

Eelgrass Trends in MA



MassDEP
1 Winter Street
Boston, MA

Our Seagrass Beds



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MA DEP Eelgrass Mapping and Monitoring Program

- ❖ Commenced 1994
- ❖ Complete Statewide Mappings 1995 and 2001
- ❖ Mapping of most stressed embayments 2006-07 and continuing on regular basis into future (major flight scheduled for 2009)
- ❖ Commencement of Optical Water Quality sampling and biological monitoring 2004 - present



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Mapping Methods

- ❖ **Acquire high resolution aerial imagery to the specifications of the NOAA-C-CAP program**
- ❖ **Photointerpret imagery**
- ❖ **Conduct fieldwork as required to verify photointerpretation**
- ❖ **Record field data**
- ❖ **Geo-reference analogue data to state digital map base**

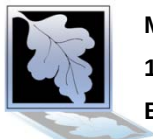
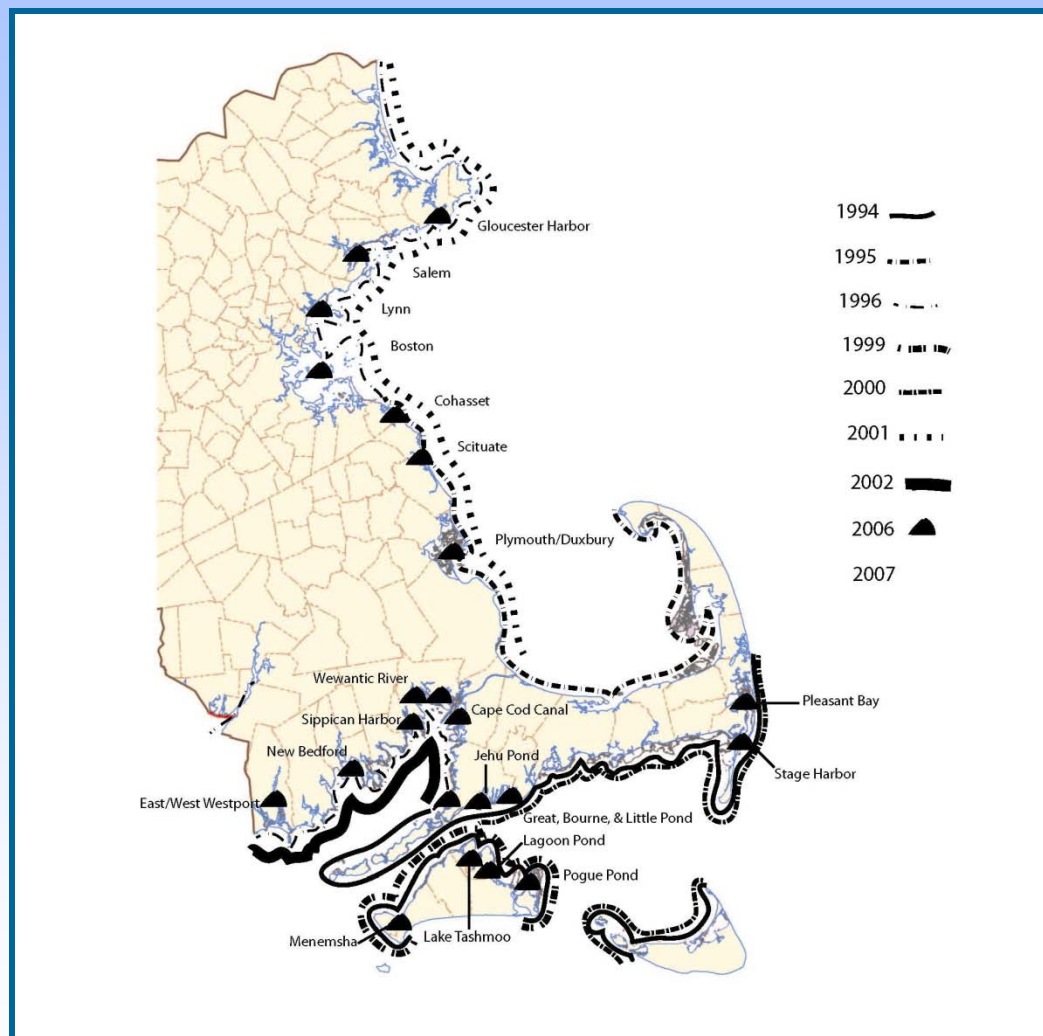


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Aerial Imagery
1:20,000 Scale or
0.5 -0.25m Resolution Digital
Low Tide Low Sun Angle



DEP Seagrass Aerial Photo Missions



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Field Boat Console



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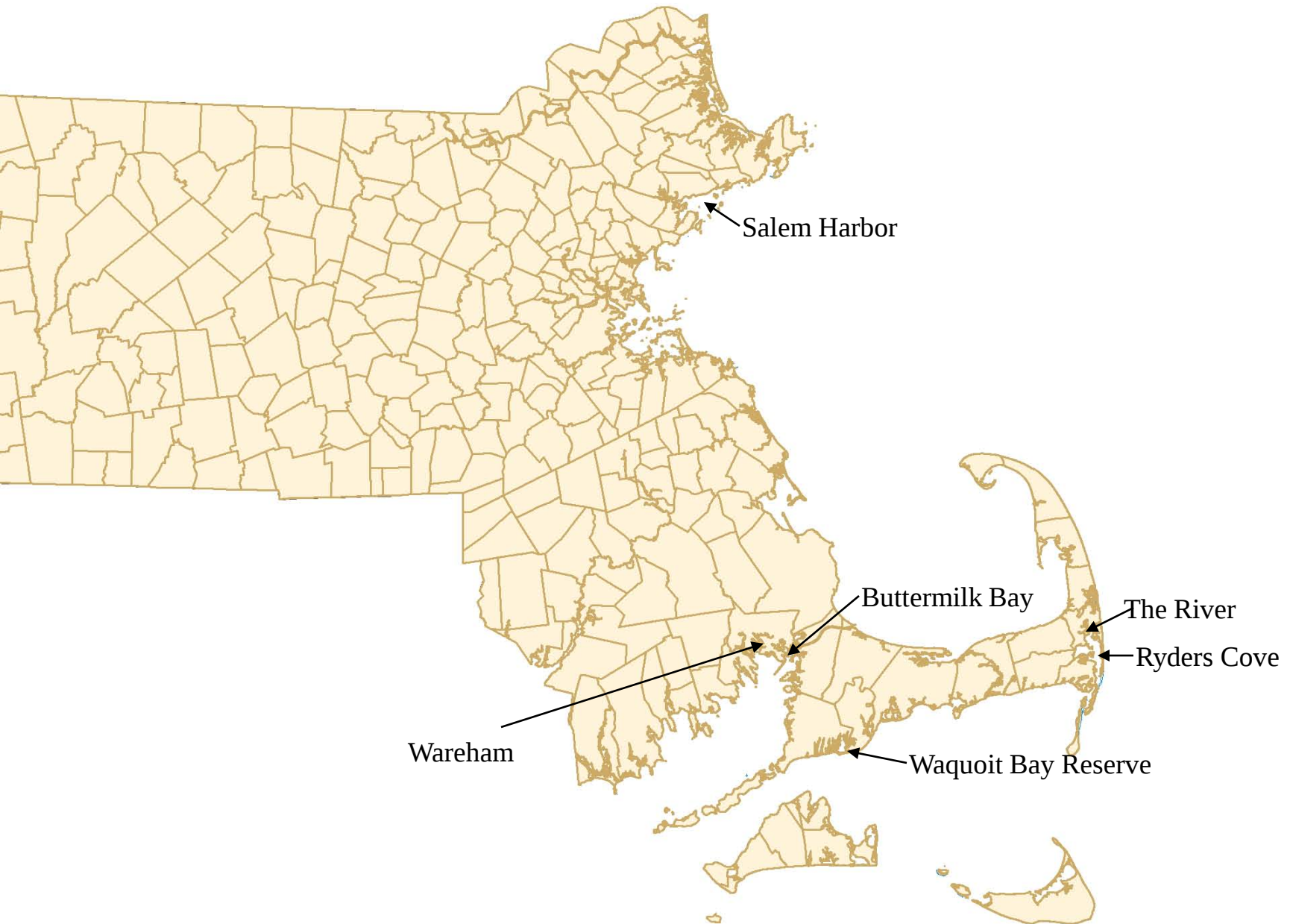
Efficient Observer



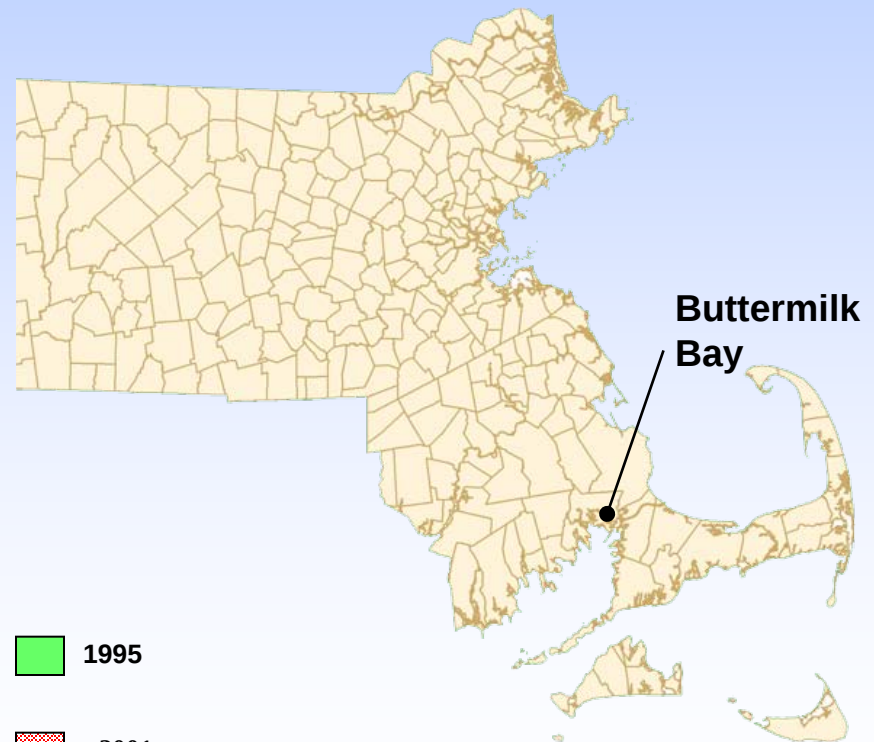
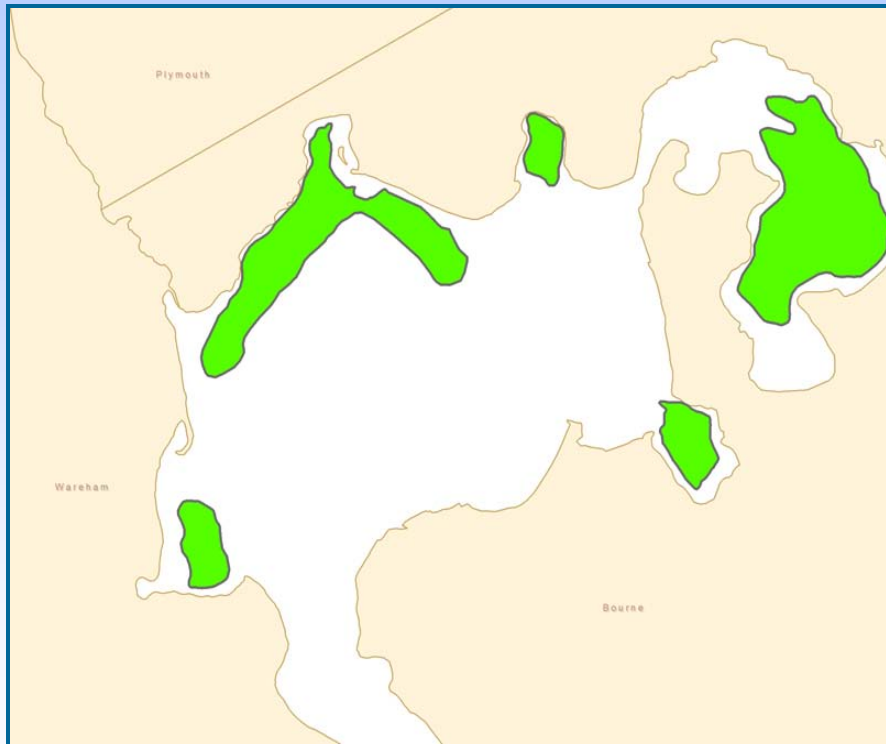
Underwater Video Camera System



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Buttermilk Bay -- The First Alarm --94.6 acres



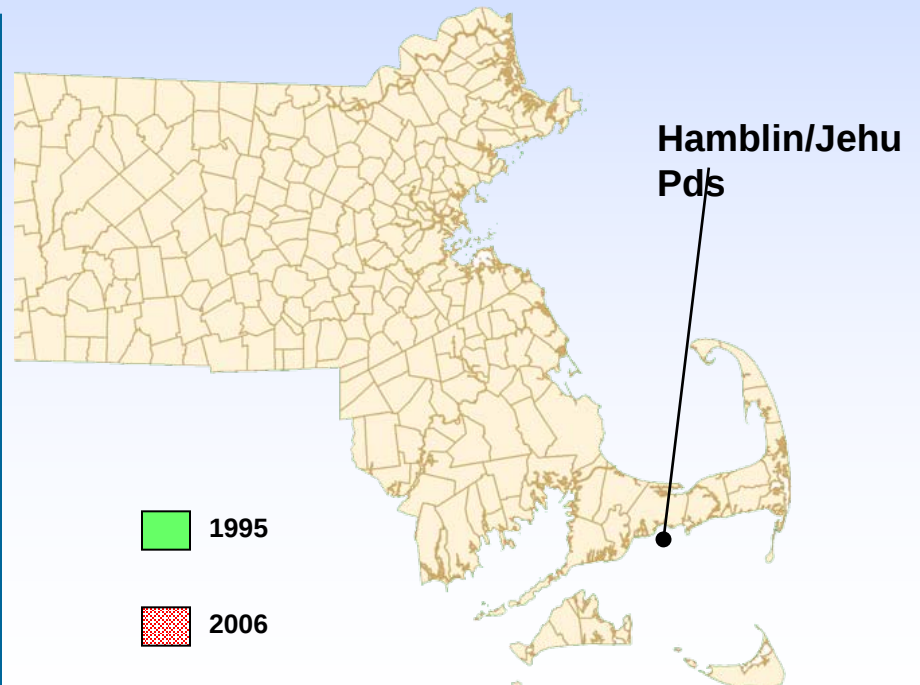
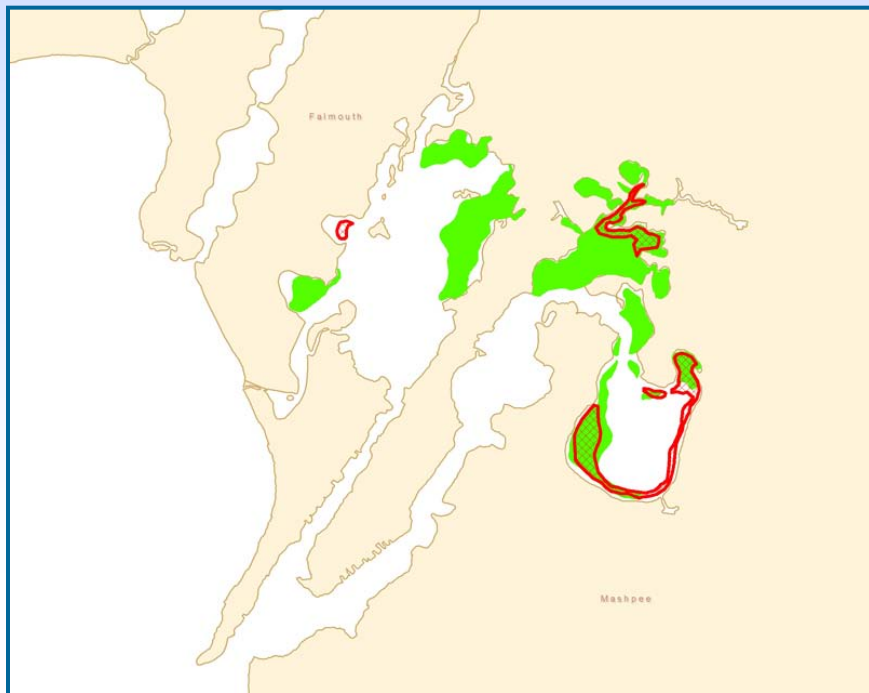
1995

2001

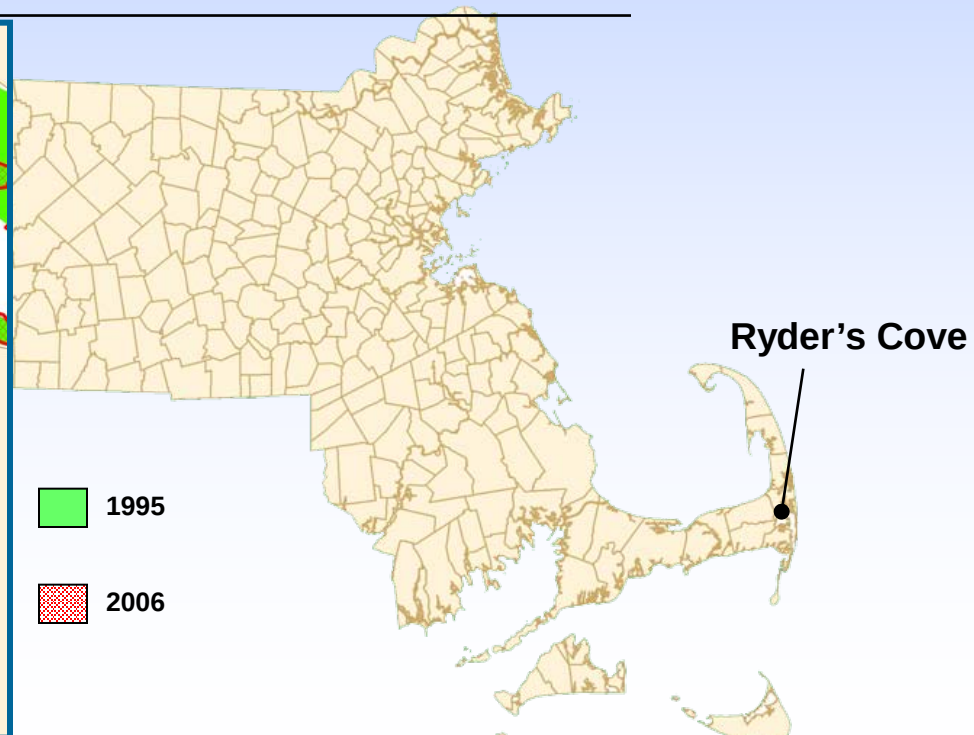
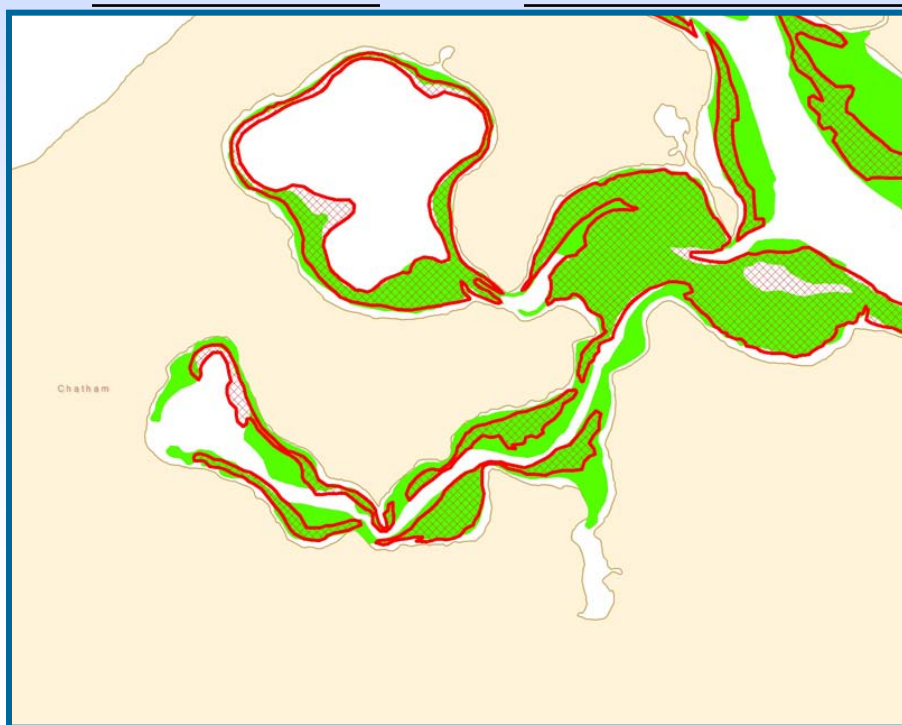


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LOCATION	REGION	ACRES MAPPED				ACRES CHANGE	% CHANGE	RATE (%/y)
		Initial Year	Baseline	2001	2006	Initial - Final		
Hambln/JhuPds&Grt/LitRs	S. Shore	1994	73.91	17.2	14.92	-58.99	-79.81	-6.65
Lower Pleasant Bay	S. Shore	1994	1288.98	1,170.64	1,075.15	-213.83	-16.5	-1.37
Morris Island	S. Shore	1994	170.87	142.51	155.77	-15.1	-8.84	-0.73
RydersCove/Crow/Bassing	S. Shore	1994	158.86	119.15	124.11	-34.75	-21.87	-1.82
Stage Harbor System	S. Shore	1994	261	161.53	155.93	-105.07	-40.26	-3.35
Upper Pleasant Bay	S. Shore	1994	299.89	188.63	182.03	-117.82	-39.29	-3.27
Waquoit Bay	S. Shore	1994	25.29	14.7	0	-25.29	-100	-8.33



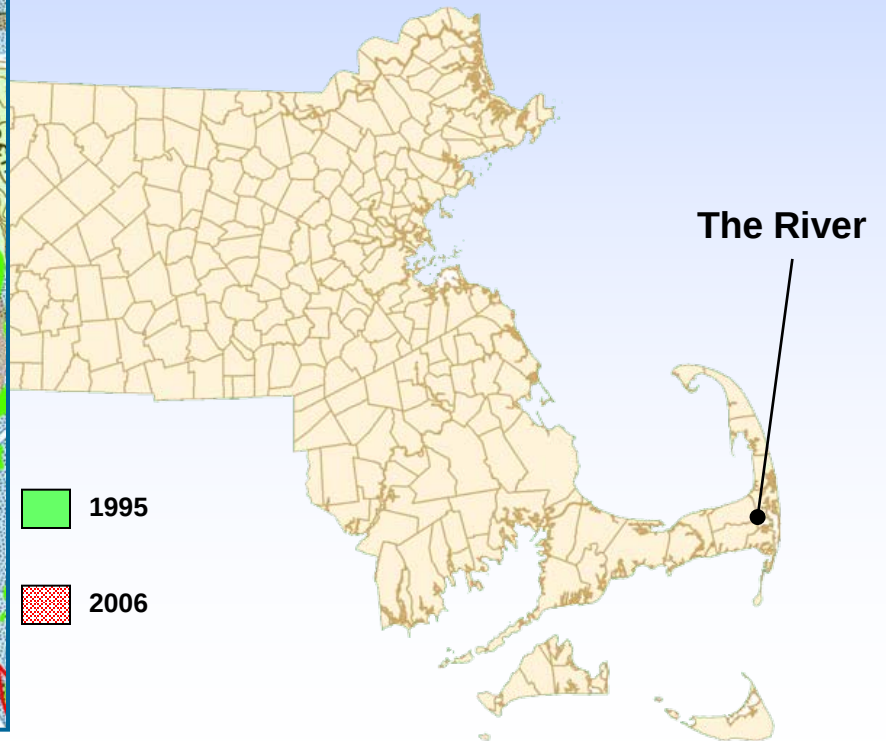
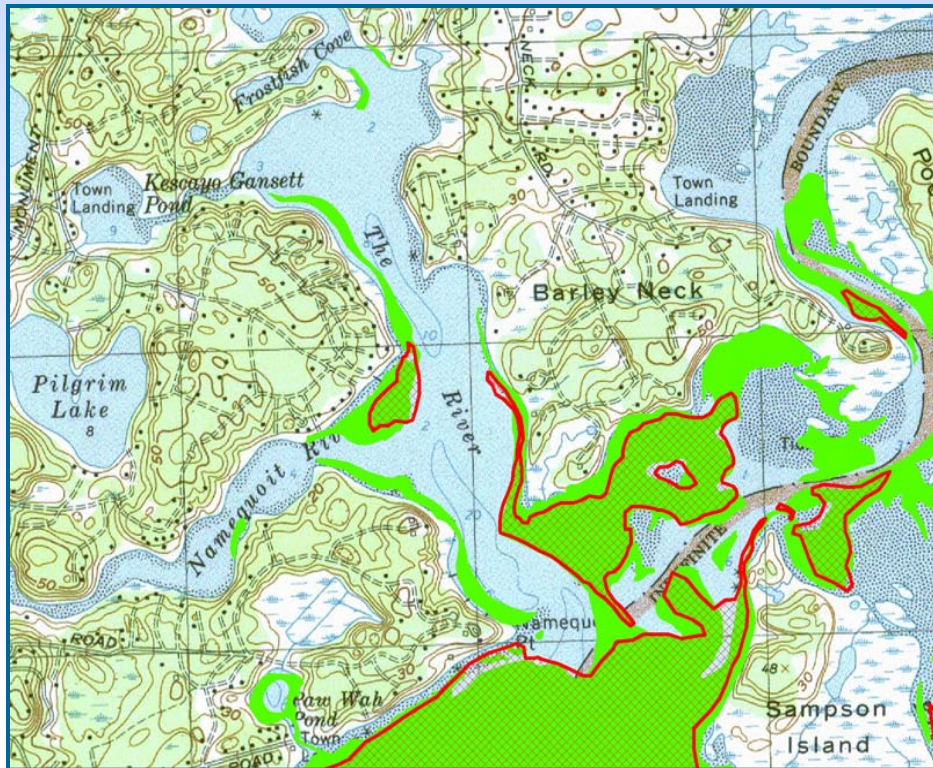
LOCATION	REGION	ACRES MAPPED				ACRES CHANGE	% CHANGE	RATE (%/y)
		Initial Year	Baseline	2001	2006	Initial - Final		
Hambln/JhuPds&Grt/ LitRs	S. Shore	1994	73.91	17.2	14.92	-58.99	-79.81	-6.65
Lower Pleasant Bay	S. Shore	1994	1288.98	1,170.64	1,075.15	-213.83	-16.5	-1.37
Morris Island	S. Shore	1994	170.87	142.51	155.77	-15.1	-8.84	-0.73
RydersCove/Crow/B assing	S. Shore	1994	158.86	119.15	124.11	-34.75	-21.87	-1.82
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Waquoit Bay	S. Shore	1994	25.29	14.7	0	-25.29	-100	-8.33



Eelgrass Mapping Areas

1995 45.3ac

2006 16.0ac





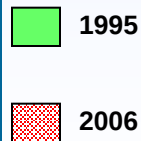
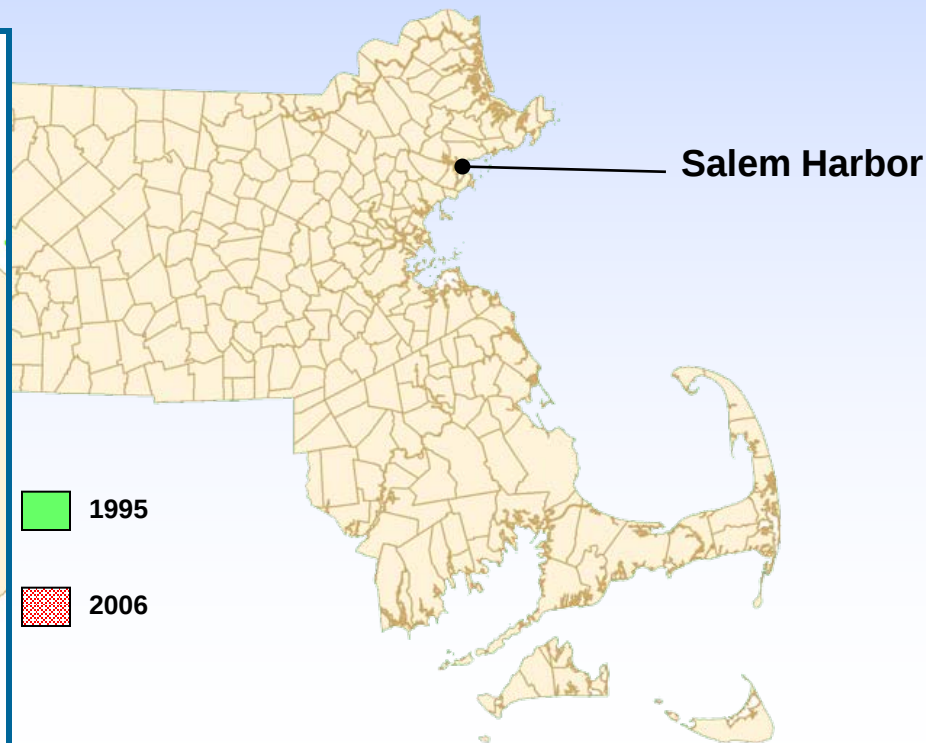
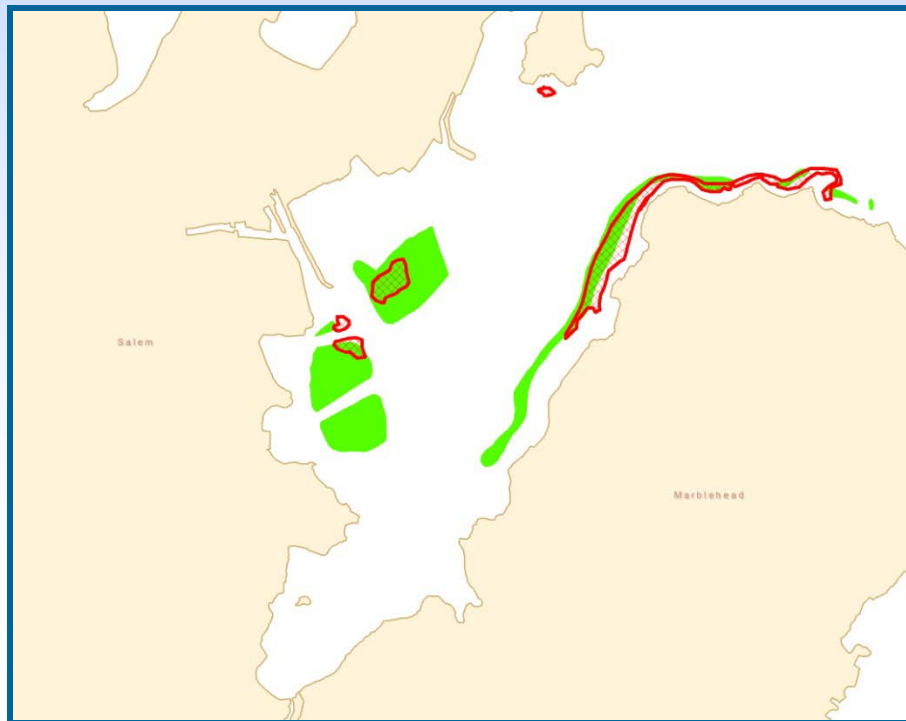
The River

Site of Breach

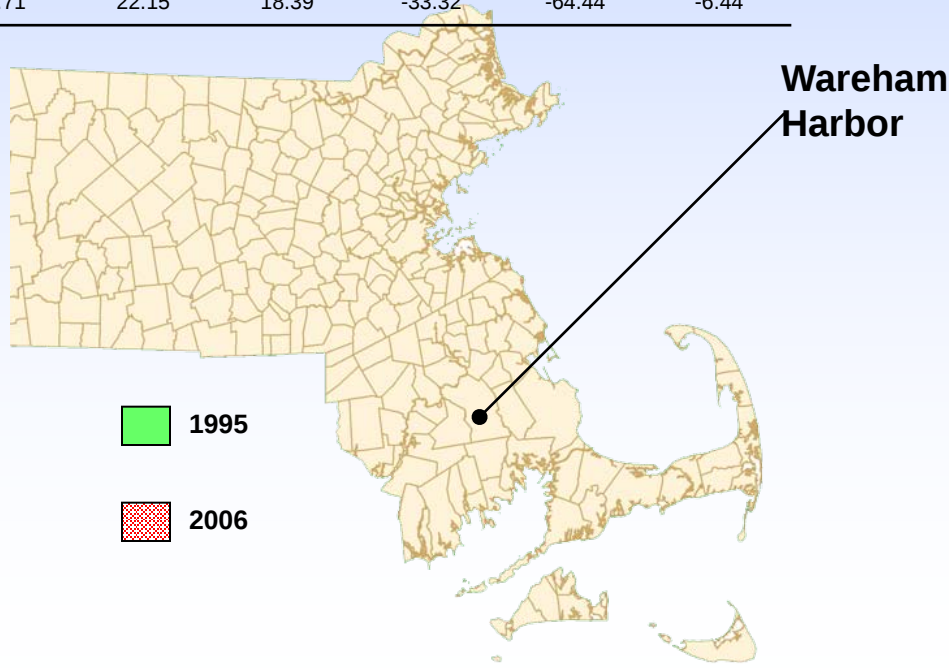
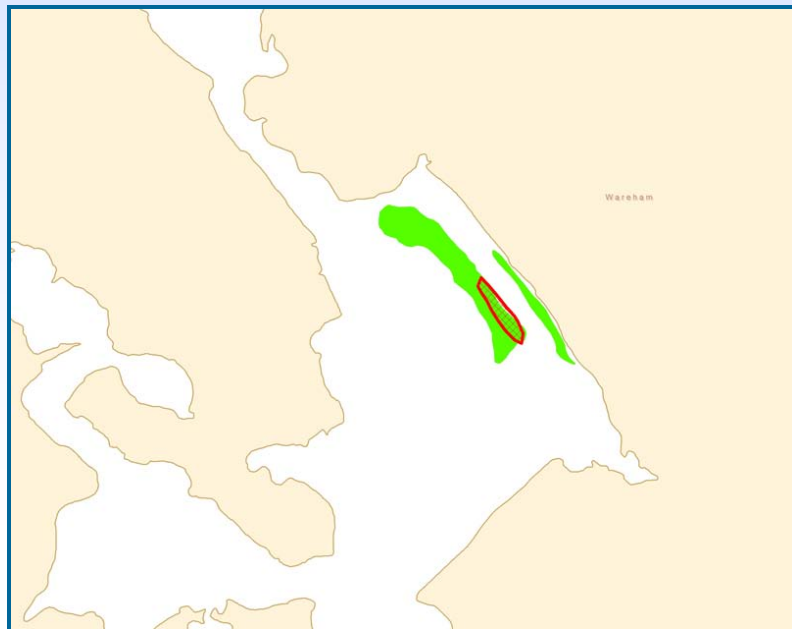


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LOCATION	REGION	ACRES MAPPED				ACRES CHANGE	% CHANGE	RATE (%/y)
		Initial Year	Baseline	2001	2006	Initial - Final		
Boston Harbor	N. Shore	1996	201.33	66.64	116.27	-85.06	-42.25	-4.22
Cohasset Harbor	N. Shore	1996	112.71	117.48	111.99	-0.73	-0.64	-0.06
Duxbury\Plymouth Harbors	N. Shore	1995	2,249.32	1,958.17	1,909.52	-305.64	-13.5	-1.24
Gloucester Harbor	N. Shore	1996	45.84	37.13	59.6	13.76	30	3
Lynn Harbor	N. Shore	1996	715.18	640.49	672.16	-43.01	-6.01	-0.6
Salem Harbor	N. Shore	1996	103.61	19.06	31	-72.61	-70.08	-7.01
Scituate Harbor	N. Shore	1996	11.97	10.32	10.3	-1.67	-13.92	-1.39



LOCATION	REGION	ACRES MAPPED				ACRES CHANGE	% CHANGE	RATE (%/y)
		Initial Year	Baseline	2001	2006	Initial - Final		
Cuttyhunk Harbor	Buzz. Bay	1994	13.25	ND	31	17.75	134	11.16
Hadley Harbor	Buzz. Bay	1994	55.48	ND	52.87	-2.61	-4.71	-0.39
Inner Sippican Harbor	Buzz. Bay	1996	158.79	100.07	80.48	-78.31	-49.32	-4.93
New Bedford Outer Hbr	Buzz. Bay	1996	105.59	100.82	121.88	16.2	15.2	1.54
Pocasset Harbor	Buzz. Bay	1996	41.35	36.29	30.82	-10.52	-25.45	-2.54
Quisset Harbor	Buzz. Bay	1996	51.72	44.4	36.38	-15.35	-29.67	-2.97
West Cape Cod Canal Area	Buzz. Bay	1996	390.4	243	232.28	-158.13	-40.5	-4.05
West Falmouth Harbor	Buzz. Bay	1996	55.72	50.09	50.6	-5.11	-9.18	-0.92
Westend Pond	Buzz. Bay	1996	3.1	ND	1.34	-1.76	-56.77	-5.68
Westport R-E&W Branch	Buzz. Bay	1996	677.04	465.71	513.23	-163.82	-24.2	-2.42
Wild Harbor	Buzz. Bay	1996	20.53	17.39	13.48	-7.05	-34.34	-3.43
Wareham Harbor	Buzz. Bay	1996	11.22	2.54	2.2	-9.02	-80.39	-8.39
Weweantic River	Buzz. Bay	1996	51.71	22.15	18.39	-33.32	-64.44	-6.44



-Comprehensive Report –

In Preparation for Publication

TWELVE YEAR MAPPING AND CHANGE ANALYSIS OF EELGRASS (*ZOSTERA MARINA*) DISTRIBUTION IN MASSACHUSETTS (USA) IDENTIFIES STATE WIDE DECLINES

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I. INTRODUCTION

Massachusetts has approximately 2400 km of coastline, extending from the eastern border of Rhode Island Sound (71° 7' 13.9938" N, 41° 29' 50.3952" W) north to the state line of New Hampshire (70° 48' 57.5136" N, Long 42° 52' 19.3512" W), including a series of large offshore islands along the south coast and numerous smaller islands distributed throughout the state (Fig. 1). The Elizabeth Island chain forms the southeastern boundary of Buzzards Bay. Martha's Vineyard, Nantucket and Monomoy partially enclose the waters of Nantucket and Vineyard Sounds protecting the south shore of Cape Cod from the open waters of the Atlantic Ocean.



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On-Going MDEP-Smithsonian Cooperative Project

2008 Progress

Optical WQ Monitoring to calibrate a MA optical modeling tool

Relationships between inherent optical properties and water quality parameters needed to calibrate a bio-optical model are emerging from the measurements.

Project will complete its second and final year in FY2009

Delineation and Characterization of the Deep Edges of Eelgrass Meadows in 5 Embayments in SE MA

Accurately measured outer eg bed depth in 5 embayments to within 0.1 m relative to the National Geodetic Survey Mean low low water North American Vertical Datum (NAVD88)

Biological Sampling in the 5 study sites captured the following: canopy cover measure, shoot density, shoot morphology, (including leaf length, leaf width, and canopy surface area) and sediment samples for analysis of sediment grain size (sieving technique) and organic matter content (by combustion)



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Biological Monitoring



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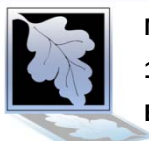
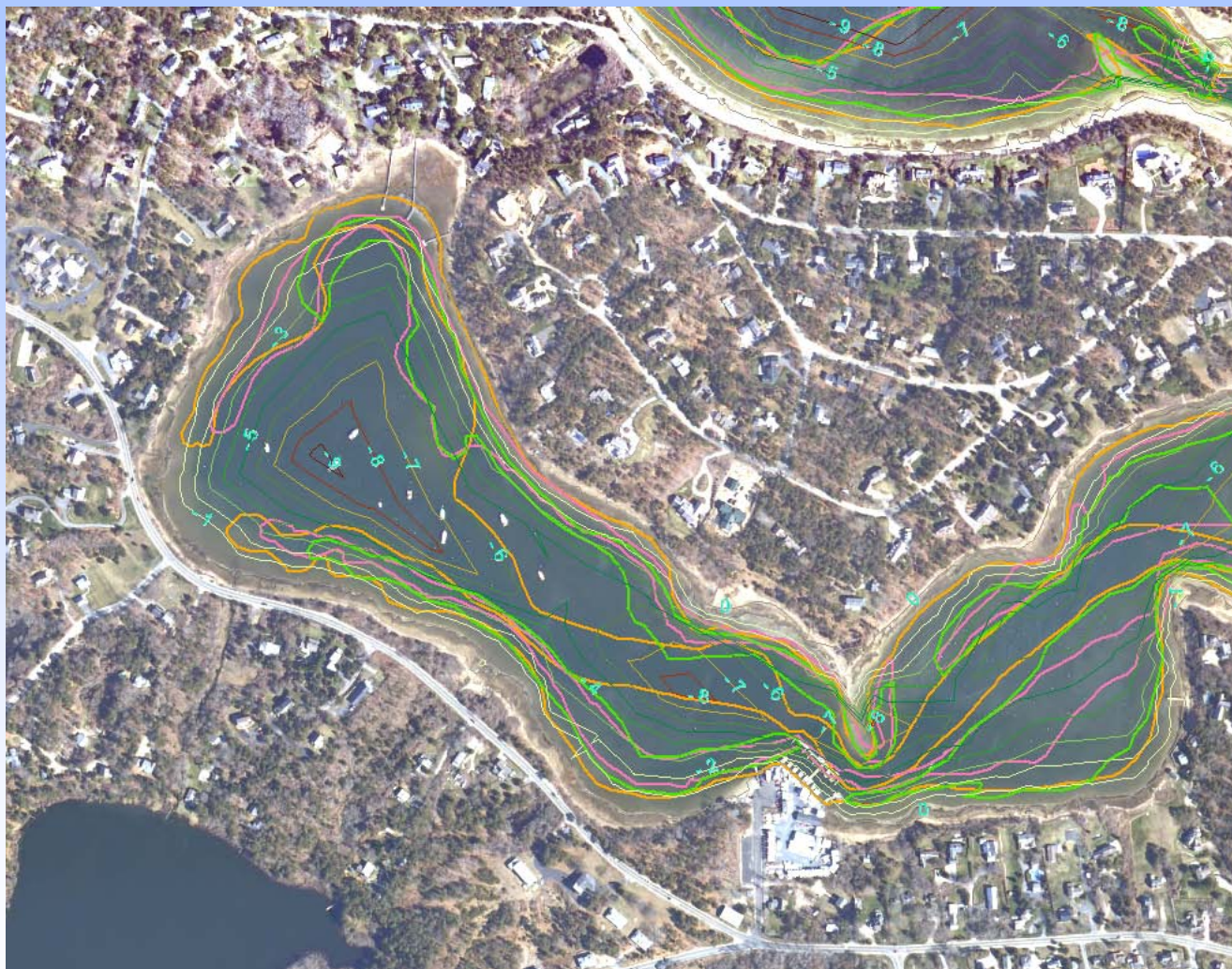
Ryder's Cove, Chatham



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Raw Bathymetric Points obtained from UMD SMAST Partners

Ryder's Cove, Chatham



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Application of Bathymetry and EG Coverage

Future Objectives

- ❖ **Integrate EG Project with MEP**

Capture Baseline EG Data concurrent with implementation of MEP remediation

- ❖ **Finalize Calibration of Bio-Optical Model (need Bathymetry...)**

- ❖ **Plan future mapping to detect changes**

- ❖ **Select “focus areas of interest” where changes are occurring (both positive & negative) creating a “performance measure”**



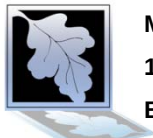
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Poor Water Quality



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Impacts Can't Be Hidden



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Boston Harbor	North Shore	201.33	116.27	85.06	42.25	4.22
Cohasset Harbor	North Shore	112.71	111.99	0.73	0.64	0.06
Duxbury\Plymouth Harbors	North Shore	2249.32	1904.42	344.90	15.33	1.53
Gloucester Harbor	North Shore	45.84	59.60	13.76		
Lynn Harbor	North Shore	715.18	672.16	43.01	6.01	0.60
Salem Harbor	North Shore	103.61	31.00	72.61	70.08	7.01
Scituate Harbor	North Shore	11.97	10.30	1.67	13.92	1.39
<i>Region Mean</i>		3439.96	2905.74	561.73	24.71	2.47
		1994	2006			
Hambln\JhuPds&Grt/LitRs	South Shore	73.91	14.92	58.99	79.81	6.65
Lower Pleasant Bay	South Shore	1279.07	1068.29	210.78	16.48	1.37
Morris Island	South Shore	169.82	153.62	16.19	9.54	0.79
RydersCove\Crow/Bassing	South Shore	155.87	121.51	34.36	22.05	1.84
Stage Harbor System	South Shore	261.00	155.93	105.07	40.26	3.35
Upper Pleasant Bay	South Shore	312.73	193.93	118.80	37.99	3.17
<i>Region Mean</i>		2252.40	1708.21	544.20	34.35	2.86
		1996	2006			
Cuttyhunk Harbor	Buzzards B.	13.25	31.00	17.75		
Hadley Harbor	Buzzards B.	55.48	52.87	2.61	4.71	0.47
Inner Sippican Harbor	Buzzards B.	158.79	80.48	78.31	49.32	4.93
New Bedford Outer Hbr	Buzzards B.	105.59	121.88	16.29		
Pocasset Harbor	Buzzards B.	41.35	30.82	10.52	25.45	2.54
Quisset Harbor	Buzzards B.	51.72	36.38	15.35	29.67	2.97
Wareham Harbor	Buzzards B.	11.22	2.20	9.02	80.39	8.04
West Cape Cod Canal Area	Buzzards B.	390.40	232.28	158.13	40.50	4.05
West Falmouth Harbor	Buzzards B.	55.72	50.60	5.11	9.18	0.92
Westport R-E&W Branch	Buzzards B.	677.04	513.23	163.82	24.20	2.42
Weweantic River	Buzzards B.	51.71	22.96	28.75	55.60	5.56
Wild Harbor	Buzzards B.	20.53	13.48	7.05	34.34	3.43
<i>Region Mean</i>		1632.81	1188.18	512.71	35.33	3.53
		1994	2006			
CapPogue\Pocht\CalebsPds	Islands	546.83	528.69	18.14	3.32	0.28
Lagoon Pond	Islands	164.56	51.36	113.20	68.79	5.73
Lake Tashmoo	Islands	91.16	37.89	53.27	58.44	4.87
Madaket Harbor	Islands	673.31	605.14	68.16	10.12	0.84
Menemsha	Islands	427.98	319.43	108.55	25.36	2.11
<i>Region Mean</i>		1903.84	1542.51	361.33	33.21	2.77
LOCATION TOTAL		9229.01	7344.00	1885.00	20.4	3.01

