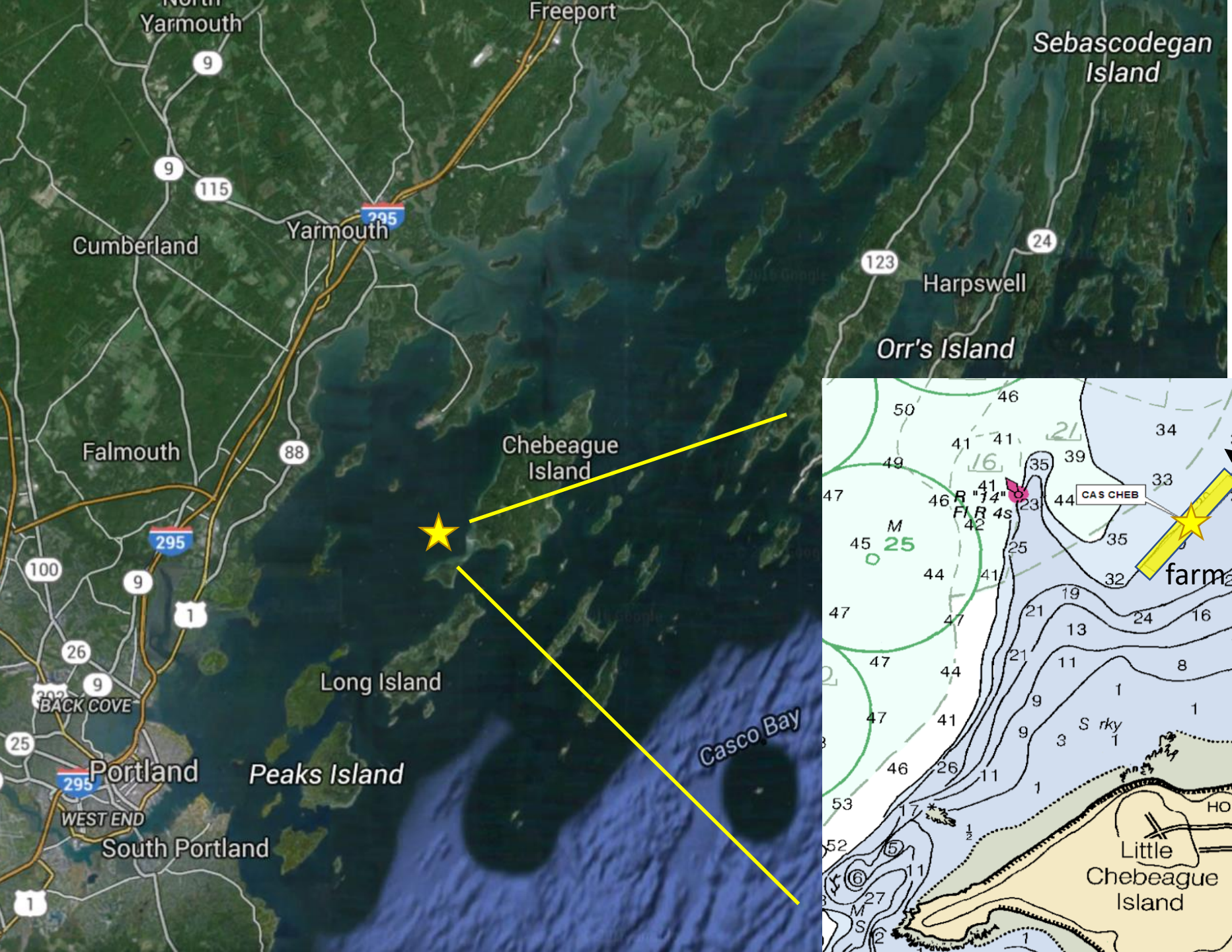
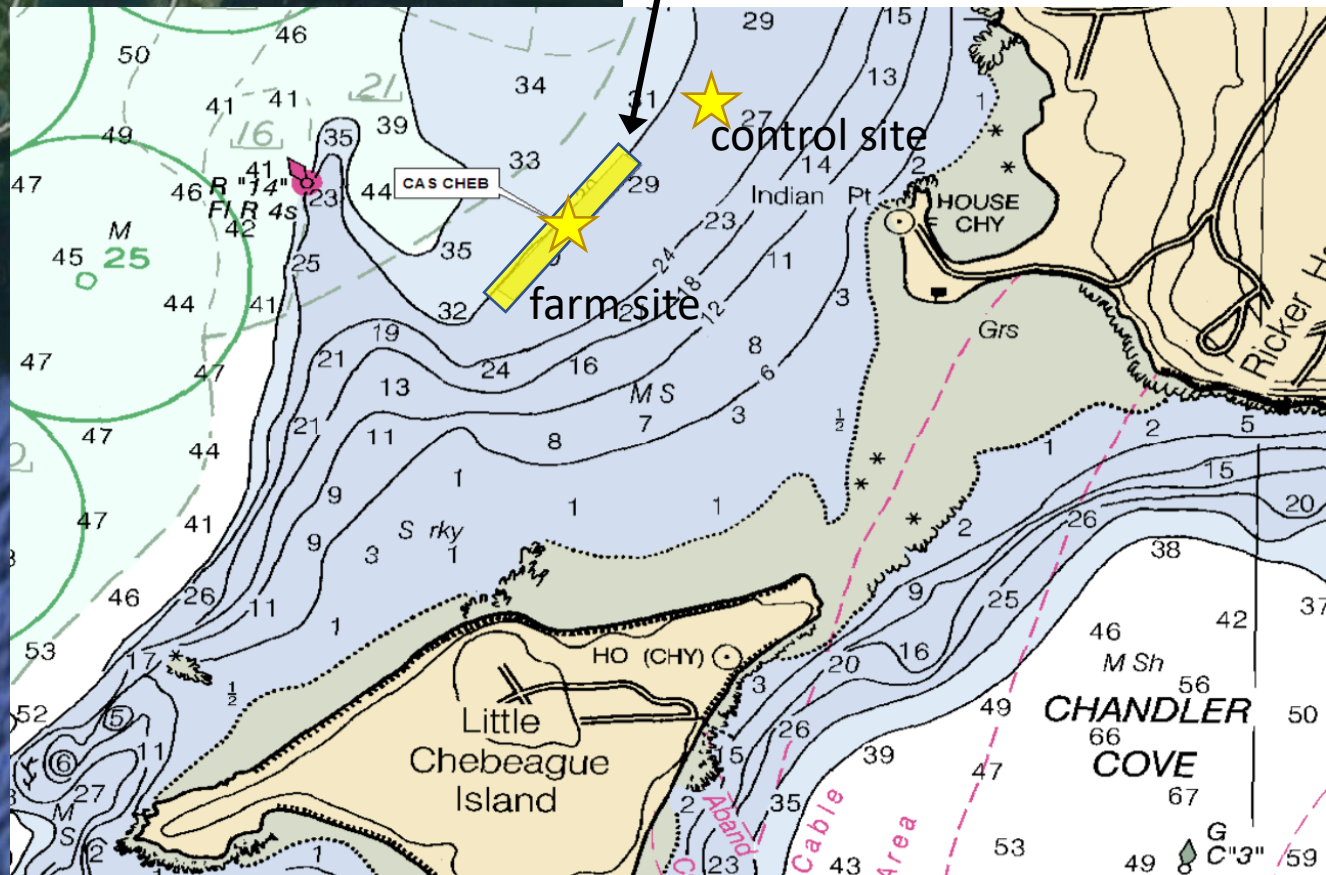
Can growing kelp remediate ocean acidification and improve growing conditions for farmed mussels?

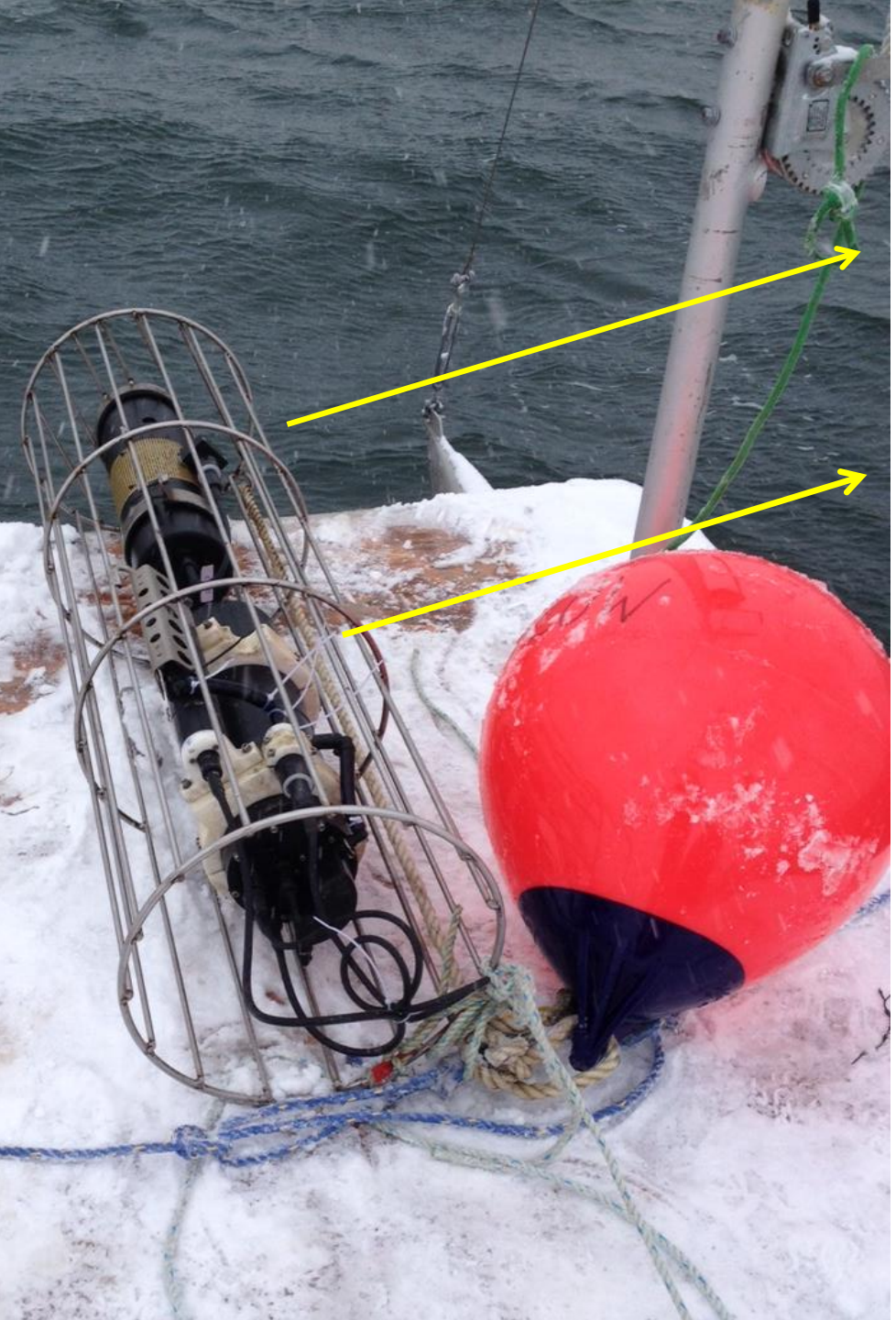
Footprint of Ocean Approved sugar kelp (*Sacharina latissima*) farm

Site Selection-

Similar bathymetry, hydrography, and residence time – 'upstream' control site





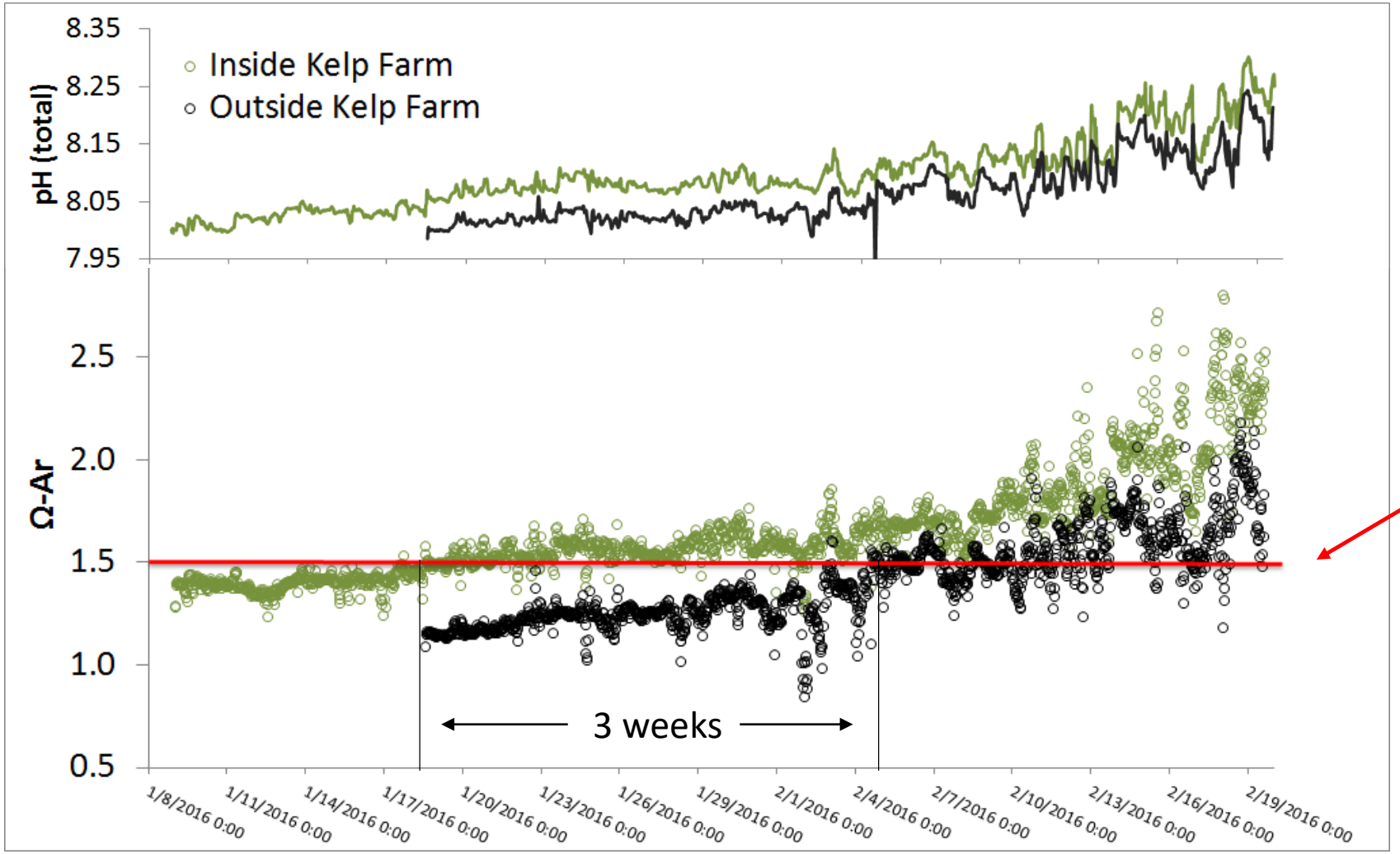


Parameters measured:

- SAMI pCO_2
  - pCO_2, Temp every 30 min
- SeapHOx
  - pH, O_2, Salinity, Temp, Depth every 30 min
- Discrete H_2O samples
  - Total alkalinity, total dissolved inorganic carbon every 2 weeks
- Kelp biomass

Yr. 1 Findings-

Farmed sugar kelp raises seawater pH and Ω

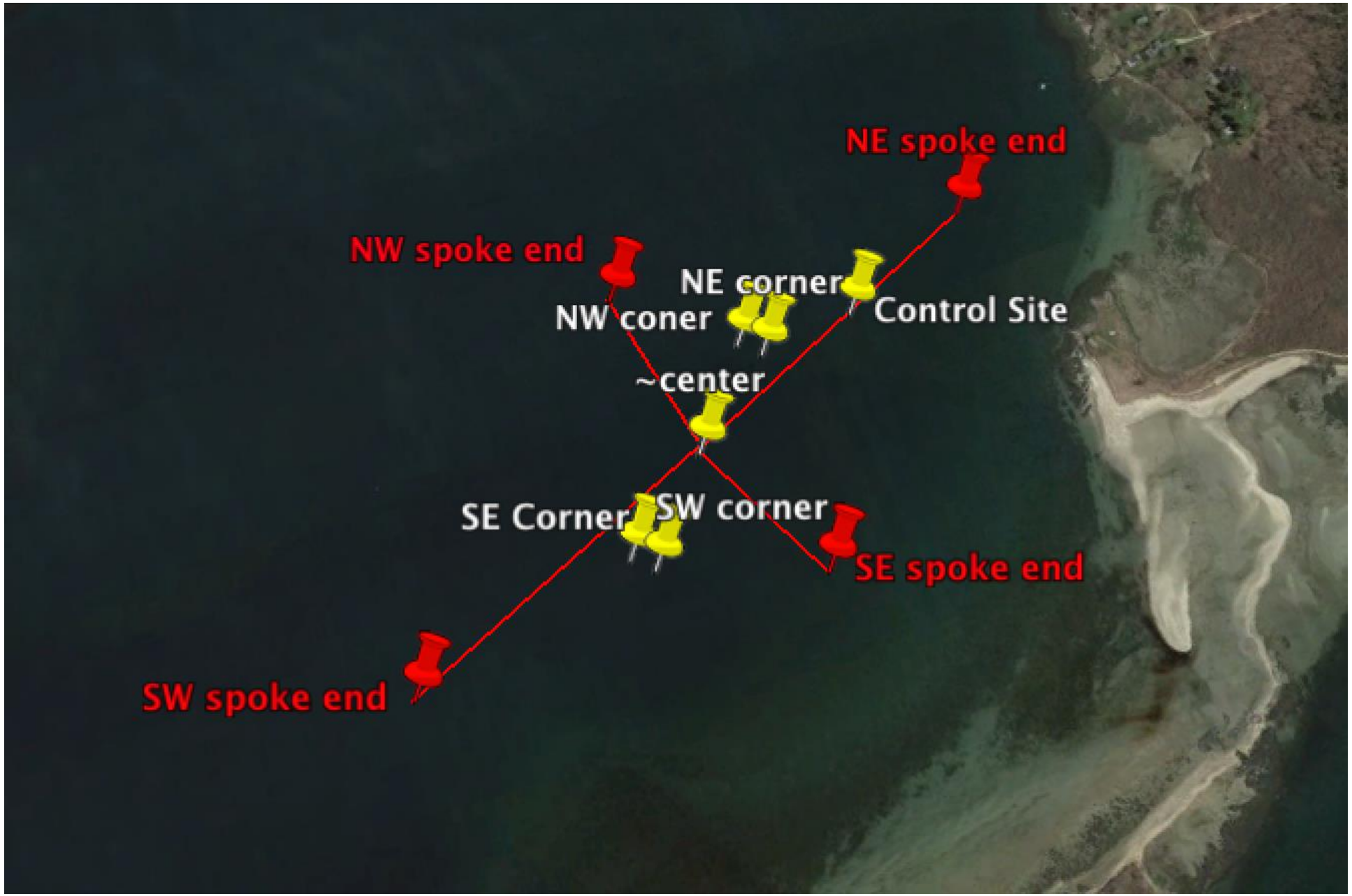


Threshold below which shellfish larvae are expected to experience acute effects of OA

0.05 ± 0.003 pH (13% higher)

0.32 ± 0.017 Ω_{Ar} (23% higher)

<u>Yr. 2 Goal</u>- Determine the spatial extent of the remediation “halo”



CO2 Map

May 2 2017

In-Water fCO_2 (uatm) 20170502 - Temp Normalized (Mean T= 7.5374)

Legend

- 'Control' Mooring
- Ocean Approved

310 320 330 340 350 360

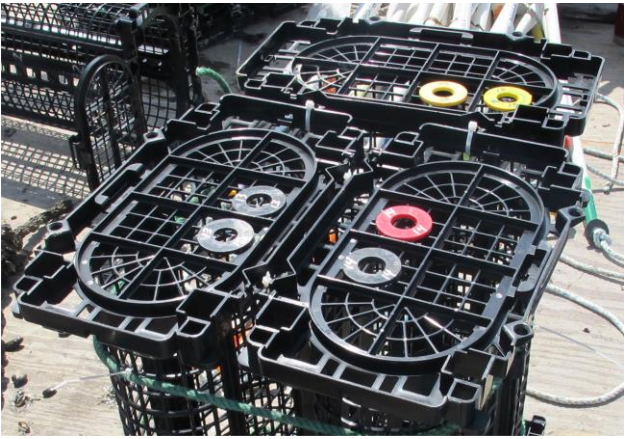
Google Earth

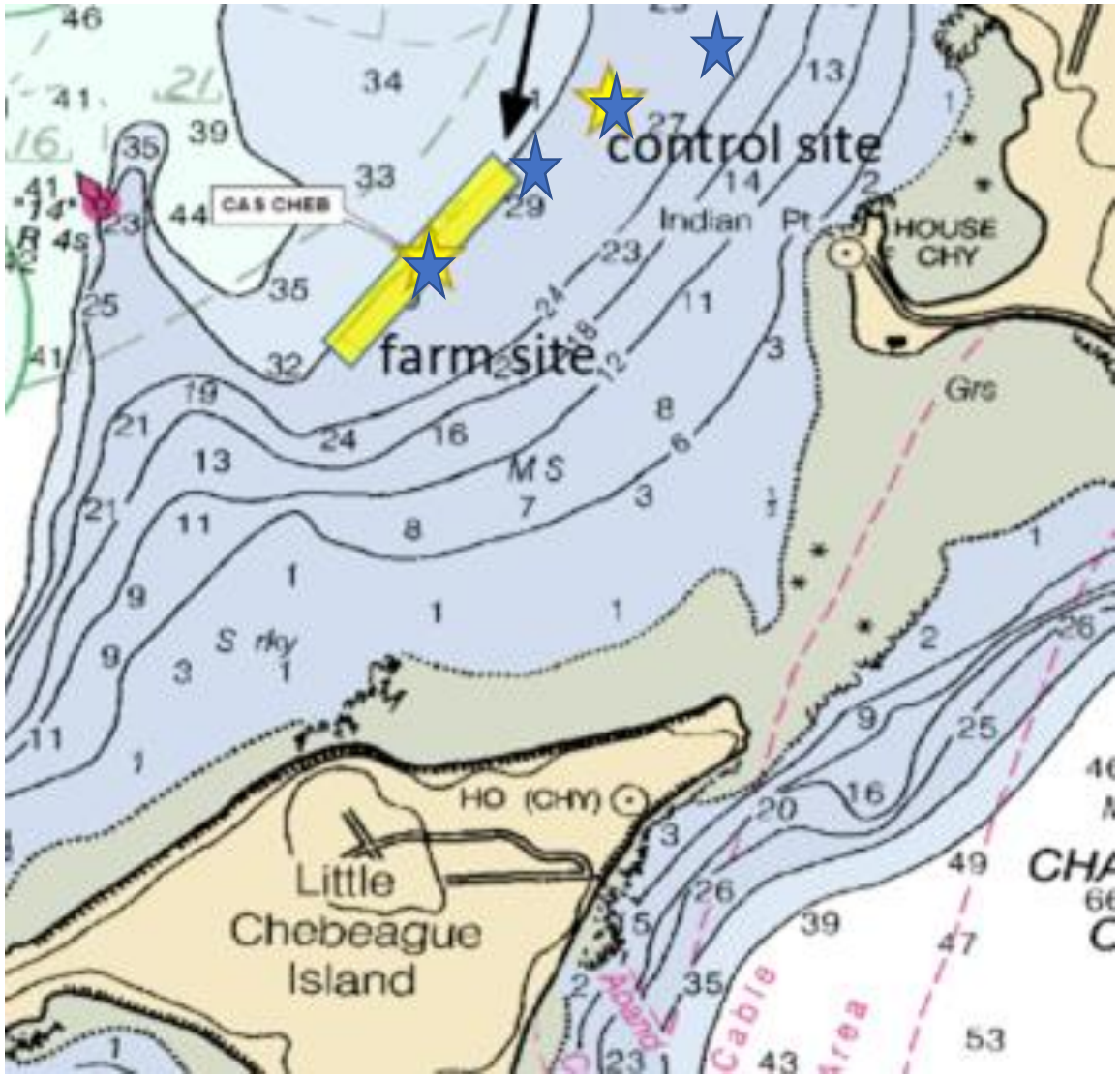
N

2000 ft

Yr. 3- Can shellfish benefit?

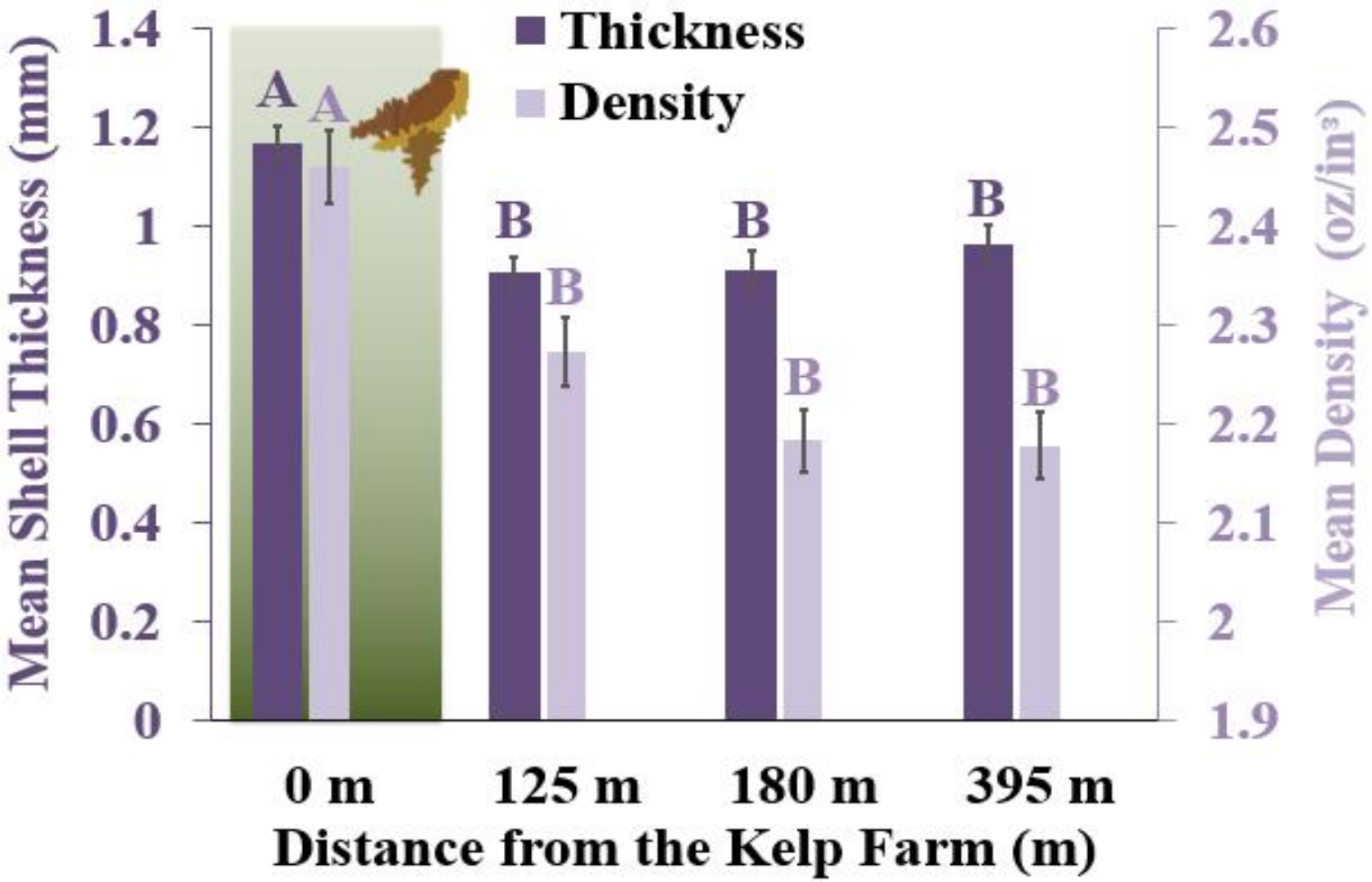
-100 mussels per cage
-3 cages per site
-Mussel baskets 0, 125, 180, 395 meters away from kelp



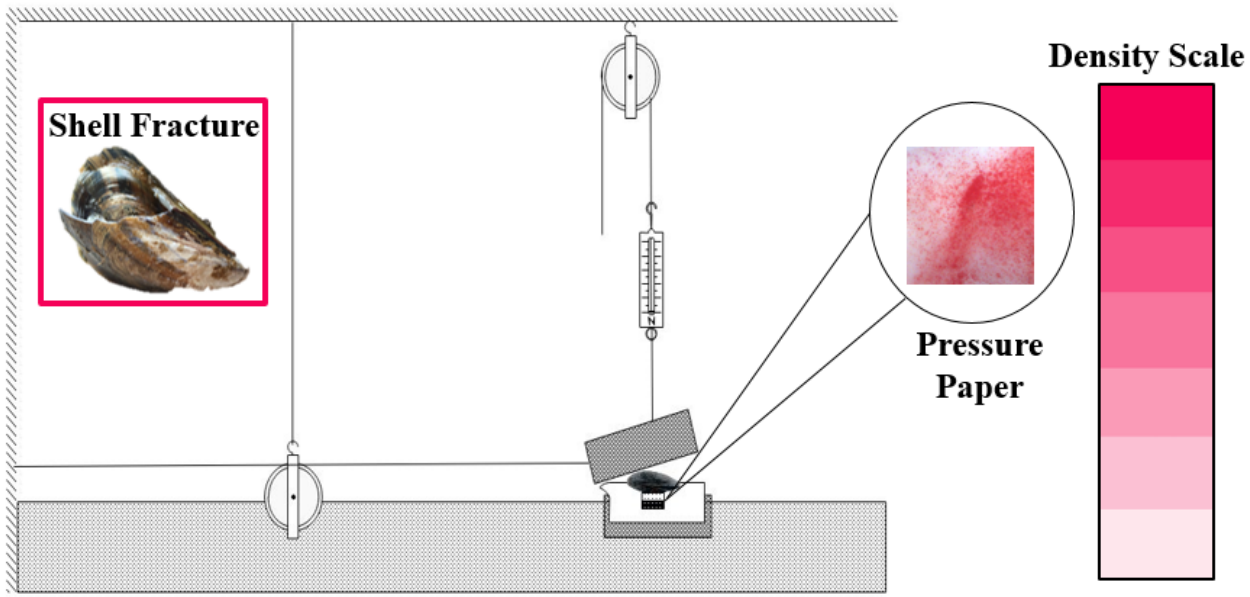


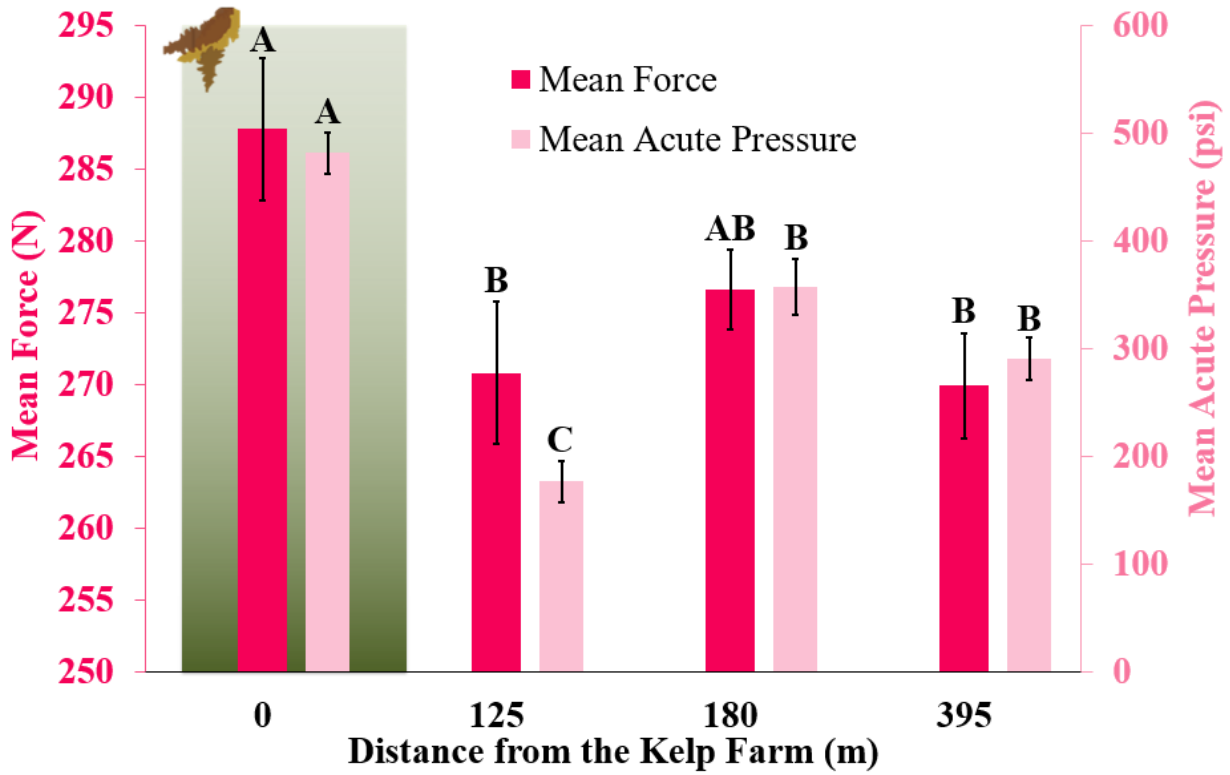
Results:

- Denser shells inside kelp farm

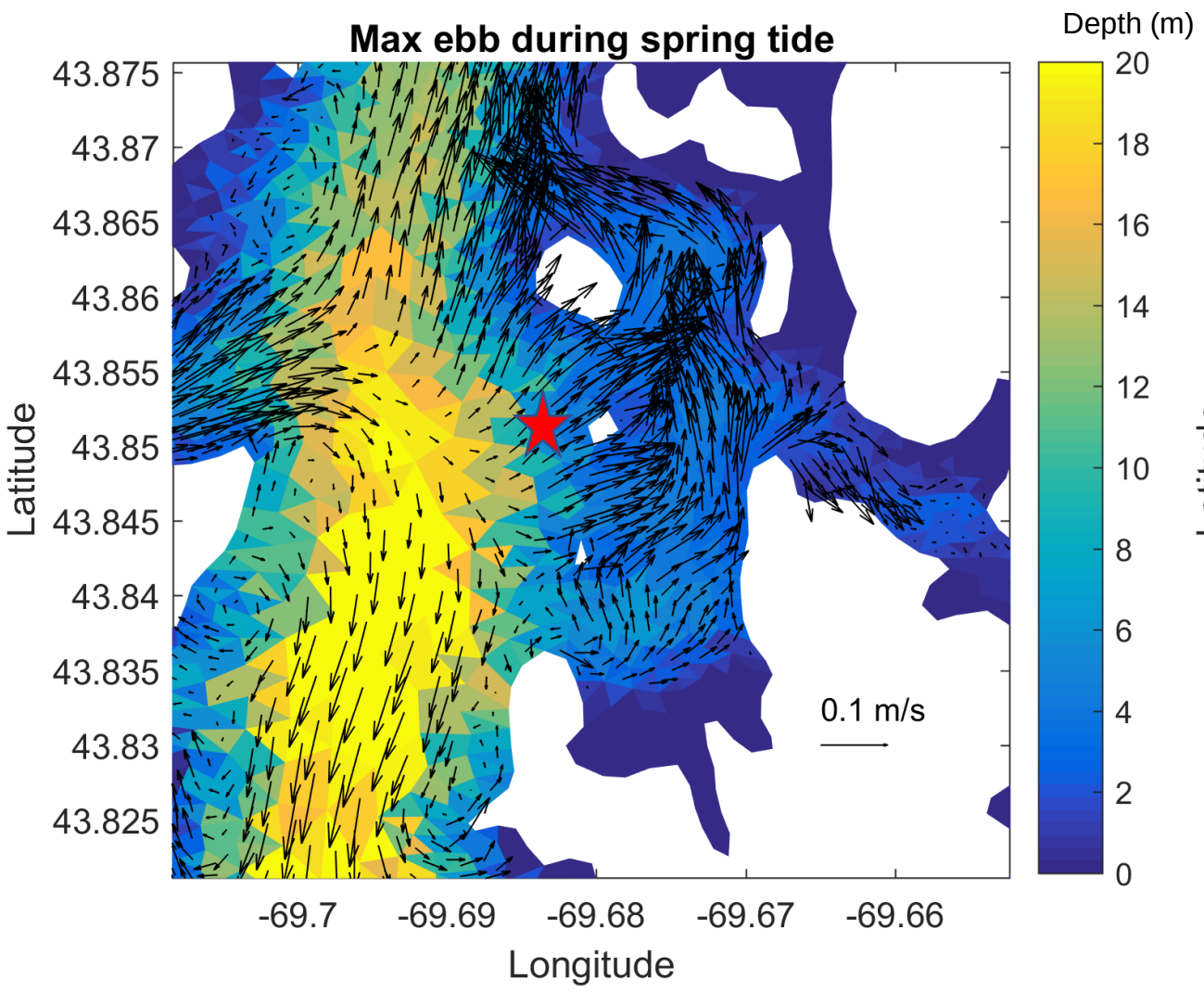


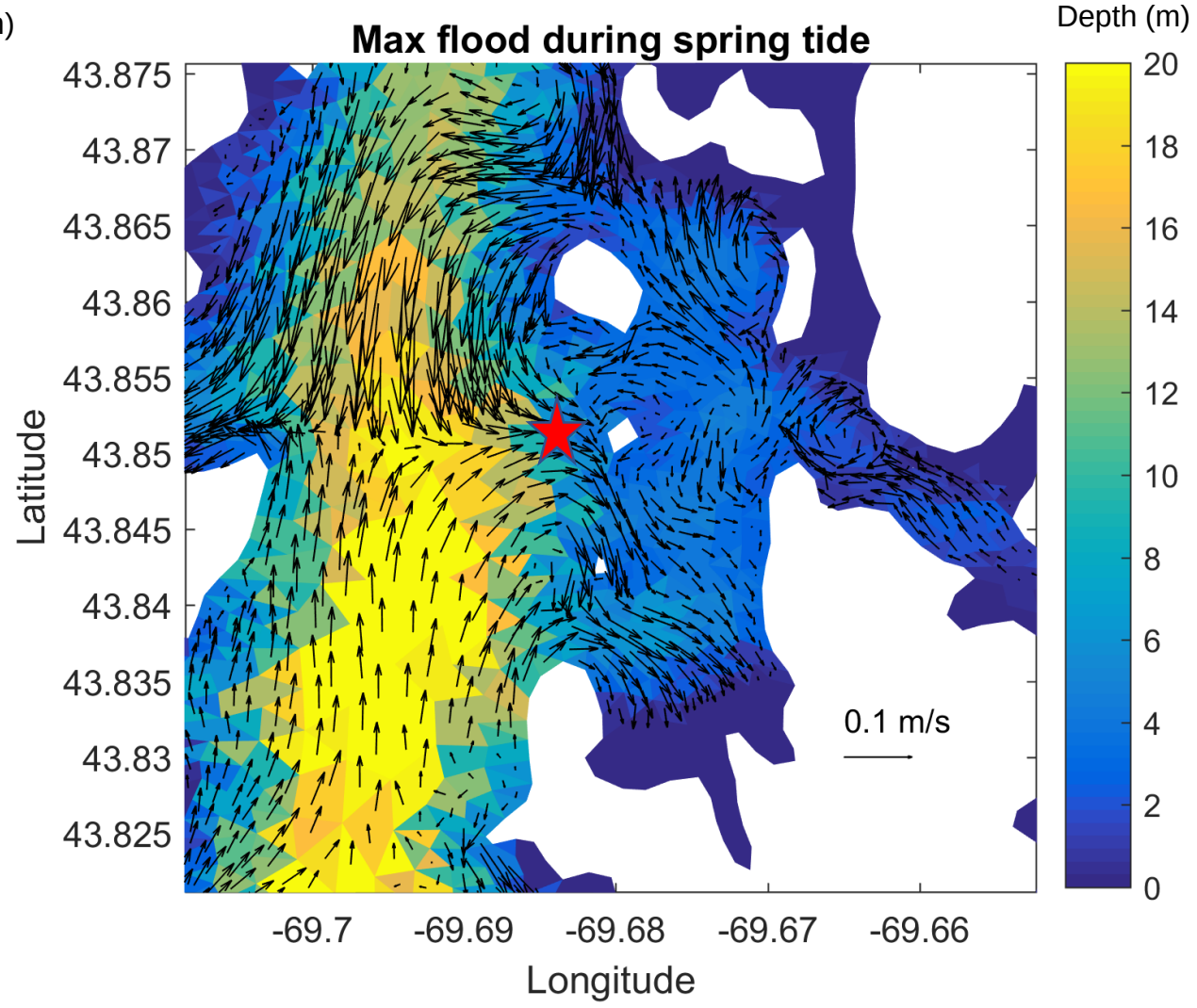
- **Shells harder to break**





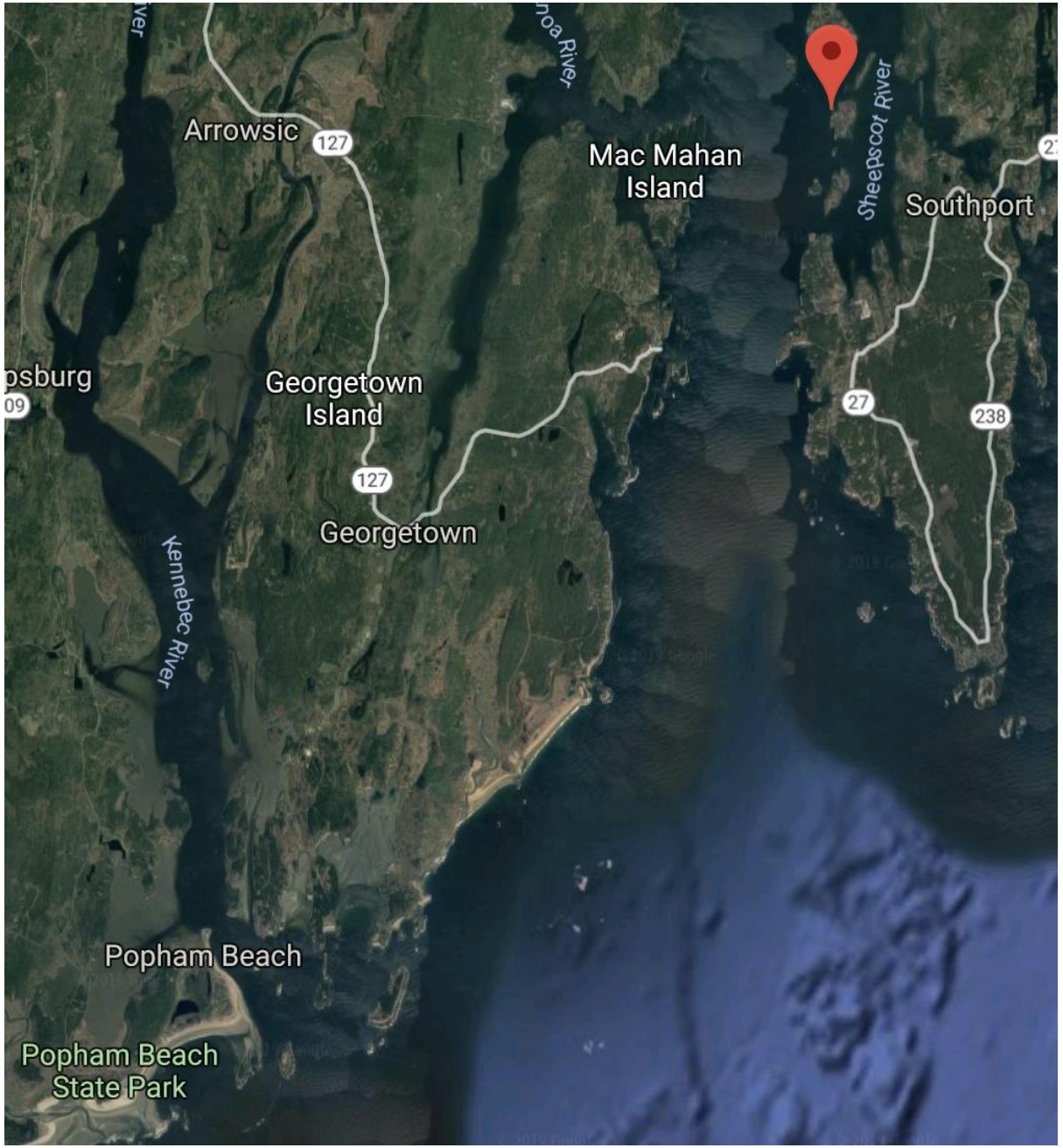
Yr. 4- Test the concept at a new study location





Velocity at 2 m depth

Figures created by Wei Liu, University of Maine


Arrowsic
127
Mac Mahan
Island
Sheepscot River
Southport
27
238
Georgetown
Island
127
Georgetown
Kennebec River
Popham Beach
Popham Beach
State Park


STEARNS

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Maine Coastal Program

Maine Coastal Program

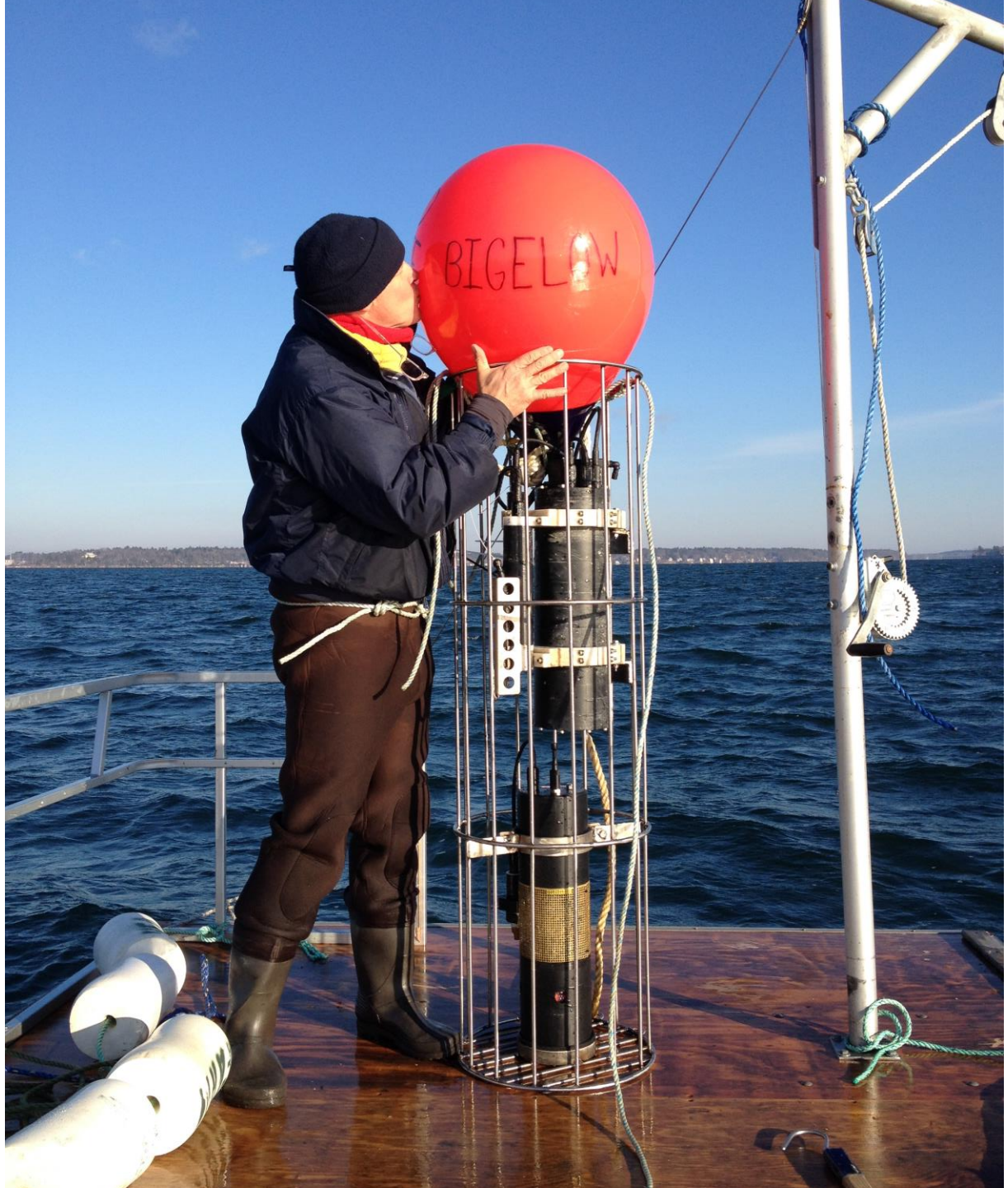
The Nature Conservancy

SEANET

NOAA

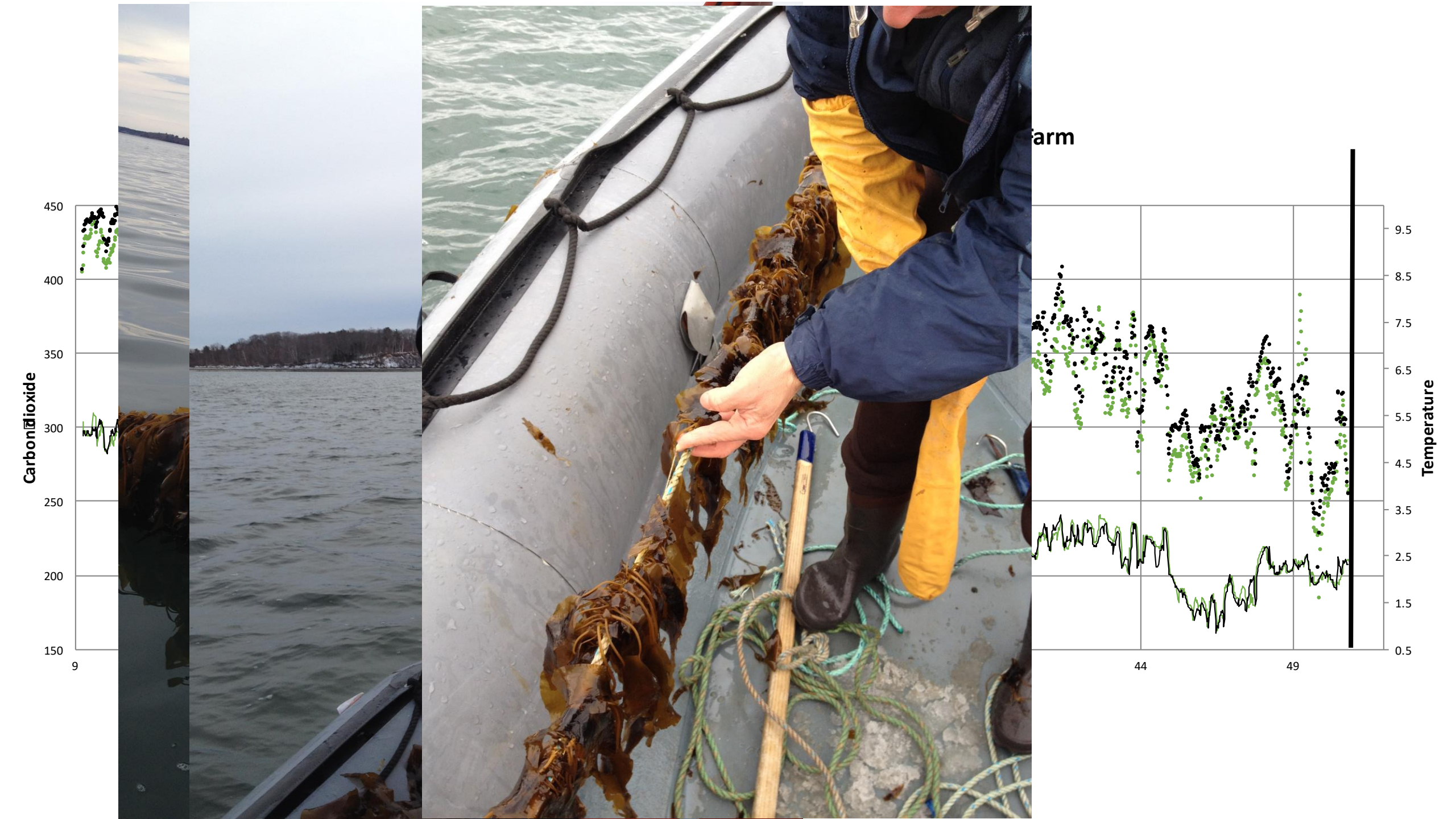
The Ocean Foundation

& private family foundations



Instrument updates

- Fluorometer mounted with SAMI pCO2 to measure chlorophyll a as proxy for phytoplankton abundance through time
- MAVs (a travel-time acoustic point sensor to measure water velocity at the depth of kelp lines) mooring system built (paid for with supplemental funding) to deploy current meter in between two pCO2/pH instrument packages and measure
- Mini underwater PAR (photosynthetically active radiation) sensors with wipers (purchased with supplemental funding) to be placed just above and below kelp lines in the farm
- 4-Pi PAR sensor added to Southern Maine Community College Weather Station to contextualize underwater irradiance


Carbon Dioxide
450
400
350
300
250
200
150
9
44
49
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
Temperature