NEW YORK TIDAL WETLAND TRENDS: PILOT STUDY IN SHINNECOCK BAY ESTUARY AND RECOMMENDATIONS FOR STATEWIDE ANALYSIS

by

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INTRODUCTION

New York State has been protecting its tidal wetlands for the past fourteen years, since passage of the Tidal Wetlands Act in 1973. This Act gave the New York Department of Environmental Conservation (NYDEC) authority to protect the state's tidal wetlands. Consequently, widespread destruction of coastal wetlands was ended (NYDEC Tidal Wetlands Advisory Committee 1987). Recently the NYDEC has been interested in evaluating recent trends in tidal wetlands. In August 1986, the NYDEC, Bureau of Marine Habitat Protection, and U.S. Fish and Wildlife Service, Region 5, entered into a cooperative agreement to conduct a pilot study of recent tidal wetland trends. The Shinnecock Bay Estuary was selected by NYDEC for this study. The purpose of this report is to present the study findings along with recommendations for future tidal wetland trends analysis.

STUDY AREA

Shinnecock Bay Estuary lies in Suffolk County near the eastern end of Long Island. It is the easternmost bay of the large coastal bays that characterize the south shore of Long Island. The Bay is connected by canals to Greater Peconic Bay to the north and to Moriches Bay to the west.

STUDY OBJECTIVES AND METHODS

Basic study objectives were: (1) to determine the current status and recent trends in Shinnecock Bay's tidal wetlands, (2) to examine various techniques for identifying recent human-induced changes in these wetlands, and (3) to develop recommendations for conducting a statewide tidal wetland trends analysis program.

Conventional photo interpretation techniques have been proven effective in identifying wetland trends at national, regional, and state levels (Frayer, et al. 1983, Tiner and Finn 1986, and Hardisky and Klemas 1983, respectively). Moreover, such techniques have been successfully used in court to provide evidence of illegal wetland filling or other alterations.

For determining the status and recent trends in Shinnecock's tidal wetlands, 1:12,000 color infrared photography from 1973 and NYDEC tidal wetland maps (which are photo-based maps) were compared with 1:12,000 color infrared photography taken in October 1986. This photography was flown specifically for this project by Aerographics of Bohemia, New York. The 1986 photos were examined using a Bausch and Lomb zoom transfer scope which projected the photo image directly onto the NYDEC tidal wetlands map. Changes in tidal wetlands between 1973 and 1986 could be readily identified by this technique. Any questions required examination of the original 1973 photography for resolution. Appropriate changes were delineated in pencil on the maps. A field trip to the study area was conducted to answer photo interpretation questions and to verify results. Wetland boundaries from the tidal wetlands maps and identified changes were digitized by personnel from the University of Massachusetts, Department of Forestry and Wildlife Management. Acreage totals for wetland types in 1973 and 1986 and for changes were generated.

When planning large-scale wetland trend studies, one must examine the available sources of aerial photography and consider whether a complete (100 percent) assessment or statistical sampling techniques are appropriate. This study evaluated four scales of color infrared photography for identifying recent human-induced wetland changes: (1) 1:12,000, (2) 1:24,000, (3) 1:36,000, and (4) 1:58,000. The first three types of photography were acquired specifically for this project from Aerographics of Bohemia, New York. The latter photos were obtained from the U.S. Geological Survey's Federal High-Altitude Photography Program. To compare the effectiveness and limitations of the various types of aerial photographs for showing human-induced changes, areas of change were initially identified on the 1:12,000 imagery and subsequently these areas were examined at the other photo scales. Besides photo evaluation, this study would also explore the potential for estimating recent human-induced wetland trends in Shinnecock Bay through statistical sampling techniques. This procedure would only be useful if considerable human-induced changes had occurred. If only small-scale changes had occurred, statistical sampling would be rendered ineffective, since extensive sampling, approaching the 100 percent level, would be required to obtain reliable estimates of wetland change.

RESULTS

Current Status and Recent Trends in Shinnecock Bay

In 1973, 770 acres of tidal marshes existed in the Bay area. By 1986, nearly all remained (764 acres), thus only a net loss of six acres of marsh took place since the Tidal Wetlands Act was passed. Table 1 summarizes the status and trends for six categories mapped on the NYDEC tidal wetlands maps for the Bay. Table 2 shows the nature of the recent changes in three categories - intertidal marsh, high marsh, and shoal/flat. In Table 2, the dynamics within each of these categories are evident.

Since 1973, fill activities have affected less than four acres of marshes and shoals/flats. About two acres of shoals/flats have been filled for marina facilities and a park at Shinnecock Inlet, yet marina developments have also established new areas of shoals/flats and littoral zone from upland in conjunction with these projects. Filling of marshes in residential areas accounted for about 1.5 acres.

Table 1. Current status and recent trend figures for the Shinnecock Bay Estuary. Gains are indicated by a "+" and losses by a "-".

Category	1973 Acreage	1986 Acreage	Net Acreage Change
Intertidal Marsh	450	443	-7
High Marsh	320	321	+1
Shoal/Tidal Flat	3,874	3,871	-3
Littoral Zone	9,889	9,887	-2
Formerly Connected Marsh	12	12	0
Dredge Spoil Area	156	149	-7

Table 2. Recent changes in intertidal marsh, high marsh, and shoal/tidal flat in Shinnecock Bay (1973 to 1986). Figures are given in acres. Symbology is designated below.

	-----Recent Gains From----					Subtotal	----------Recent Losses To---------						Subtotal	Net Total
Category	DS	LZ	SM	IM	UP	Gains	UP	LZ	SB/SP	SM	IM	HM	Losses	Change
Intertidal Marsh	+3.1	+1.2	+6.9	----	+1.0	+12.2	-0.1	-0.1	-6.7	-12.2	----	----	-19.1	-6.9
High Marsh	+1.7	+0.1	+0.6	----	+0.4	+2.8	-1.4	----	-0.5	----	----	----	-1.9	+0.9
Shoal/Flat	+1.2	----	----	+12.2	+3.8	+17.2	-2.0	----	-10.5	----	-6.9	-0.6	-20.0	-2.8

Symbology: DS = dredge spoil area;
LZ = littoral zone;
SM = shoal/tidal flat;
IM = intertidal marsh;
HM = high marsh;
UP = upland;
SB/SP = sandy beach/spit.

Techniques for Detecting Human-Induced Wetland Impacts

The utility of four scales of color infrared aerial photography for identifying human-induced wetland changes was evaluated. The four photo scales were: (1) 1:12,000, (2) 1:24,000, (3) 1:36,000 , and (4) 1:58,000. The first three types of photographs were taken in October 1986, while the latter type was spring photography taken in March 1985. The early fall photography was better for separating intertidal marsh from high marsh, since vegetation was fully developed. The spring photography did not permit clear differentiation between these two marsh types. Also, the upper limit of the high marsh was better defined on the fall photography. An interesting observation was made on eelgrass beds within Shinnecock Bay, although not the objective of this study. The eelgrass beds were easier to detect on the spring imagery, although the beds were not as dense as seen in the fall. The deeper bay waters were medium blue colored in the spring photos vs. dark blue on the fall imagery; this made it easier to see eelgrass beds in deeper water in the spring. This condition may be due to increased water clarity on the spring imagery or due to photo quality related to processing.

Aerial photo coverage for the Shinnecock Bay Estuary required varying numbers of photos depending on photo scales. As the number of photos increases, so do the costs of photo acquisition (aerial survey) plus the costs of purchasing a complete set. In addition, more photos require more storage space and more time for photo retrieval. For Shinnecock Bay, 56 photos at a scale of 1:12,000 provided total coverage, while it required 25 photos at 1:24,000, 10 photos at 1:36,000, and 5 photos at 1:58,000.

An evaluation of the four photo scales for detecting small-scale wetland changes showed the following results. The 1:58,000 imagery was too coarse for detection of small-scale changes, such as fills less than one acre in size. The other photo scales, however, allowed detection of changes down to one hundredth of an acre in size. Changes observed on the 1:12,000 photos were visible at 1:24,000 and 1:36,000. The main difference was the minimum polygon size that could be delineated. Change polygons of one-tenth of an acre could be delineated on the 1:36,000 photos with smaller areas of change being represented by dots. At the 1:12,000 scale, all changes could be delineated as polygons, with the 1:24,000 minimum polygon size falling in between the 1:12,000 and 1:36,000 levels. For detection purposes, the 1:36,000 photography can be used. Bulkheads, piers, and small fills and excavations down to about one hundredth of an acre can be seen. The 1:24,000 photography mainly offers an improvement in scale. In any event, detection of small-scale impacts as well as large-scale changes can be adequately made at either 1:36,000 and 1:24,000. Selection of one scale over the other can be based on the difference in acquisition costs and available funding.

Since only four acres of marshes and shoals/flats were filled from 1973 to 1986, it is unreasonable to expect that statistical sampling techniques could be used to adequately detect these changes. It is much simpler and more effective to perform a complete trends analysis (100 percent assessment). In this way, small-scale changes can be accurately located, without the need for making estimates. Moreover, information on newly formed wetlands as well as previous misinterpretations can be obtained. In doing a complete survey of tidal wetland trends in Shinnecock Bay, about ten acres of former tidal marshes (now isolated by the main beach road and subject to periodic overwash) and nearly twenty acres of potentially high marsh that were not shown on the NYDEC tidal wetlands maps were observed. A complete survey allows these areas to be located and subsequently added to the wetlands maps as appropriate, while statistical sampling does not.

CONCLUSIONS AND RECOMMENDATIONS

Recent trends (1973 to 1986) in Shinnecock Bay's tidal wetlands were readily determined by conventional aerial photo interpretation techniques. Comparing 1986 photography with NYDEC tidal wetland maps and 1973 photography provided an efficient and effective means for identifying these trends. Since relatively few human-induced changes took place due to the strict regulatory environment, a total survey (100 percent assessment) of wetland changes was required. Statistical sampling techniques are not efficient in this situation, since extensive sampling, approaching the 100 percent level, would be required to achieve reliable results; this effort would demand considerably more time and expense due to random plot selection, identification of plot location on photos, calculating estimates, etc. Moreover, statistical sampling would only provide estimates and not actual numbers as generated by a total survey. The total survey allows for identification of tidal wetlands misclassified on the original maps, detection of all new wetlands plus all sites of wetland filling, pier construction, and other changes. This is important for updating tidal wetland boundaries, for detecting illegal activities, and for overall management of the tidal wetlands resource.

Based on the results of this study, the following recommendations are made for conducting future tidal wetland trend assessments:

1. Aerial photo interpretation techniques should be employed for change detection, with follow-up field work for verification purposes.

2. Aerial photos can be flown by local contractors and the following specifications are suggested:

   Photography Specifications

Emulsion:	Color Infrared.
Scale:	1:36,000 or 1:24,000 (depending on available funding).
Season:	Late Summer to Early Fall preferred for vegetative signature of tidal marshes.

Time of Day:	Mid-Morning to Early Afternoon (9:00 am to 3:00 pm) to avoid late afternoon shadows.
Stage of Tide:	Low Tide, preferably Low Spring Tide to show maximum exposure of tidal flats and to avoid flooding conditions in marsh at high tide.
Stereo Coverage:	60% end lap and 30% side lap.
Additional Specs:	(1) All photos should be individually numbered.
	(2) Locations of each photo should be plotted on an index map (perhaps using the NYDEC Tidal Wetlands Maps Index as the base) or a photo mosaic index map could be prepared at added expense, if desired.

3. A total wetland trends survey (100 percent assessment) should be conducted; this will permit updating of tidal wetland maps in addition to detecting all recent changes.

4. By acquiring photos on a periodic basis and evaluating wetland trends, an efficient and cost effective tidal wetlands monitoring program can be established.

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