Causes of Eelgrass Degradation and Jet-Clamming Issues

Presentation to the Bourne Shellfish Advisory Committee

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September 9, 2004

Additional Information at
www.BuzzardsBay.org

Buzzards Bay Comprehensive Conservation and Management Plan (CCMP)

Recommendation: All municipalities should adopt embayment or harbor management plans that identify watersheet uses for their entire coastline.

An embayment plan that effectively plans watersheet uses should identify resource protection areas and also designate dock-free zones, mooring areas, boat exclusion zones, boat speed limit zones, exclusion zones for hydraulic dredging (so-called "jet clamming"), and areas where dredging is permitted.

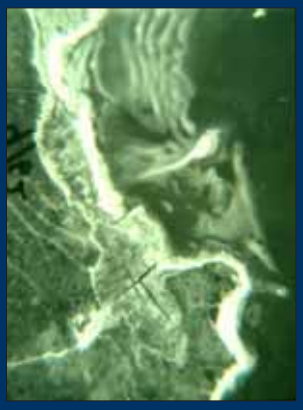
They should also specify times of year when construction or dredging are permitted so as to minimize ecosystem impacts. To effectively support such a plan, a municipality should document the distribution and abundance of shellfish beds, eelgrass beds, fringing marshes, spawning or migratory areas, nurseries, and any other valuable habitats. Only with this documentation and the plans in place will conservation commissions and harbormasters successfully deny activities that would adversely impact critical resource areas. Embayment and harbor plans should include representative public participation in all aspects of their development. Before plans developed by conservation commissions or harbormasters are used as the basis for decisions, these plans should be reviewed by residents of the municipality. These plans may also need to be adopted as town bylaws.

Some past work…

Costa 1988: PhD Thesis and 1988 EPA eelgrass report (Distribution, Production, and Historical Changes in Eelgrass Distribution in Buzzards Bay.)

Review of Nitrogen Loading verses eelgrass cover through the 1990s

Costa 1980s study…

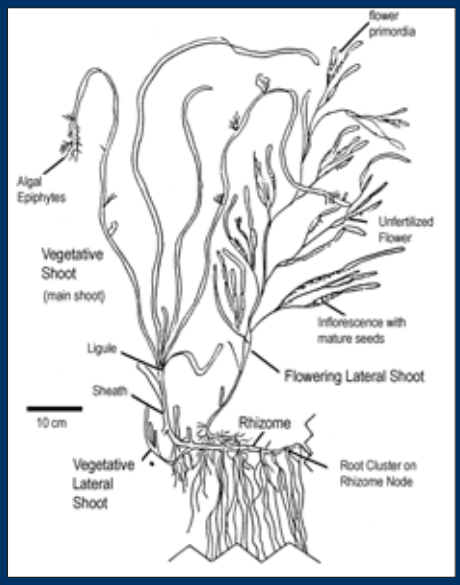


Documentation of existing distribution of eelgrass in Buzzards Bay and Historical trends at numerous sites. Above: West Island, Fairhaven.

Measurements of biomass, and rates of growth using the leaf punch method. Above: Collection of biomass. Above: Woods Hole, Falmouth site.

Collection of sediment cores to examine historical trends in eelgrass abundance over 3 centuries. Above: core from Apponagansett Bay, Dartmouth

Eelgrass 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.

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.

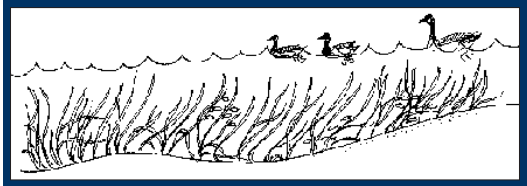
Benefits of Eelgrass

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

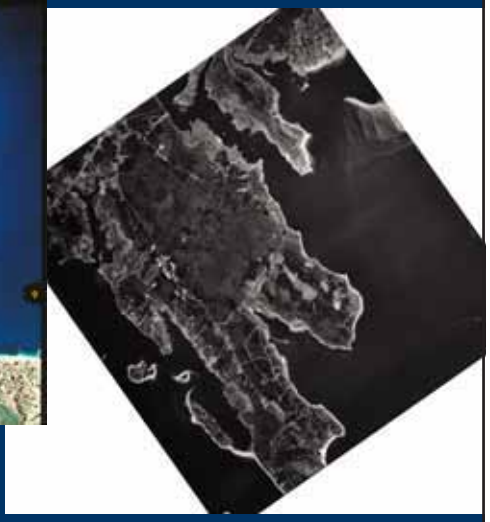
Examples: settlement of scallop spat, protection of molting blue crabs

Eelgrass Beds help stabilize the bottom; may slow erosion

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



Mapping Eelgrass: Primarily using aerial photographs, many surveys available…



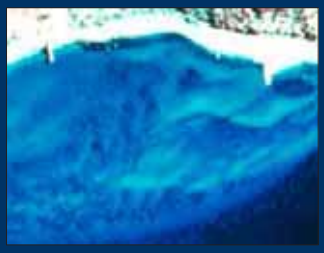
Mapping Eelgrass Difficulties

1) Photos need to be taken during calm period, low rainfall, and low tide

2) Photos need to be taken when "annual beds are fully established (June through October)

3) Photos should be taken during good water transparency (October, September, June)

4) Algal covered rocks, "drift" algae, *Codium*, salt marsh peat can be misidentified.



Comparison of March 1991 survey (top) to October 1981 survey (bottom). Beside the shape and location of the the beds changing over 10 years, notice the March bed density is far less than the October coverage.

Eelgrass Surveys

Two major surveys have been completed for Buzzards Bay.

- The Costa 1980s survey (based on aerials and field surveys largely between 1980 and 1985.
- The DEP survey using 1996 aerial photographs.
- A new survey based on 2002 aerials is expected to be released soon by DEP

One problem with 1996 DEP survey was that the aerials were taken too early in growing season, and many annual beds difficult to see or not established. The photograph below of the entrance of West Falmouth harbor shows the two surveys superimposed on a April 1, 2001 aerial photograph. This aerial survey had exceptional water transparency. Both the 1980s and 1990s survey overlooked the deep beds further offshore.

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.

Historical Distribution and recovery during wasting disease recovery

1) Only a few percent of eelgrass beds survived the wasting disease, mostly in deep offshore areas of BB

2) In Buzzards Bay, moderate recovery in 1940s to mid 1950s, but greatest expansion during the period 1955-1965

Area off Great Neck, Wareham

1951 1956 1961

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.

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)

Causes of Eelgrass Loss– Mooring Chains

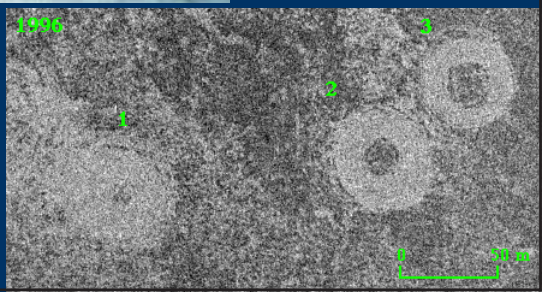
Photograph from shoal near Provincetown. Source: MassGIS 2001 ortho coverage

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.

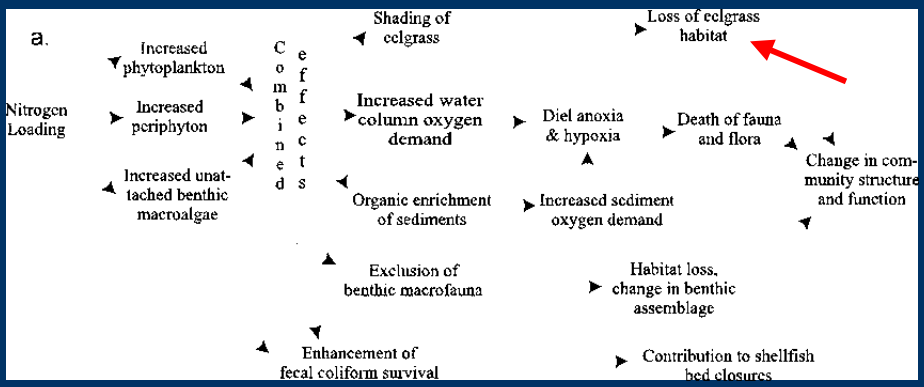
Right: Scars from hydraulic clamming for Soft Shell Clams in Chesapeake Bay eelgrass beds. Scale bar is 160 feet.

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– Nitrogen Loading / Coastal Eutrophication



More Nitrogen >>

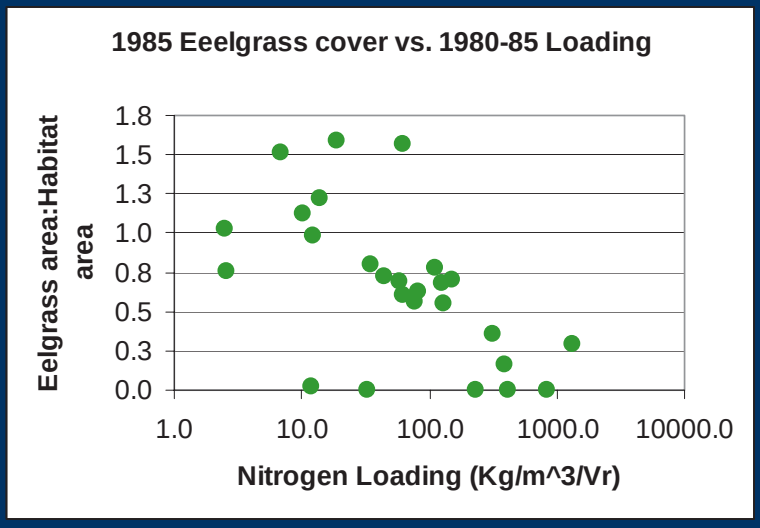
More Algae (less light) >>

Less Eelgrass

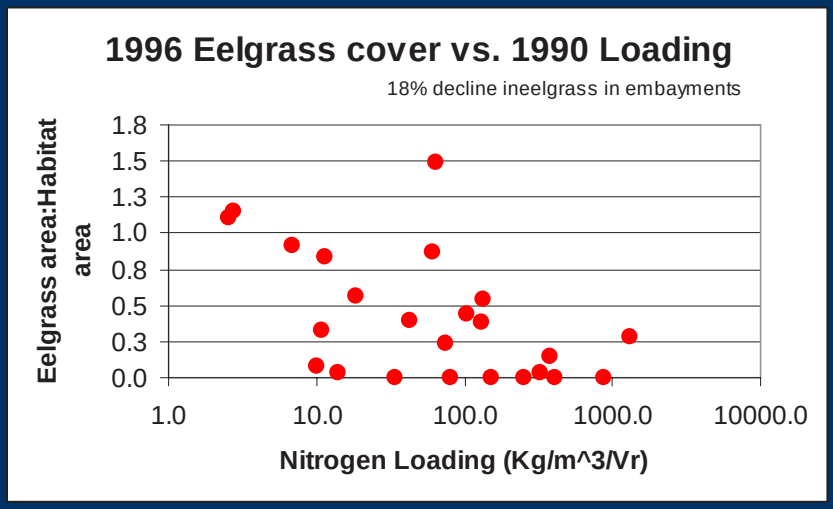
The Problem with Nitrogen

Eelgrass bed in area with good water quality (top left) compared to eutrophic sites.

Eelgrass Cover versus Nitrogen Loading



Eelgrass Cover versus Nitrogen Loading



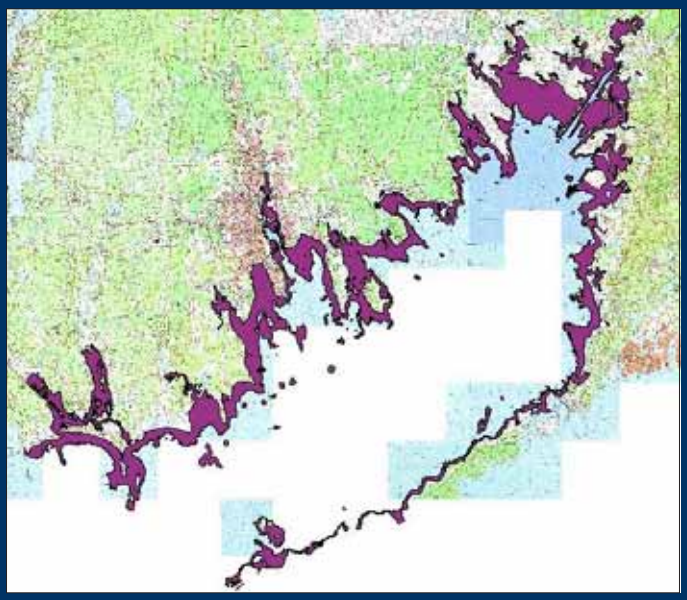
Hypothesized Eelgrass circa 1600

Assumptions:

Eelgrass grew to 12 ft. MLW in upper Buzzards Bay, down to 20 feet MLW in lower Buzzards Bay.

Half of the area between MLW and these boundaries were assumed to actually have eelgrass

Hypothesized Eelgrass circa 1600

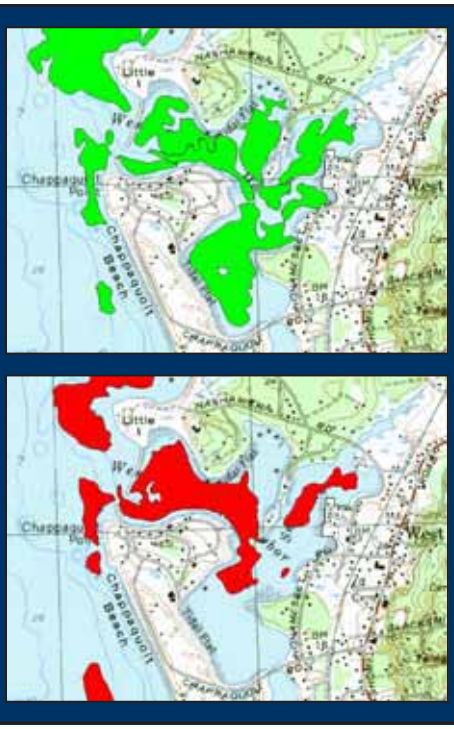


COSTA 1980s Survey

DEP 1996 Survey

1980s vs 1996 Surveys

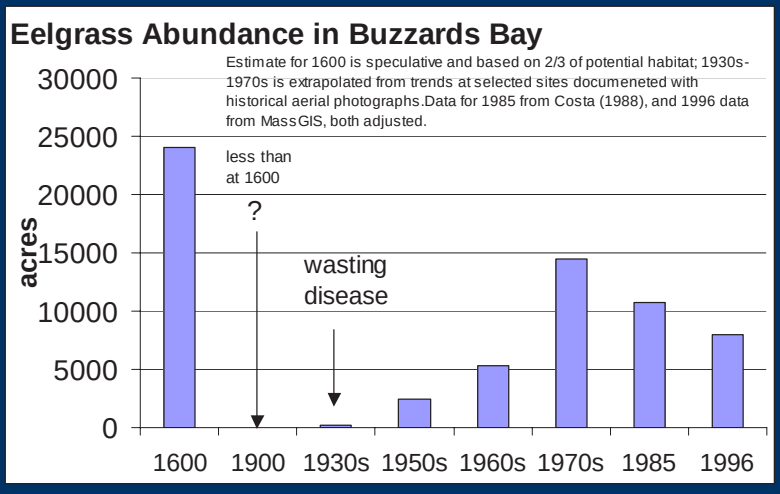
Expansion continued in 1970s and 1980s, but new declines began in areas of heavy development



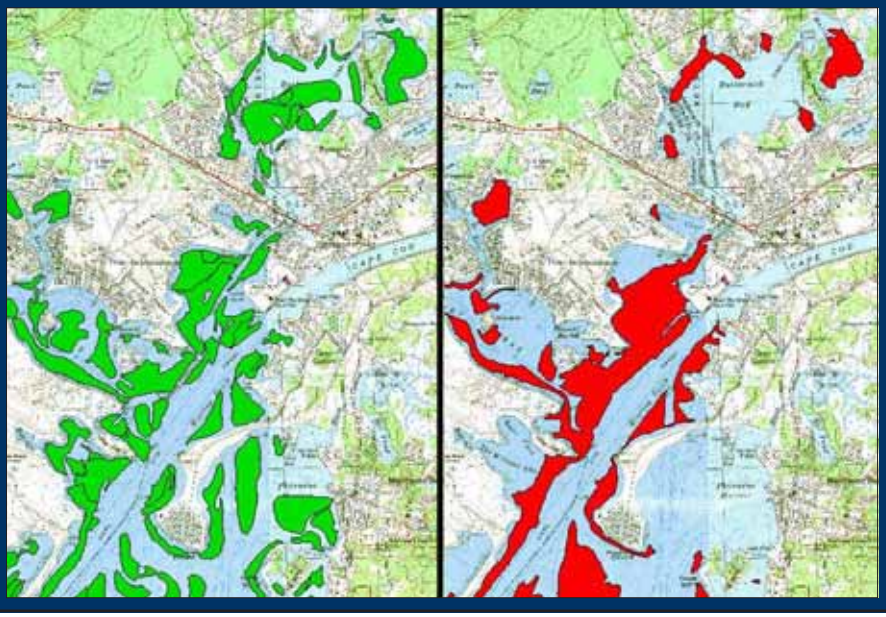
Expansion continued in 1970s and 1980s, but new declines began in areas of heavy development

New Bedford is the only site of major recovery from pollution

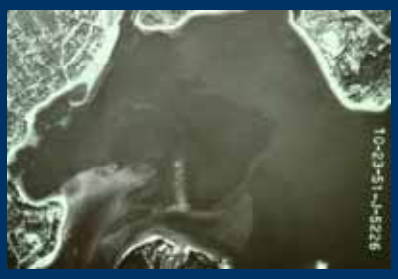
Historical Summary



Bourne Historical Changes: 1980s vs. 1996

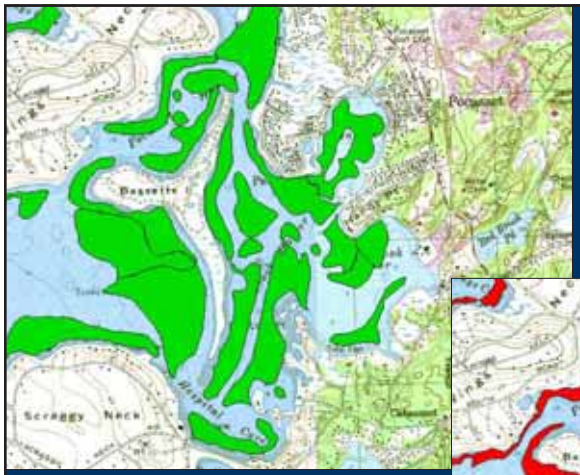


Bourne Historical Changes 2 (Buttermilk Bay)



October 1951

October 1994



1980s

Bourne Historical Changes 3

1996

1994

Bourne Historical Changes 4

2001

The “Hay Field” flat

Bourne Historical Changes 5

Buttermilk Bay
April, 2001

Bourne Historical Changes 6

Bourne "Jet-Clamming" Issues

(hydraulic harvesting of shellfish)

Bourne is the only town around Buzzards Bay that allows hydraulic harvesting of soft-shelled clams.

Only one other Town on Cape Cod allows the practice shellfishing: Barnstable on the South Side.

Two Town's on the Cape allow hydraulic harvesting for shellfish grants.

DMF allows hydraulic dredging in deeper waters for Ocean Quahogs and Surf Clams, but excludes the practice from most of Bourne's outer waters

Hydraulic Dredging Techniques

Different hydraulic clamming techniques used in US, Europe, & elsewhere.

Some small scale techniques are used in very shallow nearshore areas:

- Bourne, Barnstable Mya (Soft Shell Clam) Fishery
  (hand held units, fisherman in water with rake)
- Pacific Northwest Geoduck Clam fishery
  (hand held units, diver in water hand taking clams)

Some are intermediate scale operations and utilize conveyor belt systems:

- Maryland Chesapeake Bay Mya Fishery
- European *Cardia* (Cockle) Fishery)

Some are large scale hydraulic dredging operations:

- Ocean Quahog and Surf Clam harvesting in MA and elsewhere

Scientific Literature on Hydraulic Dredging Impacts has mostly focused on

larger types of ocean quahog and surf clam harvesting equipment, and…

Photograph taken from www.njscuba.net.

….and intermediate scale hydraulic dredging operations for the Chesapeake Bay and South Carolina *Mya* soft-shell Fishery.

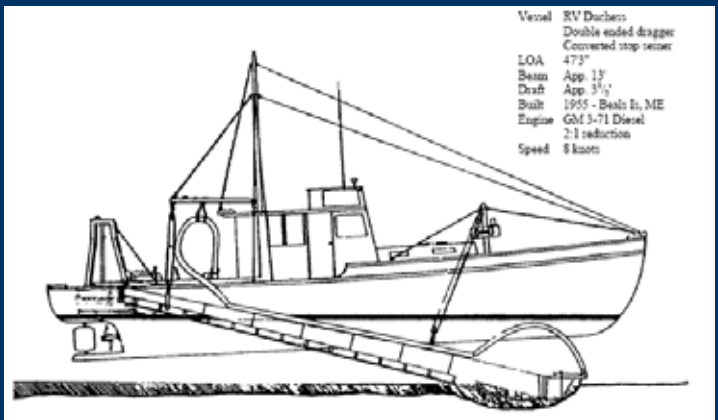
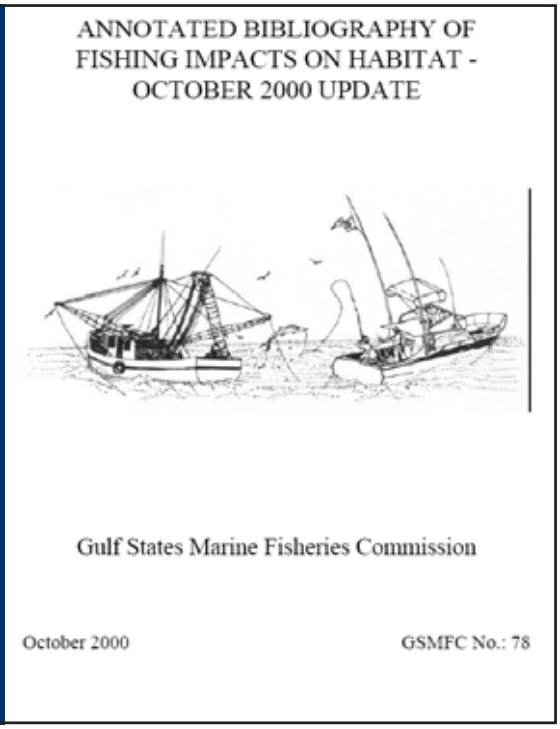


Figure 1a. The schematic details of the hydraulic escalator dredge mounted on a Maine Department of Marine Resources research vessel (from Matheson and DeRocher, 1974).

Various Bibliographies have been compiled on fishing impacts to natural resources.



Regulatory Outcomes

Washington State Geoduck Clam Fishery, Maryland:
No fishing in eelgrass beds with Hydraulic Equipment

Model Dock and Pier Zoning approach in Marion

BB CCMP: "An embayment plan that effectively plans watersheet uses should identify resource protection areas and also designate dock-free zones, mooring areas, boat exclusion zones, boat speed limit zones, exclusion zones for hydraulic dredging (so-called "jet clamming"), and areas where dredging is permitted."

At the request of the Marion Marine Resource Committee, the Buzzards Bay Project developed maps of natural resources and applied scoring criteria based on values adopted by the committee members.

Marion Dock and Pier Case Study

not idealized, but a real world example

Regulatory Context:

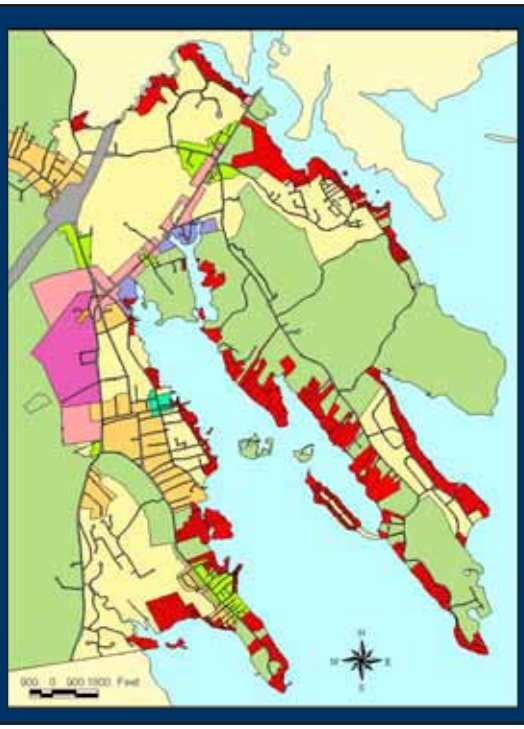
Eight years ago, the Town of Marion adopted a land zoning bylaw that limited the construction of docks on non-conforming lots as follows:

The zoning law said you can build a dock, provided:

"4. The zoning map does not designate the area as a no pier construction zone. [no designations made]

5. The lot for which the permit is sought fully conforms with the current area and frontage requirements for the district in which it is located."

-Section 7.4.5 Accessory Piers (Marion Zoning Bylaws)



Impetus:
Four years ago the Town of Marion down zoned. This effectively prohibited new dock construction over large areas

Current Dock Prohibition

Based on lot size and road frontage, over 55% of the Marion water front is closed to new pier construction.

The situation is politically untenable, so the Marine Resource Commission wanted to develop a rational on dock exclusion based on protection of natural resources.

Base Dock & Pier Decision-Making on Natural Resources

Resources evaluated for CRITERIA RANKING:

- Eelgrass
- Quahogs
- Soft Shell Clams
- Razor Clams
- Diamond-backed Terrapin (habitat)
- Oysters
- Bay Scallops
- Swimming Beaches

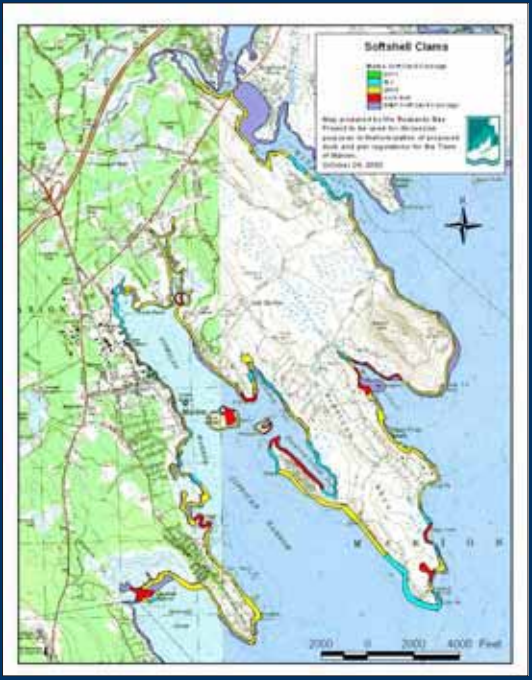
Eelgrass & Scallops

Sources were;

DMF for Scallops

DEP/Costa for Eelgrass

MSD for Scallops & Eelgrass



Soft shell Clams

Sources were:

DMF & Marion Shellfish Department (MSD)

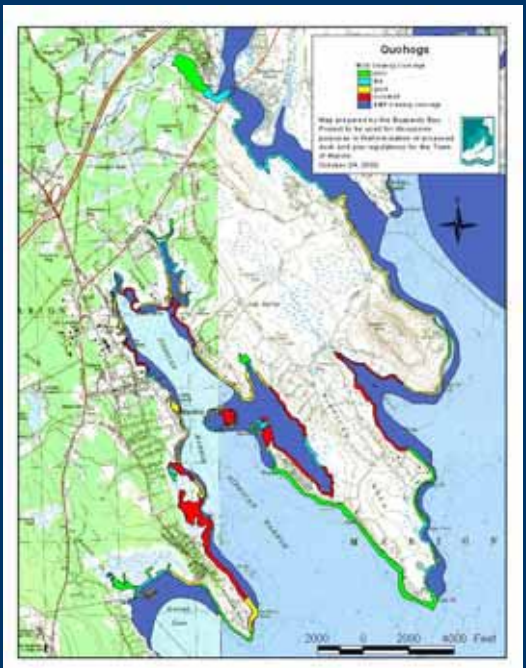
MSD rated areas:

Poor

Fair

Good

Excellent



Quahogs

Sources were:

DMF & Marion Shell Department (MSD)

MSD rated areas:

- Poor
- Fair
- Good
- Excellent

Oysters

Sources were:

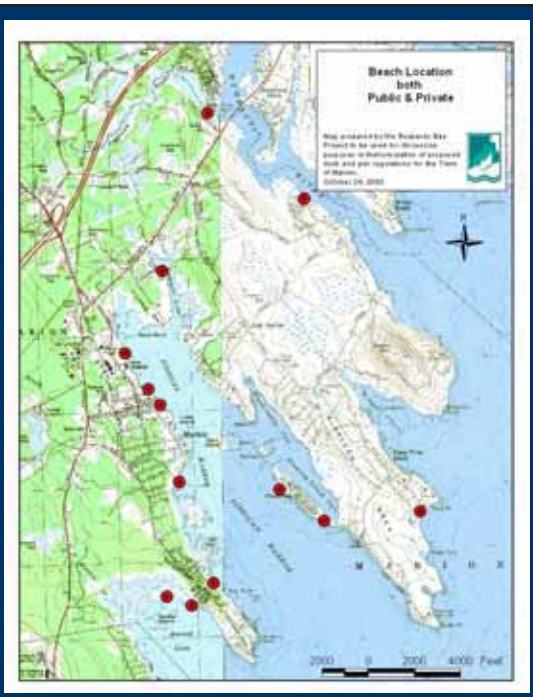
DMF & MSD

MSD rated areas:

- Poor
- Fair
- Good
- Excellent

Razor Clams

Diamond-Backed Terrapin



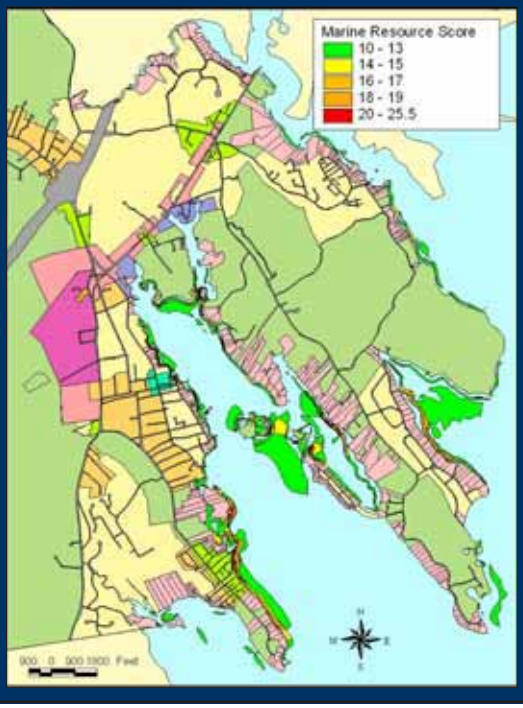
Public and semipublic Swimming Beaches

Proposed: No dock within 150 feet of a swimming beach, but rejected.

Current dock prohibition resulting from the based on most recent zoning changes

Zoning is generally based on a public purpose.

Zoning laws are extremely difficult to overturn in court, but zoning board of appeals can easily overturn zoning prohibitions.

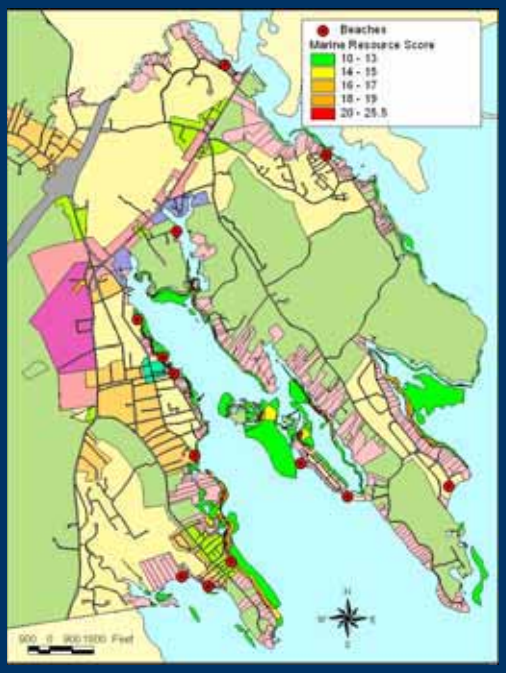


Marine Resource Area Scores

Possible scores:
0 (least important sites)
to 25.5 (most important)

Results were to aid decision making, not to define the decision making. Final decisions are policy decisions based on many factors.

Marine Resource Area Scoring Details



Beaches and Docks

Beaches were not scored, but were a factor in placing final exclusion zones.

50 foot setback proposed from existing docks.

Proposed No Pier Construction Areas

Draft 1 developed by Marine Resource Commission after consideration of BBP analysis

No Pier Construction Zone Final Draft

Goes to Marion's (open) fall Town Meeting for a vote by residents.

Relevance to Bourne:
Try using a similar strategy.

Jet ski exclusion zones?

Dock exclusion zones?

Jet Clamming Exclusion Zones?

Possible Criteria:
- Distance from shore
- Natural Resources
- Depth of water or depth MLW
- Consideration of poorly flushed areas
- Existing eelgrass beds