Measuring Temperature and Salinity Variations in the Water in Sitka, Alaska

Sierra Isaak[1, 3], Turtle Larson[1, 3], Autumn Treadway [2, 3], Shannon Cellan [4], Ian Derauf [4], Kari Lanphier [5]
Willa Johnson [6], Ellen Chenoweth [3, 6]

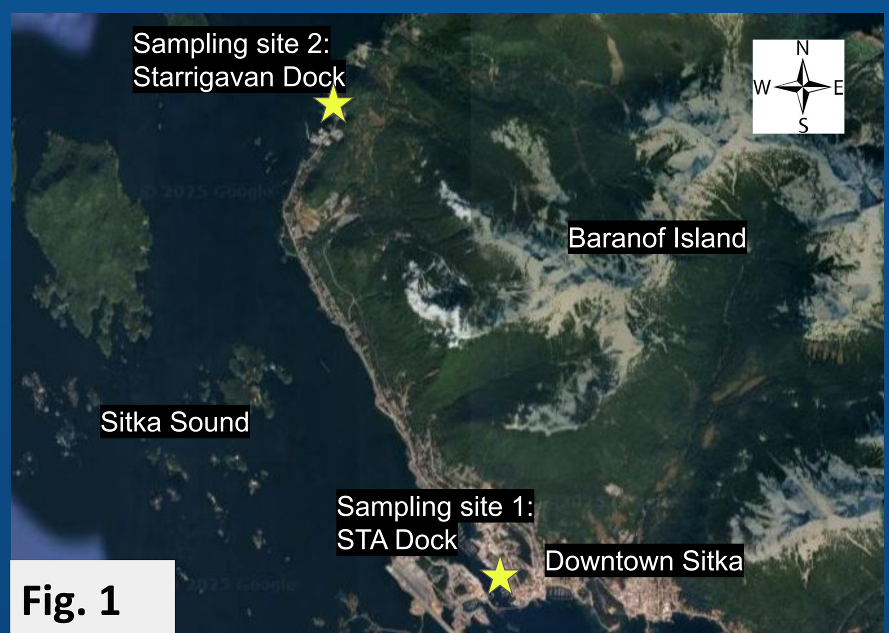
1. Mt Edgecumbe High School, 2. Sitka High School, 3.University of Alaska Southeast 4. Sitka Tribe of Alaska
5. Southeast Alaska Tribal Ocean Research Network 6. University of Alaska Fairbanks

Introduction

The atmospheric carbon dioxide has increased more in the last 250 years than it did in the previous 800,000 years (Lintner et al., 2006). Rising atmospheric CO_2 levels due to the increased usage of petroleum products like coal and oil and the products made from them, also affect the oceanic CO_2 levels, which lead to ocean acidification (Doney et al., 2009). There is monitoring going on across the oceans for ocean acidification including in Sitka, Alaska, however there is not a lot being done for coastal communities. Sitka is geographically diverse in the sense that there is an open ocean, a channel, mountains that have run off water, and glaciers that play a role in the water chemistry. These changes in water chemistry can have a negative effect on animals, in particular the shellfish that the locals have been harvesting for many generations. It is the reason for wanting to better analyze and understand what is happening in this area by testing conductivity, salinity, water and air temperatures, and current direction and strength that this project is ongoing. Monitoring salinity is important because the level of salinity in the water indicates the availability of carbon ions in the water, and since ocean acidification is directly tied to the ocean's pH levels, salinity is a contributing factor of how fast the ocean acidifies. Lower levels of salinity make it harder to get accurate OA data due to how salinity decreases closer to freshwater outlets that are abundant in coastal communities due to there being a high level of rivers and snowmelt.

Hypothesis

We predict that in the February to early April waters, the salinity and conductivity will increase in deeper water because there will be less influence from precipitation and runoff deeper into the water.



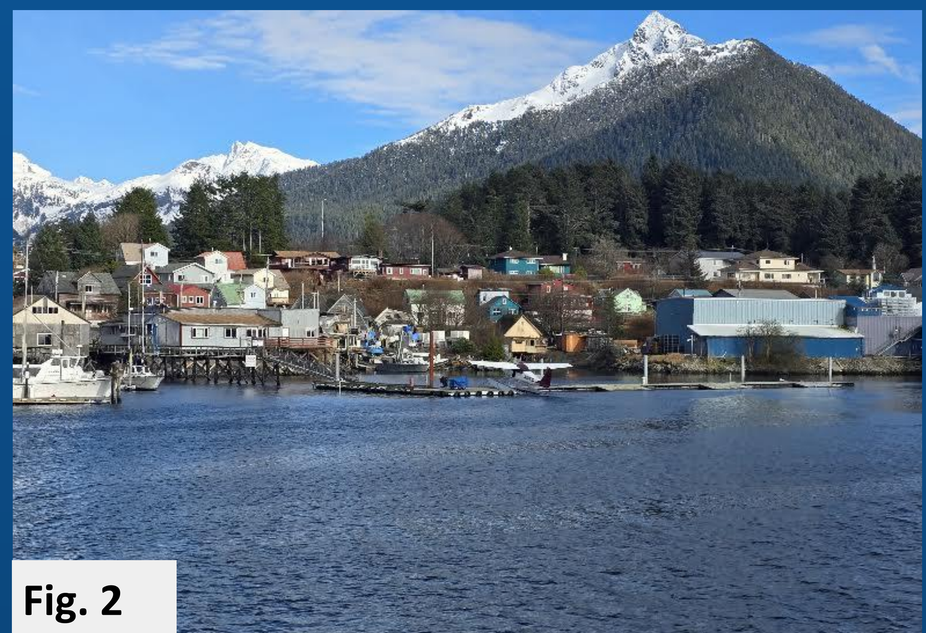


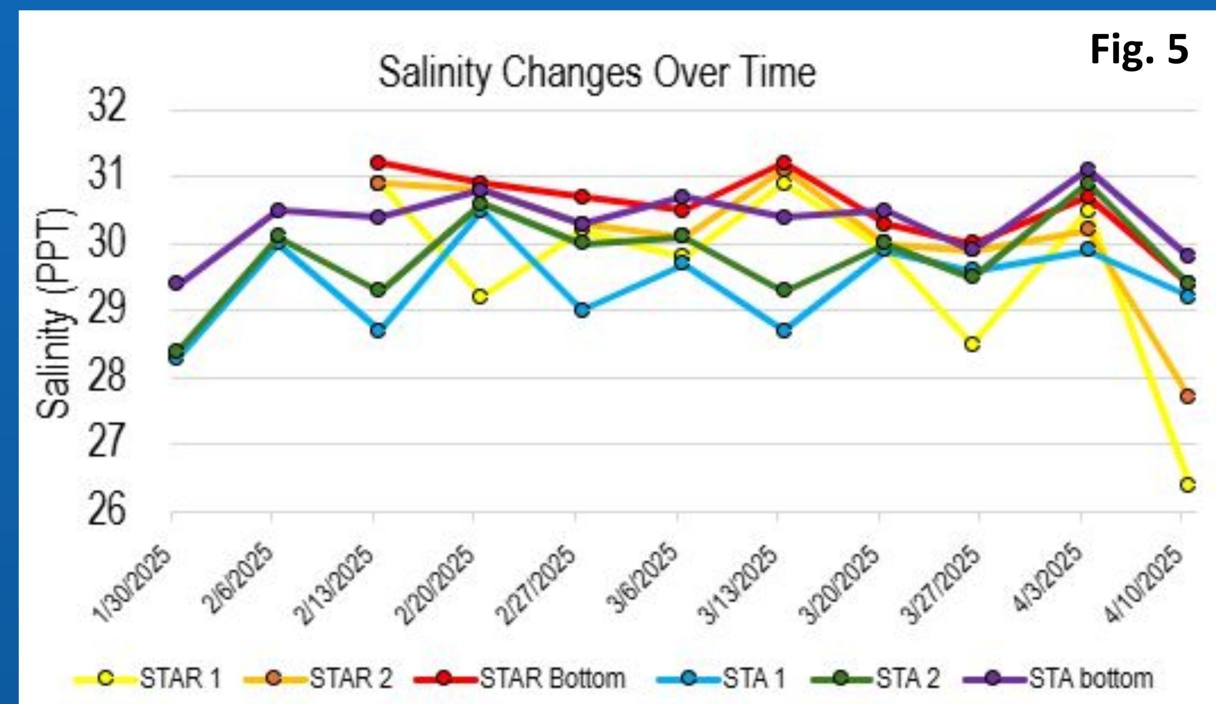
Figure 1: The map of location and sampling sites
Figure 2: Sitka Tribe of Alaska (STA) sampling dock from across the channel
Figure 3: Geographical location of Sitka
Figure 4: Starrigavan (STAR) dock from the top of the boat launch

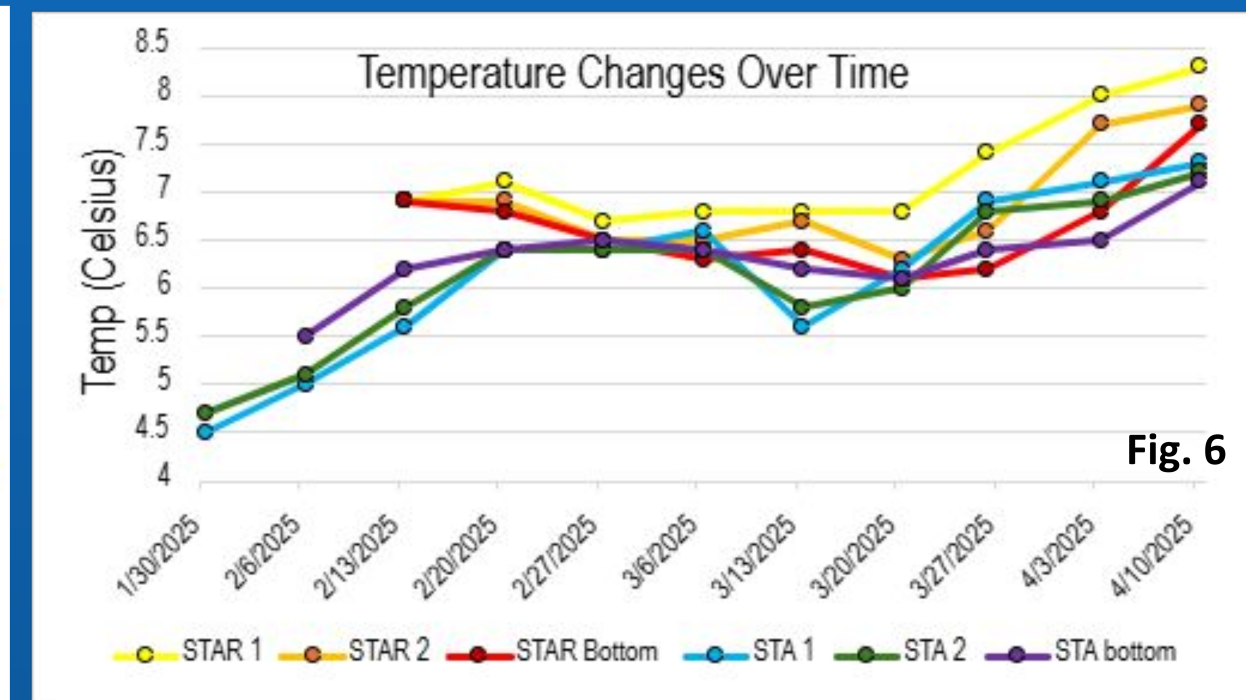
Methods

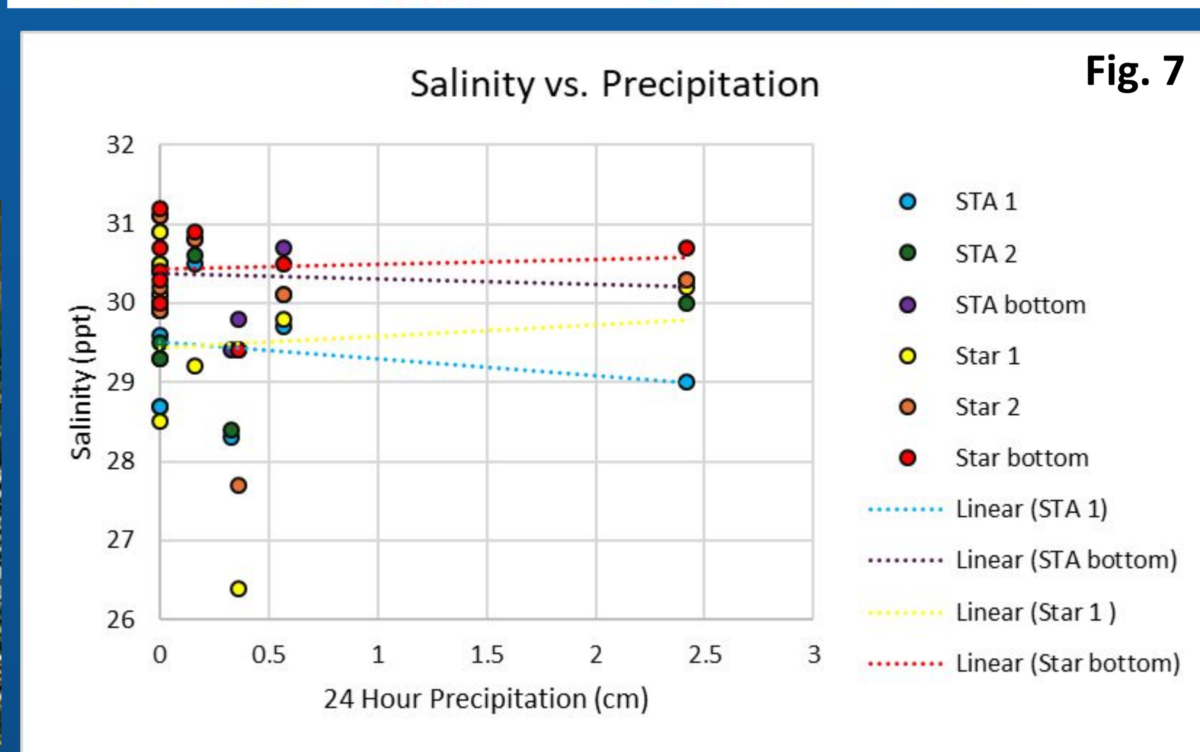
The ocean chemistry data relevant to ocean acidification was collected in Sitka, Alaska, from two sampling sites, the same method of measuring was used once a week for 11 weeks consecutively between 4 and 5 PM (1/30/25-4/10/25). Water depth, air temperature, water temperature, salinity, and conductivity were measured. To measure the depth a cannon ball attached to a rope was lowered off the dock and labeled with meter markers. When the cannon ball touched bottom, the measurements of water temperature, salinity and conductivity was recorded and the depths 1 meter, 2 meters, and 1 meter off the bottom were tested. Air temperature was measured first and left to sit to ensure the right temperature was recorded. Testing required the use of a water quality sampling instrument (brand YSI) that recorded salinity, water temperature, and conductivity. It was also marked with tape for every meter to ensure the accurate depth was tested. Tide height was recorded from NOAA when testing was done and time was always recorded to ensure consistency. Measurements were taken at three depths at the two sampling sites, the STA dock and Starrigavan.

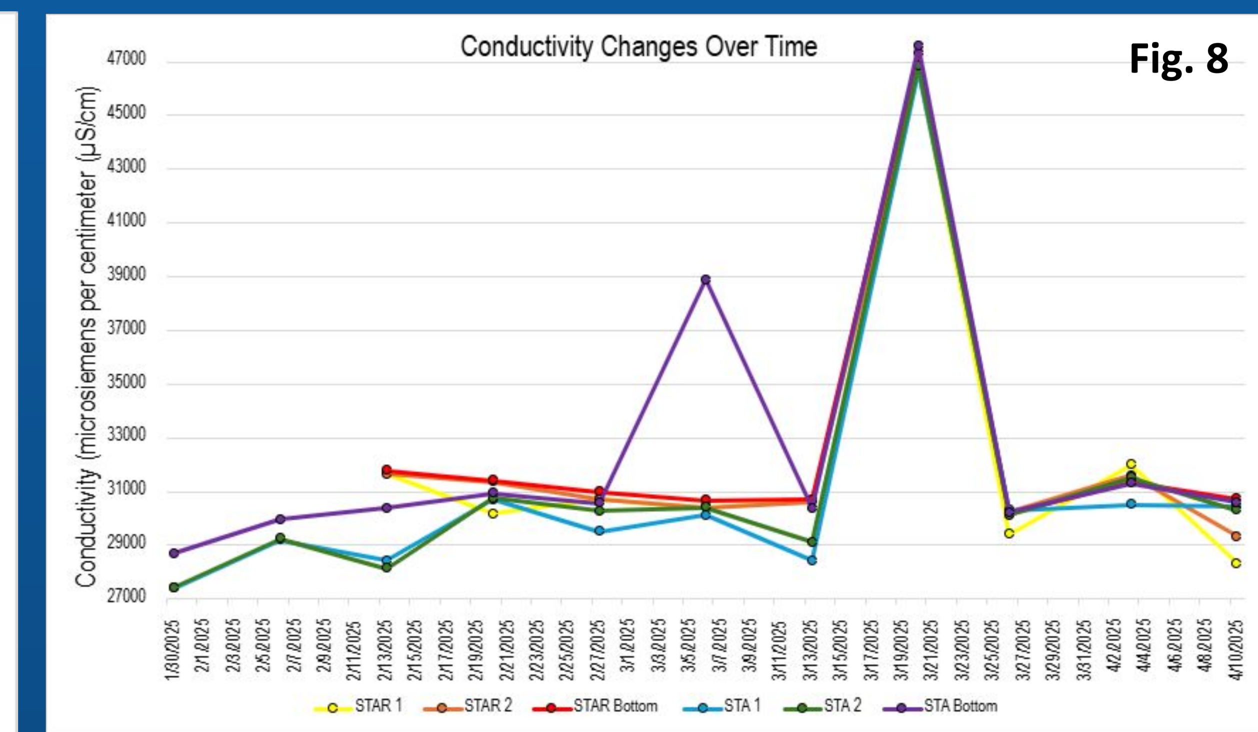
References: Lintner, B. R., Buermann, W., Koven, C. D., & Fung, I. Y. (2006). Seasonal circulation and Mauna Loa CO2 variability. *Journal of Geophysical Research: Atmospheres*, *111*(D13). https://doi.org/10.1029/2005jd006535
Doney, S. C., Fabry, V. J., Feely, R. A., & Kleypas, J. A. (2009). Ocean acidification: the other CO2 problem. Annual review of marine science, 1, 169–192. https://doi.org/10.1146/annurev.marine.010908.163834

Results









- The salinity was slightly variable throughout the experiment in the lower and more variable closer to the surface. (Fig. 5).
- The temperature was more stable deeper in the water than shallower (Fig. 6).
- At the bottom of each sampling site (STAR bottom, STA bottom),the precipitation had a weak relationship with salinity (Fig. 7).
- On the surface at Starrigavan (STAR 1), there was a slight positive relationship between precipitation and salinity (Fig. 7).
- At the Sitka Tribe of Alaska surface sampling site (STA 1) there was a slight negative relationship between precipitation and salinity (Fig. 7).
- Conductivity was relatively stable between the locations and depths (Fig. 8).

Discussion

Our hypothesis is that salinity would decrease at the surface and stay more consistent at deeper depths was supported. The conductivity varied only slightly by depth and location, but our hypothesis that conductivity would increase in deeper water was also supported. One possible reason behind the differences in salinity could be due to the precipitation and regular boat traffic that changed the surface depth of salinity compared to deeper depths, there were less variables to change and lessen the salinity. There are a few things in our research that can be changed in future studies such as: more locations in Southeast Alaska, sampling during a longer period of time especially in the fall when Sitka gets the most rainfall throughout the week, and different time of years when there is more boat traffic and weather variety. This work is important to Sitka Tribe of Alaska and the SEATOR network, which runs the ocean acidification measurements across Southeast Alaska, Our research will help them get more precise measurements to observe ocean acidification. This research is important to coastal Alaska communities because not only does the higher acidification affect the marine life that dwells in these waters, but it also affects the human life that uses these areas of water for subsistence.

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