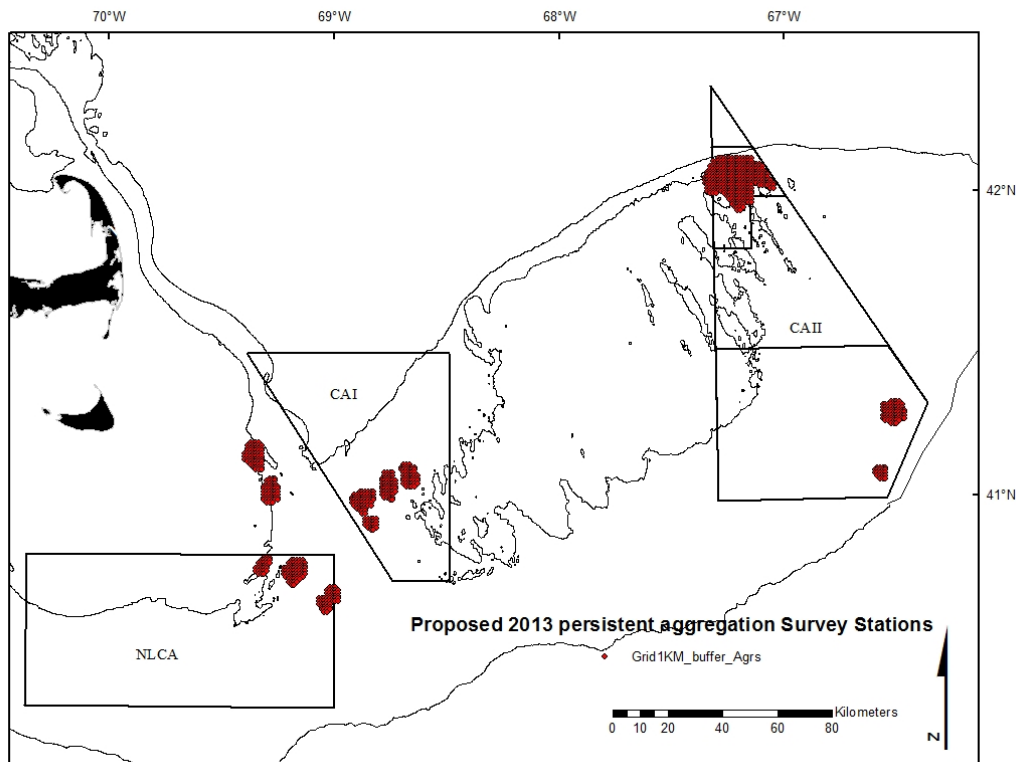
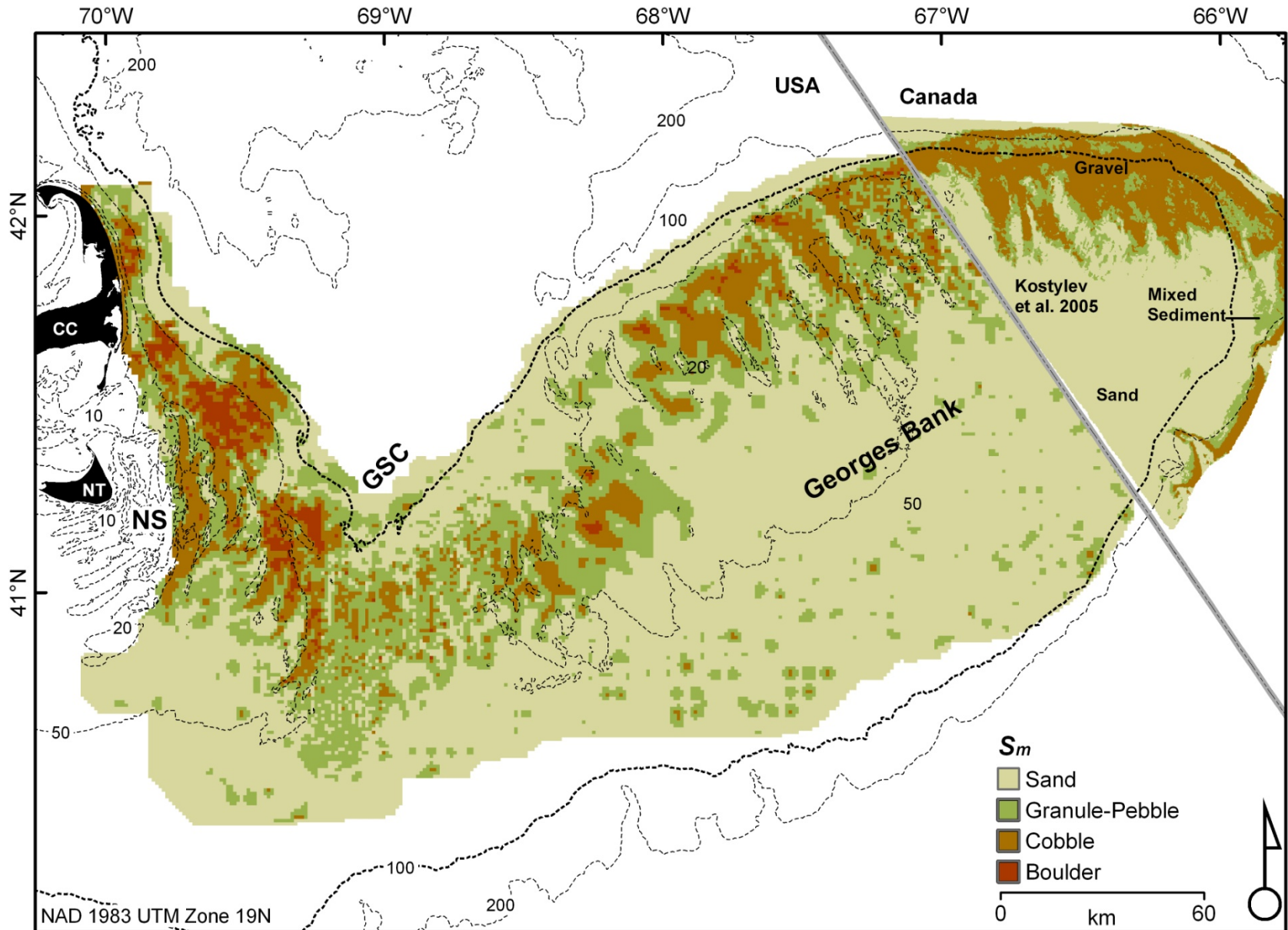


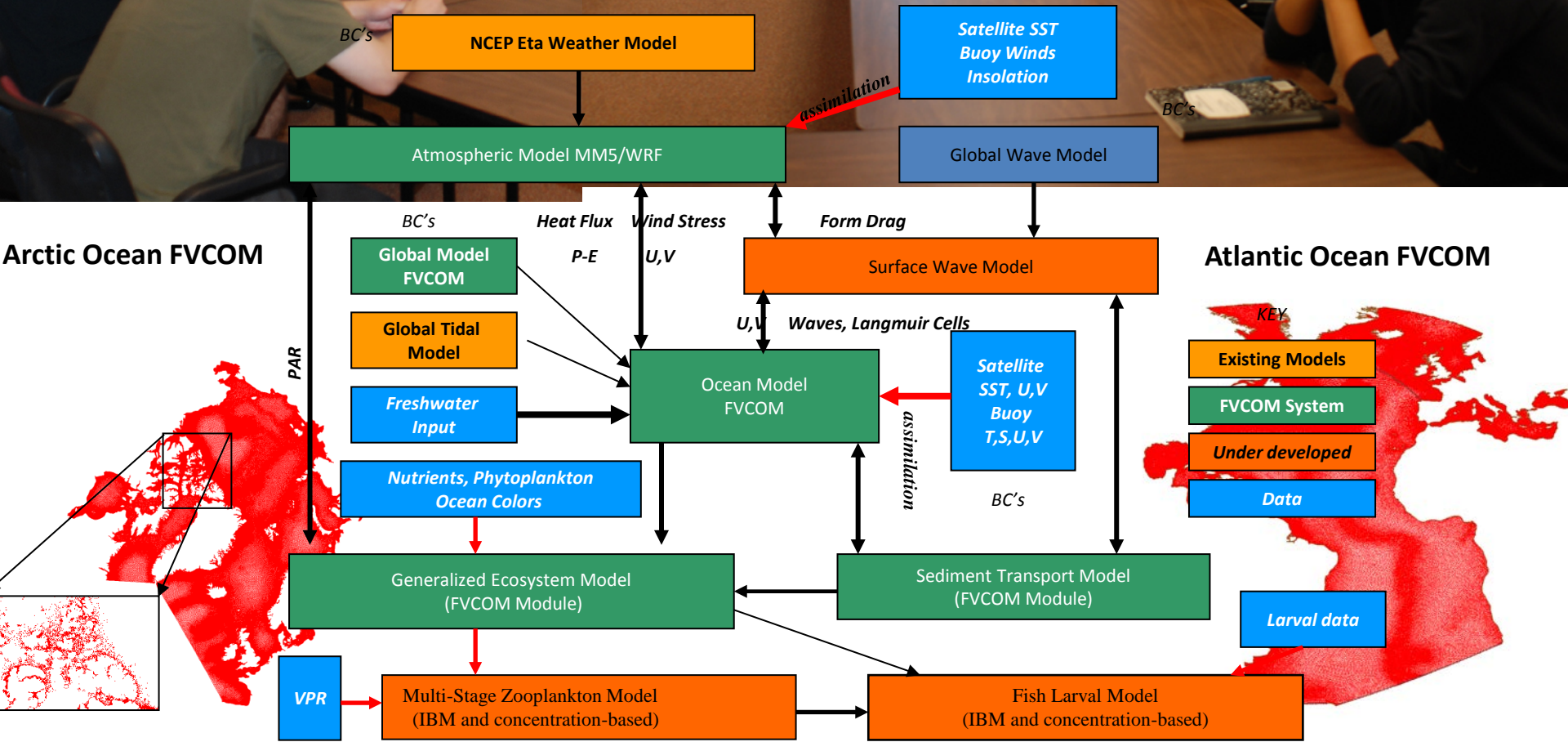
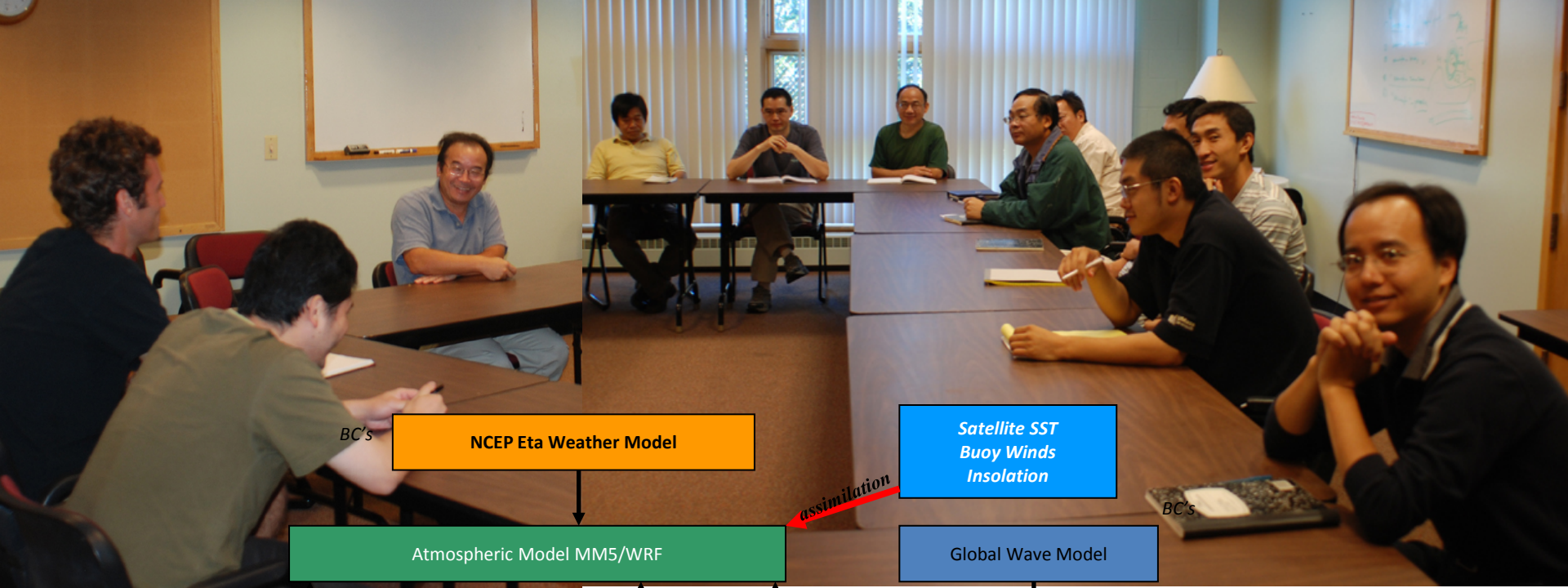
# Survey of persistent aggregations and their input into scallop recruitment



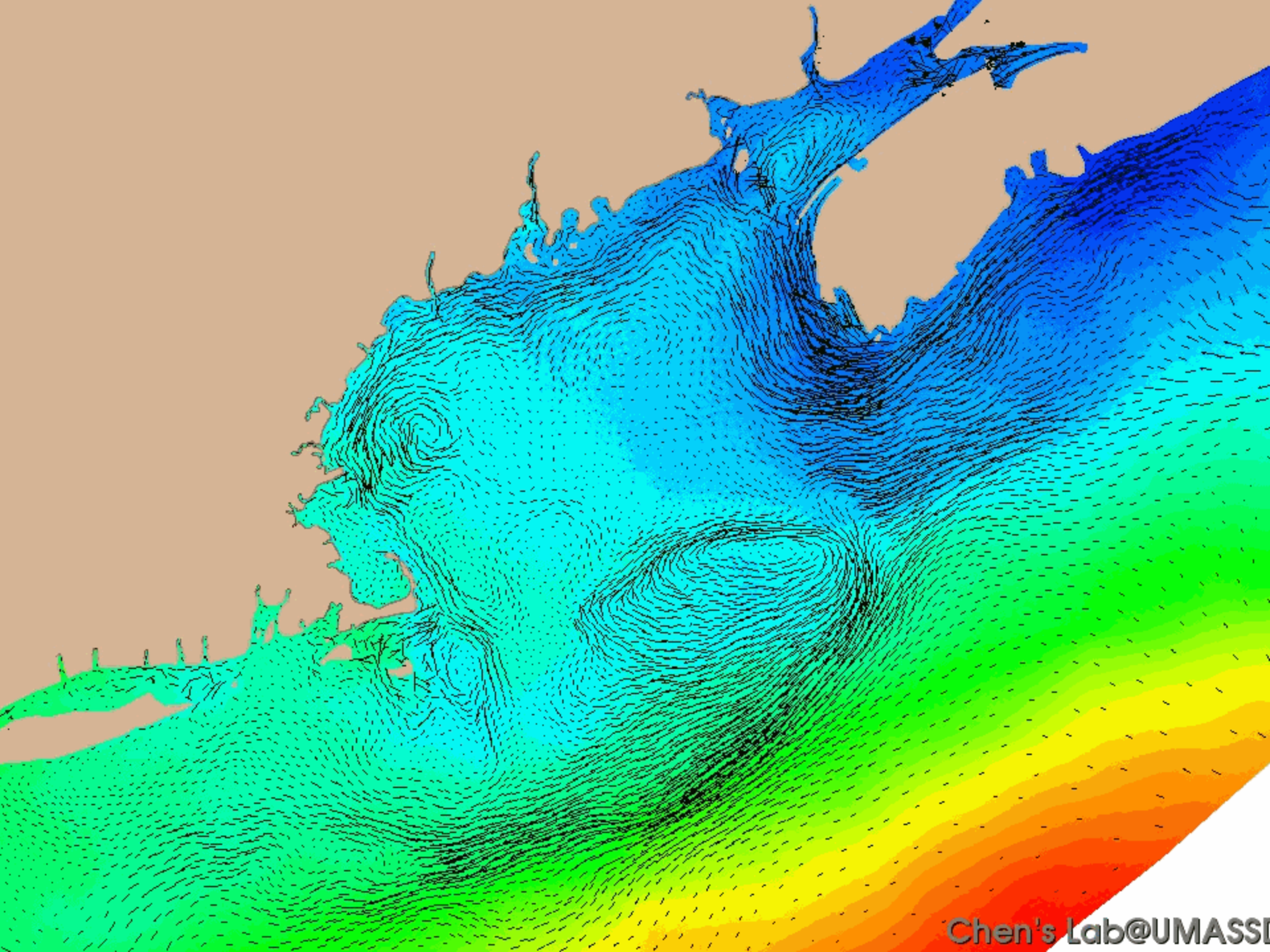
Kevin Stokesbury and Brad Harris  
SMAST RSA Project



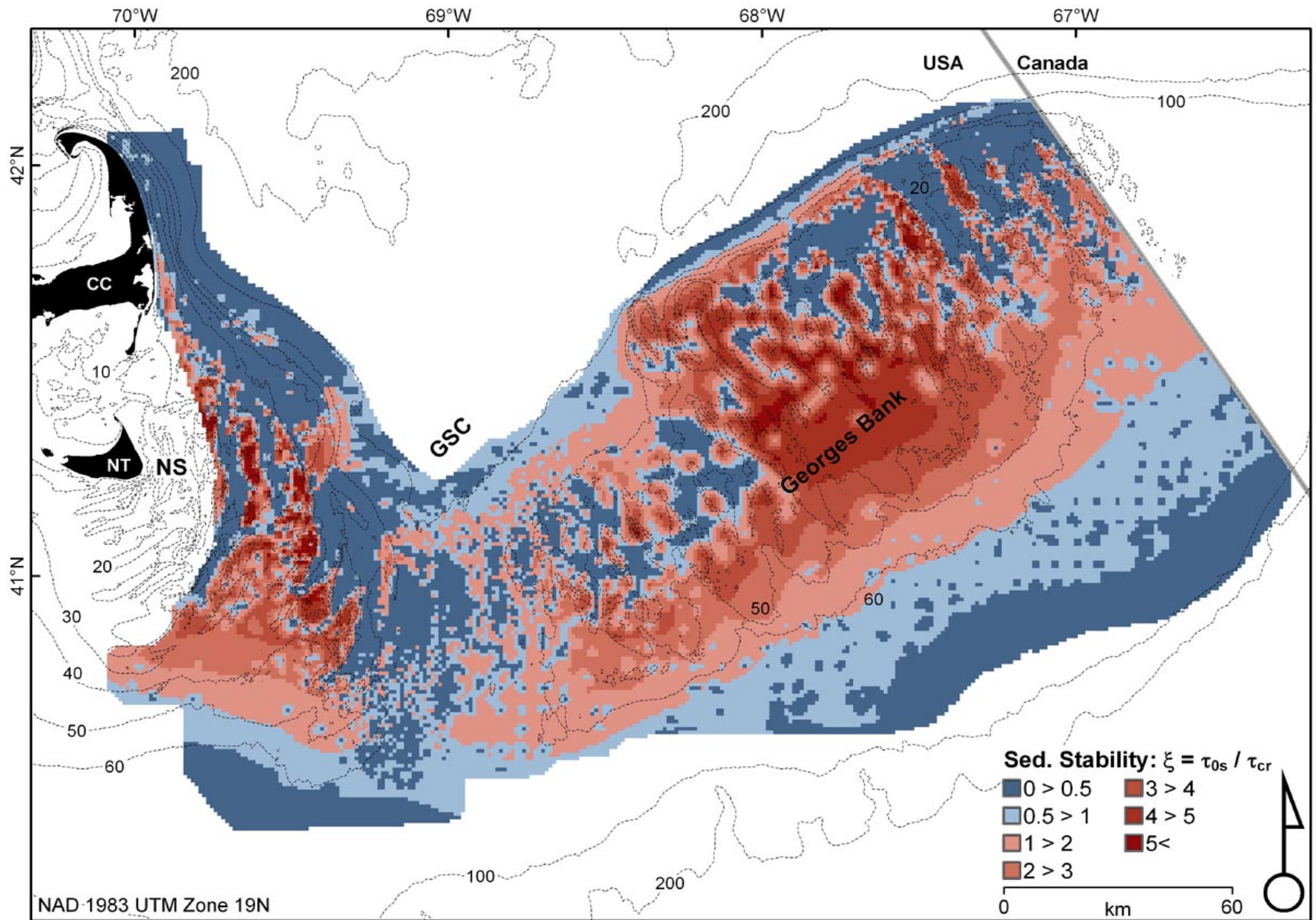








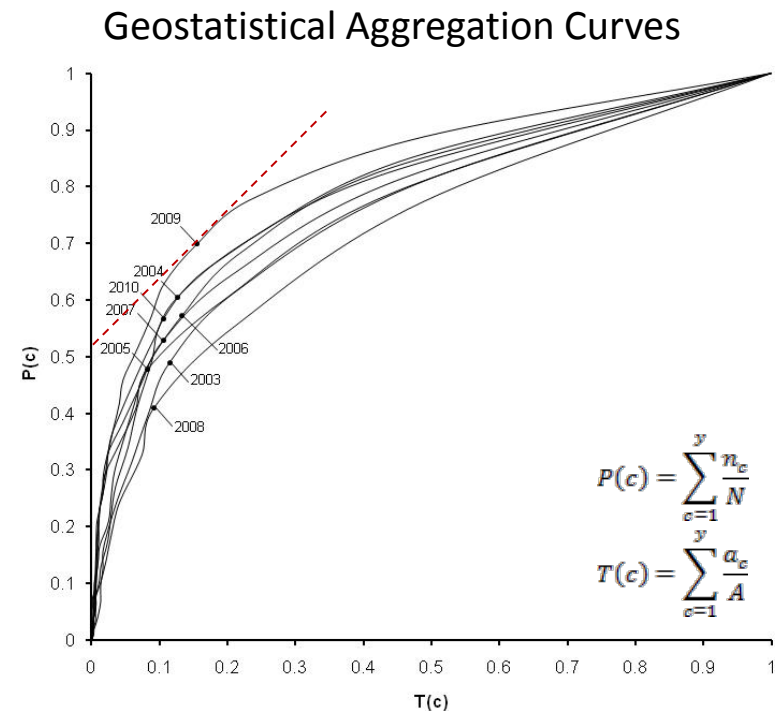
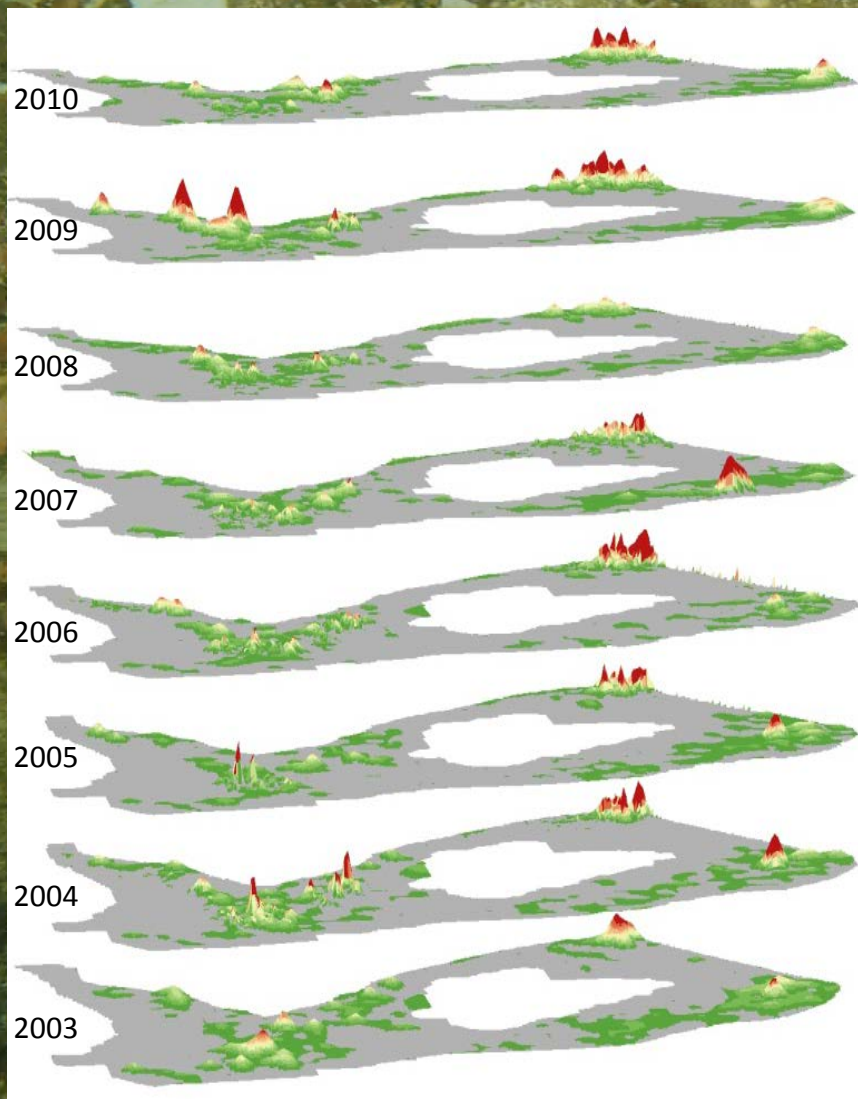
# Map of Georges Bank sediment stability index ( $\xi = \tau_0 / \tau_{cr}$ ).



Harris, B.P., G.W. Cowles and K.D.E. Stokesbury. 2012. Surficial sediment stability on Georges Bank in the Great South Channel and on eastern Nantucket Shoals. *Cont. Shelf Res.* 49: 65-72.



# At what concentration ( $C_a$ ) do Georges Bank scallops aggregate?



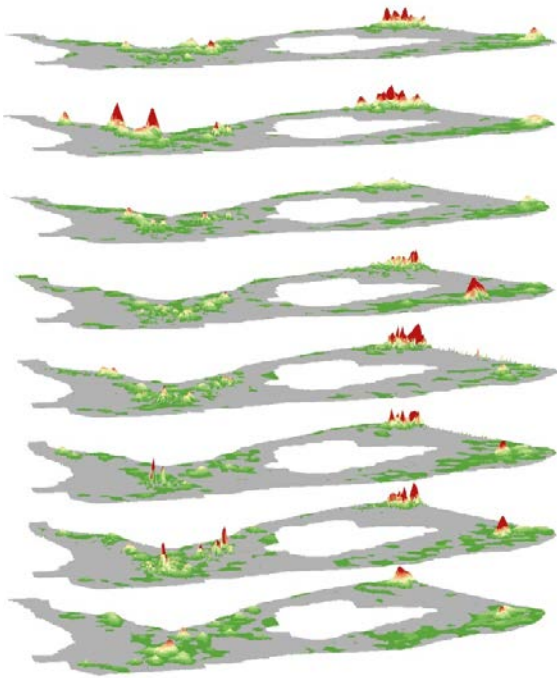
Year	$\theta$	$C_a$	$P(c)$	$T(c)$
2003	52	4	0.49	0.12
2004	43	4	0.60	0.13
2005	47	4	0.48	0.08
2006	52	4	0.57	0.13
2007	49	4	0.53	0.11
2008	51	4	0.41	0.09
2009	45	4	0.70	0.16
2010	52	4	0.57	0.11

## High-concentration

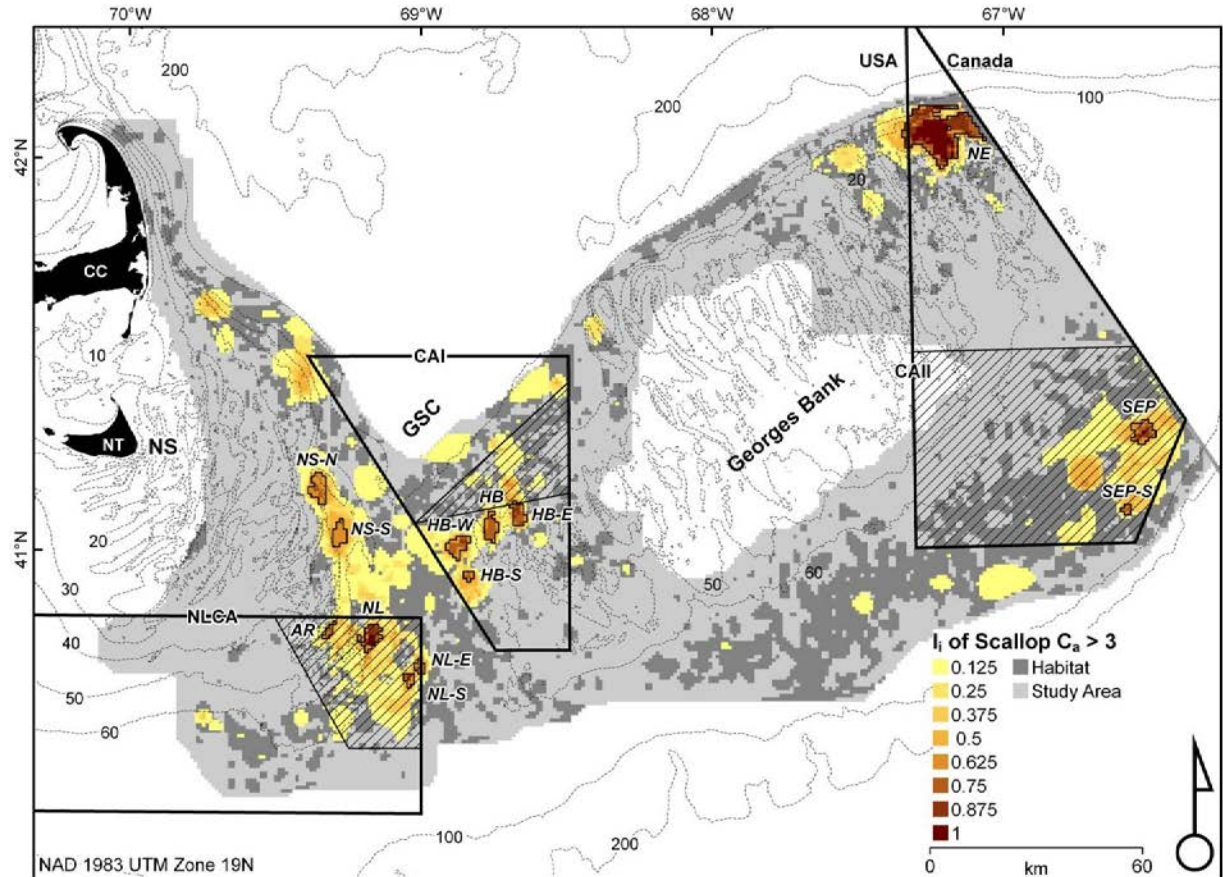
3 - 4 scallops per scallop in 3.24 m<sup>2</sup> (>3).

# Where do these aggregations persist?

$$I_i = \frac{1}{y} \sum_{j=1}^y \delta_{kj}$$

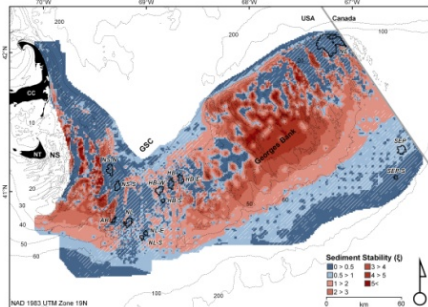
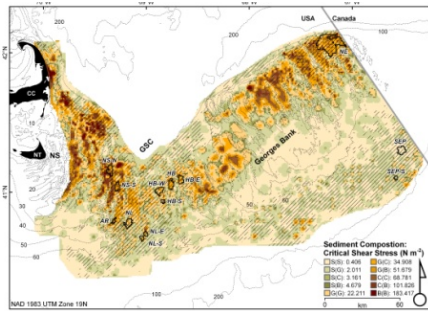
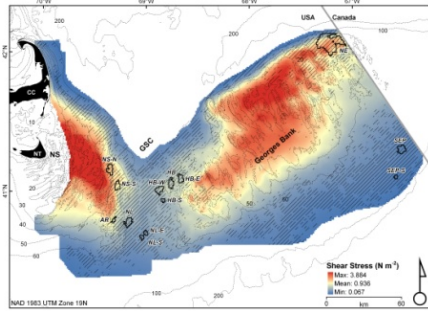
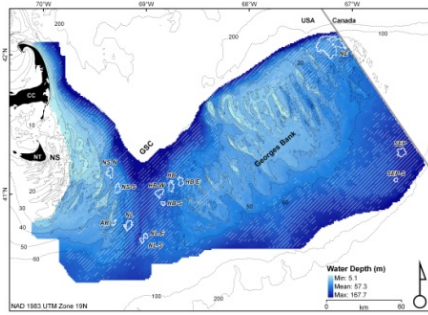


$I_i \geq 0.625$   
 ( $\geq 5$  of the 8 years)

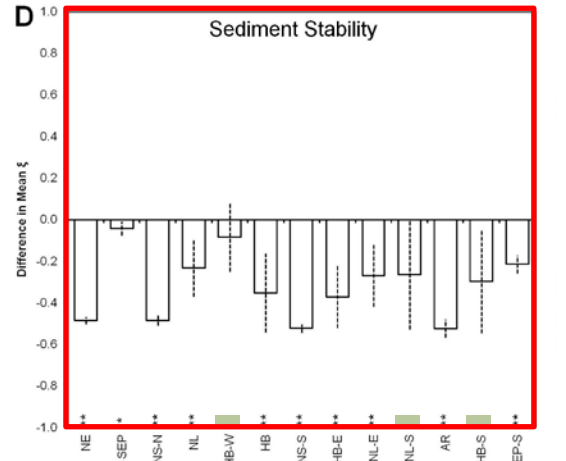
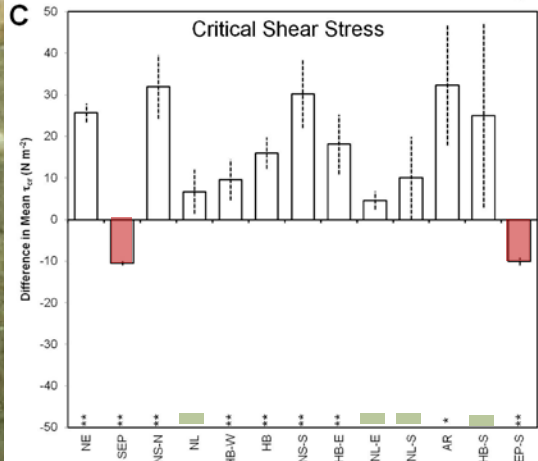
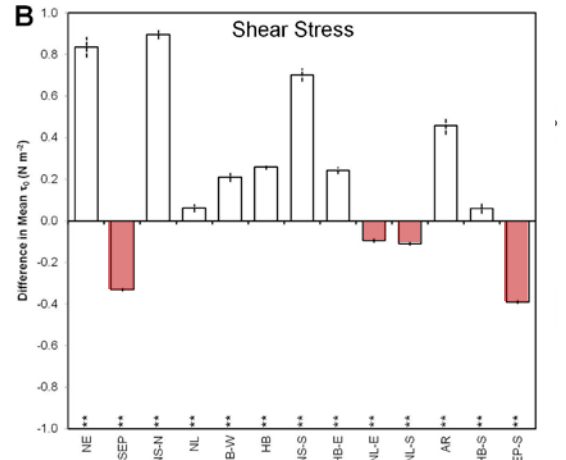
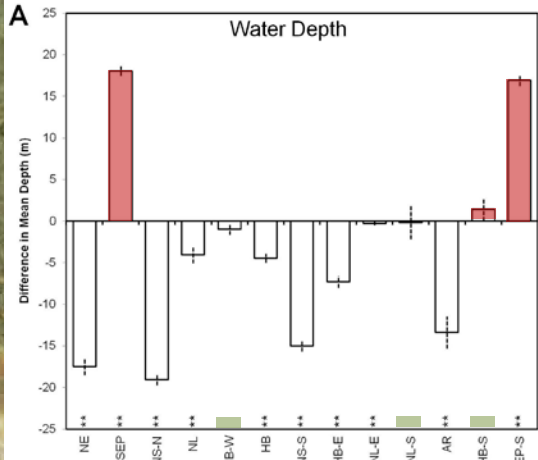




# Scallop Habitat vs. Aggregations: Depth, Shear stress, Critical shear and Sed stability



Some variability in Depth, Shear stress, critical shear.  
ALL aggregations Occurred in Stable Sediment





# Scallop Habitat vs. Aggregations

- **Shallower:** -12m ( $\pm 1.18$ m).
- **Higher Flow:** 2.3 times more SS.
- **Threshold Flow:** 2 N m<sup>-2</sup>
- **More Stable Sediments:** More stable despite higher SS.
- **Sediments:** Coarser, more heterogeneous, and larger sediments
  
- **Sediment Conditions:** Intermediately coarse  
Mixed  
Granule-pebble Dominated  
With Cobbles

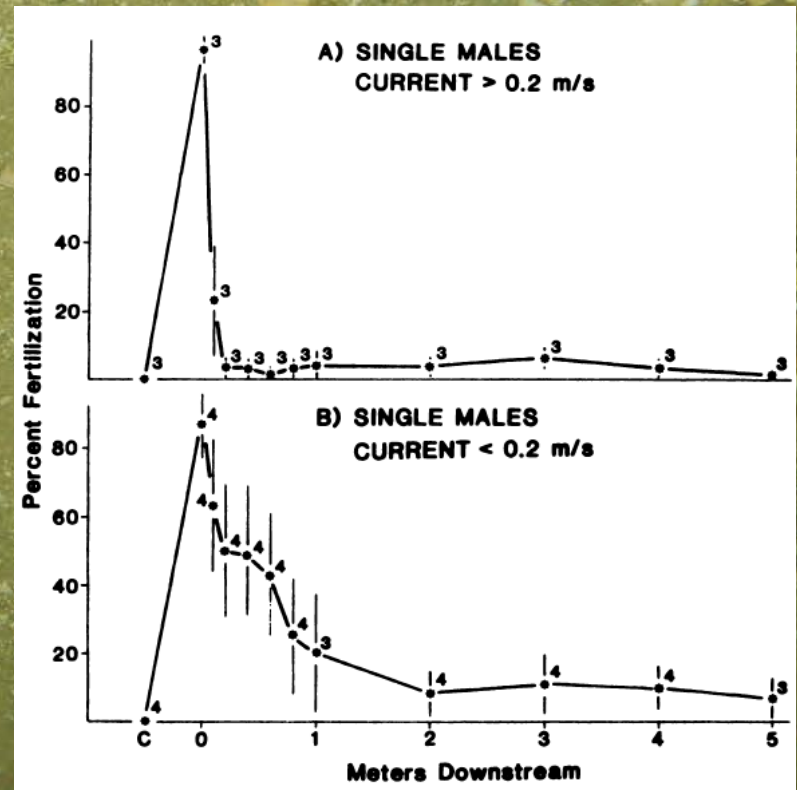
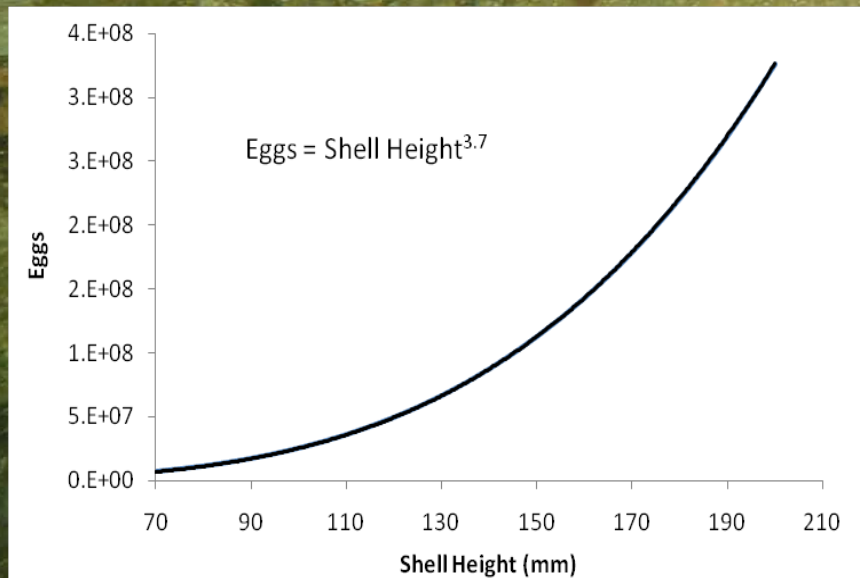
- From 2003-2010 GB had 4 billion scallops.
- Persistent High-Concentration Aggregations contained 670 million (17%) of them.



# Scallop Population Biology

*“Small high-concentration sub-populations may produce a much higher proportion of the zygotes generated by the entire population than expect based on abundance” (Claereboudt 1999).*

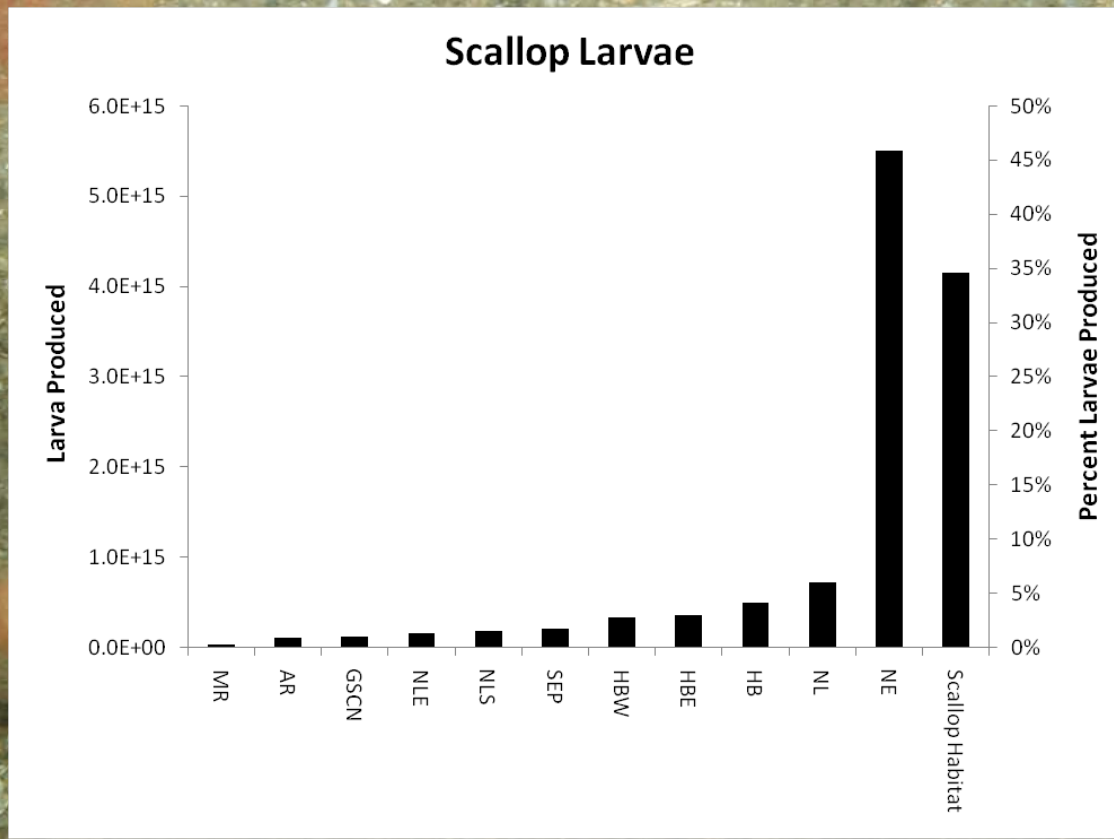
- Egg Production:  $E = SH^{3.7}$  for  $SH > 70\text{mm}$  (Smith and Rago 2004 from Langton et al. 1987)
- Fertilization Success is a function of NND (Pennington 1985, Claereboudt 1999).





# Scallop Population Biology

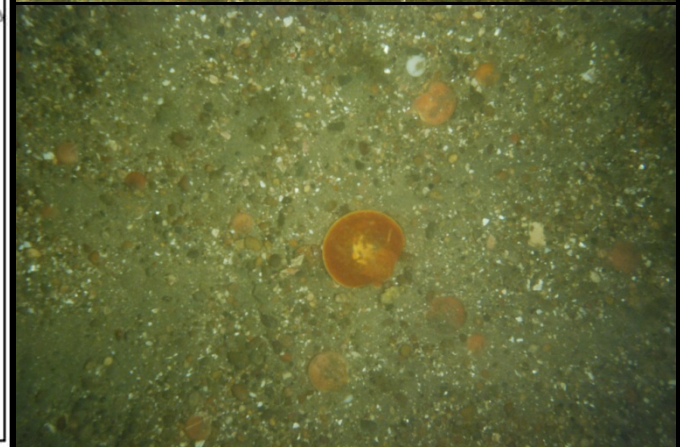
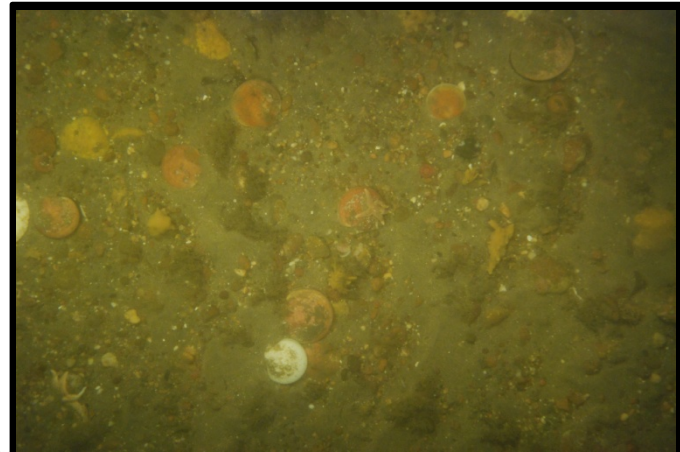
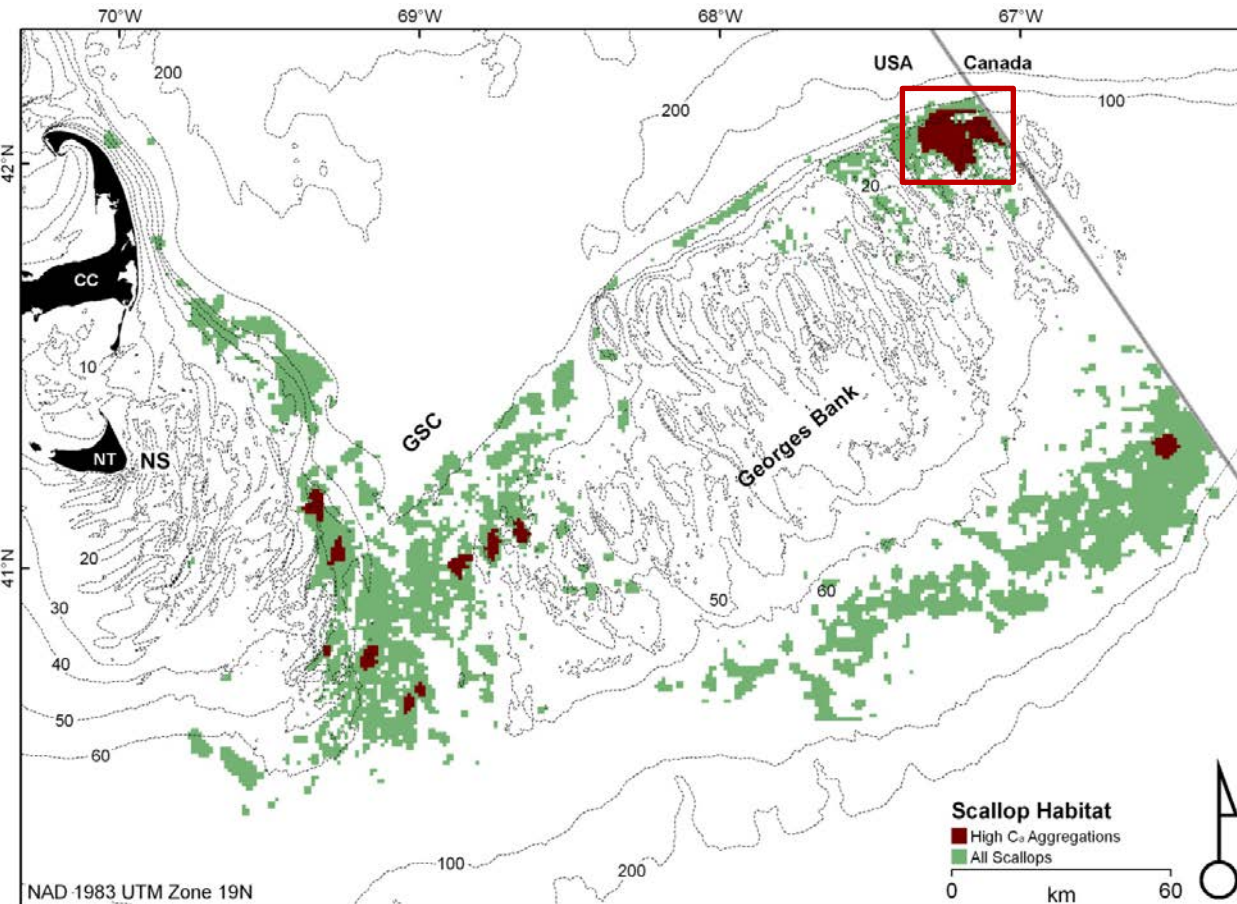
- These areas may produce 2 times more larvae than the rest of the scallop population.
- The NE aggregation has 10% of the scallops and may contribute 45% of the larvae!





# The Northern Edge (NE) Aggregation

**Area:** 218 km<sup>2</sup> (3.4%)  
**Scallops:** 330 Million (10%)  
**Egg Production:** 45%

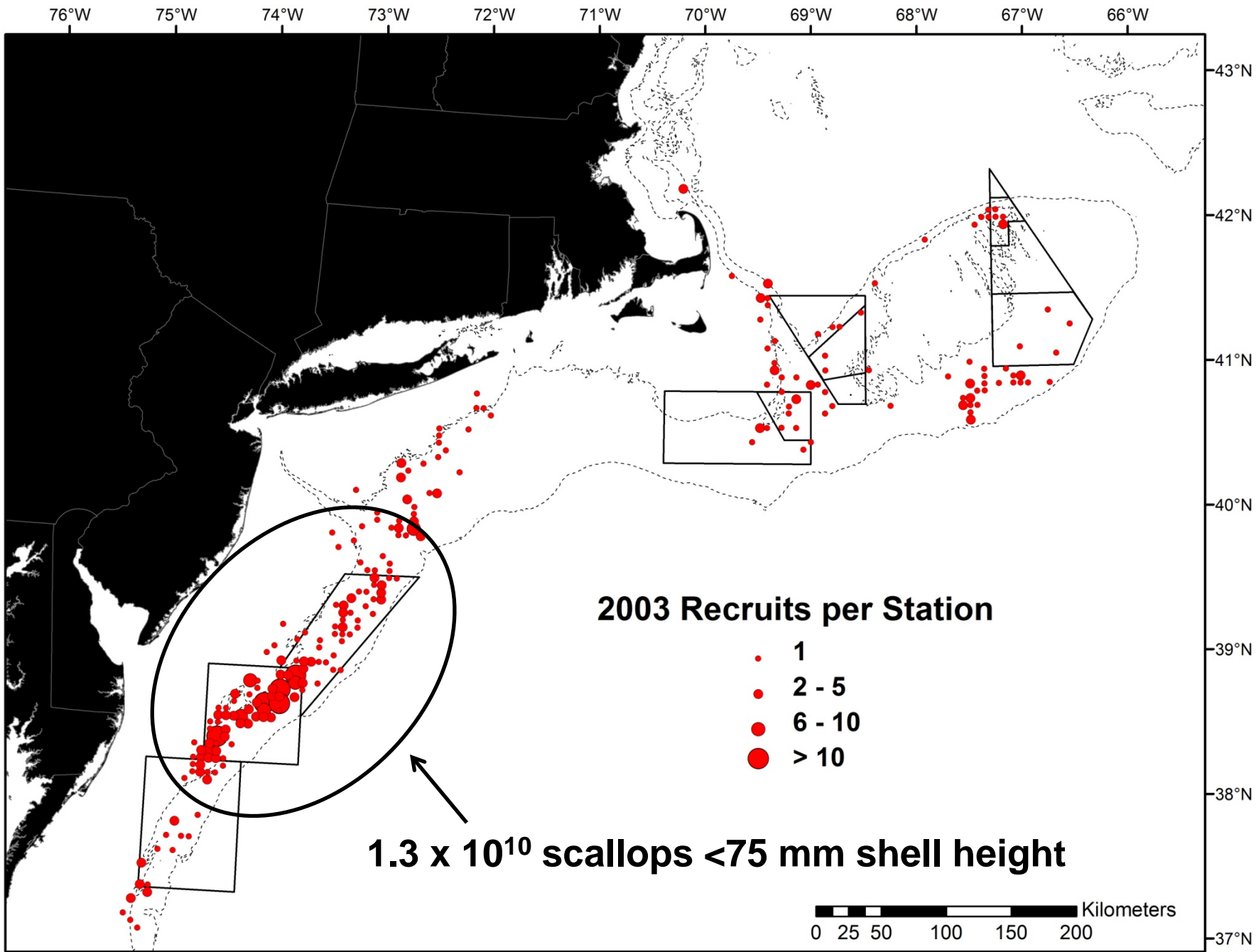




A photograph of a sandy beach with several seashells and a starfish scattered across the surface. The shells are mostly light-colored with some reddish-brown hues. A single starfish is visible in the lower-left quadrant. The text "Extreme recruitment events" is overlaid in the center of the image.

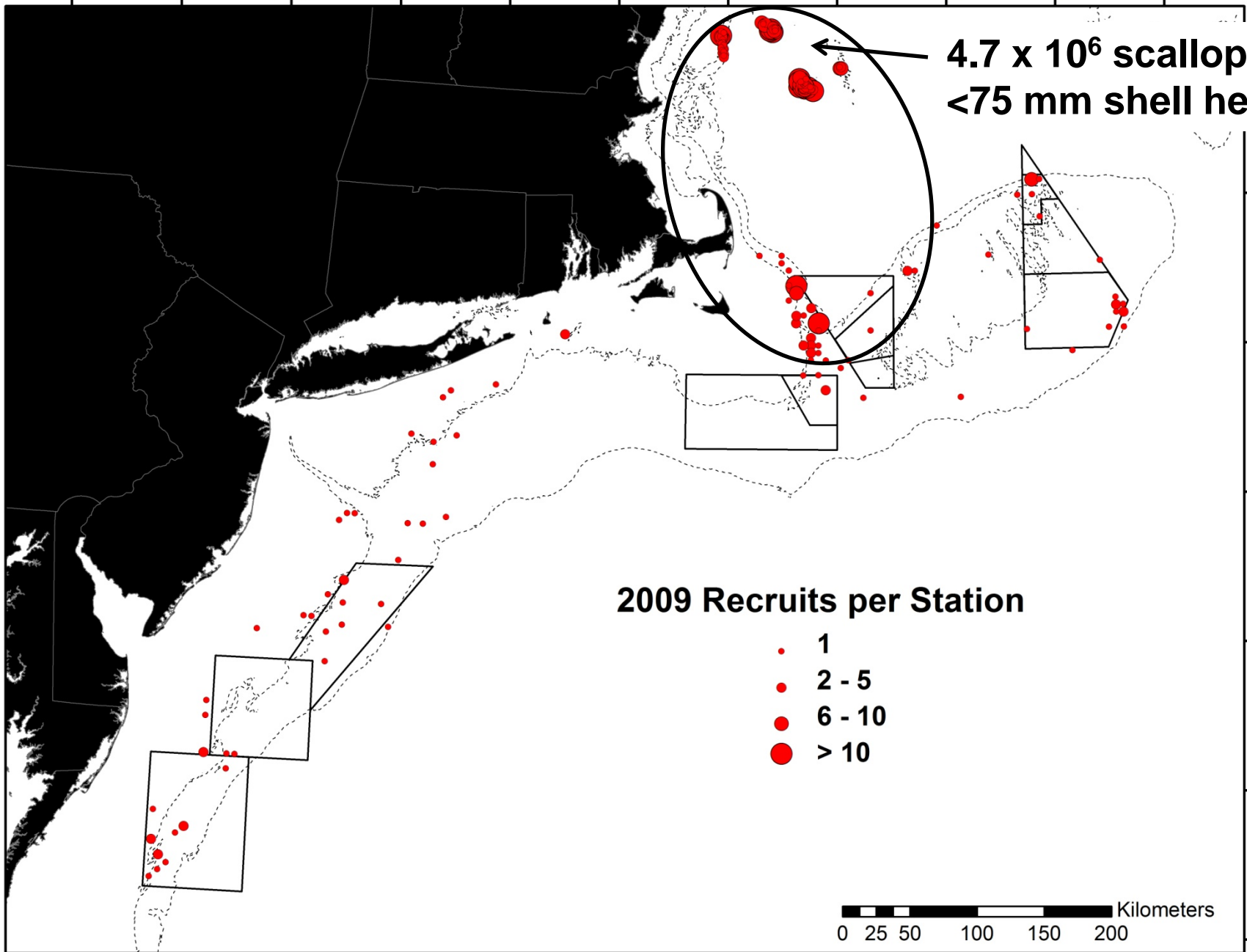
**Extreme recruitment events**







76°W 75°W 74°W 73°W 72°W 71°W 70°W 69°W 68°W 67°W 66°W



# Summary

- Persistent aggregations identified through Harris sediment analysis and FVCOM dynamics analysis
- Aggregations surveyed at fine scale (1 km) in 2013
- Project is in extension through May 2015
- Modeling underway to examine larval transport and distribution
- Analyses ongoing to examine importance of NE aggregation to overall scallop resource