

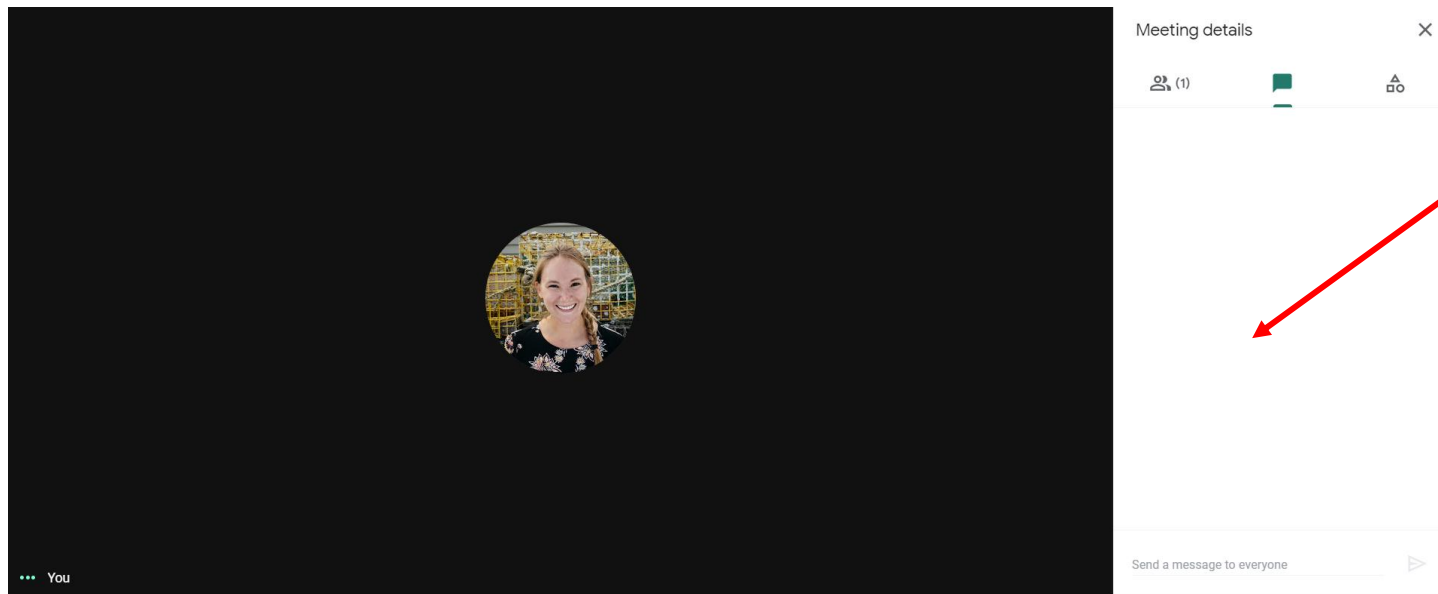


# CFRF/WHOI Shelf Research Fleet

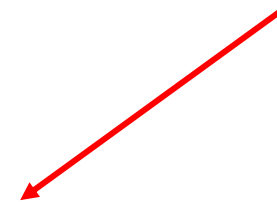
**Glen Gawarkiewicz and Frank Bahr, WHOI**

**Aubrey Ellertson and Dave Bethoney, CFRF**

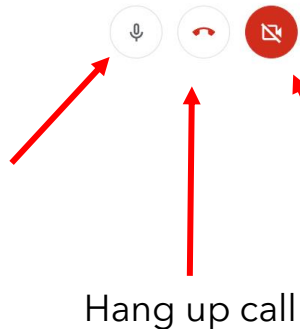
# Housekeeping for Google Meets



- You can enter questions in chat box. This will be seen by everyone



How to turn mic on  
When someone is presenting,  
please keep yourself muted  
(red), and then unmute to speak.



Hang up call

Turn video on and off



Raise hand

# Outline



Introductions



Salinity Intrusion Project



Shelf Research Fleet Update



Data Summary



Industry Input & Discussion



Pioneer Array Data Update



Future Directions



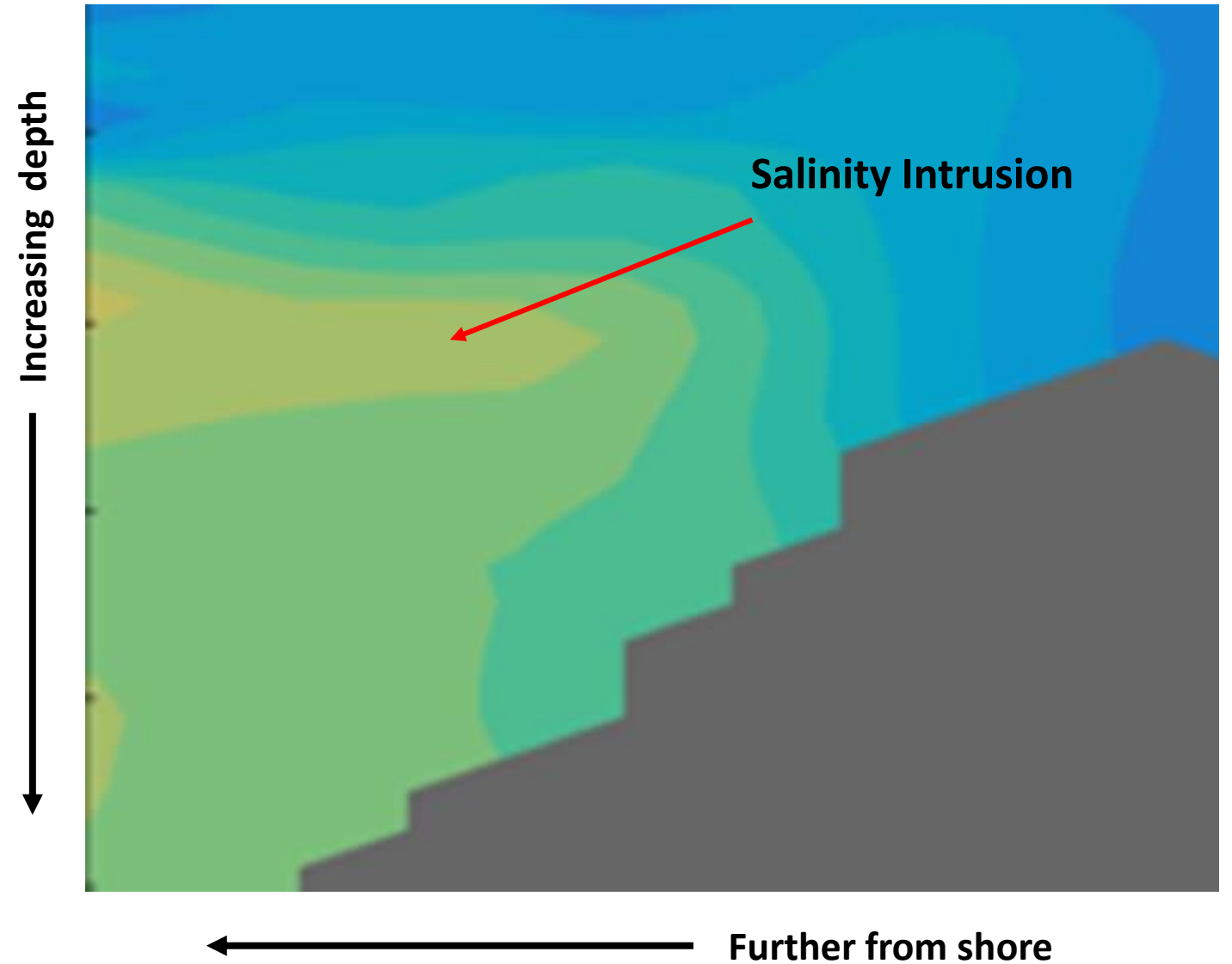
Discussion & Closing Remarks

# Introductions

---

- I am going to unmute each of you and ask that you introduce yourself:
  - Name
  - Affiliation
  - If in the fishing community please say: where you fish out of, and for what species, gear type

SALINITY MAXIMUM  
INTRUSIONS ON THE  
NEW ENGLAND SHELF





## PROJECT GOALS

- Use historical oceanographic data and reports from fishing partners to identify likely positions for these salty intrusions for research cruises to investigate.
- Map mid- depth salinity maximum intrusions and establish how far they travel inshore, at what depth, and thickness using Autonomous Underwater Vehicles (AUVs)
- Measure turbulence and mixing characteristics
- Determine nature of organisms riding onshore in intrusion (through acoustics, and net tows). Does it affect the fishery?



REMUS 100  
Autonomous  
Underwater Vehicle

Photo by Chris Linder, WHOI



## Collaborative Research

**SALINITY MAXIMUM  
INTRUSIONS ON THE  
NEW ENGLAND SHELF**

**HOW DOES IT EFFECT  
COMMERCIAL  
FISHERIES ?**

Funding has been provided by the  
National Science Foundation

- Brochure: March 2021

Project Description  
Results

Cruise Schedule

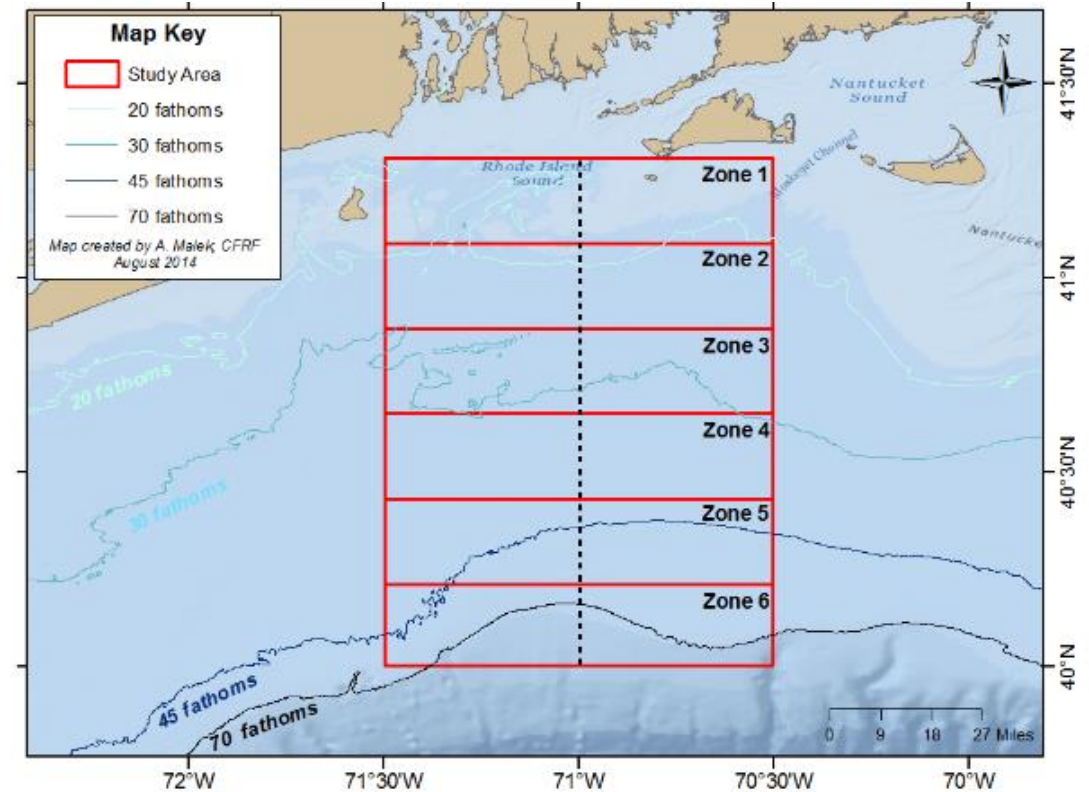
How You Can Participate- WE NEED YOUR HELP

Report Events: temperature, salinity , depth, location

- Workshop: Fall 2021

# CFRF/WHOI Shelf Research Fleet

- Project Goals:
  - study the oceanographic conditions across the continental shelf off the coast of RI
- Fishing vessels collect temperature, salinity, depth from six designated study zones
- Each F/V samples 2 stations every other week
- Currently funded through June 2021





# Huge thank you to our fleet participants!

- Brooke C, Erica Knight, Excalibur, Finast Kind II, Harvest Moon, Mister G
- We would also like to formally welcome our newest member: Rob Walz, FV Finast Kind II



# Progress to Date



691 profiles as of  
March '21



Numerous media  
interactions (WBUR  
Boston NPR, WHOI)



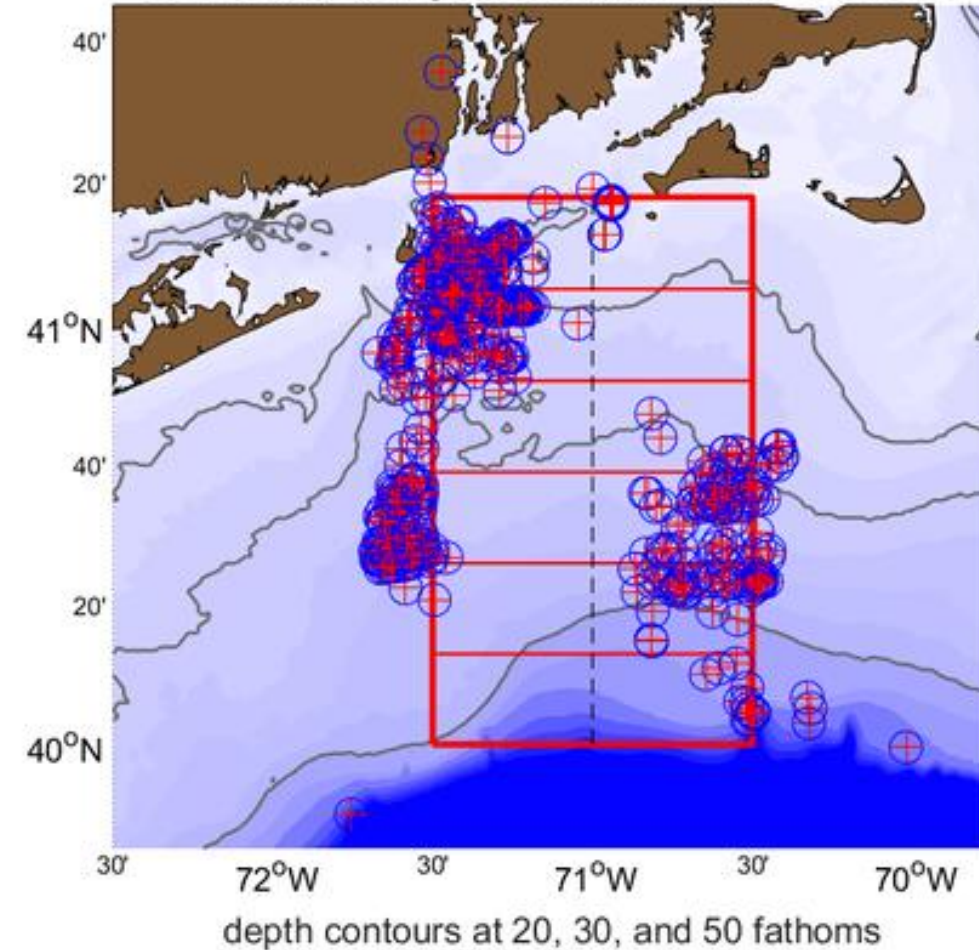
Photo credit: Robin Lubbock/WBUR

"It's tough to define  
essential workers, but  
certainly monitoring the  
health of the ocean is  
essential."  
– Mark Sweitzer

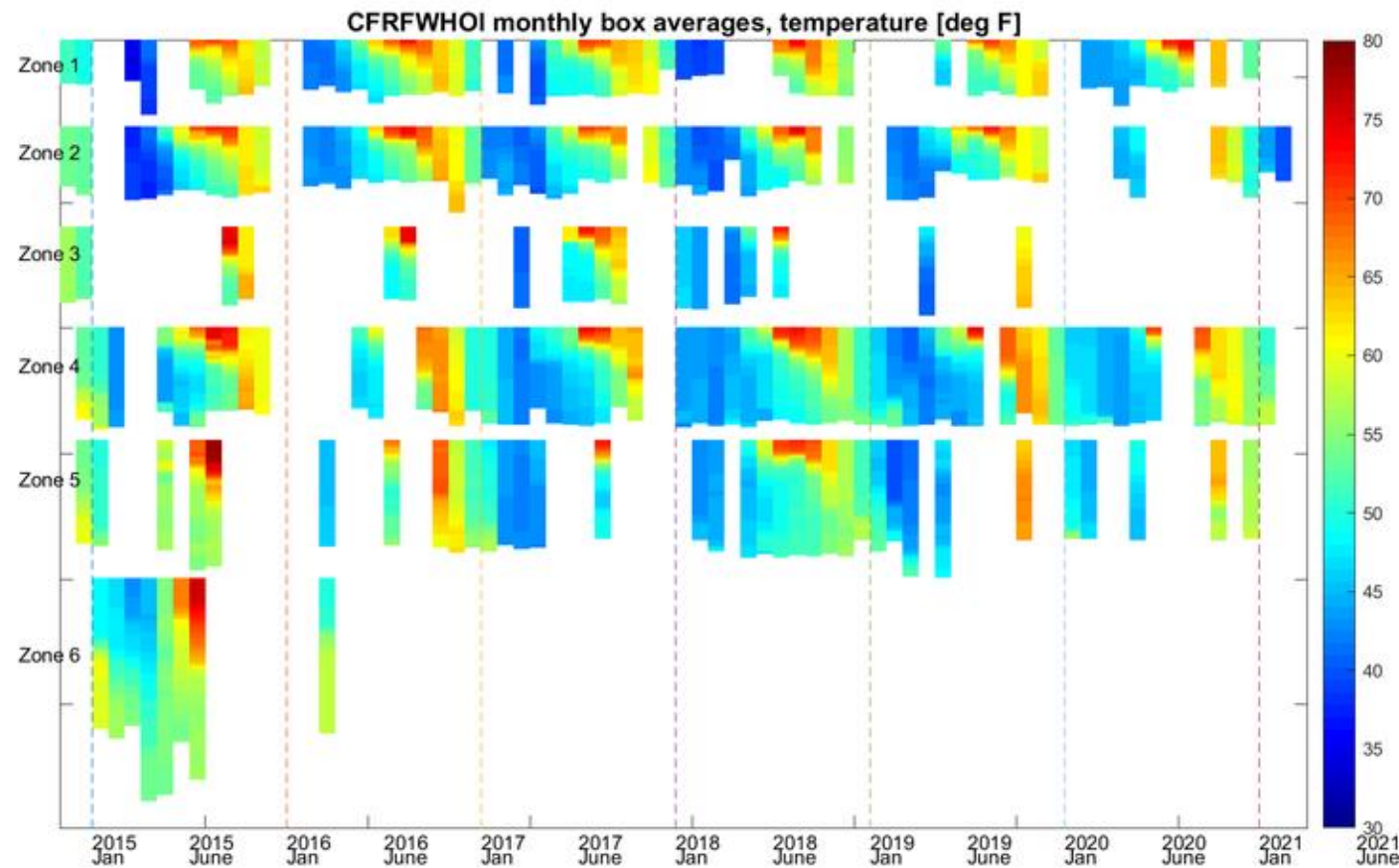


Photo credit: Aubrey Ellertson

Collected 691 profiles as of Mar 02, 2021



# Temperature Data by Month and Zone



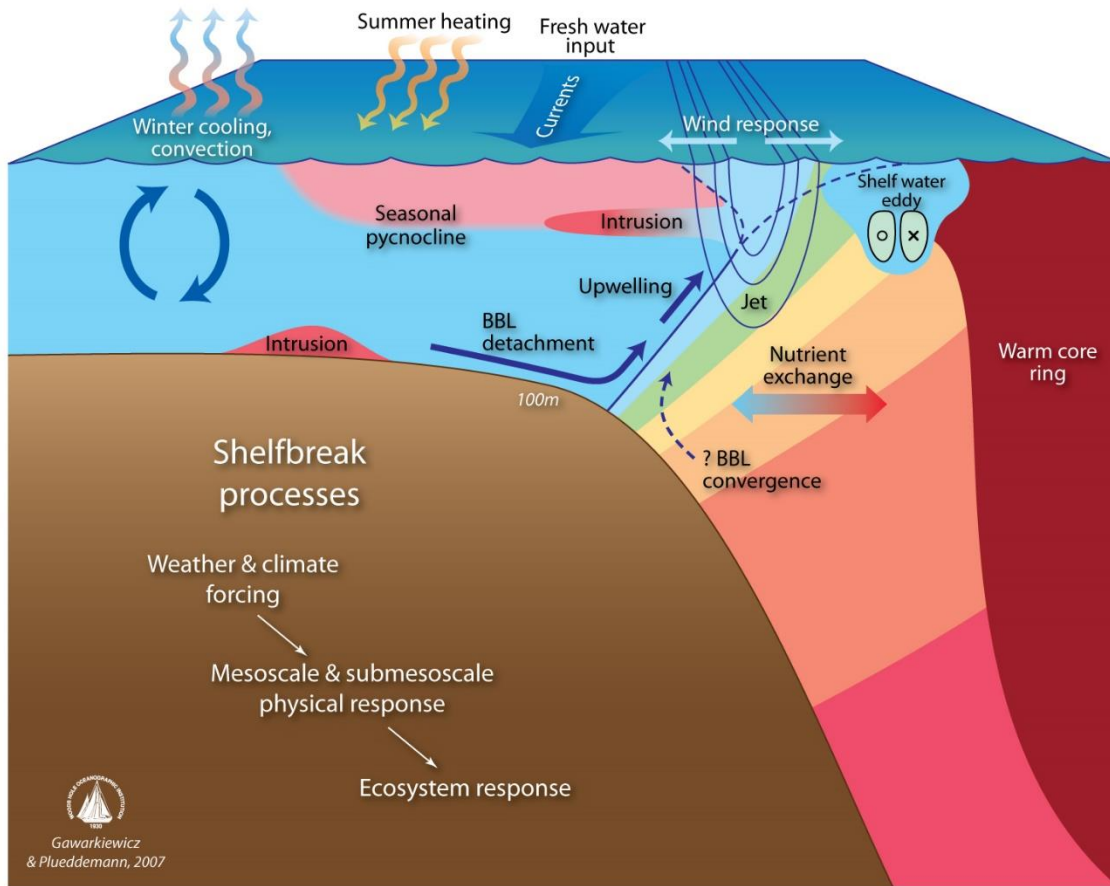




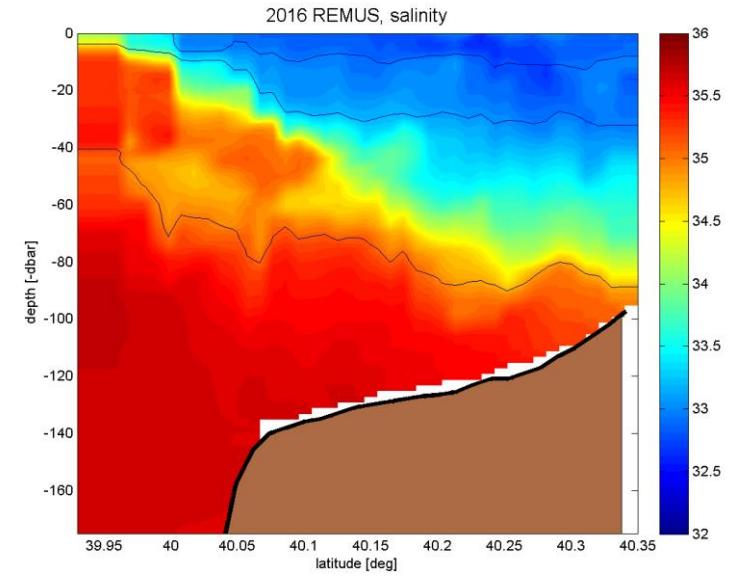
# Glen Gawarkiewicz, Physical Oceanographer, WHOI



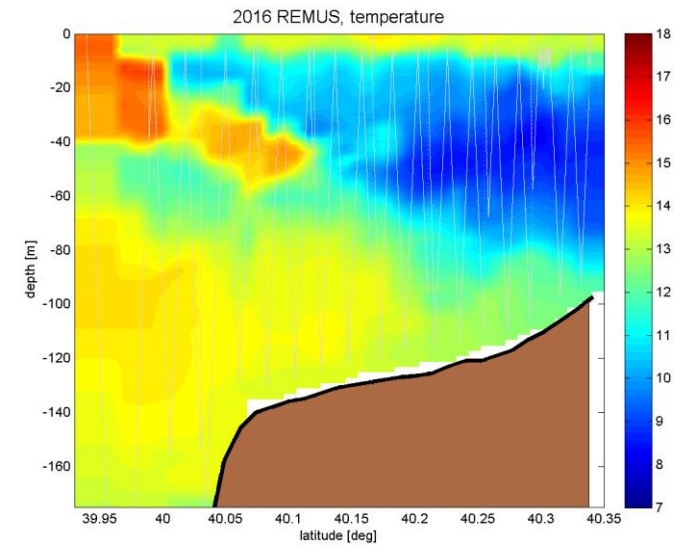
# Shelfbreak Front



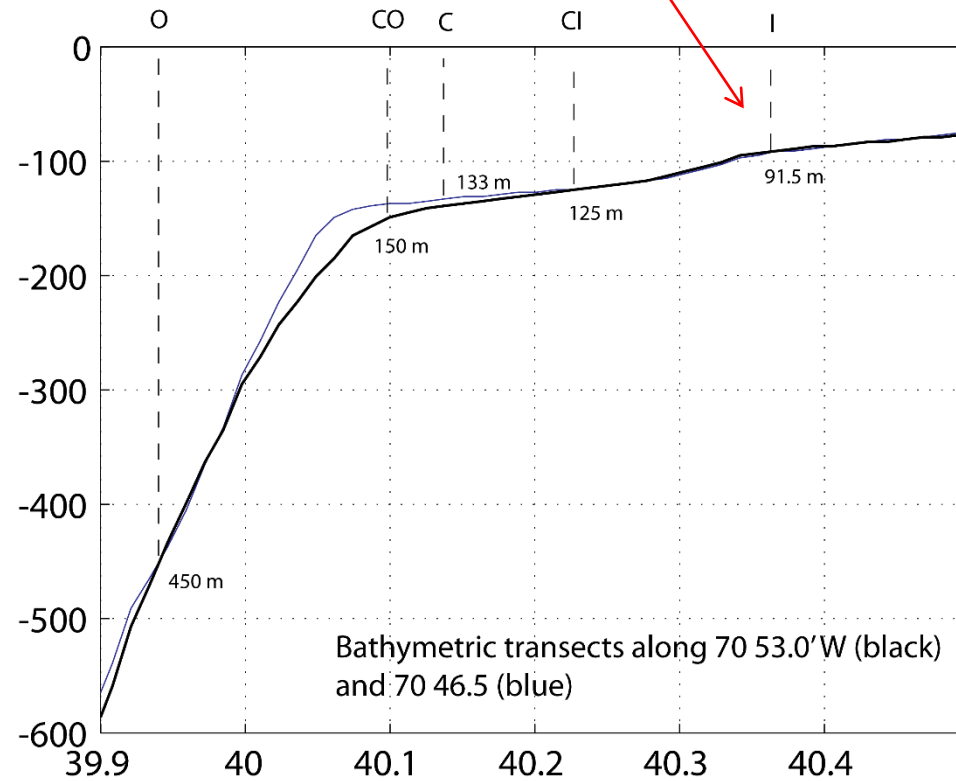
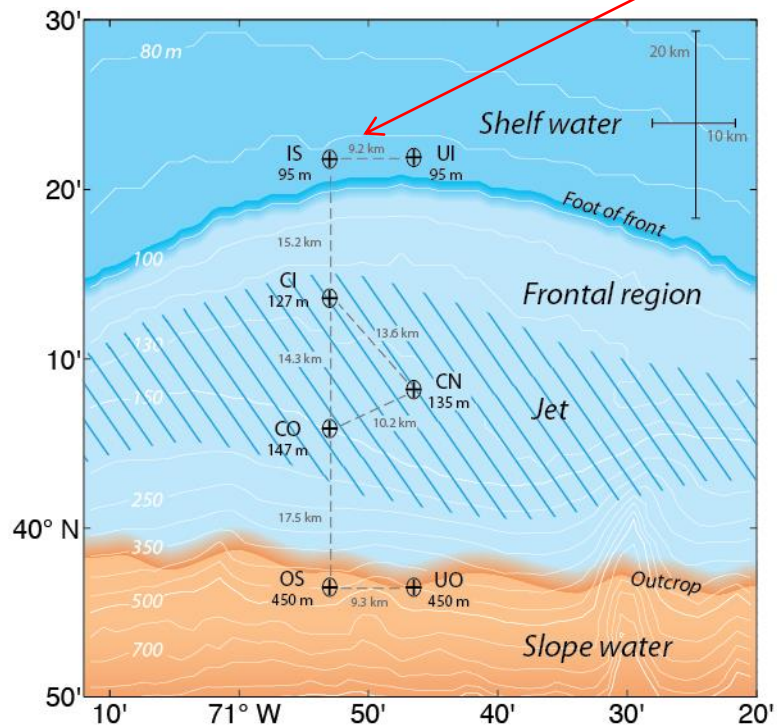
## Salinity



## Temperature

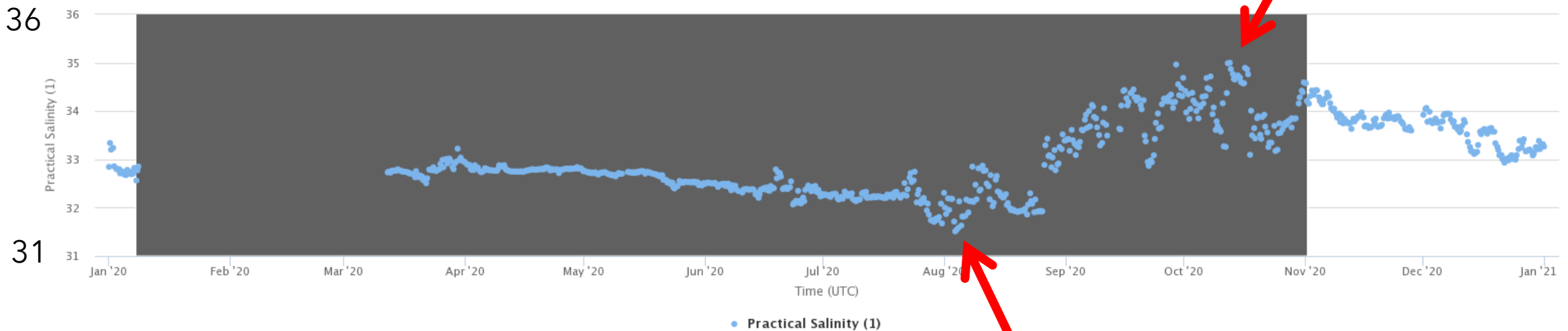


# Pioneer Array- Inshore Mooring- At 45 fathoms



# Pioneer Array- Data from Inshore Mooring Depth- 21 feet

Coastal Pioneer Inshore Surface Mooring – Near Surface Instrument Frame – CTD  
Data Products



High salinity  
35.0 October

Low Salinity- 31.5  
First week August

Salinity- Jan. 1, 2020 to Dec. 31, 2020

Shelf Water < 33 PSU  
Ring Water > 35.5 PSU

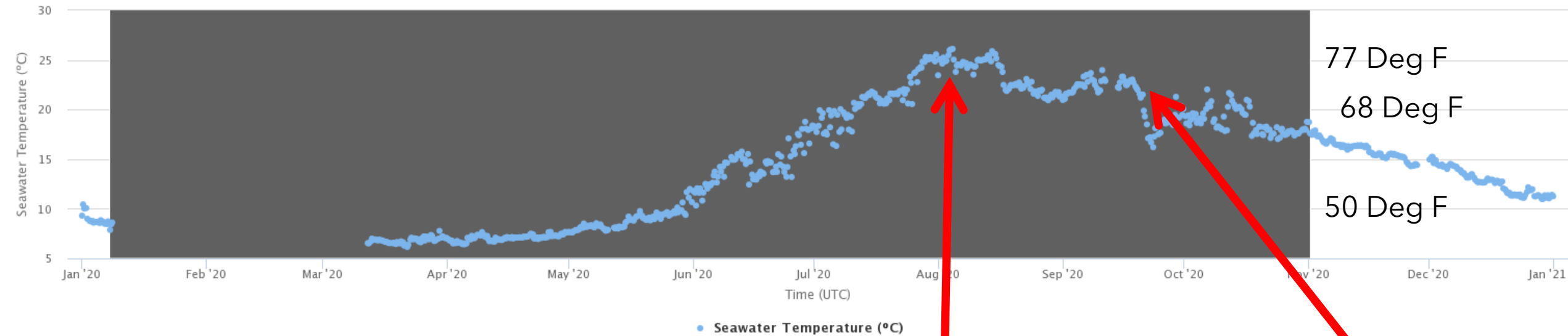
Frontal Water 34 – 35 PSU

Slope Water 35.0-35.2 PSU



# Pioneer Array- Inshore Mooring- At 45 fathoms

Coastal Pioneer Inshore Surface Mooring – Near Surface Instrument Frame – CTD  
Data Products



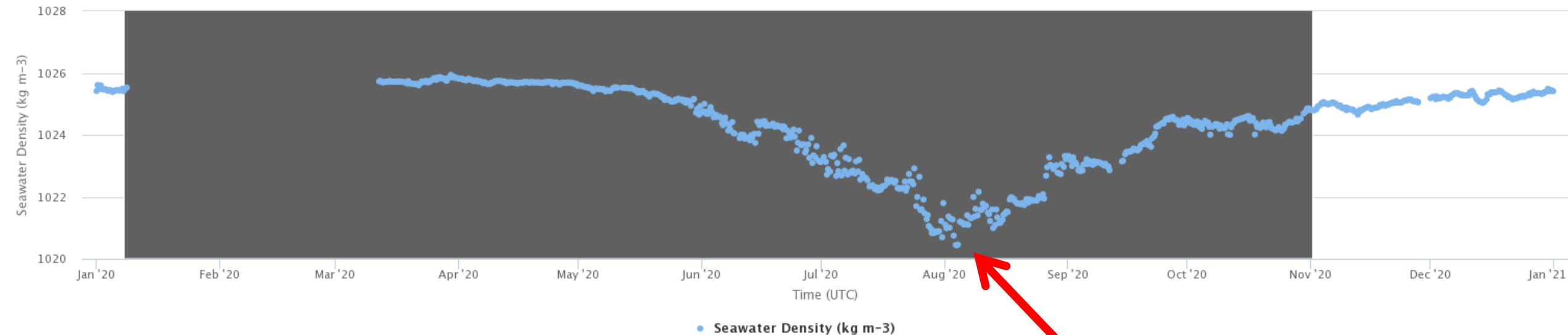
77 Deg F  
68 Deg F  
50 Deg F

Very warm!  
First week August  
80 Deg F

Still pretty  
warm  
October  
70 Deg F

# Pioneer Array Inshore Mooring- 45 fathoms

Coastal Pioneer Inshore Surface Mooring – Near Surface Instrument Frame – CTD  
Data Products

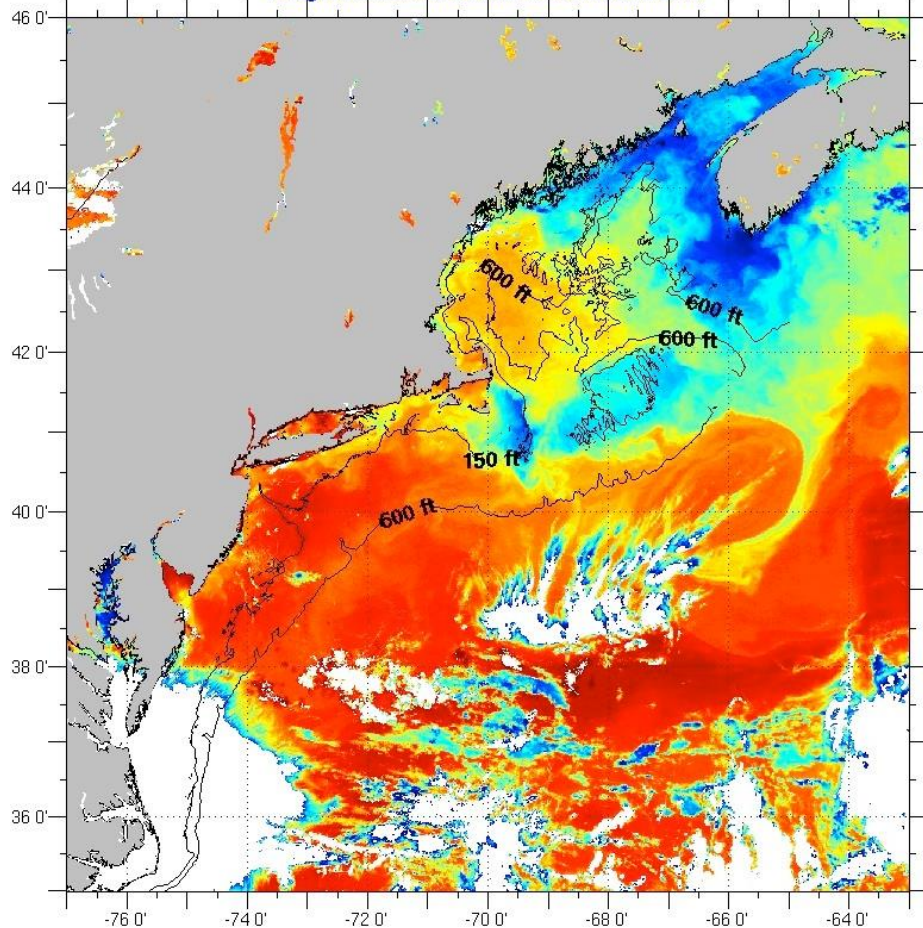


Very buoyant water (low density)  
May be highest stratification  
(density difference with depth)  
recorded in first week of August

# Sea Surface Temperature

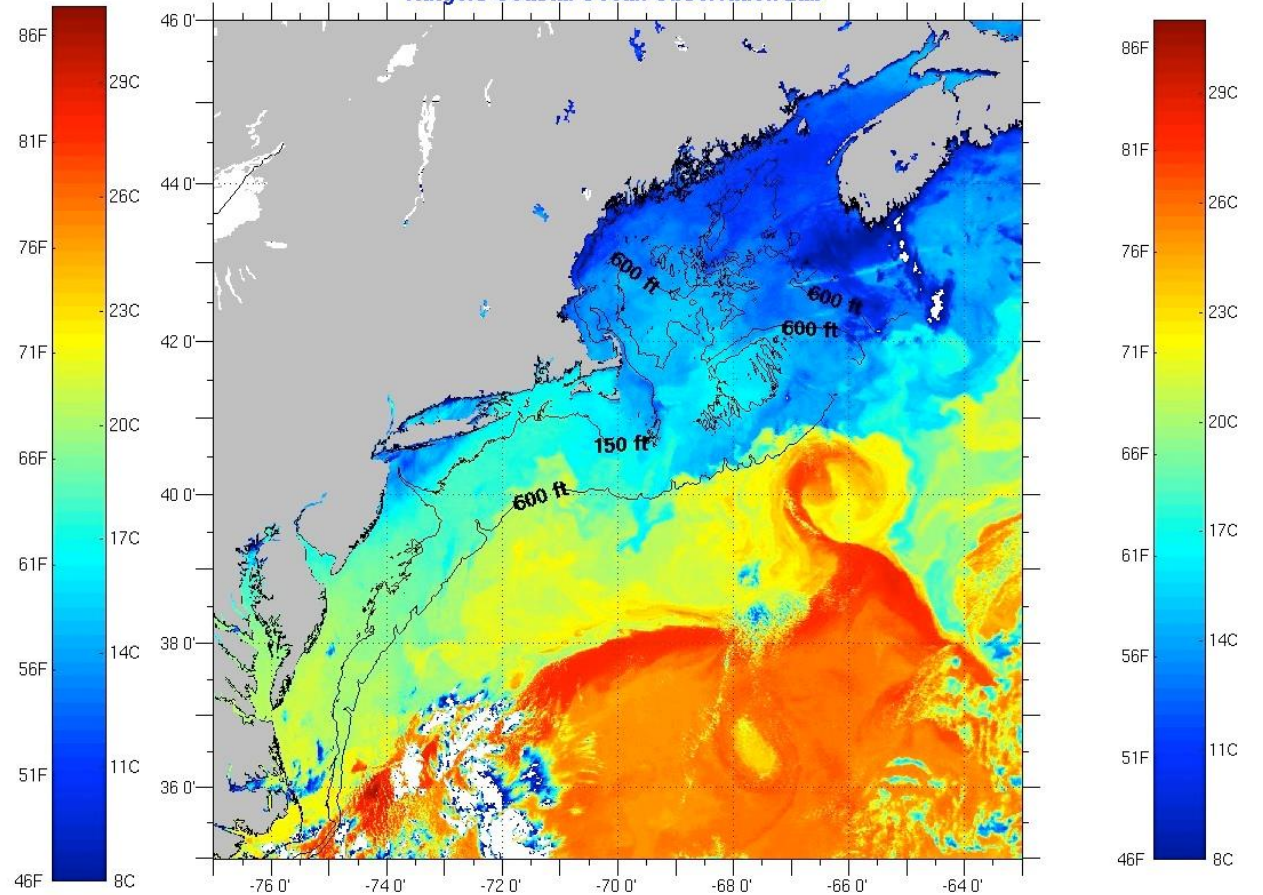
August 1, 2020

NOAA-15 Sea Surface Temperature: August 01, 2020 2332 GMT  
Rutgers Coastal Ocean Observation Lab



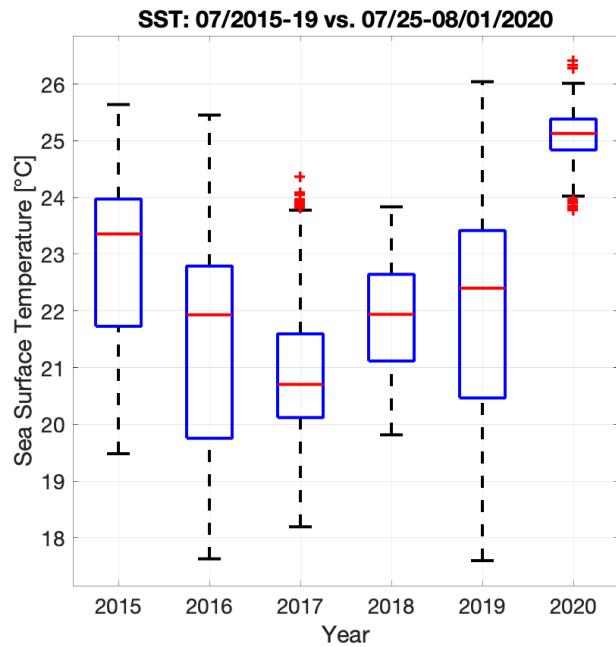
October 16, 2020

NOAA-18 Sea Surface Temperature: October 16, 2020 0201 GMT  
Rutgers Coastal Ocean Observation Lab

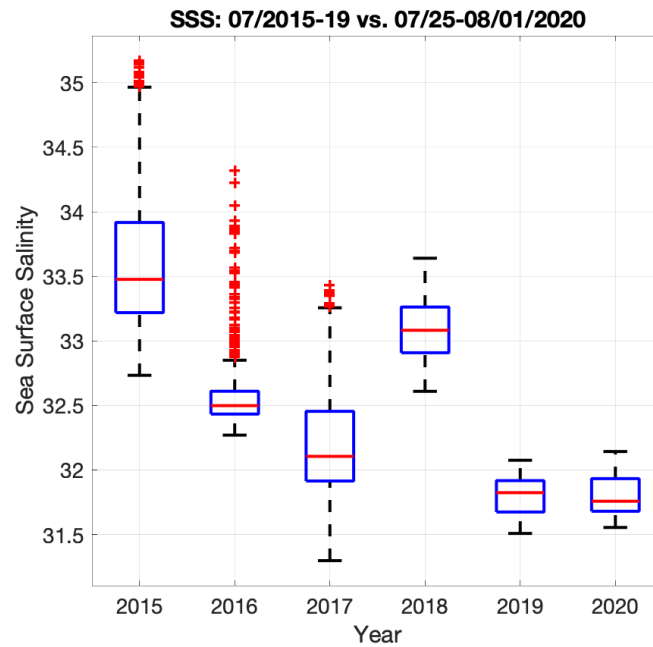


# Surface Temperature and Salinity

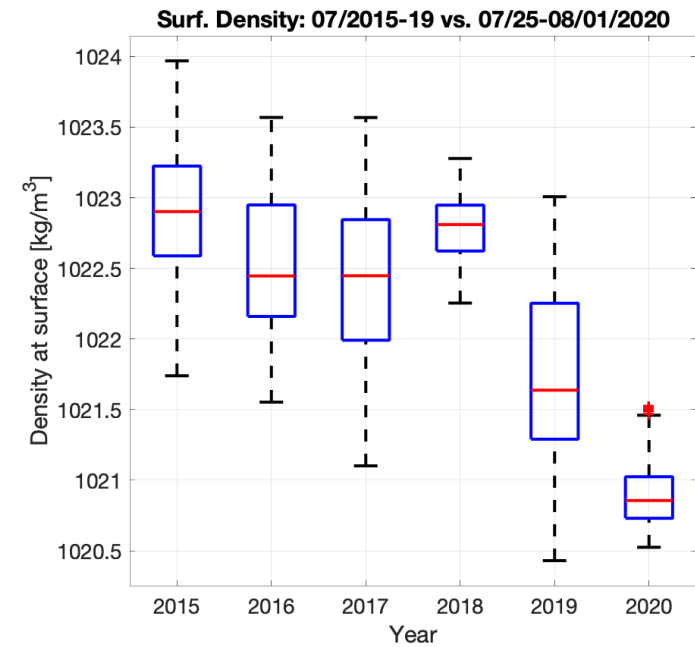
## Last week July 2015-2020 (from L. Lobert)



2020 Very Warm!!!



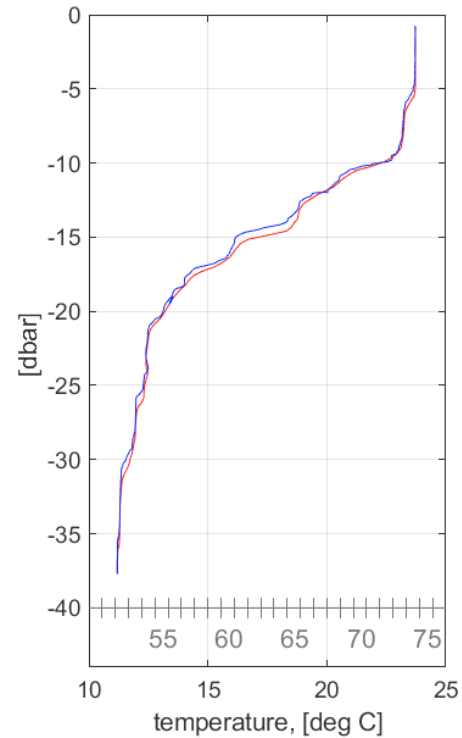
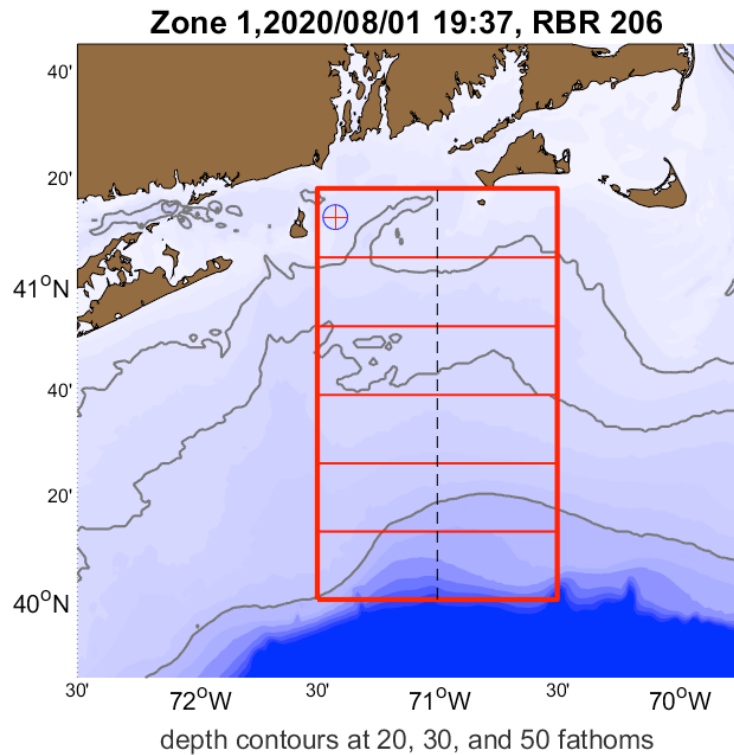
2019 and 2020 Very Fresh!



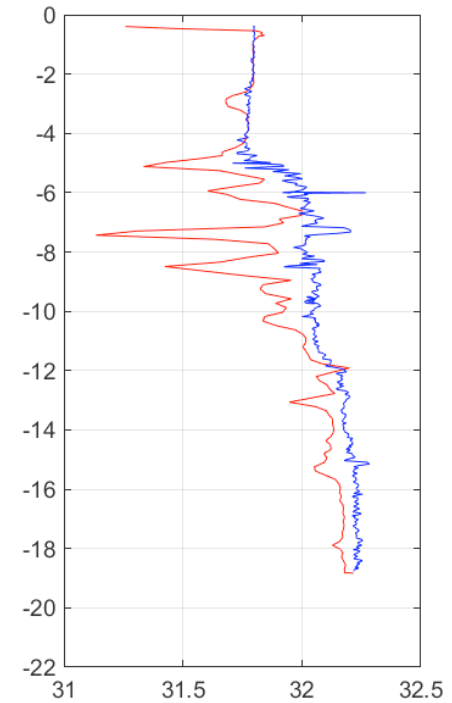
2020 Very buoyant  
(low density)



# Shelf Fleet Profile- August 1, 2020

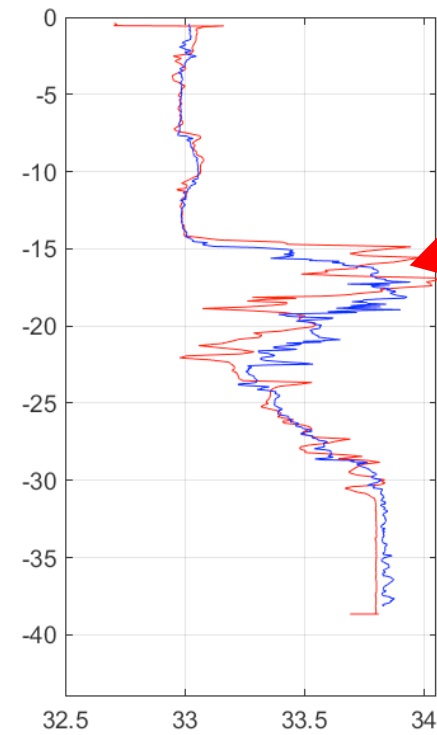
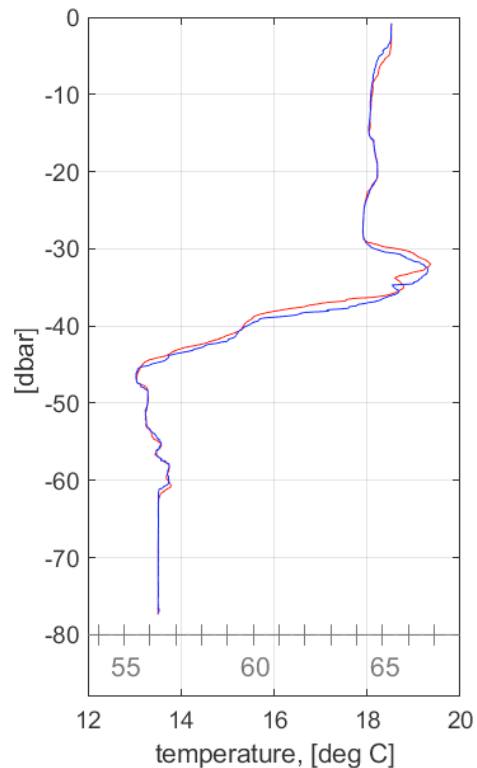
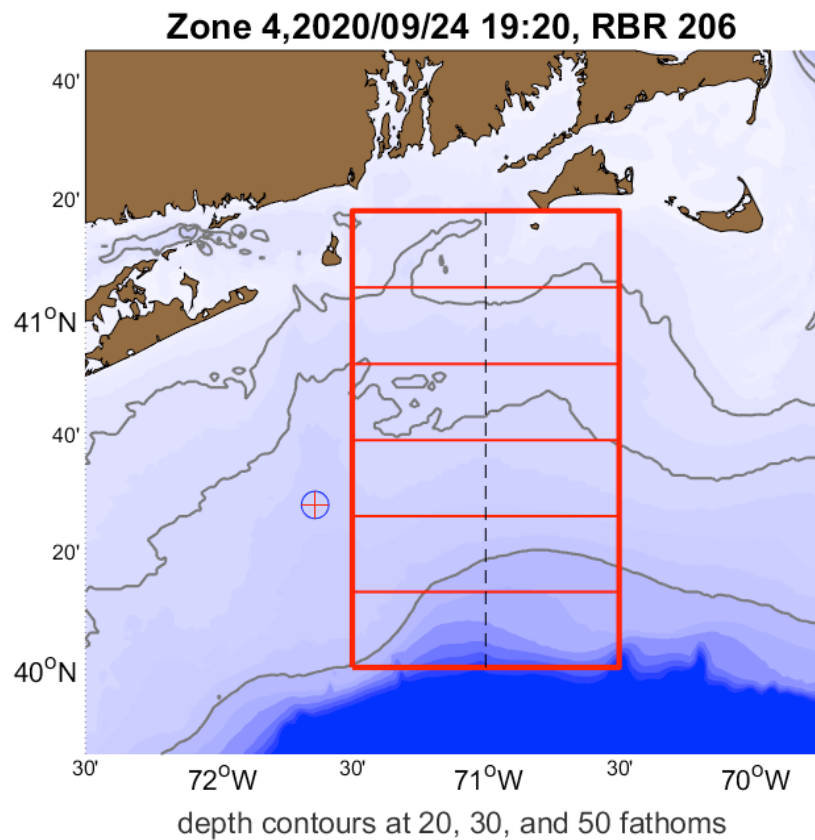


Surface Temperature  
73 Deg F



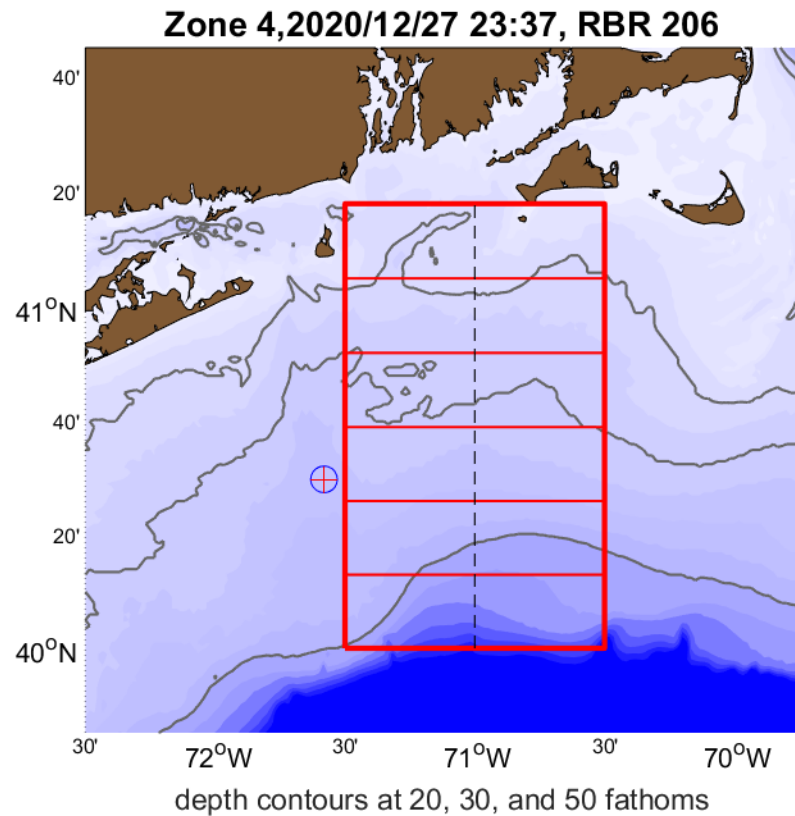
Surface Salinity  
31.8 PSU

# Shelf Fleet Profile- September 24, 2020

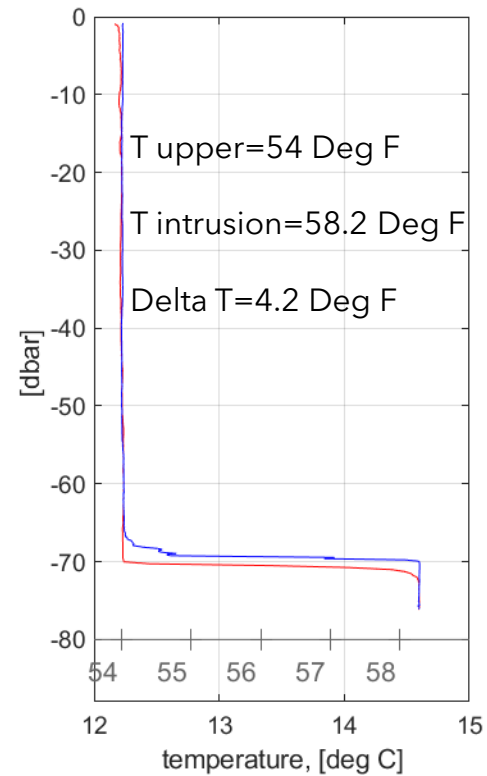


Salinity  
Maximum

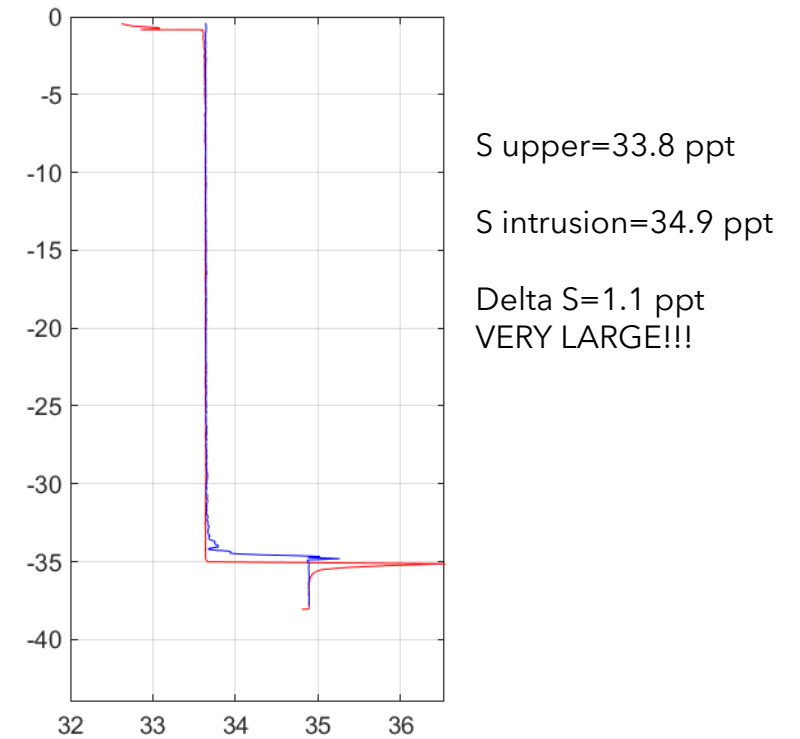
# Shelf Fleet Profile- December 27, 2020



Depth 38 fathoms



4 Deg. F jump  
Near bottom



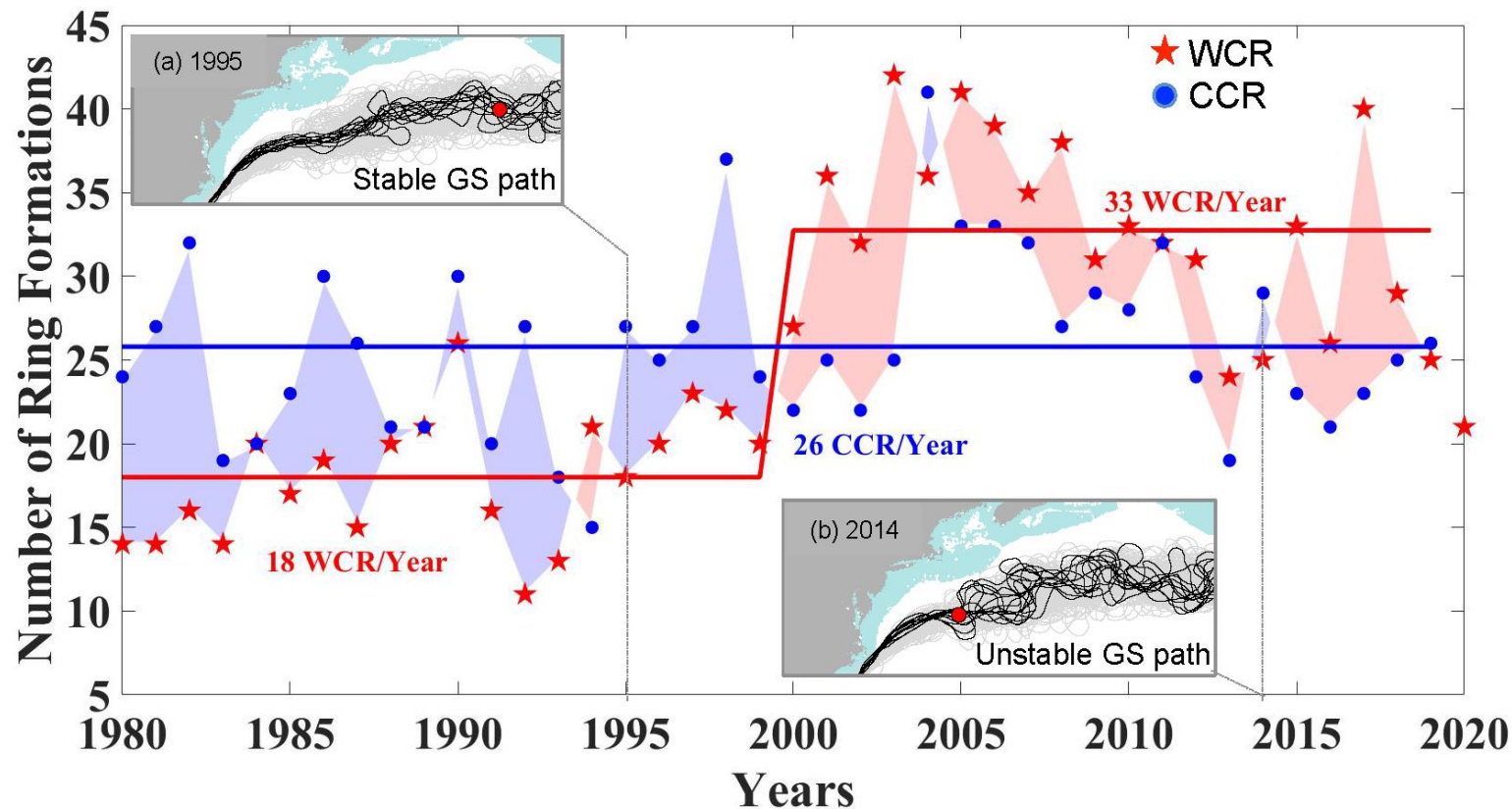
1.0 PSU Salinity  
Jump near bottom



# Salinity Intrusions

- Mid-depth intrusions May-October
- 70% more frequent 2015-2019 than before 2003
- Profiles frequently have multiple salinity maxima (2-4)
- Big question- do squid or other species concentrate in the intrusions?

# Warm Core Ring Update (Avijit Gangopadhyay)



## Researchers shed light on the effects of ring formation

A new study explores how the formation of cold core rings and warm core rings from the Gulf Stream has changed over the last 40 years and might have long-term effects on the ecosystem.

By Adrienne Watts  
508-910-6543 | awatts@umassd.edu | Claire I. Carney Library 024  
Posted Thursday, March 4, 2021

### scientific reports

#### OPEN Interannual and seasonal asymmetries in Gulf Stream Ring Formations from 1980 to 2019

Adrienne Silva<sup>1</sup>, Avijit Gangopadhyay<sup>1</sup>, Glen Gawarkiewicz<sup>2</sup>, E. Nishchitha S. Silva<sup>1,3</sup> & Jennifer Clark<sup>4</sup>

As the Gulf Stream separates from the coast, it sheds both Warm and Cold Core Rings between 75° and 55° W. We present evidence that this ring formation behavior has been asymmetric over both interannual and seasonal time-scales. After a previously reported regime shift in 2000, 15 more Warm Core Rings have been forming yearly compared to 1980–1999. In contrast, there have been no changes in the annual formation rate of the Cold Core Rings. This increase in Warm Core Ring production leads to an excess heat transfer of 0.10 PW to the Slope Sea, amounting to 7.7–12.4% of the total Gulf Stream heat transport, or 5.4–7.3% of the global oceanic heat budget at 30° N. Seasonally, more Cold Core Rings are produced in the winter and spring and more Warm Core Rings are produced in the summer and fall leading to more summertime heat transfer to the north of the Stream. The seasonal cycle of relative ring formation numbers is strongly correlated ( $r = 0.82$ ) with that of the difference in upper layer temperatures between the Sargasso and Slope seas. This quantification motivates future efforts to understand the recent increasing influence of the Gulf Stream on the circulation and ecosystem in the western North Atlantic.

The Gulf Stream carries more than half of the total annual oceanic heat transported toward subpolar regions in the northern hemisphere<sup>1</sup>. Part of this heat is advected by both Warm and Cold Core Rings formed from the Gulf Stream meanders in the Slope and Sargasso Seas, respectively. Two recent studies by Gangopadhyay et al.<sup>2,3</sup> have shown that there has been a significant regime shift in terms of Warm Core Rings formed in the Gulf Stream between 75° and 55° W. The average has increased by 15 Warm Core Rings per year—from 18 per year during 1980–1999 to an average of 33 per year in the 2000s, largely affecting the continental shelf and slope waters of the northeast US and Canada. Environmental regime shifts have been shown to have long-lasting effects

Read the full scope of the study titled “Interannual and seasonal asymmetries in Gulf Stream Ring Formations from 1980 to 2019,” in [Nature Scientific Reports](#).



# Discussion:

- "58 on the bottom seemed to shut the crabs right off"
- "We caught the most octopus this year."
- "Lots of jellyfish"



Photo: Holden Reynolds,  
9/26/20



Photo: Holden Reynolds, Jan 2nd



Photo: Rich Lodge, FV Select, Jan 8th

# Pioneer Array Operations Summary

- 2020 Mooring service cruises were limited
  - Still maintained all seven mooring sites (plus gliders, but no AUVs)
  - Moorings left in the water longer, some data gaps
- Overall good operational status through 2020
  - One fishing vessel interaction at the Upstream Inshore site
  - Hope and Sydney (John Ainsworth), 8 Dec 2020
- New data delivery interface: "Data Explorer"
- Expect to return to full mooring service in 2021
  - First cruise of the year scheduled for Mar/Apr
  - R/V Armstrong out of Woods Hole

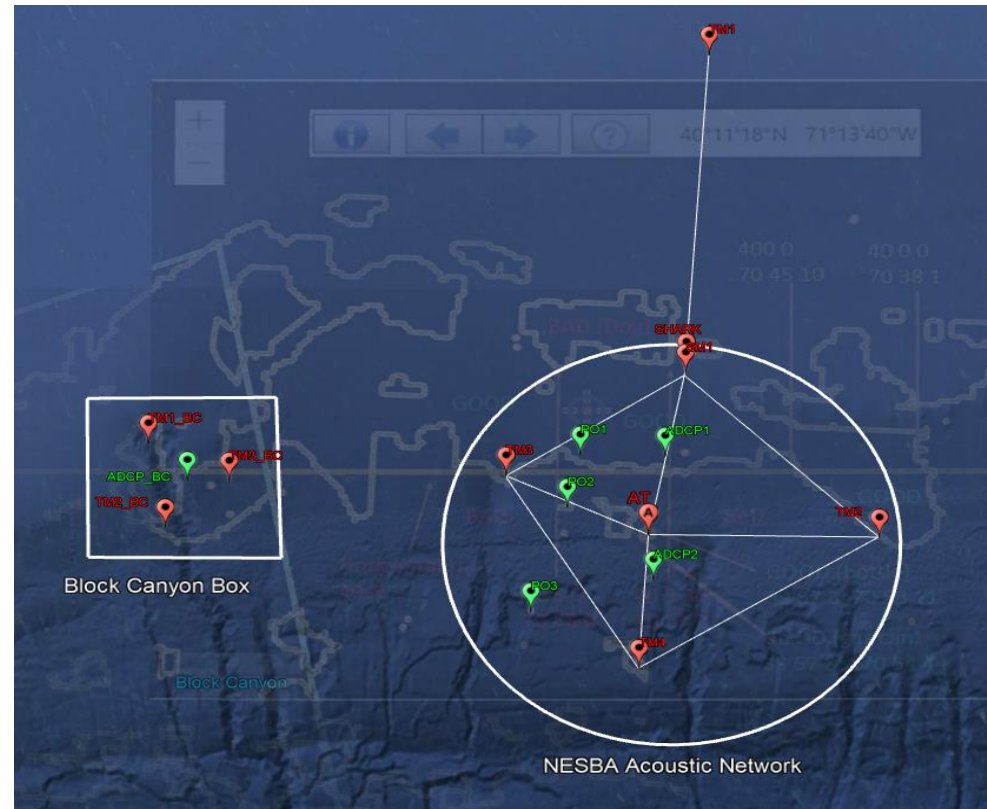
# Potential Pioneer Array Relocation

- Conceived as a re-locatable observing system
  - Same assets could be deployed elsewhere in US coastal ocean
  - Address different science questions at the new location
  - Potential move would be in 2-3 years (e.g. Fall 2023)
- Also possible that the Array stays where it is
  - The NE Shelf is changing, strong motivation to keep observing
- Decision process is starting
  - National Science Foundation sponsoring workshops
  - Decision expected by the end of the summer

# Collaboration with Shelfbreak Acoustics

- OOI is working with New England Shelf Break Acoustics (NESBA)
  - NESBA “Acoustic Telescope” mooring at the Pioneer Offshore site
  - Goal is to transfer data by WiFi from the NESBA mooring to the OOI mooring, then from the OOI mooring to shore
- NESBA mooring will be deployed in April for a short-term test
- Additional NESBA moorings will be part of a process study to be conducted in May

# New England Shelfbreak Acoustics



Real-time Acoustic Propagation Experiment

Late April-early June (6 weeks)



# NSF Coastlines and People Proposal

- Would fund Shelf Research Fleet for 5 years
- Would fund 2 graduate students (Lukas Lobert and Elena Perez)
- Tie-ins to Governor's Offices and Sustainability Offices throughout New England
- Would fund research into storms as well as Warm Core Ring linkages to squid and other species



# Future Communications

- Considering developing short videos on specific ocean processes (salinity intrusions, response to storms, marine heatwaves)
- Develop a video library that could also include topics like Autonomous Underwater Vehicles, the Pioneer Array, Jet Stream variability and link to Arctic warming

# Thank you for joining us!

For Shelf Research Fleet data access and visualization please visit:

<http://science.whoi.edu/users/seasoar/cfrfwho/>

[Introduction](#)

[Sections](#)

[2014/15](#)  
[2016](#)  
[2017](#)  
[2018](#)  
[2019](#)  
[2020](#)

[Monthly](#)

[Averages:](#)

[Overview](#)  
[Temp.\(deg\\_E\)](#)  
[Temp.\(deg\\_C\)](#)  
[Salinity](#)  
[Density](#)

[Individual profiles](#)

[Data Access](#)

[related info](#)



MacArthur Foundation



## CFRF - WHOI Shelf Research Fleet

