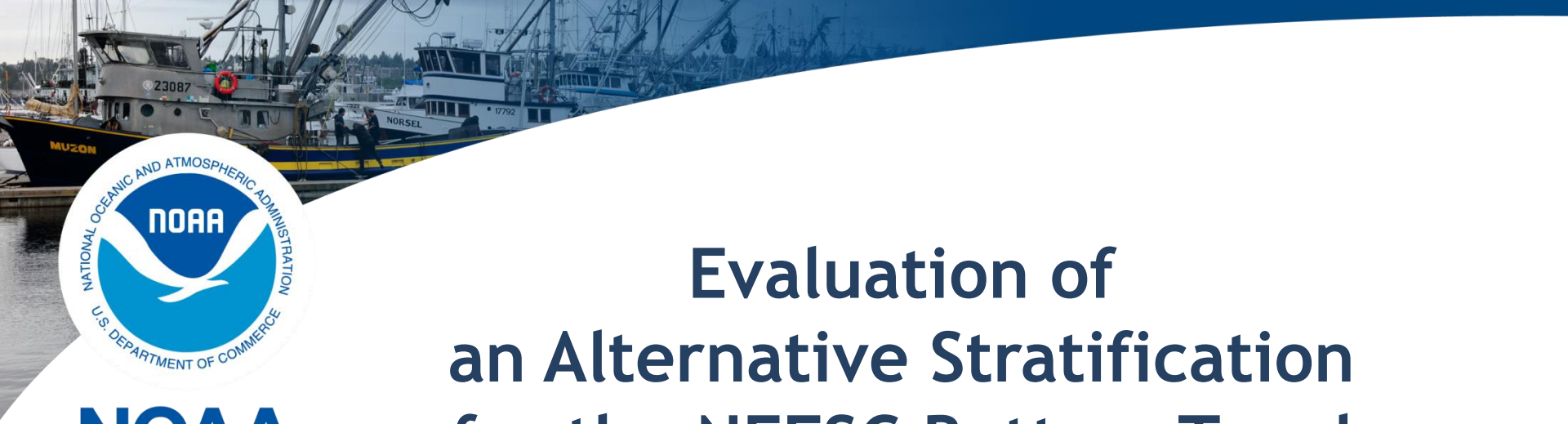

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Evaluation of an Alternative Stratification for the NEFSC Bottom Trawl Survey

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Background

There is interest from stock assessment scientists and the NTAP to consider alternative stratification for the Bottom Trawl Survey (BTS)

Motivations

- Disparity in sampling density between strata
- Better distribution of sampling effort
- Explicit recognition of Hague Line in stratification = improved stock assessment and management

Concerns/Considerations

- Minimize disruption in current time series
- Take into account known habitats, environmental gradients and differential species growth rates

Steps

1) Work with Population Dynamics Branch to identify a re-stratification scenario that is acceptable by consensus

2) Evaluate the implications of re-stratification on sampling density (allocation of sampling effort)

3) Evaluate the impact of re-stratification on stock abundance indices and time series

4) Make decision on implementation

Proposed re-stratification

- Two types of proposed changes:
  - Combine strata
  - Split strata

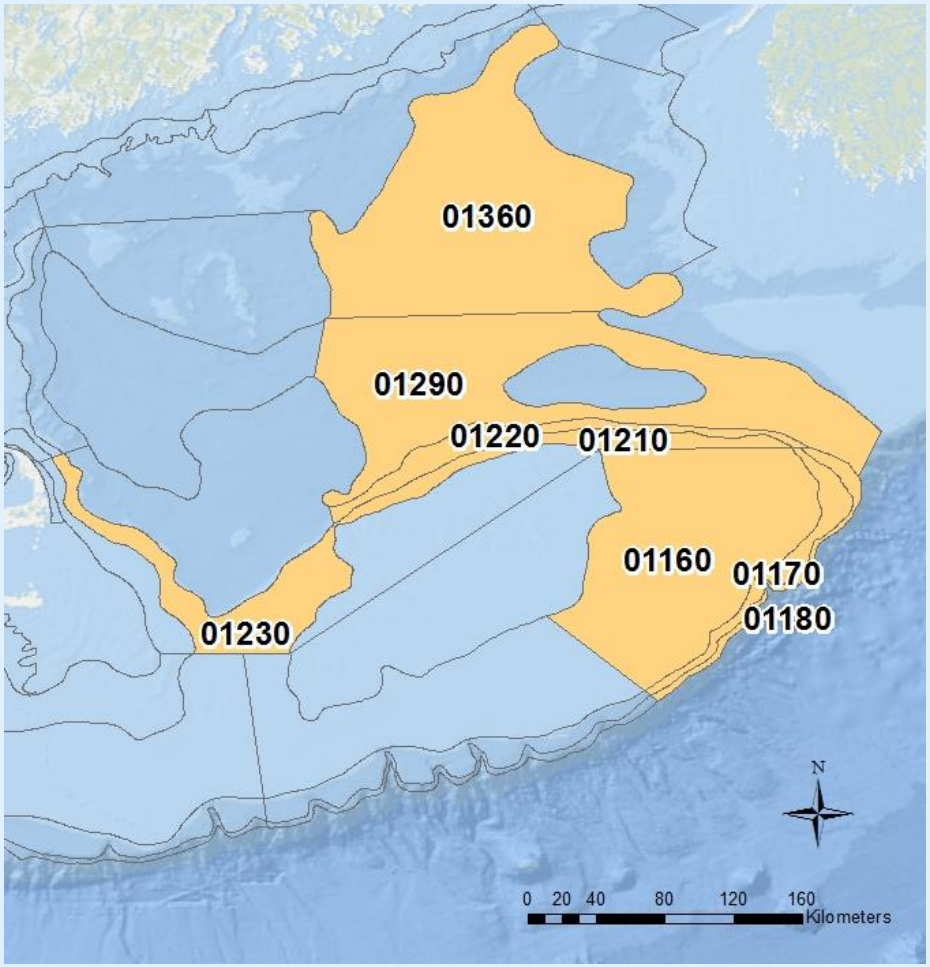
- No changes proposed in Cape Cod Bay, Massachusetts Bay due to importance to key stocks

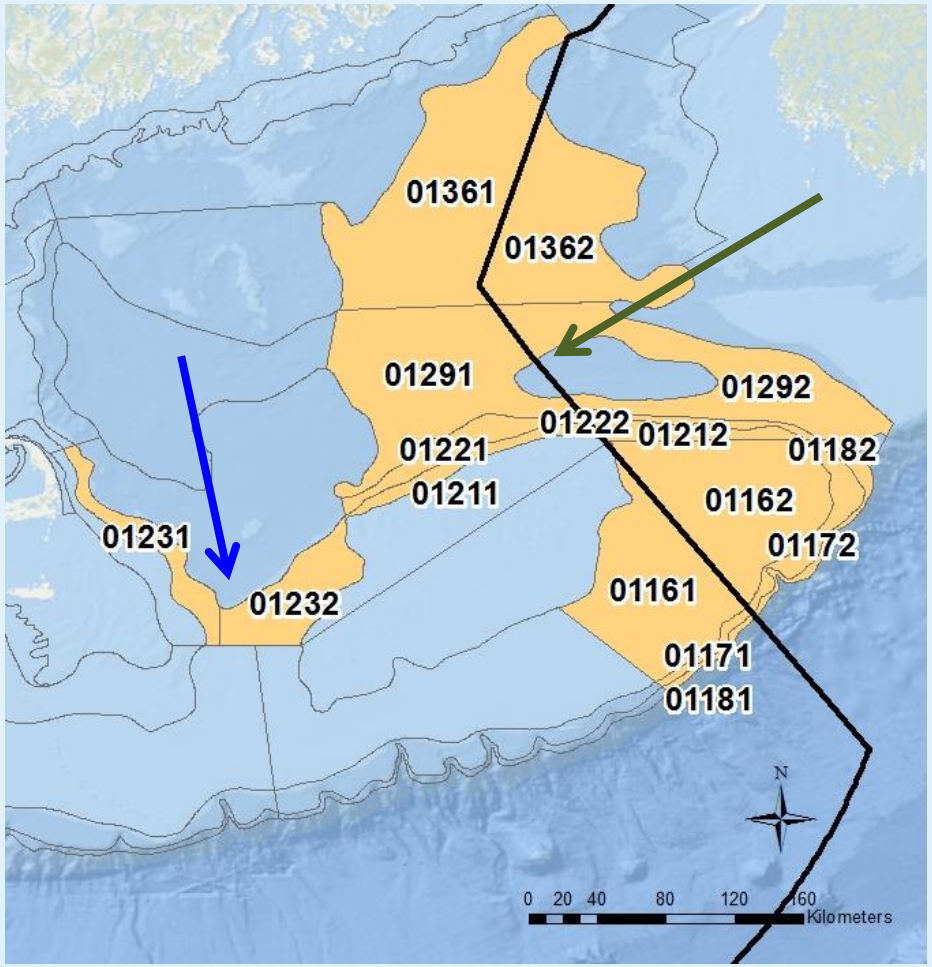
- Retain two deepest offshore strata south of Hudson Canyon

- No change in current survey area

Current stratification:	82 strata
Proposed re-stratification:	81 strata

Split offshore strata

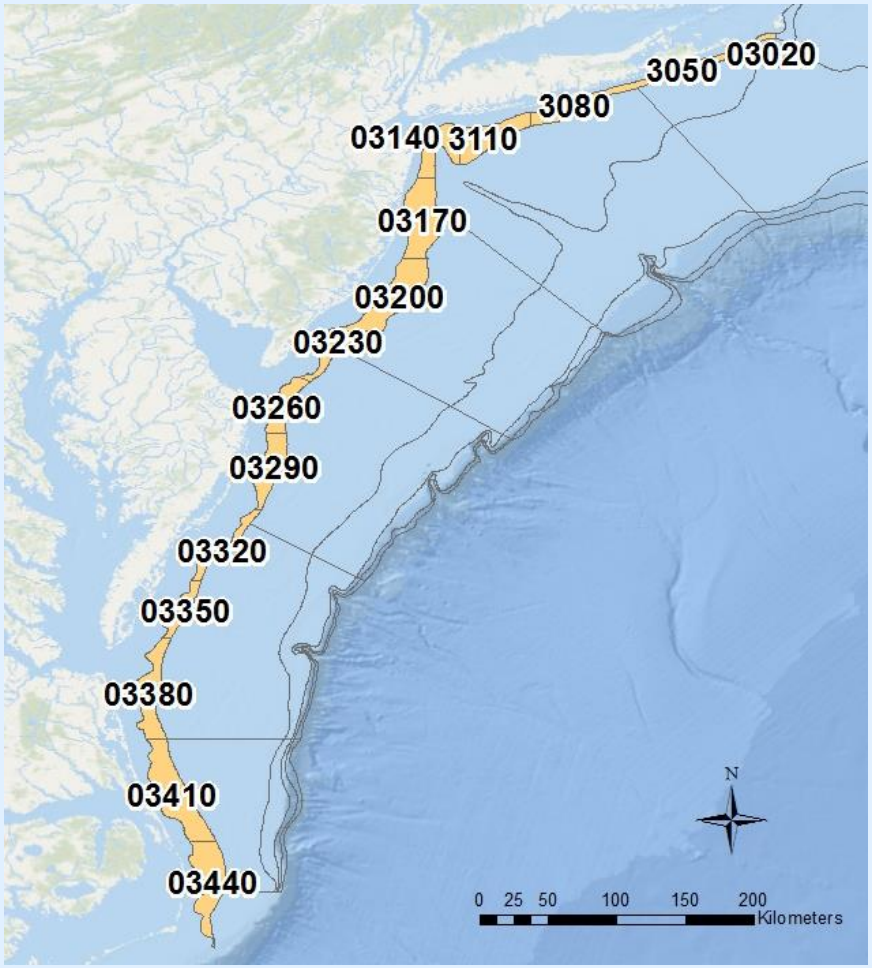


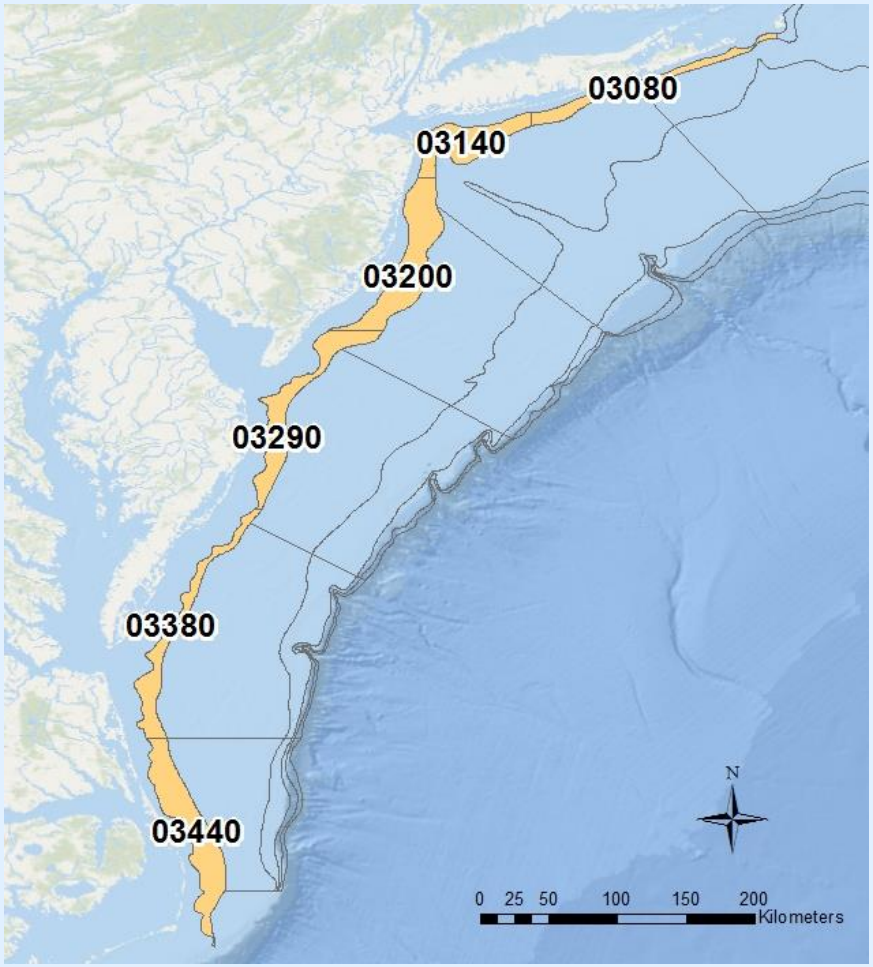


Stratum 23 - Winter flounder biology

Strata 16, 17, 18, 21, 22, 29, and 36 - Hague Line

Combine inshore strata





Combine inshore strata 2-5-8, 11-14, 17-20, 23-26-29, 32-35-38, and 41-44

Implications for sampling density and station distribution

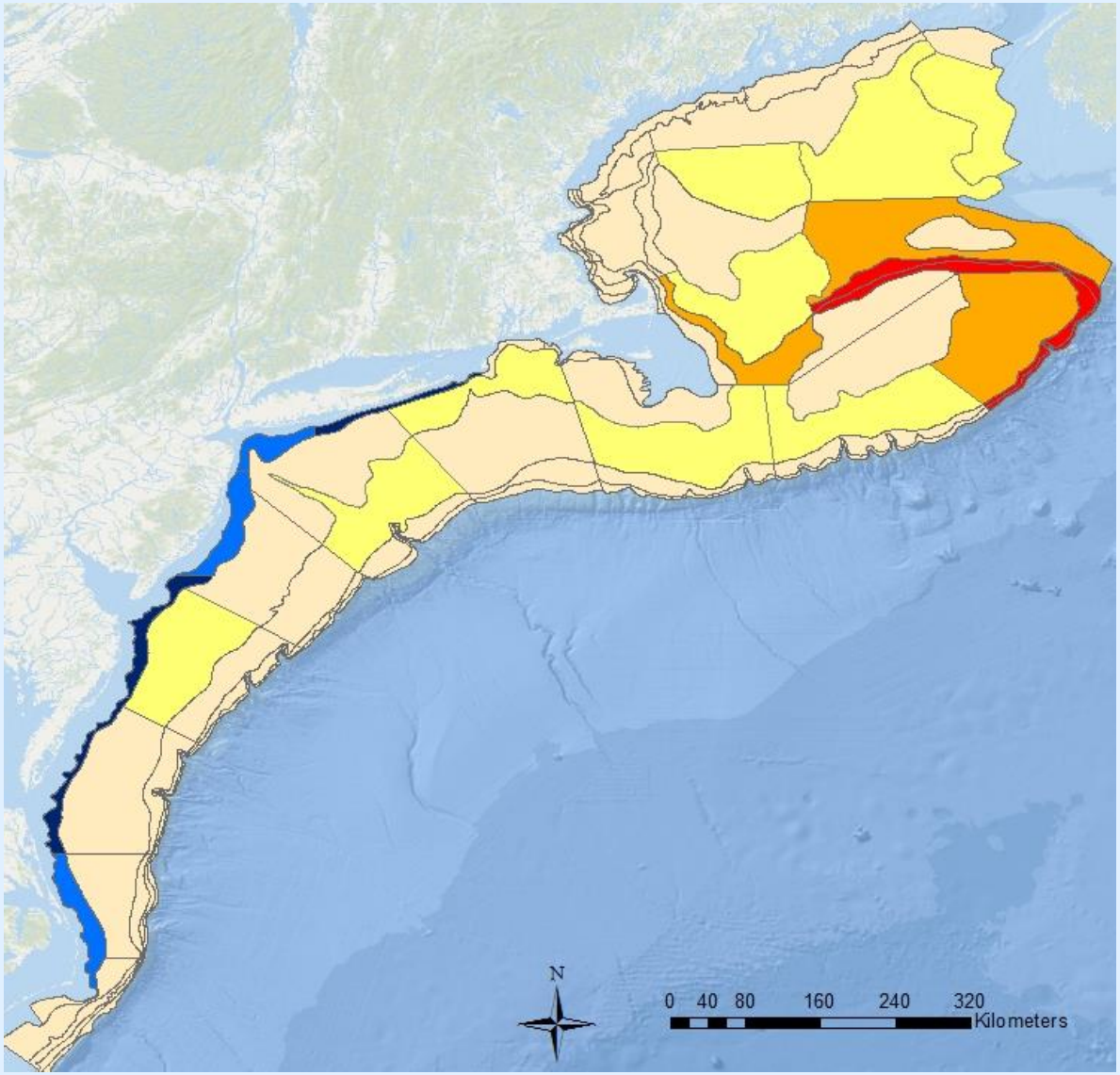
How would proposed re-stratification change station allocation in each stratum?

- Assumed 360 total stations

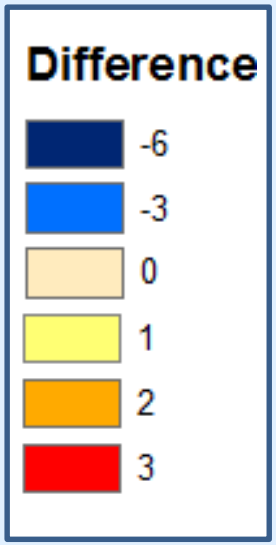
- Considered 2 allocation scenarios:
  1. Minimum of 3 stations per stratum (current)
  2. Minimum of 2 stations per stratum

  - Remaining stations allocated proportional to area

Minimum 3 stations per stratum

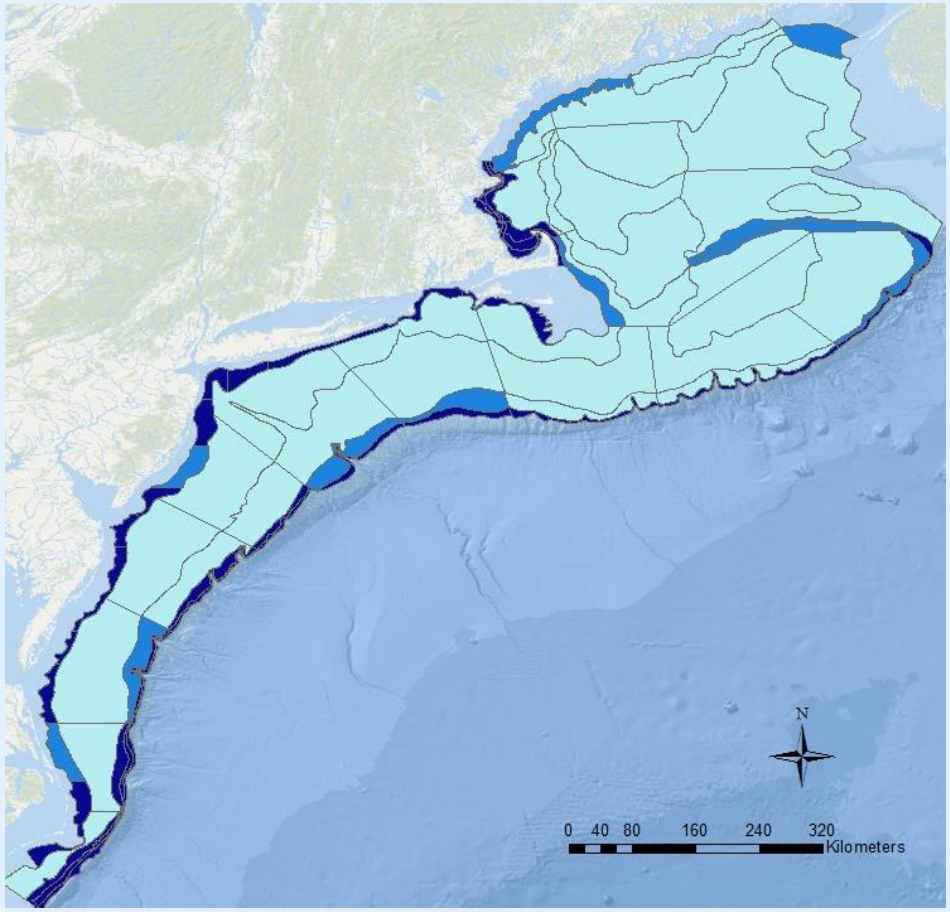


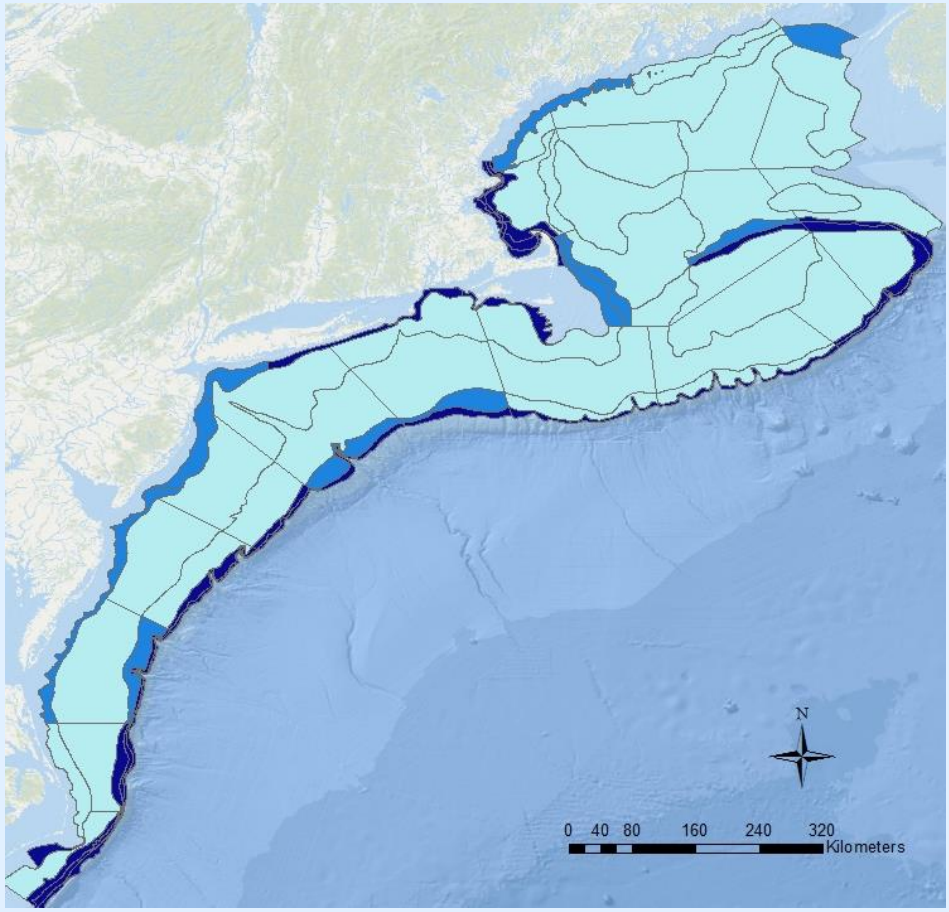
Difference in number of stations allocated (R - C)



Minimum 3 stations per stratum

Difference in sampling density (nm^2 per station)

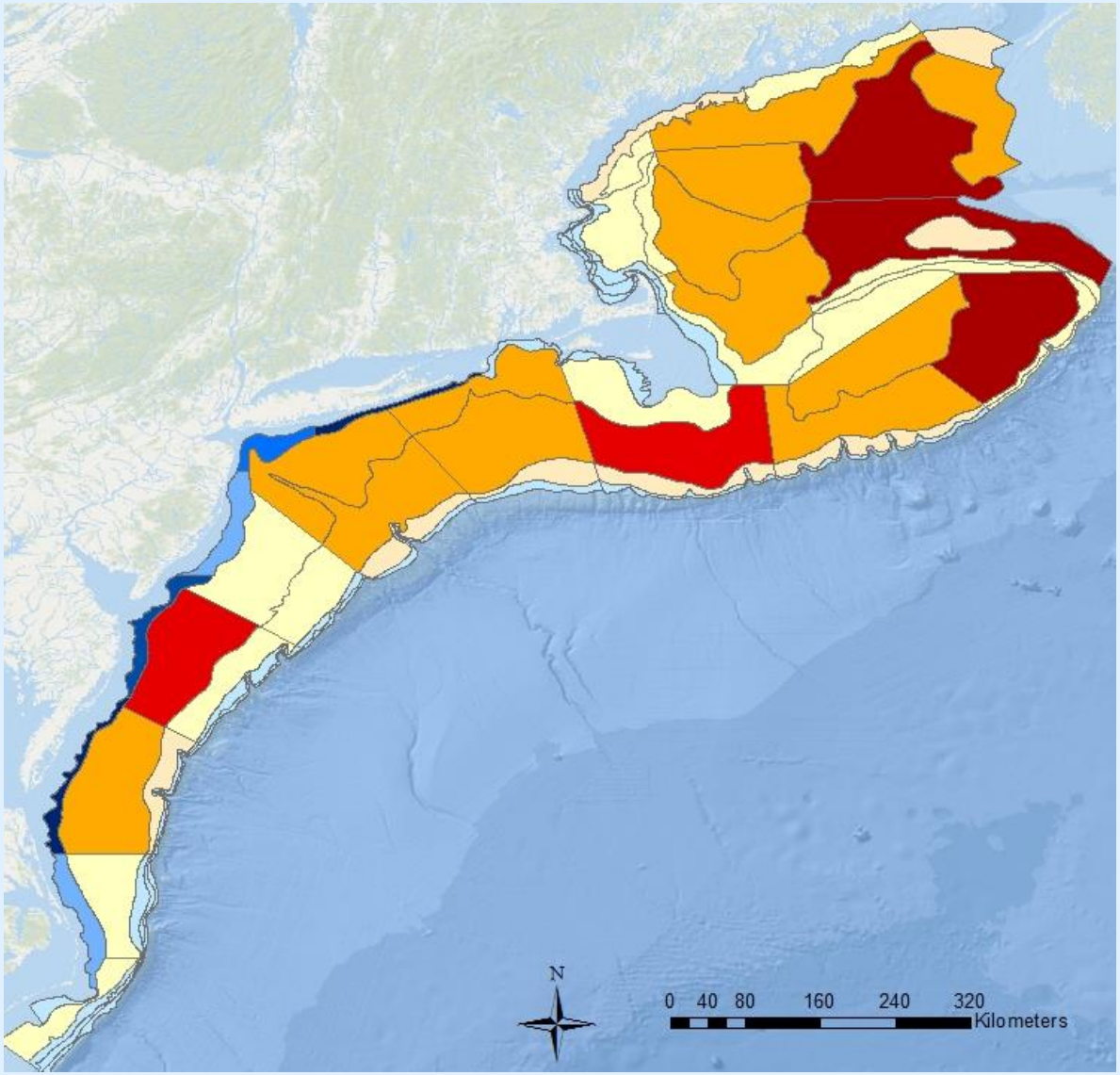




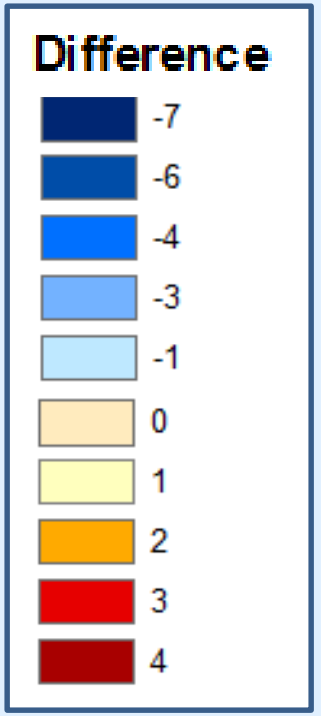
Sampling Density (nm^2 per station)

- 24 - 102
- 103 - 204
- 205 - 306

Current stratification/allocation vs. re-stratified with minimum 2 stations/stratum

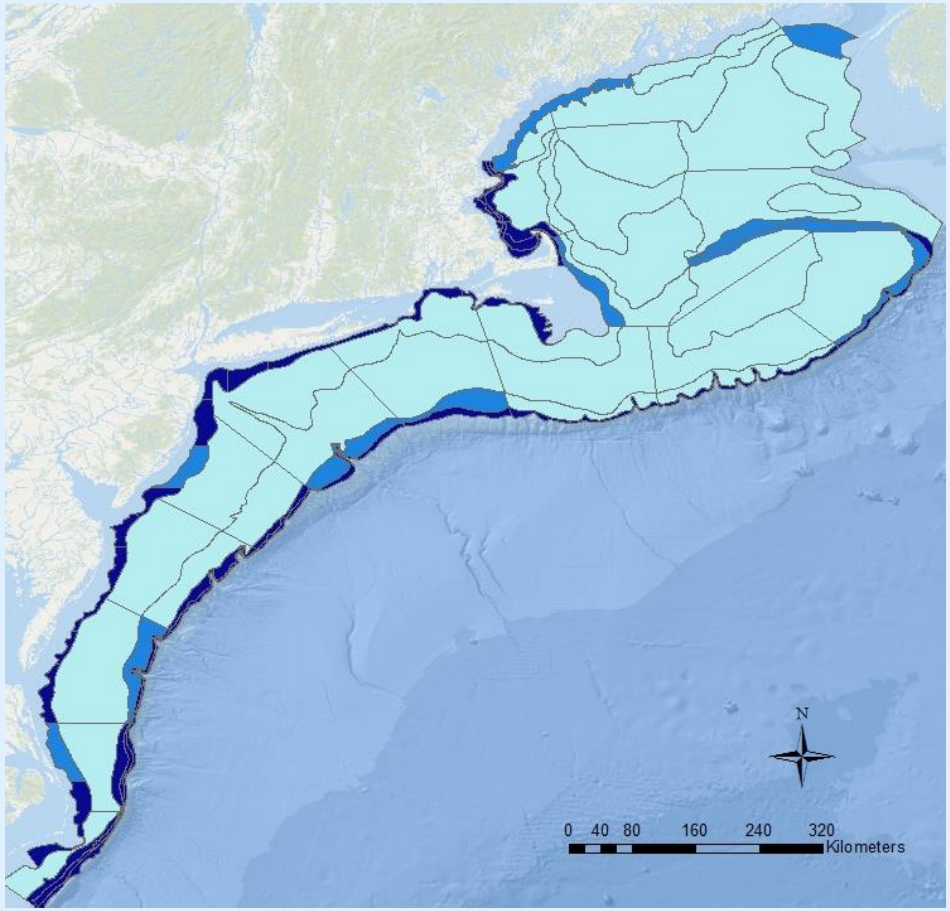


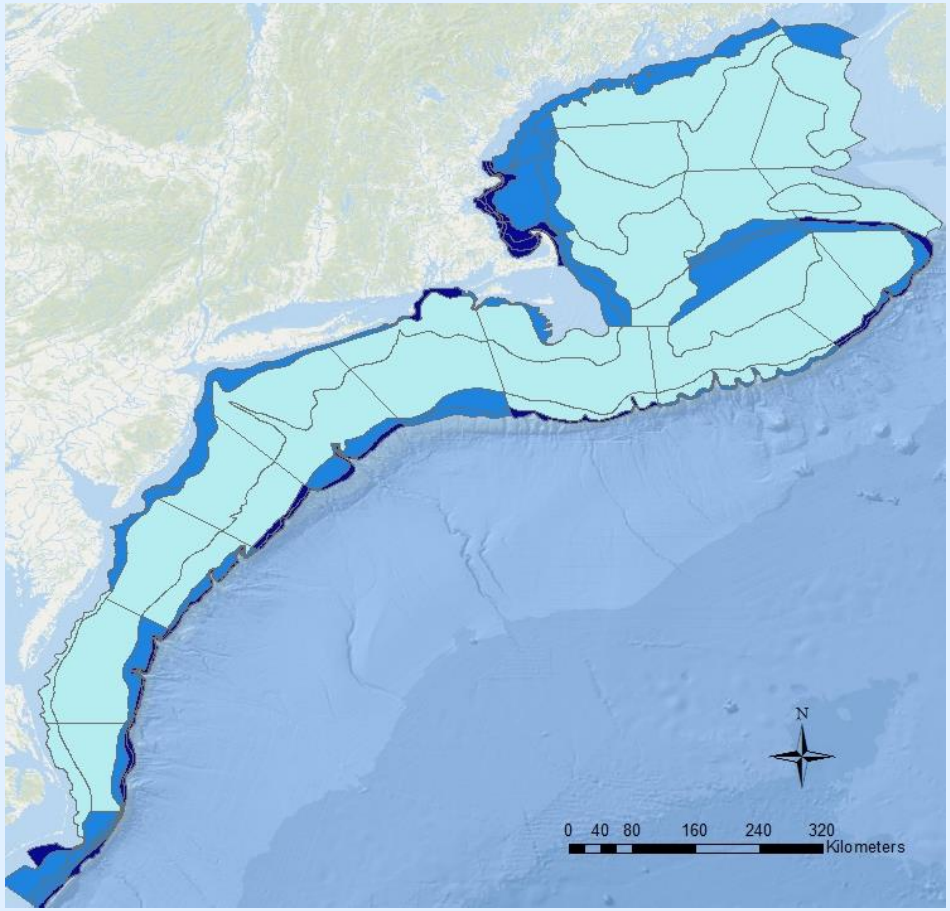
Difference in number of stations allocated (R2 – C3)



Current stratification/allocation vs. re-stratified with minimum 2 stations/stratum

Difference in sampling density (nm^2 per station)





Sampling Density (nm^2 per station)

- 24 - 102
- 103 - 204
- 205 - 306

Evaluation of survey indices - *in progress*

How does re-stratification affect:

- Stratified mean catch estimates for each species?
- Variance estimates?
- Perception of changes in abundance over time series?

- 1985-2015 data
- 2 data sets: current and re-stratified
- Subset of 17 representative species identified by Population Dynamics staff

Species for Analysis

black sea bass
butterfish
cod
fluke
haddock
long-finned squid
monkfish
offshore hake
rosette skate
scup
short-finned squid
silver hake
smooth skate
spiny dogfish
winter flounder
witch flounder
yellowtail flounder

Use bootstrap sampling with replacement:
Calculate bootstrap estimates of survey indices (catch biomass and catch number) with 90% CIs

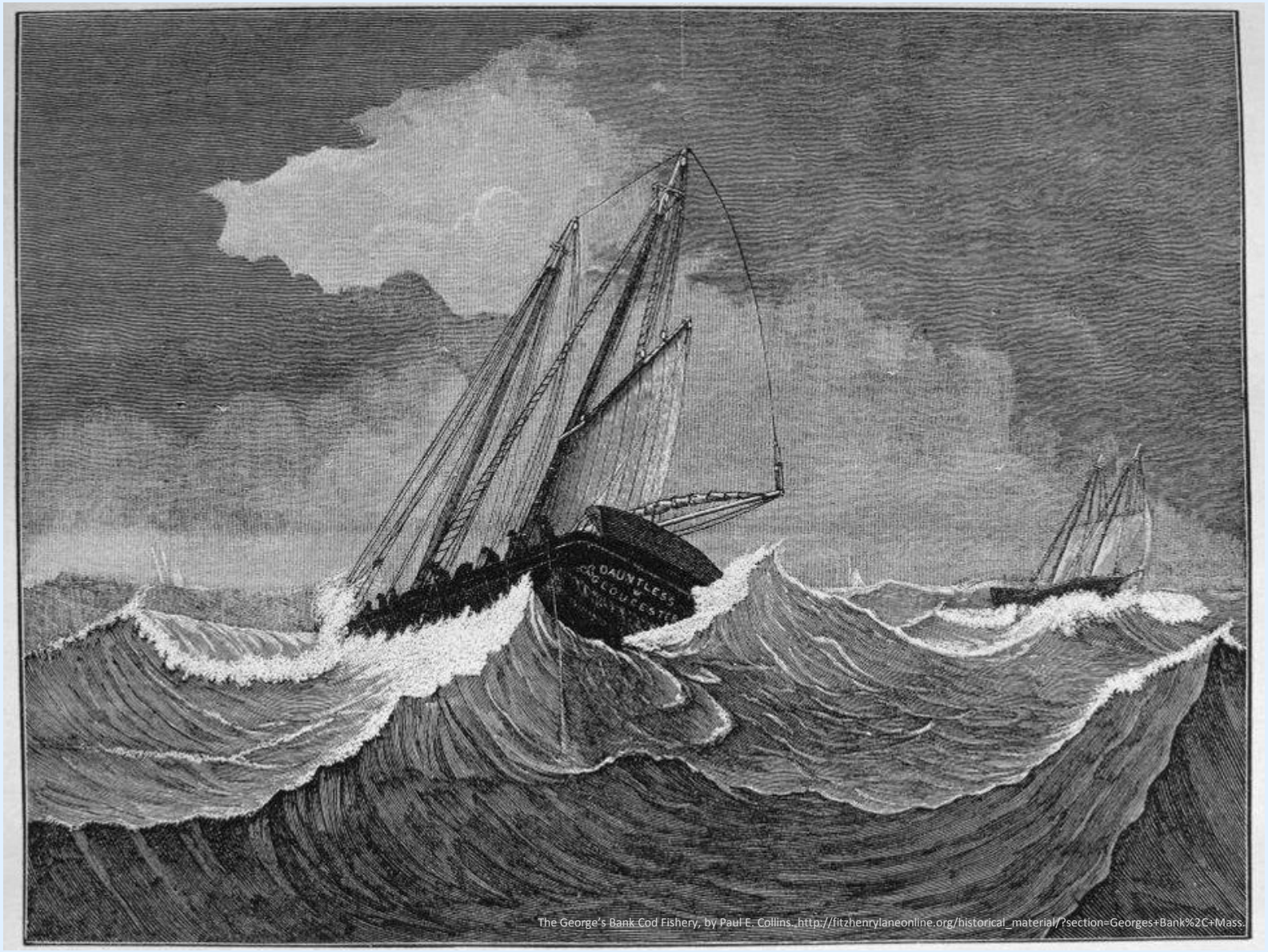
Next steps

- Complete bootstrap analysis
- Present results to Population Dynamics staff
- Assess feasibility of alternative stratification

Additional issues/questions to resolve

- Strata area: GIS versus digitized
- Accuracy of strata delineation
- Several strata south of Cape Hatteras have not been consistently sampled – not used in most assessments – continue to sample?

Questions?



The George's Bank Cod Fishery, by Paul E. Collins, http://fitzhenrylaneonline.org/historical_material/?section=Georges+Bank%2C+Mass.