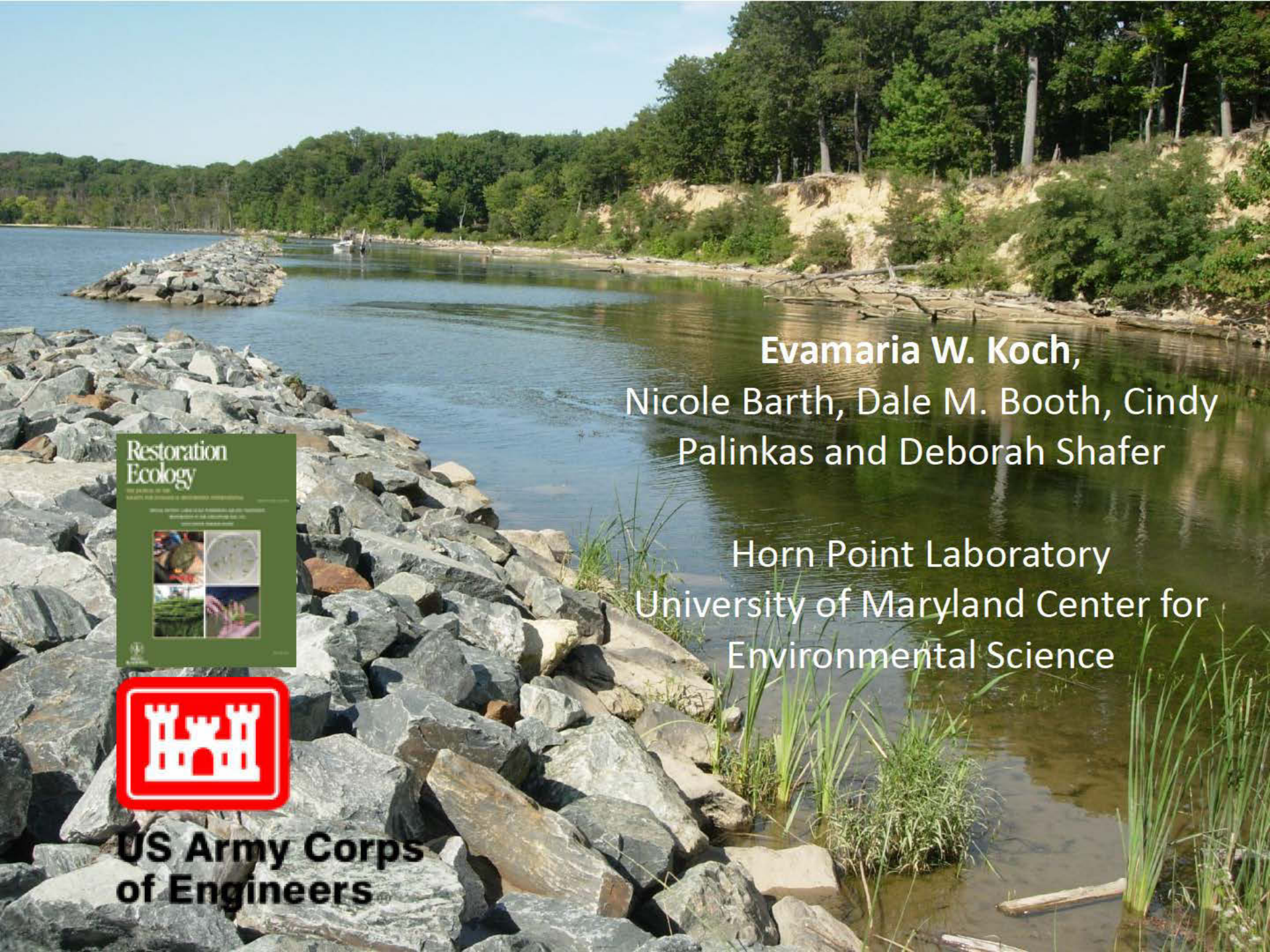
Engineering with Nature: Breakwaters for the creation of Submerged Aquatic Vegetation (SAV) habitat

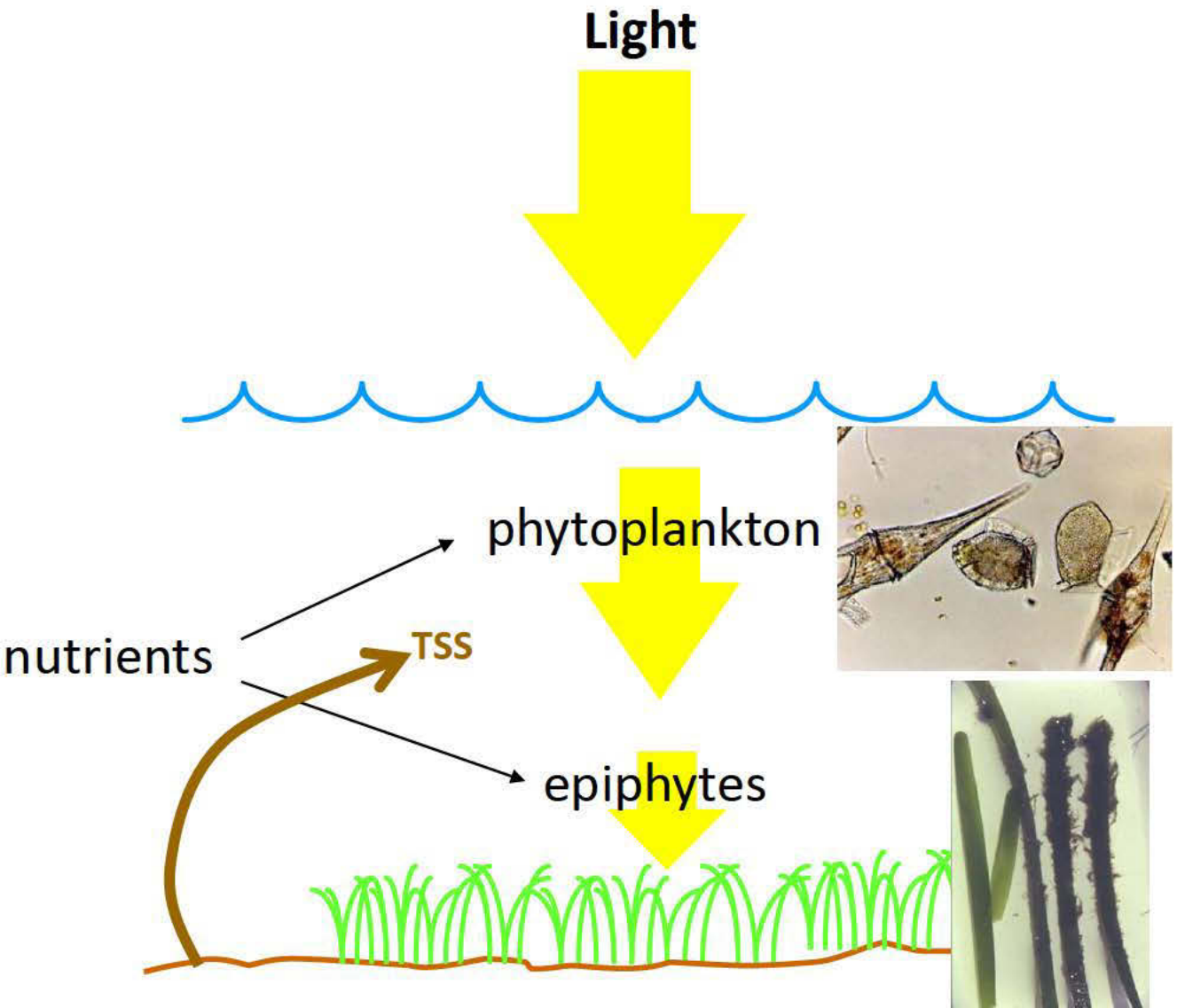


Evamaria W. Koch,
Nicole Barth, Dale M. Booth, Cindy Palinkas and Deborah Shafer

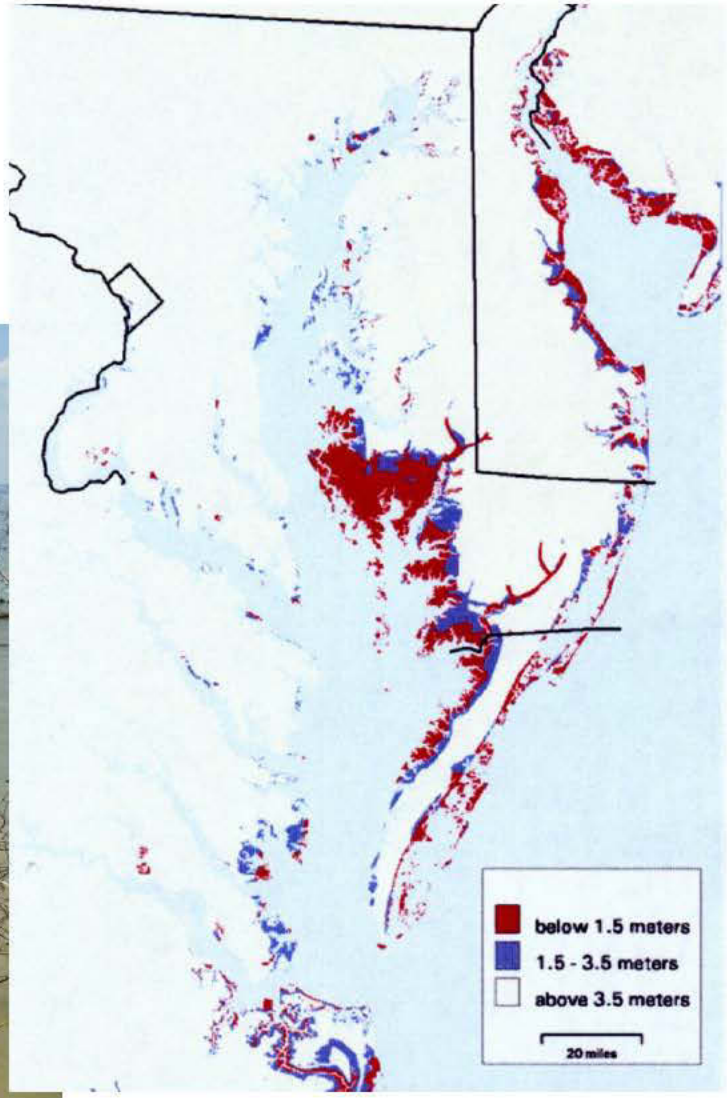
Horn Point Laboratory
University of Maryland Center for Environmental Science

SAV – flowering, rooted aquatic (submersed) plants
One of the most important coastal habitats.

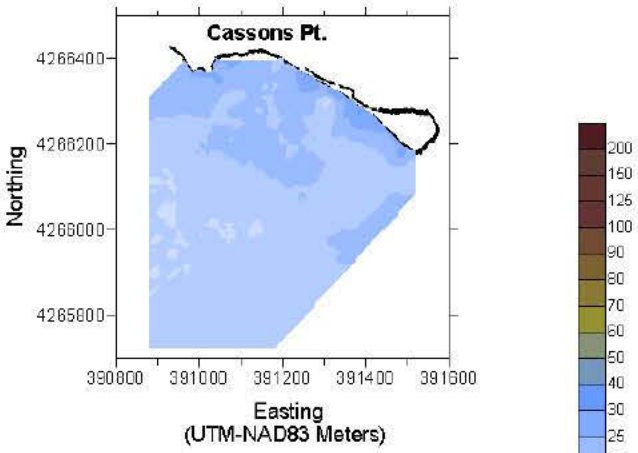
SAV have been disappearing at an alarming rate.
Causes: eutrophication = lack of light.

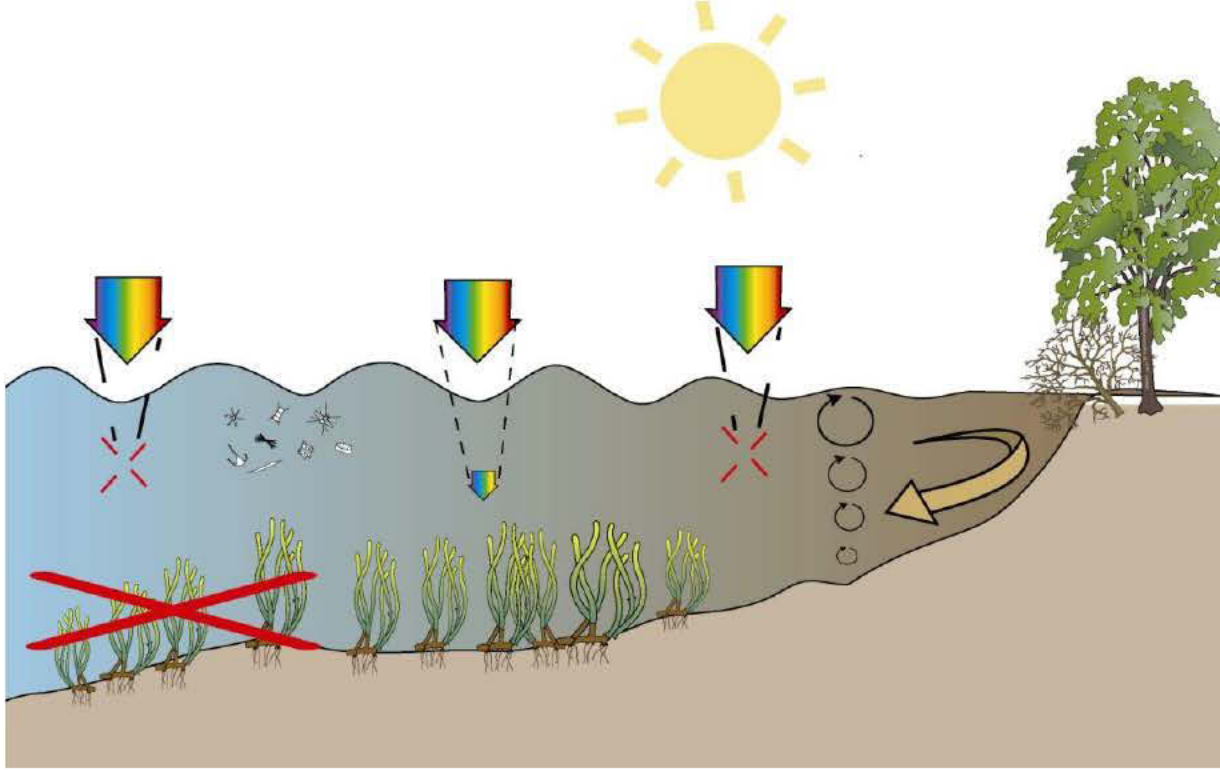


Another cause of water turbidity: shoreline erosion



CTD Survey: SGLC3S1: June 20, 2006





Casson Point, Little Choptank

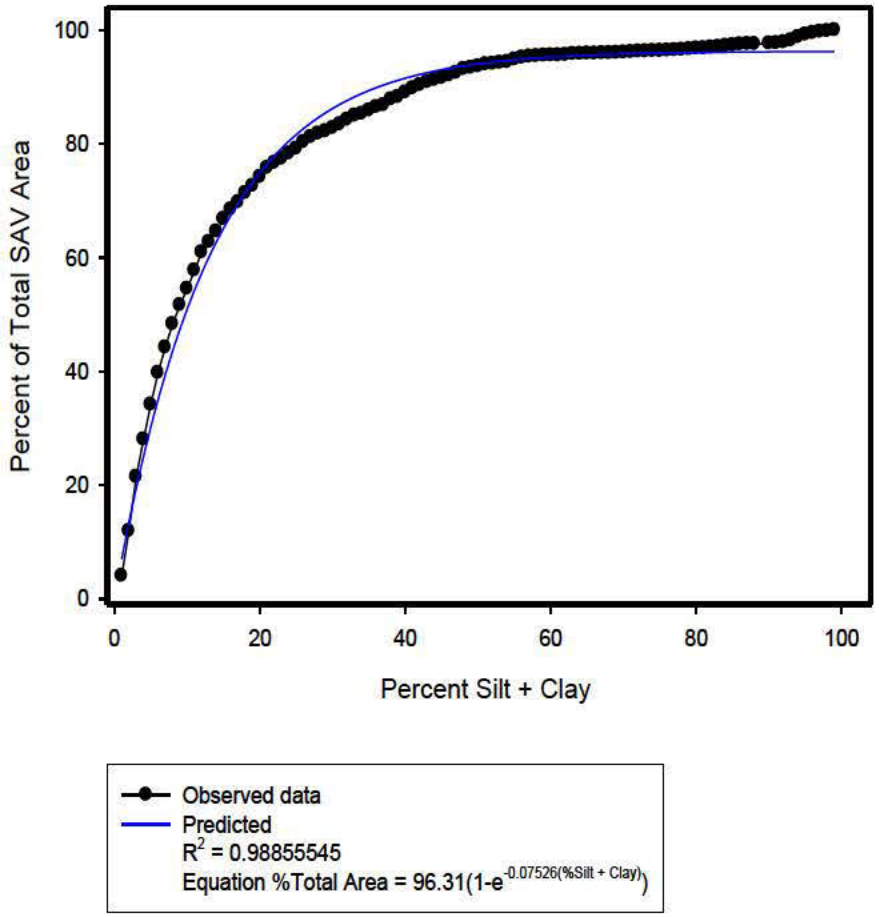
But not all sediments are equal. Sediment type being eroded matters!

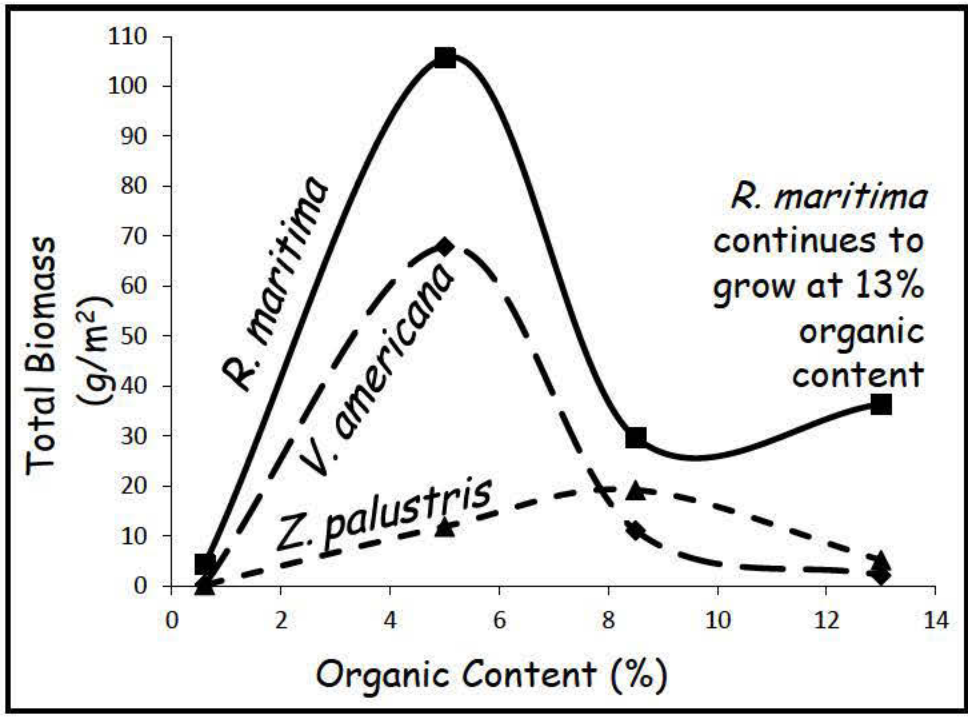
Erosion of mud leads to higher turbidity – bad for SAV.
Erosion of sand – to a certain extent, good for SAV

Mason Neck State Park, Potomac River

Cook's Point, Choptank River

SAV need > 65% sand, < 5% organic matter

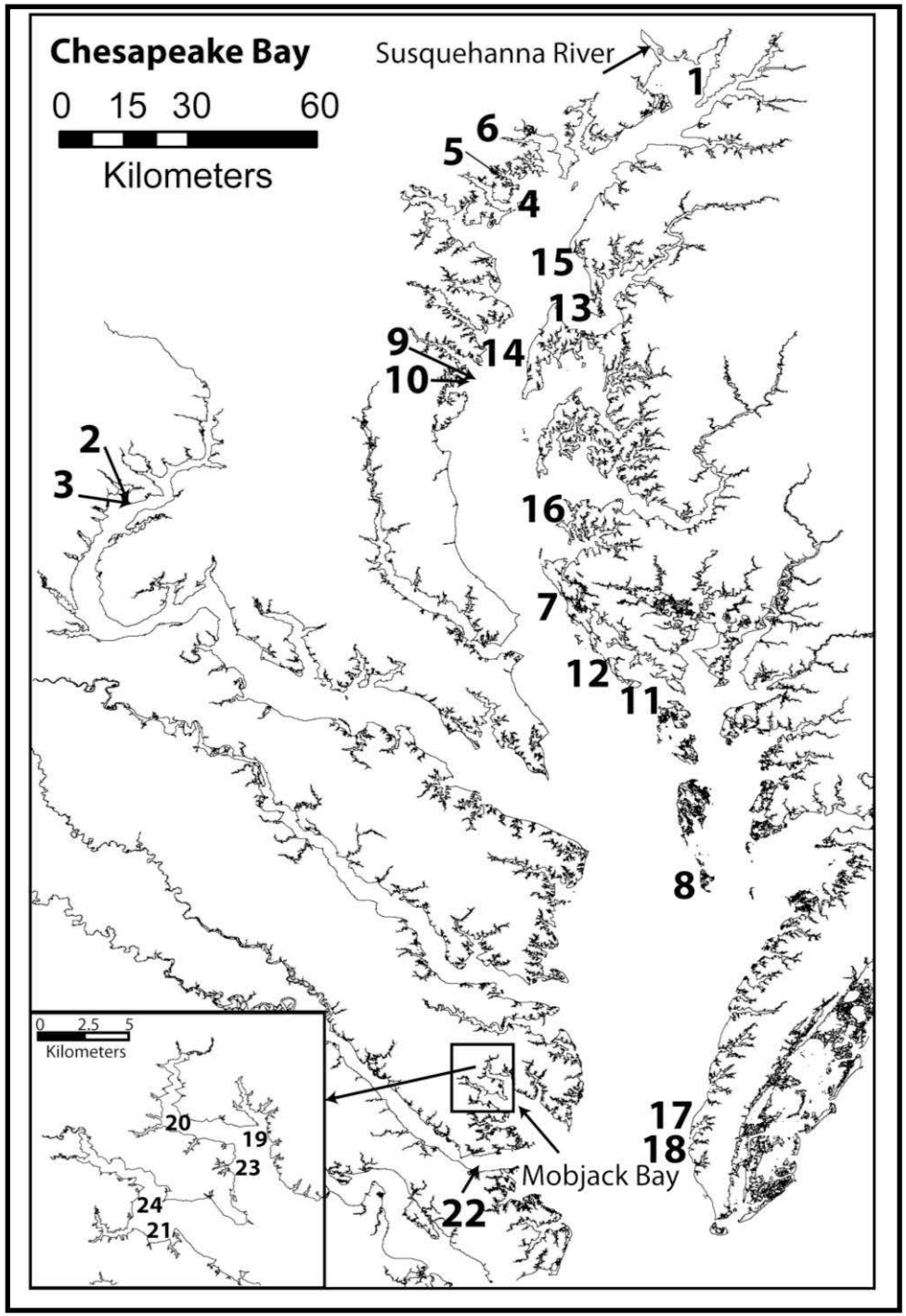




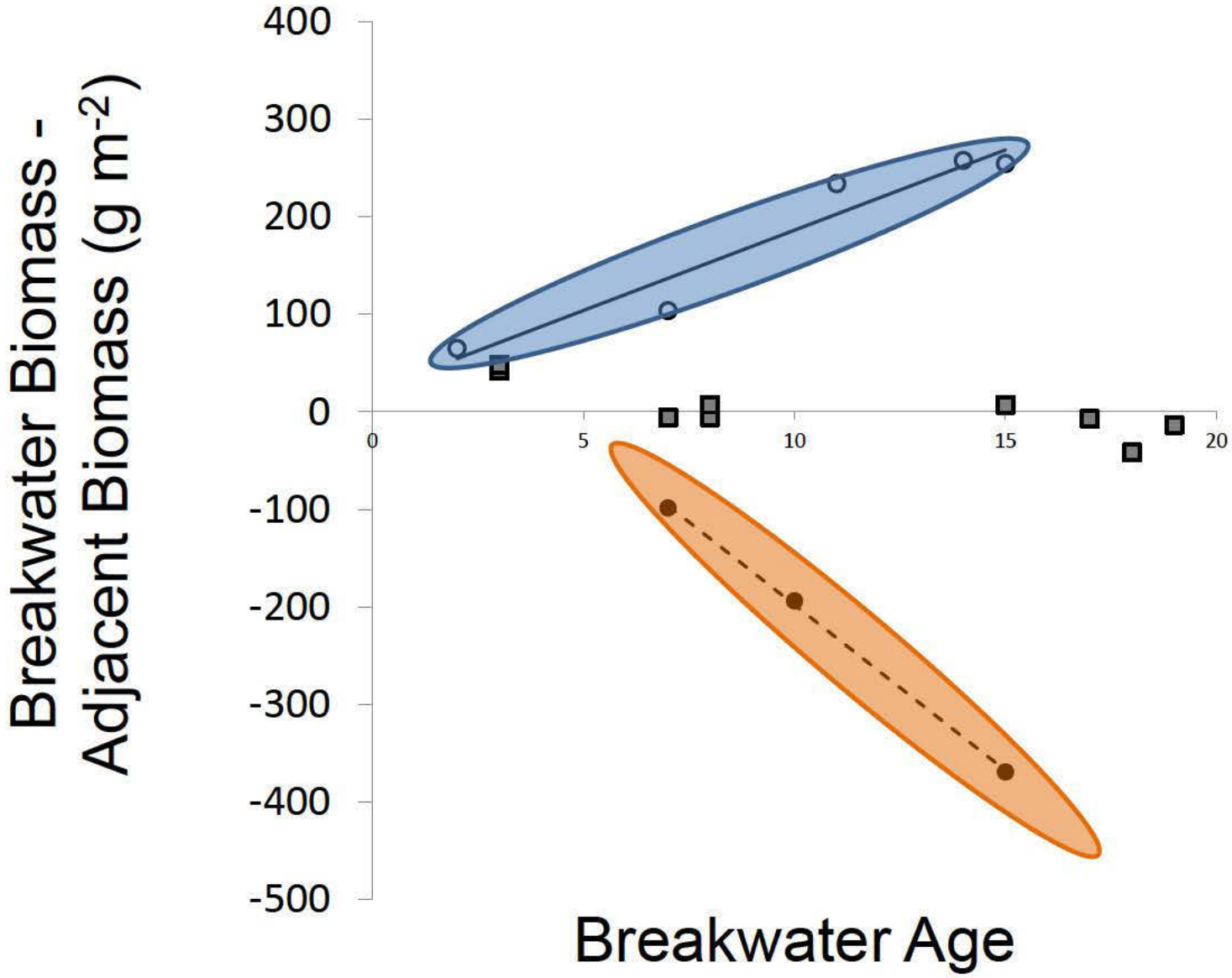
Sand is of the essence in the creation of viable SAV habitat!

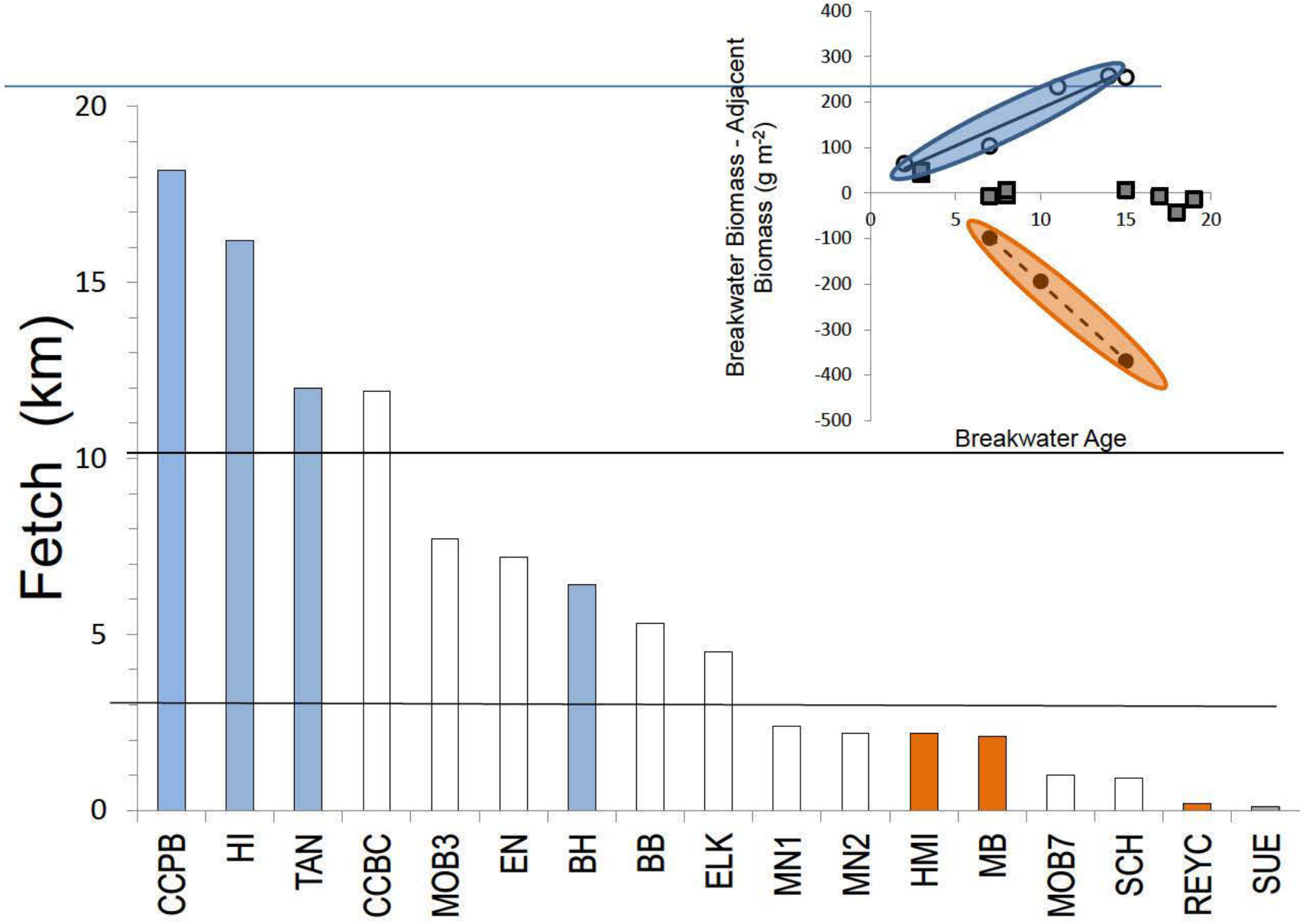
Can breakwaters create suitable SAV habitat?

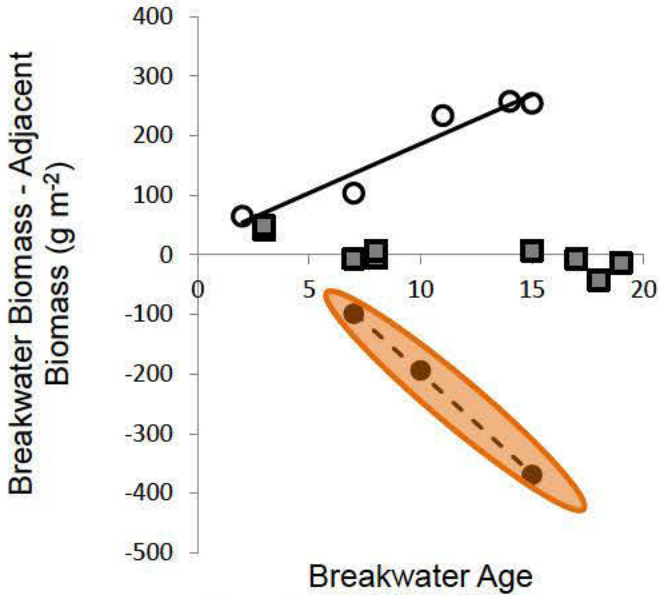
- ages from 0 to 20 yrs old



US Army Corps
of Engineers

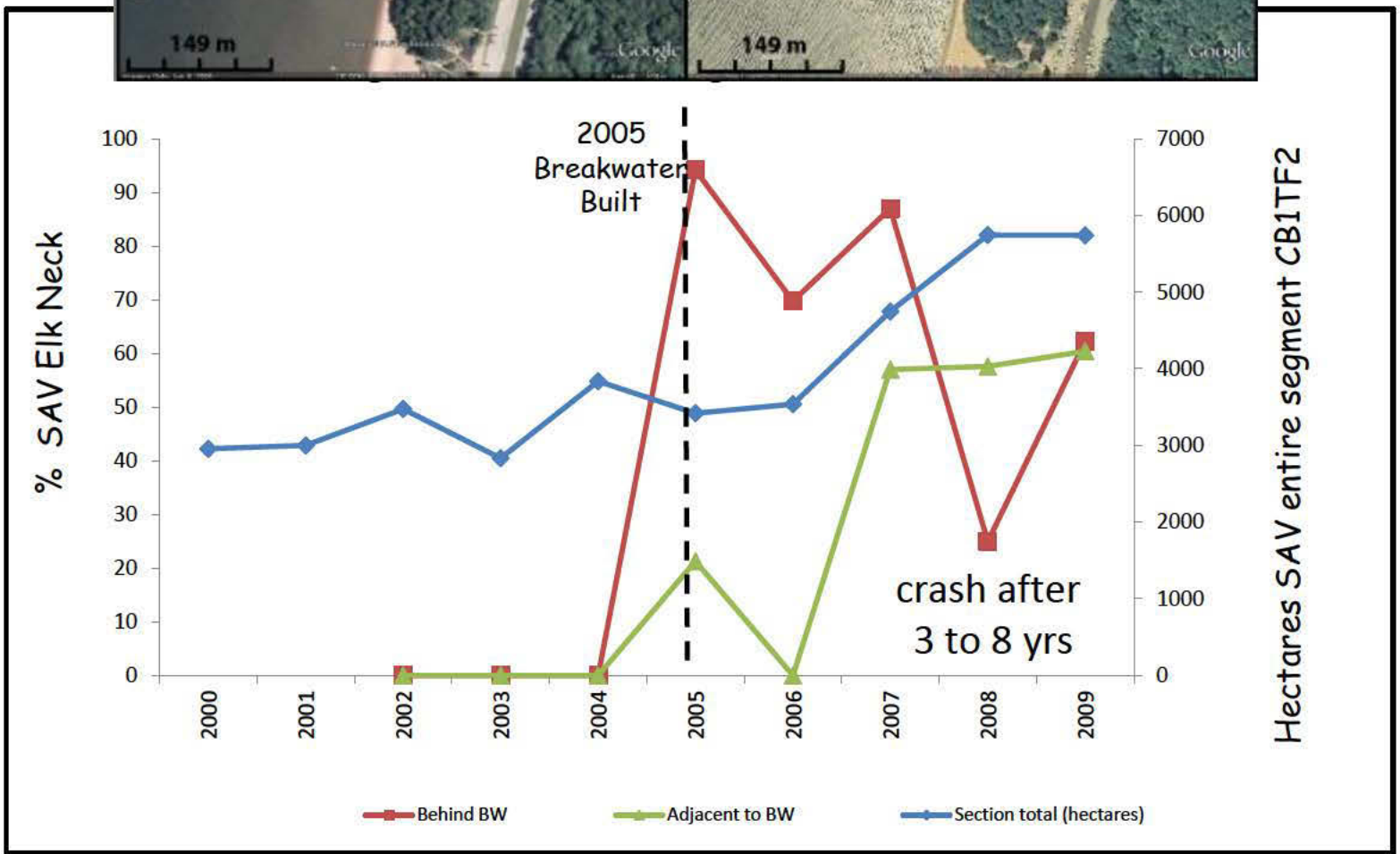

Breakwater Biomass - Adjacent Biomass (g m-2)
400
300
200
100
0
-100
-200
-300
-400
-500
0
5
10
15
20
Breakwater Age


Fetch (km)
20
15
10
5
0
CCPB
HI
TAN
CCBC
MOB3
EN
BH
BB
ELK
MN1
MN2
HMI
MB
MOB7
SCH
REYC
SUE
Breakwater Biomass - Adjacent Biomass (g m-2)
400
300
200
100
0
-100
-200
-300
-400
-500
0
5
10
15
20
Breakwater Age

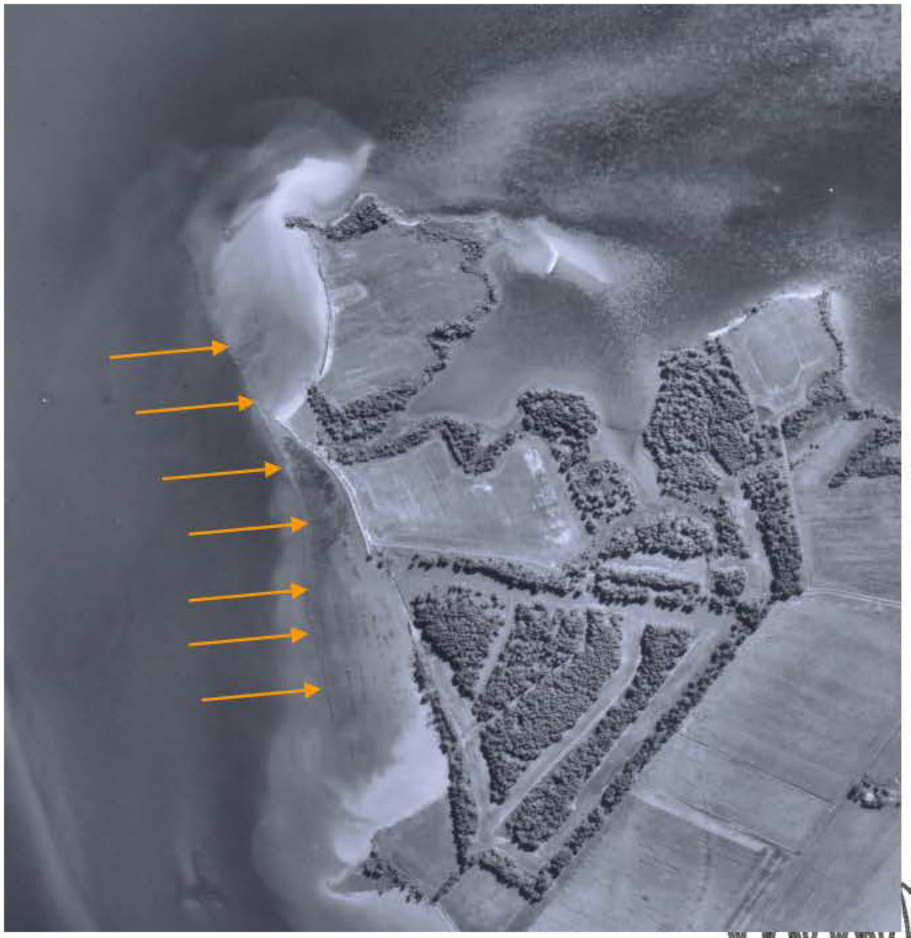

Breakwater Biomass - Adjacent Biomass (g m-2)
400
300
200
100
0
-100
-200
-300
-400
-500
0
5
10
15
20
Breakwater Age

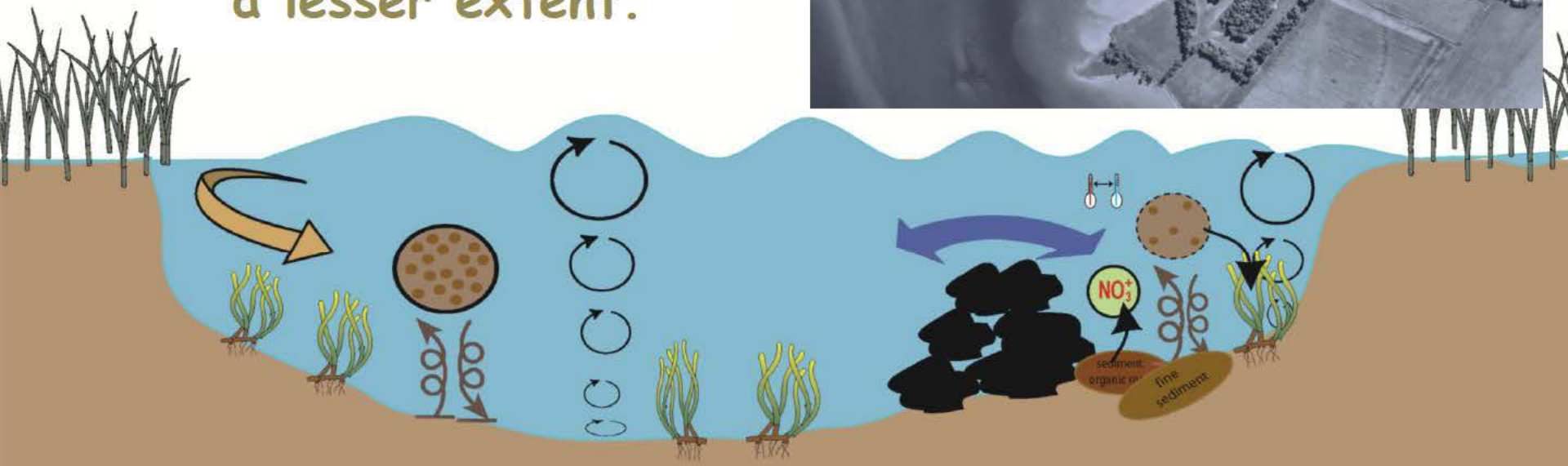

NH4+
fine sediment
sediment organic matter

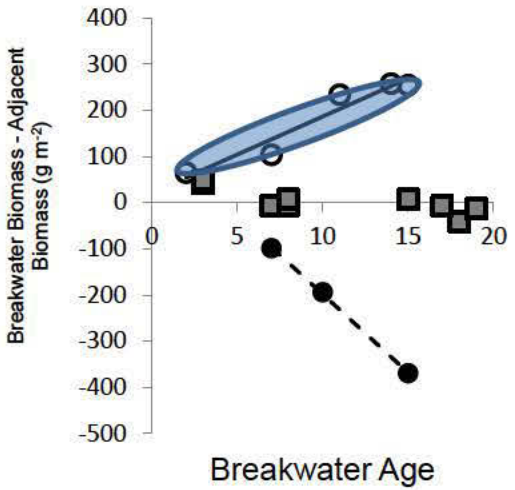
Vallisneria americana
Hydrilla verticilata

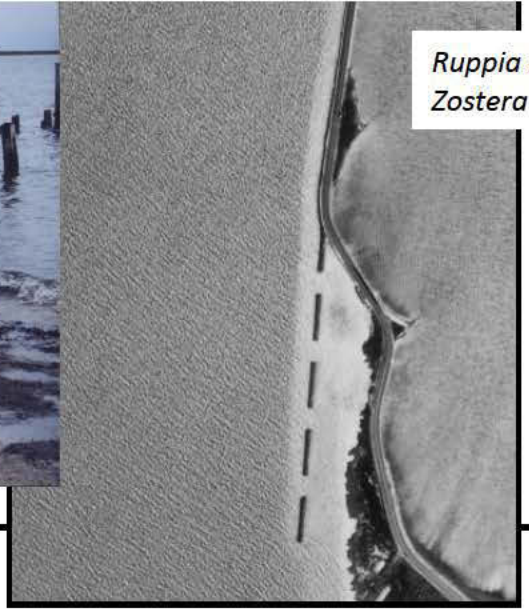


SILLS still have the same detrimental effects as some breakwaters, just to a lesser extent.



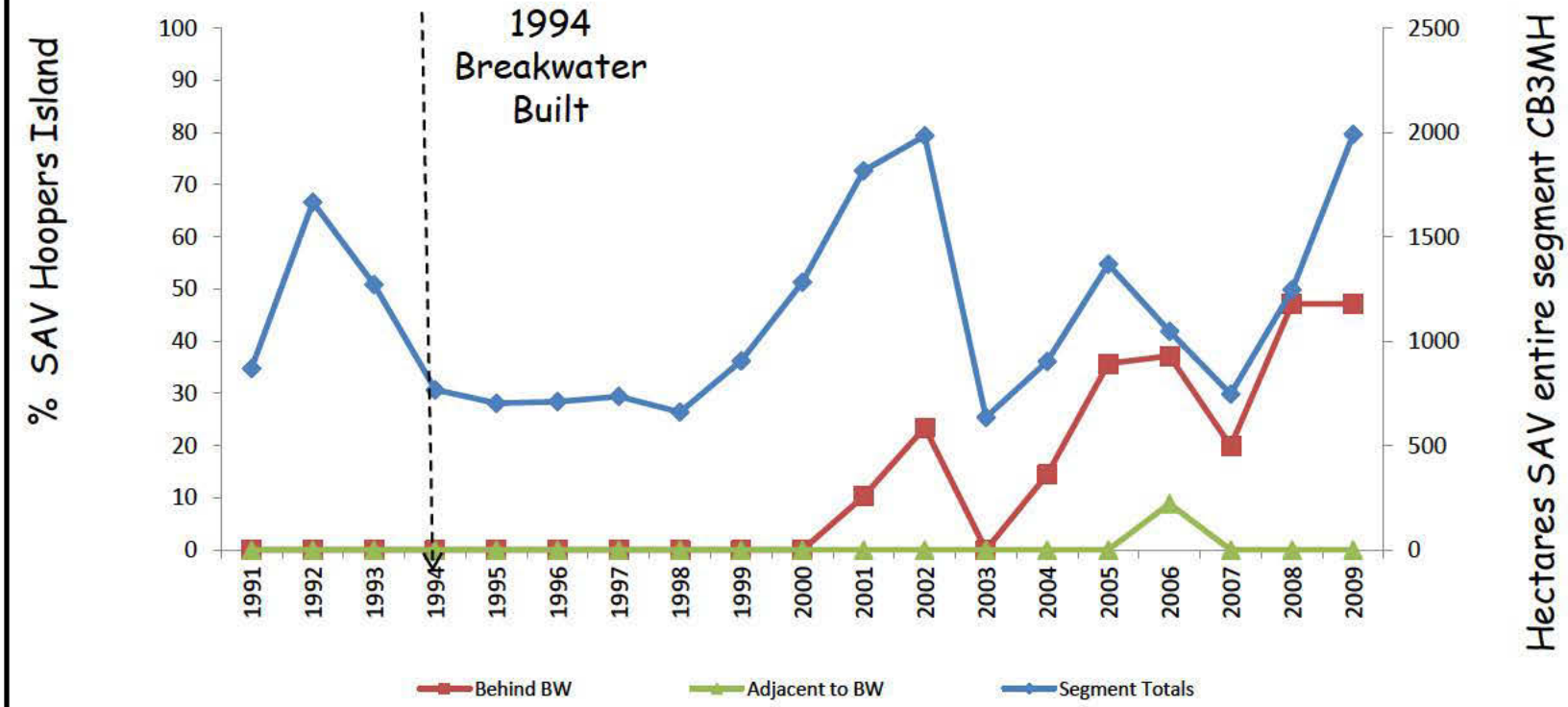






Ruppia maritima
Zostera marina

Segment SAV coverage vs. Hoopers Island



Learning from nature: what is the right sediment accumulation rate to create SAV habitat?

Estuaries and Coasts
DOI 10.1007/s12237-012-9542-7

Sediment Accumulation Rates and Submersed Aquatic Vegetation (SAV) Distributions in the Mesohaline Chesapeake Bay, USA

Cindy M. Palinkas · Evamaria W. Koch

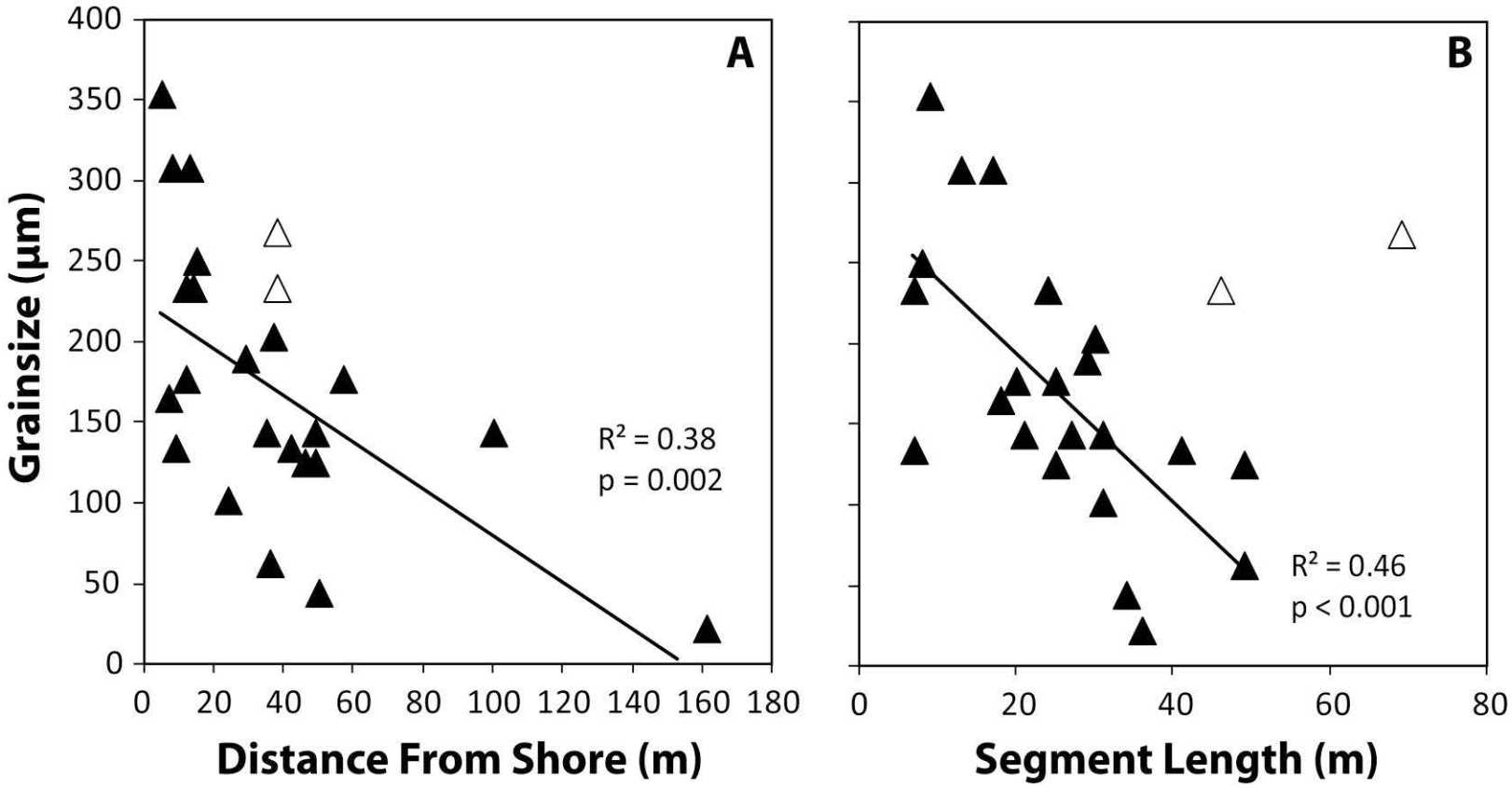
Depositional rates > 9 mm/yr are beneficial for SAV

Conclusions

Breakwaters can sustain SAV populations as long as some habitat requirements are met:

- **Water quality** – regional water quality needs to be good enough to support SAV growth
- **Water depth** – deep enough so SAV can remain submersed at low tide
- **Sediment** – needs to remain sandy (<35% silt+clay) with low organic matter (<5 to 8% organic matter) over time. Sedimentation rates >9mm/yr are also beneficial but no infilling (habitat becomes intertidal)
- **Fetch** – breakwaters are most beneficial to SAV in long fetch areas (> 10 km)

Management Recommendations
breakwater construction for SAV conservation and/or restoration



Management Recommendations
breakwater construction for SAV conservation and/or restoration

Shoreline characteristics also need to be considered:

- **Eroding Marshes** – a layer of sand* needs to be added to cover the marsh peat in the sub-tidal (*>2cm, Wicks et al. 2009)

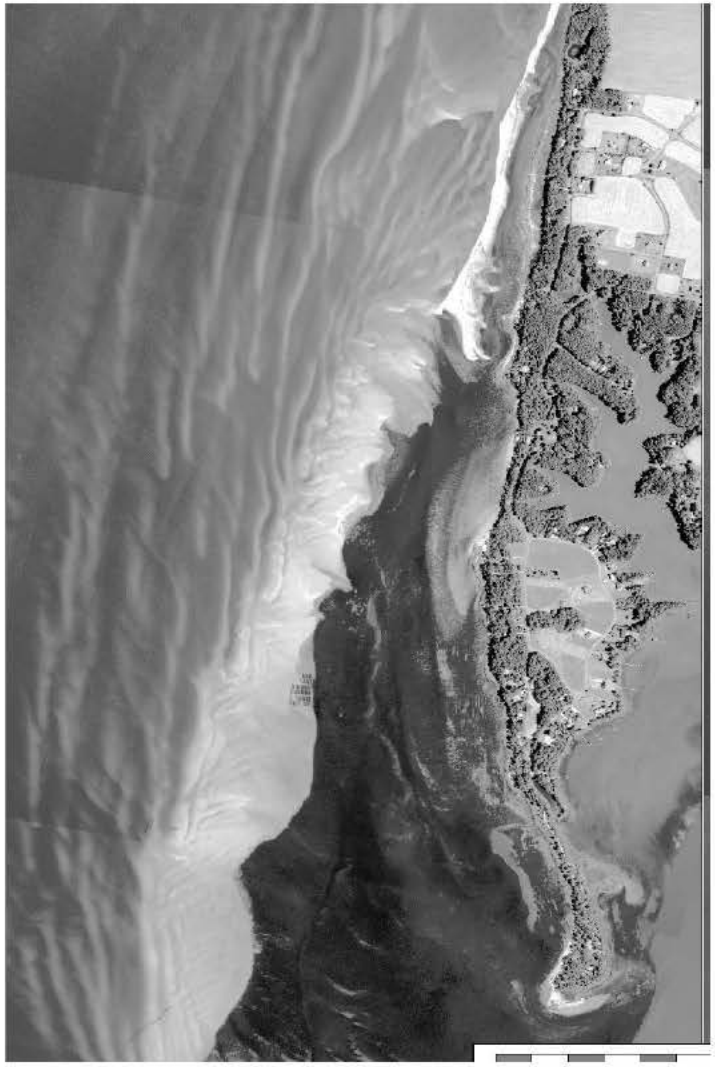
- **Sandy Beach** – breakwater beneficial to SAV especially when fetch > 10 km

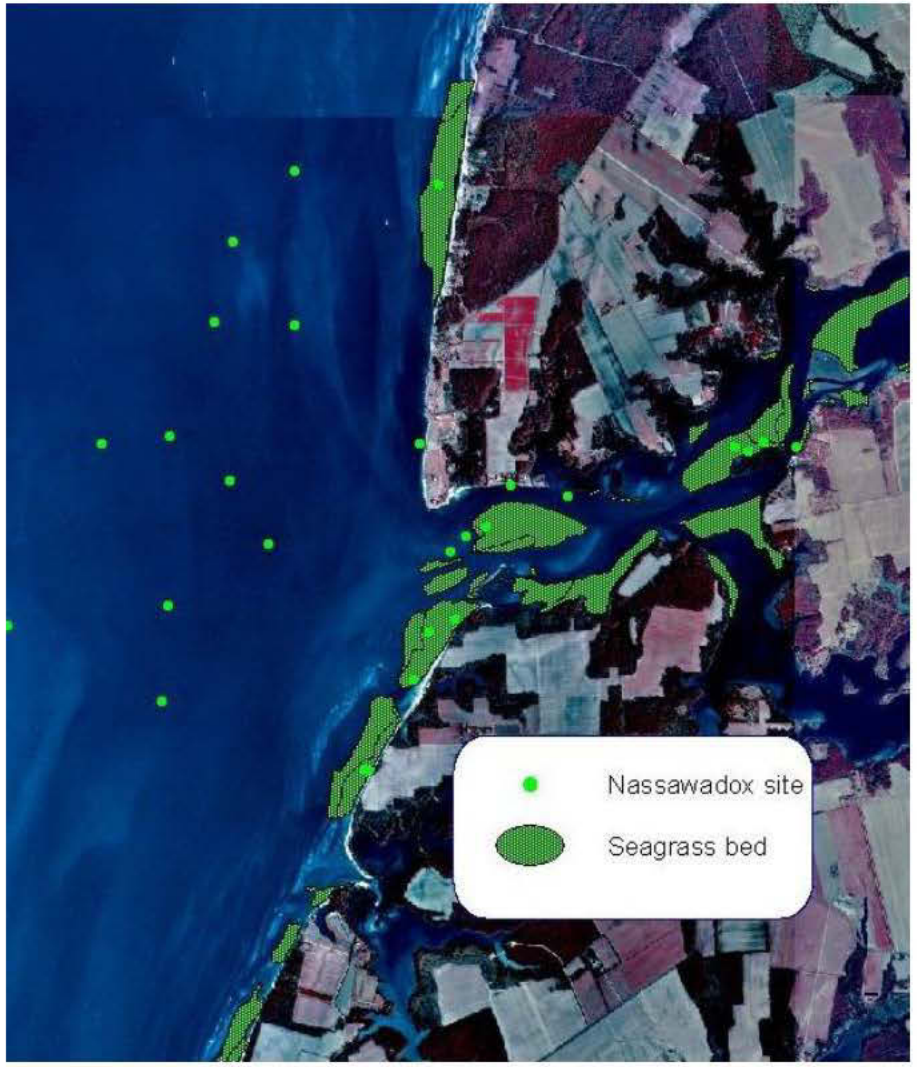
- **Cliffs** – base of cliff needs to be stabilized to reduce sediment input and shoaling breakwater-protected area

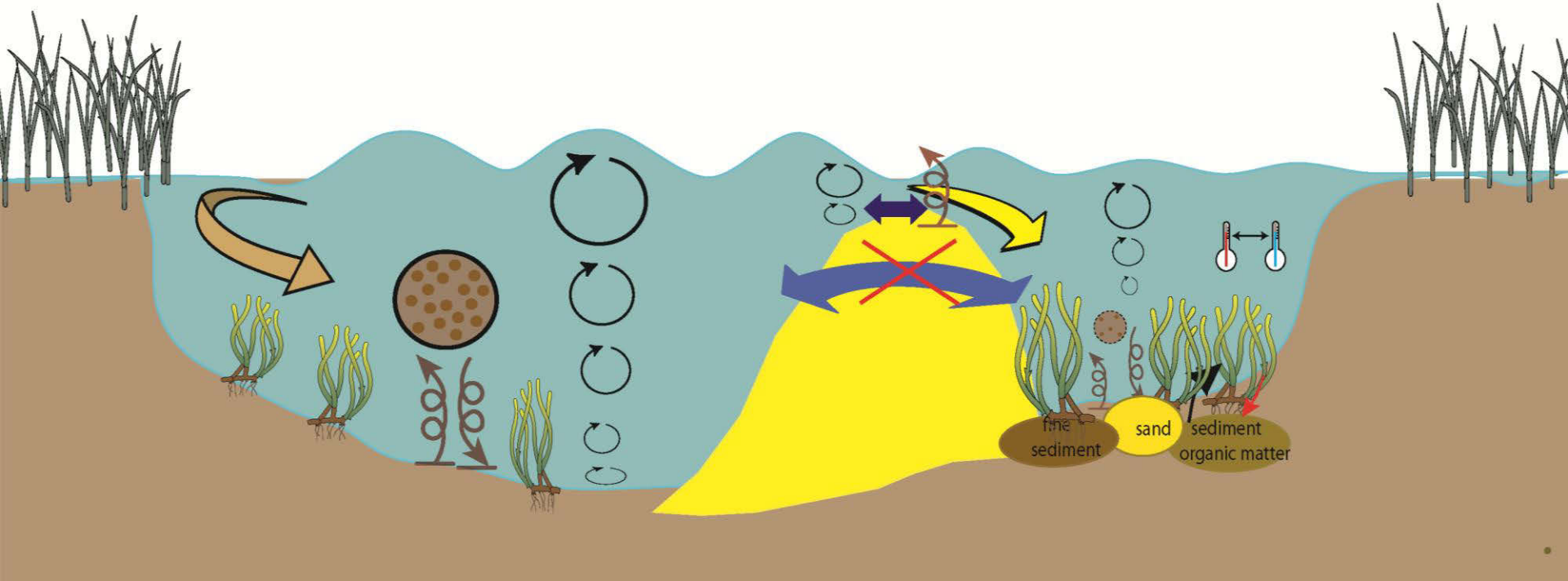
Questions for Evamaria Koch?

koch@umces.edu

Learning from nature:
what is the right sediment accumulation rate to create SAV habitat?






fine sediment
sand
sediment organic matter