CFRF Shelf Fleet: Preliminary Results for 2015

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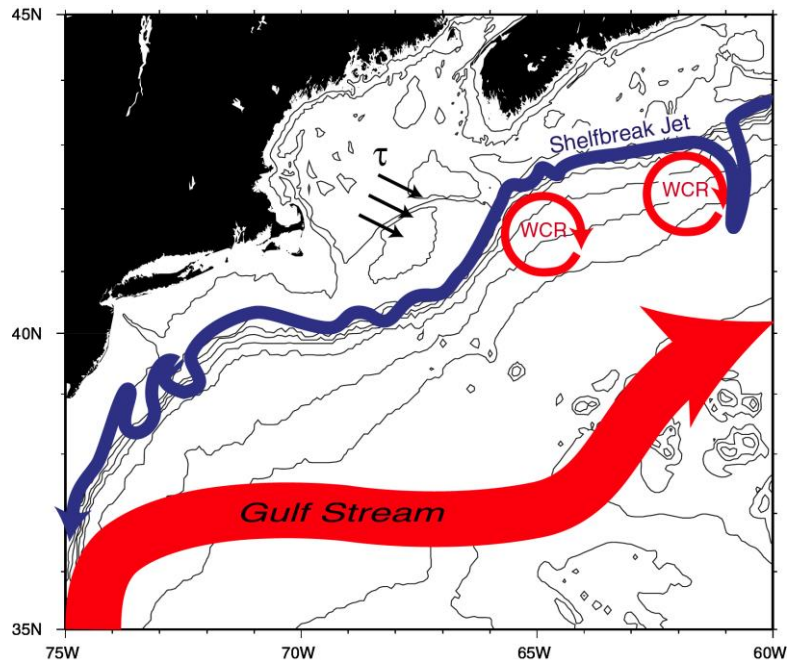
February 4, 2016

Outline

- Review Statistics of Profiles
- Overview of Seasonal Progression from Profiles
- Anomalies: NDBC Nantucket Shoals versus 2000-2010 average
- Explaining the anomalies- Warm Core Rings from the Gulf Stream
- Where do we stand compared to 2012?
- On seasonal predictability of temperature over the continental shelf

Background- Regional Circulation

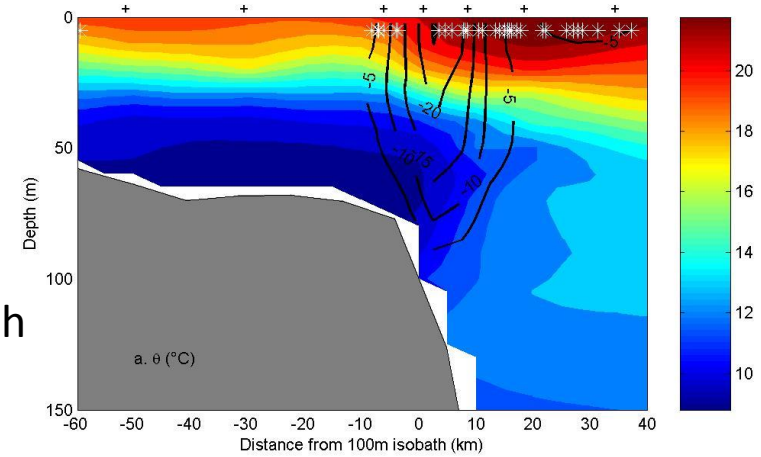


The Shelfbreak Jet and the Gulf Stream

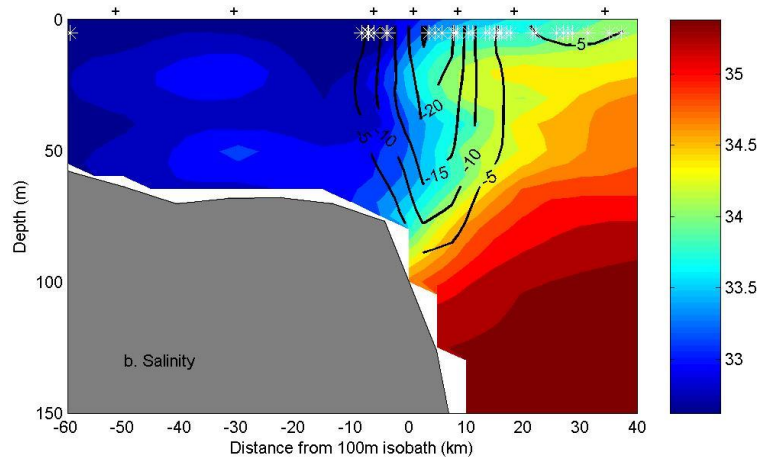
Figure courtesy
P. Fratantoni

Temperature

Depth

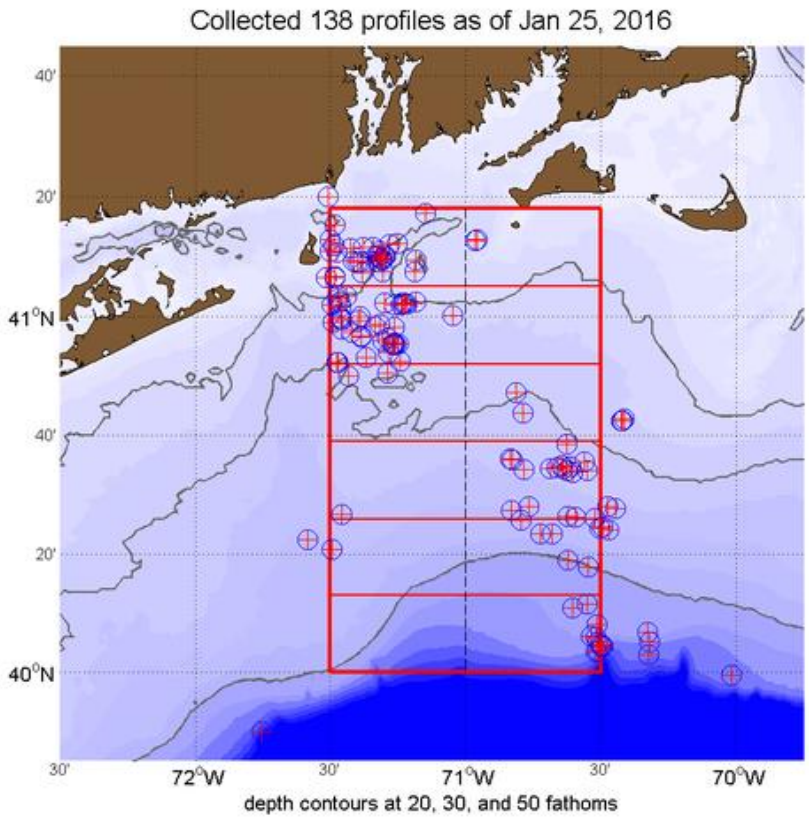


Salinity



Offshore Distance

Overall Statistics

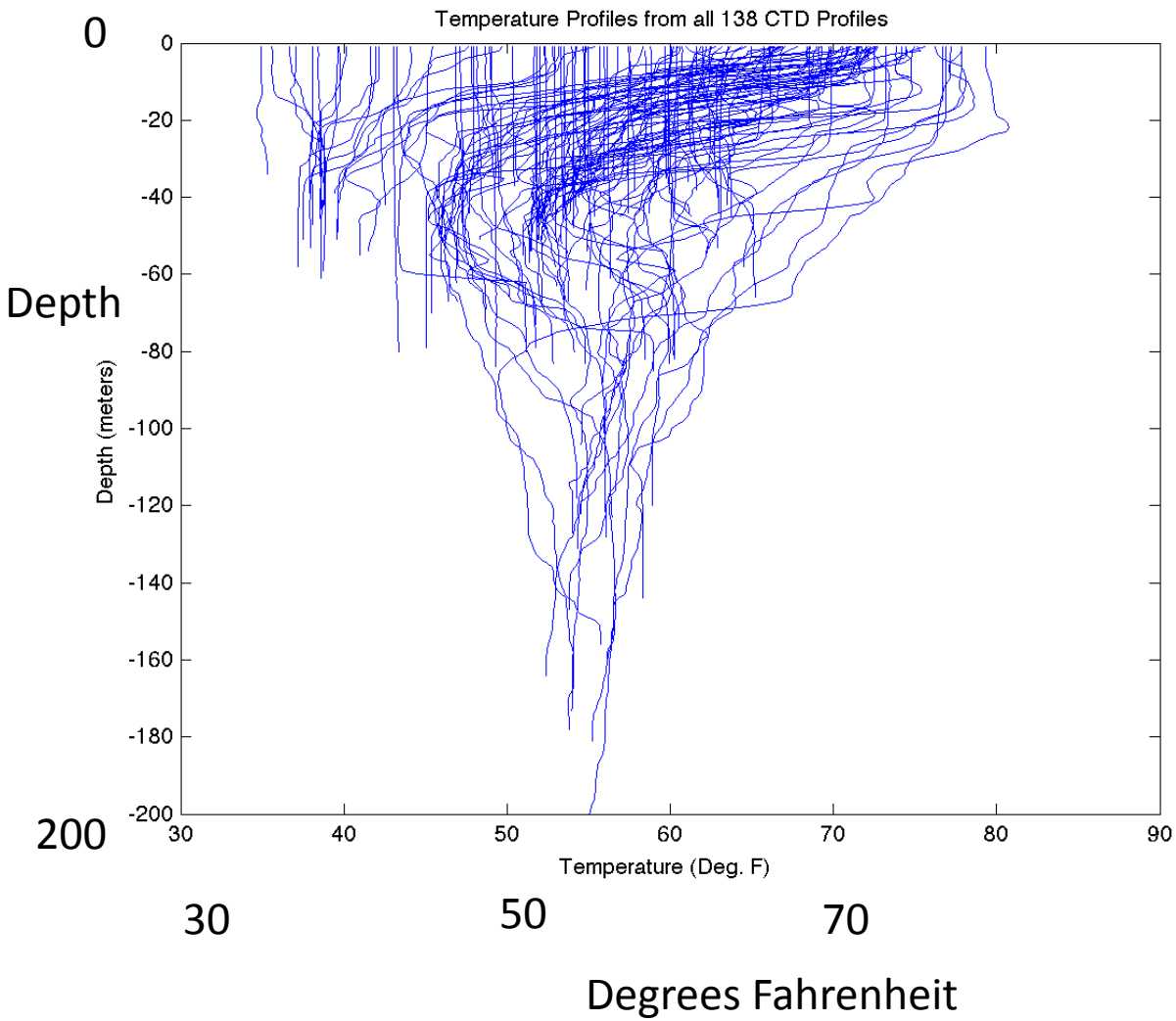


Total of 138 profiles from November 2014-January 2015

Breakdown by box-

1- 35
2- 44
3- 4
4- 19
5- 8
6- 11
Outside- 17

All Temperature Profiles

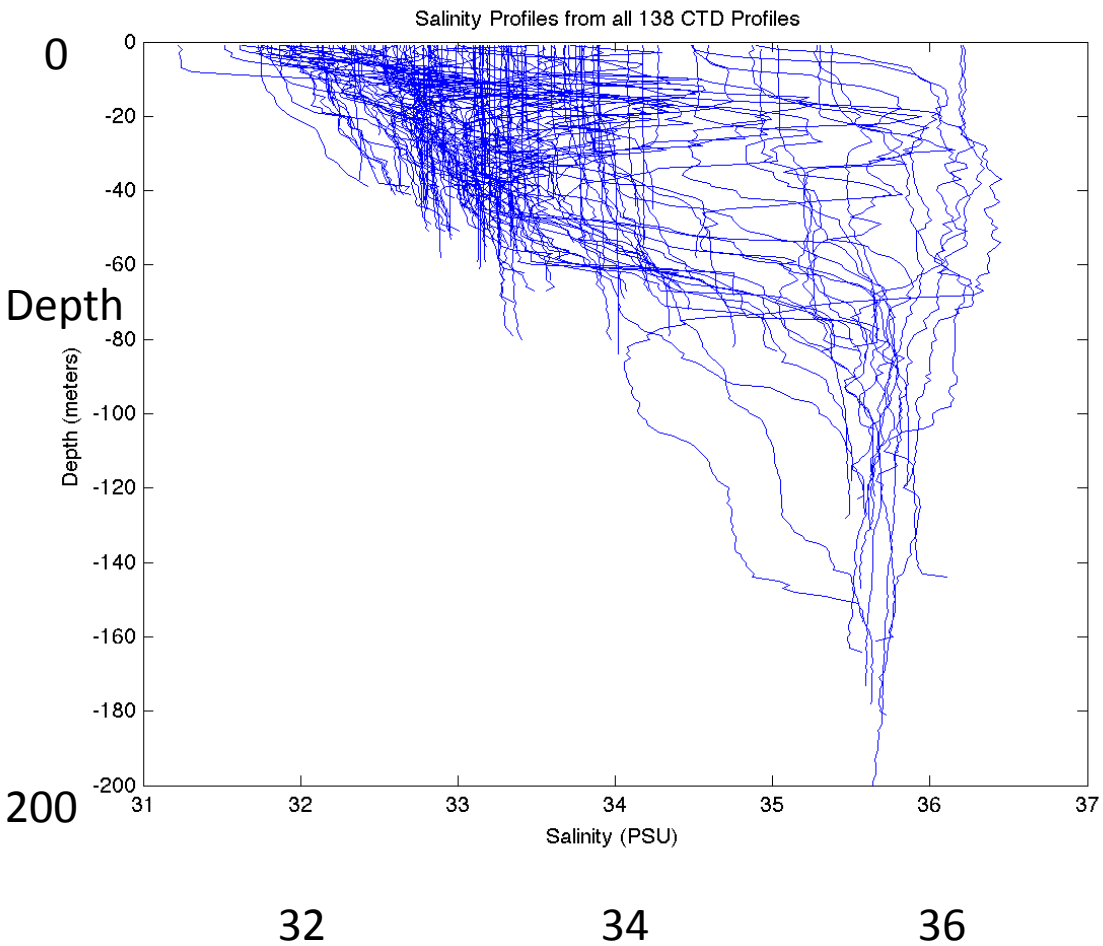


Maximum Temperature
~ 80 Deg. F

Minimum Temperature
~35 Deg. F

Can see structure of the Thermocline in the summer (big change with depth from 20-40 m)

All Salinity Profiles

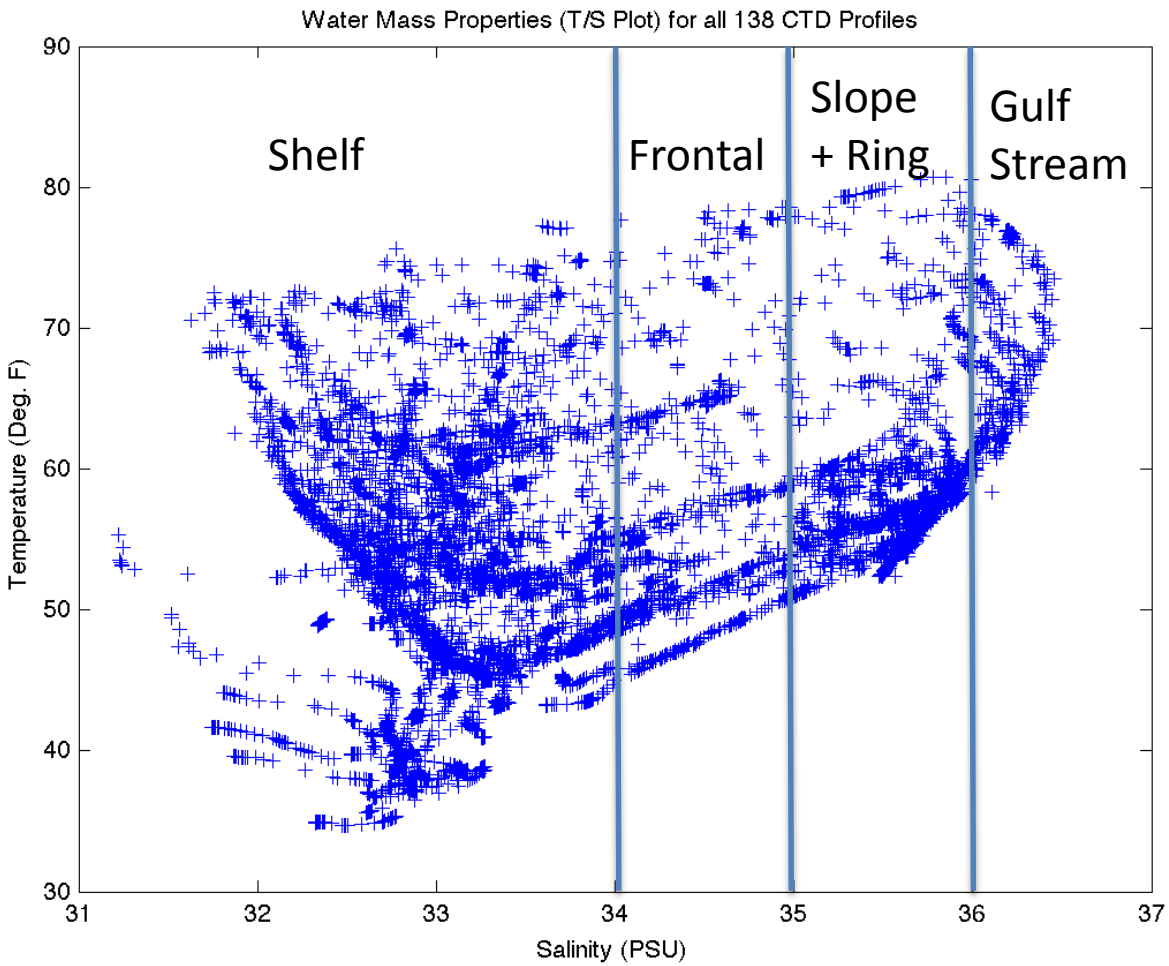


Maximum Salinity
~ 36.3 PSU

Minimum Salinity
~31.3 PSU

Salinity generally
Increases with depth

Water Mass Properties (T/S Plots)



Shelf Water
< 34 PSU

Frontal Water
34-35 PSU

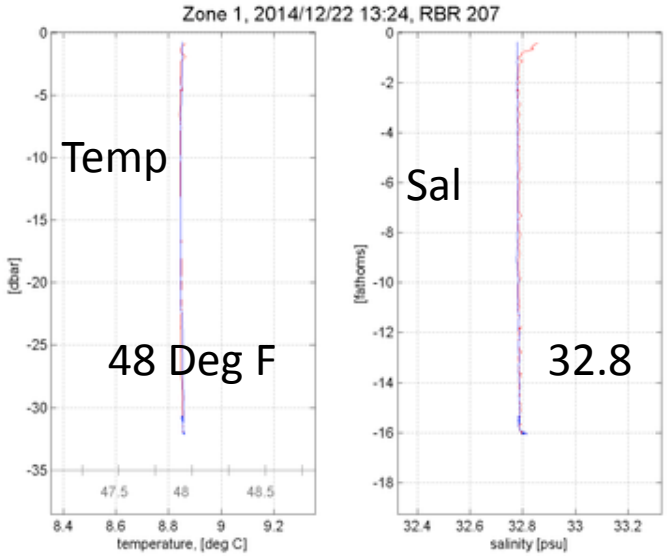
Slope Water
35-35.2 PSU

Ring Water
35.2-36 PSU

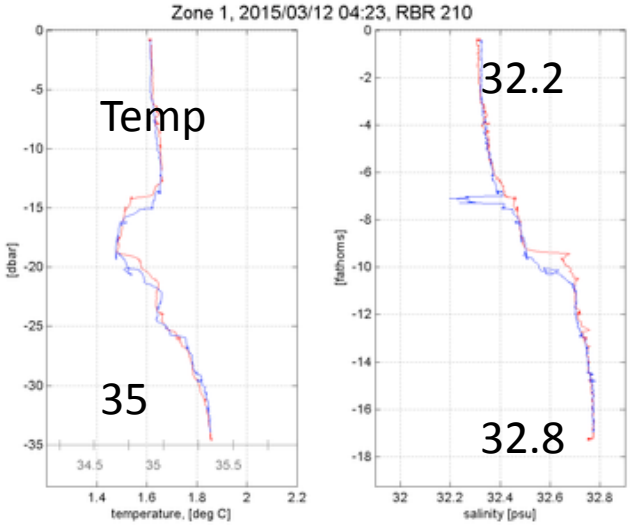
Gulf Stream Water
36 PSU or greater

Highlights Box 1 (Northernmost)

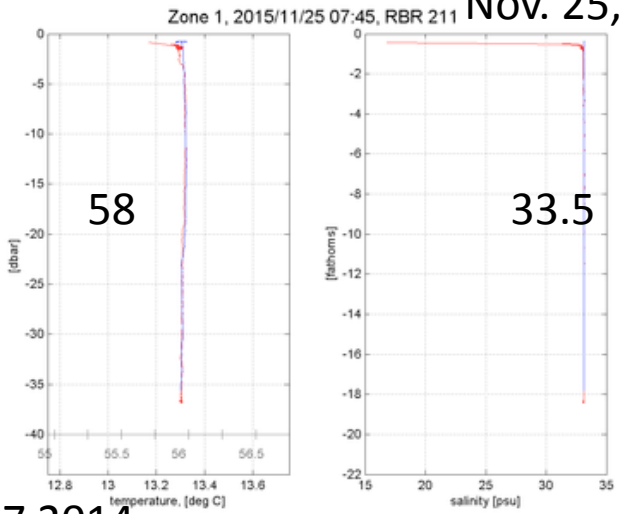
Dec. 22, 2014



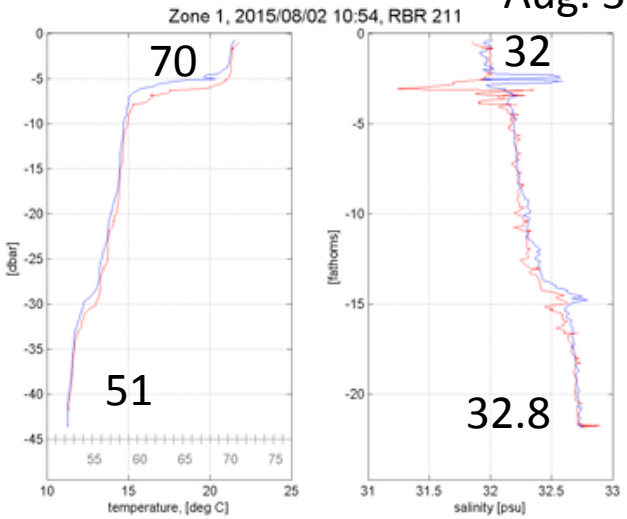
March 12, 2015



Nov. 25, 2015



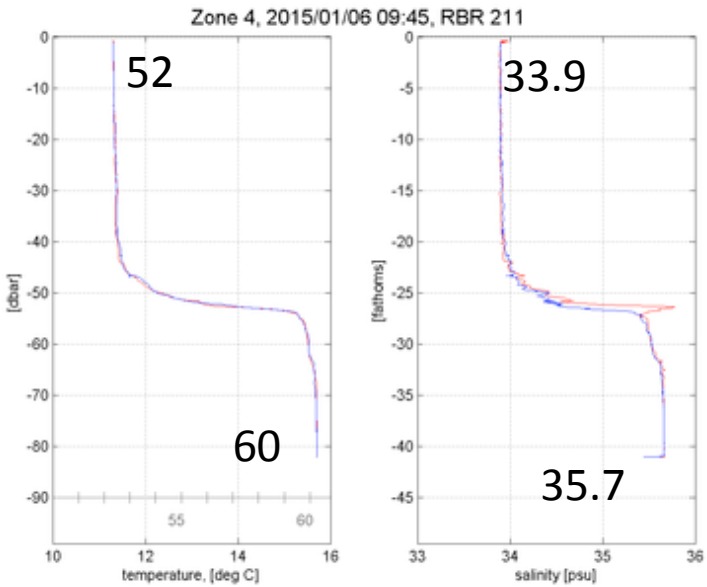
Aug. 3, 2015



51.7 2014

Highlights Box 4

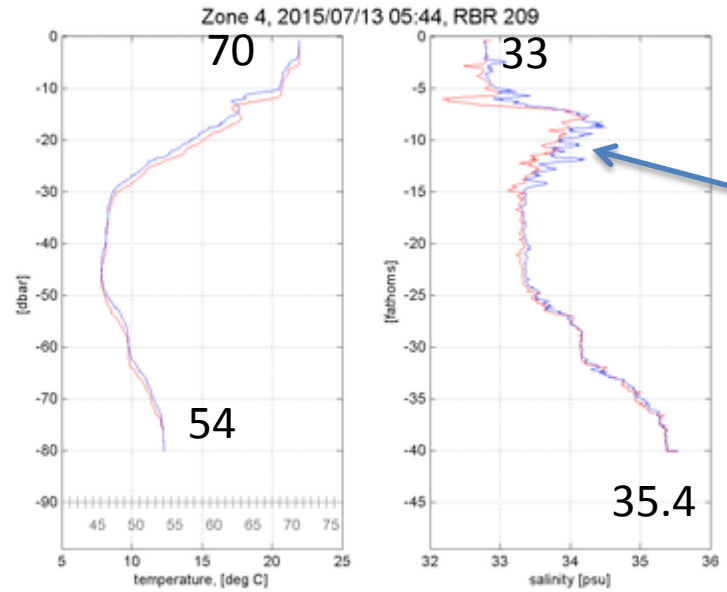
Jan. 6, 2015



Temp.

Salinity

July 13, 2015

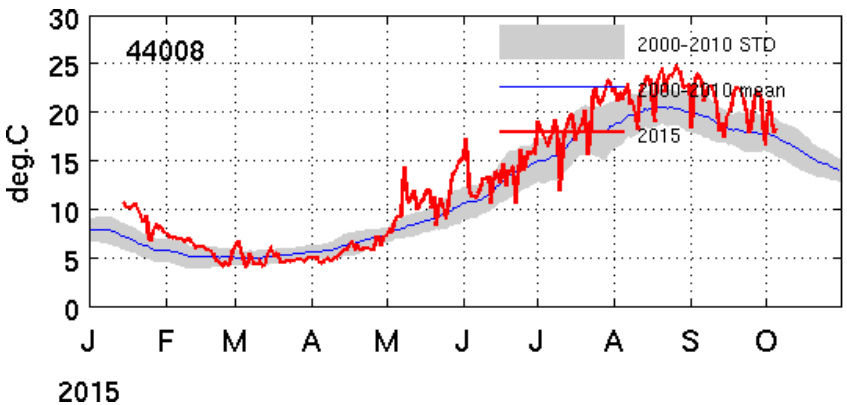


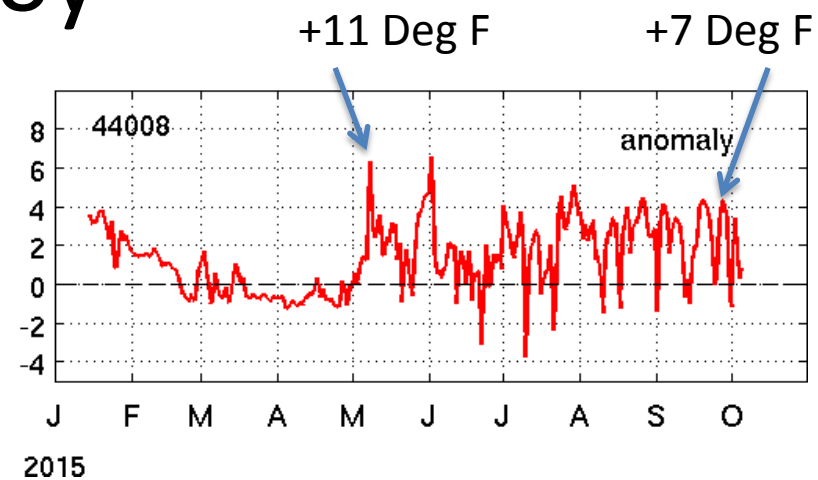
Salty Intrusion

Two layer system in winter- shelf water overlying ring water

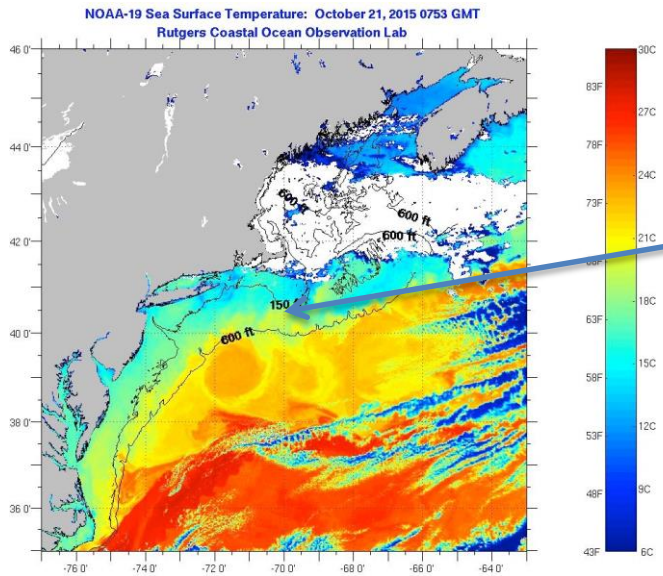
Summer profile shows high salinity intrusion between 5-10 fathoms

Time Series at Nantucket Shoals NDBC Buoy

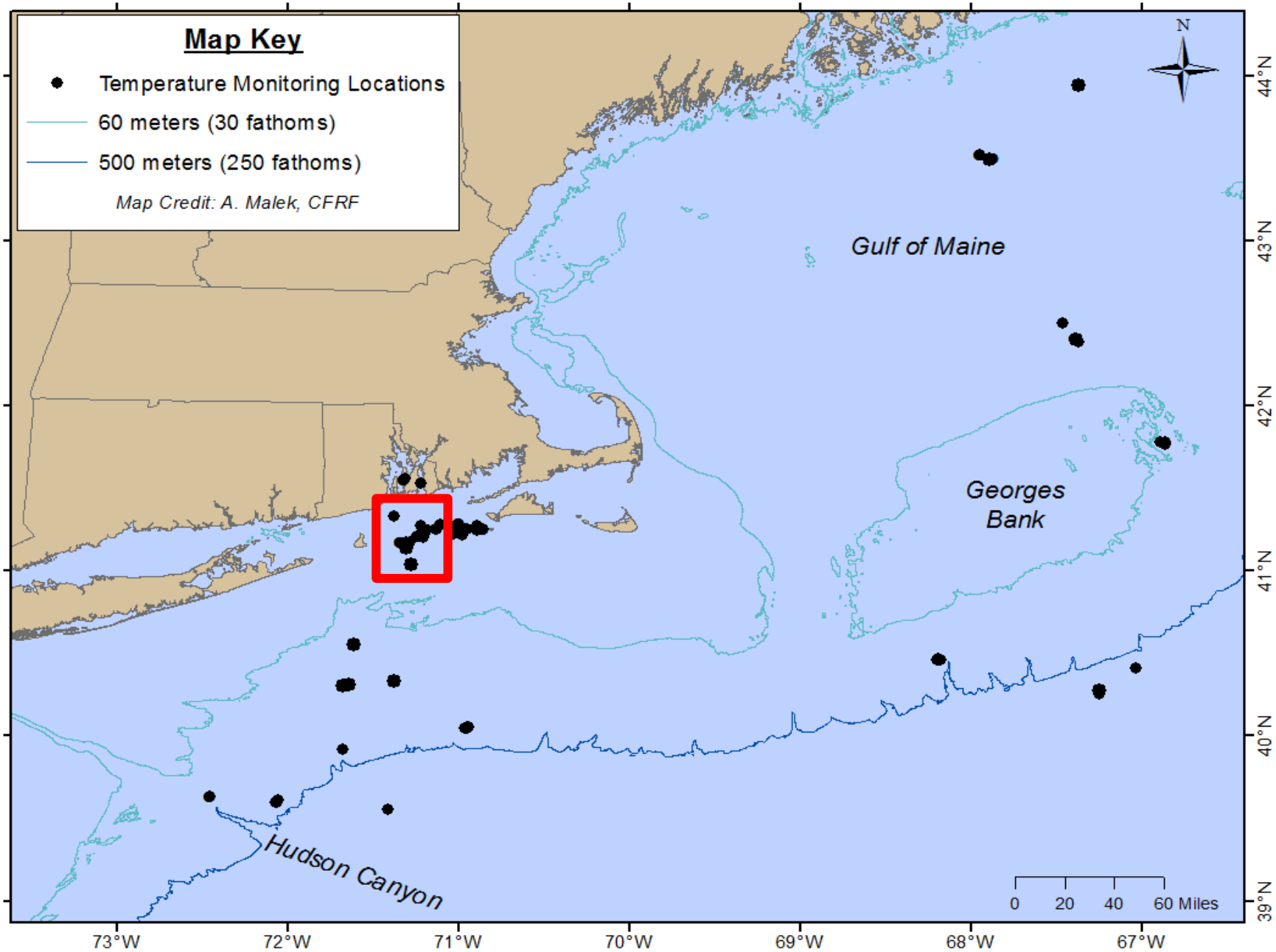


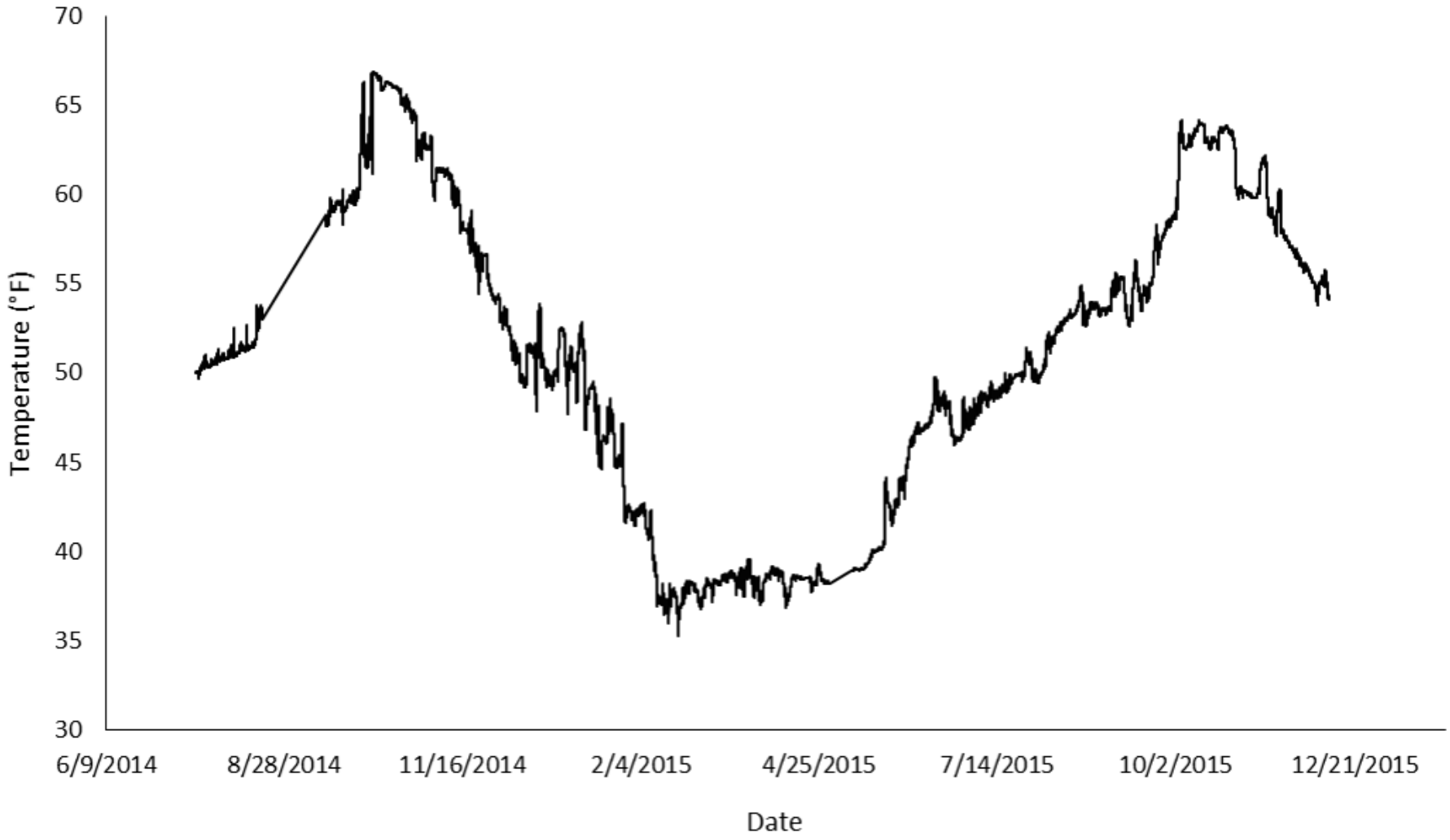


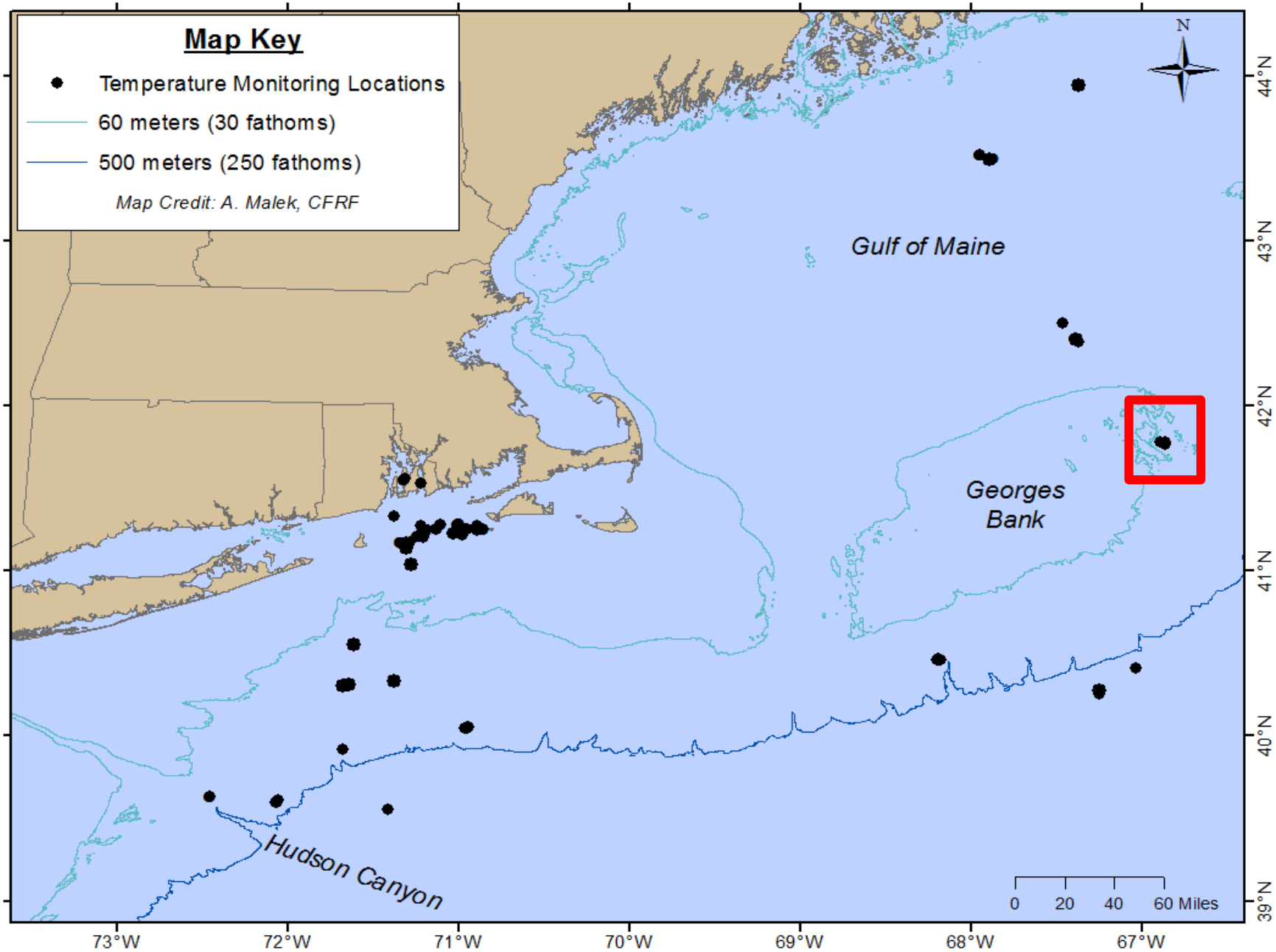
Main factor in shelf warming was Gulf Stream Warm Core Rings



NDBC Buoy At Nantucket Shoals ~40 fathoms


Map Key
Temperature Monitoring Locations
60 meters (30 fathoms)
500 meters (250 fathoms)
Map Credit: A. Malek, CFRF
N
Gulf of Maine
Georges Bank
Hudson Canyon
0 20 40 60 Miles
44°N
43°N
42°N
41°N
40°N
39°N
73°W
72°W
71°W
70°W
69°W
68°W
67°W


70
65
60
55
50
45
40
35
30
Temperature (°F)
6/9/2014
8/28/2014
11/16/2014
2/4/2015
4/25/2015
7/14/2015
10/2/2015
12/21/2015
Date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N
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0 20 40 60 Miles
44°N
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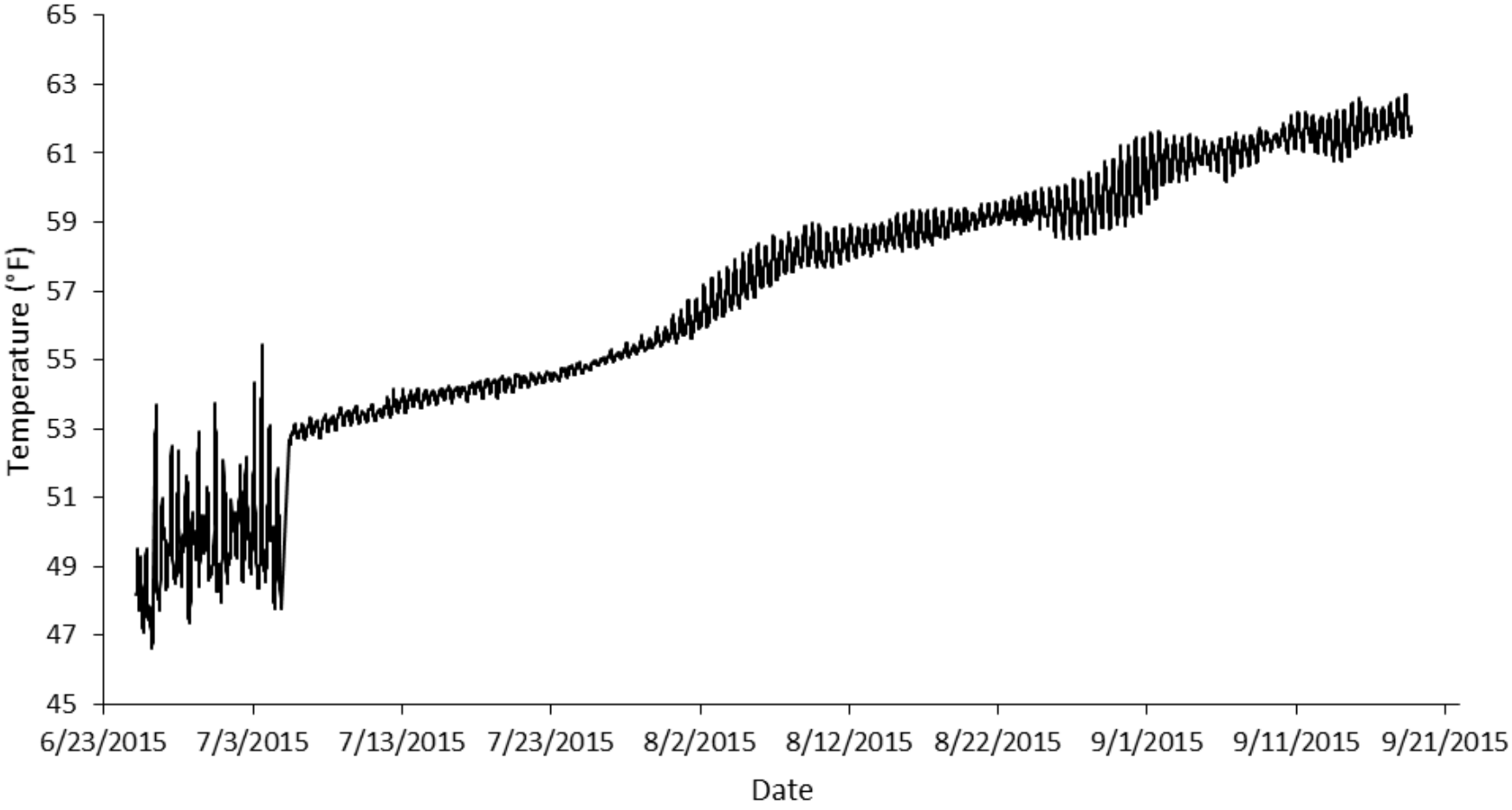
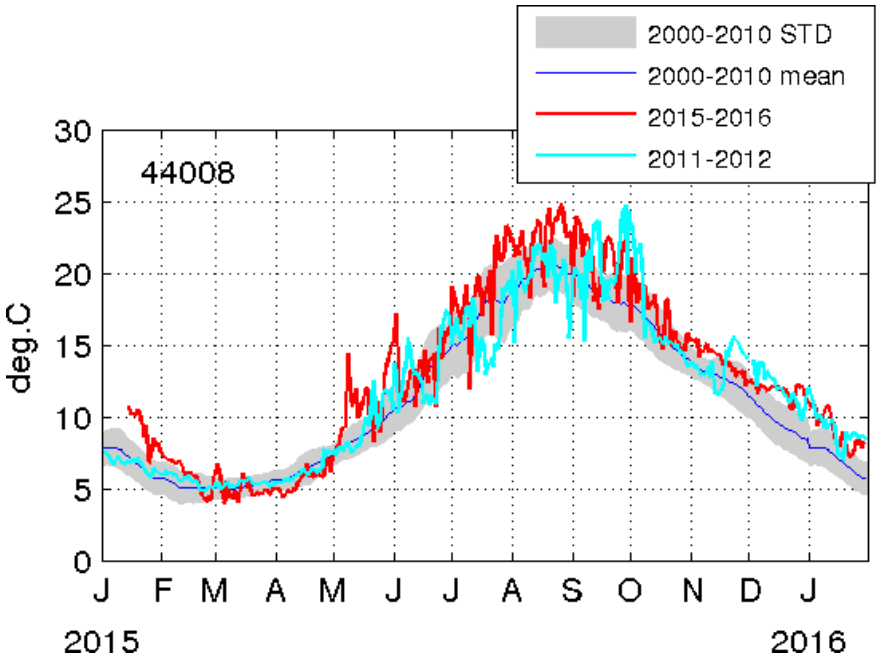
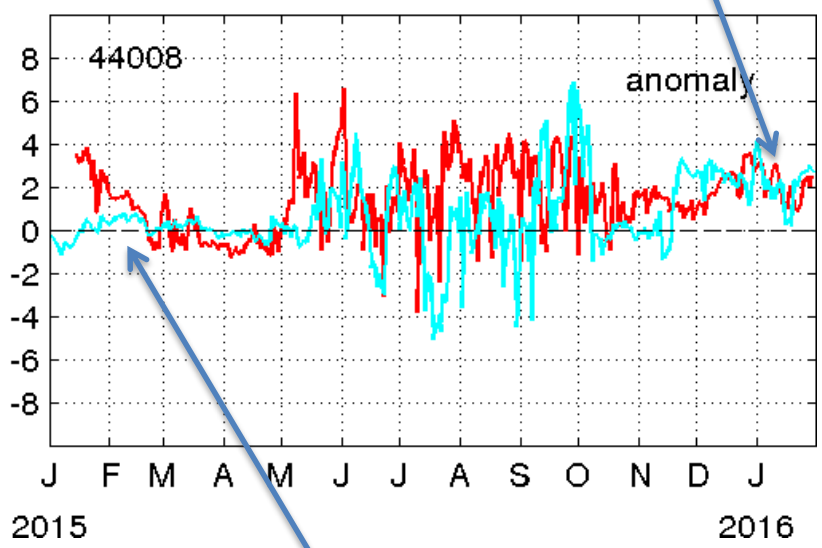
68°W
67°W


65
63
61
59
57
55
53
51
49
47
45
Temperature (°F)
6/23/2015
7/3/2015
7/13/2015
7/23/2015
8/2/2015
8/12/2015
8/22/2015
9/1/2015
9/11/2015
9/21/2015
Date

Current Conditions relative to 2011-2012

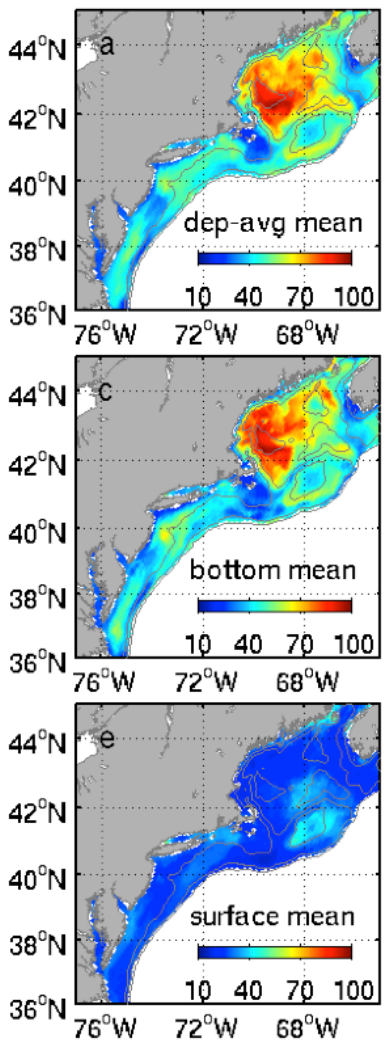




Present conditions
Are comparable to
2011-2012

Cooling result of
2 blizzards Jan/Feb 2015

On Predictability of Shelf Temperature: How long are the statistics good (positive correlation)?



Left panels: Time scale for which the temperature values remain correlated for depth average (upper panel), bottom (middle panel), and surface (lower panel)

Values are highest in central basins of Gulf of Maine (80+ days), around 50 days in mid-shelf in Middle Atlantic Bight

Smallest in Nantucket Shoals and near the shelfbreak (10-20 days)

Values are short near the surface (10-15 days)

Summary

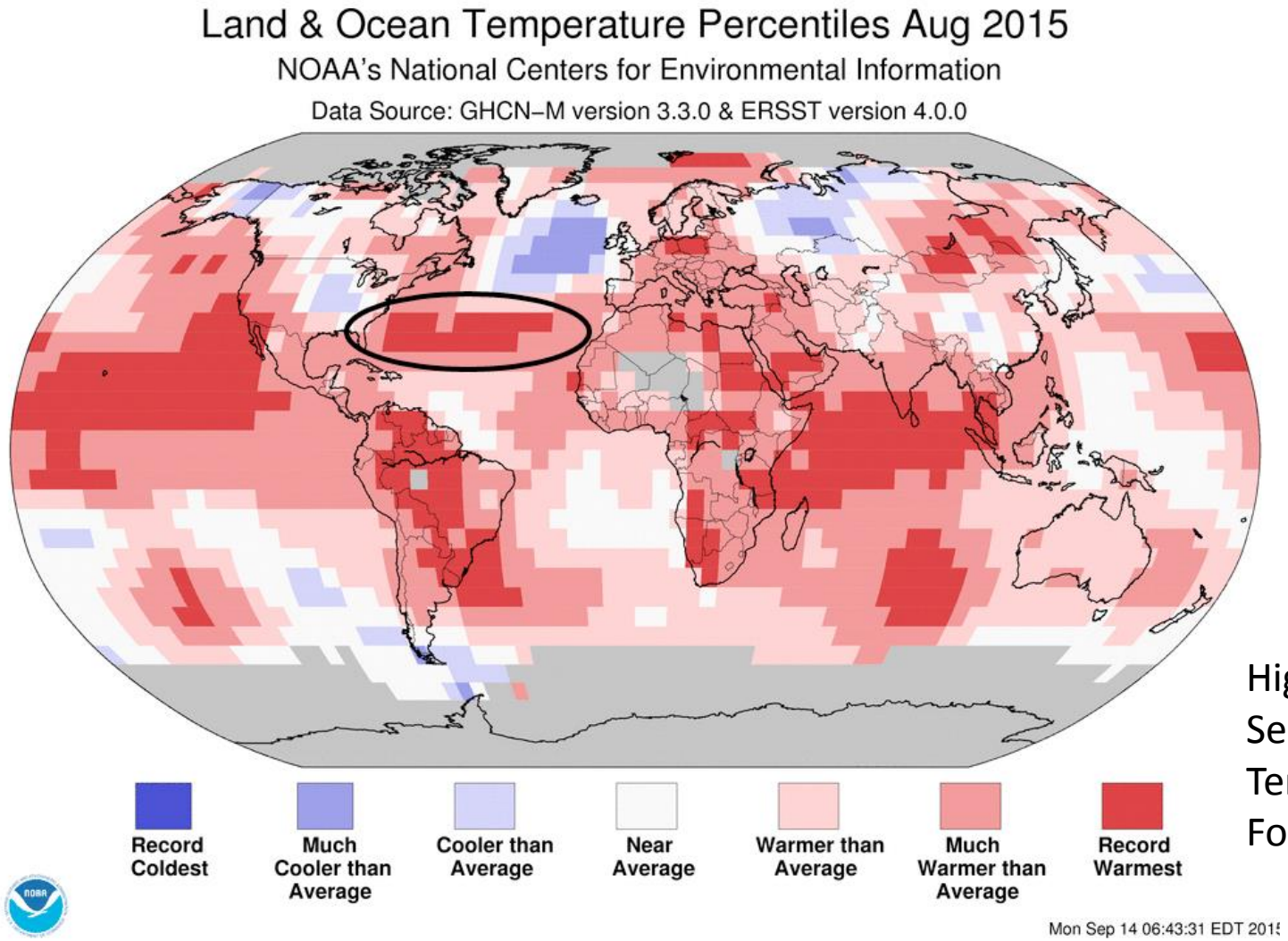
Data collection has been very successful, 138 total profiles

Data shows about a 6 Deg. F increase from Nov. 2014 to Nov. 2015

Warm Core Rings led to significant warming and higher salinities over much of the continental shelf

Present temperatures are about 1 Deg. F lower than late Jan. 2011-
Significant possibility that summer temperatures may be comparable to 2012

Record Warming in Tropical Atlantic

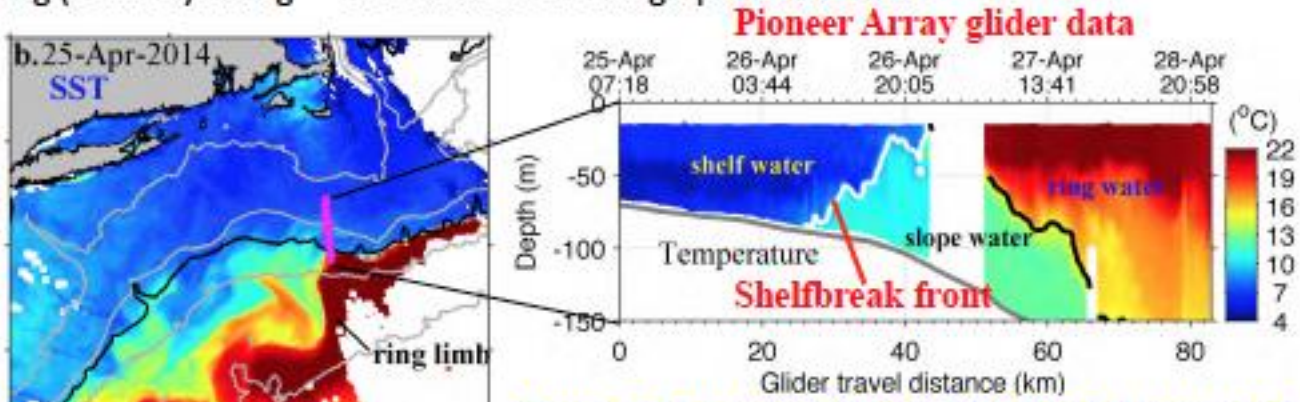


High
Sea Surface
Temperature
For Joaquin

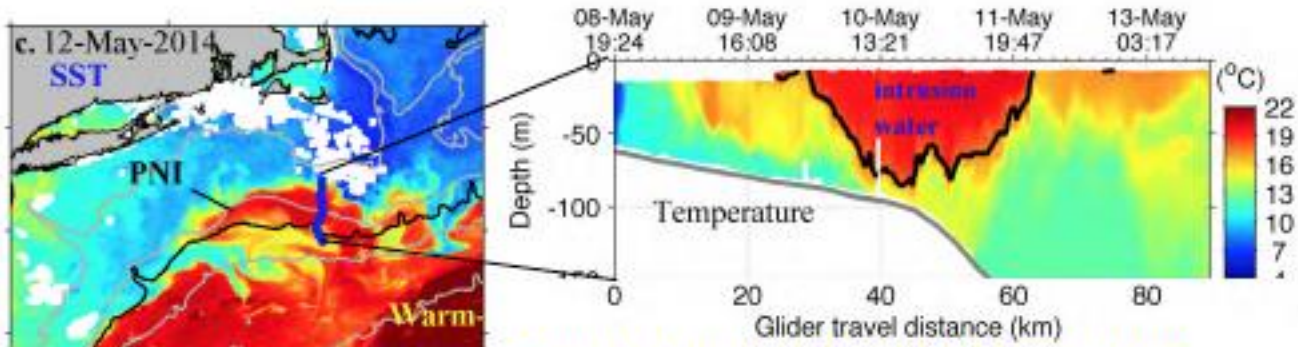
Warm Core Rings in 2014-Pinocchio's Nose Intrusion

Combining the Pioneer Array data with numerical models to study the shelfbreak frontal dynamics and cross-frontal exchange

Weifeng (Gordon) Zhang --- Woods Hole Oceanographic Institution



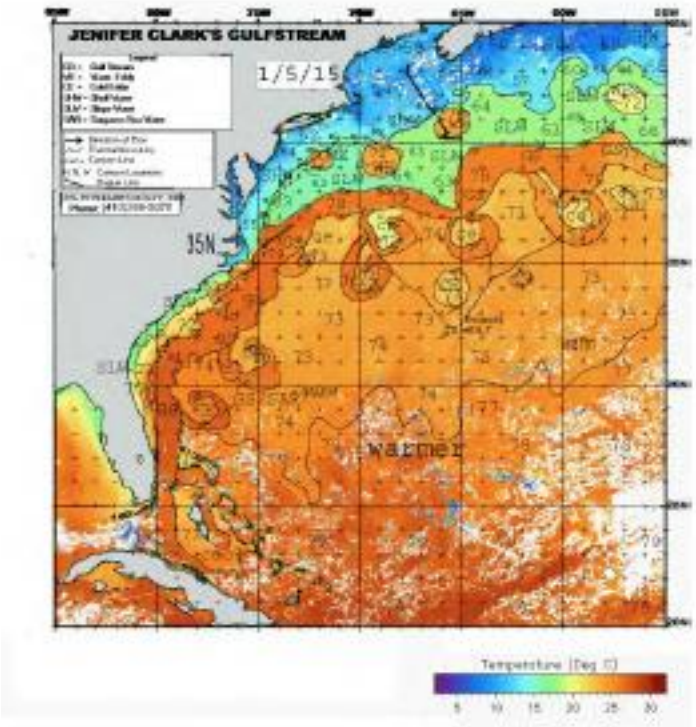
Topic 1: The variability and biological impact of the shelfbreak front

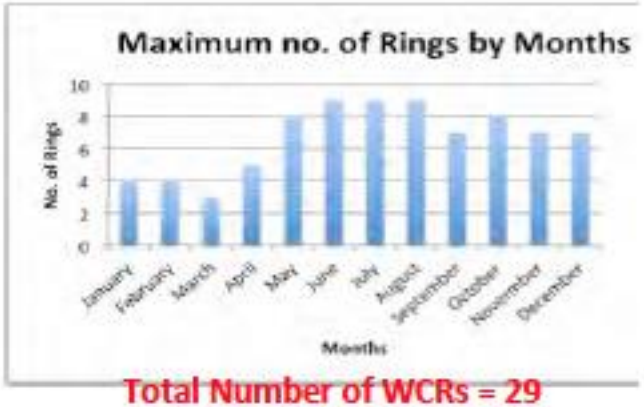


Topic 2: Characteristics of the cross-shelf exchange, e.g., velocity pattern of the intrusion

Warm Core Rings in 2015- 29 Total

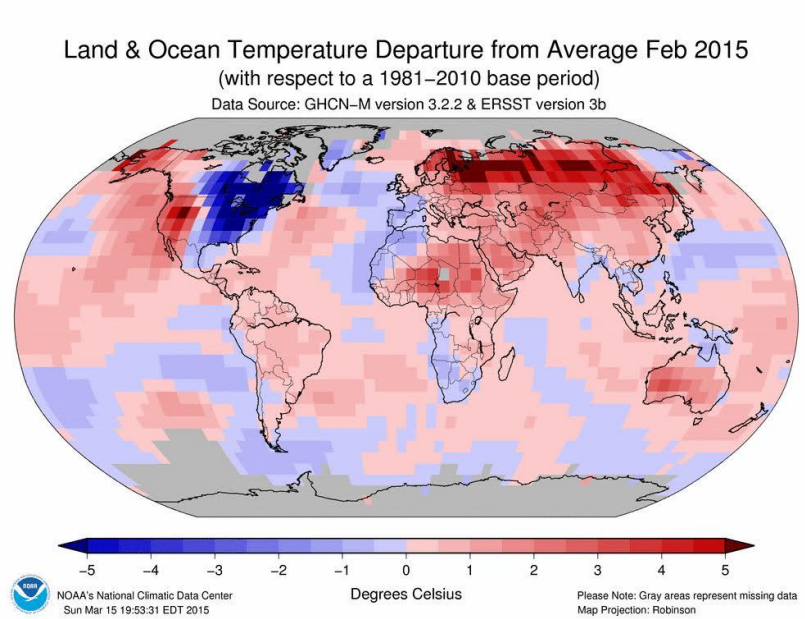
The Western North Atlantic in 2015



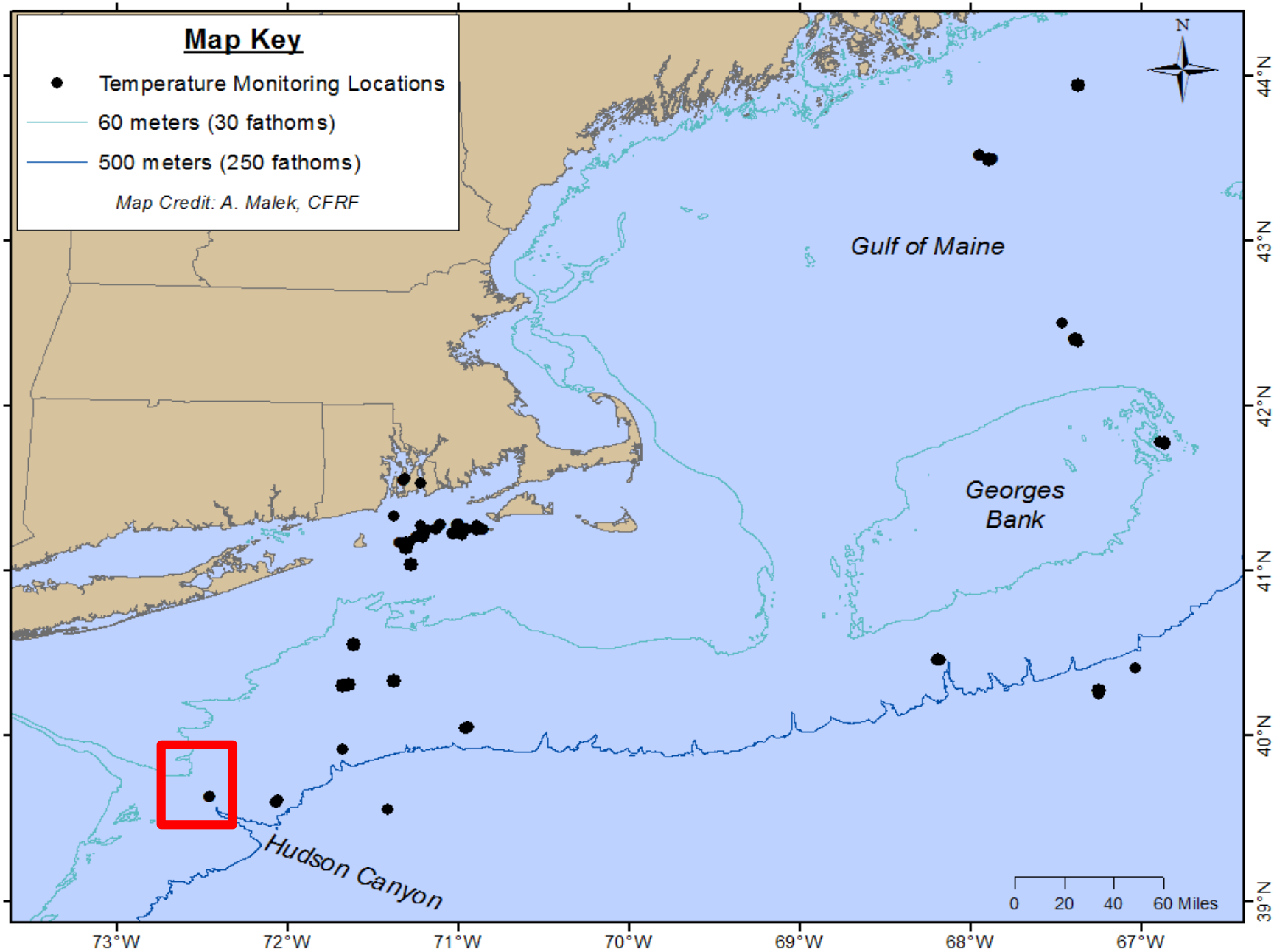


Total Number of WCRs = 29

What is going on with the atmosphere?



Jet Stream trough over eastern half of US from mid-January to March
Opposite pattern from winter 2011-2012 (exceptionally warm winter on East Coast)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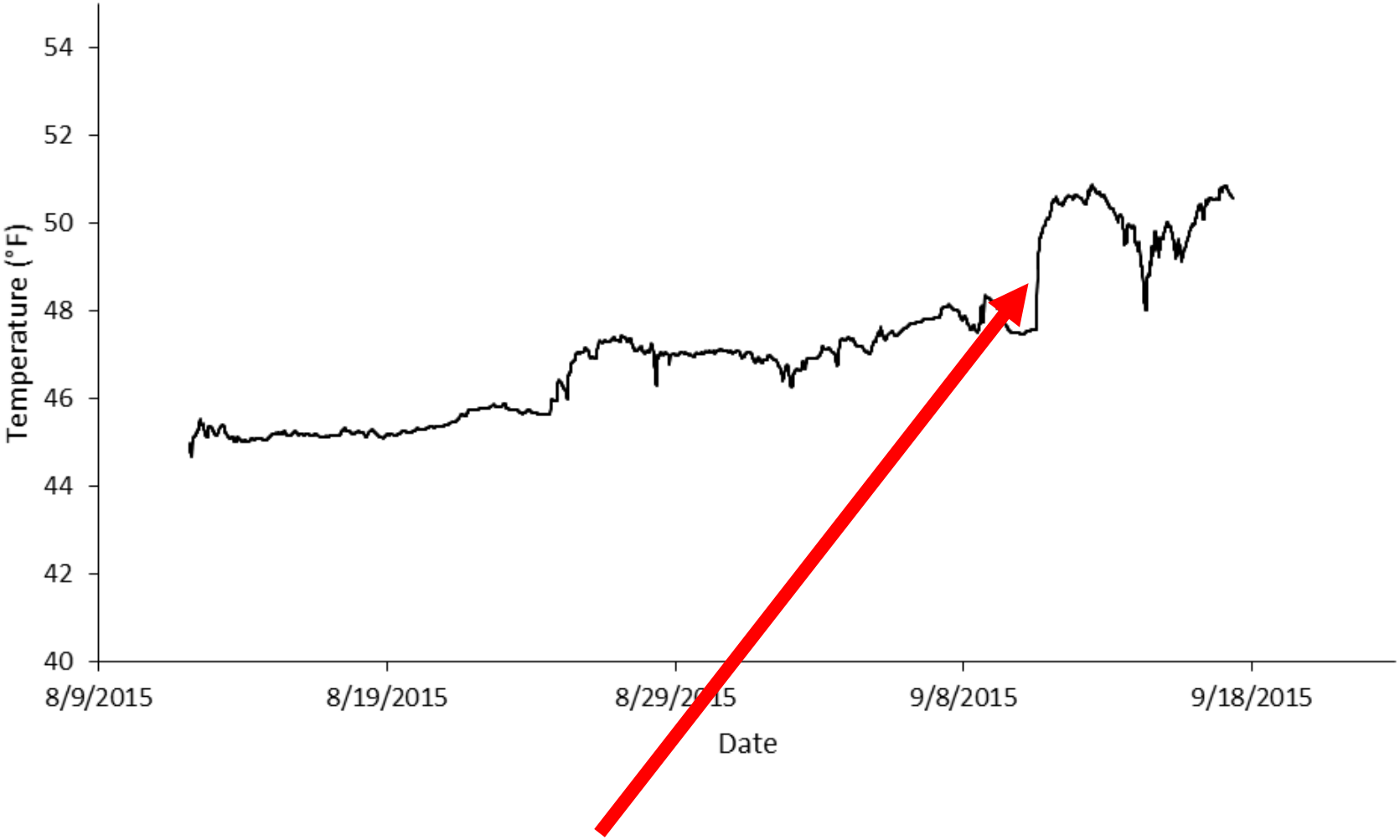

Note: Temp spike on 9/10 seems to coincide with incidence of lobsters shedding. Surface temp ~74°F.