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

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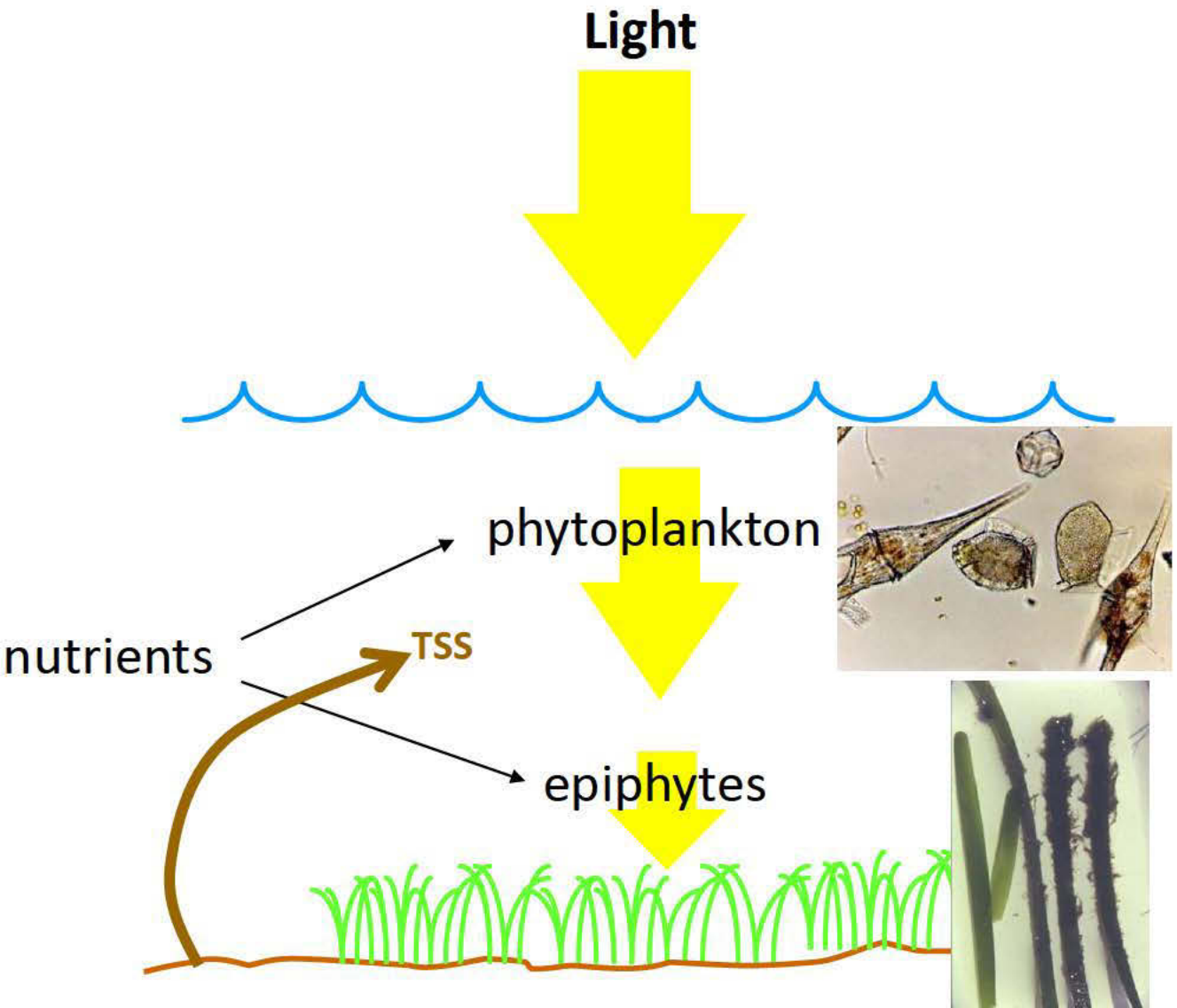
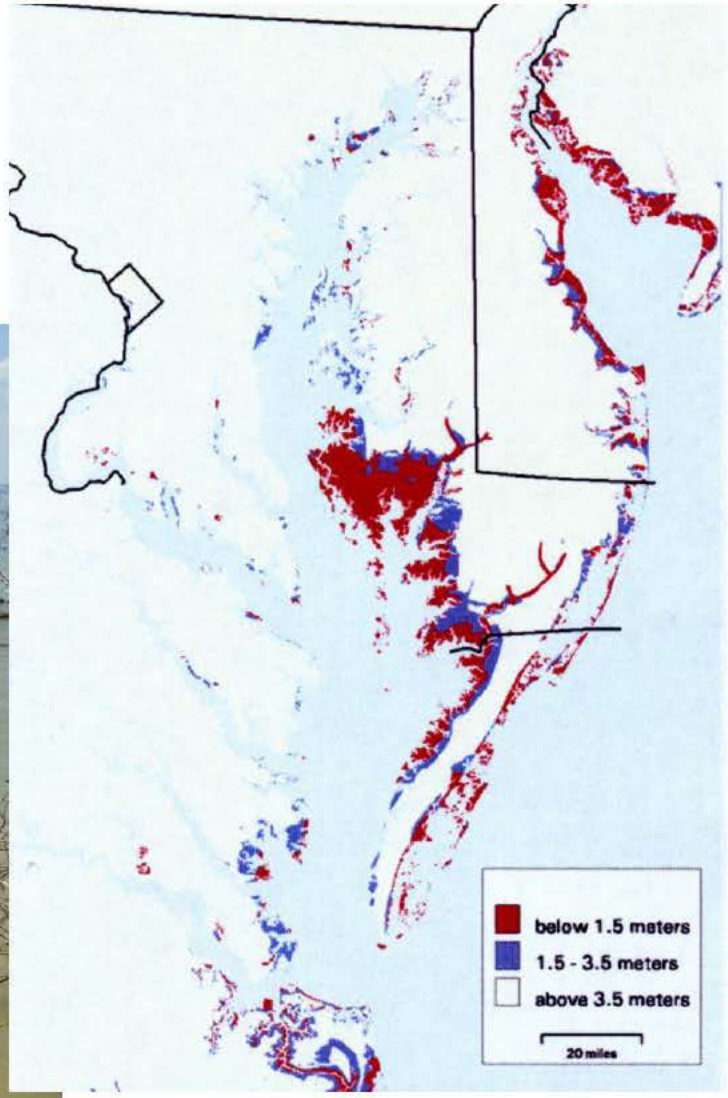
SAV – flowering, rooted aquatic (submersed) plants
One of the most important coastal habitats.

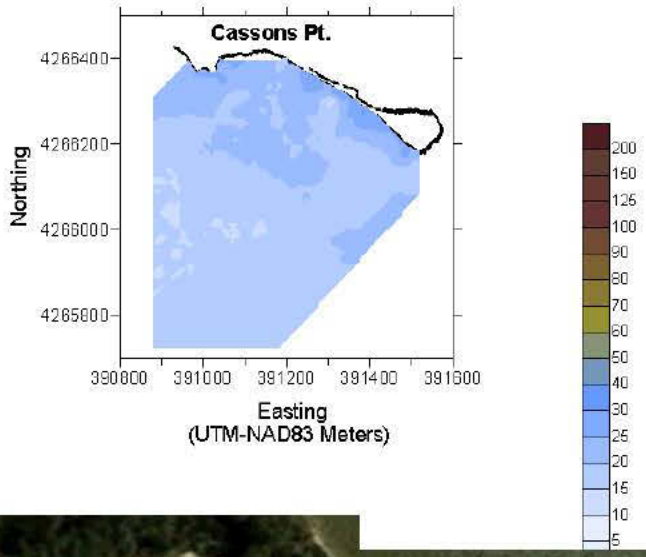
SAV have been disappearing at an alarming rate.
Causes: eutrophication = lack of light.

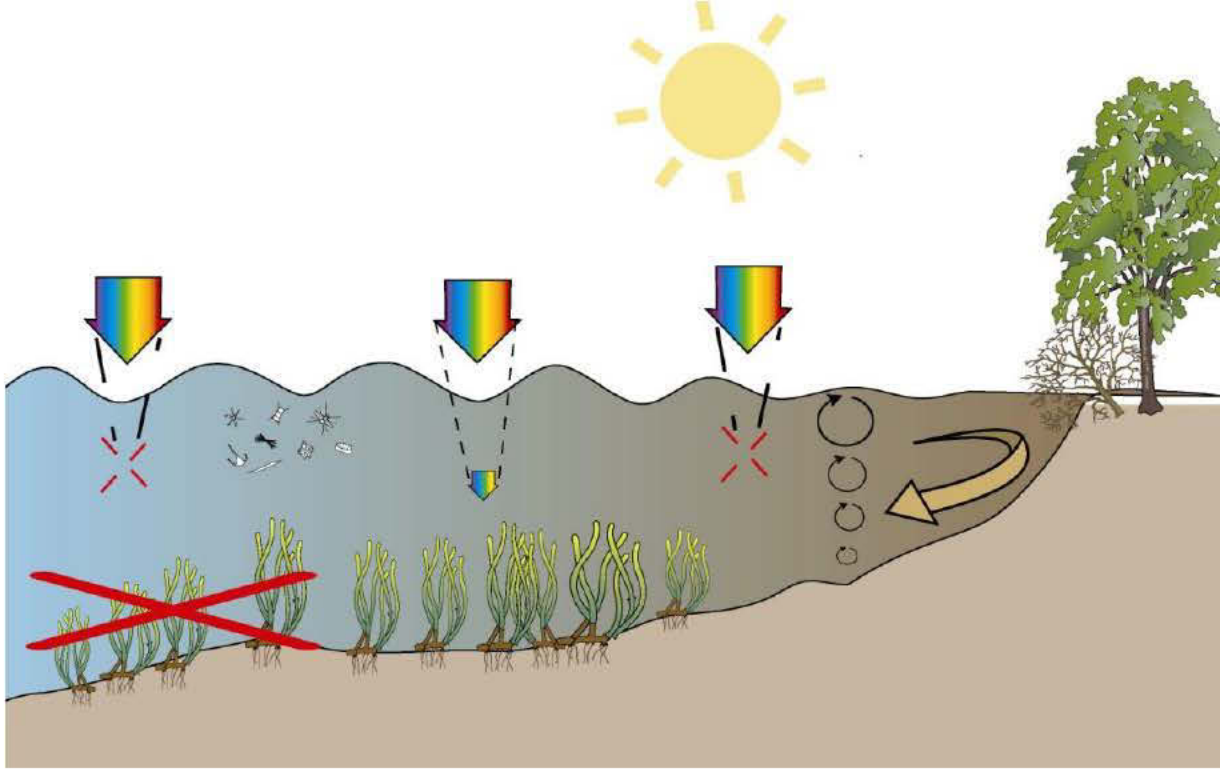


Another cause of water turbidity: shoreline erosion



CTD Survey: SGLC3S1: June 20, 2006





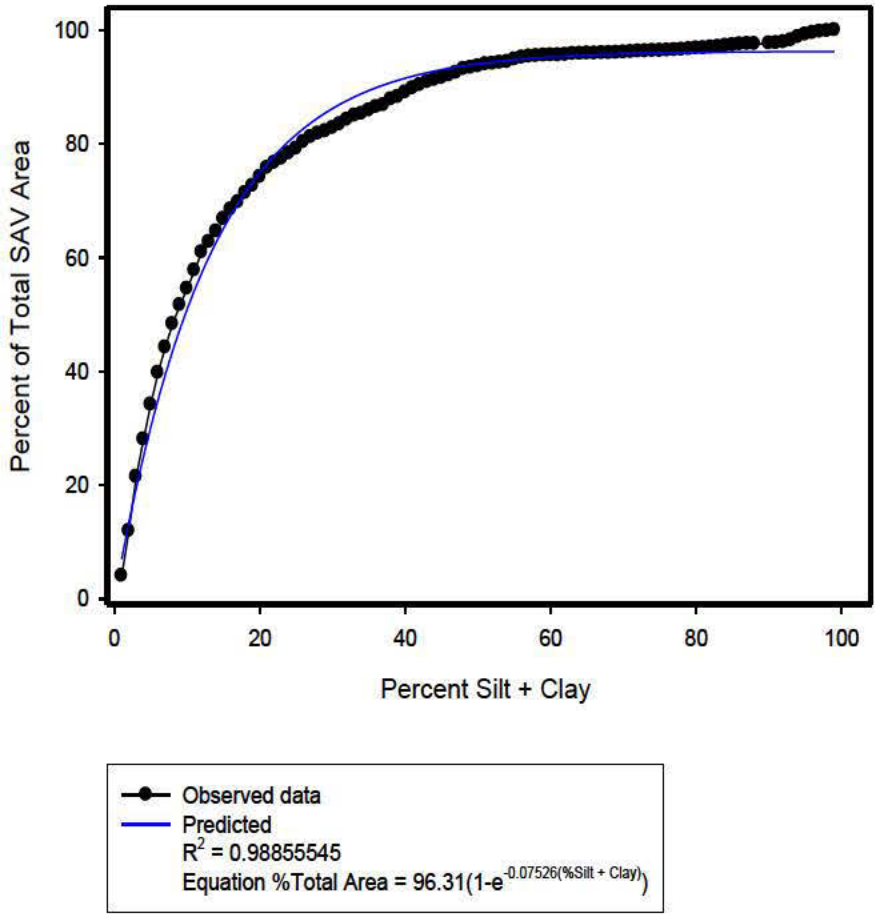
But not all sediments are equal. Sediment type being eroded matters!

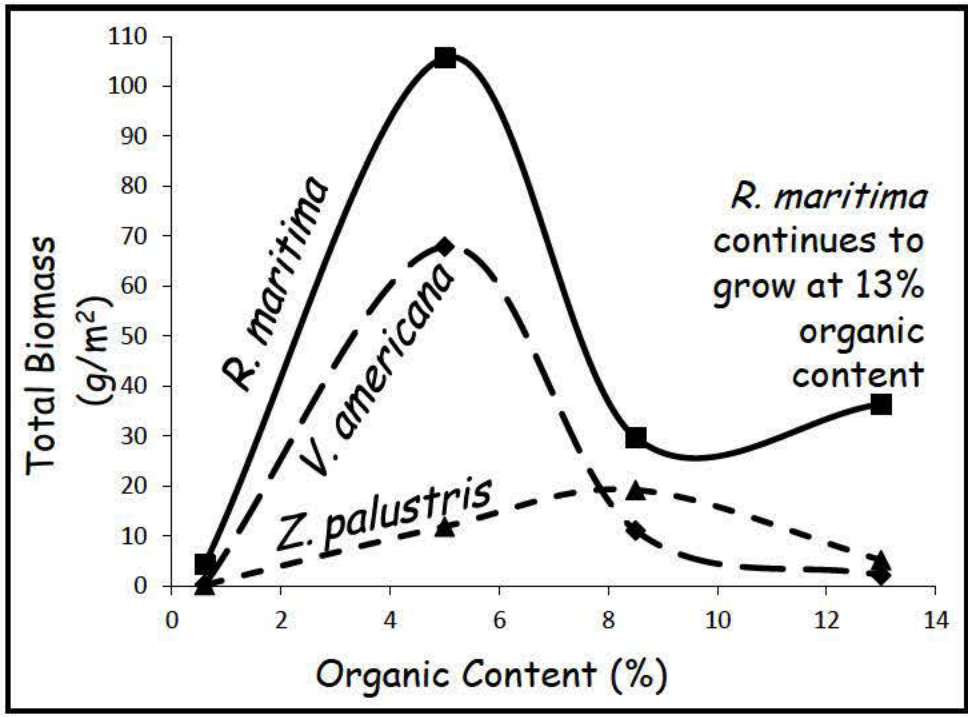
Erosion of mud leads to higher turbidity – bad for SAV.
Erosion of sand – to a certain extent, good for SAV

Mason Neck State Park, Potomac River

Cook's Point, Choptank River

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

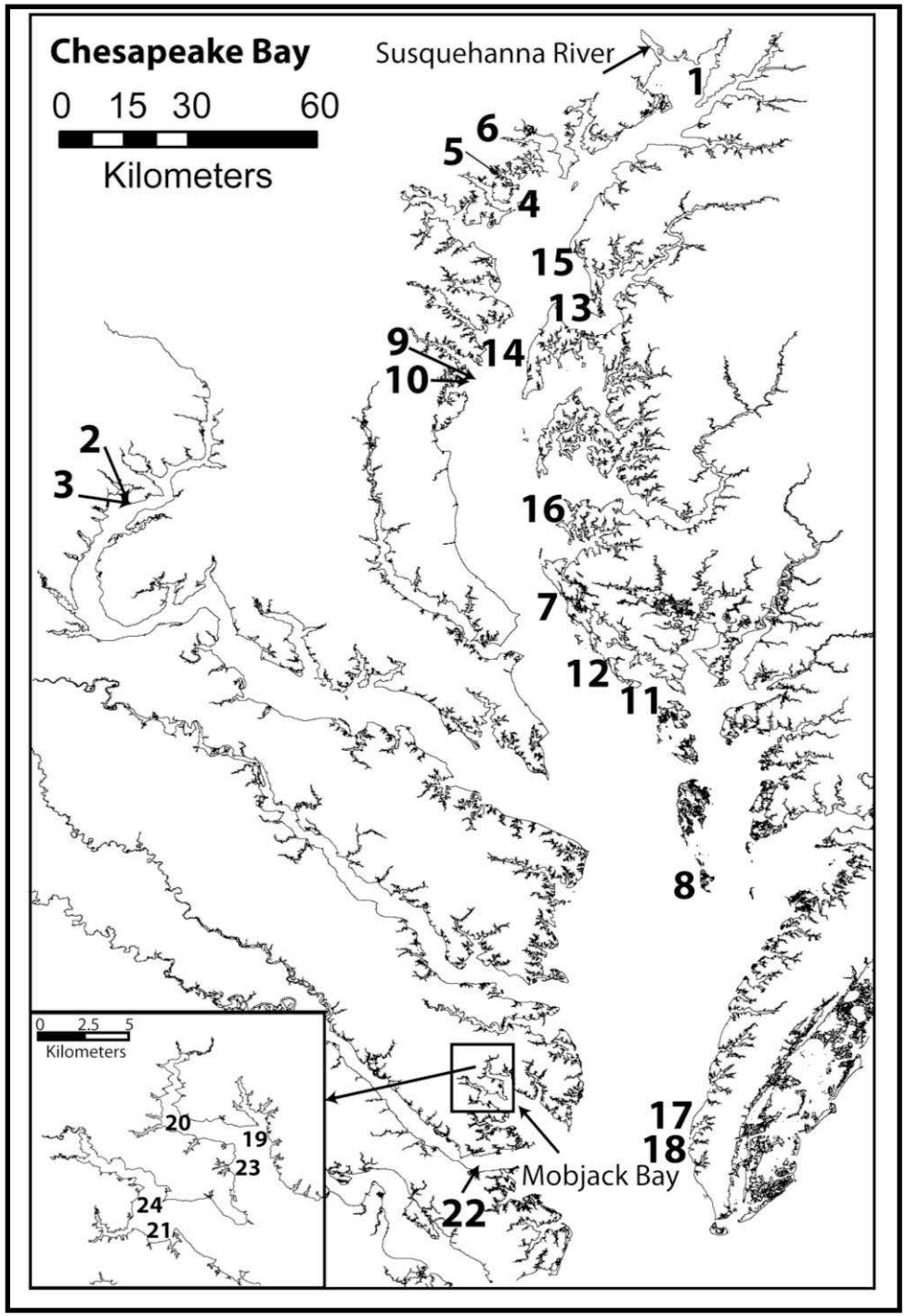




Sand is of the essence in the creation of viable SAV habitat!

Can breakwaters create suitable SAV habitat?

- ages from 0 to 20 yrs old



US Army Corps
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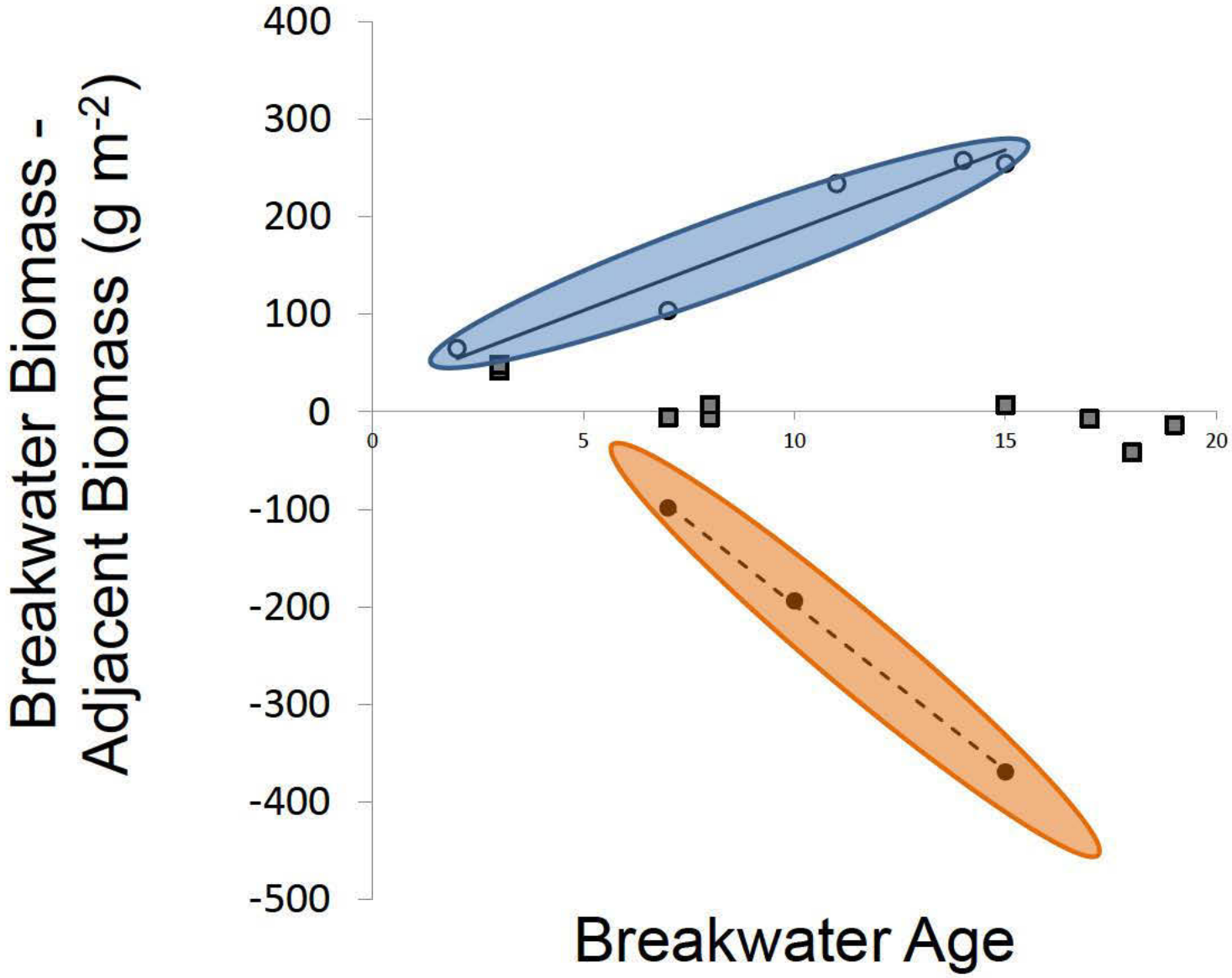
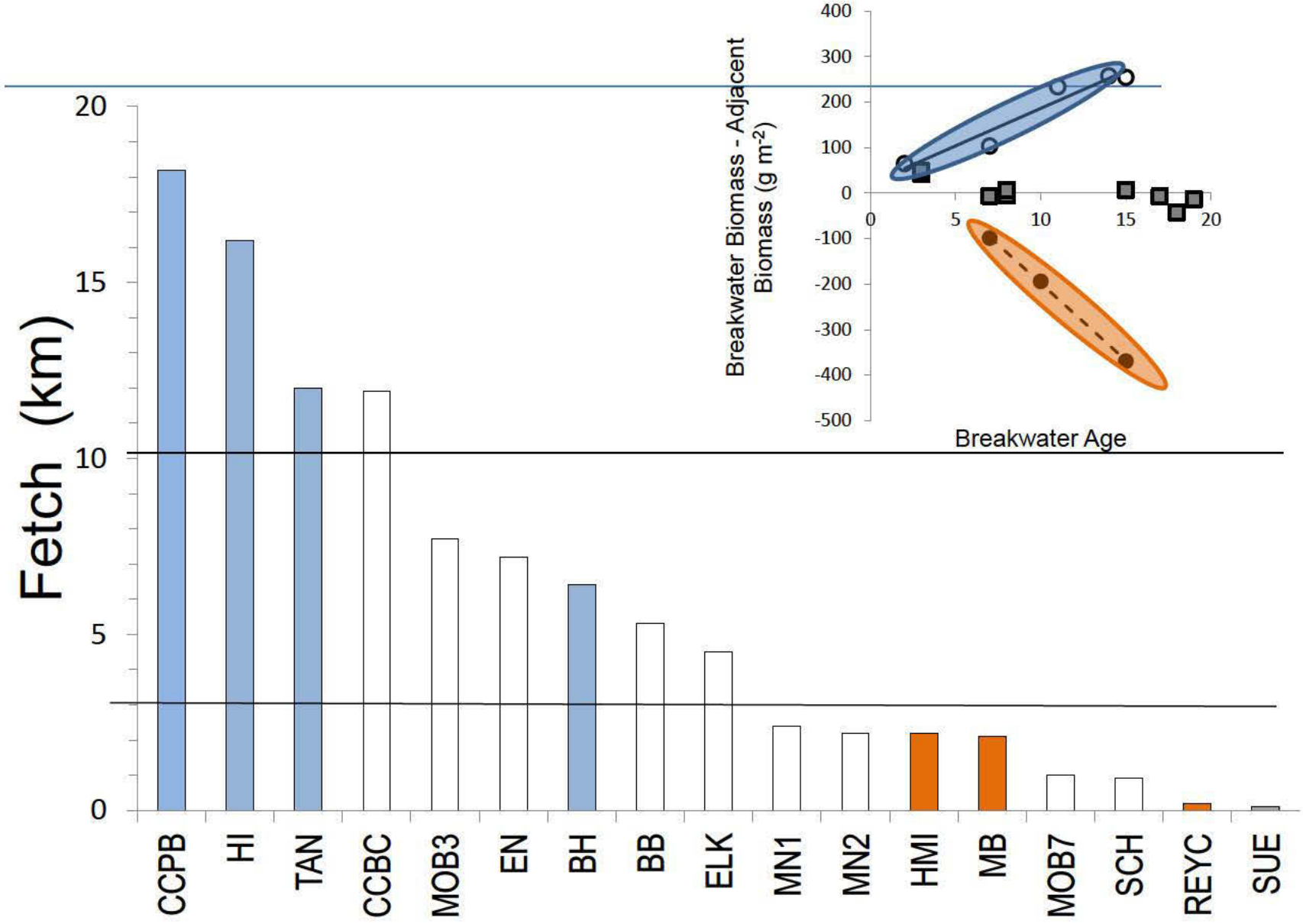
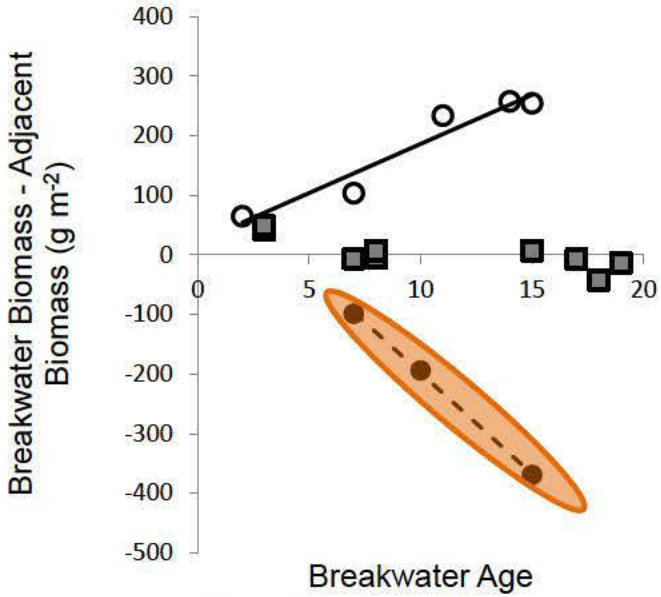
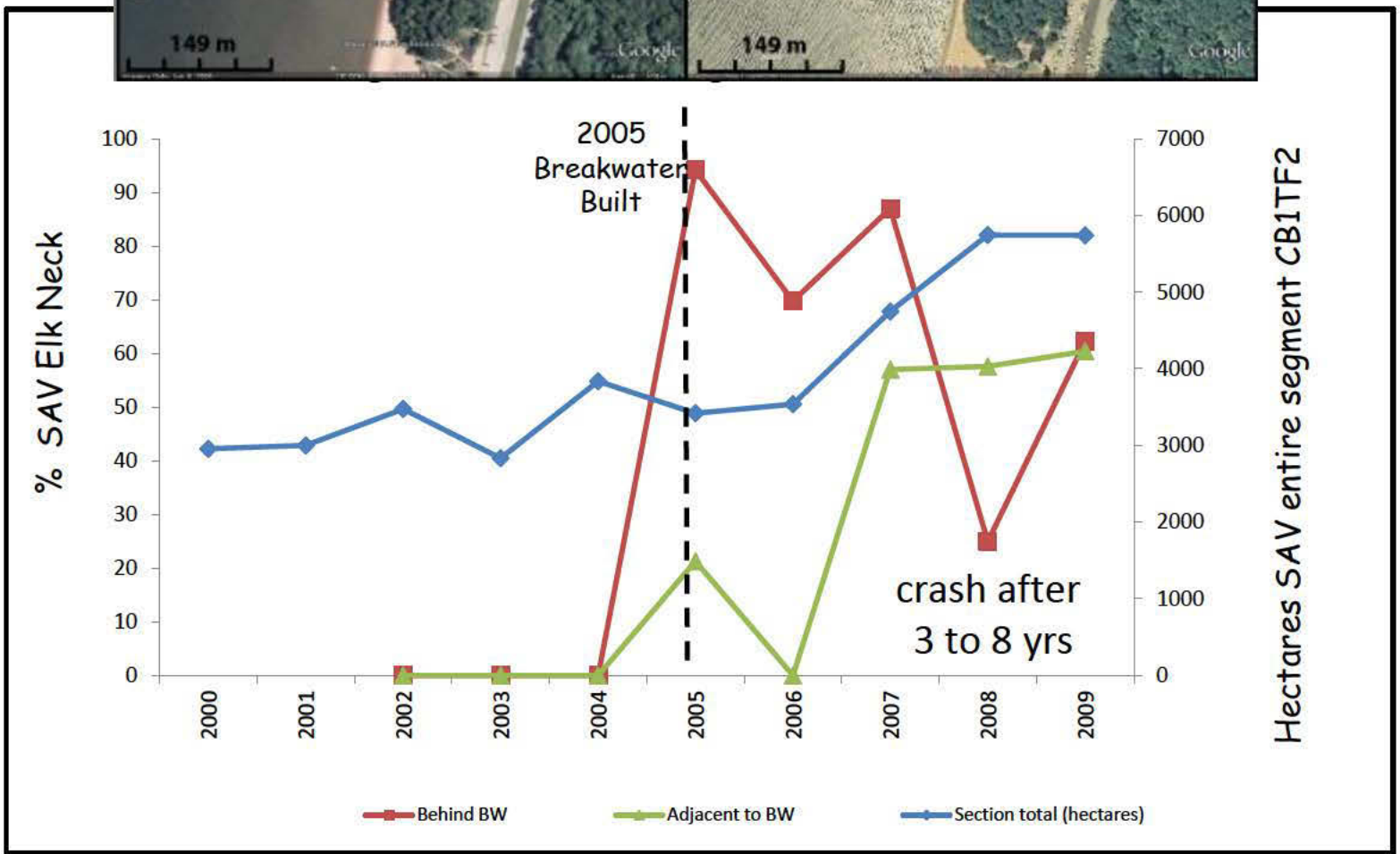

Breakwater Biomass - Adjacent Biomass (g m-2)
400
300
200
100
0
-100
-200
-300
-400
-500
0
5
10
15
20
Breakwater Age


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

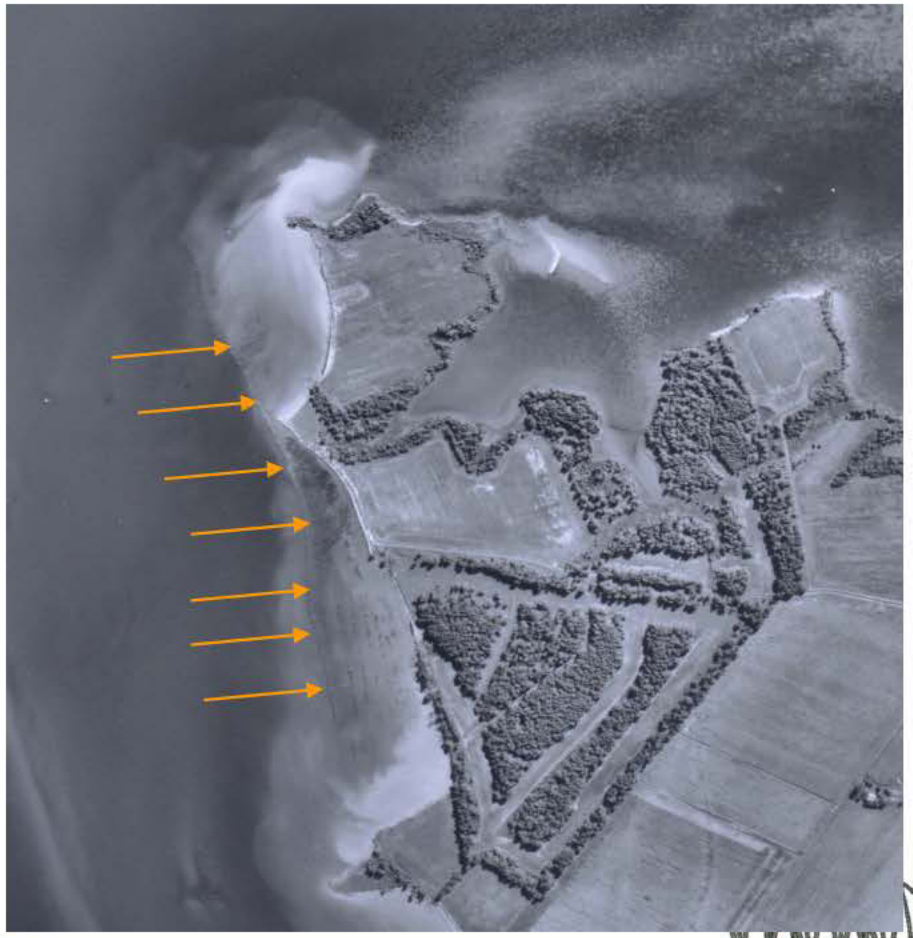

Breakwater Biomass - Adjacent Biomass (g m-2)
400
300
200
100
0
-100
-200
-300
-400
-500
0
5
10
15
20
Breakwater Age

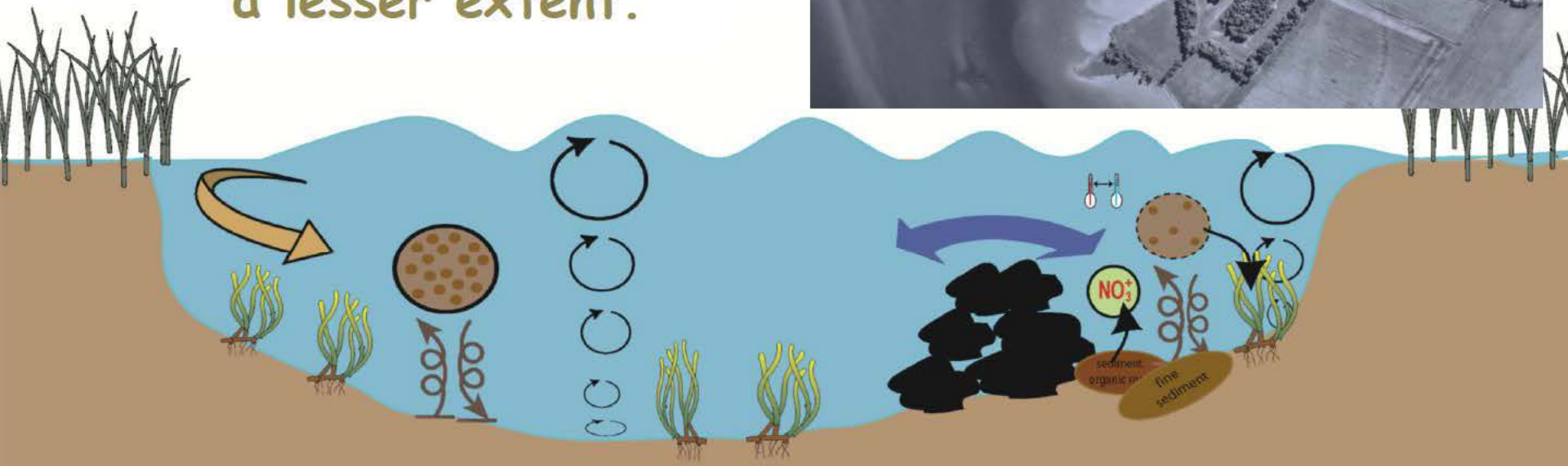
NH4+
fine sediment
sediment organic matter

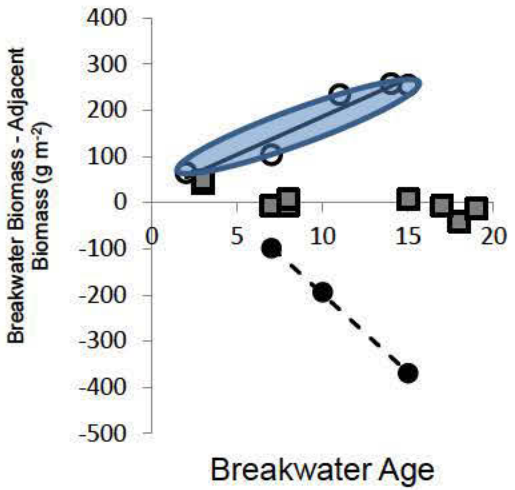
Vallisneria americana
Hydrilla verticilata

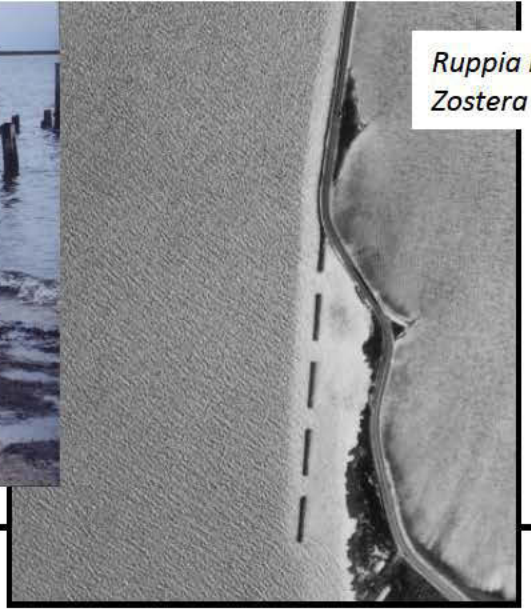


SILLS still have the same detrimental effects as some breakwaters, just to a lesser extent.



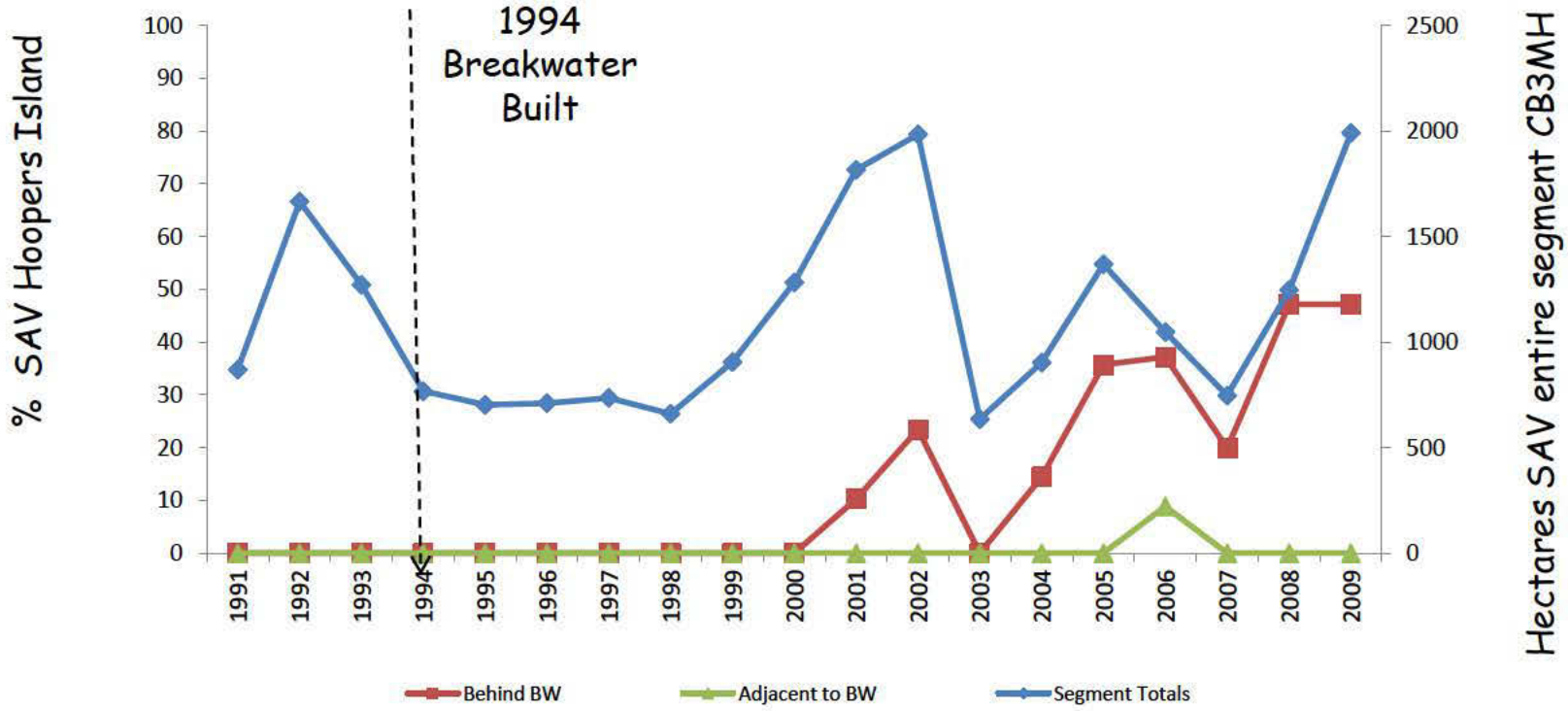






Ruppia maritima
Zostera marina

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

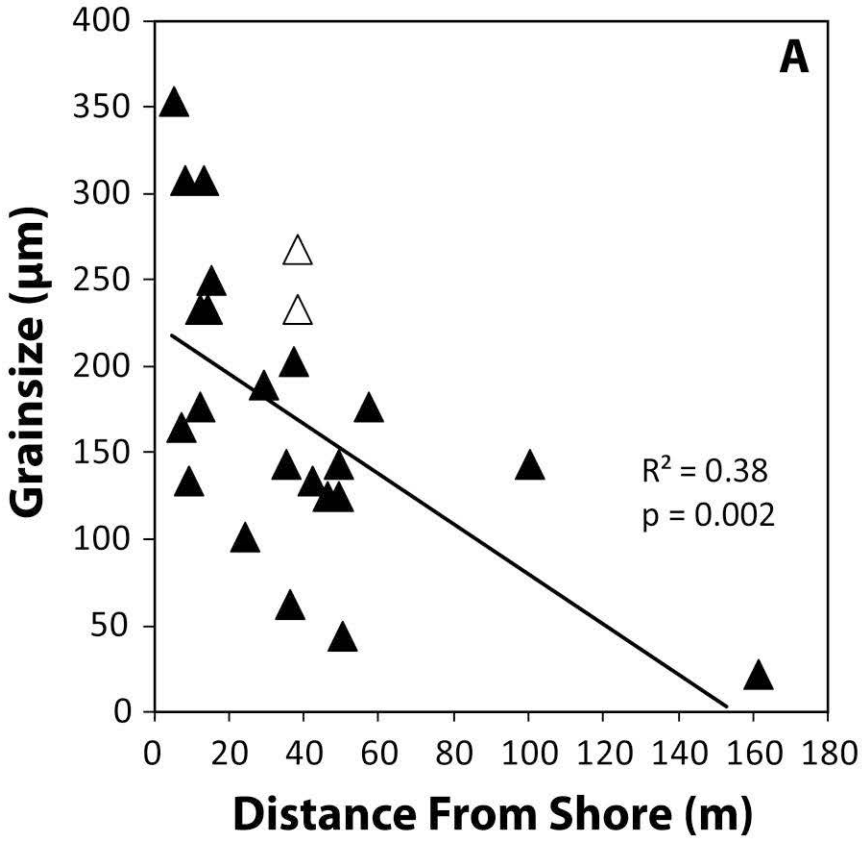
Depositional rates > 9 mm/yr are beneficial for SAV

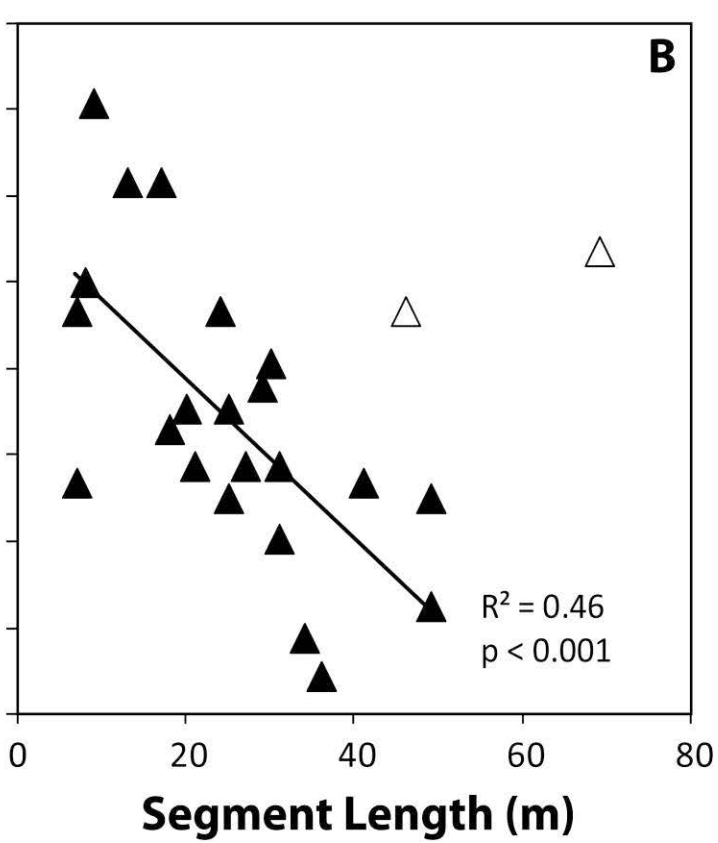
Conclusions

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?

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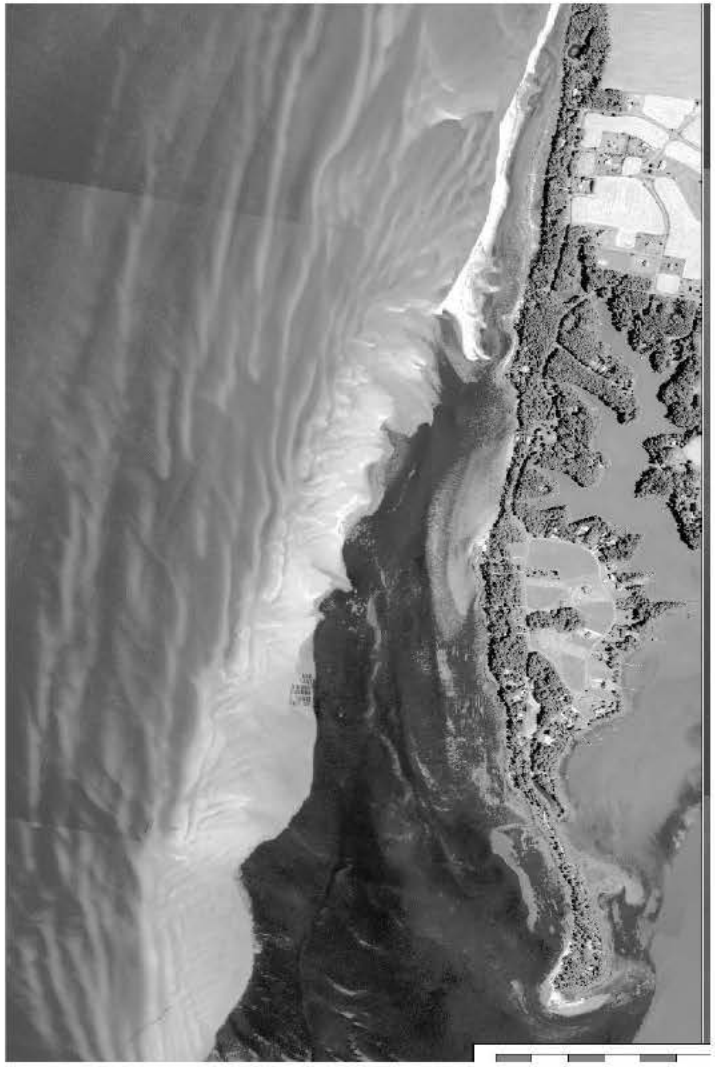
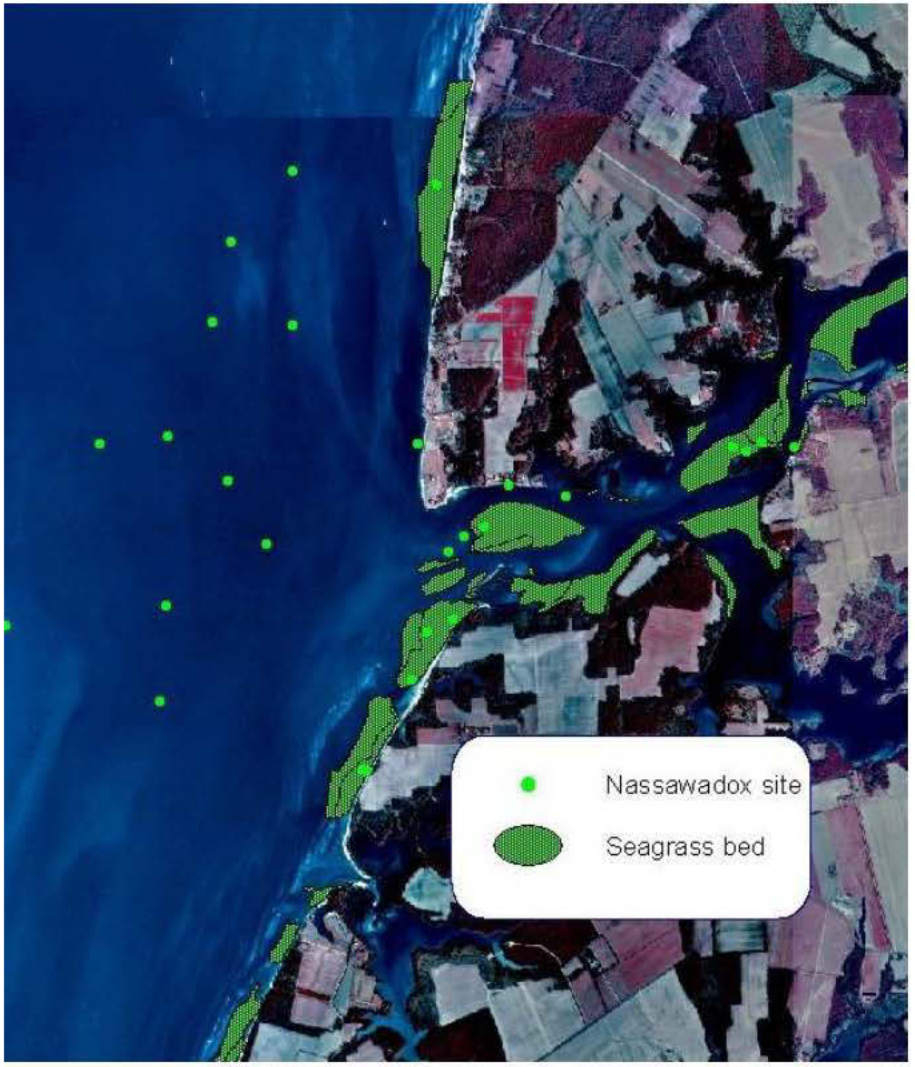
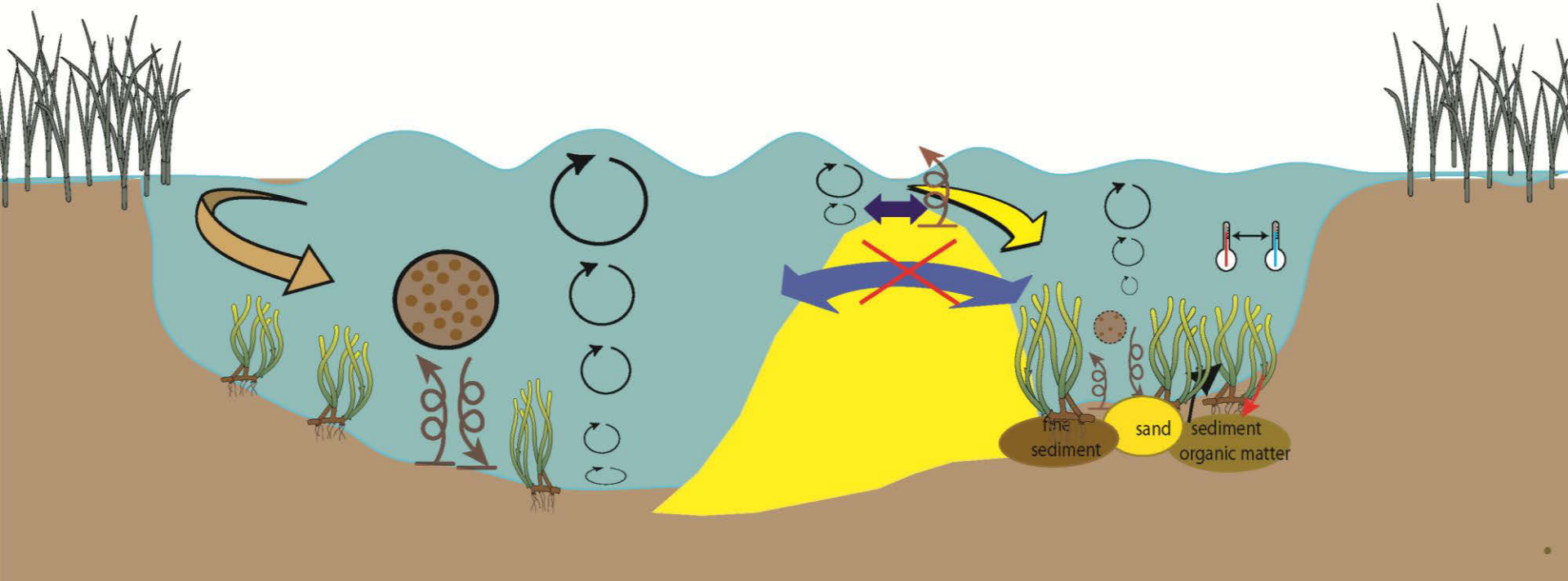
Learning from nature:
what is the right sediment accumulation rate to create SAV habitat?






fine sediment
sand
sediment organic matter