


NATIONAL MARINE SANCTUARIES

South Atlantic Climate Variability and Fisheries

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NOAA Office of National Marine Sanctuaries

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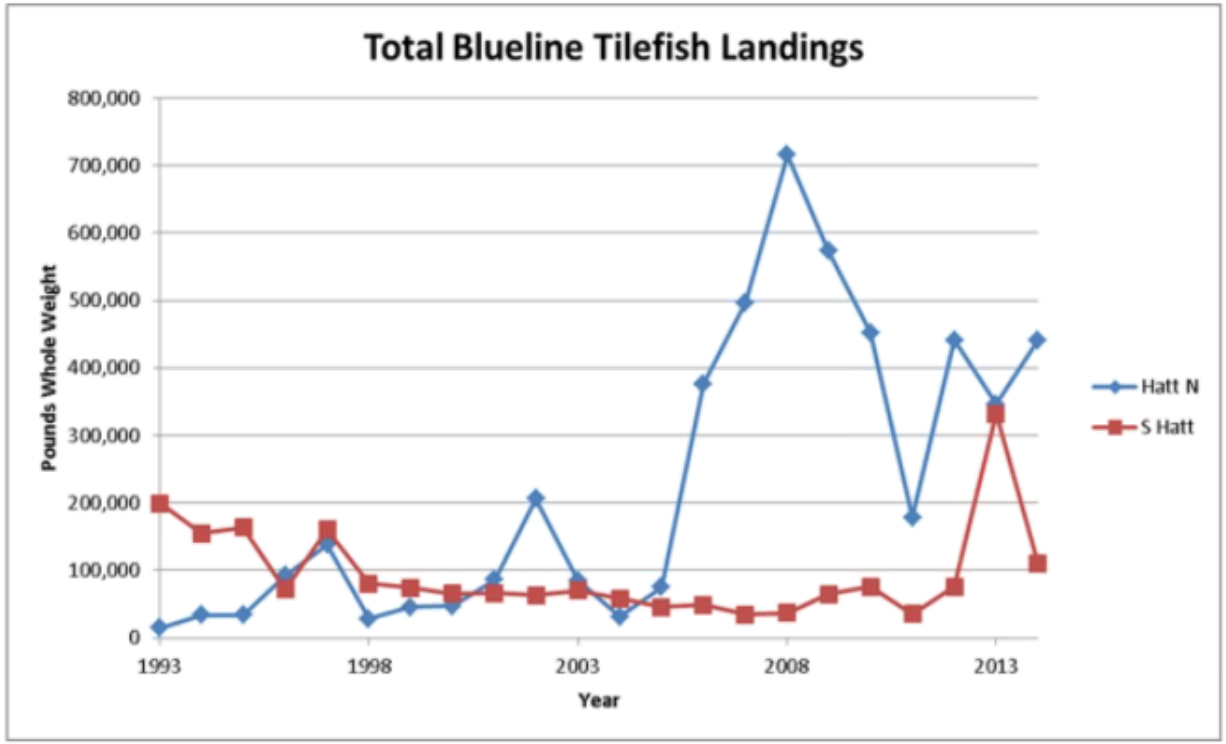
Some Climate Change & Fisheries Issues

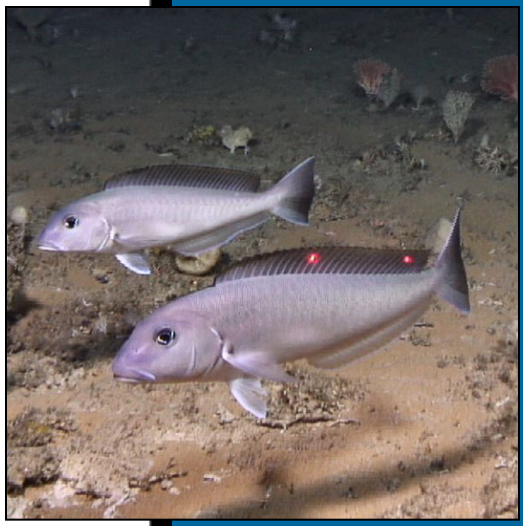
- Tropical species moving to South Atlantic area
- South Atlantic spp. moving to Mid Atlantic area
  - Blueline Tilefish
  - Snowy Grouper
  - Wreckfish

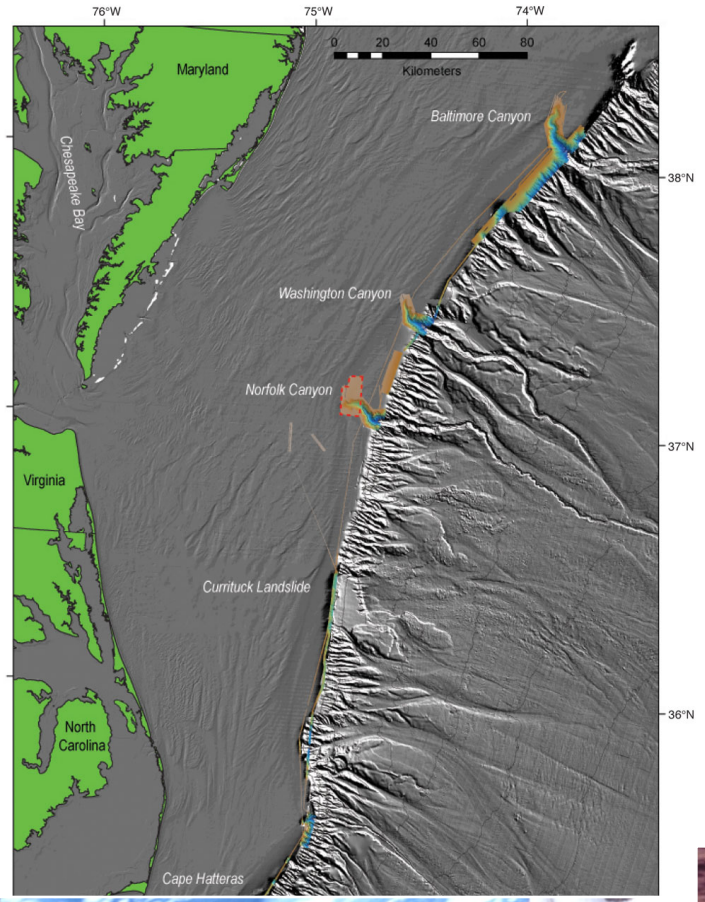
Biological/ecological and management challenges

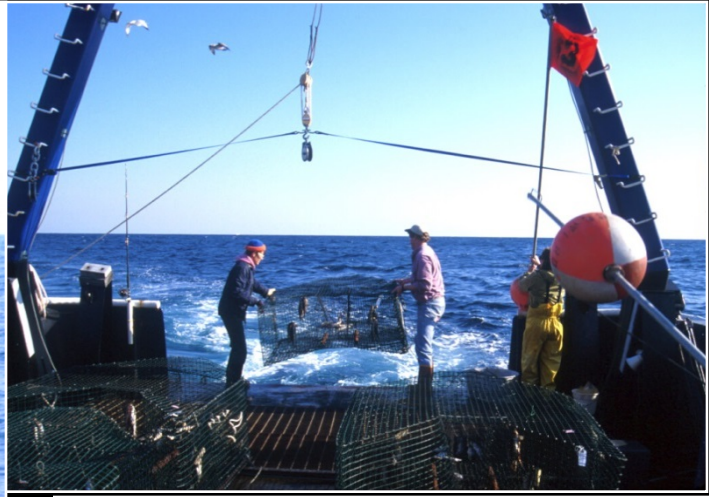
- Climate change vs "normal" variability
- Climate change and fishing effects
  - Reduced competition/predation by fishing allows recruitment of warmer "replacement" species from the south
- Ocean acidification effects on species, habitats

Example of Apparent Climate Change





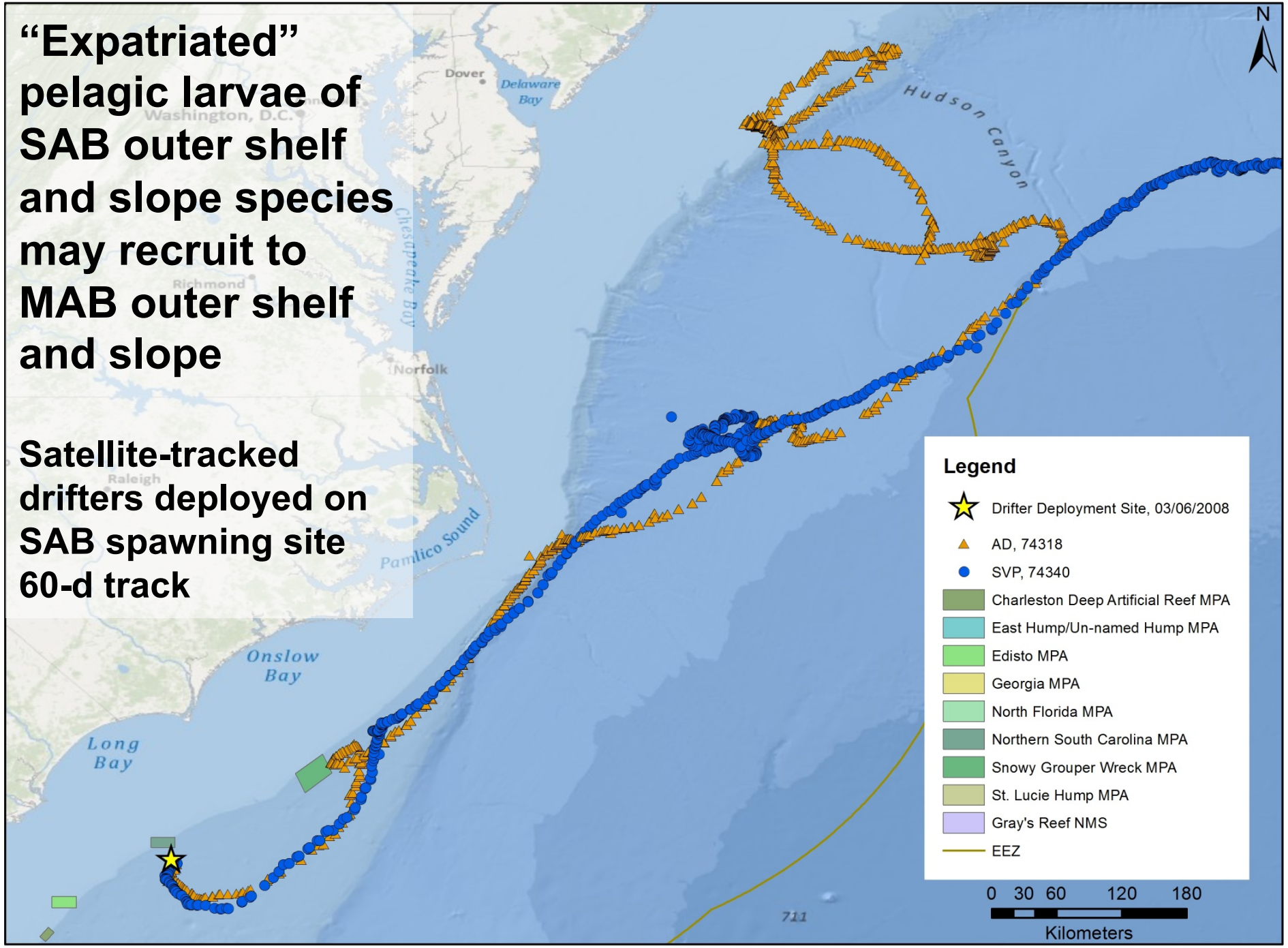

76°W
75°W
74°W
0 20 40 60 80
Kilometers
Maryland
Chesapeake Bay
Baltimore Canyon
38°N
Washington Canyon
Norfolk Canyon
37°N
Virginia
Currituck Landslide
36°N
North Carolina
Cape Hatteras

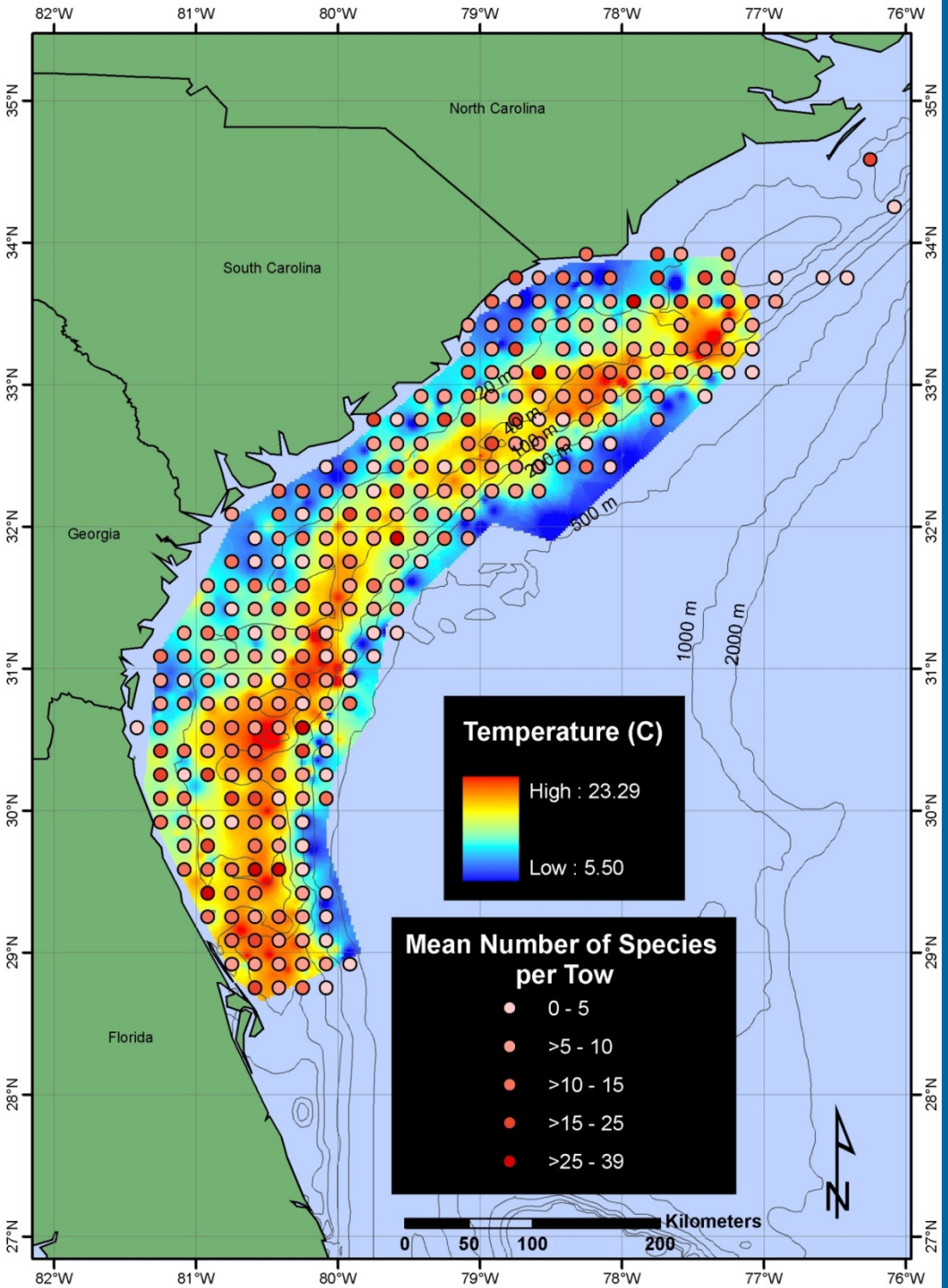


Fish and fisheries shifting northward

“Expatriated” pelagic larvae of SAB outer shelf and slope species may recruit to MAB outer shelf and slope

Satellite-tracked drifters deployed on SAB spawning site 60-d track

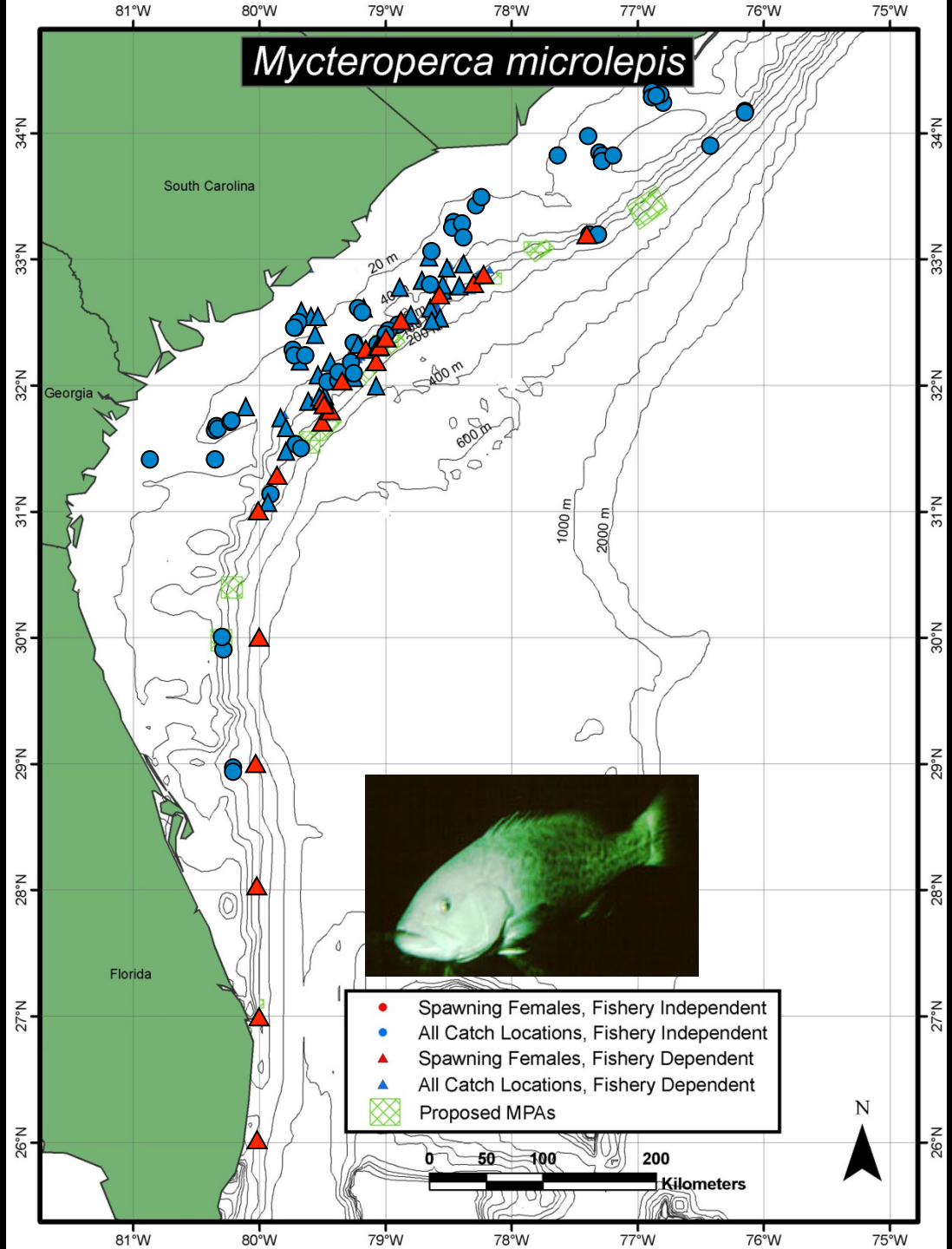




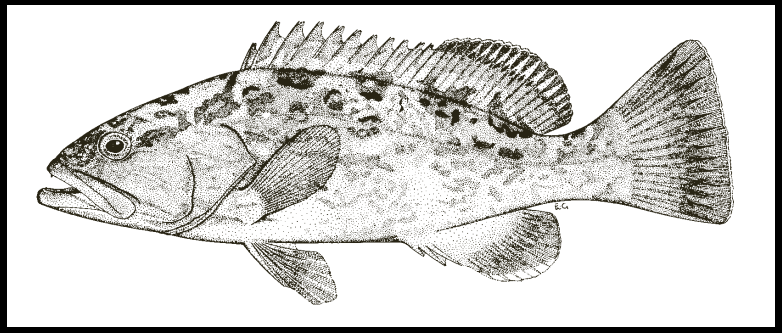
Winter bottom temperatures and fish diversity (mean number of species per trawl tow).

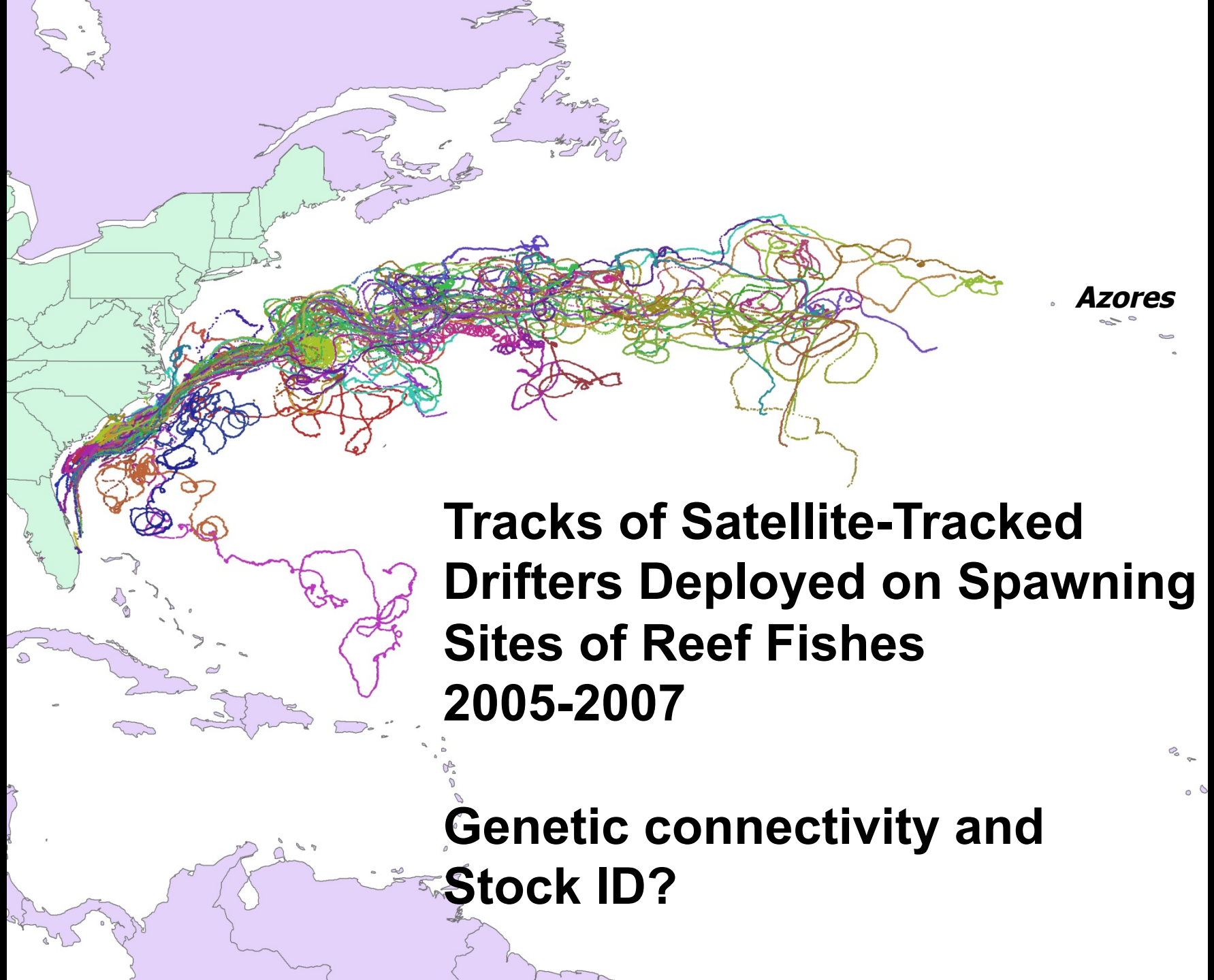
High diversity and community stability is associated with warmer waters of the middle shelf and southern part of the SAB.

May shift northward.



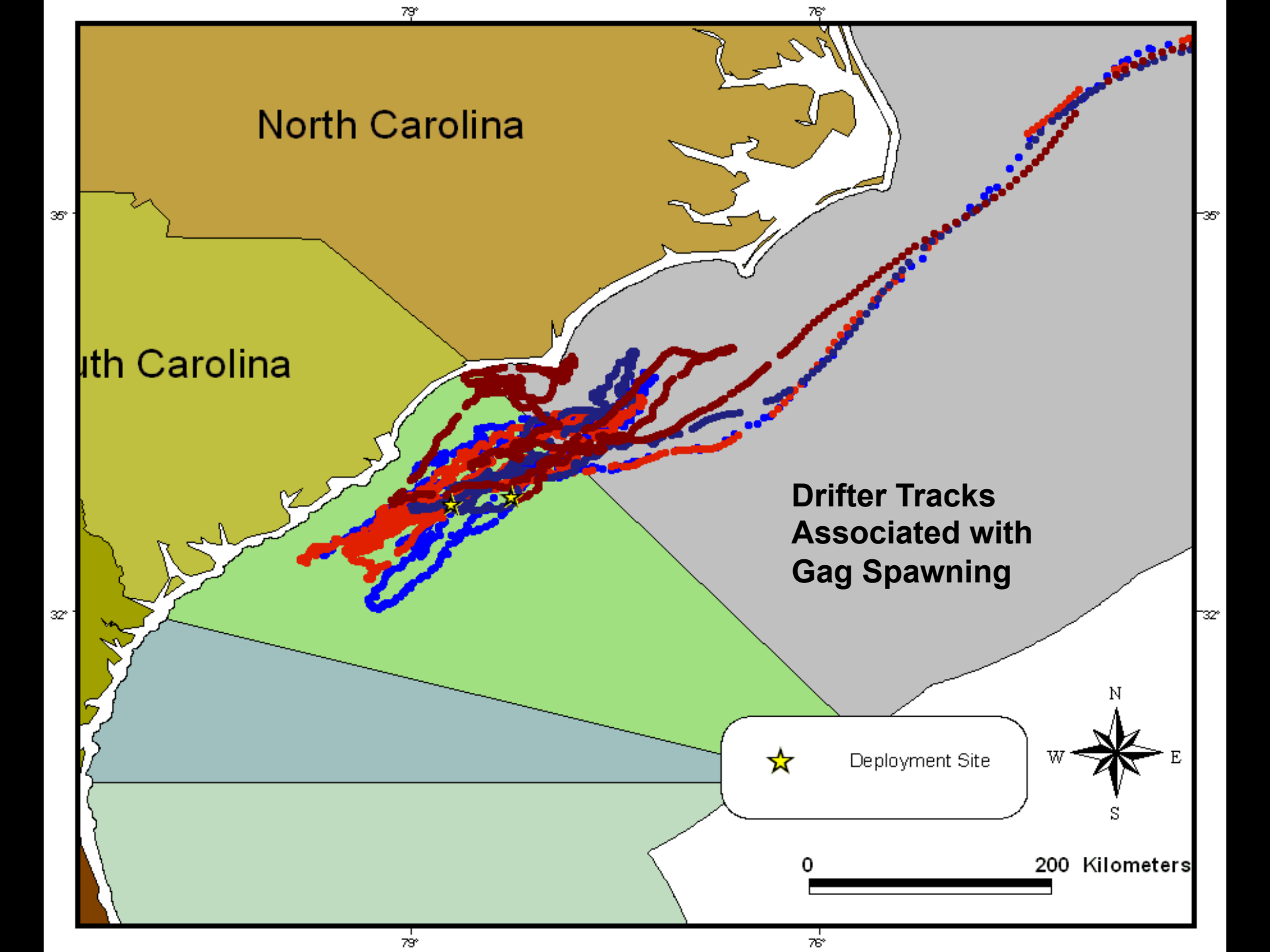
Shelf-edge warm waters are important spawning grounds for Gag and other species.

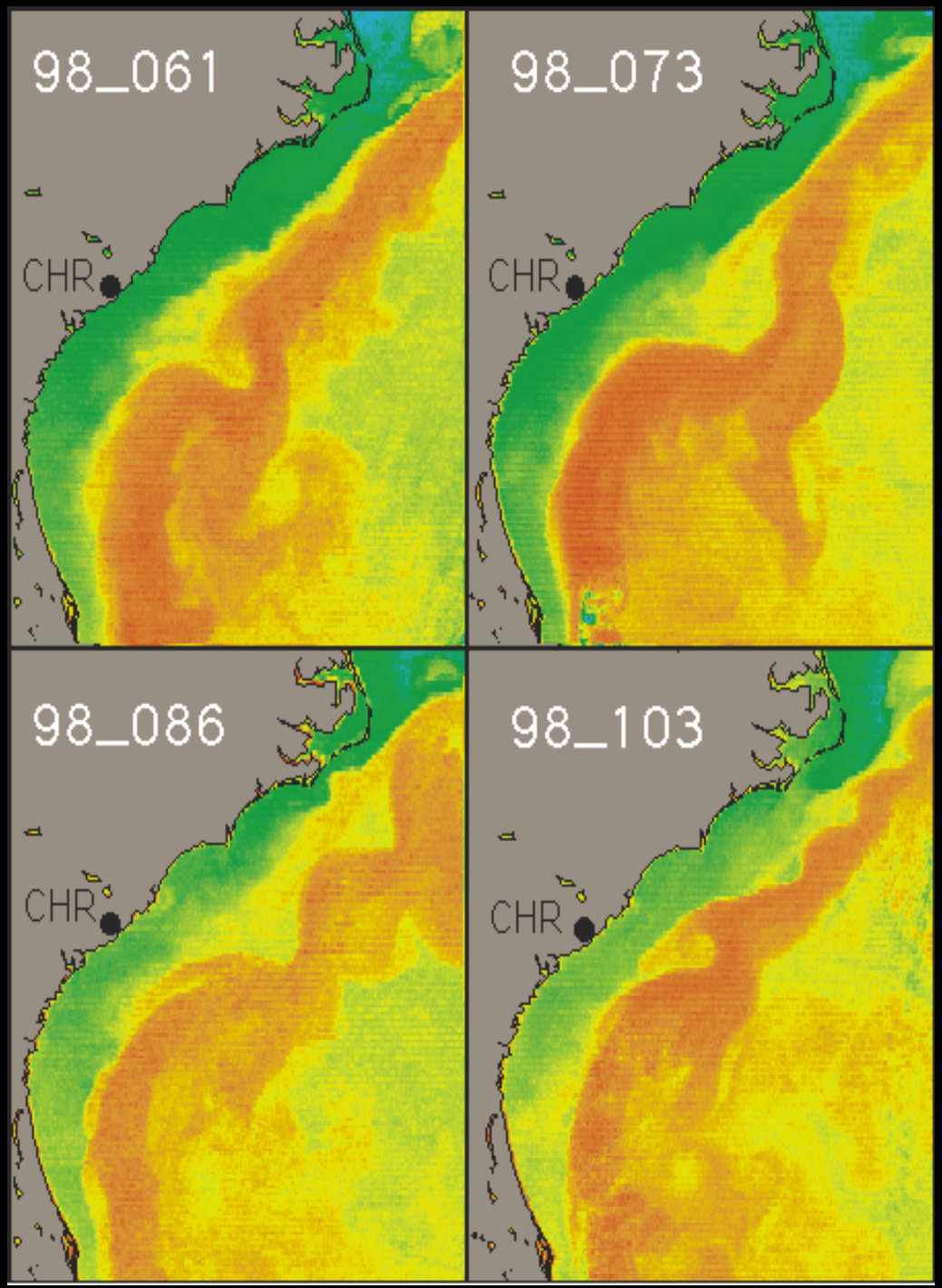




Tracks of Satellite-Tracked Drifters Deployed on Spawning Sites of Reef Fishes 2005-2007

Genetic connectivity and Stock ID?


79°
76°
North Carolina
35°
uth Carolina
Drifter Tracks
Associated with
Gag Spawning
32°
Deployment Site
N
W
E
S
0
200 Kilometers



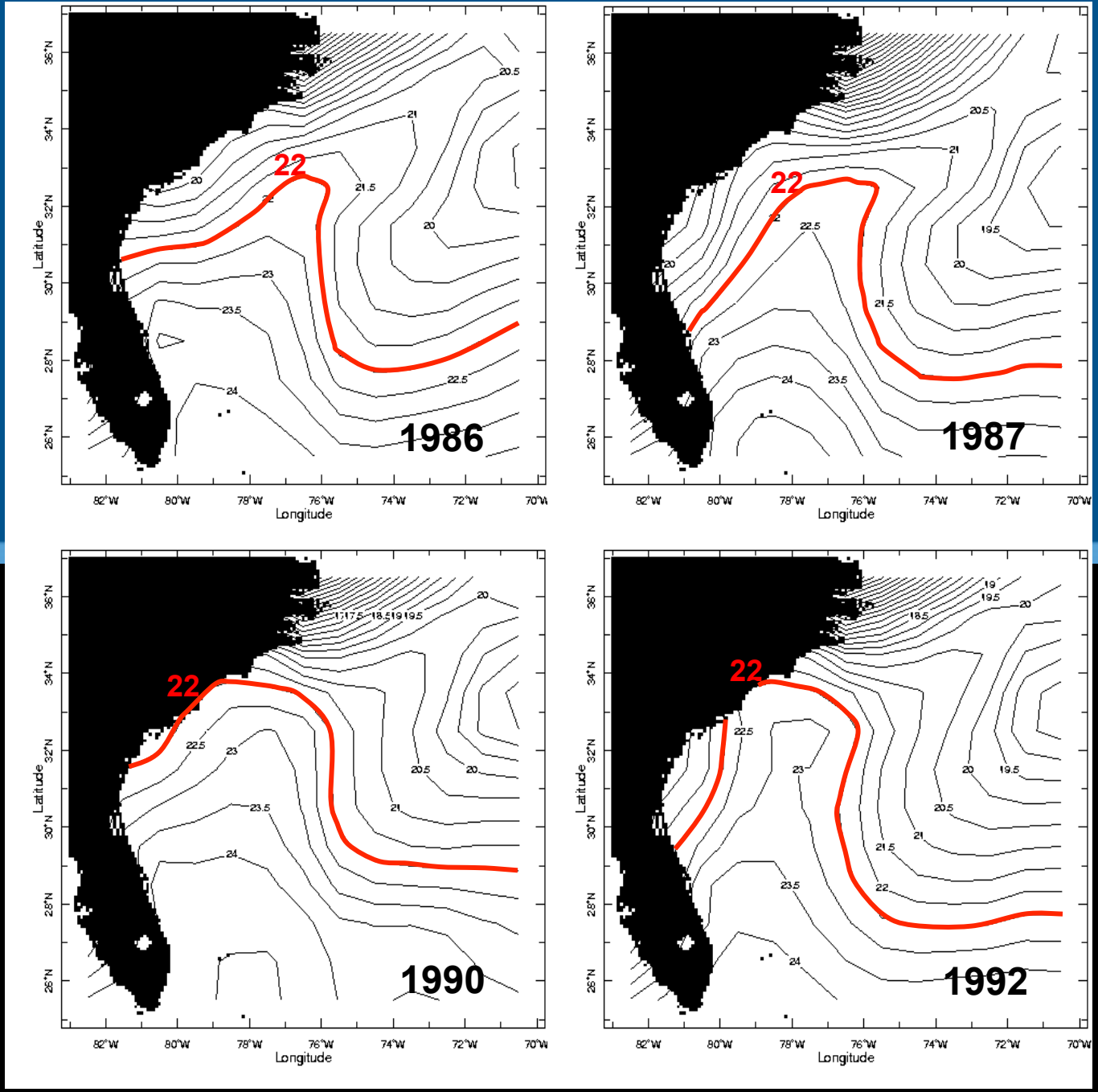
Defection of the Gulf Stream at the Charleston Bump

Sets up the Charleston Gyre

Short-term variability vs. climate change

Temperature may affect recruitment

Sea Surface Temperature Isotherms in March (a peak of gag spawning)



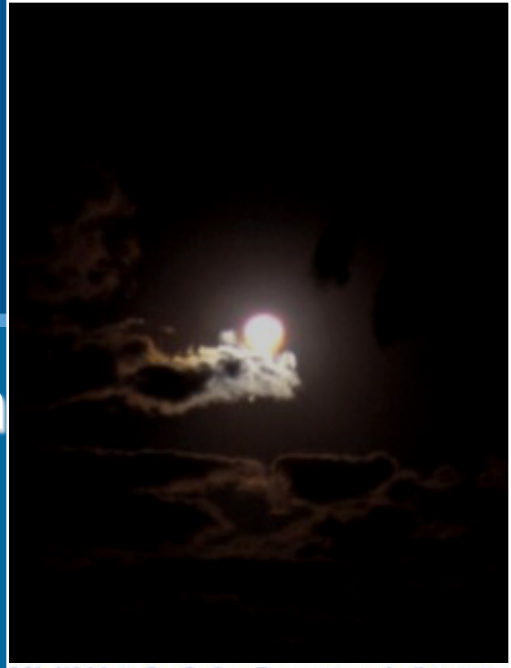
Note 22° Isotherm

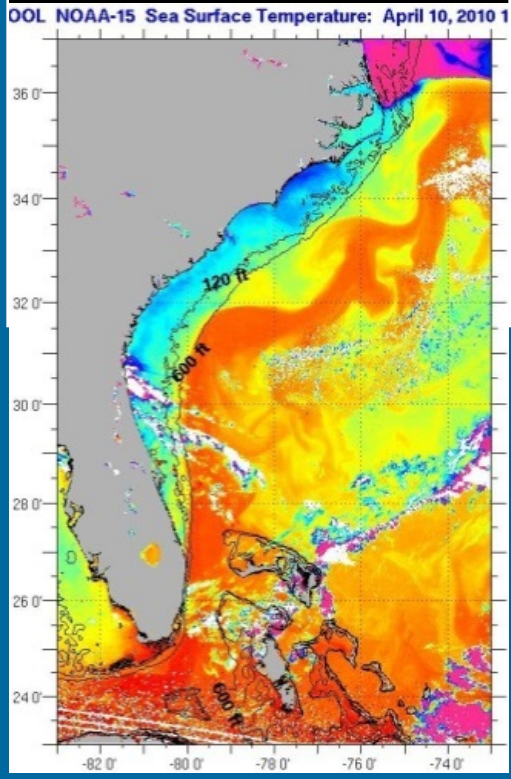
NOAA *Oceanographic Monthly Summary*

Sedberry *et al.* (2001)

Spawning in Gag (Grouper)

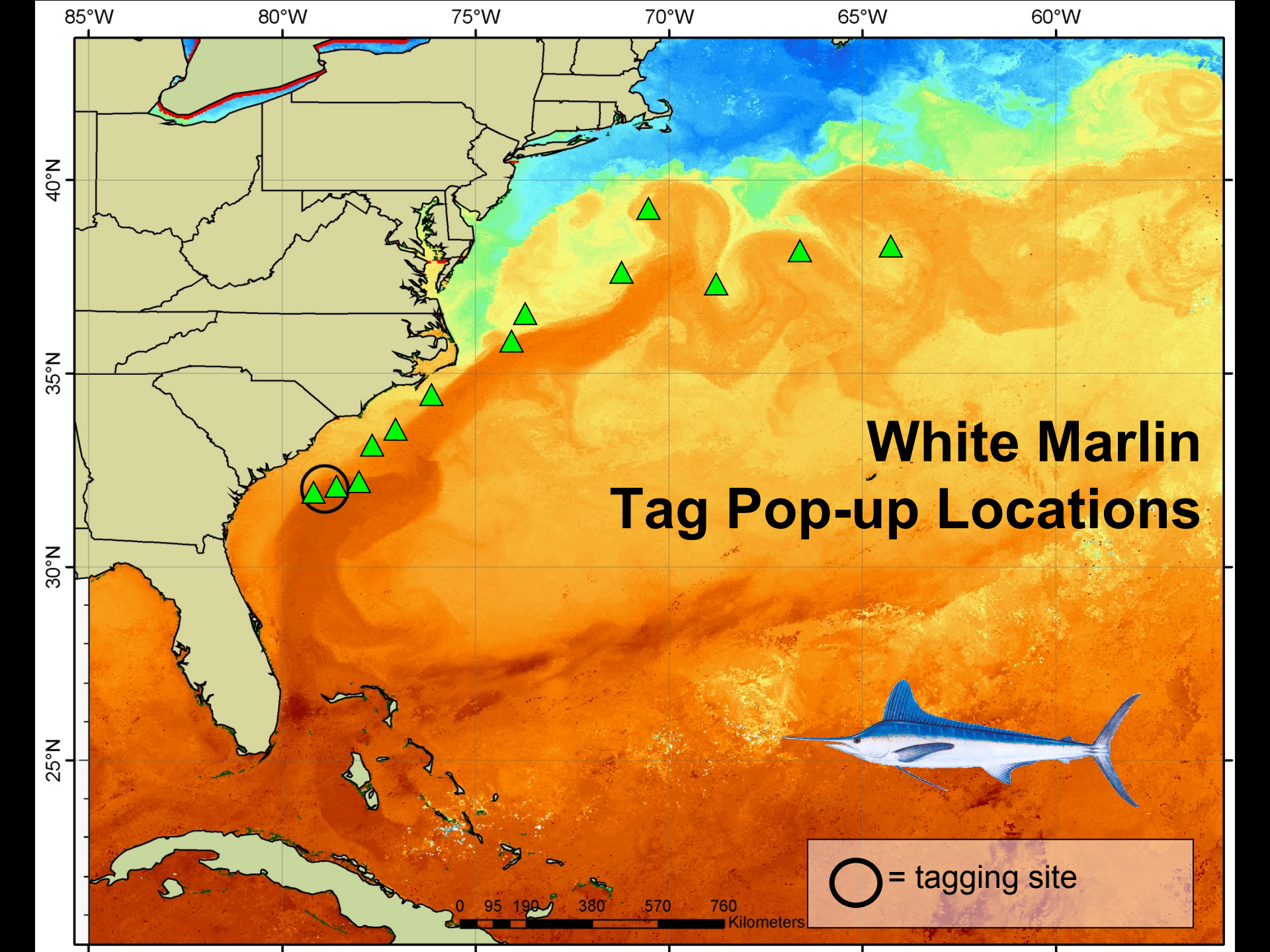
- It takes the right combination of moon phase, water temperature, day length, sex ratio, primary productivity and ocean circulation to produce a good year class of gag.
- Many conditions are variable
- Climate change may affect some conditions
- Can gag adapt?



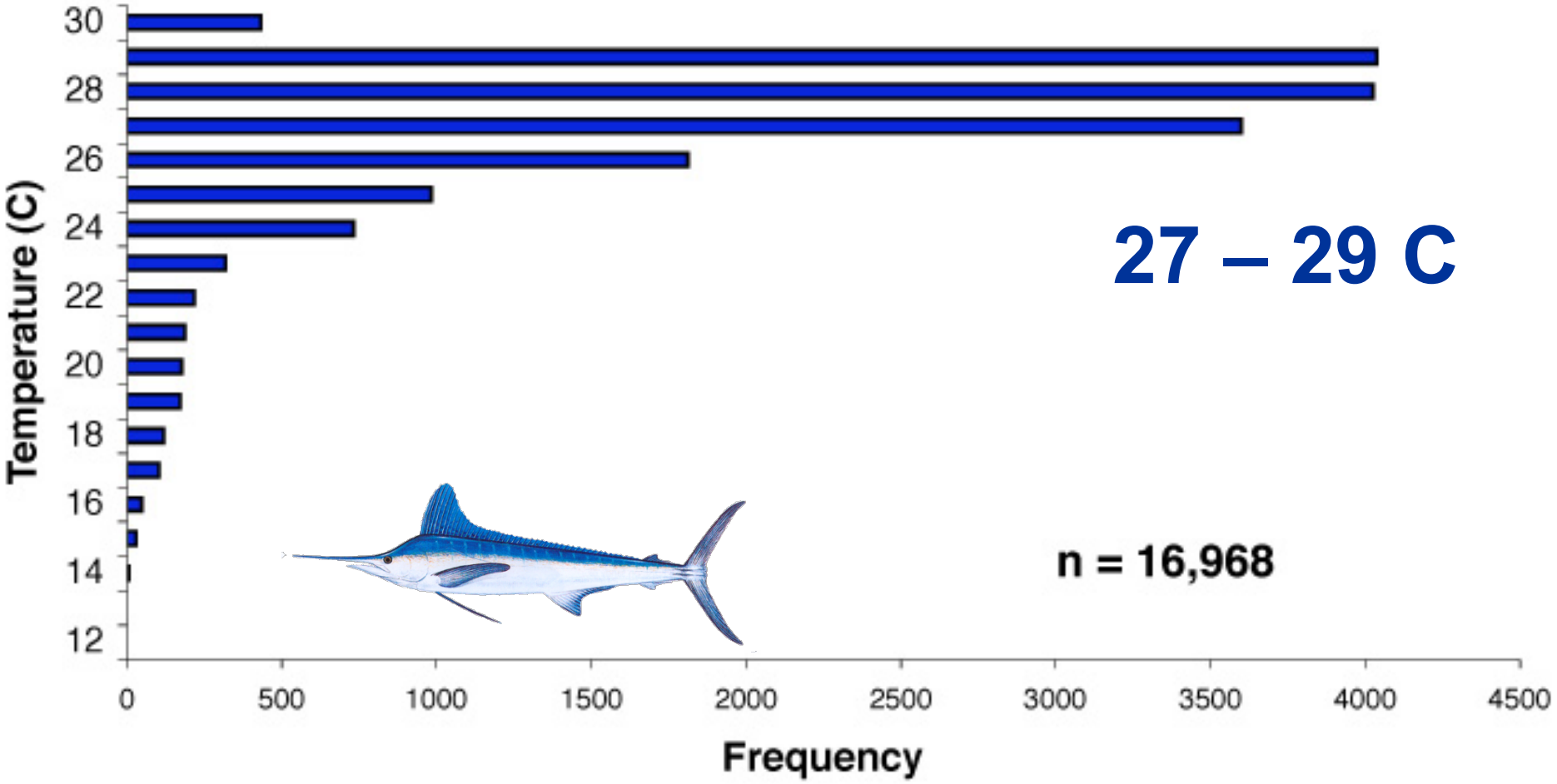


Stock	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	References
Black sea bass													Sedberry et al. (2006); SEDAR-25 (2011)
Blueline tilefish													Harris et al. (2004)
Cubera Snapper													pers comm. SA fisherman to WDH
Gag													McGovern et al. (1998); Sedberry et al. (2006)
Gray triggerfish													Kelly (2014)
Greater amberjack													Harris et al. (2007)
Red grouper													Burgos et al. (2007)
Red porgy													Daniel (2003); Sedberry et al. (2006)
Red snapper													White and Palmer (2004); Seberry et al. (2006)
Scamp (NC)													Matheson et al. (1986); macroscopic
Scamp (FL)													Gilmore & Jones (1992); based on courtship behavior
Scamp (29.95-32.95 °N)													Harris et al. (2002), Sedberry et al. (2006)
Snowy grouper													Wyanski et al. (2000), SEDAR-36 (2013)
Speckled hind													Ziskin et al. (2011)
Tilefish													Erickson et al. (1985); Sedberry et al. (2006)
Vermilion snapper													Cuellar et al. (1996); Sedberry et al. (2006)
White grunt													Padgett (1997); Sedberry et al. (2006)
Warsaw Grouper													Sedberry et al. (2006)

Farmer *et al.* in prep.


85°W
80°W
75°W
70°W
65°W
60°W
40°N
35°N
30°N
25°N
White Marlin
Tag Pop-up Locations
0 95 190 380 570 760
Kilometers
= tagging site

White Marlin Temperature Preferences



Charting a New Course
A Workshop to Design a Fishery Citizen Science Program for the U.S. South Atlantic





Photo credits: NC Sea Grant, Gray's Reef NMS, SAFMC, Miss Judy Charters

What is citizen science?
Citizen science is a growing field in which trained members of the public collaborate and engage with scientists in the inquiry and discovery of new knowledge. Public participation in scientific research advances science, research, and policy and fosters an informed and engaged citizenship.

Why are we doing this?
For many years the South Atlantic Fishery Management Council (Council) has grappled with the challenge of ensuring adequate and timely science to support management despite limited resources, a multitude of species to manage, and a complex and highly diverse ecosystem. Discussions of data shortcomings and the resulting scientific uncertainties often lead to offers from fishermen to provide their vessels as research platforms, collect samples and record their own observations to help increase scientific knowledge and 'fill the gaps'. The Council recognizes the desire of constituents to get involved and the need to have a well-designed program and accompanying sampling protocols to ensure that information collected through such efforts is useful. To meet this growing need, the Council intends to develop a comprehensive Fishery Citizen Science Program.

Initial Steps
In March 2015, the Council created a Citizen Science organizing committee. As a first step, the committee has recommended convening a workshop where interested citizens, fisheries managers and scientists, and citizen science practitioners gather to develop recommendations for designing such a program.

Vision
The committee crafted the following draft vision for a Fishery Citizen Science Program to serve as a guidepost for the proposed workshop:

"A collaborative fisheries research and monitoring program run by the South Atlantic Fishery Management Council that effectively blends citizen science and technical science to expand the base of information available for Council decision-making."

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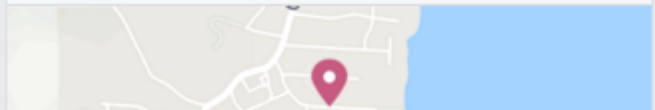

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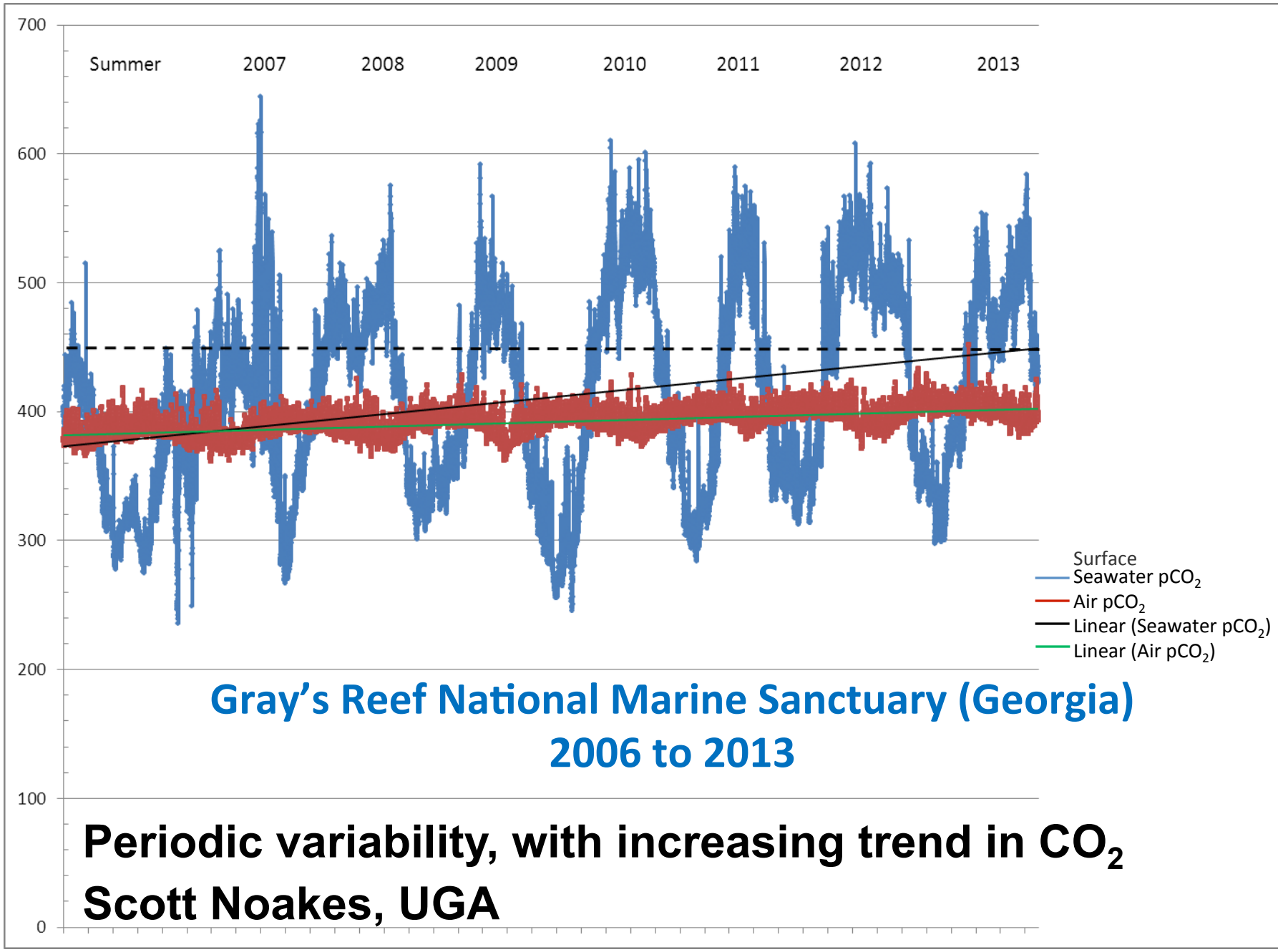
Redmap - What's on the move in Australian seas?
September 30 at 9:24pm ·

Check out the Redmap t-shirt design competition! Open Oct 1 – Nov 5th 2015.

Break out your best marine drawings or graphic designs for your chance to win a custom designed t-shirt (with your design on it!) courtesy of Bolt and Run Co. AND a copy of Edgar's Australian Marine Life!

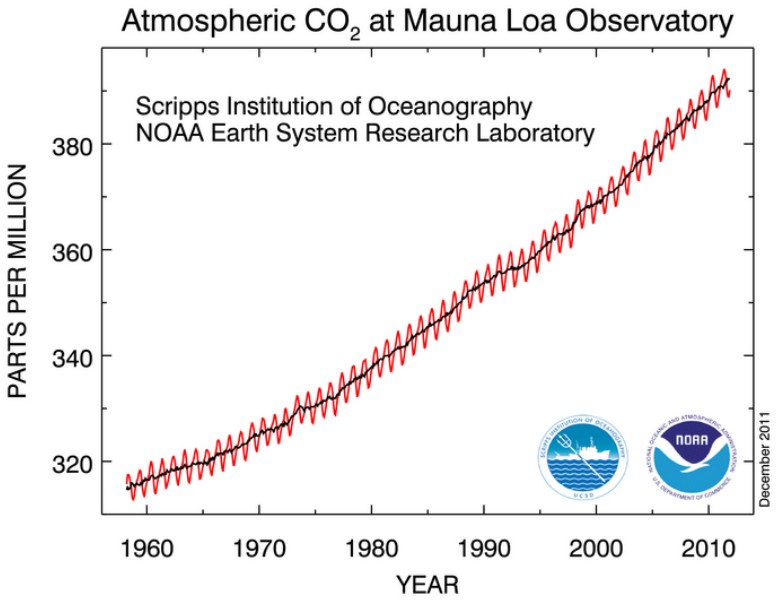
There are two children and two adult categories. See the website for more

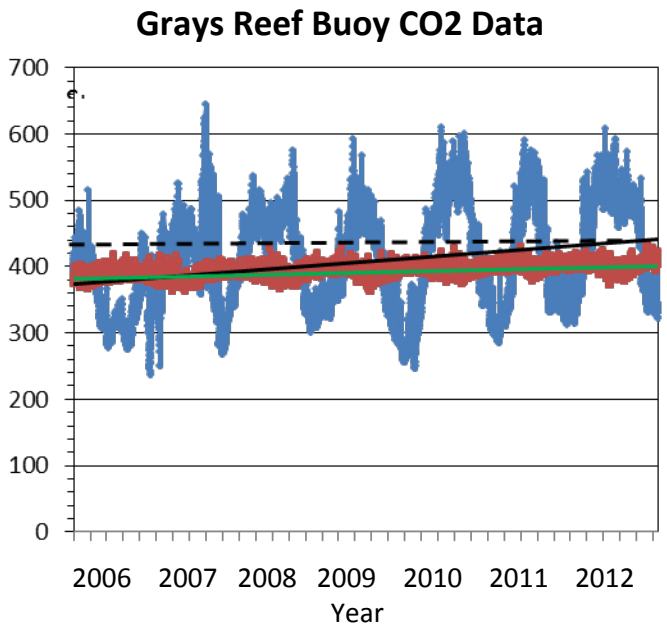


Gray's Reef National Marine Sanctuary (Georgia)
2006 to 2013

Periodic variability, with increasing trend in CO_2

Scott Noakes, UGA





Atmospheric CO_2
15 ppm in 5 years
=0.783%/year

Worldwide Seawater CO_2
1.2 to 2.1 ppm/year
= ~0.5%/year

Atmospheric CO_2
21 ppm in 7 years
Average=391.7 ppm*
=0.77%/year

Seawater CO_2
78 ppm in 7 years
Average=411.6 ppm*
=2.7%/year

Note: Averages based on Gray's Reef data set

Scott Noakes, UGA

Hard/Soft Corals and Hard Substrates

Are likely to be impacted

Oculina arbuscula

Phyllangia americana

Titanideum frauenfeldii

Telesto fruticulosa

Scott Noakes, UGA

Key Challenges

- **Flexibility in management jurisdictions and exchange of ideas/data among them**
  - **Changing stock structure**
- **Sorting out climate change vs climate variability vs effects of fishing on population ecology**
- **Multidisciplinary approach, connecting physics, meteorology, oceanography and biology**
- **More MPAs?**
- **Fishery-independent data need**
- **Fishery-dependent data need**
  - **Precise catch, effort, location, etc. from all sectors**