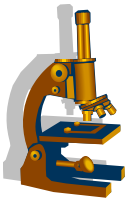
Marine Academy of Technology & Environmental Science

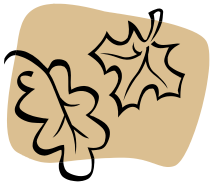
Twelfth

Research Showcase

Abstract Guide

February 28, 2018





February 21, 2018

I cannot believe that is the twelfth MATES Research Expo! This was a good year for student research outside of MATES with multiple projects selected for the Delaware Valley Science Fair and posters presented at the South Jersey Junior Science Symposium. One of our seniors will be presenting her research at the South Jersey Symposium in March, and over 60 projects will compete at Stockton University's Jersey Shore Science Fair. All freshmen and transfer students were required to conduct an independent experiment. Once completed, the students completed a poster culminating in the poster session on February 28, 2018. Many hours went into the projects as the first year MATES students will be presenting their posters. All posters will be displayed in alphabetical order of their last names in eight categories. They will also be judged based on their category.

We would like to thank the students for their project presentations this year. The students worked hard and it will show in the following abstracts, and during their poster session. Mr. Jason Kelsey, fellow student research coordinator who provides the students with tremendous insight on research. Thanks to the MATES Parent-Teacher-Student Organization that was generous in providing funds for materials for numerous projects. Also, thanks to SUEZ, the Fish Hawks, the Garden Club of Long Beach Island, and Exelon for their contributions to our research program. We wish to thank our Ocean County Vocational Technical School Board of Education, Administration (Mr. Hoey, Ms. Weber-Loeffert, Mr. Frazee, and Mr. Biscardi, MATES Principal). A special thanks to the MATES Staff, especially Mr. David Werner (research advisor), Dr. Michael Bixler, Mr. Brian Jones, Ms. Maryann Minnier, Ms. Mia Dill, Ms. Jennifer Hudak, Mrs. Kelly Kelsey, Mr. Adam Sprague, Ms. Michele Colon, Mr. Joseph Arfin, Mr. Sean McAndrew and Mr. Brian Coen who contributed to the success of the project. Also, many thanks to Ms. Katie Manna, Ms. Esther Gallacchio, and our wonderful maintenance staff for all of their support and assistance.

Thanks to the parents who have contributed much time and effort in making the projects possible. Without their support, this research would not be possible. I would like to point out that this year's Research Class (sophomores) helped to organize the Expo, and all the thanks in the world to our Research Assistance and Development (RAD) Team for helping the young researchers for outside fairs and this Expo. RAD met over the summer and provided the students with a lot of assistance! Thanks to the RAD senior coordinators Riley Nevil and Sadie Wolfarth. And, last, but not least, a very special thank you to all of our judges who volunteer to provide our students with constructive feedback about their projects. We greatly appreciate your time and expertise in making the 2018 MATES Research Expo a true success.

Congratulations to all of the students listed in this guide for their hard work this year.

Sincerely,

John Wnek

John Wnek, Supervisor,
Science and Research

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BEHAVIORAL AND SOCIAL SCIENCE

101. HOW HIGHLIGHTING AND UNDERLINING AFFECTS THE RETENTION OF FACTS FOR DIFFERENT LEARNING STYLES

Emily Baubinas, Block 1 Science Class, Marine Academy of Technology and Environmental Sciences (MATES), Advisor: Dr. John Wnek

When studying, the ultimate goal is to retain the information being read. There are a plethora of strategies that can be used to assist in this goal; however, the effectiveness of each strategy depends on the user's learning style. Highlighting and color coding are two methods used for visual learners, while auditory learners tend to benefit from the use of repetition and pneumonic devices. On the other hand, kinesthetic learners benefit from studying in a group setting, making flashcards, and taking notes. After taking an assessment titled "What's Your Learning Style?" from educationplanner.org, 27 participants were separated based on their results. A group of three within each group was given a passage to read that had facts highlighted. Another group of three was given the same passage but had the facts underlined instead highlighted. The last group was given a plain version of the passage that had no marks on it. Immediately after reading this passage, each person was instructed to complete a ten question assessment that reflected the information that was highlighted or underlined in the passage. Following statistical calculations, there was no significance in the correlation between the use of highlighting or underlining to retain facts; although, it was found that the data is trending towards the participants that had no marks on their paper, while auditory learners as a whole performed the best in the study.

102. HOW HAVE CURRENT EVENTS AFFECTED DIFFERENT AREAS OF THE STOCK MARKET?

Matthew Chinique, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

The news has always influenced the stock market throughout the world. For example, the September 11, 2001 Terrorist Attacks, the 2011 Japan earthquake and tsunami, and President Trump's election all had impacts on the markets. The goal of this project was to examine how certain events affect different industries. Exxonmobil, BP, and Sunoco were examined during Hurricanes Harvey and Irma (8/17/17-9/16/17), and the hurricanes appeared to benefit these stocks, probably because of fuel demands during this time. Apple and Google stocks both dropped after the release of The Google Pixel (10/20-16-11/4/16). For Google this is most likely because the phone didn't live up to the expectations, but the cause for Apple is unknown. Delta, Spirit, and United Airlines all raised in value after the United Flight 3411 Incident (4/9/17-5/2/17), most likely due to people having negative views on United Airlines after the incident. From the experiment, is was concluded that natural disasters can positively impact fuel companies, any travel incident will most likely aid uninvolved corporations, and tech companies can rely heavily on the flops or successes of their products.

103. DOES CHILDHOOD NOSTALGIA MODIFY A CONSUMER'S PERCEPTION?

David Ciullo, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

The human mind is designed to perceive different things in its own way. Some people have an eye for detail, some are more punctual and take in everything they see, and some, as has been tested, respond to what interests them. For instance, a man born in the late 1970's may see an advertisement for a product that is being modeled by Wile E. Coyote. This would quite possibly trigger a feeling of nostalgia, and cause him to pay more attention to it. However, if he sees a commercial featuring a modern singer, he may tune it out. This experiment was designed to test that theory. Several posters were made with slogans from different idols from throughout the years. These were posed to people of varying age groups, then interchanged to combine two groups that are likely incompatible. Results showed what was hypothesized: That nostalgia in advertising can be used to fuel the mind of the consumer into at least giving it note, as opposed to brushing it off. The sampling consisted of participants filling out a short survey, with pictures of icons from different eras that showed certain products. The participants were then asked if any of they recognized the characters of the images, and if they paid took more notice of them than they did the others. Overall, a combined total of 263 people consented to be a part of the survey, over the course of a three-day period.

BEHAVIORAL AND SOCIAL SCIENCE (CONT'D):

104. HOW DOES MARINE FOG AFFECT THE DISSIPATION OF CUMULUS AND CUMULONIMBUS CLOUDS?

Ethan Kerr, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Dr. John Wnek

It has been well documented that thunderstorms, and even small cumulus clouds, begin to dissipate, sometimes significantly, as they approach the New Jersey coast. Another Jersey Shore weather phenomenon is the development of marine fog, which forms when a surface layer of ocean-cooled air is trapped under a warm air mass, creating condensation. The weakening of these thunderstorms is often attributed to many things, but could the cool, marine fog air mass limit the instability enough to contribute to this weakening? To determine this I simulated a scenario where thunderstorms move over fog and the effect of the fog on the thunderstorm clouds was observed. I hypothesized that the clouds would begin to dissipate as they passed over the fog. I used a smoke machine to act as the thunderstorm, and dry ice placed into a pan filled with hot water to act as the fog. Just like marine fog, the dry ice created a cooling effect of the air at the surface which was measured. After simulating this scenario fifteen times, there were no consistent observations that could be made to definitively prove that the fog made the clouds dissipate, and therefore my experiments did not support my hypothesis.

105. HOW OFTEN STUDENTS USE EDUCATIONAL SITES AS OPPOSED TO ENTERTAINMENT SITES

Ilana Lavene, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Jason Kelsey and Dr. John Wnek

In today's world, technology is becoming more and more prevalent every day. Only about a decade ago most people were using flip phones, but now most people have access to pretty much the entire world at their fingertips. For many people this can be unsettling; especially for parents. They have no idea what their children are looking at on the internet at any given point in time. That is why it is important to know what exactly current teenagers are using technology for and the age of such technology usage. The hypothesis being tested was that students from MATES, a more advanced educational school, spend more time on technology for educational purposes (rather than entertainment purposes) than students at a traditional high school, New Egypt High School, that constitutes a similar student body size to MATES. This experiment was conducted by sending out a survey via the website Survey Monkey. After the data was compiled, the hypothesis was supported. On average, MATES students spend more of their time using technology for educational purposes then students at New Egypt High School. Based on this study it can be decided that in theory, the type of education you receive impacts how you use technology.

106. WHAT DOES THE NEXT GENERATION THINK OF GLOBAL WARMING AND RENEWABLE ENERGY?

Christopher Norris, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. Jason Kelsey

Over the past year, the prominence of global warming has risen extensively in the past year with President Macron of France setting a plan to ban the sales of petroleum and diesel powered vehicles by 2040 and President Trump of the U.S. announcing his plan to withdraw from the Paris Agreement. Past research has been conducted showing what people think of global warming, but one demographic that also happens to be society's greatest resource has been left out: children. In order to find out what the next generation thinks of not only global warming but the innovations we've made to stop it, I conducted a survey among students at Pinelands Regional Junior High School and their parents regarding both their feelings about global warming in general as well as alternate energy innovations. Surprisingly, I found that the students' and parents' results from my survey as well as the results from a survey conducted by Yale University in 2016 had the same results: people of all ages in the 08087 area have a semi-progressive agenda on global warming and renewable energy.

BEHAVIORAL AND SOCIAL SCIENCE (CONT'D):

107. THE EFFECT YOUR ATTITUDE HAS ON YOUR ACTIONS

Jamie Peña, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Dr. John Wnek and Mr. Jason Kelsey

It is a common thought that your actions and/or results can be affected by your attitude. This experiment was conducted to find if those in a negative environment would show worse or fewer results on a critical thinking quiz than those in a positive environment. To create the desired atmosphere, my participants each viewed one of two videos. After watching the video, they completed a quick survey with critical thinking questions while music was played to keep the mood the same. Once results were submitted, they were checked first to see if an answer had been attempted, and then for the accuracy of the answer. In total, thirty-six tests individuals participated, and half of them viewed the negative videos before the test, the other half viewed the positive videos before the test. The data collected showed that the amount of unanswered questions from each group were tied at six. In addition, there were fourteen incorrect answers total on the positive exams, and twelve incorrect answers total on the negative exams. After analyzing the data, it was concluded that there appears to be little to no correlation between the results of the tests and the environment that was created.

108. EFFECTS OF AGE ON TIME PERCEPTION

Hannah Poulos, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Dave Werner

The world revolves around time; everyone depends on it for stability. Knowing how well a person perceives time could help that person in their daily life. However, people are commonly susceptible to the temptation of an escape. Whether that be in casinos, TV, or a book, they are all forms of entertainment. People tend to lose track of time while they are entertained, but some keep track of it better than others. When people from the ages of 14-22, 38-46, and 62-70 were made to watch TV and estimate how much time had passed without any time-telling devices, it was hypothesized that the 14-22 age group would have the most accuracy with their estimates. This is because time seems to speed up when you get older from the lack of new experiences, and the typical youth has not yet experienced all of the things the older people have. To test this, the subjects watched TV for 13 minutes in a room with no windows, clocks, phones, and/or watches, and they estimated how long they watched TV for. As a result, the 38-46 age group had the most accurate estimates, with the 14-22 age group placing behind them and the 62-70 age group coming in a close third. After running an ANOVA test, the test showed that there was no statistical difference between any of the age groups' estimates, meaning that age does not affect the perception of time.

109. THE EFFECTS OF SUPERSTORM SANDY OF FUTURE STORM EVACUATION MINDSET

William Tyler Zylinski, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey & Dr. John Wnek

The purpose of this project was to determine how Superstorm Sandy has affected Barrier Island residents and their process in evacuation; however, the project eventually measured how damage to property from Superstorm Sandy affected Barrier Island Residents evacuation process. It was hypothesized that Superstorm Sandy did had an effect on our evacuation process through multiple factors. The data for this project was collected by distributing surveys to Barrier Island residents by hand and email. The survey consisted of multiple questions such as BFE (base flood elevation of property) of property, damage to property from Superstorm Sandy, and would residents be willing to evacuate again for another Sandy-Sized Superstorm. The results however, focus on the damage to property and evacuation for another Sandy-Sized Superstorm aspects of the survey.The first trend that was observed while analyzing the survey data, was that residents that suffered under $1,000 in damages to property were less likely to evacuate for another Sandy-Sized Superstorm compared to residents that suffered $1,000 to $49,999 in damages to property. The second trend notices was that residents that retained $50,000 to $99,999 in damage to property were less likely to evacuate than residents who retained $1,000 - $49,999 in damages. However, past the $100,000 threshold residents were once again more likely to evacuate in the face of another Sandy-Sized Superstorm.

BOTANY

201. WHAT IMPACT WILL NEW JERSEY'S CLIMATE HAVE ON *HIBISCUS ROSA-SINENSIS* AND *HIBISCUS SYRIACUS*?

Kyle Agudo, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. David Werner and Dr. John Wnek

The environment greatly impacts the Chinese hibiscus (*Hibiscus rosa-sinensis*) and the rose of Sharon (*Hibiscus syriacus*). Since they are tropical plants, they are not strong enough to endure the colder climate of New Jersey. Therefore, New Jersey's climate is not fit for their optimal plant growth or survival. To determine the environment's effect on the health and survival of the Chinese hibiscus and the rose of Sharon, different physical parameters were analyzed and recorded. Once a week, the height of the plant was measured from the surface of the soil to the highest point of the plant. Daily, the amount of flowers and dead leaves were counted, the plant structures were observed for any signs of pests. To ensure the environment conditions were persistent over the course of the experiment, on the fifth day of the experiment, it was observed that the air temperature dropped below 0° C. This aspect of New Jersey's environment caused the plants death. After three months the height of both the Chinese hibiscus and the rose of Sharon kept indoors increased by 3 cm each. Both plants kept indoors survived the duration of the experiment. The experiment demonstrated that the climate and environment of New Jersey is not suitable for the Chinese hibiscus and the rose of Sharon unless they are brought indoors during the colder months of the year.

202. THE EFFECTS ON IRON LEVELS AND GROWTH OF *SALVIA HISPANICA* FROM INVERTED AND LATERAL GROWING

Julianne Chan, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

One of the most common health problems in the world is iron deficiency anemia, a condition where a person's blood has a less than average amount of red blood cells due to the lack of iron. This issue can be combated through the increased consumption of iron, which can be provided by sources like chia (*Salvia hispanica*); however farmers need to know how to grow them so that they yield the most produce and the most iron. To determine if growing them in different positions would affect their iron composition, nine samples of chia were grown upright, laterally, or inverted and measured by height daily. After 16 days, the sprouts were measured for their body length, mass, and iron levels, by boiling them to extract their iron and then tested with a calorimeter. The results indicated that the upright plants had the highest iron levels, followed by the lateral sprouts and then the inverted plants and seeds. The inverted sprouts were also the shortest, while the others were usually the same height; however, the lateral plants were thinner and had less mass. This implies that gravity caused water to not remain in the center of the pot, which left the plants with less time or less water to absorb nutrients from.

203. WILL CHANGING THE TYPE OF GROWTH SYSTEM AFFECT PLANT GROWTH?

Zachary Davenport, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Plants are mainly grown in three different systems, hydroponics, aquaponics, and common soil growth. Each of these systems has benefits and downfalls. The first system, hydroponics, uses water and chemicals to grow plants in much less space. It is mostly used in big cities where there isn't enough soil to garden. One downfall is that it uses chemicals, which could lead to plants not as healthy as the other systems, and could be expensive. Next, the aquaponics system utilizes fish for its nutrients. The waste from the fish get filtered through the plants and the plants keep the tank moderately clean while collecting the nutrients. There is effort in maintaining the fish species so you need to take care of a fish tank system as well. Finally, soil growth is like your garden in your backyard. This method is the cheapest, and the healthiest, yet slow. To compare the effectiveness of plant growth in each system, I grew parsley, basil, and chives using each method. I periodically measured the stem growth as a parameter. Based on the results of my experiment, plants in the hydroponics system grew the fastest, and largest out of the three systems. Overall, comparing plants, parsley grew the best in each of the three types of systems.

BOTANY (CONT'D):

204. DOES THE LEAF SIZE OF PLANTS ALLOW THEM TO ABSORB NITROGEN BETTER?

Zachary Hoegler, Block 2 Science Classes, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mrs. Kelly Kelsey and Mr. David Werner

Leaves of plants contain most of a plants chloroplasts that allow them to photosynthesize. Photosynthesis allows the plants to capture energy, which they use to remain in homeostasis and grow. Nitrogen in plants is used for growth, development, and reproduction. Being that larger leaves would have more cells they would take more energy and nutrients to produce, but in return would give the plants more chloroplasts to capture energy. Since plants would need more nutrients and energy to stay alive and reproduce, does the size of the leaf actually correlate with the amount of nitrogen absorbed? To determine this I created a lab in which 3 types of plants, one with large leaves, one with small leaves, and aquatic moss balls, are used to remove nitrogen from fish based fertilizer added to a containers water. Data was recorded on each plant based off of the amount of nitrogen, algae, and snails that was in the water. The data was the analyzed to determine if leaf size was a significant factor for high nitrogen absorption rates. It was discovered that, with the species that were chosen plants with leaves performed better than moss, but larger leaves did not perform as well as smaller leaves. A correlation was not identified between larger leaves and nitrogen absorption rates.

205. THE EFFECTS OF RISING SEA LEVELS AND SALT UPTAKE ON ZOYSIAGRASS (*ZOYSIA JAPONICA*)

Sean Kelly, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES)
Advisors: Mr. David Werner and Dr. John Wnek

A growing threat to the world is rising sea levels, and thus, exposure to plants towards higher salinity levels. The osmosis of seawater is known to cause issues for plant growth, but at what exact point can you observe negative effects? For this experiment, I observed how a range of salt parts per thousand from 0-2 affected the growth of Zoysia grass, or *Zoysia japonica*. I hypothesized that there would be no effect at 0 ppt, but as salt levels increased, the plant's growth would decrease. All plants were treated with the same soil and same amount of UV light and temperature, the only difference being the parts per thousand of salt within the water they received weekly. The data collected showed that while the growth of samples with 0.5 and 1 parts per thousand of salt showed little to no affection, samples with parts per thousand upwards of 1.5 suffered poor health.

206. THE EFFECTS OF CARBON DIOXIDE ON SEA LETTUCE

Molly Lada, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Dr. John Wnek

Biofuels produced from macroalgae can solve the problem of fossil fuels quickly depleting. Macroalgae uses carbon dioxide along with other nutrients to gain energy during photosynthesis. Two tanks of sea lettuce, a type of macroalgae, were set up. One received supplemental carbon dioxide, and the other did not. It was hypothesized that the sea lettuce in the tank receiving supplemental carbon dioxide would have a faster growth rate and greater production of chlorophyll than the sea lettuce that did not. After one month, two sets of samples from both tanks were tested. A handheld chlorophyll analyzer was used to measure the relative chlorophyll levels of the water. The measures were greater for the carbon dioxide samples in both sets. A leaf fluorimeter was used to measure the relative chlorophyll levels of the sea lettuce. The measures were greater in the carbon dioxide samples for both sets as well. The hypothesis was supported, as the sea lettuce that received supplemental carbon dioxide was concluded to produce more chlorophyll than the regular sample.

BOTANY (CONT'D):

207. THE EFFECTS OF CHANGING SALINITY LEVELS ON THE GROWTH OF *GLYCINE MAX*

Maya Quinn, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Dave Werner

Every type of plant requires water to be able to grow and thrive, and one of the most popular cash crops is the soybean (*Glycine max)*, grown along the Chesapeake Bay. The purpose of this experiment is to determine how soybeans react to various levels of salinity and the long term effects on the plants. It was hypothesized that the groups with higher salinities would not do well, and those with no salt in the water would survive. Four groups of 36 plants each was prepared, and the water of each group had a salinity of 0, 3, 6, or 9 ppt. The 0 ppt group was used as the control. Over the course of several weeks, the plants' growth was carefully observed. At first, the data showed that plants watered with a higher salinity experienced a burst of growth compared to the control group. After four weeks, this growth burst ended, and the plants affected by salt began to die. An anomaly in the data was that, according to chlorophyll fluorometer testing, the 3 and 6 ppt groups were actually healthier than the control, yet the control group was the only set of plants to survive more than four weeks. This likely happened due to the salt in the plants absorbing the water that was necessary for its survival, thus killing the plants.

208. HOW DOES THE INTRODUCTION OF RED WIGGLER WORMS AFFECT THE OVERALL HEALTH OF A TOMATO PLANT?

Caitlin Spafford, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. David Werner

In natural growing conditions, plants are exposed to many different organisms that can help or hinder their growth. One of these organisms is the red wiggler worm (*Eisenia fetida*), which are common in vegetable gardens if not controlled. To conclude how the introduction of red wiggler worms impacted the overall health of plants, 30 Tiny Tim tomato plant seeds (*Solanum lycopersicum*) were planted. A control was run with 10 seeds exposed to no worms, 10 seeds were introduced to 5 worms, and 10 seeds were introduced to 25 worms. Plant health was assessed using observations, and a handheld leaf fluorometer was then used to determine the chlorophyll fluorescence of the plants. Data was analyzed, and it was then found that the overall health of the tomato plants was the best in the control group. This study clearly shows that red worms affect the growth of tomato plants and should be monitored when growing plants in our local soils.

209. WHAT EFFECT DO VARYING LEVELS OF pH HAVE ON THE ABILITY OF *ZOSTERA MARINA* TO PHOTOSYNTHESIZE AND MAKE THE WATER LESS ACIDIC?

Julia Weppler, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Eelgrass (*Zostera marina*) is a species of submerged aquatic vegetation that can be found in many areas of the world in quiet, shallow waters, including the Barnegat Bay. When eelgrass undergoes the process of photosynthesis, it uses dissolved oxygen in the water. Dissolved oxygen directly affects the acidity (pH) of waters. Researches are currently looking into using eelgrass to help with ocean acidification, but how much acidity can eelgrass stand, and how does higher acidity affect the plant's rate of photosynthesis? To come to a conclusion, 30 eelgrass plants of the same size were separately introduced to a pH of 6.8, 7.0, 7.3, 7.6. The levels were chosen based on the predicted increase of acidity world-wide over the coming century. After every hour, the pH of the waters were tested and recorded to determine an average rate for each set of plants exposed to the different pH levels. The experiment demonstrated that acidity had a drastic impact on the plant's ability to photosynthesize, and once exposed to an acidity of 6.8, the plant would begin to die.

EARTH AND SPACE SCIENCE:

301. HOW DOES THE CORRELATION OF SEDIMENT CONDUCTIVITY AND WATER SALINITY RELATE TO PLANT GROWTH?

Fiona Cheng, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

Global warming threatens coasts with rising ocean levels and intense weather. These conditions can be harmful for vegetation growth and agricultural land. The objective of this research was to observe the correlation between sediment conductivity and the salinity of the water surrounding the sediment and the relation of that data to plant growth. For this experiment, 12 containers were used with salt water and sand for sediment. There were two salinities of water used, 10 ppt and 30 ppt, and two kinds of sand used, loamy sand and medium-coarse sand. Different sands were utilized to see the effect of sediment composition on conductivity of the sediment. Over a week, containers sat undisturbed and were tested every other day for salinity. Results showed that the sediment were substantially lower than the salinity of the water they were exposed to. Sediment composition proved to factor the conductivity; medium sand exhibited higher salinities than loamy sand of the same water concentrations. This meant that as oceans rise, the effect of the sea water will hinder plant growth and create harsher growing environments. Understanding the correlation between sediment and water conductivity is beneficial to the understanding of the future of our coastal environments.

302. SEASONAL DIFFERENCES IN WATER QUALITY OF THE BARNEGAT BAY VS. BEACH HAVEN WEST LAGOONS

Isabella Cozzone, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and, Dr. John Wnek

During the summer of 2017 in Beach Haven West, the quality of the water in lagoons farther from the Barnegat Bay decreased resulting in a lot wildlife dying such as ducks and fish. I wanted to find out if it was the quality of the water decreasing or a bacteria in the water farther back into the lagoons. With the information that was researched, I hypothesized the water in the bay will have higher Dissolved Oxygen levels, pH levels in the 7.5-8.0 range, and cooler water temperatures than farther from the bay. I tested Dissolved Oxygen, pH, and water temperature approximately 300 meters from the bay and in the bay to see the difference in the results. I tested in winter and summer to receive more data. My summer results showed the pH levels higher, the Dissolved Oxygen lower and the water temperature higher in the bay. My winter results showed the pH levels lower, the Dissolved Oxygen lower, and the water temperature lower in the bay. The results contradicted the hypothesis showing there were higher Dissolved Oxygen, lower pH, and lower water temperatures around 300 meters from the bay. This information shows that the water's oxygen, acidity, and temperature may not have been the cause for the death of all the wildlife.

303. DETERMINING THE EFFECTS OF DIFFERING FERTILIZERS ON SOIL pH

Alexander DeDuke, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

When the pH of soil is altered, a plant's ability to obtain resources is greatly limited. This experiment explored how fertilizers affect a soil's pH and why pH can be detrimental to plants/agriculture. In order to determine this, I collected soil samples from an isolated area in the Pine Barrens of New Jersey and separated them into ten pots. Each pot was filled with the same soil, but different fertilizers were applied to different pots. Three contained Fertilizer A, three with Fertilizer B, and three with Fertilizer C, while one didn't contain fertilizer, as a control. After adding distilled water once a day for three days, it was found that Fertilizer A barely altered the soil pH (decrease of 0.3 pH in three days). Fertilizer B, on the other hand, had a more detrimental effect (decrease of 0.8 pH in three days). Finally, Fertilizer C had a slight effect on pH numbers (decrease of 0.4 pH in three days). In the end, my research indicated that fertilizer must be used with caution when maintaining anything from a small garden to a whole farm. In the bigger picture, it was demonstrated that pH is easily altered by, including, but not limited to, fertilizer use.

EARTH AND SPACE SCIENCE (CONT'D):

304. BACTERIAL RESIDENCE TIME IN SAND AND WATER

Emily Downs, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mrs. Kelly Kelsey

During swimming seasons, scientist test waters for the indicator bacteria, *E. coli*. If the amount of bacteria is less than 200 colonies per 100 ml of water, it is deemed safe to swim in. However it has been theorized that bacteria has a longer residence time in sand than in water, which could contaminate the clean waters shortly after. I decided to test this hypothesis by taking five samples of sand and water and test the bacteria levels, especially of *E. coli* over a 5 week span. To test the water, I placed 1ml of sample into a Coliscan EasyGel® color indicator bottle, then into a petri dish. To test the sand, I used similar methods, only I flushed the sand with distilled water, then used that water in the indicator bottle. After the petri dishes were placed in an incubator for 24 hours, I counted the number of colonies. After all of my samples were tested, it was clear that the bacteria colonies in the sand had a significantly longer residence time. This data shows that since bacteria in the sand will have a longer residence time, it could lead to the waters that were deemed clean before being contaminated.

305. THE IMPACT OF MELTING PERMAFROST ON OCEAN ACIDIFICATION

James Kerwin, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

Permafrost is ground composed of rock, ice, and organic material that remains at 0°C for at least two years in a row. In Arctic regions, warming due to climate change is defrosting permafrost. If this warming continues at the current rate, millions of kilograms of permafrost will melt. This will potentially release large amounts of carbon into groundwater, lowering the pH and increasing the acidity of the oceans and lakes fed by the runoff. Ocean acidification has been shown to have a negative effect on marine ecosystems. My experiment tests the pH change of seawater due to melting permafrost. Five hundred grams of Alaskan permafrost each was placed in three perforated containers over three buckets filled with 1 liter of seawater. A fourth bucket, the control, held 1 liter of water without any permafrost. The containers were placed in an environment where they would be warmed from 0°C to 3°C to mimic the conditions in which the permafrost is melting in the Arctic. The pH of the seawater was tested each day. After 40 days, the data was analyzed, and it was found that two of the three test groups had a statistically lower pH overall than the control.

306. THE CORRELATION BETWEEN pH LEVELS AND THE NUTRIENTS FOUND IN THE SOIL

Leana Salgado, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

The pH levels of soil are an important factor for determining the amount of nutrients soil has. This gives a better understanding of why some plants grow better and flourish in one type of soil than another. Since there is a better chance of finding nutrients in neutral to slightly acidic soils, plants will more likely to thrive in those areas. In this research 9 soil samples were collected from three different locations of Monmouth and Ocean counties. Additional 9 samples were collected seven days after the significant snowfall in the same locations. For each soil sample, pH level and an amount of nutrients (nitrate and phosphate) was measured. Data then was analyzed to determine the correlation between the soil pH level and nutrient availability. From the results after the snowfall it was observed that the nutrient availability increased whereas the pH level remained relatively unchanged. In the results (before the snowfall) when the pH was slightly acidic, ranging from 5.5 to 5.9, nitrate and phosphate availability was measured at 15 ppm and 1.44 ppm respectively. It is very unlikely for a large amount of nutrients to be in extreme pH conditions because when the soil is intensely acidic or alkaline the nutrients will not be able to dissolve into the soil. When the results presented a significantly acidic soil of pH 4, there was a lesser amount of nitrate and phosphate available (3 ppm and 0.39 ppm respectively). If the nutrients are not soluble then it won't be available for uptake by plant roots. Soil pH is important for plant life because fixing the pH level of the soil to where there are the most nutrients assists in the growth of plants. Analyzing soil uncovers many biological and physical properties that are important for plant nutrition.

EARTH AND SPACE SCIENCE (CONT'D):

307. VIEWING THE TOTAL SOLAR ECLIPSE AND ACCURATELY PREDICTING THE MARGIN OF ERROR IN VIEWING PROJECTIONS

Zachary Todd, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mrs. Kelly Kelsey and Mr. Dustin Todd

The purpose of this research was to predict the margin of error of the viewing projections for the solar eclipse occurring on April 8th 2024. In order to do this, research was carried out on five solar eclipses from the past and margin of error for the viewing projections was found for each. These values were taken, and were then placed onto three graphs, each with a different type of trend line. The trend lines chosen were linear, exponential, and polynomial. Then the best and most logical trend line was chosen, which was the linear model. Though the linear model was chosen, the prediction for the 2024 solar eclipse was taken for each model. The exponential model predicted that the margin of error for the viewing projections would be 824.264941246 meters. The polynomial model predicted that the margin of error for the viewing projections would be -645.262494 meters. The linear model predicted that the margin of error for the viewing projections for the 2024 solar eclipse would be 215.2 meters.

308. WHAT IS THE BEST RATIO OF BROWNS TO GREENS FOR *EISENIA FETIDAS* TO FEED ON TO MAXIMIZE THE SPEED OF CONSUMPTION?

Ethan Wong, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

The trash and waste we dump into the environment each year is usually buried underground or otherwise disposed of improperly, which has detrimental effects on the Earth but by using nature's natural decomposers, worms, we can cut down on the wastes that go straight to landfills. Worms eat a variety of substances, such as "brown food", or organic carbon sources, such as cardboard, and "green food", which are organic nitrogen sources, such as fruit skin. Worms eat brown foods and green foods at differing rates, so what percentage of browns-greens are most effective for worms to eat the fastest? By giving four groups of 50 worms differing ratios of browns-greens, 1:1, 2:1, 1:3, and 1:2, but keeping the amount of food the same, we can find out which ratio of food is the best for the most efficient disposal of wastes by measuring which group of worms eat through their portions the fastest. The results show that the 1:3 ratio of browns-greens performed the best, followed by the 1:2, 1:1, and 2:1, respectively.

ENVIRONMENTAL SCIENCE:

401. ALGAL BIOFUELS AND THEIR RELEVANCE IN MODERN SOCIETY

Kaileb Cole, Block 4 Chemistry, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Our current society is based on fuel consumption. From transport to production, all processes require fuel. A fossil fuel based society however, must soon come to a close. Due to high Carbon Dioxide concentrations in our air, and the decline of available oil, fuel prices are on the rise. Many scientists have turned to biofuels and other synthetic sources of power to aid our lust for energy in the modern age. I elected to look into algae to solve these concerns. I spent one month growing algae in direct sunlight, as well as red light, but to no avail. My algae had died, so I started over. I collected the algae and grew it again, under different conditions. This algae was better than the previous batch, but was not concentrated enough for a crude oil at the conclusion of a month. After this research, I determined that algae as a fuel source, while abundant, would be an expensive source in our market. Costing 10 dollars to the gallon of mass-produced fuel, and upwards of 25 to 30 dollars for a single gallon of homegrown fuel. At its present cost, and growth difficulties, algae is not the right path for energy.

402. ANALYSIS OF NITRATES, pH, CHLORINE AND COPPER IN FIRST DRAW VS. LATE DAY SAMPLES IN PUBLIC AND WELL WATER

Alyssa Costello, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Tap water is a vital part for everyday activities, whether it be cooking, drinking, etc... So it should not have any contaminants that could cause the water to become harmful. In my experiment I tested for chlorine (free, total, and combined), nitrates, pH, and copper in various East and West Jersey towns. I collected a first drawn A.M. and a P.M. sample from each town to compare if the water is worse coming out of the pipes after sitting all night. I looked for a correlation in chlorine to nitrate levels, copper to pH levels, and a difference in well and public municipal water. After analyzing my data I discovered that water with a lower pH had higher copper levels which means that the acidity of the water causes copper pipes to corrode and leak copper into the first drawn water. Also, East Jersey samples contained more nitrates because the towns were located in suburbs rather than the rural towns most of the West Jersey samples were from. A correlation was draw from the fact that well water had some of the lowest chlorine levels. This shows that well water does not receive the same purifying quality as public water. I did not find a big enough correlation between chlorine and nitrates.

403. IS THERE AN ENVIRONMENTALLY CONSCIOUS WAY TO WASH A CAR?

Matthew Learn, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. Jason Kelsey

School sports teams often raise money through car washes. Leftover car wash is dumped and becomes runoff and enters Barnegat Bay. The presence of sodium alkyl benzene sulfonic acid, an ingredient in most car wash solutions, is acutely toxic to the organisms in Barnegat Bay. Given the prevalence of this type of fundraiser, as well as the personal hand washing of cars, a question arises. Is there an environmentally conscious way to wash a car? One possible solution is to use a water and vinegar car wash. To come to a conclusion, 150 brine shrimp *Artemia salina* were introduced into six shoebox size tanks. Two tanks had Blue Coral Car Wash introduced, two tanks had a water and vinegar car wash introduced, and two tanks had nothing introduced. After five days, results were recorded. This procedure was repeated three times. Data was analyzed and separated by tank and week. The Blue Coral Car Wash showed to be very harmful to the brine shrimp and therefore the environment. On the other hand, the water and vinegar car wash had no harmful effects on the brine shrimp.

ENVIRONMENTAL SCIENCE (CONT'D):

404. THE EFFECTS OF RISING SEA LEVELS ON FRESHWATER DIATOMS

Brigid McMahon, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. David Werner

Diatoms are phytoplankton that are essential life on Earth, producing a large portion of the world's oxygen through photosynthesis. They can be found in almost all waters of the world, whether the environment is saltwater or freshwater. However, climate change may pose a threat to these vital organisms, through the alteration of their habitat. As sea levels rise, fresh inland waters become saltier, affecting the life that exists there. Phytoplankton such as diatoms are a strong indicator of a body of water's health, and measuring the water's chlorophyll is one method of monitoring them. Freshwater samples containing diatoms were taken, and the salinity was gradually increased to simulate rising sea levels. The chlorophyll from each sample was measured over a five week period, salt being added each week. After data collection and analysis, it was determined that the chlorophyll decreased as the salinity was increased. The diatoms in the water were dying, and no longer producing chlorophyll in the water samples.

405. QUANTIFYING A SOURCE OF POLLUTION IN PINE LAKE USING OPTICAL BRIGHTENERS

Jillian Peslak, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Dave Werner and Dr. John Wnek

Pine Lake, NJ, has been considered a non-swimmable lake for many years. One such cause of this designation results from human runoff from the surrounding neighborhood, Pine Lake Park. To quantify a source of human pollution water samples were collected from throughout the lake and refrigerated to stabilize the samples, and then brought into the laboratory at the Marine Academy of Technology and Environmental Sciences to be analyzed. An Aquaflor Handheld Fluorometer was used to measure the amount of optical brighteners, in the water that could directly indicate human sources. The pH of each sample was also tested. Samples were taken over the course of four months, from November 2017 to February 2018. During this time period Pine Lake was lowered and the bed of the lake was exposed during the winter months. Nineteen water samples were tested, along with three ice samples and one sample of mud from the bottom of the lake. After testing it was revealed that optical brightener levels were higher during the warmer month (November) and dropped significantly with the lowering of the lake and the decrease of air temperature. The results indicated that few optical brighteners were found near storm drains throughout Pine Lake Park in the winter; however the evidence that there were higher levels in the fall made it apparent that there is a negative human impact on Pine Lake.

406. THE EFFECTS OF INTRODUCING *CAREX PENSYLVANICA* INTO ENVIRONMENTS WITH DIFFERENT SALINITIES

Madison Surette, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Dave Werner

Many salt tolerant plants can be found in the Pine Barrens of New Jersey. The Pine Barrens are well within the reach of salt spray and the soil pH is constantly. *Carex pensylvanica* is a type of ground covering sedge found in oak forests and acidic soils. It is important to recognize the plasticity of abundant Pine Barren plants because these areas are growing progressively more acidic due to climate change. It was hypothesized that the optimum level soil pH for *Carex pensylvanica* was 4.6. To determine the effects of introducing *Carex pensylvanica* into environments of different salinities, specimens were collected and planted into standardized Pine Barren soil composition. The pH levels were manipulated by adding acidic solutions to distilled water and watering the vegetation. Health deterioration was recorded through visual and tangible signs such as browning, low moisture, and dryness of the blades. The results of this study have shown that the optimum pH for *Caren pensylvanica* is roughly 6, and the plant has a high resilience to drought and increased acidity. The ability of the vegetation to withstand such salinities makes it a functional coastal plant.

ENVIRONMENTAL SCIENCE (CONT'D):

407. THE BIOREMEDIATION OF BISPHENOL A AND THE EFFECTS ON *ARTEMIA SP.*

Lana Van Note, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

Bisphenol A (BPA) is a synthetic chemical that is extensively used in the fabrication of polycarbonate plastics. Biomagnification of BPA in the oceanic consumer-resources system raises concern for the health of both humans and marine ecosystems. Degradation processes with microorganisms are used in industry to reduce pollutants like BPA in wastewater and groundwater. This study examines the use of this type of bioremediation. Primary consumers (brine shrimp) were used to determine whether the effects of BPA were better tolerated than the effects of microbial degradation of BPA and the resulting byproducts. *Artemia sp.* trials were exposed to either saltwater spiked with only BPA or BPA with *Pseudomonas putida,* both in aerobic conditions. Specimen were exposed for 12 hours to observe changes in behavior or appearance. UV-spectrophotometry and a T-test showed that the amount of BPA significantly decreased in trials with the microbe. Wet-mount slides were analyzed with Imagej to compare physical changes. Specimen in habitats containing the microorganism had a significantly stronger body structure and length as compared to specimen exposed to only BPA. However, the average body length was 71% shorter than null specimen. Results suggest that no additional toxicity was added by the presence of *Pseudomonas putida* degradation.

408. HOW OFTEN IS PRODUCE HANDLED?

Sarah Zhang, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

When buying from a public market, food is handled by many people. Customers inspect produce to make sure there are no defects. For this reason, people tend to rinse their food before consuming it. However, it's hard to know how many people have handled the food and if rinsing it will help. How often is produce handled? In my project I tested the produce from my local supermarket for fingerprints. Using a fiberglass brush I dusted latent fingerprint powder on the fruit or vegetable to reveal the fingerprints. I then used lifting tape to remove the fingerprints from the surface of the crop and onto a fingerprinting card. This was conducted on pears, apples, grapes, cucumbers, and tomatoes. From the produce tested, most yielded fingerprints. However, most were partial due to the surface of the fruits and vegetables not being smooth and flat. The results show that, though it's not often seen, the food that you buy has been touched and handled by other individuals.

HEALTH, MEDICINE AND SPORTS:

501. THE DURATION OF RECOVERY TO BASE-LINE VITALS AFTER SWIMMING ONE-HUNDRED YARDS OF EACH STROKE

Alessandro Barlotta, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Dr. John Wnek and Mr. Jason Kelsey

The sport of swimming consists of four strokes, butterfly, backstroke, breaststroke, and freestyle, all with differentiating techniques and muscle usage. In each, a change can be observed in the vitals of blood pressure, heart rate, and oxygen saturation after intense, usually anaerobic, swims. To observe and measure which stroke would lead to the slowest decrease to base-line level heart rate, blood pressure, and oxygen saturation, eight subjects sprinted one hundred yards of each stroke and had their blood pressure measured every three minutes and their heart rate and oxygen saturation measured every fifteen seconds for two minutes and every minute after that. The results suggested that breaststroke had the longest recovery time for blood pressure at an average of 315 seconds, backstroke had the longest recovery time for heart rate, at an average of 199 seconds, and freestyle had the longest recovery time for oxygen saturation, at an average of 51.875 seconds.

502. INVESTIGATING IF DIFFERENT TYPES OF DISINFECTANTS ARE MORE EFFECTIVE AT ELIMINATING BACTERIA

Declan Botwinick, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. David Werner

The purpose of this experiment is to investigate how much bacteria will be eliminated by two different types of Purell products. These products are Purell Alcohol-Free Foam Hand Sanitizer and Purell Hand Sanitizer (includes Alcohol). The bacteria that I will be using for this experiment is *Escherichia coli.* For this experiment, the independent variable is the different concentrations of the Purell substance, or the percentage. The dependent variable is how much of the bacteria will be eliminated by a Purell product. I am testing this because in schools, like MATES, there has been a change from Purell with alcohol to the non-alcoholic version. My hypothesis was that the Purell Alcohol base Hand Sanitizer would be more effective at eliminating the bacteria. Three trials were run and the results suggested that the Purell Alcohol base was more effective at eliminating bacteria. It eliminated bacteria more effectively in two of three trials. In terms of overall bacteria counts, the Purell Alcohol base killed 92% of the bacteria while the Purell non-alcohol base killed only 86% of the bacteria. The experiment shows that alcohol-based sanitizers are more effective.

503. THE EFFECT OF DANCE ON COGNITIVE FUNCTION

Daniela Covello, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

Dance is a physical activity that demands stamina in not only the body, but the mind. To be able to move your body in a plethora of ways, perform countless pieces of choreography, and dance harmoniously with music all while under pressure, requires a brain that can handle multiple tasks simultaneously without strain. All of these things are the requirements of every dancer, and the science behind it correlates to *cognitive function.* Cognition can be defined as the ability to think, recollect, and process the concept of thoughts subconsciously. By practicing these skills constantly and all at once can heighten said skills. Each day dancers practice and perfect a performance, they are merely strengthening their cognition skills. In this experiment, 76 participants completed a short quiz comprised of three questions testing cognitive ability, created by Dr. Shane Frederick, Yale University professor. Of the 76 people tested, 38 were dancers (people who practice dance at least 10 hours a week), and 38 were not; all participants were within the range of 14-17 years of age. After analyzing the data, it was conclusive that those who dance did in fact receive higher scores than those who do not. These results suggest that people who practice the art of dance often are likely to have heightened cognitive function.

HEALTH, MEDICINE AND SPORTS (CONT'D):

504. THE EFFECT OF VARYING pH LEVELS ON THE REPRODUCTION RATE OF *ESCHERICHIA COLI*

Alexis Jankovich, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

Escherichia coli is a gram negative bacteria commonly found in the intestinal tract of humans. Some strains are pathogenic and can cause gastrointestinal problems among humans; however, many strains are not harmful, and are even part of a healthy human digestive tract. The purpose for investigating this experiment was to take the average of a water body and see whether rain events will lower the pH to around 7 where the highest number of colonies would grow making the water body unsafe. The average pH of rain water is 5.6. This would only occur if the pH of the water body was above seven, which is quite common in summer droughts. It is hypothesized that when the bacteria is exposed to the neutral pH of 7, the conditions will be the most optimal, cultivating the greatest reproduction rates of the bacteria. Nutrient rich agar was experimentally altered using distilled white vinegar to acquire the pH level that was necessary for the experiment. The each pH level had five trials and there were 7 pH levels in total. After the agar was poured into the petri dishes, the petri dishes were streaked with Luria Broth treated with Escherichia coli and placed upside down in the incubator at 34° Celsius to reproduce. The bacteria was examined every other day and each time it was checked upon data was collected and analyzed. From this experiment, it was concluded the pH level of 7 proposed the foremost optimal living conditions for the bacteria.

505. COMPARING THE ULTRAVIOLET BROAD SPECTRUM PROTECTION SPECIFIC TO CHEMICAL AND MINERAL/BOTANICAL SUNSCREENS

Hayley Jankowski, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

People everywhere use sunscreen to protect their bodies from the sun's ultraviolet rays, but the chemicals used for shielding our skin can damage our bodies in other ways. The manufactured chemicals stunt our production of antioxidants and disrupt natural hormones; therefore, damage to DNA, lipids, and proteins might occur along with the disruption of sexual development and reproduction. However, there are alternative sunscreens that involve pure, natural ingredients that reflect UV rays instead of absorbing them, yet many people are unsure if these natural sunscreens can provide the same broad spectrum protection as commercial sunscreens. Thus, this experiment was designed to measure the overall protection provided by three natural sunscreens and a standard chemical sunscreen. Each sunscreen was spread evenly on plastic wrap, and tested nine times, and then nine times again after being doused in water and then dried. Using a UV detector it was determined that all the sunscreens provided sufficient protection for the fall season, but Sunscreen 3, a mineral based sunscreen, allowed the least amount of rays through to the detector.

506. THE EFFECTIVENESS OF CONCUSSION BANDS TO PROTECT THE BRAIN FROM INJURY

Morgan Montana, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

This research project centered on testing the ability of concussion bands to reduce impact force to the head upon hitting the ground. Many youth athletes sustain concussions and there is a lack of scientific research to validate solutions. To evaluate if concussion bands are a reasonable solution, a device was made to drop a human bust filled with gelatin and an accelerometer inserted from a controlled height. The bust was dropped with the device with and without a headband. Upon looking at the data, it was discovered that the average x value Gs decreased by 42.4%, the average y value Gs decreased by 87.5%, and the average z values decreased by 29.1%. The average of all the axis g-force decreases is 53%. These values show that the headbands did aid in reducing impact force and therefore may prevent concussions. With impacts of 36 Gs when unprotected and 24 Gs with a headband, this may reduce concussion rates substantially if used. Reduced concussion rates in youth sports could allow more athletes to feel comfortable playing and less athletes to be affected in their future by a traumatic brain injury.

HEALTH, MEDICINE AND SPORTS (CONT'D):

507. THE INFLUENCES DIFFERING SANITIZED SURFACES HAVE ON *ESCHERICHIA COLI'S* GROWTH RATE.

Makana Steinmetz, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mrs. Kelly Kelsey

The purpose of this experiment was to determine how sanitizing wipes frequently used in healthcare (Medical Germicidal Wipes) affected the growth rate of bacteria, specifically non-pathogenic *E. coli*. It was hypothesized that, once sanitized, wood would minimize the bacteria's growth rate the most due to wood already possessing antibacterial characteristics, such as its durability and composition. The three surfaces, including varnished wood, tile, and water resistant sheetrock, were each treated with a Luria broth containing strains of *E. coli*, then sanitized with a Medical Germicidal Wipe. Samples were then swabbed and cultured for two weeks. The results showed an increase in growth rate for all three surfaces, therefore refuting the hypothesis. These results, however, show that healthcare environments must be conscious about when and how long ago a certain surface was disinfected. If not, more bacteria will appear than originally theorized. Hospitals need to aware of when a certain type of surface is going to experience its highest increase in *E. coli's* growth rate, or any bacterium for that matter, so they can sanitize the surface periodically and properly. A new method on how cleaning procedures should be done will also aid the sterilization of bacteria, in place of the wipes. The percentage of bacteria killed was not determined in this experiment; only how quickly the survivors were capable of reproducing.

508. DOES LEAD APPEAR IN LIPSTICKS?

Anna Valente, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Dave Werner

Lipsticks are often made with colorants that contain lead. Although the government has the ability to track all of the chemicals in cosmetics, lead, a toxic substance, is still often used in lipsticks. No amount of lead is safe, as it can build up and cause health problems such as cardiovascular effects, increased blood pressure, decreased kidney function, reproductive problems in both men and woman, fetal defects and premature birth in pregnant women. This leads to a concerning question- does lead appear in a significant amount of lipsticks? To come to a conclusion, 15 different lipsticks were purchased and tested for lead with the Lead Inspector Lead Test Kit. The lipsticks tested ranged from cheap, $1 lipsticks made in China, to well known drugstore brands, to high-end and luxury lipsticks made in the USA and Europe. The data from the tests was collected and analyzed, and it was found that 7 out of 15 (46.7%) of lipsticks had lead in them. The amount of lead ranged from 1-7 ppm. The amount of lead wasn't related to the cost of the lipstick studied, as lead was found in the "super-cheap", drugstore, and high-end lipsticks.

509. HOW THE METHOD IN WHICH A SOCCER BALL IS KICKED AFFECTS ITS PROPERTIES OF SPEED, DISTANCE, AND HEIGHT

Blake Weiner, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. David Werner

The objective of this project was to observe different methods of kicking a soccer ball, and to see which method was the best. The three aspects that were being looked at were the measure of height, distance, and speed. A spring-loaded leg with a foot was created to keep testing consistent. In total, 130 successful trials were completed. The soccer ball was divided into nine different sectors, and the foot angle was separated into five different angles. The height was found by utilizing a slow motion camera to view the ball striking a lined paper system. The results of the experiments prove that kicking the ball at different places with different foot angles have a direct correlation with the ball's attributes of speed, distance, and height. It was found that kicking the bottom of the ball with a low foot degree results in a greater height and speed. Additionally, kicking the ball with a high angle degree in the middle of the ball produces a great distance. The results of this experiment show a methodized procedure that can be used to obtain a specific type of kick, thus revealing the success of the experiment.

MARINE SCIENCE AND BARNEGAT BAY STUDIES:

601. RATES OF SHELL MASS DISSOLUTION IN ACIDIC WATER AMONG *GEUKENSIA DEMISSA* OF DIFFERENT ORIGIN

Don Bonifacio, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

In waters of high acidity, the calcium carbonate in shells of the Atlantic ribbed mussel (*Geukensia demissa*) have the potential to dissolve in low pH waters through chemical reactions, and this may lead to the shell thinning in these acidic environments. After years of increasing acidity in marine waters, will the shells of *G.demissa* have different rates of shell dissolution depending on the pH levels of their origin? By comparing the shell mass dissolutions rates of *G.demissa* from areas of differing pH levels, it can be determined which shells from which location will experience the faster rate of dissolution and largest loss in mass. Shells from two locations, one with the pH of 8.5 and the other with 8.0, will be placed in containers holding acidic water with different levels of acidity. A total of 12 shells of *G.demissa* have been kept in a container with the pH levels of 7.4, 5.5, and 4 for 14 days to dissolve. The results of the experiments showed that overall five of the six shells from the area of lower pH tended to dissolve at a faster rate than the shells of the area with a higher pH level.

602. EXAMINING SHIFTS IN SEASONAL DIVERSITY OF SPECIES OF ZOOPLANKTON IN THE NORTHERN AND SOUTHERN BARNEGAT BAY

Samantha Glover, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

Diversity is an important factor when looking at the condition of an environment, as a sudden loss or increase can be a sign that something is not right. However, there can be natural shifts during seasonal changes. In my project, I looked at the shifts in diversity of zooplankton species in the inlets of Barnegat Bay: Barnegat Inlet, Manasquan Inlet, and the Little Egg Harbor Inlet during the fall to winter. The purpose being to find which inlet had the most diversity and if there would be a decrease in diversity due to that shift. I used a plankton net to collect my samples and a microscope to examine them. A guide to marine zooplankton was used for identifying them. My data was graphed and species richness and indexes of diversity were used to analyze it. Barnegat Inlet had the most diversity, the fall test being the most diverse. It is seen as the season is changing, that the overall diversity is decreasing as some species are frequently being seen. Plankton studies are limited, especially when it comes to diversity, and this just further shows how diversity is not only limited to animals capable of being seen.

603. HOW THE BIOLUMINESCENCE OF THE MARINE *PYROCYSTIS LUNULA* (DINOFLAGELLATE) IS AFFECTED BY CHANGES TO SALINITY

Diya Jariwala, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisors: Mr. Jason Kelsey and Dr. John Wnek

Pyrocystis lunula (marine dinoflagellate) live in tropical areas where there is warm water (21-32 degrees Celsius) and salinities around 35 ppt. The purpose of this project was to examine the changes in the bioluminescence when dinoflagellate cultures are put into different salinities. My hypothesis states that the bioluminescence brightness will grow dimmer as the salinity increases. To test this, dinoflagellates were cultured in salinities that ranged from 25 ppt and 45 ppt. Two methods were then used to analyze the bioluminescence of the cultures. A spectrophotometer was used to determine the amount of light reactivity in each culture based on certain wavelengths and a photometer was used to measure the amount of light emitted by each sample in photons. The results indicate that as the salinity levels increase, the light intensity of the cultures did as well. Statistical analysis showed a significant difference ($P<0.0001$) in the light intensity between dinoflagellate cultured in each of the salinity values with 45 ppt showing the greatest intensity. This research is important because it exposes how dinoflagellate emit more light in higher salinity ranges. In addition, studies show that dinoflagellate can only grow if the salinity levels are over 30 ppt and the temperature is greater than 10 degrees Celsius. This project concluded that marine dinoflagellate emit more light when in higher salinities due to the danger the increased salinity provides to the organisms.

MARINE SCIENCE AND BARNEGAT BAY STUDIES (CONT'D):

604. THE EFFECT THE SIZE OF THE *CALLINECTES SAPIDUS*' PREY HAS ON DETERMINING THE LIKELIHOOD OF ITS CONSUMPTION

Kayla Johns, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason. Kelsey

The *Callinectes sapidus*, or blue crab, is known to be an opportunistic feeder; however, do they take into account the size of their prey before consuming it? In order to answer this, an isolated crab was given one 3cmx2cmx1cm piece of tilapia that equaled 0.3 ounces, and six 1cmx1cmx1cm pieces of tilapia that totaled 0.3 ounces, at one time. This was performed once a day on a total of three different crabs. After the crab was done eating, the remaining pieces of tilapia were weighed and the amount of food the crab ate of both sizes of tilapia was recorded (in ounces). Then, the total amount of each size of tilapia eaten between all three crabs were averaged, and it was revealed that the average amount of the 3cmx2cmx1cm piece consumed each day was slightly higher than the average amount of 1cmx1cmx1cm pieces consumed. A t-test was then performed and determined that the difference in the two means was statistically different, suggesting that there is a connection between the size of a blue crab's prey and its chance of consumption.

605. RED-JOINTED FIDDLER CRABS (*UCA MINAX*) REACT AND RESPOND TO DIFFERENT ENVIRONMENTAL CONDITIONS

Jared Longo, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

Many people know that global warming and habitat loss are two very devastating factors for many species. To figure this out, red-jointed fiddler crabs (*Uca minax*) were studies to see if varying environmental factors would help or harm them. Throughout this research, four experiments were conducted: lighting, heat, salinity, and substrate. Data was then recorded to see if there was a preference during any of the experiments. It was concluded that they could easily adapt to the mud being added over sand and the temperature being changed. The differences were that a slight preference was shown over higher salinity and they disliked the light. Two main observations were made as well as the experiments. The first is that individual personalities within the crabs were shown, giving them more diversity and chance to adapt. The other is that each has shown a need for their own territory. Overall, they were highly adaptable, but habitat loss is still a threat because it would put them in more direct sunlight as well as limit their territory.

606. WHAT EFFECTS DO *CRASSOSTREA VIRGINICA* HAVE ON NITRATE AND PHOSPHATE LEVELS IN BARNEGAT BAY

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Crassostrea virginica (the North American Oyster) is an oyster species native to the eastern coast of the Americas. They are filter feeders with the ability to filter small particles and nutrients out of the water. Barnegat Bay is currently in a eutrophic state where high nutrient levels can be observed. The purpose of this project was to analyze the effects that the North American Oysters have on nitrates and phosphates in Barnegat Bay. The hypothesis states that given time, the oysters will improve the water quality by removing some of the nitrates and phosphates. To determine how nitrate and phosphate levels in the Barnegat Bay can be affected, the oysters were placed in 68 liters of water from Barnegat Bay. Every eight hours a sample was taken and tested for nitrate and phosphate levels. The results, partially supporting the hypothesis, showed that nitrates and phosphates were removed from and released back into the water, not consistently improving the water quality in terms of nutrients, varying from each test set. To conclude, *Crassostrea virginica* are in fact able to filter out nitrates and phosphates, although in some trials the water quality did not improve as much as anticipated.

607. CRAB POTS CONTRIBUTING TO DECLINING POPULATION OF THE NORTHERN DIAMONDBACK TERRAPIN

Alexis Osborn, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

Crab pots are a major concern for the sake of much undersea wildlife, and they are especially an enormous threat for the diamondback terrapin, *Malaclemys terrapin*. In New Jersey, regulations have been put in place as of 1998 for commercial crab pots to be fitted with Bycatch Reduction Devices (BRDS) under certain fishable conditions; however, many companies do not offer them and the regulations are not strictly enforced. In my research, I compared survey data from (103) crab pot companies and broke them down to see the percentage of companies that are taking precautions to help this species by providing BRDs. Furthermore, the survey contained data for the company, type(s) of cages, if BRDS are included on the trap, if the BRDS come separately for free, or if the BRDS come separately at an additional cost. The types of crab pots they offer are also an important factor because if people are not supplied with the correct equipment, then there could be potential impacts on bycatch species. A significant amount of companies showed to not include any magnitude of precaution, such as BRDs or pots with cull rings, though many provided an escape panel. Altogether, even though regulations are set to protect this species, there crab pot retailers do not provide the resources necessary for crabbers to comply.

608. MICROPHYTOBENTHIC RESPONSE TO CHANGES IN SALINITY

Caitlin Sia, Block 3 Science Class, Marine Academy of Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

Microphytobenthos are small, photosynthetic, single-celled organisms that live in estuarine habitats as well as salt marshes and coastal environments. They are very important to coastal ecosystems since they are primary producers and provide food for the other species that live there. Recently, human activity has caused fluctuations in coastal salinity levels which could deeply affect the growth of microphytobenthos. Samples of diatoms, cyanobacteria, and dinoflagellates, which are primary phytoplankton that make up microphytobenthos, were placed in three different salinity levels set at high, medium, and low. The results showed that diatoms grew well in high salinity while cyanobacteria grew well in medium salinity and dinoflagellates in low salinity. This was due to the different characteristics that each organism possessed that helped aid in growth. These results can aid in the planning of conservation efforts of marine coastal environments.

PHYSICAL SCIENCE AND ENGINEERING:

701. THE EFFECT OF SWITCHING THE COMPOSITION OF A TABLE TENNIS BALL FROM CELLULOID TO PLASTIC ON THE POST-COLLISION BALL TRAJECTORY

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The official material used in table tennis balls was changed from celluloid to plastic, a material free of celluloid, in 2014. The purpose of this study was to understand the differences and similarities between these two types of ball materials by comparing their behavior upon collision with a table tennis table to aid serious table tennis players. The behavior of the balls before and after collision with a table, at various initial speeds ranging from 15 to 115 km/h, was captured using high-speed cameras. Velocity and spin rates before collision, along with velocity and spin rates after collision, were computed to calculate the coefficients of restitution and friction. Based on the computed variables, the post-collision trajectories of both table tennis balls were calculated via the equation of motion for simulated service, smash and drive conditions with respect to time. The coefficients of restitution were higher for the plastic balls than the celluloid balls when the initial vertical velocities were higher. The coefficients of friction were greater for plastic balls when the initial horizontal contact point velocities were slower. Because of the differences in the material traits, the plastic table tennis ball trajectories of services with backspin and drives with copious topspin were expected to differ from those of celluloid table tennis balls. Since the extent of dissimilarities between the two ball types varied depending on the initial conditions, testing with a myriad of initial conditions was suggested for comparing and comprehending the characteristics of the balls.

702. COMPARING SOLAR CELL ELECTRICAL OUTPUT USING VARYING GEODESIC DOME FREQUENCIES AS THE BASE FRAMEWORK VERSUS REGULARLY MOUNTED SOLAR ARRAY

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Flat configuration of solar cells allow maximum performance during peak sun hours. However, this configuration is known to be inefficient due to loss of sunlight-capturing ability on certain angles particularly at early and late phases. The aim of this study is to determine if spherical forms of geodesic domes that statically follow the sun's path as foundation for solar cells can present an extended period of maximum performance. Three geodesic domes with frequencies of 1v, 2v, and 3v, and one flat set-up were built and mounted with the same number of solar cells. A rotating structure for an incandescent lightbulb was then built as artificial sunlight. Testing was done at angles from 0° to 180°. Electrical output and lux of each set-up was measured to obtain the total wattage and consistency in terms of output and light-capturing ability. The following values were obtained for the three domes and flat set-up, respectively. 1v dome: 5.85W with 0.71 correlation. 2v dome: 1.88W with 0.95 correlation. 3v dome: 1.44W with 0.82 correlation. The flat set-up: 11.77W with 0.09 correlation. Comparing all three domes, the 1v dome had the highest total electrical output and more consistency than the flat set-up.

703. COMPARING THE PHYSICAL PROPERTIES OF THREE DIFFERENT FORMULATIONS OF BIOPLASTICS AND A PETROLEUM PLASTIC

Jillian Jankowski, Block 3 Science class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Dr. John Wnek

Every year plastic pollution on earth increases by 300 tons due to their inability to biodegrade. Scientists are continually trying to find an environmentally sound solution that will not be harmful to the planet. One solution is utilizing bioplastics to successfully replace petro plastics. Bioplastics are made from bio-polymers which naturally biodegrade due to their place in nature's cycle of renewal. The goal of this experiment is to compare the biodegradability in soil and saltwater, and tensile strength of three biopolymer plastics (bioplastics) and a synthetic polymer plastic (petro plastic). In this experiment, the physical properties of a petro plastic along with starch, agar, and gelatin bioplastics were compared. Three of each were placed into the soil, saltwater, and were tested for tensile strength. It was hypothesized that starch would have the fastest biodegradability rate in soil and salt water, and gelatin would have strongest tensile strength. The results did not fully support the hypothesis. When the results were analyzed it was determined that agar had the highest tensile strength, gelatin had the fastest biodegradability rate in soil, and starch had the fastest biodegradability rate in saltwater.

PHYSICAL SCIENCE AND ENGINEERING (CONT'D):

704. HOW CERTAIN NANOMATERIALS CAUSE VIBRATIONS IN FIELD HOCKEY STICKS

Haley Korwan, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

The stick is the most important piece of equipment in field hockey. As the sport evolves, the composite materials used to create a stick are becoming stronger. Sticks can be made up of combinations of Carbon, Fiberglass, Aramid or Kevlar®. Carbon produces such a force that result in great vibrations, many sticks will be balanced out with either aramid, fiberglass, or Kevlar®. These materials are considerably weaker than Carbon, but this means it dampens vibrations. Fiberglass and aramid should resist fatigue, which would allow for great control due to increased impact absorption. Each stick tested incorporates different percentages of each material, which projects different vibrations. The sticks that were chosen have the same weight of 530 grams, 36.5 inches (93 cm) in height, and a bow of 25 mm. Sticks with more carbon produce both greater vibrations and overall feel of a stick. A stick with 100% carbon should be used by more experienced players since they are less forgiving to absorption by about 2 Hz. The significance between an 100% carbon stick and a 70% carbon stick can result in better ball control for a less experienced player, and decreased sting and shook up the stick.

705. THE ACCURACY OF GLOBAL POSITIONING SYSTEMS IN ANDROID AND IPHONE MOBILE DEVICES

Dominick Mustaro, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

The technology used in mobile devices is constantly evolving. Every year, there are many new phones released worldwide. As the components of the phones are continually upgraded, people are more likely to utilize the functions the phone offers instead of using an older form of electronic. The GPS in phones is used every day to navigate to certain places. In addition, it is used in field work to find coordinates and calculate distance. But how accurate exactly are these phones? In my tests, I traveled to five different areas and searched for survey markers in the ground, objects that are placed to measure distance and elevation of areas in order to accurately plot coordinates on maps. Survey markers provide a way to compare the coordinate measure of a phone to that of the correct measure. By hovering four different mobile devices over each marker, an iPhone 6 Plus, an iPhone X, a Samsung Galaxy Note 8 Phone, and a Samsung Galaxy Tab S2, I was able to note down the coordinates they were reading and compare them to those of the survey markers. This data is important because it shows that the Samsung devices could find coordinates better than the iPhones when being compared to the markers.

706. A TECHNICAL ANALYSIS OF PIXELS AND THEIR COMPONENTS

JP Ostapovich, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey, Mr. Brian Jones, Mr. John Ostapovich, and Mr. David Pitts

Pixels are everywhere, from smartphones to jumbotrons. The technology behind these engineering masterpieces is now being put into Christmas lights. Technology from the entertainment industry, has come together to create a system for these to work. I have a system at my house and have researched how it works. First, you program the sequence into a computer application called xLights. Then, using a web server, you input the files on to the Falcon Player (FPP). The FPP outputs the files to the F16V3 or AlphaPix4 Controllers using E1.31, a standard first pioneered by ESTA for the theatre industry. The F16V3 uses an FPGA (Field Programmable Gate Array) in VHDL (VHSIC (Very High Speed Integrated Circuit) Hardware Description Language) code to output to the lights. The AlphaPix4 Controllers output to the lights in DMX512, a computer language from the show industry. DMX uses binary data, that can only equal the numbers 0-255. The pixels have three inputs for data. The binary from the DMX corresponds to how much light goes into each LED that makes up the interior of the pixel. That is how the pixels operate, from the computer file to the light you see in beautiful colors.

PHYSICAL SCIENCE AND ENGINEERING (CONT'D):

707. THE VARYING DESIGNS OF WINDBREAKS AND THEIR EFFECTIVENESS

Madelyn Privett, Block 4 Science Class. Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

Wind damage is a common issue in many countries. One solution for reducing wind damage is to use windbreaks. Windbreaks are used to block and redirect wind. Some factors that increase the strength of windbreaks are length and height, and internal/external structures. For example, porous structures are better at redirecting wind, and an increased surface area will block wind. The hypothesis of this project is that the surface area of a structure will not affect the success of reducing drag, but rather the design. Five different sample structures were designed by me. They were then built out of wood. The designs were then placed into a filled tub for testing. Using an ink test, we were able to determine the amount of time it took for the ink to travel from 10 cm to the design. With the data gathered, I could calculate drag force. Design 1 had the highest surface area but the lowest drag. Design 2 had a lower than average drag. Design 3 had a higher than average surface area. Design 4 had the lowest surface area, but it didn't have the lowest drag. Overall, a low correlation was identified between surface area and the drag force.

708. THE REACTIONS OF DIFFERENT MATERIALS WHEN CHANGES IN PRESSURE ARE APPLIED IN A VACUUM CHAMBER

Jack D. Putnam, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Boyle's law, a gas law, states that the pressure and volume of a gas are inversely proportional for a fixed mass when the temperature remains constant. A proportion exists between the amount of gas that is compressed and the amount of pressure applied; $P_1V_1 = P_2V_2$. One way to observe this scientific law is to use a vacuum chamber in order to lower the air pressure beyond that of the atmospheric pressure. Using common household materials, various mediums were placed in a container and observed while the air pressure was decreased. Inside the vacuum chamber, the balloon, shaving cream, and marshmallows expanded causing an increase in volume when the air pressure decreased. When hot water was placed inside the vacuum container and the air pressure was decreased, there was no noticeable difference in the volume. Unlike the balloon, shaving cream, and marshmallows, water exerts its own pressure and therefore, cancels out any decrease in air pressure. Atmospheric pressure pushes on the balloon, shaving cream, and mini-marshmallow; however, once in a vacuum container, the air trapped inside those materials pushes out causing them to expand. A proportion does exist between the amount of gas that is compressed and the amount of pressure applied; when pressure is increased, the volume does decrease, and when the pressure is decreased, the volume does increase.

709. CAN EELGRASS (*ZOSTERA MARINA)* BE AN EFFECTIVE HOME INSULATOR COMPARED TO MODERN DAY INSULATION?

Cassandra Vongrej, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Insulation is an important part to home construction, and is a material used that reduces heat loss and gain by providing a barrier between a home and the outside temperatures. Eelgrass insulation dates back to the Middle Ages, and was very popular. Advancements in home insulation were made, and fiberglass became popular. The objective of this experiment was to see if eelgrass insulation would be as effective as modern insulation. Three structures were built, each filled with different insulation material. One with fiberglass insulation, another eelgrass, and one with a combination of both. A light bulb was placed inside each structure, along with a digital thermometer. Three tests were conducted, each over a 2 hour period, with 15 minute intervals. For one hour the light bulb was on, and off the other. This tested retained heat. The data was analyzed by observing how well each structure maintained internal temperature, as well as the maximum high temperature. It was determined that although each of the structures were able to maintain heat well, the combination insulation worked best. The fiberglass insulation was able to reach higher temperatures, but was unable to maintain those temperatures over time, and the eelgrass insulation was unable to reach higher temperatures, but maintained the temperatures longer.

ZOOLOGY:

801. *BRANTA CANADENSIS'* ROLE IN SEED AND PLANT DISPERSAL

Logan Bukowski, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Dave Werner and Dr. John Wnek

Canada geese (*Branta canadensis*) are known to consume up to four pounds of various plant life per day. These birds are thought to have a weak digestive system, creating stools within an hour of eating. This is a lot of feces that may contain undigested seeds. If there are any undigested seeds in the feces, they could grow into plants when deposited. This would spread invasive species of plants into new areas. A Canada goose's diet depends on where the bird lives and what is readily accessible in that area; therefore, the diet of one flock of geese to another will vary. Four diets of Canada geese were sampled in this experiment. These diets included geese who feed in salt marshes, geese who feed in residential parks, geese who feed in horse paddocks, and geese who feed in soybean fields. Fifteen samples of fecal matter were collected from each of the four settings. The samples collected were then pushed through a filter. Each sample was thoroughly investigated for any undigested seeds. The salt marsh, recreational park, and horse paddock fecal samples did not contain any seeds. However, the soybean field diet contained three soybean seeds. All in all, the likelihood of geese contributing to the migration of seeds is not very plausible because only three seeds were found in a total of sixty samples of fecal matter.

802. THE EFFECT OF VARIOUS BYCATCH REDUCTION DEVICE DESIGNS ON THE CAPTURE OF *MALACLEMYS TERRAPIN TERRAPIN*

Mackenzie Fries, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. David Werner.

With the use of commercial-style crab pots, catching and harvesting crabs has become much less of a challenge. However, these crab pots can easily become a major source of death among different types of animals. One victim of these 'ghost pots' is the Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*). Terrapins, like the crabs, often cannot push back through the opening after accessing. Stuck there, many of them starve or drown. Devices called Bycatch Reduction Devices (BRDs) have been developed, which hinder the terrapins' ability to access the crab pots. These devices are rectangular in shape, but a different shape may be more efficient. Various BRD shapes were tested, to see if they will work better, so triangular and square BRDs were attached to the crab pot and placed into a controlled tank with terrapins and other animals. The number of times the crab pot was accessed, and how many of those times resulted in the terrapin escaping versus drowning was among the data collected. This was repeated for each shape: rectangular, square, and triangular, with the rectangular BRDs being the control. The behaviors were analyzed and converted into behavior intensity scales. After analyzing the results, the conclusion was made that triangular BRDs function the best since terrapins struggled the most to get inside and the drown percentage was the lowest of all the BRD shapes.

803. THE EFFECT OF COPPER SULFATE ON *PALAEMONETES PALUDOSUS*

David Gelinas, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Copper is a substance that is detrimental to the oceanic environment because it is considered lethal to many invertebrate species. The purpose of the project was to test the effect of copper on the marine environment by determining lethal concentrations. Several trials were conducted in fish tanks (called systems) using *Palaemonetes paludosus*, ghost shrimp, as the invertebrate species. For each trial, using different levels of copper, a control system was run in conjunction with the experimental system. In all systems the pH, temperature and volume of the water were kept the same throughout the experiment. Copper sulfate was dissolved into the water of the test tank at predetermined concentrations. Shrimp mortality and changes in their general behaviors were noted over time. The results from this experiment indicated that for a concentration of 2.4 grams of copper in 16 L of water, led to almost a 100% mortality of shrimp within the first two hours of the experiment. In other trials, it was concluded that shrimp exposed to that same concentration of copper-treated water for less than thirty minutes were able to recover in clean water. The results of this experiment are important, as invertebrates exposed to higher dosages of copper over a brief period may not be as susceptible to mortality as those exposed to dosages over longer periods of time.

ZOOLOGY (CONT'D):

804. HOW IS *PALAEMONETES SPP.* AFFECTED BY TYPES OF SALT THAT ARE COMMONLY USED TO MELT ICE ON ROADWAYS?

Kiernan Geoghegan, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Every winter various parts of the United States are hit with blizzards and snowstorms throughout the colder parts of the year. To counteract the frost and layers of ice that these storms leave on roadways local and state governments will cover the roads with salt. As the ice melts the salts will dissolve into water, the water will run off and eventually find itself in larger bodies. This introduction of salts into the water can greatly affect local species. This experiment was conducted to find out how these salts affected a species of local shore shrimp, *Palaemonetes vulgaris*. One hundred twenty shrimp were tested in four different types of water. Thirty were used as a control and placed in bay water taken from the Barnegat Bay. The remaining 90 were divided among containers with calcium chloride, magnesium chloride, and sodium chloride added to them. The effects of these substances were monitored for twenty five days. Calcium chloride proved to have the highest mortality rate among the three tested substances.

805. THE EFFECTS OF SEDIMENT ON *GEUKENSIA DEMISSA'S* ABILITY TO FILTER

Lindsey Hancock, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. David Werner

Sediment is a natural form of matter, made from the decaying remains or dead organisms that is commonly found in waterways. However though it may be natural, according to the Environmental Protection Agency (EPA), fine sediment is the leading cause of pollution in rivers, streams, lakes, and reservoirs. Fine sediment is considered sub sized particles that combine with larger particles, ultimately not letting light through. Sediment enters our waterways through stormwater runoff. Runoff occurs when there is not enough pervious surfaces to absorb the runoff from a storm event. Runoff from roofs, paved areas, and lawns combines with eroded sediment then enters waterways. The goal of this experiment was to find if the Atlantic ribbed mussel (*Geukensia demissa*), was able to filter varying amounts of sediment from the water. Throughout a period of three weeks, varying amounts of silt, was dispersed into three separate, 10 gallon tanks. Each tank holding 100 mussels each. The varying amounts of silt, ¼ cup, ½ cup, and 1 cup, was added to the water, then after six hours samples from each were collected. Temperature, and salinity was recorded daily to maintain filtering stability. Using a turbidity meter, the results were analyzed. Analyzation showed that after the six hour period, the bivalves decreased the amount of sediment in each tank by 30%, 45%, and 60%. The results of this experiment suggest that *Geukensia demissa* can be a cost effective, and natural alternative to the rising sediment pollution problem.

806. FEEDING HABITS OF *ILYANASSA OBSOLETA*

Sam Morabito-Pipher, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. David Werner and Dr. John Wnek

Ilyanassa obsoleta, or the Mudsnail, is an invasive species found that can be commonly found on the east coast of the United States, its native range. When introduced into a foreign environment, the Mudsnail becomes a huge competitor for native species of the region. This behavior could greatly be attributed that *Ilyanassa obsoleta* is a facultative scavenger, meaning it will eat anything sustenance it finds for survival and obtains it by any means necessary. The Mudsnail is commonly attributed to eating mollusks, crustaceans, fish remains, among other organisms generally found in its habitat. An experiment was conducted to observe the differences in feeding habits of *Ilyanassa obsoleta* when introduced to shrimp and bay scallops, things it feeds on naturally, and lettuce and carrots, things it would not find naturally. All options were tested separately and for a period of time in a water basin containing 27 Mudsnails taken from the Barnegat Bay. It was found that when fed shrimp; the snails ate more grams per day than any other option. Lettuce was eaten the least, this could be due to the fact that shrimp are found in Mudsnail' natural environment and lettuce is not.

ZOOLOGY (CONT'D):

807. ANALYSIS OF COMPETITION BETWEEN *CALLINECTES SAPIDUS* AND *CARCINUS MAENAS,* REGARDING THE QUANTITY OF EACH SPECIES

Lexi Pereira, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Jason Kelsey and Dr. John Wnek

The presence of green crabs (*Carcinus maenas*), an invasive species, in Barnegat Bay is having a perilous effect on our ecosystems. Due to the lack of predators, green crabs are flourishing, while populations of other inhabitants of the region are declining. Blue crabs (*Callinectes sapidus*) are one of the numerous species affected by the introduction of green crabs. The relationship between blue and green crabs, in correlation to different quantities of each, was determined by three parameters: the average centimeters moved per minute, average seconds to obtain a piece of bunker fish, and the number of times blue and green crabs attacked each other or their own species. To conduct the experiment, different combinations of blue and green crabs, of similar sizes, were placed in the same container with a piece of bunker fish in the middle. It was found that intra-species competition occurred between the blue crabs. The blue crabs disregarded the green crabs and competed with each other. In every trial that involved one or more green crabs, the green crab obtained the food and avoided conflict with the blue crabs. The results showed that blue crabs do not promote a dominant characteristic over green crabs while competing for resources.

808. THE EFFECTS OF PREDATORS ON *MERCENARIA MERCENARIA* SURVIVAL INSTINCTS

Jessica Sweet, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisor: Dr. John Wnek

Hard Clams, scientifically called Mercenaria mercenaria, live in intertidal zones, with abundant predators that more commonly preyed upon while they're within a few months of age. My experiment tested whether despite their size, if the younger clams will have the ability to hold more weight than larger clams, due to that younger clams need to protect themselves against predators more often than larger clams. To test this hypothesis, I tested the strength of clam shell at two different sizes, by placing weights on top of them to track at what point the shells gave in. This process was completed 180 times, with 150 smaller clams and 30 full size. My results showed that the smaller clams could not hold more weight in total compared to the full size clams, but the ratio of grams held per gram the clam weighs showed that the smaller clams had a higher result, proving my hypothesis to be correct. One possible reason for this is that the smaller clams have adapted to build up a stronger defense system to keep predators from entering their shells. This data gathered is important to conservations because sanctuaries attempt to increase the amount of commercial supplies while maintaining the clam population

809. THE EFFECT OF SALINITY ON THE STROBILATION OF *CHRYSAORA QUINQUECIRRHA*

Devyn Walkowicz, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisors: Mr. Jason Kelsey

A problem facing many properties, businesses, and people around Barnegat Bay and its connected waterways is the overabundance of Atlantic Sea Nettles, scientific name *Chrysaora quinquecirrha*. The rising reproduction rates can be attributed to many things such as rising water temperatures and eutrophication, but does the salinity of different areas affect the rate at which *Chrysaora quinquecirrha* polyps strobilate? In order to find if there is a correlation between salinity levels and polyp strobilation, three tanks were set up to account for varying salinity levels in Barnegat Bay, separated by high (30 ppt), low (17 ppt), and intermediate (24 ppt) salinity levels, with 12 polyps in each tank. Data was collected by counting how many polyps were in the tanks within three day intervals. The data was analyzed to find the percent increase between the beginning and end of data collection. There was, in fact, a correlation between the three sets of data collection, with the lowest salinity having the greatest percent increase, and the highest salinity having the lowest percent increase. This can be applied to real situations by showing that the influx of freshwater into Barnegat Bay is affecting how *Chrysaora quinquecirrha* strobilate as well.