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U.S. Department of the Interior
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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 Cobscook Bay/St. Croix River Estuary in Maine. 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 east-coastal Maine, from the Canadian border along the St. Croix River at Calais, to West Quoddy Head in Lubec, to the Grand Manan Channel off Trescott (Figure 1). It has a total (upland + wetland) land surface area of approximately 229 square miles (146,742 acres), and also includes approximately 58 square miles (37,286 acres) of deepwater habitat, most of which is in Cobscook Bay, the St. Croix River, Passamaquoddy Bay, Western Passage, and the Grand Manan Channel. The study area encompasses 9 large-scale (1:24,000) U.S. Geological Survey topographic quadrangles: Calais, Devils Head, Eastport, Lubec, Pembroke, Red Beach, Robbinston, West Lubec, and Whiting.

METHODS

Wetland trends analysis involves comparing aerial photography from at least two time periods. For the present study, aerial photos from 1975/77 (mid-1970's) and from 1983-85 (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). These interpretations served as the basis for evaluating recent wetland trends.

The two sets of photographs were compared and interpreted 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 20,805 acres of wetlands (roughly 14.2% 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 6,272 acres of estuarine wetlands were present, with 8.8% of this total (555 acres) classified as emergent marshes. Estuarine vegetated wetlands represented 13% (2,700 acres) of the study area's wetlands. Palustrine wetlands predominated with about 11,805 acres, representing 56.7% of the study area's total wetland acreage. Palustrine forested wetlands accounted for 43.5% (5,131 acres) of the palustrine wetlands.

Recent Wetland Trends

Wetland trends results are presented in Tables 2 through 7. 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 the mid-1970's and the mid-1980's, over 27 acres of vegetated wetlands were changed to other vegetated wetlands (Table 2). Most of these changes affected palustrine forested wetland, and to a lesser extent palustrine emergent wetland. Beaver activity was the most significant cause of vegetated wetland change to other vegetated wetlands, representing 75% of all such changes (Table 3). Over 51 acres of palustrine emergent wetlands were changed to nonvegetated wetlands, with beaver again playing a significant role (Table 4). Approximately 20 acres of palustrine emergent wetlands were created in nonvegetated wetlands, due entirely to natural succession (Table 5). Vegetated wetland gain from upland was limited to approximately 0.6 acres (Table 5).

Nonvegetated Wetlands

Over 14 acres of new ponds were created from upland, and about 73 acres were constructed in vegetated wetlands (Table 6). More than 20 acres of ponds changed to vegetated wetlands. Approximately 32% of the new ponds built in uplands were constructed in undeveloped areas (Table 7).

CONCLUSION

The study area has approximately 14.2% of its land mass covered by wetlands. Wetlands totaling 20,805 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 56.7% of the wetlands in the study area.

Between the mid-1970's and the mid-1980's, the study area lost about 77 acres of vegetated wetlands, all of which were converted to nonvegetated wetlands or deepwater habitats. No changes were observed in estuarine wetlands during the study period. Pond construction added about 88 acres of palustrine nonvegetated wetlands; however, there were 20 acres of pond succession to vegetated wetland, reducing the net gain in ponds to 68 acres. Beaver converted over 58% of the palustrine vegetated wetlands that changed to nonvegetated wetlands, and were the cause of 54% of all changes recorded in the study area.

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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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 Cobscook Bay/St. Croix River Estuary wetland trends analysis (1975/77 to 1983-85). Canada was not included in the analysis. Inset map of Maine shows location of enlarged area.

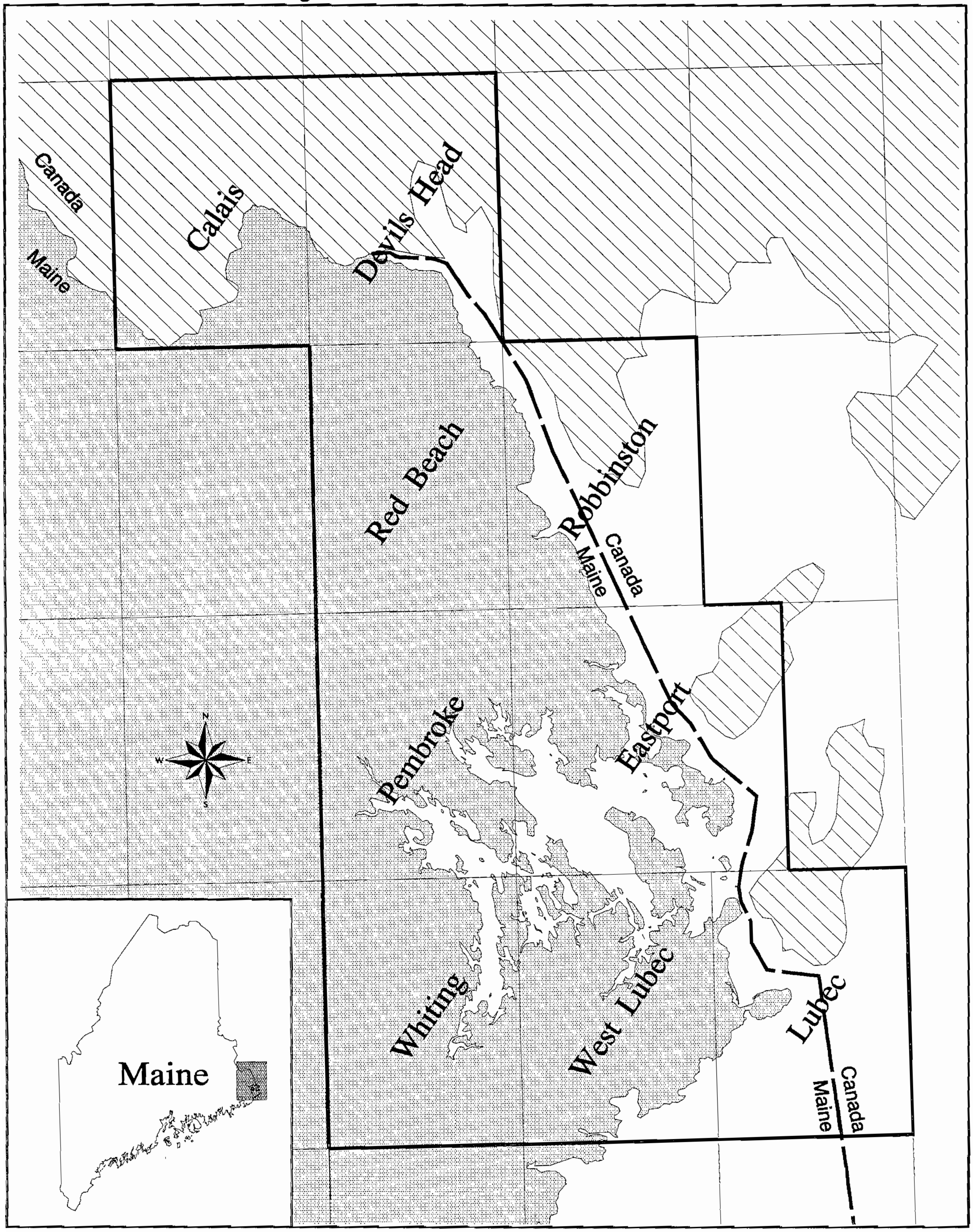

Table 1. **Acreage of wetland types for selected areas of the Cobscook Bay/St. Croix River Estuary of the Gulf of Maine (1983-85).**

Wetland Type	Acres	% of Total
PALUSTRINE WETLANDS		
Tidal Emergent	36.41	
Nontidal Emergent		
Semipermanently Flooded	381.12	
Seasonally Flooded/Saturated	1,744.30	
Seasonally Flooded	5.68	
Saturated	4.88	
(Subtotal Nontidal)	*(2,135.98)*	
Total Palustrine Emergent Wetlands	**2,172.39**	10.44
Tidal Forested		
Evergreen, Needle-leaved		
Seasonally Flooded-Tidal	1.00	
Nontidal Forested		
Evergreen, Needle-leaved		
Seasonally Flooded/Saturated	3,406.22	
Seasonally Flooded	2.79	
Saturated	842.12	
Deciduous, Broad-leaved		
Seasonally Flooded/Saturated	606.99	
Seasonally Flooded	19.42	
Deciduous, Needle-leaved		
Seasonally Flooded/Saturated	56.09	
Saturated	17.31	
Dead	178.96	
(Subtotal Nontidal)	*(5,129.90)*	
Total Palustrine Forested Wetlands	**5,130.90**	24.66
Tidal Scrub-Shrub	12.97	
Nontidal Scrub-Shrub		
Evergreen, Needle-leaved		
Seasonally Flooded/Saturated	163.73	
Saturated	60.26	

Table 1, continued

Wetland Type	Acres	% of Total
Evergreen, Broad-leaved		
Seasonally Flooded/Saturated	64.41	
Saturated	89.93	
Deciduous, Broad-leaved		
Seasonally Flooded	11.40	
Saturated	63.89	
Semipermanently Flooded	343.22	
Seasonally Flooded/Saturated	2,659.09	
Evergreen, Unknown	569.25	
(Subtotal Nontidal)	*(4,025.18)*	
Total Palustrine Scrub-Shrub Wetlands	**4,038.15**	19.41
Aquatic Bed	1.26	
Total Palustrine Vegetated Wetlands	**11,342.70**	54.52
Unconsolidated Bottom (Ponds)	462.03	
Total Palustrine Nonvegetated Wetlands	**462.03**	2.22
GRAND TOTAL PALUSTRINE WETLANDS	**11,804.73**	56.74
ESTUARINE WETLANDS		
Emergent		
Regularly Flooded	415.15	
Irregularly Flooded	139.59	
Total Estuarine Emergent Wetlands	**554.74**	2.67
Aquatic Bed		
Regularly Flooded	2,145.07	
Total Estuarine Aquatic Bed Wetlands	**2,145.07**	10.31
Total Estuarine Vegetated Wetlands	**2,699.81**	12.98

Table 1, continued

Wetland Type	Acres	% of Total
Unconsolidated Shore	3,154.75	
Rocky Shore	57.61	
Total Estuarine Nonvegetated Wetlands	**3,572.36**	17.17
GRAND TOTAL ESTUARINE WETLANDS	**6,272.17**	30.15
MARINE WETLANDS		
Aquatic Bed	995.39	
Total Marine Vegetated Wetlands	**995.39**	4.78
Unconsolidated Shore	1,478.89	
Rocky Shore	134.24	
Total Marine Nonvegetated Wetlands	**1,613.13**	7.75
GRAND TOTAL MARINE WETLANDS	**2,608.52**	12.54
RIVERINE WETLANDS		
Unconsolidated Shore	119.34	
GRAND TOTAL RIVERINE WETLANDS	**119.34**	0.57
TOTAL WETLANDS	**20,804.76**	**100.00**

Table 2. Changes of vegetated wetlands in selected areas of the Cobscook Bay/St. Croix River Estuary of the Gulf of Maine (1975/77 to 1983-85).

Wetland Type	Changed to Other Vegetated Wetlands* (acres)	Changed to Nonvegetated Wetlands (acres)	Changed Water Regime Only (acres)
Palustrine Emergent**	9.21	51.95	8.37
Palustrine Forested	17.57	2.59	17.16
Palustrine Scrub-Shrub	0.93	18.67	18.86
Total	**27.71**	**73.21**	**44.39**

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

****3.66** acres of palustrine emergent wetlands were converted to deepwater habitat.

Table 3. Causes of vegetated wetland change to other vegetated wetlands* in selected areas of the Cobscook Bay/St. Croix River Estuary of the Gulf of Maine (1975/77 to 1983-85).

Wetland Type	Cause of Change*	Acres
Palustrine Emergent	beaver	9.20
	natural succession	7.24
	unknown cause	1.14
	Subtotal	(*17.58*)
Palustrine Forested	beaver	27.78
	timber harvest	6.95
	Subtotal	(*34.73*)
Palustrine Scrub-Shrub	beaver	17.30
	excavation	1.11
	natural succession	0.93
	road construction	0.45
	Subtotal	(*19.79*)
	Total	**72.10**

*Represents both changes in class (e.g., emergent to scrub-shrub) and changes in water regime within a given wetland class.

Table 4. **Causes of change to nonvegetated wetlands in palustrine emergent wetlands in selected areas of the Cobscook Bay/St. Croix River Estuary of the Gulf of Maine (1975/77 to 1983-85).**

Cause of Change	Acreage
Beaver	29.15
Impoundment	10.20
Federal Installation	9.71
Farm Pond Construction	1.17
High Water (Cause Unknown)	1.05
Unknown Cause	0.67
Total	**51.95**

Table 5. **Gains in vegetated wetlands in selected areas of the Cobscook Bay/St. Croix River Estuary of the Gulf of Maine (1975/77 to 1983-85).**

Wetland Type	Gain from Nonvegetated Wetlands (acres)	Gain from Upland (acres)	Gain from Other Vegetated Wetlands (acres)*
Palustrine Emergent	20.31**	0.00	11.12
Palustrine Forested	0.00	0.00	1.71
Palustrine Scrub-Shrub	0.00	0.60	14.88
Total	**20.31**	**0.60**	**27.71**

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

**All due to natural succession.

Table 7. **Causes of recently constructed ponds on upland sites in selected areas of the Cobscook Bay/St. Croix River Estuary of the Gulf of Maine (1975/77 to 1983-85).**

Causes	Pond Acreage Created
Ponds in Undeveloped Areas	4.78
Impoundments	3.61
Farm Ponds	2.83
Detention Basins	1.47
Beaver Ponds	1.44
Excavated Ponds	0.40
Unknown Cause	0.20
Total	**14.73**