Glider-Based Assessment of the Susceptibility of Important Commercial Fishery Habitats to Ocean Acidification

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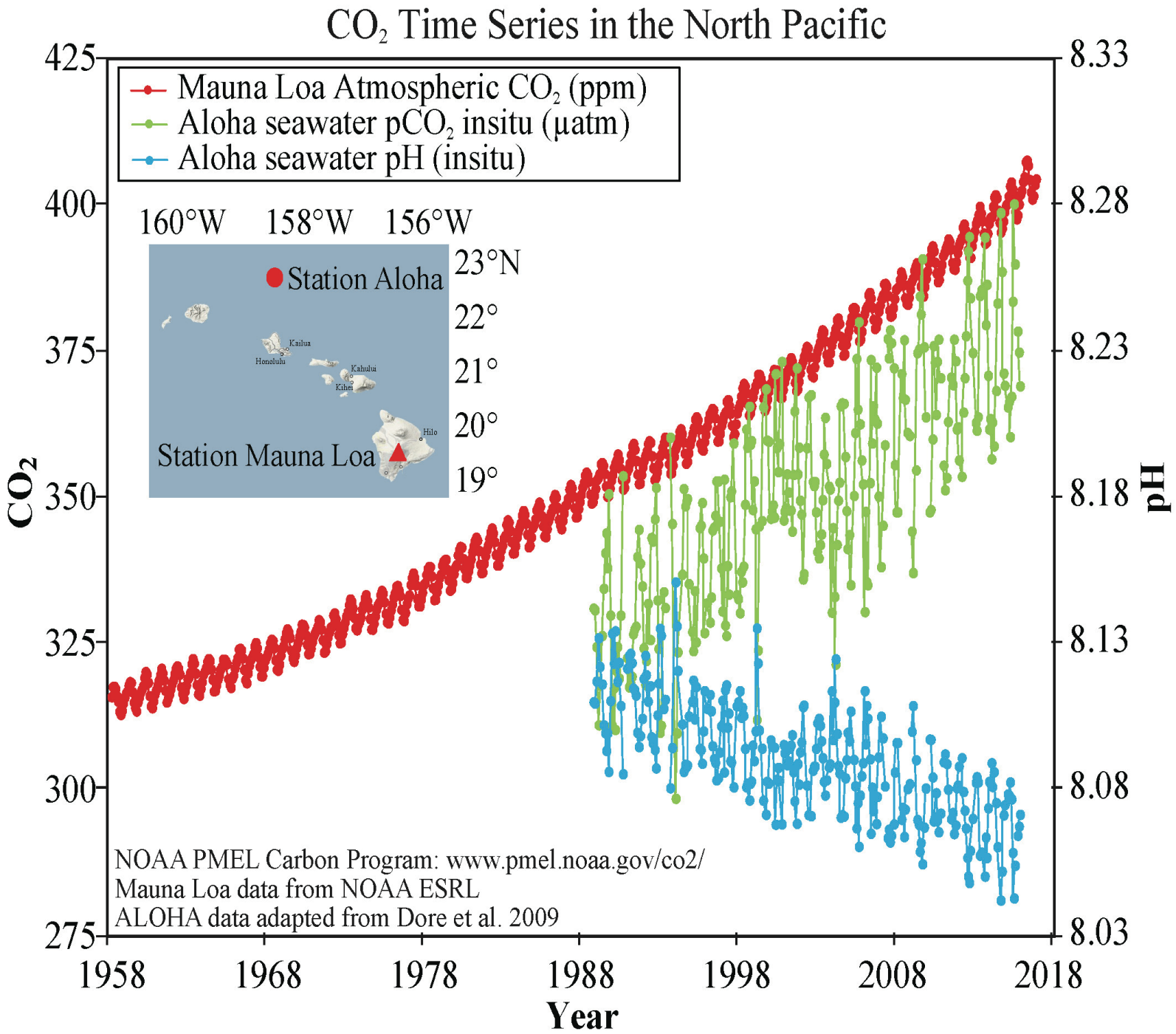
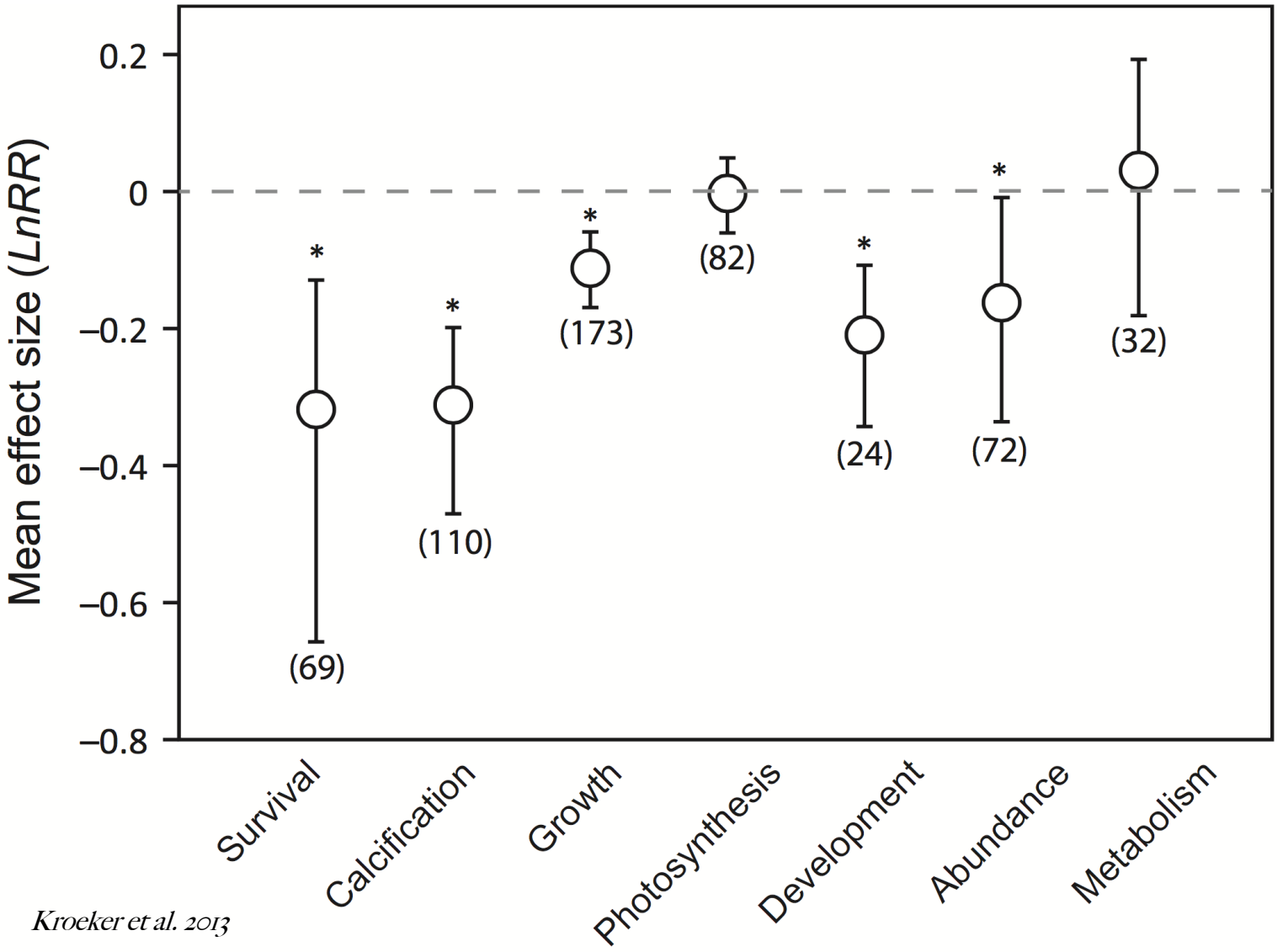
EGO Meeting 2019



~30% increase in ocean acidity since the industrial revolution

Impact of Acidification on Organisms



Kroeker et al. 2013

Decrease in...

- Survival
- Calcification
- Growth & Development
- Abundance

Impacts both Shellfish and Finfish

Objective

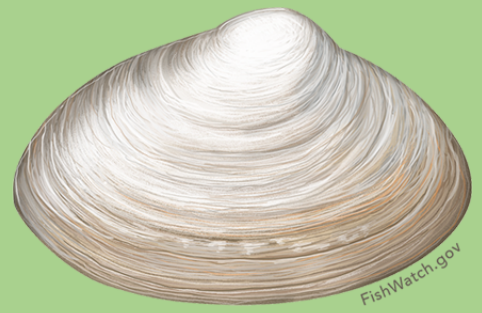
Determine potential vulnerability to ocean acidification of commercially important shellfish and finfish using glider-based observations of acidification

Species of Interest

Atlantic Sea Scallops

Summer Flounder

Atlantic Surfclam



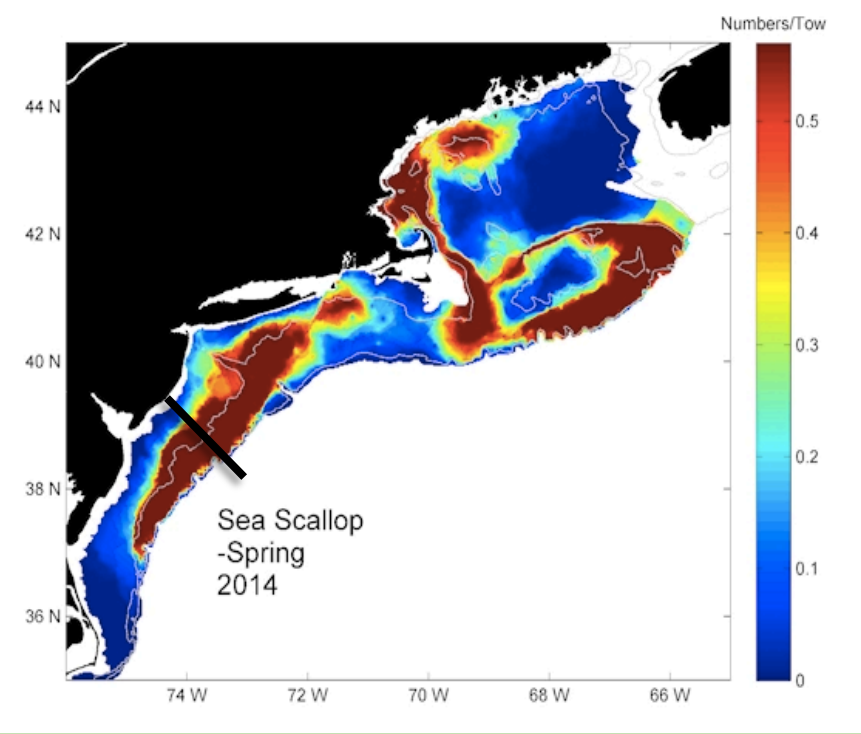
Black Sea Bass

NOAA

Atlantic Sea Scallop

Placopecten magellanicus

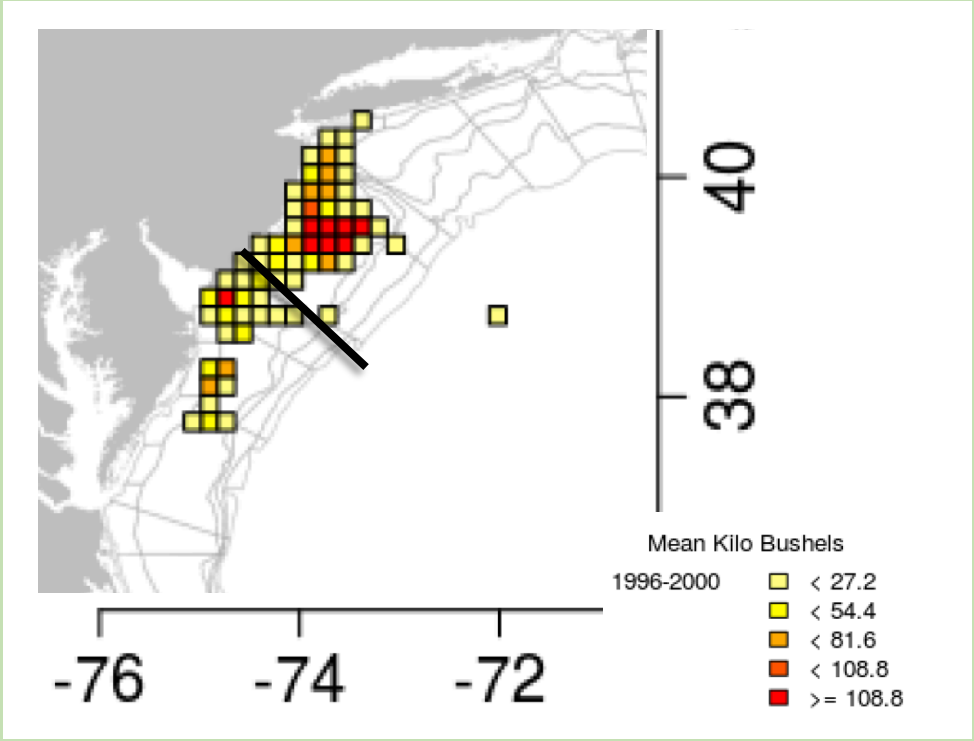
- Usually spawn in late summer or early fall
- Can live up to 20 years
- Stay offshore near the slope



Atlantic Surfclam

Spisula solidissima

- Spawn from late spring through early fall
- Can live up to 35 years
- Stay nearshore in shallow water



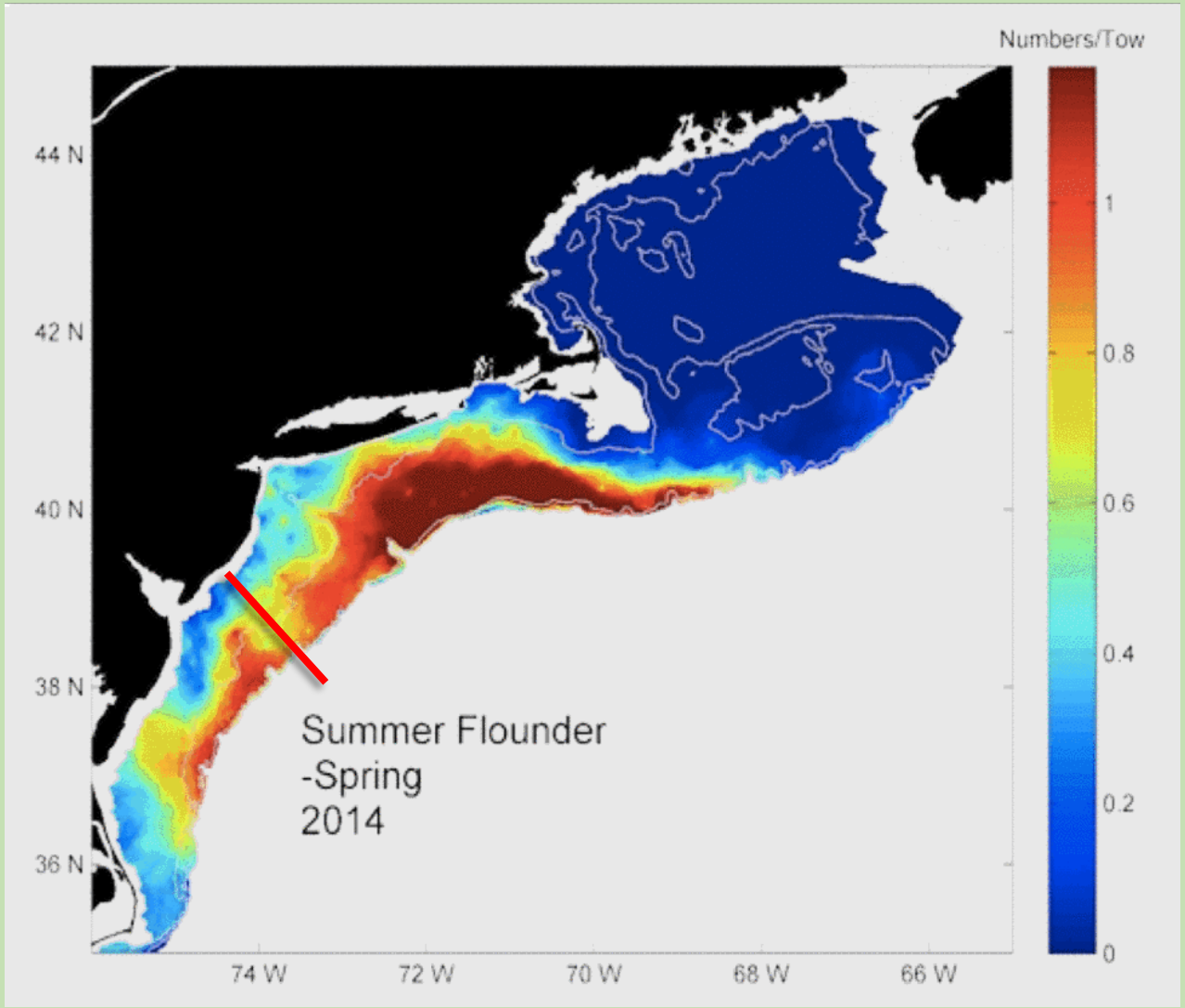
NOAA

Summer Flounder

Paralichthys dentatus

- Spawn several times in coastal waters (Oct - Nov)
- Live about 12 to 14 years
- Live offshore in spring, and migrate into coastal waters in the Fall for spawning

NOAA



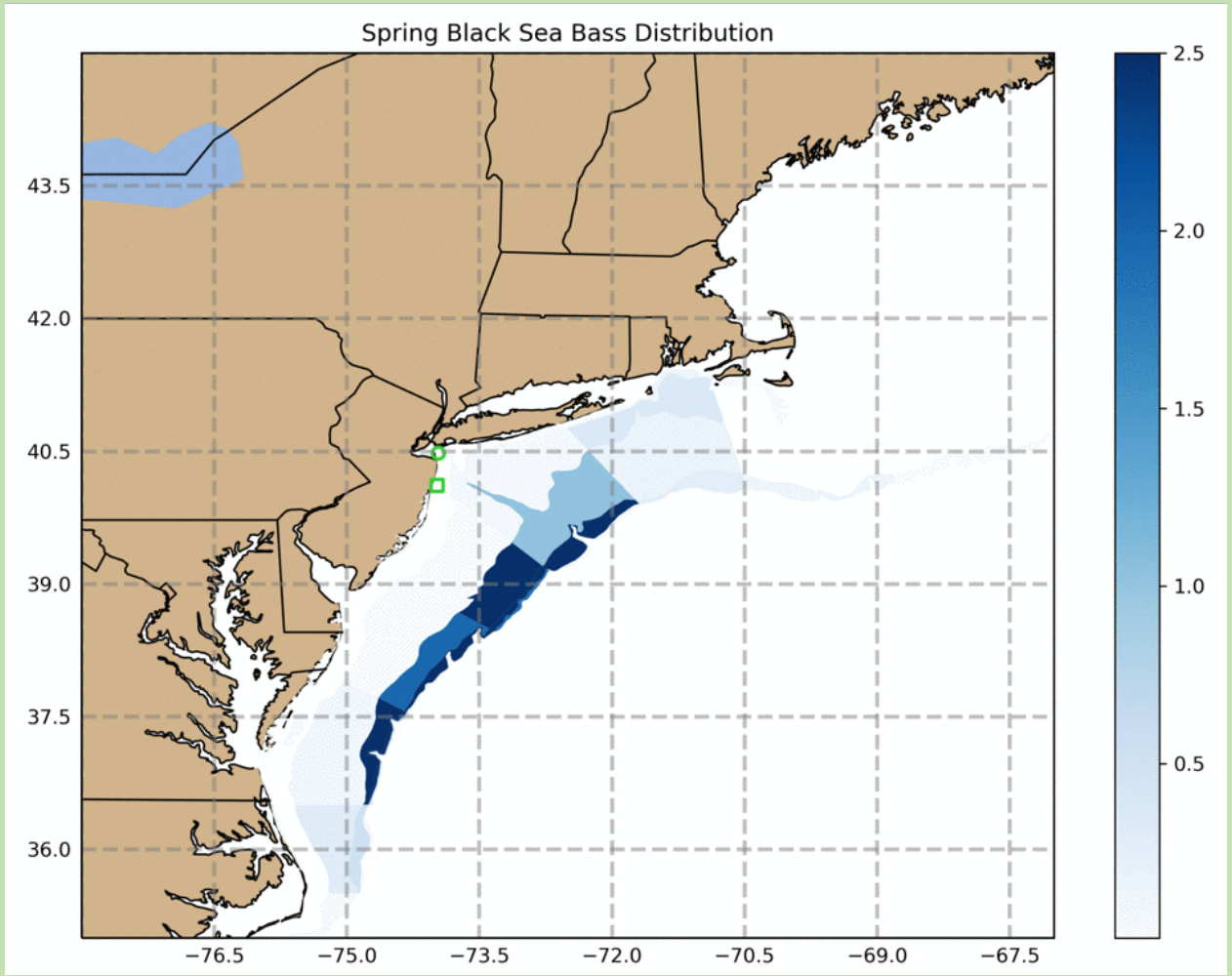
Black Sea Bass

Centropristis striata

- Spawn in coastal areas (Jan – Jul)
- Females live up to 8 years, males live up to 12
- Cool months, they live offshore. Warmer months move inshore.

NOAA

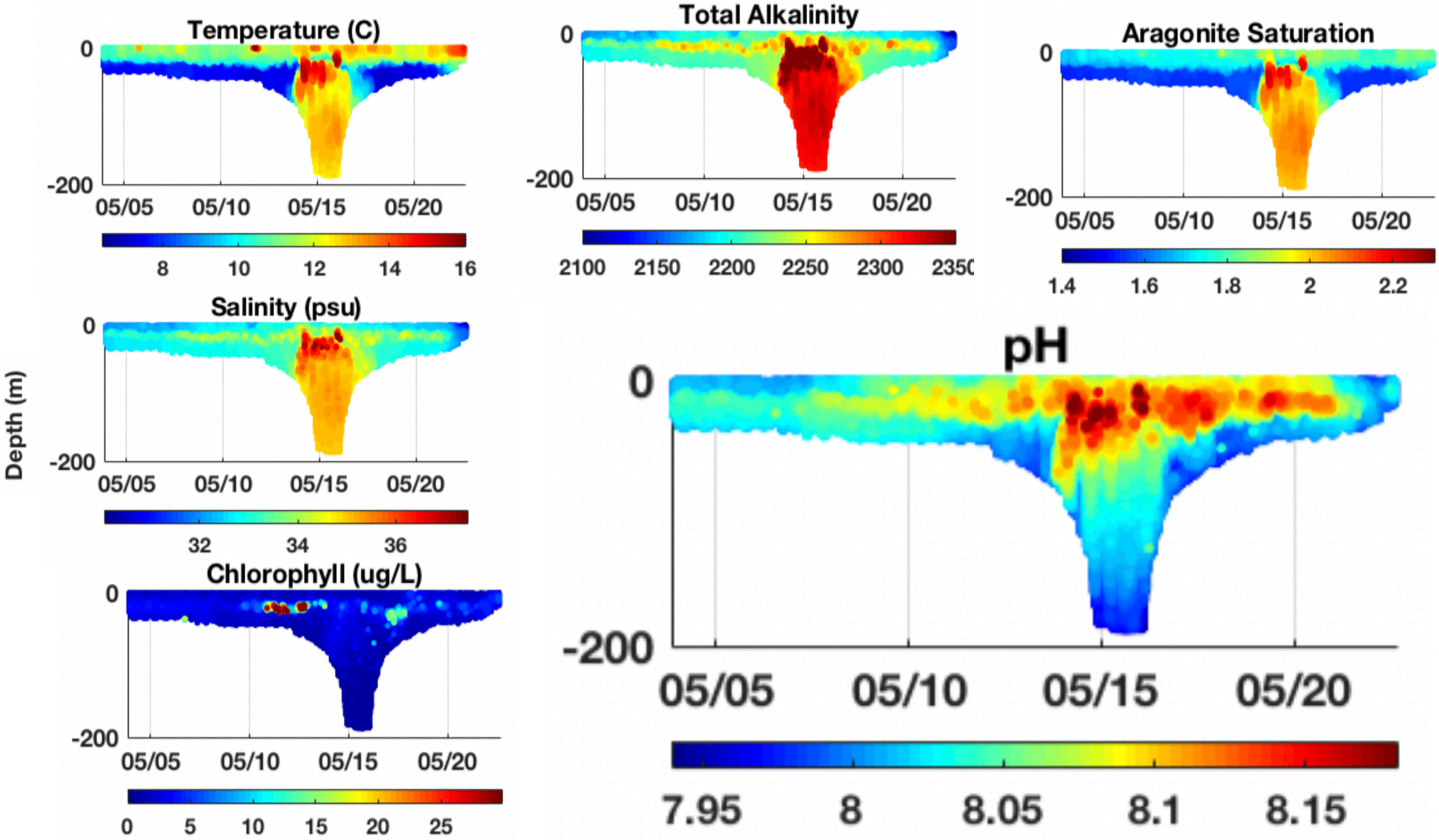
Potential Thermal Habitat Distribution



Source: Laura Nazzaro

Gliders Monitor the State of Acidification in these Fishery Habitats


May 2018 Deployment
Deployment Location
Last Surfacing
RU30
495
295
9
50
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
© 2018 Google
Data LDEO-Columbia, NSF, NOAA
Google Earth
39°09'08.14" N 74°29'17.17" W elev 0 ft eye alt 182.22 mi


Temperature (C)
0
-200
05/05
05/10
05/15
05/20
8
10
12
14
16
Total Alkalinity
0
-200
05/05
05/10
05/15
05/20
2100
2150
2200
2250
2300
2350
Aragonite Saturation
0
-200
05/05
05/10
05/15
05/20
1.4
1.6
1.8
2
2.2
Salinity (psu)
0
-200
05/05
05/10
05/15
05/20
32
34
36
Chlorophyll (ug/L)
0
-200
05/05
05/10
05/15
05/20
0
5
10
15
20
25
Depth (m)
pH
0
-200
05/05
05/10
05/15
05/20
7.95
8
8.05
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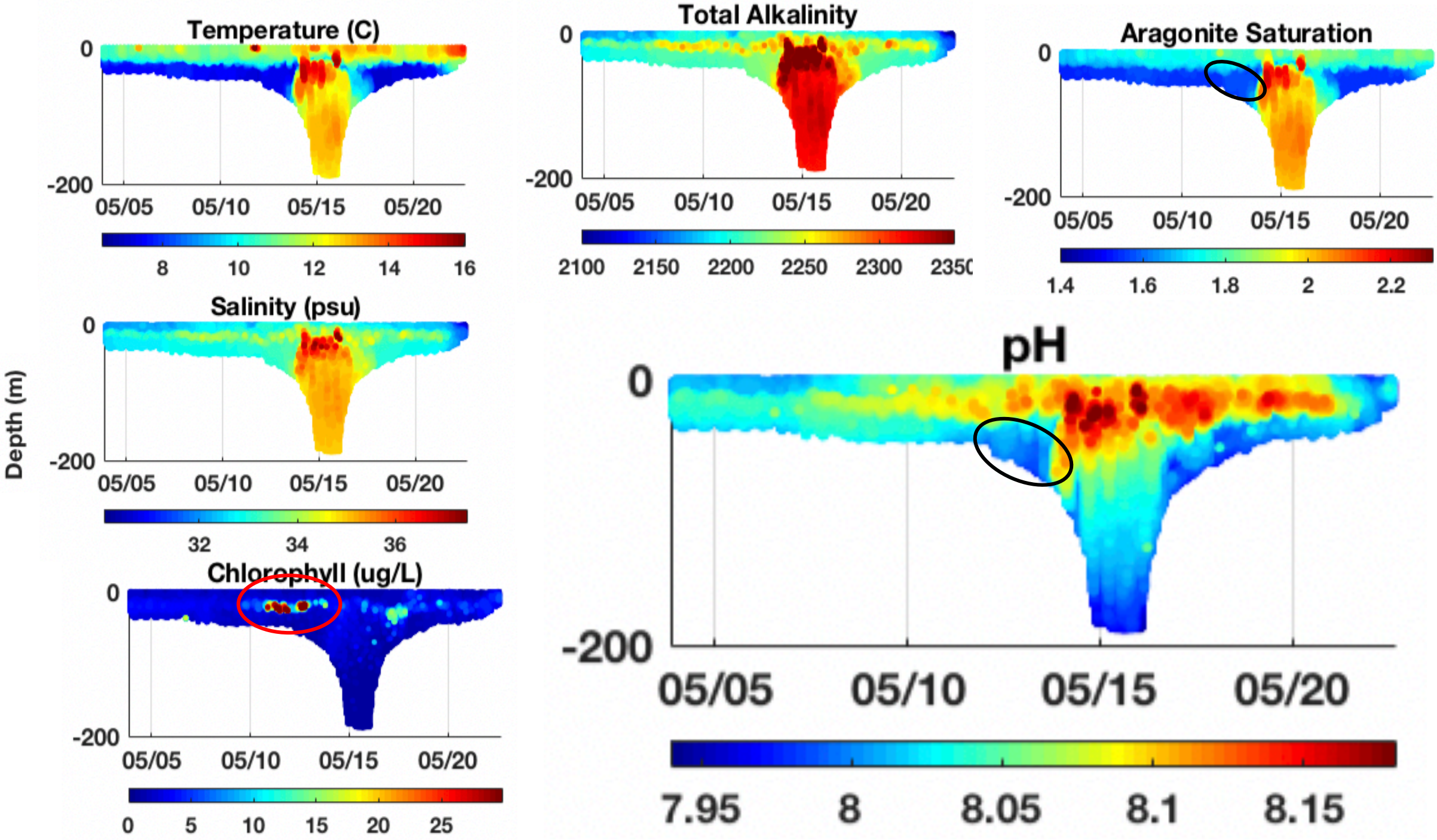
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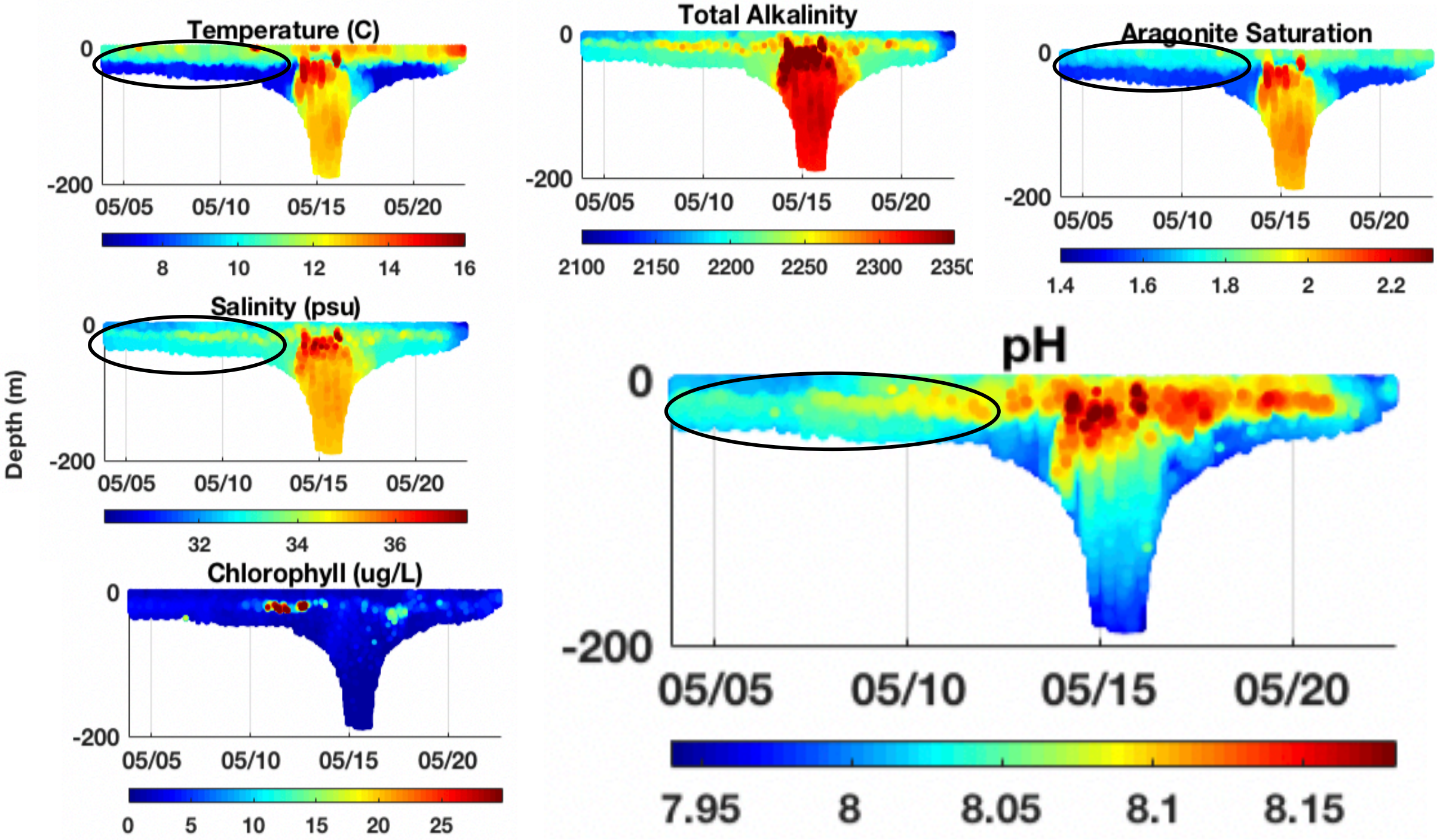
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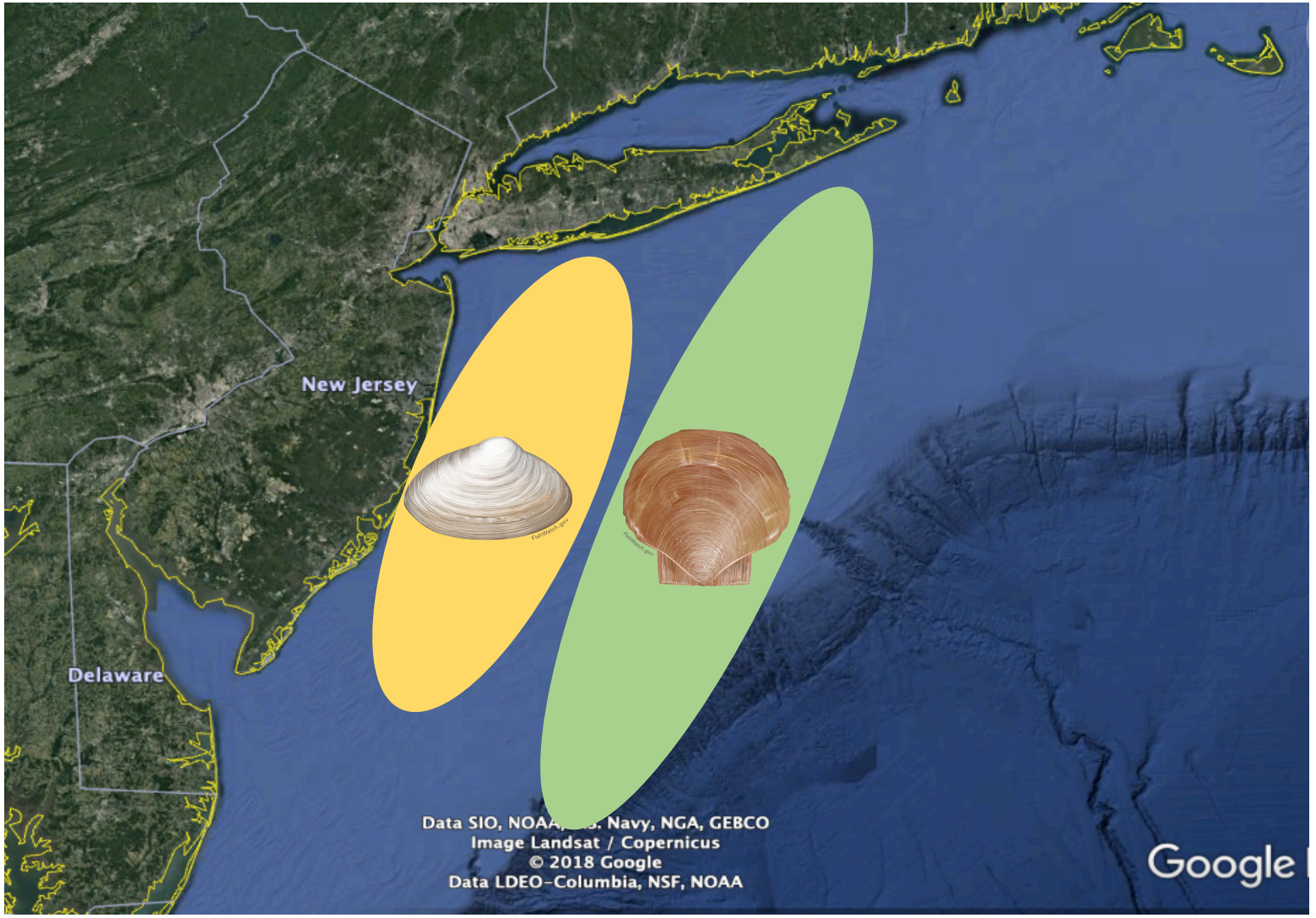
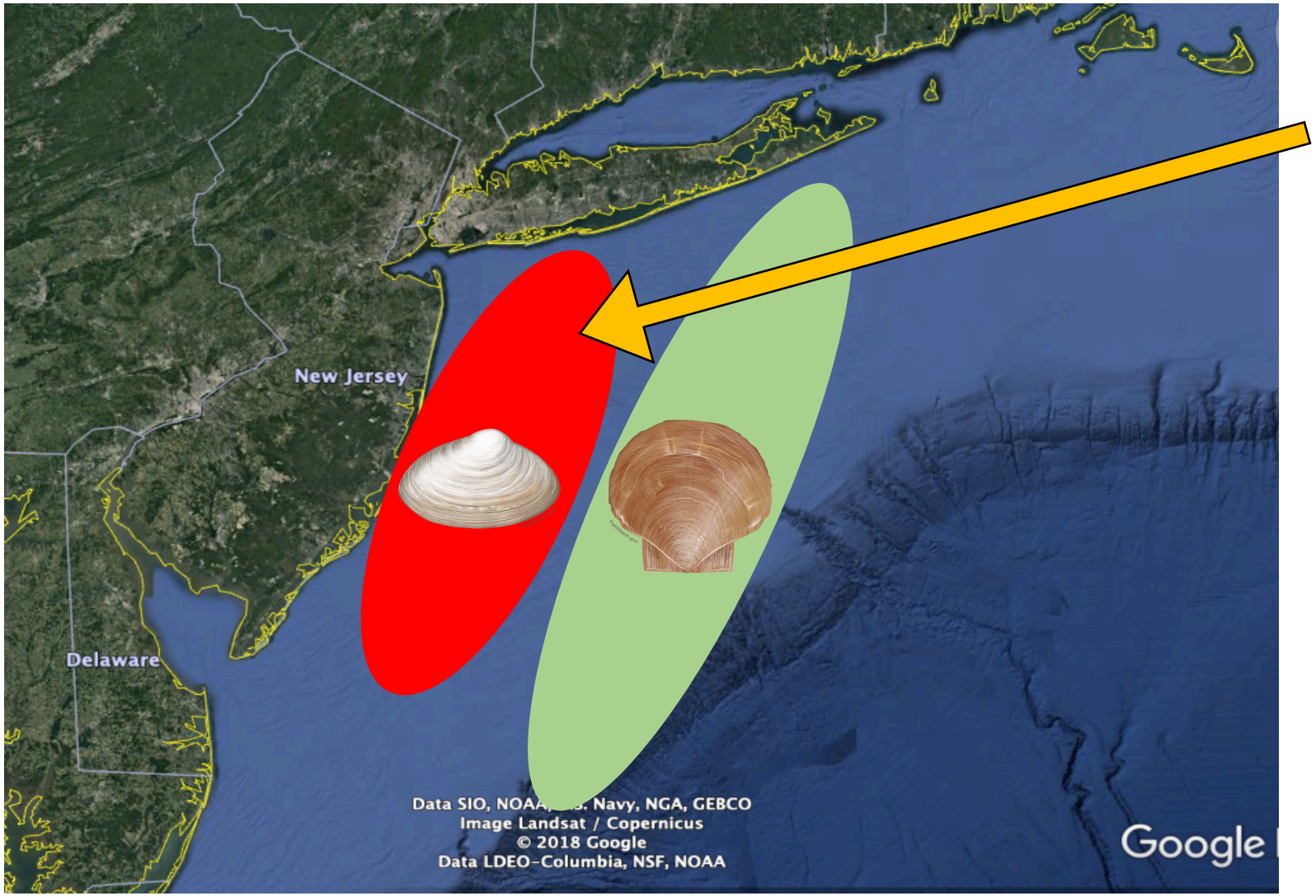
Vulnerability in Shellfish

Returning to Shellfish Distribution...



Vulnerability in Shellfish



Higher Vulnerability Inshore

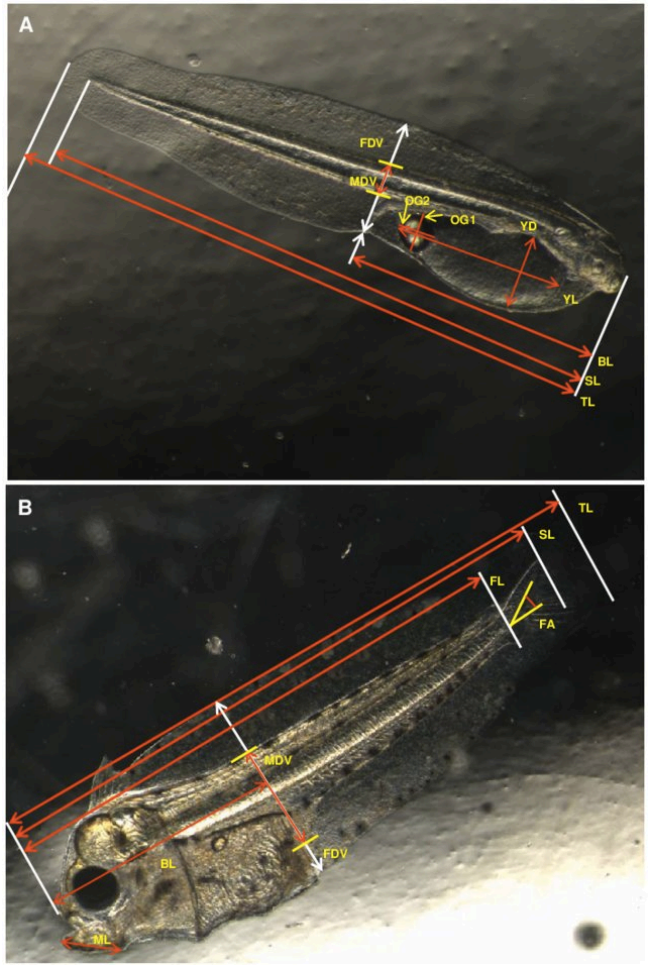
- Lower pH in freshwater
- Lower pH in water coming South from the Labrador Sea
- Less buffered Gulf water coming in
- Higher Productivity
  - Lower pH in bottom water

Vulnerability in Finfish

- OA impacts will be dependent on:
  - Spawning timing
    - Lab studies show lower survival to hatch in Summer Flounder

    Therefore:
    - Early onset of stratification hurts Black Sea Bass
    - Late Fall mixing will hurt Summer Flounder

  - Episodic events nearshore
    - Increased rainfall in Fall
    - Affects inshore spawning by both species



Chambers et al.

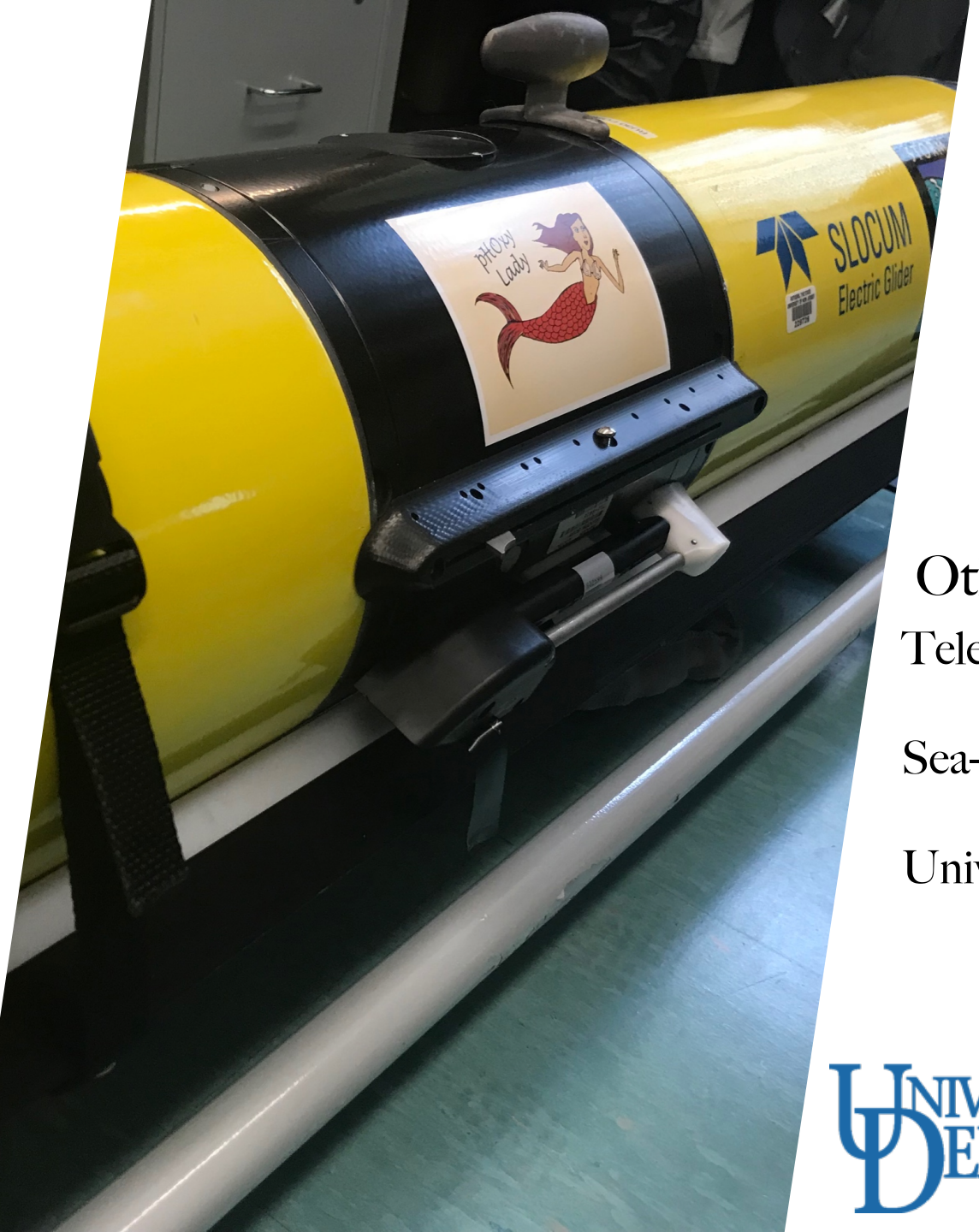
Economic Significance

Group	Common Name	Total Landing Revenue
Shellfish (in 2015)	Atlantic Sea Scallop	$400 million
	Atlantic Surfclam	$30 million
Finfish (in 2016)	Summer Flounder	$27 million
	Black Sea Bass	$9 million

NOAA

Next Steps...

- Complementary quantitative lab studies of acidification, incorporating natural variability as determined by the glider
- Continued monitoring of acidification in the region
  - Seasonal and interannual variability
- Use glider data to validate biogeochemical models that include carbonate chemistry
- Spread awareness among fisherman



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