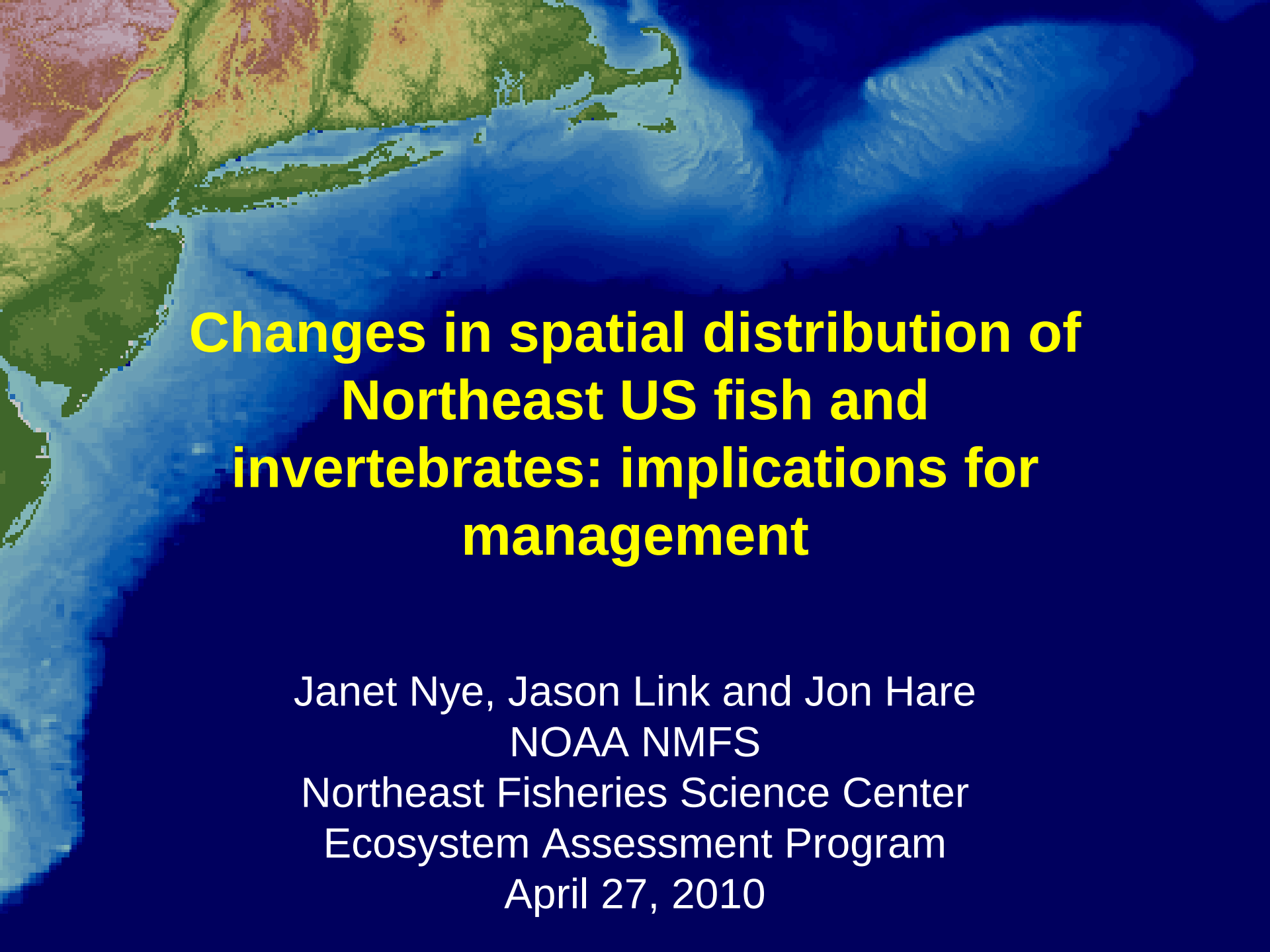

Changes in spatial distribution of Northeast US fish and invertebrates: implications for management

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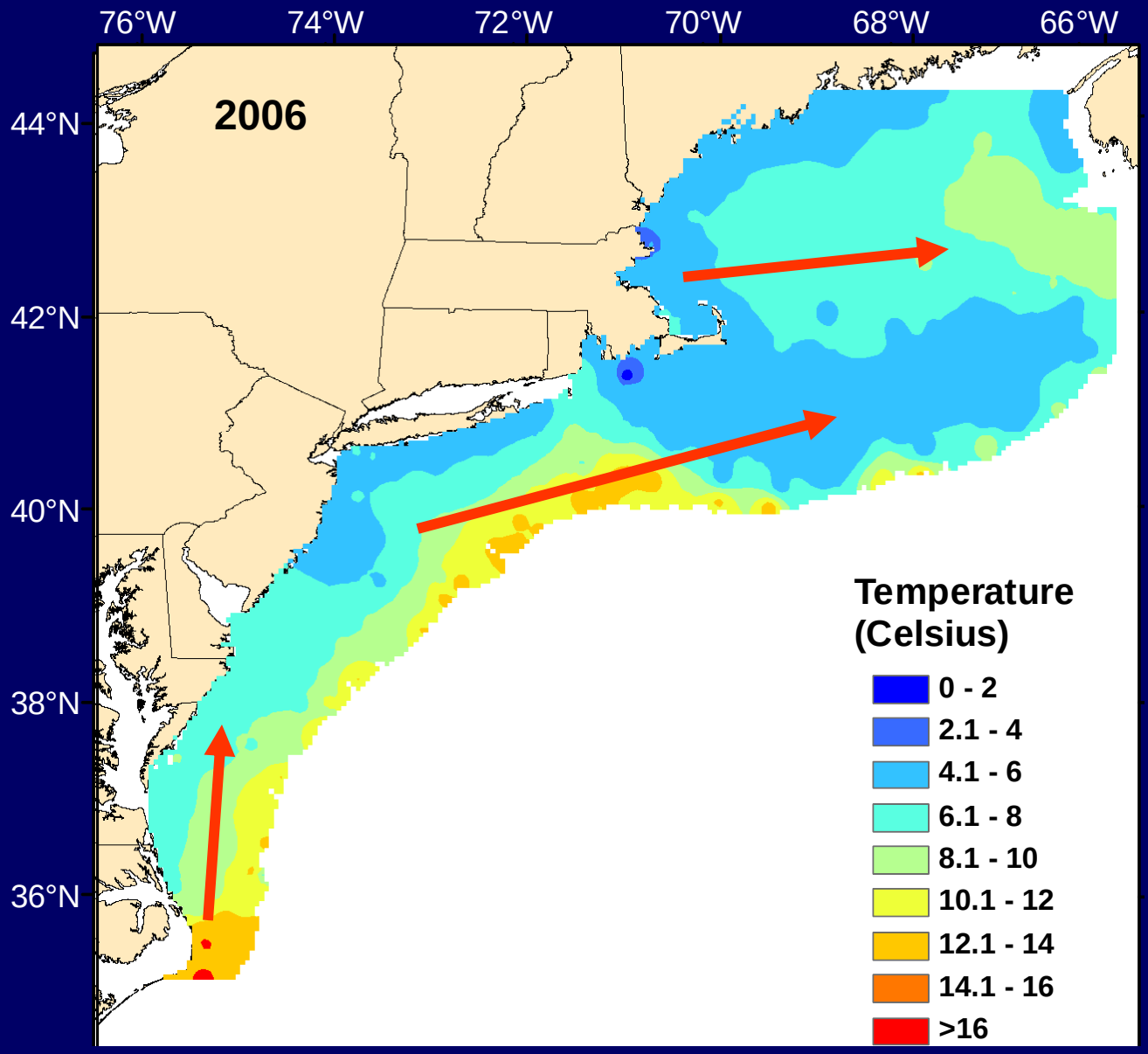
NOAA NMFS
Northeast Fisheries Science Center
Ecosystem Assessment Program
April 27, 2010

Hypothesized shifts in distribution



Objectives

- Identify trends consistent with warming scenario
  - Change in center of biomass
  - Change in depth
  - Range contraction or expansion
  - Increase/decrease in maximum/minimum latitude
  - No distributional changes, but an increase in mean temperature of occurrence
- How are these trends related with warming and stock size?

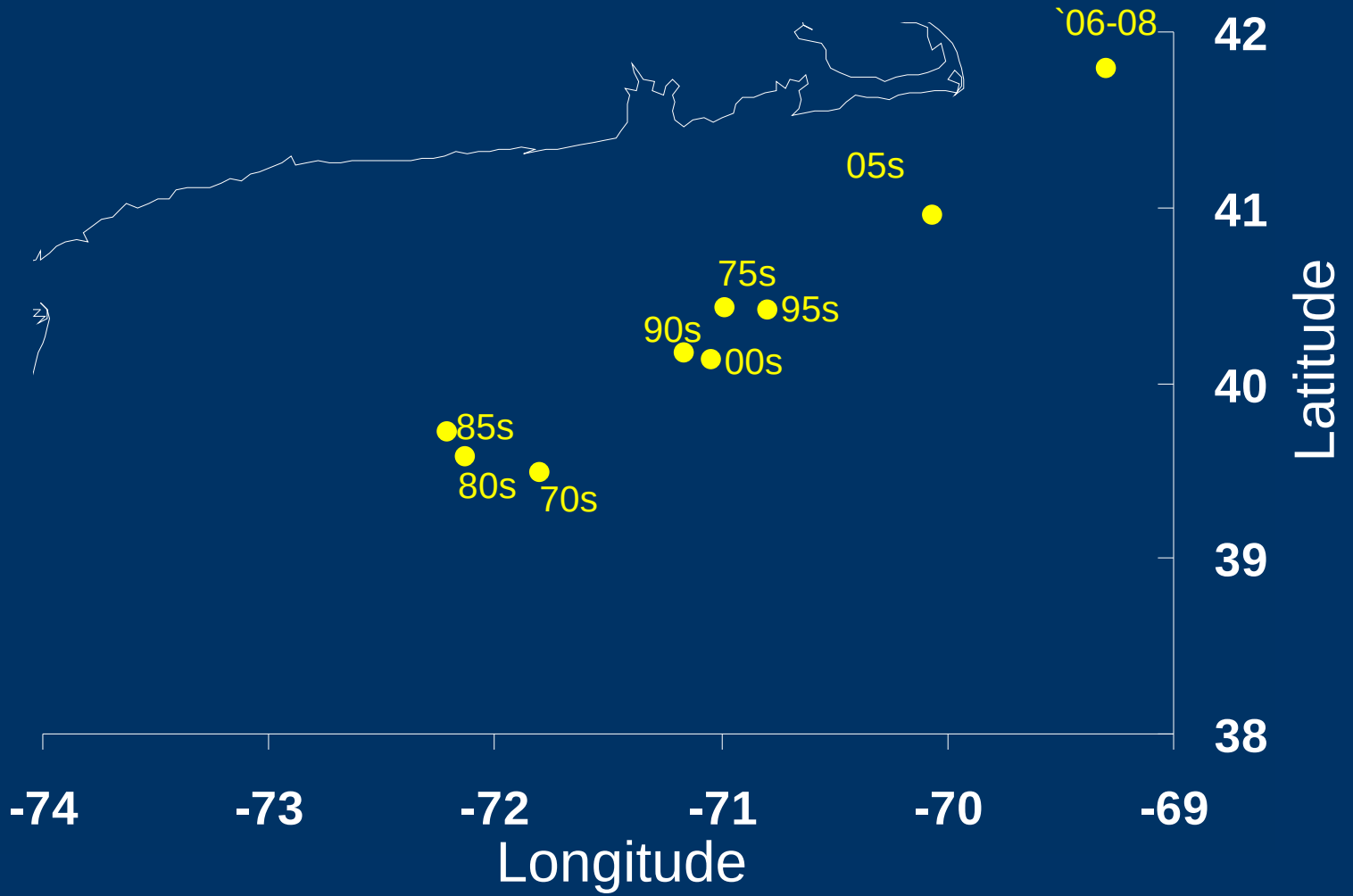
Stocks examined

- White hake
- Silver hake-N
- Silver hake-S
- Red hake-N
- Red hake-S
- Atlantic cod-N
- Atlantic cod-S
- Haddock-N
- Haddock-S
- Pollock
- Spotted hake
- Cusk
- Halibut
- American plaice
- Summer flounder
- Fourspot flounder
- Yellowtail flounder-N
- Yellowtail flounder- S
- Winter flounder-N
- Winter flounder-S
- Windowpane
- Spiny dogfish
- Winter skate
- Little skate
- Thorny skate
- Atlantic herring
- Alewife
- American shad
- Atlantic mackerel
- Acadian redfish
- Blackbelly rosefish
- Longhorn sculpin
- Searaven
- Atlantic wolfish
- Ocean Pout
- Goosefish

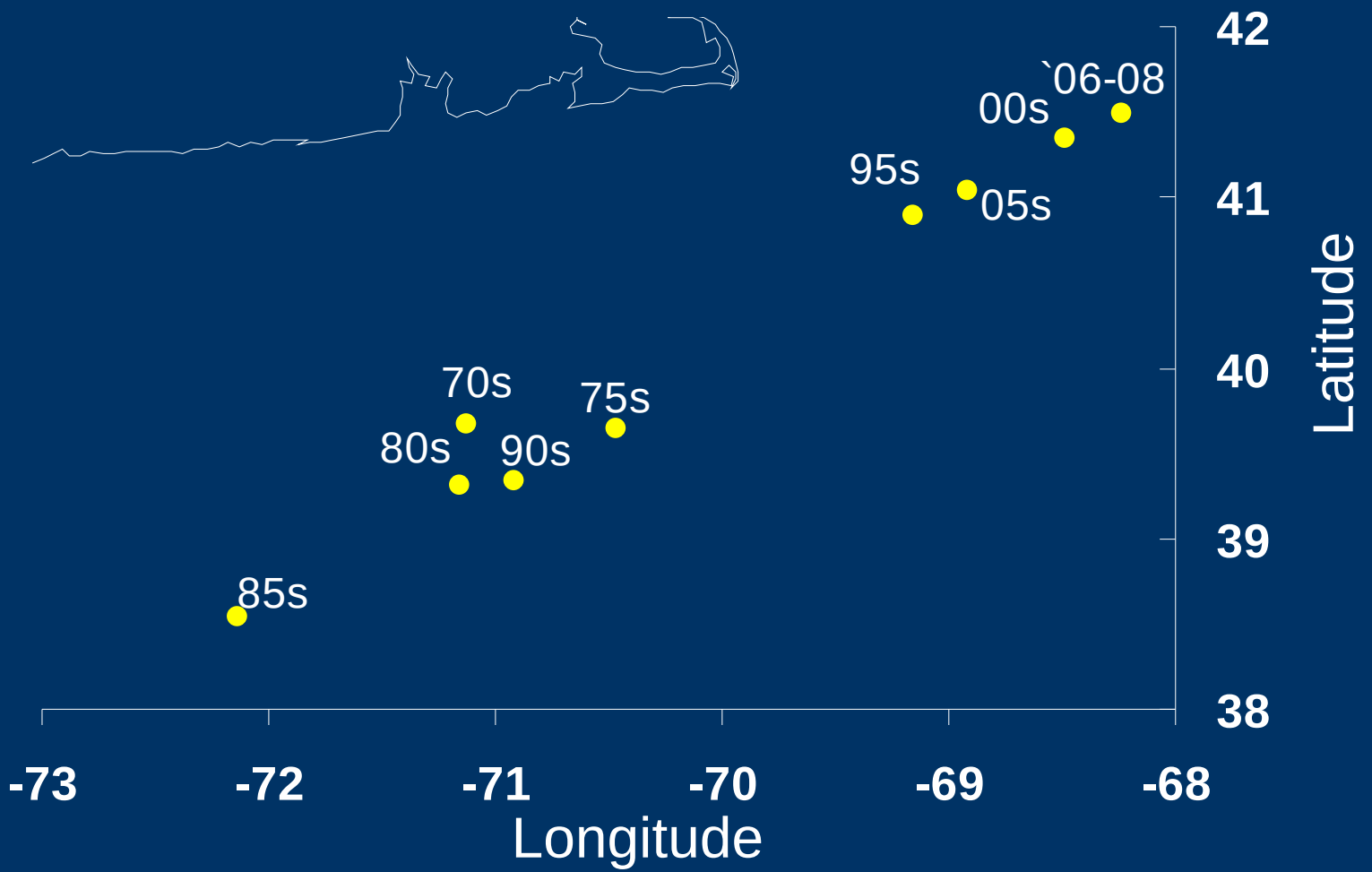
Significant changes in spatial distribution consistent with warming in 24 of 36 stocks

Nye et al. 2009 MEPS 393:111-129

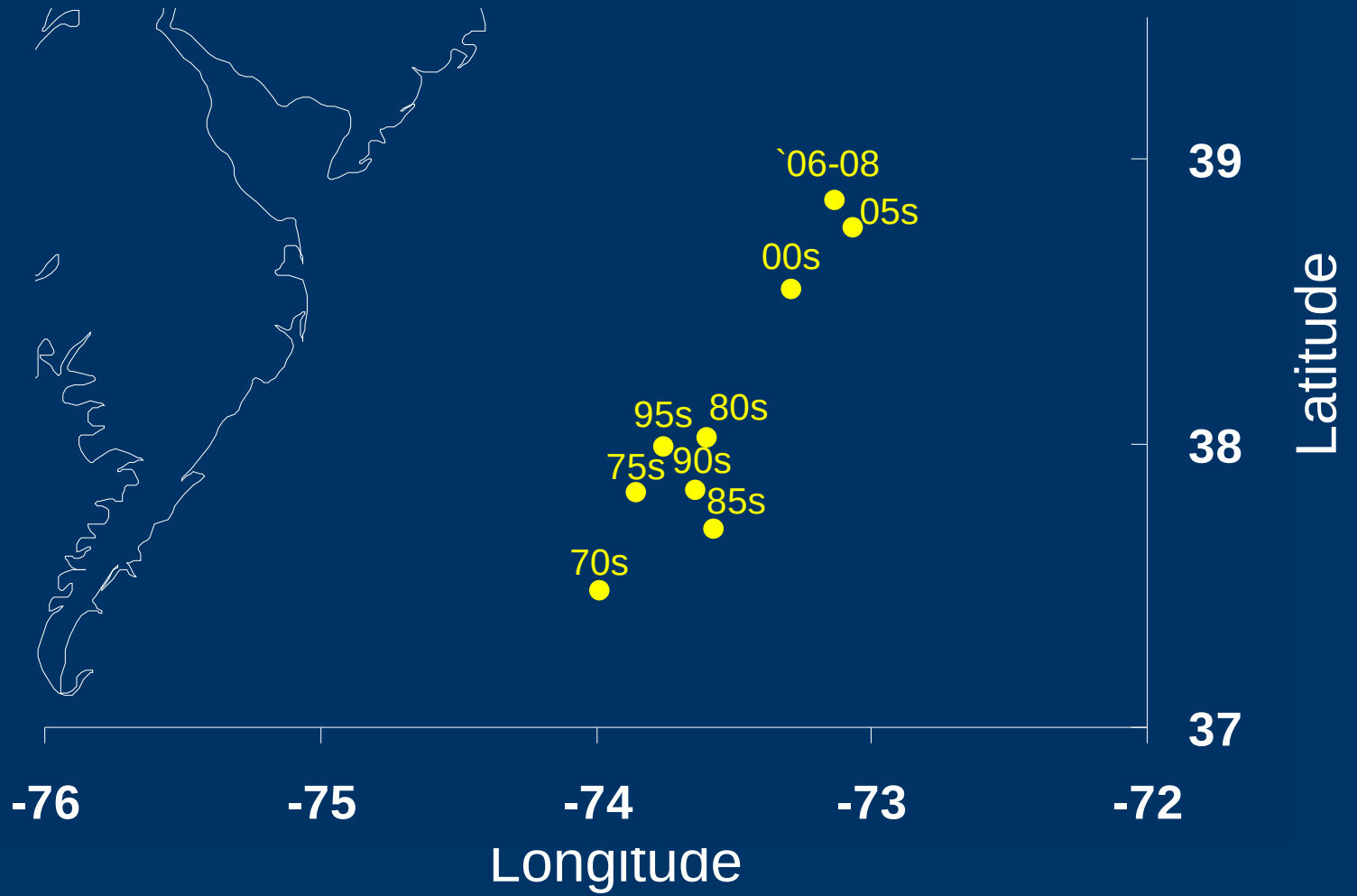
Changes in Center of Biomass
American shad



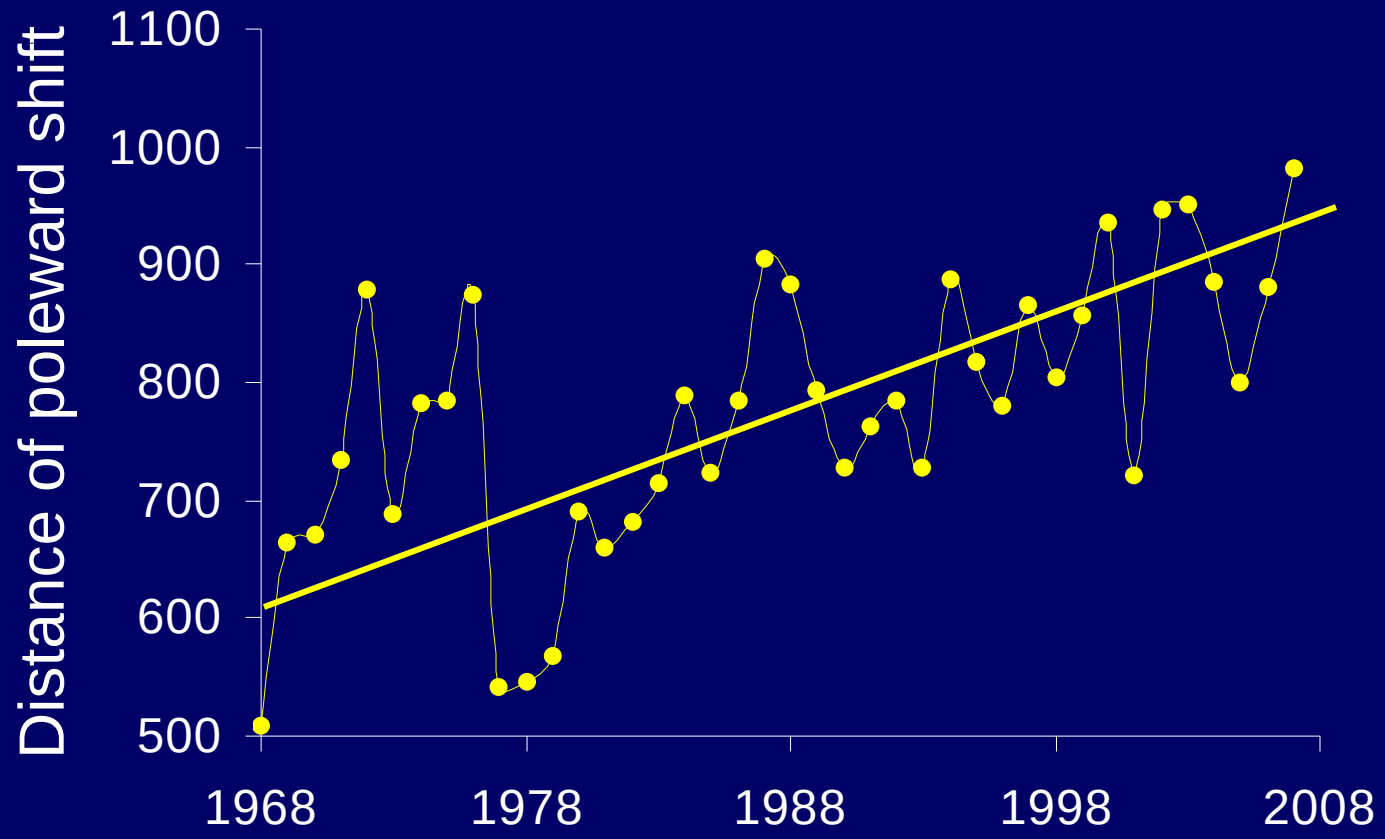
Changes in Center of Biomass
Blackbelly rosefish



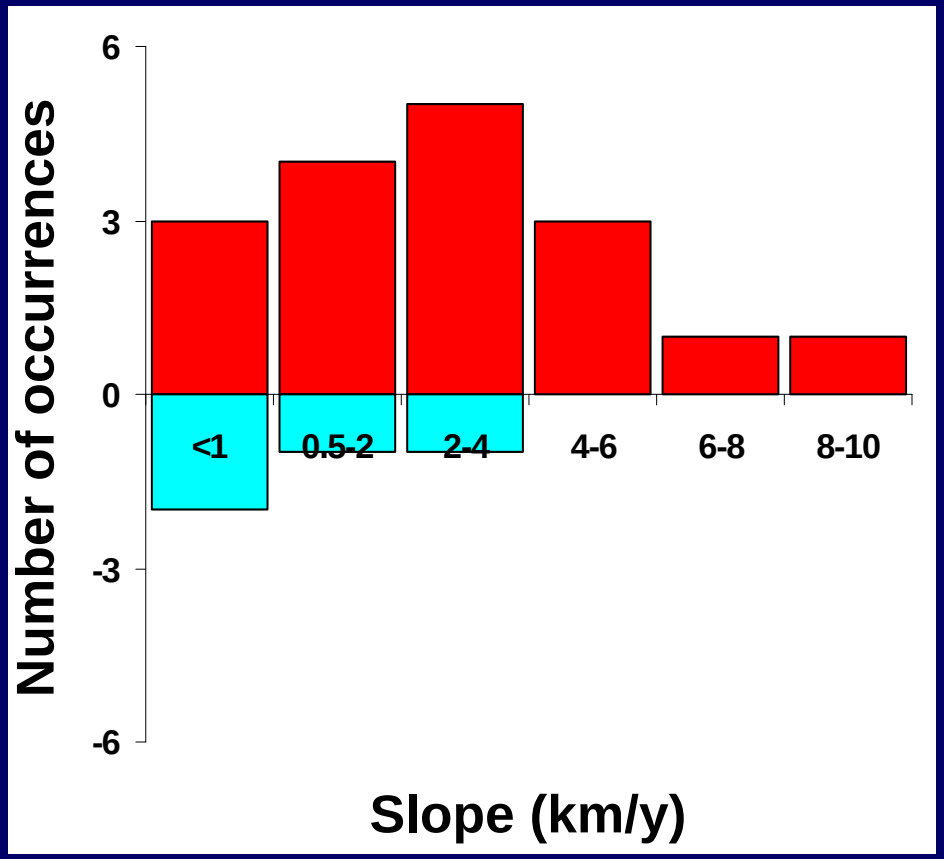
Changes in Center of Biomass
Spotted hake



Time series of poleward shift
American shad



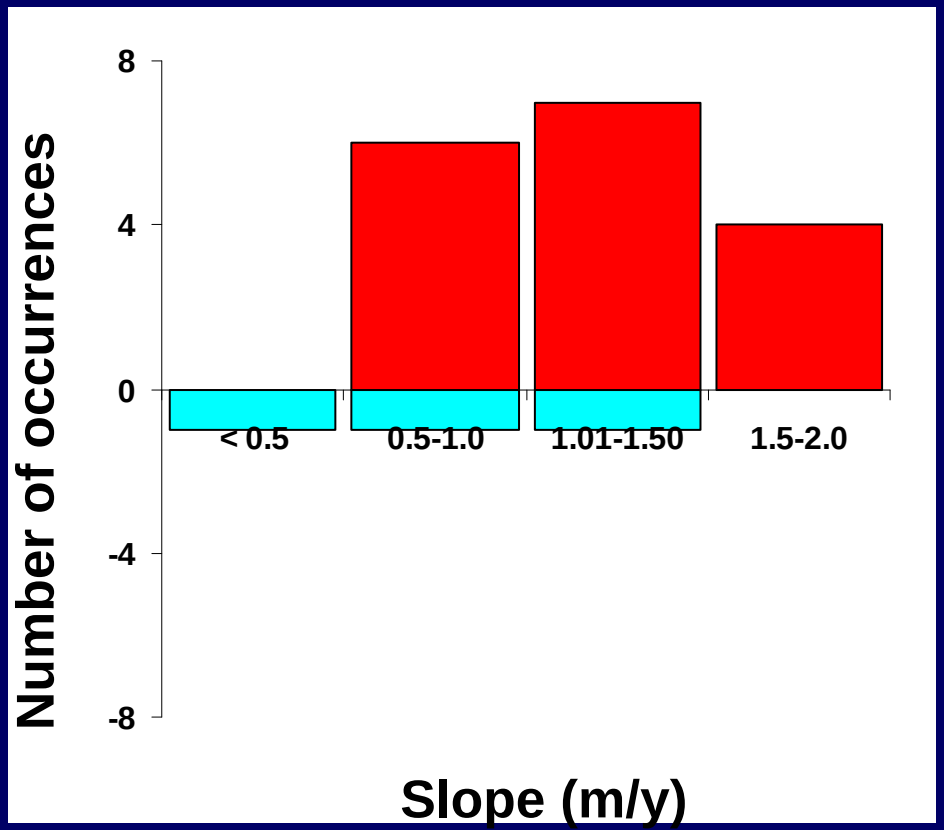
Significant shifts in center of biomass



17 of 36 stocks exhibit northward shift in center of abundance

4 of 36 stocks exhibit southward shift in center of abundance

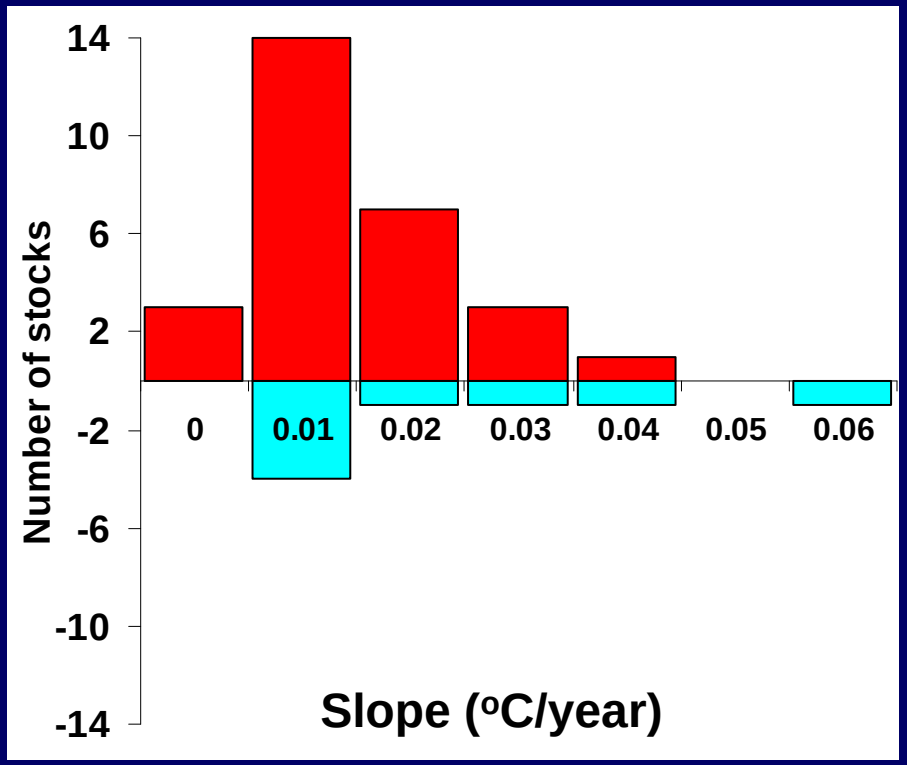
Significant shifts in mean depth



17 of 36 stocks occupied increasingly greater depths

3 of 36 stocks occupied increasingly shallow depths

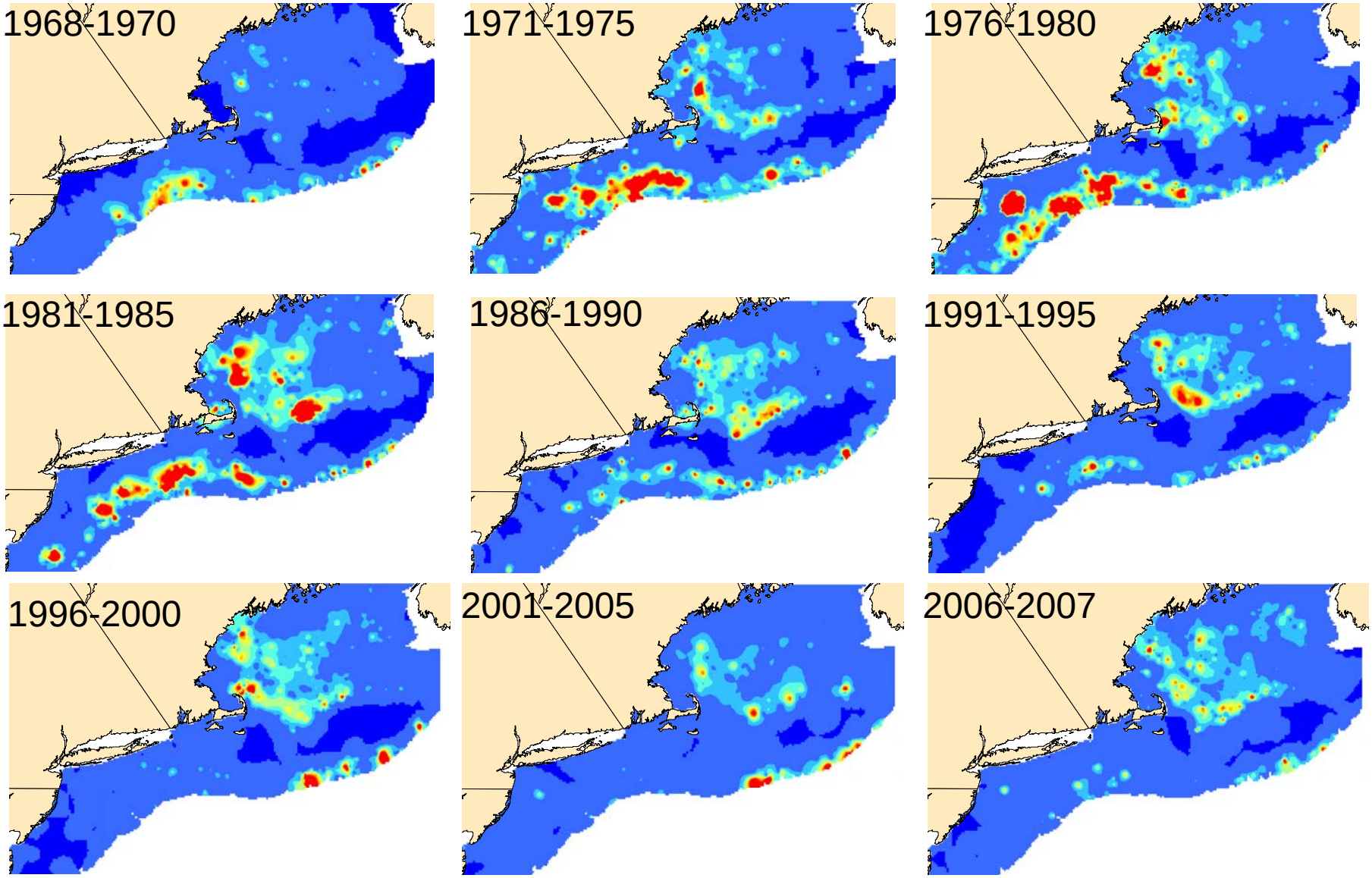
Few species alter temperature of occurrence



Only Atlantic herring and pollock exhibit increases in mean temperature of occurrence

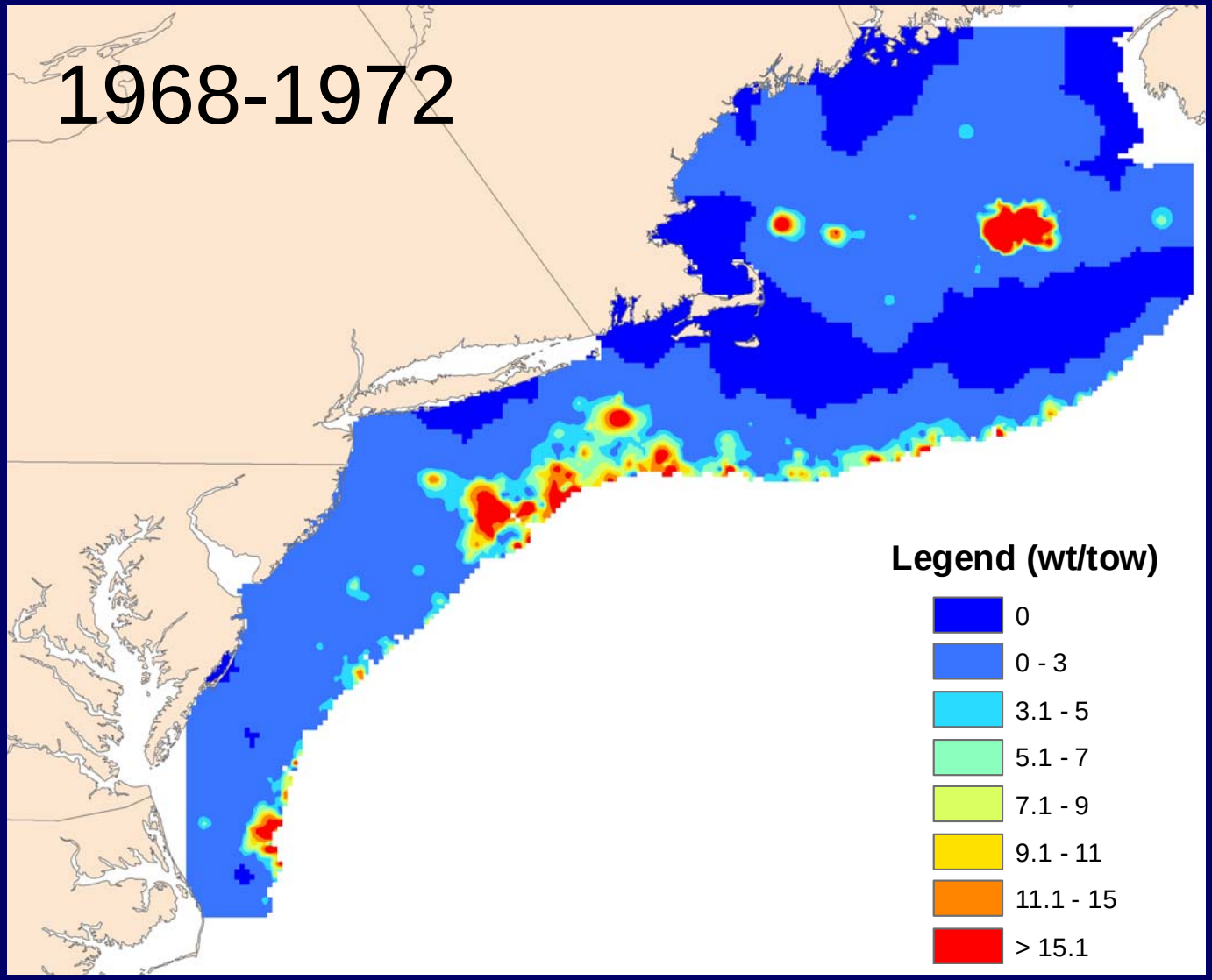
Only American shad and blackbelly rosefish exhibit decreases in the mean temperature

Changes in red hake spatial distribution

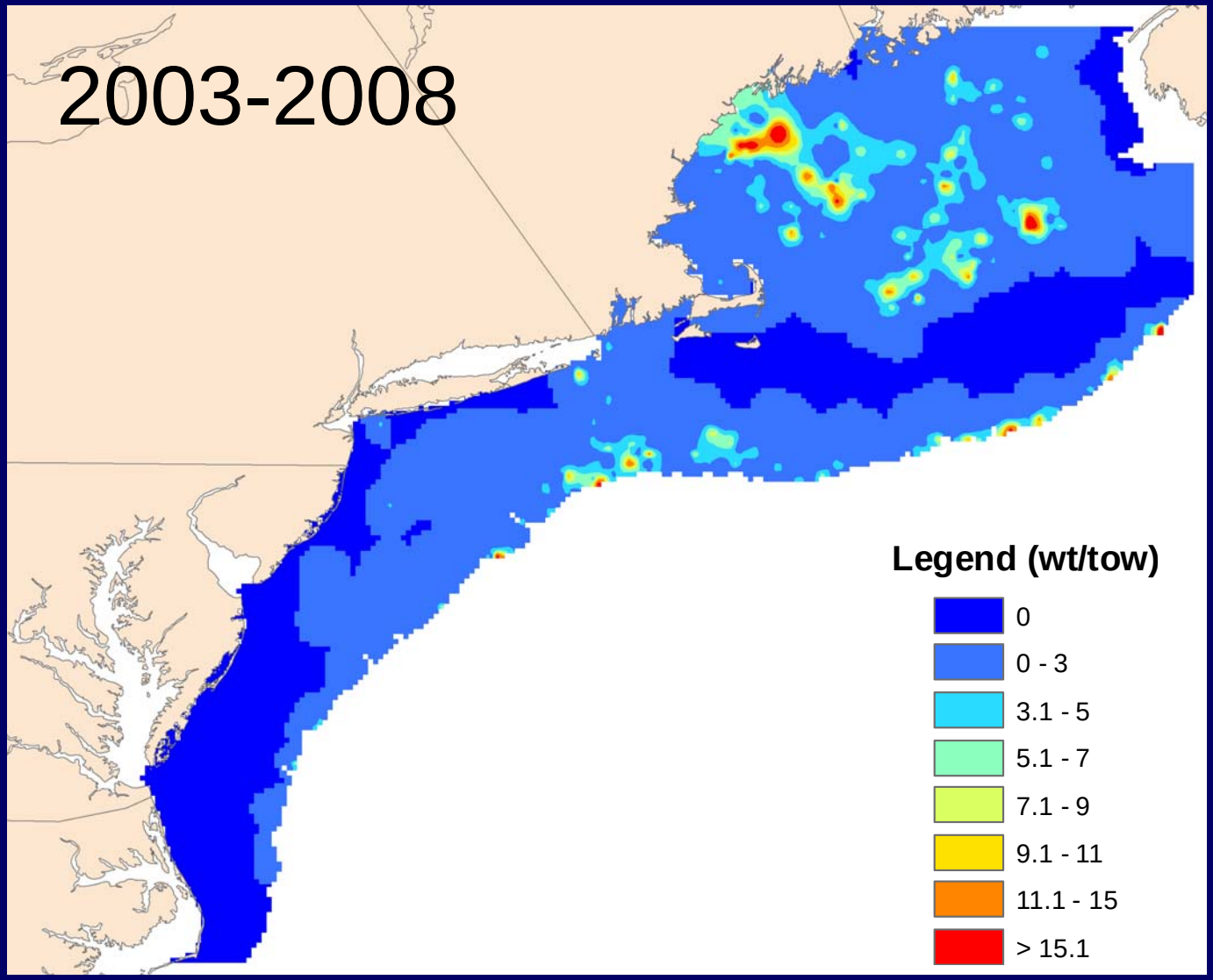


Nye et al. 2009 MEPS 393:111-129

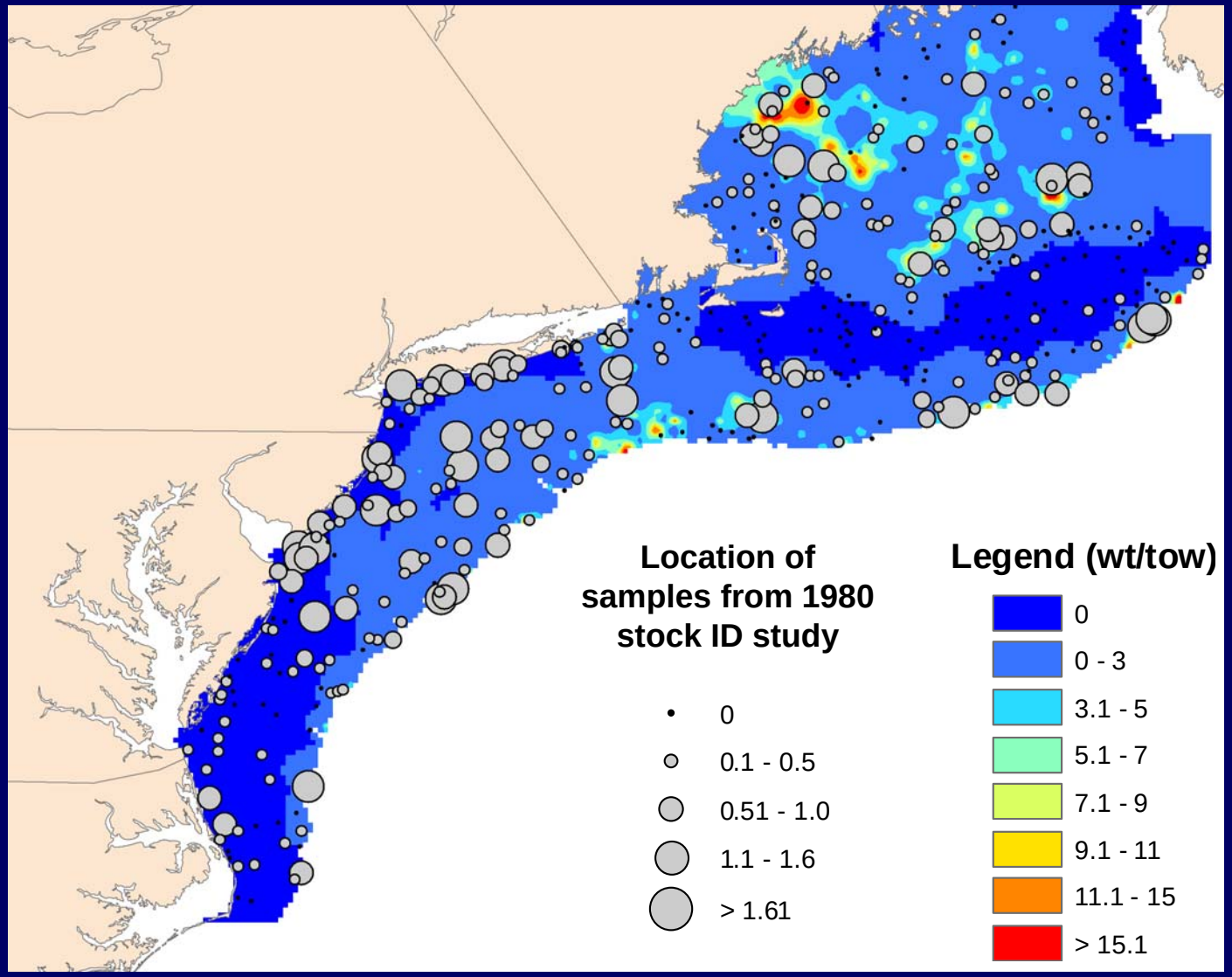
Silver hake stock structure



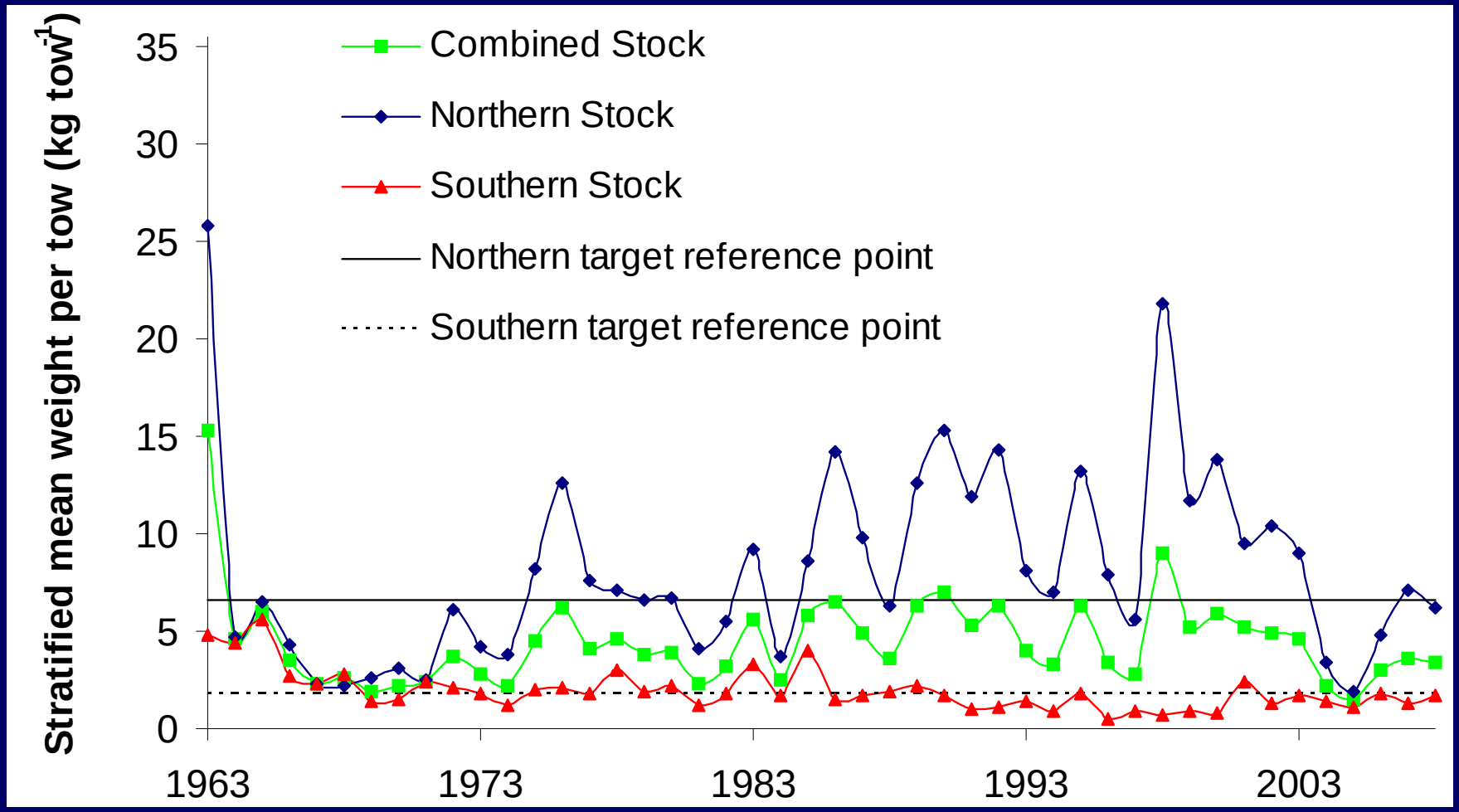
Silver hake stock structure



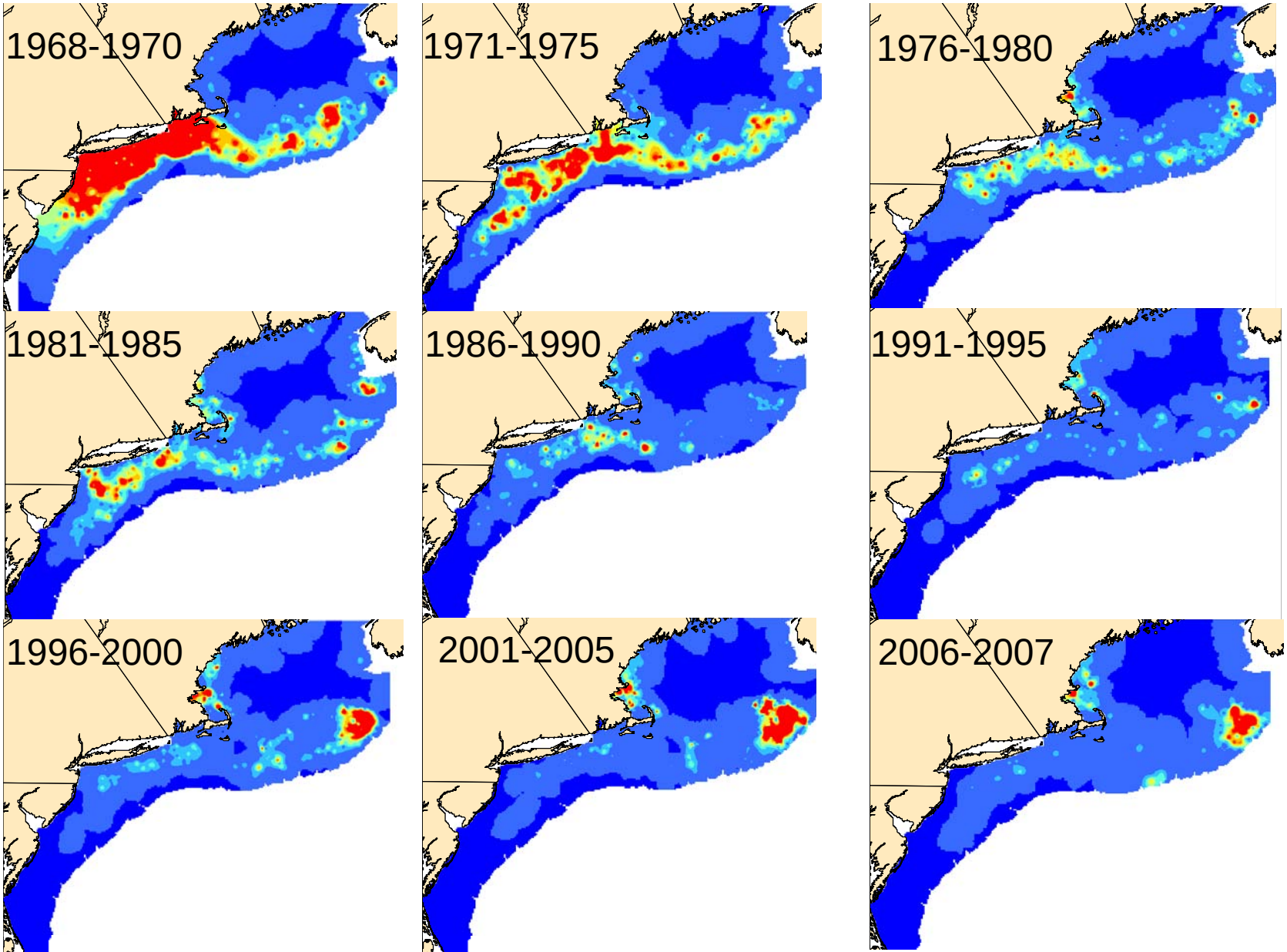
Silver hake stock structure



Management implications

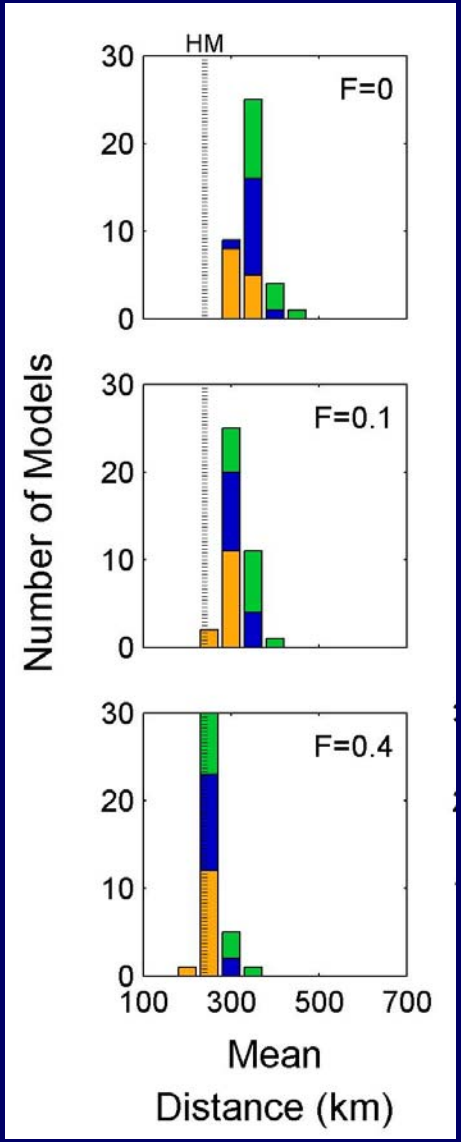


Changes in yellowtail flounder distribution



Consider climate and fishing simultaneously

- Shifts of greatest magnitude were in unfished stocks
- Fishing may have reduced the adaptive capacity of some stocks to shift spatial distribution in response to climate



Hare et al. 2010 Ecological Applications 20(2):452-464

Conclusions

- Distributional responses consistent with warming were evident in over half of the stocks examined
- Changes in community assemblage (9am Wednesday, Lucey and Nye)
- Must re-evaluate stock structure of these species now
- Must consider climate change as a factor inhibiting recovery of some stocks
- Must consider climate and fishing simultaneously-not separately

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- Participants of the NEFSC multispecies bottom trawl survey
- Ecosystem Assessment Group:
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