Eelgrass Distribution in Selected Study Areas in Casco Bay

(Mackworth Island, Broad Cove, Cousins Island, Little Diamond Island, and Widgeon Cove)

2014

Final Project and Data Report
for the Casco Bay Estuary Partnership
and the Maine Dept. of Environmental Protection

Submitted by

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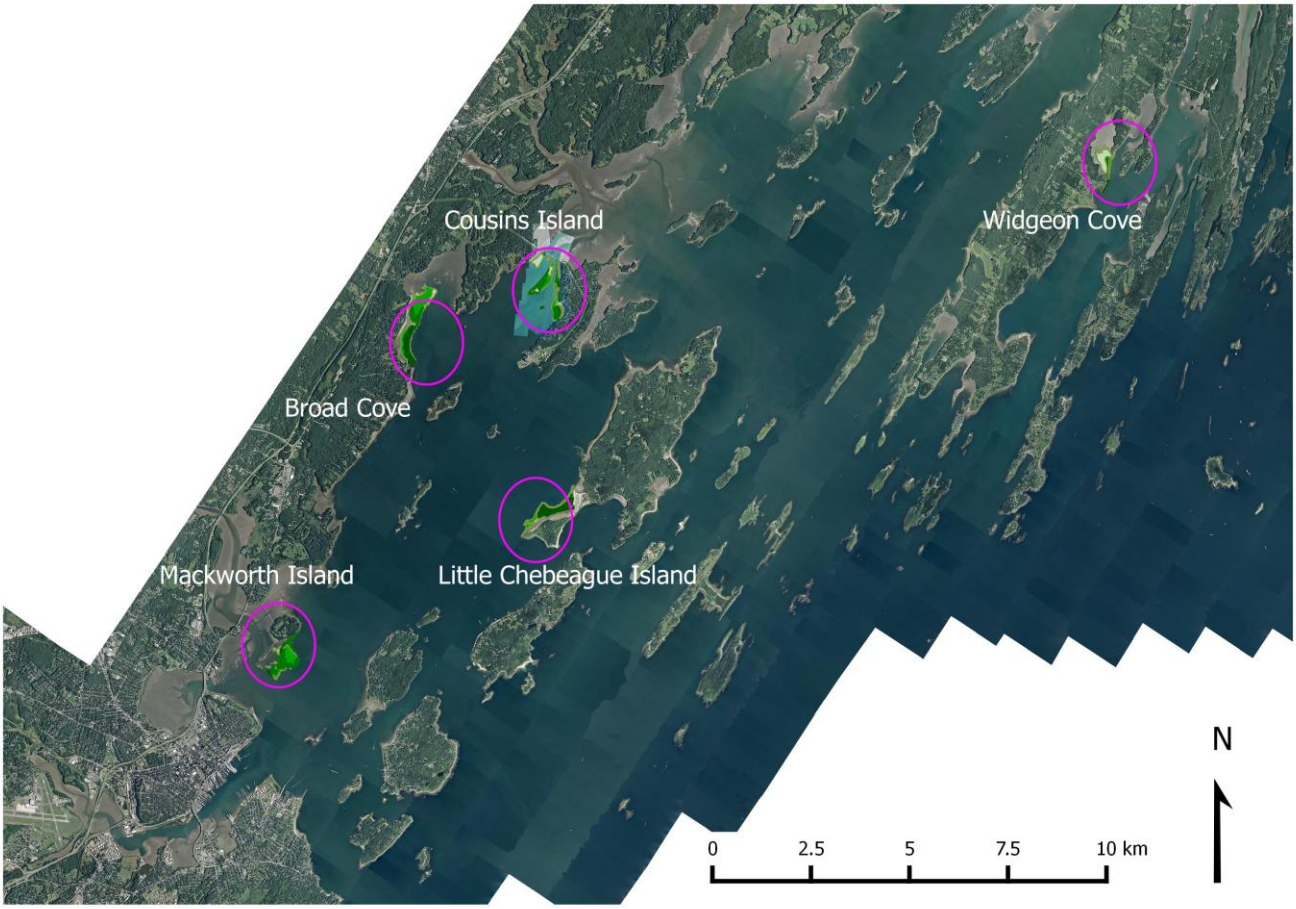
Vignette: Location of Study Areas, 2014.



The following report was written in partial fulfillment of the contract entitled "**Aerial Eelgrass Photography Coordination, Photo Interpretation and GIS Mapping".**

I would like to acknowledge the support provided by The Casco Bay Estuary Partnership and the Maine Dept. of Environmental Protection. The following people provided invaluable assistance: Beverly Bayley-Smith (CBEP), Angela Brewer (MEDEP), Jim Stahlnecker (MEDEP) and John Sowles.

Introduction:

This project was initiated as part of a study to investigate the effect of green crab populations on eelgrass distribution and to further investigate the status of eelgrass in five study areas distributed throughout the bay. The larger study was carried out over multiple scales and looked at a number of aspects of both the health of eelgrass beds and the relationship to green crab populations in the vicinity of the study sites. The work reported here was designed to collect information on the large scale distribution of eelgrass at five study sites and in the process compare these sites to identical areas mapped in 2013.

Monitoring eelgrass distribution over a large geographic area and identifying potential factors responsible for changes in distribution is no small task but most efforts to understand and preserve the ecology of an area begin with these basic steps. Though direct cause and effect relationships are often difficult to prove, enough is know of the root causes of the decline of sea grasses that with careful collection of data on many of the parameters that are important to eelgrass and other SAV (submerged aquatic vegetation), well informed decisions can be made as to where to place scare resources to improve the environment and the future of this important habitat. A necessary first step is to periodically obtain documentation of the distribution and the relative density of eelgrass beds. This project is such a benchmark.

In Maine, eelgrass has be mapped in Casco Bay on several occasions. Eelgrass was included as a feature in the Coastal Marine Geologic Environment (CMGE) maps (Timson,1976). In some portions of the Maine coast these maps have limited value historically as it appears that eelgrass beds were not consistently documented for the following reasons. First, the conditions at the time of the aerial photography may not have been optimal and eelgrass may not of been clearly identified in the black and white photography taken at that time. Second, the CMGE maps had over 50 categories of coastal features making it possible that other categories such as subtidal flats were used rather than eelgrass beds. It does appear though that in Casco Bay, this map series can serve as a reliable record of distribution.

In 1993, eelgrass distribution in nearly the entire of Casco Bay was mapped as were a number of other embayments along the coast (DMR, unpublished, Maine office of GIS, “Eelgrass97.shp”). In that effort the area round the New Meadows and Small Point were completed in 1994. Eelgrass distribution was mapped in 2001 and 2002 (DMR unpublished, Maine Office of GIS, “Eelgrass2010.shp”). Eelgrass distribution was again mapped using essentially the same approach in 2013. This study used comparable methodology.

Methods:

Aerial Photography - Digital aerial photography was collected for this project by John Sowles, North Yarmouth, Maine under a contract with the CBEP (Casco Bay Estuary Partnership). The photography was small format (35mm), digital, and was acquired near the time of low water. Care was taken to collect photography in a manner that was as near to metric quality standards as possible and for the purposes of this project it appears that this objective was met. Additional processing steps were required to produce seamless mosaics for each of the study sites. The protocol for acquiring the photography for this project was based on the NOAA Coastal Change Analysis Program protocol (NOAA, 1995 and NOAA, 2001). Flights were carried out in July, August, and September, 2014. After

review of the aerial photography, the decision was made to use the better of either the July or September flight for the photo-interpretation.

Eelgrass Bed Mapping - Polygons were screen digitized using the GIS software program Quantum GIS and saved in an ESRI shape file. Screen scale for digitizing was generally between 500 and 1000. Eelgrass beds are often continuous over large areas but sometime patchy in nature. To more clearly identify the degree of patchiness, four categories of coverage were used in the delineation of polygons. These categories were based a scale originally developed for forest crown covered and applied to eelgrass by Orth et al, 1996. The four categories are: >0-10%; >10-40%; >40-70%; >70-100% and were coded 1-4 respectively. A photointerpretation aid is shown in Figure 1. For this project a fifth category was created to accommodate portions of polygons that did not contain eelgrass. These polygons were interior to other polygons and coded as "0" and are often referred to as null polygons.

There were two basic types of observations of eelgrass and other biological features that were made throughout the course of this work. During the photointerpretation step, the digital photomosaic was inspected carefully at a high resolution (zoomed in) on the screen. To the extent that features were visible and interpretation was possible, the aerial photographs provided an excellent overview of landscape of which eelgrass beds were an element. Features such as mussel bars, and mudflats were all fairly easily identified and provided visual clues to the type of environment present in the vicinity of an eelgrass bed. Observations on the ground provided details at a totally different scale. This second type of observation was made during the verification step, otherwise known as groundtruthing.

The normal mode of groundtruthing was in the form of observations from a boat but it was also done at several locations by foot. In the September-October time period, groundtruthing was carried out by boat using a GPS, drop camera and a monitor on the surface. With all observations, a Trimble XM GPS unit was used. GIS software, ArcPad (ESRI, Inc), was used to provide a map display of draft eelgrass distribution for 2014. In addition a Garmin Colorado GPS unit was used to record a track file. This allowed the evaluation of the mapping accuracy which was used to improve the accuracy of the mapped distribution.

Review and revision of 2013 eelgrass GIS data – To insure consistency between the 2013 and 2104 interpretations, 2013 GIS data for the study sites were reviewed and revised to the extent needed thus allowing better correspondence between cover categories in the interpretations for each year. A new GIS file was produced for the study sites based on the revised interpretation and a copy included with the final products that were delivered.

Dates of Photography used for photo-interpretation in 2014 – The following mosaics were selected for photo-interpretation as they presented the clearest view of eelgrass distribution at that time:

Mackworth Island – July
Broad Cove - September
Cousins Island - September
Little Chebeague – July
Widgeon Cove - July

Results:

Five areas were mapped in detail from the 2014 aerial photography and minor revisions were made to the interpretation of the 2013 photography. Some change was detected in all the study sites and in some locations occurred at a number of locations within a site. The distribution mapped for 2014 is shown in Figures 2 through 6. A comparison of areas in each of the cover categories was made with the revised 2013 data and the results shown in Table 1.

The following are observations for each of the study area:

Mackworth Island – The Mackworth Island bed is essentially one large bed. The central portion of the bed had less cover in 2014 than in 2013. This was the largest area of change. There were some small patches and groups of small patches newly identified to the western side of the bed. When groundtruthed, these were found to be dense and slightly raised above the surrounding substrate. These areas had been missed in the original interpretation in 2013 and were corrected where visible in the 2013 imagery.

Broad Cove – One of the largest areas of change was in the northern end of the study site. The eelgrass bed had lower cover in 2014 as compared to 2013.

Cousins Island – There was change throughout the area with loss on the west side of the channel, in the middle bed, and along the eastern shore of Cousins Island. A new patch was found in deeper water towards the southern end of the study area. On review of the 2013 photography the same patch was located and added to the revised 2013 GIS file.

Little Chebeague Island – The primary area of change was in the deeper water in the upper two thirds of the bed. Eelgrass was present at this location in 2013 and absent in 2014.

Widgeon Cove – The primary area of change was the shallow subtidal flats at the mouth of the cove where eelgrass was present but scattered in 2014. In 2013 there was heavier cover. These flats are poorly drained and though exposed on most tides, continue to support eelgrass.

When looking at the change in total area mapped over all the study sites in 2013 and 2014, there is only a 9% decrease. The change of concern is how the cover categories are apportioned. There was clearly a shift towards lower cover in 2014.

Literature Cited

NOAA Coastal Change Analysis Program (C-CAP): Guidance for Regional Implementation, NOAA Technical Report 123, Department of Commerce, 1995.

NOAA Coastal Services Center. 2001. Guidance for Benthic Habitat Mapping: An Aerial Photographic Approach by Mark Finkbeiner [and by] Bill Stevenson and Renee Seaman, Technology Planning and Management Corporation, Charleston, SC. (NOAA/CSC/20117-PUB).

Orth, R. J., J. F. Nowak, G. F. Anderson, D.J. Wilcox, J. R. Whiting, and L.S. Nagey, 1996. Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1995. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. CB993267-01-0. 293 pp.

Timson, Barry S., 1976, Coastal Marine Geologic Environments : Maine Geological Survey (Department of Conservation), Open-File Maps

Tables and Figures

Figure 1. Per Cent Cover scale used to categorize the relative density of eelgrass beds. From Orth, et al. 1996.

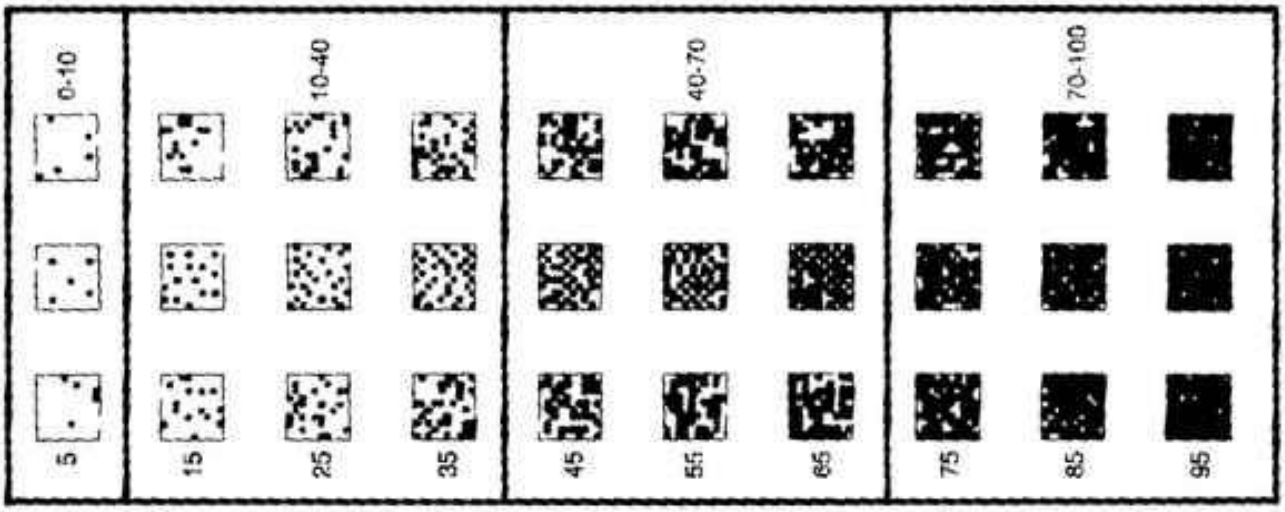


Table 1. Comparison of the area of cover categories between 2014 study sites and the same area of interest in 2013.

2014	0	1	2	3	4	Total Area (ha)
Broad Cove	0.02	5.73	28.69	6.90	13.80	55.14
Cousins Island		9.04	14.73	12.56	2.85	39.18
Little Chebeague Island		2.58	10.08	1.44	18.47	32.57
Mackworth Island		2.19	14.50	16.17	2.87	35.73
Widgeon Cove		12.14	1.94	3.28	0.46	17.82
Total Area (ha)	0.02	31.69	69.95	40.35	38.43	180.44

2013	0	1	2	3	4	Total Area (ha)
Broad Cove	0.02	7.44	11.71	8.72	29.51	57.40
Cousins Island		1.79	0.77	16.08	21.82	40.46
Little Chebeague Island	0.37	0.63	13.98	4.39	24.91	44.27
Mackworth Island		2.31	4.24	1.76	27.50	35.81
Widgeon Cove	0.02		14.30	4.31	0.66	19.29
Total Area (ha)	0.41	12.17	45.00	35.26	104.40	197.23

Figure 2. Mackworth Island Eelgrass Distribution and Cover, 2014.

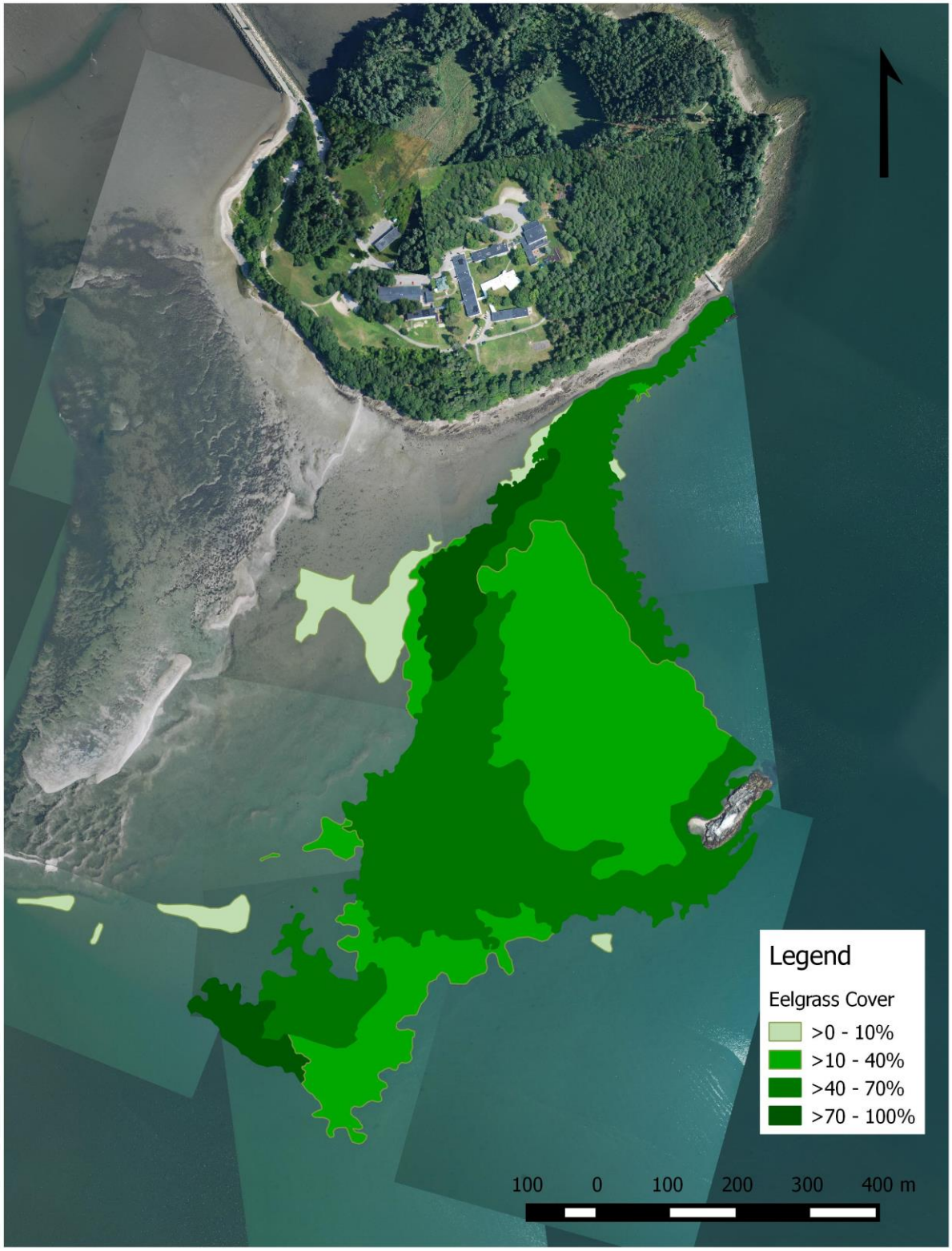


Figure 3. Broad Cove Eelgrass Distribution and Cover, 2014.

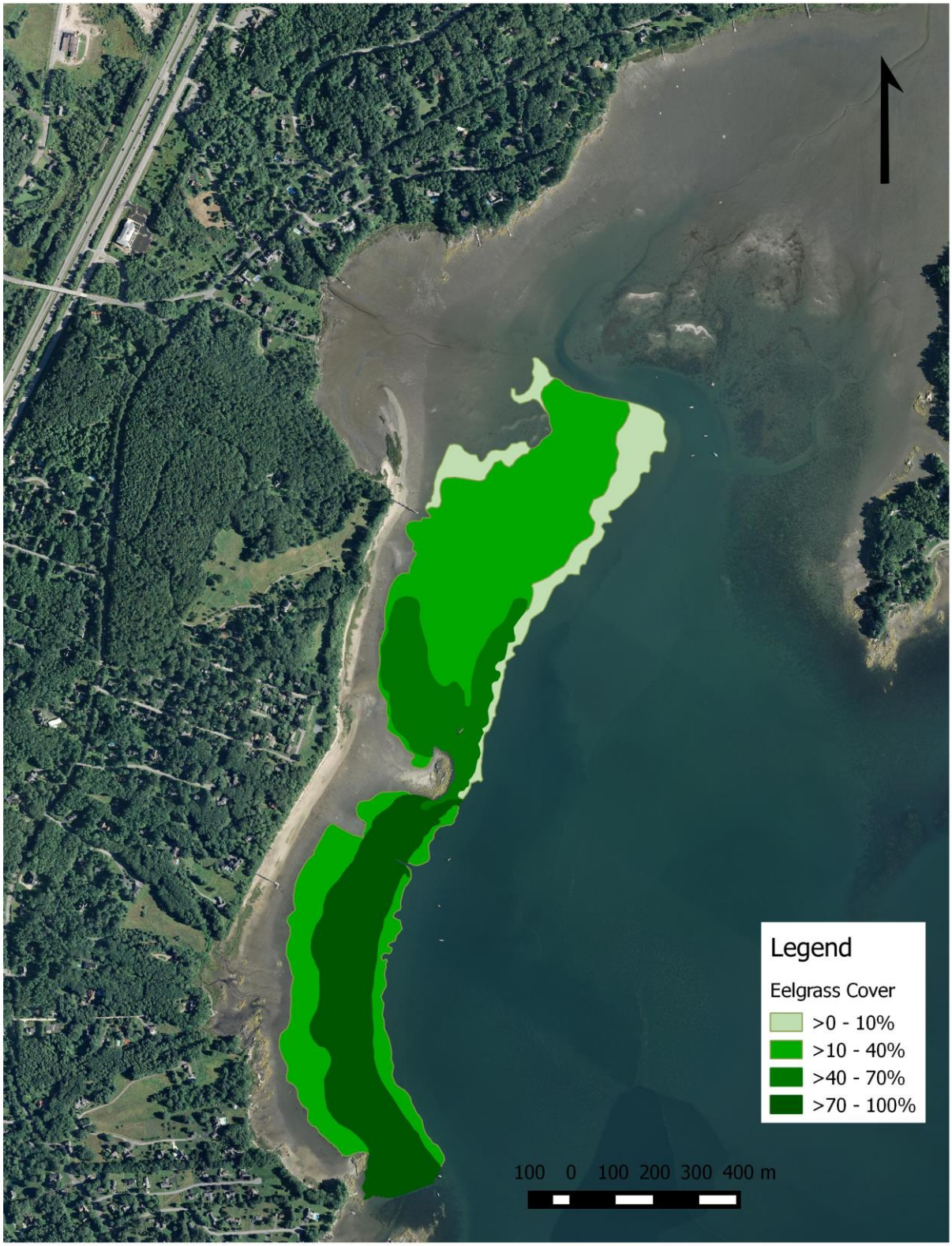


Figure 4. Cousins Island Eelgrass Distribution and Cover, 2014.

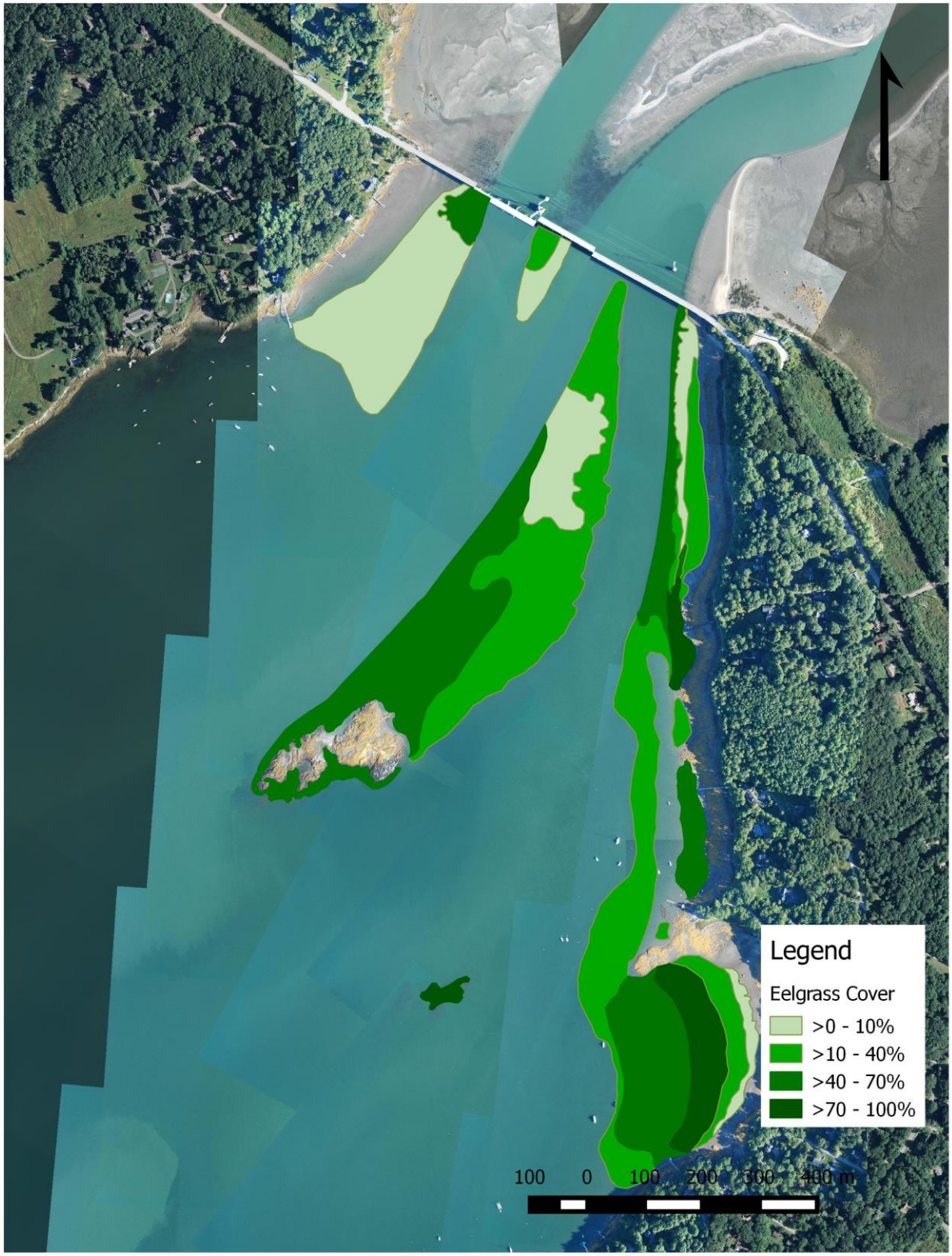


Figure 5. Little Chebeague Island Eelgrass Distribution and Cover, 2014.

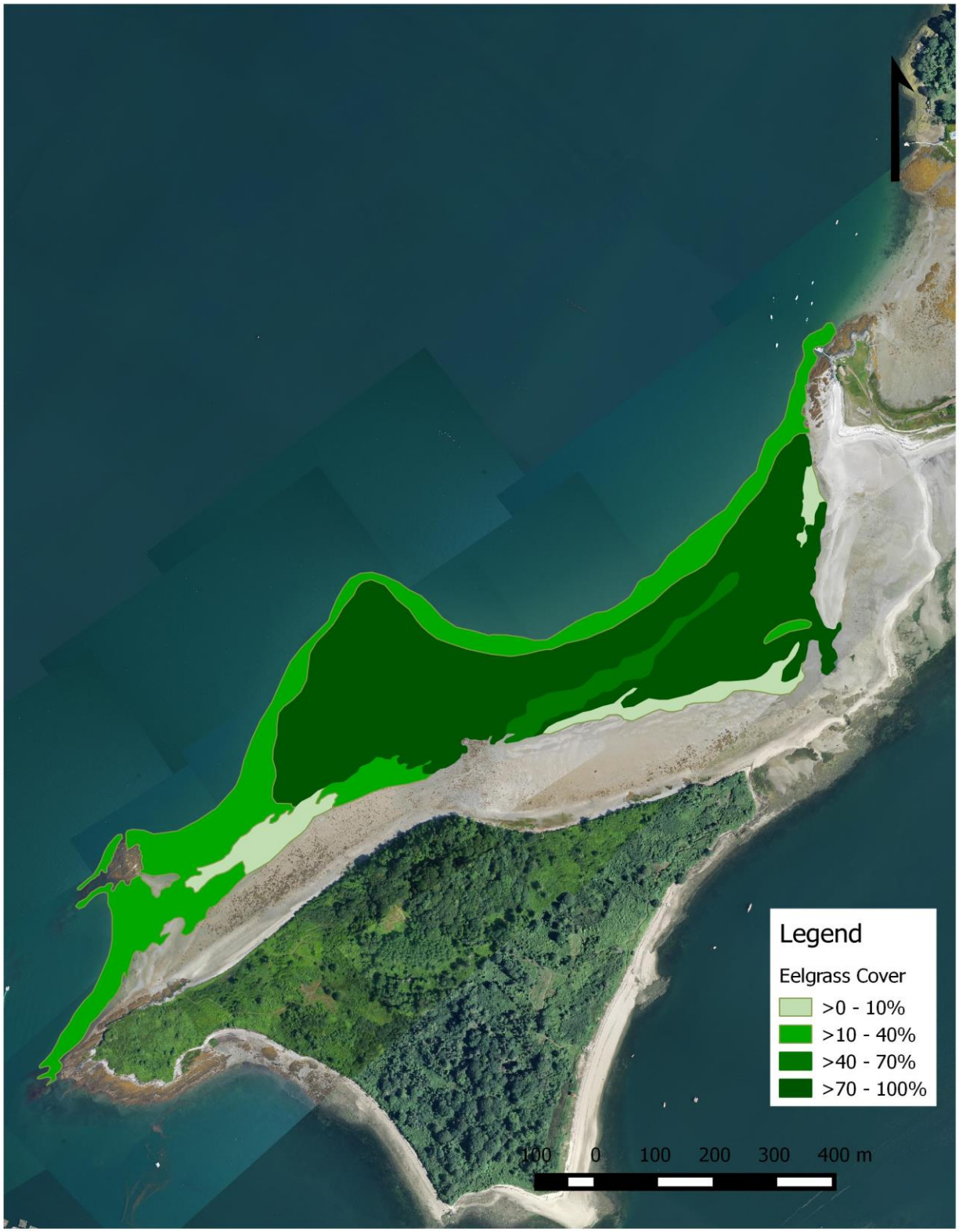


Figure 6. Widgeon Cove Eelgrass Distribution and Cover, 2014.