Casco Bay Estuary Partnership and University of New Hampshire
Matthew Liebman, EPA, Curtis Bohlen, CBEP and Chris Hunt, UNH

- The purpose of this project is to install continuous monitoring sensors in Casco Bay to measure at a high temporal resolution ocean and coastal acidification parameters.

- CBEP and UNH teamed up with Southern Maine Community College to install sensors at a pier in South Portland.

- One of nine NEPs with sensors

Presented at: Casco Bay Estuary Partnership Monitoring Network meeting
April 15, 2021

Operations, Instrumentation and Installation

To calculate omega, UNH installed four instruments:

- Satlantic SEAFET pH sensor (owned by CBEP);
- Sunburst Submersed Automated Monitoring Instrument (SAMI) for CO_2 (owned by UNH);
- Aanderaa Optical Oxygen Optode sensor (owned by CBEP); and
- Seabird conductivity (salinity) and temperature sensors (owned by UNH).

UNH built a cage to house the sensors:

- Attached via a davit within a secure box at the pier in about 1 to 5 meters of water (depending on tide).
- Rests on the bottom and the sensors are about ½ meters off the bottom and always submerged.
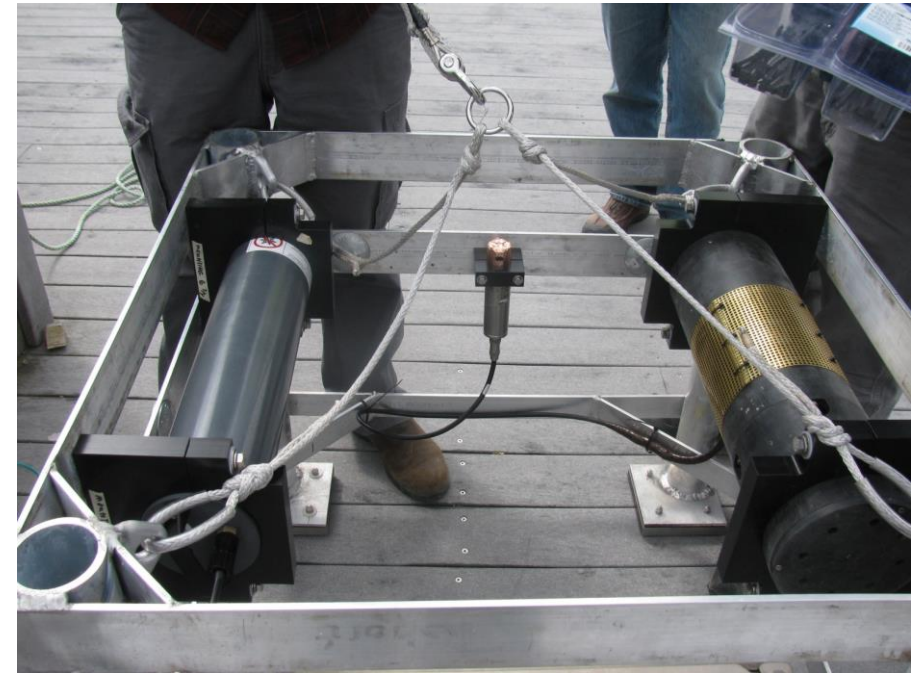
Sensor data averaged or recorded per hour

| Parameter	Method/Instrument	Range	Accuracy	Precision/Resolution
pH	SeaFET pH sensor is an ion-sensitive field effect transistor (ISFET).	6.5 to 9.0 pH	0.02 pH	0.004 pH
CO_2	Colorimetric SAMI Sunburst CO_2	150 to 1000 µatm	+/- 3 µatm	±0.5 - 1 µatm
Dissolved oxygen	Aanderaa Oxygen Optode	0-500 µmol/l	<8 µmol/l	<1 µmol/l
Conductivity (salinity)	Sea-Bird Electronics SBE-37	0-70 µS/cm	0.003 µS/cm	0.0001 µS/cm
Temperature	Sea-Bird Electronics SBE-37	-5-45 degC	0.002 degC	0.0001 degC

Although we collected more than 70 percent of the observations for most parameters, concurrent observations of pH and CO_2 were observed 40%

| Parameter	Units	Number of Observations	Percent of Dataset
Salinity	psu	35,590	96.8%
Water Temperature	degrees Celcius	36,712	99.8%
Dissolved Oxygen	μmol/kg	24,740	67.2%
pCO2	μatm	26,731	72.7%
pH	Total Scale	23,355	63.5%
pH and pCO2 (concurrent)		14,664	39.9%

Seasonal patterns of temperature, salinity, oxygen and measured or derived carbonate chemistry for the period from April 2015 to June 2020.
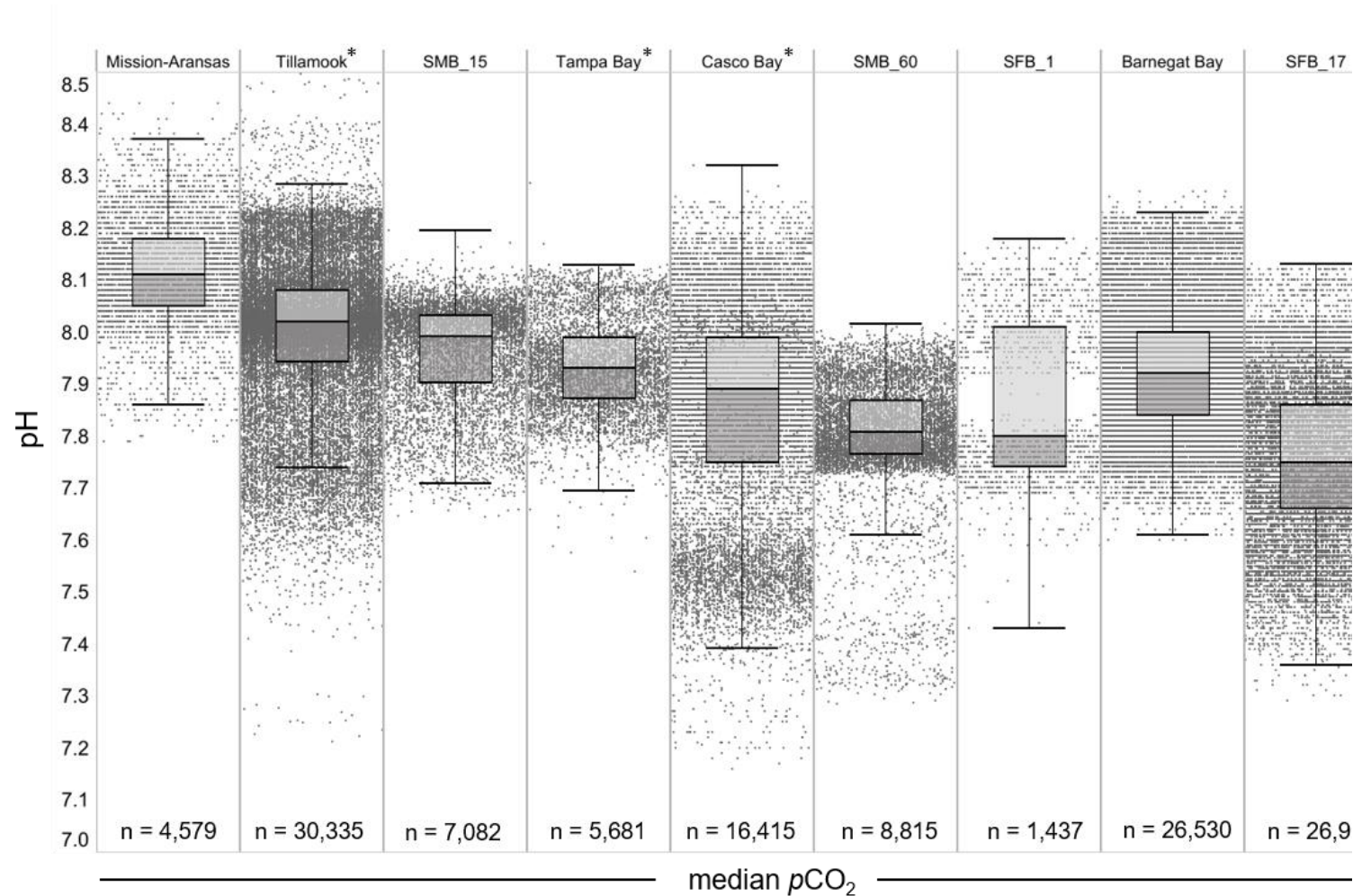
From Hunt and Melendez, 2020
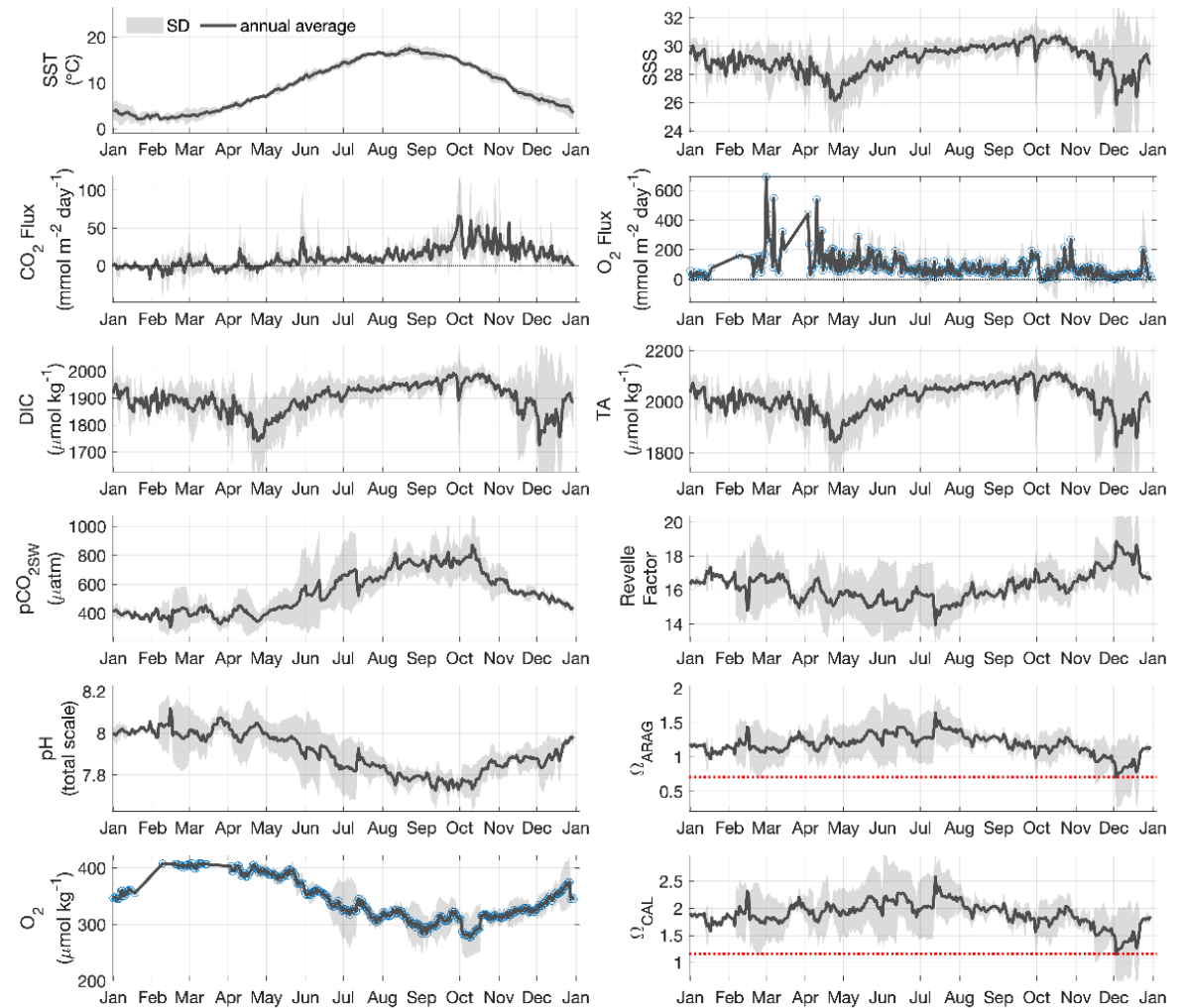
Box plots and underlying data showing the distribution of carbon dioxide (pCO_2) data across seven NEPs.

From Rosenau et al., in prep
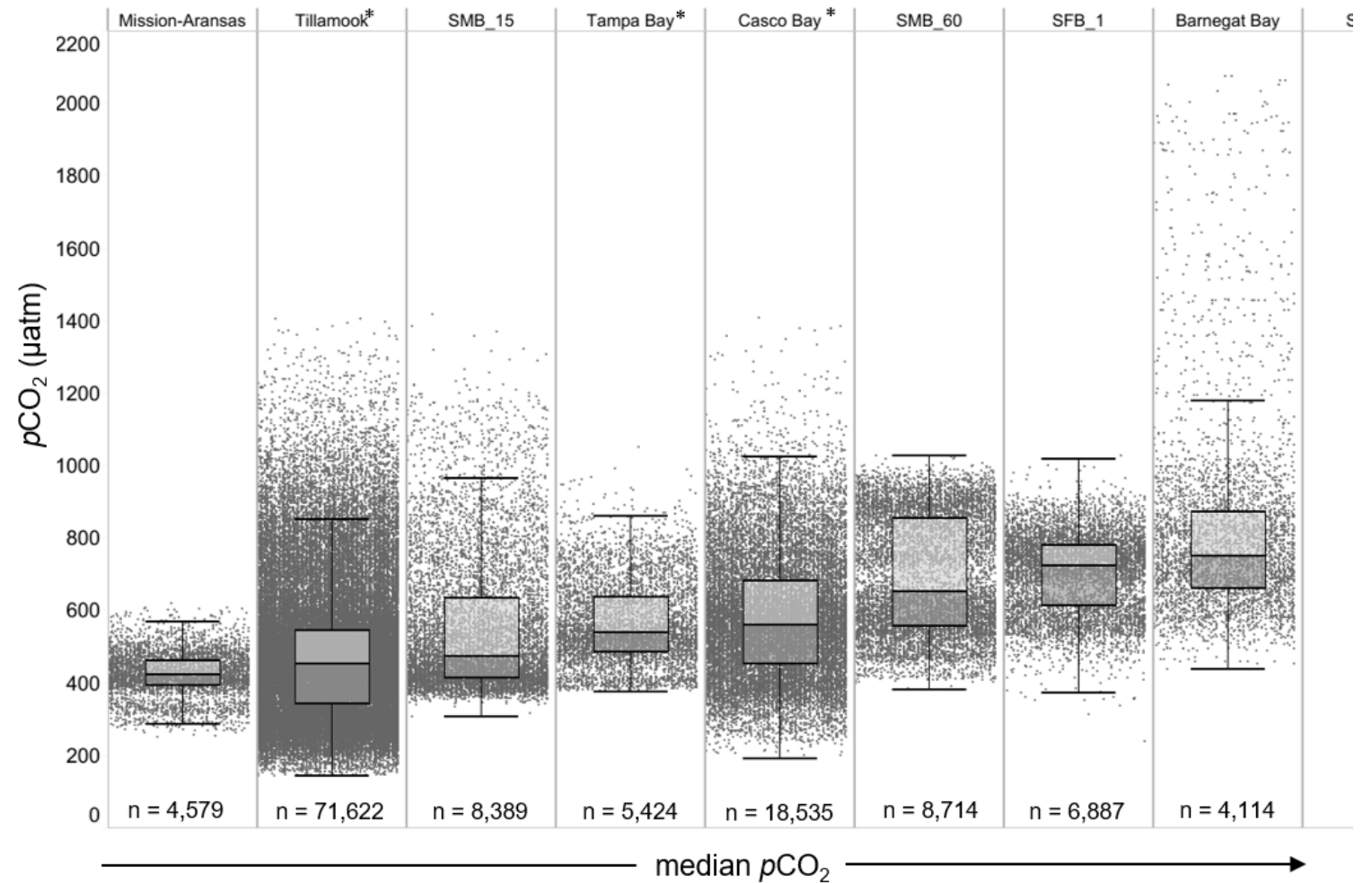
Box plots and underlying data showing the distribution of pH data across seven NEPs.

From Rosenau et al., in prep

Conclusions

- Five years of data establishes a baseline

- Calculated aragonite saturation lowest in the fall

- Despite pCO_2 values among the median of NEPs, Casco Bay among the lowest in pH

- Discrete samples for TA helped validate and constrain observations

- Preliminary one-dimensional ecosystem modeling suggests there is an external source of CO_2 to this site that provides positive flux of CO_2 to the atmosphere year round

- *The Future: The project has ended, but some of the equipment will be used to help validate continuous monitoring at sites established by Friends of Casco Bay, partially funded by CBEP*