

Senior Research Project Abstracts, CBGS Class of 2024

A Field Study of Water Quality Impacts of a Rainfall Event on the Rappahannock River

Abby Almassy

ABSTRACT

Water quality is a very important issue around the world because it has a great effect on wildlife and even humans if it is poor. There are many parameters that determine the quality of a body of water and they can be affected by many factors including point and non-point source pollution, precipitation, and climate. If too many pollutants enter a body of water through storm runoff, issues such as eutrophication, bioaccumulation, and biomagnification can occur. This study monitored several parameters of the water quality of the Rappahannock River at five sites for 8 days after a rainfall event. At the height of the pulse of water from the rainfall event, there was a significant concentration of phosphates and high turbidity. There was also a significant increase of the surface water temperature over the eight days. Storm runoff likely caused the high concentration of phosphates. Sediment runoff and suspended sediments from the quickly flowing water likely caused the high turbidity. This high turbidity is likely what caused the warmer surface water temperature. It is important to monitor water quality during rainfall events and in general to see what pollutants and how much of them enter the water through runoff. If this is known, people can work to reduce the amount of pollutants entering waterways in this way to prevent events such as eutrophication from occurring. This will help to keep the wildlife living within the water safe and healthy.

The Effect of Salt Type on Kimchi pH and Sugar and Salt Content

Adelina Bowden

ABSTRACT

Kimchi is a traditional Korean food that has been around for thousands of years. It was a healthy way to ferment vegetables for the winter and is now eaten year round in many different countries around the world. Because of globalization, kimchi has become more commonly eaten and more commercial production of the product has taken place. With this comes the processing

and packaging of kimchi and the search for the most optimal ingredients for kimchi to give it a good taste and a long shelf life. This study proposes to find the differences between the three salts, kosher, Himalayan rock, and iodized, in their pH, salinity, and specific gravity. These factors have been shown to have a correlation with fermentation rate. This can be used to find which salt is optimal for longer shelf life. The salinity, pH, and specific gravity, also known as sugar content, were compared to convey how long each batch took to ferment. There were two batches tested with three duplications of each salt, and they were tested every 12 hours for three days. While there was no significant difference found between the pH values, there were significant values found between the salinity and specific gravity. This allows the null hypotheses for both to be rejected. This study serves as a basis for further research, as microbial and nutrient profiles have not been tested, along with more trials of the experimental batches present.

**Assessing Reproductive Substrate Availability and Timing for the Chesapeake Stinging
Nettle, *Chrysaora chesapeakii***

Ailin Harpole

ABSTRACT

Most micro-organisms of the Chesapeake Bay start in a planktonic state and are susceptible to the constantly changing coastal estuarine environments, especially in their juvenile stages. *Chrysaora* Jellyfish reproduce through broadcast spawning events in the water column, creating swimming planula larvae who then have to find a suitable hard substrate, like oyster shells, to attach themselves to. Competition with fouling organisms like barnacles and tunicate over substrate space causes population control for jellyfish scyphistoma. Without proper clean space for settlement *Chrysaora chesapeakei* cannot reproduce properly. Five sites with docks were identified along the tributaries of the lower Chesapeake Bay. Larval collectors were constructed similar to spat collectors used for oysters. Three downturned oyster shells were tied onto a string, at their center of mass, that would hang vertically, one resting at the bottom, one in the middle, and one sitting at the top of the water column. Over the course of 10 weeks,

Hallieford showed significant increases from week to week of scyphistoma coverage on shell . Starting in July the average scyphistoma coverage across shells at each site steadily increased before leveling off in September for Hallieford. Scyphistoma polyps were found at four out of the five sites at the end of the study period, but Port Haywood showed no signs of jellyfish reproduction and tied for the least amount of fouling on a determined index. The results for this study are important because it outlines the environmental factors that are best suited to jellyfish reproduction.

Allelopathic Effects of the Invasive Species *Phragmites australis* on Native Wetland Plants

Aimee Dunham

ABSTRACT

Allelopathy is a common mechanism found in plants to outcompete other species. This mechanism is used by released chemicals from one plant to another that will limit growth. *Phragmites australis* is an invasive species found in Chesapeake Bay wetlands that uses allelopathy. Weeding out other species will greatly decrease the biodiversity of wetlands. In this study *Phragmites* extract was taken from the plant and used to hydrate native wetland seeds. The seeds were hydrated daily with the extract to test germination when exposed. Based on the germination rates, it does have chemical effects on other native wetland species, sometimes inhibitory but sometimes stimulatory.

Allelopathic Effects of *Lonicera japonica* and *Pueraria montana* on Native Virginia Plants

Alora Rohm

ABSTRACT

Invasive plants like Japanese Honeysuckle (*Lonicera japonica*) and Kudzu (*Pueraria montana*) have many negative impacts on Virginia's ecosystems. These fast-growing plants have different effects on many types of native species. This study examined the effects of Japanese Honeysuckle and Kudzu on three native plants of Virginia: Switchgrass, New England Aster, and Virginia Wildrye. The tissues of the invasive plants were turned into a water based extract and used to water the three types of native seeds. The seeds were watered every other day with

each extract type and a control for 20 days. Each day the seeds that germinated in each treatment group were counted. Each graph shows three sigmoid growth curves that levels out at varying maximums. For New England Aster and Switchgrass, the Kudzu extract showed signs of stimulation while the Japanese Honeysuckle showed signs of inhibition. However, both Japanese Honeysuckle and Kudzu extracts showed signs of inhibition when used in Virginia Wildrye. These results help bring insight to the positive and negative effects that Japanese Honeysuckle and Kudzu have on native plant species in Virginia. These insights could help combat the spread of invasive plants and weed them out from our ecosystems.

BioCaching: A Study on Citizen Science

Amber Goens

ABSTRACT

The purpose of this study was to use citizen science (Citizen Science) to collect data from the eastern shores of the Chesapeake Bay watershed. The data were collected from 11 sites along the eastern coast of Virginia. The site was located in the Norfolk branch of the Virginia Department of Conservation and Recreation website (DCR). The study had a total of 97 responses from all locations combined. Of the 16 sites, the Virginia branch was the most popular for responses. The study was also shown in a way in which taxa were the most frequently reported taxa. Almost 70% of birds were seen taxa, and 53% of the data that we could identify the taxa and species and their names. The results from this study have a huge impact on the environment around the Eastern shores and the animals in the area. The use of citizen science is a technique that promotes the democratization of the scientific process and more universal access to scientific data.

What Is the Best Way to Dry Your Hands After Washing Them?

Anajah Owens

ABSTRACT

Bacteria are transmitted to humans through air, water, food, or living vectors. Bacteria can be the root of things like diseases, viruses, infections etc. When testing bacteria and germs

on hands after washing, there are different drying techniques that could track bacteria back into your hands. This problem could cause higher or lower bacterial counts when drying hands and could be transmitted by hands. This can be assessed by the proper hand washing technique and different drying methods. Main thing is to see and compare the propensity of four common hand-drying methods (air dry, powered hand dryers, cloth towel, and paper towels) to contaminate the environment, and us humans. Most studies say that powered hand dryers have the most bacteria transmitted back into your hands while drying, and air drying had less transmitted bacteria after drying. This study assessed the four variables and used hand washing methods for all contestants. This study looked at the number of bacteria before washing hands and the number of bacteria after washing and drying. Results of data showed that the powered hand dryer, paper, and cloth towels were similar by 50% of people before and after increased, bacteria count went higher, and the other fifty%^{2/4} had less than before than after, bacteria count went lower. The cloth towel showed that bacteria decreased from before to after. Cloth towels had a decrease on each contestant while the other three variables had a change in increasing and decreasing. This shows that cloth towels are safer and more efficient in keeping bacteria off hands after washing and drying hands. The other variables can be unsuitable in settings and causes of cross contamination when drying hands.

Determining the Frequency of Erosive Wind Wave Conditions at OBX

Andrew Greve

ABSTRACT

Coastline erosion is shaping the way people live along the coast. In the United States alone, coastline erosion causes a substantial amount of financial hardship, totaling more than \$500 million in damages and property loss each year. An alarming 80,000 acres of coastal wetlands are lost each year. The U.S. Government spends nearly \$150 million dollars every year on trying to delay coastline erosion in certain areas of high human development by practicing beach nourishment in these areas. The wind speed, wind direction, and wave height data was obtained from the Diamond Shoals Buoy of the National Data Buoy Center. The data were collected from the website for a period of 46 days from Aug 28, 2023 to Oct 12, 2023. The wind from 0-89 degrees has the highest average speed and the wind that comes from 270-359 degrees

has the lowest average speed. The frequency of non erosive wind conditions is 49%. The frequency of erosive wind conditions is 51%.

The Effect of Positive Versus Negative Portrayals of Sharks on People's Dispositions Towards Them

Arwen Kintz

ABSTRACT

Predators are typically feared, which can hurt conservation efforts to protect them. Losing the top predator in an environment can devastate the entire ecosystem. This study focuses on the change in people's disposition due to the different portrayals of sharks. Human participants completed a ten-question pre-survey containing positive and negative statements about sharks. Then the participants were divided into two groups and watched a presentation. One presentation provided positive information about sharks, while the other one was negative. After viewing the presentation, the participants completed a similar post-survey, including questions about their experience with sharks. Viewing positive information caused an average increase in participant's scores. The group that saw the negative information observed an average decrease in scores. Personal experience interacting with sharks also influences how much negative information affects people. Positive past experiences caused a smaller change in scores than negative past experiences. The different portrayals of sharks do impact someone's disposition towards them based on the type of information presented.

Assessing Motivational Strategies for Teens to Increase Core Strengthening Exercise

Aubrey Micket

ABSTRACT

Loss of proper posture and body core strength has had lasting effects on the posture of school students, as most were schooled at home on computers. Exercise and strengthening muscles in the body core is the only way to guarantee good posture among students. Research that explored teens' motivation towards exercise discussed how teens knew they needed to participate in exercise, but not for the reason of becoming more healthy. Teens seem to lack being active or gaining muscle not out of lack of wanting to, but as not getting up and moving to

reach their goal. Yoga improves body function movement in everyday life, while usually being weighted by one's own body. Study participants were divided into three groups by motivation strategy: fact-based motivation, image-based motivation and the control which received no motivation. Each group was given four yoga poses (downward dog, boat, extended side-angle, warrior) to complete for two minutes three times a week (Monday, Wednesday, Friday). Results showed that core strength could reach significance with a higher sample size meaning that core strength can be achieved through the exercise of yoga. Fact based motivation was also discovered to be the most effective for teens, rather than physical appearance based motivation or no motivation. Stress levels also decreased concluding that yoga can have a lessening effect on stress levels among teens.

The Effect Different Pharmaceuticals have on the Hatching and Survival of Brine Shrimp

Bailey Fones

ABSTRACT

The Chesapeake Bay is home to many species, however, due to its shallow water depths pollution with excess nutrients and sediment degrade both the water chemistry and the environment. Nearly 5 million tons of pollutants get dumped in the Chesapeake Bay. Studies have found, two of the highest concentrations are from caffeine and cotinine, a substance found in cigarettes. This study compared how concentrations of cotinine and caffeine affected the hatch and survival rate of the brine shrimp over a week period. Using these two pharmaceuticals, each were tested to see the effect on brine shrimp when being compared to the control, no pharmaceutical was added. Using the two concentrations to determine the number of hatched brine shrimp and the survival rate of those brine shrimp. The importance of this study is to see how unused or unwanted pharmaceuticals that are disposed into the waterways can affect smaller organisms, the base of the aquatic food chain. The number of hatched brine shrimp for both cotinine and caffeine are not significant and the survival rate of brine shrimp for cotinine and caffeine are significant. These results correspond to the concept of a cellular "Fight or Flight" reaction to stress, going into this stress causing a quick response to the pharmaceutical allowing the brine shrimp to hatch rapidly and then followed by an overwhelming panic-driven response for survival.

Determining LD50 of Gadolinium on a Population of Brine Shrimp

Barry Ewell, Jr.

ABSTRACT

Using gadolinium-enhanced MRI, pathologic processes that are not visible with other imaging modalities can be detected. Over 300 million doses of gadolinium-based contrast agents (GBCAs) have been given globally throughout their nearly 30-year clinical usage. These drugs have an amazing safety profile, with very few toxicity documented. Given the toxicity of unbound gadolinium, stability is a crucial component in gadolinium toxicity. The majority of GBCAs are extracellular contrast agents that are not specific and are primarily eliminated by the kidneys. The relationship between gadolinium and nephrogenic systemic fibrosis (NSF) was identified when the correlation between GBCA exposure and NSF was discovered. Renal function is a crucial predictor of subacute gadolinium toxicity. (Ibrahim et al., 2019)

Prevalence of Macroparasites with *Crassostrea virginica* in Varying Environmental Conditions

Bevan Ransone

ABSTRACT

Crassostrea virginica, the Eastern Oyster, serves as a keystone species within the Chesapeake Bay and has been well established in the aquaculture industry and livelihoods of many people in the commonwealth of Virginia and beyond. However, numerous studies have been calling attention to the mud blister worm, *Polydora websteri*, threatening the health and marketability of the Eastern Oyster. The shell boring parasitic polychaete leaves behind unaesthetic and detrital filled blisters in the bivalve's shell, threatening product edibility. Infection with the parasite may also potentially leave the oyster weak and susceptible to predation and infection of other macroparasites, such as the oyster pea crab *Zaops ostreus*. This study examined two-hundred fifty oysters across five locations in Virginia for prevalence of *P. websteri* and *Z. ostreus* in varying salinities and temperatures, in efforts to investigate correlation amongst macroparasite populations in relation with each other and in varying environmental conditions. All oysters contained *P. websteri* parasitic intrusions at varying degrees, and 19.2%

contained *Z. ostreus*. *P. websteri* prevalence significantly increased in oysters found in warmer and less salty waters, noted by an ANOVA test yielding a p-value of 0.0023. *Z. ostreus* prevalence also significantly increased with a p-value of 1.18E-08 as temperature increased and salinity decreased. As climate change and ocean acidification impacts the aquatic ecosystem, changing water quality parameters may directly impact *C. virginia*, and its ability to resist macroparasites, that in turn may impact the health of the bay and those who rely on it.

A Study of the Tick Population in the Local Area- Are You “Tick”lish?

Brayden Enoch

ABSTRACT

Tick borne diseases are at an all time high in the world. Tick borne diseases were on a constant rise up until 2020 when this leveled off with the Covid-19 pandemic, when researchers suggest that the dip was due in part to people staying in quarantine and inside more. The purpose of this study is to find which ticks are most predominant and associate which types of diseases can threaten humans in the local area of Virginia to better understand what symptoms present with each disease. Ticks were collected from Gloucester county in Woods Crossroads area and from sites in Essex and Middlesex counties from August, 2023 until February, 2024. A total of 64 ticks were collected over the study period from July, 2023 to January, 2024 in Gloucester, Virginia. Of those ticks, 27 were the Lone Star Tick (*Amblyomma americanum*), 13 were the Blacklegged Tick (*Ixodes scapularis*), 20 were the American Dog Tick (*Dermacentor variabilis*), 3 were Asian Longhorned (*Haemaphysalis longicornis*) and 1 was unidentifiable. It can be concluded that the majority of ticks located in Gloucester Virginia carry tick borne illnesses based on the known species associations with diseases. There have been many instances where tick borne diseases have been misdiagnosed because doctors are unfamiliar with the local disease vector ticks. When the leading tick disease issues are recognized better by local doctors, the diagnosis can be more clear. Understanding the impacts of tick borne illness, and taking more precautions while outdoors is critical to leveling off the prevalence of tick borne in the local area and throughout the United States.

The Influence of Visual and Olfactory Stimuli on Adolescents' Degree of Risk-Taking

Brendan Kraisser

ABSTRACT

Risk-taking is the psychological phenomenon where humans decide to take a risk to reach a goal. My study examined the influence of visual and olfactory stimuli on participants' degree of risk-taking. I was able to study the degree of risk-taking through the dice game task where participants choose odds to earn points to win a non-monetary reward. My results were statistically non-significant through a standard t-test ($p = .40$). However, there was a trend where the group with visual and olfactory stimuli began to play more conservatively than the baseline. Through the behavior of the participants becoming more conservative shows that in the presence of a reward that is presented in a desirable manner the effort put forth to obtain the reward is increased. Although my data is statistically non-significant. This trend in data could be significant if given more testing.

Exploring the Use of Reclaimed Eutrophic Water for Growing Butterhead Lettuce (*Lactuca sativa var. capitata*) in a Hydroponic System

Caitlin Murphy

ABSTRACT

Eutrophication, which is the accumulation of excess nutrients in a body of water, is a phenomenon that is detrimental to humans and aquatic ecosystems alike. Traditional farming is a major source of eutrophication, as fertilizer and animal waste runoff are leading contributors to nitrates and phosphates in aquatic habitats. As a result, non-traditional methods of farming are increasingly emphasized to decrease environmental impact. One of these methods is hydroponics. Hydroponics is a soilless cultivation method that utilizes water with an artificial nutrient solution to grow plants without the pollution of traditional farming. Using a nutrient solution is the standard method with hydroponics; however, it was hypothesized that a hydroponic system using reclaimed eutrophic water would have the same or a greater rate of plant growth as a conventional hydroponic system. Growth of lettuce was measured by the plants' height, leaf length, and biomass before and after exposure to two different treatment groups: a conventional hydroponic system with water and artificial nutrient solution, and an

experimental hydroponic system with only reclaimed water. The experimental group outperformed the control group, which implies that eutrophic water can be used in hydroponic systems to grow crops effectively. The study found that the experimental group had a statistically highly significant difference in mean plant height, leaf length, and biomass measures. This experiment served as a proof of concept study to determine the feasibility of reclaimed eutrophic water in hydroponic systems; future studies could expand upon these initial findings in subsequent applications.

Fighting Global Warming's Evil Twin- A Study on Alkalinity and Calcium Buffering Capacity in the Lower Chesapeake Bay

Camryn Micket

ABSTRACT

Many people have heard of global warming but not as many people have heard of its "evil twin", ocean acidification, which is causing harm to our coastal ecosystems. There are two main causes of coastal and ocean acidification: globally the greatest cause is due to the large amounts of carbon dioxide (CO₂) that are being produced from the burning of fossil fuels. CO₂ in the water leads to ocean and coastal acidification and an unstable living environment for organisms like the Eastern Oyster, *Crassostrea virginica* and many other bivalves. Oysters are calcareous organisms that need calcium ions (Ca⁺²) and carbonate ions (CO₃⁻²) to build their shells. The acidified lower pH water starts to change the water's carbonate chemistry. The sample sites selected were: Warehouse boat ramp on the Ware River, Deep Point boat ramp on the Piankatank River, and Gloucester Point boat ramp on the York River. Once at a sampling site, the test water was collected and the water temperature was recorded. A total of 18 samples have been tested from the three testing sites combined. Comparing the three sites to each other across the study period using an ANOVA test found that the levels of pH, calcium, and salinity were all statistically significantly different by site. The results from this study show that calcite concentration does change over space and time. This study found that Alkalinity does vary in space and time but not enough to be statistically different.

Testing the Effectiveness of Different Removal Methods For *Phragmites australis*

Caroline Neale

ABSTRACT

Phragmites australis (Cav.) is an invasive plant that originated from Eurasia and now resides in the Chesapeake Bay. This invasive plant outcompetes native plant species in the Chesapeake Bay that provide a food source, habitat, and biodiversity. Therefore, removing *Phragmites australis* (Cav.) is beneficial to the Chesapeake Bay since phragmites have many negative impacts. This study tested the effectiveness of different removal methods for *Phragmites australis* (Cav.) to see which would be the most effective in reducing the number of new phragmites shoots and the height of the new growth. The removal methods used were clear cutting, burning, spraying of an herbicide, and there were two control plots. Each removal method was applied two sections of phragmites and once every two weeks the height and the number of phragmites was measured for each section. After three months the removal method was applied once again to one of two sections that had already been treated with a removal method. After the removal method was applied once more the height and number of phragmites was measured for each section until the end of the study. The result of this study showed that the spraying of a herbicide was most effective in reducing the amount and the height of phragmites. Therefore, determining that applying the herbicide removal method is beneficial because it can make way for the plants it once overtook creating biodiversity and a healthy Bay habitat.

The Effect of Depth Variation on Oyster Growth Using Aquaculture Techniques

Carter Wood

ABSTRACT

Aquaculture has become an increasingly prevalent technique used for the growth of many aquatic species. More specifically, we began incorporating this method within the Chesapeake Bay with hopes of reviving the Eastern Oyster (*Crassostrea virginica*) population. Oysters are grown with many types of human-designed mechanisms. To increase efficiency, we must decide which method will achieve the highest growth rate. This study was designed to examine oyster growth rate in enclosures at various depths. To do so, a custom design was built and implemented on a residential pier on the Rappahannock River. Using mesh bags, the design

resembled a “rope ladder” and stretched from the surface to the benthic zone. Three bags composed the “rungs” of the ladder. It was found that the largest amount of growth was in the benthic bag. To further investigate the results, a larger-scaled study could be executed within a broader range of water depths. If a future study obtained similar results, then we could suggest that benthic aquaculture results in the greatest productivity.

Growing Green: The Effect of Microplastic Concentrations on Soil Quality and Romaine Lettuce Growth

Christon Jones

ABSTRACT

Microplastic pollution poses a significant threat to terrestrial ecosystems, with its impact on soil health and plant growth garnering increasing attention. This study investigated the influence of microplastic concentrations on soil characteristics and lettuce (*Lactuca sativa*) growth. Building upon existing research, hypotheses were formulated to assess the effects on soil’s mean nutrient levels, water holding capacity, and microbial activity. Polystyrene beads were used to represent microplastics, with soil samples supplemented with varying concentrations (0%, 1%, 5%, and 10%). Results indicated a negative correlation between microplastic concentrations and soil nutrient content, water holding capacity, and microbial activity. Lettuce plants exposed to higher microplastic concentrations exhibited stunted growth, impaired root development, and reduced microbial activity. Statistical analyses confirmed significant differences among treatment groups, highlighting the detrimental effects of microplastics on soil health and plant growth. These findings underscore the urgency of mitigating microplastic pollution to preserve soil fertility and ecosystem functionality. Further research and proactive measures are necessary to address this pressing environmental concern.

A Comparison of Copper, Copper Alloys, and Stainless Steel in Bacterial Contact Killing Ability

Christopher Miller

ABSTRACT

HAIs (hospital-acquired infections) are a problem in the modern healthcare setting. They are a major source of illnesses today. Copper and its alloys may be part of the solution. These metals can be used in high-touch areas to significantly reduce bacteria. This study aimed to demonstrate this idea. Pure copper was compared to copper alloys and stainless steel to determine the best choice for use in hospitals. *E. coli* and *M. luteus* were chosen to represent gram-negative and gram-positive bacteria. Based on previous research, it was hypothesized that pure copper would have the highest antimicrobial power and stainless steel would have the least. Our results confirmed this for short-term exposure of metals to bacteria. Copper and its alloys had a clear effect on *M. luteus*. This was seen again in long-term exposure, with copper having the greatest effect on *M. luteus* over time. Stainless steel had little to no effect on both bacteria. *E. coli* results were less clear for both short and long-term exposure tests. This supports the use of copper or its alloys in hospitals. These results suggested that these metals could save money and lives for hospitals over time by preventing needless infection.

A Cost-Based Risk Assessment of Climate Events for the Southeastern US

Davis Kildoo

ABSTRACT

Severe climate events threaten the health and wealth of the population in the southeastern United States. As climate events have become more destructive, the population and housing index has been increasing at the same time. In this study, the population data were gathered from 1970-2020 and the housing index data were gathered from 2014-2022, from coastal and inland cities: Norfolk and Richmond, VA; Dare County and Rock Mount, NC; Charleston and Columbia, SC; Savannah and Athens, GA; Miami and Orlando, FL. In addition, using National Oceanic and Atmospheric Administration (NOAA) risk mapping from severe storms, tropical storms and flooding from the preceding counties were assessed. Also, the monetary cost from severe storms, tropical cyclones and flooding were analyzed from: Virginia, North Carolina,

South Carolina, Georgia and Florida from 2003-2023. A comparison of the growth of population, growth of housing index and risk mapping was conducted showing no statistical difference between coastal and inland cities. The monetary cost from severe weather events did appear to increase over time, but was not a statistical increase.

The Relationship Between an Aerially Assessed Growing Index and Watermelon Sweetness

Davis Unser

ABSTRACT

Normalized Difference Vegetation Index (NDVI) is a tool used by agriculturalists to determine the density of vegetation in a given sample area, and it is usually indicative of a plant's growing conditions. It is a non-invasive way to sample crops before harvesting and in several cases, NDVI has been linked to yield quality of several crops. This study's objective is to establish whether there is a correlation between the NDVI of watermelon crops, *Citrullus lanatus*, and the sweetness of a watermelon fruit. NDVI was collected from an unmanned aerial vehicle (UAV) equipped with a near-infrared (NIR) camera. NDVI was automatically calculated for 8 sections of watermelon rows. Four ripe watermelons were randomly selected per section. A Brix refractometer was used to determine the sucrose percentage of each sample. A Pearson Correlation Coefficient was calculated, and Kendall's tau analysis was performed to test for a correlation between the variables. NDVI was found to be strongly correlated with degrees Brix with high statistical significance. This is a significant pilot study for further researchers who could determine if NDVI can be used to prescribe exact supplements to watermelons, which would prevent excess fertilizer or water waste produced by traditional farming practices.

The Effect of Suture Spacing on Continuous and Interrupted Suture Strength

Dylan McIlwain

ABSTRACT

Recent studies had presented the idea of using more significant lengths of spacing in sutures due to an overall lack of change in cosmetic outcome when larger spacing is used; however, it was unknown whether or not changing the length of spacing significantly affected

the strength of the suture. To provide insight into this subject, sixty pieces of pig skin received a laceration and were sorted into six groups based on suture method and length of spacing. Each piece of skin was then sutured according to its assigned group and pulled perpendicularly to the laceration on both sides until the suture failed. Once the suture failed, the force in Newtons (N) displayed on the force sensor was recorded. After collecting all data, a two-factor analysis of variance (ANOVA) was run to determine possible statistically significant differences. On average, the continuous suture was predicted to resist more force before failure than the interrupted suture. The sutures with less spacing were predicted to resist more force before failure than those with larger spacing. The data supported the hypothesis for suture type, while the data suggested that the opposite of the hypothesis about the length of spacing was true. The results showed little change in the mean force before failure for the continuous suture as spacing increased, while the mean force before failure for the interrupted suture decreased as the length of spacing increased or decreased from 10 mm. Trends in the data support using larger spacing when making sutures. Differences in the resulting strength for the different sutures as spacing increased provide implications for their optimal uses in healthcare and general medical aid.

Impact of Wheat Pesticides on the Beneficial Insect *Hippodamia convergens*

Emily Withers

ABSTRACT

Maintaining a healthy and effective relationship between beneficial insects and the pesticides used to treat pests is vital to producing the highest quality crops. Aphids which are the most common wheat pests, are treated in agriculture with a slew of different insecticides. With the insecticides being applied only to treat the aphids and other pests, the important, beneficial insects may also be effected. Lady bugs also known as *Hippodamia convergens* are beneficial insects that naturally help with aphid control. The purpose for this study was to help better the understanding of the relationship between the beneficial insects and insecticides. Wheat plants were grown and lady bugs were applied to each plant. Wheat treated with neem oil, sevin dust and one control group were all examined to assess the avoidance and mortality of the ladybugs due to the insecticide. Supported by statistical data found with an ANOVA test, there is a

significant affect and Relationship between lady bugs and the insecticides used to treat pests. The toxicity of the insecticides and strength had a major effect on the beneficial insect and could be prevented in ways to keep the health of the plants and beneficial insects consistent in the future.

Does Physical Activity Have an Effect on Short-Term Memory?

Harmony Williams

ABSTRACT

Physical activity is the key to a healthy lifestyle for people of all ages. Many teenagers find themselves participating in school sports or going to the gym to remain physically active. When exercising the hippocampus, a part of the human brain that retains memory, expands in volume. Memory plays a key role in many adolescents' everyday routines, between memorization within studying or basic recall during classroom lessons. This study compared the time it took the participants to complete a timed memory test in the morning versus the afternoon. An additional study was conducted to compare the time it took participants who took part in sports practice to the participants who did not. Results showed that there was no correlation between the time of the day that the participants completed the memory test, morning or afternoon, and the time they took to complete it. In addition, there was no correlation between partaking in a sports practice or not and the time it took to complete the memory test. By understanding the connection between physical activity and memory, students can better understand when to fit studying into their schedule and if they can better recall information after partaking in such activities. For adults, understanding the connection between physical activity and memory can better reduce the likelihood for cancer, mental illness, and memory diseases.

The Effect of Makeup Brush Cleaner on Bacteria

Jenaya Cox

ABSTRACT

Makeup is important to many daily routines, with foundation being the key to various looks. It smoothens the skin and evens out tones. To apply flawlessly, a blending brush or beauty blender is needed, requiring cleaning every 7-10 days with specialized cleansers. In this study,

high-end and low-end cleansers were tested to see if price correlates with bacteria removal from applicators, aiming to identify the cleaner option. The experiment involved four foundation brushes, four beauty blenders, Ecotools and Cinema Secrets cleansers, and Il Makiage foundation. After seven days of use, applicators were sealed and incubated, then cleaned with one cleanser. Analysis revealed a significant p-value (0.001798) for bacteria removal between high- and low-end cleansers and another (0.0042185) for average CFU before and after cleansing. This highlights the importance of investing in antibacterial cleansers for better applicator hygiene and overall safety.

The Effect of Different Background Music Genres on Reading Comprehension Accuracy

Jessica Velazquez

ABSTRACT

With the rise and availability of technology, students and workers advocate being able to listen to music while they work. Previous studies indicate that background noise may be helpful and detrimental to concentration and accuracy, and several contradict others' findings. Some say it has indirect positive effects, but others say it has a negative influence via distraction. Specific genres and types of music (tempo, mood, lyrical or non-lyrical, etc.) may also have varying effects by influencing emotion and the ability to focus. This study compares the effects of classical, lo-fi, and rock music on reading comprehension accuracy. A significant difference was found between the treatment groups overall. However, the difference between pairs was not significant.

The Differences in Size and Sex Ratio of Blue Crabs when Caught in Open Rivers vs.

Creeks

Joseph Scripture

ABSTRACT

The Chesapeake Bay is a prolific estuary in Eastern United States and is home to a massive variety of different marine species. Blue Crabs, a keystone species, have their own well-known population in the Chesapeake Bay. Blue Crabs in the bay face harsh conditions from their

environment and thus their population size fluctuates each year. This study was performed in order to compare Blue Crabs in open river habitats versus creeks branched off of the river. The size and sex of each crab was recorded at each site and the date from the river sites and creeks were analyzed. Tests concluded that the size of females were significantly larger in the river than in creeks. There was no significant difference in the male to female ratio. The size difference in females could likely be due to younger female crabs seeking more protection from the environment, leading them to the more secluded creeks.

Sweeteners Effect on the Oral Microbiome

Kylie Jones

ABSTRACT

The present study experimentally investigated the effect of sugar and sweeteners on different oral microbiome bacterium and if it differentiated from a mouth swab or when isolated cultures were taken. The oral microbiome is the mouth and all of the bacteria types that make up the oral cavity. Sugar types (7) were picked due to the fact that the sweeteners chosen all contained different chemicals to test. These sugars were tested by making a concentration and seeing the growth and non-growth on bacteria types from an individual's mouth swab. Artificial sweeteners were tested as well as natural sugars. The results that were observed were if there was a zone of inhibition or a growth of bacteria. A zone of inhibition looks like a halo around the sugar or sweetener. The importance of a zone of inhibition is that the sweetener would not do well growing on that certain type of bacteria which would mean that the chemical in the sweetener would be killing and causing an imbalance in the oral microbiome bacteria. The importance of this study is to see which sweeteners could potentially throw off the imbalance of oral microbiome bacteria.

The Effects of Visual and Auditory Stimuli on Learning Retention and Focus

Layanna Hayes

ABSTRACT

This study investigates the combined effects of background music and lighting colors on high school students' reading comprehension. Based on existing literature, it is recognized that both auditory and visual stimuli significantly influence cognitive performance. The experiment involved four treatment groups exposed to different instrumental versus vocal music combinations and red versus blue lighting. Results suggest that participants exposed to red lighting and vocal background music performed better in reading comprehension than other groups. In contrast, those exposed to blue lighting and vocal background music exhibited lower scores. Statistical analysis did not yield significant results, indicating that observed differences may have occurred due to chance rather than experimental conditions. Limitations include a small sample size and the controlled experimental setting. Despite lacking statistical significance, the study provides valuable insights into the relationship between environmental factors and cognitive performance. Future research could explore additional variables to clarify their effects on focus and retention.

The Effect of Pesticides on Soybeans and Water Quality

Layla Dawson

ABSTRACT

The Chesapeake Bay plays a key role in everyday life by providing habitats, ecosystems and clean drinking water. However pesticide use has been rapidly increasing in agriculture which creates pollution in the bay harming these key roles provided by the bay. Many agriculture use fields are located near the bay due to its supply of water. The study investigated the effects of seven dust, an organic pesticide, and a DIY pesticide on soybean plants to see if it effected the growth, germination, and number of pests seen. The experiment was conducted by having 4 sets of plants and 3 of them were different pesticides and they were sprayed daily on the plants. Growth was recorded after the plants had grown for a specific time line and germination was recorded in the beginning of the experiment. The pest activity seen on the plants was recorded throughout them growing over a certain timeline. The experiment found that different pesticides

had no effect on the germination and growth of the plants. Further research needs to be done on brine shrimp to determine whether or not the pesticides have an effect on them to relate it to impacts on the bay and human health. By doing this study and furthering it, it gives people a better understanding as to why common pesticides should or should not be used daily on plants.

The Impact of Livestock Antibiotics on Marsh Microbes

Layla Leo

ABSTRACT

Salt marsh ecosystems play a crucial role in coastal community stability, providing essential ecosystem services. Microbial communities within these marshes significantly contribute to the overall health and productivity of the ecosystem. This study investigates the impact of antibiotics, particularly tetracycline, sulfamethoxazole, and ciprofloxacin, on bacterial communities in different salinity locations (oligohaline, mesohaline, and polyhaline) and marsh zones (low, mid, and high marsh) within the York River. Antibiotics, originating predominantly from livestock farming, can alter water quality and affect microbial communities. It was hypothesized that the polyhaline and low-marsh zones would have the greatest antibiotic resistance with the oligohaline and high-marsh zones having the lowest antibiotic resistance. Soil samples were collected from three salinity locations and three marsh zones within each location. The soil samples were serially diluted and plated on petri dishes. After incubation, the bacterial colonies were isolated and tested for antibiotic resistance for three antibiotic disks by measuring the ring of inhibition. The results reveal distinct antibiotic resistance patterns among bacterial colonies, with sulfamethoxazole exhibiting the highest resistance and ciprofloxacin exhibiting the lowest resistance. Salinity locations and marsh zones showed complex associations with antibiotic resistance, highlighting the intricate interplay of environmental factors. There were significant associations between salinity locations and antibiotic resistance. Additionally, there was a trending significant relationship between marsh zones and antibiotic resistance. The study emphasizes the need for further research to understand the ecological implications of antibiotic pollution on salt marsh microbial communities, vital for sustaining estuarine ecosystems.

A Comparison of Agricultural and Forested Ponds

Leah Medlin

ABSTRACT

The Chesapeake Bay is the largest estuary ecosystem in the United States and the Northern Neck of Virginia has a direct impact on the bay. As the Northern Neck is an agriculturally based community, the runoff can impact the bay from two large river systems. The impacts of fertilizers can be various and may take decades before impacting the larger community. This study compared the water quality and bass structures of an agricultural versus forested pond. The agricultural pond has direct exposure to a Nitrate based fertilizer. In both freshwater ponds, Largemouth Bass live. This study was to first compare how much the fertilizer could affect the bass while searching for clues in other areas. Within the following research water quality, such as pH, dissolved oxygen, and nitrates, as well as bass weights were found and recorded. This study found the pH in the agricultural pond was higher, 10, while the forested tended to stay around 5. Dissolved oxygen in both ponds was low, however, the forested pond had a higher level of DO by 1.5. The nitrates were found to be higher by PPM in the forested pond compared to the agricultural pond. This data is not as significant as expected, however, the data can be found to have an impact on the organisms of the pond. This can be found important due to the overall situation fertilizers have a larger effect on ecosystems.

A Comparison of Oyster, Shell and Rock Habitats

Liam McDonough

ABSTRACT

The Oyster are currently struggling to maintain a healthy population as a result of the Oysters not being as abundant many species are finding themselves without a habitat. This problem is only growing bigger so an alternative idea has been suggested in terms of habitat using rocks and oysters shells to replace lost oyster habitats for these materials. The data on the three graphs shows the Species Count, Species Richness and the Diversity for all species. First graph of species amount and with as it can be seen the habitat with the highest species count in the shell habitat mostly consisting of barnacles. Then the next graph shows species richness

which is how many species were in each habitat and the habitat with the highest count is Live Oysters. Finally for Diversity the habitat with the best diversity was the Rock habitat. This shows that Oyster shell and rocks are a suitable replacement for loss of habitats and species can still thrive in these areas even though there are no live Oysters.

Examining Autochthonous Alternatives to Tropical Coconut Coir for Shoreline

Engineering

Libbie Hospodar

ABSTRACT

Living shorelines are "soft" engineering strategies that reduce erosion by reinforcing the coastal edge using structures built with natural materials like coconut fiber coir logs, instead of concrete, rocks, and rip rap for an organic stabilization solution. While coconut fiber coir logs are a great solution for erosion control in living shorelines in Virginia, coconut coir cannot be sourced anywhere near the location of use. In the Chesapeake Bay region, the use of more locally abundant, autochthonous materials like pine needles, corn crop residue, and the reeds of invasive *Phragmites australis* should be explored as replacements for coir. In order to determine the effects of weathering on the organic substrates, 15 bundles were manufactured per material, coconut coir, pine straw needles, corn stalks, and *Phragmites australis*, for a total of 60 bundles weighing around 40.00g. To determine the effect of the manufacturing method on degradation in the actual tidal estuarine environment, 27 additional bundles were manufactured using each of the experimental materials. In both experiments, coconut coir outperformed the autochthonous materials and bundling methods. Coconut coir had the lowest average percent mass loss of -6.61% after the 24-week exposure period in the dry experiment followed by pine straw -15.91%. Similarly, for the wet experiment for manufactured biologs, the average percent change in mass was best for coconut coir at 4.04%, followed by the pine straw bales -5.51%, and the pine straw sock -6.86%, after the 8-week exposure period.

An Analysis of Gender Equality and National Success- Are You Happy, Healthy, and Wealthy?

Lily Brame

ABSTRACT

Understanding the effects of gender equality on societies can help us understand how nations thrive throughout history. The emphasis on gender roles can affect the system within a country. Assessing the role of women in various nations aids progress in changing how gender equality is addressed. Research was conducted by analyzing a ranking of gender equality across the globe. The world population review was used to find the top ten, middle ten, and least ten equal countries in relation to gender equality based on a gender gap index (GGI) of that country. The parameters of happiness, healthiness, and wealthiness were each individually chosen as a means of assessing the overall success of a country. The results for these parameters, which were happiness ranking, population, life expectancy, air pollution, birth rate, and years of school, had a significant correlation with $P < 0.05$. The results for unintentional poisoning deaths, GDP, and unemployment came out with a P value greater than 0.05, making them insignificant. Six out of nine parameters provided a significant correlation indicating that the gender gap index of a country has an effect on the parameters of success for a country. Happiness and health are directly correlated with gender equality. Promoting gender equality will promote prosperity. The success of women is a determining factor for the success of a country. The entirety of the data supports the idea that gender equality will positively impact health and happiness, but it has no impact on the wealth of a country.

***Hydrilla verticillata* in the Chickahominy River- Are All Invaders Really Bad?**

Lily Ohlschlager

ABSTRACT

Invasive species are a costly recurring problem throughout the United States and put native plants and animals at risk. An aquatic invasive species that dominates many bodies of water in Virginia is *Hydrilla verticillata* (Hydrilla). Hydrilla was first introduced into the U.S. in the 1960s and was first spotted in Virginia in 1982. Some studies have shown the negatives associated with Hydrilla, while others have shown a range of positive attributes. In this study, a

submerged aquatic vegetation (SAV) grass bed in the Chickahominy River in New Kent County, Virginia was identified as containing *Hydrilla verticillata* and other different types of native aquatic plants living together. These SAVs were harvested and tested in experiments with a low dose of 3.0 ppm and a high dose of 8.0 ppm fertilizer treatments to look at the absorption rate of ammonia (NH₃). There was not a significant difference in the composition of grasses by weight in samples, indicating that invasive Hydrilla cohabitates harmoniously with the native species, $p=0.2205$. Results also showed that all four SAV types tested in both fertilizer treatments had a significant difference in the NH₃ absorption compared to the control group; $p\sim 0.05$ in low-dose treatment and $p<0.05$ in high-dose. When comparing Hydrilla NH₃ absorption to the native SAV, the p values reveal that invasive Hydrilla outperformed the native SAVs that were tested with $p>0.05$ in the low-dose treatment and $p<0.05$ in the high-dose treatment.

Developing a Method for Aquaculture of a Local Polychaete Worm to Replace Imported

Bloodworms

Madeline Miller

ABSTRACT

Polychaete worms are a class of marine worms that are typically used for fishing bait, more commonly referred to as bait worms. Bloodworms, *Glycera dibranchiata*, are a very popular fishing bait that are being harvested by hand from the coast of Maine, and are shipped to coastal southern states including the Chesapeake Bay region. Bloodworms are extremely expensive and require immense amounts of human labor, and they are also being depleted from their native habitats due to overharvesting. If another method of bait worm production can be developed, the risks of ecosystem depletion, increased cost, and increased labor can be tackled. This study tests methods to determine if these worms can be successfully aquacultured using a simple in situ enclosure method. Observations were made at two different sites, Oyster Seed Holdings on Gwynn's Island and Urbanna Creek, to see if this method was successful. Research showed that this method is most likely not the best method of aquaculture for marine worms, due to high mortality, assumingly caused by predatory access. Continuing to develop the most successful method for batu worm aquaculture would allow the environment to have the pressures off of it for it to begin to restore itself from habitat disruption and invasive species effects. It

would also be able to provide a source of income for new establishments, or increasing income and benefits for already existing aquaculture facilities, such as oyster or fish aquaculture.

**Under Pressure: The Effects of Time Pressure on High School Students' Reading
Comprehension**

Madison Gulasky

ABSTRACT

This study aimed to identify whether time pressure can affect reading comprehension in high school students. It also explored why stress occurs and whether removing timed testing from a school setting can demonstrate a student's true capabilities. Two groups were tested using a Scholastic Aptitude Test (SAT) during the experiment. One group was put under time pressure while the other was not. The sets also took a baseline test with an extended time limit. Individual scores were compared for every student. While there were no significant results when comparing both experimental groups, there were significant differences when comparing each group to its baseline mean. The baseline scores for both experimental groups were significantly higher than those of the experimental groups. Students who had 30 minutes during testing showed better marks than those who only had 15 minutes. These results suggest that students do not perform as well when under a time restraint, regardless of whether there is additional time pressure from outside sources.

Comparing Sister Cropping to Various Modern Fertilizers Indoor and Outdoor

Madison Hensley

ABSTRACT

Sister cropping is an indigenous mixed planting system that uses beans as a source of nitrogen fertilizer, squash as a natural pesticide, and corn for the beans to grow up along the stalk. This method is a natural fertilizer that has no runoff and increases biodiversity in a garden area, whereas modern fertilizers create runoff which can cause eutrophication in the Chesapeake Bay. This study investigated the use of sister cropping, 10-10-10 fertilizer, liquid nitrogen fertilizer, manure, and a control of no fertilizer to measure the effects of these methods on the

growth of yukon chief corn in a controlled indoor environment compared to an uncontrolled outdoor environment. The results of this experiment found that fertilizing methods (p-value = 0.000000012) and being grown in indoor or outdoor environments (p-value = 0.017383) significantly impacted overall corn growth. It was found significant that 10-10-10 fertilizer differed from sister cropping, manure, and the control while there was a difference in sister cropping in the indoor versus outdoor experiment. Due to the natural temperature fluctuations outdoors, it could have caused the variations in the data which would have affected the p-values. This study shows that sister cropping may provide a more natural alternative to synthetic fertilizers that could then prevent the eutrophication issue by reducing fertilizer runoff and promoting a more diverse plant structure which can help lower the number of dead zones present in the Chesapeake Bay.

The Relationship Between Auditory Distractions and Reading Comprehension in a Classroom

Marcus Fero

ABSTRACT

Students in the classroom are typically subjected to a lesson, test, or reading assignment that requires cognitive function and concentration. While accomplishing their work, students either prefer silence or they some sort of auditory distraction. Some students claim that the background noise helps them work or that talking generally boosts their ability to focus. Others claim a simple assignment is deemed near impossible with any auditory distraction. This study investigated how different background noises affect students' ability to concentrate and use cognitive functions in a classroom environment. Each participant was randomly assigned an abbreviated portion of the SAT exam, with each test being administered under one of two conditions. One condition was the auditory deviant effect (random noises), while the other was the changing state effect (constant audio). Results indicated that scores were statistically nonsignificant and lower for the changing state effect than the higher auditory deviant effect. This suggests that background distraction can impact the cognitive functions of a student.

The Effect of Varying Baits used in Crab Pots on the Quality of Crabs Caught

Nathalie Biddlecomb

ABSTRACT

Blue crabs, or *Callinectes sapidus*, play a key role in the Chesapeake Bay today, serving as both a keystone species and an indicator of the bay's health. Furthermore, crabbing in the Chesapeake Bay is a crucial part of many people's lives, along with the economy because so many blue crabs are sold commercially in the bay area. This study hopes to find the most sustainable bait which watermen can use to get the best quality catch. It considers the effect of different baits on the quality of crabs caught, measuring the abundance, mass, and lateral spine length of each crab. This was carried out by setting ten crab pots, three of each bait (menhaden, chicken, squid), and one with no bait. The crab pots were set in a line in Cockrell's Creek for a five-day period, checking and measuring abundance, mass, and size of each crab caught once daily. This was repeated for two trials: once in June and once in August. The results found that the abundance of crabs was significantly increased when being caught with bunker versus chicken or squid. Therefore, in order to increase catch rate, one should use menhaden as bait, however, if one were to use chicken or squid the quality of catch would not be affected. This could give watermen a few alternative baits to use, which would help the Chesapeake Bay in the long run, as it prevents overfishing and population decline of both menhaden and blue crabs.

The Effect of Pacifier Usage on Speech Development

Samantha McKenney

ABSTRACT

Effective communication is crucial for navigating life, and speech-sound development plays a pivotal role in establishing communication skills. Communication disorders, affecting 5-10% of all children in the United States, encompass impairments in speech, language, and hearing. Speech pathology, a field focused on communication science and disorders, is instrumental in diagnosing and treating these disorders. Previous research has linked non-nutritive sucking habits, such as pacifier usage, to speech development delays. Pacifier usage has been associated with altered tongue and teeth positioning, leading to malocclusion, and

diminished auditory input, potentially affecting speech comprehension and pronunciation. This study explores the impact of the duration of pacifier usage on speech development in children ages six and seven. Speech screenings were conducted with first and second graders at elementary schools to assess the number of phonemes (speech sounds) they could accurately say. Parents were surveyed regarding pacifier usage history, and participants were assigned numbers for anonymity. The screenings involved presenting pictures targeting specific phonemes, with students pronouncing the phoneme displayed on the page. The number of phoneme pronunciation errors were tallied for analysis. Results indicate that 85% of six-year-olds and 60% of seven-year-olds in the sample used pacifiers. The average number of phoneme errors increases with the duration of pacifier usage, with the highest average (9.3 errors) observed in children using pacifiers for over 36 months. A linear regression test resulted in a highly significant P-Value of 0.01, suggesting a significant correlation between longer pacifier usage and increased phoneme errors.

The Effect of Different Lure Colors on Catch Rate

Sarah McGee

ABSTRACT

The Chesapeake Bay is an important estuary to the fishing industry and the people surrounding it. Generations of watermen have made their living through fishing and harvesting all the various species in the Chesapeake Bay. There are a variety of fish that can be caught in the bay, like *Pomatomus saltatrix* (Bluefish), *Scomberomorini* (Spanish Mackerel), and *Morone saxatilis* (Rockfish). There is also a variety of bait that can be used to catch these fish like cut and live bait and fishing lures. Fishing lures come in a rainbow of colors and sizes and there are not many studies on which is truly the best colored lure to use. Many studies concluded that the different colored lures did not make a significant difference on the catch rate of various fish. This experiment was conducted in Chesapeake Bay in the months from July to September and in the Potomac River in the month of November. This study tried to see if the catch rate of various fish would change due to the color of fishing lure used. A charter boat was used at two different marinas and went out for 5-9 hours each time. For all three fish, fishing poles were put out with different colored lures on them and when a fish was caught it was recorded which colored lure

caught it. Based on the data the yellow-colored lure had the greatest catch rate on average, however an ANOVA test comparing lure colors to catch was not significant. While the hypotheses were not supported, based on the data it is still recommended to use the yellow-colored lure as it did do best overall. The reason this study was done is because fishing is very important recreationally and economically to this area of Virginia. Using the best lure color will make it so the fishermen can catch the greatest number of fish possible.

The Effect of *Mycorrhizal* Fungi on the Plant Growth of Grass, Cress, and Carrots

Savana Balderson

ABSTRACT

This study compared the effect of *mycorrhizal* fungi on different types of plants. The main focus of this study was to see what fertilizer produced the best growth in plants. Generally chemical fertilizers, like Miracle-Gro, are the most common when used to speed up plant growth, but they can be harmful to the environment, causing alterations in the pH of the soil, added acidification, and reduction in organic matter content. But, there are alternative natural fertilizer, like *mycorrhizal* fungi, that can be just as beneficial as chemical fertilizer, but much better for the environment. Three different groups of plants were tested: root plants, leafy plants, and stem plants. The root plant used in this study was a carrot, the leafy plant used was cress, and the stem plant used was grass. Since the *mycorrhizal* fungi is a natural fertilizer, it was compared to a man-made chemical fertilizer, Miracle-Gro, and soil without any fertilizer was used a control group. The effects were tested in plant growth. Plant growth included sprouting rate, plant height in centimeters, and root growth. The root growth was measured with root length, abundance, and biomass combined. The results of this study showed that *mycorrhizal* fungi does have an effect on all three kinds of plants. The sprouting rate and height growth were similar for both the fungi and top soil, but there was a major difference when comparing root growth. The fungi had beneficial effects on root length and root biomass. All p-values for root growth proved to be significant. The results also show that overall, Miracle-Gro performed the worst out of the three groups of fertilizers tested. This study showed that natural fertilizers, like *mycorrhizal* fungi, can be just as effective as the widely used chemical, man-made fertilizers like Miracle-Gro and they can be less harmful to the environment.

The Collection and Usable Return of Natural Sorbents in an Aqueous Environment

Shawna Tarkington

ABSTRACT

This experiment was conducted to find which of four natural materials is able to collect and return the most oil when applied to an oil spill in an aqueous environment. This study has applications for environmentally friendly cleanup methods of large-scale aquatic oil spills. The sorbents compared were cheesecloth (cotton), human hair, mulch, and wool. This study simulated an oil spill in a controlled environment and used booms fashioned out of cloth bags and filled with the sorbents to determine how well these materials were able to clean up the ‘spill.’ Human hair was found to be the optimal sorbent for removing oil from the aquatic environment as well as then allowing it to separate out for use. The human hair also removed the least water from the environment and as such had the optimal oil to water removal ratio.

The Effect of Grass and Track Surfaces on Runners’ Speed and Stride Length

Sydney Nash

ABSTRACT

This study aimed to determine whether the surfaces that athletes run on affect their speed or stride length. Athletes were tested running along the same distance on grass and a high school track. The athletes’ times were recorded after each of their trials on each surface, and while they ran, a camera took a video of their feet to measure their stride length. This study showed that rubberized tracks were better for the runners’ speeds while the grass was better for their stride lengths. This means that runners who prioritize running performance should train solely on track surfaces; whereas, those who prioritize the efficiency of their running and the protection from injuries should practice on grass surfaces. All information gathered can be applied to any novice team or athlete looking for a way to train more effectively depending upon their specific goals.

The Effect of Image Complexity and Color on Short-Term Memory Retention and Recall

Taylor Allen

ABSTRACT

This study examines the effect of image complexity and color on memory recall rate and recall. Image complexity is categorized in two ways. ‘Simple’ images are icons representing everyday objects and ‘complex’ images are photographs of nature landscapes. Color is categorized with ‘color’ images where the images have been colored using the full color spectrum and ‘grey-scale’ where the images are colored using white, black, and all shades of grey. Two tests with two experimental sections were made, each section showing a different combination of image complexity and coloring. A test section showed ten images of the same image complexity and coloring, then participants were quizzed with six A or B style questions asking to pick which of the images were shown in the test. Poll Everywhere was used to collect answers and record recall speeds. Simple images and colored images showed a higher likelihood of recalling faster than complex and grey-scale images. Using this data, teachers or advertisers can create images with a higher likelihood of being recalled faster than other images.

The Effect of Temperature Stress on the Filtration Rate of 3 Different Bivalves

Taylor Logan

ABSTRACT

The Chesapeake Bay is very susceptible to stress because of how shallow it is, and this allows the temperature to fluctuate very often. In the upcoming years, the temperature of the Bay could reach temperatures close to 31°C. When the Bay does reach this temperature because of climate change, will the Bivalves not only be able to survive, but maintain the health and different ecosystems of the Bay? This study was conducted to see the effect that rising temperatures would have on the different bivalve’s ability to filter water. For the study, local Chesapeake Bay hard clams, mussels, oysters, sediment, and water were placed in to 15 containers of the same dimensions. Water samples were taken every 25 minutes and placed into the spectrophotometer for each trial to measure their filtration rate. ANOVA tests were run on each trial and the p-value for the 90-minute time marker at 22 degrees Celsius was 3.157×10^{-10} while the p-value for the 90-minute time marker at 31 degrees Celsius was 3.0048×10^{-10} ,

indicating that there was a significant difference in filtering of the different bivalves at the end of both trials. For the room temperature water trial mussels filtered the best and a Tukey's post hoc test showed that all the groups filtered significantly different from each other except for when directly comparing clams to the control, mussels to oysters, and oysters to all 3 together. For the heated water trial oysters filtered the best, the Tukey Post-hoc test showed that all the groups filtered significantly different from each other except for when directly comparing clams to oysters. Since the oysters did the best at making the water clear in the heated water trial, could it be worth spending the extra money on restoration efforts for them in the Chesapeake Bay?

Has Redlining Had an Effect on Quality of Life in Low-Income Neighborhoods Today?

Tripp Walker

ABSTRACT

Throughout the 1930s in New Deal America, a prominent example of systemic discrimination occurred with the implementation of redlining in American cities by the Home Owner's Loan Corporation (HOLC). Redlining was an endemic factor in the design period in many major American cities, and D-ranked neighborhoods became the only areas where low-income families were able to settle reliably. Through metadata analysis of city maps, data can be collected to determine these differences and used to further promote improvement for previously redlined communities. Six urban sites in the United States were chosen for analysis based on their similar population size (~200,000), history of red-lining, and relative proximity to one another on the east coast: Richmond, VA; Norfolk, VA; Lexington, KY; Pittsburgh, PA; Greensboro, NC; and Springfield, IL. In each city, 30 data points were collected in A-rank and D-rank neighborhoods for distance to greenspace, distance to public transport, distance to major highways, Walk Score, Transit Score, and Bike Score for comparison. All three distance based comparisons yielded statistically significant t-test, $p < 0.05$; however, all three score based comparisons failed to yield statistically significant t-test, $p < 0.05$. Redlining has influenced the design of many of America's modern day cities with discriminatory intentions that continue to promote inequality in health, reduced access to necessities, and diminished quality of life today for affected communities; however, city design can still be improved to reduce the differences in equity between low-income and high-income neighborhoods. In order to make cities more equal

for all residents, moving towards implementation of high quality and accessible infrastructure that is walkable and green in redlined communities is the best option.

The Effects of RipRap on Species Richness and Diversity Compared to Natural Shorelines

Virginia Tribble

ABSTRACT

This study was based off of a need for better alternatives to preventative shoreline measures from erosion in coastal areas; specifically the Chesapeake Bay Area. Three different shorelines were compared, two natural and one with riprap. These three shorelines were tested for biodiversity and species richness differences over a two month time period. They were tested by using a seine net, cast net, and minnow trap to gather organisms and collect data on them. The results showed that natural shorelines do indeed had a significantly higher species richness and biodiversity level than riprap shorelines do and rejected the null that there would be no difference between shorelines. This study shows that there is a difference in the aquatic ecosystems based on the structure of the shoreline and poses the question of what could be the better alternative for preventing erosion that will continue to protect the ecosystem around it like natural shorelines do.

Using Food Waste To Produce Biogas

William Ochoa

ABSTRACT

As human population continues grow and technology continues to advance three large problems grow with them. These three large problems are climate change, possible energy crisis, and wasted food. Human population increasing exponentially has resulted in production of more technology, food, and other necessities. Along with this need for more production comes more wasted food and a larger consumption of energy which humanity is trying to produce in a more environmentally friendly way in hopes of combating climate change. This has led to energy companies moving to renewable energies like wind, solar, water, biofuels, etc. Even though these energy companies are reducing lots of emissions by switching to more renewable sources of

power there are still many other large pollution producers one of them being from our waste mostly in landfills. This research project focuses on if most of the food that is wasted in the world can be turned into a biogas without disrupting or lowering the Biogas production. During this research project four of the most wasted foods in America were used which included milk, bread, fruits and vegetables, and meat. Each of those foods were placed into their own biodigester and the gas produced was measured. Along with those four biodigesters a fifth biodigester containing an equal portion of all the other foods was made as a constant. This study did show that biogas can be made from the most wasted food items without completely disrupting the production of biogas. This study is important because it can help give proof to investors that this will solve many problems like reducing pollution, fighting the upcoming energy crisis, and turn large amounts of waste into something useful all while still being profitable.

Does The Presence of Macroalgae Influence The Growth of Eastern Oysters?

Zoe Camp

ABSTRACT

Aquaculturists can grow multiple species that benefit from each other synergistically to produce more goods at a lower cost. Using the native Eastern Oyster, *Crassostrea virginica*, for aquaculture, the oysters can improve the overall water quality of the Chesapeake Bay and boost adjacent ecosystems while increasing the abundance of the oyster population. Similarly, macroalgae acts as a carbon storage sink and can remove excess carbon from the oceans while simultaneously being a nursery habitat for fish. This study examined the potential of a growing symbiosis of *Crassostrea virginica* when paired with *Agardhiella tenera*. The *Crassostrea virginica* spat and *Agardhiella tenera* were each put into bags with oysters for two weeks in the water and length measurements of the oysters were taken. For the second experiment, initial water quality (pH, temperature, and ammonia levels) was measured from three 6 liter buckets with oysters added to produce metabolic waste. *Agardhiella tenera* was added to the buckets to photosynthesize and a final water quality was sampled. From the first experiment, comparing the growth rate of Eastern Oysters with macroalgae, the growth rate of macroalgae and oysters was 11.1% and 10.5%; the growth rate of oysters without macroalgae was 15.8% and 5%, these data

were inconclusive, $p=0.275$; showing no significant change. For the second experiment, testing macroalgae's effect on oysters' water quality was significant, the t-test $p= 0.0007$ showing significant change between the symbiosis of the oysters and macroalgae. This study concludes that *Agardhiella tenera* does not directly affect the growth rate of *Crassostrea virginica*, but the macroalgae does positively impact the water quality when paired with growing oysters.