U.S. Fish and Wildlife Service

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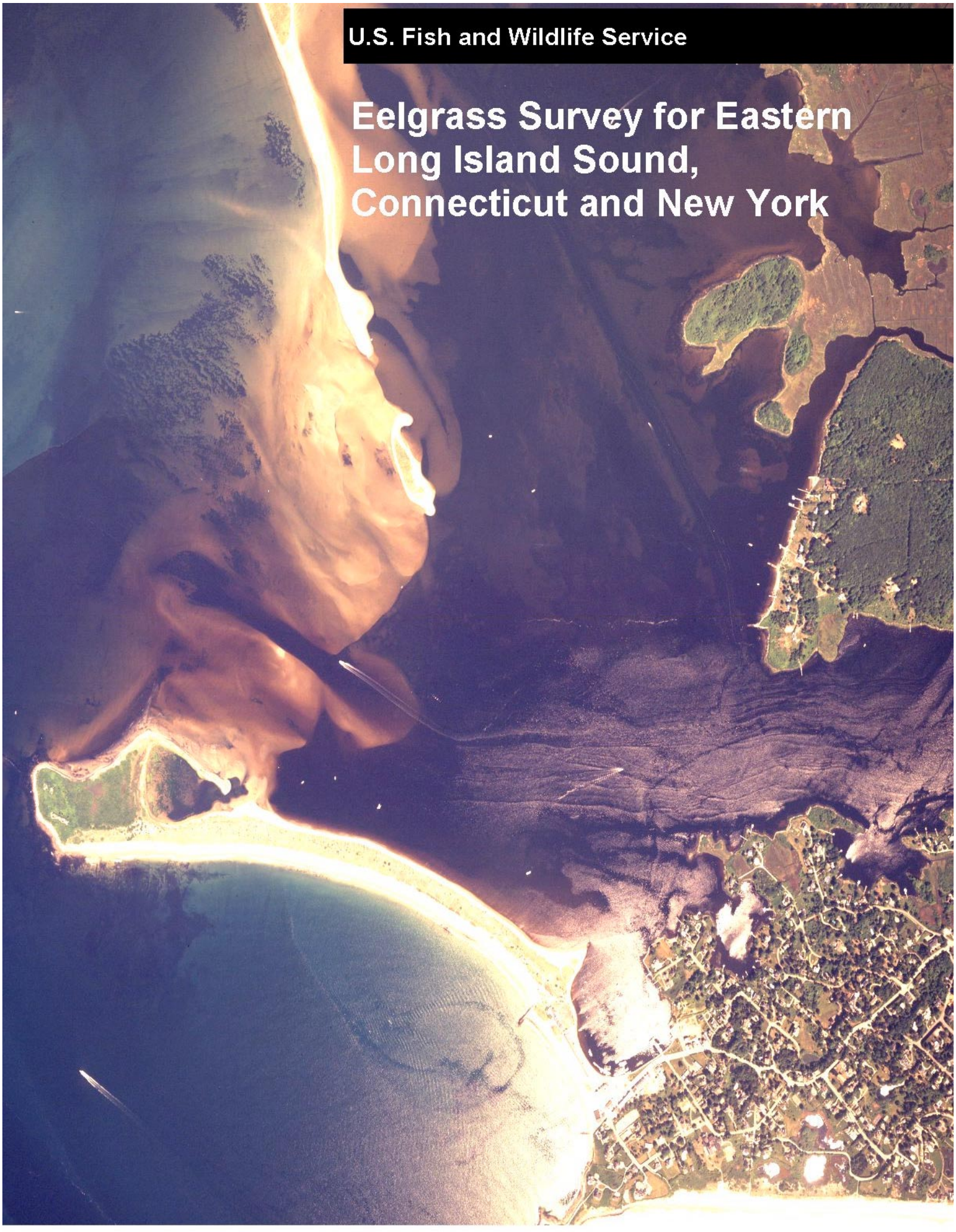

Eelgrass Survey for Eastern Long Island Sound, Connecticut and New York

Ralph Tiner[1], Herb Bergquist[1], Tom Halavik[2] and Andrew MacLachlan[2]

[1]U.S. Fish and Wildlife Service
National Wetlands Inventory Program
Northeast Region
300 Westgate Center Drive
Hadley, MA 01035

[2]U.S. Fish and Wildlife Service
Southern New England Coastal Program
3769 D Old Post Road
Charlestown, RI 02813

Prepared for:

Connecticut Department of Environmental Protection
Office of Long Island Sound Programs
79 Elm Street
Hartford, CT 06106

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Introduction

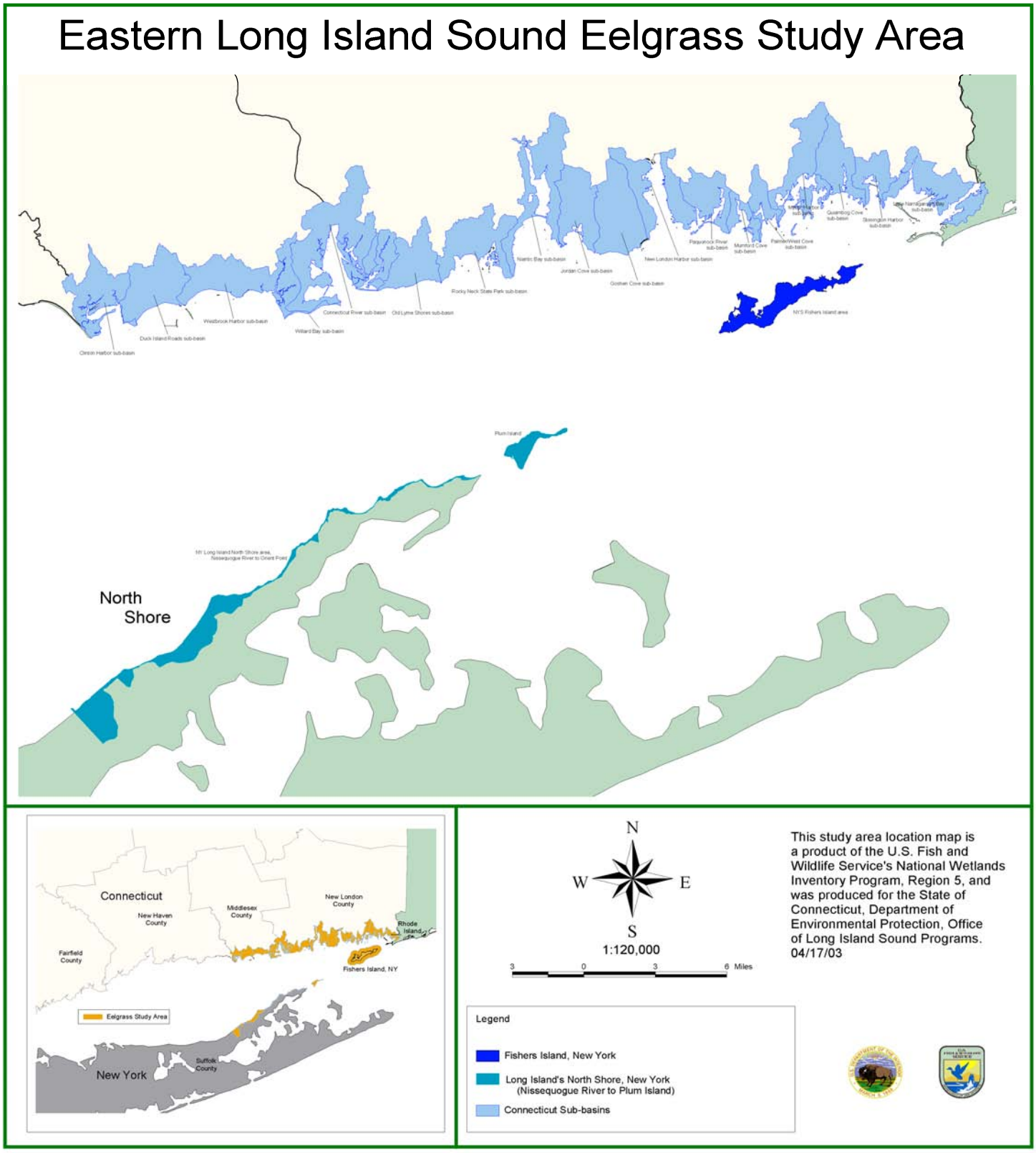
The Office of Long Island Sound Programs (OLISP) within the Connecticut Department of Environmental Protection (DEP) is responsible for assessing and restoring natural habitats in the Long Island Sound ecosystem. In 2001, the OLISP contacted the U.S. Fish and Wildlife Service (Service) about undertaking a survey of eelgrass beds in Long Island Sound. The survey would be conducted through application of photointerpretation techniques with some field checking. The Service's National Wetlands Inventory Program (NWI) has been mapping wetlands and deepwater habitats through air photointerpretation techniques since the mid-1970s and had recently completed preliminary mapping of submerged aquatic vegetation for the Peconic Estuary in eastern Long Island, New York. The Service and the DEP developed a cooperative agreement to perform an eelgrass inventory for the eastern end of Long Island Sound, which included acquiring tide-synchronized true color photographs for maximum resolution of eelgrass beds.

This report outlines the methods used in the survey, summarizes inventory results, and provides detailed maps showing the location of eelgrass beds detected during the survey.

Study Area

The project area encompasses the eastern end of Long Island Sound, including Fishers Island and the North Fork of Long Island (Figure 1). It included all coastal embayments and nearshore waters (i.e., to a depth of –15 feet at mean low water) bordering the Sound from Clinton Harbor to the Rhode Island border and including Fishers Island and the North Shore of Long Island from Southold to Orient Point and Plum Island. The study area includes the tidal zone of 18 sub-basins in Connecticut: Little Narragansett Bay, Stonington Harbor, Quiambog Cove, Mystic Harbor, Palmer-West Cove, Mumford Cove, Paquonock River, New London Harbor, Goshen Cove, Jordan Cove, Niantic Bay, Rocky Neck State Park, Old Lyme Shores, Connecticut River, Willard Bay, Westbrook Harbor, Duck Island Roads, and Clinton Harbor, and two areas in New York: Fishers Island and a portion of the North Shore of Long Island.

Figure 1. Location of eelgrass survey study area, with sub-basins designated.



Methods

Acquisition of Aerial Photography

Aerial photography for mapping eelgrass beds and other submerged aquatic vegetation must meet certain requirements for the best level of bed resolution. The National Oceanic and Atmospheric Administration's Coastal Change Analysis Program has developed aerial photography specifications for such mapping (Dobson et al. 1995). June is the recommended flying time for submersed rooted vascular plants in the Northeast. Aerial photos acquired for this project met these specifications; the Service acquired 1:19,200 true color aerial photography captured during low tide on June 18, 2002. Figure 2 shows an example of a portion of one aerial photo used in this study.

Eelgrass Database Construction

Eelgrass beds were detected through aerial photointerpretation techniques using a digital transfer scope (DTS). The DTS allowed identification and delineation of suspected eelgrass beds and simultaneous creation of a digital database. Digital orthophoto quarter-quads (DOQQs; obtained from: http://magic.lib.uconn.edu/index.html) served as base data for this inventory for geospatial registration of beds and historical data.

After initial photointerpretation and digital database construction, draft maps were prepared for field review. Data were displayed on coastal geodetic survey (navigation) maps to show bed locations relative to recognizable landmarks for field review. Aerial photos plus these maps were used to help locate interpreted beds for inspection. An underwater video camera mounted on an aluminum pole was used to examine potential eelgrass beds where beds or bottoms were not visible from the boat.

Biologists estimated the density of eelgrass in the beds by eye from the boat or by area observation using the underwater camera. No quantitative analysis of stem density was recorded, so density estimates are approximate. Eelgrass beds were placed in three potential categories based on relative density of vegetation: high, medium, and low. As a general guide, low density beds had an estimated shoot density of less than 20 percent cover of shoots per square meter; medium density beds - 20 to 60 percent shoot density; high density beds - 60 percent or higher (Figure 3). A sample of the field form is presented as Figure 4.

Field work was performed by Service personnel from our Southern New England Coastal Program Office (SNEP), with assistance from Regional NWI personnel. Cornell Cooperative Extension Service, Marine Program (CMP) inspected the North Shore of Long Island. Eleven days were spent in the field verifying locations of potential eelgrass beds during the summer and early fall of 2002 (September 18, 19, and 29; October 3, 4, 8, 10, 15, 18, 22, and 28) by SNEP. CMP spent two days (November 4 and 20, 2002) searching for eelgrass beds on the North Shore. A total of 246 sites were inspected; specific locations (latitude/longitude) of these sites were recorded using ground positioning system (GPS) technology by SNEP. These data were added to the digital

database. Data were not recorded in this manner from field inspections of the North Shore covered the area from Goldsmith's Inlet to Mulford Point and from preliminary field work by SNEP in the Little Narragansett Bay area.

Based on field review comments, aerial photos were re-examined, needed revisions made, and the eelgrass database was finalized.

Figure 2. Portion of true color aerial photograph (1:19,200) showing eelgrass beds (marked by arrows).

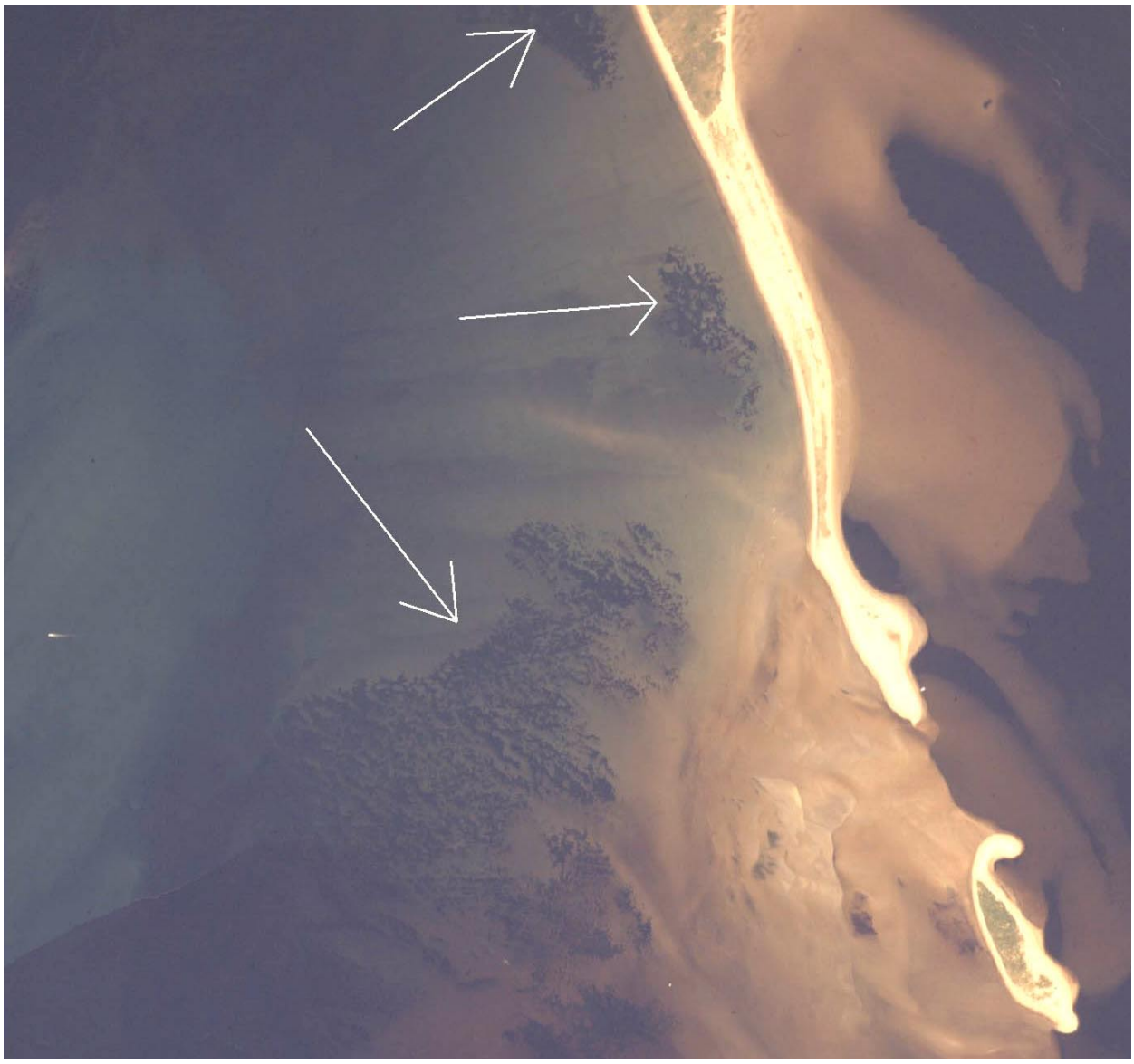


Figure 3. Underwater view of an eelgrass bed that was typical of our observations.

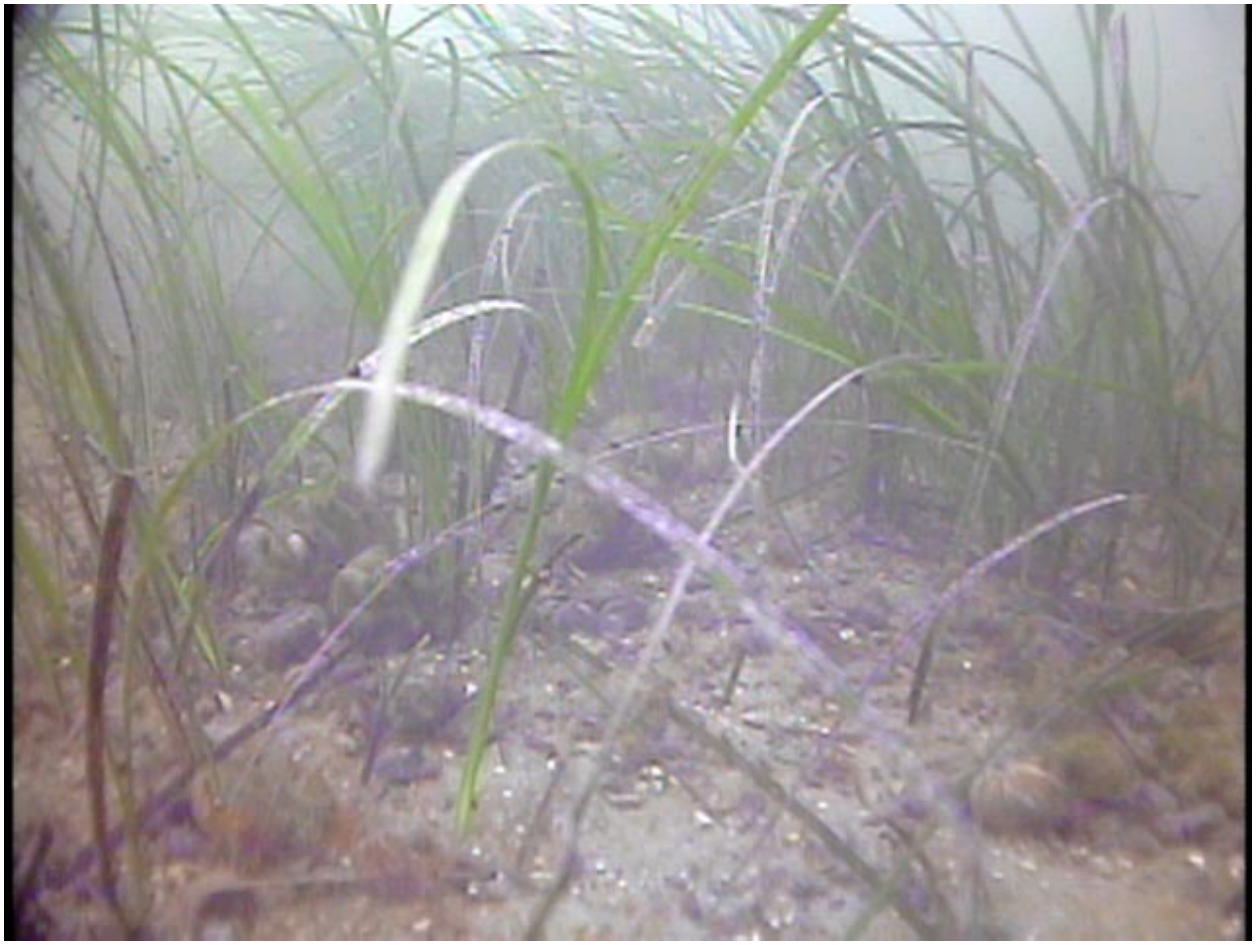


Figure 4. Blank field data form.

Submerged Aquatic Vegetation Field Data Sheet

Project: Eastern Long Island Sound

Investigators:____

Date of Investigation: ____________

Predicted Tidal Data: Time of High Tide ________ Height ______ feet

Field Site Data:

Site #:____ Location (lat/long):____dd
Map Name/State: ___________________ Estuary/Bay Name: ____________________
Time: _____ Water Depth:____ ft Eelgrass Present? Y N Estimated Cover: H M L
Other Species? Rockweed Other Algae Other
Comments: ____
____

Site #:____ Location (lat/long):____dd
Map Name/State: ___________________ Estuary/Bay Name: ____________________
Time: _____ Water Depth:____ ft Eelgrass Present? Y N Estimated Cover: H M L
Other Species? Rockweed Other Algae Other
Comments: ____
____

Site #:____ Location (lat/long):____dd
Map Name/State: ___________________ Estuary/Bay Name: ____________________
Time: _____ Water Depth:____ ft Eelgrass Present? Y N Estimated Cover: H M L
Other Species? Rockweed Other Algae Other
Comments: ____
____

Site #:____ Location (lat/long):____dd
Map Name/State: ___________________ Estuary/Bay Name: ____________________
Time: _____ Water Depth:____ ft Eelgrass Present? Y N Estimated Cover: H M L
Other Species? Rockweed Other Algae Other
Comments: ____
____

Results

Field Review

Out of a total of 246 field sites, 112 were found to have eelgrass (Zostera marina) (Table 1). Of these sites, 11 had high cover, 83 had medium cover, 6 had medium to low cover, and 12 had low cover. Sites lacking eelgrass had varying amounts of other submerged aquatic vegetation including rockweeds (Fucus and Ascophyllum) attached to underwater boulders and bedrock outcrops and other algae, or were devoid of such vegetation. Nine small eelgrass beds (not photointerpretable) were identified on the seaward side of Fishers Island. For the database, each of these field check sites was given a 10m buffer for producing an area estimate of slightly less than 0.1 acre.

Field observations about water depth at which eelgrass was observed relative to predicted high tide are summarized for selected areas in Table 2. Eelgrass beds were found at water depths ranging from 4.5 feet to 16.0 feet (Site 74a). The deepest reading came within 4 hours of predicted high tide and the predicted tide for the day of inspection was 3.4 feet.

Table 1. Number of field check sites in each sub-basin and number with eelgrass beds.

Sub-basin	# of Sites	# with Eelgrass	Sub-basin	# of Sites	# with Eelgrass
Fishers Island (NY)	63	32	Goshen Cove	7	7
Mystic Harbor	14	9	Palmer-West Cove	10	1
Quiambog Cove	10	9	Stonington Harbor	6	5
Jordan Cove	9	6	New London Harbor	9	7
Niantic Bay	17	9	Connecticut River	6	0
Westbrook Harbor	28	0	Willard Bay	2	0
Clinton Harbor	12	0	Duck Island Roads	8	2
Little Narragansett Bay	6	6	Mumford Cove	12	12
Paquonock River	6	6			

Table 2. Examples of observed water depth for eelgrass beds in eastern Long Island Sound. Note: Tide predictions are based on expected tide at New London State Pier. Predicted values for sites are mostly within 1.0 foot and 1/2 hour of predicted values for New London. Of course, the actual time and height of tide on day of record varies due to weather conditions. (Source data for predicted tide: http://www.tidelinesonline.com)

Site #	Study Sub-basin	Depth of Eelgrass (ft)	Time Observed	Predicted Time of High Tide	Predicted Height of High Tide (ft)
116	Mystic Harbor	5.0	1:55PM	11:17AM	3.9
201a	Mystic Harbor	11.0	4:30PM	11:17AM	3.9
105	New London Harbor	7.0	10:05AM	8:05 AM	3.1
125a	Fishers Island	10.0	11:30AM	7:17AM	2.8
126	Fishers Island	6.0	12:00PM	7:17AM	2.8
123a	Fishers Island	4.5	12:34PM	8:18AM	3.1
139a	Fishers Island	14.0	11:05AM	8:18AM	3.1
99	Niantic Bay	5.0	4:00PM	1:02PM	3.6
307a	Duck Island Roads	6.0	2:40PM	8:26AM	2.9
74a	Jordan Cove	16.0	10:40AM	2:01AM	3.4
74b	Jordan Cove	14.0	10:40AM	2:01AM	3.4
251b	Jordan Cove	11.0	11:29AM	2:01AM	3.4

Extent of Eelgrass

A total of 163 eelgrass beds accounting for nearly 1,600 acres were inventoried. A summary of their locations by sub-basin is given in Table 3. Figure 5 shows the location of eelgrass beds in the study area. More detailed maps showing the location, size, and shape of these beds in each sub-basin are presented in Appendix A.

Most of the sites with eelgrass were estimated to have medium stem density (Table 3). Only 17.6 acres of high density beds were inventoried. Please note that the density estimates are subjective and not based on quantitative analysis of cover; medium to low density beds from field observations were mapped as medium density beds.

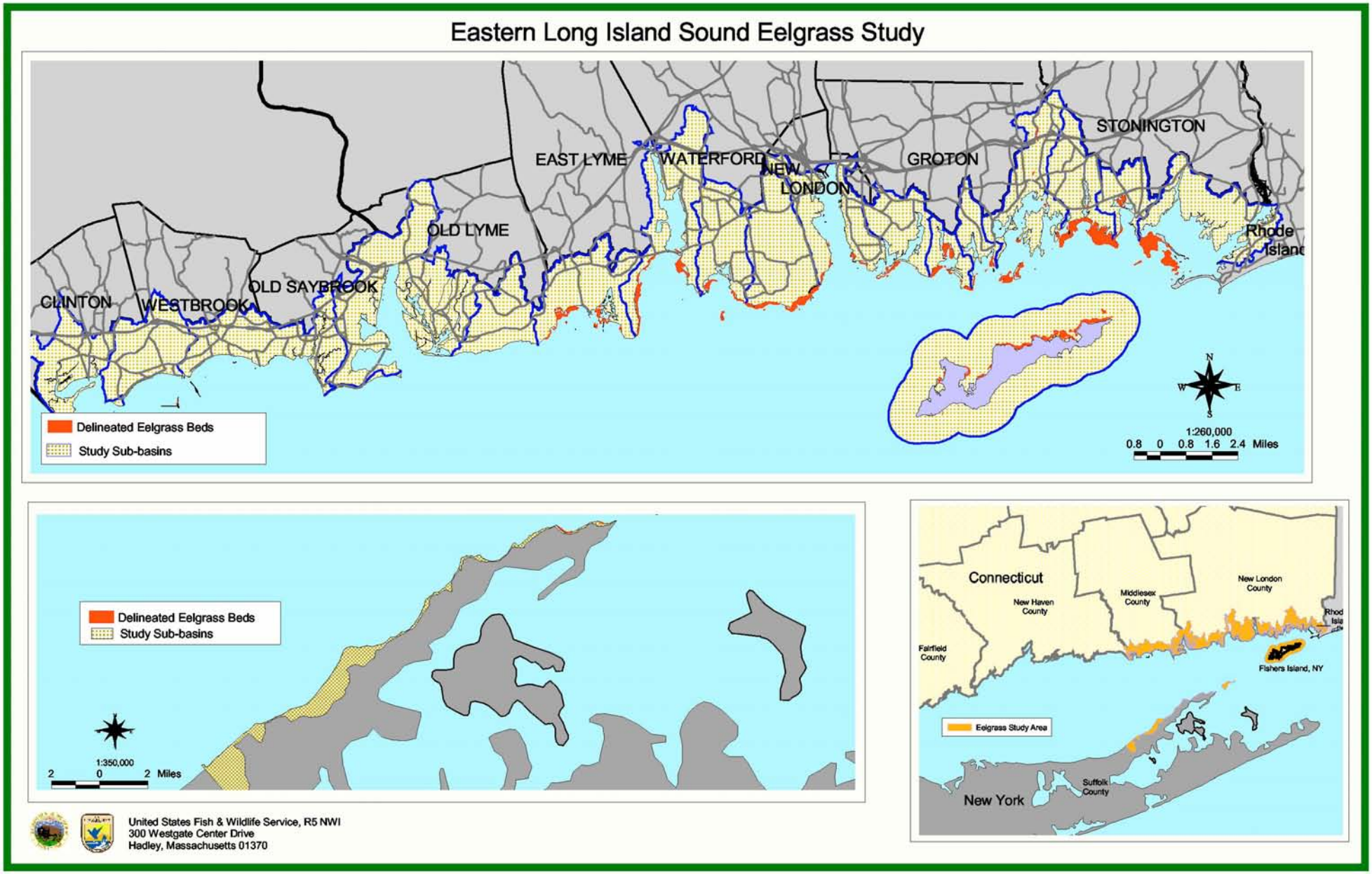
Six sub-basins had over 100 acres of eelgrass beds. Quiambog Cove had the most acreage with 357 acres. Only one other area had over 200 acres of eelgrass: Little Narragansett Bay (286), while Fishers Island had almost 200 acres. The remaining sub-basins with more than 100 acres of beds were Goshen Cove (157), Niantic Bay (139), and Rocky Neck State Park (103).

Table 3. Eelgrass beds in eastern Long Island Sound. Sites are in Connecticut, except where noted otherwise.

Sub-basin	**Acres of High Density (number)**	**Acres of Medium Density (number)**	**Acres of Low Density (number)**	**Total Acres (number)**
Little Narragansett Bay	0	285.8 (13)	0	285.8 (13)
Stonington Harbor	0	42.8 (8)	0	42.8 (8)
Quiambog Cove	1.0 (1)	356.2 (9)	0	357.2 (10)
Mystic Harbor	0	78.9 (12)	0	78.9 (12)
Palmer-West Cove	0	34.8 (6)	0	34.8 (6)
Mumford Cove	0	86.2 (9)	0	86.2 (9)
Paquonock River	0	30.1 (6)	0	30.1 (6)
New London Harbor	0.2 (1)	23.3 (5)	7.1 (1)	30.6 (7)
Goshen Cove	1.7 (3)	73.3 (3)	82.0 (2)	157.0 (8)
Jordan Cove	0	19.2 (6)	24.1 (1)	43.3 (7)
Niantic Bay	9.2 (2)	129.5 (12)	0	138.7 (14)
Rocky Neck State Park	0	102.8 (28)	0	102.8 (28)
Duck Island Roads	0	1.1 (2)		1.1 (2)
Fishers Island, NY	5.5 (8)	184.8 (19)	3.2 (4)	193.5 (31)
North Shore, NY	0	15.7* (2)	0	15.7* (2)
Total	17.6 (15)	1,464.5 (140)	116.4 (8)	1,598.5 (163)

*Beds listed as medium although no record of density was reported by field inspector.

Figure 5. General distribution of eelgrass in eastern Long Island Sound based on a 2002 survey by the U.S. Fish and Wildlife Service.



Historical Data

During this study, we gathered information from past eelgrass surveys and compiled information in our digital database. A series of seven maps were prepared to show the results of these surveys in more detail as compared with our data (see Appendix B). These products provide a composite view of the results of various eelgrass surveys. No historic data were available for the North Shore of Long Island.

Summary

Our survey located and mapped roughly 1,600 acres of eelgrass beds in eastern Long Island Sound. Six sub-basins had over 100 acres of eelgrass beds: Quiambog Cove (357), Little Narragansett Bay (286), Fishers Island (194), Goshen Cove (157), Niantic Bay (139), and Rocky Neck State Park (103). Eelgrass beds were mostly present from Rocky Neck State Park east to the Rhode Island border. Two small beds were found on the North Shore of Long Island, New York. No eelgrass was found from the Old Lyme Shores sub-basin to Clinton Harbor, except for two small beds (totaling 1.1 acres) associated with the Duck Island breakwater in the Duck Island Roads sub-basin.

Acknowledgments

Funding for this project was provided by the Connecticut Department of Environmental Protection (DEP) through a grant from the U.S. Environmental Protection Agency as part of the Long Island Sound Study. Ron Rosza was project officer for DEP. Ralph Tiner was the principal investigator for U.S. Fish and Wildlife Service (Service) and was responsible for project design, management, data analysis, and report compilation.

Photointerpretation, digital database construction, and geographic information system (GIS) processing was done by Herb Bergquist (Service). He compiled data for summation in this report and prepared maps and figures included herein.

Our Southern New England Estuary Program (SNEP) was responsible for field review of potential eelgrass beds, with Andrew MacLachlan and Tom Halavik taking lead roles in this effort. Others assisting in the field included Mark Engler, Don Henne, and Julianna Wyman (SNEP), Greg Mannesto (New England Field Office, Service), Lisa Holst (New York State Department of Environmental Conservation), Chris Pickerell (Cornell Cooperative Extension, Marine Program), Herb Bergquist, and Ralph Tiner.

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Appendices

Appendix A.

Maps showing distribution of eelgrass beds located during this inventory

Appendix B.

Maps showing historical data combined with the results of this inventory

U.S. Department of the Interior
Fish & Wildlife Service

http://www.fws.gov

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