

A STUDENT JOURNAL OF ECOLOGICAL AND ENVIRONMENTAL SCIENTIFIC INVESTIGATIONS

Findings

FROM THE FIELD

JUNE 2024 — VOLUME 7

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Gulf of Maine
Research Institute

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Note from the editors

Findings from the Field is an intergenerational community of scientists dedicated to ecological research. Taking account of the shifts and changes in the world around us has never been so important and pertinent as it is now. Climate change becomes more visible every day and our observations are the key to resilience and adaptation. By asking questions, making observations and sharing their findings, teachers, students, scientists, both professional and community, are working towards better understanding our habitats, animals, and plants. The Findings from the Field journal is a collection of their work, written by and peer reviewed by students in classrooms around Maine and New Hampshire. Volume 7 saw 159 submissions and over 165 peer-reviews completed from 14 classrooms, resulting in 8 Research Articles and 17 Nature Notes accepted for publication. The work selected through this process represents an impressive level of scientific engagement amongst the students in our community. In addition to the journal, we hosted the first, in-person Findings-dedicated research symposium which brought together scientists, teachers, and over 50 students to share their scientific thoughts and discoveries. We are so grateful for every submission to Volume 7 and for the dedication and participation of everyone in this community. We look forward to continuing to foster, share, and celebrate student scientific work in the coming years.

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The Effect of Humans on Mammal Presence in the Casco Bay High School Wetlands

Faisal A, Casco Bay High School, Age 16

Abstract & Introduction

In a world in which the human population is constantly developing I am interested in how human activity contributes to the prevalence of wild mammals. That is why my investigation tested the relationship between mammal presence and human activity in the Casco Bay Wetlands. Data was collected by a motion-activated trail camera set up in the Wetlands from October to December 2023. The trail camera captured pictures of humans and mammals. The data collected shows there is a strong correlation between mammal prevalence and observations of humans. During the experiment, mammal prevalence decreased during human activity in the Wetlands. According to a scientific article ("NCBI, 7 June 2022"), the author states that wildlife shifts habitat use in response to variations in recreational pressure. The statistical test I did was the linear regression test. I chose the null hypothesis because I got a p-value of <0.01 , which means there is extremely strong confidence that there is a significant relationship between mammal prevalence and human activity. The mammal types include wild and domesticated mammals, humans, and their dogs. Humans count for a high percentage because the experiment location is on a hiking trail system. To conclude the investigation, there is a strong relationship between mammal prevalence and human activity. This matters because it helps answer scientific questions surrounding this.

Methods

To address the research question "How does human activity affect the prevalence of mammals in the CBHS Wetlands," our procedure involves several key steps. First, we carefully selected the study area to ensure it encompasses a range of mammal species while also exhibiting moderate levels of human activity. The variables and controls include the independent variable of human activity degree and the dependent variable of mammal prevalence, with controlled factors such as location, period, and habitat type. We utilized trail cameras, specifically the WOSPORTS Mini Trail Camera, to capture images of mammals and human activity in the Wetlands. During camera placement, we captured mammal presence frequency and habitat characteristics. We then analyzed the captured data, identifying and quantifying mammal frequency. We also used a Google form to further assess our data. Statistical analysis was then conducted to correlate mammal prevalence with varying degrees of human activity. Finally, I interpreted my findings, drawing conclusions based on observed trends or relationships between human activity and mammal prevalence. Throughout this process, I considered limitations and identified further data needs to ensure the reliability of my research findings.



Figure 1: Human activity occurring in the CBHS Wetlands.



Figure 2: Trail Camera Image of a fox captured in the Wetlands during the night.

Row#	Day	Observation (Species & number) [Human]	Mammal Count
	Numeric	Numeric	Numeric
1	1	1	0
2	2	0	0
3	3	0	0
4	4	0	0
5	5	0	0
6	6	0	0
7	7	0	0
8	8	0	0
9	9	0	0
10	10	0	0
11	11	0	0

Figure 3: Day count recorded with each day showing observation of human and mammal count.

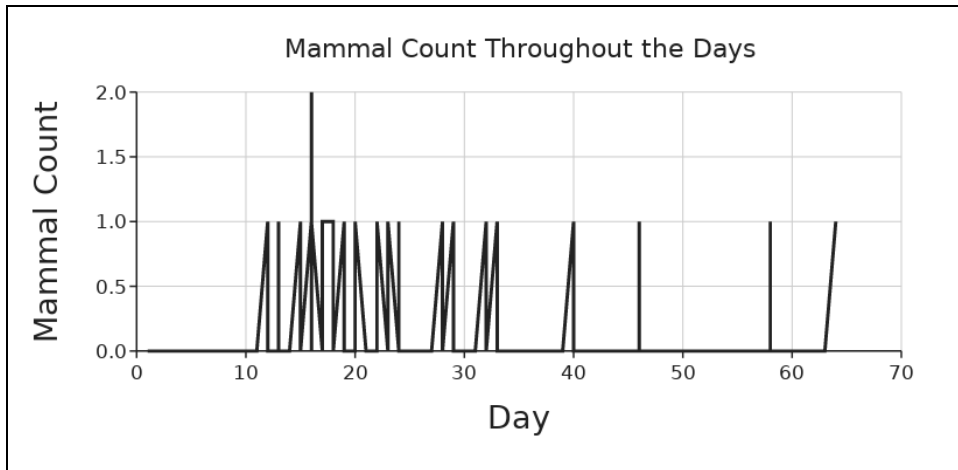


Figure 4: A dotted Graph with connected lines shows the relationship between mammal counts over a 70-day time period.

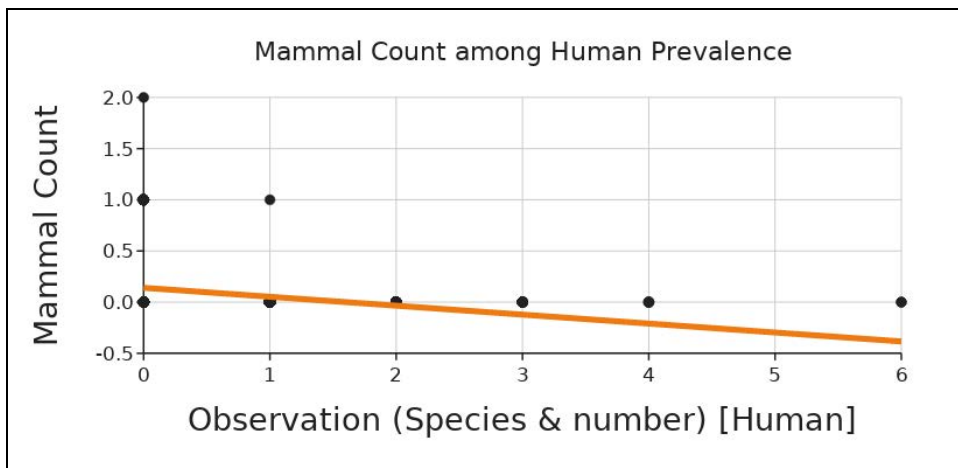


Figure 5: Dotted Graph that shows the relationship between mammal count and the number of humans recorded.

Results

Before conducting the statistical test to get my results, I observed the trends of the graphs, there happens to be a regression trend in both graphs. A regression line measures the average relationship between two variables in a scatter plot. The statistical test I did was the linear regression test. I chose the statistical hypothesis because I got a p-value of <0.01 , which means there is extremely strong confidence that there is a significant relationship between mammal prevalence and human activity. Mammal types include wild and domesticated mammals, humans, and their dogs. Humans count for a high percentage because the experiment location is on trails. The graph to focus on is the mammal count among human observations, it shows us a regression line that was interpreted by the data collected.

Conclusion & Discussion

The results of the statistical analysis revealed a significant regression trend indicating a strong relationship between mammal prevalence and human activity within the CBHS Wetlands. This finding highlights the influence of human activities on the occurrence or frequency of mammals in close proximity to or interacting with human populations in the area. The implications of this relationship are profound, suggesting that human activity is shaping the ecosystem dynamics and potentially impacting mammal populations. Understanding the drivers of this relationship is crucial for effective conservation and management strategies in many regions. My research holds significance as it unveils the direct influence of human activity on mammal populations within ecosystems such as the CBHS Wetlands. By highlighting these dynamics, we contribute valuable insights to conservation efforts, guiding the development of strategies that foster sustainable coexistence between human communities and wildlife. The analysis and existing research indicate a significant link between human activity and mammal prevalence, notably in the CBHS Wetlands. This highlights the vulnerability of wildlife to human disturbances. Urgent conservation efforts and collaborative strategies are crucial to mitigate these impacts and achieve a balance between human needs and wildlife conservation. Overall, my results support my hypothesis of whether human activity affects the prevalence of mammals.

Future Research

Further research could delve into specific mechanisms driving these changes, informing targeted interventions to mitigate adverse effects on mammalian biodiversity while promoting sustainable coexistence between humans and wildlife.

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How the Population Of Green Crabs Has Changed Over Time

Madden B, Bath Middle School, Age 13

Introduction

Invasive green crabs impact the environment. Green crabs are uprooting the eel grass, so they can find their prey easily. Eelgrass cleans the water and produces oxygen; it also protects the coastline; without it the water would be a lot dirtier. Green crabs are burrowing into the salt marsh and damaging the roots, causing them to collapse on themselves. Salt marshes help maintain water quality. If green crabs keep burrowing into salt marshes they will eventually break down and it will affect fishers because they have nowhere to stand while fishing. The increasing number of green crabs is decreasing the number of clams. The crabs are eating the clams. Clams are a lot harder to find. If the amount of clams goes down, the price of clams will increase by a lot.

The Gulf of Maine is changing. The Gulf has been warming three and a half times faster than the global average (Moran, 2023). The water is getting warmer because the water is sucking up all the heat from the atmosphere, and it's making the water heat up. Blue crabs are one of many species that are expanding their range into the Gulf of Maine, which is one of the fastest-warming parts of the Atlantic. Marine species that we've historically seen thriving in the region are migrating to cooler waters (Reidmiller, 2023).

Green crabs are being researched. The 7th graders of BMS went to Reid State Park and went looking for crabs to research. Their teacher put traps in the water for them and when they took them out we found many crabs, lobsters and more. Many scientists have been watching the population of green crabs and seeing if we need to kill them or if there's a way to stop them from breeding as fast. In 2023 did the green crab population go up or down in the past 5 years in Reid and Popham?

Methods

On November 11/3/23, we went on two field trips, one to Todd's landing and the other one to Reid State Park. We stopped at Todd's landing first and pulled some traps out of the water, and we found some green crabs. We put them in buckets and brought them with us to read. We counted every crab by hand and checked the gender of them all and put them on a data sheet after we found them and then put them in a bucket, studied them more and then released them.

Our teacher set up traps in the water the day before, and we went to them, and they were still underwater, lucky luck even though it was low tide. We put 2 tins of sardines into the traps to attract green crabs and more species such as lobsters. We got all the crabs out and checked if there was a male or female, how big a is and the species. We went for 3 days, so there were no

flake days, like having high tide and not catching anything, so that's why we went 3 days. And we had groups count how many they found. We made sure we didn't catch the same crab twice by painting the spine of the crabs with nail polish. We put all the green crabs in a bucket after we have finished and put them back in the water. We would mark them with nail polish before putting them in the water and when we come back the next year we can see if we caught a new crab or the same one.

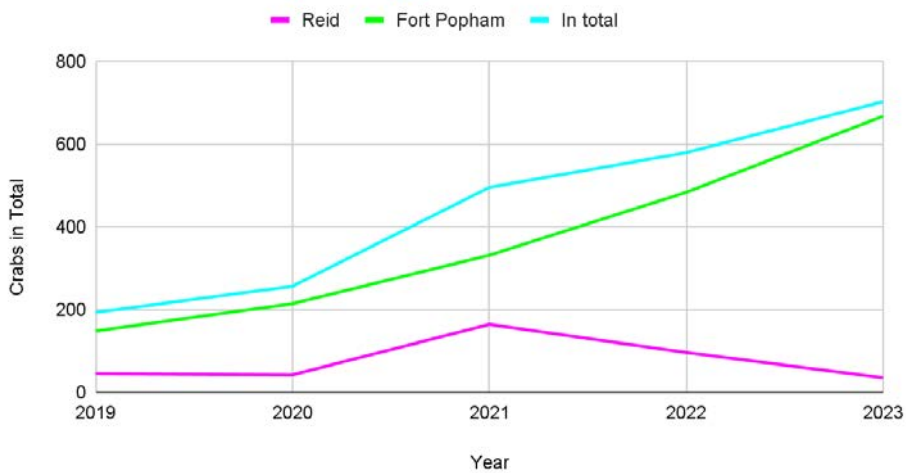
Results

I'm in the class that collected the data from 2023. Every year before 2023 was done by students before me and their date was kept online and I looked at it and added it to my own data.

This is the amount of crabs caught at Fort Popham and Reid in the past 5 years.

Year	Reid	Fort Popham	In total
2019	45	148	193
2020	42	214	256
2021	164	331	495
2022	96	483	579
2023	35	667	702

Amount of crabs caught every year



The amount of crabs at Fort Popham is on a steady increase every year and Reid peaked in 2021 and is slowly on its way down. The overall amount of crabs caught at both of these locations has only increased over time.

Discussion and Conclusion

With all this data, it shows that the green crab population is going up at Popham but is decreasing at Reid State Park. In the past five years, we have noticed that Fort Popham started at a little less than 200 crabs in 2019, but it's at over 600 caught in 2023. Reid started at barely 50 crabs caught in 2019, then peaked at around 150 in 2021 and has proceeded to decline over the past few years and in 2023 only around 50 crabs were caught, just like in 2019. This increase at Fort Popham makes the overall of both go up even though Reid is on the decline. In an article by Kennebunkport Conservation Trust, it states that "The increase in the invasive green crab population correlates with the rise in ocean temperatures." If 2024 is a hot year again then the green crab population is likely to go up at Popham.

Out of every year that we have gone to Reid State Park there have only been 5 recaptures since 2015-2023. At Fort Popham there were 7 recaptures from 2015-2023. The reason that only 7 recaptures over 8 years are so important is because this proves that the green crab population is growing at such a fast pace we can't even catch the same crabs again. This means that the green crab population needs to be monitored in different places.

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Thank you RSU1 for funding our buses to take us on the field trip.

The Changes In Crab Population In All the Sites Since 2013

Josephine D, Bath Middle School, Age 12

Introduction

Green crabs first came to America in the 1800's. Nearly 200 years later, their population has grown exponentially, especially in recent years. Studies have shown that green crabs thrive best in warm oceans. This could be one of the many effects of climate change on the East Coast and the Gulf of Maine. (Friends of Casco Bay, 2023).

Green crabs originated in Europe, eventually coming over to America. They can negatively affect the environment and industries. European green crabs were transported to America in the mid-late 1800's, through the ballast of cargo ships. When water was let in, they slipped inside, and when the water was let out, they were released into the Gulf of Maine. Green crabs can be identified by their shape and spines. They often have a distinct pentagon shape, and five spines on each side of their shell. Though they are called green crabs, they are not necessarily green. A green crab's coloration can range anywhere from red to dark green (Casco Bay Estuary Partnership, 2013).

Global warming is influencing the water's in the Gulf of Maine, which spans part of Canada, Nova Scotia, and the Northeast the US. One of the major effects of global warming is melting glaciers in the Arctic. As more of the ocean becomes heated up, the cycle of currents from the equator to the poles is disrupted. Water is traveling to the Arctic warm, and melting glaciers there. This causes water to flow down to the rest of the world, including the Gulf of Maine, which is one of the fastest warming bodies of water in the world. (Gulf of Maine Research Institute, 2023) Because of this, the sea level in the Gulf of Maine is rising at an exponential rate, causing some coastal areas to flood. Because of warming water, certain sea life such as cod, lobsters, and clams, are moving away because they can't thrive in warm water. Contrary to that, other sea creatures, such as green crabs, and other invasive species, are flourishing in population due to the warm water.

Scientists have been researching green crabs for a long time. What they are, what they look like, how to exterminate them. Something that scientists have been researching is the green crab's impact on industries. Green crabs are omnivores, meaning they can eat pretty much anything, but mainly dines on shellfish, including clams. The clamming industry is one of the largest industries in Maine's seafood sector. A large portion of jobs in Maine are in seafood industries, and many residents just lobster or fish for fun. Green crabs eat clams and other shellfish, causing the populations of these species to drop. This is a problem because many workers depend on shellfish for money, and without them, they could experience problems in their lives. Another negative effect the green crabs have on the environment is the destruction of eelgrass. Green crabs hunt baby lobsters, and eelgrass beds provide safe nurseries for the

babies to grow. Green crabs destroy them, snipping them at the base to kill the baby lobsters. Eelgrass also helps keep the sediment stable and in place. Destroying eelgrass beds can cause the shore to erode (Rossong, 2012).

For years now, Bath Middle School seventh graders have been researching the fluctuations in green crab population. With the data from other investigations, we now have a new question: How has the green crab population changed in our different sites over the years? This year, my class went to Reid State Park to check out crab traps that had been set the day before. We cataloged multiple things about the green crabs. We discussed how warming ocean temperatures have caused the green crab population to rise. Learning this helped us understand how green crabs affect the Gulf of Maine.

Methods

Bath Middle School students have been researching green crabs for many years now. The science class from BMS Seguin house went this year from November 1st to November 3rd. My group went first to Todd's Landing to check crab traps, then to Reid State Park to collect data on crab traps and quadrat areas. A different group from the seventh grade Acadia house went to Fort Popham. Something the group that went the day before noticed was that the water they were in was not true low tide. The traps were all in water for at least 24 hours, and after being checked, were reset in the exact same spot. Despite there being a half full can in most of them, we put two cans of oil marinated sardines in the traps for the bait to make the catch fair.

Along with the caught crab statistics, we also recorded by-catch that was found in the traps. By-catch means creatures that are caught in the trap that aren't crabs. These can include but are not limited to lobsters, fish, and periwinkles. A few of the details we recorded about the crabs caught were size, sex, color, if they were aggressive, and the number of claws and legs. We record this data to learn how green crabs thrive and their population. Though it was difficult to determine if a crab was aggressive, aggressive crabs push out their claws and legs, and will try to snap at someone who holds them. Both of these things would require further research. We measured crabs using the same way that scientists do by measuring in millimeters from spine to spine. To tell the sex of the crab, you must check its underbelly. If it has a triangular shape on its underbelly, it is a male. If the shape is more rounded, slightly like a beehive, then it is a female. There were a few traps pulled at the first site at Reid, and several more pulled at the Reid Intertidal zone.

Part of making sure that the data was reliable is collecting data from different sites and times. This makes sure the data is not centered on one specific location, and has data from separate areas. This is done to collect more exact data about specific crab areas. Two groups of students would work together, one group gathering data and the other group double checking it. This helped to make sure that the color recorded was exact and that the size was not rounded.

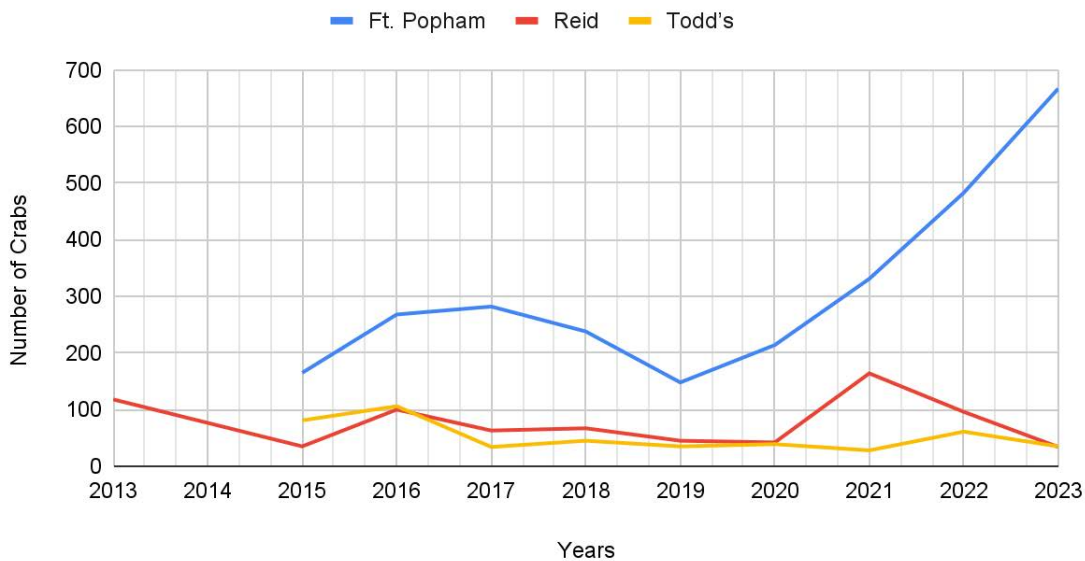
Results

In the following graphs, I'll be comparing the amount of crabs in each site over the years, as well as the amount of male and female green crabs in each different site for all years.

Year—Site	Ft. Popham	Reid	Todd's
2013	*	118	*
2015	165	35	81
2016	268	100	106
2017	282	63	34
2018	238	67	45
2019	148	45	35
2020	214	42	39
2021	331	164	28
2022	483	96	61
2023	667	34	35

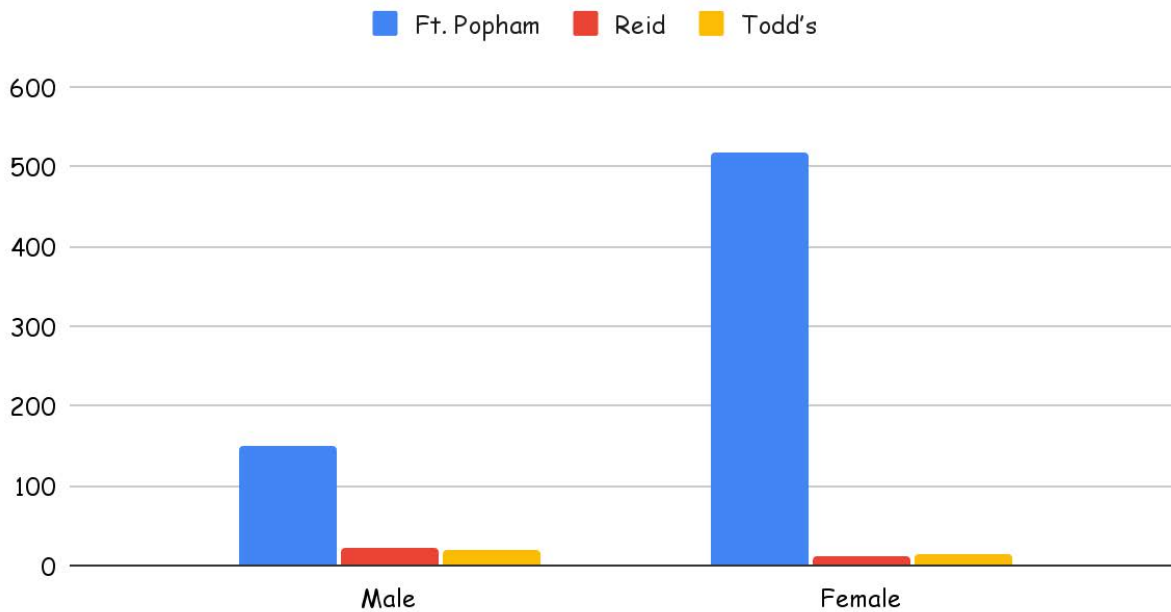
*No data collected that year

Ft. Popham, Reid and Todd's



These displays show the amount of crabs caught each year. Fort Popham has shown itself to contain most of the outliers, its numbers ranging from 165 to 667. It starts out low, but turns sharply upward around 2021. Reid is relatively steady, but around 2021 the numbers spike to 164. The Todd's Landing numbers start out around 100 crabs, but slopes downward around 2016 to steady out near 50 around 2017. Its ending number, at 2023, is about 30.

Ft. Popham, Reid and Todd's



	Ft. Popham	Reid	Todd's
Male	150	21	20
Female	517	12	15

These data displays show the amount of females versus males at each site. While Reid and Todd's have more males than females, there is a drastic difference between males and females at Fort Popham, the female numbers going up by almost 400.

Discussion and Conclusion

The green crab population has risen differently in Fort Popham than other sites.

My claim is based on the following evidence. As was shown in the results section, the male to female ratio is different in Fort Popham than in the other sites. While Todd's Landing and Reid had male ranges from 20-25 individual crabs, and female ranges from 10-20 crabs, a fairly low population in both sites. But at Fort Popham, the male crab count was 150, and the females 517. This is a higher population than what was found in every other investigation that Bath Middle School students have done since 2015 in Fort Popham.

This could potentially be explained by the location of the sites. Fort Popham is located at the mouth of the Kennebec, where the river flows out into the Gulf of Maine. The fresh water from farther inland mixes with the oceanic salt water. This creates an estuary of brackish water, which green crabs thrive in. Reid, on the other hand, is very rocky, and has shallow, salty water. This

allows for fewer green crabs, and a more diverse ecosystem, including species such as lobsters, Jonah crabs, and rock crabs, all of which were found in the Reid and Todd's crab traps. Todd's is also very different from Fort Popham, as it is a mudflat, with marshy features around the exterior. Underneath most of the mud, it has large, unmoving rocks, as opposed to the sandy beaches of the Popham area.



If this investigation were to be revisited, then I would want to know if the theory that the salinity of the water affects the crab population. This could be looked into by investigating areas with a lot less salt in the water or a lot more.

Acknowledgements

Our thanks goes to Kennebec Estuary Land Trust (KELT), who helped with both the traps and our work and investigation in the field. Thanks to Waypoint at Midcoast Youth Center, we had educators and helpers during our field work. A special thanks goes to Kathrine Cornish, for specific help in the field. And last but not least, the RSU1 School Board and the Bath Garden Club supplied funding for buses and other resources required.

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Milliken Mills Woods has enough HWA for predator beetles to be released

Holden, Lillian, Cooper, Reagan, Kevin, Chloe, Loranger Memorial School,
Age 13

Abstract

Our purpose was to find out the ways Hemlock Woolly Adelgid (HWA) affects Milliken Mills Woods in Old Orchard Beach and where the predator beetles *Sasajiscymnus tsugae* would be most effective. This topic is important due to the growing infestation of HWA in Maine. We adapted the Gulf of Maine Research Institute's protocol to collect data on the amount of HWA and whether it was alive or dead. On March 27, 2024, we found live HWA on 90% of the trees we looked at (9/10 trees were infiltrated with live HWA). Through this investigation we found that trees 10, 4, 6, and 8 had enough HWA to release the St predator beetles.

Introduction

We are investigating the amount of Hemlock Woolly Adelgid on Eastern Hemlock trees and if there are enough to release predator beetles in Milliken Mills Woods in Old Orchard Beach. On March 27, 2024, we went out to see if there was enough HWA on the trees to release the beetles. HWA is a problem because it kills hemlock trees by sucking out the sap and nutrition the tree needs. It takes about 10 years for a tree to be killed by HWA.

One way to fight HWA is biocontrol. *Sasajiscymnus tsugae* (also known as the St beetle) costs \$3 per beetle (treesaverspa.com). The OOB Conservation Commission has ordered 1,050 beetles and they spent \$3000. The beetle has to have enough HWA to live off eating HWA so there has to be HWA on that tree. HWA tends to live on the higher branches and the beetles can fly so if we find HWA on the bottom branches that probably means there is more HWA on higher branches. We learned this information from Colleen Teerling, Maine Forest Service forest entomologist. You need 100 beetles per infected tree. So with 1,050 beetles, we can help 10 trees. We know we'll release half the beetles in other forests so we only need to find 4-5 trees to put the beetles on in Milliken Woods.

This topic of HWA and predator beetles is important to scientists because we are going to be figuring out how effective predator beetles are at eating the HWA. Scientists already know that HWA is spreading throughout Maine and that it damages the trees. ([Hemlock Woolly Adelgid Detections In Maine's Forest Through 2023](#)) Our investigation will add to what scientists know because we will add to their knowledge by finding out how effective predator beetles are at eating the HWA.

This topic is also important to students and the Conservation Commission. Last spring students released

400 predator beetles in Milliken and we want to find out if the HWA increased or decreased.

Our research question is "Does Milliken Mills have enough HWA to release predator beetles this spring?" We predicted that we would find enough HWA to release the predator beetles because last year when we went to Milliken Mills there were HWA and we thought that the HWA wouldn't all disappear.

Methods

On March 27th, 2024 we went to Milliken Mills Woods in Old Orchard Beach Maine. The first step in our process was to look for an Eastern Hemlock Tree that had at least 10 branches that were each 1 meter long. We took photos of the entire tree, the needle-branch attachment, and the tree ID. We also recorded if it was in a forest or a developed area. After that, we looked at 10 unique branches (that are each a meter long) and recorded if there was any HWA. If we spotted any HWA we would do a test to see if the HWA is alive or not. It is called the smear test. The smear test is when you find HWA you would hold the branch in place, use your thumb, and run your thumb along the HWA. If your finger is brown that means it's alive for predator beetles to eat. If it's dry that means it's dead. If we saw any HWA then we would take a picture of the egg sacs on the tree and the finger that we did the smear test with. Then we recorded in our notes how many branches were infested with HWA and whether it was dry or smeared out of the 10 branches. After that we flagged the tree with flagging tape: Green if no live HWA, Pink if live HWA. We then answered yes or no questions about the tree itself including: if it has elongate hemlock scale, if the tree has new growth, a thick canopy, if there are cones, if the tree is close to the trail, and lastly if it is near other hemlock trees. We then repeated the process for 10 different trees.

To get reliable data we did the smear test on multiple branches and after we did the smear test we used a water wipe to wipe our fingers off so we had accurate data for every branch. We also made sure that we flagged the tree to show if it was infested or not. We all collected the amount of HWA/no HWA on branches live or not live (smear test). We all repeated the steps 10 times on 10 different trees so we got the same amount of data on each tree.

Some factors that might have affected the data were the recent rain before we went and how it was cold and there was snow on the ground. Snow and cold weather can kill HWA, also rain can push HWA eggs off their branches. We're confident about our data because before we went to see how much HWA is in Milliken Mills Woods we went to a different forest at Jameson Woods and practiced recording the data.

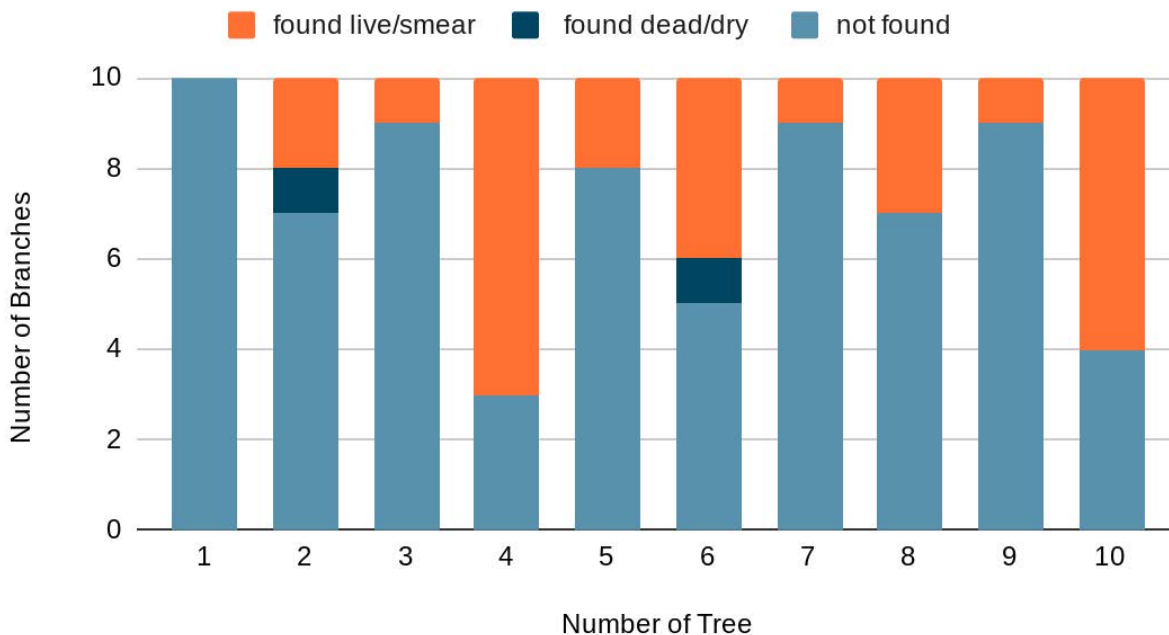
For our investigation, we changed the HWA protocol so we could include data from the smear test. First, on the data sheet, we changed what materials we needed. We needed water wipes to wipe off our fingers when we did the smear test so our data is accurate for every tree. Next, we added a place to record if the HWA was dry or smeared when you do the smear test so that we knew more than if it was found or not. Then we said that we needed to take one more picture of what your finger looked like after you did the smear test so that other people would know what it looked like when you did the smear test. Then we changed what color flagging

tape we used if the tree was infested or if it wasn't. If the tree was infested then we flagged it with pink tape and if it wasn't infested then we used green tape. Next, when you recorded if you found HWA or not we added if it was dry or if it smeared. Finally, we added to the checklist at the end if we flagged the tree or not.

Results

Here is the data we collected.

HWA In Milliken Mills 3/27/2024



The data shows that we checked 10 trees and found live HWA on 9 of them. This means that 90% of the trees we checked had it. Tree 1 might be an outlier because it didn't have any HWA on the branches we checked. The spread of the data is 0-7 so the range is 7. The highest amount of live HWA that we found was 7/10 branches on tree 4. There were a lot more live HWA than no HWA. The most common amount of infested branches was 1 and that was on 3 trees.

The next table shows the data we collected about new growth, thick canopy, cones, and if it was near other hemlocks. All the Hemlock trees were near other hemlock trees, but only 1 tree out of 10 trees had cones on them, 8 out of 9 trees had a thick canopy which is a good sign because when the trees have a thick canopy that generally means that the tree is healthy. 7 out of 9 trees had new growth which is another good sign.

Hemlock Health and Location Data					
Place: Milliken Mills Date: 3/27/2024					
Tree Number	New growth	Thick canopy	Cones	Near other hemlocks	Total points
1	Y	N	N	Y	2/4
2	Y	Y	N	Y	3/4
3	?	?	N	Y	?
4	Y	Y	N	Y	3/4
5	Y	Y	N	Y	3/4
6	Y	Y	N	Y	3/4
7	N	Y	N	Y	2/4
8	Y	Y	N	Y	3/4
9	N	Y	N	Y	2/4
10	Y	Y	Y	Y	4/4

Conclusions and Discussion

We are investigating the amount of HWA on Eastern Hemlock trees in Milliken Mills Woods. Through our investigation we found that 9 out of 10 trees we checked had HWA. Our claim is that we have enough HWA for putting beetles on tree 10, 4, 6 and 8. Our data supports this claim because they have the most live HWA. They also have high scores for hemlock health. They have new growth and thick canopies that shows they're healthy. We want to keep them healthy. They also have enough HWA to harm the tree and enough to feed the beetles. They are also near other hemlocks so the beetles could spread.

Some factors might have impacted our data, like no one collected health data for tree number 3. But tree number 3 only had one branch that was infected with HWA on it. So we would not use that tree to release the beetles so the health data isn't essential.

We observed that Tree number 1 had green tape on it from last year. That means it had beetles put on it last year. This year we found no HWA. That could mean that the beetles got rid of the HWA.

To further this investigation, we could look in the fall or winter to see if there is more or less HWA on all the trees we checked this year. Maybe the trees that we didn't release beetles on will have more HWA next year. Maybe the trees where we release them will have less HWA.

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Effect of Rainwater Water on Wisconsin Fast Plants

Leon M, Lincoln Akerman School, Age 13

Introduction

Studies show that rainwater helps plants grow greener. For example, Bonasila.com did a study on the same topic and this is a quote from their article: "Nitrate, which is naturally present in the rainwater, is a great source of Nitrogen for plants. Nitrogen is among the top nutrient elements that are required for plant growth. Thus, plants grow greener when they are watered with rainwater." (Bonasila, 2021) Could rainwater help plants grow more seeds? My hypothesis is that watering plants with rainwater will help them grow more seeds. The current agricultural system uses tap water from groundwater to water the fields. This produces an average amount of seeds and/or crop, while using rainwater to water agricultural fields could produce more crop, and potentially help to decrease the underfed population. More food could also help the farmers make more money to afford more advanced equipment to grow even more crops. In today's times, science genetically modified plants to create more crops and prevent plant disease. Science should focus on more natural methods of producing more crops and preventing disease instead of using expensive equipment to unnaturally modify plants.

Methods

Tyler and I chose a single variable to test on Six Wisconsin Fast Plant Seeds planted in a 16oz. bottle. We used meter sticks, visually and using a calculator to calculate average seed pods per plant. Our plant was watered with rainwater (our variable) and using a wicking strip. The control's and our plant used potting mix as our soil and 12 Osmolite pellets as fertilizer. Water was added whenever it was low, so almost every day. The plants were under a 40 watt grow light suspended 10 cm from the tallest plant. The experiment ran from Dec. 20, 2023 to Feb. 1, 2024, with plants checked on business days at noon. This is reliable data as Tyler and I checked every business day, and if something seemed off we recounted or re-measured. The plant was placed in the same spot every time we checked it, too. Some possible sources of error could be that the plant tipped over sometimes, as the bottom of the bottle could behave as a ball bearing sometimes. Some seeds could have fallen off during transportation from under the light to my desk. Tyler's watering tactics could have also affected the result. He squirted the water out of the bottle into the bottom, where the wick was located, and ended up spraying the water everywhere. He also watered the plant from the top, too. Algae grew on the wick because of the rainwater having the necessary nutrients for the algae to grow.

Results

Effect of Rainwater Watering on Plant Height

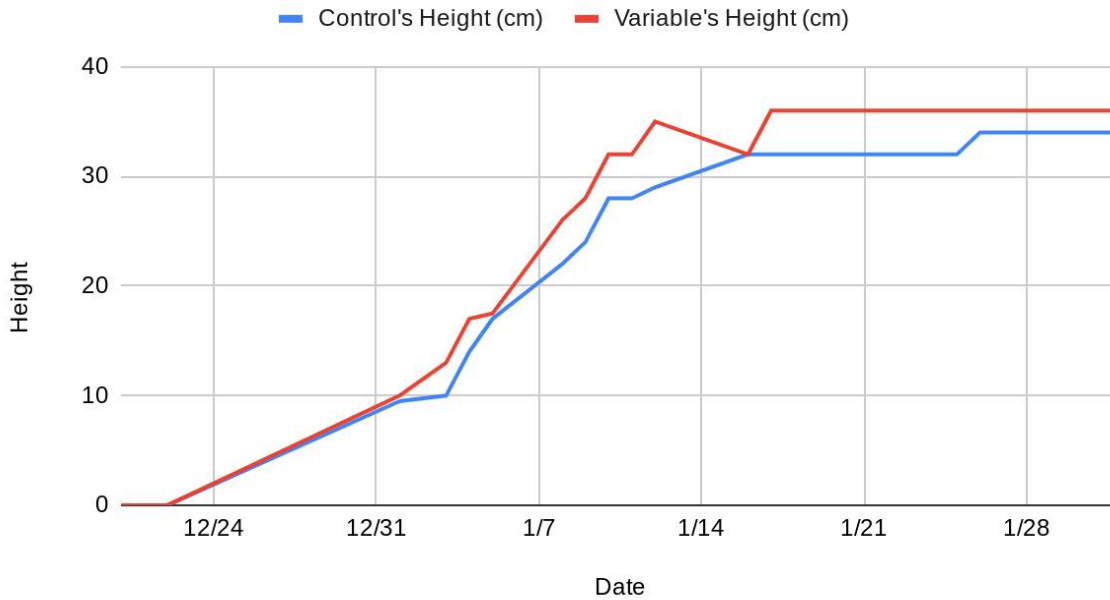


Fig. 1. This shows that watering plants with rainwater helps them grow taller.

Effect of Rainwater Watering on Seed Amounts

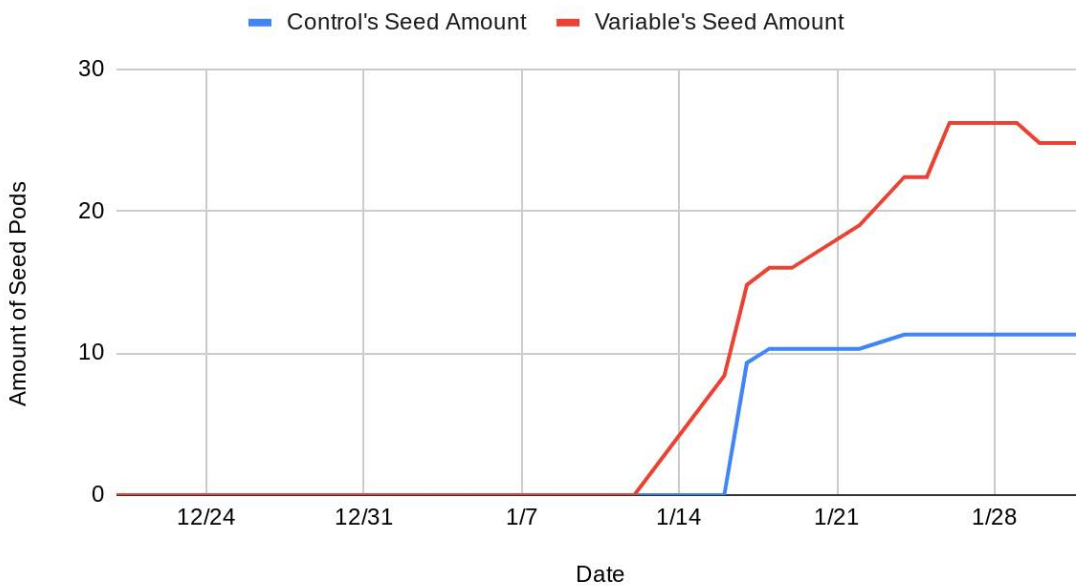


Fig. 2. This shows that watering plants with rainwater helps a plant grow substantially more seeds.

Overall, watering plants with rainwater helps them grow better. The height was only 4 cm taller than the control, with the variable being 36 cm and the control being 32 cm. The seed pod production increased almost exponentially, with the control leveling out near 1/21/24 while Tyler and I's plant kept on increasing its seed pod production until 1/26/24.

Discussion/Conclusion

Watering with rainwater improved the average amount of seed pods per plant. As seen in Figure 1, the plant that received rainwater had a lot more seed pods per plant in comparison to the control. "Rainwater consists of the required amount of carbon, which helps to unlock the micro-nutrients present in the soil around the plants. These micronutrients can be Zinc, Manganese, Copper and Magnesium. These necessary micro-nutrients aid in the rapid growth of plants" (Bonasila, 2021). I am very confident in this claim as Tyler and I followed the procedure every business day. If something seemed off we recounted or re-measured. Another reason why I am confident in this data is that we measured the height too, as that was the requirement that our teacher set. As seen in Figure 2, the height was not substantially larger, with the variable being only 2 cm taller than the control. Some possible sources of error could have been that seed pods could have fallen off during transportation of the plant from under the light to my desk.

In the future, scientists could test this claim with a larger amount of plants, a more controlled environment and more periodic watering. They could also test it with other types of plants to see what plants react well to the rainwater and which don't. This is important research because rainwater could increase food production in the world, and potentially lower the hungry population. If rainwater is not regularly available in the area, electric railways could be built to transport rainwater from places that are overflowing with water, helping disaster relief, to farms in a dry climate. For example, when the monsoon comes in Asia, in the summer, water comes pouring down on countries in Southeast Asia. When the monsoon comes and areas become flooded, rainwater could be transported on trains and/or electric tanker trucks to places that don't have that much water but need it, like Mongolia. The trains could be funded by the country's government, or when the national government cannot afford it, the United Nations could step in and help. In a modern world where tap water is used almost everywhere, but as we see, rainwater can be used instead.

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Green Crab Ratio Between Males and Females

George N, Bath Middle School, Age 13

Introduction

Have there been more or less females or male green crabs over the years? Before we answer this, you have to know that the impacts of invasive crabs are causing negative impacts on many species and valuable habitats. Green crabs have been a nuisance on the clamming industry, and clambers are losing money because of it. Green crabs eat anything in their way including clams, causing over an 80 percent reduction of productive clamming acreage (Portland Press Herald, 2013). Not only do green crabs harm clams, but they also destroy salt marshes. They do this by burrowing into them, damaging creek banks, causing them to erode. Another reason why this is bad is because salt marshes boost water quality, and without them, the water will be less clean. This isn't the only habitat they severely damage. Green crabs snip the bottom of eelgrass, killing it for easy hunting. Eelgrass is relied on by many different species for nesting ground and shelter, including baby lobsters, native crabs, and many other fish species.

Certain changes are happening on the Gulf of Maine that are allowing the green crab population to increase. The Gulf of Maine ocean is getting warmer, fast. The hottest year on record in the Gulf of Maine was 2021. This is because the Gulf of Maine stream is bringing warm water up North from the equator. Because of this, the green crab population is increasing in Maine, going up with the warmer water. Along with this, winters are getting warmer with climate change, causing green crabs to not die in the winter.

Scientists are currently researching many different things about green crabs. One of them is which fishing industries are being harmed, and how much. This is so we can possibly be prepared for these crabs, and try to get rid of them. Scientists are also researching how the green crab population is fluctuating. This is being researched to find out about how many crabs there are, and what is causing their population to go up or down. For example, Bath Middle School 7th graders have been going to Todd's Landing, Reid State Park and Fort Popham to pull up crab traps off the shore and collect data about them. They were researching things like if there were more males than females. My investigation focuses on if there have been more or less females and males over the years in Reid State Park and Fort Popham by pulling crab traps this year.

Methods

On November 1-3 and November 6-7, Bath Middle School students went to Todd's Landing, Reid State Park and Fort Popham at low tide. They pulled up three crab traps at Reid State Park, three at Fort Popham, and one at Todd's Landing, right off the shore. Once all of the crab traps were up, these students caught and recorded all of the bycatch in the trap, which is everything but a green crab in the trap, and then threw it back into the water, where it came

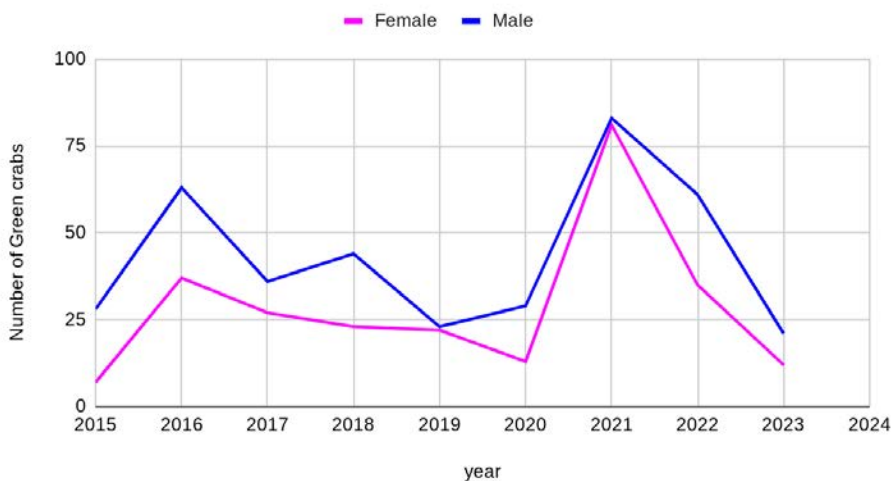
from so then they didn't die. Next, they caught all of the green crabs out of the traps, and put them in a separate bucket for each trap. After that, they rebaited each trap with two tins of sardines that had holes poked into them. Lastly, the Bath Middle School students measured, determined their sex, determined if they were aggressive, found their color, counted how many claws and legs the crabs had on each side, and if they caught any of the same crabs by painting nail polish on the backs of the ones they caught the day before.

After that, the person who measured had someone double check that all of the data about the crabs were correct. No changes were made to the process each day, besides the tides and how long each trap was in the water. The data was reliable because they went to three different sites. Each day, the tide could have changed the data. These students went at the same time every morning, causing the tide to be slightly different when they were pulling the traps. The sites were different in some ways because the traps at Popham were pulled up off of a pier, so the water was deeper, the traps at Reid were hardly under the water and on rocks, and Todd's landing was on the Sasanoa River, and very muddy, while Reid and Popham are right on the ocean. Also at Todd's landing, these students only had one trap, but at the other sites, they had three.

Results

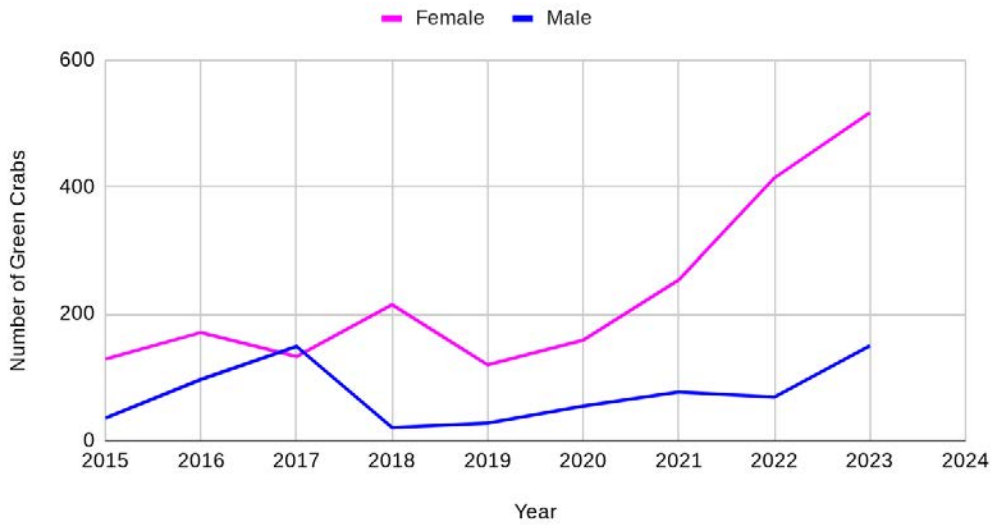
Have there been more or less females or males over the years? To address my research question, I made three line graphs to show the trend of male and female green crab's population from 2015 to 2023, at each three sites.

Reid State Park Females and Males



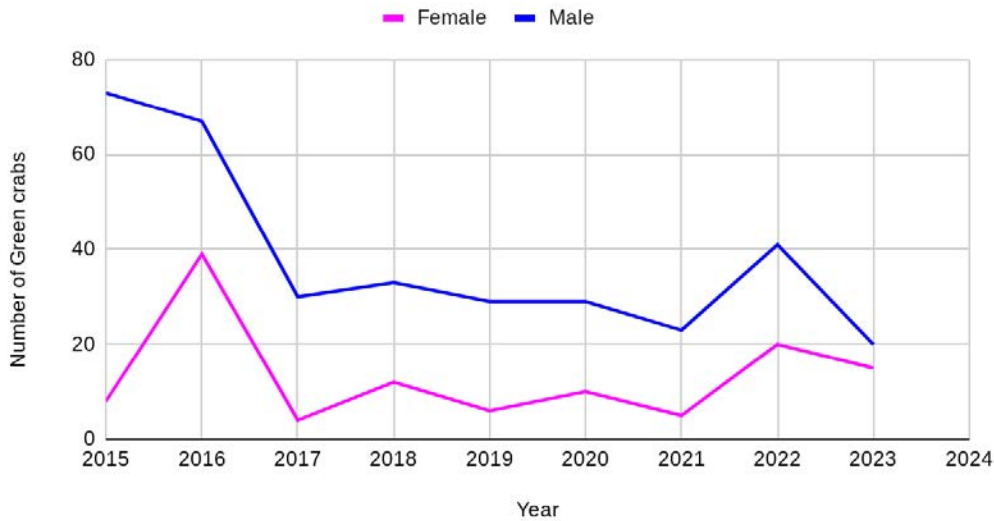
As you can see, at Reid State Park, each year there were more males than females. From 2016 to 2020, both the males' and female's population was going down, but all of a sudden it started going up rapidly in 2020, and the data peaked in 2021 at 83 males, and 81 females. From 2021 to 2023, both populations started going down immensely, and ended at around the same numbers before the spike in population.

Fort Popham Females and Males



Fort Popham, with the most green crabs out of the three sites, has had more females than males every year besides 2017. There seems to be a trend going on that started around 2018 and 2019 where the population was going up by hundreds.

Todd's Landing Females and Males



At Todd's Landing, each year there were more males than females. In 2016, the female population peaked, but since then both the male and female population was going down at Todd's Landing, until 2022, where it spiked up a little, but after that, in 2023, it went back down.

Discussion and Conclusion

Through my investigation I found that when there were more males than females, the population of the green crabs was low, and still going down. Although, where there were more females, the population was thriving, and still rising. For example, at Fort Popham, over the years there have been more females than males. This is important because at Popham the population is going up, and is very big. In 2023, there were 517 female green crabs, and 150 male green crabs at Fort Popham. Whereas at Todd's Landing, there were more males than females, and the population was low and still going down. In 2023 at Todd's Landing, there were 15 females and 20 males. Again, at Reid State Park, there were more males than females and the population is going down a lot. In 2023, there were 12 females, and 21 males at Reid State Park.

A huge factor that probably impacted why the population was like this at each site, was the depth of the water. At Fort Popham, they were hauling the traps off of a pier, which means the traps were under a lot more water. But at Reid State Park and Todd's landing, they were on a bunch of rocks, just barely sticking out of the water. To further this investigation, I would research if males survive better in shallow water than females, and what kind of environment green crabs thrive in the most.

Acknowledgements

I acknowledge Kennebec Estuary Land Trust (KELT), Waypoint, RSU1 School Board, and Bath Garden Club for funding the whole thing and helping in the field.

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Did the Green crab population from 2018-2023 increase, decrease or stay the same?

Millicent P, Bath Middle School, Age 13

Introduction

Green crabs are very invasive and impact the environment greatly. They eat lots of juvenile lobsters which leads to the baby lobsters not growing which means in a couple of years lobstermen will not have any more lobsters to catch because they have caught all of the grown lobsters and the green crabs will have eaten all of the juvenile lobsters. Green crabs also snip away eelgrass to catch their food. This is leading to the state of Maine having no healthy eelgrass for sea creatures to hide in. This is causing lots more sea animals to die. Green crabs are also greatly affecting clammers by eating the clams and other bivalves. The Gulf of Maine is changing fast.

Ocean currents are trapping warm water this can lead to the green crabs being more invasive sooner. In 2023 did the crab population go up, stay the same or go down from 2018. If the waters were staying a normal temperature, but since the water continues to be warmer, the green crabs have a better

Scientists have been researching green crabs for a long time. They have been researching how they move and population which in the past few years has increased tremendously. Middle school students have been going on many field trips to Reid State Park and Popham Beach to do some research of our own since 2013. The population of green crabs has gone up a lot in the past few years. Green crabs have been around for multiple years so why all the sudden are they so invasive. Scientists have also been researching how green crabs migrate. Green crabs migrate in winter by moving to where the water is warmer and since the water has been warm in Maine we have had lots more green crabs than previous years. Bath Middle School Students have been going on field trips to Reid State Park and Popham Beach to do some research of our own to find out if the green crab population increases, decreases or stays the same.

Methods

On November 1-3 we went to Reid State Park and Todd's Landing to collect data on green crabs. On November 6-7 we went to Fort Popham to collect data on green crabs. All of the groups used the same protocol that way the data would be most accurate. Everyone made sure to measure the size of the crabs from spine to spine and double check to make sure it was right. Our teachers put the trap in the water 24 hours in advance so that way the crabs would have enough time to eat the bait and go inside of the traps. We made sure that each time that we re-baited the trap that we used the same kind of bait which was two cans of sardines in oil. We also made sure that it was low tide. The first day we went was not low tide but all the other

times we went were. Our field days were not the same but very close.

We recorded the size, sex, color and number of claws and legs. First we went to Todd's Landing where we pulled one of our traps out of the water and wrote down on our papers all of the animals that were in the trap. Next we re-baited the trap and put it back in the water. We drove to Reid State Park When we first got to Reid we split into groups to pull out the traps that were there and to put down all of the information on our papers.

Results

Year	Number of crabs at Reid	Number of crabs at Popham	Number of crabs at Todds Landing
2018	67	238	45
2019	45	148	35
2020	42	214	39
2021	164	331	28
2022	96	483	61
2023	35	667	35

Reid is decreasing, Popham is increasing and Todds Landing is decreasing.

In my data I notice that the data started dropping in 2019 but then started increasing again in 2020 and every year after that. My graph shows the years and the number of crabs caught each year.

Discussion and Conclusion

Is the green crab population increasing, decreasing or staying the same?

Based on the data, I think that the green crab population is increasing at Popham and decreasing at Reid and Todds. The number of crabs at Reid was, 2023: 35 at Popham the number of crabs was, 2023: 667 at Todds the number of crabs was, 2023: 35. You should trust this data because we made sure to use the same protocol each time we collected the data. One way we did this was putting nail polish on the crabs to make sure we did not catch the same ones each time. We caught 7 crabs with nail polish on them in all and we knew not to count them because they already had nail polish on them. I think this is a good idea because the data is going to be MUCH more accurate. The green crab population at Reid is going down because Reid has more biodiversity such as lobsters, fish and other kinds of crabs. These are all things that we are finding in our traps at Reid. Whereas at Popham we are only finding green crabs in our traps.

Acknowledgements

I would like to thank Mrs. Wright for helping me with this project.

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Population of Green Crabs is Increasing and Decreasing in the Gulf of Maine

Navah W, Bath Middle School, Age 13

Introduction

Green crabs are an invasive species and they are impacting the environment in many different ways. They are impacting the clamming industries because they're eating lots of the clams; and us humans really benefit from clams not only to eat, but we also get a pretty good profit from them. Green crabs are also impacting the salt marshes because they burrow into the sides, which causes them to erode and the salt marshes help with lots of things. For example, they protect against storm surges by acting as a small wall for the water. The green crabs are also destroying the eelgrass which serves as a nursery for baby lobsters and other small fish. They also are cutting the grass at the bottom and then there isn't any grass left which might mean that the baby lobsters/fish will be eaten by predators and that might lead to less lobsters/fish for fishermen to catch.

There are some changes that are happening in the Gulf of Maine, do the green crabs have a negative or positive reaction to these changes? The temperatures of the waters are changing and that means that the waters that the native species are accustomed to are changing which is causing them to leave, and other invasive species (green crabs) are moving in, and that messes up the whole ecosystem. Also the sea levels are rising because of the ice melting in the arctic and that messes with where the houses along the shore are because if some houses are really close to the ocean they could get flooded if there are any big storms. Man-made global warming is also a big thing that is changing because CO₂ is being released into the atmosphere which then is causing the greenhouse effect and this gas is really bad for the environment and could affect the ecosystem of native crabs and make invasive species feel more comfortable.

There are lots of things being researched about green crabs so that we can find a way for them to have less of an impact on the environment. According to Casco Bay Estuary Partnership (CBEP): "Young lobsters have been found in the stomachs of green crabs" and studies have shown that green crabs can outcompete lobsters and other native crabs for food which then leads to the lobsters and native crabs not eating the food they need to stay alive and then they all start dying. Green crabs are considered one of the most invasive species in the marine environment because they have very few predators. Therefore, green crabs are basically the kings of the environment because they eat and destroy everything.

My research question is: did the crab population increase or decrease at Reid, Ft. Popham, and Todd's Landing from 2015-2023. I chose this question because I was very interested in how different the population is at the different sites.

Methods

On November 1st through 3rd the 7th grade BMS students went to Ft. Popham in Phippsburg, Reid State Park in Georgetown, and Todd's Landing also in Georgetown, to collect data about the population of European green crabs, we had three traps at Reid State Park, one trap at Todd's Landing, and three traps at Ft. Popham. We had to make the data fair so we did the exact same thing every day we went. The first place we went was Todd's Landing, there was one trap that we had set there the day before, we pulled it up and there were at least some green crabs in it every day.

We collected data like, how many claws they had, because if they don't have claws then they could possibly be less of a predator because their claws are very powerful. We also measured the size in mm, so that we could get a good sense of what the average size was, the color, and the number of legs they had and if they were aggressive or not. To reset the traps we put two cans of sardines, with medium size holes in the top so the crabs can get to the meat in the traps. We also marked all crabs we caught with nail polish, every day we had a different color nail polish to mark them, the reason why we did this was so that we knew if we had already caught it or not.

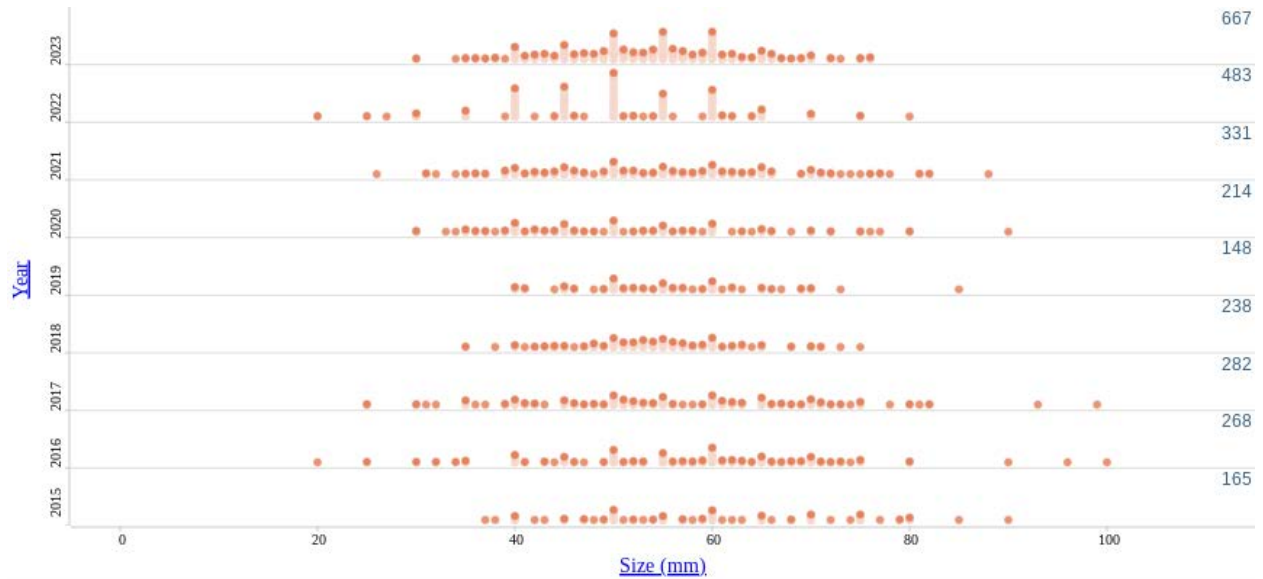
Results

My research question is: did the crab population increase or decrease at Reid, Ft. Popham, and Todd's Landing from 2015-2023?

This data table shows the number of green crabs we found at all three sites. I used the size of the crab in the graph so that I could get a count of everything.

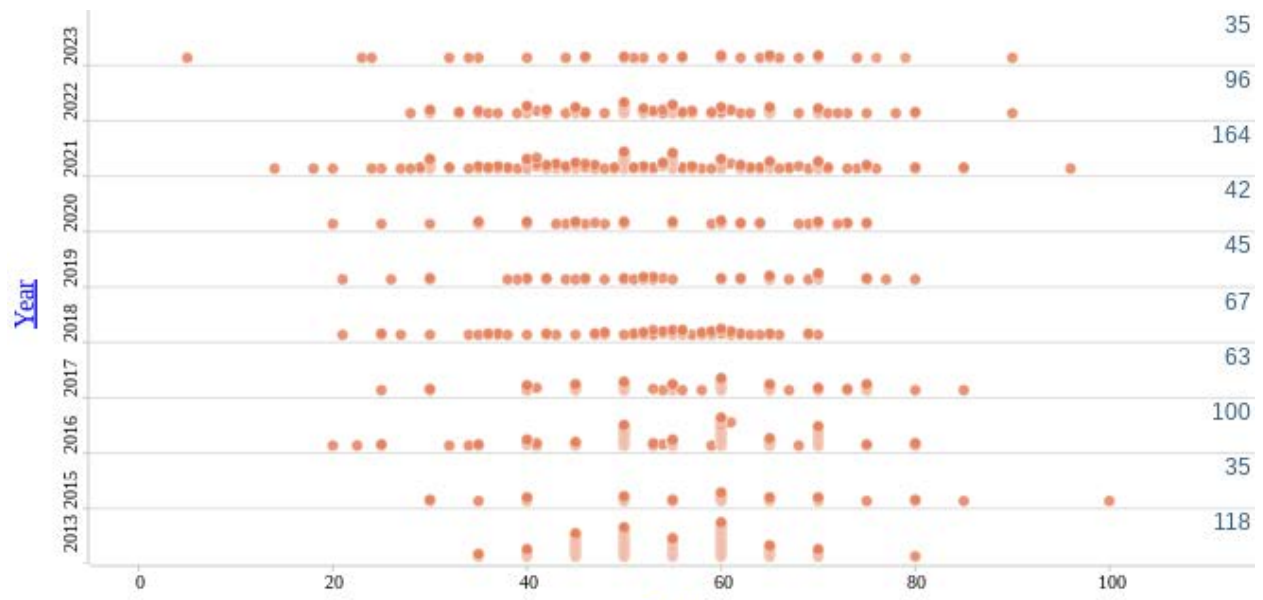
Year	Number of crabs at Reid	Number of crabs at Ft. Popham	Number of crabs at Todd's Landing
2015	35	165	81
2016	66	204	92
2017	63	282	34
2018	67	238	45
2019	45	148	35
2020	42	214	39
2021	164	331	28
2022	96	483	61
2023	35	667	35

This graph shows how many crabs throughout the years at Ft. Popham.



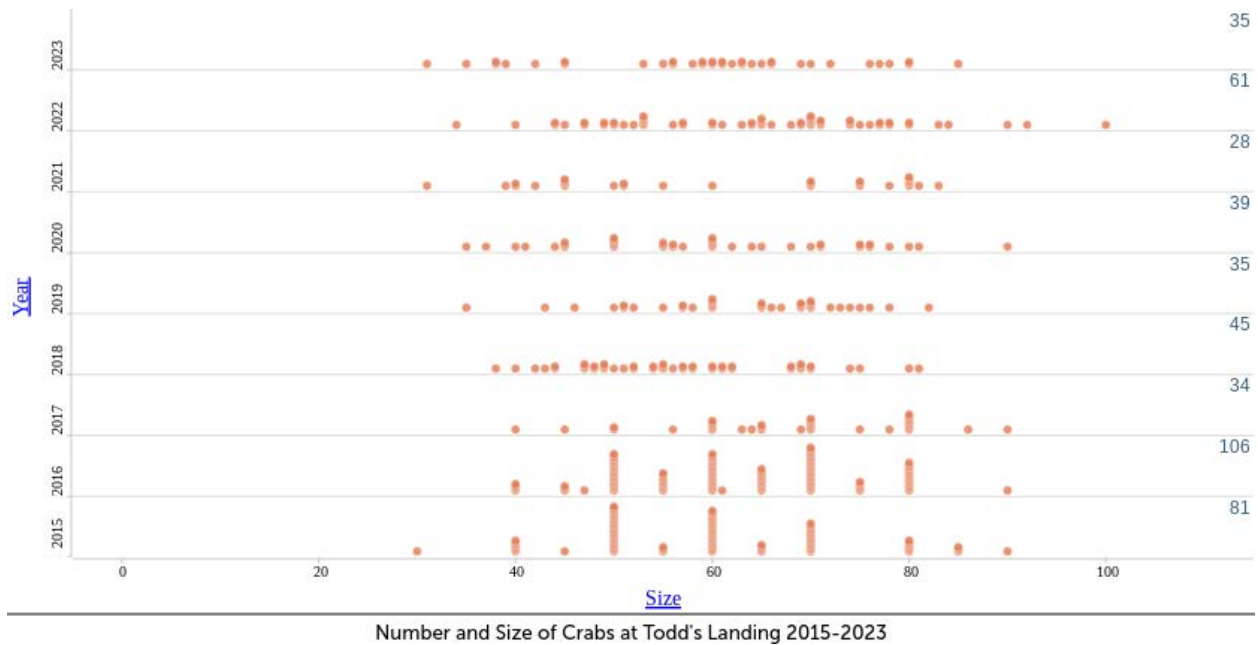
Number and Size of Crabs at Ft. Popham 2015-2023

This graph shows how many crabs throughout the years at Reid.



Number and Size of Crabs at Reid St. Park 2015-2023

This graph shows how many crabs throughout the years at Todd's Landing.

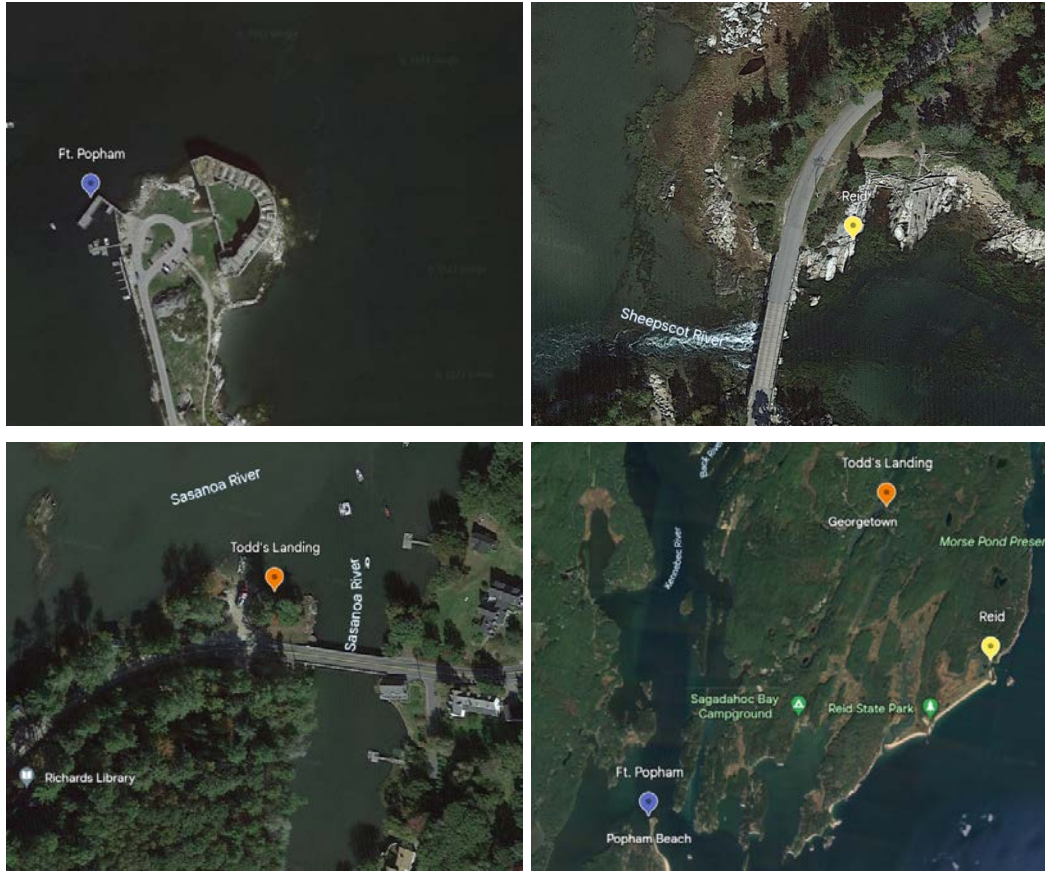


Discussion and Conclusion

The green crab population has decreased at Reid and Todd's Landing, but increased at Ft. Popham. At Reid in 2015 there were 35 crabs recorded, in 2019 there were 45 recorded, and in 2023 there were 35 recorded, the number of crabs went up 0%. At Todd's Landing there were 81 crabs in 2015, 35 crabs in 2019, and 35 crabs in 2023, the number of crabs went down 56.8%. And lastly, at Ft. Popham there were 165 crabs caught in 2015, 148 crabs caught in 2019, and 667 crabs caught in 2023, the number of crabs went up 350.7%. I believe that this data is strong because it is not only comparing the first year and the most recent, it is also comparing a year in the middle. It is also strong because we went to the same places every year and did the same exact thing.

All of the sites have such different ecosystems and I think that has a part in how the populations are so different. At Ft. Popham the water is really deep, we can't see the wildlife because of that, and it's at the mouth of a really big river (the Kennebec, 170 miles). At Reid it is really rocky, there's a lot of seaweed, and the water is colder because it's on open ocean. At Todd's Landing there is lots of wildlife: seals, eagles, fish, crabs, ospreys and many other animals, it is also very protected.

Those are some of the reasons why I think that the population of crabs have increased and decreased depending on the location.



Acknowledgements

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Bath Gardening Club: I would like to acknowledge the Bath Gardening Club for helping to fund our research.

Mrs. Wright: Thank you for all of your help with this project, I greatly appreciate it.

Mr. Depper: Thank you for helping out with the research project, it was very helpful to have another adult that knew what they were talking about.

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How Snow Helps People and Animals

Elijah B, Sacopec Valley Middle School, Age 13

Background information

In December, our science class went out behind our school to the nature trail. It was a cold 35 degree winter day. We walked to the beginning of the trail, in the middle of the woods. Our group split up to observe snow and different trees. I observed snow on the ground and on the trees. I already know that snow has been known to help with water and shelter for people by boiling the snow and creating a water source; snow is found all over and this includes the woods. Snow shelters can save lives during storms by blocking the wind and acting as an insulator. People create shelters to help them stay warm in cold climates. Snow has different layers to inspect. Sometimes it is deep enough for animals to build shelter in or it is hard enough to stand on so people can build shelter there overnight. Snow is helpful because it provides water and shelter, it has lots of purposes for people and animals.



Observation

I was surrounded by trees, snow, leaves with different colored snow in places, and broken/damaged trees with branches covered in ice. I observed ice sticking to branches and different types of snow in certain areas. I noticed ice on trees from water that froze overnight. In open areas, it will fall straight to the ground but in areas with trees, snow gets caught on the branches and sticks to them and the ground underneath the trees has barely any snow. It is interesting to find different types of snow layers in certain areas of the woods. I observed that most of the snow covering the ground has dirt or different particles that pollutes the snow.

Other ideas and questions

When snow is polluted, you can't use that snow to create clean water. This observation makes me wonder if other people have seen and considered that as well. Based on what I observed and what is already known about this, I know that people and animals can use snow for many different things to help them and protect them. I could investigate this issue further by observing how snow changes over time. What happens to the snow shelters when you leave them untouched or forget about the shelters? I would like to observe this to understand more about when snow is safe to use and how it relates to the time it has been on the ground. If I do this, I could have more information on snow for the future.

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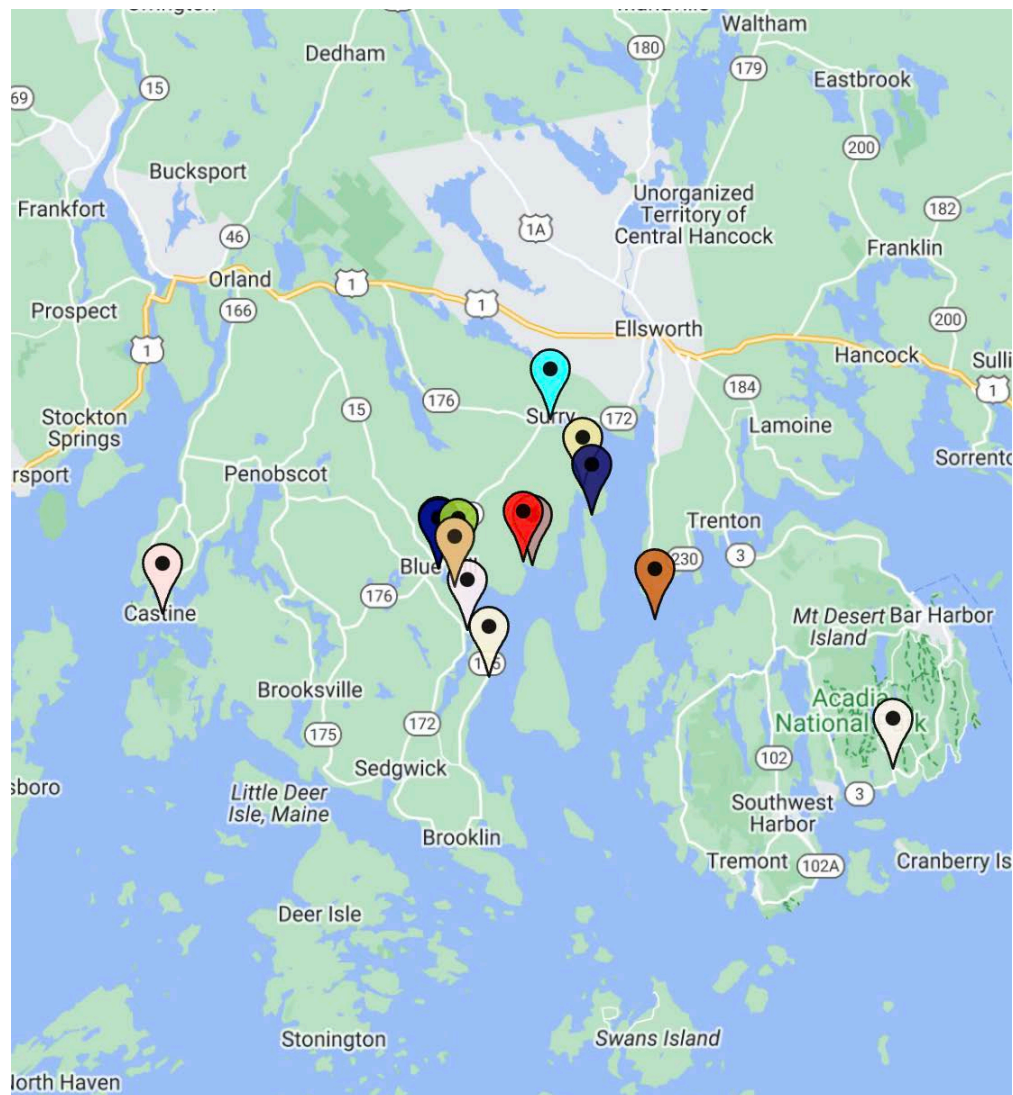
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Where does coliform bacteria come from?

Mara B, Blue Hill Consolidated School, Age 14

Coliform bacteria is a group of microscopic organisms. High concentrations of bacteria can indicate the presence of germs from sewage and can pose a public health risk. Shellfish beds and beaches are sometimes closed when coliform bacteria is found. Coliform bacteria can come from failing septic tanks, marine toilets being dumped by boats, pet waste, wildlife waste and livestock. Some coliform bacteria, like *Escherichia coli* (*E. coli*), can cause disease in humans. Swallowing water contaminated with *E. coli* can result in diarrhea, cramps, nausea, headaches, and other symptoms. Coliform bacteria can be especially dangerous to people with compromised immune systems, the elderly, and children younger than five years old (Maine.gov). During the summer of 2016, Curtis Cove, a beach near my house, was closed because of high levels of bacteria (weeklypacket.com). During the summer of 2023, many beaches in the northeast were closed due to bacteria in the water (abcnews.go.com), including beaches in Maine (mainepublic.org).

I wanted to learn more about water quality in my town, so I conducted fieldwork at fifteen sites on the Blue Hill Peninsula and surrounding areas during the winter and summer of 2023. These sites are shown on the map. They are: Steamboat Wharf, Curtis Cove, Tug Mutton Cove, Blue Hill Bay, Salt Pond Canary Cove, Deer Isle Causeway, Seal Harbor, Carter Preserve, Newbury Neck, Surry Wharf, Peters Cove, South Blue Hill Wharf, Ellsworth Harbor, Castine Harbor, and Blue Hill Golf Course. I chose these sites because they are all easy to access for water sampling, and they are places I visit with my family. Some of the sites are natural coves, and some are man-made wharfs. Some have houses near them and others do not. Some have a lot of boat activity and others have little or none. I thought that because the sites are different, with some being more remote than others, there might be coliform at some but not others. For example, Curtis Cove, the beach near my house that was closed, has many houses nearby. There are often boats and kayaks there in the summer, and many people bring their dogs to that beach. It would not be surprising to find coliform bacteria at Curtis Cove because of all the people and dogs. Carter Preserve is more remote. It does not have houses nearby or much boat traffic, so I did not expect to find coliform there.



Study Sites

I used a LaMotte Earth Force Low Cost Estuary and Marine Monitoring Kit to test the water at each site. The weather varied on days I visited the sites, but I recorded that most of my sampling days were either sunny or partly cloudy. I did not expect to find coliform bacteria at most of the sites because the water looked clean and I didn't see evidence of animals or sewage. I observed that the water at most sites looked clear and clean from the beach, but more than half of the samples were a different color when they were in the collection bottle. Some water samples (Tug Mutton Cove, Blue Hill Bay, Carter Preserve, South Blue Hill Wharf, Castine Harbor, Surry Wharf, Peters Cove) looked yellow in the bottle and I wondered if those would be full of coliform. Some looked clear in the collection bottle (Steamboat Wharf, Curtis Cove, Salt Pond Canary Cove, Deer Isle Causeway, Seal Harbor, Newbury Neck, Ellsworth Harbor, Blue Hill Golf Course) and I wondered if those samples would be free of coliform. I was surprised to find coliform bacteria at every one of my sites! The color of the water did not seem related to coliform and neither did the amount of human activity around the sites.

What I want to know is where the coliform bacteria is coming from? Is it dangerous? Why is it present at every site? Would something be wrong if there was an absence of coliform? Maybe property maps would help me see where people's septic tanks are located. That would possibly tell me more about where the coliform comes from. I also learned that there is a certain level of fecal coliform per 100 mL of water that will cause beaches to be closed. I am going to work with the Shaw Institute in Blue Hill to get more information about the exact levels of coliform at each of my sites to see if they are within the acceptable range. Maybe some of the sites have a lower level of coliform than others. The only information the LaMotte Monitoring Kit gave me was that coliform was present at every site, but it did not tell me how much.

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Can maple syrup have long-term effects on cancer research?

Morgan B, Messalonskee Middle School, Age 13

On April 2, 2024, at around 10:40 a.m. we arrived at Bacon Maple Farms in Sidney, Maine. A vast field and forest roughly surrounded the sugar shack. Shelly Bacon, owner of Bacon Maple Farms, informed us of the process by which maple syrup is made. She also talked about how cancer researchers consider using Maple syrup to help reduce cancer. Over the field trip, she spoke about how maple syrup can benefit cancer research. Maple syrup contains various carbohydrates, organic acids, amino acids, vitamins, and phenolic compounds. Phenolic compounds are phytochemicals in most plant tissues, fruits, and vegetables. Studies from various cancer researchers have shown that these phenolic compounds in maple syrup may possess various activities such as decreasing the blood glucose level and an anticancer effect. They have studied three maple syrups based on their color. The study showed that CRC cells, colorectal cancer, that were administered maple syrup showed lower growth rates than cells that were administered sucrose. This makes me ask the question of, can maple syrup have *long-term* effects on cancer research and study?

CRC is one of the most common types of cancer. It is the leading cause of cancer-related death worldwide. Once the tumor gets to a point of no surgical removal, it can't be cured. When the tumor is limited to the mucosa or submucosa, CRC can be completely cured by endoscopic, and/or surgical therapy; however, the majority of the patients faced with this issue are already in the later stages of their diagnosis. A new chemotherapy regimen plus either oxaliplatin, one of a group of drugs called alkylating agents, or irinotecan, a type of chemotherapy drug called topoisomerase I inhibitor, is considered the standard treatment for more advanced CRC. Researchers have also been interested in phytomedicines, like botanical extracts for cancer treatment, which has been on the rise. Natural therapies using plant derived extracts may reduce side effects compared to traditional cancer treatments.

In conclusion, I found out that Maple syrup can have, potential, positive effects on Cancer. Researchers are still trying to figure out how to even cure cancer, but there's a chance they won't be able to figure it out. It's a disease that needs to be discovered in its early stages, or it will become fatal. Chemotherapy is also a difficult topic for some people. Some people are fine with it and some people don't agree with it because it can have bad effects on the person being treated. Due to this conflict, they are figuring out ways to reduce and help the stop of cancer through Maple syrup, and plant-derived extracts.

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Bacon, Shelly. School Field Trip. 2 April, 2024.

Red Maple VS. Sugar Maple

Caroline C, Messalonskee Middle School, Age 13



On April 2nd, 2024, my classmates traveled to Bacon Maple Farm. This farm prominently has sugar maples planted and tapped around their property. I know that sugar and red maples are similar but not the same so I wondered, why they only had one kind, or even why not a mix of the two species? In this nature note, we dive head first into all those questions starting with the history of the red maple.

The red maple is named for its red flowers, red fruit, red twigs, and—of course—it's breathtaking red fall foliage. People know that red maple foliage can turn yellow or orange in the fall too. Red maples are fast-growing trees that usually reach 60 to 90 feet in height. The largest ones can grow more than 120 feet tall. The red maple is one species whose sap is used to make maple syrup. The biggest syrup provider is the sugar maple, though, which is named for the high sugar content of its sap. So right off the bat, we know the sugar maple has a higher sugar content than the red maple. There is no taste difference but red maple's sap has only about half the sugar content as sugar maple. Making the sugar maple syrup just the slightest bit sweeter.

Now that we know a brief history of red maples, let's break down the smaller details; Starting with the price. Surprisingly A 3 foot-red maple is only a third of the price of a 3-foot sugar maple. With this in mind poses the question of: How much money could they have saved? How much money could they have saved if they planted a forest of red maple instead? A farm of 3000 Red maple trees comes to a total of about 300,000 dollars. A farm of 3000 sugar maple trees is 435000. Using this rough estimate of totals we can guess they could have saved about 135,000 dollars by just making this switch in species. To me knowing this I would have totally made the species switch but why didn't they? Does the sap boil differently? Does the

evaporation process vary based on different trees? These are questions I just can't answer but would love to know.

In my science class we went over all aspects of the maple industry. We briefly scanned over the different types of trees that can give you sap to make syrup.

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What environment do maple trees best grow in?

Isabella C, Messalonskee Middle School, Age 13

On April 2nd, 2024, at around 10:40am, my classmates and I traveled to Bacon Maple Farm in Sidney, Maine. At this farm, I observed roughly 3,000 maple trees surrounding the property, but only 2,000 are tapped. I know this because the owner of the farm, Shelley Bacon, told my classmates and I. Imagine counting all 2,000, that would take a long time. In front of the forest of trees, there was this huge field with short, brownish-green grass. There was a decent sized hill next to the field, and on top was a humongous maple tree. I saw that all the maple trees were growing in a swampy, marshland type of environment. It was muddy, had a variety of both dead and live leaves, some clumps of moss scattered around, and some parts of it were more moist than others. This made me wonder, what environment do maple trees *best* grow in?

I thought that where the maple trees were growing was an unusual and interesting place because I had never seen any maple trees grow in a swampy-marshland before and I wondered if that was the correct habitat for them, so that's why I chose to make my question, "what environment do maple trees *best* grow in?". After doing some research, I have found that maple trees do not like being in wet places because then they will become stressed and won't produce as much sap as they normally would on dry land. They do like somewhat moist areas, such as alongside a riverbank. In order to grow properly, they need full sunlight, a little shade is okay if you can't find a completely sunny area, but full sunlight is preferable. Maple trees are drought tolerant, but grow better and faster in moist conditions. In the winter, the preferred temperature for maple trees is 0°F (-18°C) and the preferred summer temperature for maple trees is 60°F (10°C). Note that these are the preferred temperatures, typical temperatures can range from -40°F and 100°F.

In conclusion, maple trees grow best in moist and sunny conditions to grow the best and the fastest in. Sure, at the Maple Bacon Farm, the maple trees were growing in muddy and wet conditions, but Shelley Bacon might have been able to harvest more sap if the maple trees were in their preferred environment. I have learned how many gallons of sap I need to get 1 gallon of syrup in math. Although it was only for a day, I learned a lot. 40 gallons of sap makes 1 gallon of syrup. In math, I also learned that you make approximately 25 gallons of syrup each season. In social studies, I have learned how Native Americans discovered maple syrup. It's pretty fun to learn about because we also learn the origins of how 4 different well-known Native American leaders discovered maple syrup. In E.L.A., my teacher read my class a book about a young girl, her grandfather, and two horses collecting sap and turning it into sugary treats. My classmates and I have also done Nature Notes. In science, we have learned about the maximum and minimum temperatures that are good for tapping maple trees. A high of 35 or higher and a low of 32 or lower. My classmates and I also played a game about maple syrup where there are tokens, representing water, and beans, representing the sap. There would be a tree, collector, evaporator, and the market. Together, the team of people have to try and get the most amount of money. In science, we have also done a maple syrup business project slideshow.

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Japanese Knotweed

Caroline CB, Messalonskee Middle School, Age 12

At Messalonskee Middle School, we have been observing the Japanese knotweed and collecting data. We visited at 8:46 A.M. on October 25, 2023, and October 31, 2023. We determined the species, we measured and determined some of the small details, like if there are ants, flowers, or seeds, and how large the knotweed itself is. We also saw how dense the patch is. It was three meters tall, which is about the average height for Japanese knotweed, which helped us determine that it was Japanese knotweed and not giant knotweed. We determined the species at the bus road field site to be Japanese knotweed. We could tell that it was Japanese knotweed because we really observed it, even the little details, like the underside of the leaf and the size of the stems and leaves. I thought that it was interesting how it was growing in a ditch with big puddles of water. I had no idea that they consumed so much water and needed that many nutrients. However, now that I think about it, it could make sense as to why it is taking over the ecosystem in this way. During our previous unit in science class, we learned about seeds and gardening, and one thing we learned about is crop rotation. This is when you plant the larger plants in a different area than the previous year. You do this because the large plants, like corn or sunflowers suck a lot of the nutrients out of the soil. I was just thinking, perhaps that is exactly what Japanese knotweed is doing since it's such a large plant. What if it sucks out all the nutrients in the soil, and so there's not much left for other plants? But its roots could spread, taking out more nutrients and killing other plants?

Photo 1. This is our field site along the Bus Road. There is a big ditch so you can see just how tall the knotweed is, because it was still taller than most of us, even when we were standing on top of the hill that was there due to the ditch. You can see that the tape measure is laid out, and that shows just how much it spreads.



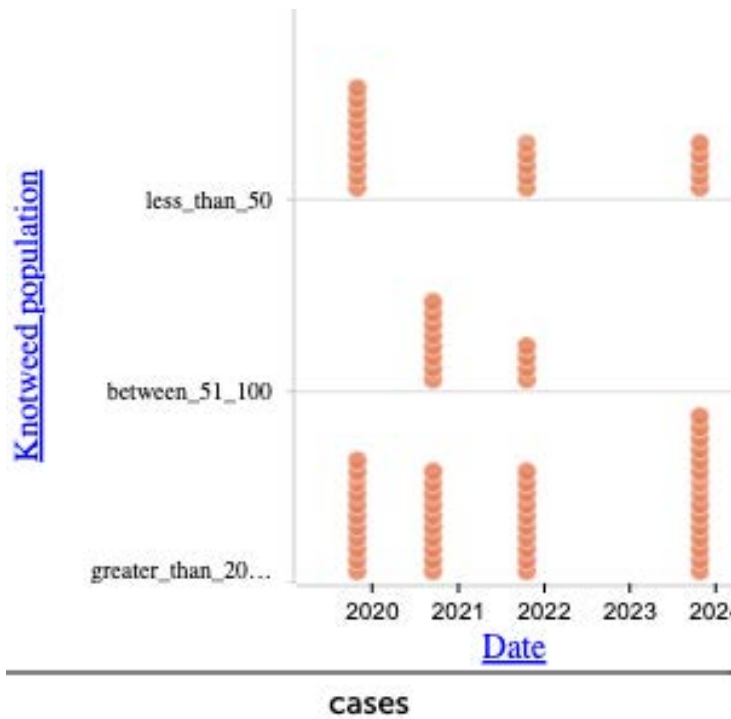
Photo 2. This is the underside of the leaf. You can see that there are no small hairs, which means it could be Japanese Knotweed, as Giant Knotweed does have the hairs underneath.



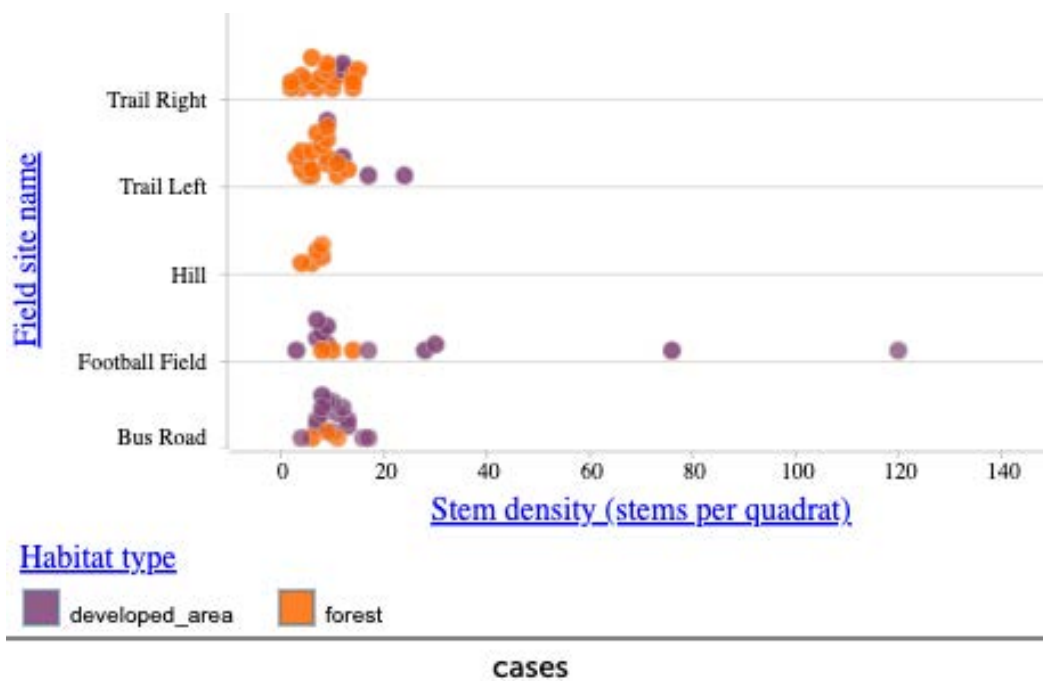
Photo 3. You can see just how big the leaf is. Not bigger than any of our hands, and certainly not the size of a Giant Knotweed's leaf.



We measured the area and followed all the protocols. We also counted how many stems were in each quadrat. In the following graphs, you can see how much the knotweed has spread in the past few years.



Graph 1. Knotweed population growth. This graph is from our school alone. You can see that in 2023/2024 for the knotweed population there were more with greater than 200 and less with less than 50 compared to previous years.



Graph 2. Stem density by habitat type. Most locations had under 2 stems per quadrat.

My prediction is that the knotweed will continue to spread more and more over the next few years until we find a way to get rid of it. The thing about Knotweed is that when you try to get rid of it the same way you would get rid of normal plants or weeds, is that doing that actually helps it to spread. The roots are so strong and durable that it can grow through things and it will grow back faster and stronger than ever. This concludes that we must be careful in the ways that remove the Knotweed. Further questions I have are, if we are just studying around schools and school areas, how are we going to find out more about the knotweed in different circumstances? For example, in the middle of the woods, the knotweed may grow differently than in a forest with trails that people come down often. I think that we should also study knotweed that is in different habitats. We could compare it to see if it really is different from school grounds, and if that type of thing affects the knotweed or not.

Invasive species come to be when people spread them. This is done when they bring an animal or plant to a place where it's not native to, and let it go into the wild. An example of this is Japanese Knotweed. However, Japanese knotweed is particularly interesting to us because it is invasive to Maine. Japanese knotweed was first reported in the mid-1890s, although it was mainly reported in Pennsylvania, New York, and New Jersey. But by the late 1930s, it was already a problematic pest. Nowadays, it's growing all over Maine, and it is killing off our Native species. Like mentioned earlier, invasive species are created by people. It is typically accidental, but can cause huge problems for the biodiversity of the area. An invasive species is a species that comes to an area, and sort of takes it over. Invasive species usually have competitive attributes and advantages over the other species. This is exactly what Japanese knotweed is doing, or at least trying to do. Japanese knotweed is usually about 3 meters tall, which blocks sunlight for the other plants, and takes up a lot of space where other species could have been growing. Japanese knotweed is large and a lot of them tend to grow in an area, so they are taking over our forests up here in Maine. GMRI has begun a project titled Project Knotweed. Active scientists are trying to better understand knotweed and what jobs we can partake in to eventually stop it. Schools all over Maine, and even a few in Massachusetts are collecting data to be any help we can to this problem.

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How Maple Syrup Becomes Vinegar

Caroline CB, Messalonskee Middle School, Age 12

On April 2nd, 2024, around 10:41 a.m., my classmates and I traveled to Bacon Maple Farm. The weather was sunny, there were a few clouds, and it was slightly windy. It was around 42°F. At the farm, I observed the Diatomaceous Earth in the sugar house. Diatomaceous Earth is very finely crushed seashells. It is white and looks like powdered sugar. Farmers can buy it in a large bag. Its main purpose is to filter the sap and remove harmful chemicals, bugs, or diseases. When the farmers remove it at the end of the season, it is a large, spongy, black square. The presented image above is a picture of Diatomaceous Earth. As you can see, its form and white color represent powdered sugar.

Shelly Bacon, the maple syrup farmer, mentioned while speaking to us that she doesn't clean her tubes, she leaves the maple syrup in for it to turn into vinegar, which cleans the lines for her. At first, I was wondering if that had anything to do with the Diatomaceous Earth. Did the maple syrup farmers also put that in the tubes, and how did that turn sap into vinegar? After that, I learned that it had nothing to do with the Diatomaceous Earth. The new information left me with a question: how does the maple syrup turn into vinegar, and how does that clean the line? After doing some research, I discovered that after the syrup sits and ferments for several months, it naturally becomes vinegar. The acid in the vinegar breaks down the dirt, bacteria, and other harmful substances inside the tubes. If I could investigate that process by watching it throughout the few months, that would truly deepen my understanding.

What we learned at the maple syrup farm connects to what we learn in school. In algebra, we did a lot of work with profits/exponential growth, and I'm sure that comes into play at the maple syrup farm. You have to calculate how much maple syrup you will make, how much money that will make you, etc. In social studies, we have been learning about the history of maple syrup, and how Native Americans discovered it. In ELA, we read a picture book about maple syrup. Finally, in science, we have been examining how climate change affects maple syrup, and we got to see that in real life at Bacon Maple Farm.

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Hemlock Trees

Brooke D, Sacopee Valley Middle School, Age 13

In early December our science class went outside and into the trail behind Sacopee Valley Middle School In Hiram, Maine. It was 10:55 a.m. and about 25°F and sunny.

I was surrounded by Hemlock trees and Pine trees, there was snow on the ground and in the trees there is a large hill behind the trail I was on. It was very shady because the trees were covering the trail from the light. Hemlock trees are commonly by or on a large or steep hill. Their roots hold in the dirt and soil and help slow down erosion. Hemlock trees are what the rest of the habitat relies on, if those trees are gone the ecosystem will be gone and others surrounding.



While looking at Hemlock trees I noticed that, despite the branches being very flexible, the snow and ice sticks to the branches very well. I was curious and looked at a branch through a magnifying glass and unexpectedly noticed small hairs on the branches.

My second observation was conducted on December 6th at 10:50 a.m. It was 36°F and partly cloudy. I observed a different branch on the same Hemlock tree and it had the same small hairs as I saw in my first observation on the same tree. As you can see in the photograph these hairs are less than a centimeter long and can not be seen very well with the naked eye.

My questions are as follows: What are these little hairs? Are these hairs helping to keep the snow and ice on the tree? My theory is that these hairs attract and provide the tree with moisture. I will conduct further research by observing the hairs on the Hemlock tree throughout the rest of the school year. We also have a forestry expert who will be visiting our class in the next few months. I will ask them if they can help answer my questions.

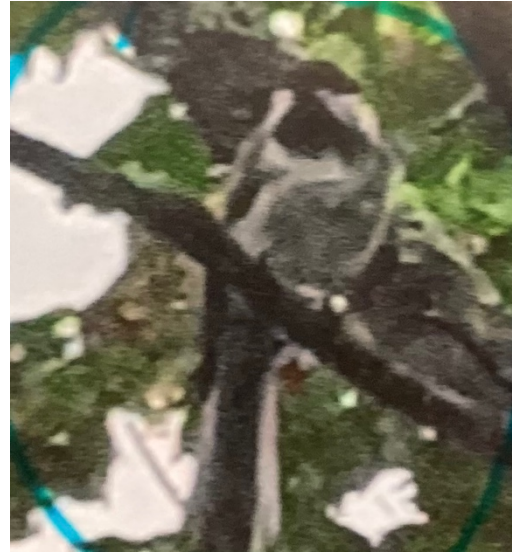
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Watching the Tree

Tessa F, Sacopee Valley Middle School, Age 12

Have you ever wondered more about the Black Capped Chickadees? 'Is there more to these birds?' I had wondered. I had already known that Black Capped Chickadees' feathers were very thick to keep them warm in the winter, but I didn't think they would have anything else to admire. How very wrong I was. These tufted, adorable little fluff balls have so much more to them.



On August 26, at 11:26 AM I was looking outside my window bird watching (but it was more like squirrel watching because there weren't any birds), but just when I was giving up, I noticed a little bird. It was a Black Capped Chickadee. It took around five days for the chickadee to realize that there was food in the

feeders. I thought of a name for him, and I liked the name Durigo, and so did my peers. Once a chickadee finds food, that chickadee will use his or her song to call other chickadees to where the food is. I also noticed that Durigo would take a seed, fly up to a branch, peck the seed until the seed opened, then use his claws on his feet as hands and nibble the seed.

While researching, I learned that chickadees are birds of the tit family. They live for 2-3 years and allow brain cells to die so they can adapt to changes in their social flock. I think that maybe Durigo was slow to find out about the food in the feeders because he had let those brain cells die. I also learned that they eat seeds, berries, insects, and invertebrates. After Durigo found the food in the feeder, he sang a little song, and shortly after, another chickadee arrived at the feeder. After researching, I learned that birds sing to claim their territory and attract their mate, which means "here I am." I think Durigo was singing to attract a mate.

After observing chickadees I am left wondering, what would they do if there were live insects in the feeders? Would they choose a feeder with seeds or a feeder with insects? I might try this experiment during the spring when there is an abundance of insects near me. I will most likely have two bird feeders and fill one feeder with insects and one with seeds, and see which one they choose.

References:

Field Guide to Birds. Eastern Region

All about birds.com

Deer Lying Place Observation

Paige H, Sacopee Valley Middle School, Age 14

Deer are habitual creatures. They follow routines and they only cross roads when it is necessary. Deer live in forests or secluded areas of land. When they go into crowded areas they do not mix well. They aren't used to the lights, sounds, or people, and most importantly the environment. Deer are known to lay under Pine or Hemlock trees especially during summer and winter months. This is why it is important that they stay as far away from all of the hustle and bustle of human life as possible. For example, since there are not really trees and wildlife in cities, but there are people and excessive amounts of noise and lights that a deer is incapable of adaptation. This causes panic, blocks roads, and destruction in cities



could cost anywhere between a few hundred dollars to a few thousand dollars. If you spot a deer in a city you must stay away from it as it could be very agitated and attack. This seems like common sense since it is a wild animal, but many people try to calm it down and most fail.

However, there are special instances that deer can adapt to smaller towns. For instance if there are less people the deer won't become agitated or scared so they can adapt to the area. The deer trail, scatt, and laying spot were within the school grounds of all three of the Sacopee Valley district schools.

The deer I observed was on the forest-school line on 6 December, 2023 at 12:35 of SVMS (Sacopee Valley Middle School). The surrounding area of my place of observation were the Ossipee river, Hemlock trees, Pine trees, snow, as well as other observers. This is a perfect example of how deer are able to live around humans without causing harm to anything in its environment or our environment. This was proven as I was not the first person to look for deer scat or a deer, but I was the only one to find one. The deer did not cause any harm so it wasn't found until someone went looking for it.

My question is do the deer live close to humans in small towns because they have adapted to the people so they trust them, or is it because they have all of their resources and can simply leave when proven necessary for survival? If so why settle where people live instead of in mountains that too have their necessary resources and far less people if any at all?

This puzzles me so I will do further research on this. I will study the habits and instincts of a deer in different situations, scenarios, and places. This will hopefully answer the question(s) I have been stewing on since my first observation. If deer do have an instinct on whether a place is safe or not why would they stay where people are.



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Deer in towns - Wild Deer Best Practice Guidance. (2018, January 26).
<https://bestpracticeguides.org.uk/planning/deer-in-towns/>

The spooky kooky pumpkin fish

David M, Gorham Middle School, Age 12

The Pumpkinseed is a very interesting species of sunfish. Pumpkinseed sunfish are very territorial, and have been known to attack much larger animals. This sunfish is very similar to an invasive species in Maine called the bluegill. It can be hard to see the difference, especially when it's underwater, but a few key things that separate them are the size, texture, and Pumpkinseed has a bright red spot on its gill cover. I do wonder, what are the behaviors of the pumpkinseed?



I was swimming in Caribou Pond, Lincoln Maine, at 1:03 P.M. There were weeds, rocks, sand, and mussels all around me. I was startled when a pumpkinseed sunfish charged at me. I've seen this sunfish before - it has the same scar after being attacked by a bigger fish (such as a bass) as the one that lived under our dock, which is where I experienced the amazement of getting to observe sunfish mating. They swim around in the nest with a circle formation, the female letting out eggs as the male releases the sperm. I swam away, giving him some space. It seemed that he was successful yet again - there was another nest behind him. I was not surprised about that, he was the biggest one I've ever seen. Right then I realized that this sunfish decided to make a big bucket for his home. My dad had placed it there a few months earlier, and it was the perfect spot for a nest. It has protection, it's hollow inside, and there is all the sunfish's diet, such as larva and insects, around it. This sunfish made a good choice. He was very protective of his nest, and even bit my dad when he tried to attach his boat to it!

This observation was a very memorable moment for me, as I got to see a sunfish defend his home and children. It was extremely interesting to observe this behavior in the wild, especially when it is the same sunfish that I had observed before. It makes me wonder what the behavior is during the non breeding season. Are they going to experience behavioral changes throughout the year? I've seen them be much more skittish, but they've also come up to my face. I think in the other seasons, it's all about them and their survival. I could figure this out by watching them during the non breeding season, such as late summer.

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Ducks

Lillian M, Brunswick Junior High School, Age 12

It was February 13, 2024 at 8:10 am. It was 31 degrees Fahrenheit and overcast for the weather. I was in a small wooded area behind our school in Maine. Often, I see ducks there on the way home from school in the very small and shallow pond that's there connected to a small stream. I was out there on February 13th, I saw a duck swimming in the stream. The ducks come in the winter but leave in the spring. Seeing the ducks made me wonder why they stay in the winter and then leave in the spring.



The stream is rather shallow and since warm water is at the top the water may keep them warm. Also ducks eat insects. Insects sometimes stay by the stream and pond as it keeps them warm, too. I examined a picture of the ducks and realized that they were Wood Ducks or *Aix Sponsa*. Wood Ducks live in tree hollows which there is an abundance of behind my school. Looking deeper, Wood Ducks eat Skunk Cabbage as well, and Skunk Cabbage is common in the wooded area behind my school. Another source of food could be the many people that throw food to the ducks as they walk by. The pond protects the ducks from snow, too. It's in a little ditch next to a sidewalk. Above, trees spread their leaves and cover the ducks with shade.

If the ducks have food, water, shelter, and warmth, why do they leave in the spring? Does the kind of duck affect their behavior? How do the ducks get there without anyone seeing them move? Do the ducks move at night? Why don't ducks migrate to the south? Wood Ducks scientific name, *Aix Sponsa*, means bridal duck. I wonder why people thought wood ducks were bridal ducks.

References:

<https://thefreerangelife.com/what-do-ducks-eat/>

<https://www.audubon.org/news/10-fun-facts-about-wood-duck>

Plant Identification

Toby R, Brunswick Junior High School, Age 12

On February 13, 2024, at the stream at Brunswick Junior High School in Brunswick, Maine, at 1:20 pm with a temperature of 35° F and overcast weather. We walked on a path to a small stream. I noticed a plant that looked like a hollow golf tee and it was about $\frac{1}{2}$ inch in diameter and $3\frac{1}{4}$ inches in length. The plant's texture was brittle and felt like it could snap in your hands. While trying to find what this plant could be by using a plant identifier, it kept coming up with some type of mushroom or flower, but it had a very low probability of it being that plant.

Photo of the Mystery plant: Approximate Length of $3\frac{1}{4}$ inches and a diameter of about $\frac{1}{2}$ inch.



While researching what this plant could be I was led to believe at different times this plant was a different plant. Then as I looked into this possibility more, I discovered that the item I found could not be what I thought it was. Currently, I hypothesize that the mystery item is a Ghost Pipe Plant. I came to this conclusion because the Ghost Pipe plant can grow in Maine. The plant grows in what looks like the same environment as the mystery plant I found, and the Ghost Pipe Plant has the same colors as the mystery item I found.

Currently, I am still determining what the mystery plant is. If it is not the Ghost Pipe Plant, it might be some sort of dried grass. The mystery plant has almost no resemblance to any plants that I checked it against. So as of right now what this mystery plant is still evades me.

How much sap does a tree produce?

Avery S, Messalonskee Middle School, Age 13

On April 2nd, 2024, at 10:40 my classmates and I traveled to Bacon maple farm. At this farm I observed a large field. It was sunny out. I noticed that most of this grass was dead, and there was almost no grass that was alive. I noticed that there were a lot of trees surrounding this field. There were not any flowers or any color on this field. There were not any trees in the field, only surrounding it. This field and trees are important because the trees were probably tapped and being used for maple syrup. When I was standing in the field and looking at the trees, I started to wonder, how much sap does a tree produce?

How many gallons of sap does one tree produce a day, and is it different for every tree? It depends on a few things, like the size, health, and age of the tree. It also depends on the weather. The average maple tree will produce ten or twenty gallons of sap. As long as it's a healthy tree, it can produce sap for many years.

Maple syrup is something we learned about in each class. In science we learned about the process of maple sugaring, which I think was a very fun lesson. In ELA we read a book about a girl and her grandfather making maple syrup. In social studies we learned about the history of maple syrup and the different legends about maple syrup. In math we learned about ratios, like the ratio of water to sugar in sap.

Citations:

Thomas, H., & Thomas, H. (2024, February 28). How much sap can one tree produce? *New York State Maple Producers Association*. <https://nysmaple.com/how-much-sap-can-one-tree-produce/>

Skunk Cabbage by the Stream

Connor S, Brunswick Junior High School, Age 12

On the morning of February 15, 2024 at 8:10 AM the weather was overcast and it was 22 degrees Fahrenheit. There weren't many birds chirping in the trees. The trees swayed in the wind and the stream wasn't frozen over. On this chilly morning I discovered this mysterious plant all around the bank of the stream. I saw that there was a purple stripe on this plant so I inferred that this plant was Skunk Cabbage (*Symplocarpus foetidus*).



The name *Symplocarpus* is from the Greek *symploce* for "connection" and *carpos* for "fruit" referring to the connection of the ovaries into a compound fruit. The species name *foetidus* is from the Latin meaning foul smelling. Also Skunk Cabbage has a bad smell hence the name **Skunk** Cabbage. Skunk Cabbage is the first native plant to start growing in the northeast starting in February. Also in the 19th century Skunk Cabbage was used as medicine for the Native Americans. The peppery root is made into a tea and is used for coughs, as a blood purifier, a kidney cleanser, and to ease the pain of labor. Also Skunk cabbage was used for food for the native americans. I also observed that there was a lot of skunk cabbage but most didn't have any near one another. Also Wood Ducks eat the Skunk Cabbage. Skunk Cabbage has three different colors that you will see, purple, green and brown but also Skunk Cabbage can be all three of those colors. Also by late spring the light green plants are everywhere near bodies of water like streams, lakes, ponds and rivers.

When I was looking at this plant I was wondering why are these already starting to grow? It was so cold out that I didn't understand how a plant would survive. I know that Pine Trees stay green and healthy throughout the winter. I wonder if Skunk Cabbage has something in common with Pine Trees? I wonder if the smell of the Skunk Cabbage is a defense mechanism for those who want to eat them? In conclusion, the unique Skunk Cabbage has interesting traits and interesting facts that people wouldn't expect.

References:

Eastern Skunk Cabbage, https://www.fs.usda.gov/wildflowers/plant-of-the-week/symplocarpus_foetidus.shtml

Bacon Maple Farm

Hazel S, Messalonskee Middle School, Age 13

On April 2nd, 2024 a breezy sunny day, at 10:45 am, my classmates and I traveled to Bacon Maple Farm. At this farm, I observed the tubing from the trees to the sugar shack. I found the tubing very interesting because of how it helps the maple farm collect sap efficiently. Also, the owner Shelly Bacon told us a story that the tubing fell and was damaged from the wind during a recent storm. I found that surprising because I thought it was going to be a lot stronger. After all, it held so much sap.

My question was can the lines go underground? It turns out they can and the farmers that do put them underground say they like it so much more. The tubing underground can control the temperature of the sap even when it's underground. Also, the tubing is a lot stronger and more manageable when it is underground. When I looked at the blue tubing for the sap it looked weak and wobbly. When she said her lines went down during the storm I thought, no wonder they look so weak and they are not low to the ground so they can be taken out by trees. That made me think, what if they were underground?

Believe it or not, maple syrup-making uses every subject you can think of. The math you can relate it to the ratios for example there are 40 gallons of sap to 1 gallon of syrup. In ELA you can find all the information in books and there is lots of writing. In social studies, you can see what tribes were the first to make maple syrup. In science, you can see the change in the temperature and how that affects the sap in the trees.

There is a lot of time and money that goes into making maple syrup and there is a very difficult process that people have to do to make it. For instance, they have to get tapped from the tree, then they need to boil the water out of the sap, then they need to filter and then put in bottles and it can take a lot of hours and maybe even days at a time. In class, we did an activity that showed the process of making maple syrup. When we went on the field trip I got to see the steps in real life and it felt like I already saw it happen. Most people just forget about it and I don't think anyone has taken the time to think about it. Maple syrup is a lot more than just something you put on pancakes and some people think it's a simple process, but from the information I have given you, I hope this makes you think more about the difficult process of making maple syrup.

Citations

Tapping and Tubing | The Maple News. www.themaplenews.com/stories/tapping-tubing/3/all.

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Skunk Cabbage

Jamie W, Brunswick Junior High School, Age 12

On February 13th, 2024 our science class went out to the forested area behind our school at around 1:20 p.m. to find something that interested us. It was 35°F out and there was a small stream and a path that went around it. When we were walking along the path, I noticed that there was some *Symplocarpus foetidus* (skunk cabbage) growing in the shallow stream. This intrigued me, since I knew that trees couldn't really live in water because their root systems couldn't latch on to the dirt. I then wondered what was so different about skunk cabbage that allowed it to live in streams.



I think I might go back to the woods some time to look at the skunk cabbage and see how high the water is, and maybe try and look at the root system. I ended up looking at a website about skunk cabbage and I found out that it has a huge root system, which explains how it survived in the shallow stream. This surprised me because skunk cabbage seems small, so I thought it couldn't have a big root system.

I wonder why skunk cabbage has such a big root system. Could it be because it needed to live in water? Did it evolve to have it so animals wouldn't rip it out of the ground and destroy it? I might look further into this and see if I can get some answers. There might be more questions that I think of and it would be interesting to learn more about skunk cabbage, and maybe go out again to see if anything else interests me.

Source:

Skunk Cabbage (*Symplocarpus foetidus*) by Craig Holdredge

<https://www.natureinstitute.org/article/craig-holdrege/skunk-cabbage> accessed 2/26/24