Findings from the Field

Volume 3 Article 8

2020

The Inverse Relationship Between Green Crabs Caught and Average Crab sizes

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Abstract

Green crabs are harming Maine's marine ecosystem and the native species that live there. We want to know what the connection between green crab populations and average cerapice sizes is over time. Middle school students from Bath have been collecting data from traps since 2015. The relationship between size and crabs caught is opposing and almost never the same. This could be due to the amount of younger crabs.

Introduction

Green crabs are a threat to native species, so researchers have tried to stop them. One thing researchers have done is eating them. This is still a challenge as their molting period lasts only 24 hours with little indication at all, and they are best eaten when molting and soft. Green crabs arrived in Maine during the mid 1800s when they were brought over in the ballast of ships (Maine.gov, 2013). They weren't much of a problem until 2012, when an ocean heatwave warmed the Gulf of Maine, and they flourished in the warm water(GMRI, 2018). Green crabs rip up eelgrass in their search for food. Over time, this affects the turbidity of the water because the eelgrass won't be able to filter out pollutants (Poppick, 2019).

Green crabs have had a huge affect on native species. They have a voracious appetite, eating mussels, clams, small worms, juvenile lobsters, and even other crabs (Massie, 1998). According to the Press Herald article written by Penelope Overton, "One green crab can consume 40 half-inch clams a day and will dig 6 inches to find clams to eat. In 2016, clam landings fell 21 percent. " This type of consumption has a ripple effect on the marine ecosystem.

It isn't helping that genetically different mutant crabs from Canada have started appearing in the past few years. These new crabs are much more resilient and aggressive. Markus Frederich, from the University of New England, is studying the genetic makeup to find out why the Canadian crabs are so aggressive. If the new crab's populations continue to grow it will have a very negative effect on the Gulf of Maine and possibly other places on the East Coast.

What is the connection between green crab populations and average carapace sizes over time? This is important to know because we can see how size fluctuates with population sizes. Do green crabs become larger when they're are more of them or less? This is important because if the crabs are big, and populations are huge, then the effect of them eating native species like clams and muscles would be much larger. Bigger crabs eat more alone, and more crabs eat more as a whole. If green crabs begin eating too many native species, this could have a negative effect on the ecosystem.

Methods

On October 21, 22, and 24, 2019, students from Bath Middle School collected green crabs caught in a trapezoid and three barrel traps at Fort Popham, Phippsburg, Maine. Reid State Park, and Todd's Landing, both in Georgetown, Maine. We used two cans of sardines in oil as bait each day. They were first set on October 20, 2019. On the 20th we put all the crabs from each trap in a bucket. Then we measured the carapace size of crabs by taking a ruler and measuring spine to spine. After that was the sex of the crabs. This was done by looking at the telson shape. The color, and the number of claws. We used a catch and release method. We painted the crabs white before releasing them and resetting the traps. On the 21 we followed the same procedure, but painted them pink, and checked for pint from the previous day. On the 24, we did everything except painting the crabs.

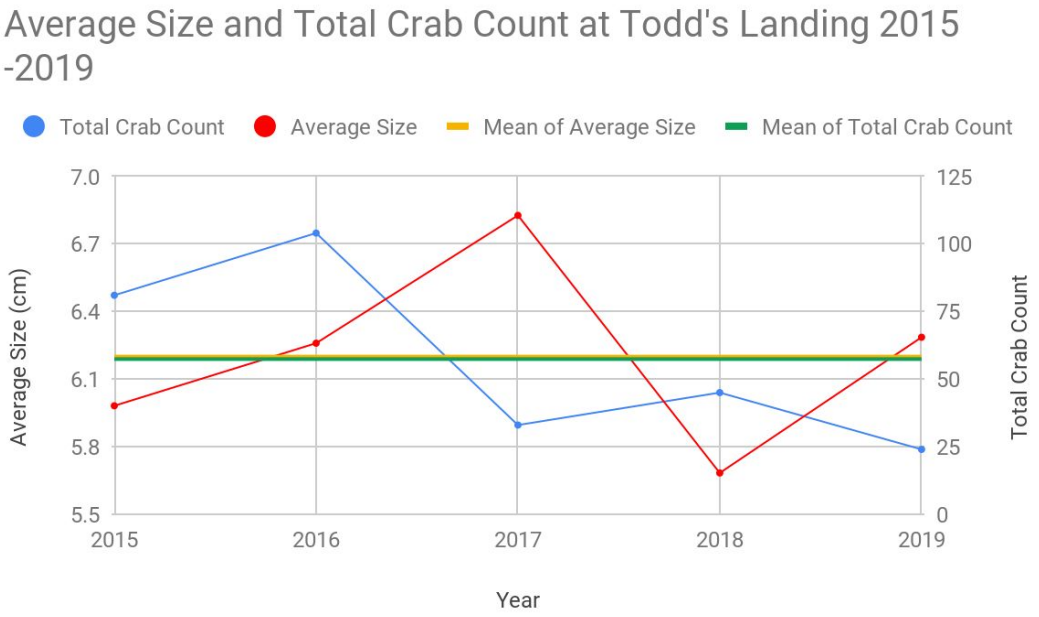
We did it this way because we can estimate population sizes. When we see how many crabs recaught have paint we can tell the size of the population. In past years we haven't caught many to any repainted crabs.

While we were collecting data, we noticed that one of the traps wasn't underwater all the way. As a result, we added rope and slightly altered the position of the traps. Another change we had to make was when we went. It rained on the 23th, so we rescheduled to the 24th. This caused traps set on the 22th to be in the water for 48 hours, as compared instead of 25 hours.

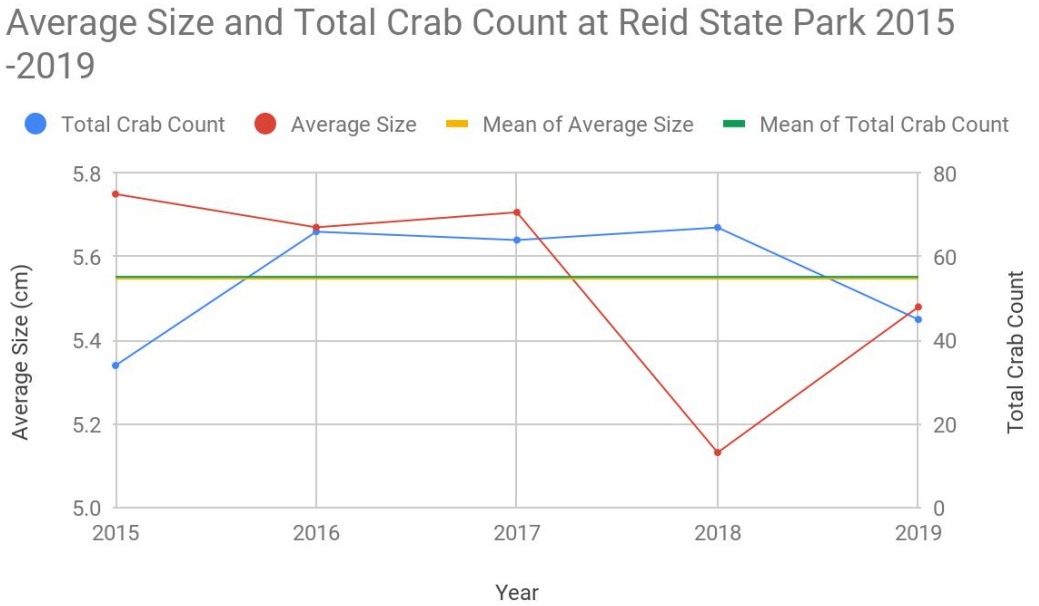
Students from Bath Middle have followed these procedures from 2015 to this year. The older data in my charts was collected by older students using the same methods.

Results

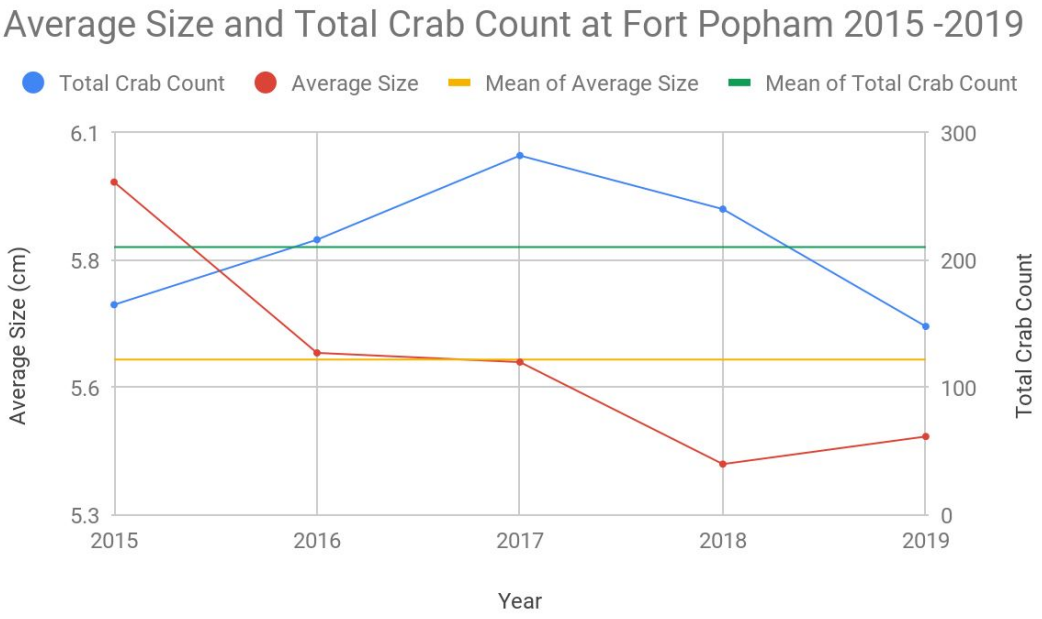
When the amount of green crabs caught increases, the average size dips. When less crabs are caught, the average size decreases.



Todd's Landing is a clear example of the opposing size and crab count. In 2016 the average size was 6.3 centimeters. The total count was 104 crabs. The next year the total count fell to 33 green crabs, and the average increased to 6.8. The pattern switching continues through 2019.



At Reid State Park, the difference between size and crab count is less noticeable. For example, in 2016 and 2019, the points of the chart are only just separated from each other, and in the case of 2016, they are both high numbers in comparison to the means, meaning that 2016 had a lot of big crabs.



In this chart, 2016 - 2019 the total crab count stays high, and the average size stays low.

Discussion and Conclusion

Through my investigation I found that the average size and amount of crabs caught have an inverse relationship with each other. Whenever the size is high, the population will be low or the other way around.

For example, the total crab count at Fort Popham in 2018, was below the mean of the total crab count for all years. Also in that year, the average size was below the mean of the average size. In other years or at other locations they're are many other examples of this difference.

This supports my claim because the data example follows through on all of the charts with only one or two exceptions, 2016 and 2017 at Reid State Park.

One reason this could be happening is because when more crabs are born as compared to other years, this would increase the population size and since more crabs would be younger, and younger crabs are smaller than the older crabs, the mean size would also be smaller. The opposite example could happen when fewer new crabs are born so they are less small crabs and more big crabs.

One thing that could be done to further this investigation is to look back at the data to try and find patterns in the size and crabs caught. This could help people understand when there will be more crabs or bigger crabs and at what location is the best. For example, if a fisherman was able to see that Todd's Landing would have bigger crabs with more meat the next year, they might fish there, and have a greater impact on the crab populations overall.

Acknowledgements

Thank you to all my peers that helped me through this journey. Also a huge thanks to the Kennebec Estuary Land Trust, who helped us in the field, supplied crab traps and much, much more.

References Cited

Green Crab, www.edc.uri.edu/restoration/html/gallery/invert/green.htm.

Georgetown Maine, www.georgetownme.com/.

Fisheries. "European Green Crab." *Fisheries and Oceans Canada*, 9 Apr. 2019, www.dfo-mpo.gc.ca/species-especes/profiles-profils/europeangreencrab-crabevert-eng.html.

Gomez, Melissa. "'Highly Aggressive' Green Crabs From Canada Menace Maine's Coast." *The New York Times*, The New York Times, 25 Sept. 2018, www.nytimes.com/2018/09/25/us/canadian-green-crabs-migration.html.

"Green Crab Overview, December 2013." *European Green Crab Overview December 2013 - Invasive Species: Maine Department of Marine Resources*,