



Investigating climate change impacts on Atlantic fish stock distributions and harvest allocations

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Atlantic States Marine Fisheries Commission

Marine Fisheries Advisory Committee
October 13, 2015

Overview

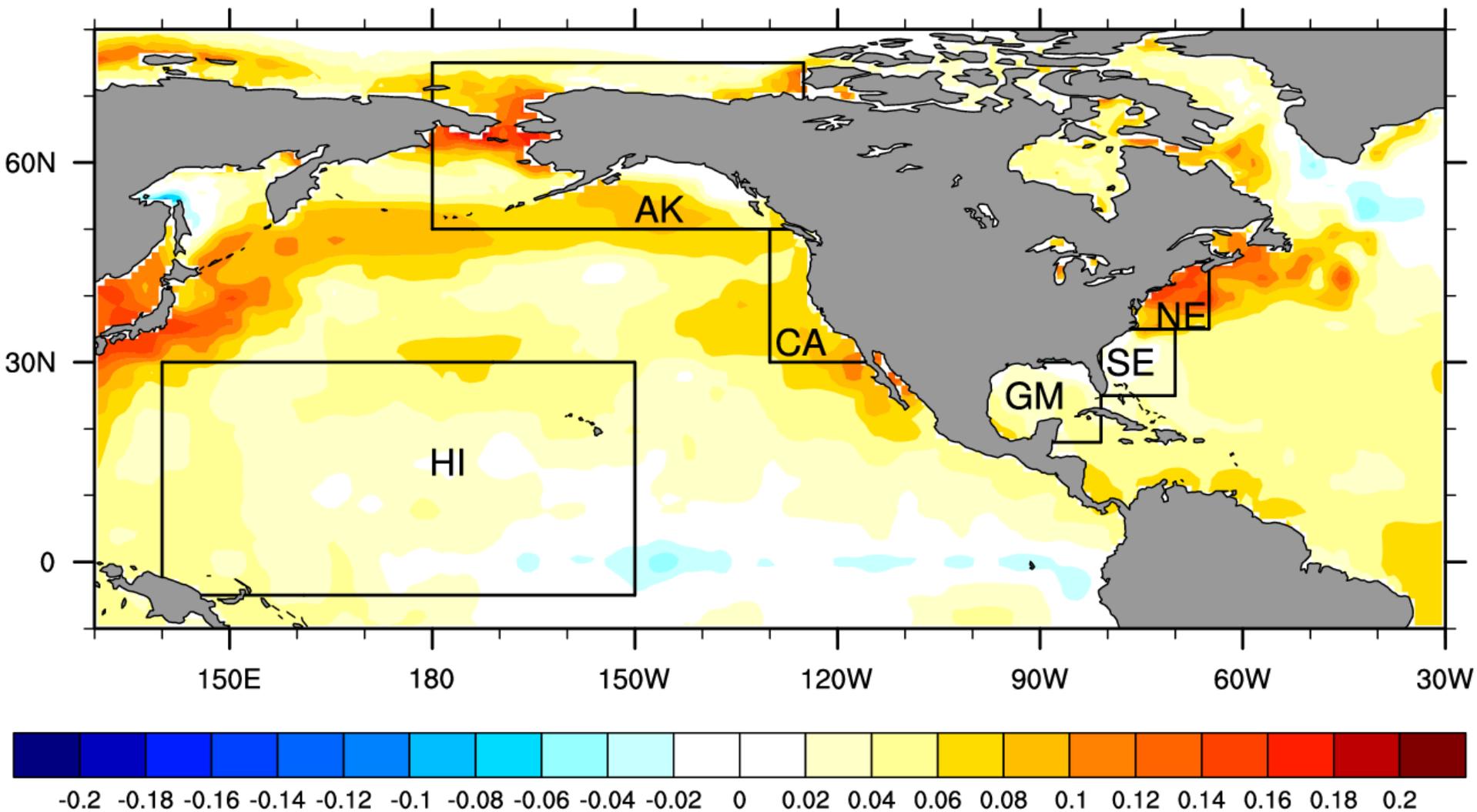


- 1) Detecting climate-induced changes in stock distributions and productivity
- 2) Soliciting constituent feedback on harvest re-allocation options
- 3) Technical and management process to adjust harvest allocations
- 4) Future directions
- 5) Questions for MAFAC

Observed sea surface temperature trend



Hadley SST Trend 1900-2011 ($^{\circ}\text{C}/\text{decade}$)



ASMFC-NMFS collaborative investigation



Focal Stocks:

black sea bass, summer flounder, scup, winter flounder

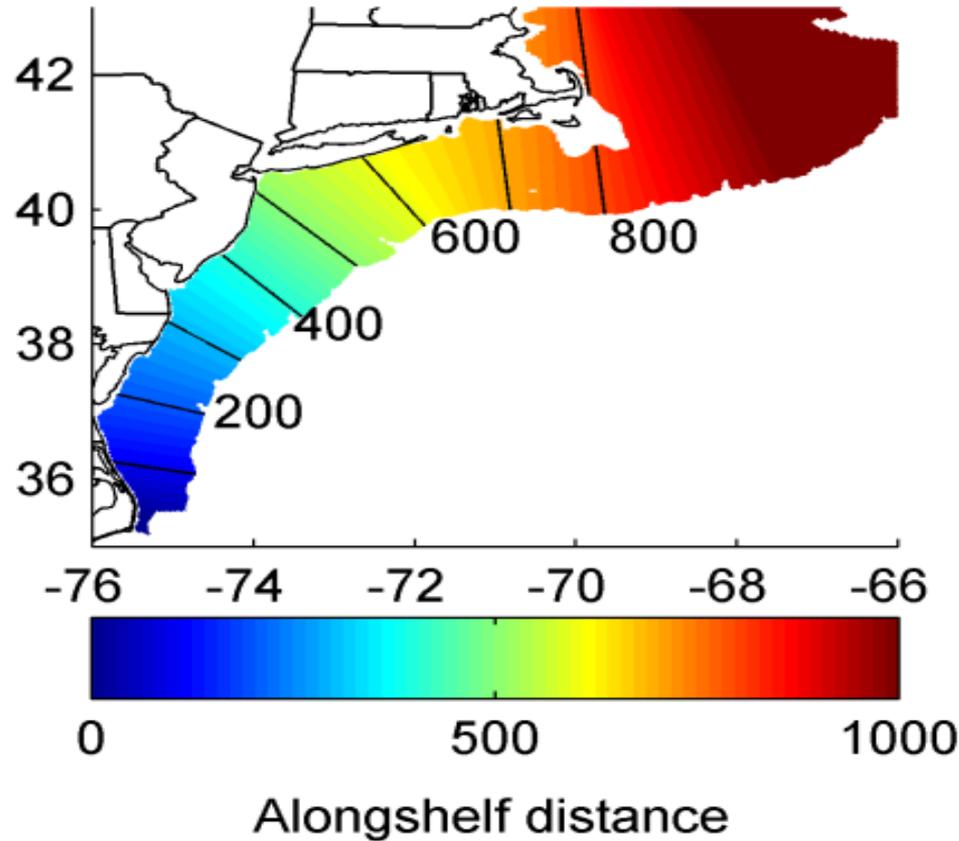
Distribution shift patterns? Factors driving distribution shifts?

Hare, Richardson, Bell (NEFSC) & Griffis, Morrison (NOAA-HQ)

ASMFC Management and Science Committee



Quantifying stock distribution shifts



NEFSC trawl survey
data analysis

Inshore and offshore
strata

1972 – 2008

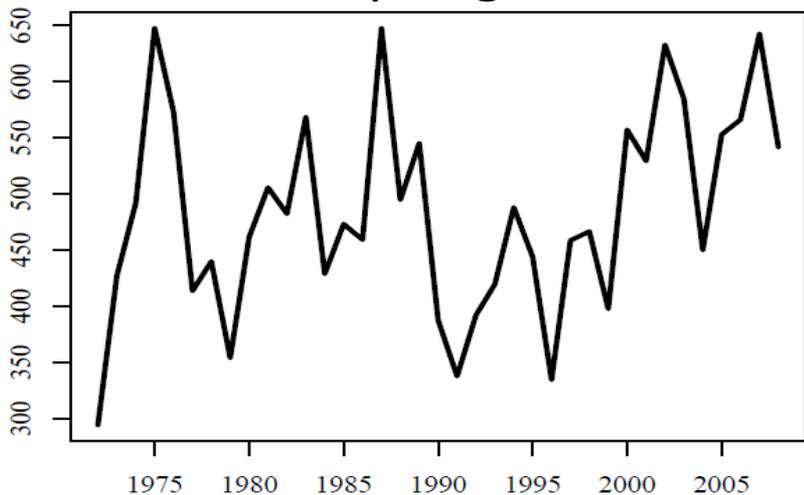
Center of Biomass: the distance along the Northeast shelf

Changes in center of biomass by species and season



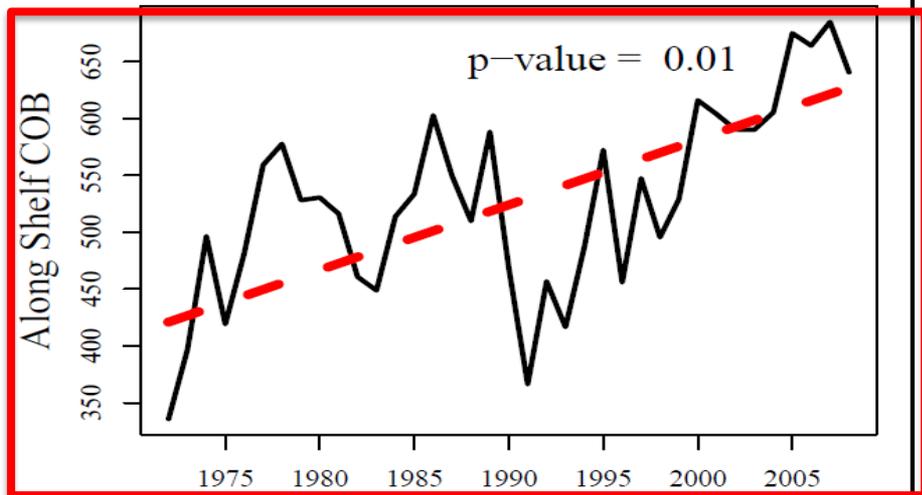
Spring

Summer Flounder

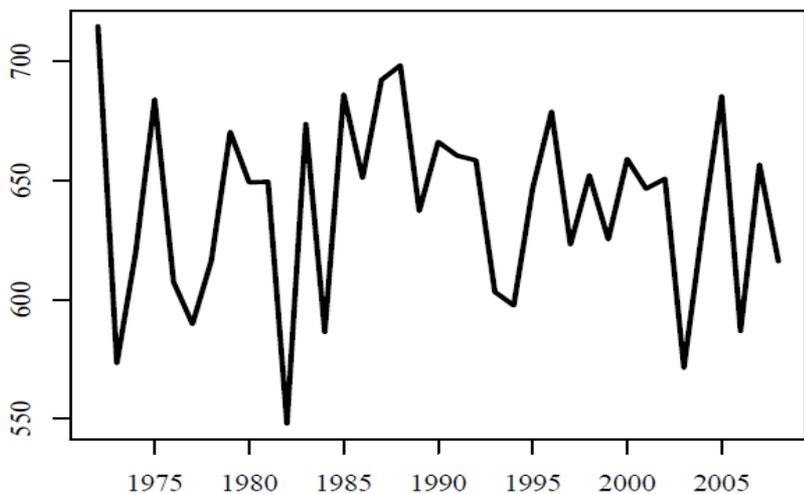


Fall

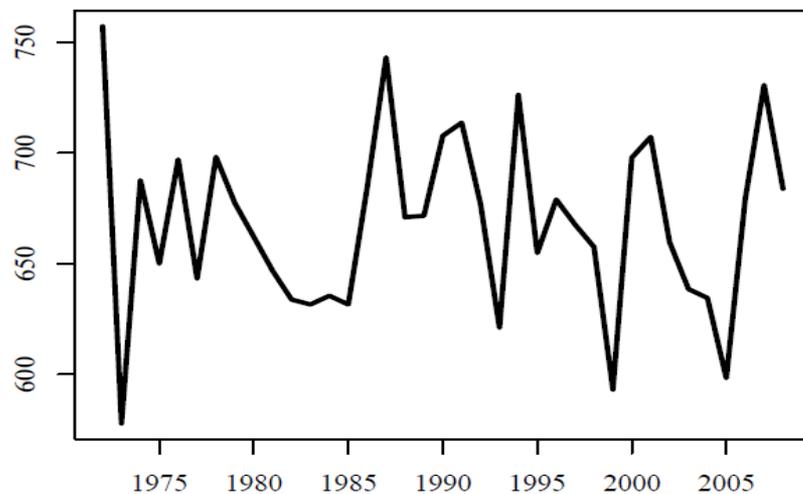
Along Shelf COB



Winter Flounder



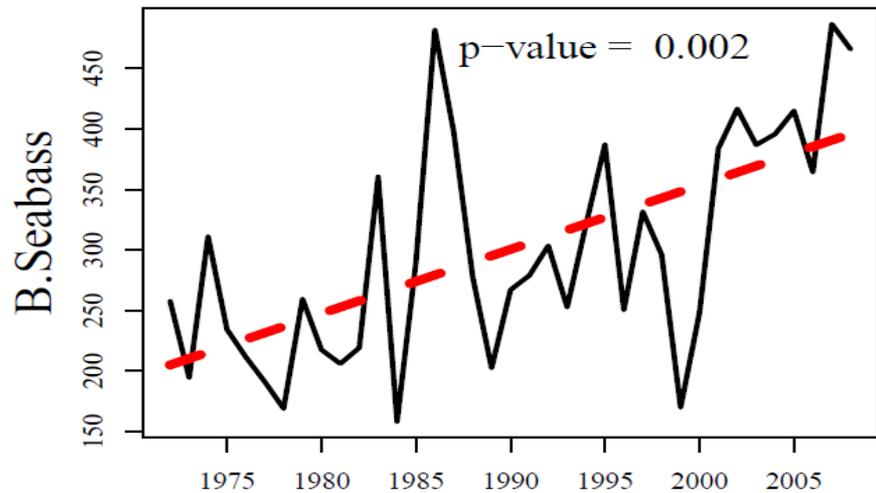
Along Shelf COB



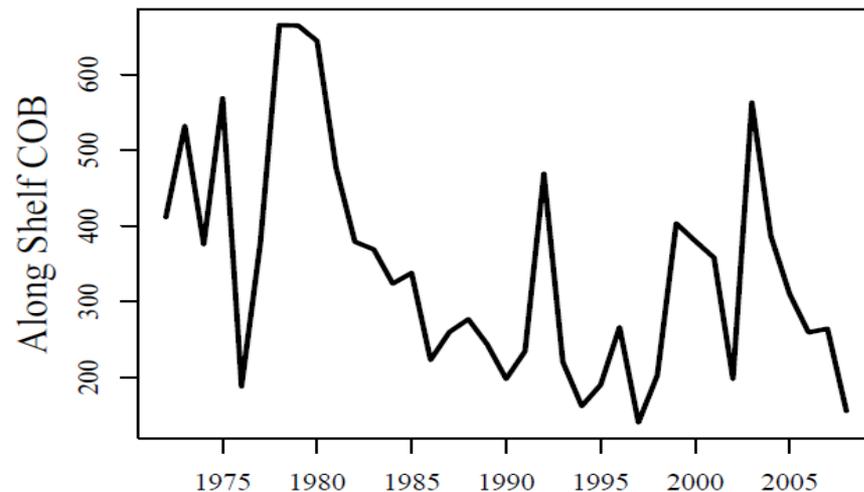
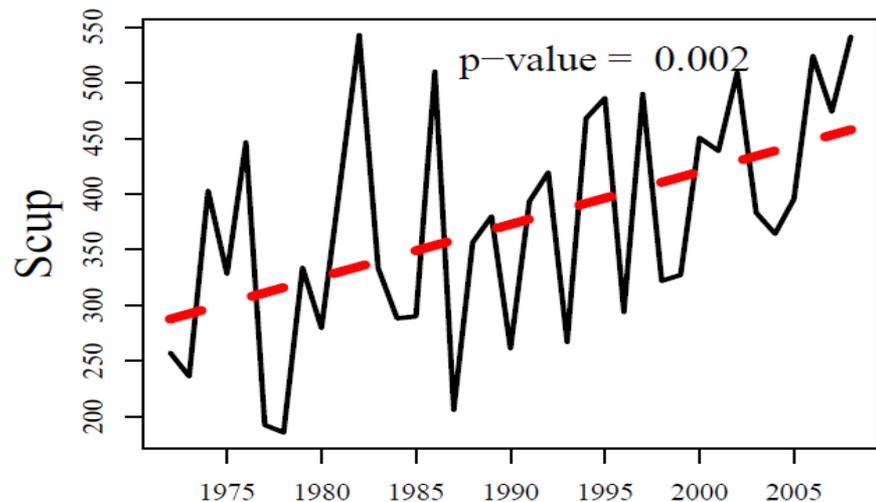
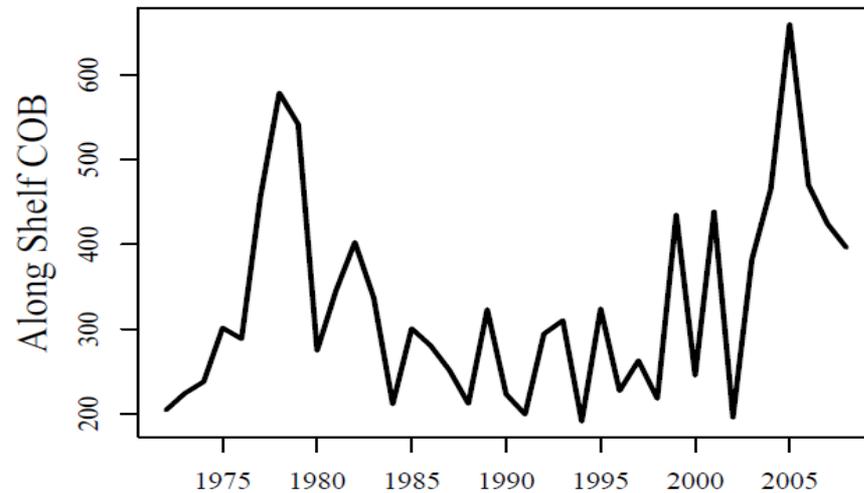
Changes in center of biomass by species and season



Spring



Fall

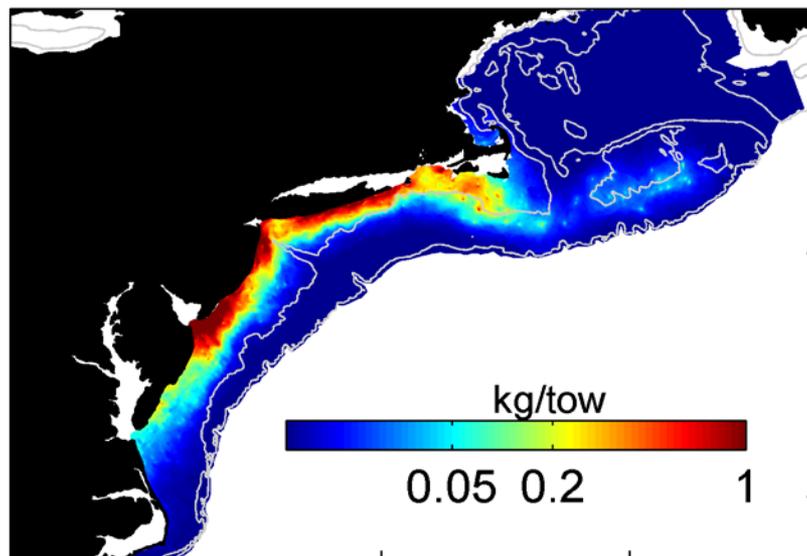


Summer Flounder

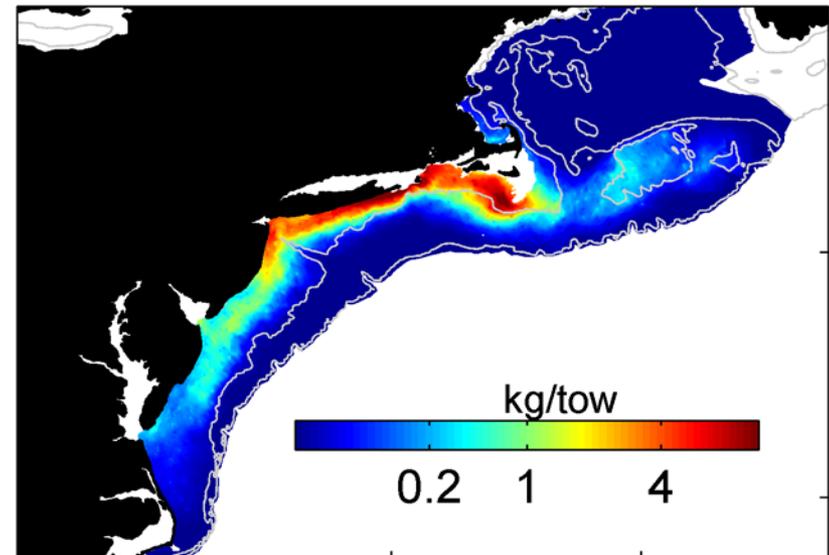


- poleward shift in distribution
- biomass increase over time

1980-1989



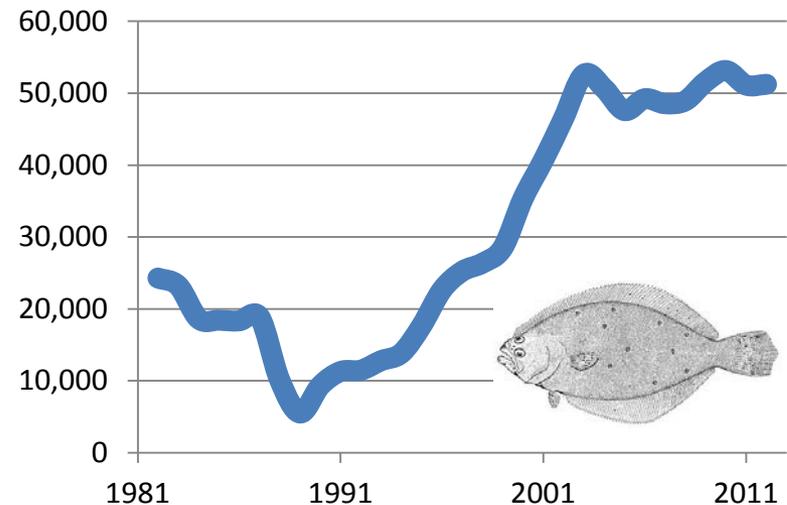
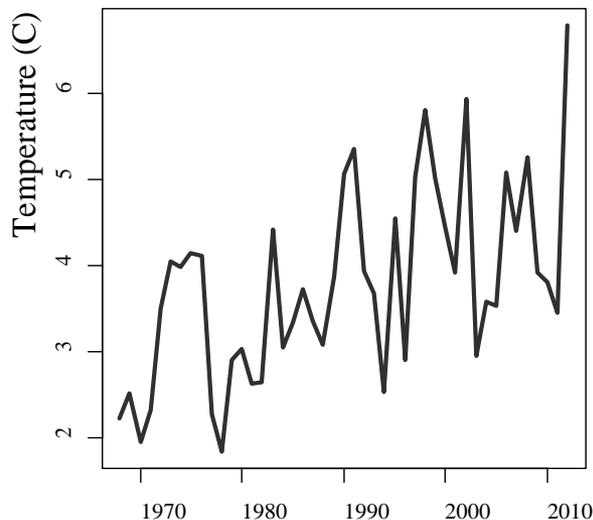
2000-2008



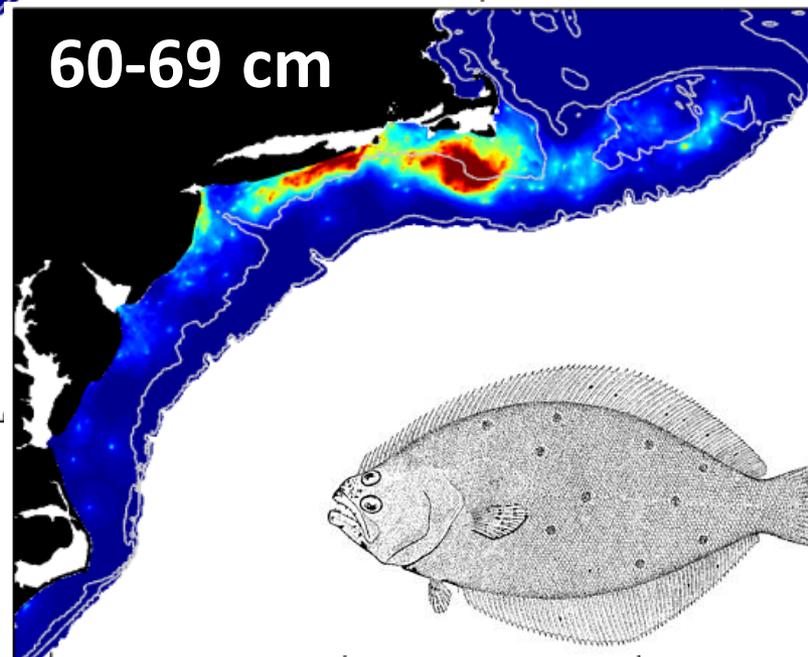
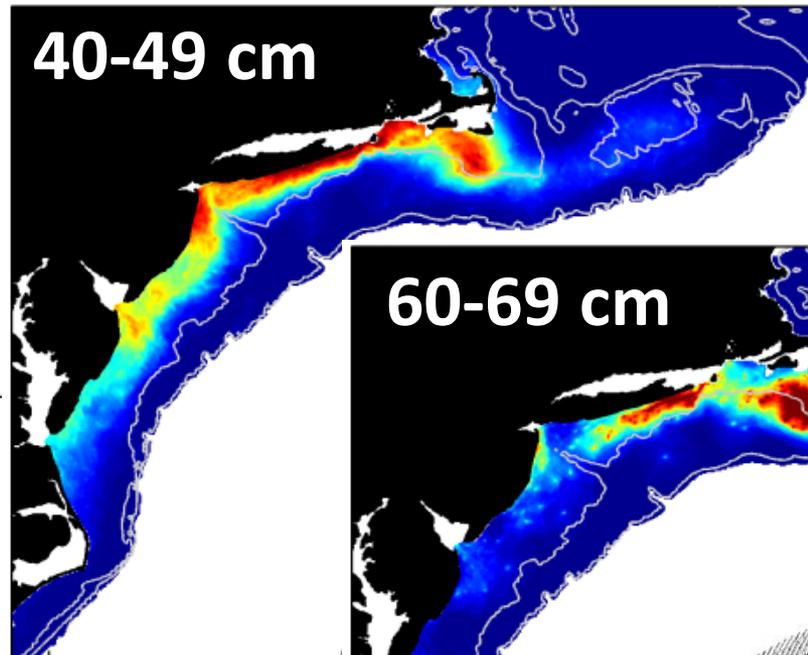
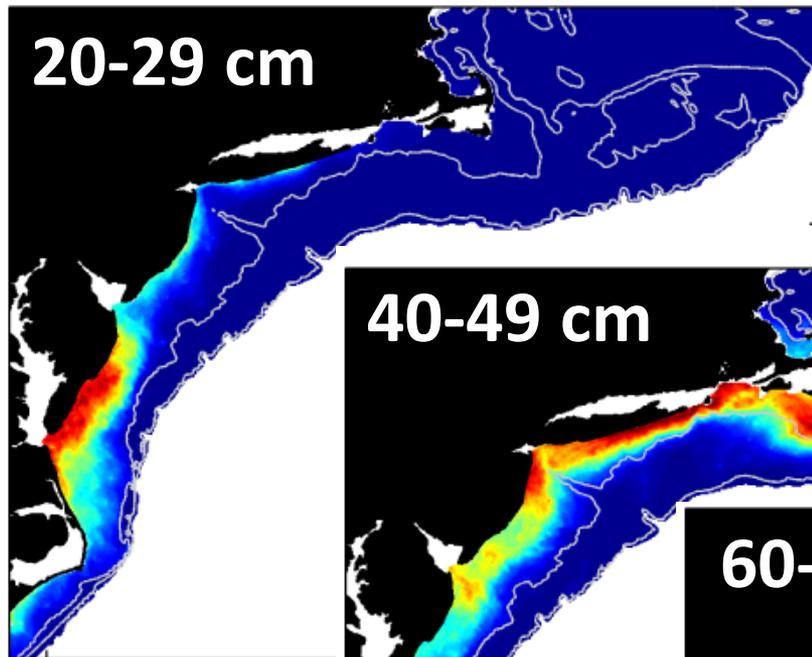
Factors driving distribution shifts



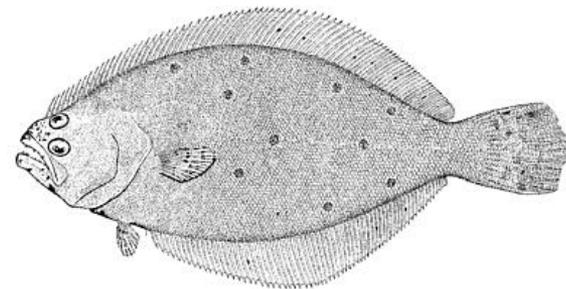
- Increasing temperature
 - Species tend to move north as temperatures warm
- Changes in population abundance
 - Populations occupy a larger, expansive area as numbers increase
- Changes in population size structure
 - Reducing fishing pressure tends to result in larger fish
 - Larger fish often occur further north than smaller fish



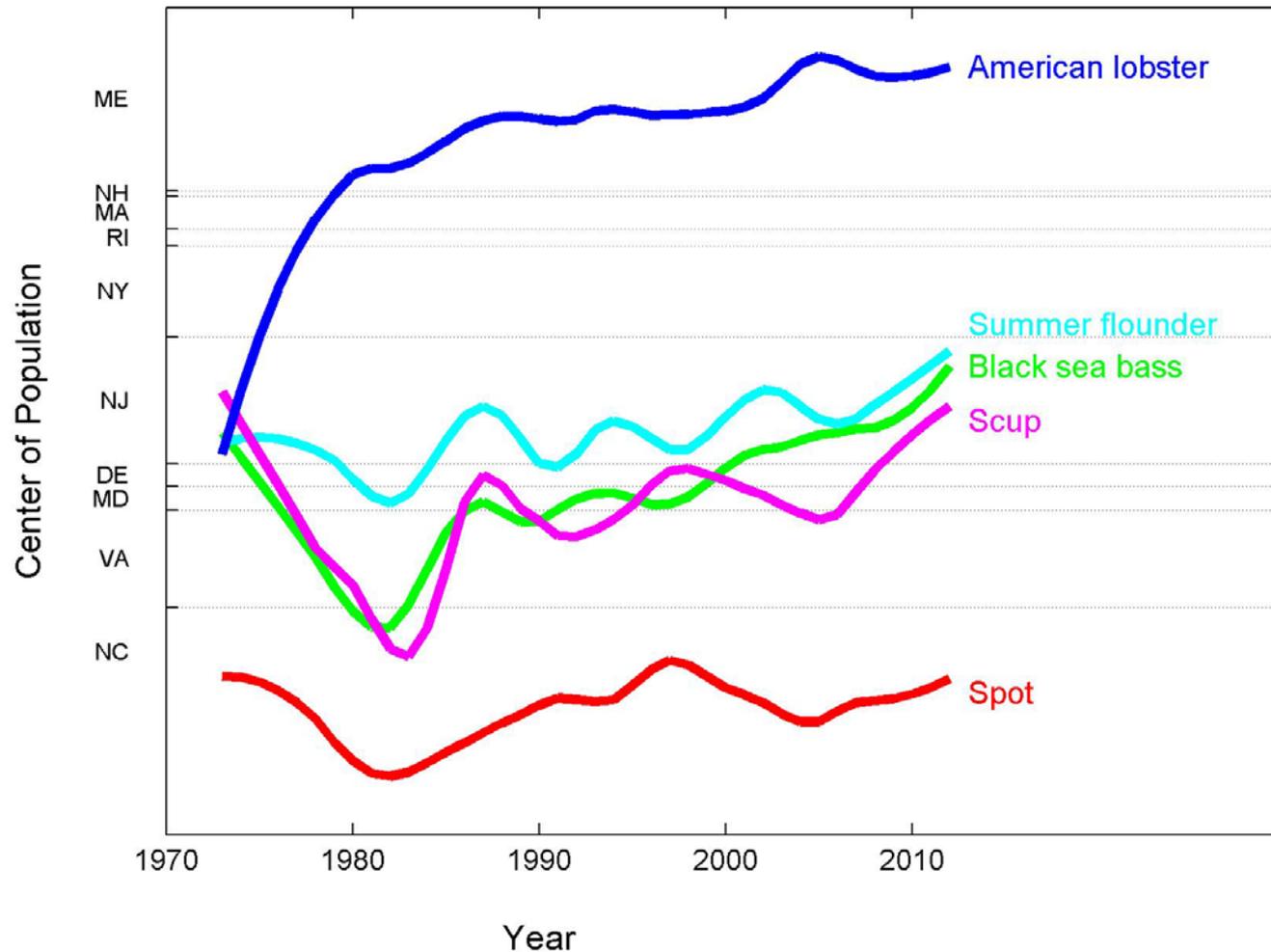
Summer flounder size structure



**Smaller fish further south
Larger fish further north
Fishing a major factor in the
size distribution of a population**



Stock shifts by Atlantic state borders



Conclusions – Stock Distribution Shifts



- Climate change and stock distribution relationships are **COMPLICATED**
- Evidence of poleward shift in black sea bass, scup and summer flounder
 - Significant impact of temperature on shift in black sea bass and scup
 - Shift in summer flounder largely driven by recovery and expansion of the length distribution
- Winter flounder stock not shifting
- Fishing pressure and climate both impact distribution and abundance

Exploring Harvest Reallocation Options



- 1) Survey of fisheries managers
- 2) Define methods for adjusting harvest allocations
- 3) Define frequency for re-evaluating stock distribution changes and allocations

Reallocation Survey Responses



- 73% did not support status quo (maintain percent allocations by state based on historical catches)

New allocation options

- 1) Biomass → Harvest - harvest %s proportional to changes in biomass %s (trawl survey data)
- 2) **50/50 - half of harvest based on new biomass, half based on historical allocation**
- 3) Fishery Performance – harvest allocations based on recent catch and retention rates

Reallocation Survey Responses



Flexible landing options

- 1) Fishermen land in the state closest to catch, count toward state quota where licensed
- catch off NJ, land in NJ → VA quota

- 2) Fishermen land in the state closest to catch, count toward state quota where landed
- catch off NJ, land in NJ → NJ quota

Reallocation Survey Responses



Recovered Stocks and Reallocation

77% would support allocating 'surplus biomass' to the states experiencing increases associated with a shifting stock

State vs. coast wide or regional allocations

60% would not support changing from state-by-state to coast wide or regional quotas

Frequency of allocation adjustments

83% supported 3-5 year intervals

Reallocation Process



Stock shifts occurring and re-allocation should be considered for black sea bass, summer flounder, and scup

ASMFC process:

Species Technical Committee determines appropriate data sources for detecting changes; provides harvest allocation numbers using 50/50 or other % options

Species Management Board selects a preferred option, or creates ad hoc regional quotas

States develop regulations to meet regional conservation

*to date, changes in recreational allocations only

Focus Areas for Future Investigations



Poleward shifts of North Atlantic stocks
- lobster, cod, pandalid shrimp

Poleward shifts of South Atlantic stocks
- red drum, tilefish, tarpon, mahi
* New climate focus in stock assessments

Tracking shifts in habitat types & understanding stock productivity implications

- shoreline hardening + rising sea levels = estuarine SAV declines
- mangroves in Georgia?
- Fish Habitat Partnership assessments

Harvest Allocation Winners and Losers

Socioeconomic analysis of re-allocation

45-Inch Red Drum Caught on Cape Cod

September 4, 2015 • moldychum



Questions for MAFAC



- Is this the best approach to investigating climate impacts on stock distributions?
- Are the re-allocation methods and outcomes reasonable? for commercial and recreational sectors?
- Climate-fisheries interactions may differ by region; what additional factors should be considered in your region?