

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

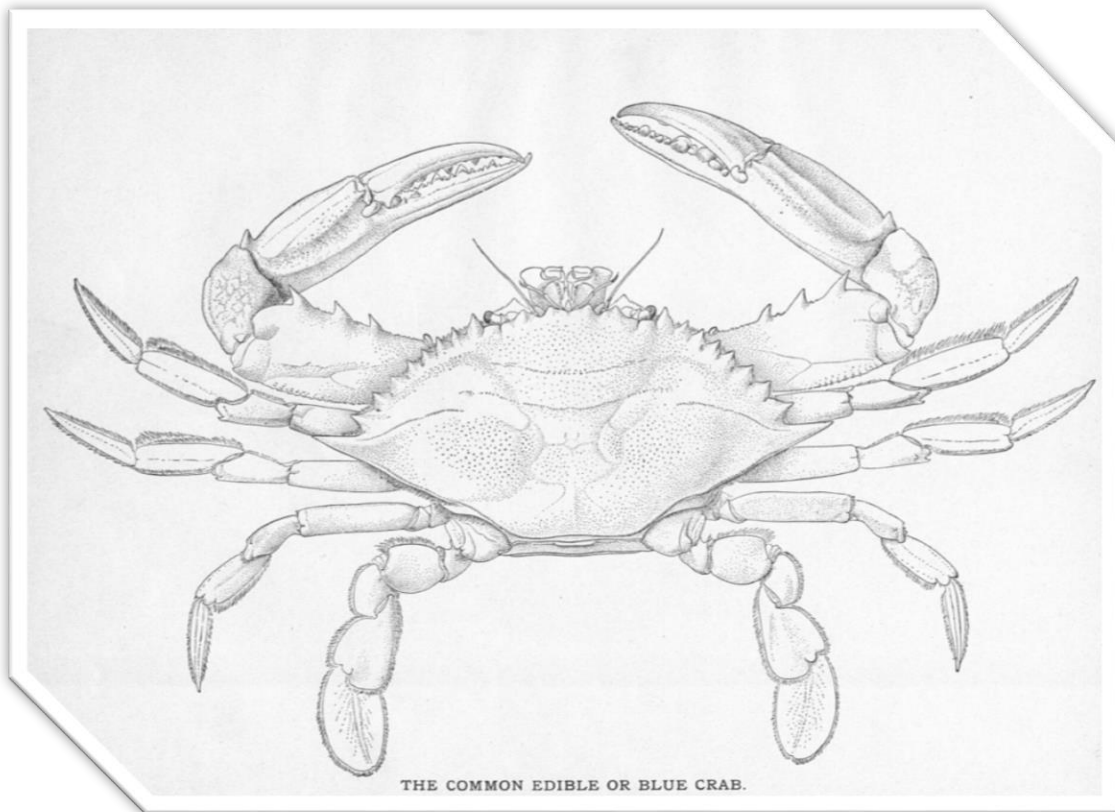
**R**esearch

**A**bstract

**B**ulletin



**Senior Research Project  
Abstracts from the  
Chesapeake Bay  
Governor's School  
Class of 2016**



**Volume 5**

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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 2016

### **Research Project Subject Legend**

BOT = Botany

ENV = Environmental Science

MAR = Marine Science

MED = Medicine and Health

PHY = Physics

PSY = Psychology

STAT = Statistics

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 2016. 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.

## Senior Project Abstract Subject Area Index

All senior project abstracts have been assigned to the following basic subject categories.

Page numbers are listed following the category heading

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## **The Effect of Bait Type on Blue Crab Yield**

Leo Ayala and Morgan Straughan<sup>W</sup>

### **Abstract**

*Callinectes sapidus* is a keystone species in the Chesapeake Bay due to its ecological and economical influence. It is the largest source of income for Chesapeake Bay fisheries, so having the best equipment and bait type for abundant catch is very important. This study looked at the number of crabs caught in pots using various types of bait: menhaden, oysters out of the shell, and chicken neck. There was also a control pot with no bait. It was hypothesized that the pot with the fish would catch more than the oysters, chicken neck, and the control pot. To conduct this study, at two sites, crab pots were baited with equal amounts of each bait. The pots were thrown overboard and then fished every other day. Data was recorded each time the pots were fished. As another part of the study, every crab was marked with nail polish and placed back in the water. After all data was collected over a three month period, 135 crabs were caught in the pot with the fish, 47 caught in the pot with the oysters, 45 caught in the pot with the chicken neck, and 42 caught in the control pot. It was then statistically analyzed with a single factor anova that gave a p-value of 1.23E-10. It was highly significant. The null was able to be rejected and the alternate hypothesis could be supported. Crabs did prefer the menhaden. The reason that the chicken neck, oysters, and control were so similar in quantity may have been that the crabs caught in that pot were using it for shelter. The crabs caught in the pot with menhaden were probably attracted to the bait in the pot. In order for fishermen of the Chesapeake Bay to get the biggest yield of crabs, they should use menhaden to bait their crab pots. Menhaden is a relatively cheap bait and it is very effective in catching Blue Crabs, so its use would be most prosperous to the Chesapeake Bay fisheries.

MAR

# **The Effects of Percent Wear on Cutting Boards on the Amount of E. Coli Colonies Present**

Sydney Ayscue<sup>BG</sup> ★

## **Abstract**

Food-borne illnesses run rampant in societies across the world. Despite being more common in third-world countries, diseases stemming from improperly prepared foods also occur frequently in more developed nations such as the United States. In order to quell the spread of such illnesses, scientists the world over have been researching ways to keep kitchen surfaces clean. This study sought to find whether the percent coverage of knife-grooves in the surface of a cutting board affected the percent coverage of E. coli found on the board after the utensil was rinsed. Using ultra-violet light, boards with various amounts of knife-groove coverage were covered in a bioluminescent E. coli cultured as a liquid. A p-value of  $4.58 \times 10^{-20}$  was calculated using a simple linear regression and that value is the reason the study is able to support the claim that percent-coverage of knife-grooves does have an effect on the percent-coverage of E. coli found on the board after it was rinsed.

MED

## The Effects of LED Light Exposure on Plant Pathogenic Bacteria

Kailey Babcock<sup>BG</sup> ★

### Abstract

With our global population steadily increasing, the need for the crops and produce provided by agriculture is growing exponentially. When the produce in these growing facilities becomes contaminated with bacteria, it not only decreases overall productivity and profit, but it also poses health risks for the general public. The purpose of this study was to formulate a method in which the growth of plant pathogens could be limited while simultaneously encouraging the growth and productivity of the plant host. In this experiment, the effects of LED light intensity were tested on the growth of three different types of plant damaging bacteria: *Escherichia coli*, *Sarcina lutea*, and *Acetobacter aceti*. Five light levels of increasing brightness were involved, generating a downward trend in bacteria colony count that was seen in each of the three bacteria types as the light exposure became more concentrated. The final results and statistical tests conducted on the collected data concluded that the intensity of light did have a significantly negative effect on bacterial growth, therefore allowing the use of LED light for produce contamination control to be an option.

BOT

# **The Effect of a Biogenic Reef on a Local Fish Population in the Lower Chesapeake Bay**

Jacob Beebe<sup>G</sup>

## **Abstract**

In the Chesapeake Bay there has been a severe decline in the stocks of Blue Crabs, American Oysters, and Striped Bass due to a number of issues including overfishing, pollution, and habitat loss. A solution is required that can solve the key issues of pollution, overfishing, and habitat loss. This solution lies with the use of artificial reefs. The ultimate goal of an artificial reef is to provide three main ecosystem services: fishery production, water quality enhancement and habitat restoration. This study will offer insight on this key characteristic of artificial reefs to see if an artificial reef does in fact have a positive effect on the local fish population. The sampling technique used was seining. Seine net sampling took place during the summer months of 2015 beginning in May, with the last observation being taken in the month of August. A total of 664 fish were collected over eight sampling events throughout the months of May through August. In total, 446 fish were caught near the reef, while 218 were caught away from the reef, however the overall data collected were not statistically significant at a two tailed  $p= 0.3396$ . The conditions changed in Mid-July and lasted throughout the month of August giving fish a choice between the biogenic reef and a large area of loose sea-grass and macroalgae that drifted in the vicinity nearby and remained for the rest of the sampling period. In regards to the experiment it is recommended that more data be obtained before determining the effects of biogenic reefs on local fish population.

MAR



## The Effects of Salt and Sucrose on a Semipermeable Membrane

Devin Berry-Tucker<sup>BG</sup>

### Abstract

The purpose of this experiment was to find out how people can be affected by the amount of salt and sugar that they regularly consume. This is an important issue because too much can result in bodily harm. I measured how different amounts of salts and sugars would effect the salinity and displacement of the water of a beaker after being put through dialysis tubing. With the levels of 5 , 10, and 15 mL of salt added to my solution, I needed to measure the salinity of the water, with a refractometer, in the beaker that the dialysis bag sat inside. After I took the bag out I had to measure how much the water had displaced after in order to find the amount in mL that was absorbed into the dialysis bag. My results showed that as the amount of salt that was put into the solution increased the so did the salinity and the displacement of water in the beaker. As my graphs shows there was an upward trend explaining how the different levels of my independent variable affected my dependent variables. With the increase of salt into my solution I got a p value of  $9.81 \times 10^{-10}$  for salinity, therefore there was an increase in salinity on the outside of the bag and in my beaker leading to me rejecting my ( $H_0$ )null hypothesis. Also with the increase of salinity in my solution I got a p value of  $1.79 \times 10^{-5}$  for displacement, therefore there was an increase of displacement in the beaker leading me to reject my ( $H_0$ )null hypothesis for displacement. With both of my p values being less than .05 it shows that with the increase of salinity there was a significant effect on both salinity and displacement of the water in the beaker.

MED

## **The Effects of Different Fertilizers on String Beans (*Phaseolus vulgaris*)**

Taylor Brooks<sup>W</sup>

### **Abstract**

The Chesapeake Bay and its tributaries are home to a plethora of indigenous and invasive wildlife. These species dwell in the rivers, swamps, streams, and ponds of the vast ecosystem as well as in the bay itself. Farming is a widely practiced occupation in the region and is popular all over the state of Virginia. With farming comes the fertilizers and other various chemicals that help crops to grow bigger and in greater numbers. However, these chemicals and fertilizers seep into the tributaries of the bay and cause harm to some species of wildlife. This experiment aimed to find alternate ways to grow crops without using the harmful chemical fertilizers that many farmers often use. Alternate substances including cow manure and food scrap compost were used to help grow string bean (*Phaseolus vulgaris*) plants. The objective was to measure how tall the plants grew as well as how much fruit each plant and group produced. Results of the study found that the chemical fertilizer did indeed grow the most amount of beans, however manure and compost grew significantly more than the control did. The beans produced for the fertilizer group was significantly higher than the other three groups having a p-value of 0.010314. The conclusion is that even though chemical fertilizers grow more efficient crops, there are alternate ways to grow them without having harmful chemicals in the Chesapeake Bay watershed. The wildlife in the area would have a better chance of living while also having a booming farming business that is environmentally friendly.

BOT

# **The Effect of Tumbling Frequency on the Growth of the Eastern Oyster**

Ben Brown<sup>BG</sup>

## **Abstract**

The procedures and ideas behind oyster aquaculture have been around for many years and there are constant attempts to revolutionize. The purpose of the experiment was to find the effects of tumbling oysters throughout their growth and whether this could help create a more marketable oyster. This is important because this could create valuable information on a process, in this case tumbling, that has not been widely studied. The ability to create oysters the customers want would be very valuable and allow aquaculturist to make more money. The experiment began with roughly 1000 triploid oysters that were separated into 17 groups. Of these 17 groups, each was given a frequency of tumbling and put into one of seventeen bags each with a different rate of tumbling. Each of the tumbled bags was tumbled using an air compressor and a manifold that directed air through different valves that opened on command. The valves were opened using a plc system that was programmed to tell the valves to open. This process went on from July to November and four measurements were taken in this time period. The results showed multiple things. The length of an oyster was found to increase as less tumbling occurred and significantly changed with each level of the IV. The width also was found to increase with less tumbling and a significant change was found across different levels. For weight, the weight increased as tumbling decreased and the weight significantly changed over different frequencies. For Cup Depth it increased as tumbling increased to a point and then decreased after the tumbling increased over the perfect amount of tumbling. It didn't however have the same significance as the other DVs. In conclusion tumbling can become a viable option to create a perfect amount of tumbling in oysters by using similar tumbling techniques.

MAR

## **Seasonal and Longitudinal Changes in CDOM and Turbidity in the Piankatank River Estuary**

JW Brown<sup>G</sup>

### **Abstract**

Colored dissolved organic matter, CDOM, as well as the overall turbidity within coastal waters affects light attenuation. If the level of turbidity is low, and the CDOM level is low, the amount of UV-B radiation entering the water can have hazardous effects on organisms living in the estuary. A seven-month study was completed to measure levels of both CDOM and turbidity, both seasonally and longitudinally. The five sites along three different sections of the Piankatank river were sampled: from the upper Dragon Run swamp; along the river as it winds between Gloucester, Mathews and Middlesex counties; and the mouth of the river which flows into the Chesapeake Bay. The seven months of sampling gave a range of seasons from early spring to mid-autumn, and the data were statistically analyzed to see if any variations could be found. This study found that there was a longitudinal difference in turbidity. The level of turbidity was shown to decrease downstream from the furthest upper stream into the Bay. This data shows that the areas within the Dragon Run Swamp are vulnerable to light penetration and the effects of ultraviolet radiation. The analysis also proved that the CDOM values slightly correlate with season, being lowest in the summer. This is significant because the UV index is at its highest, which means that the potential ultraviolet radiation damage is at its strongest.

ENV

## **To Bee or Not to Bee**

Allison Burgess<sup>W</sup>

### **Abstract**

Honeybees are a vital part of the world's food supply and overall health. The honeybees have been recently dying in mass numbers due to a condition called Colony Collapse Disorder (CCD). Colony losses in the United States have been around 30% over the winter of 2010-2011. Scientists have been attempting to determine the cause of CCD, to which no one cause has been found. There are many different possible reasons why hives are dying of CCD including pathogens, varroa mites, hive management, and lack of pollen diversity. This project looked at pollen diversity being a possible cause for CCD and if there is a change in pollen diversity over time. Hives from three locations were chosen to have pollen collected from during the summer months. Diversity was determined by separating different colored pollen pellets and counting the total amounts. Shannon's Diversity Index was used to determine the diversity for each hive in each month. The winter of 2015- 2016 was warm so it was found with preliminary data that there was no correlation between hive diversity and survival rates because all of the hives were alive. Certain data that was used in only the first two months of the project were significantly lower than the rest of the data, so it was removed so it would not bring down the data of only two months. After this, a linear regression test was used to determine if pollen diversity decreased throughout the summer. It was found with the data of the two hives with similar diversities that there was a trend of decreasing pollen diversity as the summer months went on. Statistically this decrease trends toward significance. Pollen diversity is important to beekeepers because bees would not be getting the necessary nutrition needed to stay strong over the winter. Determining the cause of CCD is urgent so that the world's food supply is not diminished. ENV

# **The Effect of Water Velocity on the Size of Aquatic Sow Bugs (*Asellus aquaticus*) in the Mattaponi River**

Nathan Carter<sup>BG</sup> ★

## **Abstract**

Different flow rates of water can be used for many things. Humans use the differences in the water flow rate to do many different things whether that be recreational or commercial. Aquatic sow bugs are small arthropods that inhabit the freshwaters of northern temperate zone. Aquatic sow bugs are known for living in stream water environments but can live across a variety of water velocity. Through statistical testing it can be said that water velocity has an effect on both the quantity of aquatic sow bugs, and the size of the aquatic sow bugs.

ENV

## **Crime and the Media – Is Bad News Good Business?**

Destiny Chamberlain<sup>G</sup>

### **Abstract**

Research throughout the world has shown that increase in crime is generally overrepresented in media coverage, compared to actual crime rates in society. There is a lot of attention paid to how crimes are reported in the news, given that the ways in which media represent these events heavily influences our understanding of crime. This study analyzes different types of news media to see if there is a bias in violent crime reporting. Three media outlets were selected: newspaper, internet, TV. Of the three media outlets types, three in each category were examined. The observations were made between July 7, 2015 and August, 25, 2015. The mean numbers of violent crimes reported in the TV news were 13.4, in internet news 12.7, and 7.7 in the newspaper (Figure 1). A single-factor analysis of variance was done to determine if each media types were significantly different from one another, the ANOVA produced a p-value=0.0114. There was a significantly different reported amount of violent crime reported in all three different media types, p=0.01. The amount of crimes being shown/reported was based on what media source people were getting their news from. . It is important to understand how crime is characterized by the media so that the public is getting the most accurate news possible and not being frightened by over emphasizing negative news stories.

PSY

## **Chemical Agriculture: Is it feasible?**

David Chewning<sup>BG</sup>

### **Abstract**

Matter is comprised of both cations and anions. These positively and negatively charged components of elements cause bonds to be made in many different combinations and mixtures. In this experiment, the impacts of chemical bonding on nutrient transfer through soils is being calculated by the amount of nitrates and phosphates that are held in the soils. After testing the levels of chemical bonding in the test environments, it was calculated that there was no impact of the chemicals on the change in nitrates and phosphates.

ENV



## **What are the effects of depth and land use on soil quality?**

Madison Coleman and Sarah Beale<sup>BG</sup>

### **Abstract**

A soil depth analysis was done in Bowling Green, Virginia to analyze how land use and depth affect soil porosity, organic matter, and texture. The areas sampled were woods, a field, and yard. The areas were all located on the same property and the same soil type, which was Kempsville- Emporia, a sandy loam. Soil porosity was tested by drying soil samples, using a microwave, and then seeing the change in weight. It was predicted that soil porosity would decrease as depth increased and that the areas with greater human impact would have less soil porosity. An ANCOVA was run and significant differences were found between the different depths and land uses. Even though the null hypothesis was able to be rejected, the land use results were not in the order predicted by the alternative hypothesis. An organic matter test was done using a loss on ignition method. After running another ANCOVA significant differences were found between the different depths, but not between the different land uses. A mechanical textural analysis was run, to find the percentages of sand, silt and clay, all of the soils started off as a sandy loam and then transitioned into sandy clay loam and then a sandy loam, but no statistical tests were run. We used these results to construct a management plan that goes along with the needs of the landowners.

ENV

## **Trees are Bore-ing: The Effect of Elevation on Tree Age, Height and Diameter**

Shaun Crutchfield<sup>BG</sup>

### **Abstract**

Over the past 85 years, reforestation, the reestablishment of forest on land that had recent tree cover, has been an important goal of the United States with the depletion of the native forests. Reforestation is a vital process for the United States not only because trees consume carbon dioxide (CO<sub>2</sub>) and produce oxygen (O<sub>2</sub>), reducing high levels of CO<sub>2</sub> emissions and providing one of the essential elements humans need to respire, but also for the economic side: tree farming (Duke University). Tree farming is vital to the agriculture business in today's time and has been growing rapidly, but tree farmers have yet to master how to get the tree population to grow at its full potential in the shortest amount of time possible, even with the help of genetic engineering. This project was conducted to see how elevation effects the growth rate of one of the most common trees used in tree farming, the loblolly pine tree. This project was conducted by collecting trees cores at a different measured elevation then determining the age and diameter of the tree. The results from the collected data showed that as elevation increased, the growth rate of the trees decreased. This decrease in growth rate at an increasing elevation occur primarily to trees at a lower elevation needing to grow at a faster rate to compete with the trees at the higher elevation. Once the linear regression was run on the data, a p-value of .01 was gathered, showing that elevation did have a significant effect on the growth rate of the loblolly pine. BOT

## **The Effect of Depth on Abundance of Juvenile Striped Bass**

Savannah Davis<sup>BG</sup>

### **Abstract**

Striped Bass are a vital species in the ecosystem because they are a major predator found in the Chesapeake Bay. They control many of the Bay's species that would overpopulate and possibly mess up the ecosystem if their population isn't controlled. However, humans majorly impact the size of the striped bass population; if fisherman continue fishing like they are now, in the long run the striped bass population will decline causing a rise in those species of which they feed on. The best way to control the population from declining is by making sure the juvenile striped bass are able to successfully grow and reproduce. Unfortunately, many fisherman catch young striped bass and use them for bait. Also, some young striped bass die from littering and predators. This dilemma happens a lot in the Mattaponi River during the mating season for striped bass. If local residents were notified of which depths juvenile striped bass are most likely to be located, they would probably refrain from fishing in those areas.

ENV

## **Effects of Various Salinities on Blue Crab Respiration Rates**

Alex Baughan and Trevor Delane<sup>W</sup>

### **Abstract**

This study compared the stress level of crabs to a range of salinities which could be found throughout the bay. Stress is a response to a physical factor. This study will see if different salinities cause stress on Blue Crabs by measuring the decline of dissolved oxygen (DO) in a closed system with salinities of 0, 15, and 25 ppt. This will be accomplished by taking blue crabs and exposing them to various salinities for a period of 25 minutes each, while a PASCO SparkProbe is used to measure the decline in the dissolved oxygen percent. The null hypothesis states that there will be no difference in DO consumption between the various salinities. The alternative hypothesis states that as salinity deviates from the normal range (15 ppt) the crabs' dissolved oxygen consumption will increase. The results showed that the normal salinity had the smallest percent change as well as the smallest slope for the DO consumption-time graph. Nevertheless, the p-value (0.92424) wasn't low enough to allow for the null to be rejected. Additional testing may show a clearer difference in how the more extreme salinities produce a greater respiration rate. From the trends shown in this study it would appear that salinity is a factor that acts as a stressor in the Potomac, but it may only be significant in extreme situations since the Potomac's salinity may not fluctuate to the extent of the salinities in this study. It is most likely that the crabs remain in areas where food is plentiful as well as an abundant supply of DO. In conclusion, it is likely that the Blue Crab's response to salinity may keep it from traveling to far from an area where it is accustomed to certain salinity.

MAR

## The Effect of the Cover Crop, *Hordeum vulgare*, on Nitrate Levels

Elizabeth Ellis<sup>w</sup> ★

### Abstract

The Chesapeake Bay has major cause of degradation.. This comes from the belief that increased pollutants are running off via farmland, but many farmers have extensive management plans to combat this. Management plans include many strategies to limit impact. Cover crops are among these tools. Cover crops work as Nitrogen fixators, especially legumes with their root nodules that fixate unusable atmospheric nitrogen to usable nitrogen. This study analyzed the strength of barley, *Hordeum vulgare*, as Nitrogen uptake source by studying soil samples taken on a working farm, in Essex County, Virginia. The farm sites are located off of Occupacia Creek, in Essex County and all fields are separated by hedgerows and forested buffers. One of the sample sites was a corn field with a winter rotation of barley while the other was a regular corn field, without a cover rotation. Soil samples were collected approximately weekly, April to November, and sent to and sent to A and L Laboratories in Richmond, Virginia for testing. It was hypothesized that the field with the cover crop would yield less nitrate levels left in the soil. Results showed , through an ANOVA, a non significant p-value. The nitrate levels across the board were relatively similar. However, when the field was fertilized on schedule there was a notable difference. In fact, after fertilization the non cover crop showed a huge spike of nitrate levels as compared to the cover crop field. It can be assumed that this much nitrate cannot be used by plants and is likely runoff as surface or groundwater. While the cover crop corn yield was only 92% that of the non-cover crop field, benefits to the environment may ultimately balance. Where the yield is less, it absorbed excess nitrogen that would have run off into the Bay.

ENV

# **How to Get Away with Murder: The Effects of Different Removal Methods and their Efficiency in Removing Blood Stains from a Fabric Swatch**

Jazmine Foster and Hannah Rhea<sup>BG</sup>

## **Abstract**

There are many different ways to remove bloodstains, such as household items, including bleach, hydrogen peroxide, lemon juice, soaps, detergents, and pineapple juice. Other methods include more chemically harsh solutions that scientists use in their professional fields. This study focuses on the removal of blood from a cotton swatch, using bleach, hydrogen peroxide, pineapple juice, and water, as well as changing the amount of each removal method. Bleach was chosen because the active ingredient, sodium hypochlorite, which oxidizes the chromophore in the blood, taking away the stain's ability to absorb light and reflect the red color. Hydrogen peroxide was chosen because it acts as a bleaching agent and can whiten or decolorize other substances. Pineapple juice was chosen because it contains the bromelain in it, which consists of two protein-digesting enzymes in it, which should break down the proteins in the blood and remove the stain. To carry out the study, blood was applied to cotton swatches, left to set, and then the removal method was applied and left to set again. Pictures were taken before and after each removal method to compare afterwards. This was done four times per removal method and per amount of removal method. The pictures were compared before and after to determine which removal had the greatest difference in intensity in the bloodstains. Intensity was measured by luminosity, saturation, and RGB. After running a two-way annova, the p-values showed that bleach worked the best to remove the bloodstains the best.

MED

# Comparing Phragmites Coverage along Bay Tidal Creeks with Surrounding Levels of Development

Mathilde French<sup>W</sup>

## Abstract

Invasive species are organisms that are not native to the land where they reside and are harming the ecosystem. There are various ways in which invasive species are transported into an ecosystem. With all of Virginia's waterways connecting directly to the Bay, Phragmites (*Phragmites australis*), or the Common Reed, is one of the most prominent invasive species in the tidal marshes bordering Virginia's rivers. This study compared the concentration of the invasive species, *Phragmites australis*, along creeks branching off of the Rappahannock river in Virginia. The creeks were categorized by the level of development (high, medium, low) surrounding them and upon which side of the Rappahannock (Tappahannock or Warsaw) they reside and position along the creek (mouth, center, upper). Results showed a significant difference of Phragmites coverage along creeks with the greatest concentrations near the creek mouth and lowest near the headwaters. This suggests the mouth is more susceptible to invasion as opposed to parts further away from the river. There was no correlation based on development or which side of the river the creeks flowed from. Phragmites is a growing problem in Virginia's tidal creeks. Using GIS and field observations to catalogue the coverage of this invasive species, researchers can get a better understanding of its true impact for better decisions concerning its invasion and control.

ENV

# The Possible Synergistic Effects between the Growth of the SAV, *Ruppia maritima*, and Presence of Oyster Aquaculture

Sam Gale<sup>G</sup> ★

## Abstract

Submerged aquatic vegetation (SAV) plays a key role in the ecosystem of the Chesapeake Bay. Underwater grass can alter water flow, cycle nutrients, and give structure to the food web. Oysters also improve the water quality by attenuating wave energy, feeding on particulate matter and phytoplankton, and absorbing nutrients. In the last century, both SAV and oysters have declined dramatically in the Chesapeake Bay. There have been many restoration efforts of oysters and SAV grass but co-location efforts have not received much emphasis. This study was conducted over the summer of 2015 from June to October. Three oyster bags of large, small and shell only treatments were placed around the perimeter of three separate SAV beds. Throughout the observation, all the SAV beds grew substantially, a linear regression over time yielded  $r^2 = 0.928$ . The percent change in perimeter of the SAV, *Ruppia maritima* over the entire study period of the small oyster treatment was 205.9% growth. The large oyster treatment was second with 130% growth, and the shell only treatment grew the least with only 96.7% growth. These data demonstrate that growth was improved with the live oyster treatments however, these data are not statistically significant, ANOVA  $p=0.440$ . There appear to be synergistic effects between oysters and SAV beds but more studies are needed to understand the relationship.

MAR



# **The Effects of Different Oil Types on the Amount of Water Consumption and Change in Mass of a Clarinet Reed**

Nina Gerlock<sup>BG</sup>

## **Abstract**

The following study tests the effects of different oil types on the amount of water consumption and change in mass of a clarinet reed. The amount of consumption and mass change is dependent on the amount of time the reed is soaked. These variables are also dependent on the type of oil being used to soak the reeds. The reasoning behind conducting this study is to find which oil best preserves the clarinet reeds. Preserving the wooden reeds would not only save woodwind players' money, but it would also allow for the reed to exceed its usual playability time. The findings based on the data collected showed that both the contrasting oils types and the amount of time involved in soaking the reeds did have an effect on the percent change of the mass of the reed. The qualitative factor of playing the oil covered reeds showed that there was a similarity in the way the reeds played as well as the way they initially broke in. However, oil residue and other minor factors did differentiate the oil covered reeds from those without oil. It may be concluded that based on evidence, the type of oils did have an effect on the change in mass of the reed. In addition, time also had an effect on the change in mass of the reed. Even though these factors have an effect on the reed mass, they only cover the reed surface. With this said, soaking the reeds in oils does not allow for the maximum longevity of the clarinet reed. Proper care of the clarinet reed through proper storage and cleaning can save money for woodwind player and ensure the desired reed longevity.

PHY

# The Impact of Invasive Predatory Catfish on the Chickahominy River Food Web

Jackson Gray<sup>G</sup>

## Abstract

*Ictalurus furcatus*, also known as blue catfish, were originally introduced into the Chesapeake Bay in the late 1970's. The blue catfish were originally placed there for the purpose of ridding a type of clam species from the water. Over some period of time the catfish have taken over the Chesapeake Bay Watershed. With few natural predators, the catfish have taken over the benthos, which has eliminated most native species from this area of the water column, and have destroyed the submerged aquatic vegetation that used to be prevalent on the floor of the rivers. It is necessary to understand these fish so that we can get a better idea of the potential damage that this invasive species could potentially have on our ecosystem. In the project, fish were sampled and 21 blue catfish were caught, while 16 fish of different species consisting of bass, bluegill, gar, perch, and bowfin were caught. When sampling gut contents of the blue catfish caught percentages of contents were taken and yielded mean percentages of 25% seaweed, 41% native fish, and 34% molluscs. A single-factor analysis of variance was conducted to determine whether any of the gut content percentages was significantly different from one another, The ANOVA produced a p-value  $\ll 0.05$ . In sampling, not only were more fish caught in the benthic zone than the pelagic zone (21-16), but also every fish sampled in the benthic zone was of the *Ictalurus furcatus* species. This is very significant due to the fact that the benthos should be flourishing with numerous species. In a normal environment in the Chickahominy River, species such as bass, the common carp (also invasive), and channel carp. The lack of diversity among fish species in the benthos points to how damaging are the effects of the blue catfish.

ENV

## **The Difference in Reverberation Time at Tested Locations at Different Frequencies**

Rachel Groover<sup>BG</sup> ★

### **Abstract**

King William High School does not have an auditorium. Because of this, the drama club has used a stage in the school's cafeteria which is only big enough for one speaker or performer. In this location, it is hard to hear the performances, because the reverberation time of the sound waves creates too much sound at one time. The Hamilton Holmes Middle School gymnasium is also used for the performing arts, but reverberation time makes it difficult to have the best sound quality. The reverberant sound in an auditorium dies away with time as the sound energy is absorbed by multiple interactions with the surfaces of the room. In a more reflective room, like a room made out of cinder blocks, it will take longer for the sound to die away and the room is said to be 'live'. These two locations were tested, along with the West Point Auditorium, to see which had the closest reverberation time to that of a professional auditorium. After testing, the cafeteria was found to have the best sound quality out of the three locations.

PHY

## The Effect of Microplastics on the Growth of *Crassostrea virginica*

Hannah Gross<sup>W</sup> ★

### Abstract

The Eastern oyster (*Crassostrea virginica*) plays a key role in the Chesapeake Bay, serving as a habitat for plants and animals, as a filtration system, and as a source of commercial value. However, their population has been depleting, and is at only about 1% of historical population levels due to a variety of reasons such as overharvesting, diseases, and pollution. Eastern oysters are bivalve filter feeders who feed on phytoplankton by opening their shells and intaking suspended particles and water. Oysters are susceptible to the intake of microplastic pollution, a form of pollution only in its infancy of being researched. This study investigated the effects of microplastic particles smaller than 5mm suspended in the water column on the growth in mass and length on the Eastern oyster. The experiment was conducted using two silos, one control group and one experimental group that had 5 grams of plastics added each week. Length was recorded weekly of both groups and a final mass was taken of each oyster. Gut content was also compared at the conclusion of the study. The experiment found two significant P-values for mass and length: 0.0269 and 0.007 respectively. This permits the rejection of both null hypotheses and suggest support of the alternative hypotheses. However, further research and studies are required to draw conclusive data on microplastics in gut content, as there were no plastics found inside their digestive system in this experiment. This could mean that microplastics were not ingested by oysters, but their presence may have impeded oysters from effectively feeding on plankton affecting growth.

MAR

## The Effect of Sodium Ascorbate Concentration on Bacteria Growth

Winter Haigler<sup>BG</sup> ★

### Abstract

A previous study was conducted with the purpose of finding a natural preservative for meats while avoiding harmful synthetic chemicals. The student tested the effects of different essential oils on the amount of bacteria growth in steak. In the end, she was unable to reject her null hypothesis. It was said that one of the few variables that was unable to remain constant was the natural antioxidant levels of the essential oils themselves. This purpose of this experiment was to test the effects of solely antioxidant concentrations on the amount of bacteria growth. Different concentrations of Sodium Ascorbate powder were added to separate steak homogenate dilutions and the dilutions were spread in AGAR plates to be incubated for 24 hours. After 24 hours, the amount of bacteria colonies in each concentration group were counted and averaged. The data underwent a simple linear regression test with a confidence level of 95%. A p-value of  $3.5 \times 10^{-26}$  was received, declaring that the amount of bacteria growth is significantly different at different levels of sodium ascorbate concentrations.

MED

## Effect of Wood Preservatives on the Abundance of *Festuca arundinacea* at Multiple Distances

Elizabeth Hipple<sup>W</sup>

### Abstract

In 2004, the United States Environmental Protection Agency (EPA) released a list of approved wood treatments. These treatments were considered safe to use around open waterways. Chromated copper arsenicals had been very popular, until the EPA found that this treatment was not good for the land and water environments. However, it was not banned from use despite its destructive nature towards the environment. This experiment aimed to analyze the extent to which one of these approved chemicals may have on the plants around it, focusing mainly on the density of the grass blades. *Festuca arundinacea*, was planted around treated wood, untreated wood, and in a control tray with no wood. After six weeks of growth, the grass was analyzed for the number of grass blades per sample. Once these numbers were collected using randomly placed quadrats, they were further analyzed with a two way ANOVA test, which yielded highly significant p-values. It was concluded that the presence of some leaching substance from the treated wood was negatively impacting the grass growth. This shows how leachates from wood treatments impact surrounding plants can help to justify the use of certain treatments over others, especially in crop field fencing. The treated wood posts (presumably treated with unsafe chemicals) may break down over time causing the chemicals to leach into nearby crops or water sources for the crops. This has the potential to contaminate miles of acres of farmland and crops.

ENV

## The Effects of Time on Sea Turtle Displacement

Selena Hubbard<sup>BG</sup>

### Abstract

*Caretta caretta*, or the Loggerhead sea turtle, is the most abundant species compared to other sea turtles. Sea turtles are diverse marine organisms. They are a critical bio indicator of the ocean's diversity and climate changes. Past studies have shown that it is unknown what navigational skills sea turtles use for their migratory patterns. Sea turtles migrate annually to reproduce. This study focused on different time elements; specifically year, Julian day, individual, and new moon and full moon phases. The experiment tested the effect of time on the displacement rates of Loggerhead sea turtles. It was hypothesized that year, Julian day, individual, full moon and new moon would have an effect on displacement rate. An ANCOVA was run to test the categorical independent variables: year, Julian day, and individual. A p value of 0.000129 for individual showed that it did not have an affect on displacement rates. The alternate hypothesis for year and Julian day was rejected because the p value showed that it had an affect on displacement rates. Also, a t test was run to compare new moon and full moon phases; which obtained a p value of .611. In regards to the full moon and new moon phases, the p value showed that they did not have an effect on displacement rates. It can be concluded that time does have an effect on displacement rate when it is Julian day and year.

MAR

## **Allelopathic Effects of Sweet Basil, *Ocimum basilicum*, on Tomato Plant Growth**

Keondra Jenkins<sup>W</sup> ★

### **Abstract**

Allelopathic interactions have various effects on organisms' growth, survival, and reproduction processes. This study compared the growth results of allelopathic relationship between basil and tomatoes against fertilized tomatoes and untreated tomatoes. With the information from this study and conclusions can be made about whether or not allelopathic or "companion planting" can serve as a viable alternative for fertilizer. After nearly 5 months of growth, the allelopathic properties of basil were found to be equal, if not more, beneficial to the growth of the tomato plants as fertilizer. Basil being planted along the tomato plants resulted in more tomatoes produced, faster germination time, and more massive roots. In those cases, the findings were all significant and the null hypothesis was rejected. There was no significant difference in the effects of basil or fertilizer final plant height, final plant biomass, and root length and growth rate. In those cases the null hypothesis fails to be rejected. This study seemed to indicate that the allelopathic relationship seems to greatly benefit the root growth of tomato plants. With more massive, dense roots, the plants maintain greater water retentions which is likely the cause of its greater tomato production. Considering this may mean the companion planting is in fact a suitable alternative to fertilizer, thus lessening the effects of its harmful chemicals.

BOT



# **An Analysis of Hurricane Trends in the North Atlantic and Pacific Oceans – Is Our Hemisphere Out of Phase?**

Zhide Andy Jin<sup>G</sup> ★

## **Abstract**

Hurricanes are storms that store a large amount of tropical energy and redistribute it toward the poles in the form of rain, wind, and waves. The Atlantic Multidecadal Oscillations (AMO) and Pacific Decadal Oscillation (PDO) can also affect hurricane intensity and frequency. This study uses meta-analysis to determine if the Atlantic Ocean and the Pacific Ocean is in their low or high activity period of the AMO and PDO. Prediction is made that the Atlantic Ocean is currently in its low activity period of the AMO and the Pacific Ocean is in its high activity period of the PDO. As results show that there are significantly less storms in recent years compared to high activity year, the Atlantic Ocean is in the low activity period of the AMO. The study can be used to predict frequency of future tropical storms and the strength of the storms, and allow nations to better respond to the consequences of tropical storms.

ENV

## Effect of Caffeine on the Growth Rate and Molt Size of *Callinectes sapidus*

Michael Johnson<sup>W</sup> ★

### Abstract

The Blue crab has been a historically important source of income and a regional delicacy to members around or near the Chesapeake Bay. Over the past century there has been a great decline in the historic population of the Blue Crabs located in the bay, not only from diseases and pollution but from overharvesting. With the crabs not being able to repopulate fast enough they declined to historic lows. This study looked at a way to increase the growth rate and potentially see if there was a way to increase the size of the crabs per molt at the same time. Naturally crabs have a calcium process that uses caffeine in the water to grow their shell, so theoretically more caffeine, the faster and bigger the crab should molt and grow. Each crab was collected by either seining and keeping the legal juvenile limit (3-4 inches) or purchased from local watermen who seined for them. Four tanks or “floats” were constructed and filled with local water from the Lower Machodoc and a filtration system was established for each float. Four groups, no caffeine, 1000mg, 2000mg, and 3000mg were tested. Each crab shed was recorded versus its hard-shell molt. The higher the levels of caffeine, the larger and faster the crabs seemed to molt and grow. This is depicted by the highly significant p-values that were acquired by running single-factor ANOVAs. The finds from this study are potentially great because this means that potentially you could give caffeine to crabs to speed up their growth and aquafarm them at a rate greater than the natural populations.

MAR

## **A New Method of Aging Longnose Gar, *Lepisosteus osseus***

Sylvia Jones ★

### **Abstract**

A new method for aging Gar is needed because the current method of aging with branchiostegals does not work for all fish. This study uses Longnose Gar to test a method of aging with opercles, and compares it to the branchiostegal method. The results show that when compared, the age estimates of both methods are symmetrical. Also, there is no significant difference in curve of the projected length at age models, or in the models' parameters. This proves that aging with opercles is just as accurate as aging with branchiostegals, and could be used for aging other Gar, such as the Alligator Gar. Future research might compare these methods to an otolith aging method.

ZOO

**An Evaluation of the Accuracy of HabCam Image Analysis Data in Assessing the Abundance of the Sea Scallop, *Placopecten magellanicus***

Zachary Kaylor<sup>G</sup>

**Abstract**

The Atlantic sea scallop is a marine bivalve that inhabits the western part of the Atlantic Ocean. This animal lives in the benthic zone of the ocean, making sampling and assessing fishery stocks a difficult thing to do. The current sampling method of using a dredge to directly sample and physically count scallops is inefficient and it creates significant disturbance in the benthos. In order to avoid causing stress to benthic organisms, Woods Hole Oceanographic Institute (WHOI) has developed a camera system that is towed behind a boat similar to the dredging method. Known as the “HabCam”, it takes a continuous stream of pictures of the ocean floor that are then analyzed to sample the scallop population. In this study, data from the WHOI HabCam is compared to data from Virginia Institute of Marine Science (VIMS) dredge sampling in order to determine which is more suitable for assessing the scallop population. The average difference between the HabCam and dredge was 0.41 scallops per m<sup>2</sup>, indicating that there is a difference between the accuracy of the HabCam assessment and the accuracy of the dredge assessment. A t-test was run on the two sets of data and returned a two-tailed p=0.2134, indicating the difference between the accuracy of the two sets is not statistically significant. Further work is required to determine the exact difference between the sampling by the HabCam and the sampling by the dredge; the HabCam may be a better sampling method due to the lack of benthic disturbance.

MAR

## **Tidal Flow Makes Spat Grow**

Patrick Kelly<sup>W</sup>

### **Abstract**

Farming oysters on the Chesapeake Bay or in one of its many tributaries has become a substantial business in the recent past. Watermen who have been unlucky with natural reefs due to the destruction of oyster reefs and diseases in past decades have started to grow oysters from spat and larvae to adults in cages, baskets, bags, many other different ways. This experiment was based around testing different locations in a creek and measuring the survival rate and growth rate of oysters. The experiments purpose is to find the best location for oyster beds to be placed so that watermen can get the highest yield for their product. The independent variable of the experiment is the tidal flow at the different locations of the creek, and the dependent variable is the growth rate of the spat from each location site in the creek and also the survival rate of the spat on oyster shells. The results of the experiment show that with increase of tidal flow due to the location in the creek then the spat on shell oyster have a faster growth rate due to increase of nutrient flow and oxygen. The location nearest to the mouth of the creek produced a higher growth rate for the spat compared to the location deep in a cove due to the large difference in tidal flow. There was no significance difference for survival rate of the spat between the 3 different locations. To sum it all up more trials do need to be done on the experiment, because he did not have the necessary time or money to more trials, but the little results of the experiment showed that if fishermen strategically bought oyster grounds in areas with high tidal flow they maybe able to increase their product significantly.

MAR

## **Seasonal Analysis of the Butterfly Population in Eastern Virginia**

Kirby Lingenfelter<sup>G</sup>

### **Abstract**

Many butterfly species are declining because of habitat fragmentation and loss, and increasing use of pesticides on plants. In this study, butterflies were counted at three different habitats in Gloucester County, VA to determine how the population numbers changed throughout the summer and whether the different habitat types would have an effect on the number and types of butterflies observed. The more mature and diverse gardens attracted more abundant and more types of butterflies, but the types of plants (native vs. non-native) did not make a difference. Butterflies are important pollinators and their loss would threaten our food supply. People everywhere can play an important role in saving butterflies by growing appropriate backyard habitats and reducing their pesticide use.

**The Effect of Aragonite Enrichment on the Growth Rate of the American Oyster,  
*Crassostrea virginica***

Kiwan Lipscomb<sup>G</sup> ★

**Abstract**

Ocean acidification is becoming a very significant problem for marine ecosystems and is often called the evil twin of global warming. As humans continue to burn fossil fuels, the ocean is becoming more acidic. The shell formation process of the Eastern Oyster is very dependent on dissolved calcium. In this specific study, the effect of aragonite enrichment was tested. Since aragonite is composed of calcium carbonate, it should raise the pH of the water and act as a growth enhancement for the oysters as it dissolves into the water. For this experiment juvenile oysters of relatively the same size were placed in 6 bags of oysters, 3 of them contained 100 grams of ooid sand. The bags that did not have any ooids were the control group. During the study period, oysters of each treatment showed signs of growth in both shell length and mass. The oysters with the ooids grew on average 4.88 mm in length while the oysters without the ooids grew on average 8.06 mm. A t-test was run on these data and  $p=0.88$  which means that this difference was not significant. During the experiment period the pH of the water did not drop below a neutral value of 7, so ooids did not dissolve. The ooids could have had a better effect on the oysters if they were added during the juvenile stage. If this project were continued, it would be expanded to a larger scale experiment. This project is very important to the environment because oysters play a key role in estuarine ecosystems.

MAR

# **The Effects of Triclosan on Plankton Taken from the Elizabeth River, the Rappahannock River, and the Potomac River**

Gillian Love<sup>BG</sup> ★

## **Abstract**

Antimicrobial agents (substances that kill or inhibit the growth of microorganisms) are common ingredients in many everyday household, personal care and consumer products. Pharmaceuticals and personal care products (PPCPs), specifically triclosan (TCS), entering the environment may have detrimental effects on aquatic organisms. This study analyzed the effect of TCS on plankton, overall, and the effect on plankton as a whole in the Elizabeth, Rappahannock, and Potomac River. Information was gathered on the overall grade of each river, decided by the Chesapeake Bay Foundation, before plankton was towed from them. TCS was diluted in 100mL of water at .2, .4, .6, and .8 grams – then added into a 200mL solution of nutrient and river water. Overall, there was no effect on the rivers, meaning they were more similar than originally thought, but it was shown that plankton did have a negative impact from the chemical. Detrimental effects on phytoplankton populations could ultimately impact nutrient cycling and food availability to higher trophic levels. The results of this study are a step toward identifying the risk of PPCPs like triclosan on estuarine organisms and may benefit environmental resource managers.

ENV



## Age and Growth in the Sea Scallop *Placopecten magellanicus*

Nicholas Mann<sup>G</sup> ★

### Abstract

The objective of this study is to develop an age at length description for the sea scallop *Placopecten magellanicus*, collected from currently fished populations in U.S continental shelf waters in the Mid Atlantic and Georges Bank regions. Scallops came from 2012 collections on Georges Bank (GB), Nantucket Lightship (NL), Hudson Canyon (HC), and DelMarVA (DMV). Ages at length descriptions were developed from measurements of hinge to annual growth rings on the shells. Data were examined as von Bertalanffy plots that describe  $L_{inf}$  (maximum size) and K (growth rate). GB, NL, HC, and DMV scallops had  $L_{inf}$  values of 160.2mm, 168.4mm, 175.53mm, and 163.7mm respectively; and K values of 0.31, 0.23, 0.20, and 0.21 respectively. All populations had comparable  $L_{inf}$  values but GB grew more quickly. GB values were compared with historical records from 1959, which had  $L_{inf}$  and K values of 147.1mm, and 0.31 respectively. Present day GB scallops have maximum lengths of approximately 20mm larger than collections of those 50 years ago.

MAR

## **The Effect of Ocean Acidification on the Oxygen Production of the Diatom *Cyclotella***

Nancy McClain<sup>w</sup> ★

### **Abstract**

The world faces a great problem today: ocean acidification. As one of the many negative results of global warming, ocean acidification has proven a destructive force in many marine environments. In an attempt to better understand just how significant its impact is on environments, this study observed how *Cyclotella* (a common diatom in the Chesapeake Bay) reacted to both a decrease and an increase in pH. Over the course of nine days, the study measured the oxygen production of 15 samples of *Cyclotella* and 15 samples of possible bacteria in three different pH groups (7.7, 8.1, and 8.5). The bacterial data was then subtracted from the algae data, so that the only thing being considered at the end of the experiment was the dissolved oxygen production of the *Cyclotella*. At the end of the study, it was found that while the 8.1 pH group produced more D.O. overall, it was the 8.5 pH group that was significantly different from the other two groups. With this result, it was inferred that perhaps the issue of decreasing pH may not hold the quick and disastrous effects as was once thought. Instead, an increase in pH may prove more detrimental to marine organisms and environments. However, this study was only performed on one common species of phytoplankton in the Chesapeake Bay; so the trend found may not hold consistent with other species, or even other groups of *Cyclotella*. Further study will be necessary to understand how ocean acidification affects the entire hierarchy in marine environments such as the Chesapeake Bay.

MAR

# **The Effect of Oyster Type and Location on Amount and Type of Micro-plastic and Anthropogenic Debris Embedded in Oysters**

Safia Nizami<sup>BG</sup> ★

## **Abstract**

Micro-plastics have shown to be a great threat to environmental health. It has been found that shellfish are more susceptible to contain micro-plastics over other marine organisms (Rochman, 2015). Of these shellfish, main concerns revolve around oysters. This study investigates the amount and type of micro-plastic found in Eastern Oysters (*Crassostrea virginica*) from upstream Rappahannock River, Eastern Oysters oyster from downstream Rappahannock River, and whole preserved Pacific Oysters (*Crassostrea gigas*) from Washington State. This study shows no correlation between the amount of plastic and these different oysters; however, it did show a surprising amount of plastic debris in all oyster types. Seafood containing Micro-plastic may show to be a health risk for humans along with marine life.

MAR

## **The Effect of Population Density, Country, and Year on Net Immigration**

Thomas O'Saben<sup>BG</sup>

### **Abstract**

This experiment was conducted to figure out the effects of population on the net immigration and to show the effects of country, year, and population density. Net immigration is the overall movement of people moving in and out of an area which in this case would be countries. The data used for the experiment was gathered by the World Bank. The findings are useful in showing trends in the movement of people to and out of the five countries of Canada, Chile, Estonia, Spain, Greece, and the United Kingdom. After an Anova was run on the data showing that there was an effect of the different countries and the year when it came to population density the p value showed there was no effect of one on the other.

STAT

## **Are Bridges a Vector of Introduction for *Commelina communis* and *Microstegium* *Vimineum* in the Dragon Run Swamp?**

Britney Owens and Brandon Owens<sup>W</sup> ★

### **Abstract**

The Dragon Run Swamp is the most important ecosystem in Virginia, considering its proximity to the Chesapeake Bay. The Dragon Run Swamp provides a home for many marine and terrestrial organisms, including migrating organisms. It also provides a habitat for many plants, both native and non-native. However, these non-native, invasive, species are taking over the Dragon Run Swamp and slowly killing the native plants. This study compared the amount of *Commelina communis*, commonly known as the Asiatic Dayflower, and *Microstegium* *Vimineum*, commonly known as Japanese Stiltgrass, at three different distances from three different bridges along the Dragon Run Swamp. Three 10x30 foot zones were measured and the amount of each of the two invasive species was measured. The alternate hypothesis stating that the amount of each invasive species would decline as the distance away from each bridge increased was confirmed after recording the data. A p-value of 3E-7 for the Japanese Stiltgrass data and a p-value of 6E-12 for the Asiatic Dayflower data were highly significant. After confirming the alternate hypothesis, this study gives scientists a more accurate representation of the habitat of Japanese Stiltgrass and Asiatic Dayflower in the Dragon Run Swamp region. This data can then be used to help attack the invasive species at the bridges in the Dragon Run area and eradicate these harmful invasive species in the pristine Dragon Run environment. The data helps show if human influence from the bridge and roadway affects the population of invasive species around that bridge.

ENV

## **The Effect of pH on the Growth Rate of Blue Crabs (*Callinectes sapidus*)**

Stephen Parker<sup>W</sup>

### **Abstract**

Global Warming is a serious issue in the environment nowadays. The carbon dioxide emissions produced primarily by industry and automobiles not only heat the atmosphere, but some dissolves into the world's oceans to cause Ocean Acidification. A change in the acidity of water could possibly alter the well-being of marine organisms. Blue Crabs have previously been used as indicators of ocean health, via salinity. Blue Crabs must molt to grow, and only molt if the crab is healthy and in safe conditions. This experiment tests the possibility of relation between the pH of water and the growth rates of Blue Crabs living in said water for two weeks.

The blue crabs in question were placed in separate tanks in which the water's pH was raised or lowered using aquarium-grade pH modifying drops. Different pH levels from 6 to 8 were used. Crabs tended to grow more in 7.5 water, and appeared healthier. There was not enough significant evidence to reject the null hypothesis. Studies such as this one could help to assay an underlying cause of estuarine health decline, as many different factors can cause small changes in pH.

MAR

# **The Effect of Leaf Pack Composition on the Evenness and Total Number of Macroinvertebrates Collected**

Abigail Raposo<sup>BG</sup>

## **Abstract**

Leaf packs are a common tool used for collection and identification of macroinvertebrates in shallow water along the Chesapeake Bay and its tributaries. Leaf packs are traditionally bags filled with leaves that serve as a food source and habitat for the macroinvertebrates. By removing the food source (the leaves) and replacing it with synthetic material of the same mass the food source is taken away and macroinvertebrates with unique dietary needs are not disproportionately attracted to the bag and create biases that affect relative abundance. While removing the organic component had no discernable effect on the actual number of macroinvertebrates caught it did cause the richness to decrease and the evenness of the feeding groups of macroinvertebrates to increase, which showed an influence of biases in the current used method. This could open up new opportunities in leaf pack formation, use, and limit restrictions that exist on the packs currently.

ENV

## CO<sub>2</sub> Emissions from Different Land Uses During the Fall Senescence

Edwin Rice<sup>W</sup> ★

### Abstract

Land use change and conversion is a modern contributor to rising atmospheric CO<sub>2</sub> concentration. With the expansion of human population and urban development, human activities including the burning of fossil fuels, deforestation, and land use change are directly contributing to elevated CO<sub>2</sub> levels globally. According to the Mauna Loa Observatory in Hawaii, data records report that present global CO<sub>2</sub> levels have reached extreme measures of 397 ppm. Pre-industrial CO<sub>2</sub> levels accounted for only 280 ppm, and since then, has seen a significant increase in the concentration of atmospheric CO<sub>2</sub> that has resulted in current CO<sub>2</sub> level trends. The purpose of this project was to determine if different types of land uses (Farmland, Forest, Marsh, Marina, and Clear-Cut Forest) contribute to elevated Atmospheric Carbon Dioxide Concentrations found at three local locations: Ophelia, VA, Fleeton, VA, and Reedville, VA, during the fall senescence. CO<sub>2</sub> levels from each land use were measured using a CO<sub>2</sub> Meter Probe with a PASCO Spark Interface and collected at the three local testing sites over a 10 day period. This study concluded that when native land uses (Forest and Marsh) are converted to modern land uses (Farmland, Marina, and Clear-Cut Forest), the result is an increase in net flux of CO<sub>2</sub> contributed to the Earth's atmosphere. Statistical Analysis was conducted on this study using a two-way ANOVA test which supported that this study was not significant yielding a p-value of 0.51 level of significance.

ENV



## **Distributions of Microplastics Along the Shorelines of Atlantic Beaches in Virginia and North Carolina**

John Richardson<sup>W</sup> ★

### **Abstract**

Plastics are a major source of pollution in the world's oceans. Microplastics (defined by NOAA as plastic particles < 5mm in diameter) in particular represent several potential threats to marine ecosystems, such as toxin bioaccumulation and zooplankton ingestion. Research into the global distribution of microplastics and their effects on the environment is ongoing and relatively recent, making said effects difficult to determine. Multiple studies from around the world have confirmed the existence of microplastics in the marine environment with varying degrees of density. This study looked at the level of microplastic pollution on barrier islands off the east coasts of Virginia and North Carolina in order to see if there was a relationship between local urban development and microplastic density. Samples of intertidal sand (n = 15) were taken from four sites along the Atlantic coast and tested using density separation in a saturated NaCl solution for microplastic content. Results show that while there was a difference in mean potential microplastic levels between the samples from Virginia and the samples from North Carolina, there was no statistically significant difference (p-value  $3.01 \times 10^{-6}$  compared to level of significance 0.05) in mean levels between the two sample sites in each state. This could mean that microplastic levels on barrier islands might be controlled more by ocean-based sources than immediate land-based ones. Further research is required in order to understand the movement and distribution of microplastics across the globe, their sources and resting places, and how significantly they could affect global marine ecosystems.

ENV

## Effects of Ocean Acidification on Respiration Rates of *Palaemonetes pugio*

Kenneth Rioland and Alec Westall<sup>W</sup> ★

### Abstract

Global warming is a significant issue which affects marine life due to the increase of carbon dioxide in the atmosphere. This increase of CO<sub>2</sub> emissions results in the decrease of pH in the oceans and estuaries of the world. This paper discusses the effects of this decrease in pH and the effect it has on marine life. In the experiment conducted, the focus was on the respiration rates of grass shrimp and how various pH's will determine the number of respirations a grass shrimp will have within a thirty second interval. It was hypothesized that the shrimp's respiration rates would have an inverse relationship and the respiration rates would increase as the pH decreased. This supports the belief that marine organisms with a bicarbonate structure are highly stressed in more acidic environments which increases respiration rates, decreases dissolved oxygen, and increases mortality rate. The results from the study conducted supports this theory that pH causes marine organisms, specifically with a bicarbonate shell, to increase respiration due to stress. The null hypothesis was rejected and the results failed to reject the alternate. A statistical analysis was conducted and the resulting p-value proved to be highly significant. Three test subjects were placed within three different pH levels and was shown to be most stressed at a pH of 6.0 with a mean respiration rate. With this information, it can be concluded that the decrease of pH does in fact cause stress to marine life.

MAR

## How Grass Beds act as Habitats for Blue Crabs

Dylan Rose<sup>W</sup>

### Abstract

Grass beds are an essential part to the health and well-being of the Chesapeake Bay, serving to help keep the bay clean and provide habitat to many species that are also crucial to helping and maintaining a healthy bay. One of the species that tend to reside in these grass beds is *Callinectes sapidus*, the Blue Crab. The Blue Crab uses the grass beds as a habitat, especially the smaller juvenile crabs, soft crabs, and peelers, since the grass provides a good source of protection and hides the crabs from any potential predators, allowing them to grow into their hard shell, mature stages where they are able to defend and protect themselves much more effectively. The Blue Crab is a vital species to both the ecosystem and the economy of the seafood industry, being a large part of the market due to its popularity, and being the most valuable market from the Chesapeake Bay. The Blue Crab is a keystone species, being a vital part of the ecosystem as it acts as prey and being a food source for many of the larger species in the bay, such as the striped bass, red drum, catfish, and some species of birds. The blue crab larvae, called the zoeae, also serve as a vital part of the diet of the filter feeders, which get their nourishment off of the plankton in the water. The blue crab also serves as a vital predator in the Chesapeake Bay food web, feeding on many of the benthic species of the bay, primarily bivalves such as oysters and mussels, and also preying on periwinkles, which has a large effect on marshes to keep them from overfeeding on the grasses. They also act as scavengers, feeding on detritus, freshly dead animals, and nearly anything else that ends up on the floor of the bay, helping to keep it clean.

MAR

## **The Effect of Time on Sharks**

Jarlene Salgado<sup>BG</sup>

### **Abstract**

The general migration patterns of sharks is unknown especially since sharks can be difficult to catch and tag, and because they are usually solitary creatures. Since tagging is difficult, scientists cannot see if there is any particular time that sharks will migrate more or less, or to a certain area. Time of year is usually signal for other fish to migrate to certain areas such as season on anadromous and catadromous fishes. Finding when sharks migrate can tell when they are spawning or searching for food. Since sharks are becoming more and more extinct and endangered because their valuable fins are being used for sharkfin soup or because people want to hunt them for game or fear, finding the time they migrate the most allows for shark conservation to be put to greater lengths because currently there is minimal protection on sharks and even less in international waters. Shortfin mako, *Isurus paucus*, is one of the most hunted sharks because of its fins for sharkfin soup and for game, thus labeling it as a Vulnerable species. Shortfin mako sharks are one of the species of sharks that has been caught and tagged through NOAA through their GTOPP program. The shortfin mako sharks have been monitored over nine years and the purpose of this study was to see when will shortfin mako sharks travel the most during year, season, and even on the particular day. Using an ANCOVA statistical test using displacement rates, it was found that the shortfin mako sharks will be displaced more during an El Nino year, colder seasons, and will move at higher displacement rates particularly on April 21. This is likely due to the temperature and migration of prey causing them to breach out of the water more and have higher displacement rate.

MAR

## The Effect of Turbidity on Mummichog, *Fundulus heteroclitus*, Predation

Sydney Scherer<sup>w</sup>★

### Abstract

The Chesapeake Bay is an extremely productive environment and contributes to the watershed area with a unique set of economic opportunities. However, the Chesapeake Bay has been degrading. The excess nutrients present in the Bay due to man-made sources have several repercussions including increased turbidity and low levels of oxygen in the water. This study compared the effects of varying turbidities on the amount of common grass shrimp, *Palaemonetes pugio*, to be located and consumed by Mummichogs, *Fundulus heteroclitus*, in an illuminated and dark setting over a five hour time span. Both species are abundant in the Bay and contribute largely to the food web of their ecosystem. After two full days of withholding food from the Mummichog, the Mummichog was released into the cooler one hour after the Common Grass Shrimp and the time started for the fish. The Mummichogs were observed for a time of five hours. The fish were then removed from the cooler, the water sifted, and the remaining shrimp counted. Each trial had one Mummichog and five grass shrimp. This process was repeated in low, mid, high, and very high turbidity with six trials for each turbidity level, three of which were conducted under a light source while the other three were conducted under a covering. The turbidity levels were shown to have a significant effect on the ability of Mummichogs to catch prey. This was supported by a significant p-value of 0.0396 between the turbidity levels and a significant p-value of 1.86E-4 between the light and dark trials. However, the P-value between each combination of turbidity and illumination was 0.0829 and not statistically significant. This study shows that increased turbidity levels in the Bay can negatively impact the ability of organisms to locate food sources.

MAR

## A Comparison of the Ecological Effectiveness of Natural vs Manmade Ponds

Kristen Shipman<sup>W</sup>

### Abstract

Habitat destruction, due to industrialization, has claimed forests, lakes, ponds, and marshes along with their inhabitants at an alarming rate. Industrialization cannot be stopped altogether therefore, habitats *will* be destroyed. However, once a habitat is destroyed a new, manmade, one could potentially take its place. This is not a new concept. Manmade marshes have already begun being implemented after organic marshes have been torn down. Manmade marshes have been shown to, overtime, be generally as effective as organic marshes. What if this idea was more widespread across other types of habitats, like ponds? If the relative effectiveness of manmade ponds is that of a natural pond, then they could possibly be implemented in the place of natural ponds, and the unique ecosystem of a pond may be saved. This study compared the relative effectiveness of manmade verses natural ponds. Two ponds were tested, one manmade and the other of natural origin. Relative effectiveness was measured by the ponds' dissolved oxygen, pH, temperature, turbidity, and minnow population. Over a ten week sampling period each of these were measured at both ponds once a week. The data showed significant p-values for turbidity (0.000016) and minnow population (0.022) in the tested ponds, and non-significant p-values for temperature (0.091), pH (0.32), and dissolved oxygen (0.46). These results showed that generally manmade ponds are as ecologically effective, if not superior to, organically made ponds. The immense biodiversity that lives in natural ponds may no longer be threatened if manmade ponds are implemented in place of natural ponds after natural ponds are destroyed. Urbanization has taken many organically made ponds, however, new manmade ponds may provide high biodiversity and prosper.

ENV

## **The Effect of Transport Distances on Horse Heart Rate Recovery**

Jenna Sisson<sup>BG</sup>

### **Abstract**

Like humans, stress can be unhealthy for horses. Stress can cause horses to react unpredictably, thus putting handlers in dangerous situations. Prolonged stress can also weaken the immune system leading to illness and depression in the horse. Transporting horses is increasingly common and often necessary. Horses can be transported for multiple reasons including competitions, livestock and equine sales, breeding, medical purposes, and leisure activities such as trail riding. Because of this, it is important to understand how trailer rides affect horse stress levels. To do this, heart rate recovery time was observed after trailer rides at different time intervals. The resting heart rates were first determined in the horse's normal pasture using a Polar equine belt. As soon as the horses were loaded in the trailer, a timer was started for either 5, 30, 60, 90, or 120 minutes. The horses were driven around for the appropriate amount of time and then brought back to the same farm property at a different entrance for easier unloading. The horses were quickly unloaded and secured and heart rate was recorded until it was equal to the average heart rate previously recorded. The P value was 0.002529655, showing that these data are significant. As transport distances increased, heart rate recovery time increased as well. . From these data, it can be concluded that approximately five minutes should be allowed for a horse's heart rate to recover for every 30 minutes that it has been in the trailer.

ZOO

## **Effects of Living Formations on *Crassostrea virginica***

Megan Squires<sup>W</sup>

### **Abstract**

In this experiment the growth rate of oysters in different group arrangements were measured and tested. Several oysters were grouped together in different arrangements, left to grow for several weeks and measured each week for growth as measured by length. The arrangements included a cylindrical formation, cluster formation, flat formation, and a control group where they are left to settle naturally. The oysters that grew in the cylinder group showed the greatest growth rate followed then by the clustered oysters, the oysters that were flat and finally the control group. The p-value of the data shows that the information gathered was not significant and this shows that the null cannot be rejected and the alternate cannot be supported. However, all experiments showed greater growth than the control group. The trend also showed that the cylindrical formation is double the rate of the control group and may have been more evident if the sample size had been greater. The results found in this experiment are not significant however, there was a growth difference among the different arrangements of the oysters. This is likely due to the water flow being more accessible to some of the oysters than to others and their ability to filter also being linked to the water flow. This information is also useful for the waterman and scientists that are trying to grow and restore oyster populations in the Chesapeake Bay by giving them different ways to grow and faster ways in which to grow. This information can increase their likelihood of building their population back up to help the condition of the Chesapeake Bay.

MAR



## **The Effect of Development on Dissolved Oxygen and Macro-Organisms**

Laura Stickler<sup>W</sup>

### **Abstract**

Higher areas of development have been shown in various studies to have an impact on nearby water sources. More pollutants are able to enter into the water when located near development. This study looked at the effect of varying levels of development on the dissolved oxygen and macro organisms in Chesapeake Bay tributaries. Three sites were tested each Saturday from June 20<sup>th</sup> until July 11<sup>th</sup> for the dissolved oxygen level of the water and the number of macro organisms found at each site. Additional data was taken from the Chesapeake Bay Interpretive Buoy System from their Stingray Point site; the data collected from this source was taken from the same days as the other three sites. The averages for dissolved oxygen were 7.25 parts per thousand for Belle Isle; 9.375 parts per thousand for Ottoman; 9.75 parts per thousand for Windmill Point; and 7.21 parts per thousand for Stingray Point. Looking at these averages, it shows Belle Isle and Stingray Point as being very similar. This also shows Ottoman and Windmill Point as being similar to each other. This may represent other similarities between these sites. The anova performed on the data for the dissolved oxygen levels gave a p-value of 0.004861692 which shows that there is a significant difference between the dissolved oxygen levels found at the sites. Belle Isle had an average of 3 macro organisms, while the averages for the other sites showed that there was no macro organisms found for Ottoman and Windmill Point. Each site did have different sediment types present which may have contributed to different results than what may have been found if each site had similar sediment types. The two sites with the lower dissolved oxygen levels were the two with the least surrounding development.

ENV

## **Understanding Fixed vs. Growth Mindsets to Achieve Success Through the Use of Positive Psychology**

Justin Swisher<sup>G</sup> ★

### **Abstract**

Positivity has a definite influence on the success of student's life and into adulthood. Through simple observations of students and adults alike, negativity is the observed predominate mindset in many individuals. This study focused on observing higher order thinking students seeing if positive psychology methods will alter the mindset of each student to become more growth minded individuals. The data shows that the magnet school students fall more toward a growth mindset rather than a fixed mindset. If schools and people would praise effort more, be more positive, and allow for individuals to reach their full potential, then a generation of growth mindset individuals would appear.

# **Does Land Use Surface Affect the pH of Storm Water Runoff Flowing into the Chesapeake Bay?**

Zinnie Tabb-Reed<sup>G</sup>

## **Abstract**

Stormwater runoff from many different cities, agricultural lands, and suburban areas drain into the Chesapeake Bay. These land uses are very different and can potentially alter the pH of the stormwater entering into the Chesapeake Bay. Rainwater was sampled over the months of May through November from three different land use types including an unfertilized lawn, an agricultural field, and a pavement surface. All 3 treatment types were chosen to represent the land uses that make up the Chesapeake Bay watershed. The rainwater sampled over the summer, all reflected my control. An experiment testing the effect of land use types was also ran using the land uses forest, lawn, agricultural field, asphalt and control. I concluded land uses have no effect on the pH of the water entering the bay. Ocean acidification is the biggest phenomena in the ocean and is a growing problem in the estuarine, and as more CO<sub>2</sub> emissions continue to enter the atmosphere, the rainwater will continue to become more acidic. The land will not buffer the pH to make it neutral, so acidic runoff will continue to run into the bay and other bodies of water. Green infrastructures are affordable and easy maintenance techniques that can reduce the amount of stormwater runoff entering the bay which will mitigate ocean acidification.

ENV

## **Effect of Fiddler Crab Burrows on Saltmarsh Erosion**

Jessica Thomas<sup>W</sup>

### **Abstract**

In this experiment the sediment of a saltwater marsh was measured in correlation to the population of fiddler crabs within the marsh. The three different areas contained three stakes that were measured initially. Each area was determined by the population of fiddler crabs. Every three days in August, the stakes were measured at each of the three sites. At the end of the month, a measurement was taken before and after a hurricane. The p-value of the data collected was not found significant. The null hypothesis cannot be rejected and the alternative hypothesis cannot be supported. The area containing the average population of fiddler crabs did not experience a high sediment change. The area that contained the high population of fiddler crabs saw a substantial gain in sediment. The area that had no fiddler crabs had the least amount of change overall. The area with the high population of fiddler crabs increased sediment in the high and low tide regions. The cord grass found within this experimental region was stronger due to the high population of fiddler crabs. The high fluctuation of sediment allowed for the burrows to allow excess nutrients to increase the stability of the cord grass holding sediment. The area containing the average population of fiddler crabs showed little to no change overall showing that an average population was stable enough to maintain sediment. The area that contained no fiddler crabs lost sediment in the low and mid-tide range while it saw no overall change in the high tidal region. This is due to the lack of sediment fluctuation and oxygen flow to the cord grass. The data collected after hurricane Jaocuin showed that the overall effect of burrows on the productivity of smooth cord grass is not effective in high winds. This information benefits the Bay by allowing the salt marsh habitat continue to maintain efficiency as a wildlife preserve.

MAR

## Effects of Magnetism on *Phaseolus lunatus*

Olivia Vogel<sup>W</sup>

### Abstract

This study measured the effect of magnetic fields on the growth rate of *Phaseolus lunatus*. *Phaseolus lunatus*, also known as Lima beans or Butter beans, are a popular legume grown for its edible properties. This study only tested how magnets effect the growth rate of *Phaseolus lunatus*. This study started in November, with plants grown inside in a well light room, and given as much natural light as possible. They were grown over a period of 3 weeks. Using Hydroxyl potting soil, the plants were planted in four clear plastic bins measuring 35 by 15 cm. The bins were then labeled 1, 2, 3, and 4. Six beans were placed in each bin for a total of 24 beans. Magnets were placed in bins 1, 2, and 3, and bin number 4 was the control. 1 magnet was placed in bin 1, 2 magnets were placed in bin 2, and 3 magnets were placed in bin 3. There were no magnets placed in bin 4. The bins were then watered and placed under a large window. Each plant was given its own letter for identification, and the plants were rotated in their positions under the window weekly to ensure equal sunlight. The plants in bins 1 and 3 grew two times taller than the plants in bins 2 and 4, despite the fact that there were magnets in bin 2. The plants that did the best were under the effect of an odd number of magnets. The p-value gotten from these plants was  $2.05 \times 10^{-4}$ , and that is highly significant. Plants under the effect of the magnets grew faster than plants without. This study is important because it studies a new way to increase growth rate of plants. It is important to anyone trying to grow plants in a harsher environment.

BOT

# The Effect of Cover Crops on Carbon Dioxide Emissions

Parker Wallace<sup>G</sup>

## Abstract

With the constantly rising global population, the carbon footprint of the human race is growing exponentially. Scientists and environmentalists worldwide continue to look for ways to mitigate carbon pollution with multiple methods. While farmland doesn't contribute to as much air and water pollution as large factories, the carbon released from the soil and fertilizer runoff contribute to the Earth's widespread problem of pollution. An efficient method to help solve this problem involves cover crops. Cover crops are crops planted mostly in the winter after cash crops are harvested. These crops include legumes and grasses like soybeans and wheat. The crops sequester carbon and nitrogen and store it in the soil for the cash crops to use the next year. This project focuses on the carbon sequestration side of cover crops and seeks to prove there are more benefits of planting cover crops than just fixing nitrogen. Soil cores were taken out of fields with cash crops such as corn, soybeans and wheat, and also fields with cover crops like legumes and grasses, a SPARK CO<sub>2</sub> probe was used to measure the amount of CO<sub>2</sub> given off by the soil. Based on the experimental results, the null hypothesis of there will be no difference in the two carbon emissions cannot be rejected. An ANOVA was run to see if there was a difference between the carbon dioxide emissions and the p value was  $3.94 \times 10^{-6}$  which is significant. Disagreeing with the hypothesis of the soil with a cover crop will give off less carbon than the soil without a cover crop, the project showed the cash crops emitted less carbon dioxide than the cover crops.

ENV

## **Effect of Ocean Acidification on the Eastern Oyster, *Crassostrea virginica***

Kayleigh Webster<sup>W</sup>

### **Abstract**

CO<sub>2</sub> emissions are rising rapidly. This CO<sub>2</sub> pollution is causing an accelerated rate of ocean acidification. Ocean acidification occurs when high levels of CO<sub>2</sub> diffuse into water, causing the creation of more hydrogen ions than calcium carbonate in the solution. This imbalance causes the degradation of the protective shells of calcifying organisms and increased susceptibility to illness. This experiment tested the effects of ocean acidification on the Eastern oyster, *Crassostrea virginica* over three weeks. The changes in shell length, mass, and mortality of the Eastern oyster were measured as a percentage difference from Day 1. Adult oysters and spat were tested in six pH groups: 8.2, 8.1, 8.0, 7.7, 7.5, and 6.0. Length was measured in millimeters with a ruler; mass was measured in grams with an electronic scale. It was hypothesized that positive length and mass change and the lowest mortality rate would occur in the most basic pH group, decreasing and increasing respectively as pH lowered, leaving the 6.0 pH group with the lowest length and mass change and highest mortality rate. Results showed that all measurements (length, mass, and mortality) were significant compared to the pH groups and results comparing adults and spat were significant. However, neither of the significant results rejected the null hypotheses or supported the alternative hypotheses. Data suggested accelerated growth after initial shock and health risks due to stress on the Eastern oyster.

MAR

## **Some Like it Hot: The effect of different soil and water levels on the yield of Trinidad Scorpions**

Emily West<sup>BG</sup>

### **Abstract**

Trinidad Scorpions, *Capsicum chinense*, are the second hottest pepper in the world. They can rank at 1.5 million Scoville Units, and yet, farmers often are not quite sure why they produce better one year as opposed to the last. This study wanted to find whether soil and water has a significant effect on the yield of hot peppers. The data was collected from Scorpion plants that had been allowed to grow and fruit over a normal harvest season. While the plants were growing they were subjected to different watering conditions. They were also all planted in different three different locations with three different soil types. There were a total of 45 pepper plants over all, 15 at each location, and five for each water level. A two-way ANoVa gave a P-value of  $2 \times 10^{-16}$  for soil and  $1.42 \times 10^{-8}$  for water levels, meaning the null hypothesis can be rejected, as the values are smaller than .05. This study found that soil and water levels do have an effect in the yield of peppers.

BOT



## Periwinkle Presence Possibly Poses a Threat

Micaela Wilson<sup>W</sup>

### Abstract

Energy flow through the organisms of an ecosystem is sustained by the food chains and food webs that exist within those ecosystems. The feeding habits of each living organism can have an effect on the other organisms associated with the same food web. This study observed the effect periwinkle density had on algae mass in order to determine its effect on the food chain and overall well-being of the marsh ecosystem. The algae resides on the *Spartina alterniflora* grass stalks of the marsh and serves as a food source for many marsh animals such as herbivores, deposit feeders, crustacea, and periwinkles. If periwinkles consume too much of the algae, the other species in the marsh ecosystem that rely on the algae as a food source and are connected to the same food web are threatened which may interfere with the energy flow throughout the ecosystem. An exclusion study was conducted by using cages to have stalks with and without periwinkles. The algae masses on the stalks were measured and recorded weekly for ten weeks. The length of the grass stalks and the tidal level during each trial were also recorded in order to determine whether or not they affected differences in algae mass. An average amount of algae for the stalks of grass with periwinkles and without periwinkles was able to be calculated. The stalks without periwinkles had over 10 times the algae as stalks with periwinkles. A statistical test showed that the data collected in regard to algae mass was highly significant. The periwinkles had a highly significant impact on the algae community in the marsh ecosystem which also affects the food chains, food webs, and energy flow within that ecosystem.

MAR

## **Abundance and Size Frequency of Juvenile Blue Crabs, *Callinectes sapidus*, in the Summer Season in the Nearshore Chesapeake Bay Environment**

Kelly Wood<sup>G</sup> ★

### **Abstract**

*Callinectes sapidus* are an important part of the Chesapeake Bay. The species is a cultural symbol of the East Coast and a key link in the benthic food chain. Many people who live on the East Coast depend on the blue crab fishery as a source of income. Blue crabs are under the constant influence of a combination of stressors. In the past two decades, winter dredge surveys have reported a drastically low population of this keystone species. Predation, a lack of SAV grass bed refuge, and overfishing are main causes of the crashed fishery. These factors negatively impact juvenile recruitment and mating. This study focuses on the sex ratio of juvenile blue crabs in shallow non-vegetated refuge habitat. The sampling was conducted in Urbanna Creek, along the lower Rappahannock River estuary. Crabs were caught and sexed, and then the width of their carapaces were measured and recorded in millimeters. A t-test showed that the sex ratio between males and females each month is statistically significant; in each month, there were more males. The carapace measurements were averaged and showed that the blue crabs sampled were all juveniles. The size of the blue crabs is important to examine in order to classify the maturity of the population in the shallow habitat. This allows predictions to be made about the success of the next mating period in the Chesapeake Bay based on the number of young blue crabs ready to recruit into the adult population.

MAR

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