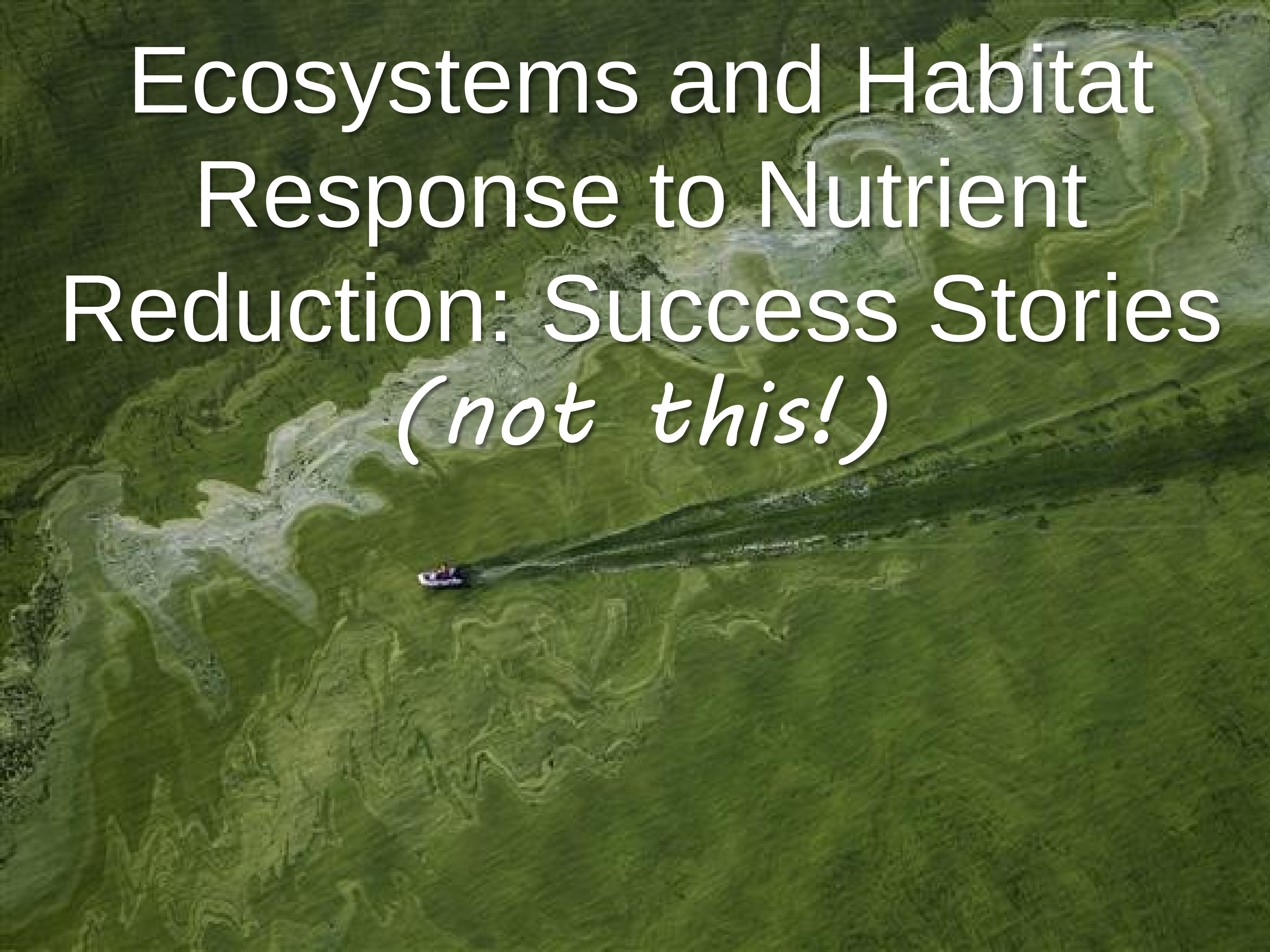
# Ecosystems and Habitat Response to Nutrient Reduction: Success Stories

*(not this!)*

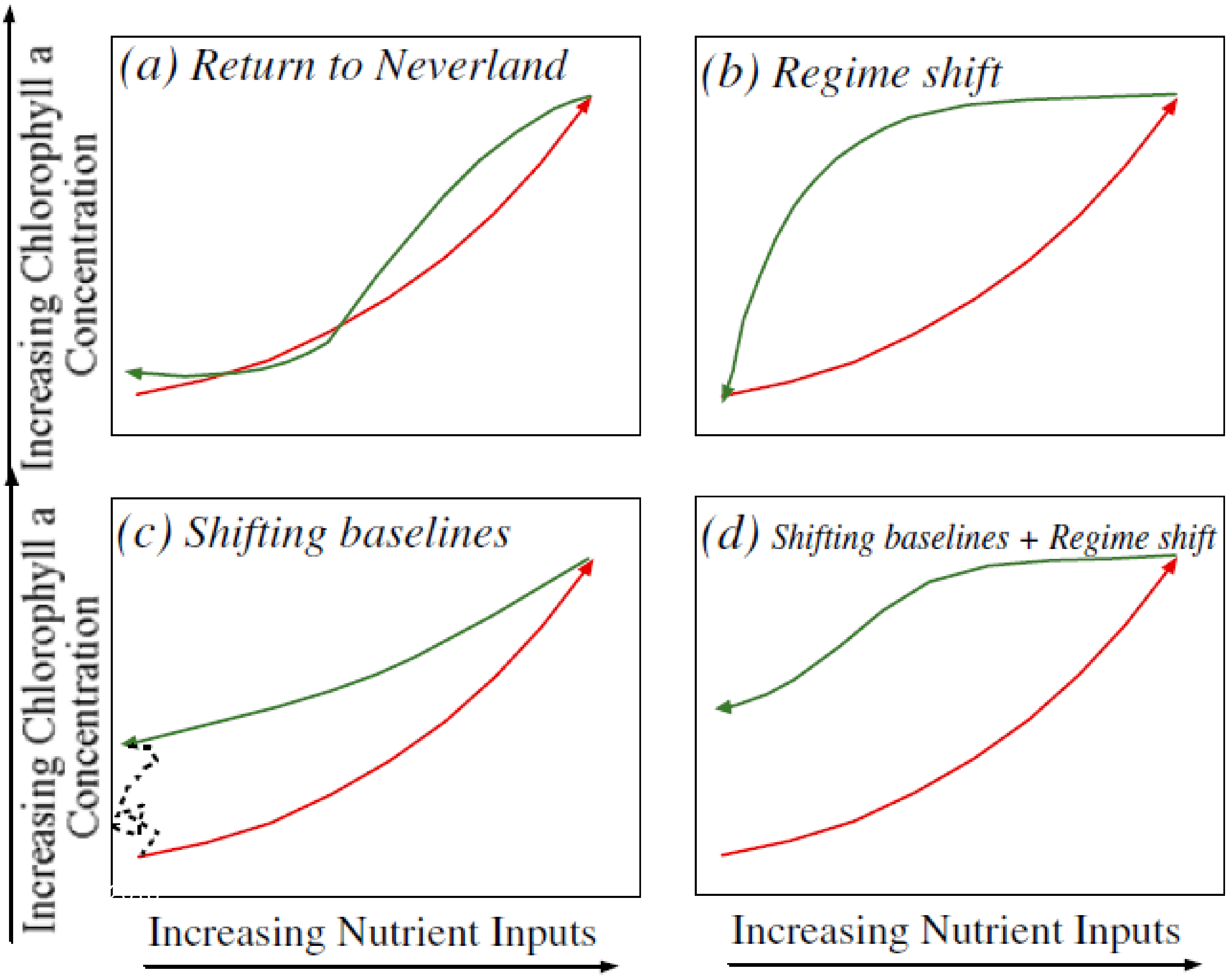


# 2018 Suffolk County Harmful Algal Bloom Symposium

May 16, 2018

Jim Ammerman
Science Coordinator,
Long Island Sound Study,
New England Interstate Water Pollution Control Commission (NEIWPCC)

Duarte, C.M., D.J. Conley, J. Carstensen, and M. Sánchez-Camacho. 2008. *Estuaries and Coasts* 32: 29-36.



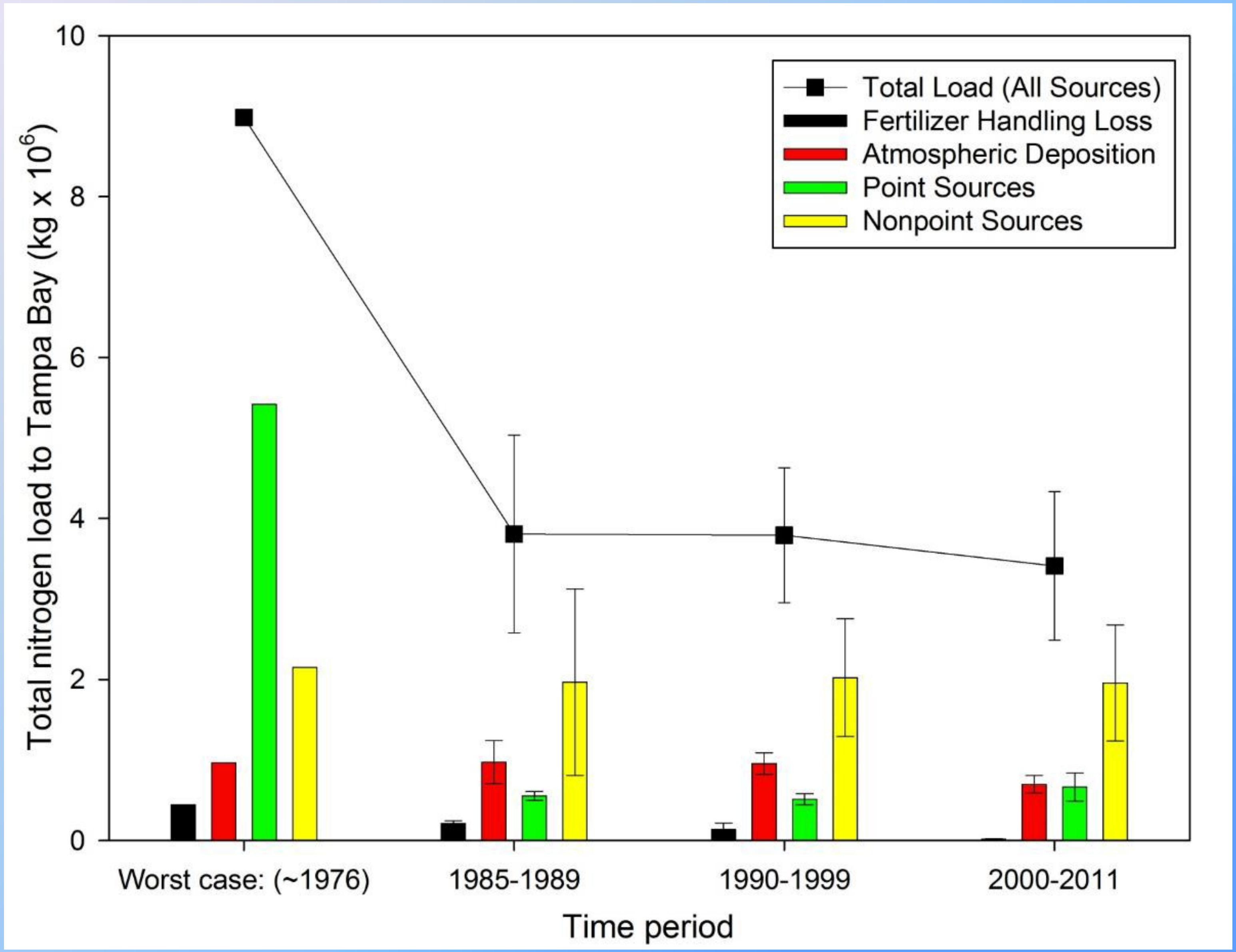

## Return to Neverland: Shifting Baselines Affect Eutrophication Restoration Targets; Or Nutrient Reductions Often Don't Return Systems to Prior Conditions

# Attributes of Successful Actions to Restore Lakes and Estuaries Degraded by Nutrient Pollution*

1. Leadership by a dedicated watershed management agency.
2. Governance through a bottom-up collaborative process.
3. A strategy that set numeric targets based on a specific ecological goal.
4. Actions to reduce nutrient loads from all sources.

*Gross, C., and J.D. Hagy. 2017. *Journal of Environmental Management* 187: 122-136.
Comments: Tampa Bay was the only estuary they judged had met its goals. Water quality goals like hypoxia were not sufficient <u>ecological</u> goals. Nutrient reductions from wastewater treatment plans alone were not sufficient.

# Tampa Bay Nitrogen load has decreased



# *Tampa Bay Water quality has improved*

Annual average chl-a concentration thresholds

| Year | Old Tampa Bay | Hillsbor-ough Bay | Middle Tampa Bay | Lower Tampa Bay |
|---|---|---|---|---|
| 1974 | No | No | No | Yes |
| 1975 | No | No | No | Yes |
| 1976 | No | No | No | Yes |
| 1977 | No | No | No | No |
| 1978 | No | No | No | Yes |
| 1979 | No | No | No | No |
| 1980 | No | No | No | No |
| 1981 | No | No | No | No |
| 1982 | No | No | No | No |
| 1983 | No | No | No | No |
| 1984 | Yes | Yes | No | Yes |
| 1985 | No | No | No | Yes |
| 1986 | No | No | Yes | Yes |
| 1987 | No | Yes | No | Yes |
| 1988 | Yes | Yes | Yes | Yes |
| 1989 | No | Yes | Yes | Yes |
| 1990 | No | Yes | Yes | Yes |
| 1991 | Yes | Yes | Yes | Yes |
| 1992 | Yes | Yes | Yes | Yes |
| 1993 | Yes | Yes | Yes | Yes |
| 1994 | No | No | No | No |
| 1995 | No | No | No | Yes |
| 1996 | Yes | Yes | Yes | Yes |
| 1997 | Yes | Yes | Yes | Yes |
| 1998 | No | No | No | No |
| 1999 | Yes | Yes | Yes | Yes |
| 2000 | Yes | Yes | Yes | Yes |
| 2001 | Yes | Yes | Yes | Yes |
| 2002 | Yes | Yes | Yes | Yes |
| 2003 | No | Yes | Yes | Yes |
| 2004 | No | Yes | Yes | Yes |
| 2005 | Yes | Yes | Yes | No |
| 2006 | Yes | Yes | Yes | Yes |
| 2007 | Yes | Yes | Yes | Yes |
| 2008 | Yes | Yes | Yes | Yes |
| 2009 | No | Yes | Yes | Yes |
| 2010 | Yes | Yes | Yes | Yes |
| 2011 | No | Yes | Yes | Yes |
| 2012 | Yes | Yes | Yes | Yes |
| 2013 | Yes | Yes | Yes | Yes |
| 2014 | Yes | Yes | Yes | Yes |
| 2015 | No | Yes | Yes | Yes |
| 2016 | Yes | Yes | Yes | Yes |

Advanced wastewater treatment begins

Stormwater regulations enacted

TBEP formed

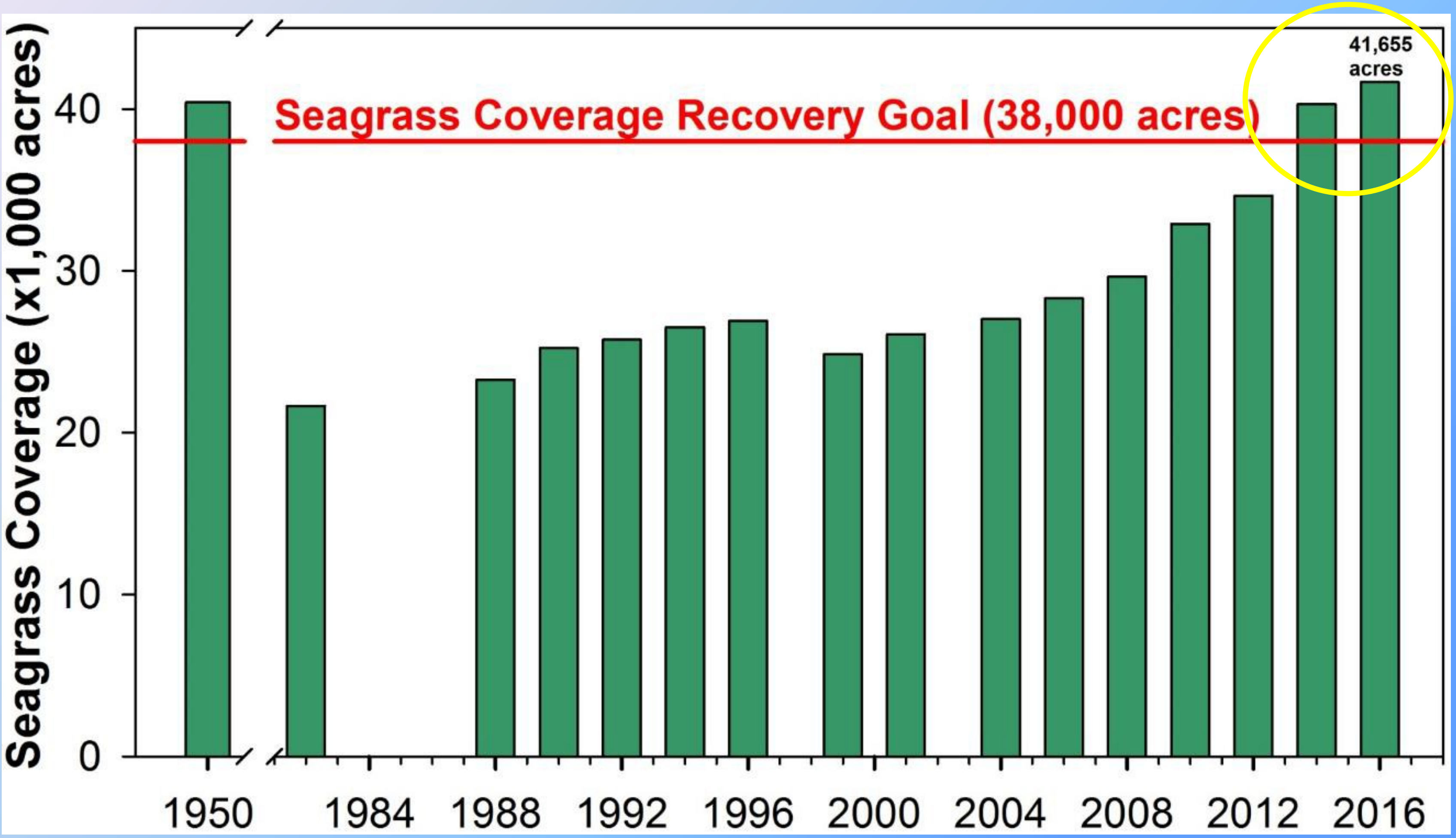
NMC formed

TAMPA BAY ESTUARY PROGRAM

NITROGEN MANAGEMENT CONSORTIUM

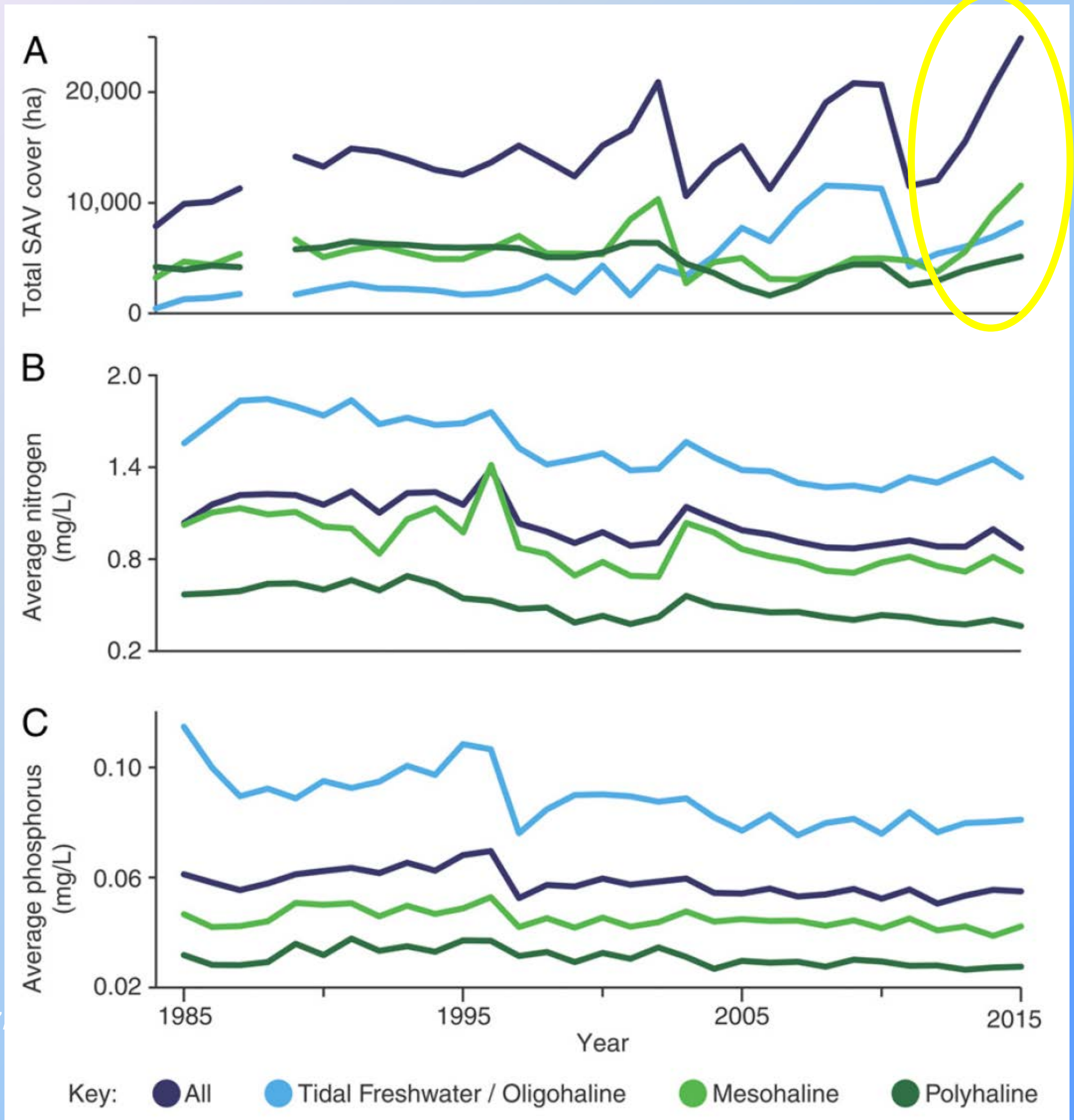
*Data source: EPCHC*

# Tampa Bay 2016- Seagrass Expansion Continues




*Data: SWFWMD*

# Chesapeake Bay Nutrient and SAV Trends



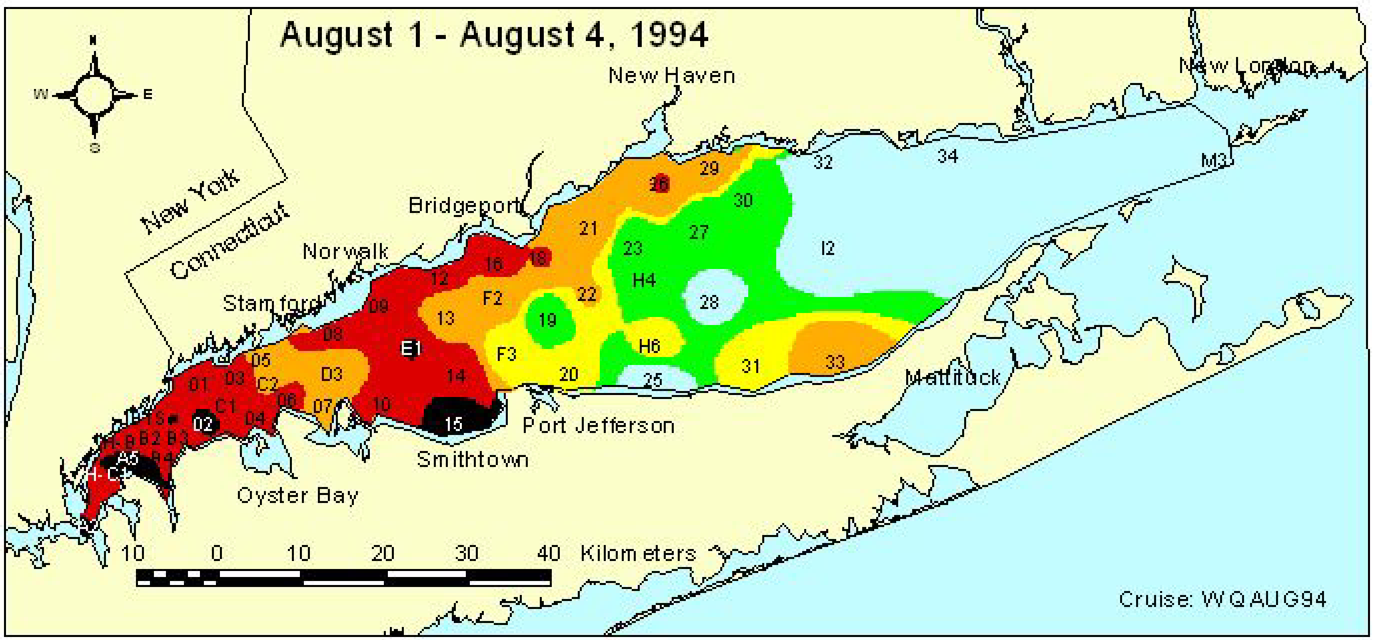

SAV-Submerged aquatic vegetation

Current *Prorocentrum minimum* tide in CB tributary

# Recent Successes in Long Island Sound and Two Embayments

# 1994 Worst Hypoxia in LIS Since Monitoring Began in 1987

Dissolved Oxygen in Long Island Sound Bottom Waters



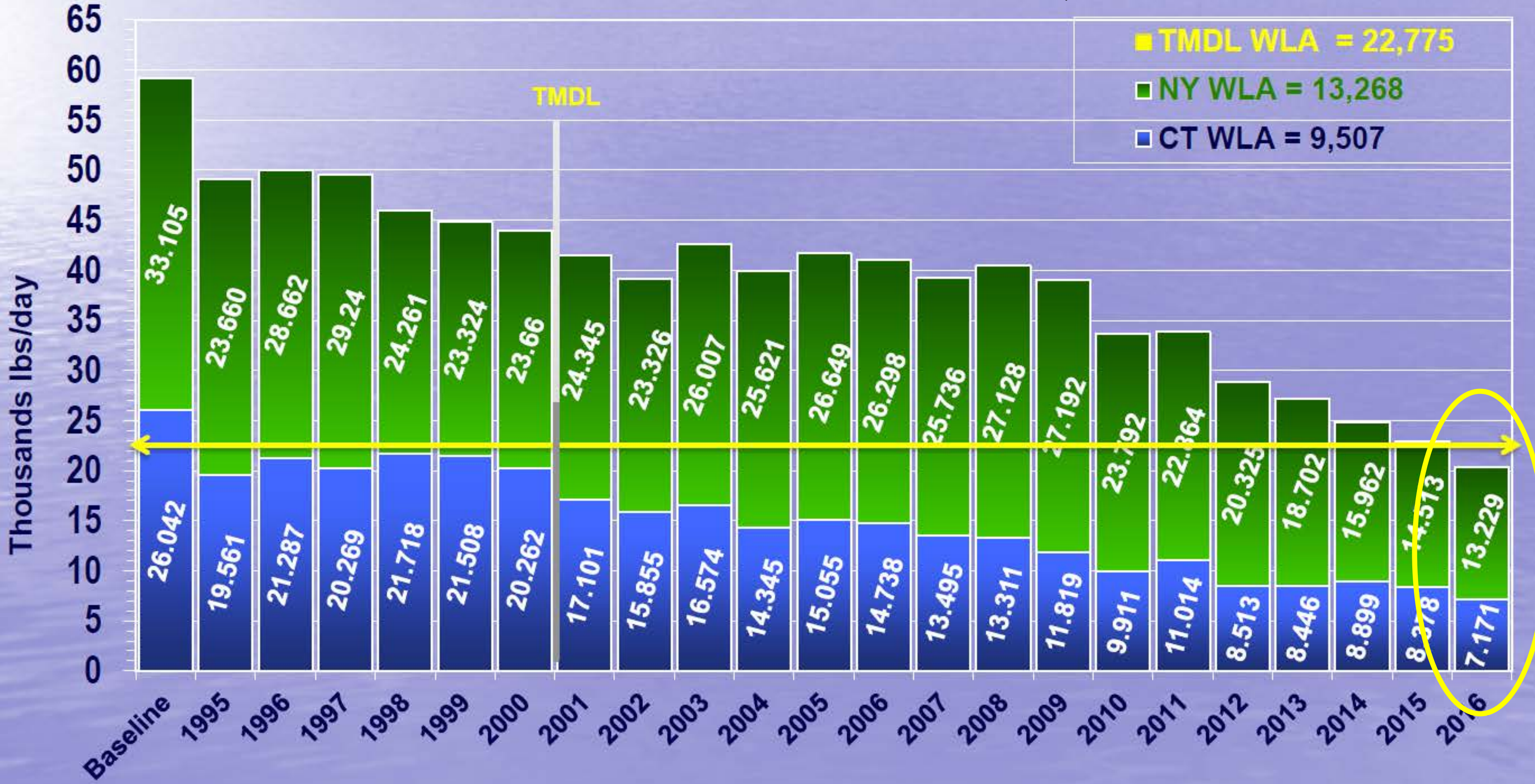

| Dissolved Oxygen | Severity of impact |
|---|---|
| 0.0 - 0.99 mg/L | Severe |
| 1.0 - 1.99mg/L | Moderately severe |
| 2.0 - 2.99 mg/L | Moderate |
| 3.0 - 3.49 mg/L | Marginal |
| 3.5 - 4.79 mg/L | Interim management goal |
| 4.8 + mg/L | Excellent - Supportive of marine life |

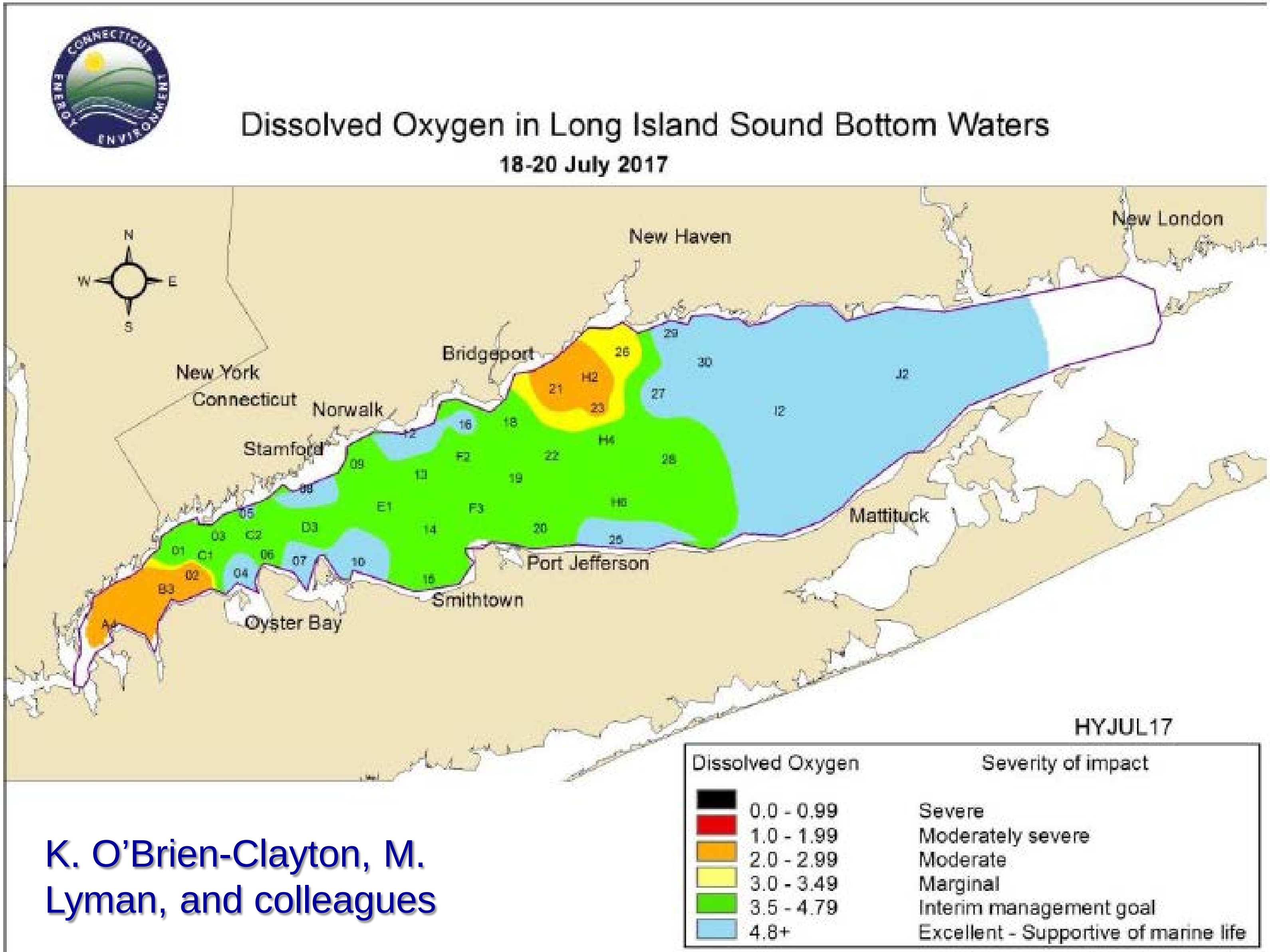
CT DEEP– 1994 Maximum areal extent of hypoxia ~400 $mi^2$, August 1-4

Duration: 68 days

# Nitrogen Loads vs. TMDL Waste Load Allocations 1995-2016 NY/CT Wastewater Treatment Plants

Watershed and Atmospheric N Inputs Also ⇩ Others ⇧






K. O’Brien-Clayton, M. Lyman, and colleagues

CT DEEP– 2017 Maximum areal extent of hypoxia 70 $mi^2$, July 18-20

Duration: 26 days, Smallest ever

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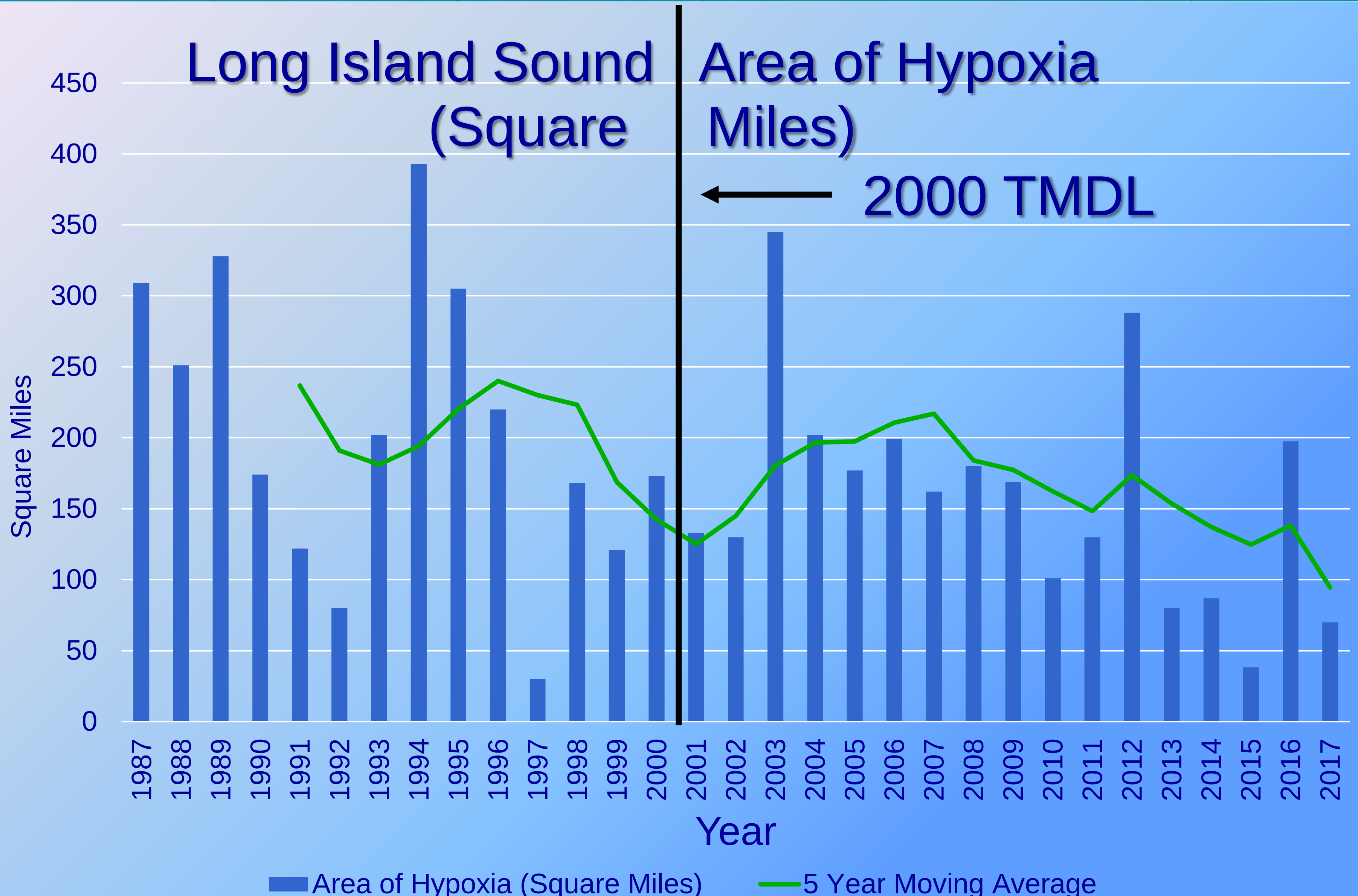
A PARTNERSHIP TO RESTORE AND PROTECT THE SOUND

# Average Duration: 53 days



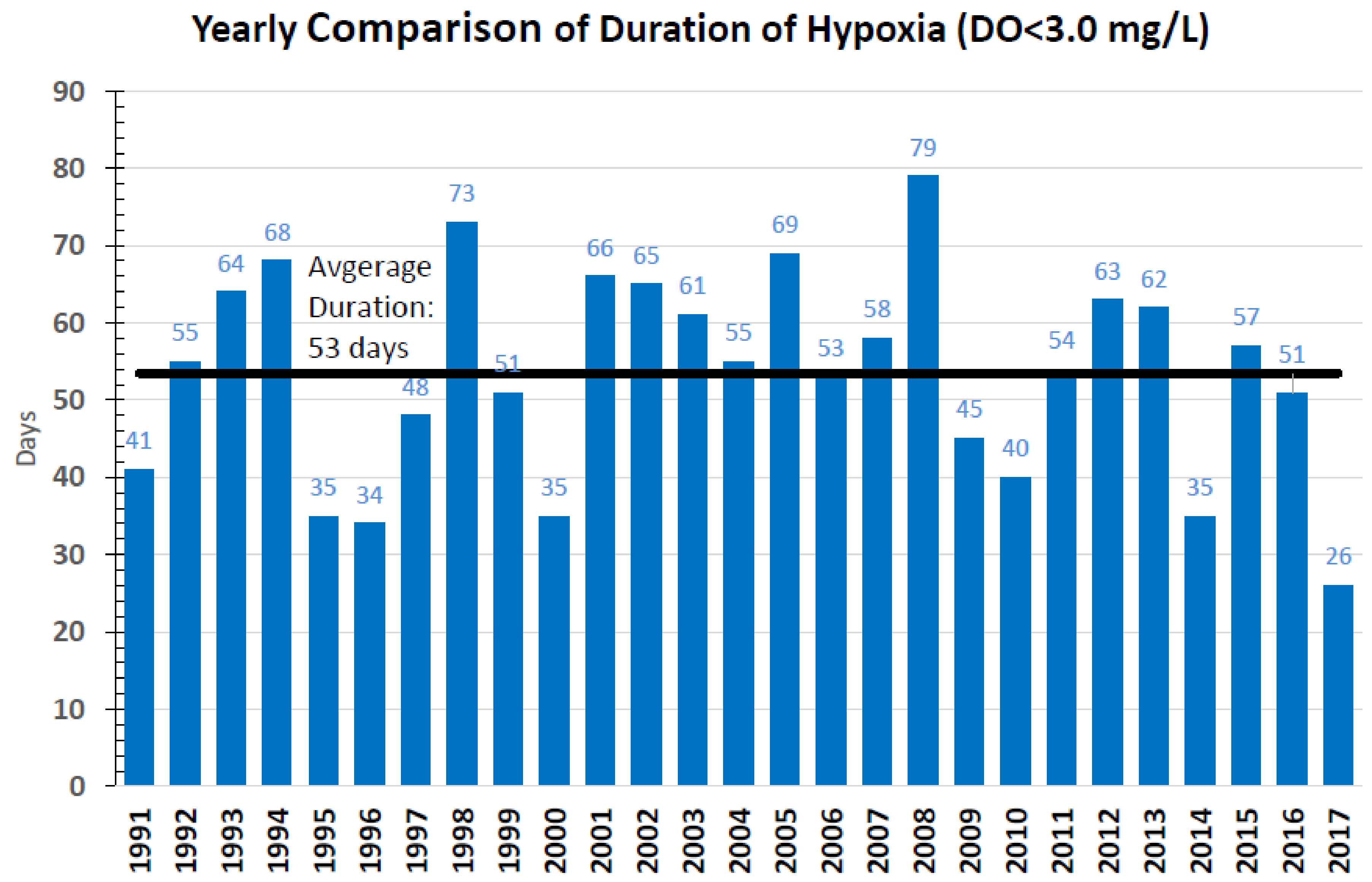


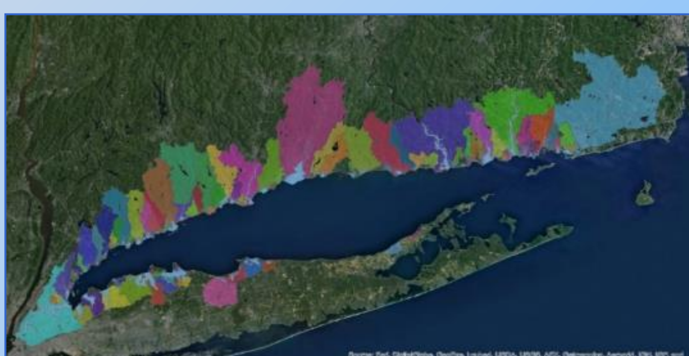

Figure 17

Source: CT DEEP

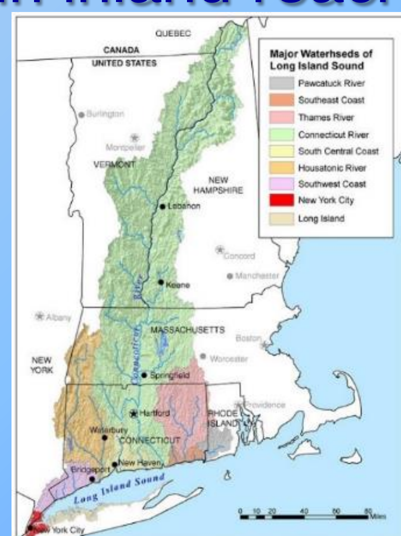
# Nitrogen Reduction Strategy

Customize the application of nitrogen endpoints to develop targets for each of three watershed groupings:

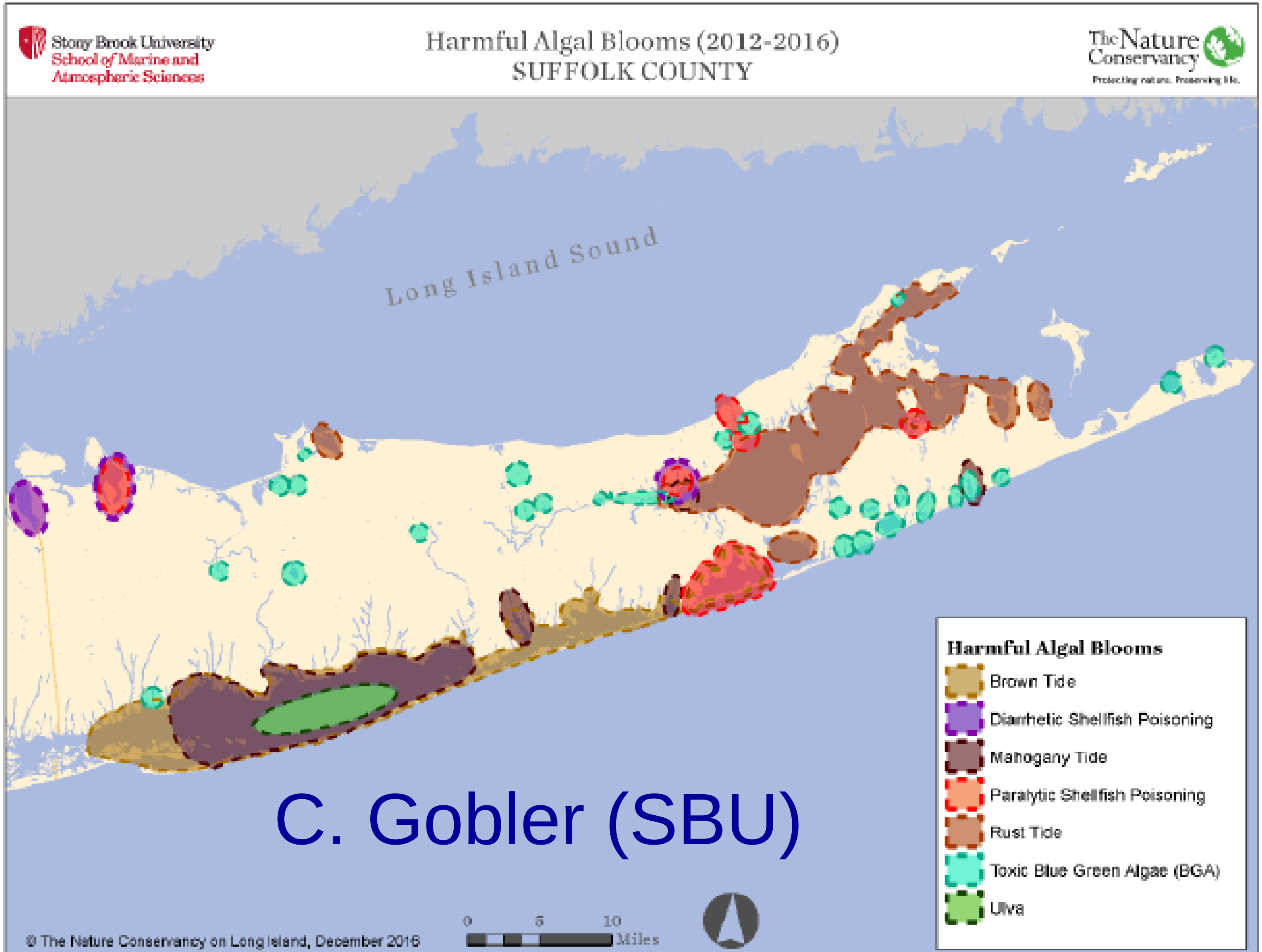
Coastal watersheds that directly drain to embayments or nearshore waters



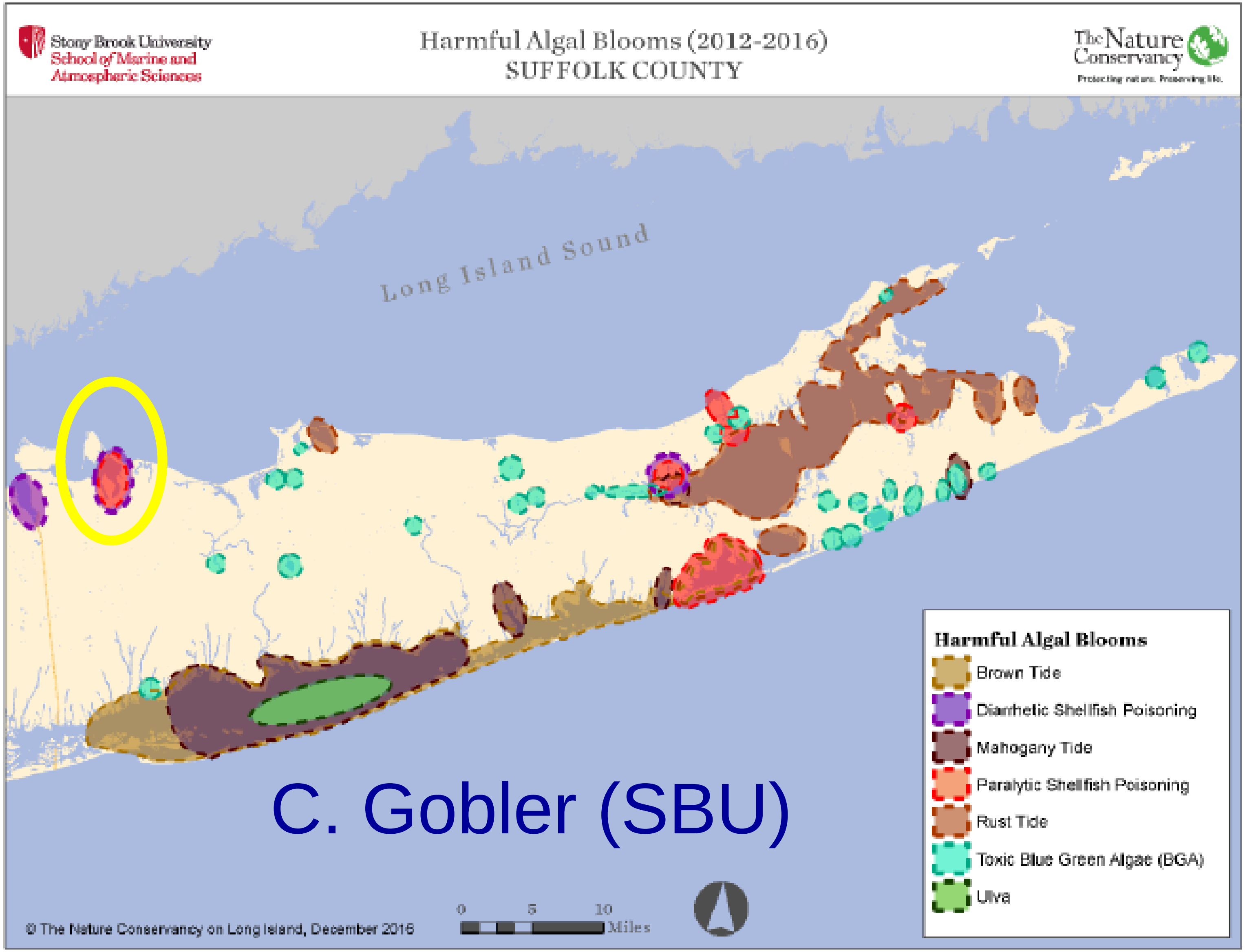
Tributary watersheds that drain inland reaches




WLIS open waters with large, direct discharging WWTFs


Stony Brook University
School of Marine and Atmospheric Sciences
Harmful Algal Blooms (2012-2016)
SUFFOLK COUNTY
The Nature Conservancy
Protecting nature. Preserving life.
Long Island Sound
Harmful Algal Blooms
Brown Tide
Diarrhetic Shellfish Poisoning
Mahogany Tide
Paralytic Shellfish Poisoning
Rust Tide
Toxic Blue Green Algae (BGA)
Ulva
0 5 10 Miles
© The Nature Conservancy on Long Island, December 2016

C. Gobler (SBU)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0 5 10 Miles
© The Nature Conservancy on Long Island, December 2016

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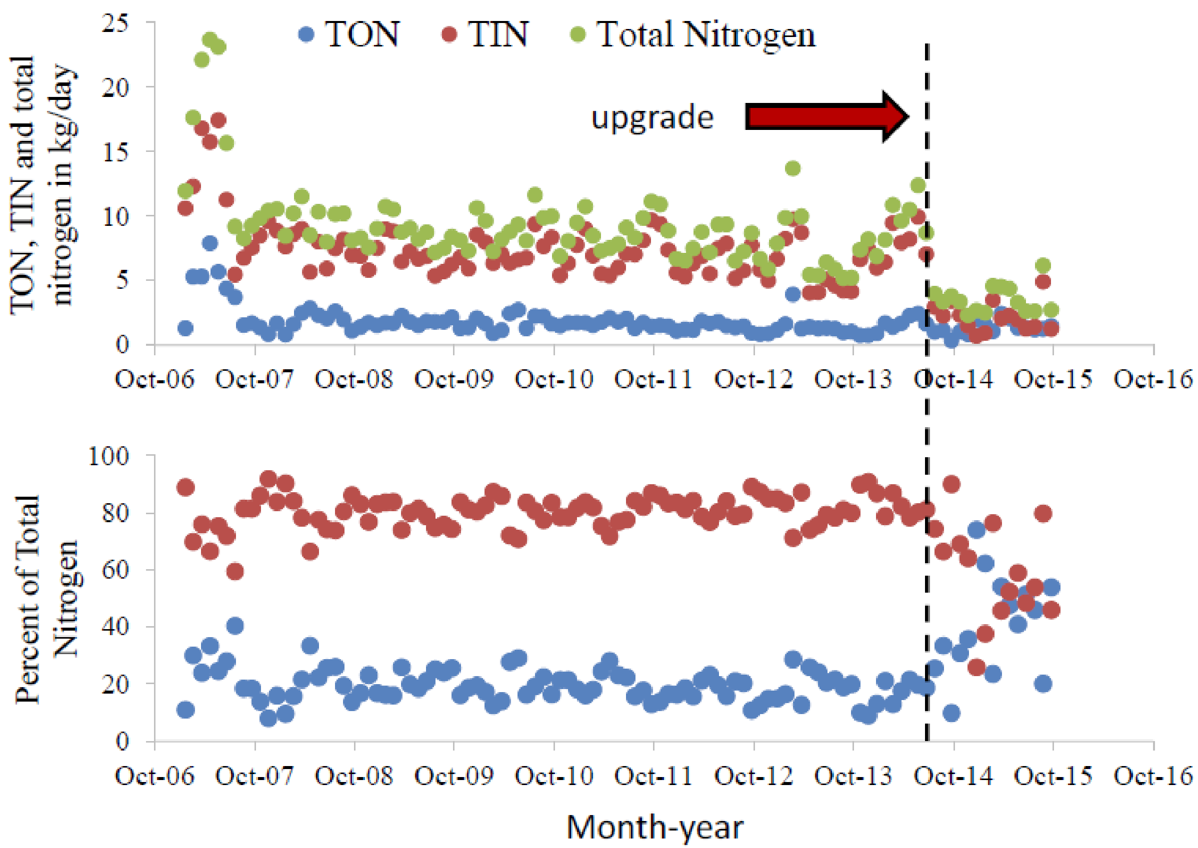
A PARTNERSHIP TO RESTORE AND PROTECT THE SOUND

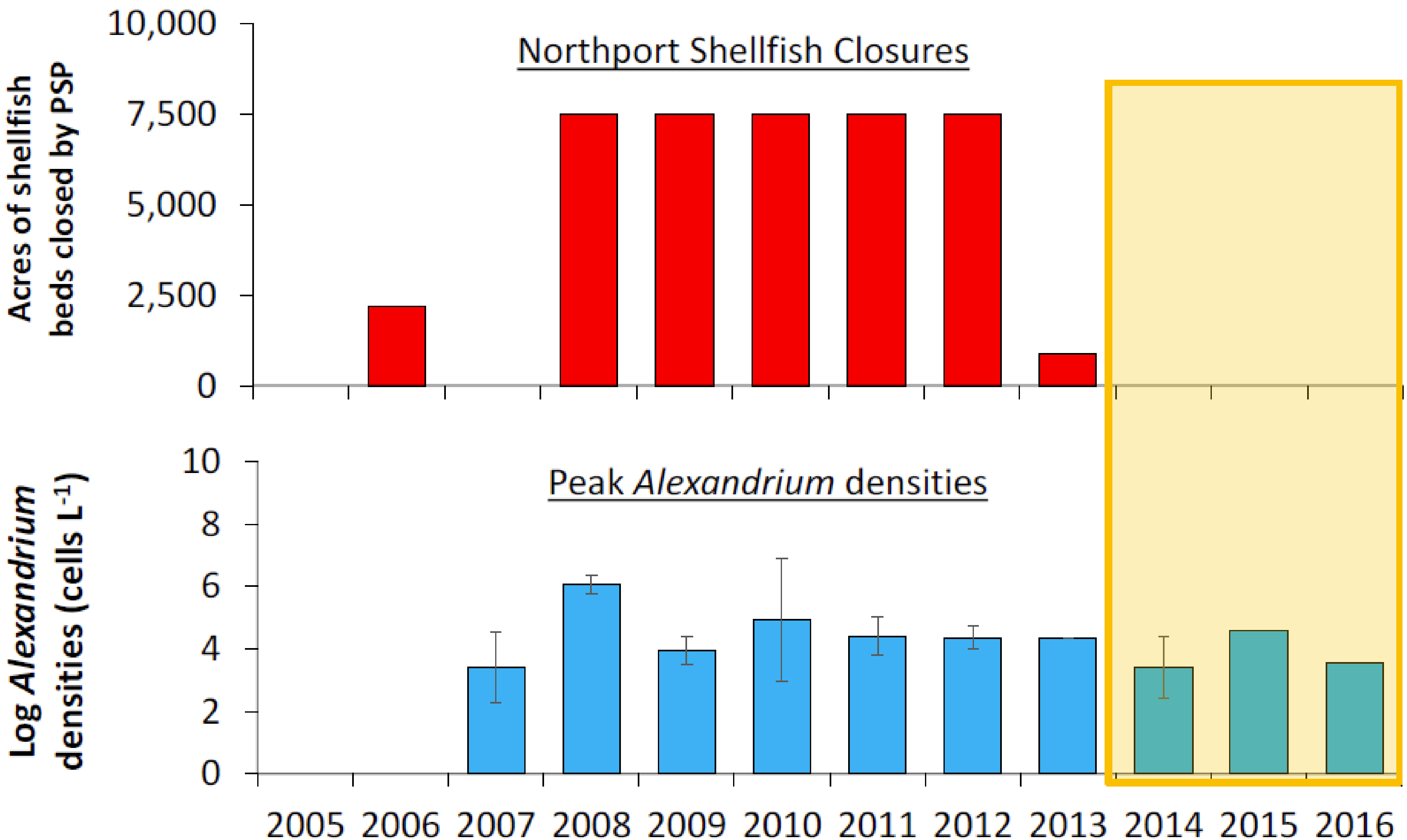
# Total Inorganic N and Total N Decline After 2013 Upgrade

## Changes in Northport Bay STP effluent

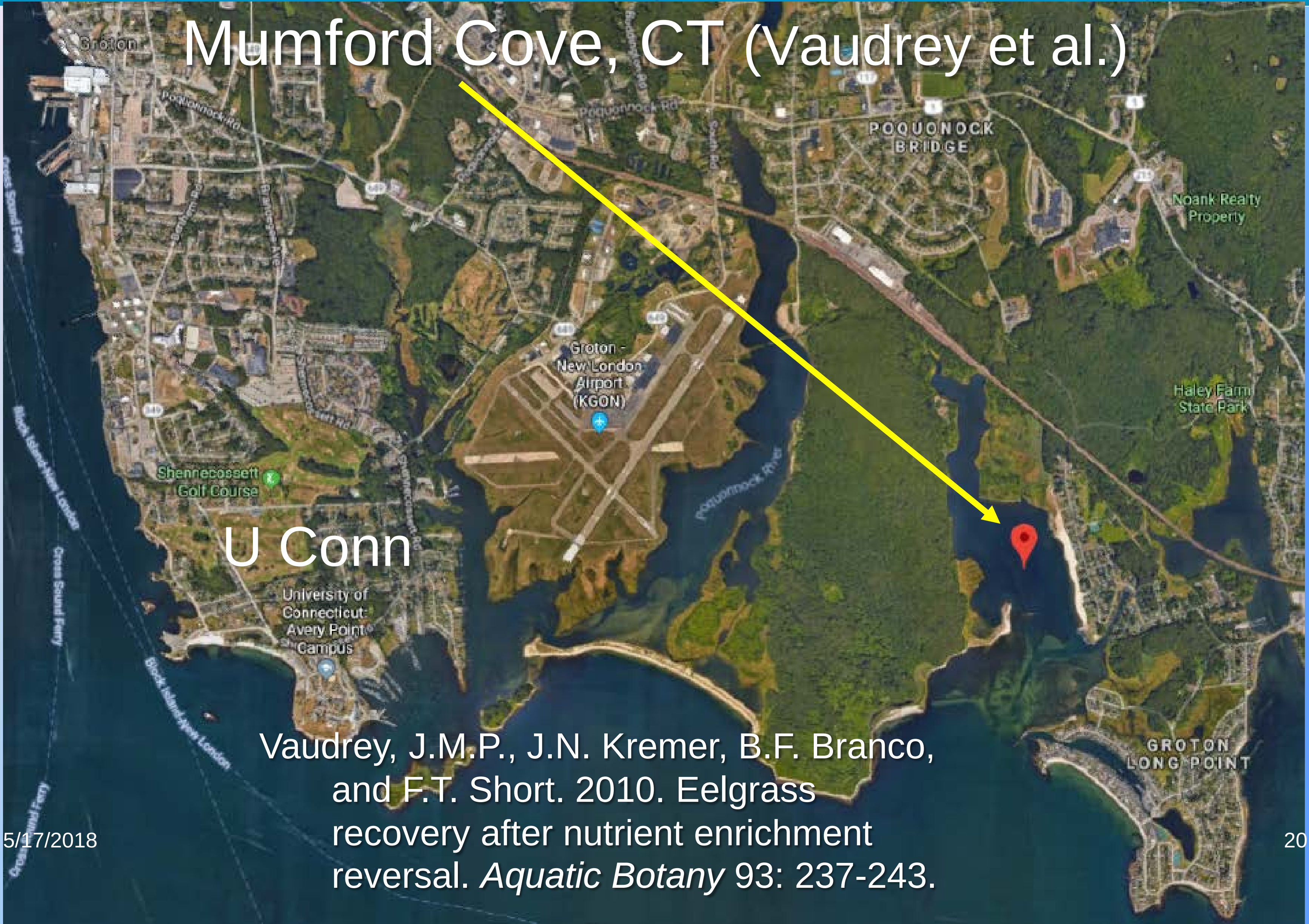



Hattenrath-Lehmann, Anderson, and Gobler 2010. *Harmful Algae* 9: 402-412 and unpublished

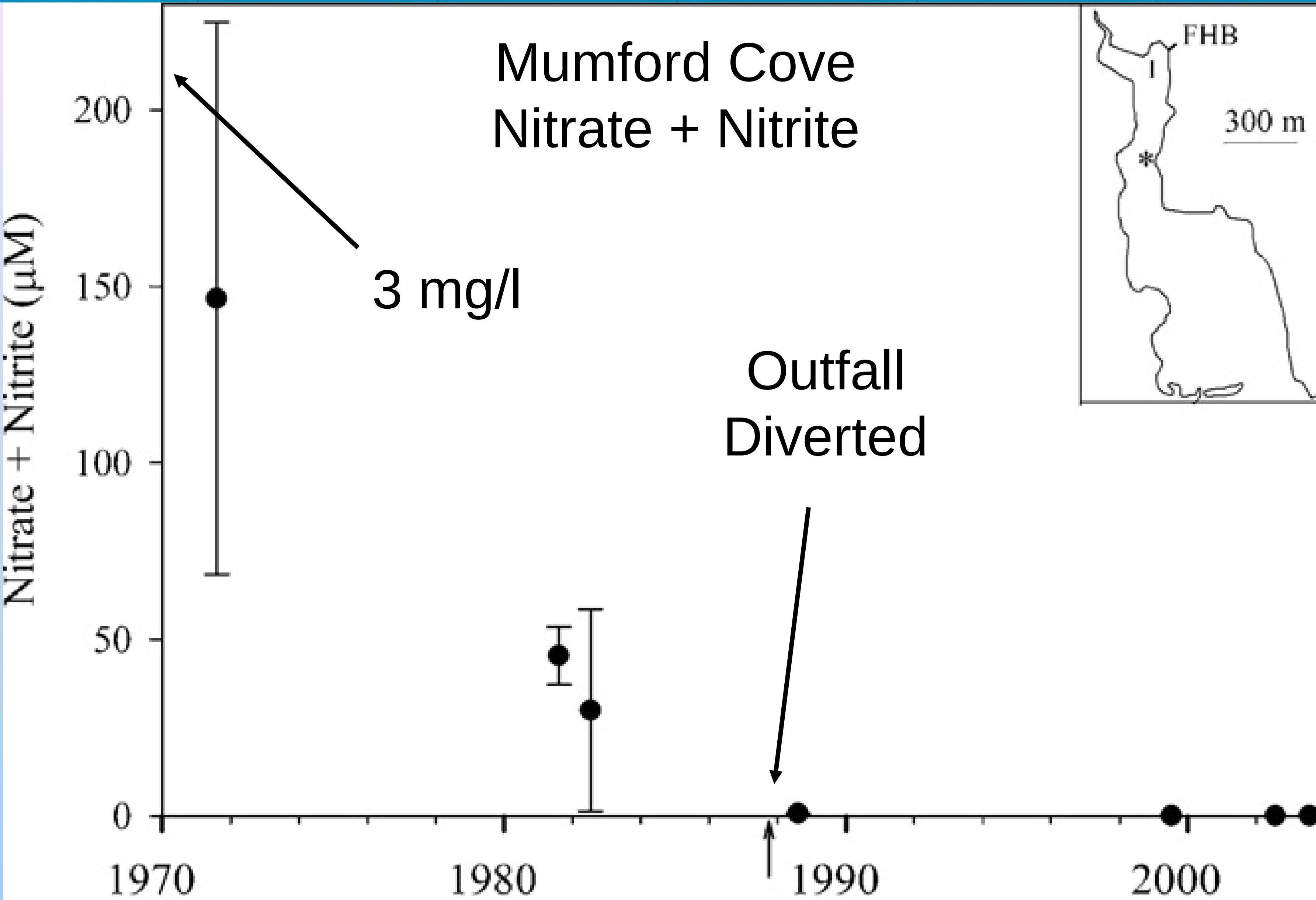
# Northport Shellfish Closures Ended After 2013 Upgrade



# Mumford Cove, CT (Vaudrey et al.)

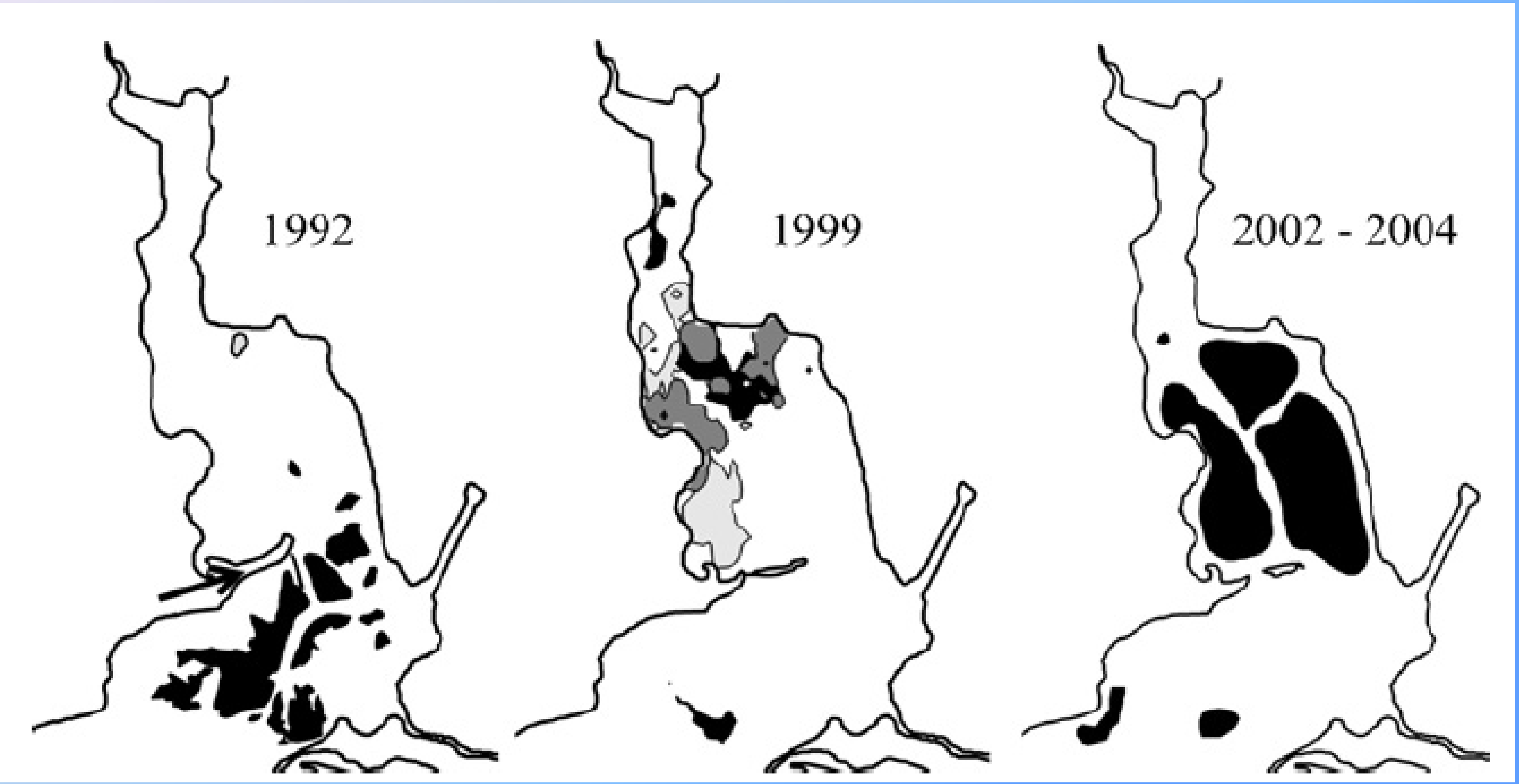



Vaudrey, J.M.P., J.N. Kremer, B.F. Branco, and F.T. Short. 2010. Eelgrass recovery after nutrient enrichment reversal. *Aquatic Botany* 93: 237-243.


Mumford Cove
Nitrate + Nitrite
3 mg/l
Outfall
Diverted
Nitrate + Nitrite (μM)
200
150
100
50
0
1970
1980
1990
2000
FHB
300 m

No specific eelgrass restoration, though may have been aided by east side marsh restoration.

# Mumford Cove, CT (Vaudrey et al.)




Black = *Zostera marina*, light grey = *Ruppia maritima*, dark grey = mixed beds of the two seagrasses.

# Summary and Conclusions

1. Reducing nutrients to reverse the negative effects of eutrophication (HABs, hypoxia, sea grass loss, etc.) is a challenging process.
2. Many systems where nutrients have been reduced do not re-trace their original path in reverse or return to their original state.
3. The greatest success has come from the following: Dedicated leadership, A bottom-up collaborative governance process, Specific ecological goals, and A reduction in all nutrient sources.
4. Tampa Bay has achieved its goals, SAV is increasing in Chesapeake Bay.
5. In Long Island Sound 60% reductions in nitrogen from wastewater treatment plants (WWTP) as a result of the 2000 TMDL have apparently reduced the area and less clearly the duration of hypoxia.
6. Diversion or improved treatment of WWTP effluent has restored eelgrass to Mumford Cove (CT) and ended shellfish closures due to toxic HABs in Northport Harbor (NY).

# Questions?