Environmental Studies Program: Ongoing Study

Title	High-frequency Characterization of the Physicochemical Parameters of Cook Inlet, Alaska (AK-13-03-23)
Administered by	Alaska Regional Office
BOEM Contact(s)	Dr. Heather Crowley, heather.crowley@boem.gov
Conducting Organizations(s)	CMI, UAF
Total BOEM Cost	$120,094 plus Joint Funding ($120,094)
Performance Period	FY 2017–2021
Final Report Due	March 2021
Date Revised	August 9, 2021
PICOC Summary	
Problem	Ocean acidification can have detrimental effects on marine ecosystems, but it is difficult to determine the natural and anthropogenic influences on ocean pH variability based on the limited data currently available.
Intervention	This study will deploy two sensors capable of measuring pH, temperature, conductivity (to calculate salinity) and oxygen concentration along the freshwater gradient in Cook Inlet, Alaska.
Comparison	Researchers will examine pH variability based on multiple factors, including: diurnal, seasonal and annual cycles; different water mass movements and changes in temperature and salinity; and increased freshwater input.
Outcome	Verification of a pH gradient across Cook Inlet will provide a unique framework for biological studies investigating aspects of ocean acidification tolerance and local adaptation and will further our understanding of complex, near-shore acidification dynamics.
Context	Cook Inlet

BOEM Information Need(s): Results from this study will support analysis of cumulative effects in NEPA documents for future Cook Inlet lease sales, and for future EPs and DPPs that may result from Cook Inlet Lease Sale 244 (2017) or from future Cook Inlet lease sales.

Background: Measuring ocean acidification (OA), the addition of anthropogenic atmospheric CO_2 to the surface oceans, is increasingly important to aid understanding of how marine ecosystems will respond to global ocean change. With few long-term and baseline ocean pH records in place, it is difficult to determine the natural and anthropogenic influences on ocean pH variability. With recent developments in pH sensor technology, monitoring networks are growing along the west coast of the United States. This study will deploy two sensors capable of measuring pH, temperature, conductivity (to calculate salinity) and oxygen concentration along the freshwater gradient in Cook Inlet, Alaska. Utilizing this new technology can vastly improve understanding of nearshore carbonate chemistry and help tease apart the source of current pH variability. Conductivity measurements will facilitate identification of the

intensity of freshwater input as well as improve calculations of pCO_2 levels. Due to oxygen's role in photosynthesis and respiration, oxygen concentration measurements will provide insight to the relative impact that biological processes have on the carbonate system, although it does not directly impact pH or pCO_2. Verification of a pH gradient across Cook Inlet will provide a unique framework for biological studies investigating aspects of OA tolerance and local adaptation. Including temperature, conductivity and oxygen concentration measurements will further our understanding of complex, near-shore OA dynamics.

Objectives:

- Establish baseline high-frequency pH, temperature, conductivity (salinity) and dissolved oxygen time-series measurements from two near-shore sites in Cook Inlet, AK.
- Quantify the sources of pH variability, including those associated with biological processes, tides and currents, and freshwater (riverine) input.

Methods: This project will deploy oceanographic SeapHOx sensors at two sites along the freshwater gradient found in Cook Inlet, Alaska. Sensors will be deployed in summer 2017 via scuba in lower Cook Inlet and Kachemak Bay. Sensor maintenance will be conducted and calibration samples collected at six-month intervals over two years. Descriptive statistics and basic time-series analyses will be used to describe the range, frequencies, and mean conditions measured at each site. Site-specific correlation and regression analyses will be employed to explore variation between sites and among measured parameters. Spectral analyses will be used to identify periodicities and correlation among parameters across different frequencies. Low pass and high pass filters will identify sources of short-term, event-scale and seasonal pH variability (if present) will be investigated and described through simultaneous analysis of oxygen, salinity, and temperature.

Specific Research Question(s): What are the sources of pH variability in lower Cook Inlet?

Current Status: Completed.

Publications Completed: None.

Affiliated WWW Sites: http://www.boem.gov/akstudies/

https://marinecadastre.gov/espis/#/search/study/100201

https://www.uaf.edu/cfos/research/cmi/