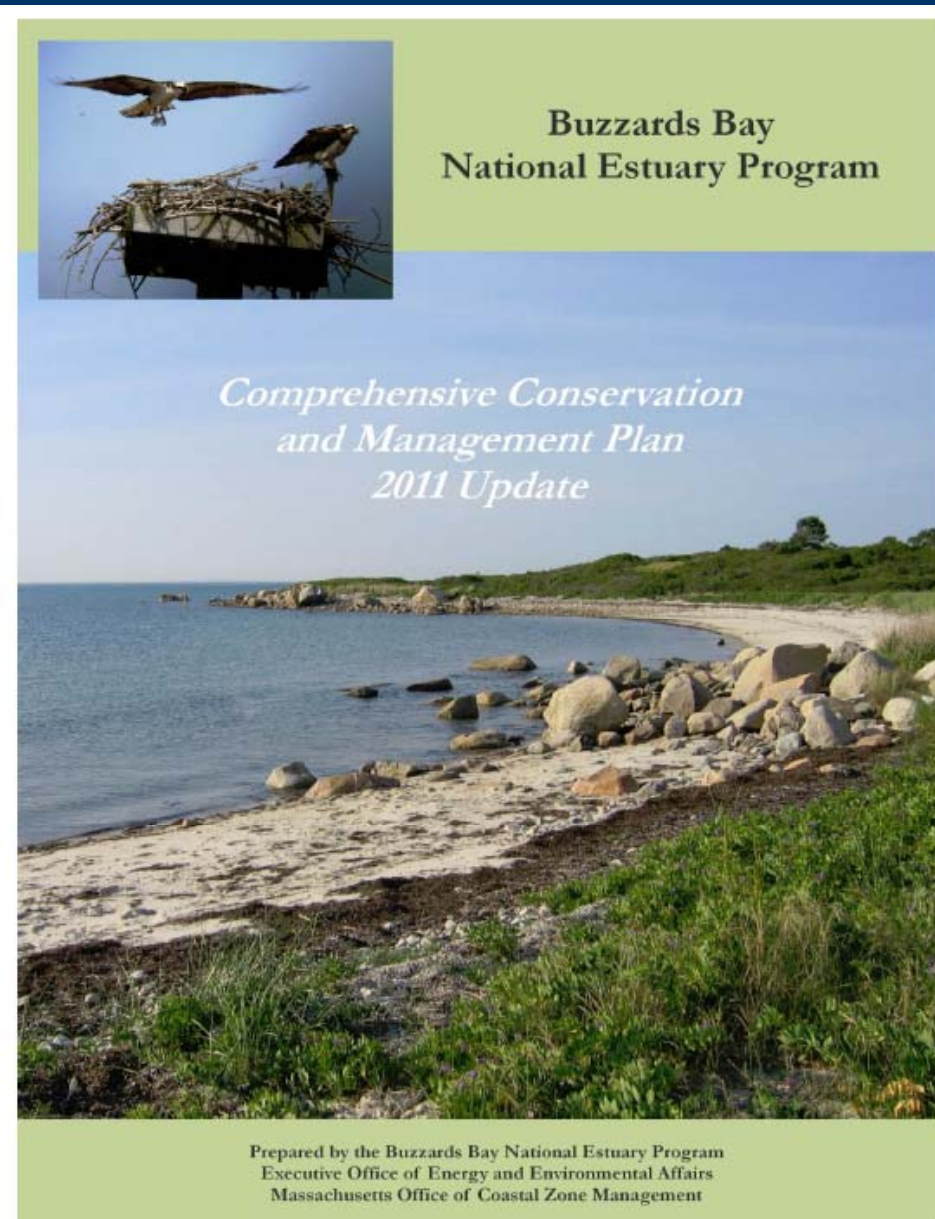


The Living Resources and Water Quality of Buzzards Bay: Trends and Opportunities



Dr. Joe Costa, Executive Director
Buzzards Bay National Estuary Program
Massachusetts Coastal Zone Management

Sponsored by the
**Falmouth Associations Concerned with
Estuaries and Salt Ponds (FACES)**

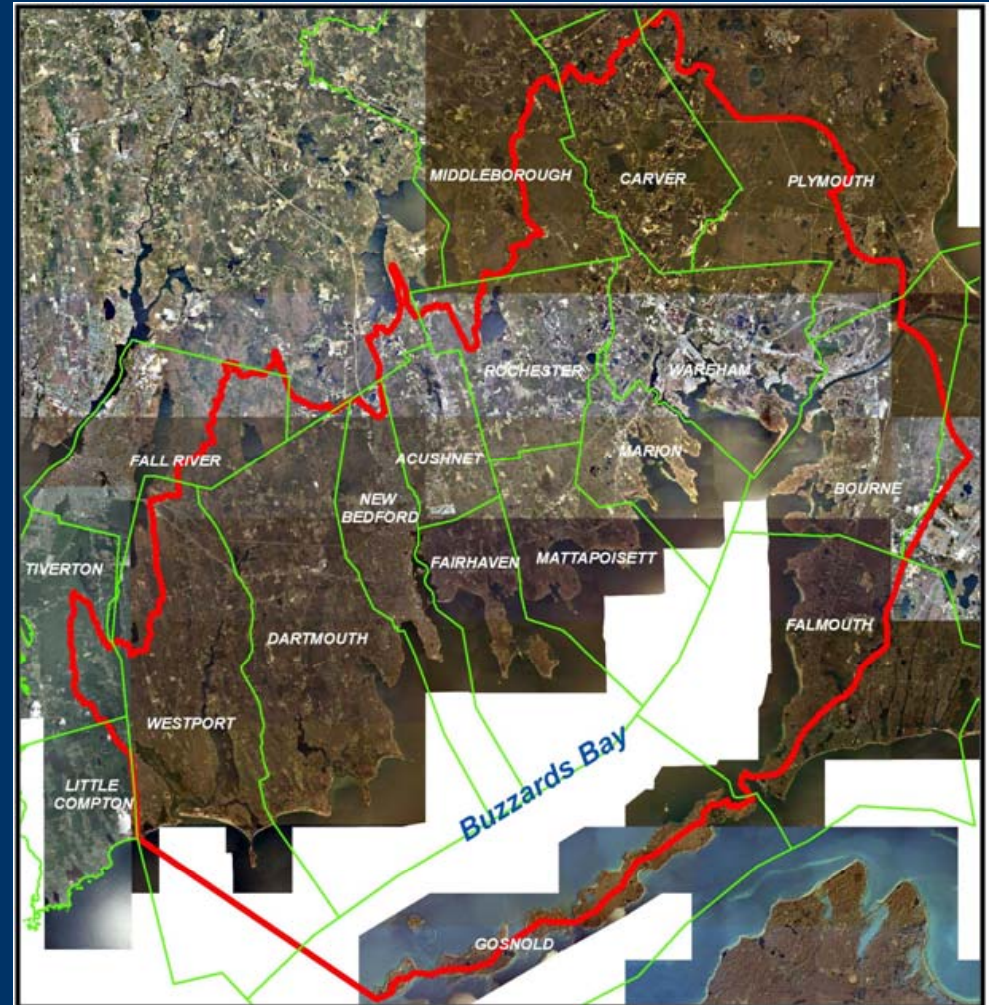
January 25, 2012
7 pm at the Falmouth Public Library

www.BuzzardsBay.org/faces2012.htm



Talk Outline

- 1) Promote the new Comprehensive Conservation Management Plan (CCMP) for Buzzards Bay, and go through a few other preliminaries
- 2) Give a little background and history about environmental protection, management, and the Clean Water Act
- 3) Show some long-term and short term trends in the environment, living resources in Buzzards Bay
 - touch upon discerning natural from manmade causes and confounding issues



FACES: Thank You and Bravo!



Preserving the Environment and Natural Resources of Falmouth, Massachusetts

Who We Are

Our Work

Join Us

Lawns

Resources

Contact



- NEW** Winter 2011 Newsletter
- NEW** FACES Position Paper on Wastewater
- NEW** Scientific Panel Confirms Scientific Validity of the Massachusetts Estuaries Project Findings on Cape Water Pollution.
- NEW** Buzzards Bay Coalition Files Appeal of the Wastewater Permit Issued to the West Falmouth Water Treatment Plant. View the appeal.
- The Boston Globe reports on the Cape's Water Pollution Troubles.
- Summer 2011 Newsletter
- Sewer Socials
- 2011 FACES Science Fair Winners
- Falmouth Coastal Working Group Report
- MA Estuaries Reports
- TMDL Reports
- The Town of Falmouth 5 Year Strategic Plan



Falmouth Friendly Lawns Project

FACES Is Offering Sewer Socials

Sideline

- 1) **Who are you?**
- 2) **Diagnosis and Advice**

About the Buzzards Bay National Estuary Program...

A unit of MA Coastal Zone Management and funded principally by the US EPA
(disclaimer)

Created by Congress in 1985, and were one of the first NEPs established by the 1987 CWA amendments. We are now one of 28 NEPs.

We completed the Comprehensive Conservation and Management Plan for Buzzards Bay in 1991. It was conceived as a blueprint or recipe to protect and restore water quality and living resources in Buzzards Bay and surrounding watershed. The new draft can be reviewed at buzzardsbay.org.

We originally funded research and assessment studies (e.g. eelgrass mapping, nutrient monitoring), but now we primarily fund management action to meet the goals of the CCMP. Because most actions needed to meet the goals of the CCMP are directed toward local government, most of our focus is to provide grants and technical assistance to municipalities.

Note: We also partner with the Buzzards Bay Action Committee and the Buzzards Bay Coalition (visit their website!)

History of Clean Water Act

1969: June 22, Cuyahoga River (Cleveland, OH) Catches Fire

1970: April 22,
- 1st Earth day
- Keep America Beautiful “People Start Pollution. People can stop it” Campaign, iconic Crying Shame

1970: December 2, U.S. EPA established

1972: “Clean Water Act”

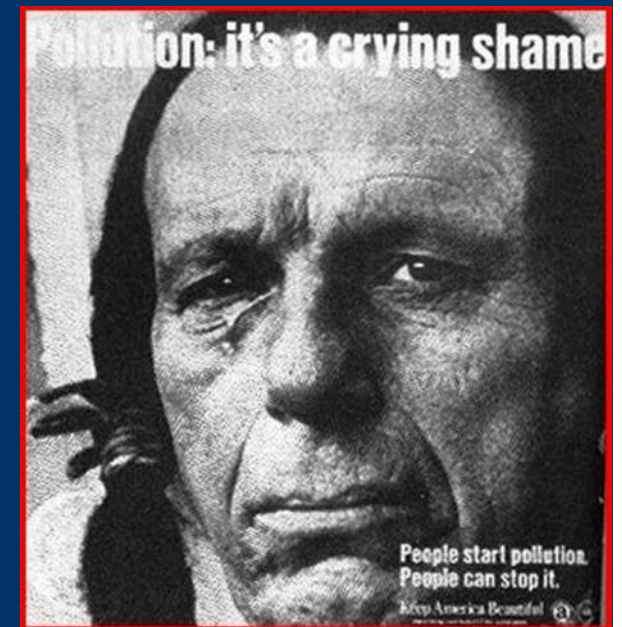
”Federal Water Pollution Control Amendments of 1972 “
Two goals established: waters “fishable” and “swimmable” by mid-1983 and zero discharge of pollutants by 1985
Established water quality and technology based standards, especially for point sources, NPDES program, Construction Grants, Citizen Suits , 303(d) list and TMDLs

1977: Clean Water Act Amendments

208 Plans (208 plans), Municipalities given to 1988 to implement secondary treatment (**CLF lawsuits in MA; consent decrees**)

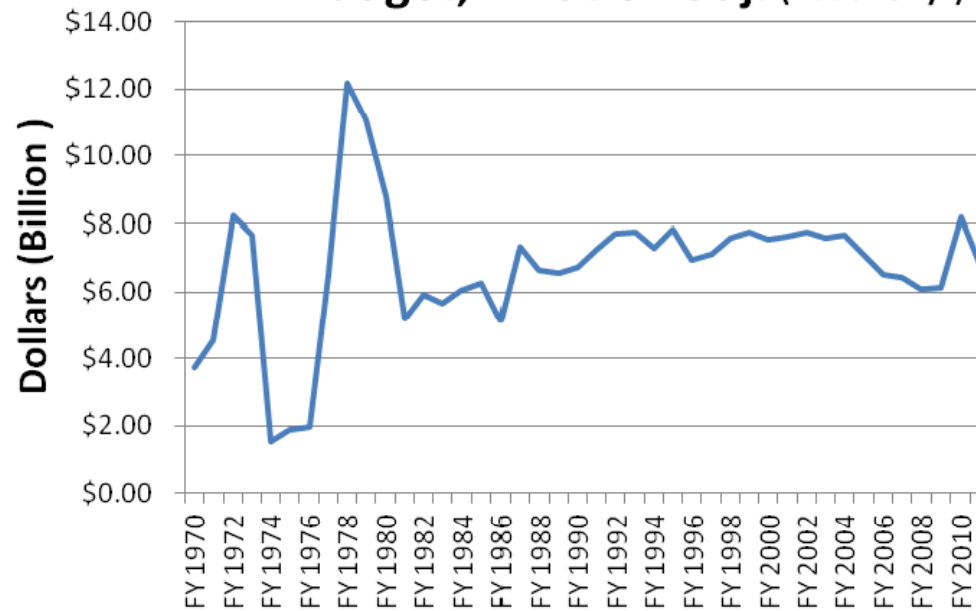
1987: Water Quality Amendments

Established Revolving Loans (State Revolving Funds), NEPs (\$320)

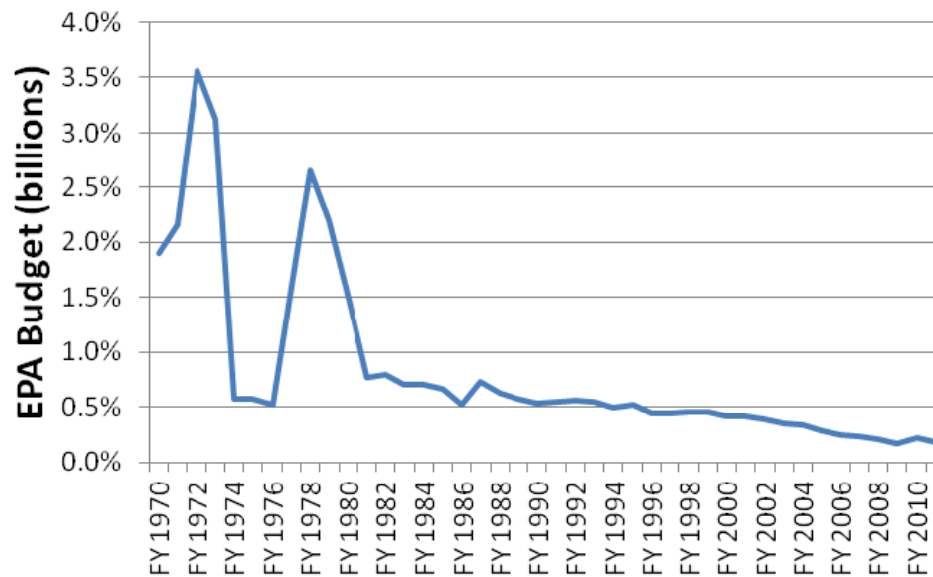


EPA Budget

EPA Budget, inflation adj. (2000 ref yr)



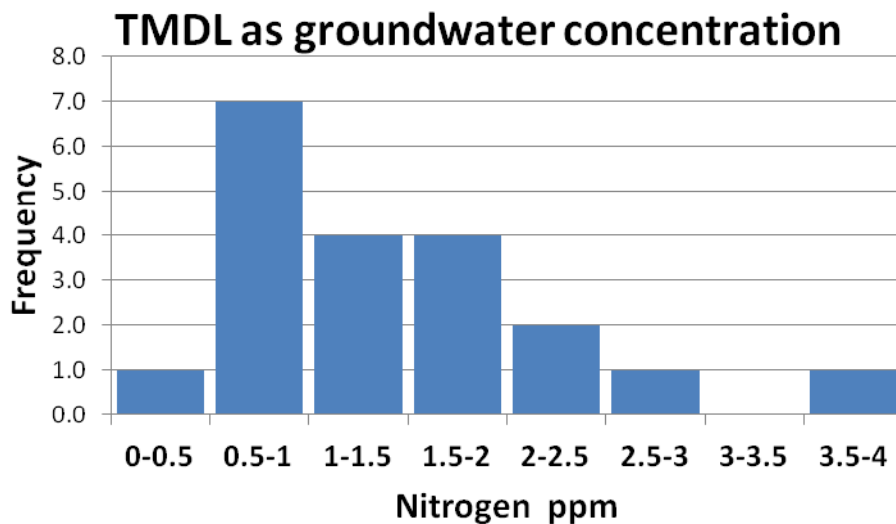
EPA Outlays as % of Federal Budget



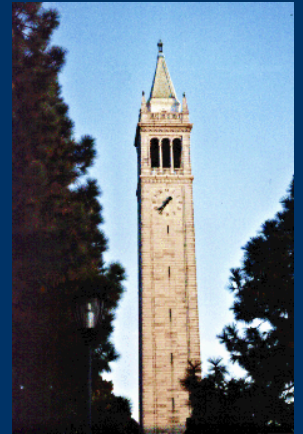
Clean Water Act Limitations

- Does not directly regulate groundwater discharges
 - Handled by Superfund and Safe Clean Drinking Water Act (1974)
 - But the drinking water standards for contaminants like nitrate are too high for protection of aquatic ecosystems (MCL=10 ppm NO₃ as N)
 - States issue their own wastewater groundwater permits.
 - This is a key issue in the CLF / Buzzards Bay Coalition CWA Citizen Suit

Photo from Oyster Pond Environmental Trust
<http://www.opet.org/project-trunkriver.html>



Step back: Environmental Management and Law is Informed by Science



“Science, not politics, should determine environmental regulations, scientist tells detergent industry”

-November 1998 headline from U.S. Water News Online

OR

“Good environmental decision-making is a complex process which requires both a careful review and assessment of relevant science and a thoughtful application of social values. Equally important are value judgments.”

-2001 EPA guidance document for managers

Environmental Management is often driven or confined by Laws and Regulations

Permits are issued as allowed by law.

Environmental Decisions (issuance of permits) at the state and federal level follows a case law (decisional law) model:

Laws are passed (informed by science?, politics, social values, government goals, policies)

- > regulations are adopted (informed by science?)**
- > decisions in gray areas lead to precedents**
- > precedents can be overturned by new policies, regulations, or laws**

...And Environmental Management and changes in Environmental Law is often driven politics and public opinion

Education of the public and students on watershed and pollution concepts is vital both to help change individual actions and to build support for public action

ORR Junior High School Presentation, Questions posed

True or False?

- 1) There are vast underground lakes and rivers from which we draw our water.
- 2) All your drinking water comes from rain that falls in Rochester, Mattapoissett, and Acushnet.
- 3) Groundwater is separate from streams, lakes and wetlands.

Municipal Water District

Clean Water Act TMDL Process

TMDLS were in the 1972 Act, but TMDL regulations were not finalized until 1992, and TMDLs were not applied to watersheds in a meaningful way until the late 1990s. The formulation of TMDLs is a scientific analytical exercise.

States must prepare lists of impaired waters.

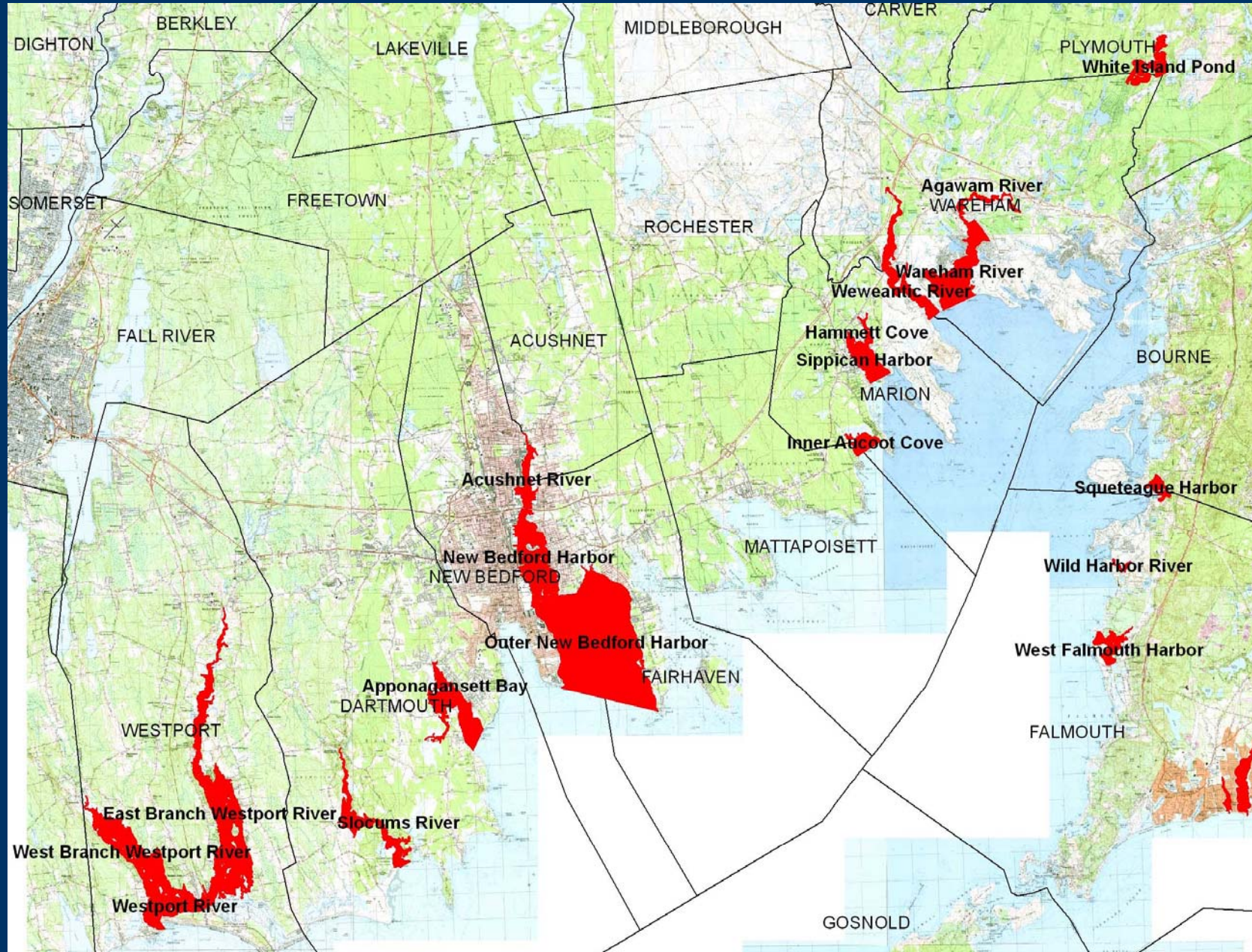
States must submit biennial reports on the condition of waters per §305(b), and a listing of impaired embayments per §305(d) that do not meet the state's water quality standards. These lists may combined in an "Integrated Report."

If waters are on the impaired list, the state must develop a Total Maximum Daily Load, or TMDL. This is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards. **At the federal level, actions to meet TMDLs can only be enforced for permittable point sources (NPDES program).**

DEP: "Once the Technical Report and TMDL are complete, communities decide through **Comprehensive Wastewater Management Planning (CWMP)** how best to implement the TMDL in order to achieve the desired water quality goals. MassDEP reviews and approves a community's CWMP, and makes subsequent permitting decisions based on its approved Plan."

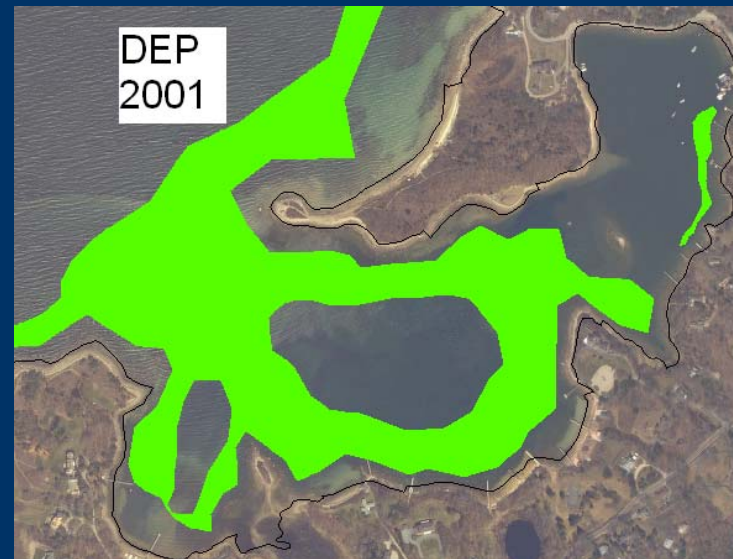
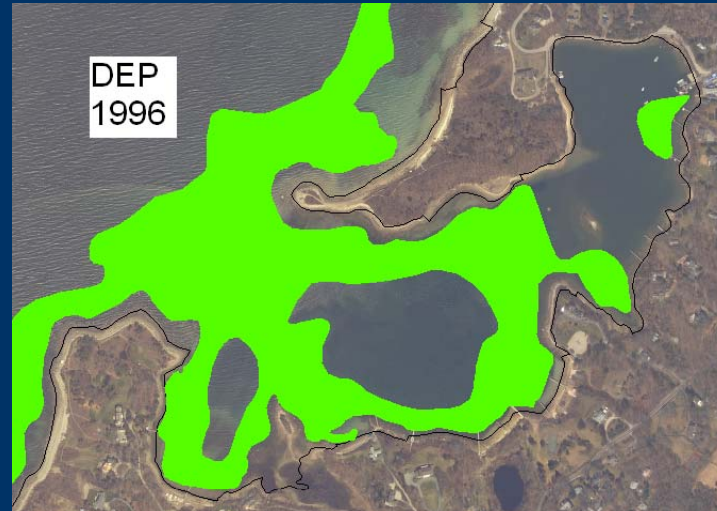
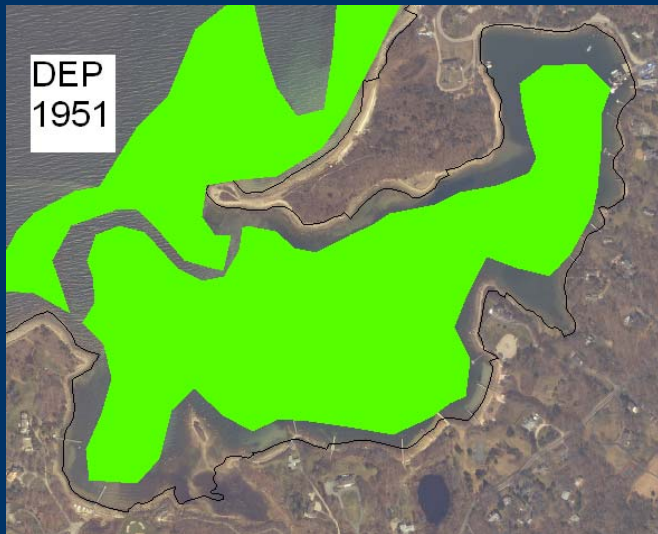
"How will MassDEP enforce a TMDL? MassDEP prefers to work cooperatively with communities to protect and restore impaired waters.... However, in the event that reasonable progress is not being made, MassDEP can take enforcement action through the broad authority granted by the Massachusetts Clean Waters Act, the Massachusetts Water Quality Standards, and through point source discharge permits."

Nutrient Impaired waters in Buzzards Bay watershed (2008)



Diagnosis and Advice #2 (a)

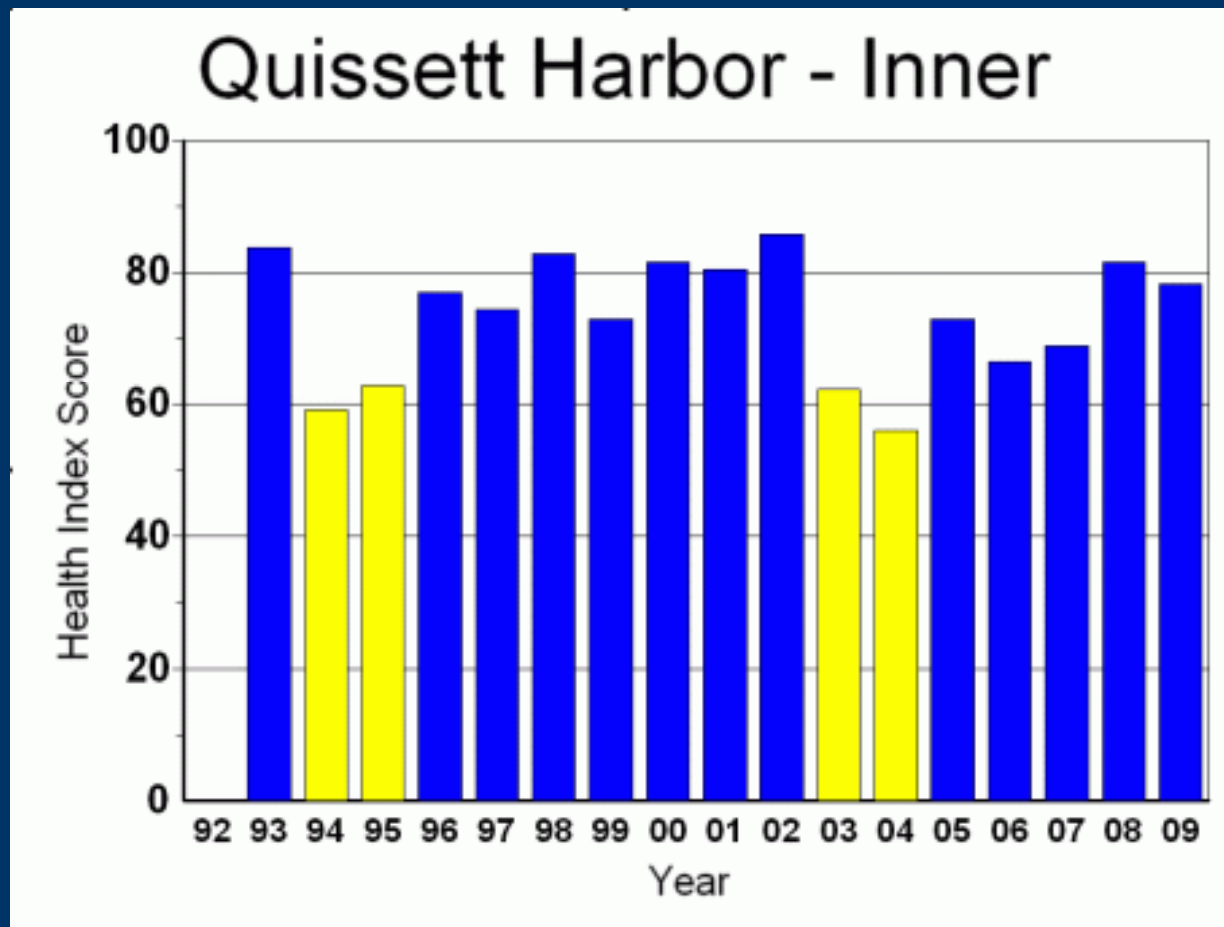
Quissett Harbor has had a loss of eelgrass since the 1950s, particularly in the upper northern end.



Diagnosis and Advice #2 (b)

It the Buzzards Bay Coalitions Water Quality Monitoring Program, water quality in this estuary has been one of the best among Buzzards Bay embayments.

Coalition website <http://www.savebuzzardsbay.org/page.aspx?pid=3213>



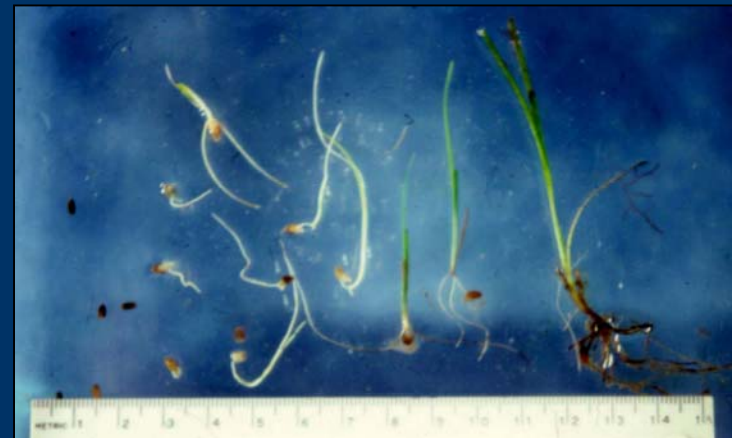
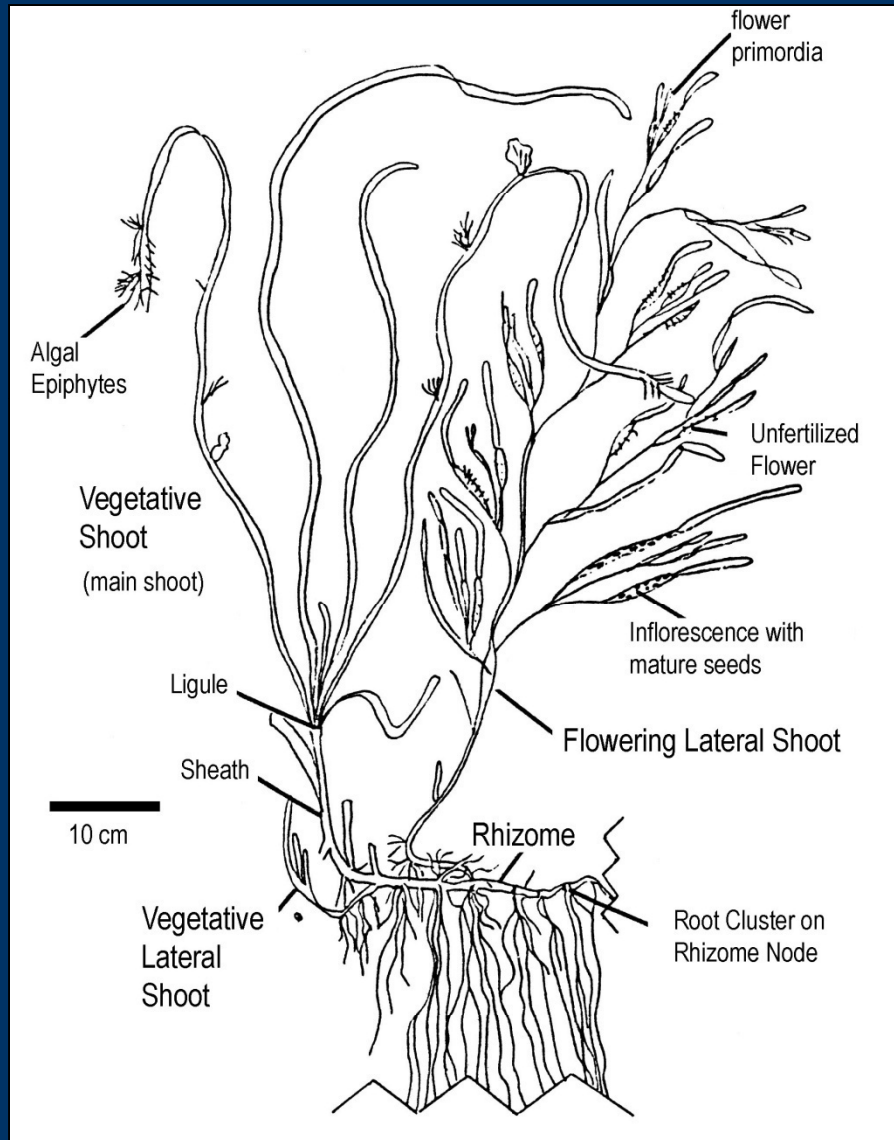
Diagnosis and Advice #2 (c)

The number of Houses in the watershed probably tripled in the past 50 years.



What are the possible causes of the eelgrass decline in the upper estuary, and what the solutions?

Eelgrass (*Zostera marina*) Biology: It is a flowering plant with seeds



Eelgrass Biology:
Found everywhere in Buzzards Bay-
Except where it cannot grow!

Where there is enough light (most of Buzzards Bay is too deep)

Where salinities average 10 ppt or above (i.e., can survive in brackish waters)

Where there is a soft or sandy bottom

Where physical disturbances are not excessive

Most Transplantation Efforts Fail.

Eelgrass Grows underwater, both in quite water and the open coast, down to 20 feet or more.



Shallow bed
(to 0.5 ft MLW in protected areas)
Note: shorter plants with dense root mat.



Deep Bed
Often to 22 feet MLW,
rarely to 50 ft+ in clearest waters
Note: Tall plants with less dense root mat typical.

Benefits of Eelgrass

Eelgrass beds are a refuge, feeding ground, or habitat to many animals.

Examples: settlement of scallop spat, protection of molting blue crabs

Eelgrass Beds help stabilize the bottom; may slow erosion



From: Virginia Institute of Marine Science, www.vims.edu

Some nautical charts from the 1890s show the locations of eelgrass beds, and between the 1890s and 1932, eelgrass from Buzzards Bay was used in a commercial product called Cabot Quilt, and early type of insulation used in houses.

Cabot's Quilt was composed of a thin layer of eel-grass (seaweed) between two layers of kraft paper that were stitched together to form 915 mm (1 yd.) wide rolls (Fig. 4).



Figure 4. Roll of single ply Cabot's Quilt

Patented in 1915 and 1916, the material was applied horizontally using "roofing caps" which are large washers stamped out of reclaimed sheet metal.

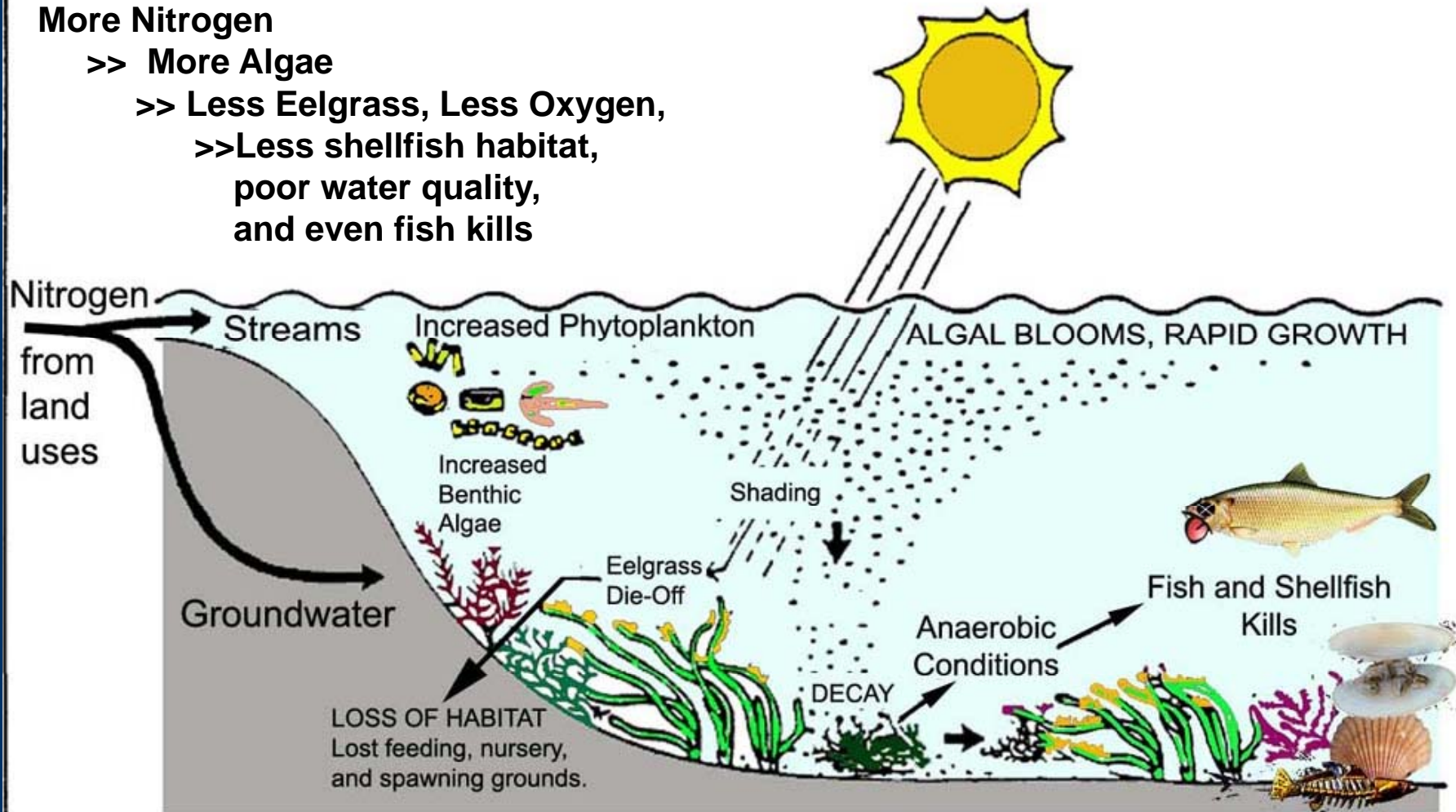
Fertilizing the Ocean with Nitrogen is Bad

More Nitrogen

>> More Algae

>> Less Eelgrass, Less Oxygen,

>> Less shellfish habitat,
poor water quality,
and even fish kills



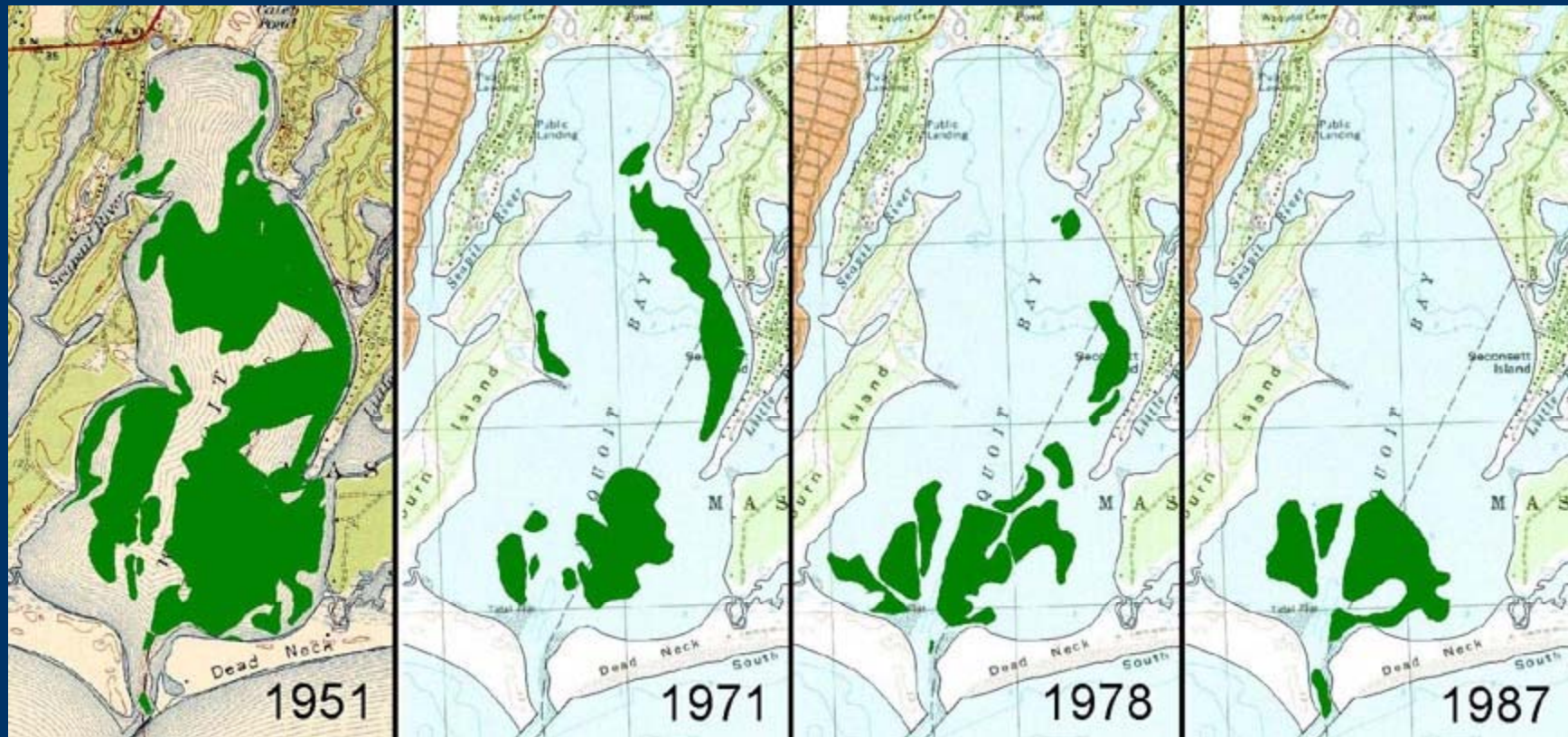
Generalized response of shallow coastal embayments to excessive nitrogen loading.

Source : Modified from U.S. Fish and Wildlife circular , Restore Chesapeake Bay (2/90).

Nitrogen is just one cause of eelgrass Loss, but it is typically the largest and most significant



In response to nitrogen loading or eutrophication, eelgrass tends to disappear in the uppermost and deepest portions of the estuary first.

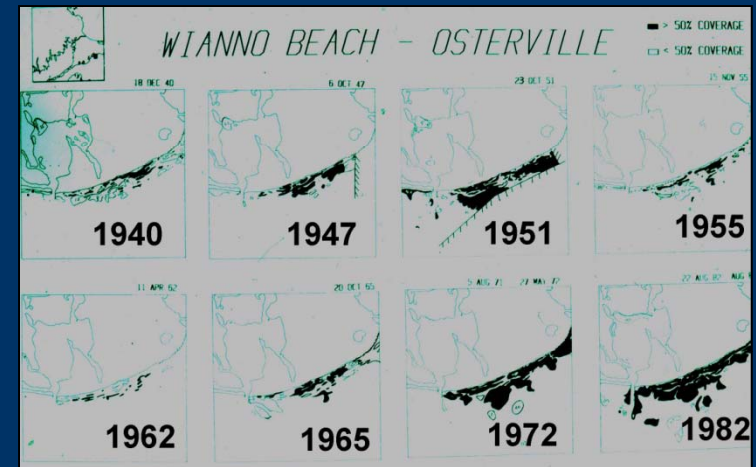


Causes of Eelgrass Loss– Storms and Ice

Storms and Icing

Storms are especially important in defining eelgrass distribution on the open coast and “high energy areas.

Heavy icing can rip out shallow eelgrass beds.
(Cape Cod Canal was closed in 1977, 1981, and 2004 during to severe ice flows)



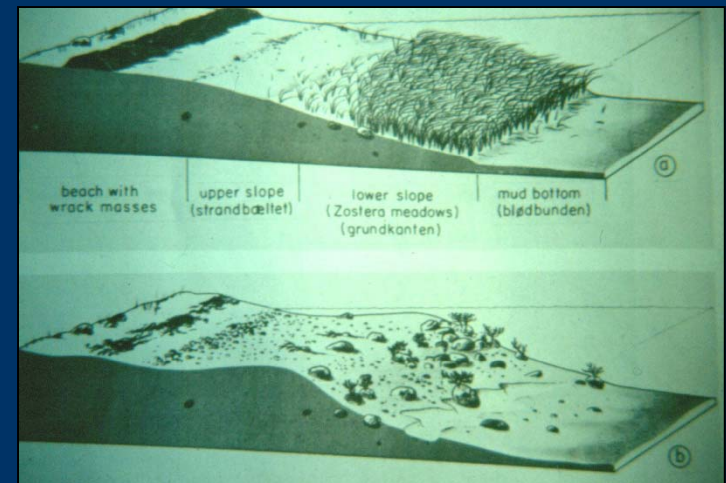
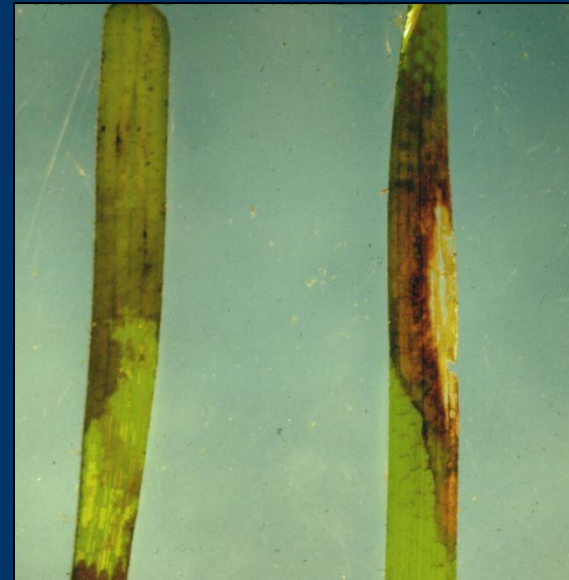
View of Buzzards Bay from Stony Beach, 1981

Causes of Eelgrass Loss - Disease

The Wasting Disease of 1931-32 wiped out nearly all eelgrass on both sides of the Atlantic Ocean

Caused by a plant slime mold, what triggered event is unclear. Eelgrass in Buzzards Bay did not recover from this disturbance until the 1950s to late 1960s.

Some have speculated that the wasting disease is a recurring phenomenon.



Causes of Eelgrass Loss— Shellfishing in Eelgrass Beds

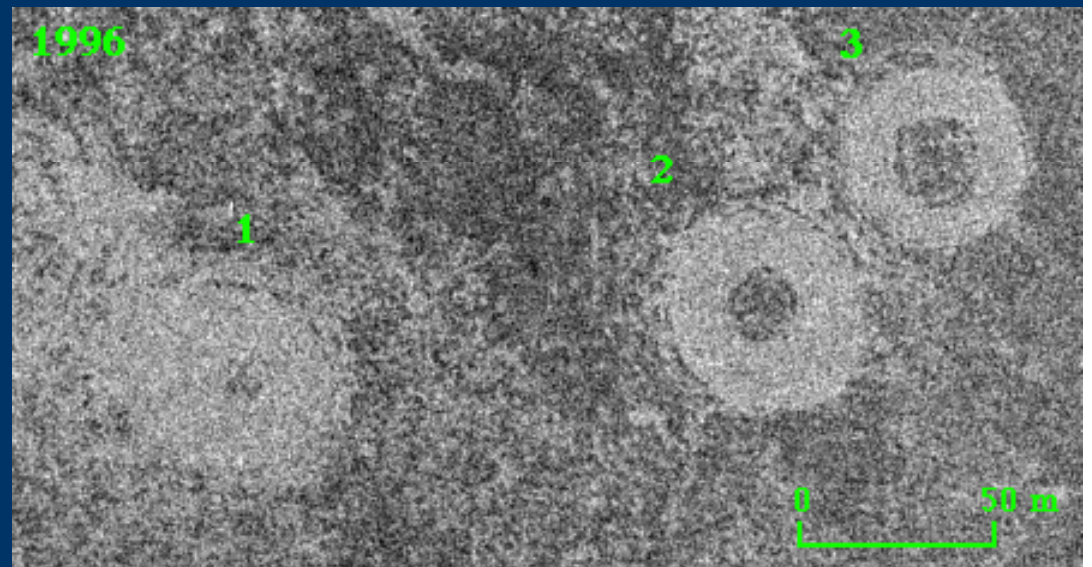


Left: If rakes are used in eelgrass beds in can dislodge the eelgrass plants, which float away and wash ashore. Dislodged plants cannot reestablish themselves in sediments.

Right: Scars from hydraulic clamming for Soft Shell Clams in Chesapeake Bay eelgrass beds. Scale bar is 160 feet.

From: Virginia Institute of Marine Science, www.vims.edu

Also scallop Dredging in Nantucket has been identified as a problem. Dredges modified there.



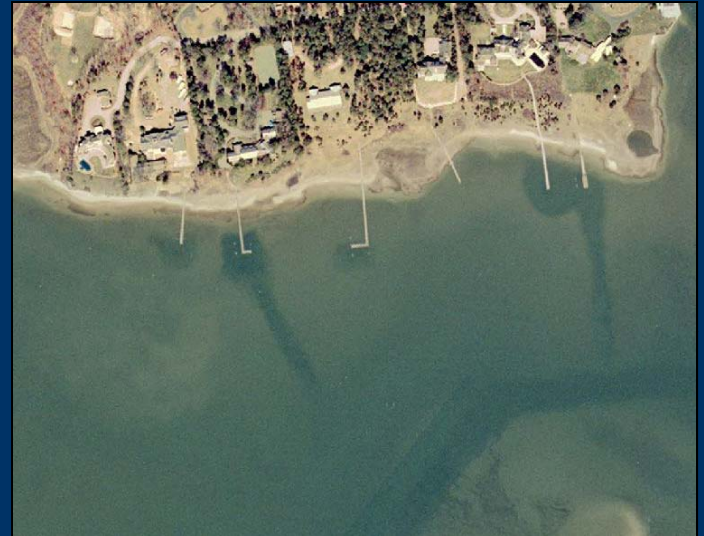
Causes of Eelgrass Loss— Docks, Boating, Dredging

Docks shade eelgrass

Boat props cut eelgrass

Boat props suspend sediments that
shade eelgrass

Dredging of channels destroys
eelgrass- permanently if channel
bottom is below depth of adequate
light (compensation point)

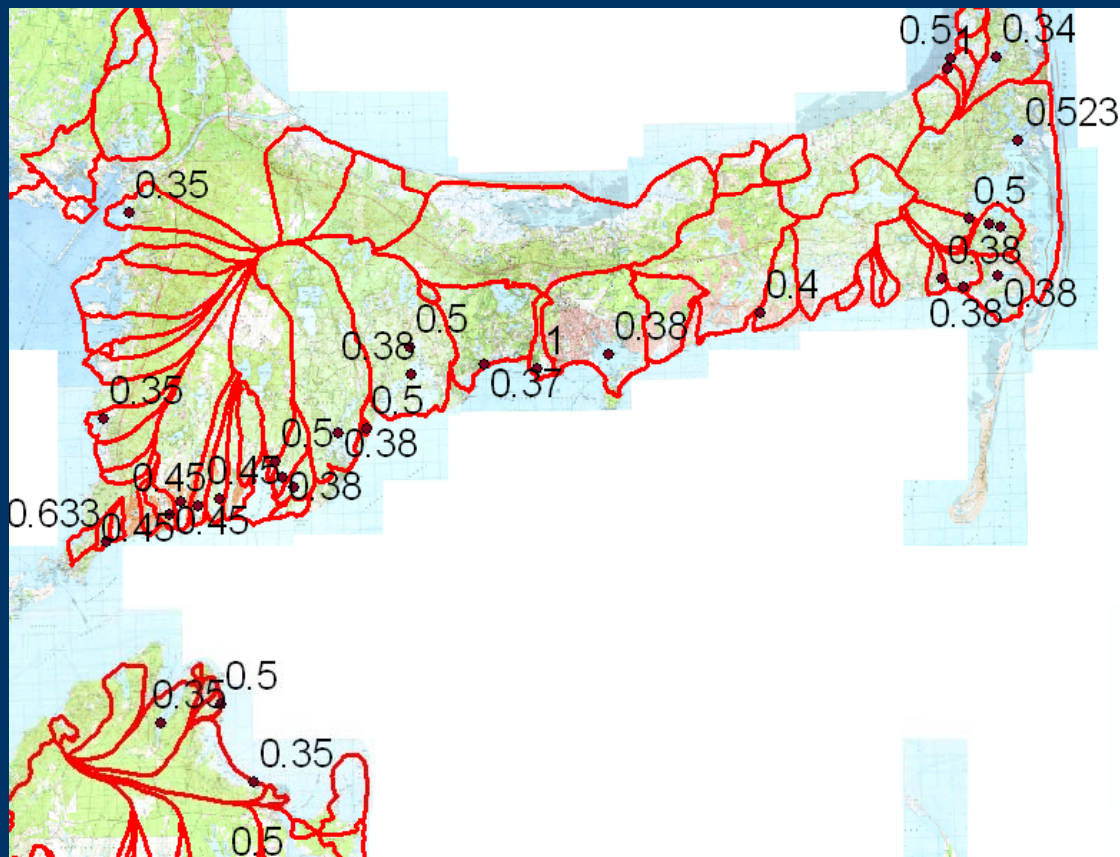


Turbidity, humic substances and other factors likely contribute to the loss of eelgrass at different average total N concentrations



**Slocums
River**

... This may explain some of the variability of nitrogen thresholds to protect eelgrass in the published MEP TMDL reports



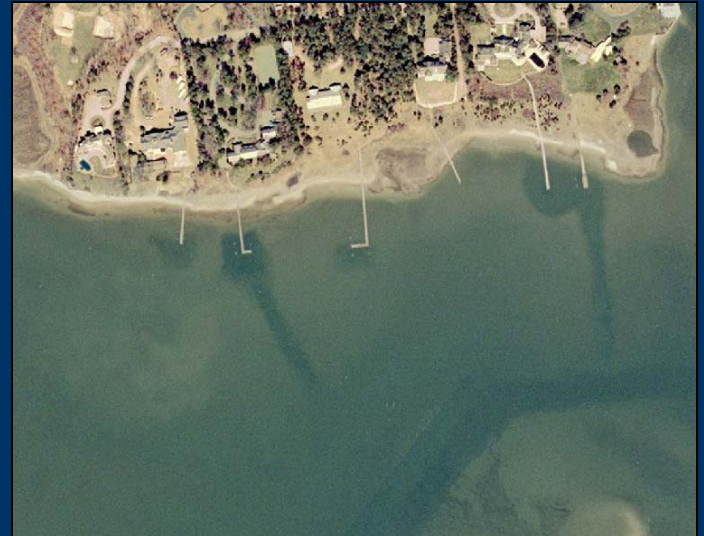
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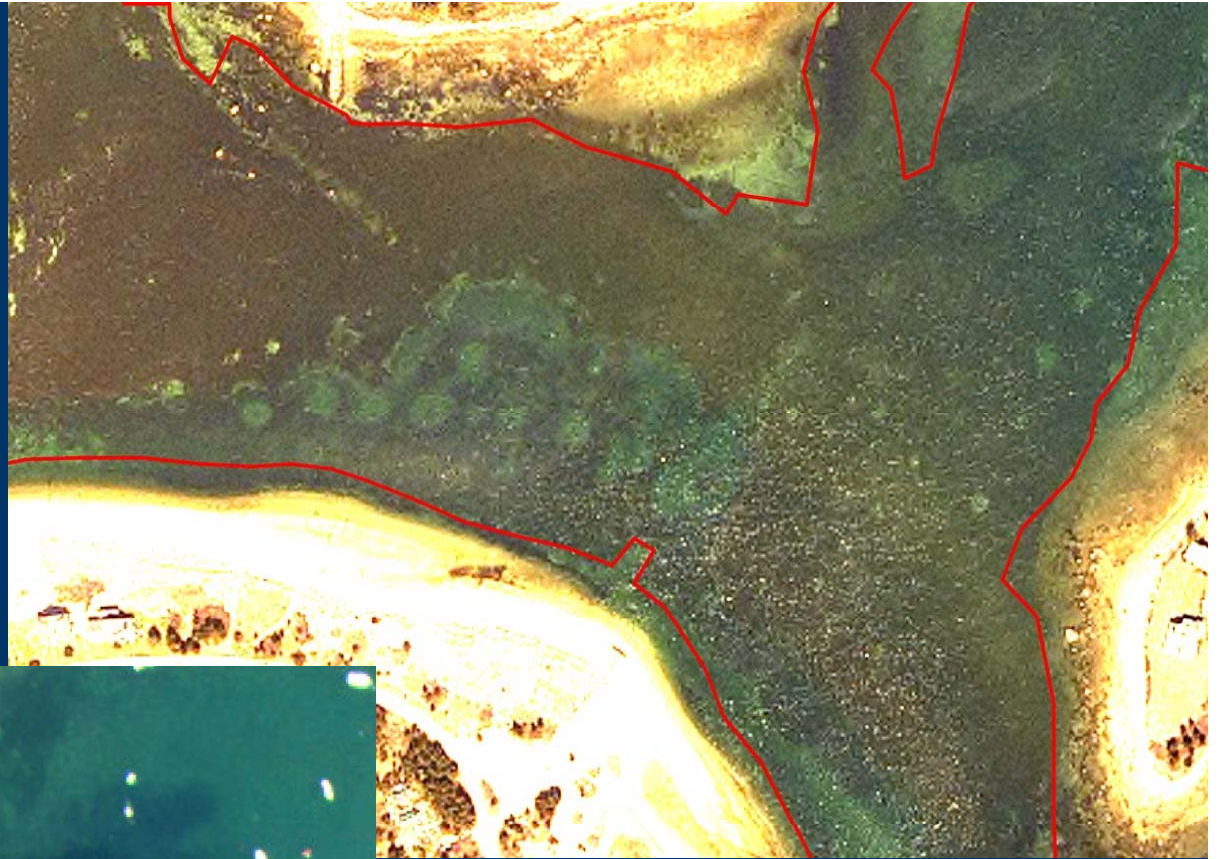
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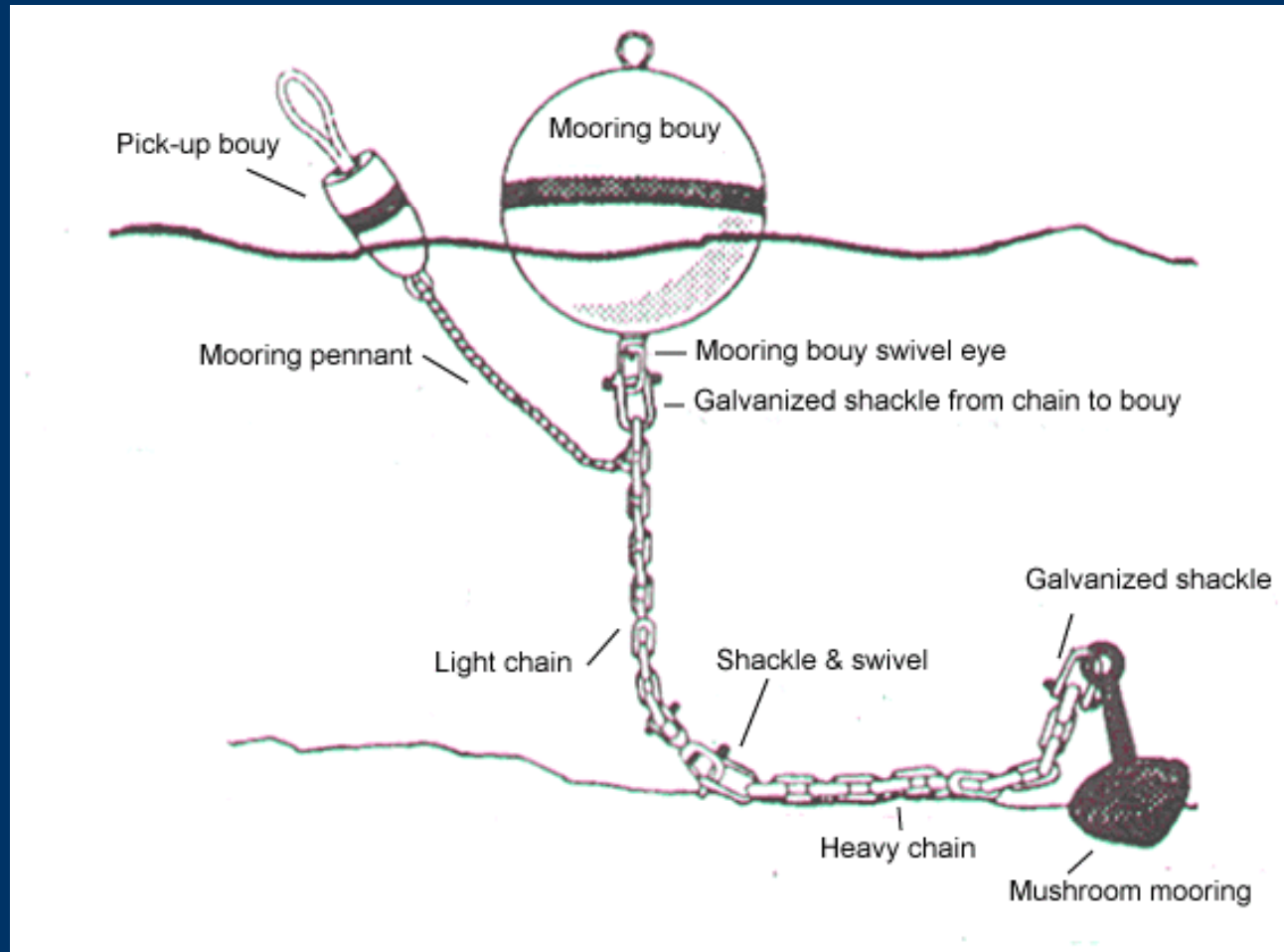
**Causes of Eelgrass
Loss—
Mooring Chain Scour
and sediment
suspension**



Mooring chain scour scars in the outer West Falmouth harbor area in June 2001 (left) and in March 2005 (above right, image contrast and brightness enhanced).

Scour circles 35-50 ft diameter; at least $\frac{3}{4}$ acre of direct scour in outer harbor.

Increased turbidity due to mooring scour



Hurricane Bob Aftermath: Push for longer scopes

Towns were allowing short scopes, afterwards anchor weights and scopes increased. BBNEP was recommending scopes of 7-10 times depth.

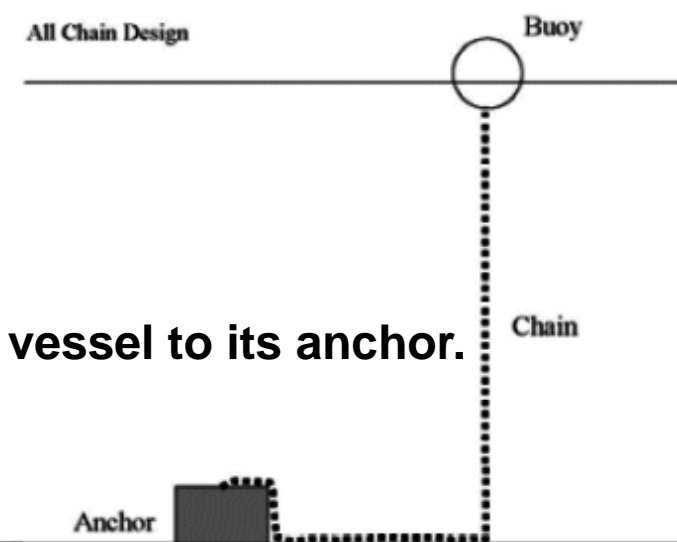
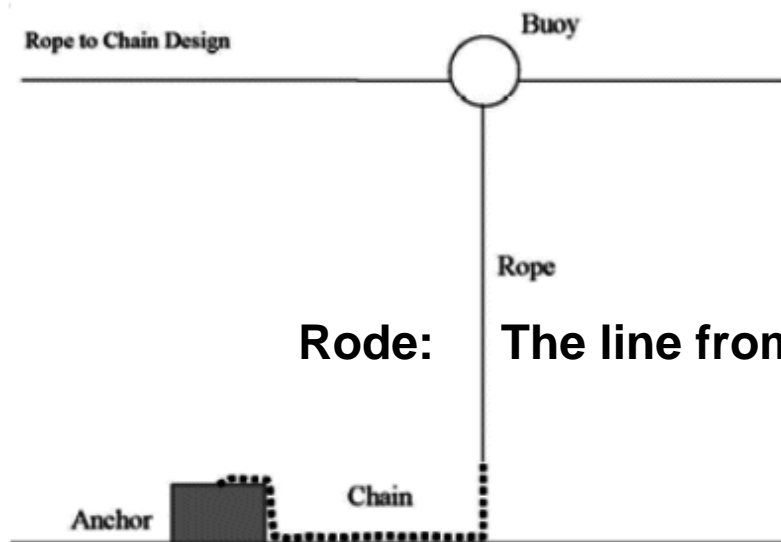
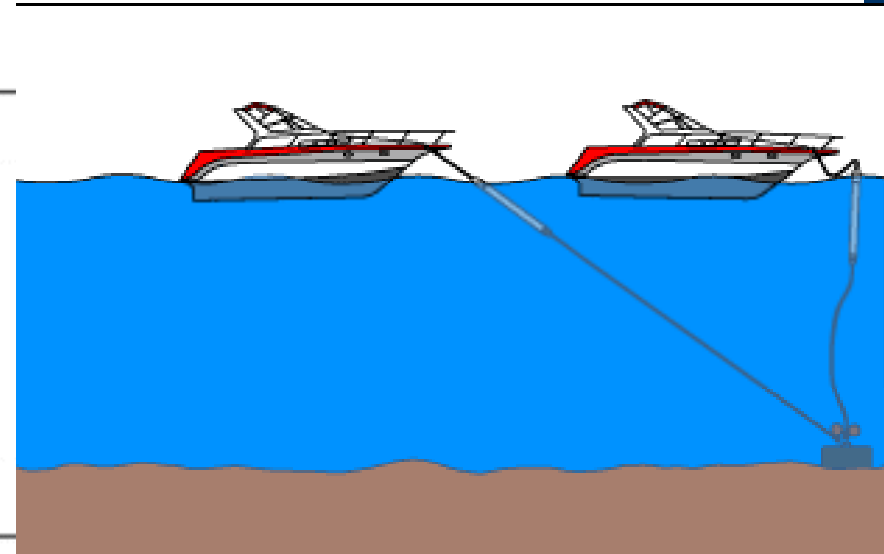
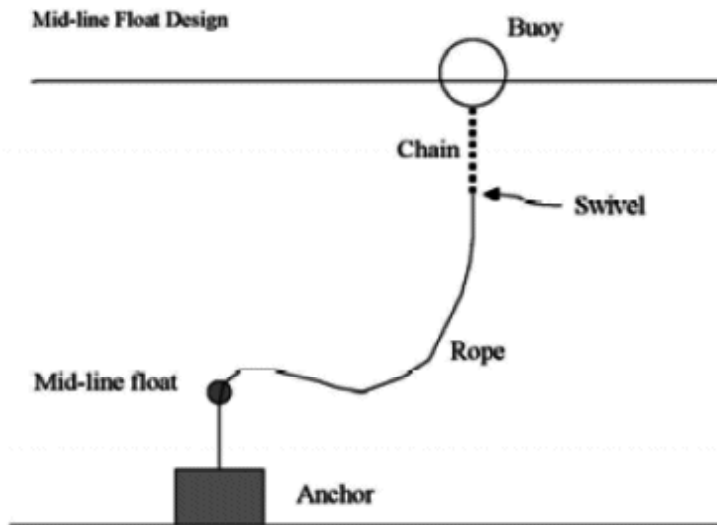


Allen Harbor after Hurricane Bob August 1992



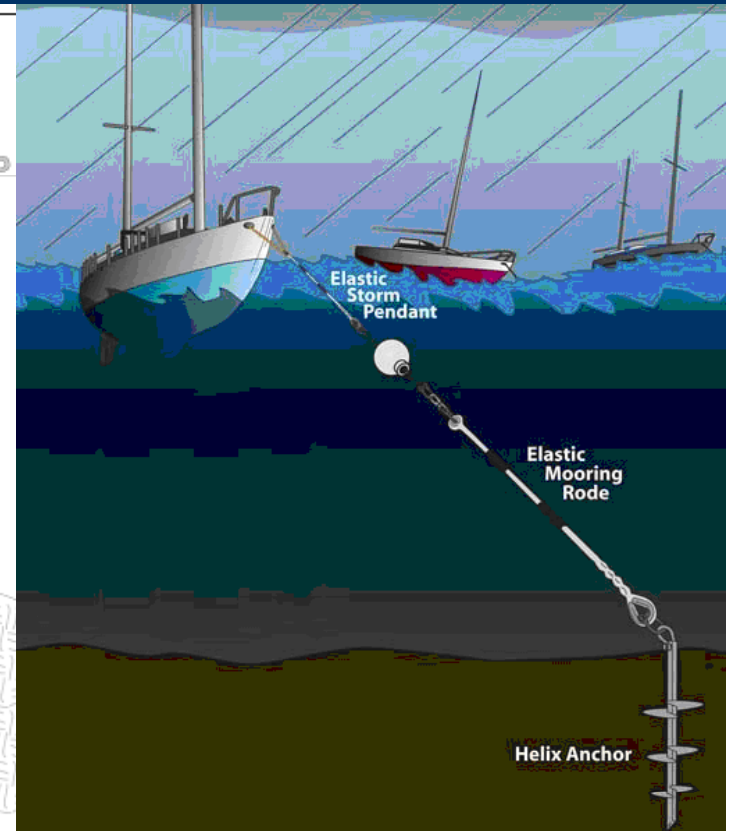
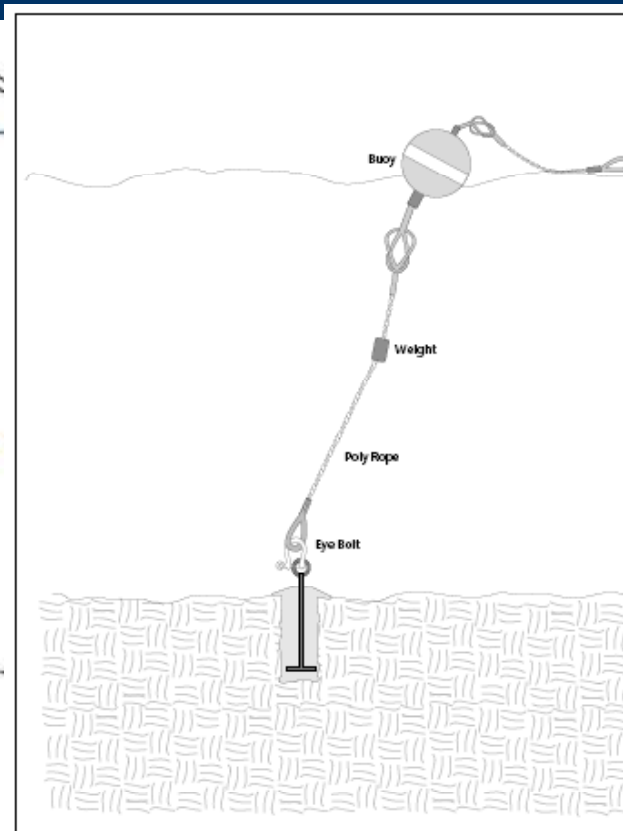
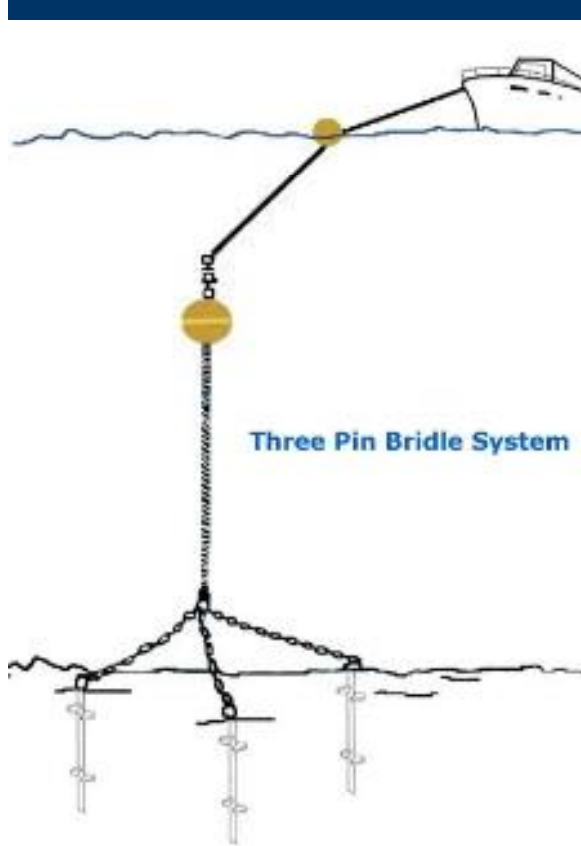
Mooring Designs

mooring buoy designs



Rode: The line from the vessel to its anchor.

3 Strategies for getting tackle off the bottom



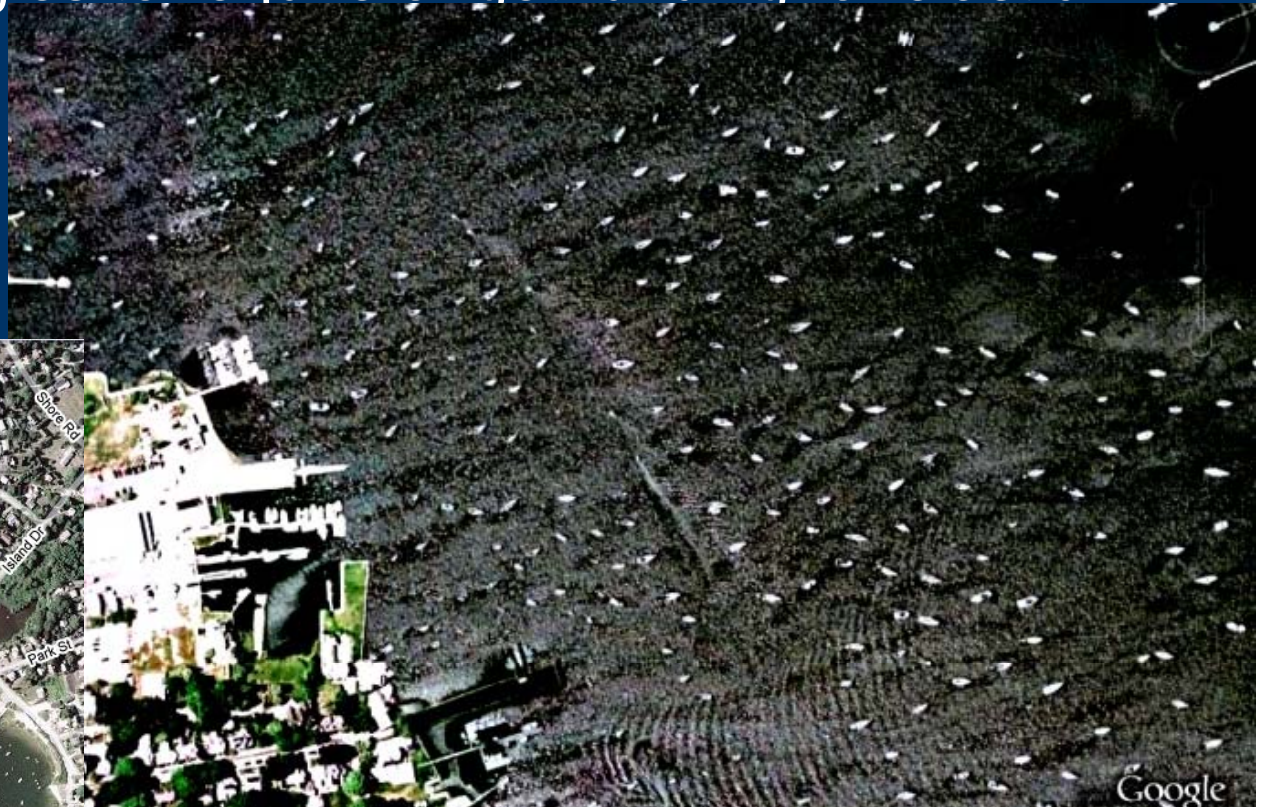
Intermediate float

Poly rope instead of chain,

elastic rode

Cheap solution? Tie Plastic Bottles to your chain.

Sippican Harbor Marion has nearly a 1000 moorings and little eelgrass in the mooring areas. The town already requires helical anchors for boats over 25 feet (about 80%). They are now looking at strategies to require or get funding for elastic rodes.



Remapping Eelgrass in Buzzards Bay



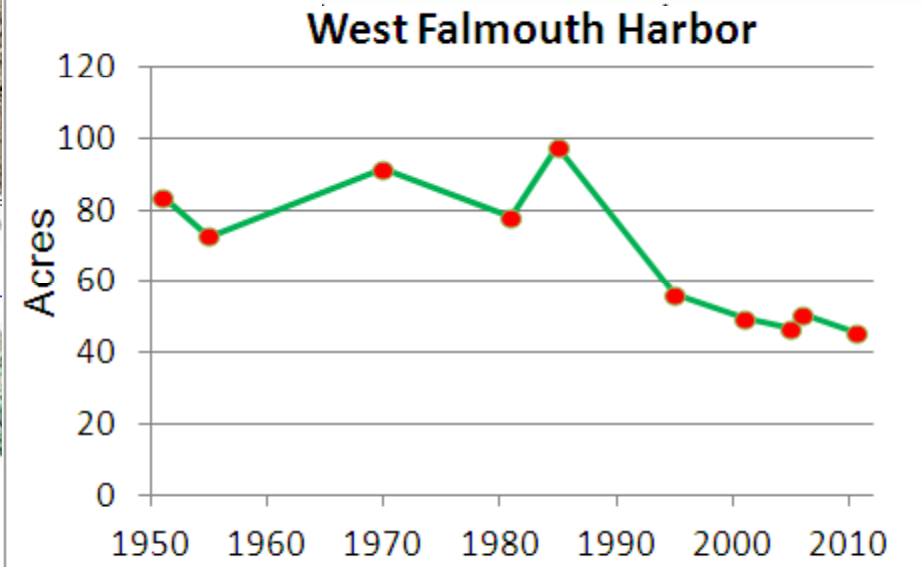
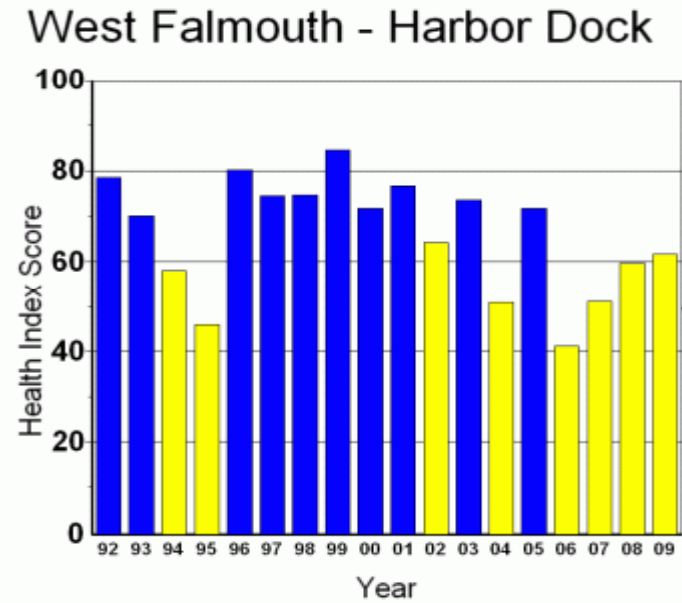
Eelgrass in West Falmouth Harbor, estimated for 1951 by DEP (left on a 1955 photo), BBP estimate for 15 November, 1955 (middle), 14 October 1981 (right on a 1985 photo). Note that eelgrass beds in photographs taken between December and May appear much sparser than beds in the summer.



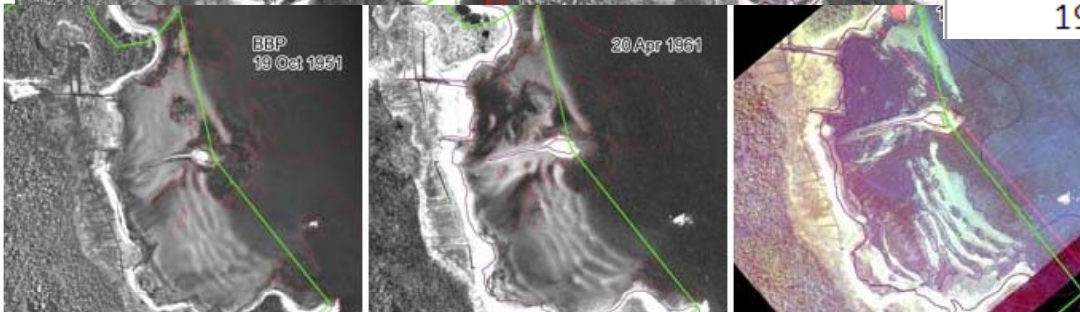
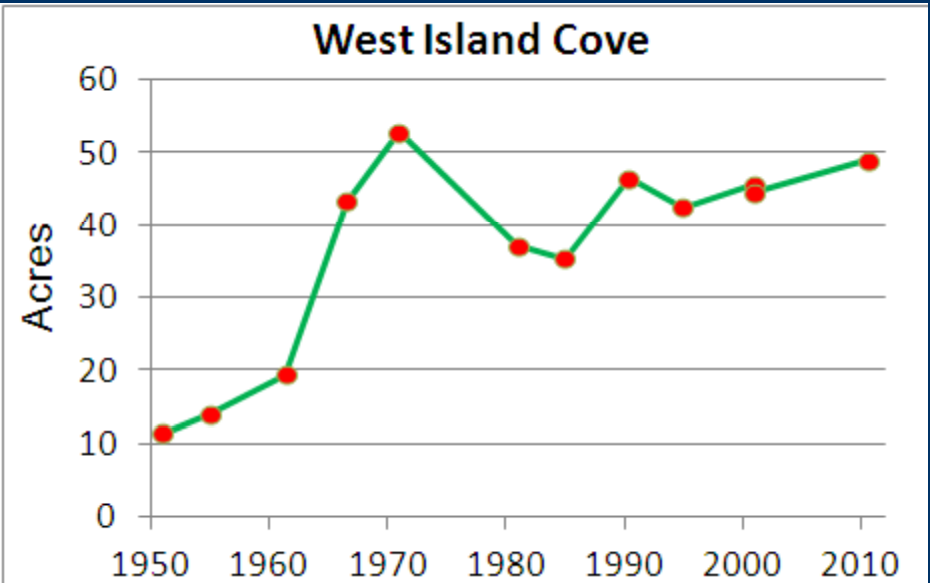
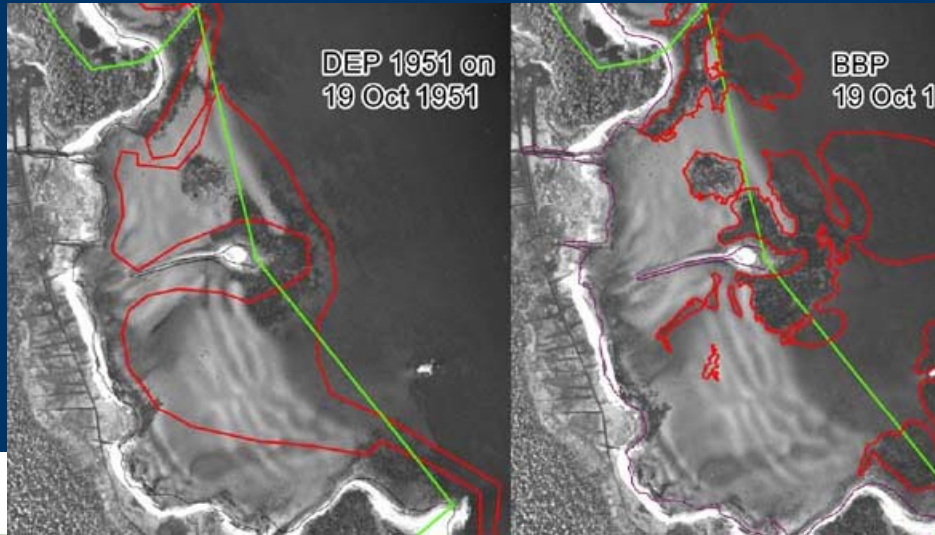
Eelgrass in West Falmouth Harbor, DEP 1996 (left), DEP 2001 estimate (middle, on spring 2001 photo), DEP 2006 (left), and BBP 2010 (right).



Eelgrass in West Falmouth Harbor, DEP 2006 on summer 2001 photo (left), and BBP estimate for 2010 photo (right).



Reanalysis of some past surveys plus new data for West Island Fairhaven, a good undisturbed reference site



Elgrass in East Cove, West Island, Fairhaven, MA on 19 October 1951 (left BBNEP interpretation), on 20 April 1961 (middle), and on 17 September 1966 (right)

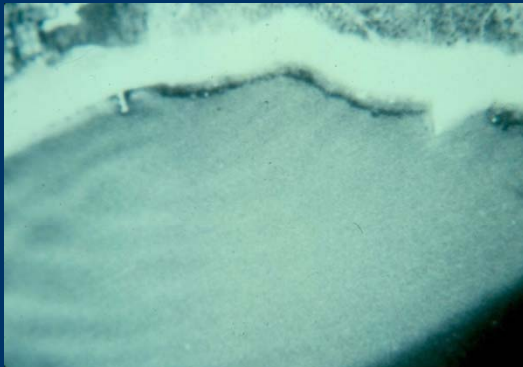


Historical Distribution and recovery during wasting disease recovery

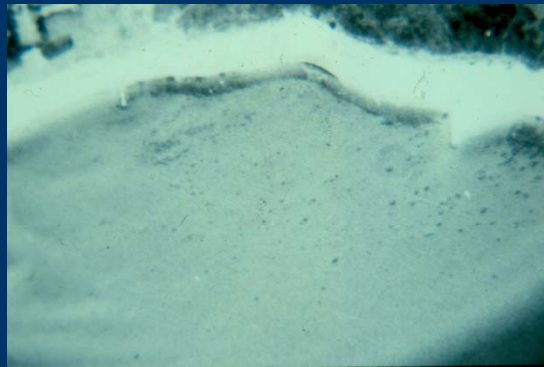
- 1) Only one to a few percent of eelgrass beds survived the wasting disease in BB, probably mostly in deep offshore areas
- 2) In northern Buzzards Bay, moderate recovery in 1940s to mid 1950s, but greatest expansion during the period 1955-1965. On Cape Cod, many beds appear fully recovered in the DEP 1951 coverage.

Area off Great Neck, Wareham

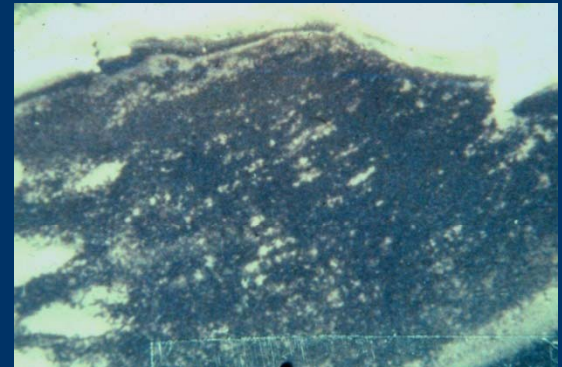
1951



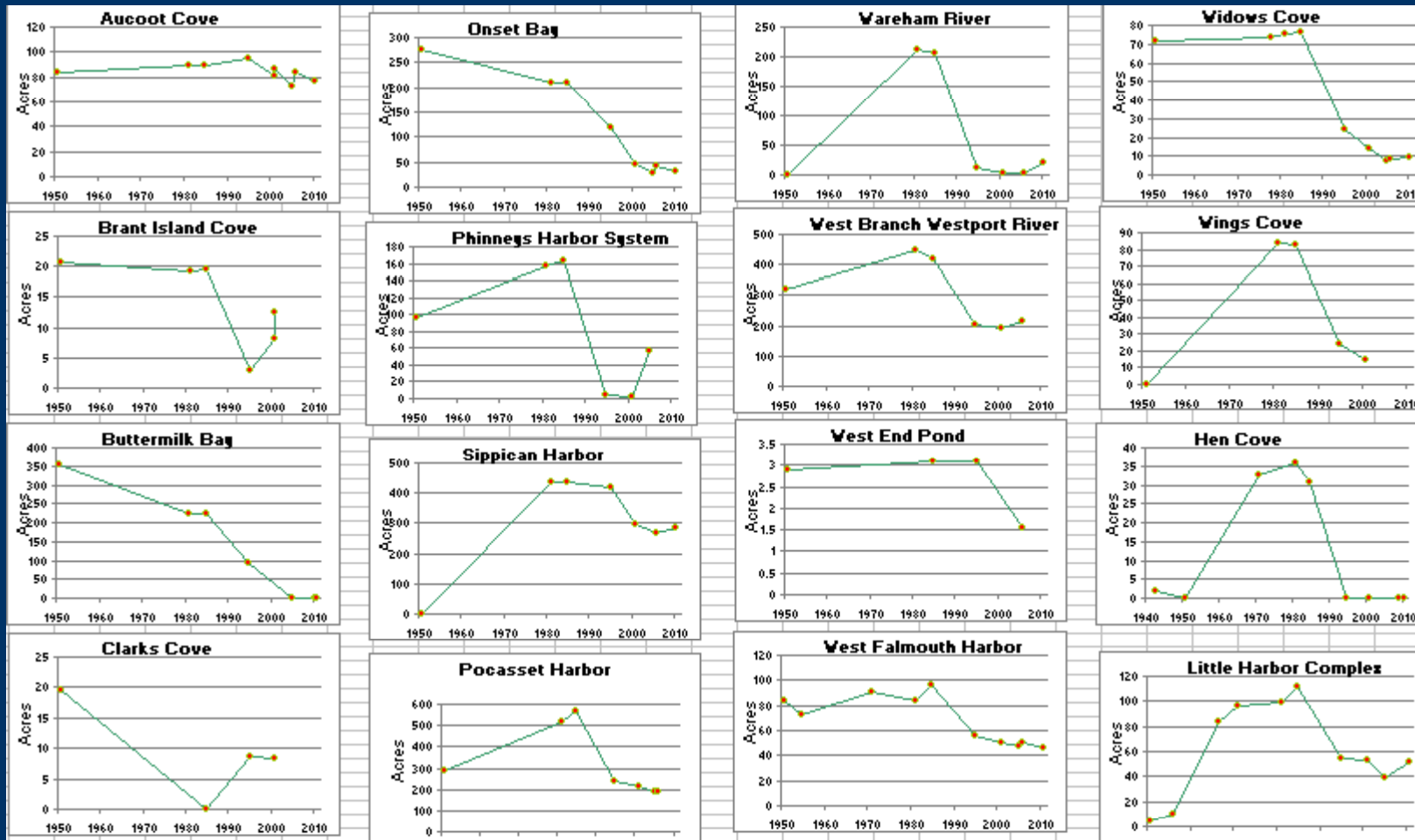
1956



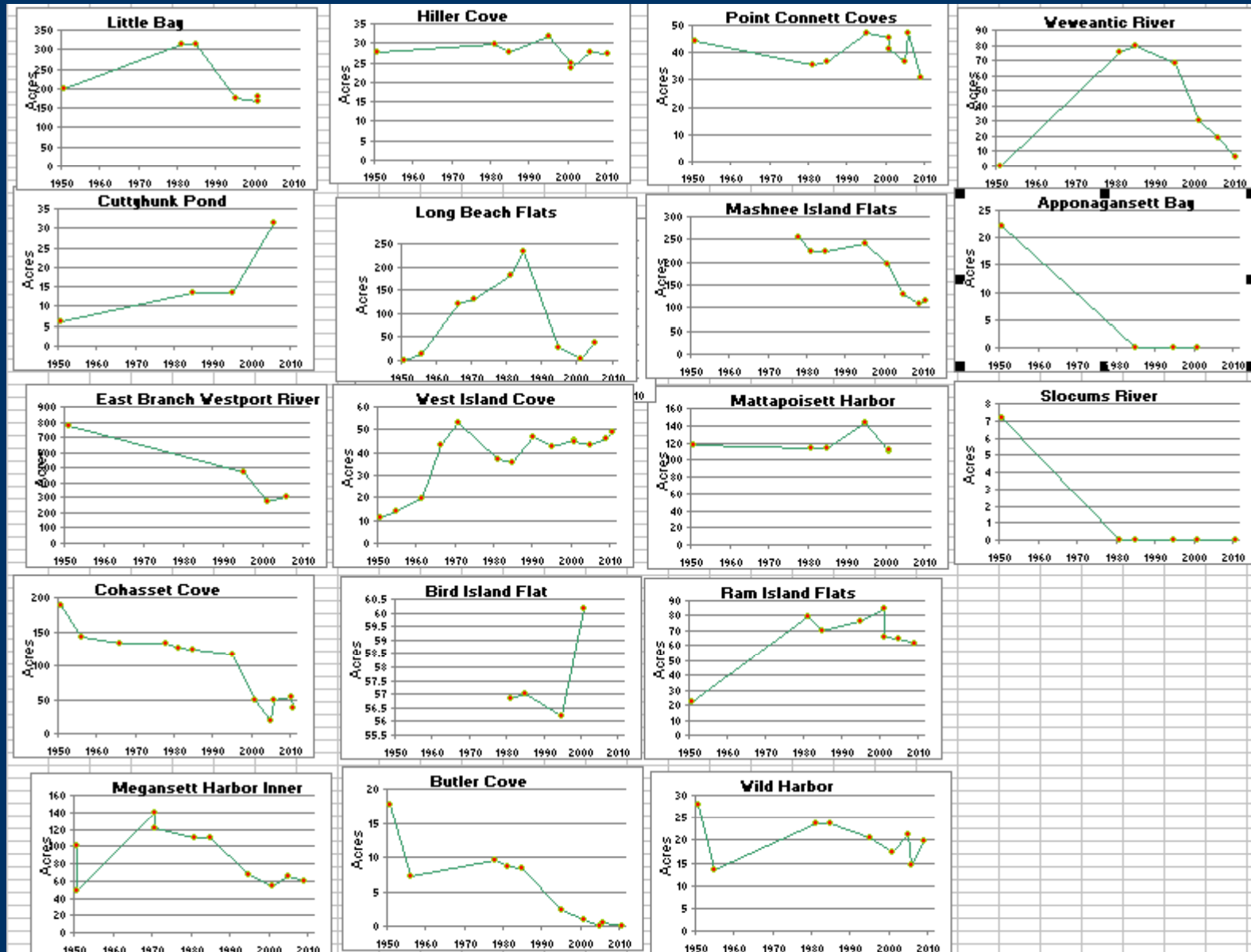
1961



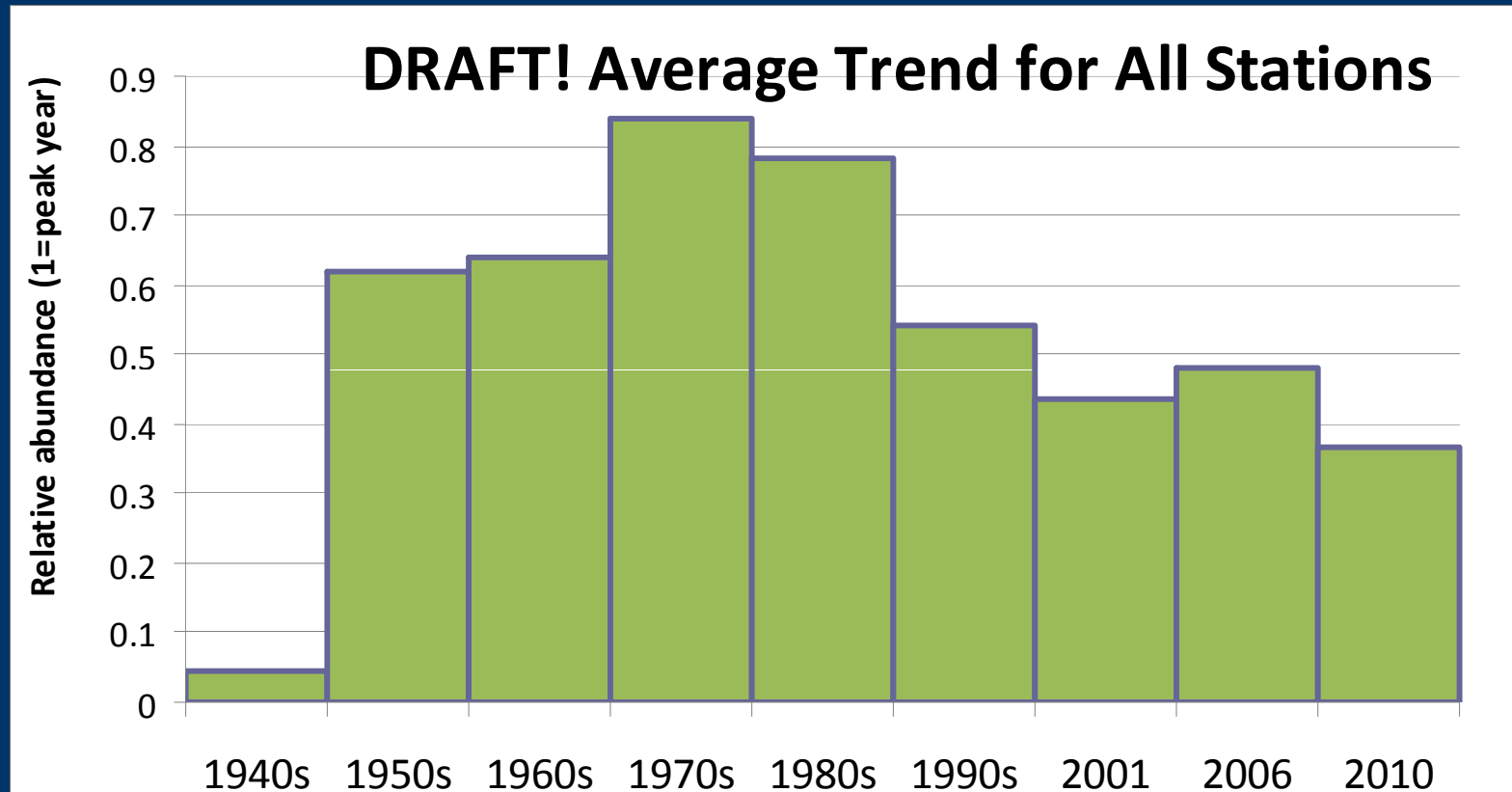
Analysis will be extended to all embayments.



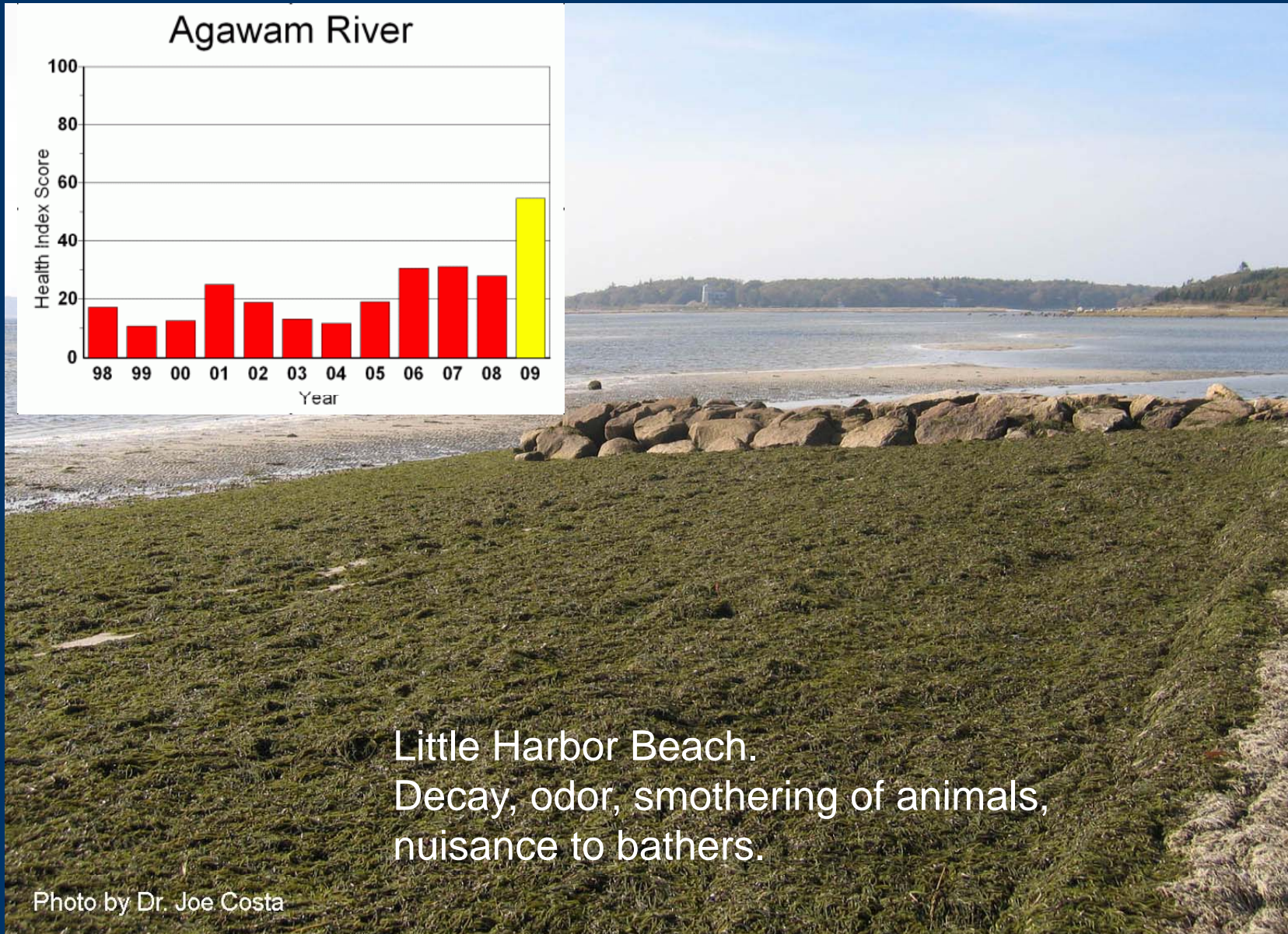
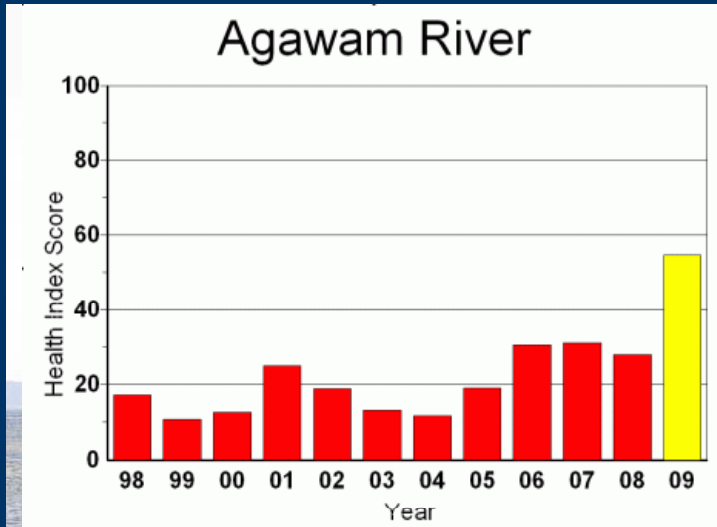
Analysis will be extended to all embayments.



Trends Can be aggregated by decade.



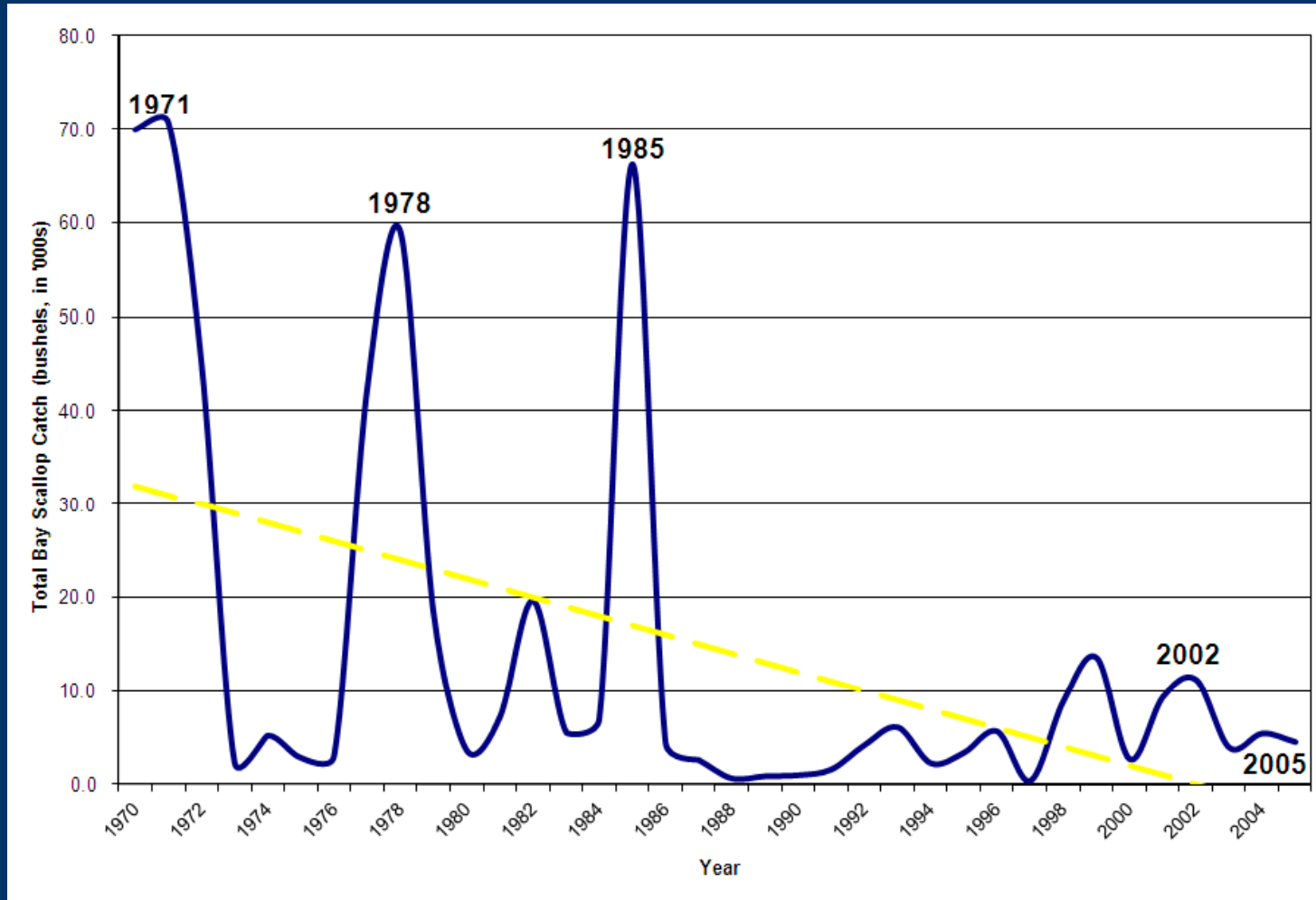
What's replacing eelgrass? Algae



Little Harbor Beach.
Decay, odor, smothering of animals,
nuisance to bathers.

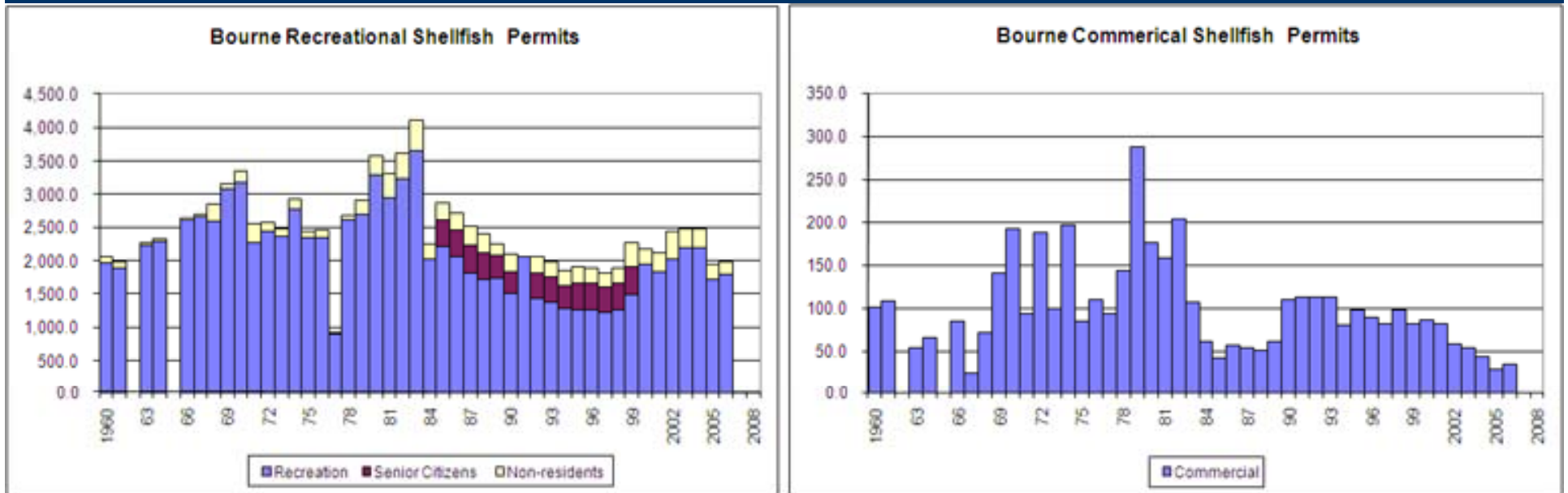
Photo by Dr. Joe Costa

Loss of Eelgrass Habitat often goes hand and hand with loss of shellfish



Scallop Catch. From Buzzards Bay Coalitions 2007 State of the Bay report

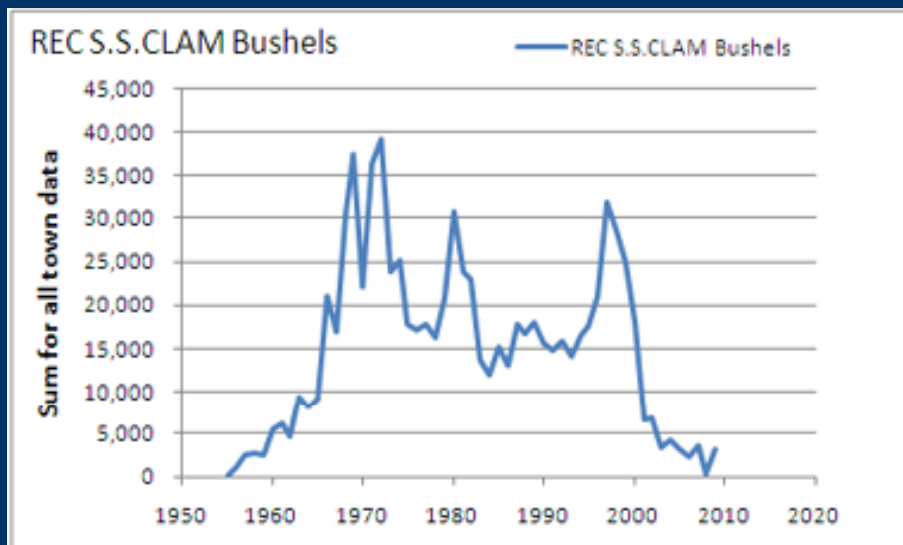
Shellfish catch plotting Tool on BBP website #1



Most towns (used to) report catch and permit data to DMF.

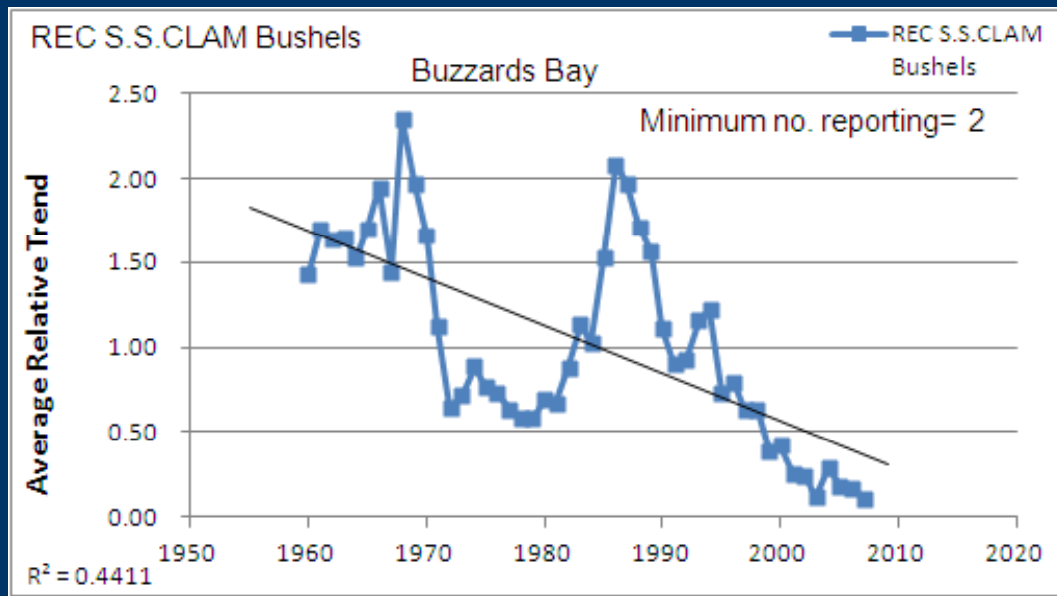
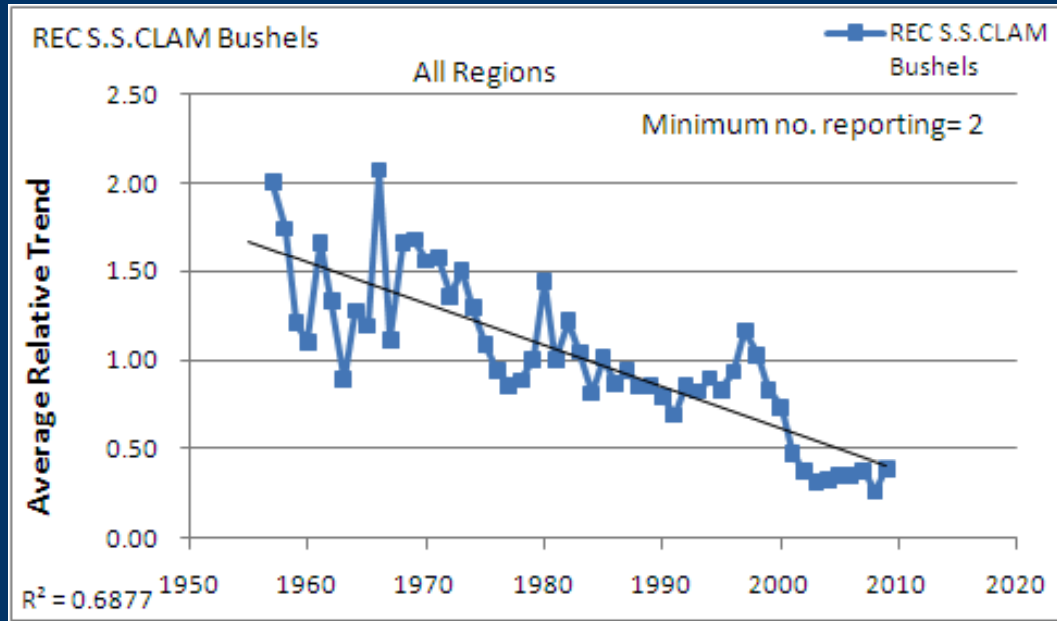
In many towns this data is now based on surveys completed at the time of permit purchase.

Shellfish catch plotting Tool on BBP website # 2

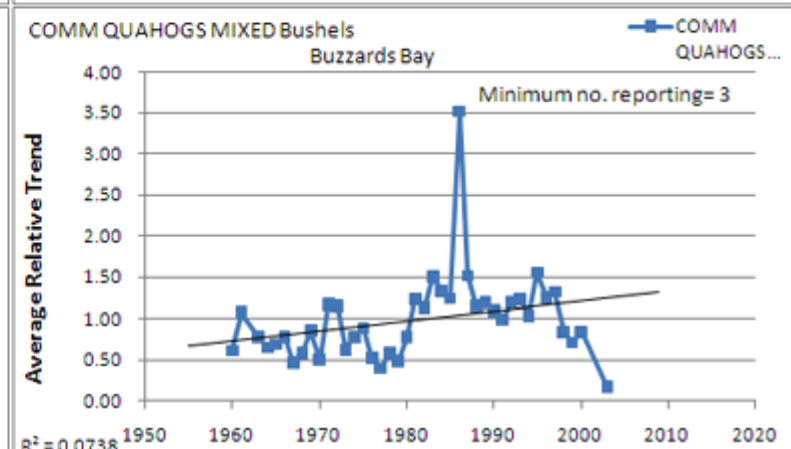
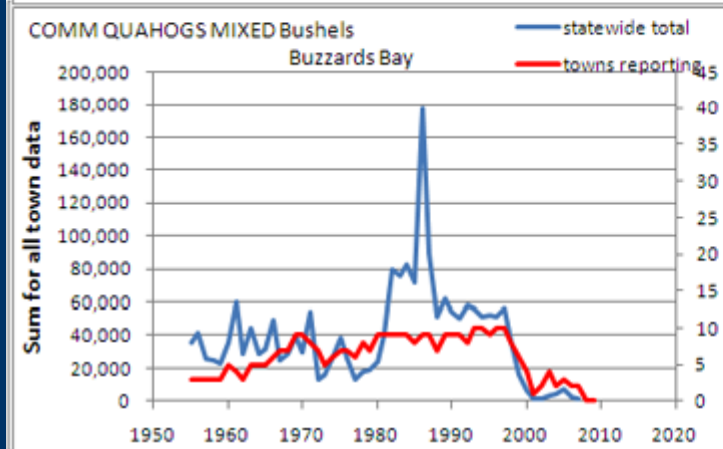
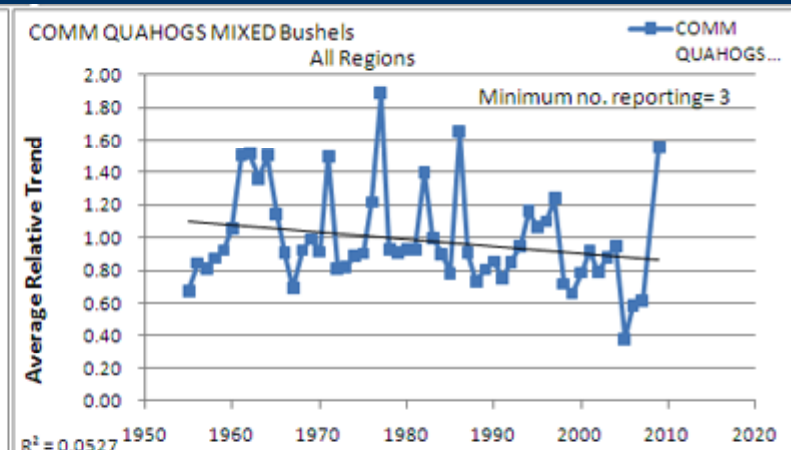
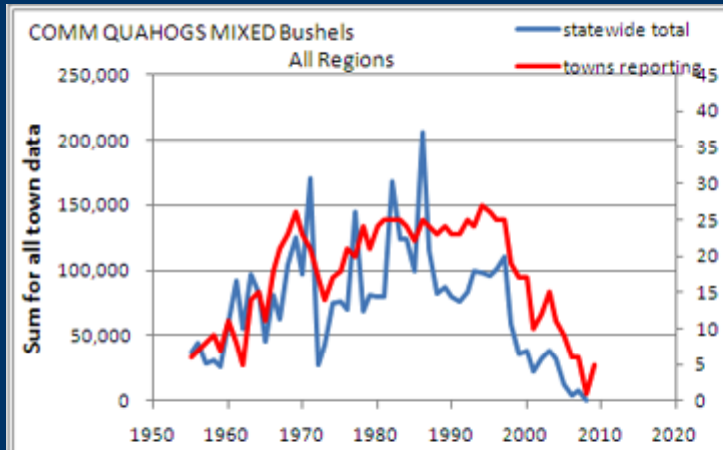


Obvious Trend?

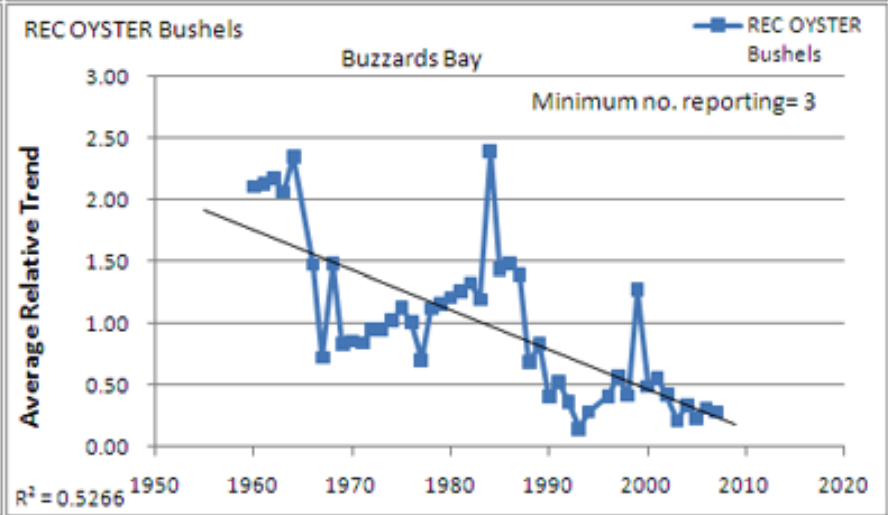
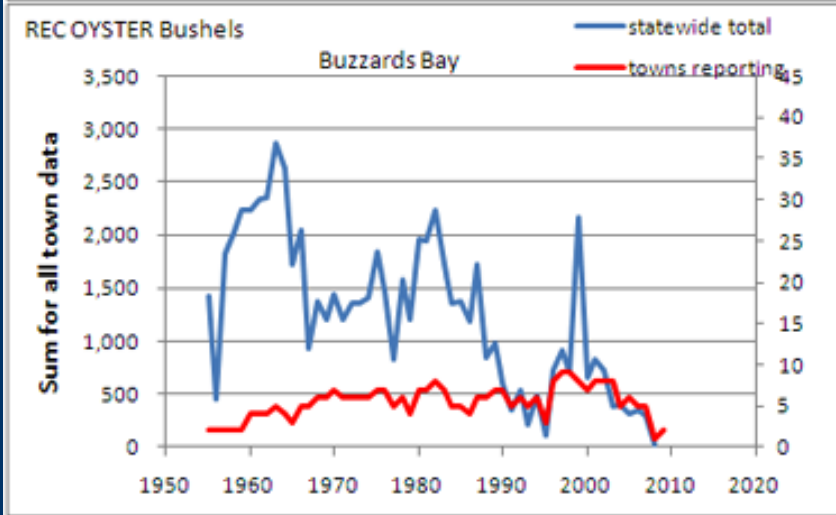
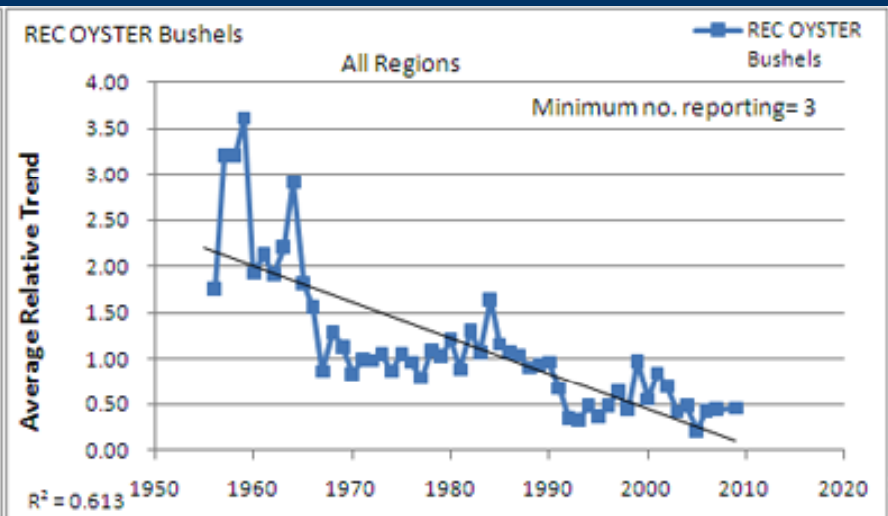
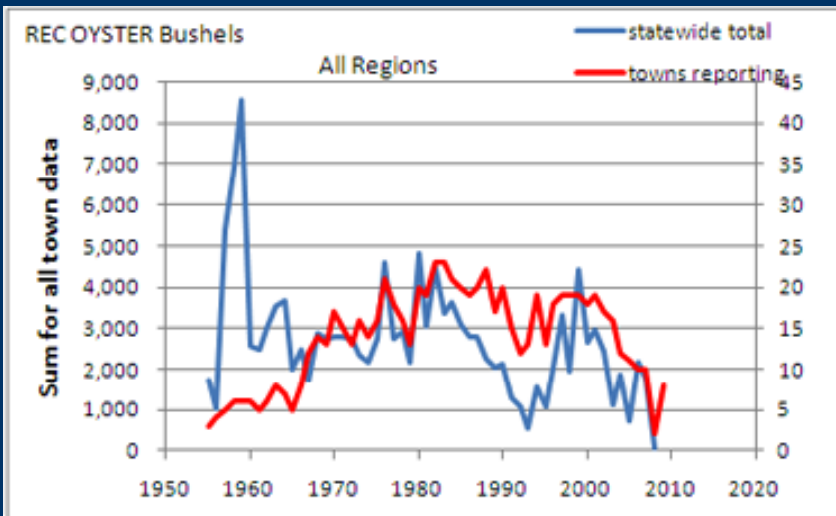
Decline of Soft Shell Clams



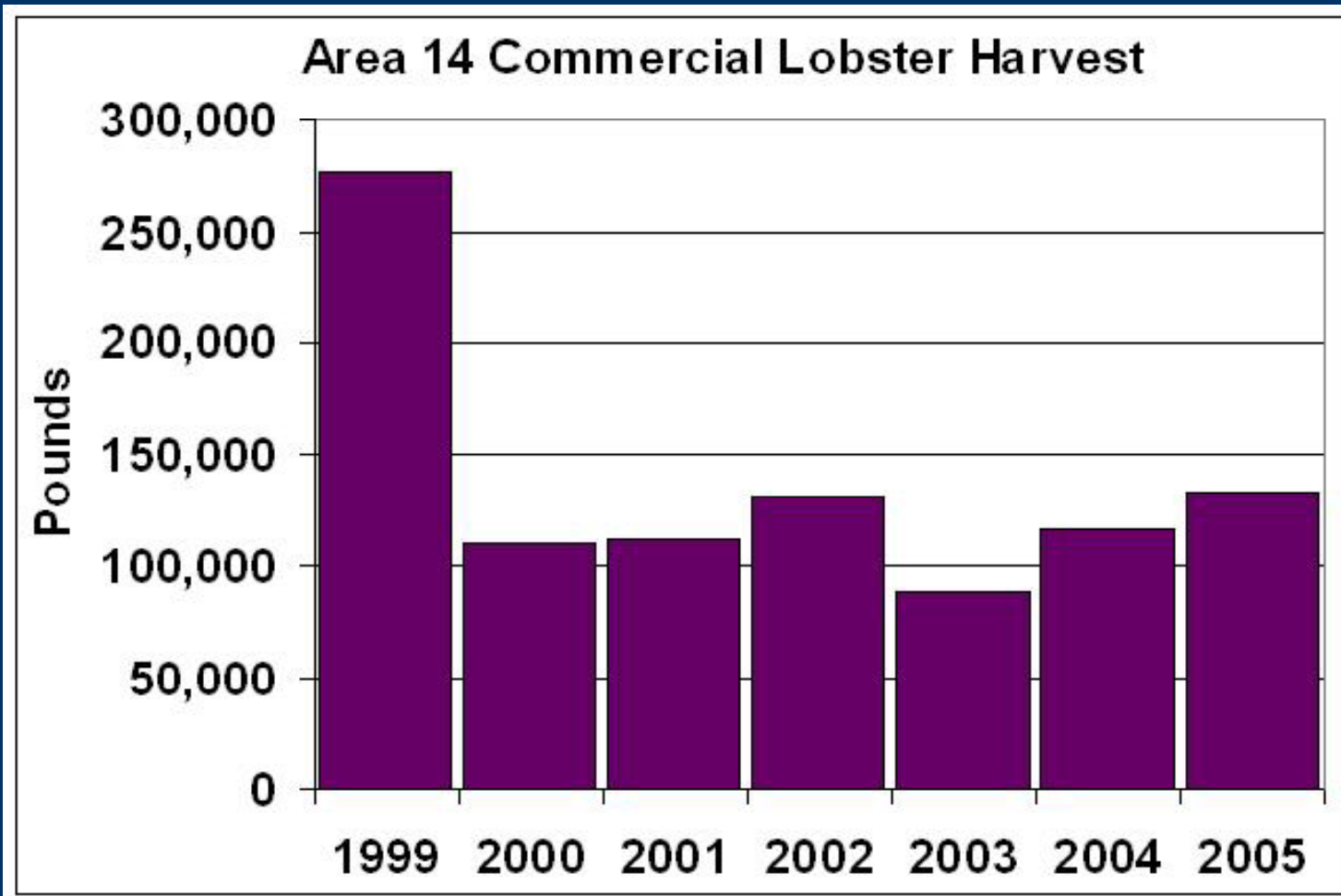
Quahog Trends



Oysters, Recreational

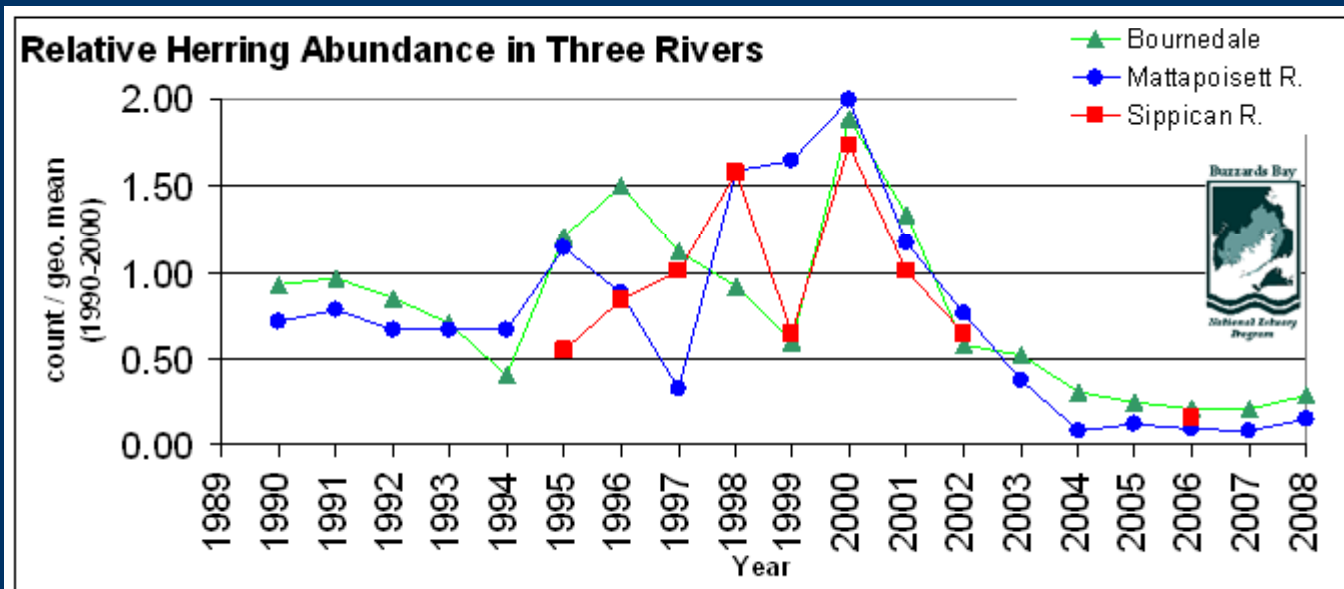
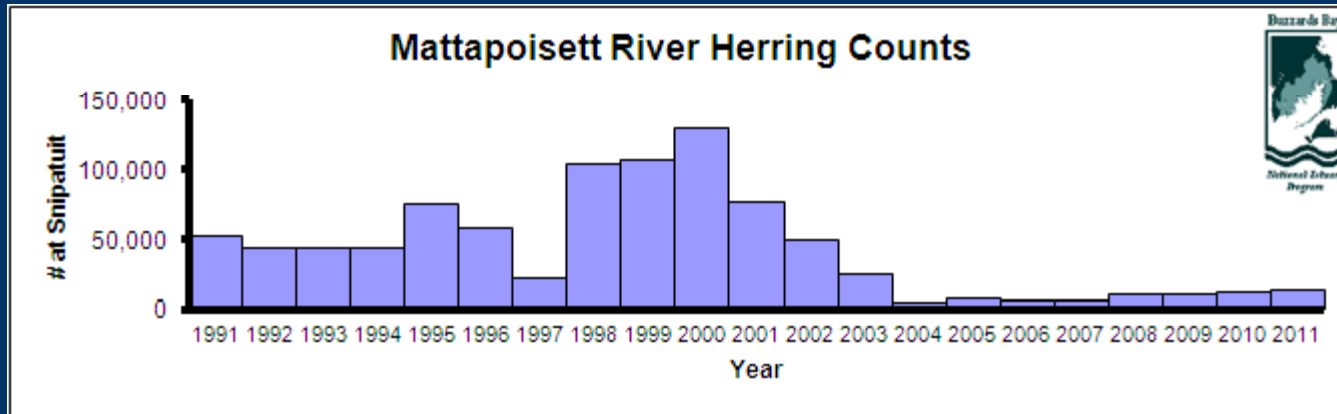


Lobster Catch Declining: Disease and warming temperatures could be a factor

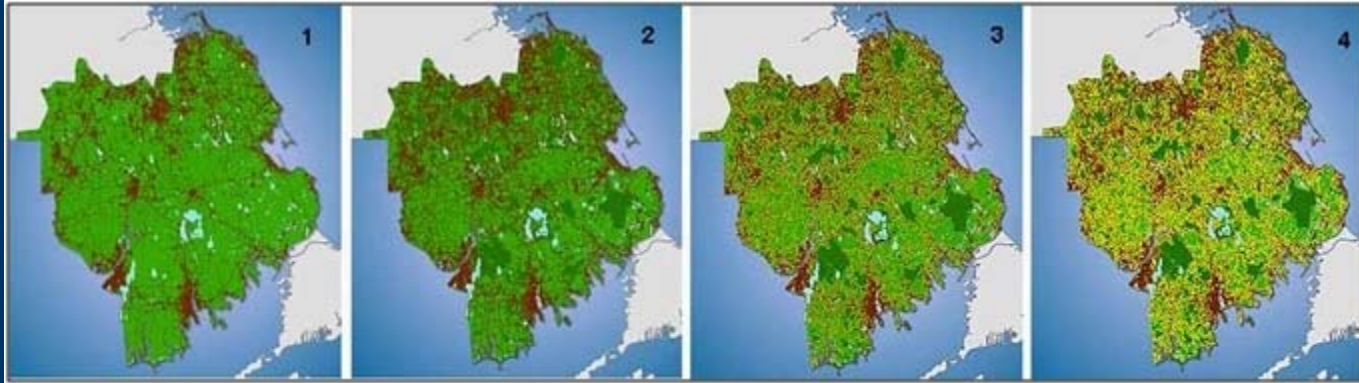


River Herring Declining: Offshore bycatch

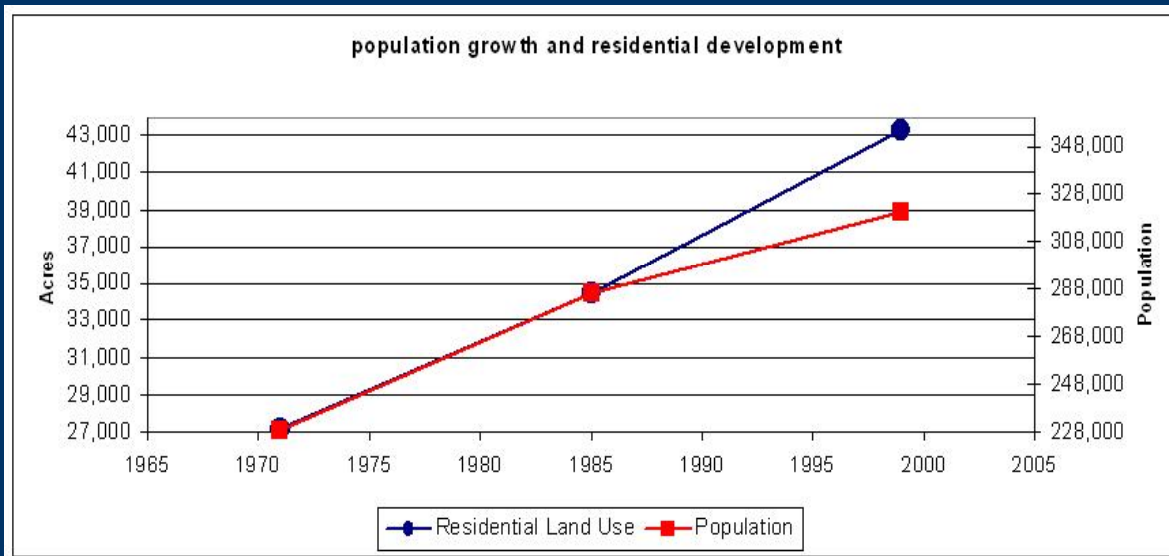
Blueback Herring (*Alosa aestivalis*)



Habitat Loss



30 Years of Land Use Change; Woods Hole Research Center www.whrc.org/new_england/SE_Mass/landcover.htm



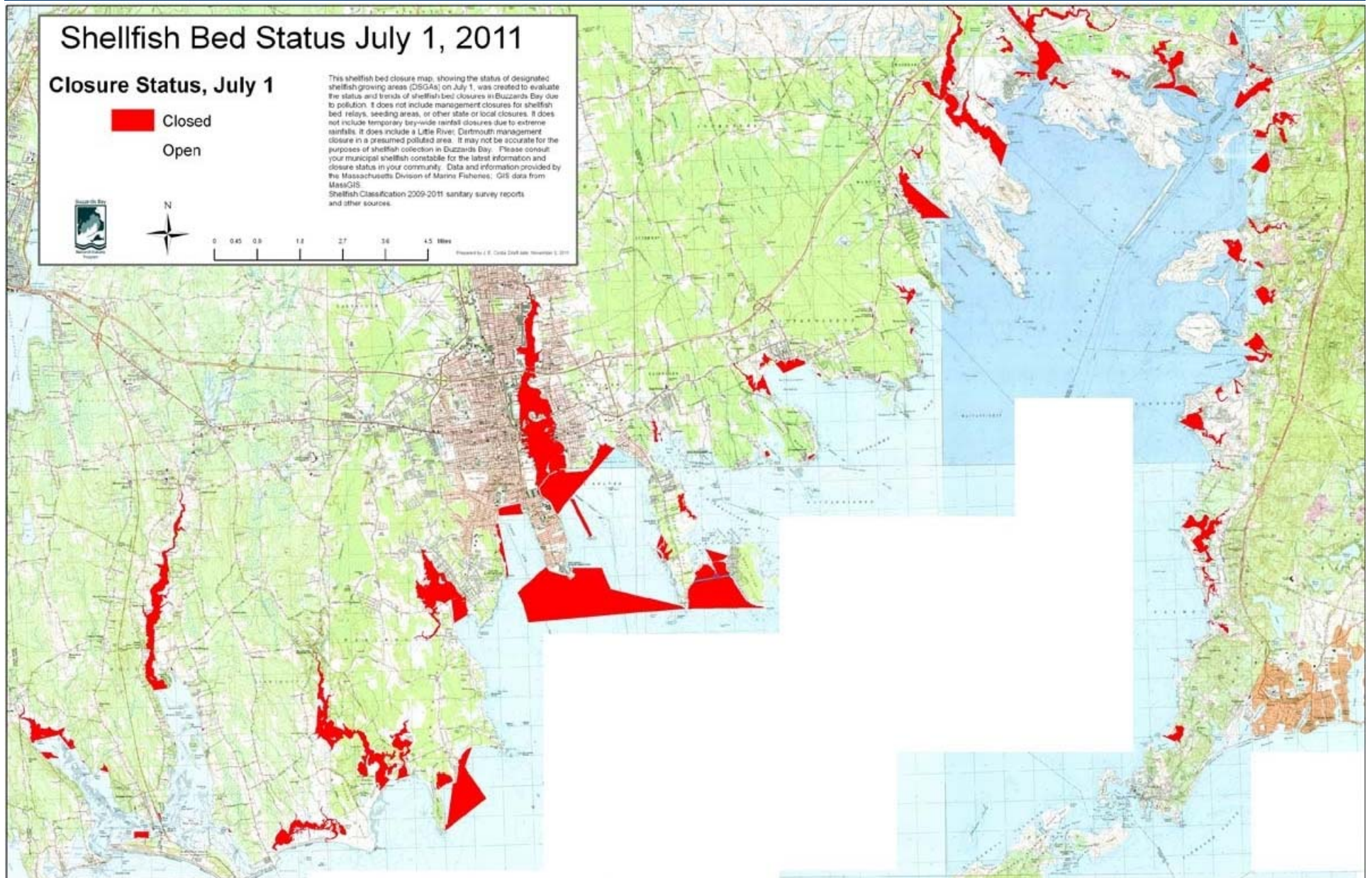
Forest Gains; Certain Wildlife



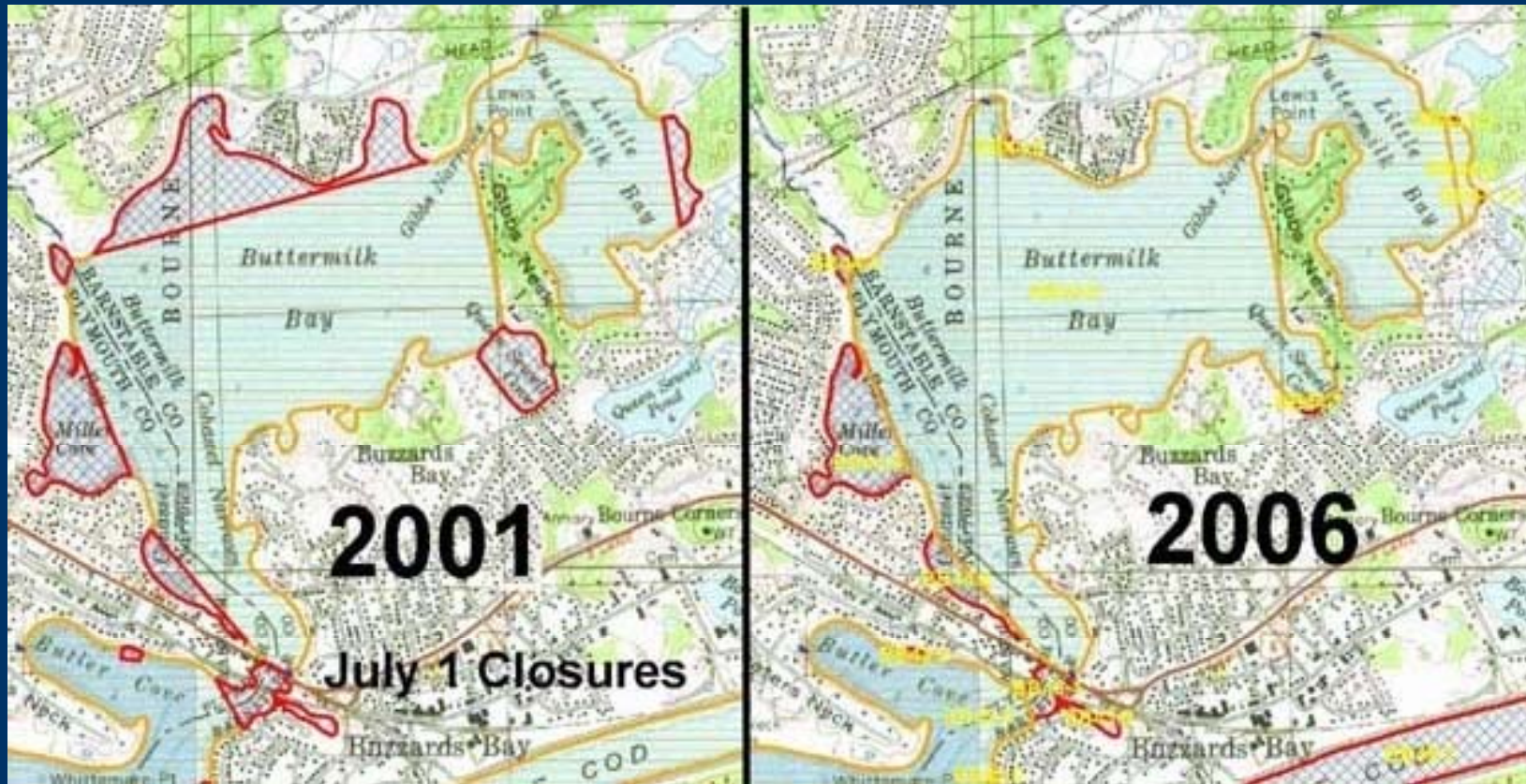
Wicked Local:
<http://www.wickedlocal.com/mattapoiset/fun/entertainment/dining/x353264590/BRIEFLY-Sept-9#axzz1kVfD6Eos>

Woods Hole Library

Shellfish Bed Closures 2011 status map

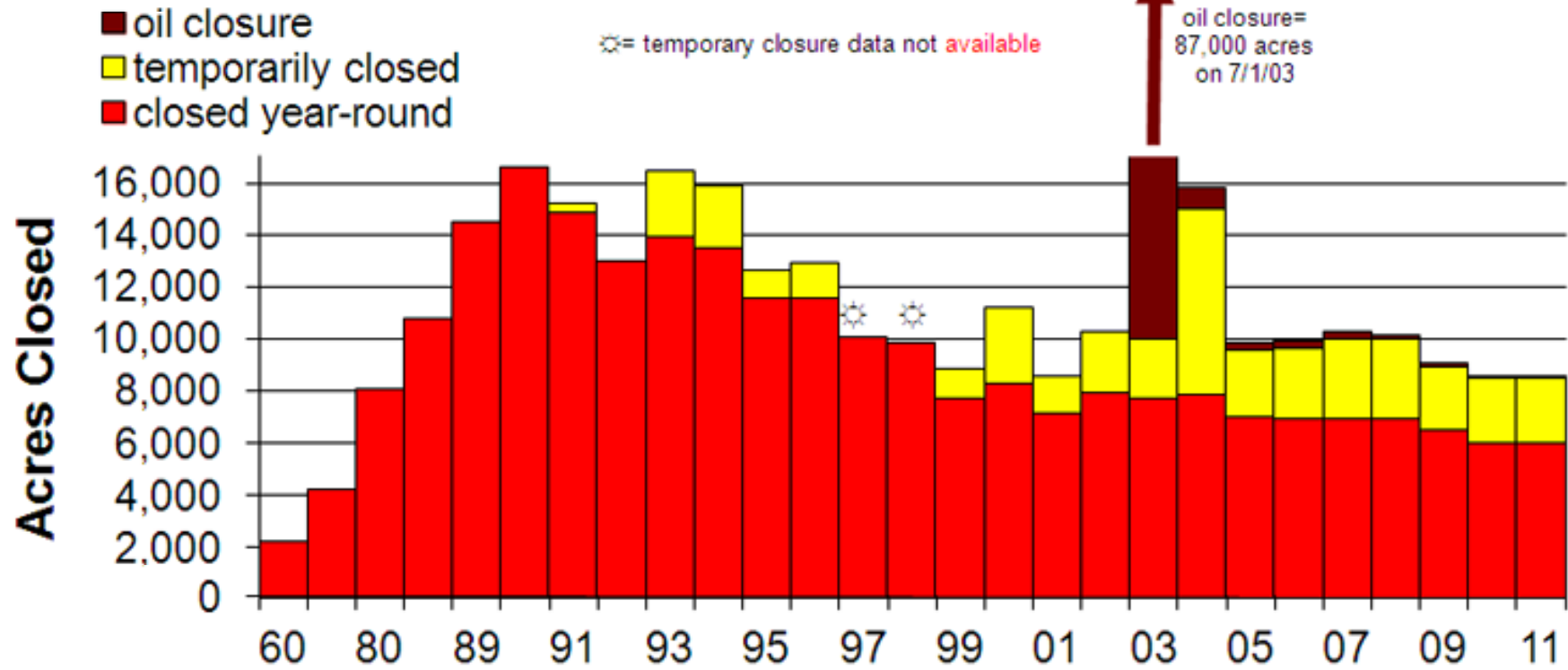


Shellfish Bed Closures : We are making progress



Shellfish Bed Closure Trends

Buzzards Bay Shellfish Closures



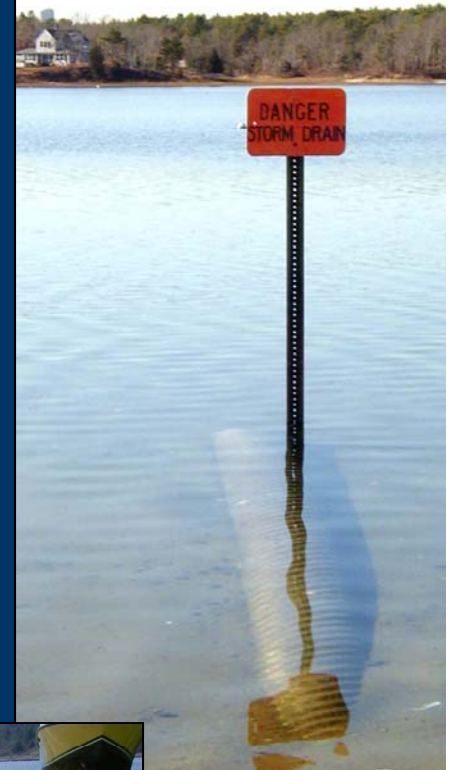
Clean Water Act and Stormwater

In 2001, EPA promulgated new rules implementing “Phase II of stormwater permits.

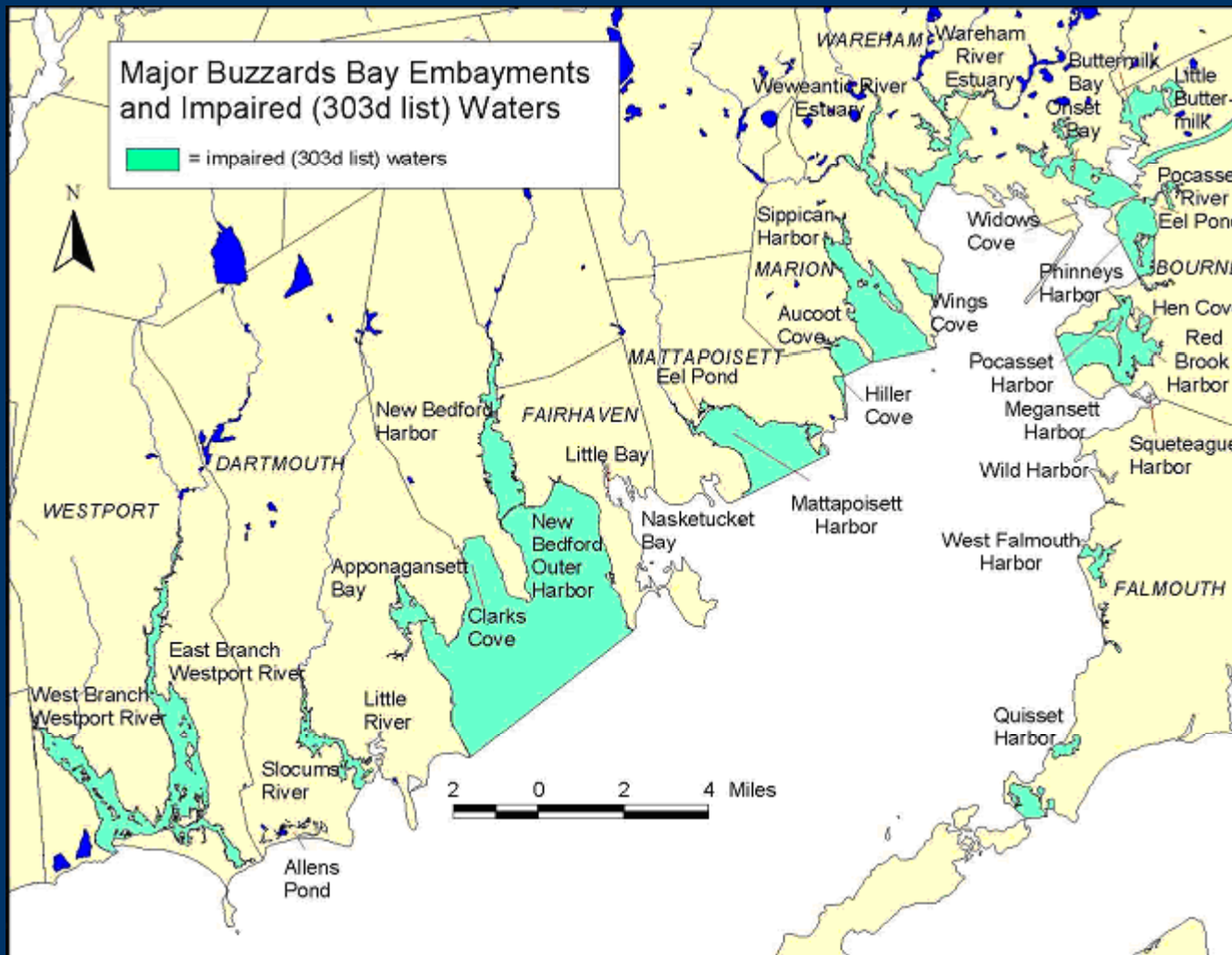
Phase I (1990) previously focused on regulating municipal stormwater systems in cities >100,000

Phase II would apply to any “urbanized area” as defined by the US Census.

In essence, EPA was converting unregulatable “non-point source” pollution into a regulated point source.



1987 Clean Water Act: TMDLs for impaired embayments, including impairments from NPS pollution



**Draft Bacteria TMDL for Buzzards Bay:
No Discharges above the resource action level**

Map: Bacteria impairments

Considerable focus on Nitrogen TMDLs, but the bacteria TMDLs will create new challenges for municipalities in their new MS4 General Permits likely to be issued in the next year.

FACES can help residents keep stormwater out of municipal drainage networks.



Will this massive effort pay off in restored waters?



1860 artist's concept of Gosnold's visit to New Bedford Harbor in 1602

We cannot return the environment to pristine conditions, but these ambitious programs and the billions of dollars needed to manage stormwater and NPS nitrogen could turn back the clock many decades. We have some very tough decisions to make.

END