National Estuarine Research Reserve System

NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

From Hydrography to Hydrologic Regime

Understanding Salt Marsh Survival

NERRS-COOPS-NGS-Collaboration

National Estuarine Research Reserve System

National Estuarine Research Reserve System

The NERRS purpose in life:

to support science-based coastal management through education, training, and original short-term research and long-term monitoring

NERRS SWMP MONITORING

NERRS VEG HABITAT MONITORING

New England High Marsh

Low Tide Profile

Sea Level Rise Happens

Coastal Habitat
Impacts and Response
driven by
Acute Storm Events
and
Chronic Sea Level Rise

Tides Rule Coastal Habitats and Coastal Habitats Protect Coastal Property

- Salt marsh sediment supply, accretion, erosion, elevation
- Salt marsh plant vigor
- Formation of drainage network
- Movement of fish and their food
- Marsh horizontal migration

Tides, Sea Level, Upland Topography, and Built Infrastructure

direct salt marsh horizontal migration

NERRS Climate Change Sentinel Sites

Goal 1. Contribute to scientific understanding of climate change and monitor ecosystem changes

Goal 2. Assess climate change impacts on human and estuarine ecosystem communities, vulnerability of these communities, and their capacity for adaptation and mitigation.

National Water Level Monitoring Network and National Spatial Reference System Essential to NERRS Sentinel Site Goal

to establish:
a long-term ecosystem-based climate change impacts monitoring program utilizing NERRS capabilities and serving NERRS priorities for addressing sea level rise and other climate-related changes.

Questions Needing Answers

1) What is happening to the tidal range at a given site?

What is happening to the marsh surface relative to the water level?

2) Can we detect a vegetation response to changes in these factors?

3) How does the response of vegetation at a given site compare to, or reflect, other site specific, relevant factors – i.e. temperature change, invasive species, etc?

As Sea Level Rises, Marshes can Drown

Figure 11. Simulated flooding of Drakes Island for 1-ft of sea level rise at HAT conditions. Note that Drakes Island Road, Shady Lane, and Eaton Avenue would all undergo flooding under these conditions.

Or, they can Migrate

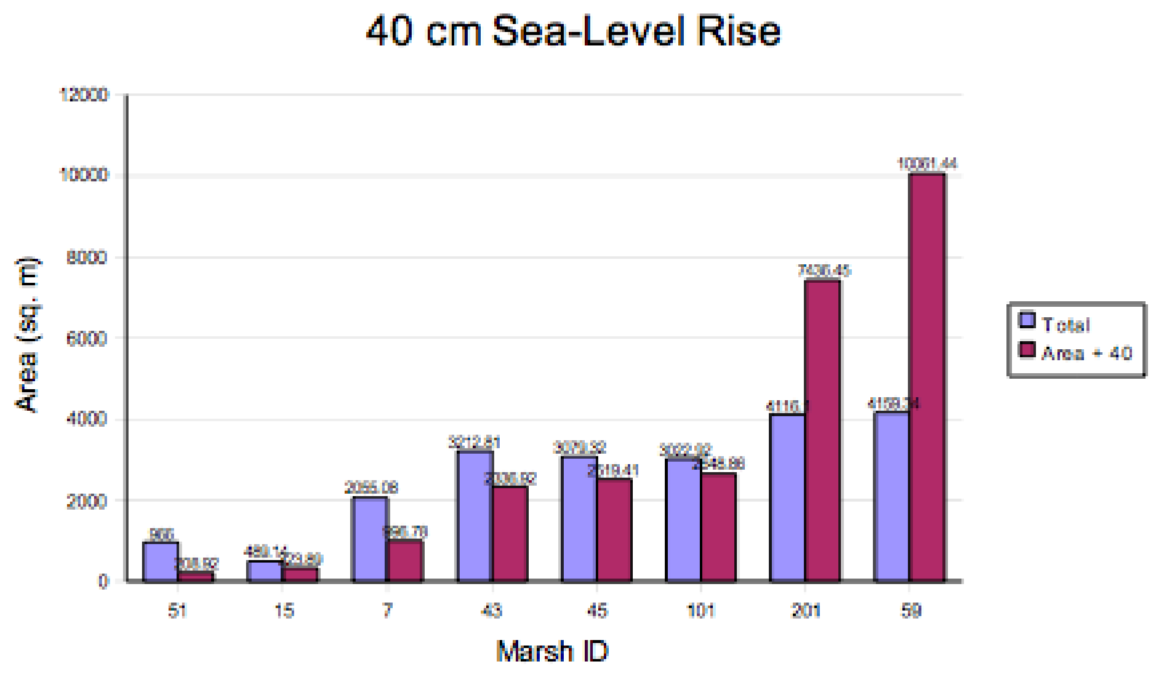
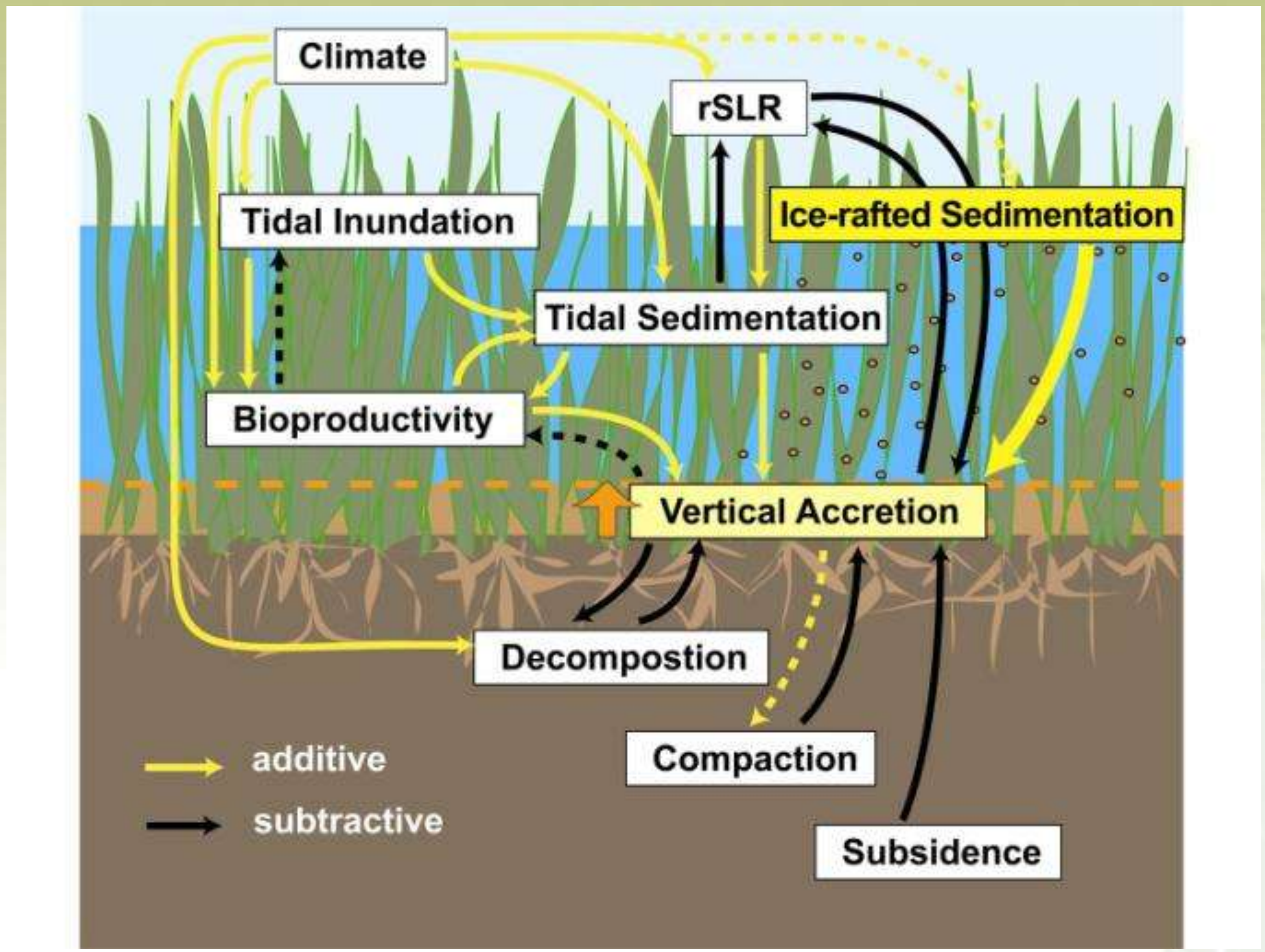


Figure 14: Total existing marsh area and estimated marsh area for 40 cm sea-level rise (both in square meters).


Climate
rSLR
Tidal Inundation
Ice-rafted Sedimentation
Tidal Sedimentation
Bioproductivity
Vertical Accretion
Decompostion
Compaction
Subsidence
additive
subtractive

To Predict Habitat Response/Change

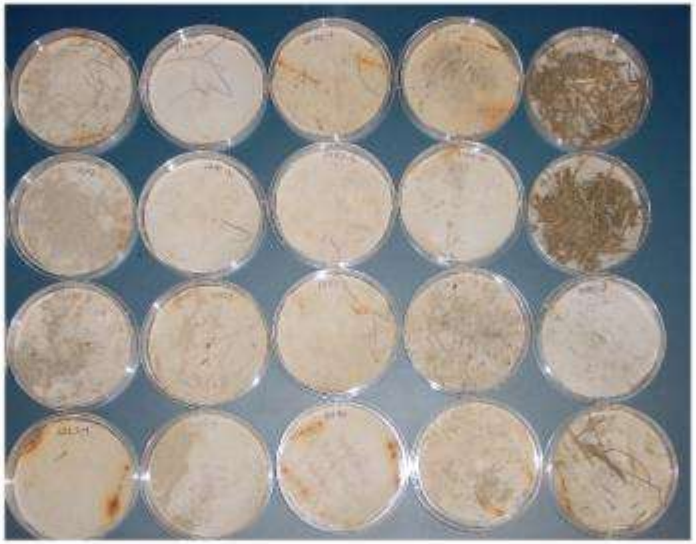
Process-based model inputs driven by Inundation Regime:

- Surface sediment deposition, accretion/loss
- Plant growth, density, biomass production
- Surface elevation change

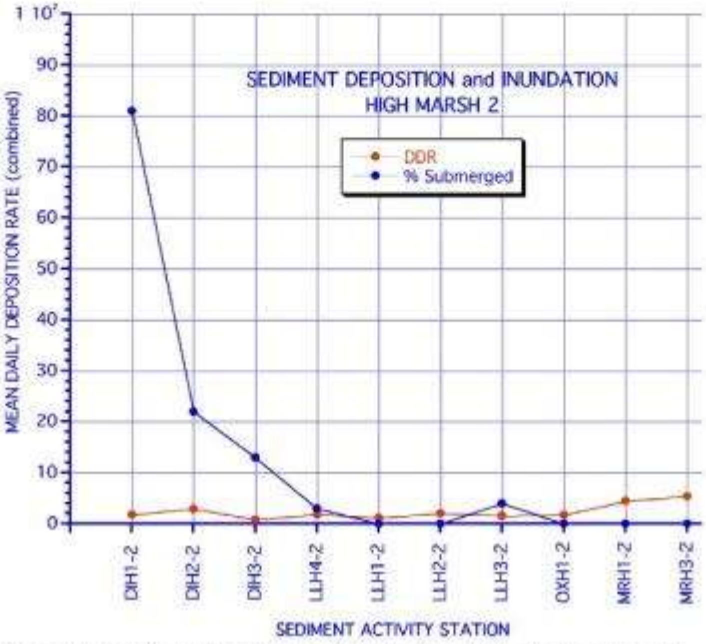
§III-4 Sediment Deposition Drives Marsh Accretion

< main menu

The pattern observed for the H1 sediment traps were consistent for the H2 and H3 traps, but the amount of sedimentation increased progressively with the slight decline in elevation, further support for a quantitative link between inundation and sedimentation.

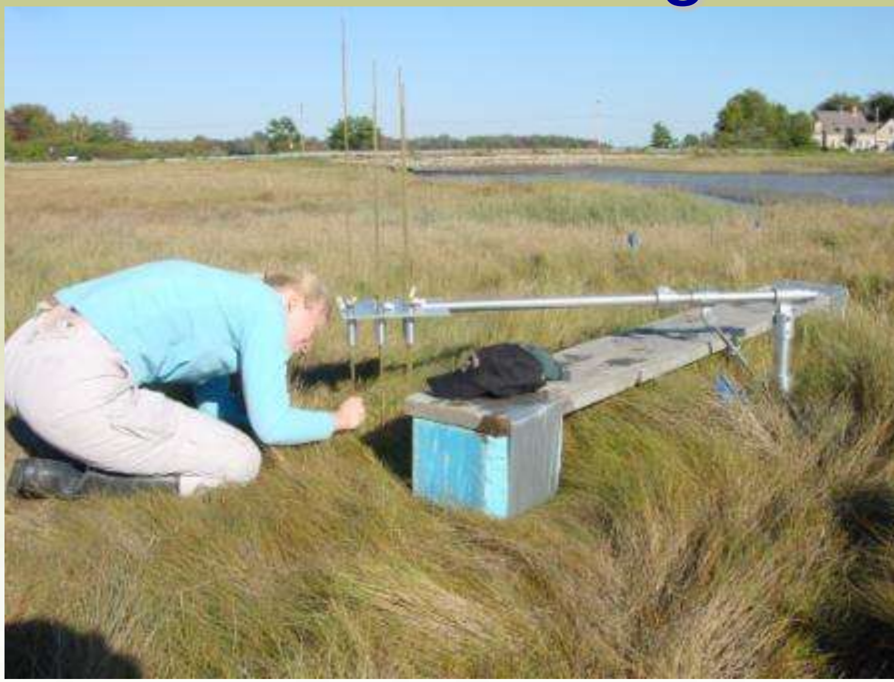


Example of variation in sediment deposition across sampling sites, with each row representing a different elevation (H1, H2, H3, L1 from top to bottom), and each column a different station. The far right column is for the impounded and subsided Drakes Island marsh, which has no real high marsh, and retained wrack due to poor drainage through an undersized culvert.



Daily average sediment deposition in relation to the percent of time submerged, over the course of the survey, with sampling stations arranged in approximate order from north to south along the estuary's main axis. Deposition and tidal inundation (i.e. % submerged) are closely matched except for the Drakes Island sites (DI-1 to DI-3), where a culvert restricts sediment input and retards drainage.

Measuring Change in Elevation and Accretion



GPS Surveying Network

Elevation Change Varies over Time

Sediment elevation

(Maroon Bars)

Overall change (11 stns)

4.2 mm/year pre dredge

-2.5 mm/year post dredge

Mean change of 1.2 mm/yr

Bay front Stations (4)

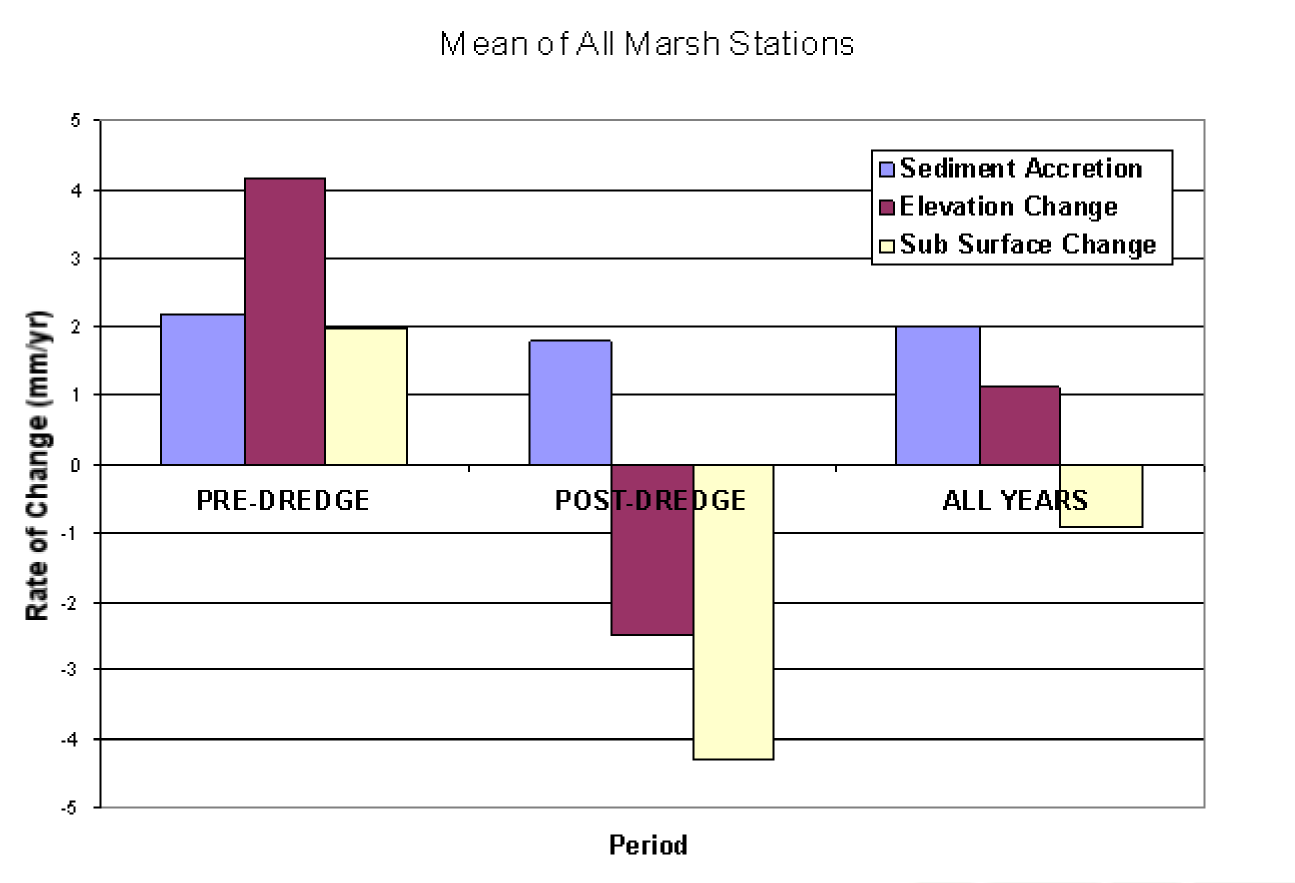
3.4 mm/year pre dredge

-3.9 mm/year post dredge

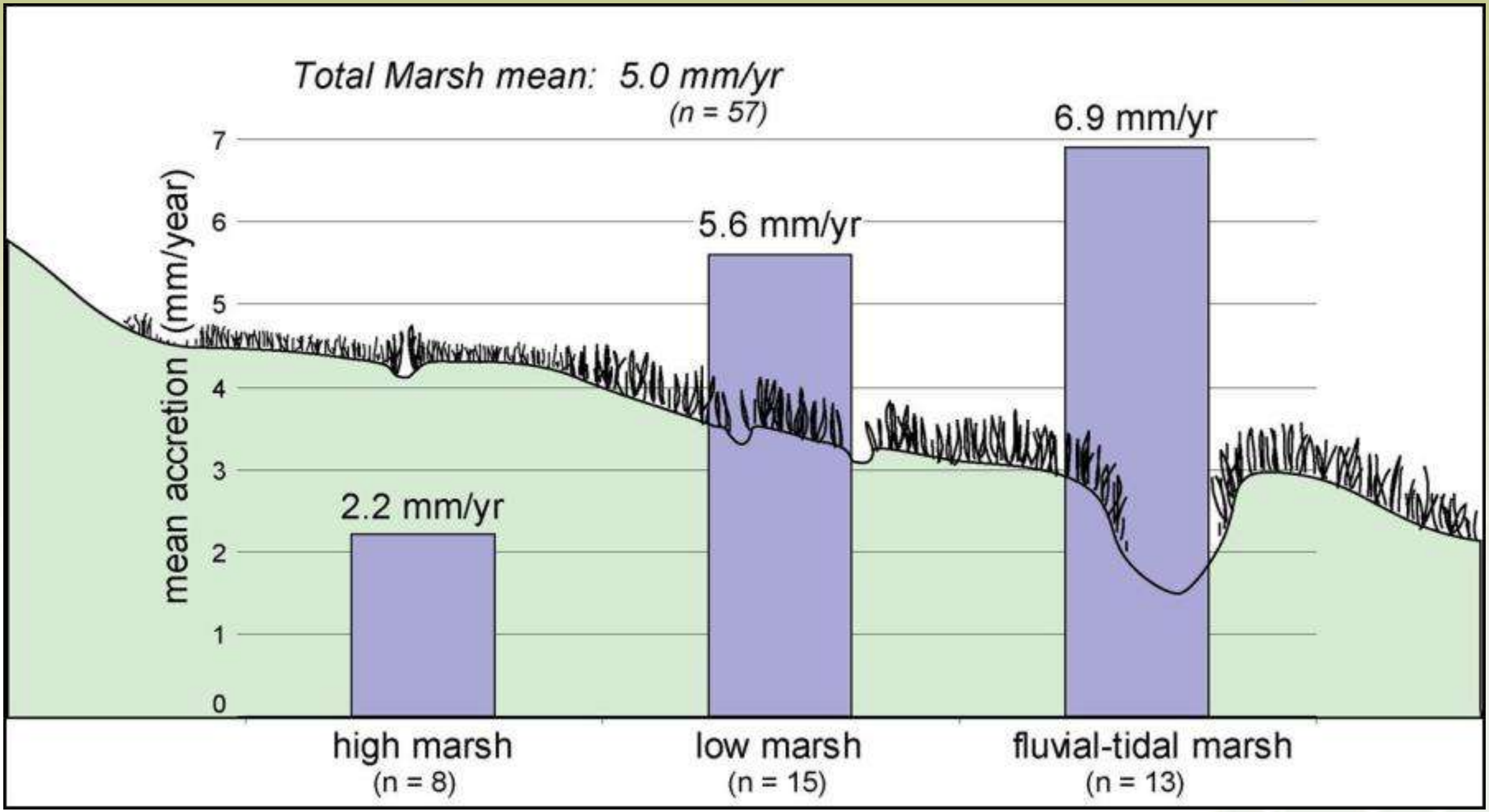
Interior Stations (5)

3.3 mm/year pre dredge

-2.9 mm/year post dredge



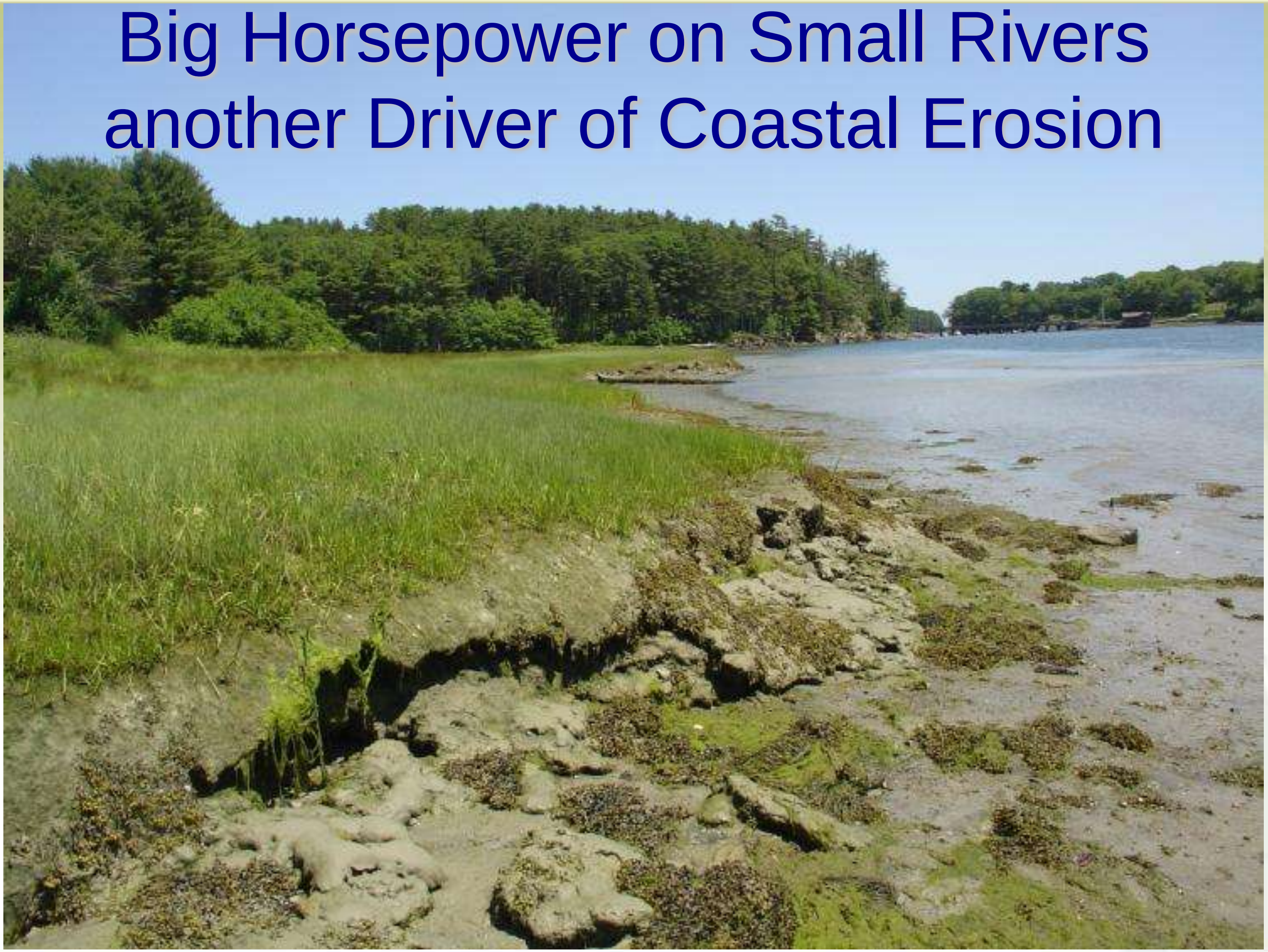
So Far Maine Marshes are Surviving



Vegetation Survey

- % Cover all species
- Stem Counts for dominant species

Big Horsepower on Small Rivers another Driver of Coastal Erosion



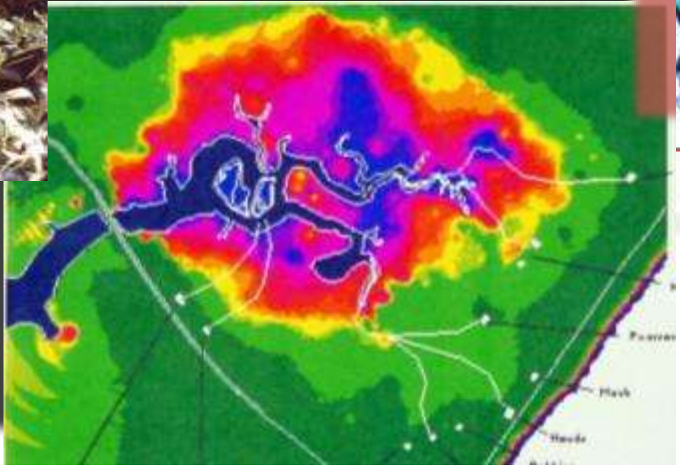
With no Tides, Marshes Subside

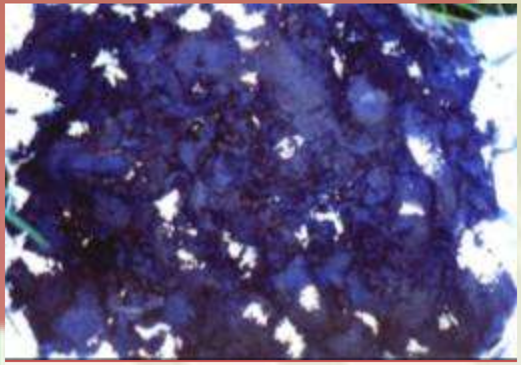
5 square foot connection

To 20 square feet

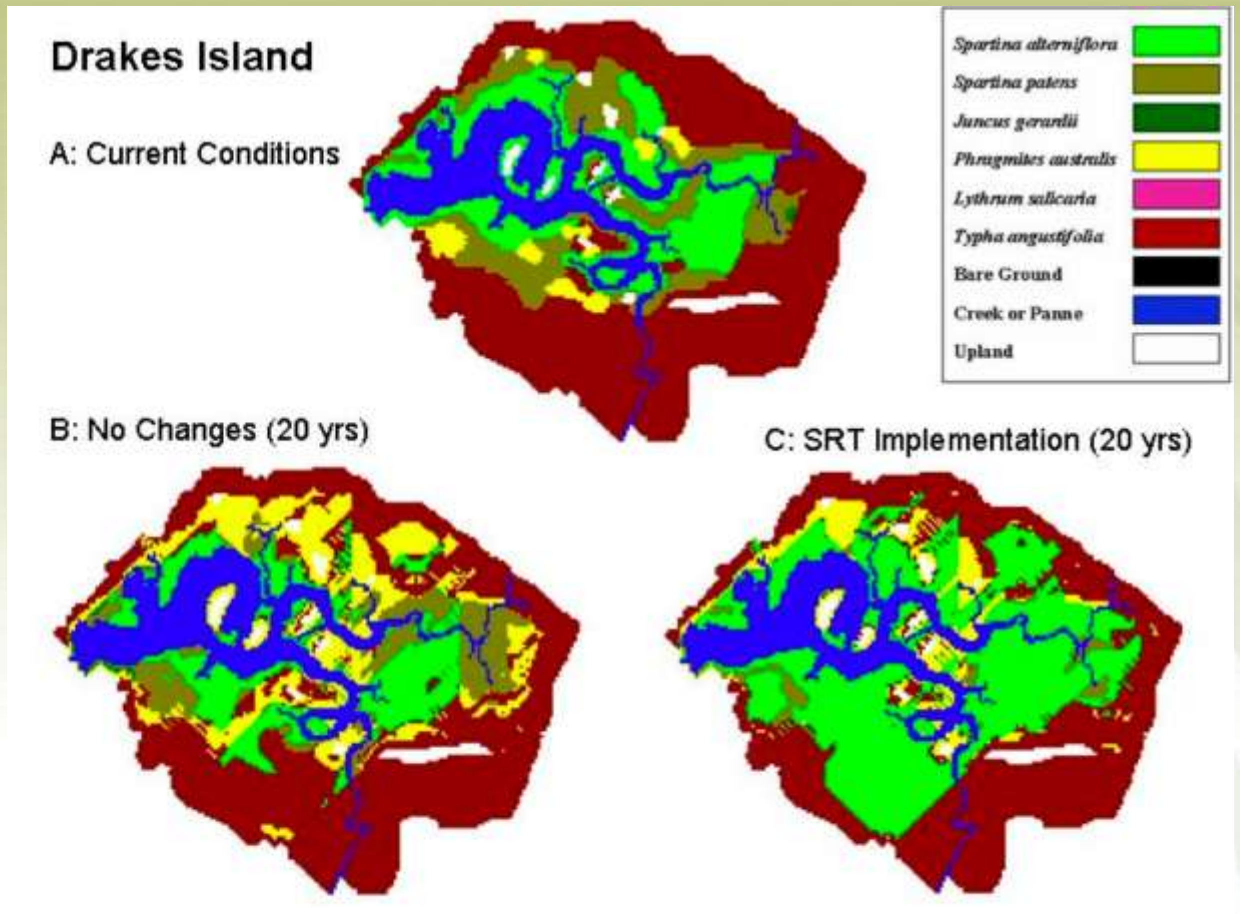
Drakes Island Marsh, Wells Maine

Peat Decay causes Marshes to Sink

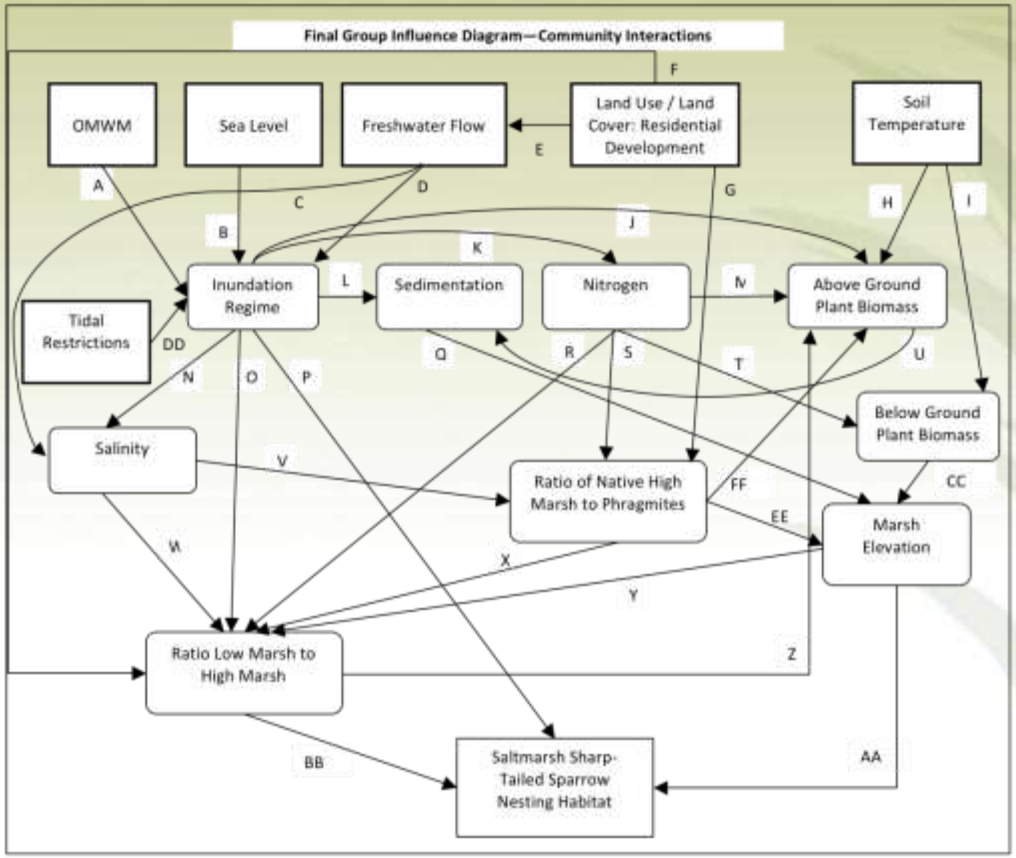




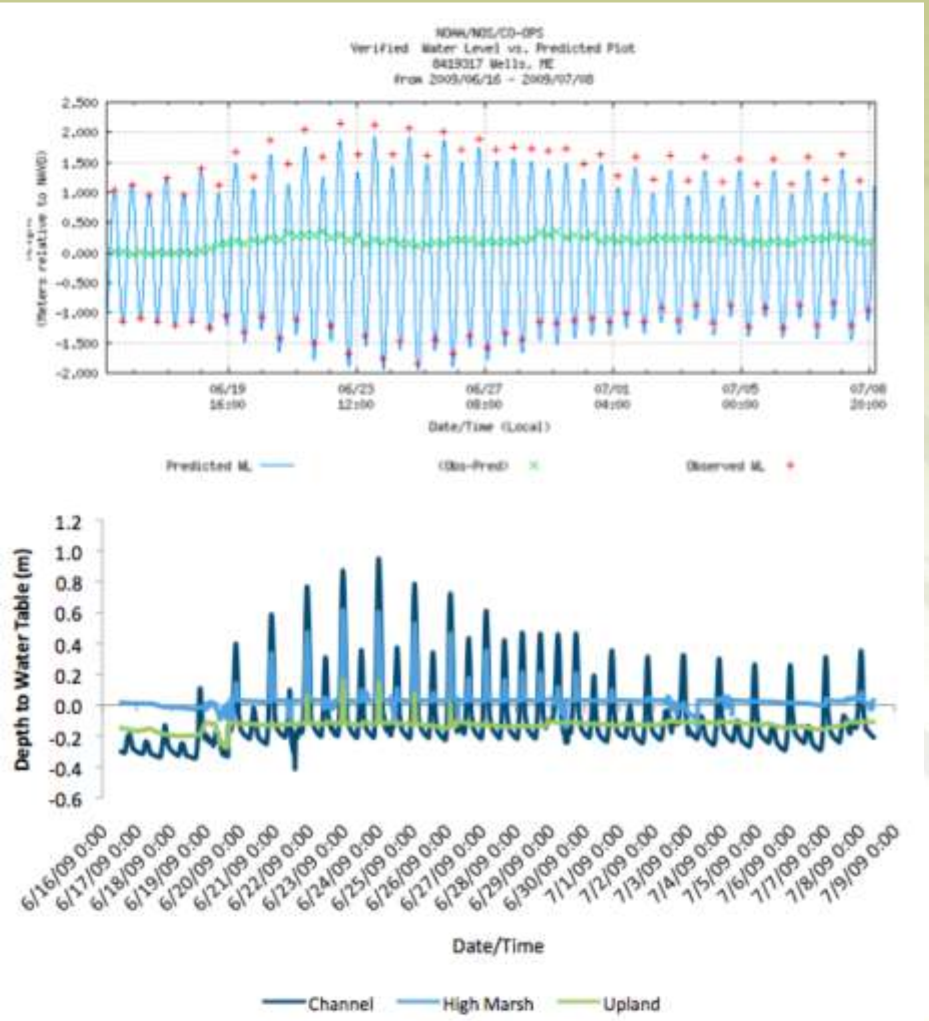
Invasive Plants always at the Ready


Drakes Island
A: Current Conditions
B: No Changes (20 yrs)
C: SRT Implementation (20 yrs)
Spartina alterniflora
Spartina patens
Juncus gerardii
Phragmites australis
Lythrum salicaria
Typha angustifolia
Bare Ground
Creek or Panne
Upland

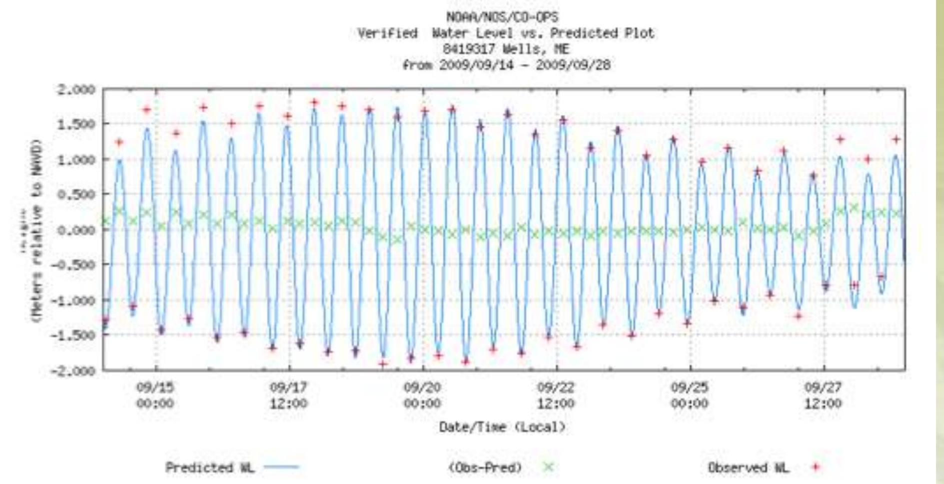
Inundation Regime is the Master Control

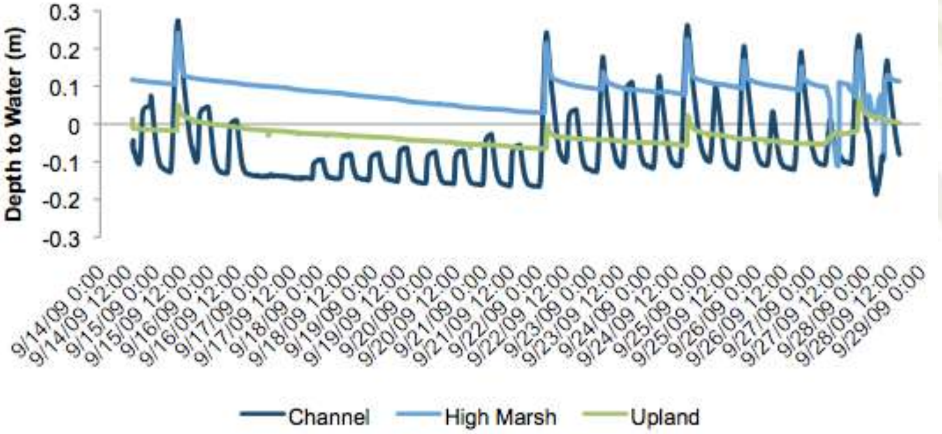


Reference Marsh Inundation

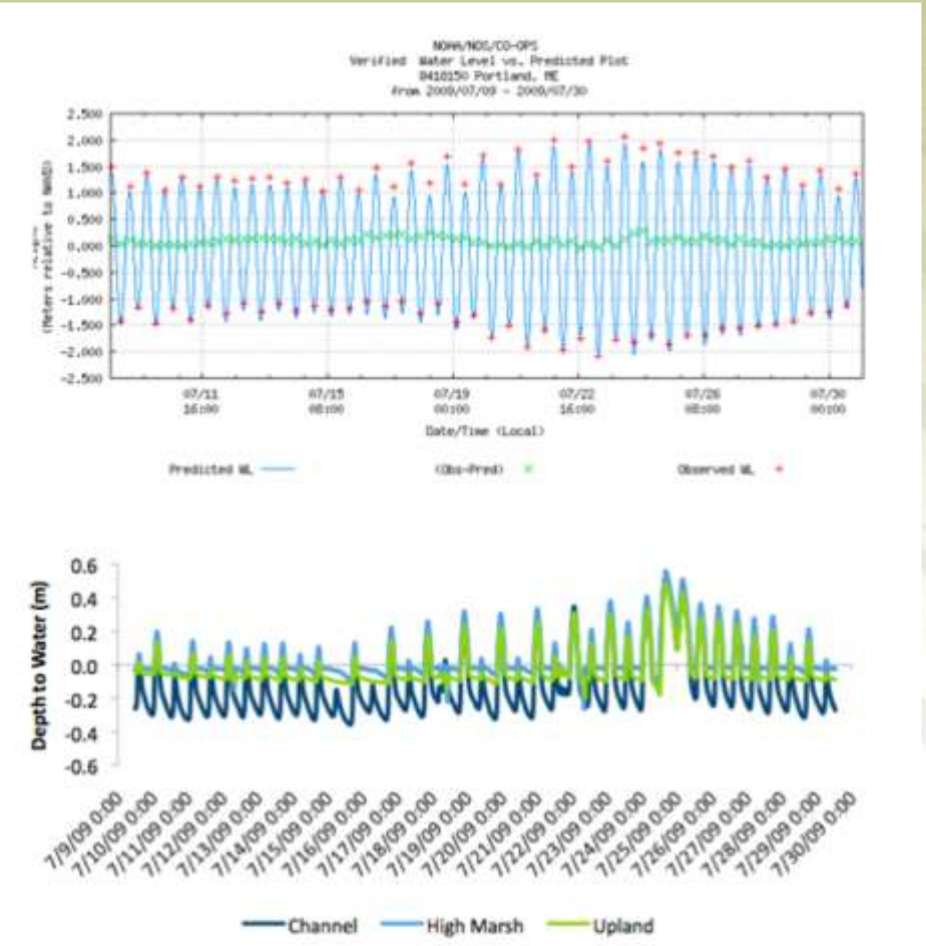


Self Regulated Tide Gate

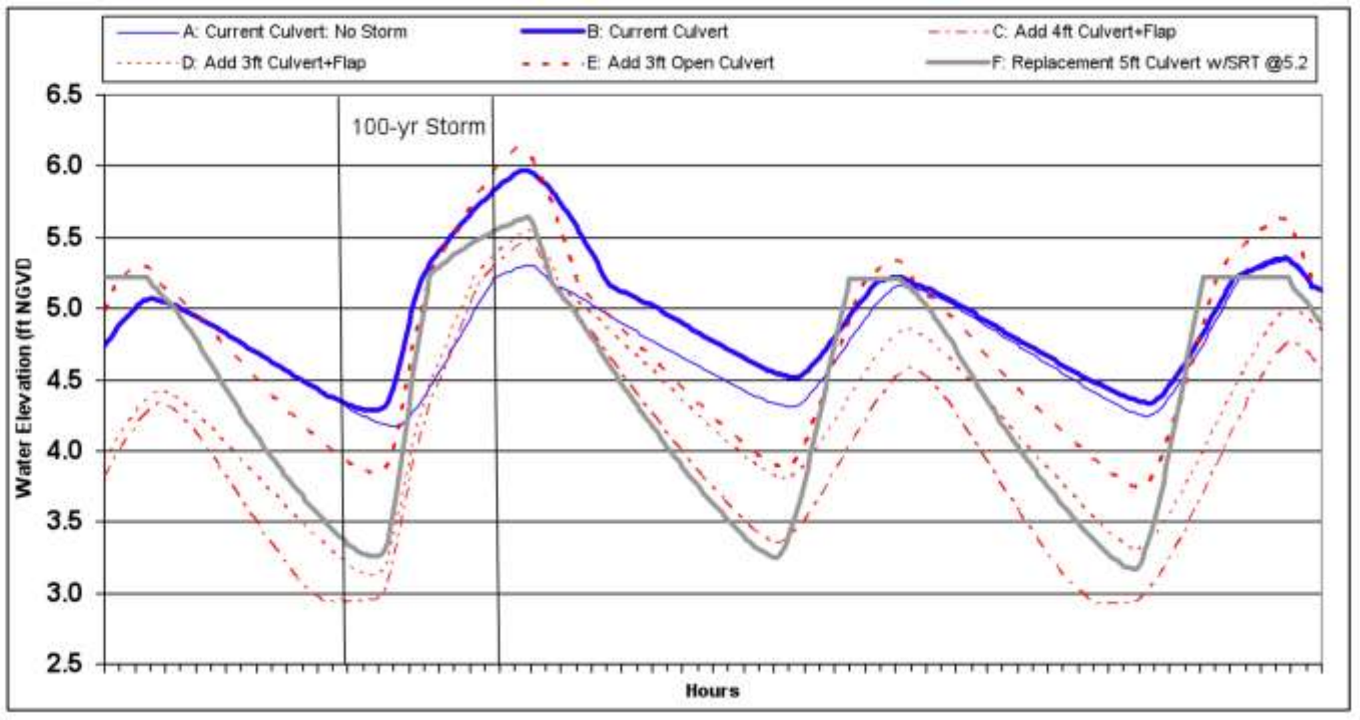




Flooded Marsh



Modeling Tides to Design Restoration



Application of Sentinel Site Monitoring and Modeling

- Identify marshes that would benefit from living shoreline management practices
- Identify marsh migration zones for protection through marine spatial planning
- Identify restricted marshes for restoration to allow marsh migration

Sentinel Site Projected Outcomes

1) Contribute to scientific understanding of climate change and effects of climate change on coastal ecosystems.

2) Develop a consensus definition and protocols for an ecosystem-based sentinel site.

3) Expand "pilot" sentinel site network and enhance capacity and infrastructure within NERRS.

4) Implement SWMP Priorities (e.g. SWMP Phase II and Phase III).

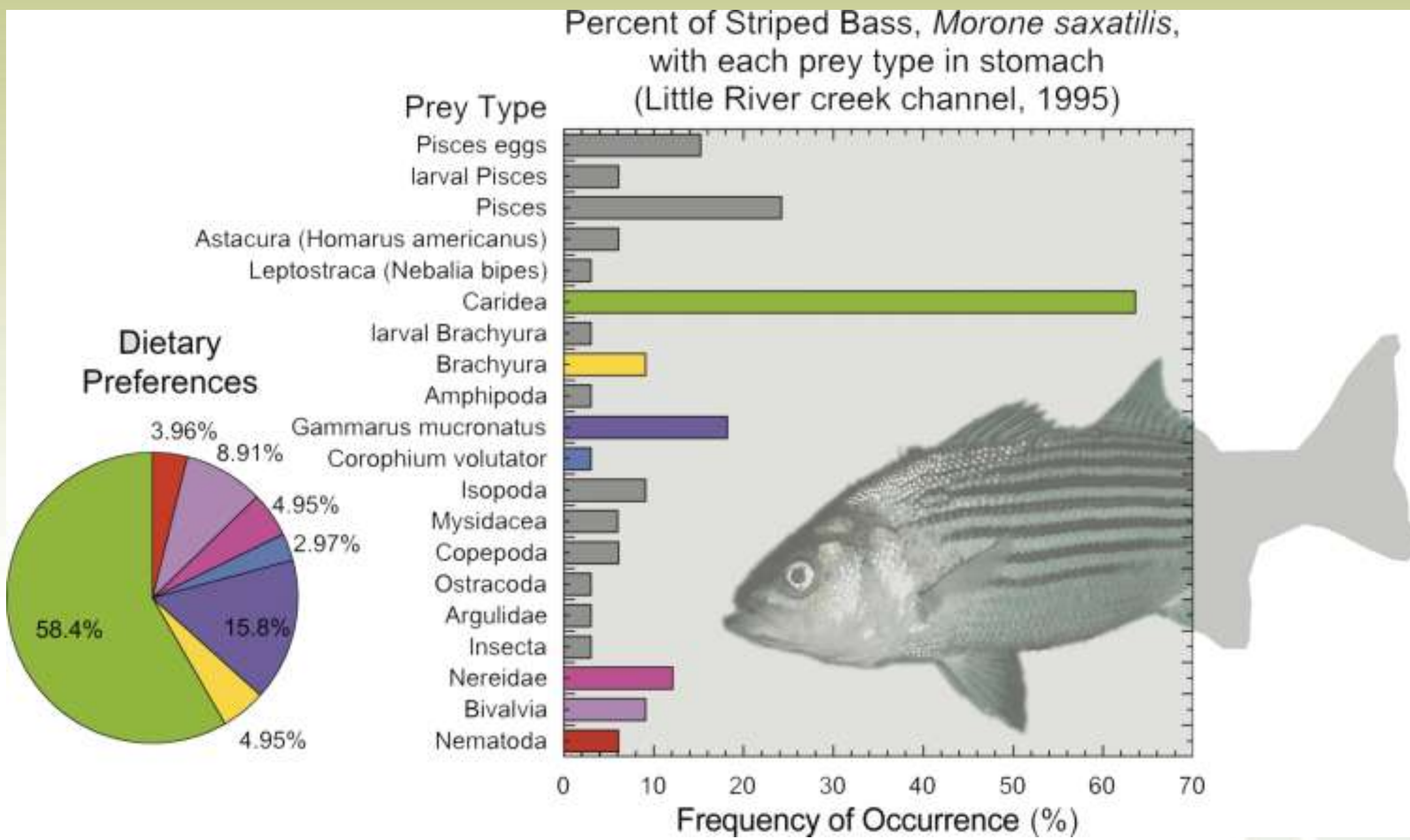
Develop data management strategy (with CDMO) for data dissemination to research community.

5) Use Coastal Training Program to define target audiences and develop products for coastal management end-users.

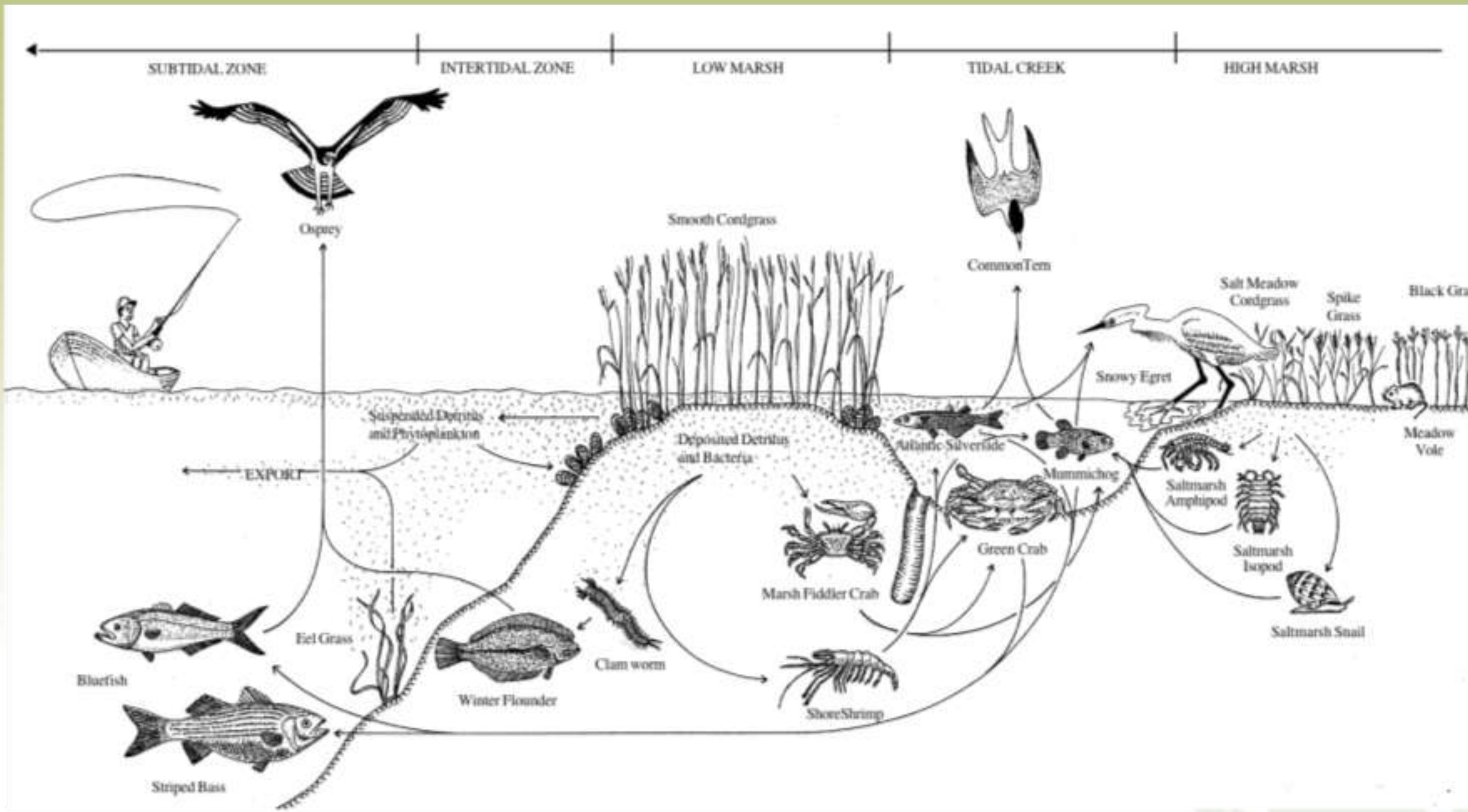
6) Enhance integration within NERRS as well as between NERRS and other NOAA partners.

One More Reason to Manage for Salt Marsh Survival

All You Can Eat Salt Marsh Buffet



National Estuarine Research Reserve System



Save a Salt Marsh and give a Fish a Chance