

Is There a Correlation Between the Salinity of the Beach Shore and Crab Population?

Tera, Tally, Max
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Research Question & Background

Our research question is, do increased salinity levels correlate with a higher crab population within the shores of the Bellingham Bay? Bellingham Bay, Washington, is part of the Puget Sound estuarine system, defined as “a partially enclosed body of water where freshwater from rivers and streams mixes with saltwater from the ocean.” Because of this mixing, salinity levels change throughout the tidal cycle. During high tide, saltier ocean water enters the bay and increases salinity, while low tide allows more freshwater to influence the area, lowering salinity near shorelines and tide pools. These changes are important for intertidal species such as crabs, since crustaceans must regulate their internal salt balance when environmental salinity changes. We know that the Salish Sea has a prominent crab population, as “Many species spend time in the intertidal zone, between low and high tide...We conclude that crabs are adapted to their immediately local habitat for the food, and water conditions where they thrive” (Cofer, Harper). This predicts that crabs are well adjusted to different beaches and their population is thriving, especially in the intertidal zone, where we have focused our research. Additionally, we know that crabs can have a positive correlation with salinity, as shown by this quote: “The results revealed a significant positive correlation between the number of crabs and salinity (Lv, WeiWei et al).”

Methods

Materials & Location

Using a tape measure, sample containers, and a notebook for data recording; we visited the Larabee State Park boat launch, Clayton beach, and Marine park. We collected our data from these beaches at around 4:30 PM for the low tide.

Procedure

We collected data from opposite ends of the beach at each site. First, we collected a water sample and labeled it. Then, directly vertically above our sample site, we marked out a 5 by 5 foot square. Inside this square, we each turned over 15 rocks and counted the amount of crabs we found for 3 minutes.



Figure 1. A crab from Marine Park

Line Graph of Crab Pop. and Salinity

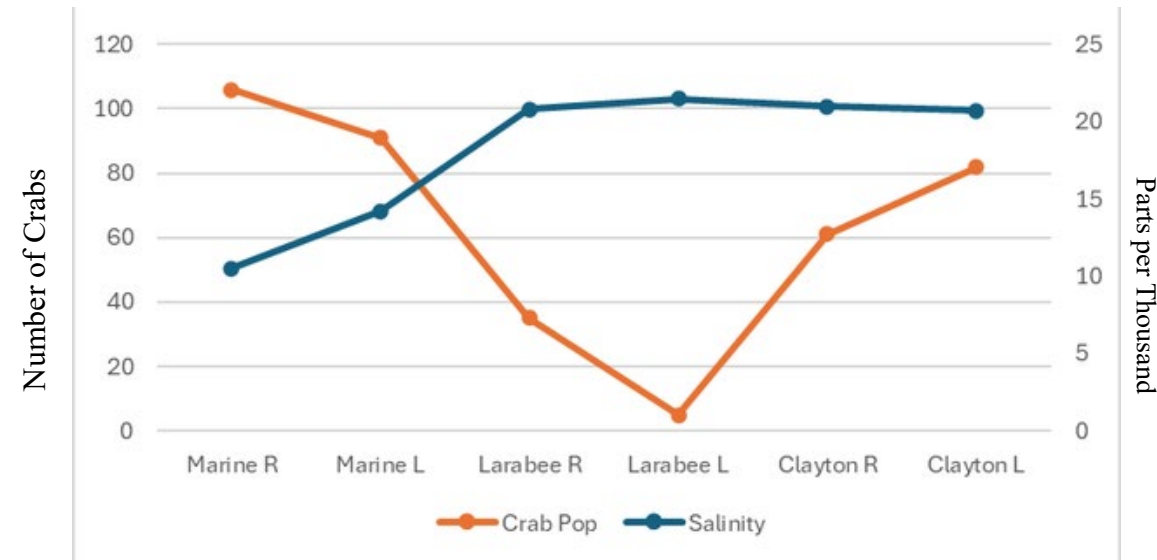


Table 1 The blue line represents salinity amounts, and the orange line represents the crab population. there is no correlation between the two.

Map of research Area

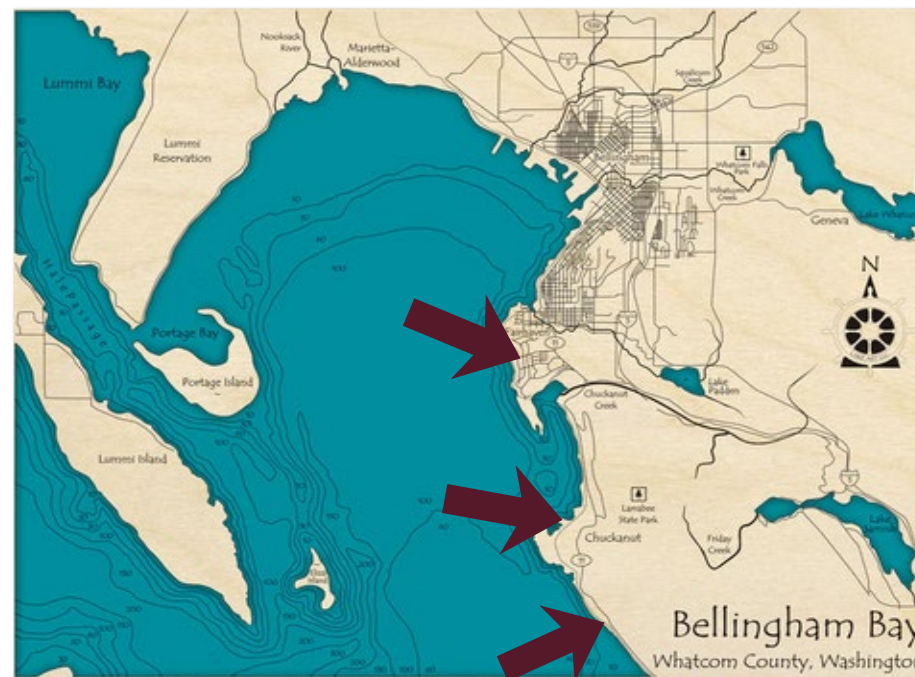


Table 2. The tables refer to our sampling locations around Bellingham Bay.

Discussion

Our findings show no correlation between salinity and crab population in Bellingham Bay. After looking at 6 sites at three beaches, our water samples and crab population numbers did not have much relation to each other. at Larabee state park, we found 35 crabs at site R (right), and 5 at site L (left). At Clayton beach, we found 61 at site R and 82 at site L. At Marine park, we found 106 at site R and 91 at site L. If our hypothesis was correct, it would indicate higher salinity at Marine park, and lower at Larabee state park. However, we found that Marine park had the lowest salinity, with Sight R having 10.5 ppt(parts per thousand), and site L having 14.2 ppt. This is significantly lower than the four other sites, which were all in the 20s ppt: Larabee site R had 20.8 ppt, Site L had 21.5 ppt. Clayton beach site R had 21 ppt, and site L had 20.85 ppt. According to our background data, there should be a higher crab population in areas with more salinity (WeiWei et. al.). However, our findings do not show that this is the case. Interpretation: .

Our results show that, in the locations we researched, there is little correlation between salinity and crab population. This is in contrast to our background research, which clearly stated that crab population and salinity have a strong positive correlation (WeiWei et al). However, this may be due to that study being in the Yangze river delta in China, while ours was across the world. Other parts of our research stand- we did, as expected, find a lot of crabs in the intertidal zone, showing that there is a thriving population (Cofer, Harper) Curiously, there was almost a negative correlation between crab population and salinity, with Marine park having lower salinity and higher crab population, but this was not shown in our data from the Chuckanut locations. We believe that, due to the time and location constraints, our ability to collect data was hindered. This, along with unfavorable tides, were some of the biggest limitations of our data. We believe that to properly replicate our study, a wider array of collection locations, and number of sites per location, would be preferable. Additionally, spring or summer would be a more ideal time to collect data due to having more favorable, daytime low tides.

Acknowledgements

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Work Cited

Lv, Weiwei et al. “Effects of reduced salinity caused by reclamation on population and physiological characteristics of the sesarmid crab *Chiromantes dehaani*.” Scientific reports vol. 12,1 1591. 31 Jan. 2022, doi:10.1038/s41598-022-05639-4

Cofer, Sam, and Diana Harper. “Crabs Pinch-Perfect Habitats: What Are Crabs like in the Salish Sea?” Whatcom Digital Commons, 17 July 2025, whatcomdigitalcommons.org/files/original/9474f80567c4036fedf67935c2eb12e523a27946.pdf.