

**Presentations**

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10-9-2015

**Detecting and Understanding Threats to Eelgrass in the Gulf of  
Maine: The Times, They Are A-Changin’**

Hillary A. Neckles

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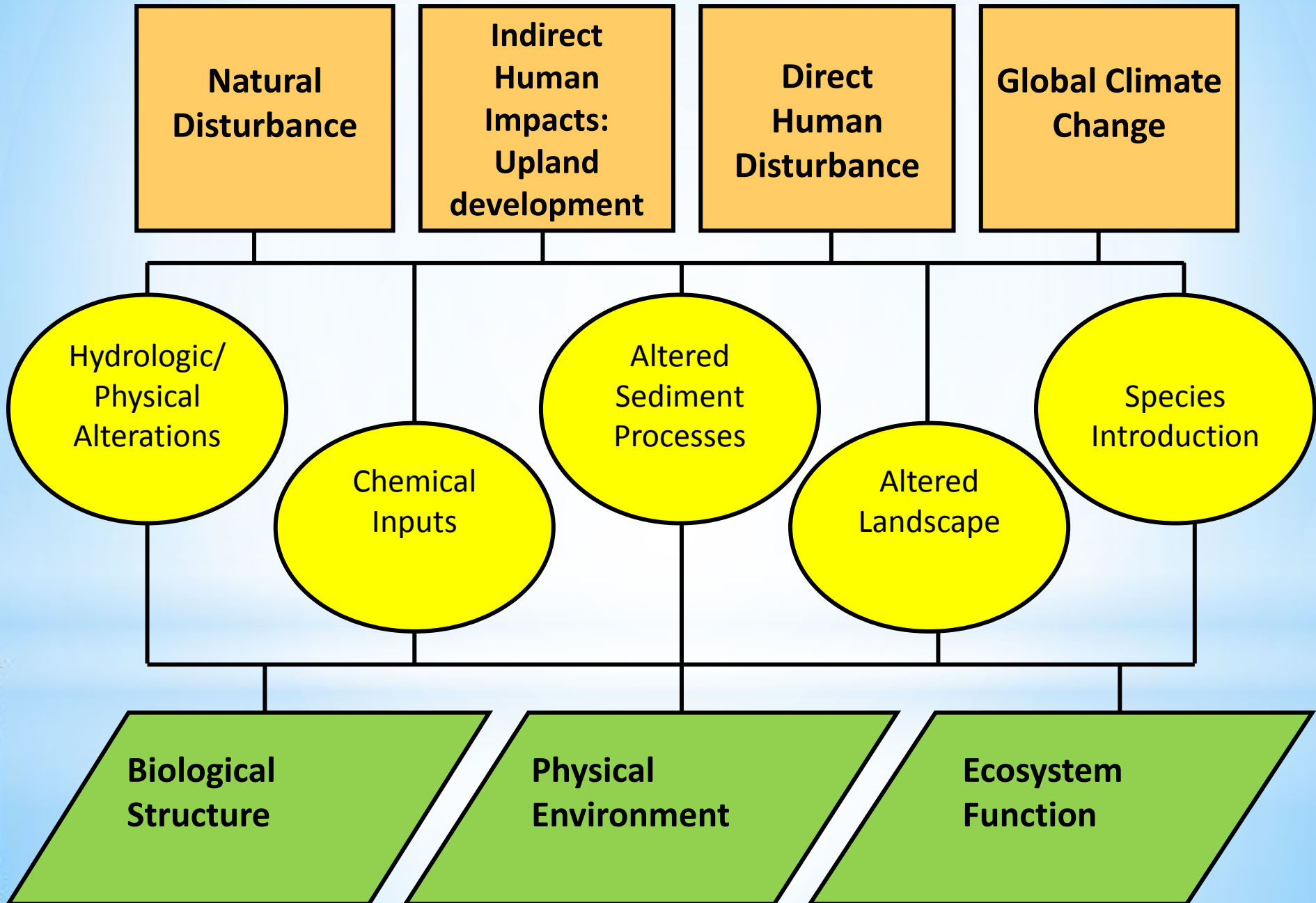
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Detecting and Understanding  
Threats to Eelgrass  
in the Gulf of Maine:  
*The Times, They Are A-Changin'*

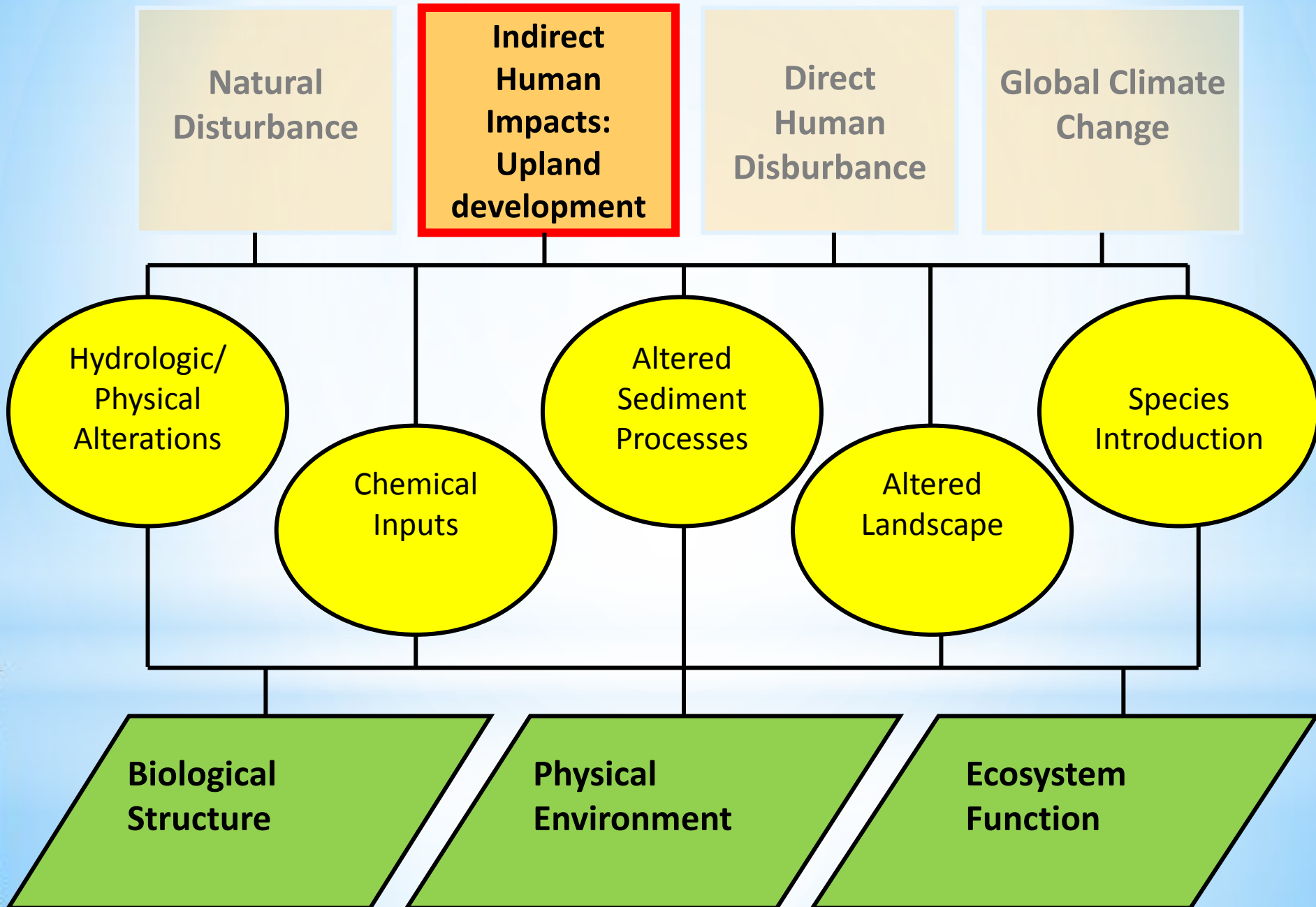


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# Threats to Eelgrass

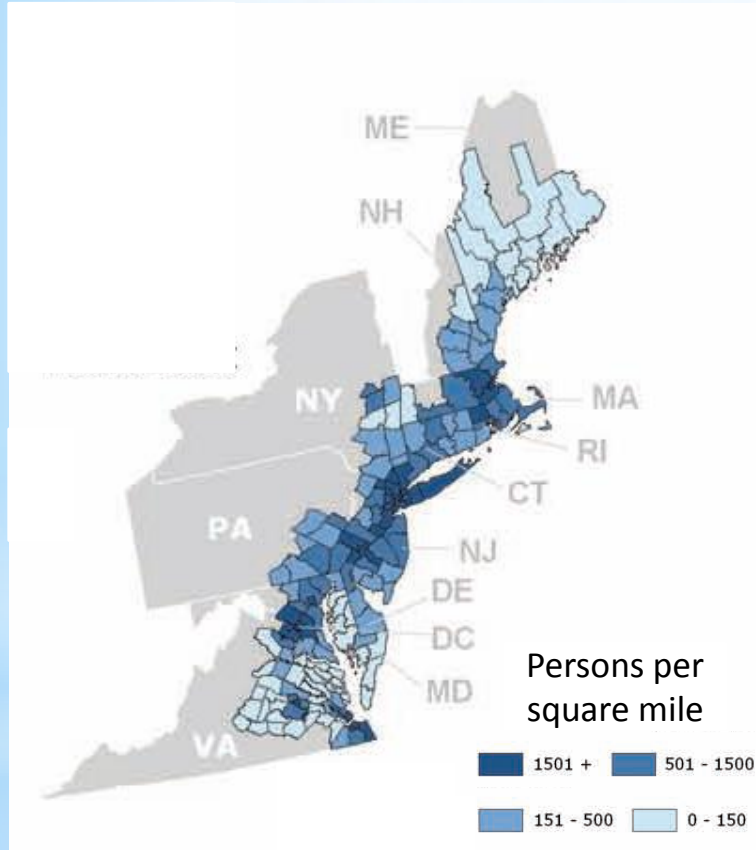


# Threats to Eelgrass



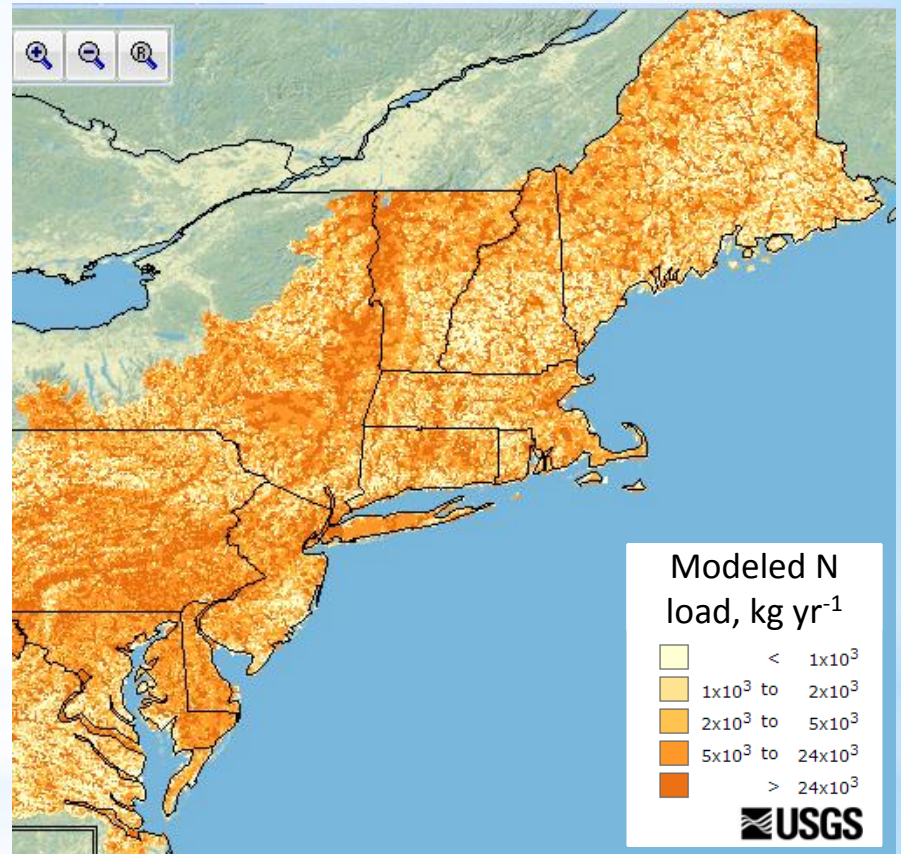
# Watershed Impacts on Coastal Water Quality

## Human Population Density



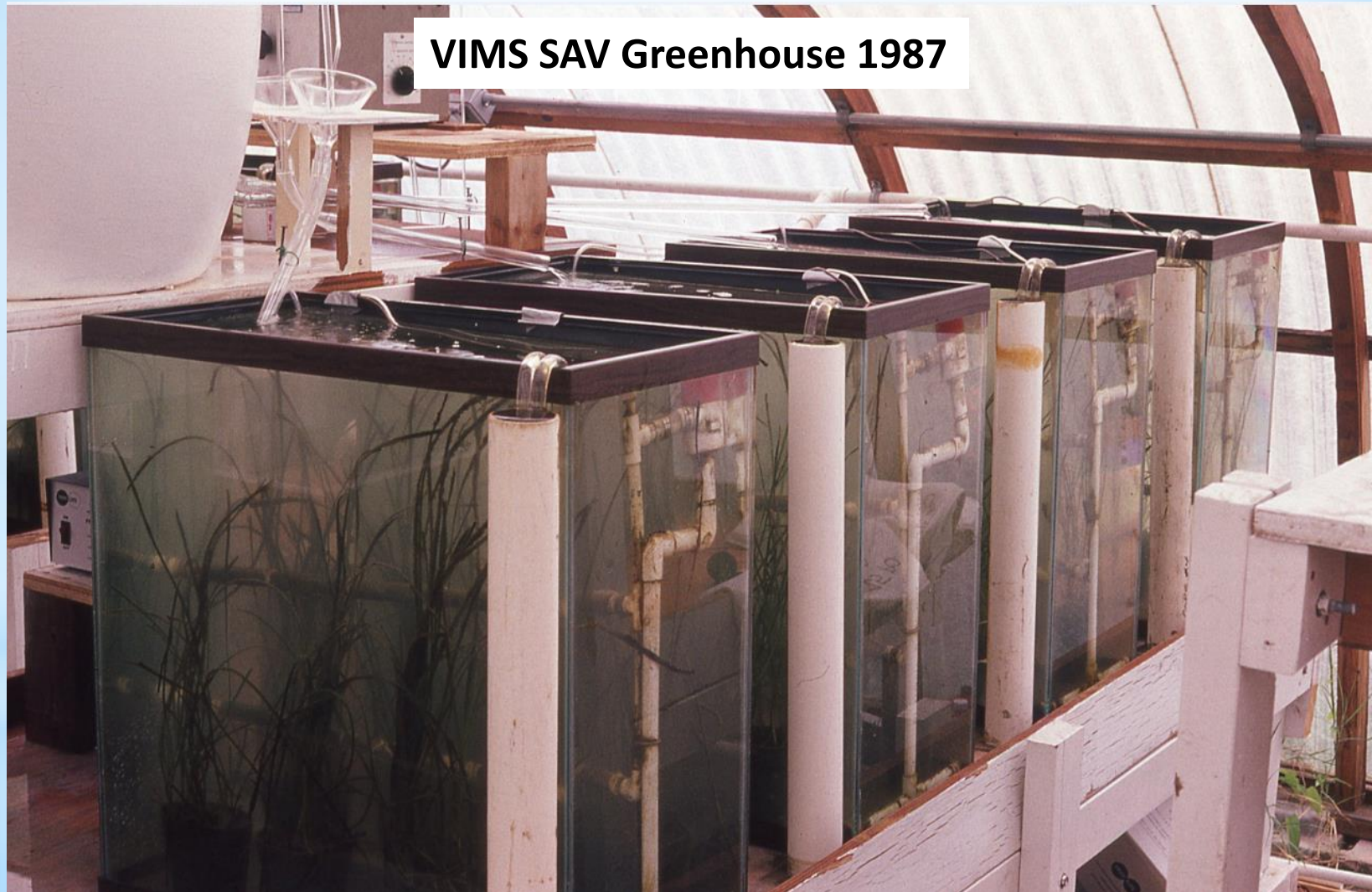
NOAA National Ocean Service/US Census, 2003

## Nitrogen Load



USGS SPARROW Model, 2002

# Relative Effects of Nutrient Enrichment and Grazing

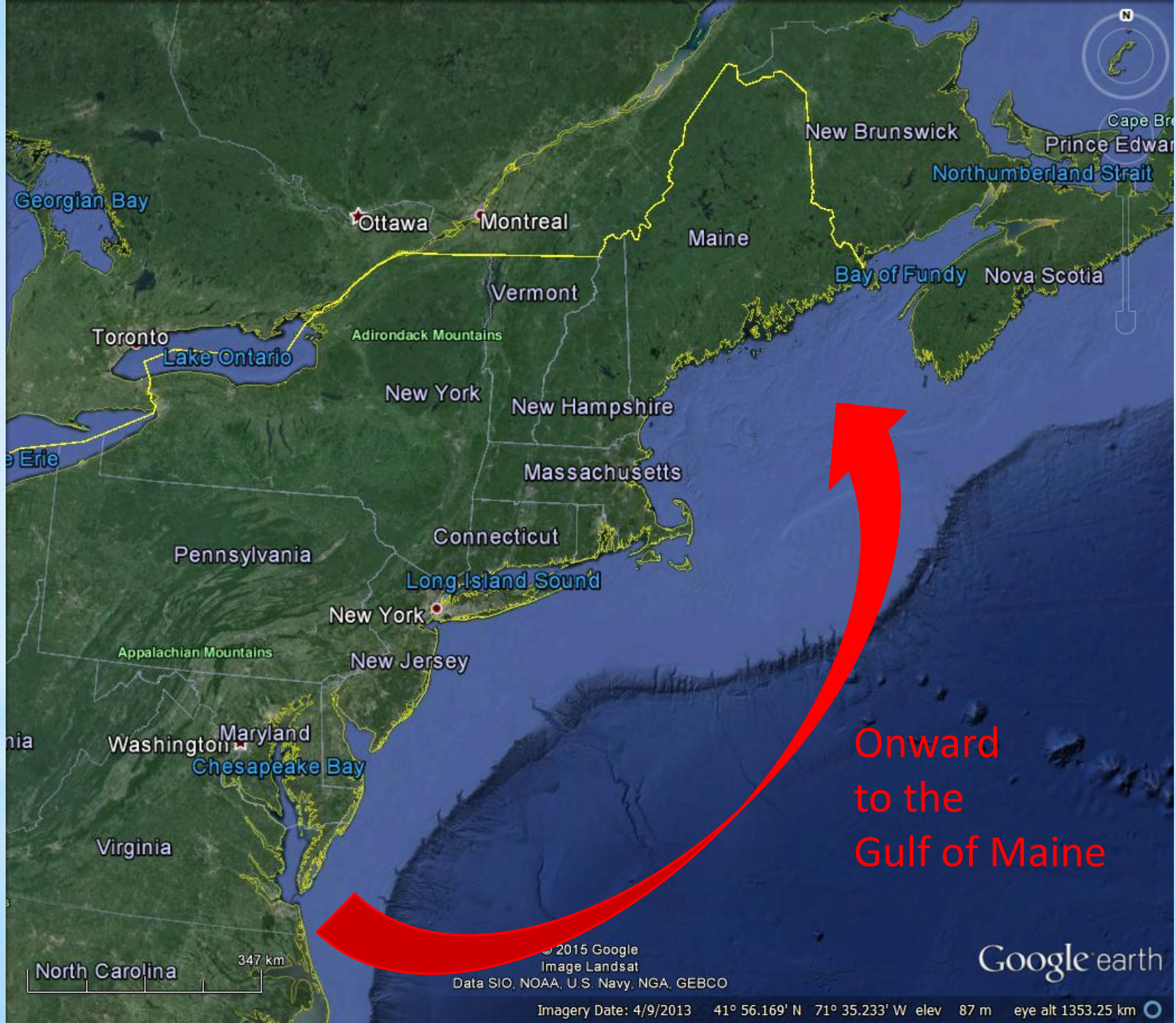


*Neckles et al. 1993. Oecologia 93:285-295.*

# Relative Effects of Nutrient Enrichment and Grazing

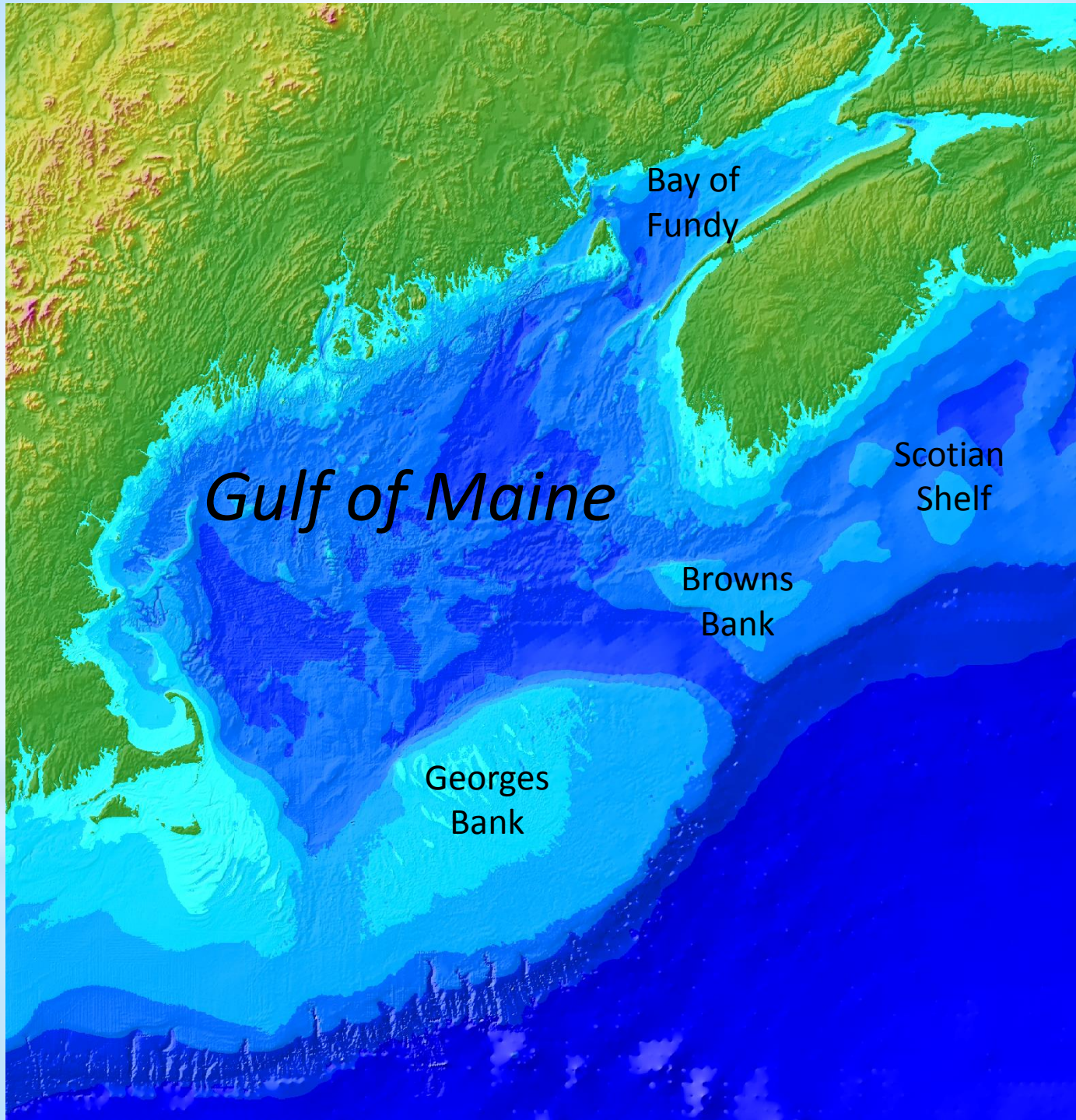
VIMS SAV Greenhouse 1987

It's complicated!



Onward  
to the  
Gulf of Maine





*Gulf of Maine*

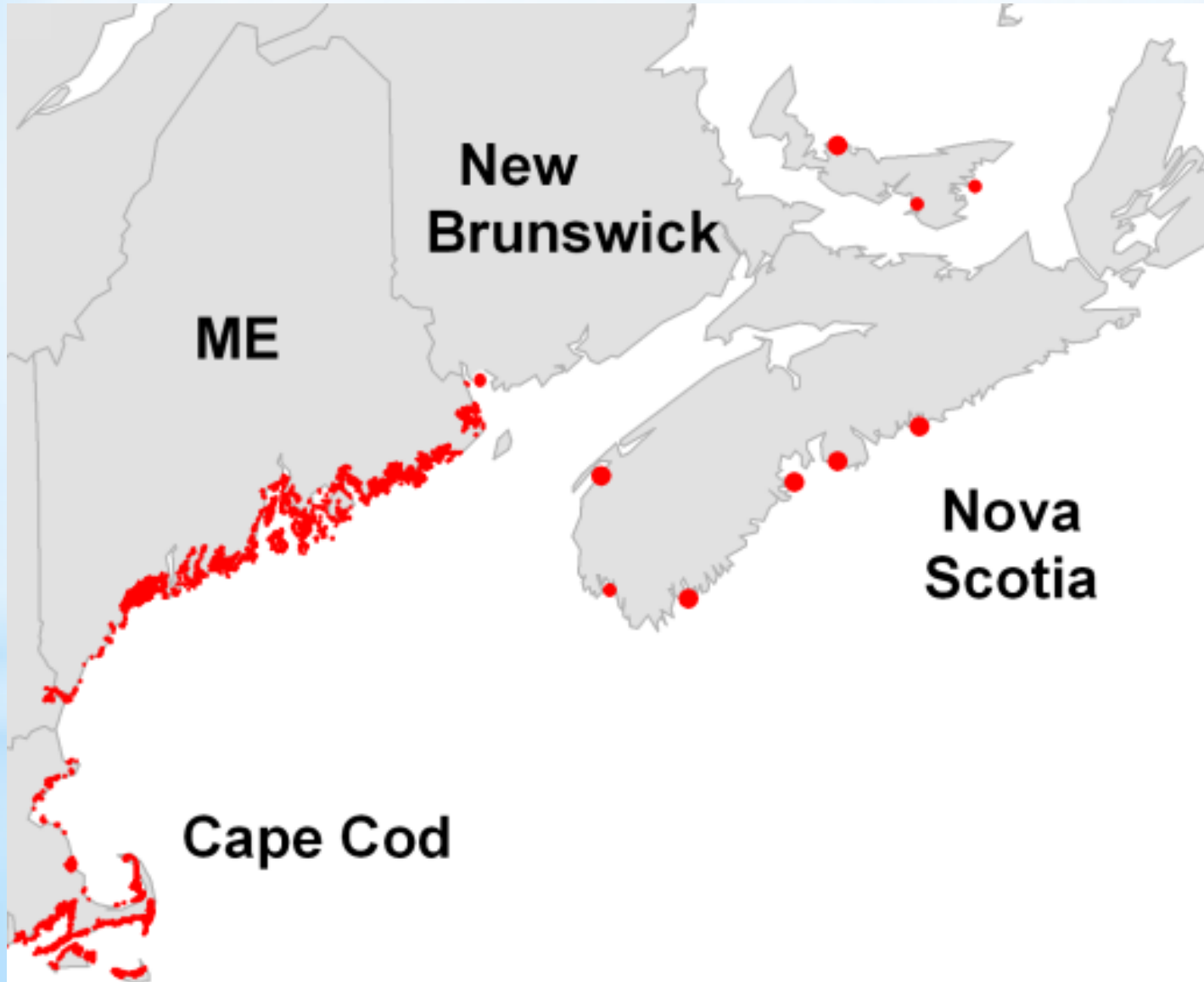
Bay of Fundy

Scotian Shelf

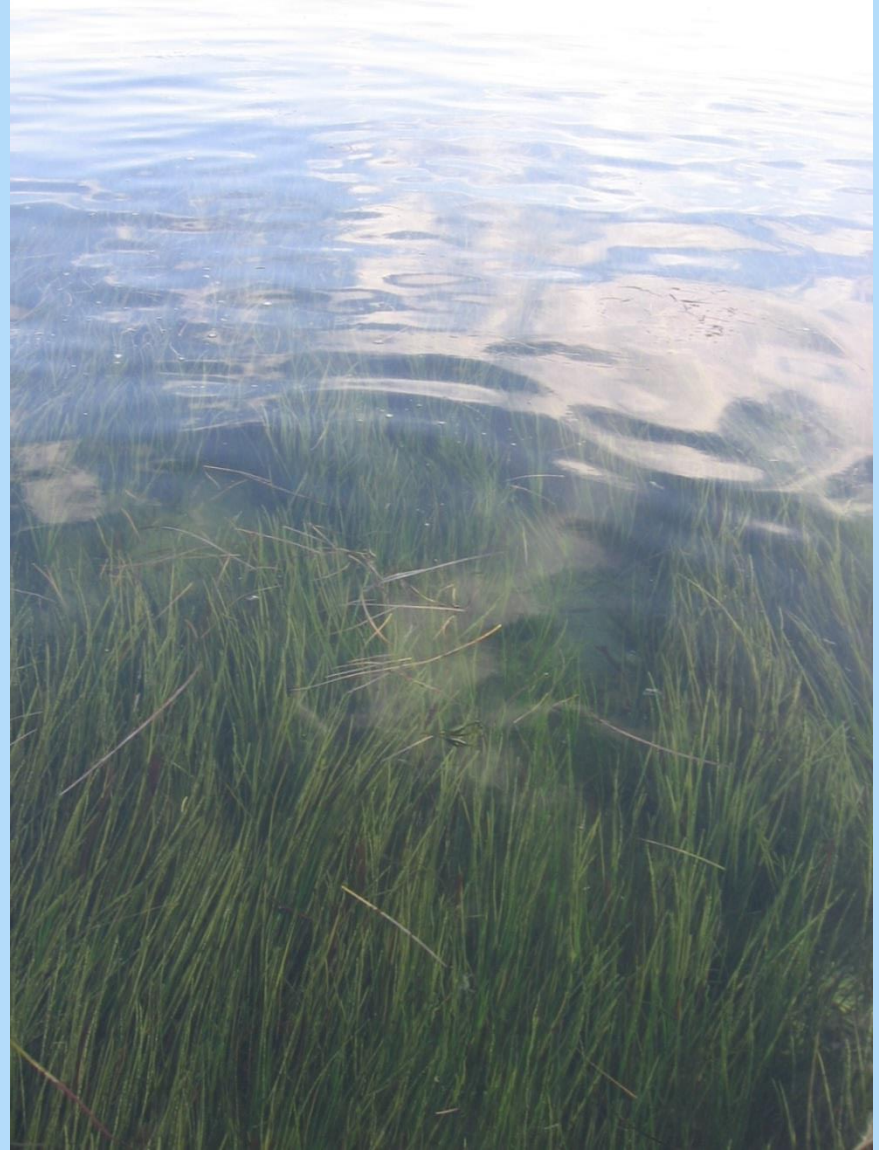
Browns Bank

Georges Bank

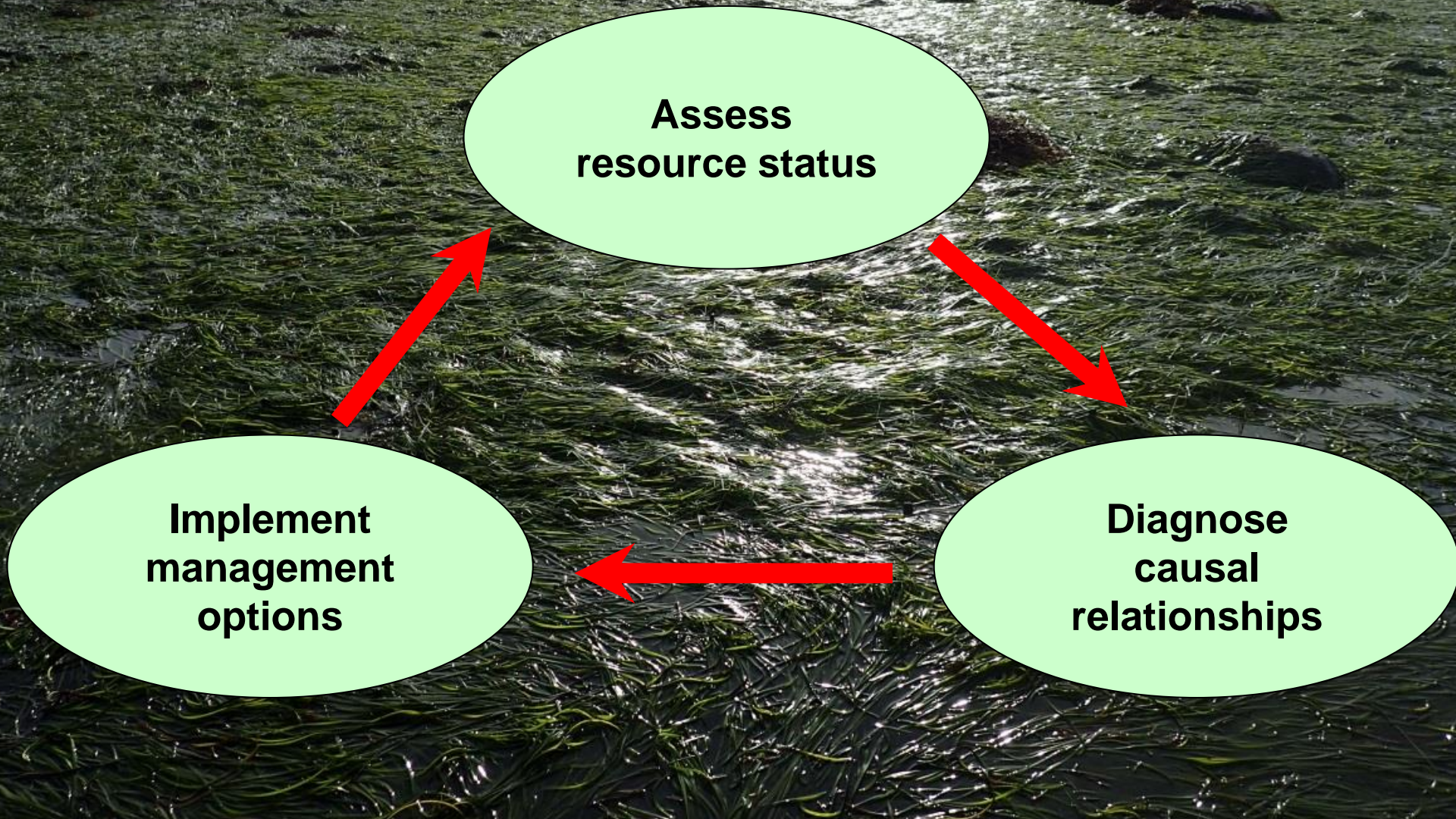
# Eelgrass Distribution Gulf of Maine



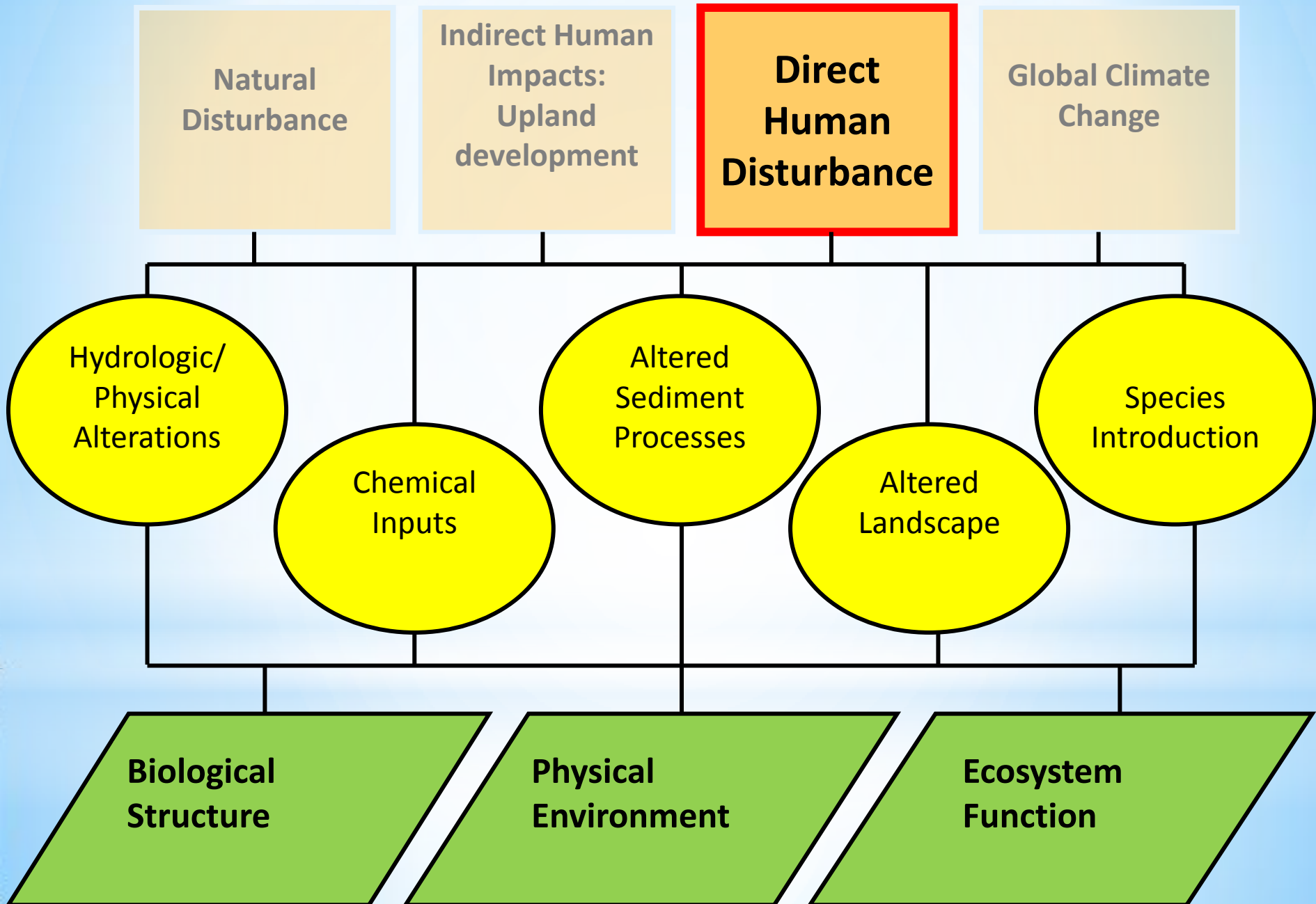




# Seagrass Conservation



# Threats to Eelgrass



# Trawling and Dragging





Hilary Neckles



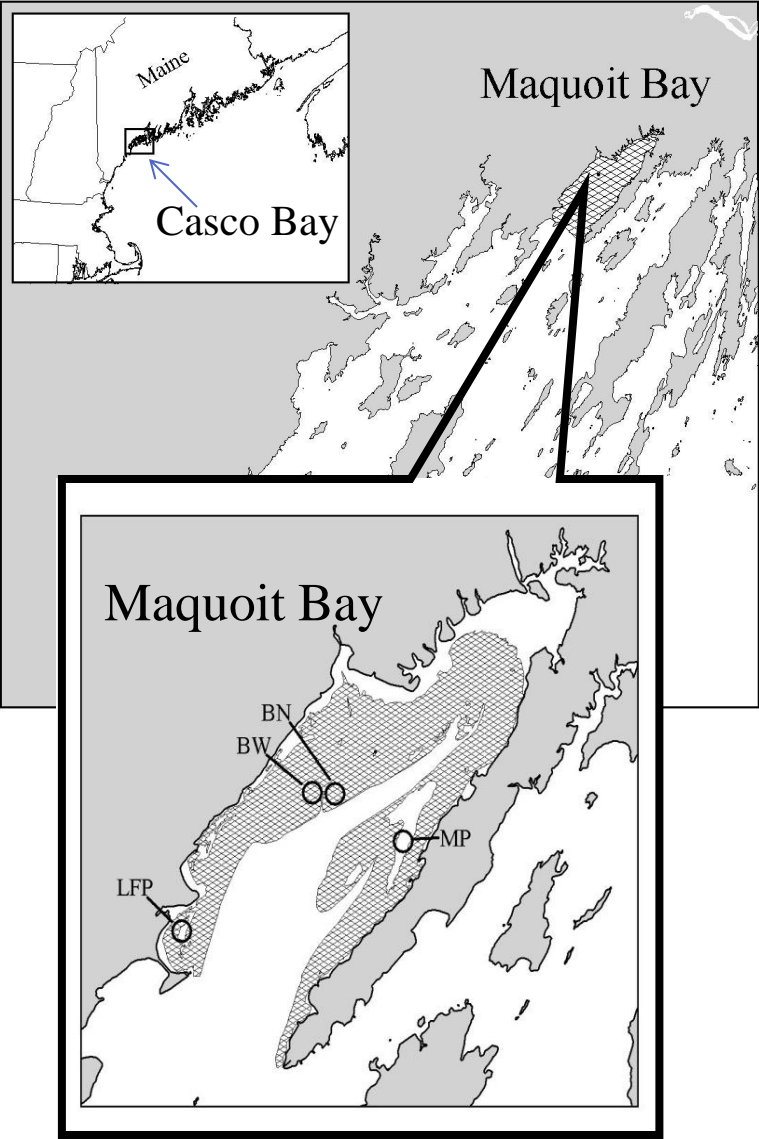


Paul Cunningham

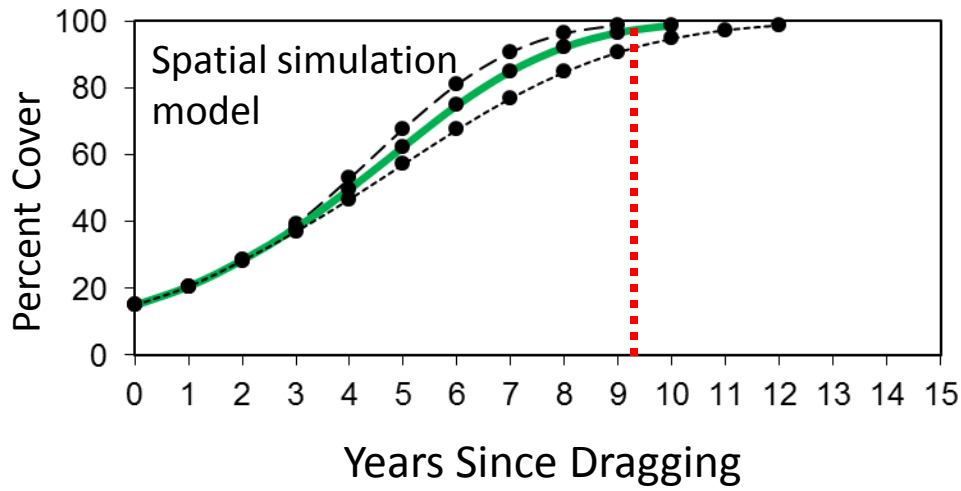
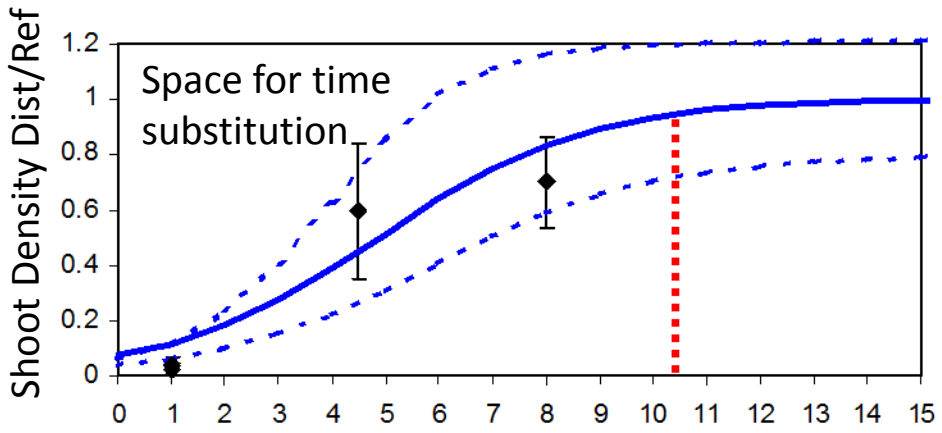


John Sowles

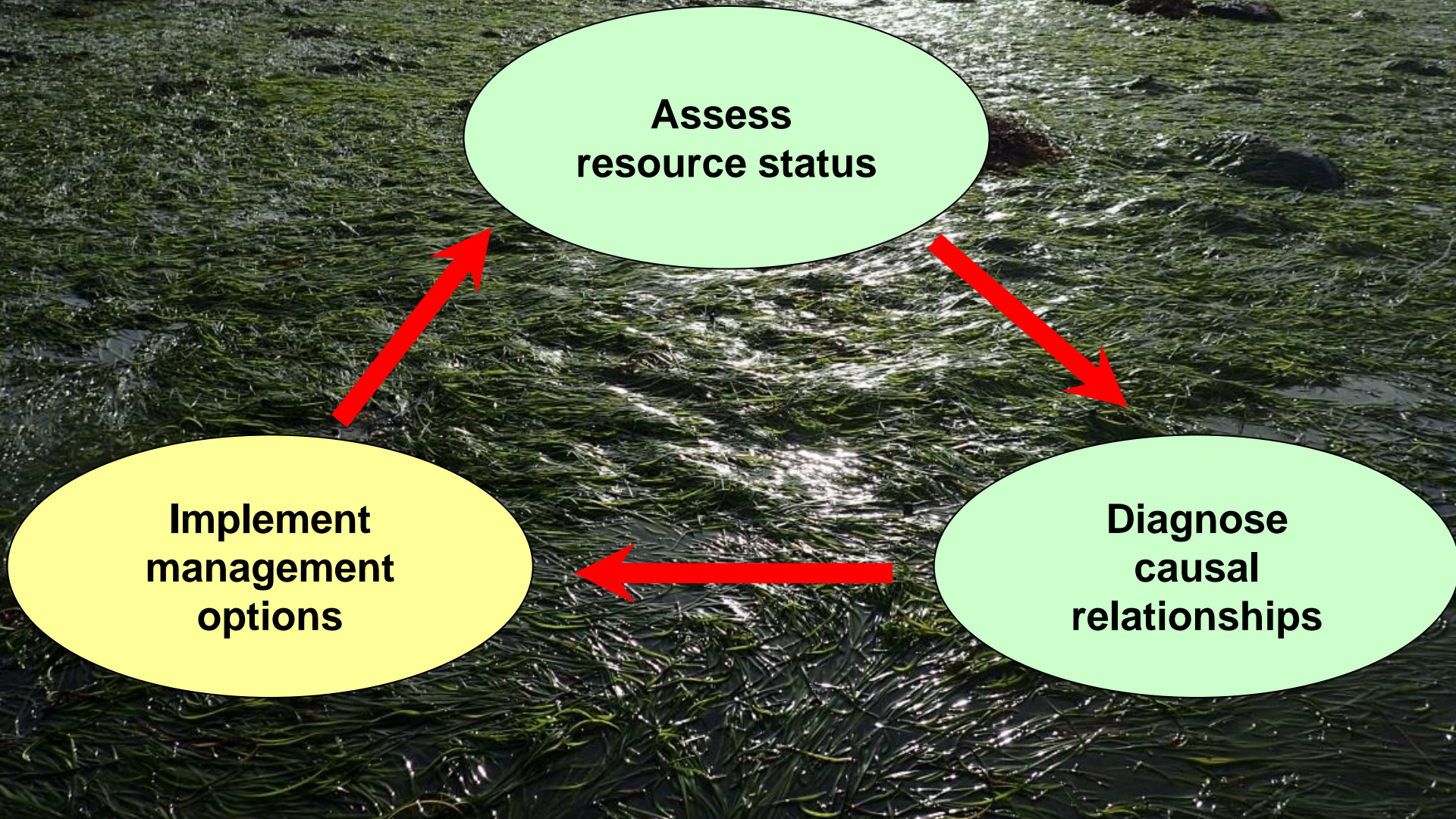
# Mussel Dragging Causes Severe and Long-lasting Impact



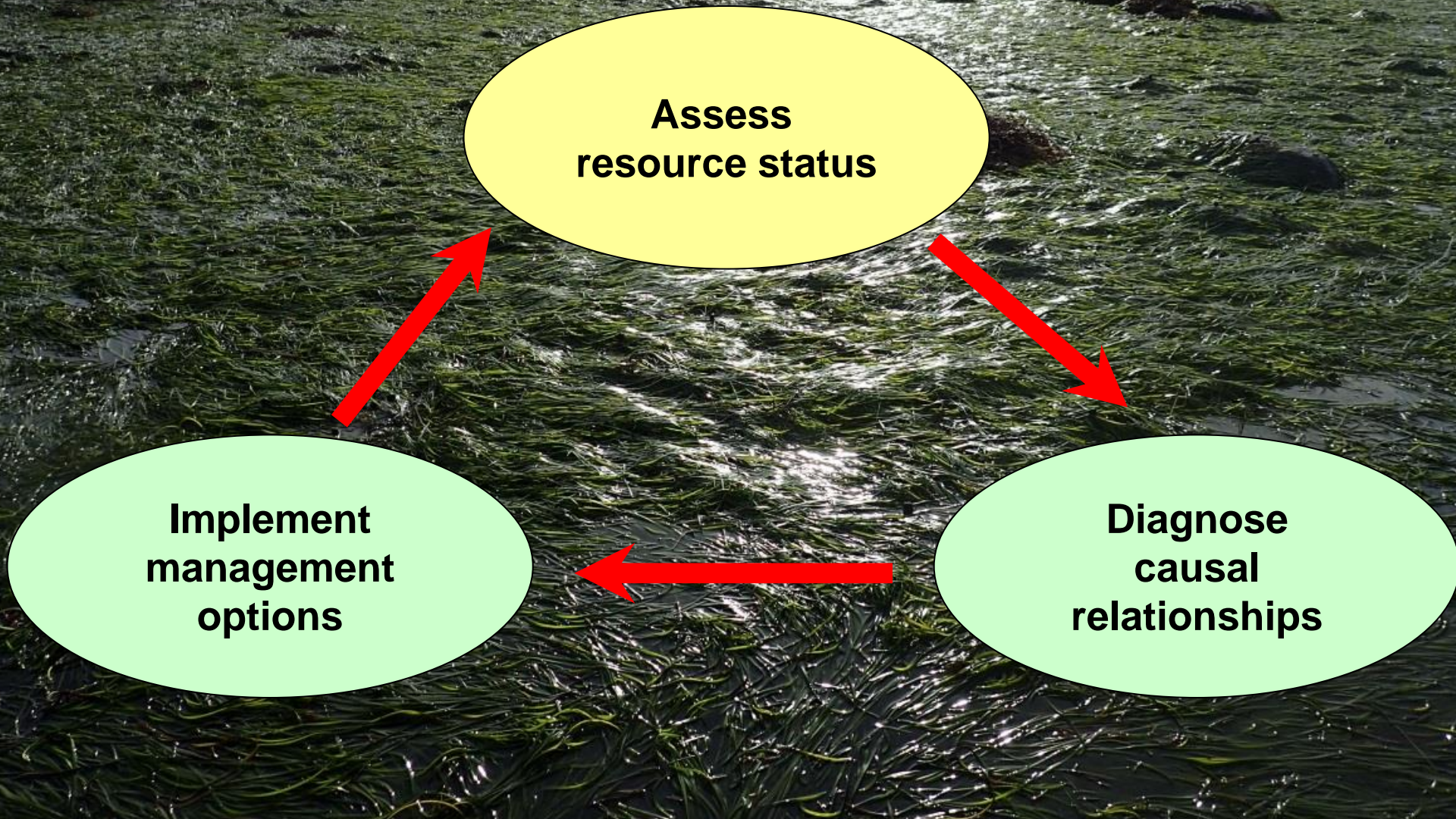
Independent Recovery Trajectories:  
9-11 years to reach 95% cover

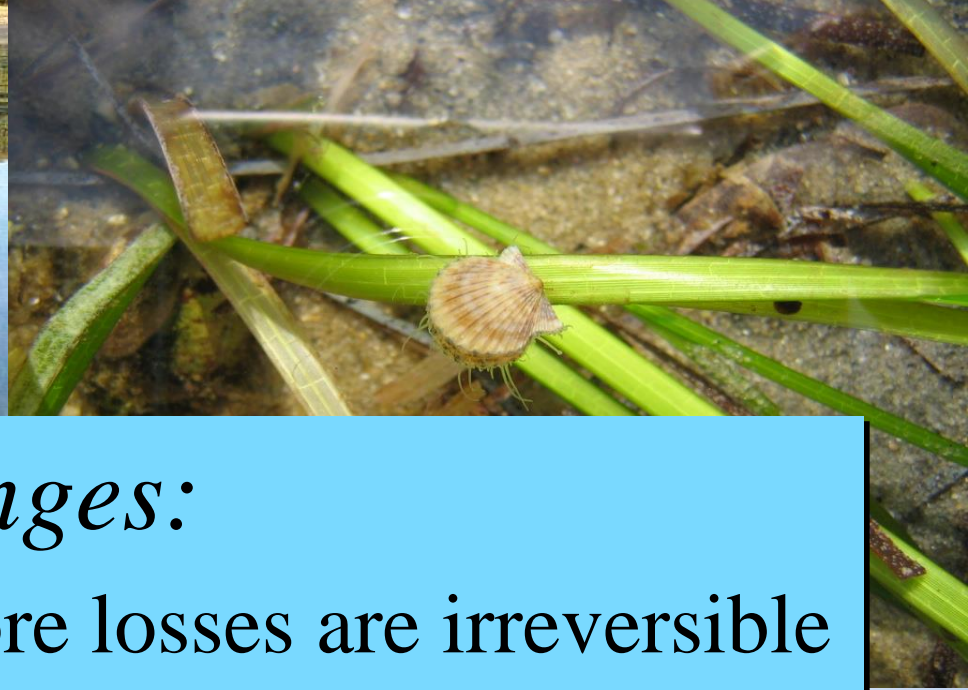


# Seagrass Conservation



# Seagrass Conservation



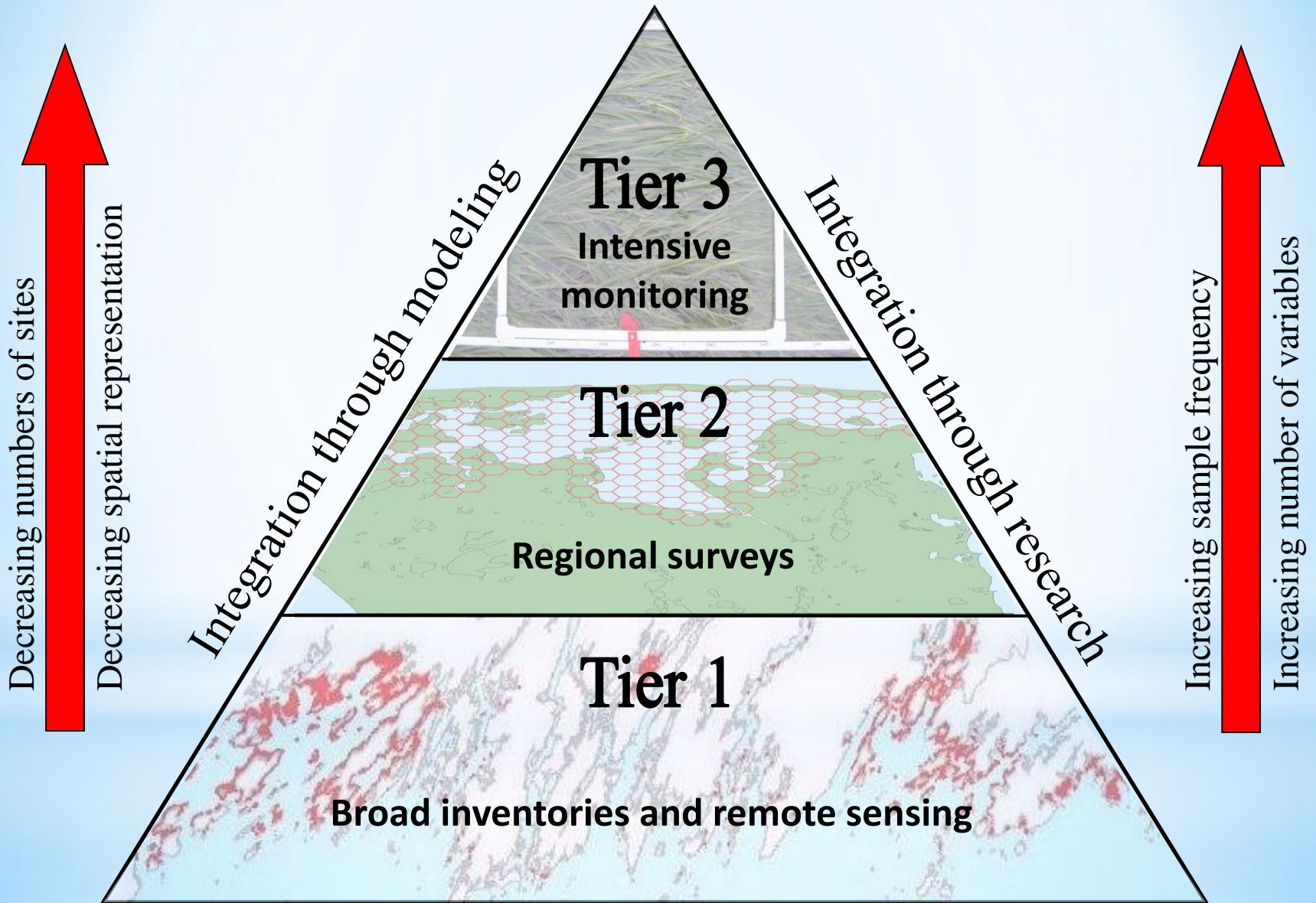


## *Monitoring Challenges:*

- Detecting trends before losses are irreversible
- Forecasting changes in distribution and condition
- Predicting changes on large spatial scale
- Efficient and affordable

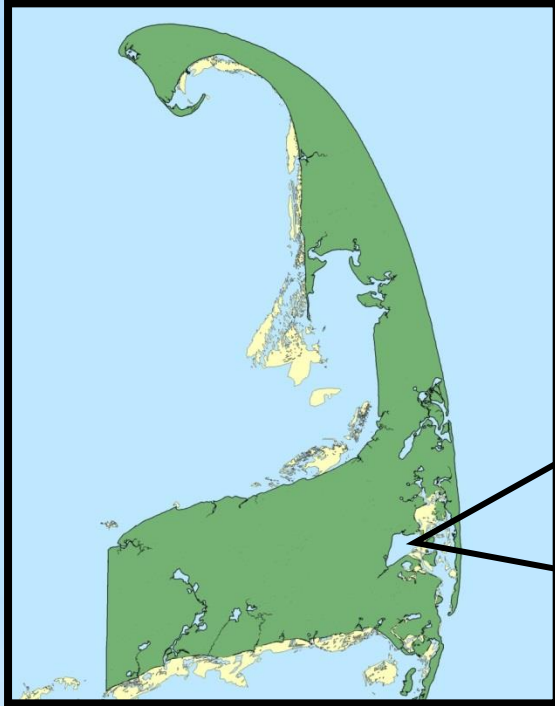


# Hierarchical Monitoring Framework



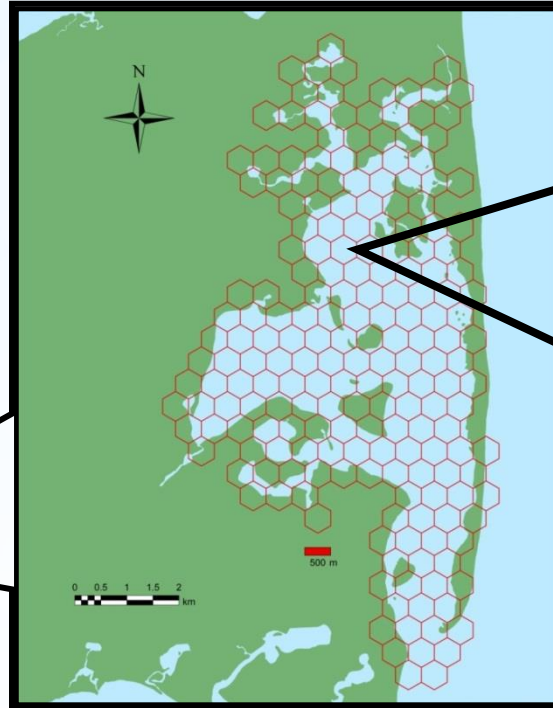
# Cape Cod National Seashore

## Tier 1 Mapping



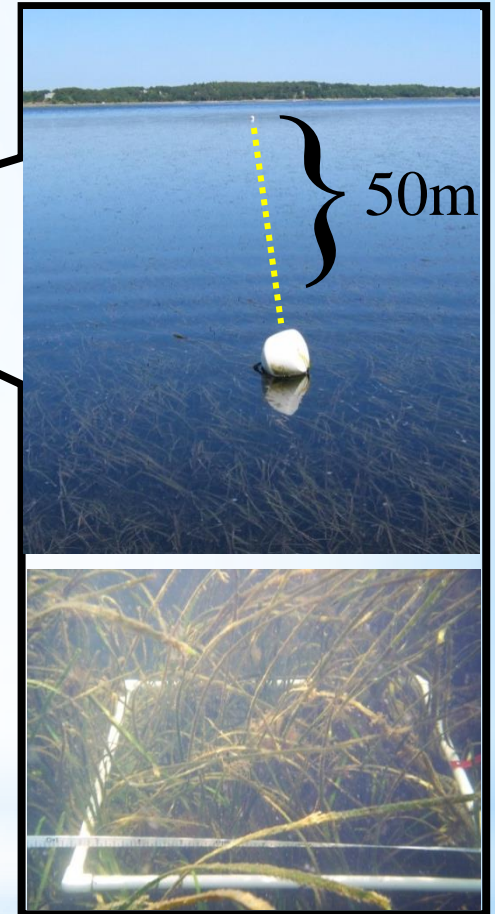
- Bed location
- Bed size

## Tier 2 Baywide Survey



- Percent cover
- Canopy height

## Tier 3 Intensive Measures



- Percent cover
- Canopy height
- Shoot density
- Biomass
- Light, temp, sed

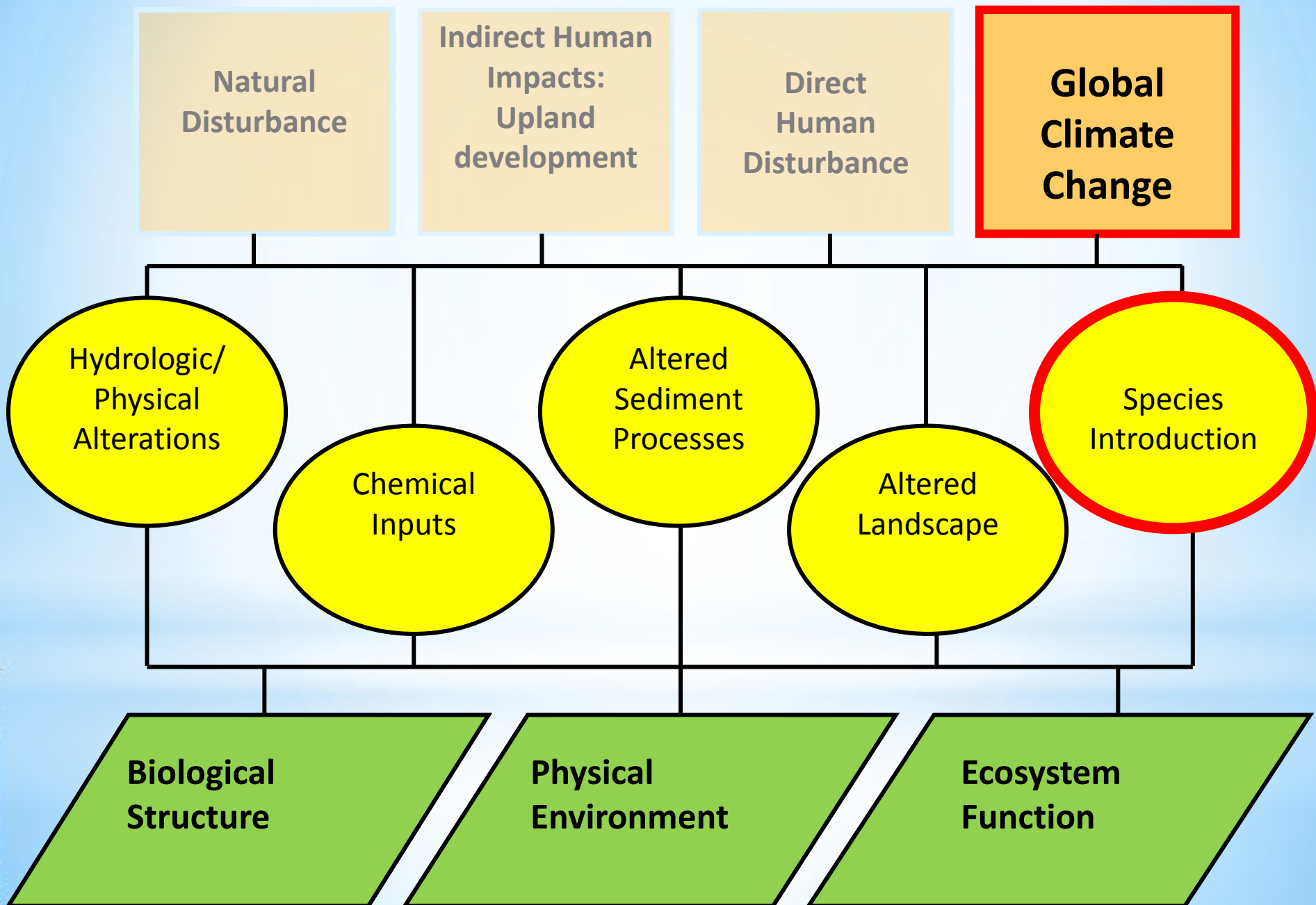
*Multiple linear regression model:*

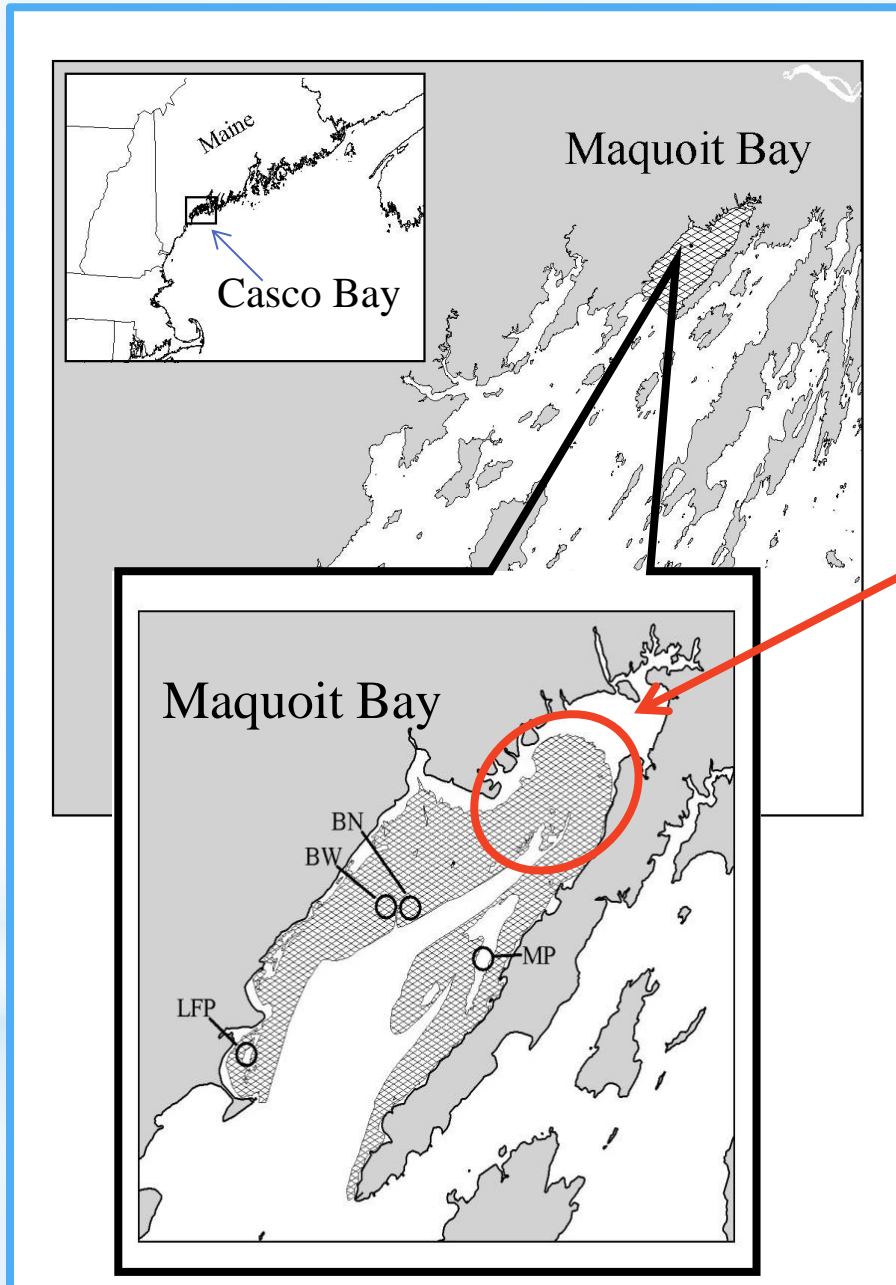
Biomass is dependent on Percent cover, canopy height

$$R^2 = 0.84$$



# Threats to Eelgrass





Change in eelgrass  
in upper Casco Bay:  
the next two slides  
are views of the  
bed at the top of  
Maquoit Bay

2001



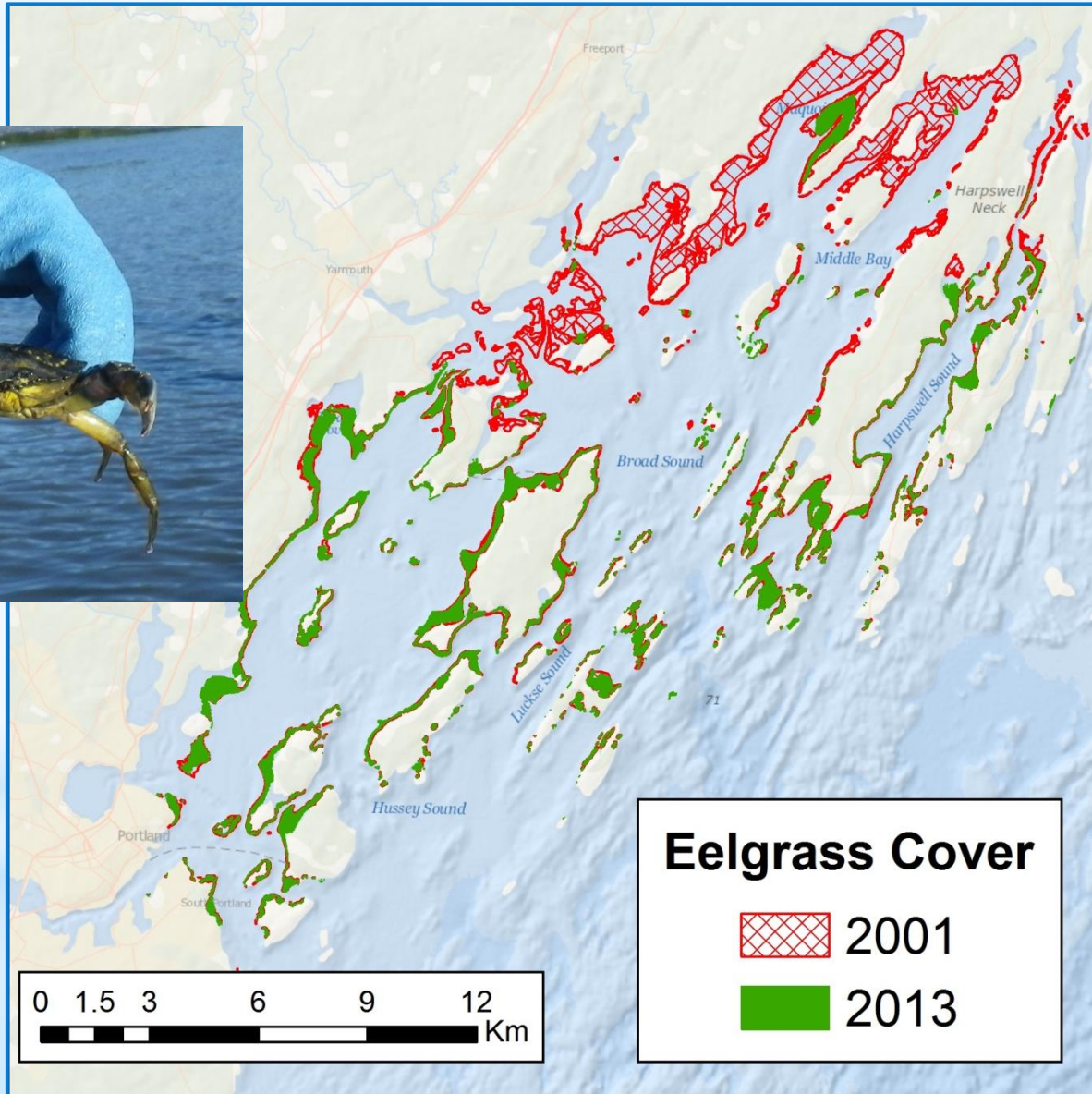
Hilary Neckles

2013



Hilary Neckles

# Eelgrass Destroyed by Invasive European Green Crabs



56% loss  
of  
eelgrass  
area:  
3,338 ha  
to  
1,477 ha

# *Impacts of eelgrass loss on shellfish calcification?*



Hilary Neckles

# Expanding Populations of Invasive Colonial Tunicates



An underwater photograph showing a dense stand of eelgrass (Zostera marina) growing from a sandy seabed. The blades are long, narrow, and green, with some showing signs of yellowing or damage. The water is clear, and the lighting is natural, highlighting the texture of the grass and the sand.

## *The Times, They Are A-Changin'...*

- It's even more complicated!
- Existing threats exacerbated by direct and indirect effects of global change
- Long-term sustainability of eelgrass in the Gulf of Maine will demand multi-faceted approaches



*Thank you and  
best wishes for the  
next 75 years!*

