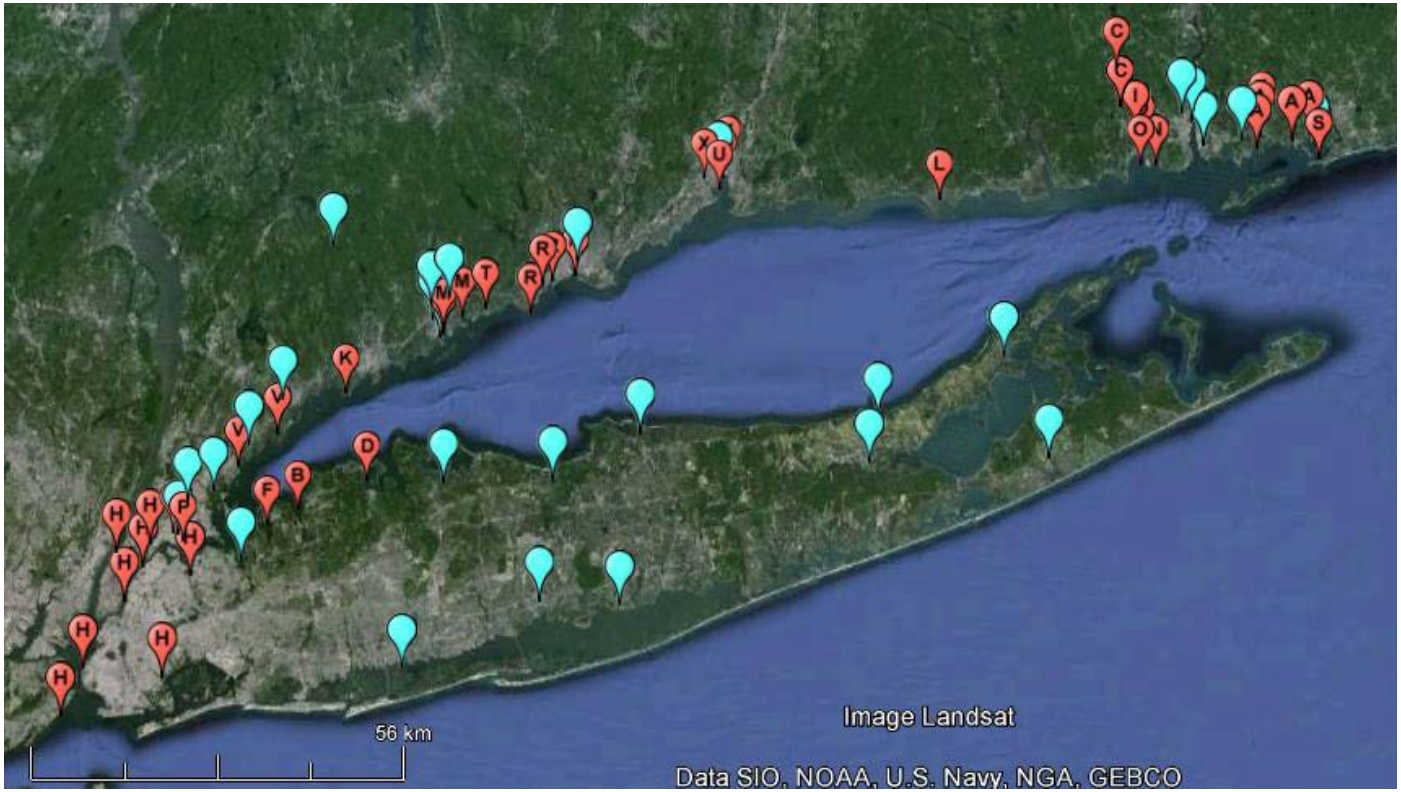
Peter H. Linderoth
Save the Sound
Western LIS Programs

Discussion Overview

- **Unified** Water Study: Long Island Sound Embayment Research (UWS)
- Open-Sound Data and Report Card
- Embayment Data Collection and Report Card
- Data Integrity
- UWS Parameters & Procedures
- Sample Site Selection
- Why you should get involved!

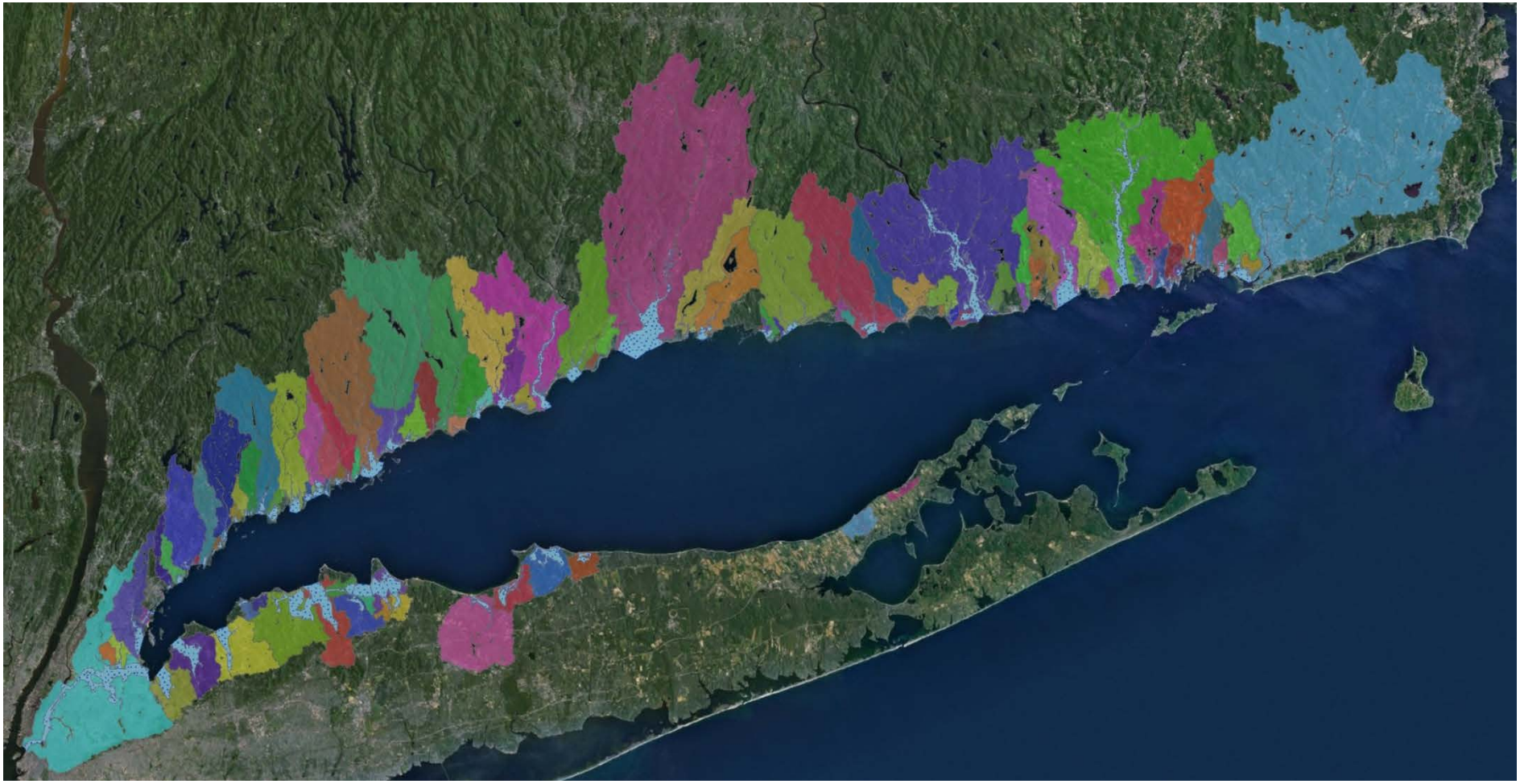
What is the UWS?

- **Unified** Study Designed to Assess the Ecological Health of our Bays and Harbors
  - Achievable Outcomes for Community Monitoring Groups



(Vaudrey et al., 2013)

Long Island Sound Coastal Watersheds



Source: Dr. Jamie Vaudrey

What is the UWS?

- Designed to Support EPA Nitrogen Reduction Strategy and State efforts such as NYSDEC LINAP & CTDEEP IWRM

- Data can Assist in Assessments and Prioritization Efforts Undertaken by Regulatory Agencies

Reduce Nitrogen Pollution & Hypoxia

Algae blooms

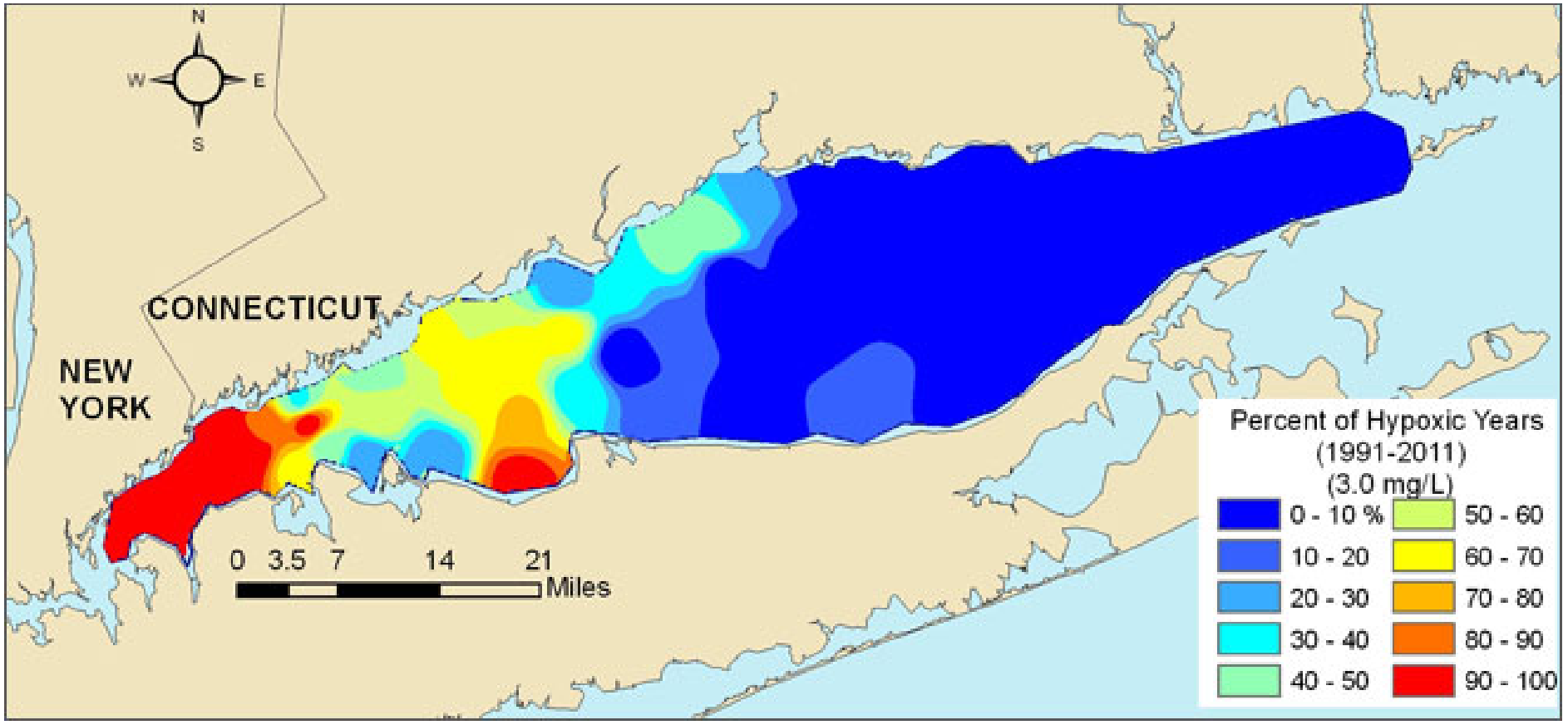
Oxygen

Nitrogen

Hypoxic conditions

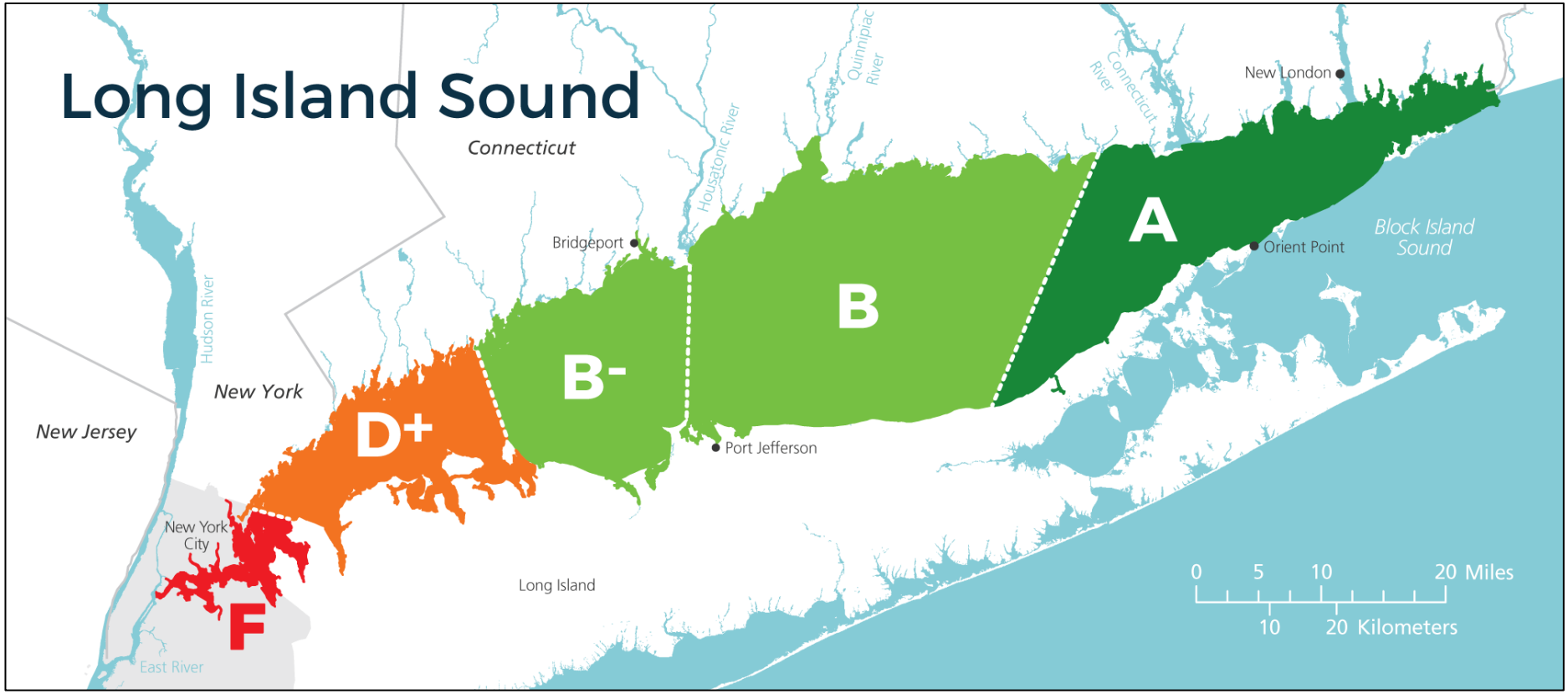
Fish and other animal Die-offs, Salt marsh loss, Acidification

Long Island Sound Hypoxia



Source: Long Island Sound Study

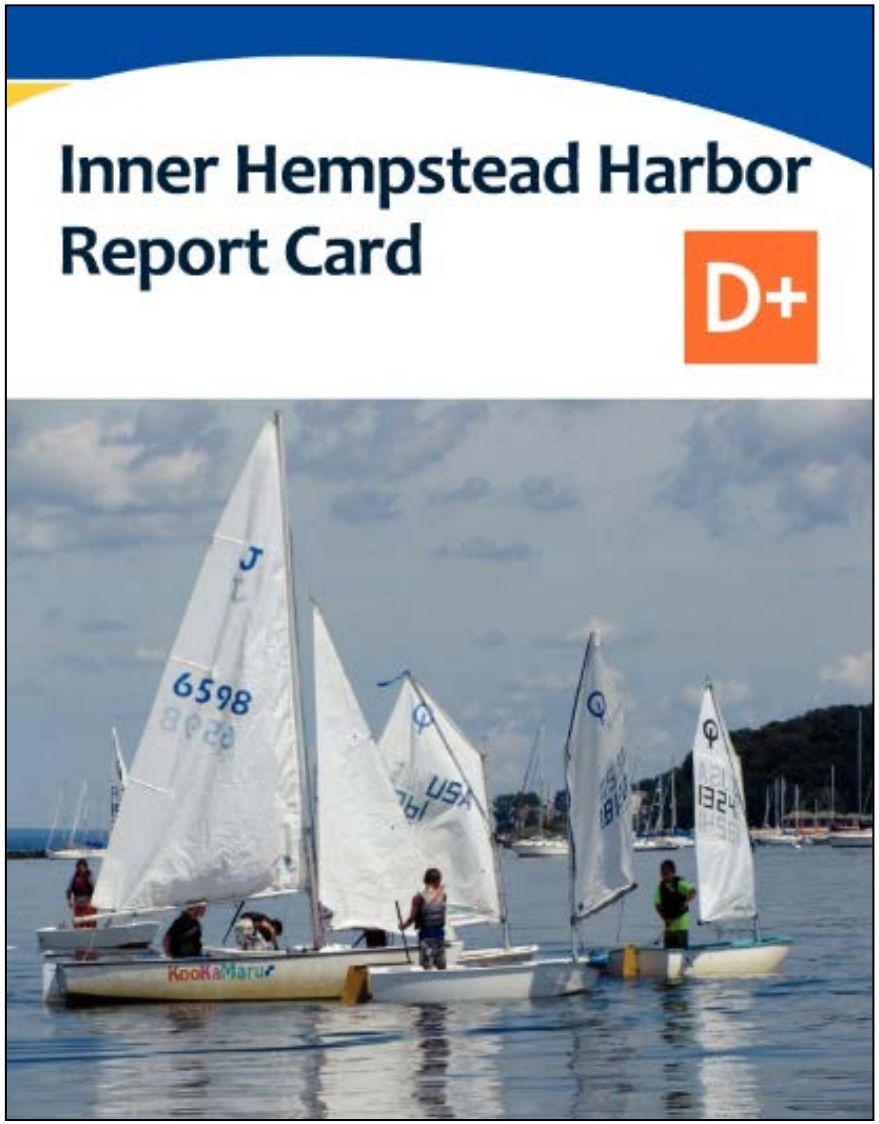
Sound-Wide Report Card



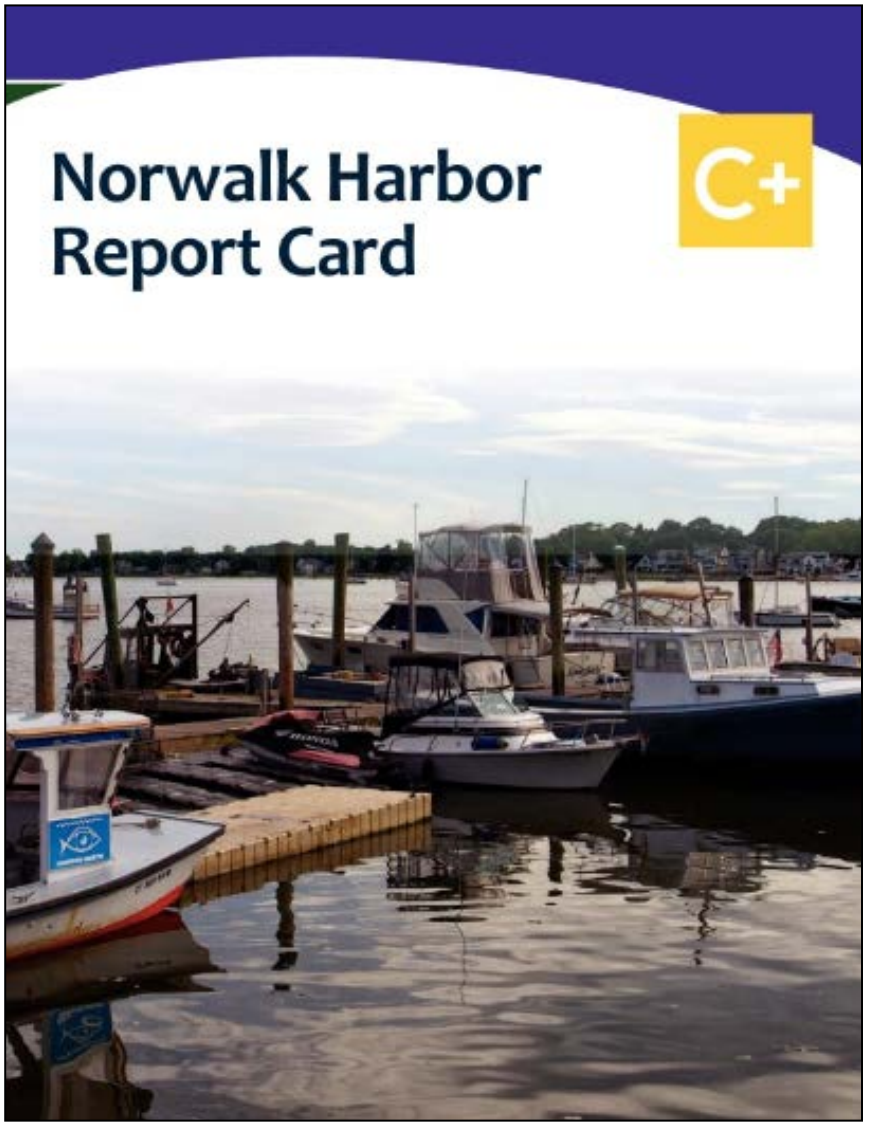
http://ecoreportcard.org/report-cards/long-island-sound/

Long Island Sound Report Card
East to West Trend in Deteriorating WQ
But what about bays and harbors?

2015 LIS Embayment Report Cards



http://ecoreportcard.org/report-cards/long-island-sound/



http://ecoreportcard.org/report-cards/long-island-sound/

Engage Community Groups and Management

- Standardize Procedures for a Unified Water Study
- Bring together Stakeholders – Regulatory and Community Sampling
- Consensus on Achievable Parameters

Tier 1 – DO, Chl-*a,* Temp, Salinity, Macroalgae, Clarity

Tier 2 – Continuous DO, Nutrients, Advanced Macroalgae Surveys

http://www.macobserver.com/tmo/article/head-to-head-comparison-of-13-streaming-music-services

Data in Action

- Standard Operating Procedures are Available
- Quality Assurance Project Plan
  - QAPP Template is Available

https://oht-webcontent.s3.amazonaws.com/field/image/translation_quality_assurance_software.jpg

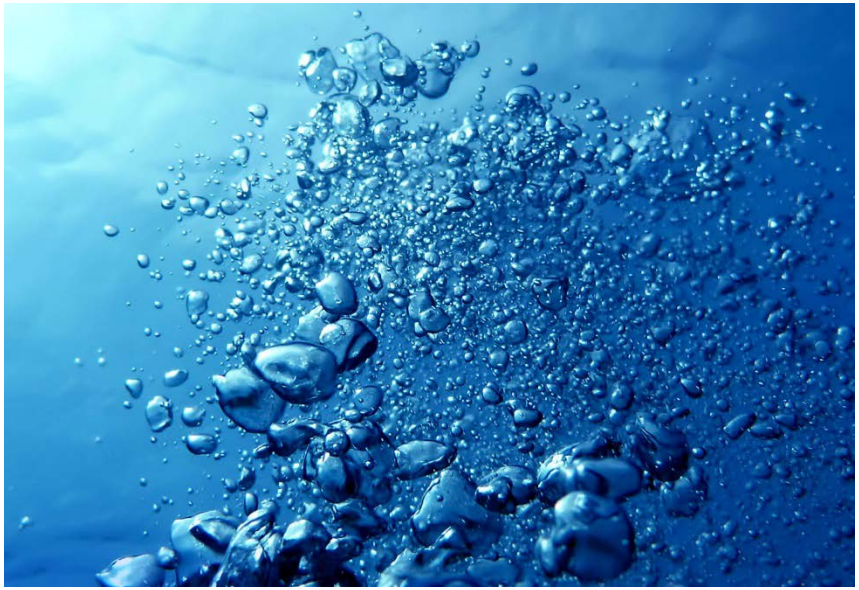
- Following SOPs Facilitates the Comparability of our Data for Sound-Wide Comparisons
- Data Integrity Associated with QAPP Strengthens Data for Municipal and Regulatory Review

Tier I – Dissolved Oxygen (DO)

- DO is Oxygen that is Dissolved in Water via Ambient Air Diffusion or from Photosynethetic Release of O_2

- Recorded in mg/l (ppm) and as Percent Saturation

http://www.fondriest.com



http://www.fondriest.com

Tier I – Dissolved Oxygen (DO)

DO < 5 mg/l Causes Stress to many Aerobic Organisms

DO < 3 mg/l is Defined as Hypoxic and Increases Likelihood Mortality

DO = 0 mg/l is Anoxic and Very Harmful to most Organisms

http://www.newsday.com/long-island/suffolk/oxygen-levels-critically-low-at-site-of-fish-die-off-in-peconic-river-1.10549955

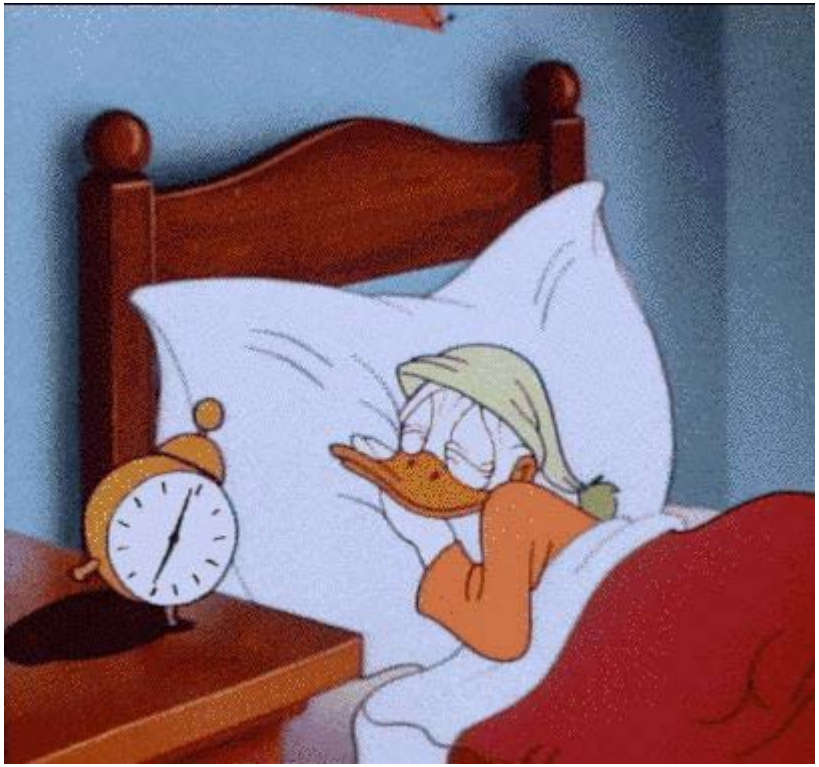
Tier I – Dissolved Oxygen (DO)

- Two Comparable Options for Analyses
  - LaMotte Winkler Titration and Sonde
- Depth Consistent for all Samples (Surface, Mid, Bottom)
  - (0.5 m, mid, 0.5 m off the bottom)

Tier I – Dissolved Oxygen (DO)

DO Time Criteria is 6 AM – 9 AM

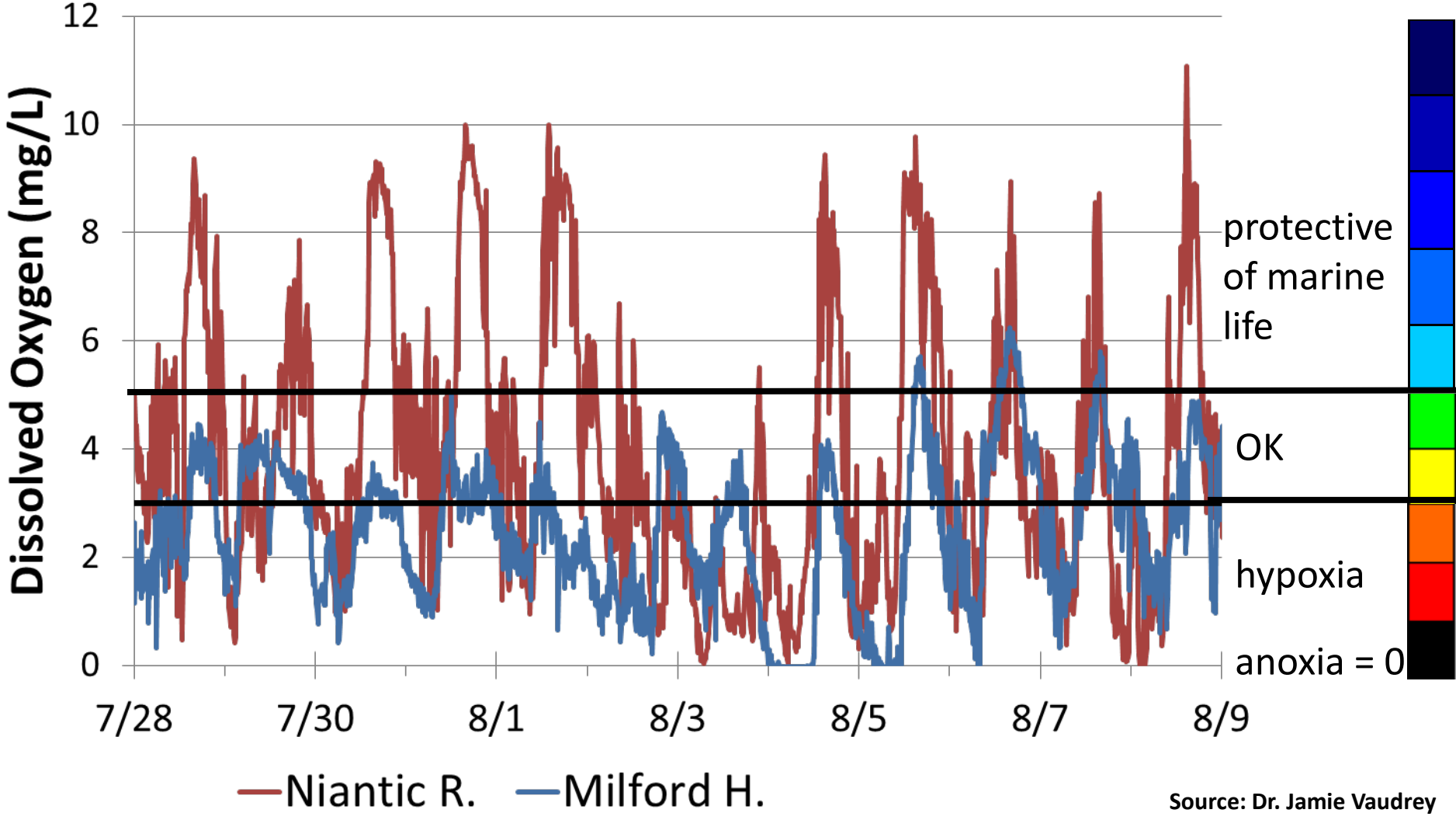
No, we are not Trying to Impede on Anyone's Beauty Rest!



http://media1.giphy.com/media/Nwz6NZkToYC4M/giphy.gif

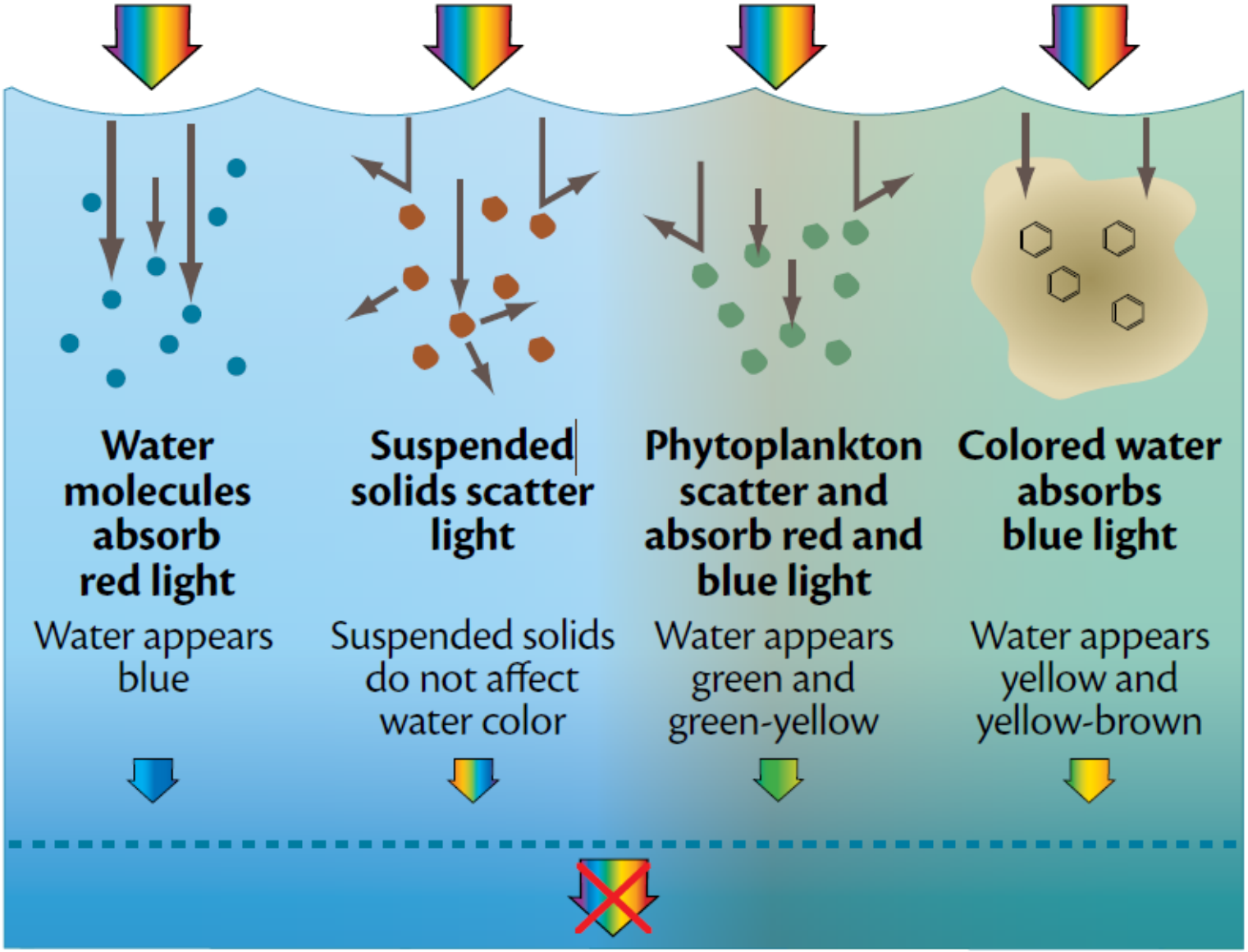
Bays are "panting."
Big swings between highs and lows are hard on marine life.

July 28 – August 9, 2014
Oxygen recorded every 15 minutes.



Source: Dr. Jamie Vaudrey

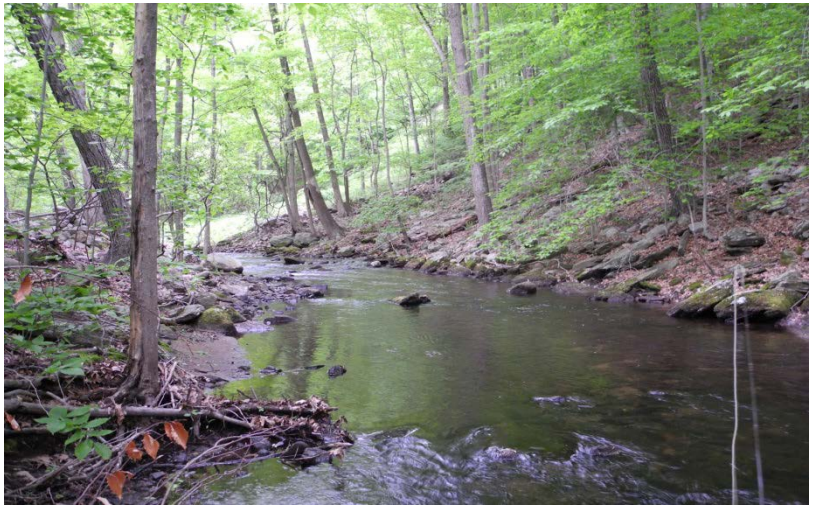
Tier 1 - Water Clarity



http://ian.umces.edu/

Tier 1 - Water Clarity

Dec.gov



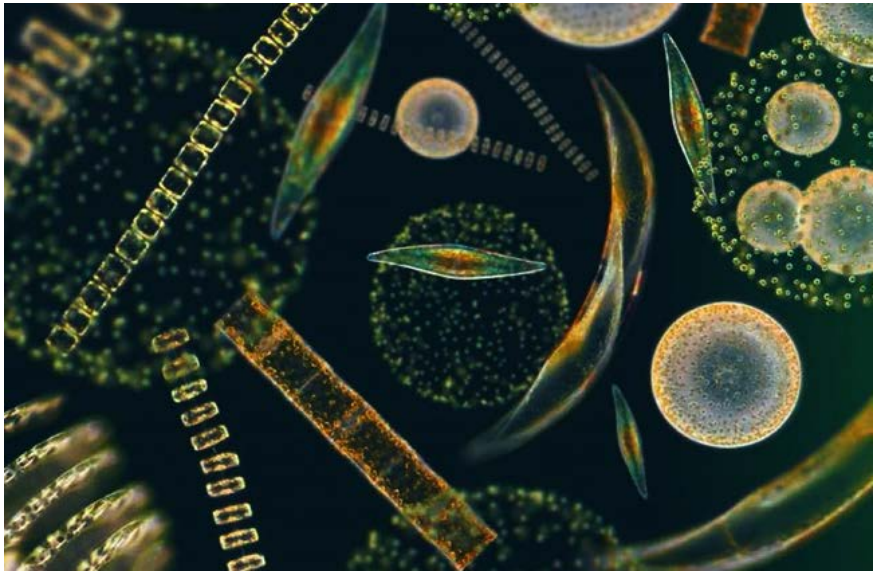
http://fishingsmallstreams.blogspot.com/2012/05/ct-wild-trout-outing.html

Clarity and Turbidity

http://www.bayjournal.com/article/get_the_dirt_out_effort_works_to_get_construction_sites_to_clean_up_their_a

http://earthobservatory.nasa.gov/IOTD/view.php?id=52059

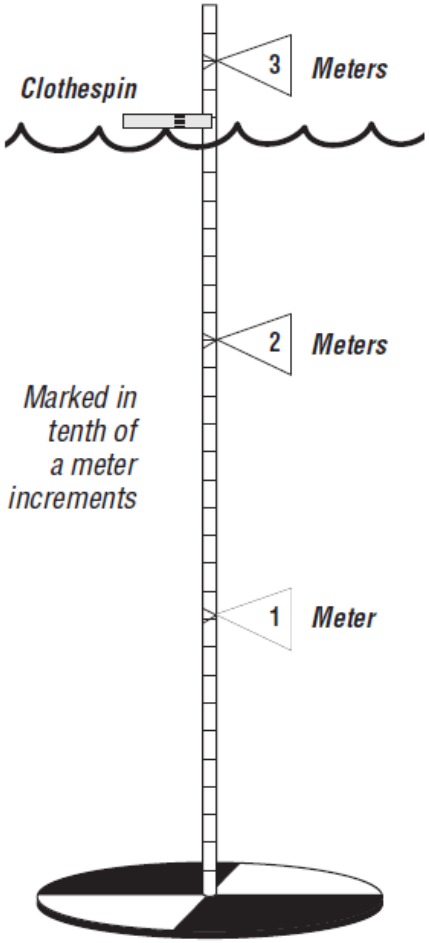
http://rvcog.org/MN.asp?pg=NR_Stormwater_General



http://www.sanibelseaschool.org/experience-blog/2014/9/26/phytoplankton-friday

Clarity – Secchi Depth

http://www.slideshare.net/CatholicLab/religious-catholic-scientists-part-1



EPA.gov

Fr. Pietro Angelo Secchi achieved some Remarkable Feats….and in his Free Time, he Developed one of the most Frequently used Measures of Water clarity:

Secchi Depth

Clarity – Secchi Disk

This document is Chapter 15 of the Volunteer Estuary Monitoring Manual, A Methods Manual, Second Edition, EPA-842-B-06-003. The full document be downloaded from: http://www.epa.gov/owow/estuaries/monitor/

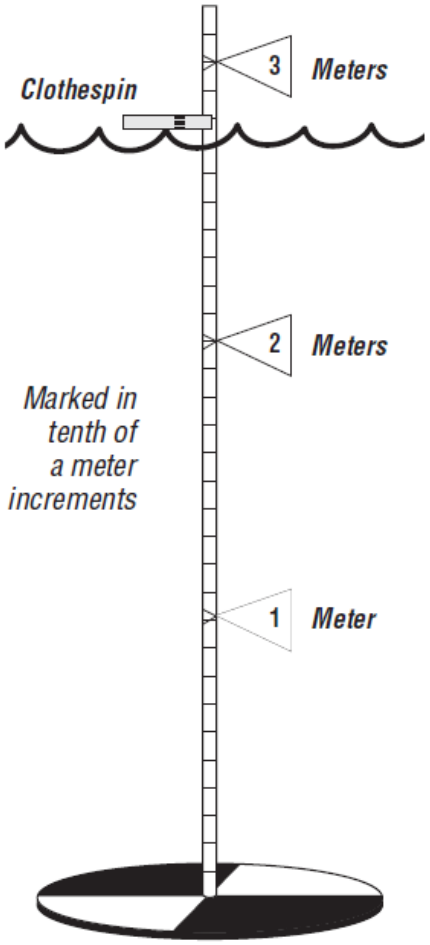
Voluntary Estuary Monitoring Manual

Chapter 15: Turbidity and Total Solids

Clarity – Secchi Depth

- Water Clarity measured by Secchi depth
- Three Repetitions of Finding the Vanishing Point then averaging

http://www.goodnewsnetwork.org/events060420/



Epa.gov

Clarity – Secchi Disk

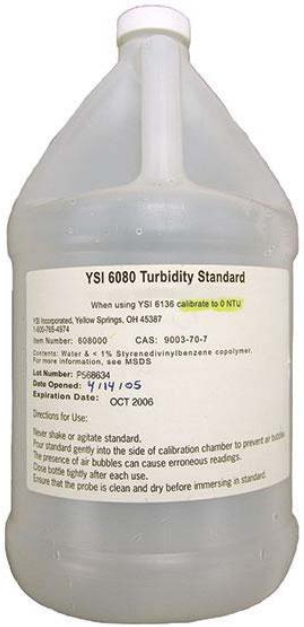
A Few do nots, Refer to SOPs or Field Manual for more Details

http://www.aslo.org/photopost/showphoto.php/photo/642/title/dog-with-secchi-disk/cat/510

http://shilpaahuja.com

Clarity – Turbidity Sonde

https://www.ysi.com/



https://www.ysi.com/

- Turbidity is recorded in NTU and Converted to Secchi Depth

- 0 & 100 NTU YSI Standards

Clarity – Turbidity Instrument

Condition of Cuvette Critical to Accurate Readings

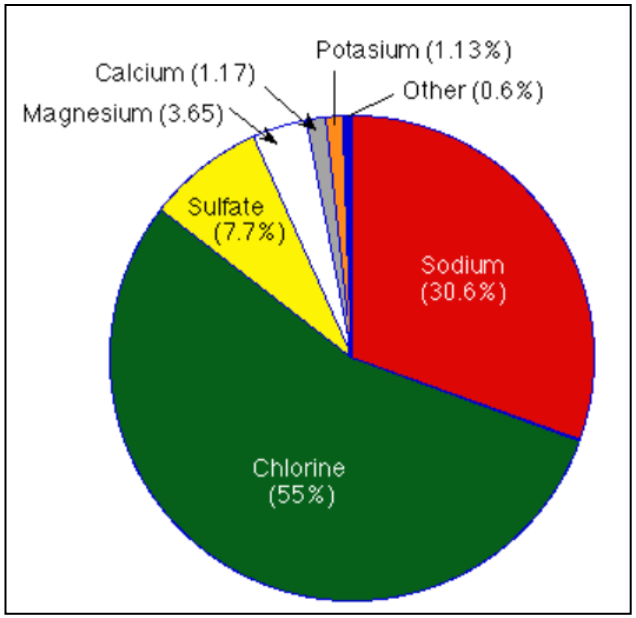
Tier 1 - Salinity

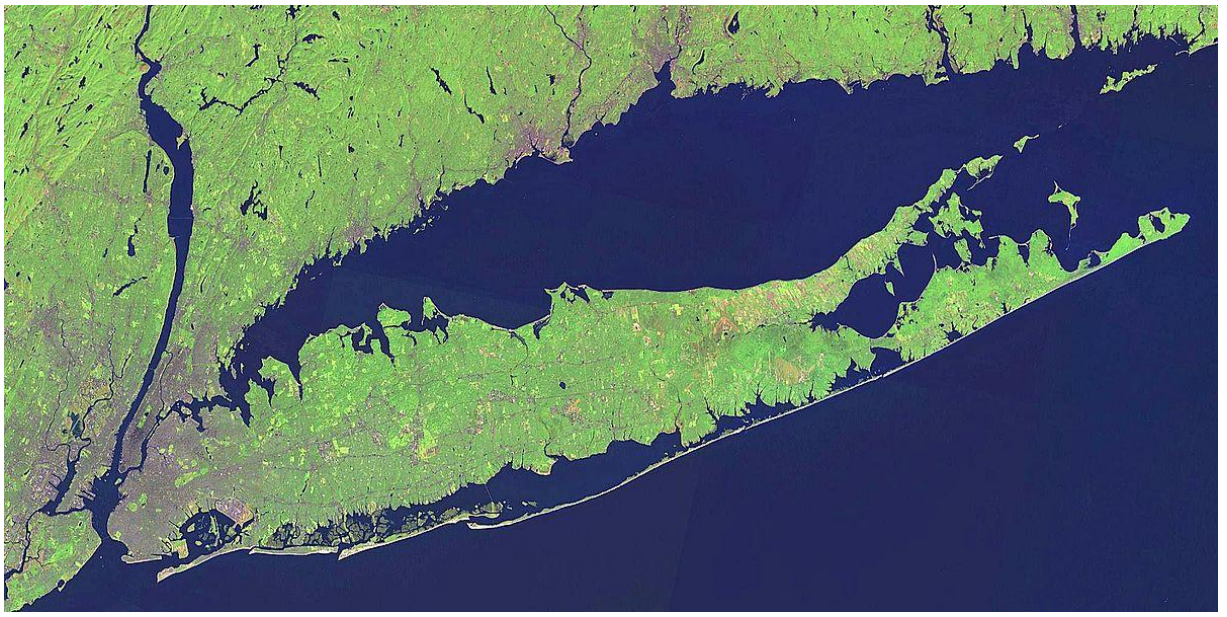
Measurement of all the salts dissolved in water

LIS Salinity

Salinity range at the western end *23 parts per thousand*

Salinity range at the eastern end *35 parts per thousand*

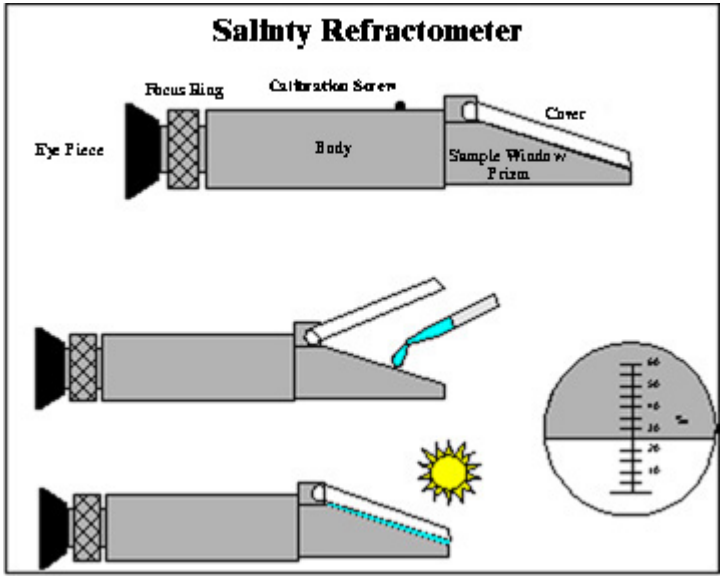


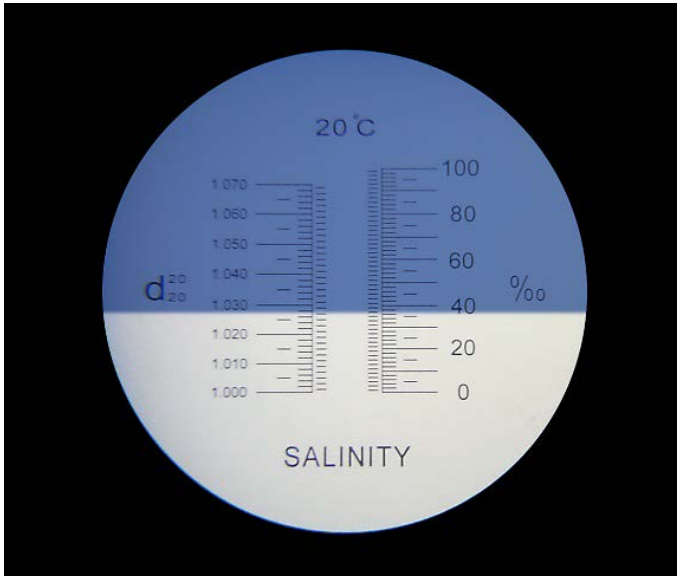


Salinity - Refractometer

Refractometer – Measures Refractive Index to obtain Salinity and Specific Gravity

Important to Calibrate and Ensure Instrument is NIST Traceable!





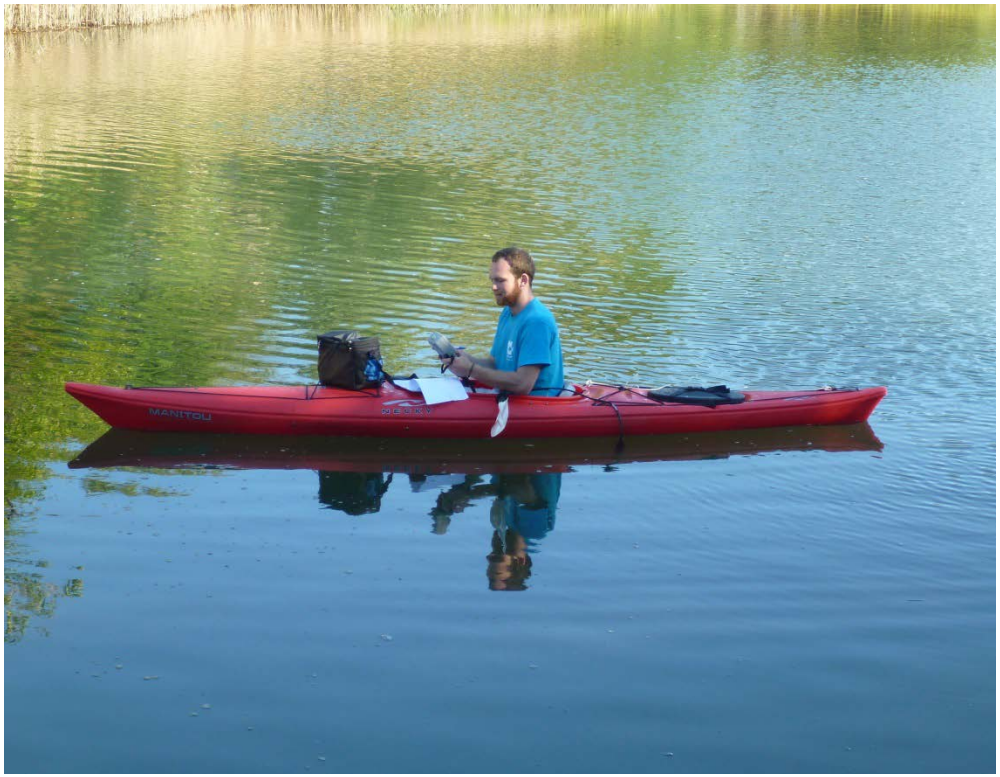
Salinity - Sonde

Sonde – Records salinity using an algorithm of temperature and conductivity

Full algorithm can be seen in *Standard Methods for the Examination of Water and Wastewater*

Temperature - Sonde

This one is pretty self explanatory



http://blogs.brown.edu/wcdaniel/blog/

Take good care of your sonde and it will take good care of you!

Temperature - Thermometer

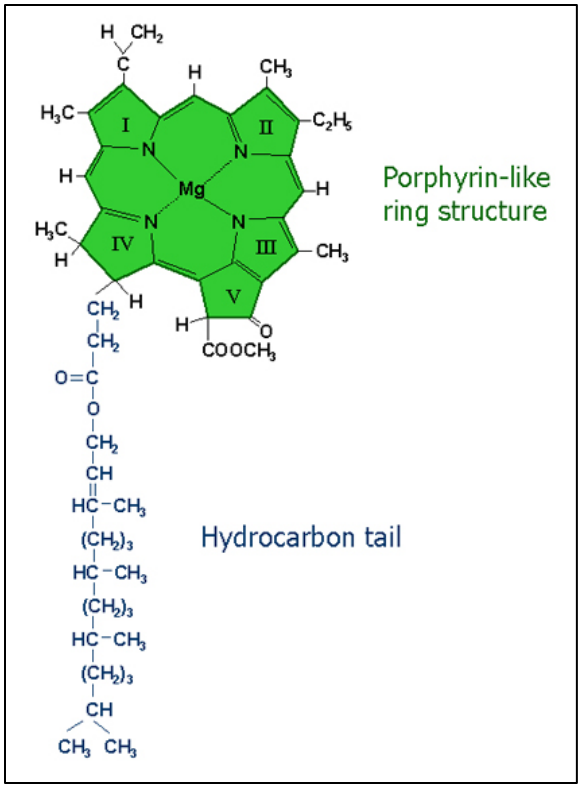
Digital and Analog Options – NIST certified

Procedures Similar for Either

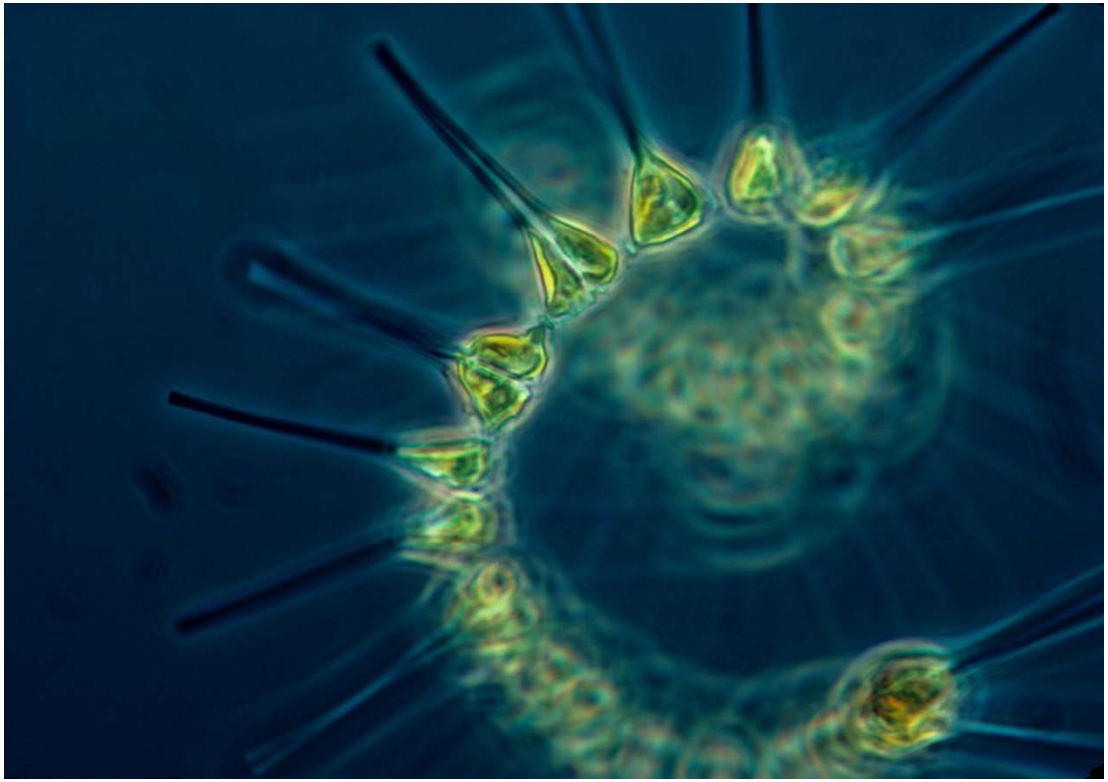
Important to use within NIST Certified Interval

Tier 1 – Chlorophyll *a*

- Chl - *a* is a green pigment found in the chloroplasts of plants which makes photosynthesis possible
  - Used as a Measure of Phytoplankton Density



http://agron-www.agron.iastate.edu/Courses/Agron317/Pigment_Inhibitors.htm



https://en.wikipedia.org/wiki/Phytoplankton

Tier 1 – Chlorophyll *a*

- Chl - *a* is measured in $\mu g l^{-1}$
- Two methods in SOPs both end with Fluorometric Lab Analysis

http://www.masterflex.com/Product/Masterflex_L_S_Digital_Pump_System_with_Easy_Load_3_Pump_Head_600_RPM_115_230_VAC_77921_60/HV-77921-60

http://www.coleparmer.com

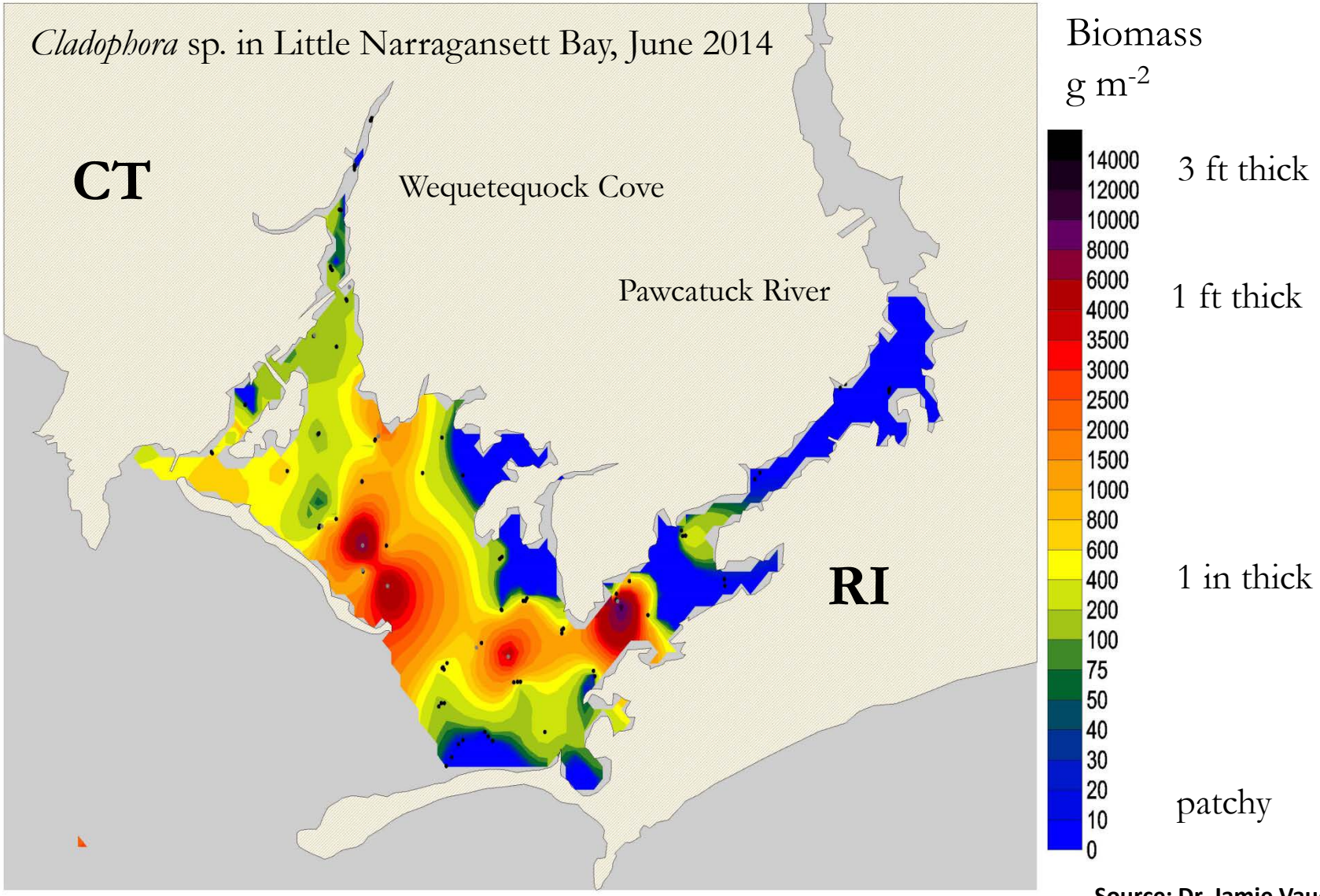
http://www.sigmaaldrich.com/catalog/product/aldrich/z242519?lang=en&region=US

Tier 1- Macroalgae

- Use what is Present on the Beach or Pulled up by a Rake to Identify if Macroalgae is a Problem
- Large Amounts of Certain Nutrient-Loving Species and if Eelgrass (*Zostera marina*) is Present

http://www.habitat.noaa.gov/abouthabitat/eelgrass.html

Tier 1 - Macroalgae



Source: Dr. Jamie Vaudrey

Ulva sp., blade form
Cold Spring Harbor, NY
7/31/12

Charlie Yarish, UConn

Gracilaria sp.
Holly Pond, CT
8/6/12

Source: Dr. Jamie Vaudrey

Tier 1- Wrack Macroalgae

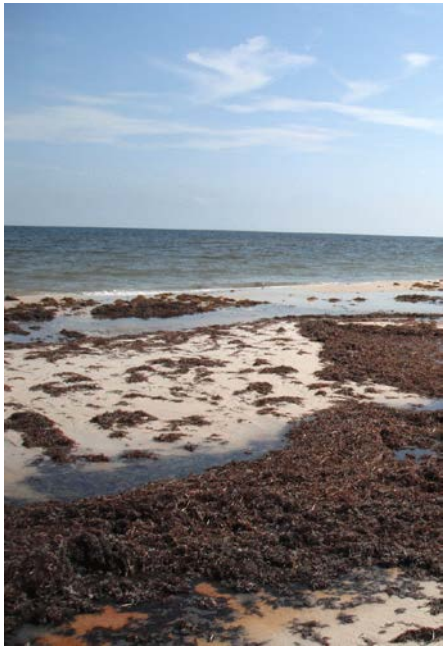
Macroalgae Survey – Qualitative…

Seagrass! Awesome!!

http://seagrant.uconn.edu/publications/magazines/wracklines/fallwinter07/eelgrass.pdf

Not much here.

This could be a problem…



ouryearoutdoors.blogspot.com/2012_12_01_archive.html

SOS! (Save our Shore)

http://www.ecns.cn/visual/hd/2013/07-04/21779.shtml

Tier 1- Hardened Shoreline Macroalgae

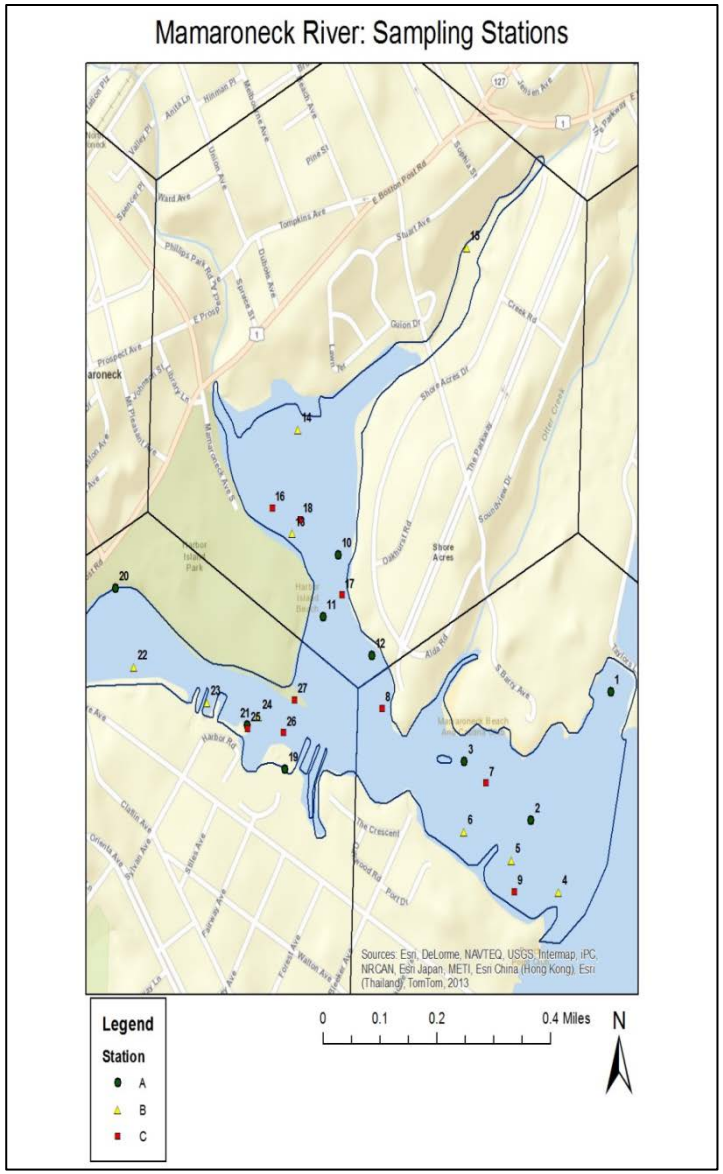
Macroalgae Survey – Qualitative…

https://upload.wikimedia.org/wikipedia/commons/0/03/Sea_wall_at_Saint_Jean_de_Luz.jpg

Site Selection Process – New Sites

Collaborative Process

Site Selection Process – New Sites



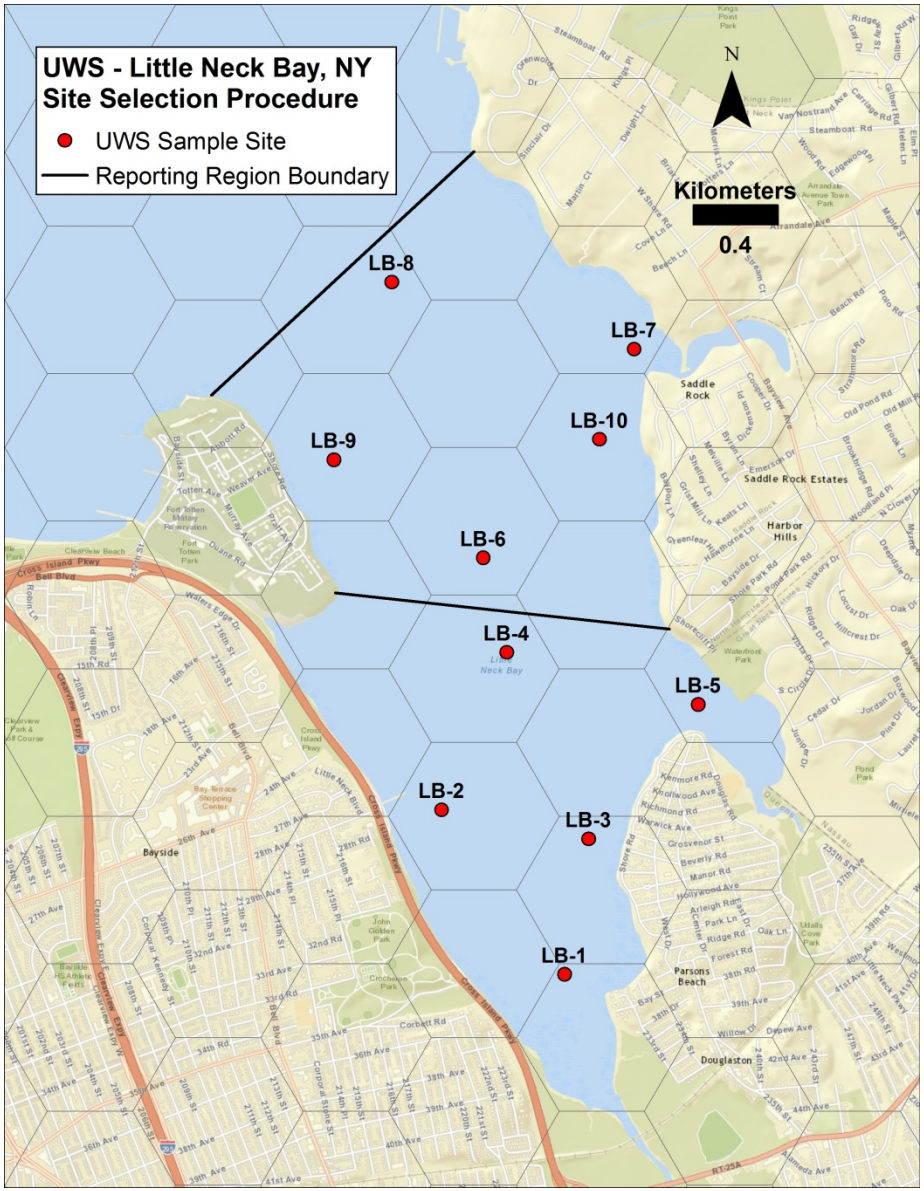
Source: Dr. Jamie Vaudrey

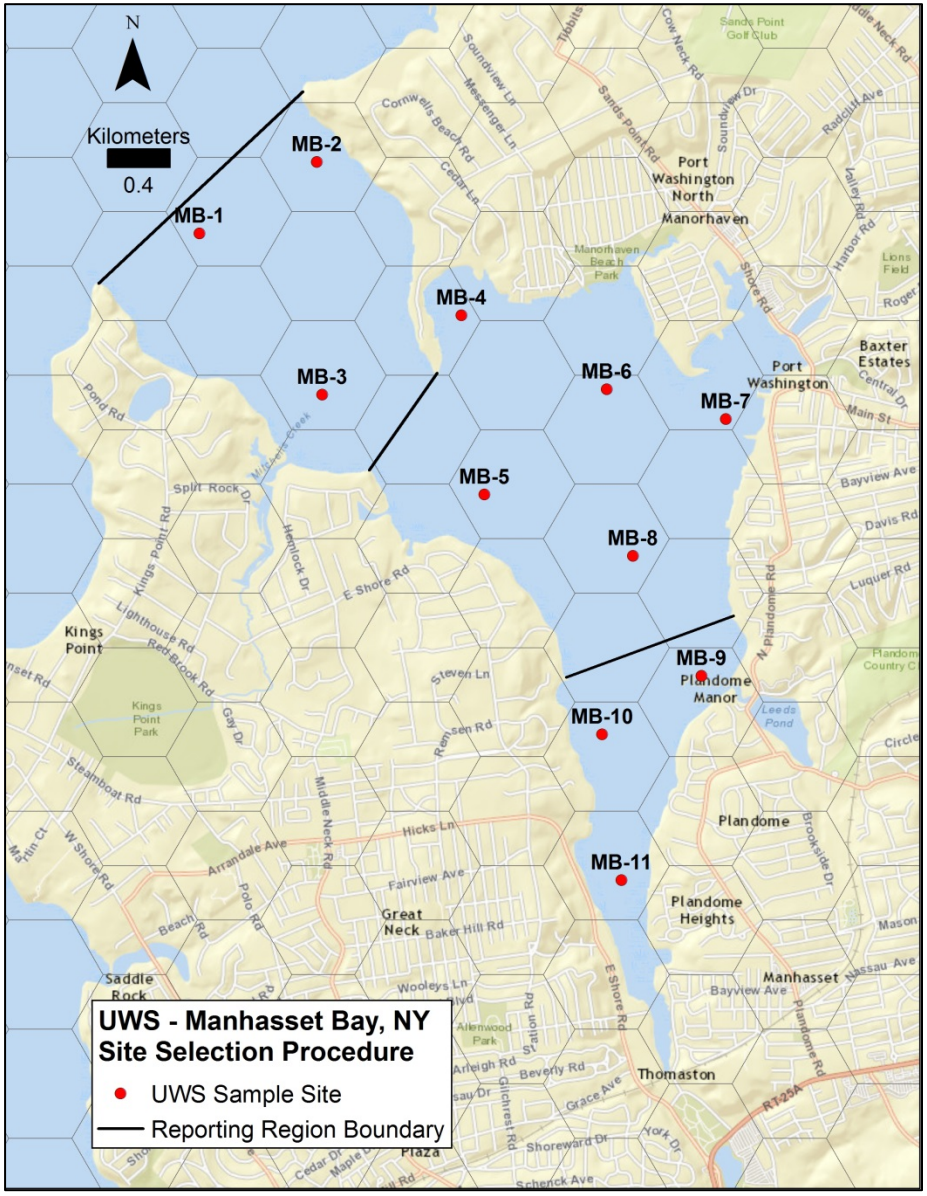
Water Quality: dissolved oxygen, salinity, temperature, turbidity, and chlorophyll *a*

minimum of 4 stations per embayment; 3 stations per reporting area

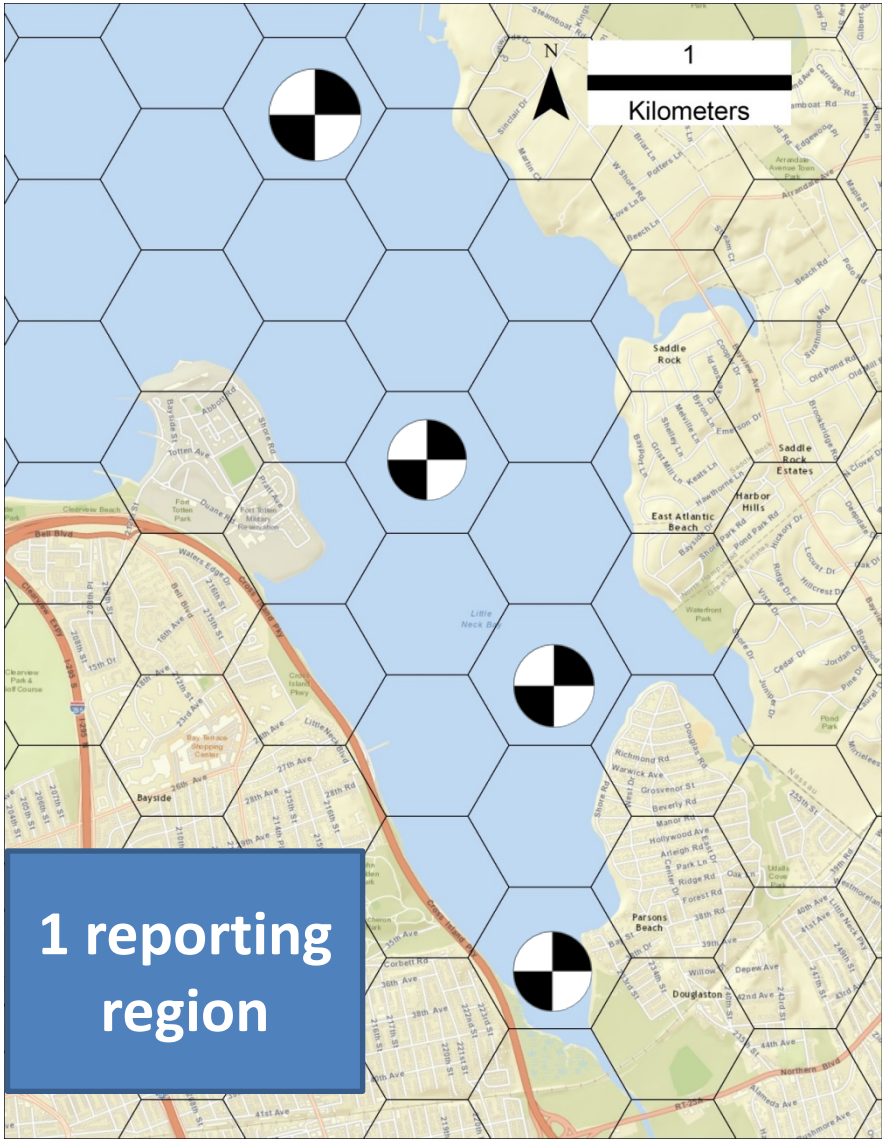
example – Mamaroneck River should have 3 stations, based on hexagons, must have 4

Site Selection Process – Save the Sound





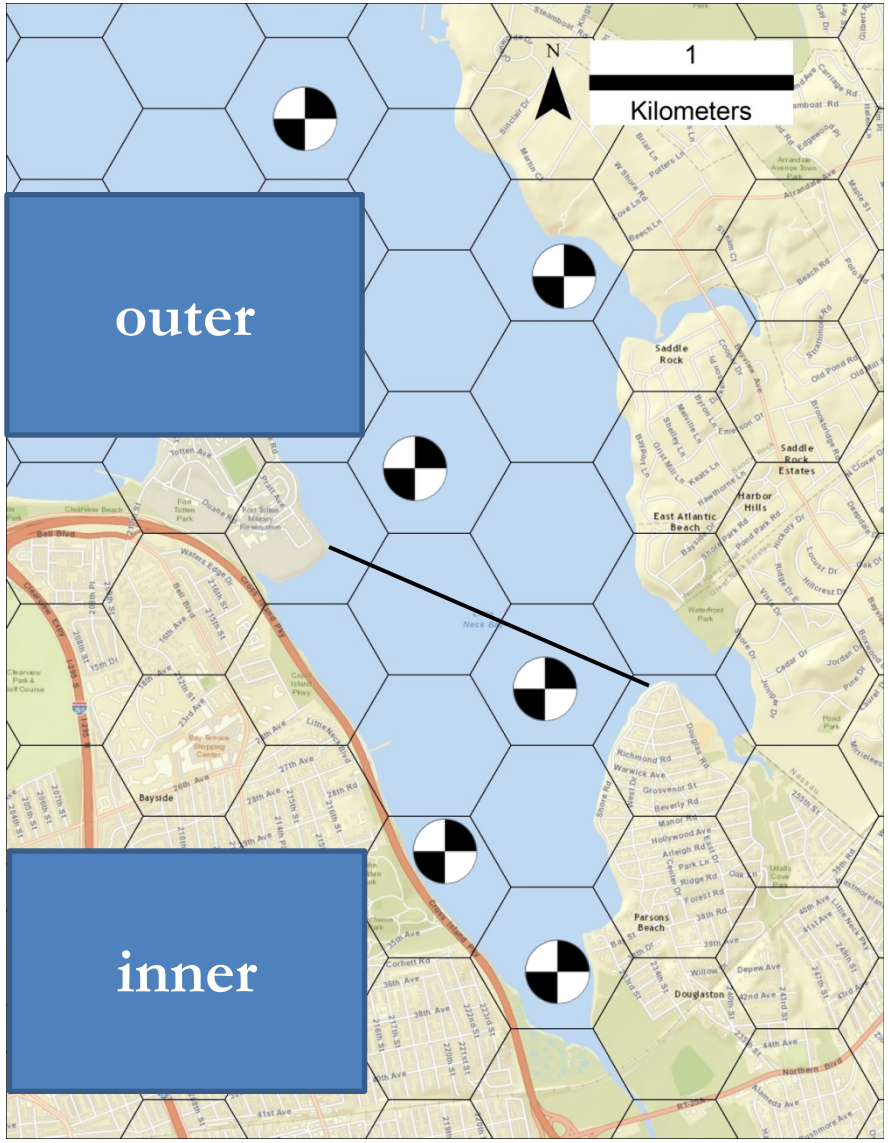
Site Selection Process – Secchi Disk



Ideally conducted at all water quality stations

minimum of 4 stations per embayment; 3 stations per reporting area

Site Selection Process – Secchi Disk



Ideally conducted at all water quality stations

minimum of 4 stations per embayment; 3 stations per reporting area

Site Selection Process – Established Sites

METHOD FOR ASSESSING ESTABLISHED STATIONS

1. Overlay Hexagonal Grid
2. Assess Station Distribution
3. Avoid Biases (targeted sampling of nutrient inputs, oversampling of beaches)
4. Choose a Station in a Hexagon Representative of the Local Area
5. Add and Omit stations as needed

http://www.fairfieldcountyctit.com/uploads/2/4/5/2/24526984/_6716010_orig.jpg

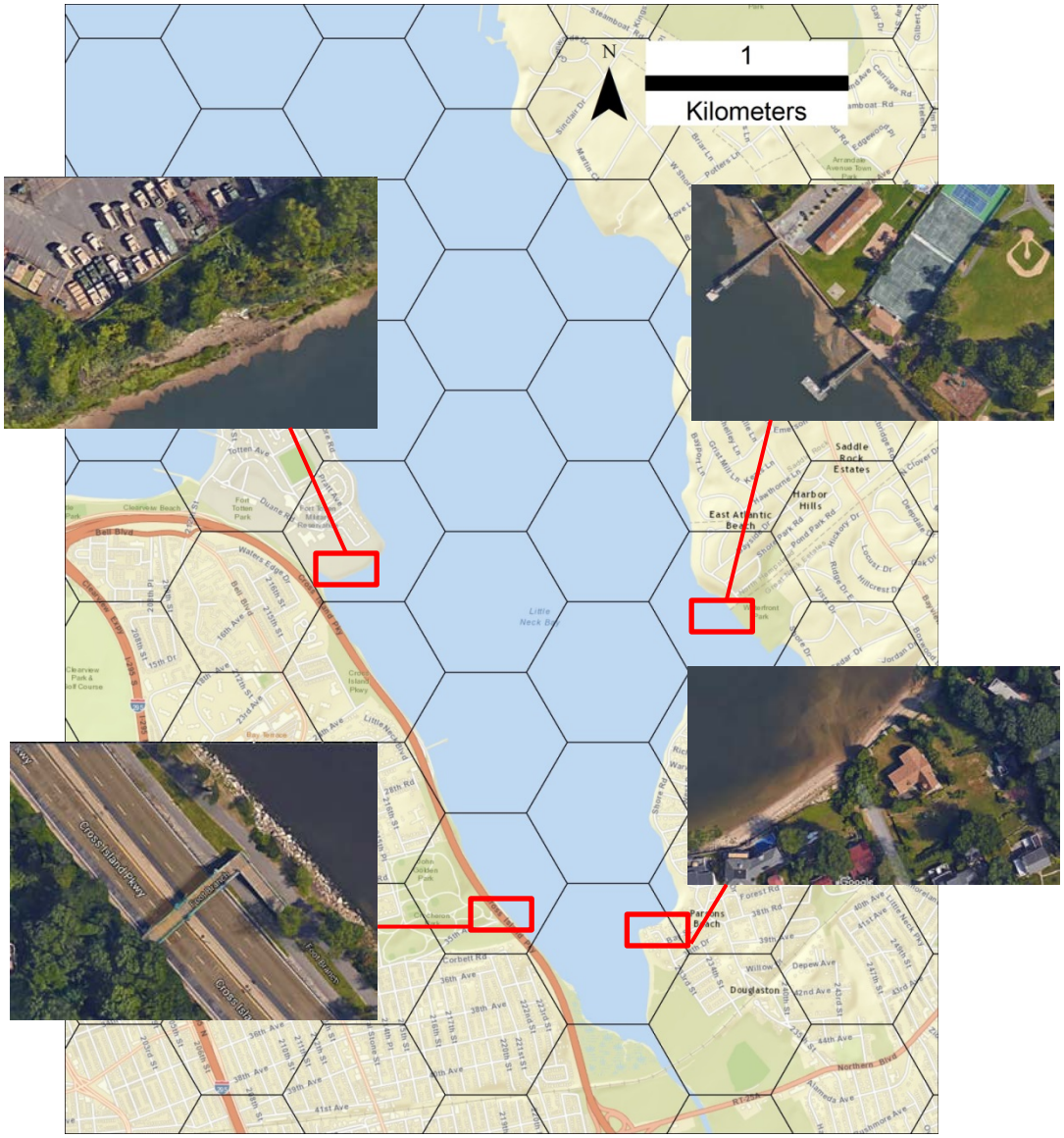
Site Selection Process – Macroalgae

- Ideally – 4 sites

  - 2 on each the western and eastern shore

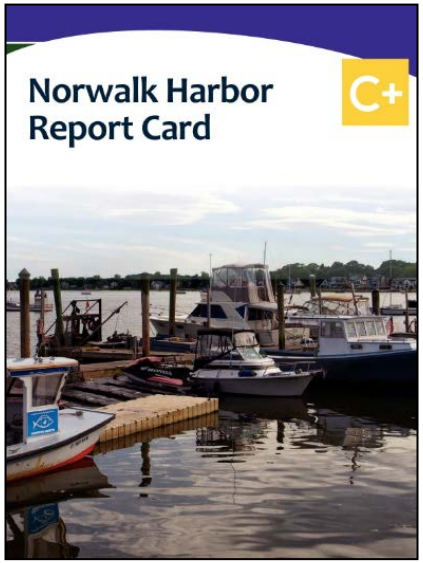
  - 2 in each the Inner and Outer Portion of Embayment

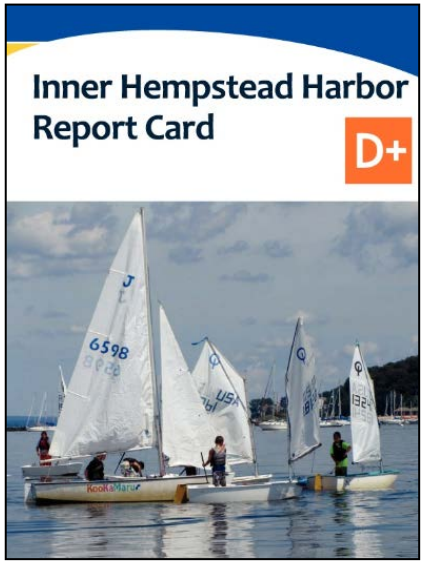
- Will Depend upon Access to the Shoreline



Benefits of the Study

https://www.virgin.com/entrepreneur/in-focus-how-to-find-funding





https://www.ldeo.columbia.edu/edu/k12/snapshotday/activities/Instruct_chlorophyll_Final.pdf

https://en.wikipedia.org/wiki/Atlantic_menhaden

Benefits of the Study

Thank you! Questions/Comments?

plinderoth@savethesound.org
(914) 263 - 6233

https://www.flickr.com/