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U.S. Department of the Interior
Fish and Wildlife Service
Region 5

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Wetland Trends for Selected Areas of the Coast of Massachusetts, from Plum Island to Scituate (1977 to 1985-86)

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INTRODUCTION

Wetlands are subjected to multiple impacts, both natural and human-induced. They may change from one type to another, e.g., emergent wetland to scrub-shrub wetland, due to natural succession or to minor filling or drainage. Wetlands are also destroyed directly or indirectly by human activities. Most wetlands, however, change gradually over long periods of time. Knowledge of wetland losses and gains is important for evaluating the effectiveness of government programs and policies designed to protect wetlands, and for developing strategies to reverse undesirable trends.

The Gulf of Maine Council on the Marine Environment and the U.S. Fish and Wildlife Service (Service) provided funding to initiate quadrangle-based wetland trends studies for selected areas in the Gulf of Maine. These studies identify the extent and nature of wetland alterations for designated local areas.

The purpose of this report is to present the findings of the wetland trends analysis study for selected areas of the coast of Massachusetts, from Plum Island to Scituate. It is one of four study areas in the Gulf of Maine chosen by the Service for detailed wetland trends analysis.

STUDY AREA

The study area is located along the coast of Massachusetts, from Plum Island to Scituate (Figure 1). It has a total (upland + wetland) land surface area of approximately 484 square miles (309,846 acres), and also includes approximately 453 square miles (289,871 acres) of deepwater habitat, most of which lies in Massachusetts Bay. The study area encompasses 15 large-scale (1:24,000) U.S. Geological Survey topographic quadrangles: Boston North, Boston South, Cohasset, Georgetown, Gloucester, Hull, Ipswich, Lynn, Marblehead North, Marblehead South, Nantasket Beach, Rockport, Salem, Scituate, and Weymouth.

METHODS

Wetland trends analysis involves comparing aerial photography from at least two time periods. For the present study, aerial photos from 1977 and from 1985-86 were examined and compared to determine the extent of the wetland changes (losses, gains, or changes in type) that occurred during that time period in the study area.

The 1977 photography was 1:80,000 scale panchromatic, black and white aerial photography[1]. The 1985-86 photography was 1:58,000 scale color infrared aerial photography acquired by the National High Altitude Photography Program (NHAP). Wetlands and deepwater habitats were interpreted on the NHAP photography and classified according to the Service's official wetland classification system (Cowardin, et. al. 1979) following standard National Wetlands Inventory (NWI) mapping conventions (National Wetlands Inventory, 1990). Field work was conducted to verify the classification of certain difficult wetland signatures. These interpretations served as the basis for evaluating recent wetland trends.

The two sets of photographs were compared using a Bausch and Lomb SIS-95 zoom stereoscope. Changes were delineated on mylar overlays attached to the NHAP photos and transferred to an NWI map using an Ottico Meccanica Italiana stereo facet plotter. Cause of change was recorded for each polygon. The minimum mapping unit for wetlands was generally 0.5 acre, except for ponds, which were mapped when 0.1 acre or larger in size. Changes as small as 0.1 acre were detected. Quality control of all photointerpretation was performed by a second photointerpreter. Interpreted data were digitized using PC Arc/Info and acreage summaries were generated. Tables were then prepared to present the study's findings.

RESULTS

Current Status

In 1985-86, the study area contained about 54,777 acres of wetlands (roughly 17.7% of the study area's land surface), excluding linear fringing wetlands along narrow streams. Table 1 summarizes the acreage of the different wetland types found in the study area. About 24,024 acres of estuarine wetlands were present, with 64.2% of this total (15,419 acres) classified as emergent marshes. Estuarine vegetated wetlands represented 28.3% (15,525 acres) of the study area's wetlands. Palustrine wetlands predominated with about 26,553 acres, representing 48.5% of the study area's total wetland acreage. Forested wetlands accounted for 66.7% (17,723 acres) of all palustrine wetlands.

Recent Wetland Trends

Wetland trends results are presented in Tables 2 through 8. The following discussion highlights the more significant or interesting findings.

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[1]Use of black and white photography presents certain limitations not inherent in the use of color infrared photography. Among these limitations are reduced image resolution due in part to the smaller scale of the black and white photography, and poor signature contrast. Comparing black and white photos with color infrared partially mitigates the reduced utility of the black and white photos through simultaneous stereoscopic comparison of the two images. Wetlands with subtle photo signatures, such as evergreen forested wetlands, are more difficult to identify on black and white photos; and as a result, use of black and white photos can reduce the overall accuracy of the trends analysis process. However, use of collateral data sources such as color infrared photography, soil surveys, and field work minimize this potential limitation.

Vegetated Wetlands

Between 1977 and 1985-86, over 61 acres of vegetated wetlands were converted to upland (Table 2). Most of these losses affected palustrine forested wetland, and to a lesser extent estuarine emergent wetland. Commercial business development and highway construction were the most significant causes of vegetated wetland loss, with ditching also significant (Table 3). About 38 acres of vegetated wetland changed from one type to another. Upland conversion impacted the seasonally flooded/saturated palustrine wetland type more than others (Table 4). Highway construction was the dominant cause of forested wetland loss (Table 5). Vegetated wetland gain from upland was limited to approximately 6 acres resulting from commercial cranberry bog construction (Table 6). Most gains in particular types of vegetated wetlands came from other vegetated wetland types (Table 6).

Nonvegetated Wetlands

Over 21 acres of new ponds were created from upland, and about 38 acres were constructed in vegetated wetlands (Table 7). More than 3 acres of ponds were converted to upland, while more than 12 acres changed to vegetated wetlands. Coastal erosion created 5 acres of marine unconsolidated shore from saltmarsh, and 2 acres from marine deepwater habitat. Approximately 36% of the new ponds built in uplands were the result of detention basins constructed at new subdivisions and business developments, but the majority were attributed to other causes (Table 8).

CONCLUSION

The study area had approximately 17.7% of its land mass covered by wetlands. Wetlands totaling 54,777 acres (in 1985-86) were identified by the Service's National Wetlands Inventory. Palustrine wetland was the dominant type, representing 48.5% of the wetlands in the study area.

Between 1977 and 1985-86, the study area lost about 164 acres of vegetated wetlands, with roughly 61 acres converted to upland. Seasonally flooded/saturated wetland was the type most frequently converted to upland. Pond construction added about 60 acres of palustrine nonvegetated wetlands, but this gain was reduced to about 32 acres by pond losses to upland, vegetated wetlands, and deepwater habitats.

The overall trend for the study area's wetlands was losses of vegetated wetlands and gains in nonvegetated wetlands (mostly ponds). The significance of the increase in ponds to fish and wildlife species has not been assessed and remains a point for discussion. The losses of vegetated wetlands, however, represent known losses of valuable fish and wildlife habitats and areas providing other valued functions, including flood water storage, water quality enhancement, and local water supply.

While this report documents recent trends in the study area's wetlands, it does not address changes in the quality of the remaining wetlands. As development increases, the quality of wetlands can be expected to deteriorate due to agricultural runoff, increased sedimentation, groundwater withdrawals, increased water pollution, and other factors, unless adequate safeguards are taken to protect not only the existence of wetlands, but their quality.

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REFERENCES

Cowardin, L.M., V. Carter, F.C. Golet, and T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Washington, DC. FWS/OBS-79/31. 103 pp.

National Wetlands Inventory. 1990. Photointerpretation Conventions for the National Wetlands Inventory. U.S. Fish and Wildlife Service, St. Petersburg, FL. 45 pp. plus appendices.

Figure 1. Location of U.S. Geological Survey quadrangles analyzed in the Coast of Massachusetts wetland trends analysis (1977 to 1985-86). Inset map of eastern Massachusetts shows location of enlarged area.

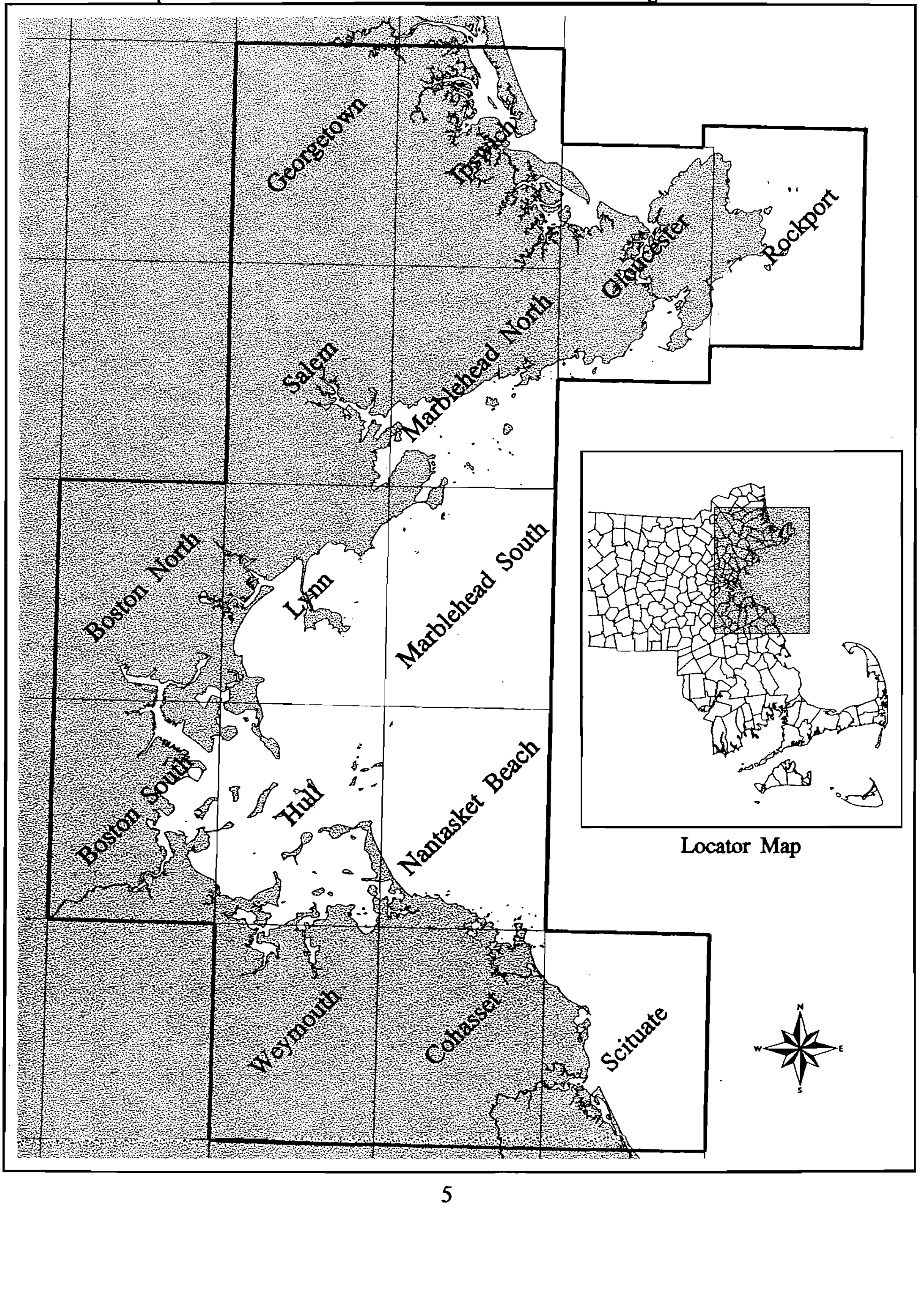

Table 1. Acreage of wetland types for selected areas of the Coast of Massachusetts, from Plum Island to Scituate (1985-86).

Wetland Type	Acres	% of Total
PALUSTRINE WETLANDS		
Tidal Emergent		
Semipermanently Flooded-Tidal	4.83	
Seasonally Flooded-Tidal	180.76	
Temporarily Flooded-Tidal	6.63	
(Subtotal Tidal)	*(192.22)*	0.35
Nontidal Emergent		
Semipermanently Flooded	560.36	
Seasonally Flooded/Saturated	1,537.98	
Seasonally Flooded	189.36	
Saturated	2.34	
Temporarily Flooded	70.93	
Artificially Flooded	170.20	
(Subtotal Nontidal)	*(2,531.17)*	4.62
Total Palustrine Emergent Wetlands	**2,723.39**	4.97
Tidal Forested		
Deciduous, Broad-leaved		
Seasonally Flooded-Tidal	25.11	
Temporarily Flooded-Tidal	2.97	
(Subtotal Tidal)	*(28.08)*	0.05
Nontidal Forested		
Evergreen, Needle-leaved		
Seasonally Flooded/Saturated	1,241.60	
Deciduous, Broad-leaved		
Seasonally Flooded/Saturated	15,228.57	
Seasonally Flooded	732.48	
Temporarily Flooded	90.47	
Semipermanently Flooded	329.01	
Dead	72.35	
(Subtotal Nontidal)	*(17,694.48)*	32.30
Total Palustrine Forested Wetlands	**17,722.56**	32.35

Table 1, continued

Wetland Type	Acres	% of Total
Tidal Scrub-Shrub		
Deciduous, Broad-leaved		
Seasonally Flooded-Tidal	39.71	
Semipermanently Flooded-Tidal	0.93	
(Subtotal Tidal)	*(40.64)*	0.07
Nontidal Scrub-Shrub		
Evergreen, Needle-leaved		
Seasonally Flooded/Saturated	19.18	
Evergreen, Broad-leaved		
Seasonally Flooded/Saturated	14.11	
Saturated	38.46	
Cultivated Cranberry Bog	49.32	
Deciduous, Broad-leaved		
Seasonally Flooded/Saturated	3,307.39	
Seasonally Flooded	56.48	
Saturated	4.03	
Temporarily Flooded	12.56	
Semipermanently Flooded	744.01	
(Subtotal Nontidal)	*(4,246.16)*	7.75
Total Palustrine Scrub-Shrub Wetlands	**4,286.80**	7.83
Aquatic Bed	1.60	
Total Palustrine Vegetated Wetlands	**24,734.35**	45.15
Unconsolidated Bottom (Ponds)	1,809.17	
Unconsolidated Shore	9.13	
Total Palustrine Nonvegetated Wetlands	**1,818.30**	3.32
GRAND TOTAL PALUSTRINE WETLANDS	**26,552.65**	48.47
ESTUARINE WETLANDS		
Emergent		
Regularly Flooded	1,685.33	
Irregularly Flooded	13,733.36	
Total Estuarine Emergent Wetlands	**15,418.69**	28.15

Table 1, continued

Wetland Type	Acres	% of Total
Aquatic Bed		
Regularly Flooded	57.22	
Total Estuarine Aquatic Bed Wetlands	**57.22**	0.10
Scrub-Shrub		
Irregularly Flooded	49.53	
Total Estuarine Scrub-Shrub Wetlands	**49.53**	0.09
Total Estuarine Vegetated Wetlands	**15,525.44**	28.34
Unconsolidated Shore	8,413.66	
Rocky Shore	13.38	
Stream Bed	71.36	
Total Estuarine Nonvegetated Wetlands	**8,498.40**	15.51
GRAND TOTAL ESTUARINE WETLANDS	**24,023.84**	43.86
MARINE WETLANDS		
Aquatic Bed	799.15	
Total Marine Vegetated Wetlands	**799.15**	1.46
Unconsolidated Shore	2,922.13	
Rocky Shore	478.88	
Total Marine Nonvegetated Wetlands	**3,401.01**	6.21
GRAND TOTAL MARINE WETLANDS	**4,200.16**	7.67
TOTAL WETLANDS	**54,776.65**	**100.00**

Table 2. Changes of vegetated wetlands along the coast of Massachusetts, from Plum Island to Scituate (1977 to 1985-86).

Wetland Type	Converted to Upland (acres)	Changed to Other Vegetated Wetlands* (acres)	Changed to Nonvegetated Wetlands (acres)
Estuarine Emergent	17.80	0.00	6.21
Palustrine Emergent**	11.06	4.11	27.81
Palustrine Forested	24.18	3.37	8.66
Palustrine Scrub-Shrub	8.64	30.49	1.82
Total	**61.68**	**37.97**	**44.50**

*Represents changes in class (e.g., emergent to scrub-shrub) but not changes in water regime within a given wetland class.

**Also, 57.97 acres of palustrine emergent wetland were converted to deepwater habitat due to reservoir construction.

Table 3. Causes of vegetated wetland loss to upland along the coast of Massachusetts, from Plum Island to Scituate (1977 to 1985-86).

Cause of Loss	Acres
Commercial Business Development	20.94
Highway Construction	8.95
Ditching	5.80
Unknown Cause	5.01
Housing, Single-Family	4.48
Industrial Development	3.46
Road Construction	3.37
Public Facilities (Federal Land)	3.29
Housing, Multi-Family	1.86
Construction of Pond Dams	1.63
Commercial	0.87
Commercial Junkyard	0.72
Airports	0.68
Sanitary Landfill	0.34
Agriculture	0.28
Total	**61.68**

Table 4. **Conversion of hydrologically similar palustrine vegetated wetlands to upland along the coast of Massachusetts, from Plum Island to Scituate (1977 to 1985-86).**

Palustrine Wetland Type	Acres	% Total Loss
Semipermanently Flooded	1.03	2.3
Seasonally Flooded	8.02	18.3
Seasonally Flooded/Saturated	28.40	64.7
Seasonally Flooded-Tidal	6.43	14.7
Total	**43.88**	**100.0%**

Table 5. **Causes of loss to upland in palustrine forested wetlands along the coast of Massachusetts, from Plum Island to Scituate (1977 to 1985-86).**

Cause	Acreage
Highway Construction	8.21
Commercial Business Development	4.21
Road Construction	3.08
Unknown Cause	2.48
Housing, Single-Family	2.13
Housing, Multi-Family	1.86
Commercial	0.87
Commercial Junkyard	0.72
Sanitary Landfill	0.34
Agriculture	0.28
Total	**24.18**

Table 6. **Gains in vegetated wetlands along the coast of Massachusetts, from Plum Island to Scituate (1977 to 1985-86).**

Wetland Type	Gain from Nonvegetated Wetlands (acres)	Gain from Upland (acres)	Gain from Other Vegetated Wetlands (acres)*
Palustrine Farmed	0.00	5.66**	0.87
Palustrine Emergent	12.82	0.00	3.37
Palustrine Forested	0.00	0.00	33.73
Palustrine Scrub-Shrub	0.00	0.00	0.00
Total	**12.82**	**5.66**	**37.97**

*Represents changes in class (e.g., emergent to scrub-shrub) but not changes in water regime within a given class.

**Upland to Pf due to commercial cranberry bog construction.

Table 7. **Gains and losses in nonvegetated wetlands along the coast of Massachusetts, from Plum Island to Scituate (1977 to 1985-86).**

	GAINS		LOSSES		
Wetland Type	Created from Upland (acres)	Created in Vegetated Wetlands (acres)	Converted to Upland (acres)	Changed to Vegetated Wetlands (acres)	Changed to Deepwater Habitats (acres)
Palustrine Unconsolidated Bottom	21.90	38.29	3.63	12.82	0.00
Palustrine Unconsolidated Shore	0.00	0.00	0.00	0.00	11.62**
Marine Unconsolidated Shore	0.00	5.07*	0.00	0.00	0.00
Total	**21.90**	**43.36**	**3.63**	**12.82**	**11.62**

*Caused by coastal erosion and deposition. 2.00 acres of M2US were also gained from marine deepwater habitat.

**Caused by sand and gravel pit operations.

Table 8. **Causes of recently constructed ponds on upland sites along the coast of Massachusetts, from Plum Island to Scituate (1977 to 1985-86).**

Causes	Pond Acreage Created
Detention Basins	7.79
Sand & Gravel Pits	3.63
Ponds in Undeveloped Areas	2.79
Quarry Ponds	2.46
Industrial Ponds	1.74
Commercial Cranberry Bog Ponds	1.73
Farm Ponds	0.73
Excavated Ponds, Unknown Cause	0.47
Urban Ponds	0.33
Impoundments, Unknown Cause	0.23
Total	**21.90**