

The background of the slide is a photograph of a large suspension bridge, likely the Verrillano Bridge, spanning a wide body of water. The bridge has two tall blue towers and a long deck supported by numerous cables. The water is a deep blue, and the sky is a clear, light blue. The title text is overlaid on the upper half of the image.

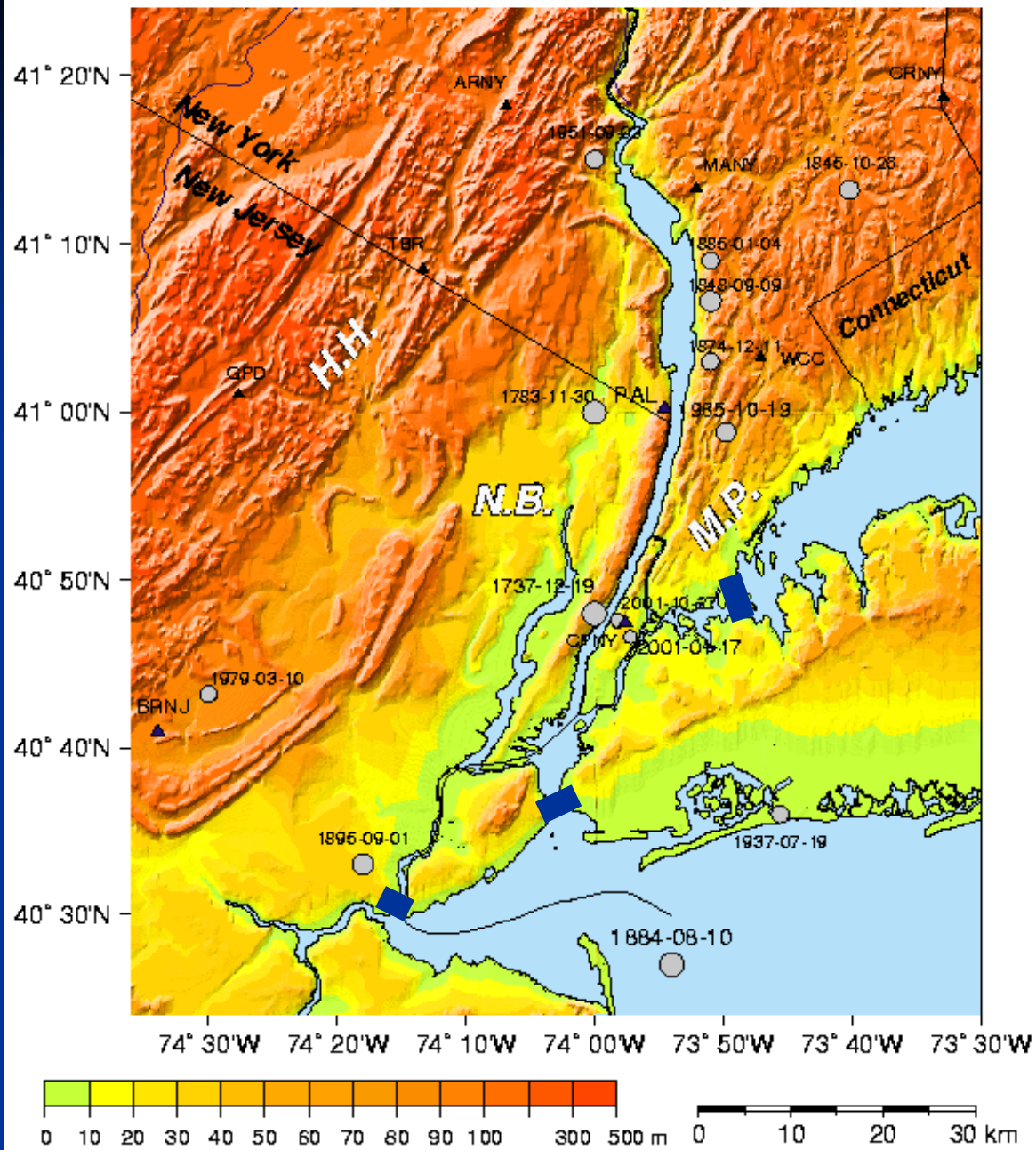
# Storm Surge Barriers: Several Ecological and Social Concerns

R.L. Swanson, C. O'Connell, and R.E. Wilson  
School of Marine and Atmospheric Sciences  
Stony Brook University  
March 31, 2009

# Assumptions

Tide gates designed to:

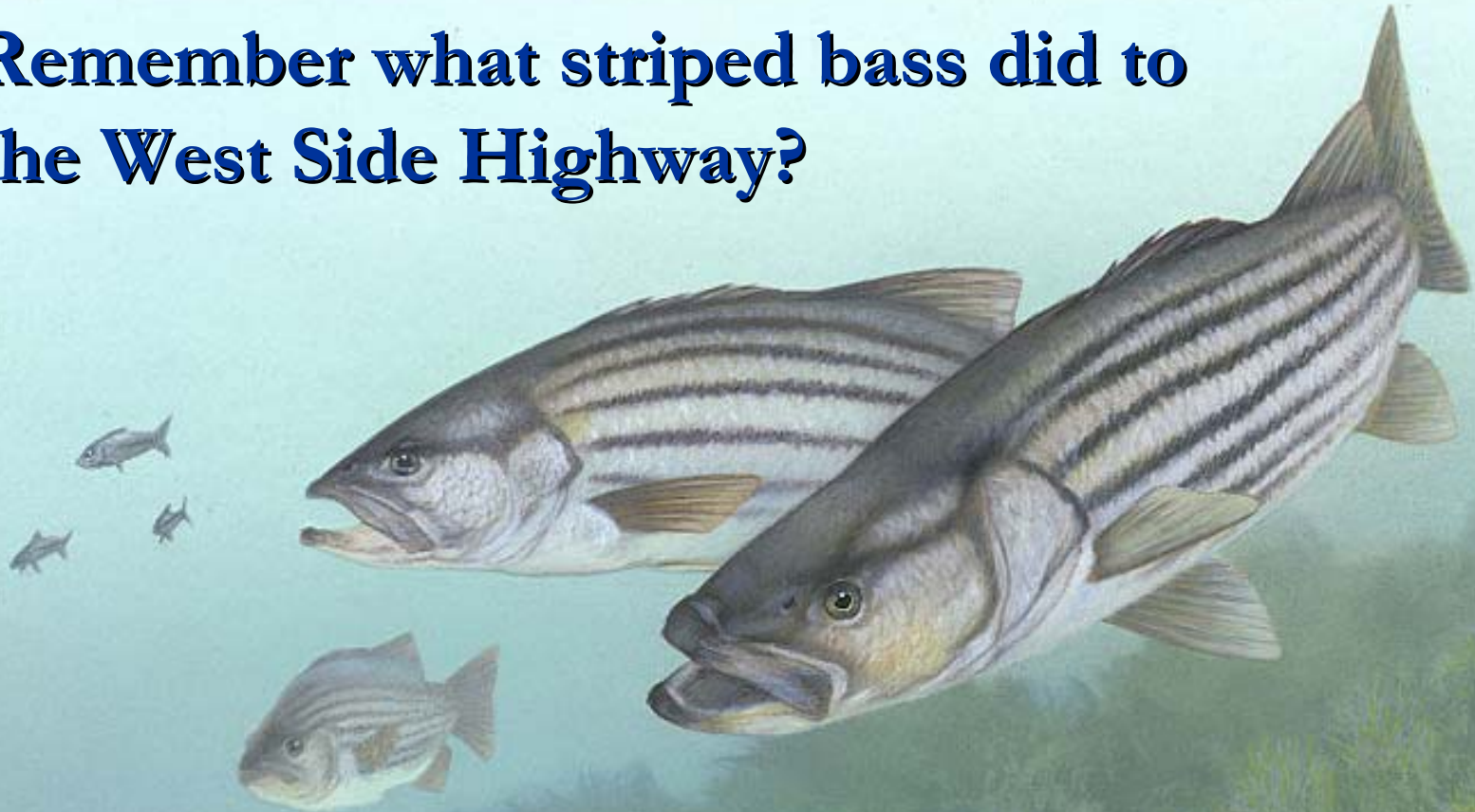
- accommodate a category 3 hurricane with a storm surge of 25 ft
- constrict the existing cross-sectional area of waterway to properly seal
- closure may last for hours (hurricane) to parts of several days (nor'easter)



W. Y. Kim, LDEO

# Ecological Issues Must Not Be Discounted

- Remember what striped bass did to the West Side Highway?




# Ecosystem Based Management (EBM)

- Disconnects like the striped bass issue have led NYS to implement EBM
  - EBM includes the human element
- Maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need
  - Science based
  - Cumulative impacts of different sectors
  - Protection of ecosystem structure, functioning and key processes
  - Interconnections within and among systems
  - Ecological, social, economic perspectives
  - Place-based

# Ecological Issues

- Altering salinity distribution of Harbor
- Disruption of sediment transport and distribution
- Localized erosion
  - Wetlands
- Impacts on shellfish/fish
- Concentration of sewage effluent and marine debris



An aerial photograph of a coastal city, likely New York City, showing a large body of water (the harbor) and a prominent suspension bridge (the Triborough Bridge) crossing it. A large red cargo ship is visible in the water. The city skyline is visible in the background, including a large island with many buildings. The text "Social Issues" is overlaid in yellow, and "Who's protected, who's not?" is overlaid in white below it.

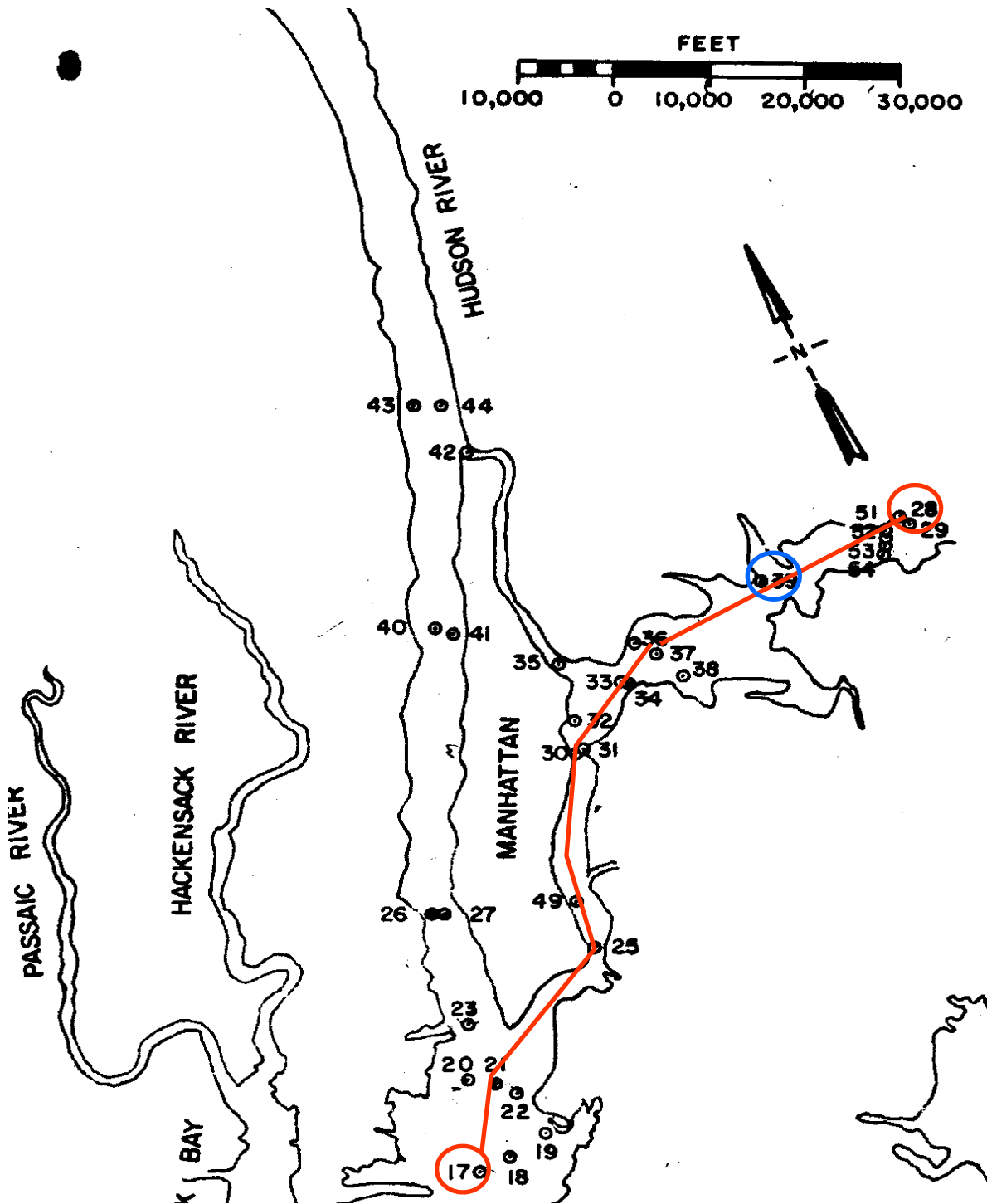
# Social Issues

Who's protected, who's not?

# Freshening of Harbor: Long Island Sound

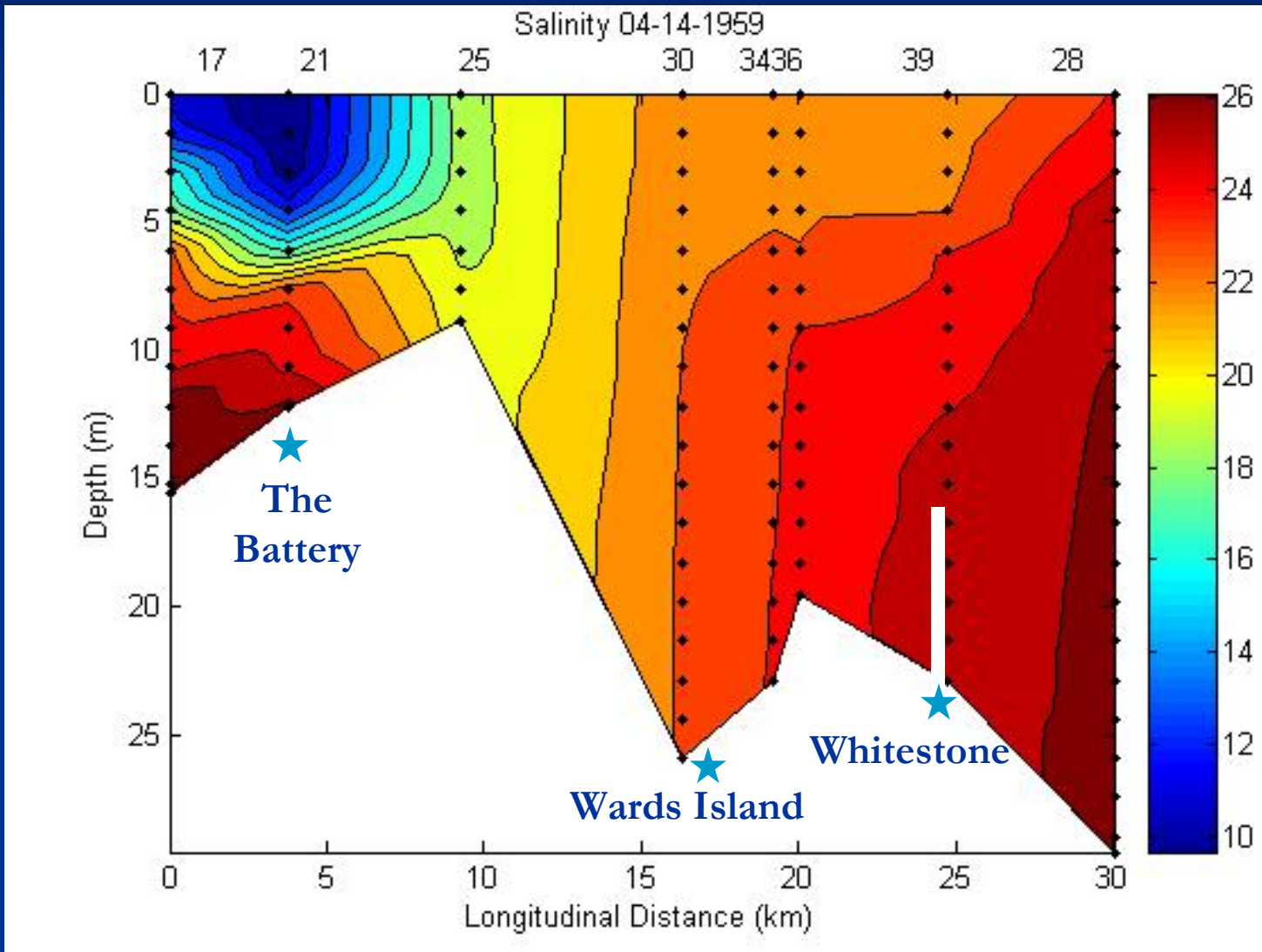
- Net flow LIS to Upper Bay
- Fresh water flow Upper Bay to LIS
- Saltwater flow LIS to Upper Bay





# Transect stations, NOAA Cruise 1959

# Salinity Section from Upper Bay of NY Harbor through the East River, 1959

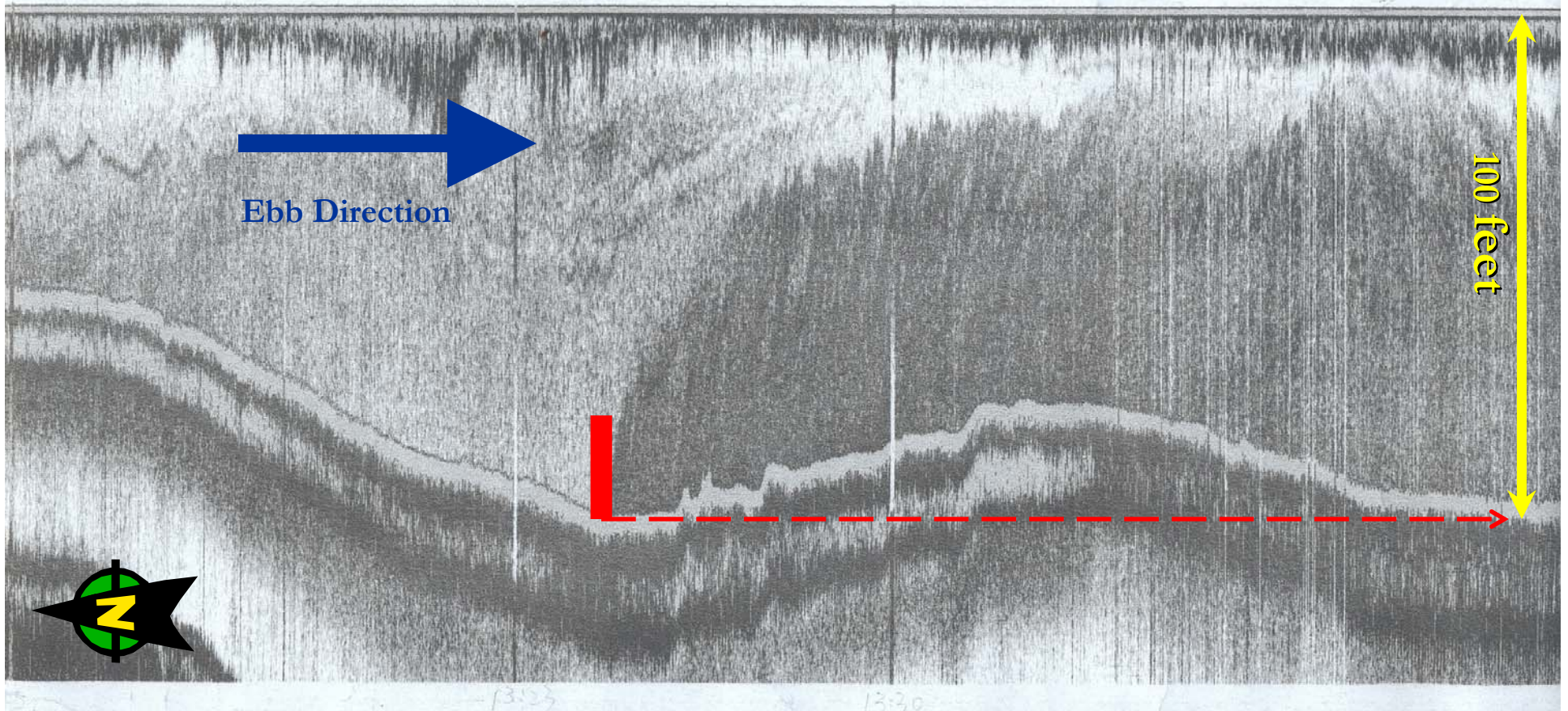


# Verrazano Narrows

Hindrance of  
salt wedge up  
Hudson River



# Salt Wedge on Spring Ebb Current at Verrazano Narrows, 3/28/91



- Tidal period hydraulics control salt infusion in contraction at The Narrows

# Long Term

Constrictions at  
Throgs Neck and  
Verrazano  
Narrows may  
restrict flow of  
salt into Upper  
Bay



# Sediment Transport and Distribution

Constriction in cross-sectional area at gates will:

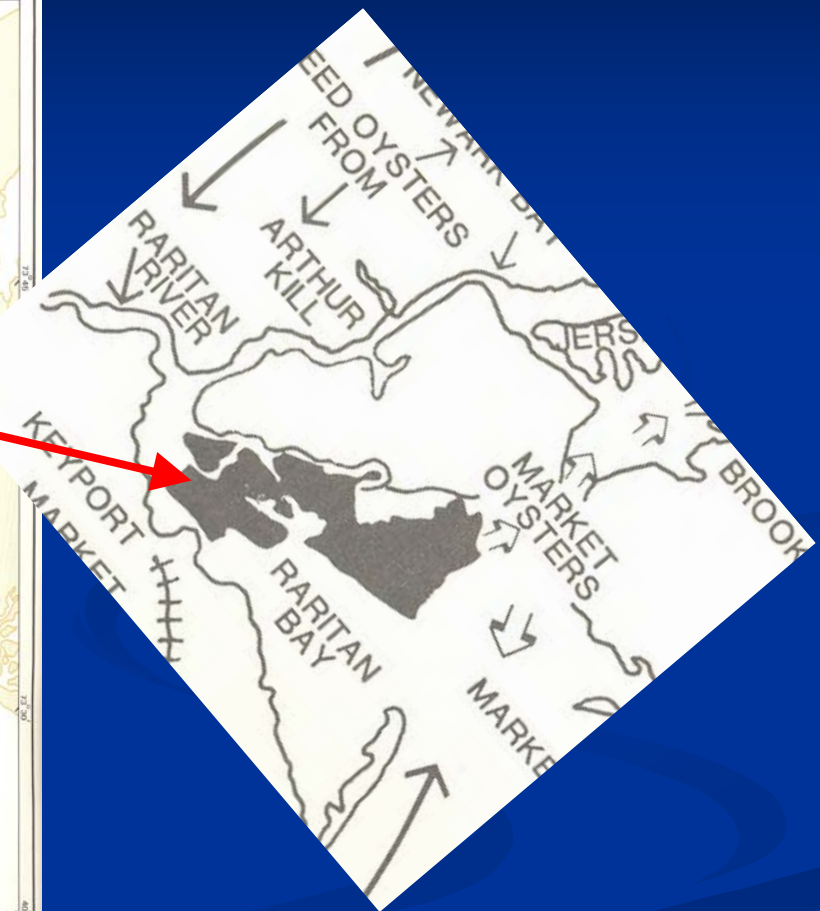
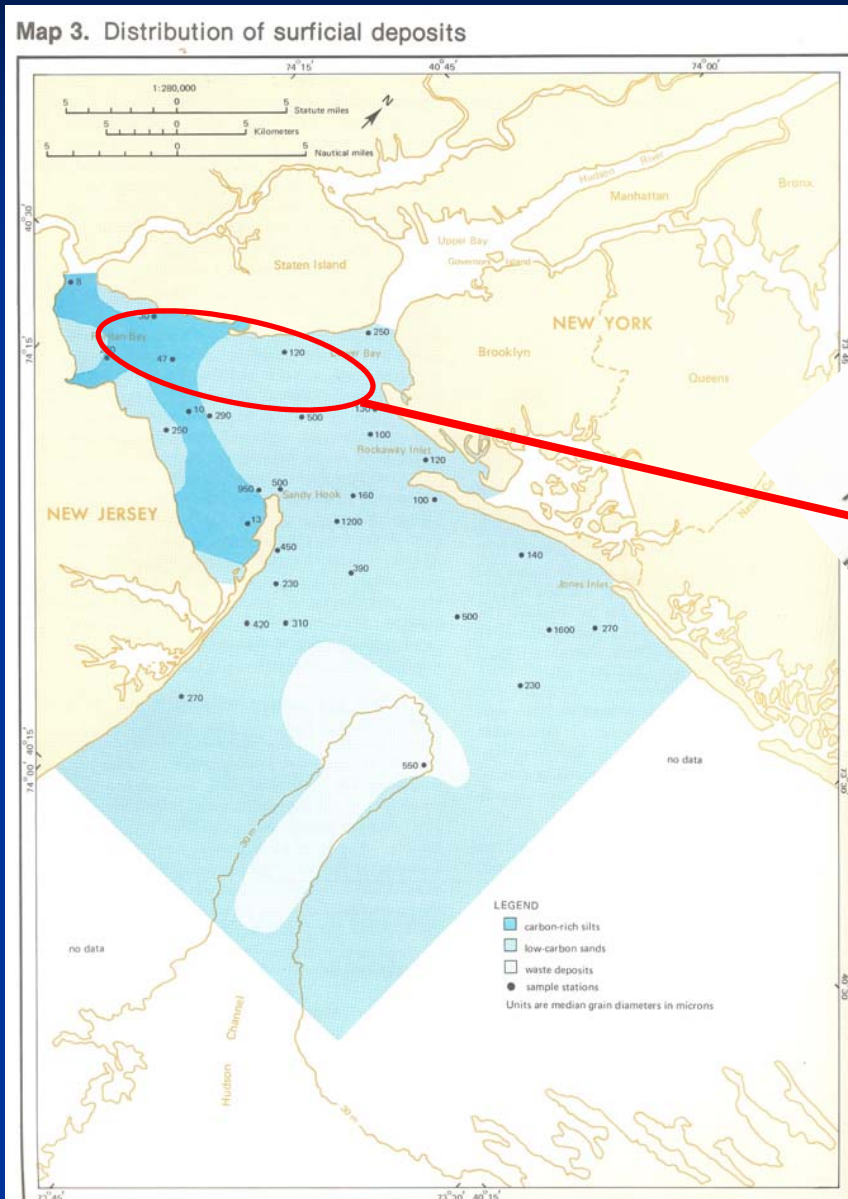
- alter velocity fields
- trap sediments
- change sediment depositional fields



# Sediment Transport and Distribution

- Sediment supply to NY/NJ Harbor Estuary\*
  - Raritan Bay and South River - 23%
  - Hudson - 22.5%
  - Other NJ Rivers – 6%
- Disruption to this sediment supply could alter sediment characteristics of the Estuary
- Raritan Bay is a productive shellfish fishery

# Surficial sediment deposits with most productive oyster beds, Raritan Bay



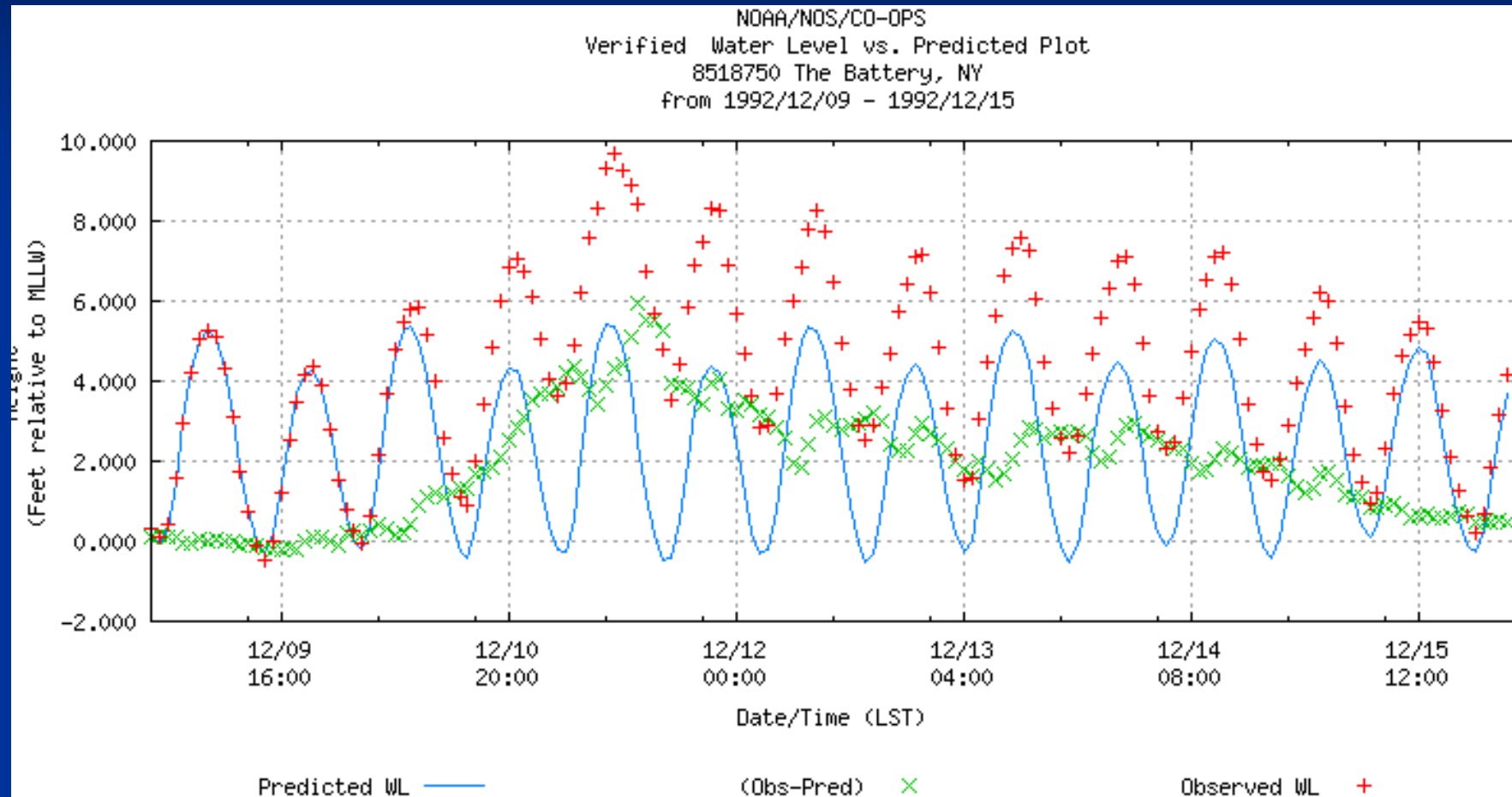


# Impact on Fisheries/Shellfisheries

- Changes in salinity could alter:
  - finfish composition
  - finfish distribution
- Changes in sediment characteristics could alter:
  - finfish distribution
  - shellfish composition and distribution (particularly in Raritan Bay)



# Dec. 1992 Nor'easter Storm Surge The Battery



- Gates could be closed for days, not hours

# Sewage, CSO, Marine Debris

Wastes that will be impounded for hours to days

## ■ Sewage

- 1.5 billion/gal/d discharged by Westchester County, NYC and NJ in waterway to be protected

## ■ CSOs

- 950-1,350 NYC discharges in area of concern

## ■ Marine debris

- Corps of Engineers and NYC capture about 5,000 ton/y



# NYC Water Pollution Control Plants Capacities and Discharge Rates, NYC DEP



# Where to Flush?

- Coastal New Jersey
- Western Long Island Sound



# Equity Issues



Downtown Bound  
Brook, NJ, Flooding  
from Spring Nor'easter  
of 2007



- Green (seaward of storm gates) shows area that would not be protected
  - Westchester
  - Staten Island
  - Brooklyn/Queens
  - Raritan Bay area

# Risk Assessment

- Risk assessment essential
- Alternatives should be considered





# Conclusion

Ecological, social, and economic costs of constructing storm surge barriers at The Narrows and Throgs Neck could be large

- Long term alteration of salinity in NY Harbor
- Disruption in sediment transport and distribution
- Impact on fisheries
- Pollution issues
- Equity issues