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Wetland Trends for Selected Areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87)

U.S. Department of the Interior
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Region 5

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Wetland Trends for Selected Areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87)

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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, have relatively stable futures that 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 Casco Bay Estuary. 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 in southwestern Maine, along the coast from Cape Elizabeth and Old Orchard Beach to Phippsburg and Richmond (Figure 1). It has a total (upland + wetland) land surface area of approximately 473.5 square miles (303,018 acres); and also includes approximately 336.0 square miles (215,062 acres) of deepwater habitat, most of which is in Casco Bay, Merrymeeting Bay, and the Kennebec River. The study area encompasses 15 large-scale (1:24,000) U.S. Geological Survey topographic quadrangles: Bailey Island, Bath, Brunswick, Cape Elizabeth, Cumberland Center, Freeport, Orrs Island, Phippsburg, Portland East, Portland West, Prouts Neck, Small Point, South Harpswell, Richmond, and Yarmouth.

METHODS

Wetland trends analysis involves comparing aerial photography from at least two time periods. For the present study, aerial photos from 1974-77 (mid-1970's) and from 1984-87 (mid-1980's) 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 mid-1970's photography was 1:80,000 scale panchromatic, black and white aerial photography[1]. The mid-1980's 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). Limited field work was conducted to answer wetland identification questions in disturbed areas. These interpretations served as the basis for evaluating recent wetland trends.

The two sets of photographs were compared and interpreted for changes 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 the mid-1980's, the study area contained about 44,760 acres of wetlands (roughly 14.8 % 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 18,130 acres of estuarine wetlands were present, with 46 % of this total (8,338 acres) classified as emergent marshes. Estuarine vegetated wetlands represented 19.2 % (8,594 acres) of the study area's wetlands. Palustrine wetlands predominated with about 20,660 acres, representing 46.2 % of the study area's total wetland acreage. Deciduous forested wetlands alone accounted for 56.5 % (11,674 acres) of the palustrine wetlands.

[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.

Recent Wetland Trends

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

Vegetated Wetlands

Between the mid-1970's and the mid-1980's, over 183 acres of vegetated wetlands were converted to upland (Table 2). Most of these losses affected palustrine forested wetland. Commercial development and housing construction were the most significant causes of vegetated wetland loss, with sand and gravel pit operations, and road construction also significant (Table 3). About 86 acres of vegetated wetland changed from one type to another. Forty-six percent of these changes were due to impoundments of existing wetlands. Close to 92% of all palustrine vegetated wetlands lost to upland were seasonally flooded/saturated wetlands (Table 4). Commercial development was the dominant cause of forested wetland loss (Table 5). Less than 7 acres of vegetated wetland were created from upland (Table 6), whereas most of the gains in particular types of vegetated wetlands came from other vegetated wetland types (Table 6).

Nonvegetated Wetlands

Over 33 acres of new ponds were created from upland, and about 36 acres were constructed in vegetated wetlands (Table 7). More than 11 acres of ponds were filled in, while less than 3 acres changed to vegetated wetlands. Approximately 26% of the new ponds built in uplands were the result of farm pond construction, but the majority were attributed to other causes (Table 8).

CONCLUSION

The study area has approximately 14.8 % of its land mass covered by wetlands. Wetlands totaling 44,760 acres (in the mid-1980's) were identified in the study area by the Service's National Wetlands Inventory. Palustrine wetland is the dominant type, representing 46.2 % of the wetlands in the study area.

Between the mid-1970's and the mid-1980's, the study area lost about 228 acres of vegetated wetlands, with roughly 184 acres converted to upland. Seasonally flooded/saturated wetland was the type most frequently converted to upland. Pond construction added about 69 acres of palustrine nonvegetated wetlands, but this gain was reduced to about 56 acres by pond losses to upland and vegetated wetlands.

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.

ACKNOWLEDGMENTS

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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.

Table 1. **Acreage of wetland types for selected areas of the Casco Bay Estuary of the Gulf of Maine (1984-87).**

Wetland Type	Acres	% of Total
PALUSTRINE WETLANDS		
Tidal Emergent		
Semipermanently Flooded-Tidal	968.72	
Seasonally Flooded-Tidal	1,249.36	
(Subtotal Tidal)	*(2,218.08)*	4.96
Nontidal Emergent		
Semipermanently Flooded	201.29	
Seasonally Flooded/Saturated	1,560.28	
Seasonally Flooded	120.42	
Saturated	23.24	
Temporarily Flooded	9.88	
(Subtotal Nontidal)	*(1,915.11)*	4.28
Total Palustrine Emergent Wetlands	**4,133.19**	9.23
Tidal Forested		
Evergreen, Needle-leaved		
Seasonally Flooded-Tidal	584.43	
Temporarily Flooded-Tidal	13.98	
Deciduous, Broad-leaved		
Seasonally Flooded-Tidal	1,409.12	
Temporarily Flooded-Tidal	73.32	
Dead	5.75	
(Subtotal Tidal)	*(2,086.60)*	4.66
Nontidal Forested		
Evergreen, Needle-leaved		
Seasonally Flooded/Saturated	3,782.84	
Seasonally Flooded	30.49	
Temporarily Flooded	4.42	
Saturated	405.67	
Deciduous, Needle-leaved		
Seasonally Flooded/Saturated	2.92	
Saturated	5.75	
Deciduous, Broad-leaved		
Seasonally Flooded/Saturated	4,923.14	
Seasonally Flooded	307.65	

Table 1, continued

Wetland Type	Acres	% of Total
Temporarily Flooded	1.37	
Saturated	45.07	
Dead	77.93	
(Subtotal Nontidal)	*(9,587.25)*	21.42
Total Palustrine Forested Wetlands	**11,673.85**	26.08
Tidal Scrub-Shrub		
Evergreen, Needle-leaved		
Seasonally Flooded-Tidal	37.38	
Deciduous, Broad-leaved		
Seasonally Flooded-Tidal	854.63	
Temporarily Flooded-Tidal	1.74	
Semipermanently Flooded-Tidal	6.23	
(Subtotal Tidal)	*(899.98)*	2.01
Nontidal Scrub-Shrub		
Evergreen, Needle-leaved		
Seasonally Flooded/Saturated	77.10	
Seasonally Flooded	3.72	
Saturated	48.43	
Evergreen, Broad-leaved		
Seasonally Flooded/Saturated	6.15	
Saturated	146.12	
Evergreen, Unknown	27.08	
Deciduous, Broad-leaved		
Seasonally Flooded	109.97	
Saturated	54.26	
Temporarily Flooded	36.03	
Semipermanently Flooded	49.09	
Seasonally Flooded/Saturated	2,140.17	
(Subtotal Nontidal)	*(2,698.12)*	6.03
Total Palustrine Scrub-Shrub Wetlands	**3,598.10**	8.04
Aquatic Bed	31.97	0.07
Total Palustrine Vegetated Wetlands	**19,437.11**	43.42

Table 1, continued

Wetland Type	Acres	% of Total
Unconsolidated Bottom (Ponds)	1,227.35	
Total Palustrine Nonvegetated Wetlands	**1,227.35**	2.74
GRAND TOTAL PALUSTRINE WETLANDS	**20,664.46**	46.16
ESTUARINE WETLANDS		
Emergent		
Regularly Flooded	1,891.34	
Irregularly Flooded	5,840.08	
Irregularly Flooded-Oligohaline	606.87	
Total Estuarine Emergent Wetlands	**8,338.29**	18.63
Aquatic Bed		
Regularly Flooded	105.99	
Irregularly Exposed	149.21	
Total Estuarine Aquatic Bed Wetlands	**255.20**	0.57
Total Estuarine Vegetated Wetlands	**8,593.49**	19.20
Unconsolidated Shore	9,500.95	
Rocky Shore	35.41	
Total Estuarine Nonvegetated Wetlands	**9,536.36**	21.30
GRAND TOTAL ESTUARINE WETLANDS	**18,129.85**	40.50
RIVERINE WETLANDS		
Aquatic Bed	9.54	
Total Riverine Vegetated Wetlands	**9.54**	0.02

Table 1, continued

Wetland Type	Acres	% of Total
Unconsolidated Shore	45.96	
Rocky Shore	3.73	
Rock Bottom	12.22	
Total Riverine Nonvegetated Wetlands	**61.91**	0.14
GRAND TOTAL RIVERINE WETLANDS	**71.45**	0.16
MARINE WETLANDS		
Aquatic Bed	1,878.09	
Total Marine Vegetated Wetlands	**1,878.09**	4.20
Unconsolidated Shore	3,502.60	
Rocky Shore	501.86	
Rock Bottom	4.59	
Reef	9.41	
Total Marine Nonvegetated Wetlands	**4,018.46**	8.98
GRAND TOTAL MARINE WETLANDS	**5,896.55**	13.17
TOTAL WETLANDS	**44,762.31**	100.00

Figure 1. Location of U.S. Geological Survey quadrangles analyzed in the Casco Bay Estuary wetlands trend analysis (1974-77 to 1984-87). Inset map of Maine shows location of enlarged area.

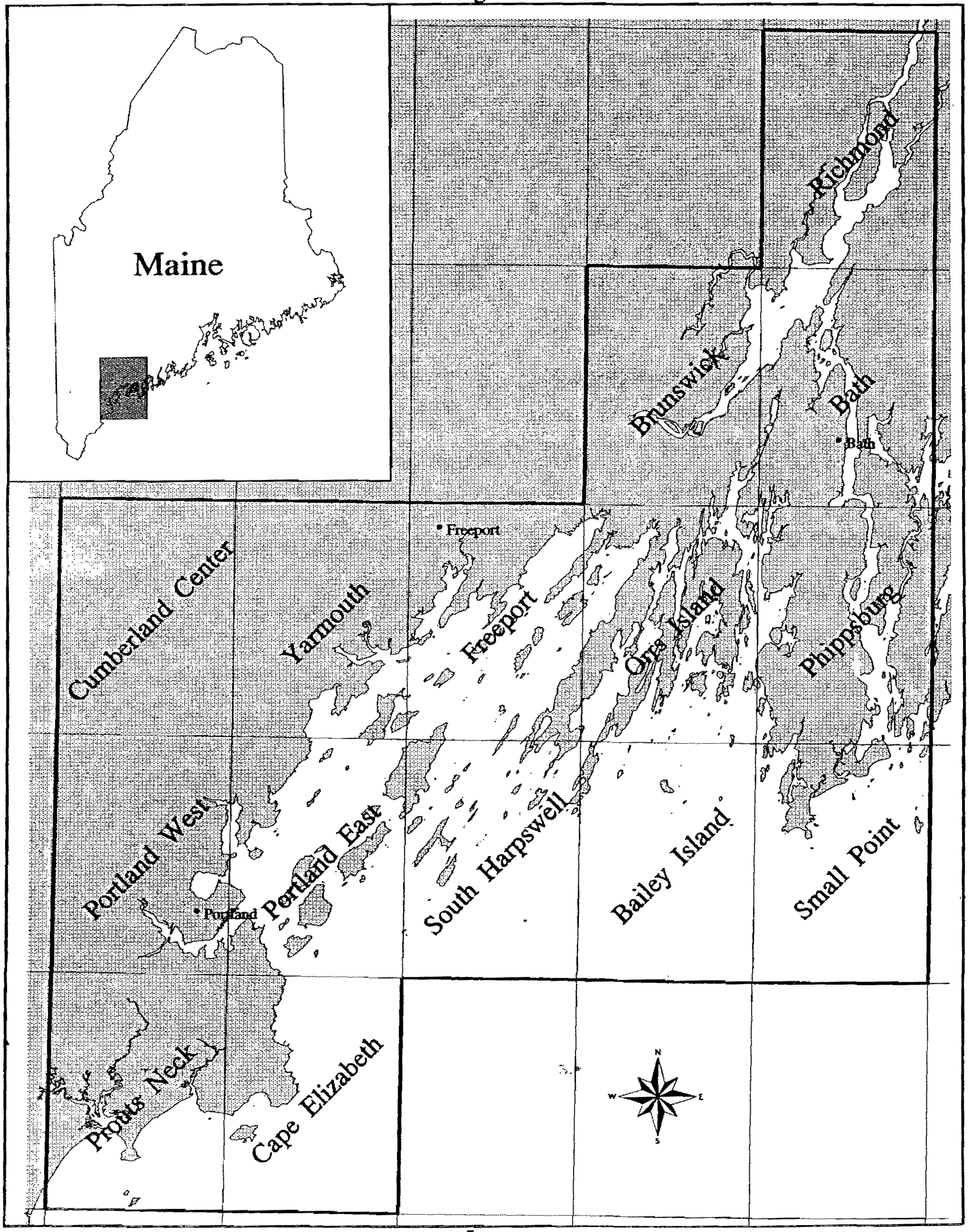

Table 2. Changes of vegetated wetlands in selected areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87).

Wetland Type	Converted to Upland (acres)	Changed to Other Vegetated Wetlands* (acres)	Changed to Nonvegetated Wetlands (acres)
Estuarine Emergent	2.10	27.78**	7.63
Palustrine Emergent	6.65	7.37	25.59
Palustrine Forested	157.51	27.70†	3.02
Palustrine Scrub-Shrub	17.62	22.68	7.63
Total	**183.88**	**85.53□**	**43.87**

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

**Over 98% of this change was due to impoundments of existing wetlands.

□Over 46% of this change was due to impoundments of existing wetlands.

†Over 62% of this change was due to timber harvest.

Table 3. **Causes of vegetated wetland loss to upland in selected areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87).**

Cause of Loss	Acres
Commercial Development	95.12
Housing	34.53
Sand & Gravel Pits	10.78
Road Construction	10.49
Agriculture	8.35
Timber Harvest	7.80
Unknown Cause	5.55
Public Facilities (Federal Land)	4.43
Trailer Parks	2.91
Construction of Pond Dams	2.48
Industrial Development	0.81
Channelization	0.63
Total	**183.88**

Table 4. **Conversion of hydrologically similar palustrine vegetated wetlands to upland in selected areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87).**

Palustrine Wetland Type	Acres	% Total Loss
Temporarily Flooded	5.03	2.8
Seasonally Flooded	6.65	3.7
Seasonally Flooded/Saturated	167.19	91.9
Seasonally Flooded-Tidal	2.91	1.6
Total	**181.78**	**100.0%**

Table 5. **Causes of loss to upland in palustrine forested wetlands in selected areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87).**

Cause	Acreage
Commercial Business Development	88.06
Housing - Single Family	29.50
Sand & Gravel Pits	10.78
Road Construction	10.49
Timber Harvest	7.80
Public Facilities (Federal Land)	4.43
Housing - Multi Family	3.17
Housing - Trailer Parks	2.91
Agriculture	3.70
Total	**157.51**

Table 6. **Gains in vegetated wetlands in selected areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87).**

Wetland Type	Gain from Nonvegetated Wetlands (acres)	Gain from Upland (acres)	Gain from Other Vegetated Wetlands (acres)*	Gain from Estuarine Vegetated Wetlands (acres)
Palustrine Aquatic Bed	0.00	0.00	4.41	0.00
Palustrine Emergent	2.13	0.50	25.77	27.78
Palustrine Forested	0.00	6.30**	8.23	0.00
Palustrine Scrub-Shrub	0.18	0.00	16.75	0.00
Estuarine Forested	0.00	0.00	2.59	0.00
Total	**2.31**	**6.80**	**57.75**	**27.78**

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

**Upland to PF05 due to unknown impoundments.

Table 7. Gains and losses in nonvegetated wetlands in selected areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87).

	GAINS		LOSSES		
Wetland Type	Created from Upland (acres)	Created in Vegetated Wetlands (acres)	Converted to Upland (acres)	Changed to Vegetated Wetlands (acres)	Changed to Other Nonvegetated Wetlands (acres)
Palustrine Unconsolidated Bottom	33.17	36.24	11.34	2.31	0.00
Marine Unconsolidated Shore	11.76*	0.00	6.18*	0.00	33.46
Total	**44.93**	**36.24**	**17.52**	**2.31**	**33.46**

*Caused by coastal erosion and deposition

Table 8. **Causes of recently constructed ponds on upland sites in selected areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87).**

Causes	Pond Acreage Created
Farm Ponds	8.46
Sand & Gravel Pits	7.38
Ponds in Undeveloped Areas	7.32
Detention Basins	4.59
Excavated Ponds	2.31
Ponds in Recreational Areas	1.20
Urban Ponds	0.98
Commercial Junk Yard Ponds	0.56
Industrial Ponds	0.37
Total	**33.17**