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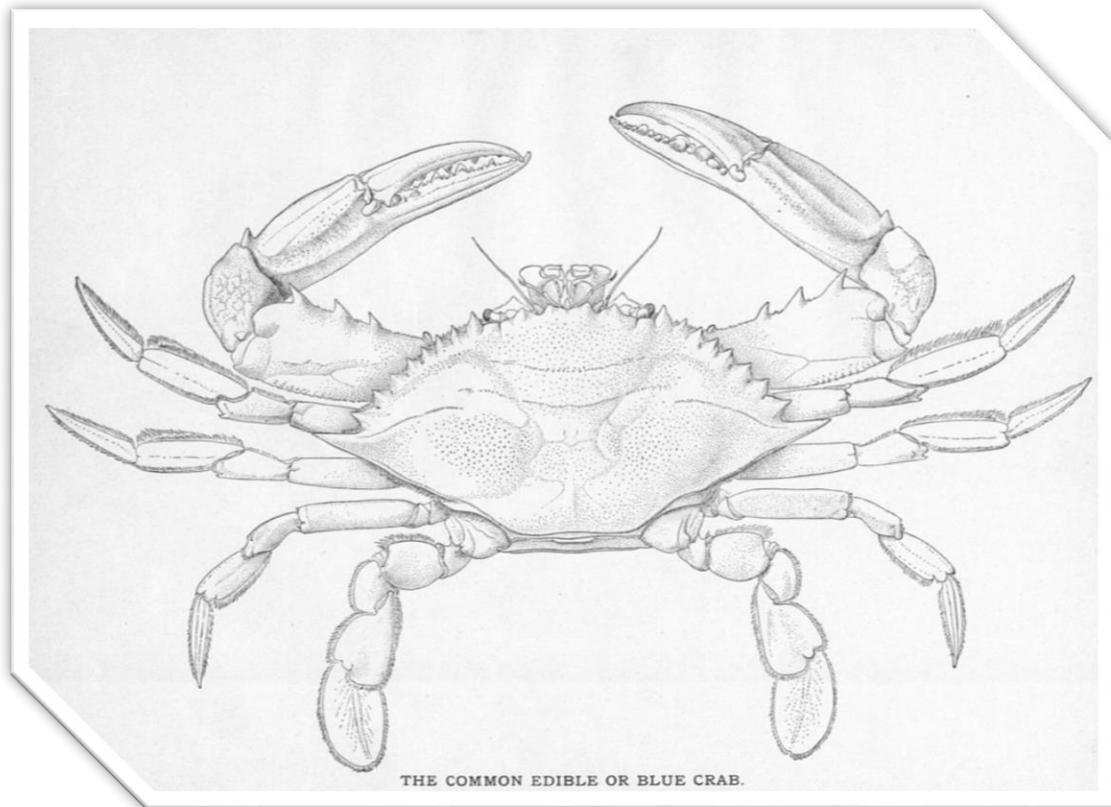
Research

Abstract

Bulletin



**Senior Research Project
Abstracts from the
Chesapeake Bay
Governor's School
Class of 2015**



Volume 4

Spring 2015

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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 2015

Research Project Subject Legend

BOT = Botany

EGR = Engineering

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 2015. 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 Effects of Tidal Patterns on the Number of Channel Catfish, *Ictalurus punctatus*,
Caught in the Potomac River**

Rachael Allison ^w ★

Abstract

The concept of fishing has been around for thousands and thousands of years. Something that started out as a basic necessity in order for animals and humans to survive has turned in to a common method for relaxation and competition. Whether for economic purposes, recreational purposes, or simply for sport, fishing has developed into a commonly known and loved practice across the world. This study was conducted over a 7 week time span in which experimentation was conducted to determine whether the tidal patterns would have an effect on the number, length, and girth of the channel catfish. In regards to the mean length of the Channel Catfish, there is not enough evidence to support the claim that the mean length of the Channel Catfish caught at high tide is less than the number of catfish caught at low tide. In regards to the mean girth of the Channel Catfish, there is enough evidence to support the claim that the mean girth of the Channel Catfish caught at high tide is greater than the mean girth of the Channel Catfish caught at low tide. The higher number of channel catfish, along with other fish caught, at low tide is likely because of the smaller amount of space at the top level of the Mattox Creek.

MAR

Plant Gas: How Can it Help?

Branden Benza ^W

Abstract

This project will test the amounts of CO₂ over multiple land types (crop fields, city land, forested land, marsh areas and town areas). The first thing that will be done at each site will involve testing the CO₂ uptake and release of the plants in that area. This will hopefully give us a good idea of which plants or combination of plants act as good CO₂ collectors, to allow for sinks that have significantly lower CO₂ levels. Then at each of these sites a collection of the CO₂ will be taken at ground level at different times (day and day to night, including some overnight samples) allowing for a comparison between the amounts of CO₂. With each of these tests, there should be a discovery of just how much CO₂ is being released from the plants at the end of their photosynthetic process. There is also the information pertaining to the difference in amounts of CO₂ that is released at the end of photosynthesis and how much they actually take in in the pre night hours. Then taking the knowledge gathered from these two experiments, a theoretical city will be made, proposing a way to design cities in a way that would reduce the large CO₂ emissions they produce.

ENV

The Use of Air Pockets to Increase Amount of Force Absorbed by a Football Helmet

Logan Blazvick ^G 

Abstract

It is known that concussions can become problematic for mental stability and ability based upon severity, and the range of successive concussions. Because of these problems, many organizations and colleges, including Virginia Tech, have conducted studies on the technology of football helmets and have made major contributions in science towards the safety of America's athletes. For my sampling, I used a stratified sampling technique with two testing subjects; foam-padded helmet and a helmet with the foam padding replaced with bubble wrap (air pocket padding). The type of padding in the helmet is the independent variable, and the dependent variable is the amount of energy in joules of how much of an impulse of energy read by a force meter inside the helmets during testing time. For this study, I used a T-test and the p-value method. The p-value method was used, because it is the most easily recognized value of being significant or not by people even just slightly familiar with statistical analysis. The study resulted, with a sigma value of 5% and a confidence interval of 1.73, in a p-value of 0.143. Looking at both Figure 1 and the calculated p-value of 0.143, it cannot be helped but to end with the conclusion that there is no statistically significant difference in the amount of joules of energy absorbed by a football helmet between one lined with the current foam padding, and a new small air pocket padding. In addition, this study therefore, cannot support the claim that a football helmet with air pocket padding in place of today's foam padding, will absorb more energy from a shock to the head, and allow less energy to impact the athlete's head itself.

PHY

Fiddler Crab Effects in a Salt Water Marsh

Adelena Bracken ^G

Abstract

Salt water marshes are coastal wetlands that transition a body of water to the land. Fiddler Crabs are mainly found in intertidal zones, but their distribution depends on predation levels and competition for living space, salinity, temperature, sediment grain size and organic content. Salt marshes are areas of intense biogeochemical cycling driven by high rates of primary production. The Fiddler Crab burrows affect the marshes sediment dynamics and the biogeochemistry that happens in a saltwater marsh. This experiment observed how fiddler crab burrows correlate to the dissolved oxygen and potential redox reactions that happen in a salt water marsh. In order to do this experiment three transects were established, with a quadrat that was used five times throughout each transect from high marsh to low marsh. In each quadrat the quantity of fiddler crab burrows was counted and recorded and a sample of groundwater was taken from burrows throughout the transects using a syringe. Then the temperature, pH, conductivity, and the ISE/ORP voltage were measured in each sample with a PASCO "SPARK" probe. The results showed the fiddler crabs preferred the zone of the marsh that was approximately 6-10m from the marsh shoreline. The dissolved oxygen was low in the salt marsh and the pH values measured at all sites in the marsh were acidic with values below 7. The ISE voltages resulted in how in the low marsh the voltages are similar and all positive which was where the marsh consisted of mainly sand. The results of this study showed how the salt water marshes are becoming very dynamic because of erosion and sea level rise. Instead of the fiddler crabs changing the salt water marsh the salt water marsh is dynamic causing the fiddler crabs to decrease. MAR

The Effects of Bacteria and Acidity on Biomass

Nicole Brem^{BG}

Abstract

Recent years there have been reports of rising pollution levels, this means an increase in the acidity in the air particles. The ascending levels of acidity causes an increase in the acidity of the pH of the water that precipitates. Considering that most of Virginia is consisted of rural areas, and most of it is covered in farms and plantations, and it is widely believed that the pH of water effects the plants it contacts. This prompted the study of whether adding nitrogen fixing bacteria to bean plants would show a difference in the biomass after the plants were given different levels of pH. After the test was run and data collected the results of the anova statistics tests run showed a significant difference in the biomass when the pH levels were different, the greater the pH the less of the biomass there was. The statistics test also showed that there was not a significant change in biomass depending on the presence of the bacteria. However, the data showed that the bacteria seemed to have an effect depending on pH, whereas the biomass decreased when pH increased the plants with bacteria showed that there might be a completely different trend, that as the pH increases the biomass also increases. This means that agriculturalists need to take notes on the pH level of the water, rain or otherwise and might need to act accordingly, adding bacteria or adding basic or acidic nutrients to the soil

ENV

Is the Water Always Bluer on the Other side?

James Briggs and Robert Umphlette ^W

Abstract

This study intended to determine the size of fish caught in two ponds of different landscapes and determine the correlation of size to water quality affected by the landscapes. The data showed clear patterns in the water quality and Standard weight of the fish that indicated that the natural pond was healthier than the altered pond. There was a significant difference in the dissolved oxygen in the natural pond compared to the altered pond. The dissolved oxygen of the natural pond was much greater than that of the altered pond. This could possibly be from the turbidity levels of the pond. The natural pond is more stable which might allow for more aquatic vegetation to grow which in turn increase the dissolved oxygen. When comparing the standard weight of the fish caught in each pond, the average standard weight was 3.14 for the natural pond while 3.09 was the average standard weight for altered pond. The average health index of the natural pond was greater than that of the human altered pond. This is mostly attributed to the water quality conditions of that pond being more hospitable than those of the altered pond.

ENV

Tom Brooks Lake: A case study in suburban stormwater retention and its potential to create healthy and productive ecosystems

David Bushhouse ^G ★

Abstract

As development of the suburbs of Richmond, Williamsburg, and Washington D.C. has steadily increased over the past decade, the necessity for efficient and affordable stormwater management strategies in Virginia has also increased. Based upon recent VADEQ licensing data however, retention and detention basins are the prevailing stormwater mitigation strategies in Virginia. Understanding the full effect to which ecosystem engineers in a healthy system enhance the filtration action of retention ponds is critical in determining which types of aquatic ecosystems to promote after development, in order to make retention ponds as efficient as possible. This study sought to identify the strengths and weaknesses of Tom Brooks Lake in Quinton, Virginia, a stormwater retention pond with prominent riparian buffers. Hypoxic conditions were observed during 80% of the sampling period. The observed *E. coli* abundances were well below the freshwater healthy maximum of 126 per 100 mL. Nitrates too were well below the recommended limit of 90 ppm for warm freshwater habitats. Phosphate levels were well above the federal guideline of 0.025 ppm for lakes and reservoirs. Tom Brooks Lake, while relatively healthy with regards to nutrient control, has room for improvement where dissolved oxygen is concerned. For further research, A random quadrat sampling of fish would demonstrate the diversity of fishes, or lack thereof, that this study has suggested. Further, an analysis of prevalent anthropomorphic toxins such as pesticides and hydrocarbons along the Northern shore would demonstrate the degree of effectiveness of the riparian buffer. ENV

Snakeheads: Friend or Foe?

Brandon Buzby and Darin Jones^W

Abstract

Snakeheads were first discovered in the United States in 1977. But, the snakehead is native to China, Russia, and Korea. Snakeheads are said to have come to the United States from the selling at Chinese fish markets and pet stores. The snakehead was most likely brought into the wild by uninformed pet owners setting them free, or releasing them for religious practices. The impact of the snakehead population could create in American waters is hard to know. The reason for not knowing is because the Snakehead is an apex predator, meaning on the top of the food chain, and has plenty of food and space to grow in numbers. A small study on this species can show if the snakehead population affects the water ecosystem. This study was done due to the rising increase of the invasive species, *Channa argus*, and the effects on the local waterways they cause. Using a fishing rod, cast net, and bow and arrow, snakehead fish and local fish were collected and counted from Machadoc Creek. The results show that the bow and arrow will catch more snakehead fish accurately than the fishing rod and the cast net.

ENV

**The Effect of Increased Turbidity on *Elodea canadensis* and the Bluntnose minnow,
*Pimephales notatus***

Kinston Carson ^W

Abstract

For centuries, turbidity has been a major factor for fishermen, farmers, and other industries. While it is well evident that turbidity affects many aspects of both human and organismal life, it is also important to be able to quantify the amounts of turbidity that organisms have difficulty surviving in. This study examined how increased levels of sediment turbidity affect the lives of an aquatic plant (*Elodea canadensis*) and an aquatic animal (Bluntnose Minnow, *Pimephales notatus*). For the experiment testing D. O. levels, there was a control group (no turbidity added over two week period), a tank with only *Elodea*, and a tank with both *Elodea* and the Bluntnose minnows. For the two experimental groups, about 100-150 grams of turbidity was added at the same time each day for two weeks. For the experiment testing organism foraging time, there was a control group (no turbidity added over two week period), a tank with only Bluntnose minnows, and a tank with both the minnows and *Elodea*. For the two experimental groups, about 100-150 grams of sediment was added each day. The time for the fish to locate the food was recorded. The statistical analysis (One-Way ANOVA) resulted in a significant P-value for the D. O. production of *Elodea*. This supported the claim that increased turbidity levels do in fact lower the overall dissolved oxygen in a typical marine environment. As for the statistical analysis (One-Way ANOVA) of foraging time for marine organisms, the results were not significant.

ENV

Interrelationship of Beach Dynamics with the Amount of *Escherichia coli*

Mikaila Clinkscales and Maryssa Moore^{BG} ★

Abstract

Escherichia coli is a major problem along the beaches. It gets there from point and non-point sources, animals and humans. When the levels of *E.coli* increase, beach closings can occur. *E.coli* can be found in the water and sand at different places, times, depth, and location along the beach. The purpose of this study is to see the interrelationship of beach dynamics on the abundance of *E.coli*. In this, the independent variables were time (8:00 a.m., 12:00 p.m. and 3:00 p.m.), depth (120 cm), placement (supratidal, intertidal, and subtidal), and location (Yorktown Beach and Virginia Beach). Hoola hoops were used as a transect and measured at every 10 meters. Samples were gathered along the beach at times of 8:00 a.m., 12:00 p.m., and 3:00 p.m. At these times a layer of sand was taken off the surface (0 cm) and then a hole was dug (120 cm) to obtain those samples of sand. This process was then repeated in the supratidal, intertidal, and subtidal zones at both Yorktown and Virginia Beach. Three samples were taken each time this process occurred. The sand was then put in centrifuge tubes and froze until the sand could be transferred to the lab. Nutrient agar was used to set the plates and then a process of streaking the plates was how the bacteria was transferred from the tubes to the plate. The plates sat in an incubator for three weeks and taken out to examine. Through careful research identifying the *E.coli* took place. The *E.coli* was a milky white, and almost transparent in color producing a round colony. After counting an ANCOVA test was ran. The result showed that 12:00 p.m., in the subtidal zone, was where the most abundance of *E.coli* appeared. Likewise, 8:00 a.m., in the supratidal zone, was where the *E.coli* was less likely to appear. After evaluating the data, it revealed that Yorktown Beach contained more *E.coli* than Virginia Beach.

ENV

Evaluating Activated Carbon for Its Use as a Runoff Buffer

Taylor Courtney^{BG} ★

Abstract

Manure from farms is contributing to eutrophication as is fertilizer. Current methods of nutrient removal are not effective at the surface. Activated charcoal can be made from most any type of organic based material, including manure. It is being investigated as a carbon sink as well as a volumetric waste reducer. A company could purchase a farmers charcoal, activate and deploy it on the field and it has been proven beneficial to soil. The effect activated charcoal has on the most prominent nutrients found in surface runoff, nitrate and phosphate, was measured.

Volumetric flow rate at late-time was too. The volumetric flow rate was obtained by a constant head method at 2-minute intervals. Late-time was observed when four consecutive seemingly similar values were obtained. A sieve grain size analysis was run. Using a scientific journal, the maximum adsorption of nitrate is about 1.9 mg/g of activated charcoal. Four different volumes of charcoal centered around 1.9mg/g were run. Similarly done with a water sample containing nitrate. It was found that an increase in phosphate was caused by an increase in charcoal at a rate of about 1 mg/3.7cm³ charcoal. However, nitrate was removed at a rate of about 1mg/1.7cm³. Maximum adsorption rate (capacity) was at about 1.9 mg/g nitrate. My findings suggest that the additional phosphate was due to pyrophosphate. Also, that the adsorption rate could be affected by the adsorption capacity. This is most likely due to the area the nitrate covers on the charcoal.

ENV

The Effects Mute Swans have on Water Quality

Rebecca Daniel ^w ★

Abstract

In 1912 the first mute swans were released in North America. Since then they have permanently established territory in about twenty five states in the United States. Being an invasive species that is very aggressive they are seen as a threat to humans and other waterfowl. More recently they have been linked to a decrease in water quality because their diet consists of mostly submerged aquatic vegetation (SAV). SAV is closely associated with improved water quality and since mute swans are decreasing SAV growth they are possibly decreasing water quality. A main function SAV's perform for the marine ecosystem is filtering excess nutrients such as nitrates and phosphates from the water. It is assumed that as SAV density decreases that nitrate and phosphate levels would rise. This project looks at the effects of that mute swans have on nitrate and phosphate levels to see if their presence has an influence on the environment. It can determine whether mute swan management plans will actually help to improve overall water quality in marine ecosystems. For this study, water samples were taken once a week for five weeks. Samples were taken at three different sites at a creek with a mute swan population and a bay without a mute swan population. The samples were given nitrate and phosphate tests. Statistical tests failed to reject the null hypothesis that stated there is no significant difference between the creek with swans and the bay with swans. It also failed to reject the null hypothesis that stated there is no significant difference between the different sampling sites. This means that mute swans may not have as big an impact on water quality as some marine biologists believe. If this is true than management plans to kill off this species may not be necessary.

ENV

The Impact of KBrO_3 on Plant Mass

Cristian Diaz ^W

Abstract

The experiment's purpose is to uncover the impact of Potassium Bromate on *Festuca arudinacea*. Bromate has been proven to be harmful on carrots and even humans. There's a problem if bio magnification occurs, for humans that wouldn't be a good thing. Testing has already been done on different animals and it always became a problem. Throughout the whole environment problems are being observed with pollutants and pollution. Some are naturally emitted from factories and such, but others humans introduce but with good intent. A lot of bad things come from just disinfecting water, depending on what technique is used. We use this agent to make bread, and in some countries this is banned. However the US still uses this method because the amount left in the final product is negligible. This experiment saw 4 containers grow grass, and three of the containers received potassium bromate solution. After a preliminary growth period the solutions were added. They were massed after they were allowed to grow for another period to examine if there would be significant plant mass change between. The experiment found that while there were differences, there weren't any significant differences in plant mass. After examining the results, maybe things would have been different with more samples, and no preliminary growth period.

BOT

GET OUT MY TRAPHOUSE!

The Effect of Light Intensity on the Closing Time of a Venus Fly Trap

Jennie Dinh ^{BG}

Abstract

A Venus Fly Trap is a carnivorous plant. However, they live in poor soil and are healthier if they get nutrients from insects. Carnivorous plants live all over the world but the Venus Flytrap is native to areas in North and South Carolina. It grows in moist, acidic soils which are poor in nutrients. Venus flytraps need an open understory (the part of the forest below the canopy) to live. Part of what keeps the understory open is natural fires that sweep through and burn away parts of trees and shrubs. These fires can become dangerous to humans, so often we stop them before they have a chance to provide benefits to the forest. This results in less suitable habitat for the sun-loving Venus fly trap. Venus Fly traps love the sun, so within the experiment, the amount of light (light intensity) was manipulated to test the health (closing rate) of the Venus Fly trap. The light intensities were manipulated at four different levels. The time it takes for a Venus Fly Trap to close does depend on the amount of light it receives. As the data was collected, a linear regression was run because there was one independent and one dependent variable. However, after the data was run, the trend line did not appear to be linear. To make the data linear, a graph was made by finding the logarithm of light intensity and the logarithm of the closing time. The null hypothesis was rejected.

BOT

Goldfish and Their Shocking Revelations

James DiSpirito ^W ★

Abstract

Fish are an important organism in this world today for good and bad. They provide food and nutrient to many of us, but could also carry disease. They are a necessary part of the food chain and other vital cycles of the world, like the carbon and nitrogen cycles, but invasive species could also destroy those important ecosystems and cycles. This study tests the ability to repel fish from an area with electricity. This could be used in the world today in the sense of containing fish. It could prevent invasive species from entering alien water as well as contain fish that have diseases in one area.

ZOO

Tree Filters: Do they work?

Lauren Donahue ^w★

Abstract

Water purifiers are in desperate need to reduce the global issues of waterborne diseases. Developing countries, who need clean water the most, lack the funds to remove contaminants from the water. Creating cheap, easily resourceful water filters helps benefit people by giving them clean water and saving money for the countries in which they reside. The Massachusetts Institute of Technology conducted an experiment determining whether plant xylem from the sapwood of coniferous could remove bacteria from water by simple pressure-driven filtration. This project, based on the findings of M.I.T., compared three trees- White Oak (*Quercus alba*), Poplar (*Populus tremuloides*), Virginia Pine (*Pinus virginiana*)- to charcoal to determine whether they could filter out water in a timely matter and effectively remove *Escherichia coli*, nitrates, and phosphates. The results revealed the branches could not effectively filter out large amounts of water with only gravity as the pressure force, but they could effectively remove about 90 percent of the *Escherichia coli* from the water. The nitrates and phosphate levels increased after filtration through each filter, therefore the potential to effectively use tree branches as an economically feasible water filter in regions with these trees.

BOT

Differences in Adolescent Stress at Different Educational Levels

Chelsea Dorsey ^G ★

Abstract

In today's high schools, adolescents experience a range of symptoms based on their level of stress. According to the Yale Stress Center, stress creates physical and behavioral symptoms that put students at a severe disadvantage because it causes for students to not be academically successful. Many of adolescents' stress levels are taken for granted, especially in the case of Advanced Placement and Honors students. It is believed that despite their higher level of education, they have an easier time of managing stress, and therefore do not exhibit the side effects of stress. Further, it is assumed that the students have become accustomed to the high stress levels associated with higher education courses, and therefore do not respond to stress in the same way as general education students. Often times, these high levels of stress are unmanaged, which leads to further development of stress, increasing the number and frequency of side effects. The Perceived Stress Scale (PSS), developed at Carnegie-Mellon University, calculates how much stress is perceived by a person. The objective of this study was to find which group (college-preparatory students or general education students) has the highest level of perceived stress and what the greatest factor of stress was between adolescents enrolled in general education courses and adolescents enrolled in Advanced Placement or Honors courses. The statistical analysis showed that there was no statistical difference between the stress levels of college bound and non-college bound students. The study showed that neither college bound or non-college bound students had higher levels of stress from academic sources and non-academic sources.

PSY

Can You Bee-lieve It?

Binh Duong^{BG} ★

Abstract

Apis mellifera, or the European Honey Bee, is the species of honey bees utilized in the production of honey and agricultural pollination across the United States. CCD, or Colony Collapse Disorder, is the disappearance or loss of honey bees, said to be caused by pesticides and predatory organisms. In this study, whether or not air pollution, which is released into the atmosphere like pesticides, has a significant relationship with honey bee colony loss is being tested through statistical tests using numerical data collected from the Environmental Protection Agency and Bee Informed which provide information on air pollution and honey bee colony loss respectively over time. The air pollution data was composed of carbon monoxide (CO), ground-level ozone (O₃), lead (Pb), nitrogen dioxide (NO₂), particulate matter (PM), and sulfur dioxide (SO₂), while the honey bee data was composed of honey bee colony count. Both sets of data were categorized by time (2010, 2011, 2012) and region (Northwest, West, Northern Rockies & Plains, Southwest, South, Upper Midwest, Ohio Valley, Northeast, Southeast). Through running a multiple linear regression statistical test due to the presence of multiple independent variables and a single dependent variable, it was found that out of the previously listed pollutants, nitrogen dioxide and sulfur dioxide have a significant relationship with honey bee colony count over time.

ZOO

Distance Makes the Oyster Grow Larger?

Selene Epps and Kallie Carson ^W

Abstract

A major decline in oysters over the past few centuries has urged many to find the best conditions for oyster growth, reproduction and ultimately restoration. Numerous aquaculture efforts have been put into place by companies, corporations, and foundations. These efforts can also be carried out by individuals that just want to help restore the oyster population. Recent research focused on finding the optimum salinity, habitat, and predator protection, in order to increase or help to replenish this precious resource. This current study aims to determine if depth and distance from shore have an effect on the growth of oysters. And to a further extent, what types of organisms are associated with these oyster growth cages. By understanding how oysters grow best in a smaller scale, homeowner type setting, restoration efforts by the public can be maximized, with the hopes of one day restoring the Chesapeake Bay oyster population to its historic levels.

MAR

Effect of Riparian Buffer Type on Soil Retention

Tyler Forbes^{BG}

Abstract

Sediments are the largest source of pollution to the Chesapeake Bay. Sediment pollution, due to its content of nutrients like nitrate and phosphate, inhibits predation and causes eutrophication in bodies of water, leading to dead zones. A popular method of preventing this pollution is to use riparian buffers consisting of layers of grasses, shrubs, and trees. This study looked to determine which of those layers was the most effective at retaining soil from entering a pond as runoff, as well as determine the ideal size of a riparian buffer. Soil runoff was represented using foam bean bag filler as a marker. Set amounts of the marker were placed at 1 meter intervals, with each distance being a different color, in each of the buffer types. These buffers were bare ground (the control), trees, shrubs, grasses. Markers were captured and counted after each rain event, and then the setup was reset. A one way ANOVA was performed, obtaining a p value less than .05, meaning that there was a significant difference in soil retention at the different buffer types. A Bonferoni correction showed a significant difference in soil retention at the tree and bare ground, and the shrubs and bare ground. A second one way ANOVA was performed, showing a significant difference in soil retention at the different distances of the buffers. The trend line for this graph crossed the x-axis at 4 meters, suggesting that this is the ideal size of a riparian buffer.

ENV

How Fast Does it Sink?

Mercedes Fortune ^W

Abstract

This experiment was to relate how the size of an object will affect its settling rate. It was predicted that a washer with about 12.7x 38.1mm size will settle the fastest. Understanding what affects settling rate can help further understand the process of sedimentation to where it can be predicted for future situations, like land development or the settling of planktonic organisms. Previous studies have been done on similar studies where only viscosity was focused on, the effects on organisms like phytoplankton, or the way the object falls. This is an area that could be explored further in the future if there was more information to work.

The Effects of Vegetation Type on the Amount of Nutrient Removal in a Riparian Buffer

Evan France ^W ★

Abstract

A major problem that results from agricultural runoff is nutrient pollution of nearby waterways. As rainwater washes over farmland and into streams and rivers, it picks up excess nutrients in the field and transfers them into these bodies of water. Even as rainwater seeps into the ground, the collection of nutrients is still present and this polluted groundwater will eventually reach nearby waterways. A widely accepted solution to this problem is the planting of riparian buffers between farmland and bodies of water to remove any excess nutrients that could potentially pollute these bodies of water. The extra vegetation planted near these waterways absorbs the excess nutrients before they can flow into the water. This practice of utilizing riparian buffers to limit nutrient pollution in nearby bodies of water has been widely used for half a century. The question that still remains, though, is what type of vegetation is most effective at nutrient removal and how dense should riparian buffers be planted for maximum effectiveness. This study looked at different plant types (shrub, grass, and multi-species buffer) and their effectiveness at removing nutrients from the soil, over the course of a 40 day period. After statistical testing, neither phosphates nor nitrates were significantly affected by changing the plant type; however, interpretation of graphs showed that a multi-species buffer was somewhat more effective at removing nutrients than a single-species buffer. This may be due to inter-species competition between the plants in the buffer which caused them to uptake more nutrients than they normally would in response to the presence of other nearby species. Therefore, in order to increase the productivity of a buffer, multiple species should be used.

ENV

The Effects of Mesh Size on Seine Net Efficiency

Laura Alejandra Garzon ^{BG}

Abstract

Beach seining is an active fish capture method used to collect finfishes as well as shellfishes and several other macroinvertebrates. Active capture methods use moving nets and gear to collect organisms. Some disadvantages of seining are the escapement of fish after closure of the net, net avoidance prior to the closure of the net as well as the mesh size in relation to the size of the fish. There are also other physical obstructions, such as rocks, macrophytes, tree logs and excessive amount of mud or vegetation that interfere with the seine and prevent it from passing through the entire water column that is being sampled. The purpose of this experiment was to find out which mesh size was more efficient in relation to the number of fish caught, the average size, and the maximum and minimum size. Three different mesh sizes were used to perform this experiment: 3.16mm., 6.35mm. and 9.52mm. A total of 45 seining hauls were taken on a sandy area near the Fall line in Fredericksburg, Virginia. The number of fish caught each haul, the substrate of the area as well as the species and the size were recorded. Statistically, there was no significant difference in efficiency within each of the sizes, thus saying that the size of the mesh does not really influence the effectiveness of your catch. However, due to other several factors observed during the experiment, it was theorized that things such as the weather, seining method and the substrate do take into account when it comes to the efficiency of any size mesh and its effectiveness in seining.

ENV

How Vehicles Exacerbate the Heat Island Effect in Parking Lots

James Giffin^G

Abstract

Modern society heavily relies on technological conveniences in order to reduce the stresses people encounter every day. One technological marvel that has helped to minimize this stress is the personal automobile. Although this has reduced one stress, it could be contributing to a much larger problem in the future. The Heat Island Effect is the result of the convenience of modern transportation and construction methods, as asphalt and concrete have much higher heat potentials than wood and dirt. Even in rural settings, something as small as one asphalt parking lot can create a heat spot in a naturally cooler spot. Cars may also contribute to this effect, as they can take in heat from the sun and release it like a radiator. To test this, an experiment was created to look at how cars contributed to the heat island effect of a grocery store parking lot. Two factors observed in this test were the size and color of cars to determine if they caused any differences in heat retention. For the experiment, two cars, a white hatchback and a black SUV, were driven to a parking lot with a thermometer inside and outside of each vehicle. Every five minutes, temperatures were taken from all thermometers for an hour everyday day after July 21, 2014 for 37 days. To search for differences in temperatures between the cars, a T-test was performed between each car's mean daily average temperature data. The result was that the SUV was significantly hotter than the hatchback with a P-value of 0.016656 with 95% confidence. In the future, it is recommended that smaller vehicles are bought and construction materials are changed in order to mitigate the Heat Island Effect.

ENV

The Effects of Different Types of Retaining Walls on Erosion Caused by Rainfall

Tyler Gilbertson^{BG}

Abstract

Retaining walls are put in place to secure an area of land and protect it against erosion. The main cause of erosion is rainfall and when a retaining wall is faced with the pressures of erosion, age, and deterioration, it is subject to collapse. The purpose of this experiment was to find out which type of retaining wall would be best to use to allow the least amount of erosion. A model was created to represent an area of land with different types of retaining walls that would be tested with a consistent amount of rain. The rainfall event was simulated evenly for each test. After collecting data, the results were analyzed using a 1-way ANOVA to find a p value of 5.84×10^{-5} . This means that the null hypothesis could be rejected because the p value was greater than .05. After running multiple comparisons with Bonferroni corrections, it was concluded that the gabion wall allowed significantly more erosion than the other designs but the other designs did not vary significantly. This study applies to construction projects and areas where a retaining wall is necessary.

EGR

Relationship Between Abiotic Factors and How They Affect Biotic Factors of Tabb's Creek

Nicholas Green ^W

Abstract

Measuring phytoplankton can be very beneficial. When they are measured, the number of primary consumers can be predicted, which can lead to more predictions of food chain functioning in the same ecosystem. This information can be used for other studies and even for setting fishing limits. The experiment focuses on the use of ecological models derived from observation of phytoplankton population in regard to environmental conditions of the tributary in which they are found. Broadcasting these models also sheds light on the communication of science in rapidly technically advancing society, as well as pondering the importance of the communication of science itself. Various water quality tests were carried out at a single site on Tabb's Creek. These observations will be implemented into a series of ecological models that are used to compare and predict how the quality of the water influences phytoplankton growth. It is predicted that there will be a correlation between nutrient availability parameters and plankton growth; an increase in nutrients should result in an increase in phytoplankton. At the end of the project, a working model that uses these correlations will be created with the purpose of predicting plankton growth based on easy-to acquire measurements. The measurements that affect the plankton most drastically will be isolated and used in the model.

ENV

Got Protein: The Effect of Days During Lactation Period on the Amount of Protein and Fat Present in Milk.

Jordann Greene^{BG}

Abstract

Milk is something almost every one drink in their adult life. Milk is most definitely something everyone drinks when they are a baby. This study shows the different levels of nutrients in milk and the amount of milk that is produced during different days of a cow's lactation period. For this study the data was collected off of data sheets that had the amount of milk, protein, and fat for 159 cows during the month of October (2014). After running a liner regression for the three sets of data a p-value less the .05 was found for all three. This showed that the day the milk is taken from the cow during its lactation period does have a significant impact on the nutrients that is present in the milk. It also has a significant impact on the amount of milk the cow gives.

ZOO

Supernormal Stimuli and Their Effect on Hedonic Hunger

Sydney Griffith ^G

Abstract

The obesity epidemic that began in the 1980s has caused overweight and obesity levels among adults and children to double in the United States and has created a new sense of urgency in taking preventative measures. An increasing amount of human consumption is becoming hedonically driven which in turn is seemingly responsible for overweight and obese Americans. When people eat food for pleasure rather than a biological need, it is called hedonic hunger. Certain foods encourage hedonic hunger and these foods have a high hedonic rating. Many of these high rating hedonic foods are the result of supernormal stimuli. In this study, the correlation between hedonic ratings and dietary intake will be found positive, negative or inconclusive based on 3 tests; visual real, visual screened and olfactory. In each test, the mean of the initially measured hunger value was lower than the treatment value. The test subjects responded to the screened images, the smells and the real foods in a way that stimulated the brain to believe they were hungrier. Based on these results, all three tests showed a statistically significant correlation between hedonic ratings, dietary intake and that correlation implies a credible link between hedonic hunger and eating behavior and thus to obesity. Over half of the adults in the United States are obese. Taking into the account all of the conditions and illnesses that stem from obesity, it is one of the leading killers in America and other countries around the world. By bringing attention to the problems hedonic hunger presents, American citizens can become more aware of the choices they make nutritionally.

MED

Crop Cross Breeding as it Varies with the Environment

Abbigail Grimes^W

Abstract

Cross bred crops are an extremely important asset to farmers all over the globe, only topped by natural pollination. Throughout time, man has experimented with ways to yield the most productive crops to feed the constant demand of the population. It is necessary to understand and respect the roles of nature in order to feed this demand and be successful in crop growing. The question this experiment attempts to answer is, just how much does the environment and animals effect cross pollination or general reproduction. While cross pollination did not occur in the results, it was very clear that environment plays a critical role in crop success. Factors in the environment such as weather (wind, rain), insect pollination, other animal pollination, and even the crop locality to each other seemed to add to the crop's success.

BOT

The Effects of Anthropogenic Fertilizer on Freshwater Ecosystems

Larkin Gross ^W

Abstract

Freshwater ecosystems are instrumental in the cognition of the planet's interconnecting web of organisms. Without these ecosystems, many organisms would have no habitat, no breeding grounds, and no food source. The health of small freshwater ecosystems such as ponds, lakes, and rivers is important to the survival of many other species, humans included. However, humans don't seem to realize it. Humans have forever had an impact wherever they set foot. Businesses and agricultural practices cause problems in these habitats due to the runoff caused by their waste and fertilizer. Fertilizer runoff is a huge cause of eutrophication in freshwater habitats. Eutrophication, the overabundance of organic material in a habitat, is a great player in the reduction of water quality in freshwater habitats. Eutrophication is known to cause low dissolved oxygen levels and low sunlight penetration in freshwater habitats. Fertilizer runoff from businesses such as golf courses and agricultural productions in recent years has created huge eutrophication issues in surrounding freshwater habitats. This project looks to do just that, by focusing on how humans influence the freshwater ecosystems that we come into contact with. The experiment compared a golf course to pond that has little to no human influence. The results of this study do show, while not statistically significant, much higher levels of nutrients in the experimental pond compared to the control pond. This experiment took place in the early fall, not at the peak of nutrient abundance, so the difference may not have been as obvious as it would have been in the spring or the summer. Also, a greater sample size may have yielded more accurate statistical results.

ENV

The effect of wing angle on Ornithopter flight paths

Austin Gross^{BG}

Abstract

Since the beginning of human existence we have envied the birds and their ability of flight. This dream was almost complete in 1503 when Leonardo Da Vinci designed the first Ornithopter, now 512 years later the Pentagon and hobbyists alike look towards these aircraft again. This experiment was conducted in order to determine whether changing the angle of pitch for the wings would affect the displacement, time of flight, and height of and ornithopter's flight. The alternative hypothesis was that the angles at zero degrees was equal to the angle at sixty degrees, which would be less effective than the angles at fifteen degrees and forty-five degrees which in turn would be less effective than the angle at thirty degrees. Test my hypothesis an Ornithopter was constructed out of balsa wood, tissue paper, a metal wire, and a rubber band. To provide the lift the rubber band was twisted 200 times and was released at 144 cm. A video was used to determine time of flight and maximum height, and a tape measure was used to determine the displacement. A Linear regression was run on each set of data. Only the displacement proved to be significant with a p-value greater than .05, meaning that I could only reject the null hypothesis for displacement. This means that the hobbyist who participate in competitions should use the angle of thirty degrees to flight the farthest forward.

PHY

A Food Desert in Southeastern Virginia

Lewis Harvey^G ★

Abstract

A “food desert” is defined as a geographic area or environment where healthy food, mainly fruits and vegetables, is difficult to obtain, because of the absence of grocery stores, specifically for individuals with a limited mode of transportation. The presence of grocery stores, and the availability of healthy food choices, are important contributors to healthy eating. Dwellers of the food deserts frequently experience food insecurity, which is a limited food access. Many researchers linked food insecurity with a larger occurrence of long-lasting diseases and health differences in urban, low income areas. Students that resides in a food desert area and a nonfood desert area were asked to complete a survey that asked them questions regarding: how far it takes to get to a healthy food source, and there weekly diet. There was a significant decline in the amount of miles a teenager travels in a nonfood desert. There was a positive incline in the amount of healthy food a teenager eats per week. The study does not show a significant increase in the amount of healthy food a teenager in a food desert eats per week. The results of the study significantly benefit the theory that food deserts has a negative impact on the lives of the residents of the area. The teenagers surveyed during this study enforced the idea that food deserts can cause chronic diseases that can not only affect them, but their family as well.

MED

The Correlation of Locomotion Scores and Experience, Individual, and Gender

Madeline Hays^{BG} ★

Abstract:

House mice *Mus musculus* were subjected to different experiences and then observed in an Open Field Test to measure the effect on their locomotion score and exploratory behavior in relation to anxiety adaptability. These experiences ranged from low adversity/anxiety of living in a normal related mouse colony to high adversity/anxiety of living near mice of a separate colony while pregnant. The study found that experience did not have a significant effect on anxiety adaptability with a p-value of 0.489, while individual genetics/disposition and sex did have a significant effect with p-values of <0.0001 and 0.003 respectively. This implies that individual personalities—more so than slight changes in experience—has a greater effect on adaptability in anxiety-producing environments, and that females are more naturally attuned to handling anxiety than males.

PSY

Land Use and Forest Diversity

Mark Herring ^W

Abstract

Forests are a key part of the Earth's whole ecosystem. Providing food, water, and shelter to a wide variety of organisms, forests have some of the widest varieties of species on the planet. However, humans can easily disrupt a forest's balance and variety. This study will look at the diversity of tree types in forests in areas of different human impact. These will range from a wildlife refuge to a farm to a beach. The study of this relationship between trees and humans can be used to great benefit by conservation efforts and for future studies on human-wildlife interactions. This study compared tree species and count at several differing locations. Within these locations, small sites were marked off, then tree species and count were taken. This data was then used to calculate the Shannon Diversity Index of each site. The wildlife refuge ended up being the least diverse, which goes against the predicted results of this study. Having the least amount of species per site, though the most in count is something unexpected. The medium range human impact site, the beach, had the most species per site. These findings are supported when the Shannon Diversity Index (Log10) is run, as the wildlife refuge has the lowest per average, with the beach having the highest per average. After statistical analysis using a Two-Way ANOVA on the species per sight and total tree count, a P-Value of .95 is reached. Thus, this study fails to reject its null.

ENV

The Effect of Weather Conditions on the Winning Times of the Kentucky Derby

Stephanie Hicks^{BG}

Abstract

The Kentucky Derby Horse race is run every year at Churchill Downs horse track on the first Saturday in May. Thoroughbreds are the horses that run in this race due to the speed, stamina, and endurance that they are bred to have. Previous studies have shown that male racehorses are faster than females, but this study shows the effect of different kinds of weather conditions on the winning times of the Kentucky Derby. The weather conditions, temperature, precipitation, and track conditions are all gathered for the past 60 years. The analysis of this data included a generalized linear model. The data came back with the weather conditions, temperature, and precipitation having p-values that were above 0.05. Track conditions had a p-value lower than 0.05 meaning that there was a significance in the different levels on that winning times of the Derby. This is due to the traction that the horses have in different surface conditions of the track. The horses are wearing aluminium shoes to protect their feet, but they are also more slippery on wet surfaces. Many horseshoes have a ridge to add traction, but not all of them. The significant difference of the track conditions on the winning times could have effects such as a different winner of the race, or a track record not being broken.

STAT

The Effects of Different Soil Types on Volume Needed to Reach Peak Salinity

Bryce Hinshaw and Brandon Ancarrow ^{BG}

Abstract

Each winter, many tons of road-salt are dumped onto roads to help prevent dangerous driving conditions during winter storms by melting snow and increasing a vehicle's traction on the road. Although the use road salt has helped save many of lives over the years, there is a growing concern about the environmental impact of this liberal salt use. The contamination of sodium chloride in drinking water can cause many health problems like hypertension. Wildlife is also predisposed to high sodium levels by ingesting salt or drinking water runoff from snow and ice melt. The purpose of this study was to identify the relationship between the flush rates of salinity on different soil types. A Soil Sample Containment Unit was constructed to simulate a ground water column; before, during, and after a precipitation or contamination event. Clay, sand, and loam were used because they are the three major soil constituents in Eastern Virginia and make up most soil types. To replicate a major runoff event after road salt application, 35ppt salt water was added to a saturated water column in the SSCU, and was periodically flushed to determine the peak salinity. There was a significant difference in the volume of water necessary to flush the peak salinity between sand and loam. Sand required the most amount of water to flush out the salinity, whereas loam required the least. The results of this experiment could have many ecological applications. For example, sand could be placed around high runoff areas to reduce salt infiltration into groundwater systems.

ENV

The Effect of Different Substance on the Coefficient of Friction

Katelyn Isaac ^{BG}

Abstract

While doing bars, gymnasts tend sweat during their routines and slip off the bar. Gymnasts commonly use chalk to help increase the friction between the grip and bar. A grip is another method gymnasts use to increase the friction. In this experiment different substances will be tested by finding the coefficient of friction for each substance. The different substances tested were honey and molasses then compared them to chalk. The higher coefficient of friction means that there is more friction between the grip and the bar. This will benefit the gymnast by lessening their chances of slipping off the bar. A structure was built to help find the coefficient of friction. Ten milliliters of the different substances were poured in front of a wooden block. A wooden block was placed on the structure so when the structure lifted the wooden block will start to move down the structure. A plum-bob help measure the angle of the structure. Once the angle was found, it was inserted into the inverse cosine. Once the inverse cosine of the angle was found we inserted that number into the tangent which calculated the coefficient of friction. A gripped surface and wooden surface was tested too. The alternative hypothesis stated that molasses will have the highest coefficient of friction, honey would have the second highest, and chalk will have the lowest coefficient of friction. The results showed there was a significant difference between the coefficient of friction at different levels of substances and surfaces. The p-value for the different substances was 2×10^{-16} and the p-value for the different surfaces was 2×10^{-16} . Therefore the null hypothesis was rejected. Molasses had the higher coefficient of friction and chalk had the lowest. Molasses would be a great alternative to increase friction.

PHY

An Analysis of Sediment Composition Respective to Shoreline Type

Samuel Jasinski^G

Abstract

Engineered (AKA hardened or nourished) shorelines are some of the biggest contributors to the growing issue with development. There are several types of these engineered shorelines, each with differing impacts on the environment in which they are placed. These can wreak havoc on the local ecosystem in varying ways and amounts. In order to accurately represent the Chesapeake Bay the study focused on the most common engineered shoreline types currently found in the Bay. These include bulkhead, riprap, and a boat ramp. Both a natural beach and marsh will also be tested. After careful analysis of the data and results the p-value of 0.484 for the one-way ANOVA comparing the hardened to natural shorelines allows for the null hypothesis (there is no significant difference between engineered and natural shorelines) to be accepted. However, the second one-way ANOVA test, evaluating the sediment at 1 meter and 5 meters for any significant difference, generated a p-value of 0.867, which is highly insignificant.

ENV

The Effect of Turbidity on Oyster Biodeposits

Haley Jenkins^G

Abstract

Oysters play a crucial role in the filtration of the bay. One of the biggest contributions to the amount of suspended material in the Bay is the addition of excess nutrients. There are, however, a lot more phytoplankton in the Chesapeake Bay than the oysters can filter out, so to reduce the use of their energy, oysters do not filter as much when there are low solid concentrations.

Oysters are a big help in restoring the bay, but they have some faults and limitations and should only be used as an extra boost to the restoration efforts instead of being the only restoration effort. The results depict that the higher the turbidity, the more pseudofeces that the oyster produce. The low turbidity did not show a significant difference between the control and the treatment, but this in turn supports the claim because that is a low level of turbidity which has very little material to stimulate pseudofeces production. As for the medium and the high turbidities, they were significant. In the other treatments the higher the turbidity got, the heavier the weights became due to the increased amount of biodeposition created by the oysters in relation to the increased turbidity.

MAR

The Effect of Different Percentages of Open and Closed Cell on Decreasing Force of Impact

Jacob Jones ^{BG}

Abstract

Protecting the human body from major impact can be extremely beneficial in preventing major injury. Contact sports have issued wide varieties of protecting equipment in order to keep athletes safe throughout practice and competition. Sports equipment being used almost always encompasses a form of either open or closed cell foam. For this project, foam with either a closed or open cell composition will be tested to find which form decreases an impact the greatest. The hypothesis states that no matter the composition of foam the amount of force absorbed will be the same throughout. The null shows that closed cell foam will decrease the force of impact the greatest and open cell will be the least effective. In order to test, a two kilogram weight was dropped onto five levels of foam composition all at a consistent thickness of 2 centimeters. After collecting data and running a linear regression, a p-value of .0583 was found. This shows there is no significant difference in force absorbed by any level of foam composition. Despite there being no significant difference, a positive trend is seen when looking at percentage of open cell foam increasing. Completely open cell foam was able to absorb an average of 30.16 Newtons and completely closed cell was only able to absorb 5.46 Newtons. Without any significant difference, open cell foam decreasing the greatest amount of force can only be suggested for wider use.

PHY

**Photosynthetically Available Radiation for Submerged Aquatic Vegetation with Respect to
Restoration in the Chesapeake Bay**

Zach Kaylor^G

Abstract

Since the 1960s, over half of the SAV in the Chesapeake Bay have died. Submerged Aquatic Vegetation (SAV) beds are receding and dying off due to factors such as suffocation, overheating, and light blocking. The level of sea floor SAV coverage has not been as low as it currently is since 1986. Many organisms depend on SAV beds for survival; eelgrass beds provide oxygen for organisms who live in the bay. These beds provide a habitat for small animals such as and juvenile shrimp and crabs. The SAV beds are vital to the Chesapeake Bay ecosystem and must be preserved and reinforced. Mathews County and Middlesex County are excellent areas for SAV restoration to take place. The purpose of this study was to discover which areas of Mathews and/or Middlesex would be optimal for restoration of seagrass beds.

MAR

The effect of grass species and seeding density on ball roll

Nathan Kendrick ^{BG} ★

Abstract

The target of this experiment was to determine which grass species and seeding density would produce the longest ball roll. A soccer ball was rolled along each grass type at each of the different densities using a constant force of 22 psi. This effect was produced by a pendulum mounted between two A-frames connected with pvc pipe. The ball was measured from the back end of the ball in its starting position through the back of the ball in its resting position after it had been kicked. Artificial turf produced the longest average ball roll distance of 5.518m for the grass types. Likewise, seeding density at half the recommended rate produced the farthest ball roll of the densities having an average distance of 3.000m. After an ANCOVA and an ANOVA with multiple comparisons, a significant difference was found in ball roll distance between both the grass type and seeding densities respectively. The tests can be used to determine which grass type and density should be used on a soccer field to maximize ball roll. Players and managers of any sport will need to adjust their style of play to conform to the type and density of the grass.

The Effect of Acidic Beverage Preference and Consumption on Salivary pH

Hannah Killian^G ★

Abstract

A major problem facing the older generation is osteoporosis, a bone disease that can be caused by acidosis. This excess load of acid in the body depletes mineral reserves and obstructs the repair of bone matrix. Diet is the main source of net acidic load, and a possible solution is an alkaline diet. The objective of this study was to investigate the effect of acidic beverages on salivary pH through both a dose-related test and a beverage preference study. In the dose-related test, each student took an initial salivary pH reading, drank an acidic beverage (cola, diet cola, or Hawaiian fruit punch), and then took a final salivary pH reading. The pH values were converted to hydrogen ion concentrations, and a paired t-test revealed $p=0.18$ for the cola group, which is not statistically significant. The juice and diet cola groups did have statistically significant values, with $p=0.0002$ and $p=0.0003$, respectively, with an increase in the hydrogen ion concentration for the juice, and a decrease for the diet cola. The beverage preference portion of this study was conducted through a survey in which students supplied how many servings per week they consumed water, tea, milk, soda, coffee, and juice. Each student was then identified by the drink they consumed the most, excluding water, and placed into groups based on beverage preference. The salivary pH of each student was recorded, and these measurements were used to determine an average pH across each beverage preference group. The test statistic of the correlation was found to be $t=7.36$, and the critical value was 2.01, allowing the correlation to be significant. The salivary pH of those who preferred more acidic drinks was more acidic, which gives support to concern that the “Western Diet” could lead to chronic metabolic acidosis.

MED

**Resistance of *Poaceae* to Random Human Foot Traffic and Its Effect on Sediment Runoff
into the Chesapeake Bay**

Chris Lee^W

Abstract

This experiment tested the resistance of grass species to wear and friction in the form of human foot traffic. The basis for this test is to see which type of grass is best suited to places of high foot traffic (lawns, parks, playing fields, etc.) in order to help limit and reduce sediment pollution of water resources and ultimately the Chesapeake Bay. This experiment compared net loss of sediments of different grasses to see which grass was able to hold the most sediment. By reducing the amount of sediment entering the Chesapeake Bay, over time, the Bay could get back to being naturally healthy and clean. This study was entered with the belief that the grass with the highest percent coverage would resist the most friction due to it having the highest amount of grass to absorb the force caused by the shoe, thus having the lowest amount of sediment lost. This study could have a large impact on watershed states in that minimal funds can go to the replacing of places with this highly resistant grass and more funds can be focused on other things. After the experiment had been finished, the data can be interpreted that the zoysia grass does in fact retain sediment more effectively than the bluegrass after experiencing friction from footwear.

ENV

Sink or Temporary Reservoir: Seasonal Senescence of Submerged Aquatic Vegetation

Halie Maass^G ★

Abstract

Submerged aquatic vegetation (SAV) is widely believed to efficiently uptake nutrients from aquatic and estuarine waters. These plants play a key role in the Chesapeake Bay ecosystem. Unfortunately, the Chesapeake Bay is experiencing increased eutrophication which has caused water quality degradation. Consequently, the Bay has suffered from a loss of submerged aquatic vegetation. In other locations, specifically in Florida's Everglades, restoration efforts have been focused on implementing an increased amount of submerged aquatic vegetation. These efforts harness the ability of SAV to uptake both nitrates and phosphates during photosynthesis. The study in this paper focuses primarily on the possibility of SAV restoration in the Chesapeake Bay and the extent of nutrient release during senescence, or plant death. Nutrient dynamics during senescence of submerged aquatic vegetation were studied in order to determine whether these plants exist as a sink or temporary reservoir in the estuarine ecosystem.

MAR

Don't Croak! The Effect of Water Quality on Amphibian Richness

Emily Martin ^{BG}

Abstract

Amphibians are bioindicators that suggest the overall health of an environment due to their sensitivity to of their skin in both aquatic and terrestrial environments. There have been observed trends in amphibian populations, thus leading to the comparison of water quality to the amphibian richness in an environment. The water quality parameters of Nitrogen (mg/L), Phosphorus (mg/L), and Dissolved Oxygen (mg/L) were compared to Amphibian richness over a nine year time span at four different sites. Water quality data was taken from the Chesapeake Bay Watershed Program Database, and the amphibian call data was collected from the FrogWatch USA Database. An analysis of covariance (ANCOVA) was run on the data due to both the continuous and categorical nature of the data. Both nitrogen and dissolved oxygen showed negative trends suggesting that higher levels of these parameters there were lower level of amphibian richness. Phosphorus showed a slightly positive trend suggesting at higher levels of phosphorus that there were higher levels of amphibian richness. Additionally, month, year, and site were taken into account. The p-value for month was <0.05 suggesting that during different months there was a noticeable difference in the amount of amphibian richness. The amphibian data was calls, so it is to be inferred that amphibians are more actively calling in the months of mating; therefore providing bias in the data. Overall, it could not be proven that the water quality parameters altered the amount of amphibian richness in the tested environments. The data collected is to be believed to be bias because all four sites tested were relatively stable environments.

ENV

**Comparison of Size, Quantity, and Diversity of Bait and Juvenile Gamefish Species
Between the Salt Marsh and Open Water Subhabitats with a Consideration to Different
Fish Sampling Methods**

Collin May and Philip Harrison^W ★

Abstract

The Chesapeake Bay has a complex food system/web with multiple energy pathways throughout multiple trophic levels, beginning with either plankton or detritus, and ending with the apex predators. A crucial consumer trophic level is made up of baitfish, which act as a food source for higher predators. Baitfish typically feed on plankton, copepods, polychaetes, and detritus. This study examined the differences (in terms of size, quantity, and diversity) of the baitfish population between different estuarine subhabitats. The sub-habitats examined were the salt marsh and the un-vegetated mud flat. Cast net and minnow trap sampling were used to capture baitfish, with the results between the two sampling methods being compared along the same parameters as the two subhabitats. Sampling of four sites was done from September-October of 2014. Visible trends showed a preference towards the Salt Marsh in terms of diversity, and a preference towards open water in terms of total population quantity and fish size. However, statistical analysis of the results showed no correlation between size, quantity, and diversity of the baitfish population to the changes in subhabitat, but showed a strong correlation between size, quantity, and diversity of the baitfish population to the changes in sampling method.

MAR

The Effect of Human Activity on Shoreline Erosion Along the Rappahannock River

Matthew Milstead and Jacob Daiger ^W ★

Abstract

Shoreline erosion is a problem that has been occurring for thousands of years. If left untreated soil erosion or shoreline migration (erosion in coastal areas) can be devastating. Shoreline erosion occurs when waves erode soil along the coast. Structures that are built by humans along the coastline can trap sand and prevent it from moving upstream to replenish sand levels downstream. Humans also indirectly contribute to shoreline erosion. Sea level rise due to global warming causes higher storm surges and higher precipitation levels which erode the shoreline. The impact of this can also have major financial and economic implications. The costs of restoring and preventing shoreline erosion can be colossal. In this experiment shoreline erosion was measured at multiple sites along the Rappahannock River. Sites varied in the amount of human activity off of the coast. A stadia rod was used to make shoreline profiles and measure the progression of erosion at each of the ten sites. It was hypothesized that the sites will experience different levels of erosion. It was believed that sites with high activity levels would experience the most erosion, followed by medium activity level sites and finally low activity level sites. The study shows that there is a correlation between the activity level of a site and the change in sediment. The statistical analysis states that the results are significant. The study may help educate property owners on the potential erosion levels at his or her piece of waterfront property. In addition, this study has the potential to educate the general public on the impact that humans have on the environment, specifically erosion levels. Individuals may think twice before they act in a manner that could increase shoreline erosion. As a result, a portion of the general public may feel inclined to take action to decrease the human component of erosion.

ENV

The Effect of Changes in pH on the Production and Respiration Rates of Native Tape Grass, *Vallisneria americana*

Adam Parker ^W

Abstract

In the past century, the world has seen an increase in the amount of carbon dioxide (CO₂) in the atmosphere. The rise in CO₂ can put stress on aquatic ecosystems due to ocean acidification, an overall decrease in the pH of the ocean's waters. Freshwater ecosystems, already stressed by pollution and recent increases in the number of invasive species are also showing signs of acidification due to the increase in CO₂. The effect of the rise in acidity is known to be harmful to calcifying organisms, but the effect on freshwater submerged aquatic vegetation (SAV) is not well studied. The invasive SAV *Hydrilla verticillata* (hydrilla) and native SAV *Vallisneria americana* (tape grass) often compete for similar environments in the freshwater portions of the Chesapeake Bay. Previous studies on the effects of pH changes on Hydrilla found that the SAV may be experiencing phenotypic plasticity allowing it to continue to produce and respire even at the most acidic treatments. This study looked at the respiration and production rates of *Vallisneria americana* under differing pH's. Samples of tape grass were incubated in water with a pH ranging from 8.2 units to 5.7 units in a light gradient box for the production treatments and a dark box for the respiration treatments. It was found that at the pH's closest to the control 7.2, the 6.7 and 8.2 treatments, tape grass experienced no production. In the 5.7 and 6.2 treatments, tape grass experienced significantly higher production rates. Data was collected and analyzed using a One-Way ANOVA and a Tukey's HSD test. There was a significant difference found in both the production and respiration rates at the varying pH levels. With the stress of an increase in acidity and invasive species, the results of this study suggest that tape grass will continue to produce and respire as a crucial part of freshwater ecosystems.

ENV

The Effect of Rapid Salinity Changes on the Respiration Rate of *Callinectes sapidus*

Thomas Parker^W ★

Abstract

The Atlantic blue crab (*Callinectes sapidus*) is a very important animal in Chesapeake Bay, both to ecosystem and as the most valuable commercial fishery. The blue crab, a medium-sized crustacean, serves as both predator and prey. As a euryhaline organism, the blue crab is capable of surviving across wide ranges of salinities; however, the blue crab is most often seen in salinities around 20-30 ppt, choosing to evacuate tributaries after heavy rains decrease the salinity. Estuaries like Chesapeake Bay are prone to rapid environmental changes, and some organisms leave an environment that may be harmful after experiencing a stress response. As part of a stress response, an organism's metabolic processes may elevate, to allow the organism to escape the stressor. This increase in metabolic function is an increase in respiration. This experiment investigated the effect of salinity on stress in the blue crab. The stress of the blue crab was determined by measuring the respiration rate of the blue crab, which was determined by measuring the rate of DO decline in a closed system. The experiment was conducted using an airtight 5 gallon container, holding water with a salinity of 0, 15, 25, 35, or 45 ppt. Every five minutes for one hour, the DO was measured using an electric Dissolved Oxygen probe. The experiment found a P-value of 0.08155, which is trending towards significance, but did not allow for rejection of the null hypothesis. Crabs subjected to more extreme salinities, such as 0 and 45 ppt, had higher respiration rates, suggesting a stress response to these salinities. Though the data is inconclusive at this point, these data may indicate that the blue crab acts on a direct stress response, and not as a result of the movement of prey, as otherwise hypothesized.

MAR

The Effects of Plastic Marine Debris on the Chesapeake Bay Environment

Katherine Ransone^G

Abstract

Plastic in the environment can be categorized into 3 different categories: plastic, microplastic, and microbeads; all types of plastic are directly introduced into the oceans and bays due to their use in cosmetics, crafting, clothing, and other sources. This study looked to see if pollution from plastic, microplastic, and microbeads was a significant problem in the Chesapeake Bay. Each month, all trash that washed up on the beach was picked up, and recorded in an Ocean Conservancy Volunteer Ocean Trash Data Form, where the trash was sorted into many different categories, including total plastic and microplastic (plastic smaller than 2.5 cm). The study was also conducted to see whether marine organisms would willingly and actively consume microbeads. The experiment testing the consumption of plastic microbeads by grass shrimp ended with the shrimp not appearing to have consumed any microbeads, where no statistics could be run. For the beach cleanups, a chi-square test was used to compare the observed number of total plastic pieces (both plastic and microplastic) per month to the expected value of plastic that washes up on beaches, which was 75% of total trash found. In the end, this test had a calculated value of 6.66, which compared to the given value of 11.07, was not significant enough to reject the null. Though it has been shown that certain marine animals will not willingly consume plastics, many of these creatures may inadvertently do so when feeding. Having large amounts of plastic pollution and trash in the environment is detrimental in many ways, mainly to the health of marine animals and the ecosystem.

MAR

Get Your Gas Kicked: The Effects of Different Gas Types on Simulated Engine Parts

Stephen Rech ^{BG} ★

Abstract

Ethanol gas has proven better for the environment, but not for consumers. Ethanol gas has been shown to be detrimental to motors through its corrosive, water gathering, and deposit forming properties. As a result, the damages have cost consumers untold amounts of money since most damages are irreversible. This experiment aims to test the consumer's alternatives to ethanol gas, ethanol free gas and ethanol gas with an anti-ethanol additive by measuring damage simulated engine parts to determine which gas types yields the least amount of damage. The alternative hypothesis stated that the "Damage" to the Simulated Engine Parts would decrease from the ethanol gas, to the ethanol free gas, and have the least damage in the ethanol gas with the additive. Simulated engine parts were placed in 24 oz. of each gas type and allowed to sit for six weeks, then an torture test was performed on the simulated engine parts (rubber hose and aluminum sheeting). After running a one way ANOVA on the rubber data, I got a p-value of less than .05 and ran a multiple comparison with a bonferroni correction, to prove that there was a significant difference in damages among the different gas types to the rubber tube, and that there was a significant difference in damage from the ethanol gas to the other two gas types (reject null). After running a one way ANOVA on the aluminum data I got a p value greater than .05, meaning I fail to reject my null. Ethanol free gas and ethanol gas with anti-ethanol additive both turned out to be satisfactory alternatives to e10.

EGR

Hail Hydra! The Effects of Pollutants on Hydras

Gaby Rivera ^{BG}

Abstract

Golf course managers have tried to keep their golf courses both healthy and environmentally friendly. Many acts and regulations were enacted to help monitor chemicals used in seasonal pesticides and fertilizers making it as safe as possible for wildlife. The most common pollutants that can be found in fertilizers are nitrate and phosphate. Wildlife tends to react to their environment to indicate if it is in balance and healthy. The organism that was used in this study was the hydra and it reproduces asexually. The purpose of this study is to observe whether a hydra's reproduction rate can be used as a bio-indicator toward pollutants, nitrate and phosphate. The study conducted by placing hydras in jars with 80 mL of water solutions that contained three different concentrations. The results for the nitrate concentrations indicated that there is no effect on the budding rates of hydras. The results for the phosphate concentrations were also indicated that there was no change in budding rates. A statistical test was used and both null hypotheses failed to be rejected. There were different factors that contributed toward the data including the temperature of the testing facility that the average was 18°C making the water much colder and inducing the hydras into a kind of hibernation state. Overall, the study showed that hydras cannot be used as a bio-indicator for cold temperatures.

ENV

Effect of Location on Catch Rate of the Blue Crab, *Callinectes sapidus*

Joseph Rudolph ^W ★

Abstract

The blue crab, *Callinectes sapidus*, supports a major and iconic fishery throughout the Chesapeake Bay and its tributary rivers. The blue crab is found throughout the waters of the Atlantic Ocean, Gulf Coast, and the Chesapeake Bay (Seitz et al. 2008). Most commonly, blue crabs are caught using crab pots, which are wired cages with one way only entrances and bait placed in the center of the cage to lure the crabs in. Crab pots, along with bottom trawl data and commercial fishery statistics are used to estimate the population of blue crabs (Sturdivant & Clark 2011). Due to the diverse types of near shore habitats available in the Chesapeake Bay, crabbers have many choices, as to where to place crab pots for the optimal harvest. The goal of this study was to determine the effect of pot location of multiple indices including catch rate, crab size, and catch sex ratio. To determine this, multiple crab pots were placed in three different locations (riprap, pilings, and beach shore line areas) and data was collected daily for a two week period in the late spring, midsummer, and early fall. The information gathered from this study could allow for higher catch per unit effort for crabbers, as well as lend support to the protection of important nearshore blue crab habitats.

MAR

The Effect of Physical Activity on the Retention of Sight Words on Fourth Grade Special Education Students

Grace Rutkowski ^G ★

Abstract

One problem today is that kids spend too much time sitting in front of a screen and not learning. Children learn differently and in order to not simply pass children along, an educator needs to learn how to teach in new or different ways. This experiment was conducted at a local elementary school with six special education students. The “cold” cards and “warm” cards were practiced everyday. The study found that the more times that the children worked with the exercises and the instructor the better their scores were. The stimulation of the children's brain by the physical activity seemed to help the children retain the words that they had practiced better. Statistical analysis of the results gave a p-value= 0.042358. The stimulation of the children's brain by physical activity seemed to help the children retain the words that they had practiced. The exercise treatment was minimal and only took one minute of class time but had a better outcome than the non-exercise group of data. This supports the fact that a brief amount of exercise will help stimulate the brain enough to make a difference in testing. It also lets the students use their energy to concentrate on the educational tasks. There are a few things that could be modified for this study in order to make it more accurate, and there are many things teachers can do in order to improve retention of information in the classroom.

PSY

Is a Four Leaf Clover Really That Lucky? : Does Burning Time Affect Clover Growth And Soil Nutrient Levels?

Jordan Schools ^{BG}

Abstract

Recently, it has been discovered that clover grown in many yards have been very hard to get rid of. Many people every year spend a lot of money on chemicals to spray on the clover, but the clover keeps growing back every time. Clover sometimes has a low tolerant level of nutrients in the soil and it cannot stand harsh conditions. This experiment sought to test whether burning of the clover at various minutes would affect the growth of the clover and the soil nutrient levels. Also grass was tested against it to test whether it would grow in place of the clover. The amount of time burned ranged from 0 minutes to 2 minutes to 6 minutes. It was hypothesized that as the amount of time increased burned, less clover would grow back. Also that as the amount of time increased, more grass plants would grow back. And also it was hypothesized that as the amount of time burned increased, so would the nutrients in the soil, specifically phosphorus. The statistical tests came up with P-Values of 3.03×10^{-6} for Clover, 7.6×10^{-6} for Grass, and 3.1×10^{-11} for the nutrient level of phosphorus in the soil. This showed there was significant differences of the growth of clover, the growth of grass, and the change in nutrients on the amount of time burned. This led to the rejection of my null hypotheses for all three variables. This should help the people that don't want to waste their money on chemicals anymore, so they now just have to burn the clover that is in their yard with a minimum of 6 minutes. Overall, the amount of time burned does affect the growth of clover and the nutrient level of phosphorus in the soil.

BOT

A Study for Possible Acidification of Estuarine Water in a Tributary of the Chesapeake Bay

Caleb Selph^G ★

Abstract

Escalation of atmospheric CO₂ through anthropogenic means has led to a sharp increase in oceanic CO₂ levels. These higher CO₂ amounts have corresponded to a decrease in marine pH, a process known as “ocean acidification.” Acidification of global ocean bodies has, in turn, led to a decrease in available carbonate for some organisms, including plankton, to grow and develop their shells. While much concern has been raised over acidification of the world’s oceans and its impact on many marine organisms, including plankton and corals, not much attention has been given to the potential that water in local estuaries may be acidifying at a rate similar to the oceans. This study explored whether a local estuary on the lower Chesapeake Bay showed signs of acidification, as well as testing different measures of water quality for outlying factors that promote a decrease in pH. Results showed a seasonal shift in the estuarine body between acidified and neutral waters, but did not observe a sustained and constant acidification. With regards to calcifying organisms living in the estuary that can be affected by this seasonal acidification, concern is raised when looking at the growth and development of young oysters.

ENV

Multi-tasking: The Effect Music has on Performance

Graham Shannon ^{BG}

Abstract

Multi-tasking has become an epidemic in the modern world. Many people think they are great multitaskers when, at their best, they are sub-par switch-taskers. Numerous people believe that music helps them work, and this is multi-tasking in itself. This experiment sought to test the effects of music while playing a brain game. Participants were split up by age and asked to play a “brain game,” named Stacked Disks, while listening to classical music, silence, and pop music. It was hypothesized that participants would generate the best scores listening to classical music based on the “Mozart Effect.” The next best scores would be generated while participants played in silence, then followed by listening to pop music, as this should be a major distraction. It was hypothesized that the variable of individuals would have a major impact on the scores and create statistical significance. It was also hypothesized that as groups increased with age, the score would also. The different age groups had mixed results, as the adults and nine through twelve year-olds did best while listening to classical, the teenagers did best while listening to music period, and the four through-eight year-olds did best while listening to pop. Though there are mixed results, it is believed that the youngest group did best with pop because they were familiar with that music, the teenagers did best with music because they have grown up in a distraction-rich environment and are used to multi-tasking and/or the technology, and the adults did best while listening to classical music because the Mozart Effect was in play. Overall, music did not affect the performance of the individuals.

PSY

The Effects of Shotgun Pellet Size on Sheetrock Penetration

Austin Simons^{BG}

Abstract

Everyday people are forced to protect their selves whether it is an intruder or someone trying to rob you on the street. No matter what though you want it to be safe for those surrounding you or in this instance in neighboring rooms. The reason behind this testing is to show which shotgun pellet size is safest for home defense. My alternative hypothesis was that larger pellet sizes would penetrate through more sheetrock due to a larger mass and diameter. Where as my null hypothesis said they would all be of equal penetration. I shot each size shotgun shell from 10 meters away into sheetrock 4 times and counted how many sheetrock tiles were penetrated. After running a regression on the comparison of diameter and a logarithmic test on the comparison of the mass to penetration I received two P values that were both less than 0.05. This meant that my test was significant and I was able to reject my null hypotheses meaning that larger pellets penetrated more sheetrock than larger sizes. The best size shotgun pellets would be number 4 buck and smaller due to less penetration.

PHY

Getting Buzzed: The Effect of Different Concentrations of Caffeine on Amount of Nectar Ingested in Butterflies

Sara Slate^{BG}

Abstract

Caffeine is often found in many things humans ingest almost every day, even in things such as chocolate. Many are unaware that it is also found naturally in many different plants nectar, such as coffee and citrus plants. This study was done to show that butterflies, much like bees, were more likely to return to feeders that contained higher concentrations of caffeine. Data was collected using 4 different feeders with varying concentrations of caffeine. After running a one way ANOVA a p-value < 0.05 was found. This shows that there is significance in concentrations of caffeine on amount of nectar consumed by the butterflies.

ZOO

A Comparison of Eastern Oyster and Atlantic Ribbed Mussel Filtration and the Effect on Light Penetration in Bay Waters

Mac Smith ^w ★

Abstract

The preservation of the Chesapeake Bay's health is crucial to its ecosystem. In the past one-hundred years, the Chesapeake Bay has exhibited serious environmental degradation. Side effects that follow along with this degradation include declines in sea grasses, decimation of shellfish and finfish populations, nutrient pollution, and deprivation of necessary dissolved gases in the water. This also affects another important aspect of aquatic life: light penetration. This greatly affects SAVs (Submerged Aquatic Vegetation) and their ability to grow and thrive in their environments, causing a break in its environmental chain. This study was conducted to test water clarity of the Chesapeake Bay and how Eastern Oysters, Atlantic Ribbed Mussels, and a combination of oysters and mussels affect its clarity. The results of the experiment showed that filtration by Atlantic Ribbed Mussels, Eastern Oyster and the pairing of Mussels and Oysters together exhibited similar water clarities during the 1 hr, 4 hr and 20 hr time intervals. However, light penetration of mussel filtered water exceeded that of the oyster and paired group in the shorter 1 hr and 4 hr trials while the oyster-mussel group had the greatest light penetration in the 20 hr trials. While not statistically significant, it does suggest that over a greater amount of time, the duo of oysters and mussels would be more effective in filtering the bay. It also suggests that if two organisms are paired that both can filter different sized particles, higher water clarity will be seen. This would also have a healthier effect on SAV's, making the Bay clear and environmentally stable for their growth and for the organisms that depend on them.

MAR

Phragmites: Marsh Destroyer Or Shoreline Savior

Andrew Suggs ^W ★

Abstract

Phragmites, also known as the common reed, is an aggressive, invasive wetland grass. Phragmites have always been considered dangerous to our native marshes, mostly salt and brackish marshes, since they are invasive and getting rid of much of the diversity within our local marshes in the United States. However, many studies have shown that Phragmites holds the power to help limit the effect of sea level rise on our marshes, which is essential to filtering much of the excess pollution traveling to large bodies of water such as the Chesapeake Bay and its tributaries. In this experiment the effect that shoreline elevation has on the growth height of Phragmites was tested to help determine whether or not Phragmites can really help marshes suffering from erosion caused by sea level rise. To do this, two marshes about 100 yards from each other along the Rappahannock River were used. Marsh 1 was very narrow only spanning about 6m, while Marsh 2 was much wider measuring about 20m wide. The marshes were measured out into separate sections based on distances from the average High Tide Line. The distances for Marsh 1 were starting from the High Tide Line, 0 meters, 2 meters, and 4 meters. The distances for Marsh 2 were the same for marsh 1 except there were two added distances for the adult Phragmites height measurements, 7 meters and 38 meters, because of Marsh 2 being noticeably longer than Marsh 1. The results from the experiment show that the Phragmites tend to grow both faster and taller in an area of the marsh close to the center, like a “sweet spot”, and increases the potential that Phragmites can function as a protector of shoreline erosion.

MAR

The Effects of Season and Location on Ground-Level Carbon Dioxide Concentrations

Robin Thady^G ★

Abstract

Levels of carbon dioxide in the atmosphere have increased at an accelerated rate since the Industrial Revolution. Atmospheric CO₂ levels have achieved 400 parts per million, and surface-level values are likely much higher. A five-month study was conducted to monitor local CO₂ levels. The study divided samples into summer and autumn strata and determined whether any of the sampling sites was statistically different from another, which would indicate whether increased vegetation in rural environments effectively reduces ground-level CO₂ concentrations. The study found an observable difference in carbon dioxide levels of different environments during the summer, but there was not sufficient evidence to support the claim that different locations have significantly different carbon dioxide concentrations during the summer or during the autumn. An additional component to this study measured the trend in CO₂ concentrations diurnally and from summer to autumn to determine how monthly seasonal change affects daily patterns. These data support the claim that across a diurnal gradient different months vary seasonally in carbon dioxide concentrations. Based on the results of this study, various steps can be taken to reduce CO₂ emissions. The city park had notably lower CO₂ concentrations than the surrounding city, suggesting that green spaces effectively counteract emissions. Simple actions like planting trees, constructing green roofs, and adopting CO₂ absorptive strategies could be undertaken to incorporate more green spaces into developed areas.

ENV

Is There A Relationship Between Male Teen Diet and Future Adult Health Issues?

James Thomas^G

Abstract

In recent decades, the number of deaths related to diseases associated with diet and weight has increased exponentially. Coronary heart disease and many related health issues are caused by different factors including diet, genetics, and environmental factors. However, many of these are life choices that can be reversed. The basic prevention of many diseases is a healthy diet and regular exercise with diet being the more important of the two. This study aimed at analyzing a collection of teens' diet journals in order to assess the potential risk that they incur to potential coronary heart disease and its related health issues in the future. By recording the number of salty, fatty, sugary, and high calorie choices each participant made, the data could be compared to the separate health issues each category is associated with. A single-factor ANOVA test was run on the types of unhealthy choices the participants made per day, with a p-value= 4.2E-11. This value showed that there is a significant difference between the the types of choices and the overall calorie consumptions per day. However, due to the high number of unhealthy daily consumptions of salts, fats, and sugars, the data suggests that teens are practicing diets that can potentially lead to coronary heart disease, hypertension, high cholesterol, and diabetes. Overall, the dietary habits of the subjects will significantly increase the risks of developing health issues associated with diet.

MED

Spatial Distribution of Macroinvertebrates in the Upper Mattaponi River

Joel Tidman^{BG} ★

Abstract

The River Continuum Concept examines a dynamic equilibrium that exists from the mouth to the delta of rivers. The width, speed, depth, and surrounding environment all change as a river moves downstream interacting to create a balanced equilibrium. Upstream many rivers are forested and leaves play an integral part as a food source, and habitat source for macroinvertebrates which in turn break down the leaves and send important nutrients downstream. Upstream leaves and macroinvertebrates interact together as part of the equilibrium of the River Continuum Concept. Presence and diversity of macroinvertebrates are a good indicator of water health as agricultural and deforestation practices continue to yield negative effects on health of stream and therefore habitat of macroinvertebrates. In this study, artificial leaf packs were produced and placed at five sites along the Upper Mattaponi River. The bags were retrieved after two weeks, and amount and diversity of macroinvertebrates was examined. Amount of organisms and richness was examined; the Shannon-Wiener number representing diversity was calculated from the data. The leaf packs further downstream demonstrated less diversity than leaf pack located further upstream. Success of macroinvertebrates and the role they play in nutrient cycle downstream needs our continued research and efforts as it relates to stream health and water quality for our future.

ENV

Effects of Sound Level and Type on Dog Heart Rate

Greyson Walsh^{BG}

Abstract:

Many pet owners do not understand the full extent of what should be known about their animal. Many dogs are susceptible to diseases because of the rapid change in heart rate they may be experiencing. This study will give knowledge to dog owners and allow them to be able to react to their dog's fluctuations in heart rate properly. The reason for this experimentation is to understand what affects the heart rate of the domestic dog *Canis lupus familiaris*. This study follows two independent variables that show that sound levels in a dog's environment may have an effect of the heart rate of the dog. The breed of the dog being experimented was also used to understand the difference in heart rate between a companion dog and a work dog. A change in the dog's surroundings was used to understand the changes in the dependent variable. The type of breed was understood to have a dramatic effect on the fluctuations in heart rate that the dog experienced, but the type of noise surrounding the dog showed to be ineffective to the dog's heart rate. This may be due an outside source that is unknown at the moment. This study will be used as a tool for many animal researchers, shelters, and future/current pet owners. This study can help reduce the effects of heart rate on dogs with unknowledgeable owners.

ZOO

A Study on Low Level Static Magnetic Fields Preset in Electronic Devices and Their Effects on Human Physiology

Johnathon Williams ^G ★

The prevalence of personal electronic technology has increased dramatically in the past few decades. In 1985, there were 340,213 cell phone subscribers while as of Dec. 13, 2014 there were 335.65M registered cell phone subscribers. With this 986% increase, the question remains about what sort of physiological effects these devices could have on users. Studies have been conducted, yet much ambiguity still surrounds the issue. Every cell phone in the world emits a magnetic field that propagates from the magnets inside the speakers. This study seeks to quantify the exposure of a person through their cell phones and headphones by measuring the strength of the associated magnetic field with a magnetometer. A t-test comparing the average calculated magnetic field and a published 100 microtesla value of concern resulted in a test statistic of $p << 0.05$. Further, participants' survey responses indicate that the majority keep their phones on their bodies for more than 8 hours a day. Based on this study, it is advised that individuals keep cellular phones and headphones off of the body to the extent possible until further studies are conducted.

MED

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