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Changes in Green Crab Sizes and Sex Ratios at Reid State Park, Maine From 2013 to 2021

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12/20/2021

Title

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Abstract

Green crabs harm Maine's intertidal zone and the native species that live there. I investigated how the crabs sizes and sex ratios changed at Reid State Park form 2013-2021. Half of the BMS seventh grade collected data from traps with bait over eight years total. Sex ratios fluctuate drastically from year to year due to unknown reasons; the sizes may fluctuate due to food availability.

Introduction

Green crabs are an invasive species from Europe that have now infested the rocky intertidal zones and saltwater marshes of Maine. The BMS seventh grade class has been researching them in and out of the field. I have been investigating how the green crab population has changed in size and sex ratios from 2013-2021 at Reid State Park. In other words, I studied the changes in crab sizes (if they are big or small), and the changes in how many females there are to males (whether there are more males or females).

According to *Down East Magazine*, "The green crab first came to American shores in the early nineteenth century, probably in the ballast of ships." These crabs can invade quickly, and have had many negative impacts since then. Green crabs have developed a diet for most everything that inhabits the Maine coast, including juvenile lobsters, soft shell clams, and eelgrass. (Young and Elliot, 2019) Consuming the juvenile lobsters and soft shell clams impacts the fishing economy because the clambers and lobstermen cannot make as much money without the catches they used to have. Not only that, but ripping up eelgrass in search of food is problematic in many ways. Eelgrass is an important habitat and food source to countless organisms, it filters the water, and prevents erosion. Without eelgrass, many species would die from loss of food and habitat, the water would become less healthy, and the coastline would erode in floods. As you can see, the negative cause and effect from green crabs is prominent.

I wanted to research the changes in sizes and sex ratios because there have been tempature increases from global warming since the green crabs arrived. I thought that studying how there sizes and sex ratios have changed could fill gaps about how green crabs will impact our environment further. For example, if there have been less females year after year, green crabs will have a harder time reproducing in the future; this could help scientists predict their

downfall. Overall, I wanted to research this so that their ease of living (food sources and reproduction accessibility) could be graphed; therefore predicting their future.

Methods

To collect data, students caught crabs in traps. Trap data was collected in 2013, 2015, 2016, 2017, 2018, 2019, 2020, and 2021. There is one location where the traps were set, Reid State Park. Reid State Park is located on the midcoast of Maine in Georgetown . The longitude and latitude of our location at Reid is 43.784770, -69.723041.

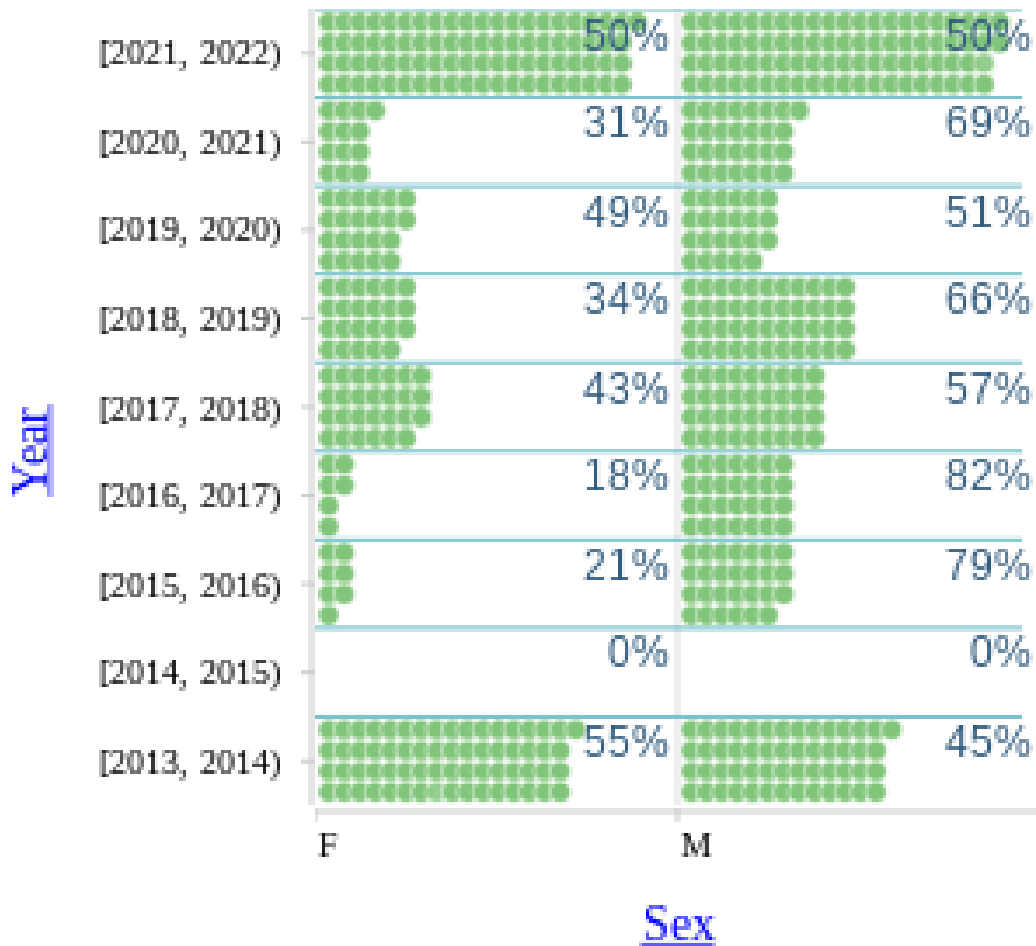
This year, a total of three traps were set three times at Reid. When the BMS students arrived at Reid the traps were already set. Then, we simply took the crabs out of the traps and collected the size in millimeters and the sex. Prior to our trip, we had been taught how to correctly and scientifically identify the sex of crabs. The size measurement was taken from the furthest spine to the other in millimeters.

When the traps were set, canned sardines in fish oil were used as bait. The cans were punctured three times to slowly release the bait and oils over a long period of time and then placed in the traps. In 2021, three traps were in the water for 72 hours instead of the 24 that the others were due to weather difficulties. That could impact the number of crabs caught. Not only that, but the time in the water could have been different in years prior.

The seventh grade classes thought about how to make this data reliable in many ways. Every year students used the same bait, were taught how properly sex crabs, were taught how to properly measure crabs, and how to search within their own quadrat. These were the four most important things that kept the data reliable, and we achieved them every year.

Results

Graph 1

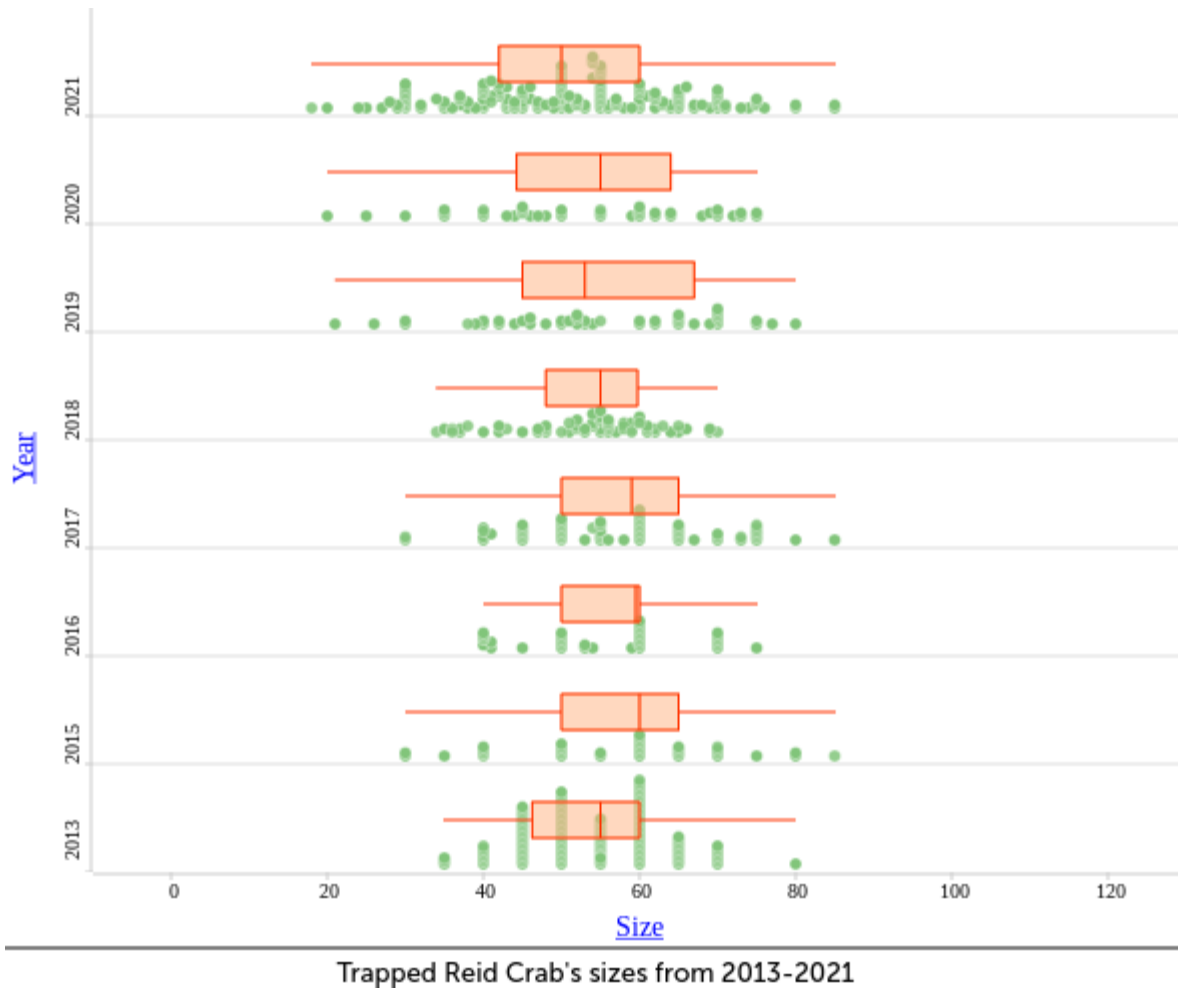


Trapped Crabs From Reid Sex Ratios 2013-2021

Key One dot:one crab

This graph shows the sex ratios at Reid State Park over eight years, from 2013-2021. The years show up twice because I had to make sections to more easily calculate a percentage. That does not affect the data. To show the ratio mare easily, this is an example from 2015 and 2016: There are 21 females for every 79 males.

Graph 2



Key one dot : one crab Note: The outliers have been excluded

This graph shows the changes in trapped crab's sizes in millimeters from Reid State Park over eight years. Along with a box plot showing the median (middle number), lower quartile (middle of the lower half), upper quartile (middle of higher half), lowest data point, and the highest data point. The dots are spread out according to measured size.

Discussion and Conclusion

Through my research, I found that the sex ratios fluctuate drastically from year to year. I observed that, in 2015, 2016, 2017, 2018, 2019, and 2020 the male population was incredibly larger than the female population. For example, in 2016, only a mere 18% of the trapped crabs were female. Compared to the 55% of females caught in 2013, the 18% came shocking for being only two years after such an even count. Nevertheless, from 2016-2021 the female population did face a somewhat steady increase, up until 2021 and the ratios were exactly

50/50. I am not sure why this has happened. There have been temperature and population increases, but I am unsure at how this would connect.

For the sizes, I think green crabs are becoming smaller. In 2013, the median crab size was 55 millimeters. As time went on, this number got bigger. In 2017, the median was 57.6, which was 2.6 millimeters larger than 2013. But, more recently the median has gone down. Now, in 2021 the median is 51.2, which is 3.8 millimeters smaller than 2013 and 5.4 millimeters smaller than 2017. I think that this has happened because of the food supply. When a green crab eats more food, they get bigger. But, when the food runs out, they don't grow as big. In 2013, the green crab populations were smaller as they were still somewhat new to Maine. Then, as time went on the crabs ate more and more of Maine's native species, they got larger. Now, as Maine's native species have depleted, they're getting smaller with the lack of food.

Like mentioned in the methods section, some factors could have impacted my data. These are: varying times the traps were in the water; and human errors, like inaccurate measurements. To further this investigation, I would take larger amounts of data from a variety of surrounding beaches. This might make the data more accurate.

Acknowledgements

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Thanks to the bus drivers who transported us to Reid. That day, we were crunched because of the tide times, but we still got there in time because of them. Not only that, but they didn't lose their minds riding with 30 hyper 12 year-olds for 25 minutes.

Thank you Fai, our voluntary helper who came all the way from Tennessee. She never missed a chance to help us with tech.

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