

Shelf Fleet and Oceanographic Update

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Outline

- Review of Oceanographic Conditions in 2019
- Broader View- Rings and Warming
- Upcoming Experiment- NSF Salinity Intrusion, May/June 2020
- Upcoming Proposals
- Outer Space!

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 versus depth in 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, Harvest Moon, and Mister G



Progress to Date

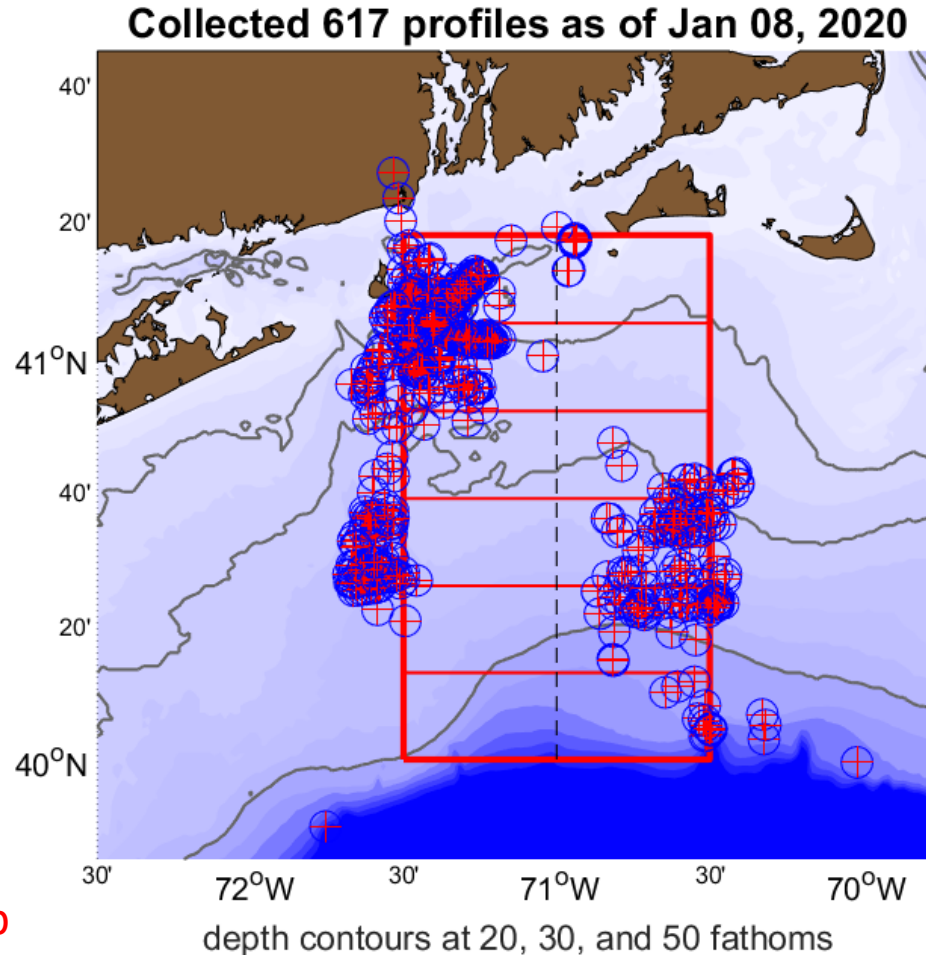
617 profiles as of Jan. 8, 2020
(HOORAY!!!!)

3 Peer-Reviewed Science
Publications (Latest in Dec. 2019)

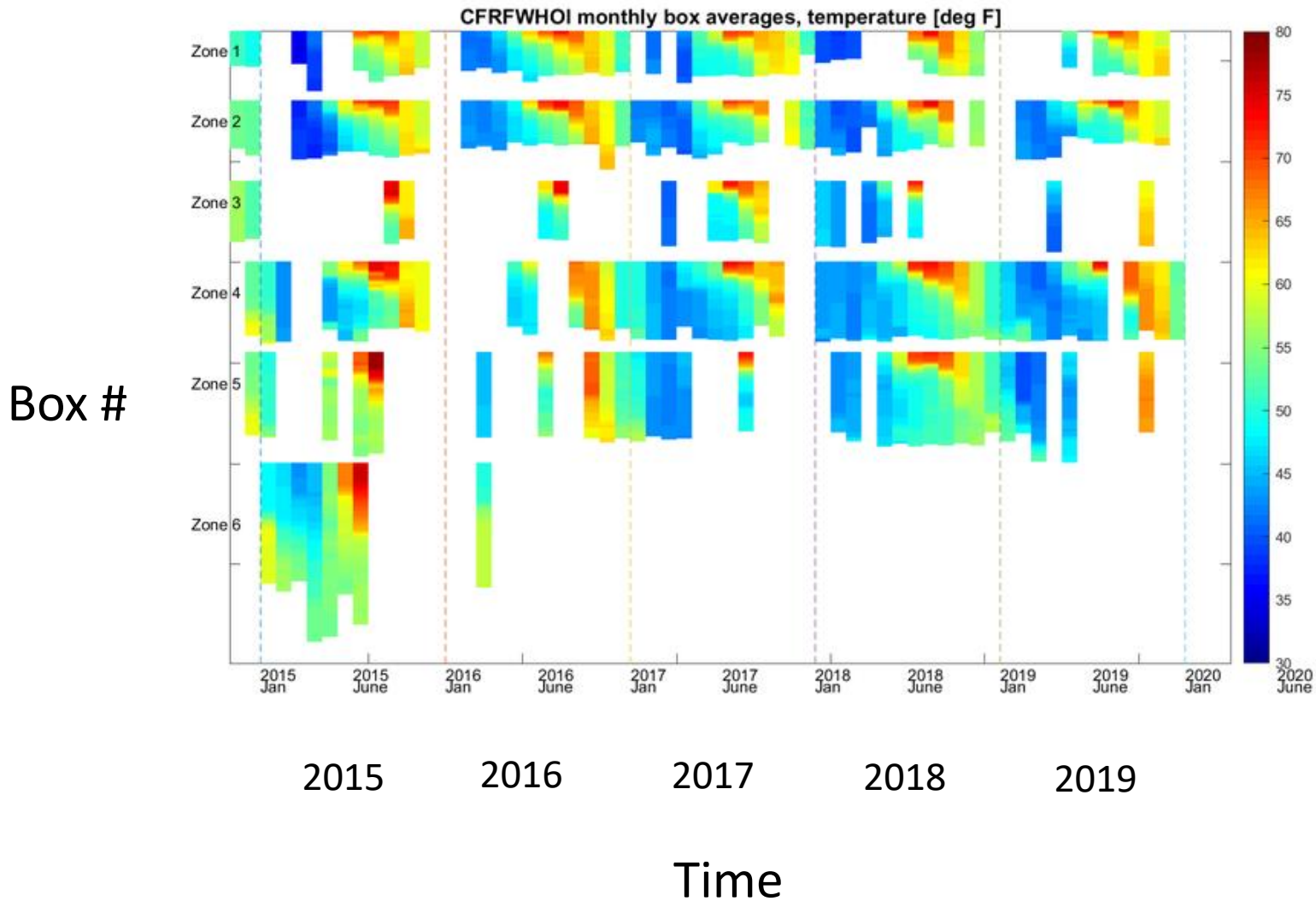
3 National Science Foundation
Proposals submitted relating to
Shelf Fleet data, 1 funded

Numerous media interactions,
latest USA Today cover article
and Yahoo Finance On the Move
interviews (Aubrey and Bob C.)

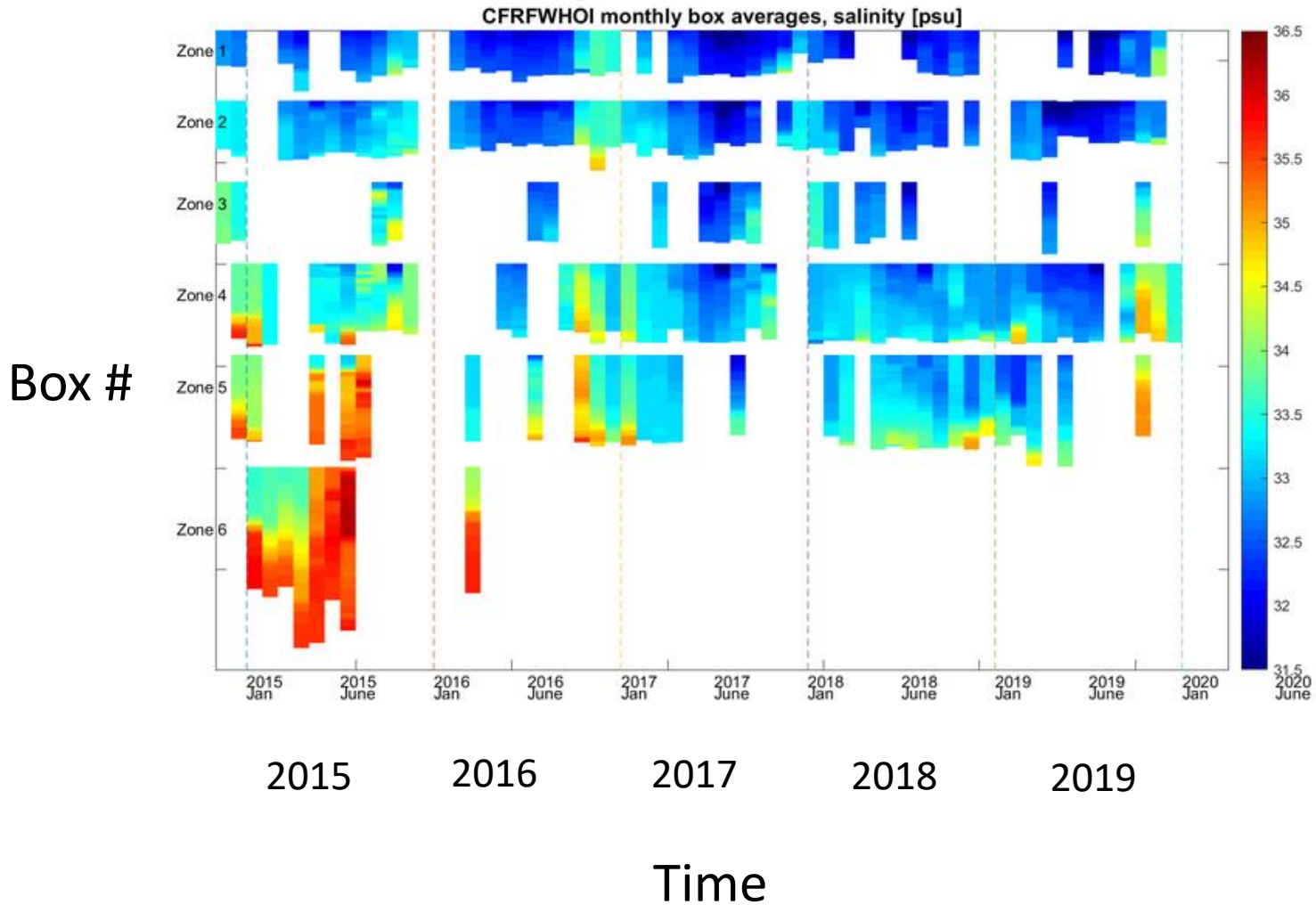
GG Participation in Illex workshop
in Wakefield RI November 2019



Temperature Data by month and box



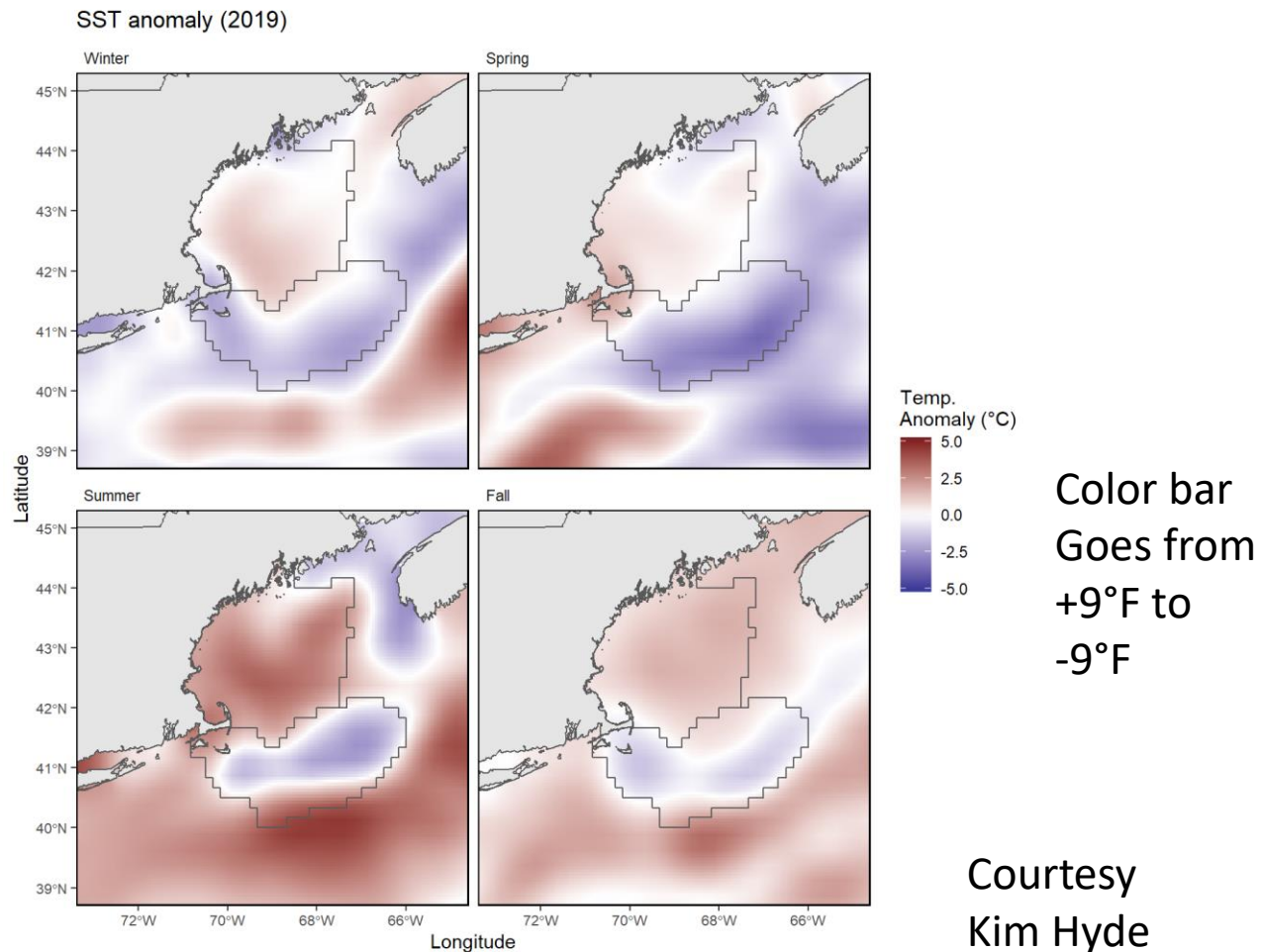
Salinity Data by month and box



Sea Surface Temperature- A Tale of Two Different Half-Years

Winter and Spring 2019
Generally cool over the
Continental shelf, slightly
Warm over continental
Slope

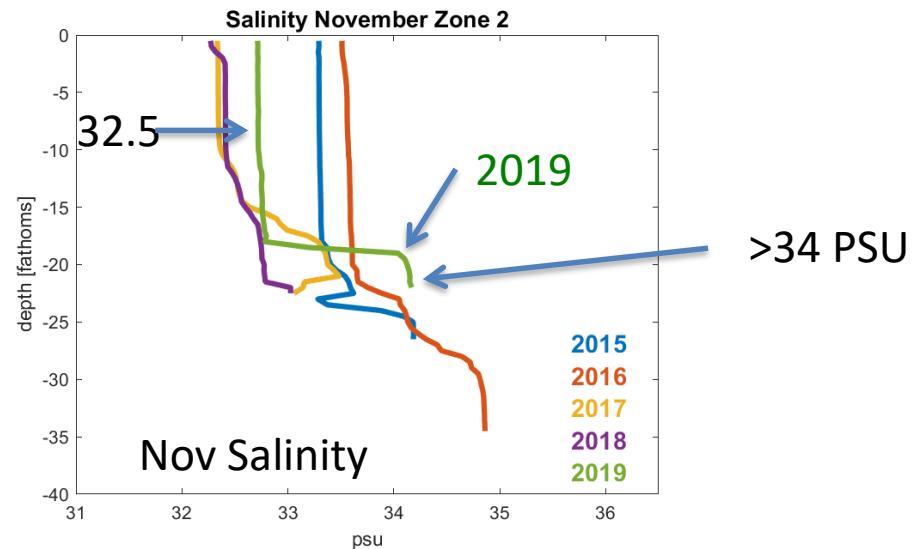
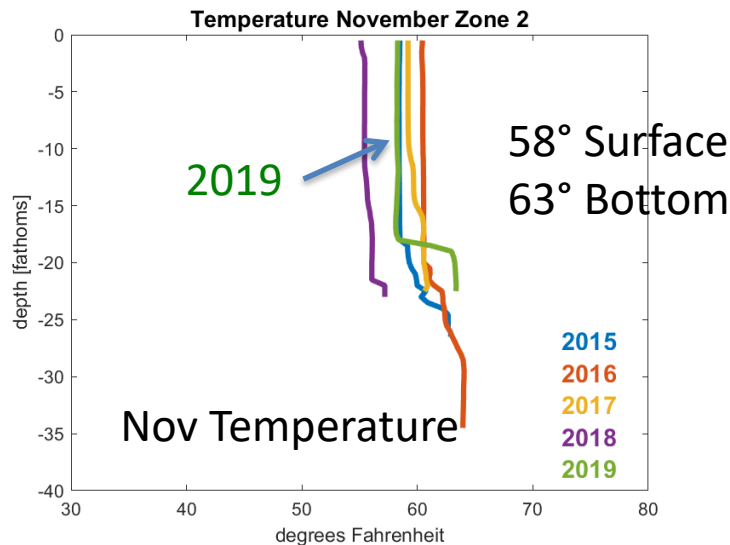
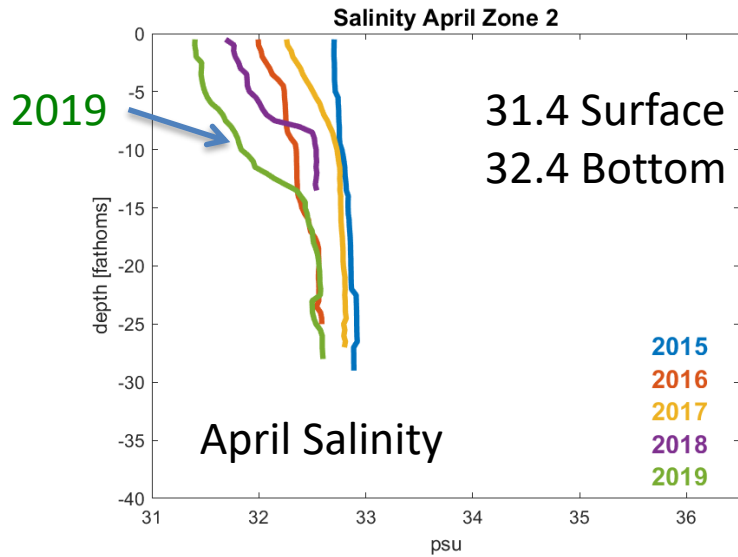
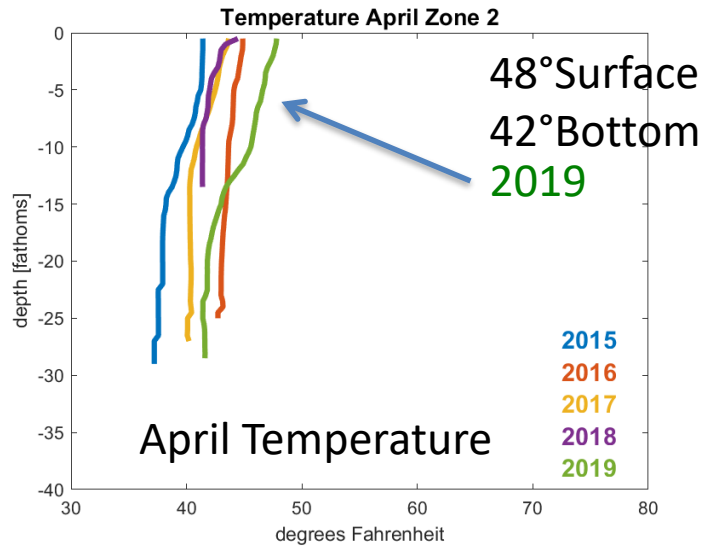
Summer and Fall 2019
Very warm over
Continental shelf and
Slope except for Georges
Bank and Nantucket
Shoals



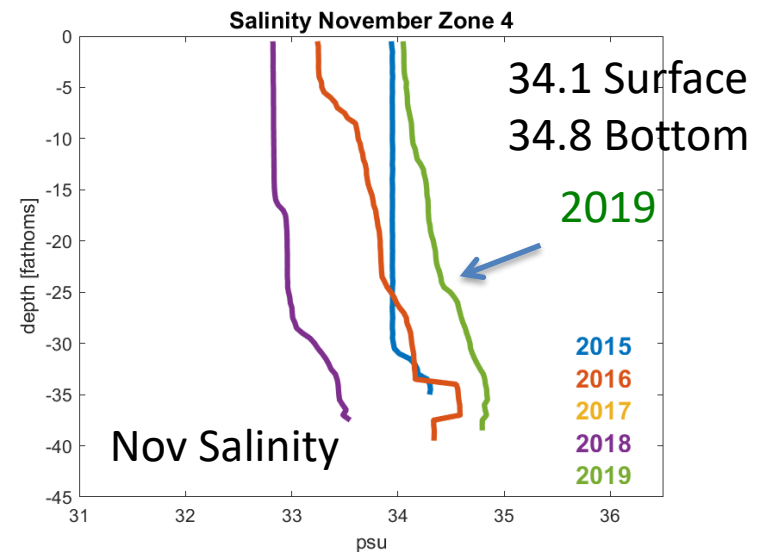
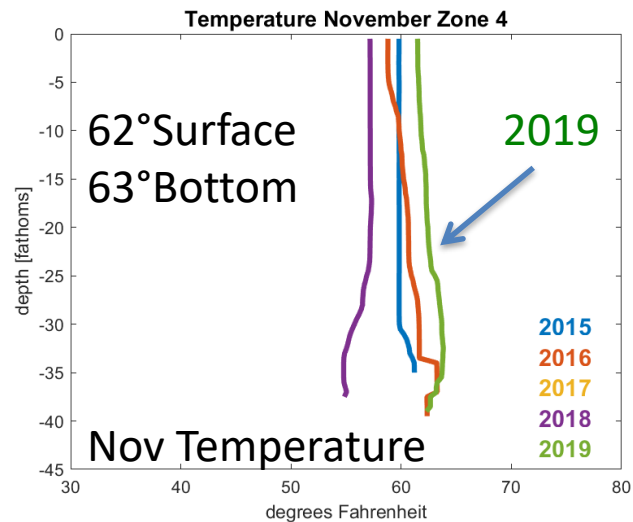
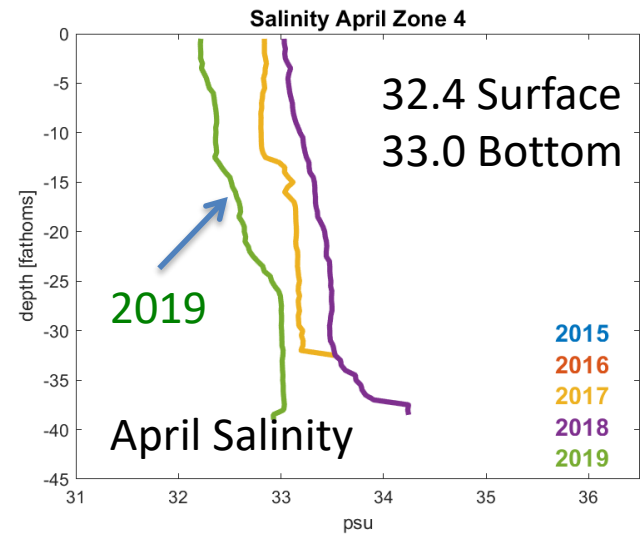
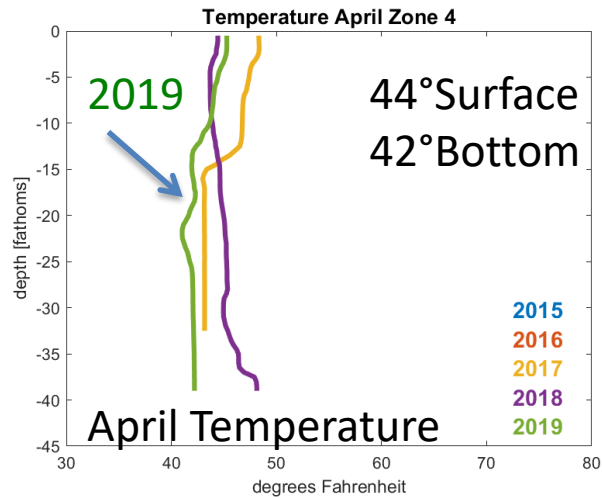
Courtesy
Kim Hyde
NEFSC

Profiles 2015-2019 April November

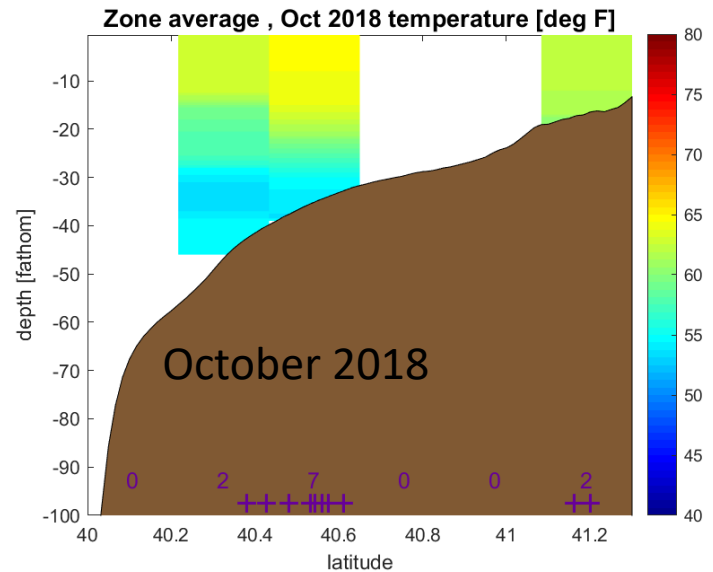
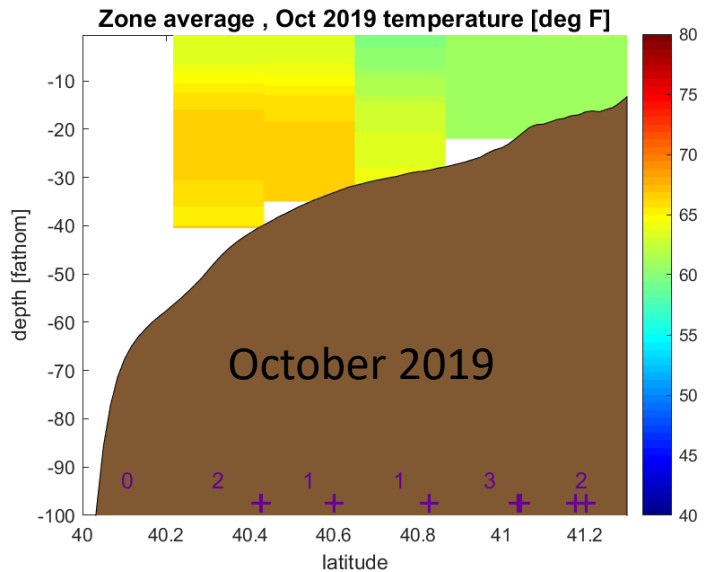
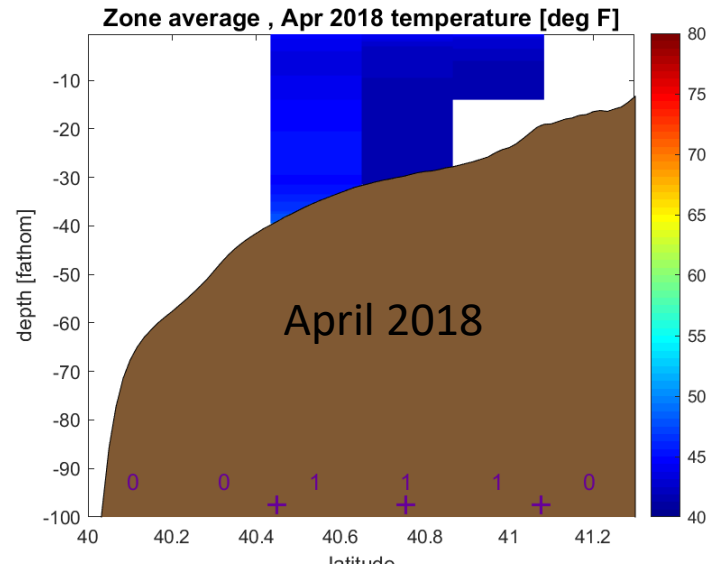
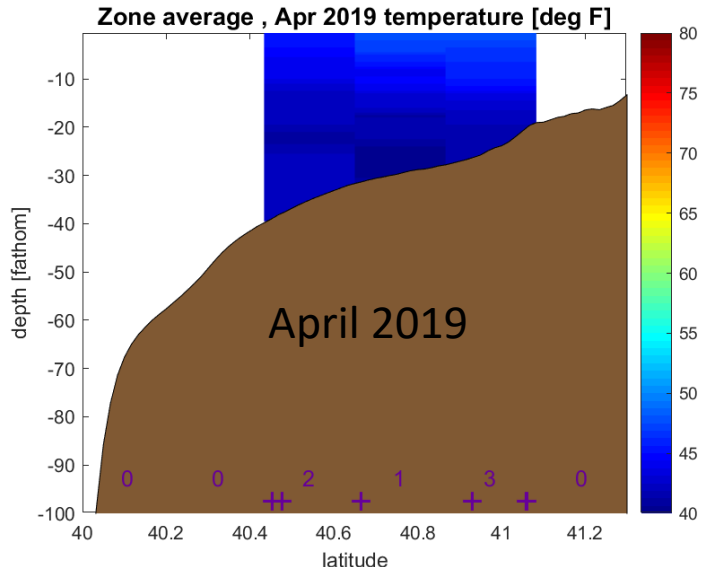
Zone 2



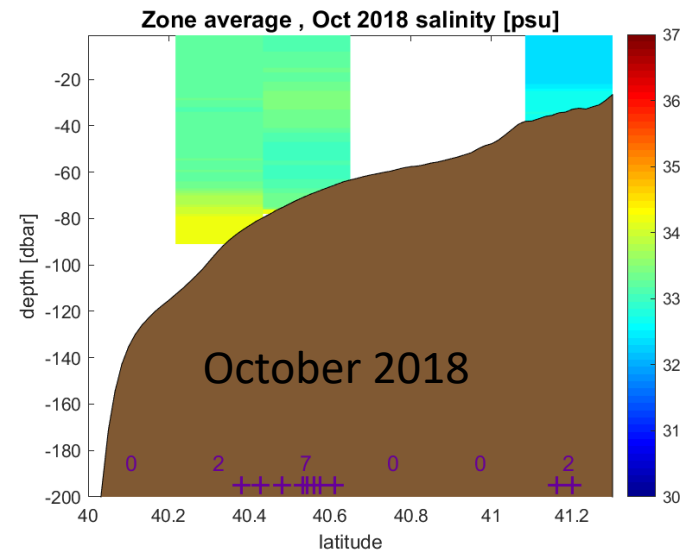
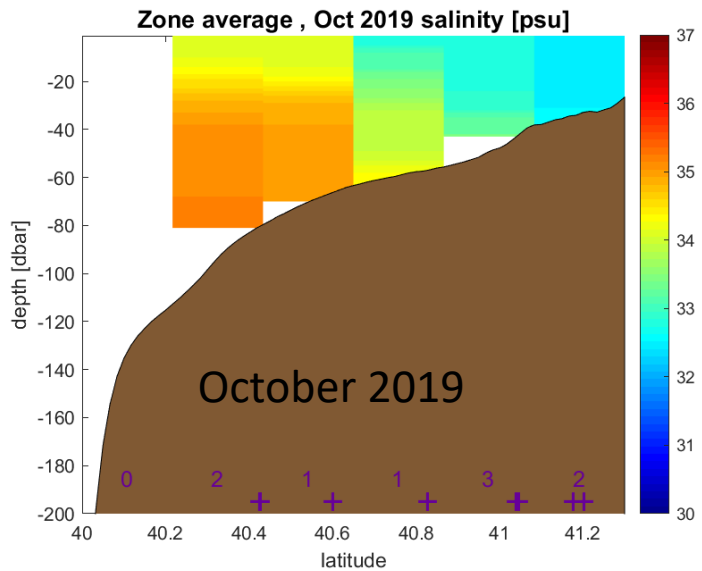
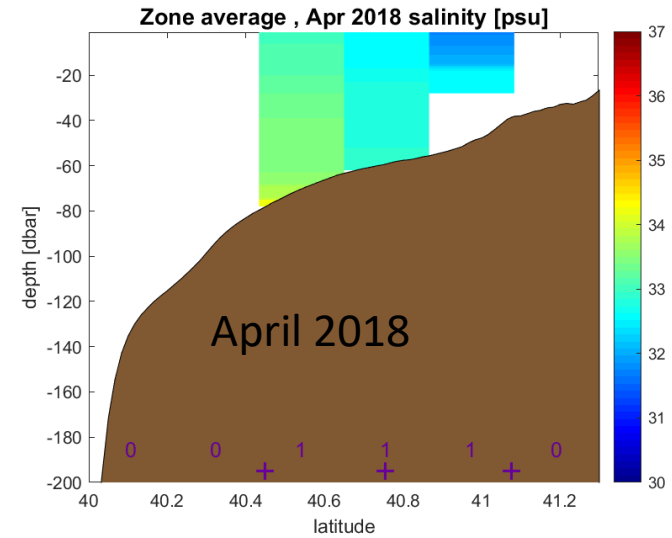
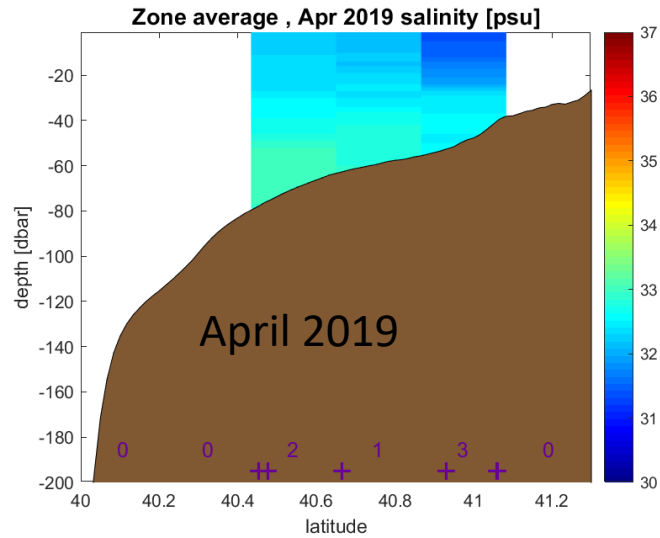
Profiles 2015-2019 April November Zone 4



Cross-Shelf Temperature 2019-2018



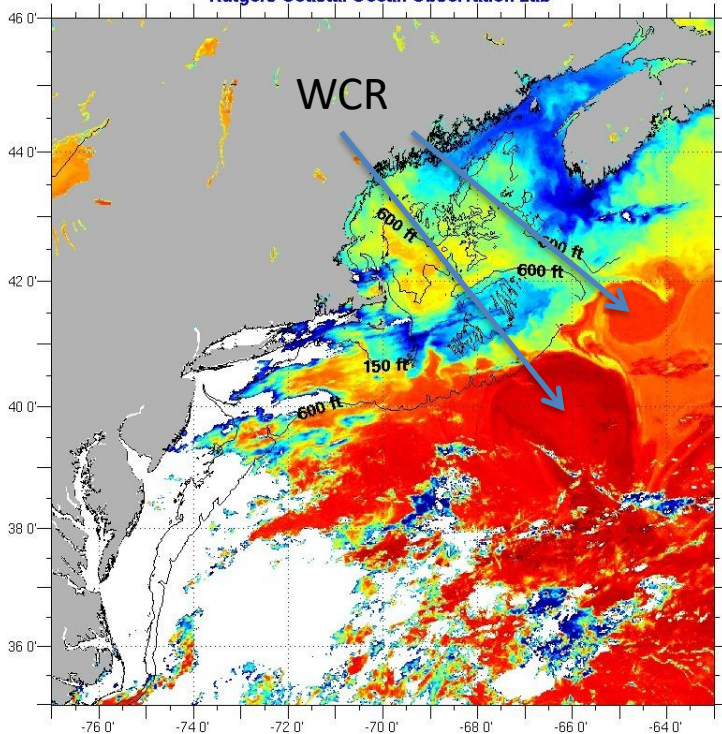
Cross-Shelf Salinity 2019-2018



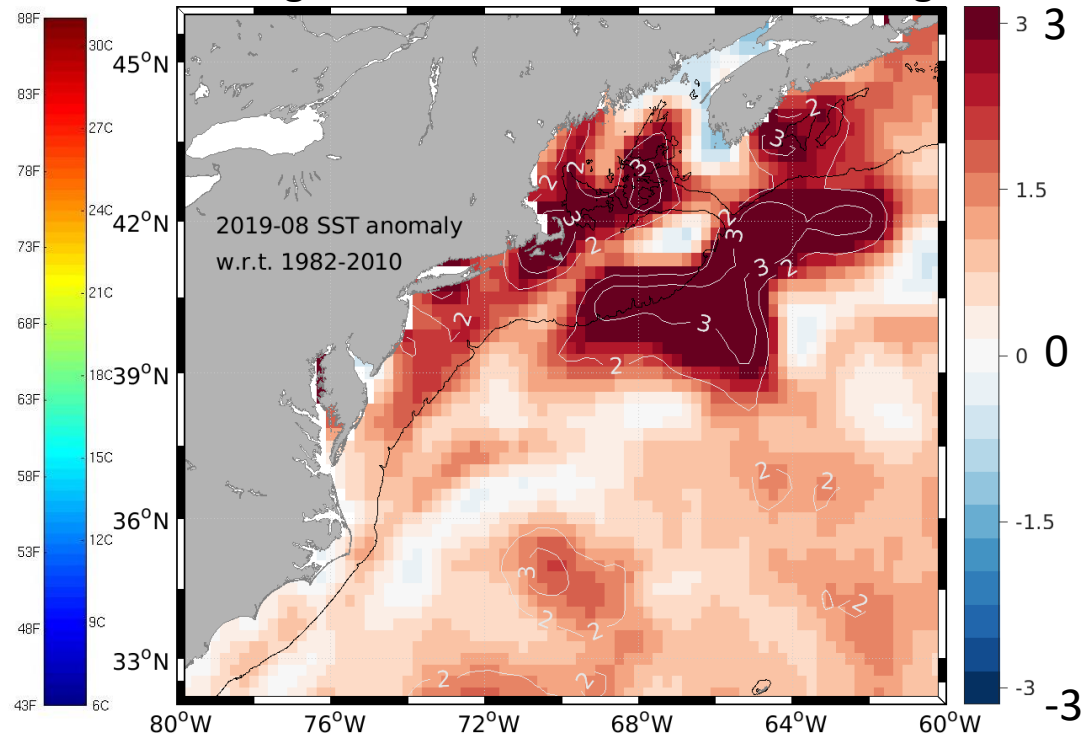
What caused the warming in Summer and Fall?

Sea Surface Temperature
August 6, 2019

NOAA-18 Sea Surface Temperature: August 06, 2019 0039 GMT
Rutgers Coastal Ocean Observation Lab



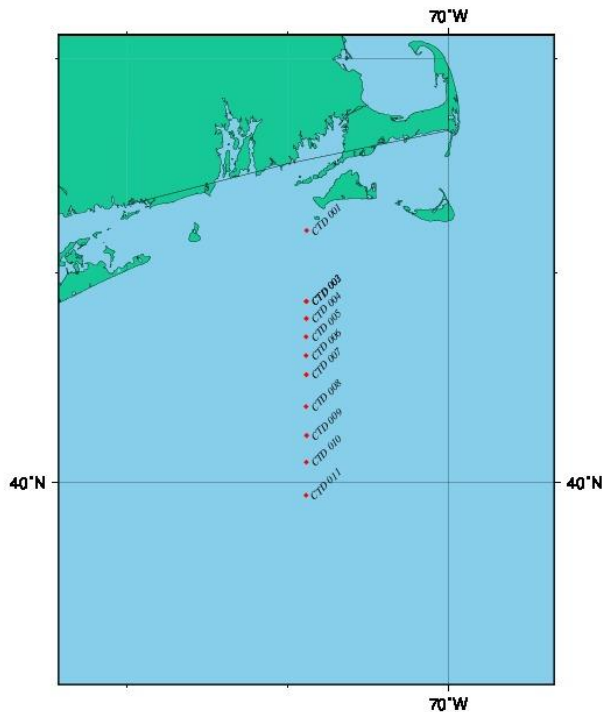
Temperature Anomaly First Week of
August relative to 1982-2010 average



Maximum Anomaly- 3°C (5.4°F)
Very warm south of Georges Bank and
In Massachusetts Bay (from Ke Chen)

R/V Armstrong Student Run Cruise September 20-22, 2019

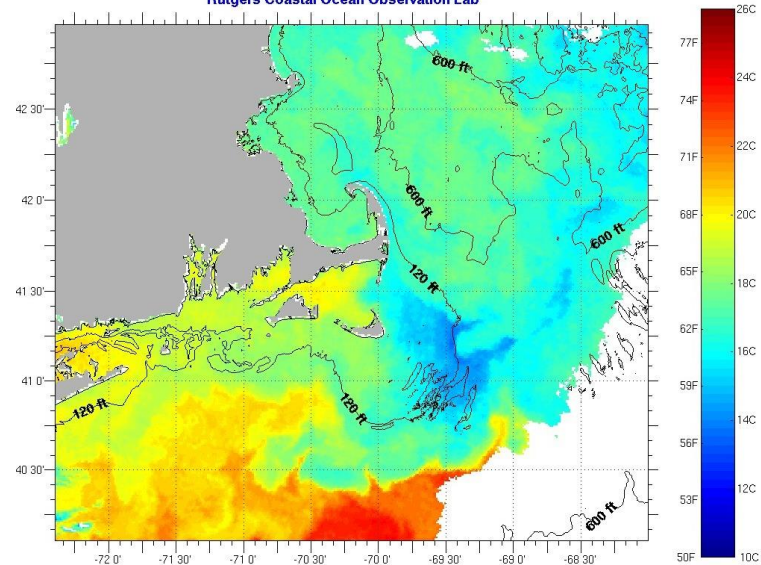
SST
Sept. 21



CSM 2019 Sep 21 13:04:41

11 CTD Profiles out to
500 fathoms

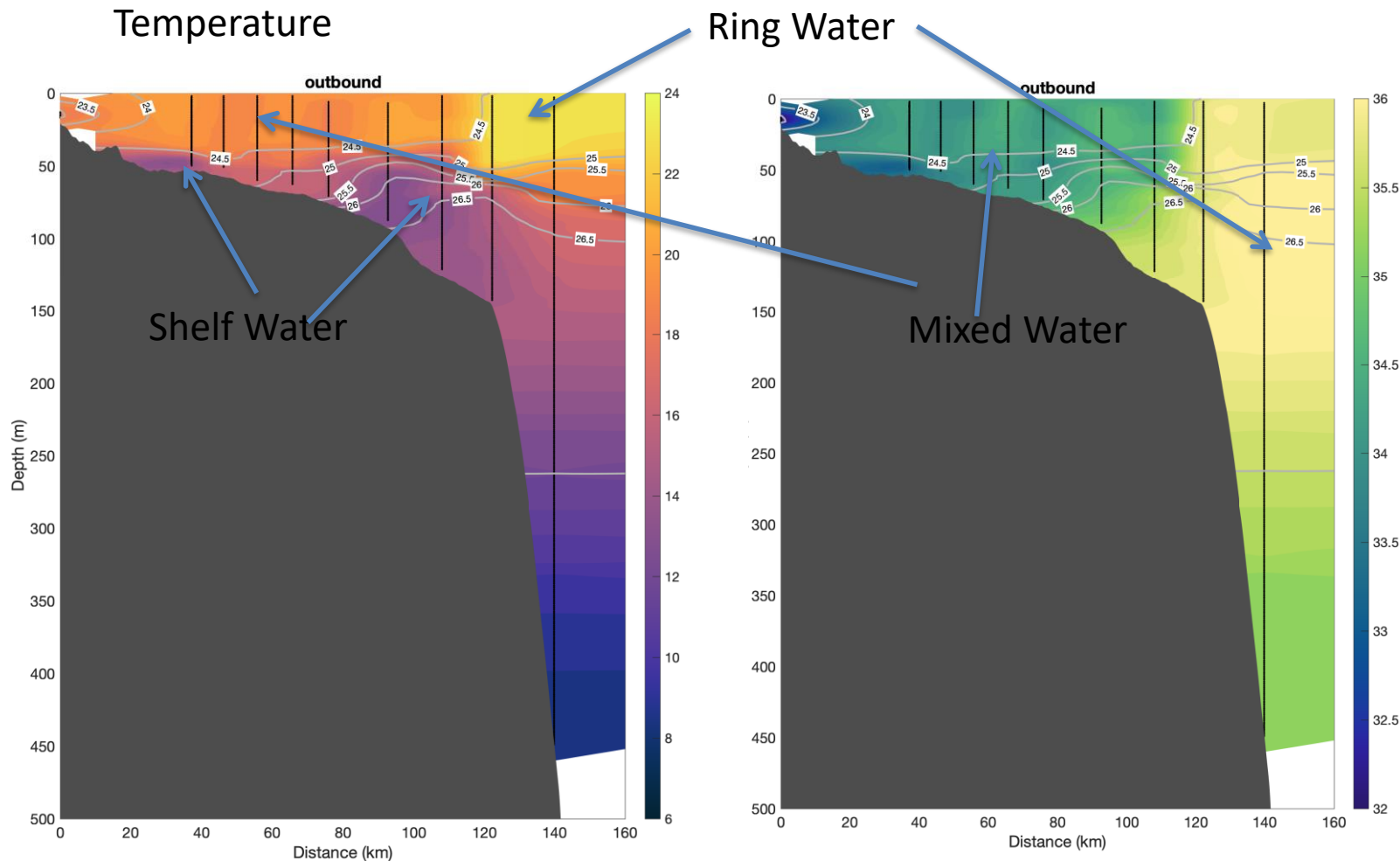
NOAA-15 Sea Surface Temperature: September 21, 2019 1233 GMT
Rutgers Coastal Ocean Observation Lab



R/V Neil
Armstrong

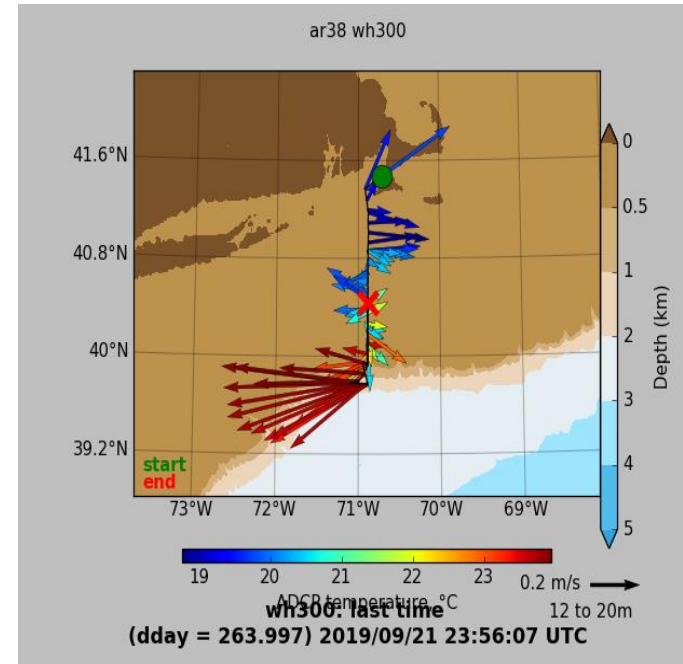
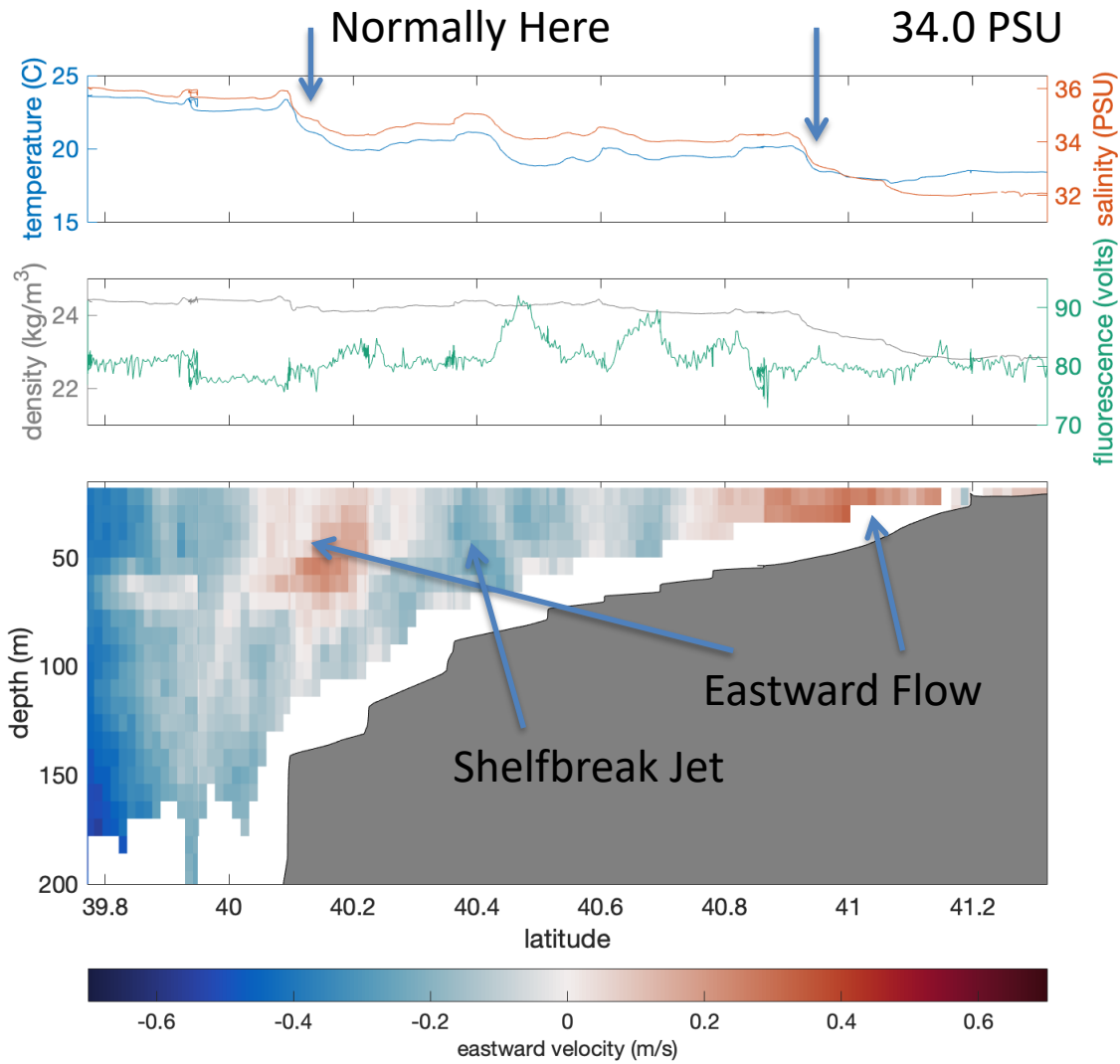


Cross-Shelf Transects of Temperature and Salinity September 20-21

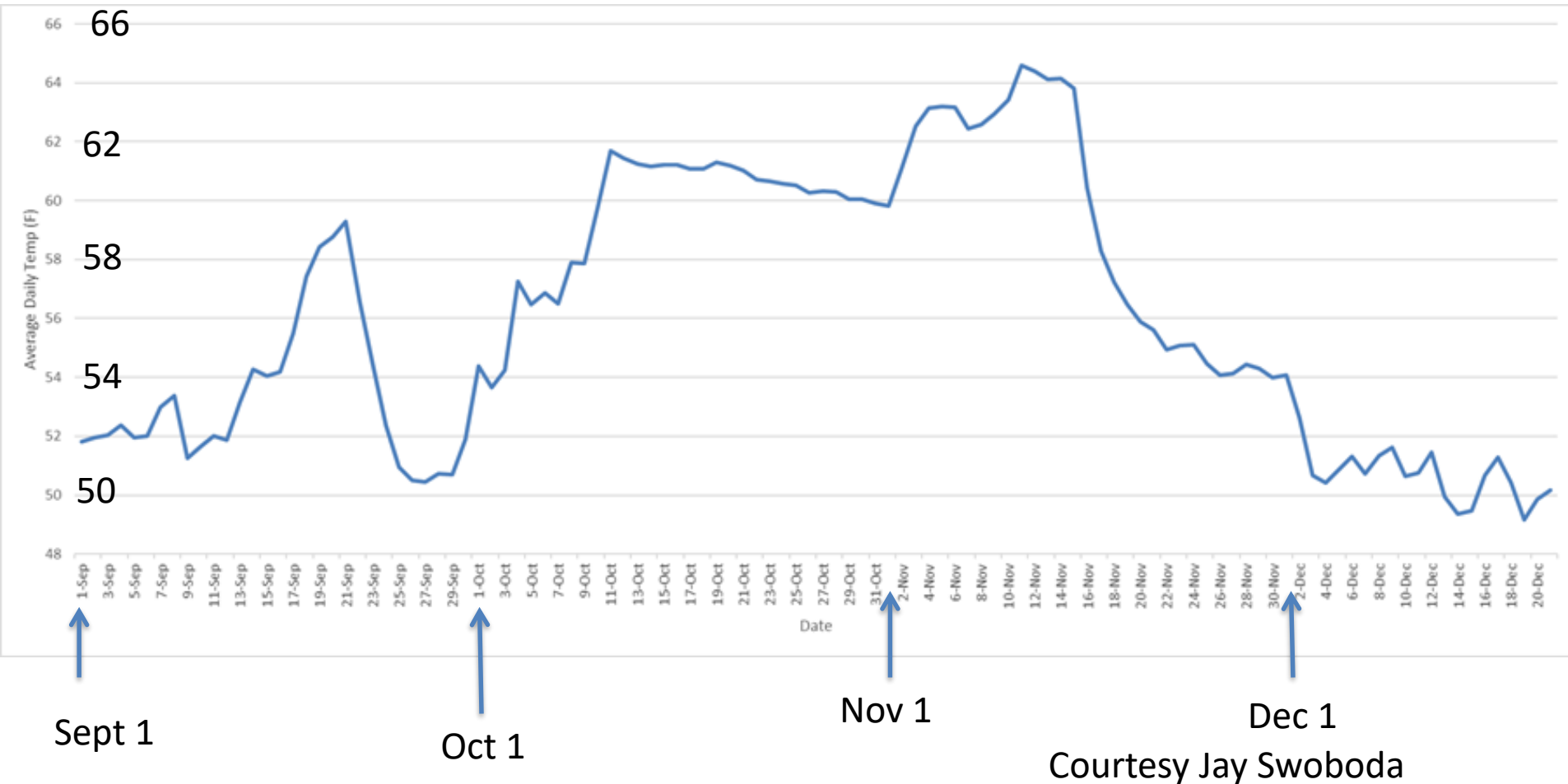


Hurricane Dorian pushed thick layer of salty (>34 PSU) and Warm (>68°F) Water to the 15 fathom isobath
Only remnants of Shelf Water in thin patches near bottom

Velocity and Surface Flowthrough

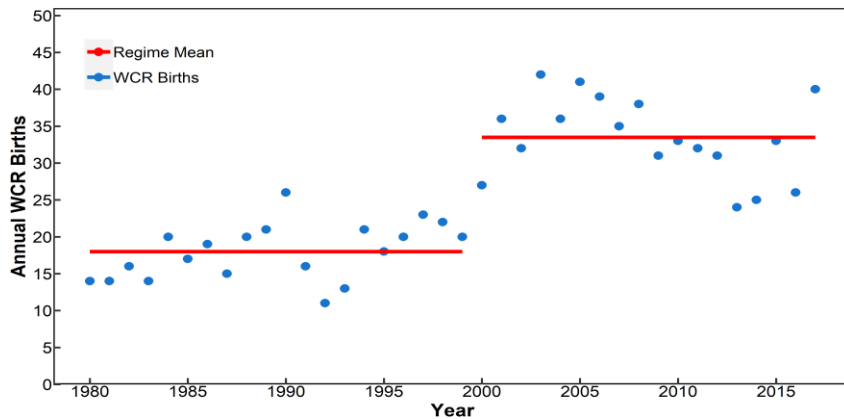


Inshore Bottom Temperature



Courtesy Jay Swoboda

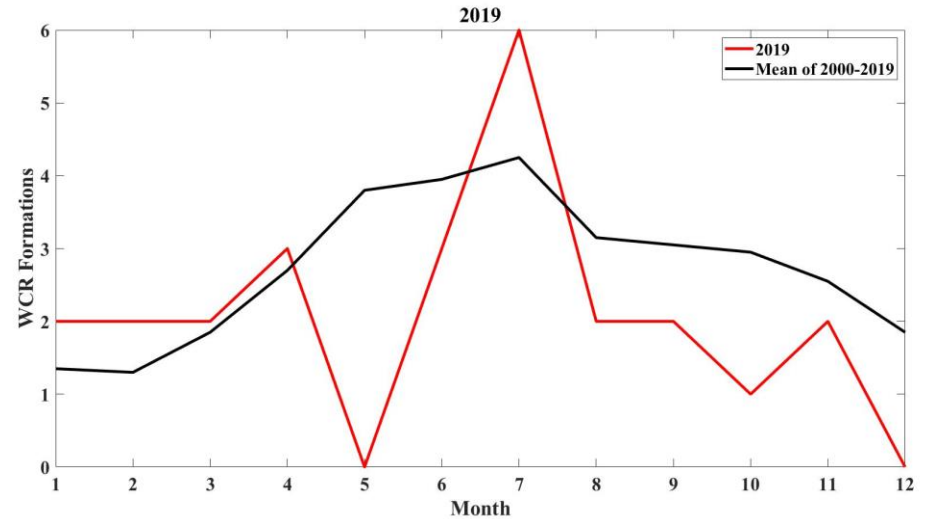
Long-Term Trend- Warm Core Rings



Regime Shift in 2000

18 per year 1980-1999

33 per year 2000-2017

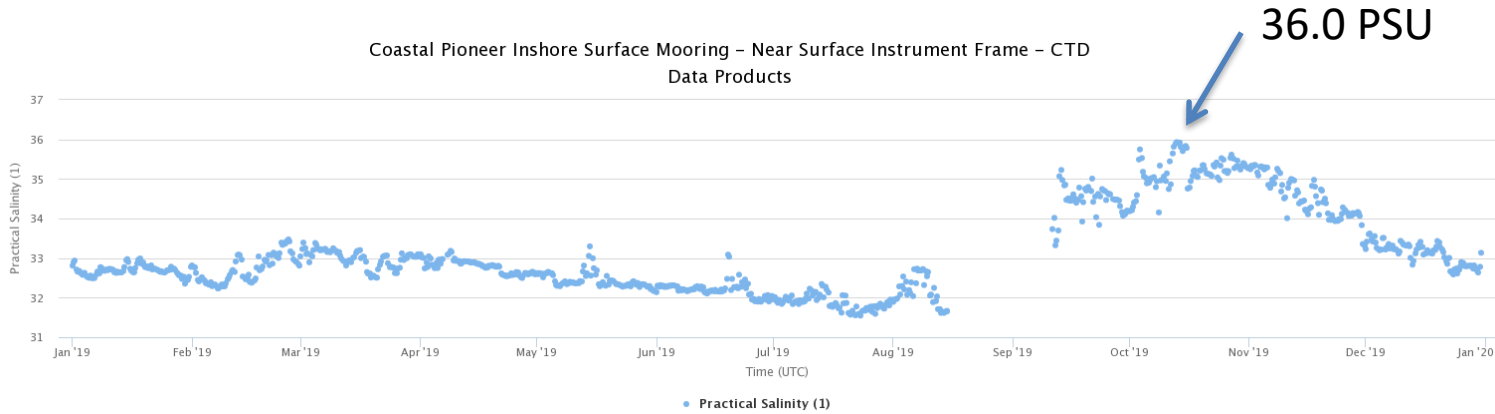
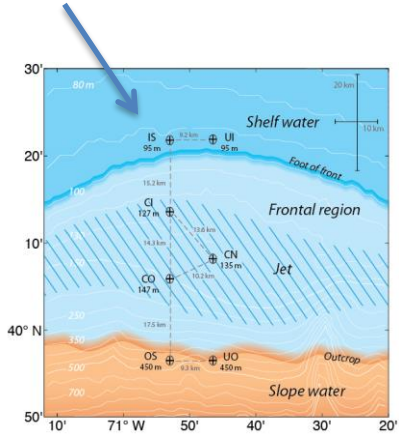


Ring Formation by month in 2019

Big spike in July

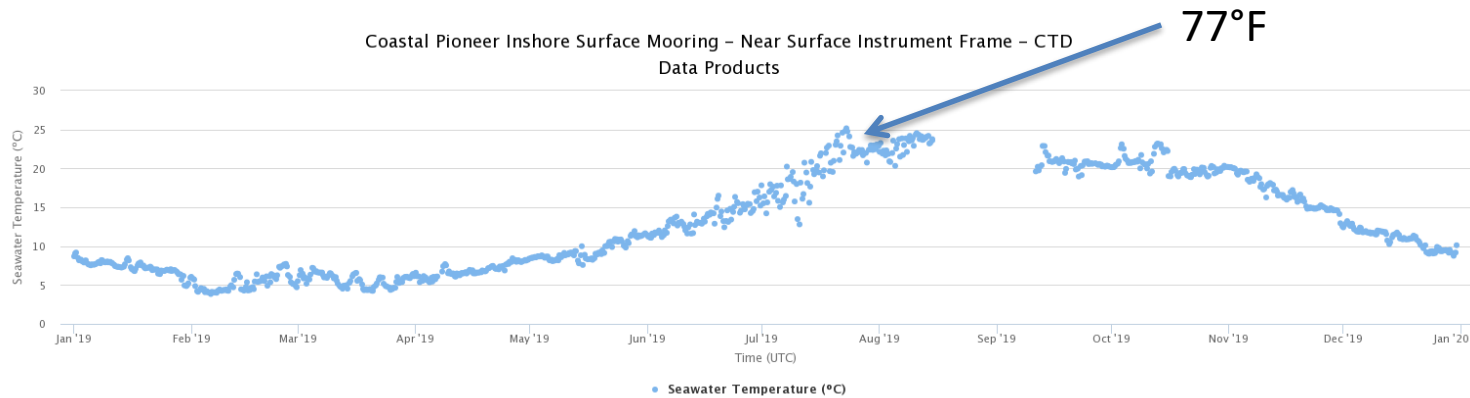
Courtesy A. Gangopadhyay and A. Silver

Pioneer Array Inshore Mooring



Very salty in October
4 PSU change from
August to October

Very warm in
August consistent
with NDBC
Nantucket Shoals
buoy

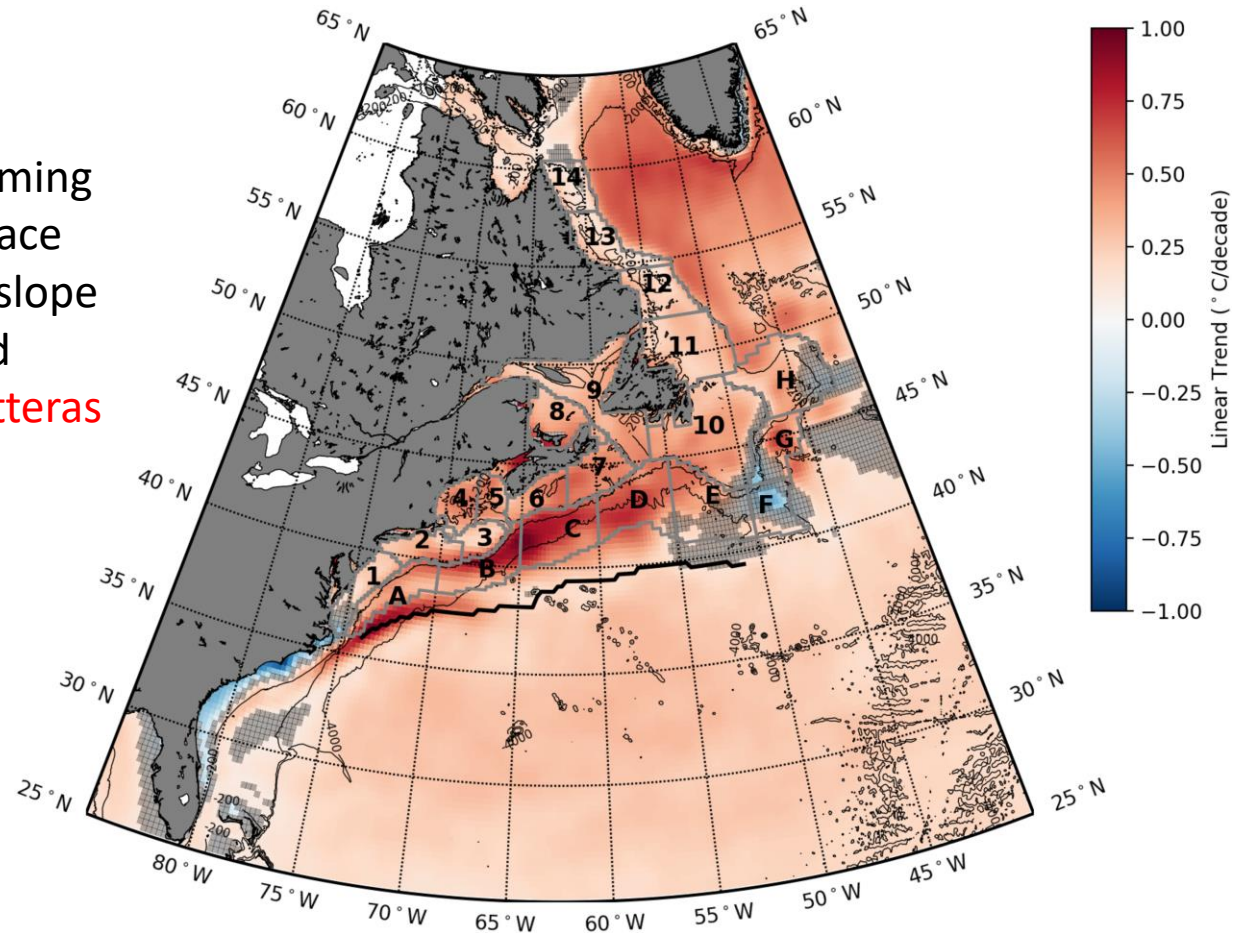


77°F

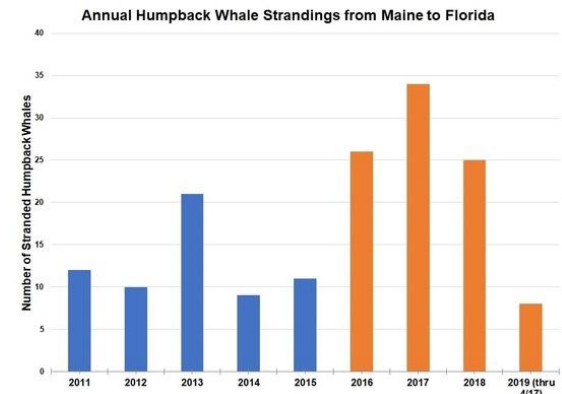
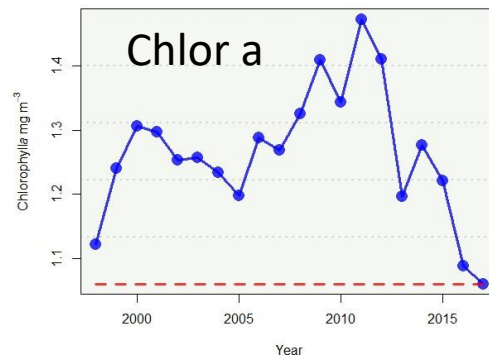
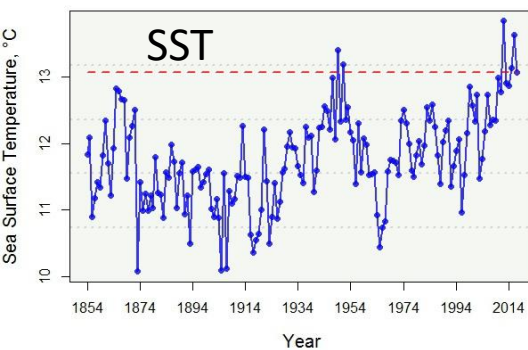
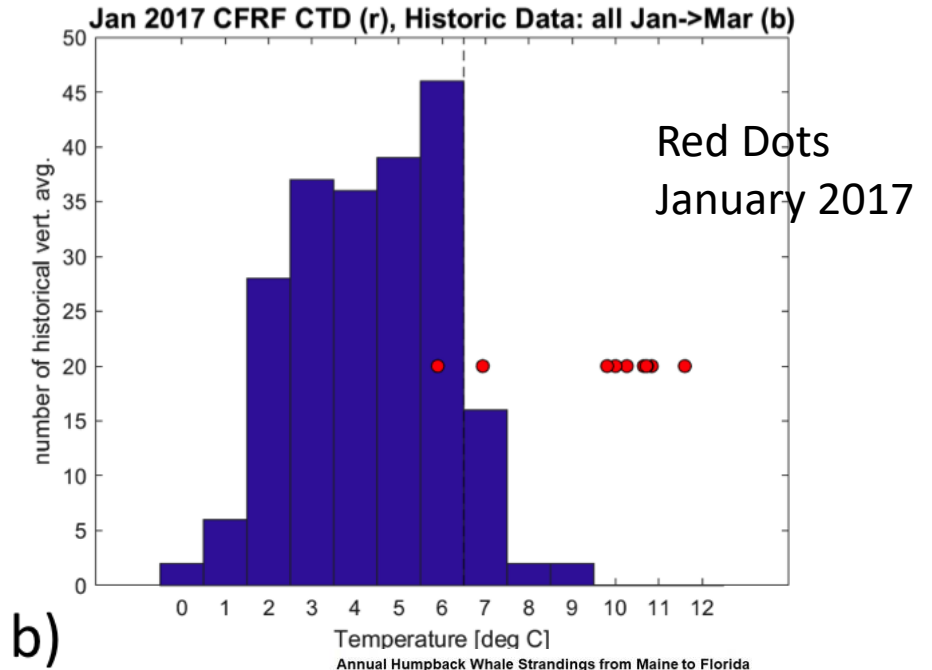
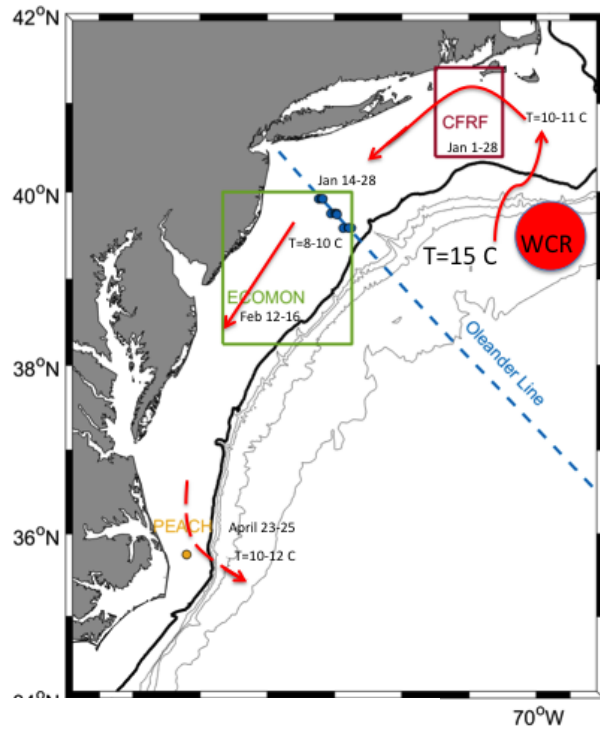
Spatial Pattern of Surface Warming 1982-2018

Two regions of fastest warming rate from satellite sea surface temperature: Continental slope south of Georges Bank and Gulf Stream near Cape Hatteras

From Chen et al. 2020

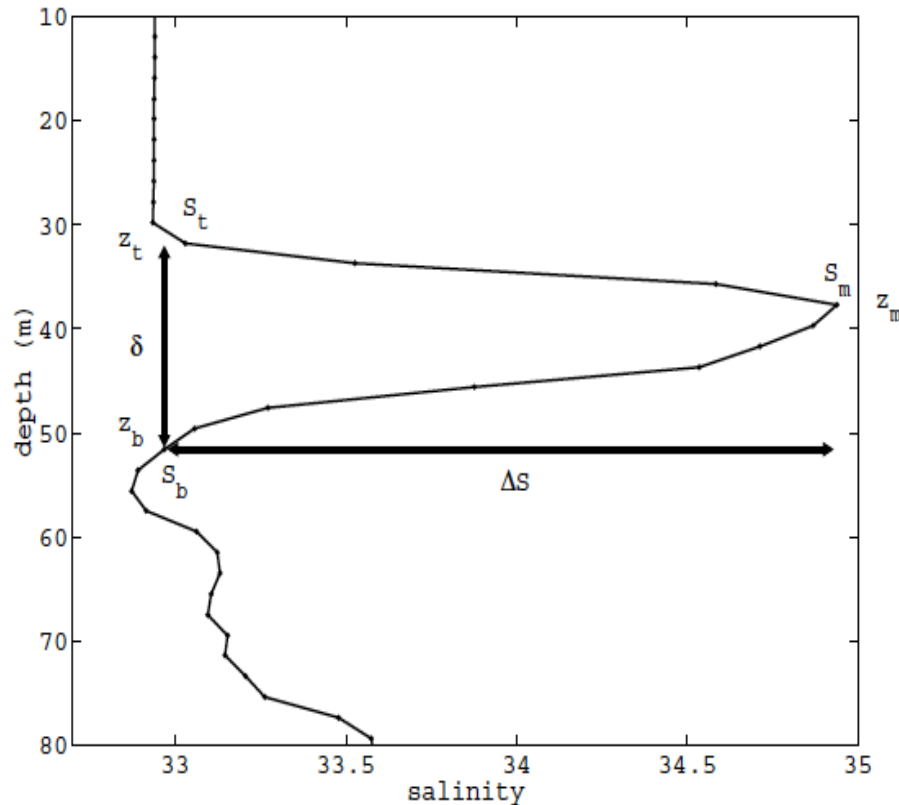


Marine Heatwave of 2017



Humpback Whale Mortality

NSF Salinity Intrusion Experiment

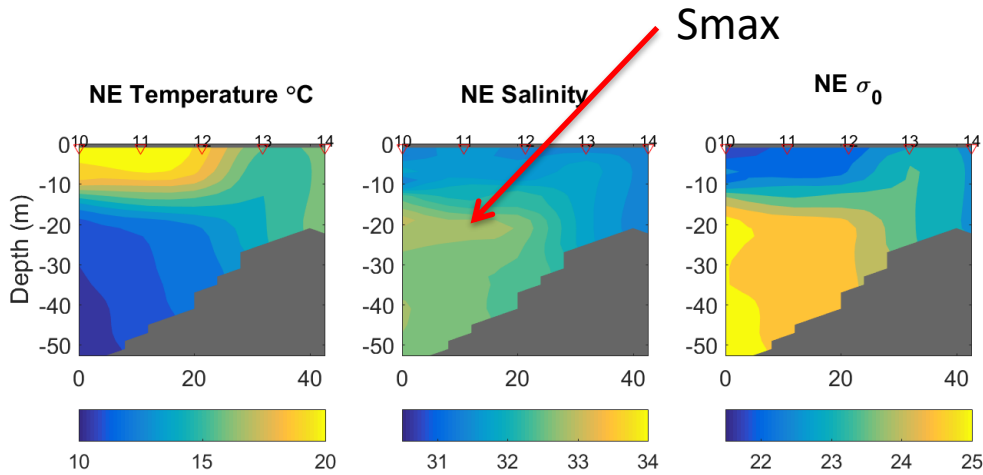


Science Question- What are the Typical alongshelf scales for mid-depth salinity maximum Intrusions?

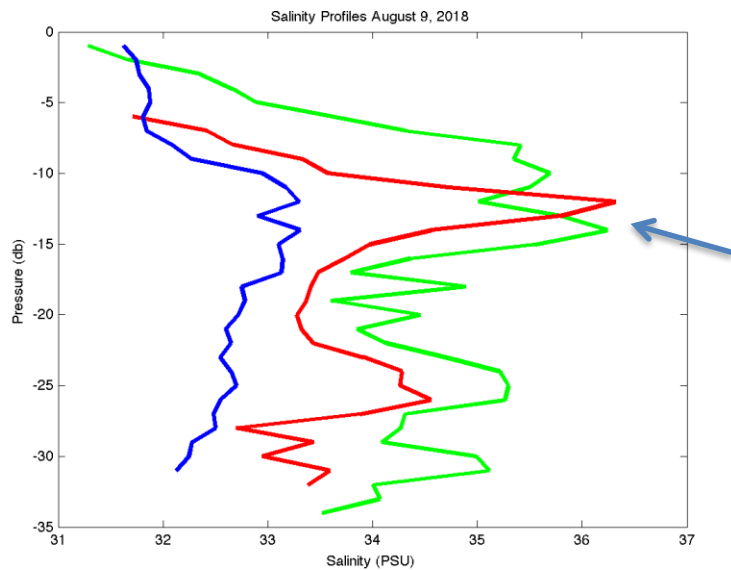
Have they been changing in terms of thickness, vertical position, maximum salinity?

Key Parameters- ΔS , S_m (max salinity), thickness, depth of intrusion (from Lentz, 2003)

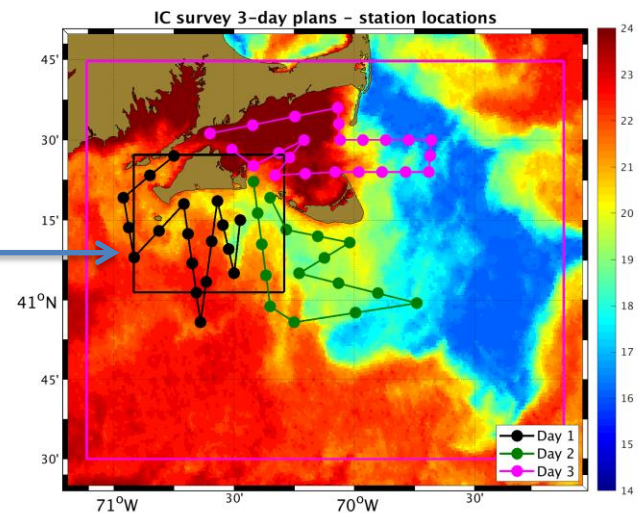
Recent Observations (2017 and 2018)



Section South of Nantucket August 2017



August 9
2018
36 PSU
Near
Martha's
Vineyard!



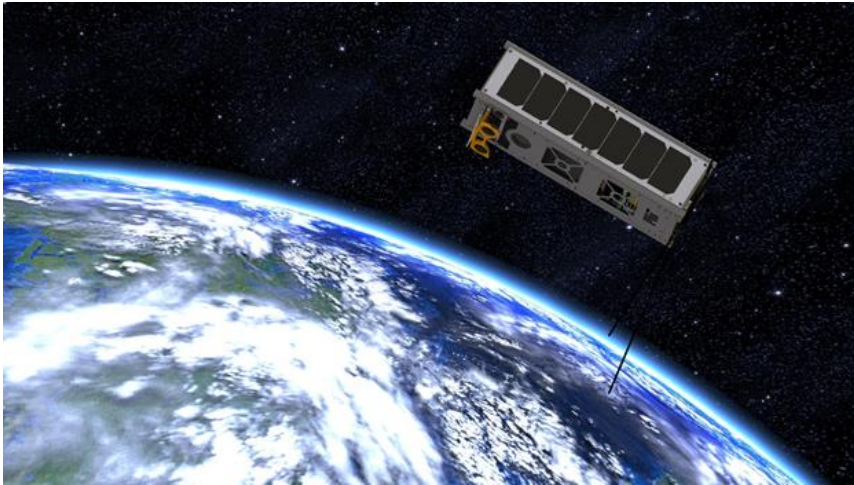
We need help!

- Communications with R/V Armstrong to initially find Smax intrusion (hear about Shelf Fleet profiles leading up to experiment)
- Cruise will be on R/V Endeavor May 27-June 4
- We will be operating multiple Autonomous Underwater Vehicles- will notify fishing community several weeks before the cruise
- We will be making turbulence measurements for mixing and also acoustic backscatter
- CFRF will be preparing brochures about the experiment and the findings for wide distribution

Upcoming Proposals

- Spring- NSF Coastlines and People- Combine Shelf and Lobster/Jonah Crab collection and data analysis, include social science for effects of ocean warming on coastal communities
- NSF Gulf Stream Ring Formation- Data analysis and theory to determine how and why Warm and Cold Core Rings form (Avijit lead)
- NSF Storms and their impact at the Pioneer Array (GG lead, Al Plueddemann, Grad Student)

The View from Space- October 2020?



BeaverCube- MIT/WHOI CubeSat will have SST and Ocean Color over our study area

Summary

- In 2019 first half of the year was generally cool and fresh, second half was very warm and salty due to Warm Core Rings
- Temperatures south of Nantucket Shoals were even warmer than 2012 in August
- Very salty at the Pioneer Array in October, Gulf Stream level salinity
- NSF Salinity Intrusion project in late May/early June