitus* as well as what location along a creek bull minnows were most likely to be caught using standard minnow traps. The marsh yielded the most minnows followed by the deep creek, the shallow creek, the marsh, and then the river. An ANOVA comparing location was not significant;  $p\text{-value} > 0.05$ . The shrimp attracted the most bull minnows followed by the bread, artificial worms, and then the control containing no bait. An ANOVA comparing bait was highly significant;  $p\text{-value} \ll 0.05$ . The most minnows were attracted by the shrimp, and were usually found in the marsh. The least effective location was shallow creek and the least effective bait was the control, a minnow trap with no bait. Factors affecting the number of mummichogs caught were the amount of rain, air temperature and depth of the water at each site. Also, as the summer progressed, a decline in the amount of minnows became evident. These factors that limit the minnows could explain one reason they are not more widely used. If a fisherman knew where the minnows could be found and what bait to use, he would be able to maximize his bait supply and proceed to catching larger fish in the river.

MAR

## **Om-Nom-Nom: The Effect of Nutritional Value on the Dissolve Rate of Burgers**

Alyssa Ross <sup>BG</sup> ★

### **Abstract**

Some fast food burgers like the McDonald's Happy Meal can survive many years without decomposing. If these burgers don't decompose outside the body how do they digest inside the stomach? This experiment is to determine if nutritional value has any effect on the dissolve rate of burgers when placed in solution of hydrochloric acid. The experiment tested vegan, turkey, 93%, 80%, and 73% lean meat, Burger King, and McDonald's hamburgers. Each burger trial consisted of 30 grams of patty and bun synthetically masticated for a set time to simulate a bite. A new mechanism was created to suspend the synthetically masticated burger in the hydrochloric acid. Data was collected by taking the volume of burger dissolved through a mesh screen after four hours submerged in the acid. A one way ANOVA produced a p-value of  $6.7 \times 10^{-12}$ . The p-value suggests a significant difference between the digestion rate of different types of burger and their nutritional values. Multiple comparison t-tests showed a difference between McDonald's and all other burgers, the 80% was significantly different to all but the turkey burger, the turkey and the 73% lean meat burgers were significantly different, and so was the Burger King and 93% lean meat burgers. Additional experimentation with condiments dissolved at a much higher rate. This is the opposite finding of some previous studies. The value that correlated most strongly with dissolve rate was sugar, while protein had a high negative correlation. This suggests that sugary foods digest faster and does not keep you full as long as food high in protein does. The null hypothesis was able to be rejected. This nutritional correlation could potentially be used to pass more regulations in the fast food industry and create healthier foods that keep a consumer fuller longer.

MED

## **The Effect of Media on Dow Jones Index Performance and Stock Volatility**

Kyle Rowe<sup>G</sup>

### **Abstract**

News drives stock market prices in a variety of different ways that many investors may not even know about. News plays a major impact in the stock market, and depending on the news story the stock market may be tremendously affected. The more significant the news day is then the volatility of the stock market will go up tremendously. This is why reporting the daily news rating each day was essential in the collection of data. The more significant the news day was then the stock market would see more shares being sold. When investors hear about a big news story that they think will affect their stock negatively, they usually end up selling their stock. Volatility is higher after bad news rather than good news because bad news always stirs up a lot of drama on Wall Street, which results in the selling of stocks to sky rocket. There were many severe news days when the volatility of the DJI was extremely high, and this only helped contributed to the average volatility being very high. Many people say that if news brings high current volatility then it will also bring high volatility in the future as well. Also, news plays a major role in the performance of the stock market because as more shares of stock are being sold then the performance of a particular stock will vary accordingly. It is becoming safer to say that daily US news and financial news does play a major role in the way investors invest.

PSY

# **The Effect of Agriculture and Development on Water Quality in the Potomac River**

Holly Sanford <sup>W</sup>

## **Abstract**

The Chesapeake Bay not only serves as a home for many different types of life, it also provides jobs, scenery, and recreation for the 17 million people living within the watershed. As society has evolved over the years the Chesapeake Bay has sustained more damage from harmful human practices. The main purpose of this study was to observe how human practices such as agriculture and development affect the overall health of the water in the Potomac River. It also looked at whether or not riparian vegetation buffers aid in the prevention of runoff that negatively affects water quality. Basic water quality parameters, specifically pH, turbidity, dissolved oxygen, and nitrate and phosphate levels, were used to determine the overall health of the water. Four sites in Currioman Bay which flows into the Potomac River were tested once weekly for six weeks. Sites included an undisturbed forested site, an agricultural site without a riparian buffer, a developed site, and an agricultural site with a riparian buffer. The results of the study showed that the developed area had the best water quality, followed by the agricultural area without a buffer, then the agricultural area with a buffer, and the undisturbed forested site demonstrated the worst water quality parameters. ANOVA statistical showed a significant difference for phosphates between sites while all other parameters were statistically insignificant. Many factors influenced the results including logging and the close placement of the sites themselves, including the effects of runoff from nearby tributaries and areas of dispersion. The Chesapeake Bay and its tributaries are rapidly deteriorating due to careless human practice. More action needs to be taken in order to save the delicate ecosystem that is home to so many living things.

ENV

**The Effect of Water Column Depth on the Growth of the Eastern Oyster,  
*Crassostrea virginica***

Hans Saunders

**Abstract**

The varying depths of the water column in estuaries have different water characteristics. *Crassostrea virginica* is affected by oxygen levels, phytoplankton concentration, and salinity in the water column. Oyster catches in the Chesapeake Bay have decreased significantly and to encourage the growth of the small population, numerous restoration efforts have taken place. To improve the success of these oyster restoration efforts locating the optimal water depth in which *C. virginica* is most successful is imperative. This will be measured by average growth of oyster treatments while comparing the results of the three treatment groups.

MAR

## **The Effect of Different Erosion Controls and Water Flow Intensity on Soil Erosion**

Hiba'Ann Seager <sup>BG</sup>★

### **Abstract**

This experiment sought to find out the effectiveness of different erosion controls as well as the difference between different water intensities and soil erosion. The experiment involved building a simulated slope to test five different erosion controls and two different water intensities. A two way ANOVA was performed on the data set and a p value of 0.0418 was obtained for the independent variable of erosion controls, meaning that there was a significant difference between the effectiveness of the four erosion controls. For the independent variable of different water flows, the two way anova revealed a p value of 0.0005, meaning there was a significant difference between the different water flows. Overall there was clearly a difference between the heavy water flow and the light water flow in regards to sediment collected. The results of this experiment can be broadly applied to the dire soil erosion problems that the world faces on a global scale. By using more effective erosion controls, terrestrial infrastructure will be strengthened and soil erosion problems alleviated.

ENV

## **The Effect of the West Point Paper Mill on Rain pH and Airborne Particulate Deposition**

Lee Siegle <sup>G</sup> ★

### **Abstract**

Since the Industrial Revolution, factory emissions have been a pressing health concern in all parts of the industrialized world. The emissions from factories can be detrimental to not only human health, but also the environment. Since inception the Clean Air Act has prevented 160,000 deaths, 100,000 heart attacks, and more than a million asthma attacks; the emissions from paper mills are still a significant polluter. Glass collecting jars were set out at eight different locations. Rain water was collected in each of these jars, and pH was tested after rainfall. Also at each site, one 20 cm<sup>2</sup> piece of plexi-glass was placed, for eight total collectors. The plexi-glass served the purpose of capturing a film of particulate matter in order to measure the amount of particulate matter deposited from the air and precipitation. There were a total of eight test sites, four within a one mile radius around the West Point Paper Mill, and four within a ten mile radius. All pH data from rain samples were acidic, with none exceeding the normal rain water pH range. This can conclude that the particulate matter coming from the paper mill has less effect on the environment and acid rain. The results show that the locations closer to the paper mill within the one mile radius have more particulate matter deposits than those within the ten mile radius, indicating an effect on the health of the immediate surrounding area and the town of West Point, Virginia. There is a strong indication that in close proximity of the paper mill there tends to be more pollution. The effects of pollution are much more significant than the amount of pollution however, because the particulate matters which are emitted from the paper mill or any pollution in general, are detrimental to human health. ENV

## **The Inaccuracy of Vanity Sizing on Women's Jeans**

DeVonte Spurlock <sup>BG</sup>

### **Abstract**

The topic of women's jean size has been addressed few times before. Previous study's attempted to create a uniform size for women but failed. Though men have a more standard system, women do not. Their sizing system labels clothes as arbitrary numbers. This study seeks to uncover the truth about vanity sizing, marketing larger clothes at smaller sizes. Different brands of clothing were tested to see if there would be a difference in the waist measurement. What was found suggested that brands do not affect the waist size, but do affect the outer seam and inner seam length of the jeans. With this analysis, Women can shop easier with the size system that is in place. At the completion of this study it has been suggested that vanity sizing does affect women's jeans.

# **An Analysis of Human Population Change and Land Use Change in the Rappahannock River Watershed of Virginia**

Elliott J. Theuerkauf <sup>G</sup> ★

## **Abstract**

Between 1984 and 2006, the population of the entire Chesapeake Bay watershed grew from 13.5 million people to 16.6 million people and the population is forecast to further increase in the decades to come. The problem with the dramatic population increase in the Chesapeake Bay is that water quality is linked to the land uses and population increases. The purpose of this study was to examine the effect of increases in population on the various types of land uses in selected counties in the Rappahannock Watershed, a smaller component of the Chesapeake Bay watershed. The Rappahannock Watershed contains 18 counties, all of which vary from rural to urban. This analysis utilizes geographic information systems (GIS) to gather land cover data in selected counties in the watershed from the years 1984, 1992, 2001, and 2006. Also, population data was gathered from the United States Census Bureau from the years 1984, 1992, 2001, and 2006. Out of the 18 counties in the watershed, 7 were utilized for study and the selection was on the basis of rate of population increase and total percent acreage inside the Rappahannock Watershed. It is hypothesized that as population increases, there will be increases in developed lands as well as increases in deforestation. Counties with extremely high population increases from 1984 to 2006 supported that hypothesis but, many other counties remained stagnant with respect to their land use. In the future, there should be smart growth and better land management practices put in place to ensure that anthropogenic pollution is at a minimum because of increases in population and urbanization.

ENV

## **Salt Water Intrusion Into Mathews County Groundwater**

Autumn Tilghman<sup>G</sup> ★

### **Abstract**

Saltwater intrusion, which is the replacement of fresh water by saltwater due to the inflow of estuarine water into a freshwater aquifer, causes some coastal aquifers to have reduced potable drinking water. As the saline and fresh water continue to mix, it is important that there is continual study of seasonal effects and how distance from the shoreline affects saltwater intrusion. The hypotheses tested were that the water samples taken from a distance <300m would show evidence of saltwater intrusion and the seasonal changes in precipitation would affect the salinity of the groundwater in Mathews County, Virginia. In order to see if and where saltwater intrusion was occurring, water samples were collected from unfiltered spigots in nine different locations/homes in Mathews County, Virginia over a span of six months from April-September 2012. For the salinities, the null hypothesis cannot be rejected because  $p=0.2338$ . For the pHs of the sampled water, the null hypothesis cannot be rejected because  $p=0.8437$ . For the masses of evaporates, on the other hand, the null hypothesis can be rejected because  $p=0.04108$ . The samples of water collected over the six months of spring and summer showed differences in salinity, pH, and evaporate masses for the samples <300m from the shoreline and >300m from the shoreline.

ENV

## Recreational Crabbing and Bycatch Reduction in the Chesapeake Bay

Locke Tucker<sup>G</sup> ★

### Abstract

In the Chesapeake Bay crab fishery, there is a serious issue with bycatch and how it is dealt with. The standard crab pot that is used in today's fisheries is basically a wire cage that anything on the Bay bottom can crawl into. Non-target species very often drown in these pots if they are unlucky enough to get caught in them. A hollow, square piece of 4.5 X 12 cm hard-plastic coated metal, called a Bycatch Reduction Device (BRD), could help Diamondback Terrapin populations and save crabbers time and energy. There are problems with bycatch in more fisheries than just the blue crab industry. For example, shrimping industry also has a problem with turtles and other bycatch when they pull the trawling nets. In order to test this, crab pots were placed at three different locations in the lower Chesapeake Bay in Mathews County, VA. These pots were fished for two weeks in three different locations, both with and without Bycatch Reduction Devices (BRDs). The crab catch varied from day to day, but the lack of bycatch was predictably consistent. When the data were compared with a standard, paired, one-tailed t-test on the average number of crabs per day per pot with BRDs against the non-BRD values,  $p=0.0918$ . The main null hypothesis is the only one which could be rejected. Both of the secondary null hypotheses could not be rejected. There was no statistically significant difference in the amount of crabs caught in BRD and Non-BRD pots. The data that were collected are inconclusive in regards to the effects of BRDs on bycatch numbers.

MAR

## The Effects of Beaver Dams on the Environment

Emmanuel Valdez <sup>w</sup> ★

### Abstract

The effects of beaver dams on the environment have always been controversial. This experiment attempted to understand the effects of beaver dams by collecting and analyzing data on dissolved oxygen levels, sediment deposition, and species diversity. Data was collected at three sites, all along a fresh water stream called Old Fox Swamp. There was a beaver dam at each of the sites. The beaver dams impaired water flow forming a small pond. D.O. levels measured water quality, the higher the D.O., the higher the water quality. Sediment deposition was measured and analyzed to see if it correlated to D.O. levels and species diversity. For example, if levels of sediment deposition were consistently high and levels of D.O. were consistently low, there could be an explanation. Sediment deposition could be impairing water flow, causing water to decrease in quality. The number of species was collected at each site throughout the experiment to analyze the health of the environment at each site. Results showed trends in dissolved oxygen levels. D.O. levels increased going down the stream. With respect to sediment deposition, levels also increased going down the stream. On the other hand, diversity richness decreased going down the stream. The single-factor ANOVA used to compare the diversity richness at each site resulted in a P-value of .020729. The P-value was statistically significant to say diversity richness decreased. The trends of the D.O. levels, sediment deposition, and species diversity show the effects of beaver dams on the environment.

ENV

## **Does the Use of Technology Really Improve Your Education?**

Michael Venter <sup>G</sup>

### **Abstract**

Schools have begun to incorporate more advanced educational technologies like Smart Boards and distance learning courses in order to keep up with the era of digital media, keeping material fresh and making it easier to understand through pictures and real world applications. However, growth in the educational industry has been limited by a lack of trained staff; some wonder if the proper and effective use of educational technologies in the classroom is even a factor in what a student will learn. A survey was distributed to three schools of varying educational levels that consisted of ten questions, five of which related to how much of the student's classes relied on the use of technology and how much technology student's used to complete assignments for the class. Students answered these questions based on their most academically challenging class(es). The other five questions on the survey related to the how much technology was used by those students in recreational environments and activities. The results indicate a higher use of technology in school environments as one becomes eligible for and participates in better educational opportunities, but they do not show any correlation between usage of technology in recreational activities and the level of education received. The biggest factor shown by this study in helping students receive a better education is more technology in schools.

PSY

## The Effect of *Hydrilla verticillata* on Water Column Nutrients in the Mattaponi River

Marissa Voight <sup>G</sup> ★

### Abstract

*Hydrilla verticillata*, a submerged aquatic plant originally from Asia, is an invasive species that is a nuisance to humans. Eutrophication is a chronic problem due to high population in the Chesapeake Bay watershed. Solutions to the eutrophication problem are usually elusive or impractical. *Hydrilla* can potentially perform important ecological services by reducing nutrients in targeted applications. Four sites on the Mattaponi River in King and Queen County were used for testing; they were labeled Upstream, *Hydrilla*, Downstream, and Melrose. Only the site labeled “*Hydrilla*” had *Hydrilla* mats. Water samples were collected and tested every two weeks from June to October. The *Hydrilla* site had the lowest nitrate and phosphate concentrations over the 5 months that data were collected with mean concentration of nitrate being 0.616 ppm and of phosphate being 0.11 ppm. The upstream site had the second lowest concentrations followed by the downstream site; Melrose had the highest concentrations. In the Chesapeake Bay’s freshwater tributaries the nutrient reduction would be significant. If *Hydrilla* mats were present in the major tributaries, then it could potentially help lower the amount of nutrients being loaded into the Bay. Most specifically, *Hydrilla* could be used in areas of rivers with point source nutrient inputs to mitigate the amount of nutrients that are available to flow downstream.

ENV

## Settlement of Epifauna and Invasive Ascidians on Artificial Eelgrass in Mobjack Bay

Shelby Ware <sup>G</sup> ★

### Abstract

In Chesapeake Bay, Submerged Aquatic Vegetation (SAV) performs critical ecological services. SAV population has drastically declined partly because of epifauna. The large amount of epifauna, including invasive species, overwhelm the SAV by preventing photosynthesis. Epifauna growth is affected by nutrient levels, water temperature, but most specifically, the presence of grazers, which reduce epifauna growth. Four artificial sea grass frames were deployed at three sites representing different salinities and substrates for three tributaries of Mobjack Bay. Data were collected every two weeks by measuring percent coverage of epifauna with the point intercept method on each grass blade. After four weeks, two frames at each site were covered with a mesh frame to preclude grazers. Two more sampling periods were performed. Epifauna were observed on all plots at each study site throughout the study period with an average percent coverage of 10.6%. The effect of the presence of grazers was analyzed on the two exclosed plots from each of the three sites. On August 26<sup>th</sup>, the pre-exclosure epiphyte coverage on the East River was 6.5%, the Severn River was 21.8%, and the Ware River was 13.4%. On September 9<sup>th</sup>, two weeks after the exclosures were added, the percent epifauna coverage on the artificial eelgrass was 2.0%, 12.6%, and 4.5% respectively. There was a significant decrease between pre and post exclosure rather than predicted increase. In this study, *Molgula manhattensis*, the invasive ascidian, covered 90% of the frame exclosures. The rapid appearance of *Molgula manhattensis* on the exclosures and the complete coverage of those exclosures over a short period of time indicates that the ascidian may be a significant problem in Mobjack Bay. Understanding the relationship between these factors will help to create management strategies to help mitigate SAV decline.

MAR

## The Effect of Electrical Current on the Growth of *Festuca arundinacea*

Kellen Wise<sup>w</sup> ★

### Abstract

Roughly one billion people, 14% of the world population, go hungry. To produce enough food to feed the population, production has to be increased. Plant cells use light to energize electrons, and then store this energy as “food” during photosynthesis. This study proposed to introduce electrons, via electrical current, into the growing medium of tall fescue (*Festuca arundinacea*) to accelerate photosynthesis. There have been a few experiments regarding the effects of electromagnetic fields on plant growth, but no one has explicitly tried to *grow plants using* electricity. This study explored how introduced electrons may affect photosynthesis, predominantly regarding the initial electron emission from chlorophyll-a and chlorophyll-b. The research specifically pertained to tall fescue (*Festuca arundinacea*), grown in water-saturated soil. The purpose of the high exposure to water was to ensure electrons reach the grass, as they were introduced through the water. This study explored the possibility that direct introduction of electrons into the chloroplasts of cells of photosynthetic organisms may allow "electro-synthesis;" the primary electron acceptor may use the introduced electrons, and cause the entire process of photosynthesis to occur without the utilization of energy from photons. The results of this study revealed that the applied current had no statistically significant effect on the mean height of the *Festuca* sprouts, including an analysis of growth rate. A current applied through the growing medium may not have been an effective way to allow the sprouts to use the electrons. It may be difficult to find a balance between effective current application and mass production, the main point of the study.

BOT

# **The Effectiveness of Totuskey Creek on Filtering Point and Non-Point Source Pollutants**

Brandon Wiseman <sup>W</sup>

## **Abstract**

This study examines the level of pollutants in the Totuskey Creek – upstream, near, and downstream from a sewage treatment plant outflow for the county seat. By evaluating the competency level of the Totuskey Creek’s ability to absorb and dilute point and non-point source pollutants that will eventually make their way to the Chesapeake Bay, we can gauge the success we are having by implementing new upgrades and other environmentally friendly practices. I hypothesized that the location nearest the sewage treatment plant would have the highest fecal coliform results, followed by the location a few hundred yards upstream, and finally followed by the location approximately four miles downstream near the mouth. I believed this because it is tidal for all three testing locations so the site nearest the outflow should still experience the highest results, and the location slightly upstream should also experience increased levels from the tides pushing the pollutants upstream. Significant results were found in the correlation of the location to the level of pollutants including fecal coliform levels. P values of much less than .05 were found by using a one way ANOVA and standard t-test. The effectiveness can be evaluated as successfully diluting pollutants like fecal coliform by the time the water reaches the mouth of the creek where it feeds into the much larger Rappahannock River. The Totuskey Creek is safe for both recreational use and for any consumption of organisms contrary to any rumors that circulate about the uncleanliness of the creek and respective sewage treatment plant.

ENV

## **Keep Calm and Test: Different Relaxation Methods on the Change in Heart Rate of High School Students**

Sarah Woolford <sup>BG</sup>

### **Abstract**

Stress is a feeling of being overwhelmed by the tasks of daily life and manifests in many physiological responses such as increase in heart rate. A heart is stressed, the heart increases beats per minute. In this experiment, five different relaxation methods; puzzles, music, stretching, prayer/meditation, and deep breathing, were being tested to see if any one of these particular techniques would yield the greatest change in heart rate. The idea being that a method that would make the participant have a greater change in heart rate (between their initial and final heart rate) would mean the method is more relaxing. 52 high school students were tested, they were asked to run for three minutes, record their heart rate in beats per minute, then participate one of the stations at random for three minutes and record their heart rates again. This was repeated until each participant experienced each method, and was then surveyed on their interest and preference in the stations. A one-way ANOVA was conducted to see if there were significant differences between the change in heart rate at each station, and there were none. A paired T-test was then used to see if there were significant difference between the change in heart rate before and after participation in the stations, which there were. The findings point out that though there is no significant difference between which relaxation method was used, relaxation does seem to have an effect on the change in heart rate of high school students.

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