# Nearshore high-frequency pH dynamics in Kachemak Bay, Alaska

Amanda L. Kelley[1], Cale A. Miller[2]
[1]University of Alaska Fairbanks, Fairbanks, AK, United States
[2]University of California Davis, Davis, CA, United States

## 1. INTRODUCTION

Ocean acidification is expected to have deleterious impacts to marine fauna, especially in high-latitude environments. Understanding the natural variability in pH dynamics, particularly in nearshore habitats, is an important step in establishing baseline data for future comparisons and to provide ecological context for manipulative ocean acidification experiments. This research is one of the first high-frequency, annual pH dataset from Alaska's nearshore habitats.

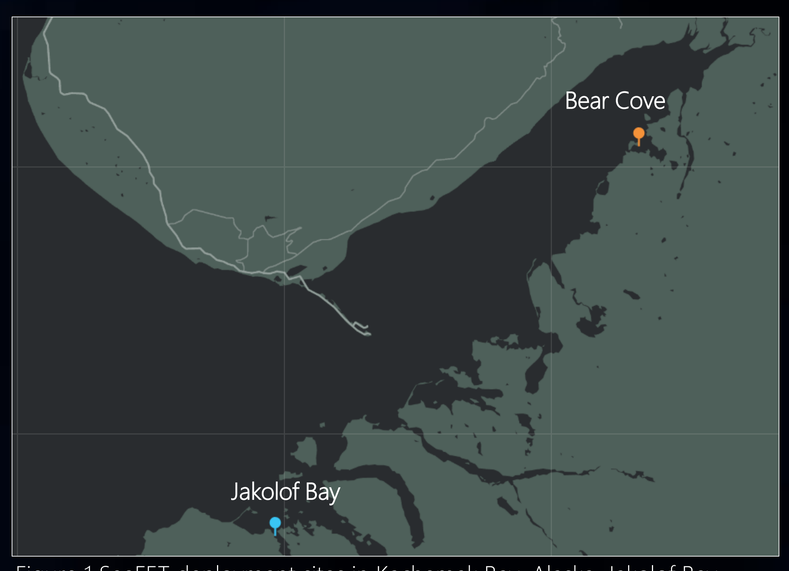


Figure 1 SeaFET deployment sites in Kachemak Bay, Alaska. Jakolof Bay (blue) and Bear Cove (orange).

## 2. APPROACH

Kachemak Bay is a biologically diverse, high-latitude estuary in the northern Gulf of Alaska (fig. 1). Two SeaFET autonomous pH sensors (co-deployed with salinity and oxygen loggers) were deployed October 2017 – December 2018 at two sites- Bear Cove and Jakolof Bay. A single-point pH calibration sample was collected from each site after deployment and analyzed for $pH_T$ following Standard Operating Procedures[1]. Multiple reference samples were collected post-deployment to determine pH uncertainty. All sensors collected measurements at a 3-hour frequency. pH was calculated using in-situ temperatures using CO2Calc[2]. A total of 14 months of high-frequency pH data was collected from each site.

## 2. RESULTS

### JAKOLOF BAY

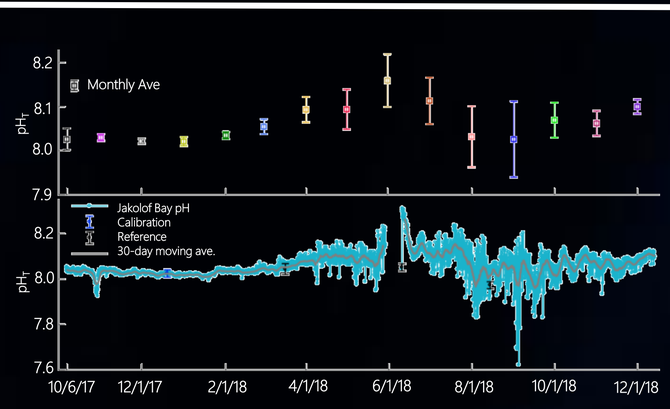


Figure 2. Upper panel- mean monthly pH, error bars represent standard deviation. Lower panel- high-frequency pH time-series. Propagated uncertainty for pH time-series is 0.0192.

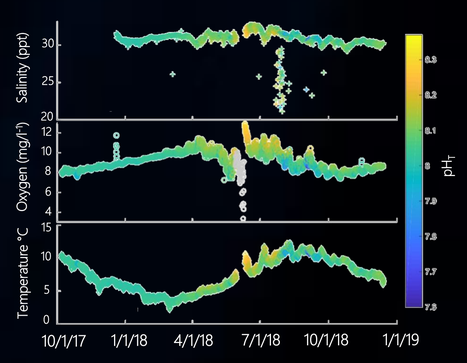


Figure 3. Upper panel- salinity, middle panel- dissolved oxygen concentration, bottom panel- temperature. All values plotted with corresponding pH.

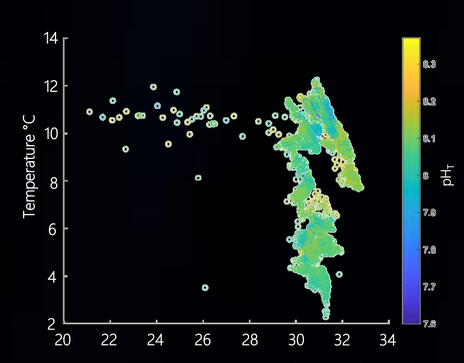


Figure 4. Temperature-salinity plotted with corresponding pH.

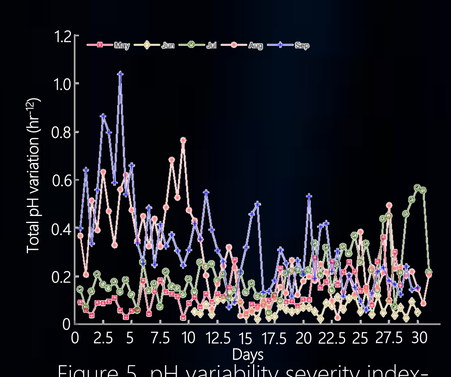


Figure 5. pH variability severity index- the additive accumulated pH variability experienced over a 12-hour period.

### BEAR COVE

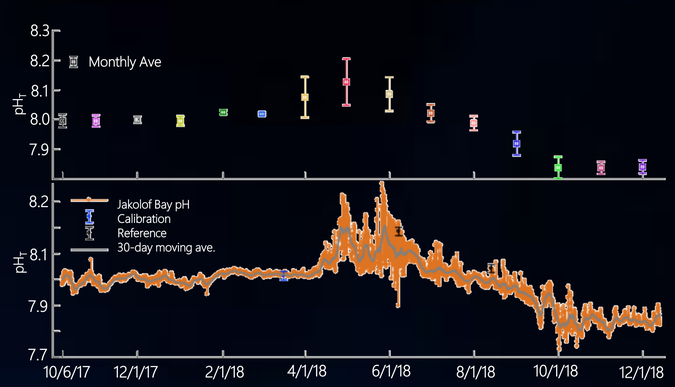


Figure 6. Upper panel- mean monthly pH, error bars represent standard deviation. Lower panel- high-frequency pH time-series. Propagated uncertainty for pH time-series is 0.0227.

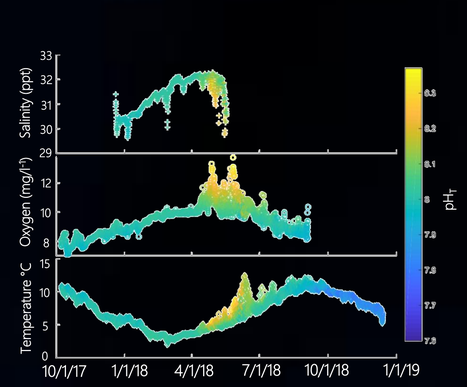


Figure 7. Upper panel- salinity, middle panel- dissolved oxygen concentration, bottom panel- temperature. All values plotted with corresponding pH.

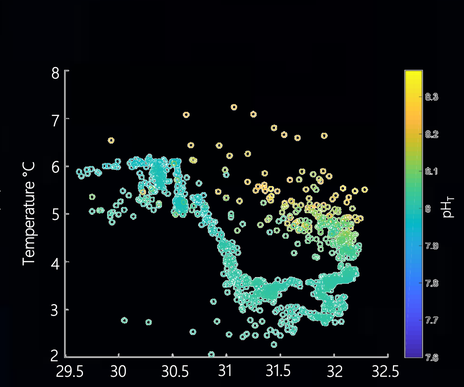


Figure 8. Temperature-salinity plotted with corresponding pH.

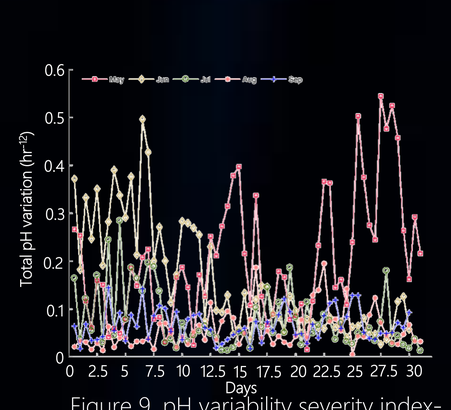


Figure 9. pH variability severity index- the additive accumulated pH variability experienced over a 12-hour period.

## 3. CONCLUSIONS

- Jakolof Bay experienced greater pH variability throughout the summer and fall than Bear Cove as monthly mean standard deviations are greater than 0.1 pH units 4 months out of the year compared to 1 month for Bear Cove.
- Seasonal timing of pH variability differed between the two sites. Bear Cove saw maximal variability in May while Jakolof Bay experienced it in September.
- Primary productivity (oxygen concentration as proxy) was largely responsible for peak pH values in summer and fall.
- From September through December, Bear Cove average pH was 7.85, with episodic events measuring < 7.73.

References:
[1] Dickson, A. G., Sabine, C. L., & Christian, J. R. (2007). SOP 6b. Determination of the pH of seawater using the indicator dye m-cresol purple. Ver. 3.01. Jan 28, 2009. Dickson, AG, Sabine, CL, Christian, JR (eds.).
[2] Robbins, L. L., Hansen, M. E., Kleypas, J. A., & Meylan, S. C. (2010). CO2calc: A user-friendly seawater carbon calculator for Windows, Mac OS X, and iOS (iPhone) (No. 2010-1280). US Geological Survey.