U.S. Fish & Wildlife Service

2001 Baseline Wetland Vegetation Monitoring for the Poplar Island Restoration Project

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2001 BASELINE WETLAND VEGETATION MONITORING FOR THE POPLAR ISLAND RESTORATION PROJECT

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EXECUTIVE SUMMARY

The objectives of the Poplar Island restoration project in Chesapeake Bay are to create wetland and upland island habitats by restoring the eroded island with dredged material from Baltimore's shipping-channel complex. Project planners anticipate creating approximately 550 acres of saltmarsh within the historic island footprint. Evaluations of wetland creation success may differ depending upon the evaluation criteria used. For this project, it was concluded that data collections must consider both the structure and function of representative natural wetlands when comparing the Poplar Island constructed wetlands with natural ecosystems. The vegetation data presented herein represents one of the wetland criteria identified as part of a multifaceted monitoring program designed to assess an array of wetland and habitat functions. The U.S. Fish and Wildlife Service began monitoring several reference marshes in the Poplar Island complex and along the Eastern Shore of the Chesapeake Bay in September of 1996. That monitoring study was intended to establish a body of local saltmarsh vegetation information to be used in evaluation of the future wetlands created on a restored Poplar Island. The 2001 iteration was intended to further define and update the baseline reference marsh conditions while comparing to those described by the 1996 study. Using a system of fixed transects, eight reference marshes were sampled in August 2001. From the data gathered, indices describing vegetative cover, stem height variation, and plant species diversity were calculated to illustrate vegetation patterns apparent in the local saltmarsh communities.

As expected, there were differences in vegetation parameters between low marsh and high marsh zones of our reference sites. Among our results from the 2001 sampling episode, we found that saltmarsh cordgrass (*Spartina alterniflora*) was the dominant plant species in the low marsh zone, with saltmeadow hay (*Spartina patens*) a secondary dominant species. Within the high marsh zone, *S. patens* was the overwhelming dominant species, but common reed (*Phragmites australis*), saltgrass (*Distichlis spicata*), *S. alterniflora,* and high tide bush (*Iva frutescens*) were also important community components. We also found that the plant community in the high marsh zone had greater diversity than in the low marsh zone. Stem heights varied from site-to-site for most species analyzed. The information yielded represents a furtherance of understanding of naturally-occurring wetland systems in the vicinity of Poplar Island that will be valuable in mid-course corrections and evaluations necessary for the success of the restoration project.

Additional information could facilitate the application of this information in adaptive management of constructed wetlands on Poplar Island and in design prescription of future projects. Linking the detailed vegetation community information directly to elevational positioning in the marsh landscape would create a more intuitively-applicable, visually-accessible representation of local saltmarsh vegetation. Establishing connections between vegetation community variation and marsh elevations would make monitoring study products more readily applicable to design and mid-course correction guidance. Future monitoring should include microtopographical elevation determinations.

INTRODUCTION

The Poplar Island restoration project, located in Chesapeake Bay off Tilghman Island in Talbot County, Maryland (Figure 1), was undertaken as a cooperative solution addressing the problems of dredged material disposal and island erosion. Records from the 1670's describe Poplar Island as 1,400 acres in size, though it may have once covered 2,000 acres. By the 1990's less than10 acres of disjunct remnants remained of Poplar Island itself (Leatherman et al. 1995), with less than 125 acres remaining of the island complex that includes Poplar, Coaches and Jefferson Islands. The restoration project is using dredged material from the Baltimore shipping channel complex to reestablish an approximately 1,100-acre island within the historic footprint of Poplar Island. Fifty percent of the reestablished island will be constructed at elevations suitable for the creation of wetlands. In order to make appropriate design and management prescriptions for these created wetlands, it was necessary to develop a body of structure and function information for local, representative wetlands.

The U.S. Fish and Wildlife Service (Service) participates in an interagency Poplar Island monitoring task force. In addition to the wetland monitoring described in this report, submerged aquatic vegetation is being monitored by the Service, wildlife usage by the U.S. Geological Survey, and fisheries usage by the National Marine Fisheries Service. Together, these multi-year efforts will enable Federal and State agencies to guide and judge the success of restoration measures at Poplar Island.

In September of 1996, the Service began monitoring saltmarsh vegetation in the remnant marshes of Poplar Island, Coaches Island and in marshes on the mainland north of Tilghman Island. The objectives of this initial sampling were to estimate baseline marsh community structure information such as plant cover dominance, diversity, and above ground biomass. The objectives of the 2001 monitoring episode were to update this baseline information while allowing interannual comparison by replicating the 1996 effort. Ultimately, the reference marsh information will be compared to the conditions in the newly-created Poplar Island saltmarshes to test for differences in community structure parameters as a measure of wetland creation success and stability.

The wetlands being sampled in this monitoring study include the following types from the U.S. Fish and Wildlife Service's classification system (Cowardin, *et al.* 1979):

Estuarine, Intertidal, Emergent, Narrow-leaved Persistent, Regularly Tidal
Estuarine, Intertidal, Emergent, Narrow-leaved Persistent, Irregularly Tidal
Estuarine, Intertidal, Beach/Bar, Regularly Tidal

These communities are characterized by species such as smooth cordgrass (*Spartina alterniflora*), saltmeadow hay (*Spartina patens*), salt grass (*Distichlis spicata*), black needlerush (*Juncus romerianus*), and threesquare (*Schoenoplectus americanus*), with lesser amounts of high tide bush (*Iva frutescens*) and common reed (*Phragmites australis*). Mean tidal range within the study area is 0.5 meters, with salinity ranges from a minimum of approximately 5ppt in Spring to 18ppt in

Autumn. Throughout this report, comparisons will be made between low marsh community parameters and high marsh community parameters. These two zones are typical of Chesapeake Bay salt marshes. Low marsh refers to the zone inundated twice daily by the lunar tidal cycle and high marsh refers to the zone inundated on a less regular and frequent basis (Gill and McGowan 1998).

METHODS

Methodologies for saltmarsh vegetation sampling were adapted from "A Manual for Assessing Restored and Natural Coastal Wetlands" (PERL 1990), and "Field and Laboratory Methods for General Ecology" (Brower and Zar 1984). In the 1996 monitoring episode, four sites were selected within the remnant Poplar Island and Coaches Island complexes. An additional five sites were selected outside the influence of Poplar Island, on the mainland between Knapps Narrows and Harbor Cove. Sites used for vegetative measurements corresponded to areas used by National Marine Fisheries Service (NMFS) for fyke net sampling for aquatic fauna. Latitude and longitude of each sampling site was determined using Global Positioning System (GPS). Coordinates of sampling locations are in Appendix A. In 2001, three sites were dropped from the study and two sites were added. Monitoring at Middle Poplar Island, North Point Island, and South Central Poplar Island was discontinued because they are now located within the project construction footprint. A second site was added on Front Creek (Front Creek "A") and a new site was established at Back Creek. Both new sites correspond to 2001 NMFS fyke net stations. Table 1 includes sampling site letter codes used in this report and Figure 2 details the location of the eight 2001 reference marshes in the study area.

Table 1. Letter codes and study status for wetland vegetation monitoring sites.

SITE NAME	CODE	Status in Vegetation Monitoring Study	See Figure #
Back Creek	BAC	added and first sampled 2001	4
Cabin Cove	CAC	sampled in 1996 and 2001	5
Coaches Island	COI	sampled in 1996 and 2001	6
Front Creek	FRC	sampled in 1996 and 2001	7
Front Creek "A"	FRCA	added and first sampled 2001	8
Harbor Cove	HAC	sampled in 1996 and 2001	9
Knapps Narrows	KNN	sampled in 1996 and 2001	10
Lowes Point	LOP	sampled in 1996 and 2001	11
Middle Poplar Island	MPI	sampled 1996, now w/in constructed island	n/a
North Point Island	NPI	sampled 1996, now w/in constructed island	n/a
South Central Poplar	SCI	sampled 1996, now w/in constructed island	n/a

The six 1996 reference sites re-sampled in 2001 were located using GPS and reestablished as necessary using PVC poles in preparation for the 2001 monitoring episode. The two new sites were arranged identically to the 1996 sites. At each site, four variable-length permanently-marked transects were established perpendicular to the shoreline, stretching from the water's edge to the upland edge of the marsh. Two central transects at each site corresponded to National Marine Fisheries Service fyke net stations, with the two remaining transects located from 2 to 10m on either side of the central transects. Transects were numbered left to right, 1 through 4, looking from the water into the marsh interior. (See Figure 3 for a representative schematic diagram of the transect layout used at each reference marsh). Figures 4 through 11 illustrate partial layouts of transects overlaid on maps of individual reference marshes.

Along each of the four transects, four, 0.25 m^2 quadrats were used to measure areal coverage and stem height of each plant species present (Figure 3). Quadrats were positioned at 2m from the water's edge (Quadrat 1), 2m channelward of the low/high marsh edge (Quadrat 2), 2m landward of the low/high marsh edge (Quadrat 3), and 2m channelward of the upland edge (Quadrat 4). Again, low marsh was defined as predominantly *S. alterniflora* with twice daily innundation by the diurnal tidal cycle. High marsh was represented by less regular innundation and plant species such as *S. patens* and *D. spicata*. Given the micro-topography of many sampling locations, the demarcation between high and low marsh was often subtle. In such cases, wrack lines or other non-dominant species were used for marsh transition delineation and quadrat placement purposes.

Areal cover is an indicator of species dominance in the vegetative community. The 0.25m^2 quadrats were further divided into 0.01m^2 subsections. The number of 0.01m^2 subsections containing an originating stem was recorded for each species within each quadrat. The areal cover was then expressed as the percentage of 0.01m^2 subsections containing each species. Relative areal cover of each species was expressed as the proportion of its areal cover to the total areal cover of all plants in the quadrat.

For the purposes of this monitoring study, stem height can serve as an indicator of the differential productivity of different wetland sites and potentially, differential success of individual species on dredged-material growing substrates vs. local marsh soils. To determine average stem height, five stems for each species found in the 0.25 m^2 quadrats were measured. Stems were selected from the center and each of the four corners of the quadrat.

Cover-segment line-intercept records were made to determine plant community composition. For each transect, a 5 m segment was measured starting at each endpoint (water's edge and upland) and extending into the marsh's interior (Figure 3). The segment beginning at the upland terminus of each transect was used for high marsh composition determination with the waterward segment used for low marsh composition determination. Presence of all plant species was recorded at 50 one-decimeter intervals along each 5m segment and totaled. From this species composition and frequency information, Simpson's Index of Diversity was calculated for each 5m segment sampled. The diversity index is an expression of the number of times pairs of individual plants would have to be taken at random from the entire plant community sampled to

find two of the same species, and is calculated as follows:

$$D_s = 1 - [\sum n_i(n_i - 1) / N(N - 1)]$$

where n_i is the abundance of each species and N is the total abundance of all species recorded. Diversity increases as Simpson's Index approaches 1.0.

In addition to vegetation sampling, all invertebrates encountered within the areal cover quadrats were recorded. Counts encompassed the total number of each faunal taxa within the 0.25m² quadrat, as well as additional observations of invertebrate and vertebrate sign, including scat, tracks, burrows, etc. Faunal data were collected to enable a general assessment of the dominant invertebrate taxa present in the reference marshes.

A photomonitoring record of site conditions was made at each transect of all reference marshes. A digital photo was taken while standing at the water terminus of each transect and focusing the camera along the transect axis toward the upland terminus. Future photomonitoring iterations will be conducted using the same positioning. At transects with a narrow band of taller vegetation near the water's edge that would otherwise obscure views of the reference marsh, photos were taken from just inside the taller vegetation. Comparing the photomonitoring record from different sampling years will provide a qualitative gauge of stability or change in site conditions, illustrating coarse-scale successional changes. Appendix B contains the photomonitoring record for 2001.

Data Analysis

Wetland vegetation data for each sampling location were entered into Excel computer data files. Analyses of all data was performed using SigmaStat statistical computer software (Jandel 1997). For each sampling location, data was analyzed for the following vegetation parameters: areal cover, relative cover, canopy height, and Simpson's Index of Diversity. Using these parameters, reference marshes were compared within respective low marsh and high marsh zones and between sampling years. Within this framework, our analyses followed a general sequence of a One-Way Analysis of Variance followed by a multiple comparison test. When data was normally distributed, a standard ANOVA was used to detect differences and a Tukey parametric multiple comparison procedure was used to illustrate those differences between sites or other groupings. When data did not meet the assumptions of a normal distribution, a non-parametric Kruskal-Wallis One-Way Analysis of Variance followed by a Student-Newman-Keuls or Dunn's multiple comparison procedure was used. The Student-Newman-Keuls and Dunn's tests are non-parametric analogs of the Tukey test and determine which pairs of ranked medians are significantly different from one another. The Dunn's test is appropriate for comparisons in cases with different sample sizes.

RESULTS

Wetland vegetation sampling at reference marshes was conducted over a nine-day period in mid-August 2001. The 1996 baseline sampling episode occurred in late September. During the 2001 monitoring period, the main objectives were to update baseline wetland vegetation community parameters while replicating the 1996 sampling effort for the purpose of interannual comparisons. Data analysis will be discussed within the framework of three categories of community indices: percent cover, stem height, and species diversity. Raw data is presented in Appendix C and all SigmaStat statistical runs are presented in Appendix D.

Percent Cover

Percent vegetative areal cover information was calculated from data collected using the arrays of $0.25m^2$ quadrats as described in the Methods section. For each quadrat, the percentage of the quadrat area covered by a given species was defined as the number of $0.01m^2$ quadrat subsections occupied by a stem of that species divided by a total of 25 subsections. Data were pooled to yield transect averages, site averages, or aggregate percent cover estimations for low marsh and high marsh zones among all reference marshes. Data from quadrats number 1 and 2 were combined for low marsh cover estimates. Data from quadrats number 3 and 4 were combined for high marsh cover estimates.

Table 2 contains percent areal cover by each plant species calculated for low marsh and high marsh locations within each site. Table 3 contains the same information, recalculated to percent relative areal cover, i.e. coverages within a given combination sum to 100%.

Percent coverages were calculated for each species from combined low marsh data from all reference sites. The average cover by *S. alterniflora* (44.3%), *S. patens* (28.6%), and *J. romerianus* (18.8%) showed these to be the three dominant low marsh species by percent cover (Table 4). Prior to analysis, we performed an arcsine transformation function on the percentage data in an attempt to normalize the distribution. The transformed data still did not meet the assumptions of a normal distribution, so we proceeded with a non-parametric Kruskal-Wallis One-Way Analysis of Variance on Ranks followed by a Student-Newman-Keuls multiple comparison test to determine if the apparent dominance relationships were statistically significant. In this case, the Student-Newman-Keuls multiple comparison procedure was used to determine which pairs of ranks (derived from each species' median rating) were significantly different from one another. The dominance by percent cover of *S. alterniflora* in the low marsh zone was statistically significant ($p<0.05$), with the secondary dominance of *S. patens* also statistically significant. There were no statistically significant percent cover differences between any of the other species observed. Table 5 details the differences in percent cover ranks by species in the low marsh zone.

In the combined-sites high marsh zone, *S. patens* (61.7%), *D. spicata* (19.6%), and *P. australis* (15.7%) had the three highest average percent coverages. Using the same method as with low marsh coverages, the dominance hierarchy of high marsh species was tested. By assigned rank, and in order, the percent cover by the following species were statistically distinct ($p<0.05$): *S.*

patens, P. australis, D. spicata, S. alterniflora, and *I. frutescens.* All other species had statistically similar percent cover (Table 6).

Stem Height

From the stem height data collected by measuring the height (in cm) of 5 representative stems of each species observed in each sampling quadrat, we calculated average stem height values for each species for the low and high marsh zones of each site (Table 7).

For analysis of stem height data we chose the 5 species with the greatest percent cover (from Table 4) in both low and high marsh zones. For the low marsh zone those species were: *S. alterniflora, S. patens, J. romerianus, D. spicata,* and *P. australis.* For the high marsh zone the 5 species were: *S. patens, D. spicata, P. australis, S. alterniflora,* and *S. americanus.* To determine if a given species had significantly shorter or taller stem heights in different reference marshes, within the respective high or low marsh zones, we again used a One-Way Analysis of Variance followed by a multiple comparison test. When stem height data did not meet the assumptions of a normal distribution, a non-parametric Kruskal-Wallis One-Way Analysis of Variance followed by a Dunn's multiple comparison procedure was used. As with the Student-Newman-Keuls multiple comparison procedure, Dunn's test determines which pairs of ranks are significantly different from one another, but is appropriate for comparisons with different sample sizes. When stem height data was normally distributed, as in the case of *D. spicata* in the low marsh and *S. patens, S. alterniflora,* and *S. americanus* in the high marsh, a Tukey parametric multiple comparison procedure was used to compare sample means between all sites.

Within the low marsh, *S. alterniflora* was significantly ($p<0.05$) shorter (median 53.5 cm) at Cabin Cove than at Lowes Point (median 73.0 cm), Front Creek "A" (median 74.0 cm), and Knapps Narrows (median 70.0). *S. patens* was significantly ($p<0.05$) taller at Lowes Point (median 56.0 cm) than at Back Creek (median 36.0 cm). There were no other differences between sites for *S. patens.* There were no significant differences between sites for *J. romerianus* or *D. spicata* stem heights in the low marsh. For *P. australis*, stem heights were significantly ($p<0.05$) taller at Coaches Island than at Front Creek, but were similar between all other sites.

Within the high marsh, *S. patens* had significantly different ($p<0.05$) stem heights at several reference marshes. Stem heights for this species were highest at Harbor Cove and Lowes Point. See Table 8 for a full description of height differences for *S. patens.* There were no significant differences between sites for *D. spicata* or *P. australis* stem heights in the high marsh. *S. alterniflora* was significantly ($p<0.05$) taller (mean 79.2 cm) at Harbor Cove than at either Knapps Narrows (mean 51.9 cm) or Back Creek (mean 61.6 cm). Also, the same species had significantly ($p<0.05$) greater stem heights at Lowes Point (mean 69.9 cm) and Front Creek (mean 66.2 cm) than at Knapps Narrows (mean 51.9 cm). Finally, for *S. americanus,* there were no significant high marsh stem height differences between sites.

When considering differences between species, *P. australis* was the species with the highest median stem heights at all eight sites in the high marsh zone, as expected. In the low marsh there was more variation, with *S. alterniflora, P. australis,* and *J. romerianus* frequently exhibiting the greatest stem heights. The stem height observations should be interpreted with caution, as the

combination with a given species' level of coverage dominance may more accurately illustrate a species' influence on marsh structure than stem height information alone.

Diversity

Plant species diversity was calculated from species occurrence data collected along two line-intercept segments per transect. Within each segment, Simpson's Diversity Indices were calculated according to the description in the Methods section. These indices were then combined for estimates of low marsh and high marsh diversity. Observations from the four waterward segments per site were pooled for estimates of low marsh zone diversity, while observations from the four landward segments per site were pooled for estimates of high marsh zone diversity. The resulting diversity indices are presented in Table 9 and Figure 12. A Kruskal-Wallis one-way analysis of variance on ranks was used to detect differences among low marsh diversity indices for all sites as sampled in 2001. There were no significant differences ($p=0.785$), indicating that the low marsh portions of each site had similar plant community diversity in 2001. As in the low marsh, there were no significant differences ($p=0.237$) in diversity among high marsh sites in 2001. We then compared the combined all-sites low marsh zone diversity indices to the combined all-sites high marsh zone diversity indices. The high marsh zone (median 0.69) had a significantly ($p<0.05$) higher level of plant diversity than the low marsh zone (median 0.59) in 2001. This comparison was made using the Student-Newman-Keuls method.

Before comparing 2001 plant diversity levels to those estimated in 1996, we tested for differences within the 1996 sites respective low and high marsh zones. There were no significant differences in plant diversity among 1996 low marsh sites ($p=0.822$) or among 1996 high marsh sites ($p=0.149$). Also, combined low marsh diversity was similar ($p=0.061$) to combined high marsh diversity in 1996.

In comparing 2001 diversity levels to 1996 indices, we first compared low marsh and high marsh zones within each sampling site. There were no significant interannual differences in any of the comparisons made for the six sites in common between the two sampling episodes. Finally, we compared the combined all-sites low marsh zone and combined all-sites high marsh zone diversity indices from 2001 to their 1996 counterparts using Dunn's method. There were no significant differences.

Faunal Data

As described in the Methods, we recorded the abundance of each faunal taxa observed within each sampling quadrat. Detailed statistical analyses were not conducted for these data, but taxa abundance by low and high marsh zones is displayed in Table 10 and illustrated in Figure 13. Raw observations are presented in Appendix E. Two molluscs composed the overwhelming majority of invertebrate observations. In the low marsh, there were similar numbers of marsh periwinkles (genus *Littorina*) and salt marsh snails (genus *Melampus*). In the high marsh, *Melampus* was by far the most numerous faunal taxon in our study, with over 1,000 observations. A list of all plant species observed during the 2001 sampling is in Appendix F.

DISCUSSION

Percent Cover

As expected, there were differences in coverage dominance between low marsh and high marsh zones of our reference sites. For the 2001 sampling episode, *S. alterniflora* was the dominant plant species in the low marsh zone, with *S. patens* a secondary dominant species. Similarly, the 1996 sampling showed *S. alterniflora* to be the dominant low marsh species. Within the high marsh zone, *S. patens* was the overwhelming dominant species, but *P. australis, D. spicata, S. alterniflora,* and *I. frutescens* all were distinctly recurring components of the plant community. The 1996 sampling showed *S. patens* and *D. spicata* to be the dominant high marsh plants.

Stem Height

Except for the *D. spicata* and *P. australis* in the high marsh, and *J. romerianus* and *D. spicata* in the low marsh, each of the species analyzed showed at least some site-to-site stem height differences, suggesting that variation in canopy height and likely productivity is a natural feature of the local marshes. After repeated monitoring, and the establishment of the constructed wetlands on Poplar Island, the stem height data analysis may prove useful in evaluating the success and health of wetland communities planted on dredged material. Species with the least variation between sites may be the most appropriate for such an analysis.

Diversity

Our 2001 data suggests that the plant community in the high marsh zone is more diverse than in the low marsh zone. Though this finding was not consistent with the 1996 study, it follows that diversity should be greater within the high marsh owing to a larger number of species adapted to infrequent tidal inundation compared to twice daily innundation and frequent wave-action in the low marsh. Within each of the two zones, there were no differences among sites, suggesting that pooling data from different sites is a reasonable approach in developing composition information for design prescriptions.

Recommendations

The current monitoring study design allows for the detailed quantification of reference marsh vegetation parameters such as the three broad categories covered in Results and Discussion above. However, additional information could facilitate the application of this information in adaptive management of constructed wetlands on Poplar Island and in design prescription of future projects. Linking the detailed vegetation community information directly to elevational positioning in the marsh landscape would create a more intuitively-applicable, visually-accessible representation of local saltmarsh vegetation. Establishing connections between vegetation community variation and marsh elevations would make monitoring study products more readily applicable to design and mid-course correction guidance. Future monitoring should include microtopographical elevation determinations.

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Table 2. Vegetative Areal Cover by site and low marsh / high marsh zones

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Quadrat Data																					
		Vegetative areal cover as measured by percentage of all 0.25m^2 quadrats																			
		Species																			
SITE NAME		***Ameranthus cannabinis***	***Aster tennuifolius***	***Atriplex patula***	***Distichlis spicata***	***Iva frutescens***	***Juncus romerianus***	***Kosteletzkya virginica***	***Limonium carolinianum***	***Lythrum lineare***	***Phragmites australis***	***Pluchea purpurescens***	***Spartina alterniflora***	***Spartina cynosuroides***	***Spartina patens***	***Salicornia sp.***	***Schoenoplectus americanus***	***Scirpus robustus***	***Scirpus validus***	***Solidago semipirivens***	***Teucrium canadense***	**Totals**
BACK CREEK	**LOW**	7.0	1.0	9.5	19.5	3.5					8.0		42.0		31.5	0.5				0.5		123.0
	HIGH	1.0	5.5	2.5		2.0					7.0		60.5		36.0							114.5
	SITE	5.8	3.5	8.4	14.6	3.6					9.5		61.8		41.6							148.8
CABIN COVE	**LOW**		3.0	0.5	35.5	8.5	15.0		2.0	1.5	3.0		10.5		52.0					5.5		137.0
	HIGH		0.5		41.5	0.5	5.0		4.0		10.5	4.0	28.5		78.0	0.5				11.5		184.5
	SITE		2.5	0.4	47.4	6.6	13.8	0.0	3.5	1.1	7.5	2.0	22.1		78.0					9.9		194.8
	1996				*23.3*	*0.5*	*4.5*				*3.5*	*2.0*	*33.3*		*31.5*	*0.5*		*0.8*				*99.9*
COACHES ISLAND	**LOW**				24.0						13.5	4.0			66.0		30.5				0.5	138.5
	HIGH				9.0						8.5		19.0		54.0		8.0					98.5
	SITE				22.5						14.4	3.0	9.5		76.5		26.9				0.4	153.1
	1996				*20.8*		*5.5*				*3.5*		*20.0*		*48.0*		*4.0*	*0.3*				*102.1*
FRONT CREEK	**LOW**			1.0	10.0	2.0					14.0		28.0		47.5			0.5				103.0
	HIGH			3.5							14.0		52.5		7.5							77.5
	SITE			2.5	7.5	1.5					17.5		47.3		39.4			0.4				116.0
	1996				*5.0*	*0.3*							*36.8*		*34.5*				*0.3*			*76.9*
FRONT CREEK A	**LOW**		7.5		12.0	1.0	25.0		1.5		19.0		18.5	3.0	21.5					3.5		112.5
	HIGH		3.5		6.0	1.5	31.0		0.5		29.0		29.5		32.5					1.5		135.0
	SITE		7.4		12.0	1.5	34.3		1.4		28.8		28.6	2.3	32.4					3.4		151.9
HARBOR COVE	**LOW**		3.5		2.0		51.5				1.0		8.5		37.5		10.0	4.0		2.5		120.5
	HIGH	0.5	10.5		12.0	0.5	24.0		1.0	1.0	12.0		12.5		61.5		9.5			10.0		155.0
	SITE	0.3	7.9		7.5	0.3	50.6		0.5	0.5	6.8		12.6		58.9		12.3	3.0		6.9		167.9
	1996		*1.8*	*0.3*	*25.8*	*1.3*	*22.5*						*13.8*		*45.0*	*1.0*	*3.3*			*2.5*		*117.3*
KNAPPS NARROWS	**LOW**		2.0	5.5	4.5	5.5					10.5		49.0		30.5	1.5		0.5				109.5
	HIGH	1.5	1.5	1.0	20.0	2.5					3.5		43.0		48.5	1.5		0.5				123.5
	SITE	0.8	2.3	4.6	13.4	5.4					9.6		58.3		47.1	1.9		0.6				143.9
	1996		*1.0*	*2.0*	*9.8*	*1.3*					*0.3*		*43.8*		*34.0*				*2.3*			*94.5*
LOWES POINT	**LOW**		4.0		9.5	6.0	12.5				5.0	3.0	33.0		48.0							121.0
	HIGH			1.0	3.0	6.5		0.5			16.5		17.5		70.5							115.5
	SITE		3.0	0.5	8.6	7.8	9.4	0.3			12.0	2.3	33.5		71.3							148.5
	1996				*28.3*	*1.5*	*6.3*				*1.8*		*24.5*		*50.5*					*0.5*		*113.4*

Table 3. Relative vegetative areal cover by site and low marsh / high marsh zones

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Quadrat Data																						
		RELATIVE Vegetative areal cover as measured by percentage of all 0.25m^2 quadrats																				
		Species																				
SITE NAME		***Ameranthus cannabinis***	***Aster tennuifolius***	***Atriplex patula***	***Distichlis spicata***	***Iva frutescens***	***Juncus romerianus***	***Kosteletzkya virginica***	***Limonium carolinianum***	***Lythrum lineare***	***Phragmites australis***	***Pluchea purpurescens***	***Spartina alterniflora***	***Spartina cynosuroides***	***Spartina patens***	***Salicornia sp.***	***Schoenoplectus americanus***	***Scirpus robustus***	***Scirpus validus***	***Solidago semipirivens***	***Teucrium canadense***	**bare ground**	**Totals**
BACK CREEK	**LOW**	5.7	0.8	7.7	15.9	2.8					6.5		34.1		25.6								100
	HIGH	0.8	4.7	2.1		1.7					5.9		51.3		30.5							3.0	100
	SITE	3.8	2.3	5.6	9.7	2.4					6.3		41.0		27.7							1.2	100
CABIN COVE	**LOW**		2.2	0.4	25.9	6.2	10.9		1.5	1.1	2.2		7.7		38.0					4.0			100
	HIGH		0.3		22.5	0.3	2.7		2.2		5.7	2.2	15.4		42.3					6.2			100
	SITE		1.3	0.2	24.3	3.4	7.1		1.8	0.6	3.9	1.0	11.4		40.1					5.1			100
	1995				***23.3***	***0.5***	***4.5***				***3.5***	***2.0***	***33.3***		***31.5***	***0.5***		***0.8***					***100***
COACHES ISLAND	**LOW**				17.3						9.7	2.9			47.7		22.0						100
	HIGH				8.7						8.2		18.4		52.2		7.7					4.8	100
	SITE				14.5						9.2	1.9	6.1		49.1		17.3					1.6	100
	1995				***20.4***		***5.4***				***3.4***		***19.6***		***47.0***		***3.9***						***100***
FRONT CREEK	**LOW**			0.9	9.4	1.9					13.1		26.3	75.0	44.6			0.5				3.3	175
	HIGH			4.5							18.1		67.7		9.7								100
	SITE			2.1	6.3	1.3					14.8		39.8		33.2			0.3				2.2	100
	1995				***6.5***	***0.4***							***47.9***		***44.9***				***0.4***				***100***
FRONT CREEK A	**LOW**		6.7		10.7	0.9	22.2		1.3		16.9		16.4	2.7	19.1					3.1			100
	HIGH		2.6		4.4	1.1	23.0		0.4		21.5		21.9		24.1					1.1			100
	SITE		4.9		7.9	1.0	22.6		0.9		18.9		18.8	1.5	21.3					2.2			100
HARBOR COVE	**LOW**		2.9		1.7		42.7				0.8		7.1		31.1		8.3	3.3		2.1			100
	HIGH	0.3	6.8		7.7	0.3	15.5		0.6	0.6	7.7		8.1		39.7		6.1			6.5			100
	SITE	0.1	4.7		4.5	0.1	30.2		0.3	0.3	4.0		7.5		35.1		7.3	1.8		4.1			100
	1995		***1.5***	***0.3***	***22.0***	***1.1***	***19.2***						***11.8***		***38.4***	***0.9***	***2.8***			***2.1***			***100***
KNAPPS NARROWS	**LOW**		1.8	5.0	4.1	5.0					9.6		44.7		27.9	1.4		0.5					100
	HIGH	1.2	1.2	0.8	16.2	2.0					2.8		34.8		39.3	1.2		0.4					100
	SITE	0.5	1.6	3.2	9.3	3.7					6.7		40.5		32.8	1.3		0.4					100
	1995		***1.1***	***2.1***	***10.4***	***1.4***					***0.3***		***46.3***		***36.0***				***2.4***				***100***
LOWES POINT	**LOW**		3.3		7.9	5.0	10.3				4.1	2.5	27.3		39.7								100
	HIGH			0.9	2.6	5.6		0.4			14.2		15.1		60.8							0.4	100
	SITE		2.0	0.3	5.8	5.2	6.3	0.2			8.1	1.5	22.5		47.9							0.2	100
	1995				***25.0***	***1.3***	***5.6***				***1.6***		***21.6***		***44.5***								***100***

Table 4. Average percent cover by each plant species for all 2001 vegetation monitoring sites with observations divided by LOW marsh and HIGH marsh zonation.

	Percent Cover			
	LOW MARSH		HIGH MARSH	
SPECIES	Mean	+/- Std. Dev.	Mean	+/- Std. Dev.
Spartina alterniflora	44.3	38	12.3	21.7
Spartina patens	28.6	38.3	61.7	38.3
Distichlis spicata	6.5	17.9	19.6	28.8
Juncus romerianus	18.75	39.9	1.8	10.2
Iva frutescens	1.6	4.1	3.4	6.4
Phragmites australis	6.2	16.2	15.7	23.7
Scirpus robustus	0.63	2.9	0.06	0.5
Solidago semipirivens	0.3	2.5	4.1	14.4
Schoenoplectus americanus	0.8	6	6.4	20.15
Aster tennuifolius	4.3	10.6	1	4.2
Atriplex patula	2.6	8.4	0.44	2.3
Ameranthus cannabinis	1.3	5.5	0	0
Salicornia sp.	0.5	1.9	0	0
Limonium carolinianum	1.1	4.8	0	0
Pluchea purpurescens	0.44	2.5	0.94	4.14
Lythrum lineare	0.3	1.6	0	0
Teucruim	0	0	0.06	0.5
Spartina cynosuroides	0.38	3	0	0
Kosteletzkya virginica	0	0	0.06	0.5

Table 5. Comparison of percent cover for each plant species observed in LOW marsh quadrats (#'s one & two combined) during 2001 wetland vegetation monitoring. Species with no letters in common in the right-hand column are significantly different ($p<0.05$). Species are listed in descending order by rank as assigned from sample medians.

	Species	Median	Min.	Max.	Different ?		
LOW MARSH	*Spartina alterniflora*	52.0	0	100.0	A		
	Spartina patens	0	0	100.0		B	
	Juncus romerianus	0	0	100.0			C
	Aster tennuifolius	0	0	52.0			C
	Distichlis spicata	0	0	100.0			C
	Phragmites australis	0	0	76.0			C
	Iva frutescens	0	0	20.0			C
	Atriplex patula	0	0	40.0			C
	Ameranthus cannabinis	0	0	40.0			C
	Limonium carolinianum	0	0	32.0			C
	Salicornia sp.	0	0	12.0			C
	Lythrum lineare	0	0	12.0			C
	Schoenoplectus americanus	0	0	48.0			C
	Pluchea purpurescens	0	0	16.0			C
	Spartina cynosuroides	0	0	24.0			C
	Solidago semipirivens	0	0	20.0			C

Table 6. Comparison of percent cover for each plant species observed in HIGH marsh quadrats (#'s three & four combined) during 2001 wetland vegetation monitoring. Species with no letters in common in the right-hand column are significantly different ($p<0.05$). Species are listed in descending order by rank as assigned from sample medians

	Species	Median	Min.	Max.	Different ?					
	Spartina patens	74.0	0	100.0	A					
HIGH MARSH	*Phragmites australis*	4.0	0	100.0		B				
	Distichlis spicata	0	0	100.0			C			
	Spartina alterniflora	0	0	100.0				D		
	Iva frutescens	0	0	32.0					E	
	Solidago semipirivens	0	0	92.0						F
	Schoenoplectus americanus	0	0	4.0						F
	Aster tennuifolius	0	0	28.0						F
	Juncus romerianus	0	0	80.0						F
	Pluchea purpurescens	0	0	24.0						F
	Atriplex patula	0	0	16.0						F
	Teucrium	0	0	4.0						F
	Scirpus robustus	0	0	4.0						F
	Kosteletzkya virginica	0	0	4.0						F
	Salicornia sp.	0	0	100.0						F

Table 7. Average stem height by species and by low marsh / high marsh zonation

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Quadrat Data																								
	Average Stem Height (cm) of Plant Species Occurring in 0.25m^2 Quadrats																							
	Back Creek			**Cabin Cove**			**Coaches Isl.**			**Front Creek**			**Front Creek A**			**Harbor Cove**			**Knapps Narrows**			**Lowes Point**		
Species	**Low* Marsh**	**High* Marsh**	**Site AVG**	**Low Marsh**	**High Marsh**	**Site AVG**	**Low Marsh**	**High Marsh**	**Site AVG**	**Low Marsh**	**High Marsh**	**Site AVG**	**Low Marsh**	**High Marsh**	**Site AVG**	**Low Marsh**	**High Marsh**	**Site AVG**	**Low Marsh**	**High Marsh**	**Site AVG**	**Low Marsh**	**High Marsh**	**Site AVG**
Spartina alterniflora	59.3	59.1	59.2	55.5		55.5	57.1		57.1	60.1	66.2	62.3	71.4		71.4	69.9	79.2	74.5	75.7	51.9	65.5	73.2	68.6	71.6
Spartina patens	36.5	56.5	51.5	44.2	49.1	46.5	50.9	55.0	53.6	44.7	55.1	51.2	48.5	39.5	43.1	49.3	59.0	56.1	43.1	46.6	45.8	54.8	59.1	57.3
Distichlis spicata	38.8	48.9	44.8	37.8	42.4	40.4	36.3	49.9	44.0		45.9	45.9	41.3	36.3	37.6	41.5	43.3	43.0	35.6	39.9	38.5	51.0	41.7	43.2
Juncus romerianus				78.7		78.7							87.8	56.8	81.6	93.1	74.3	87.5				103.2		103.2
Iva frutescens	29.0	48.5	40.7	15.8	67.4	46.7				79.3		79.3	109.0	38.7	62.1		189.0	189.0	5.0	11.9	10.2	22.9	33.9	29.0
Phragmites australis		105.9	105.9		173.2	173.2	212.0	102.6	168.2	119.0	96.3	104.8	135.5	118.4	120.8		163.7	163.7	156.2	95.5	110.7	166.5	137.3	148.3
Scirpus robustus										81.0		81.0				98.6		98.6	148.0	87.0	117.5			
Solidago semipirivens		43.0	43.0		43.3	43.3								37.3	37.3		40.1	40.1						
Schoenoplectus americanus							21.0	79.1	67.4							76.0	76.8	76.6						
Aster tennuifolius	41.1		41.1	45.3	46.0	45.5							41.1		41.1	49.3	35.5	43.8	52.5	34.3	40.3	61.0		61.0
Atriplex patula	41.9		41.9	19.0		19.0				24.3	32.1	29.5							37.4	36.0	37.1	29.0		29.0
Ameranthus cannabinis	47.8		47.8													21.0		21.0	69.0		69.0			
Salicornia sp.	43.0		43.0	3.0		3.0													22.1		22.1			
Limonium carolinianum				30.6		30.6							60.2		60.2	64.0		64.0						
Pluchea purpurescens				2.2	15.0	6.5		25.7	25.7														9.6	9.6
Lythrum lineare				32.3		32.3										33.0		33.0						
Teucrium canadense								28.0	28.0															
Spartina cynosuroides													114.6		114.6									
Kosteletzkya virginica																							21.0	21.0

* Low Marsh = combined average of Quadrat 1 & Quadrat 2 observations. High Marsh = comb. avg. Quadrat 3 & 4 observations

Table 8. Comparison of *Spartina patens* stem heights from all sites' high marsh zones. Sites with no letters in common in the right-hand columns have significantly different ($p<0.05$) *S. patens* stem heights. Sites are listed in descending order by sample means.

Species	Zone	Site	Mean	+/- Std. Dev.	Different?			
Spartina patens	HIGH MARSH	HAC	60.2	13.3	A			
		LOP	59.1	11.1	A			
		BAC	56.5	10.9	A	B		
		COI	55	12	A	B		
		FRC	54.8	8.7	A	B	C	
		CAC	49.1	13.6		B	C	D
		KNN	46.6	8.3			C	D
		FRCA	39.5	12.5				D

Table 9. Simpson's diversity indices and species richness for 2001 and 1996 sampling episodes

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Segment Data												
	Simpson's diversity indices* and species richness for 5m line-intercept vegetation segments**											
	Low Marsh				**High Marsh**				**Site**			
	2001		***1996***		**2001**		***1996***		**2001**		***1996***	
SITE NAME	**S.D.I.**	**Spp. R.**	***S.D.I.***	***Spp. R.***	**S.D.I.**	**Spp. R.**	***S.D.I.***	***Spp. R.***	**S.D.I.**	**Spp. R.**	***S.D.I.***	***Spp. R.***
BACK CREEK	0.56	6	-	-	0.71	7	-	-	0.64	10	-	-
CABIN COVE	0.66	9	*0.64*	*4*	0.66	9	*0.68*	*6*	0.66	12	*0.66*	*7*
COACHES ISL	0.46	6	*0.66*	*6*	0.60	8	*0.66*	*6*	0.53	12	*0.66*	*7*
FRONT CREEK	0.54	6	*0.60*	*4*	0.60	7	*0.39*	*4*	0.57	8	*0.49*	*5*
FRONT CREEK A	0.59	7	-	-	0.60	7	-	-	0.60	10	-	-
HARBOR COVE	0.50	8	*0.60*	*7*	0.74	12	*0.71*	*7*	0.62	17	*0.66*	*9*
KNAPPS NARROWS	0.63	7	*0.58*	*5*	0.69	5	*0.73*	*7*	0.66	9	*0.65*	*8*
LOWES POINT	0.62	7	*0.53*	*7*	0.73	8	*0.64*	*6*	0.67	9	*0.58*	*10*
ALL SITES AVG.	**0.57**	**7.0**	***0.60***	**5.5**	**0.67**	**7.9**	***0.64***	**6.0**	**0.62**	**10.9**	***0.62***	**7.7**

An index close to 0 means it is likely most individuals encountered in a sample will be the same species, i.e. low diversity.
**Species richness is the number of species observed in a sampling unit

Table 10. Faunal taxa abundance by low and high marsh zones for 2001 sampling sites

	Poplar Island Marsh Monitoring, Summer 2001: Fauna/Quadrat Data																			
		Number of individuals of spp./quadrat																		
	SITE NAME	***Littorina***	***Melampus***	**Arachnida (Spider)**	**Isopoda**	**Hymenoptera**	**Amphipoda**	**Cicadellidae (leafhopper)**	**Orthoptera (grasshopper)**	**Coleoptera**	**Orthoptera (cricket)**	**Lepidoptera**	***Uca***	**Insects**	**Arachnida (mite)**	**ribbed mussel**	**Hemiptera**	**UNK fish fry**	***Fundulus heteroclitis* (dead)**	**UNK frog**	**UNK snail**	***TOTAL OBS***
LOW MARSH	**BAC**	9	73	20	3	7	2	2	1	1				1								*119*
	CAC	53	169	12	3	11	2	8		4				1	1	1						*265*
	COI			45	10	56	6	15	3													*135*
	FRC	1	66	15	26	26	8	13			1			5								*161*
	FRCA	264	56	28		9		15	1			1		1								*375*
	HAC	104	26	20		2		4	2			1	1	1								*161*
	KNN	52	52	16		3	1	26						8					1			*159*
	LOP	82	102	16	1	21	1	8		17		1	1	2	5	1				1		*259*
	TOTAL	*565*	*544*	*172*	*43*	*135*	*20*	*91*	*7*	*22*	*1*	*3*	*2*	*19*	*6*	*2*			*1*	*1*		*1634*
HIGH MARSH	**BAC**		95	18	1	22	2	1	5	1	2	2										*149*
	CAC		175	7	2	15	8		1	1				1	1	4						*215*
	COI		4	33	2	23	3	2	2	3							25	4				*101*
	FRC		141	42	12	39	4	14	4					5	1							*262*
	FRCA		201	26	12	37	7	2	4	1	2	1		1								*294*
	HAC		85	55	23	17	2	7	2	2				2	2	1						*198*
	KNN		148	36	1	3	1	12	1	2	1			5								*210*
	LOP	1	208	18		37	1	6		5			1	6	4						1	*288*
	TOTAL	*1*	*1057*	*235*	*53*	*193*	*28*	*44*	*19*	*15*	*5*	*3*	*1*	*20*	*8*	*5*	*25*	*4*			*1*	*1717*
GRAND TOTALS ->		*566*	*1601*	*407*	*96*	*328*	*48*	*135*	*26*	*37*	*6*	*6*	*3*	*39*	*14*	*7*	*25*	*4*	*1*	*1*	*1*	*3351*

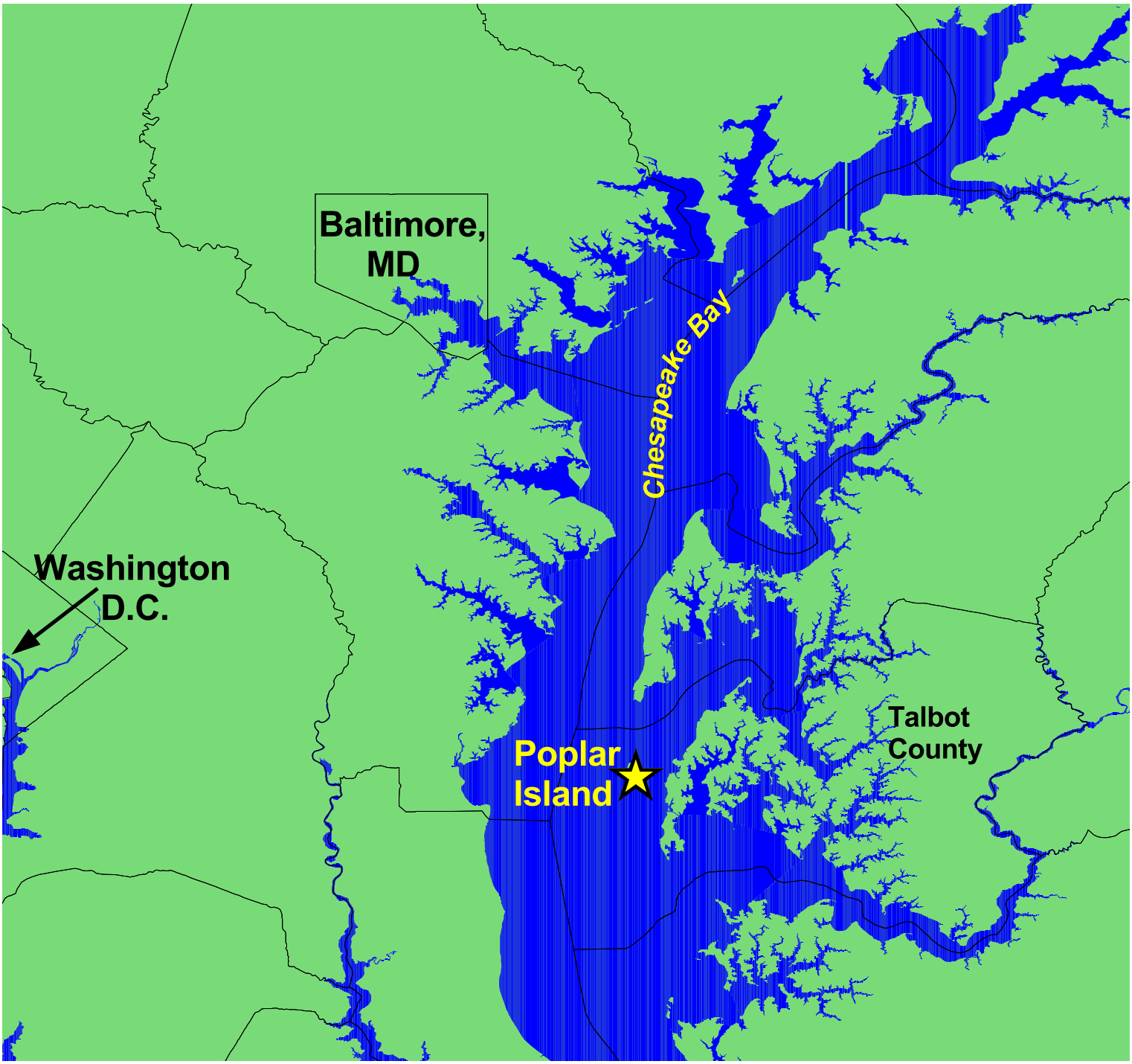


Figure 1. Location of Poplar Island in Chesapeake Bay

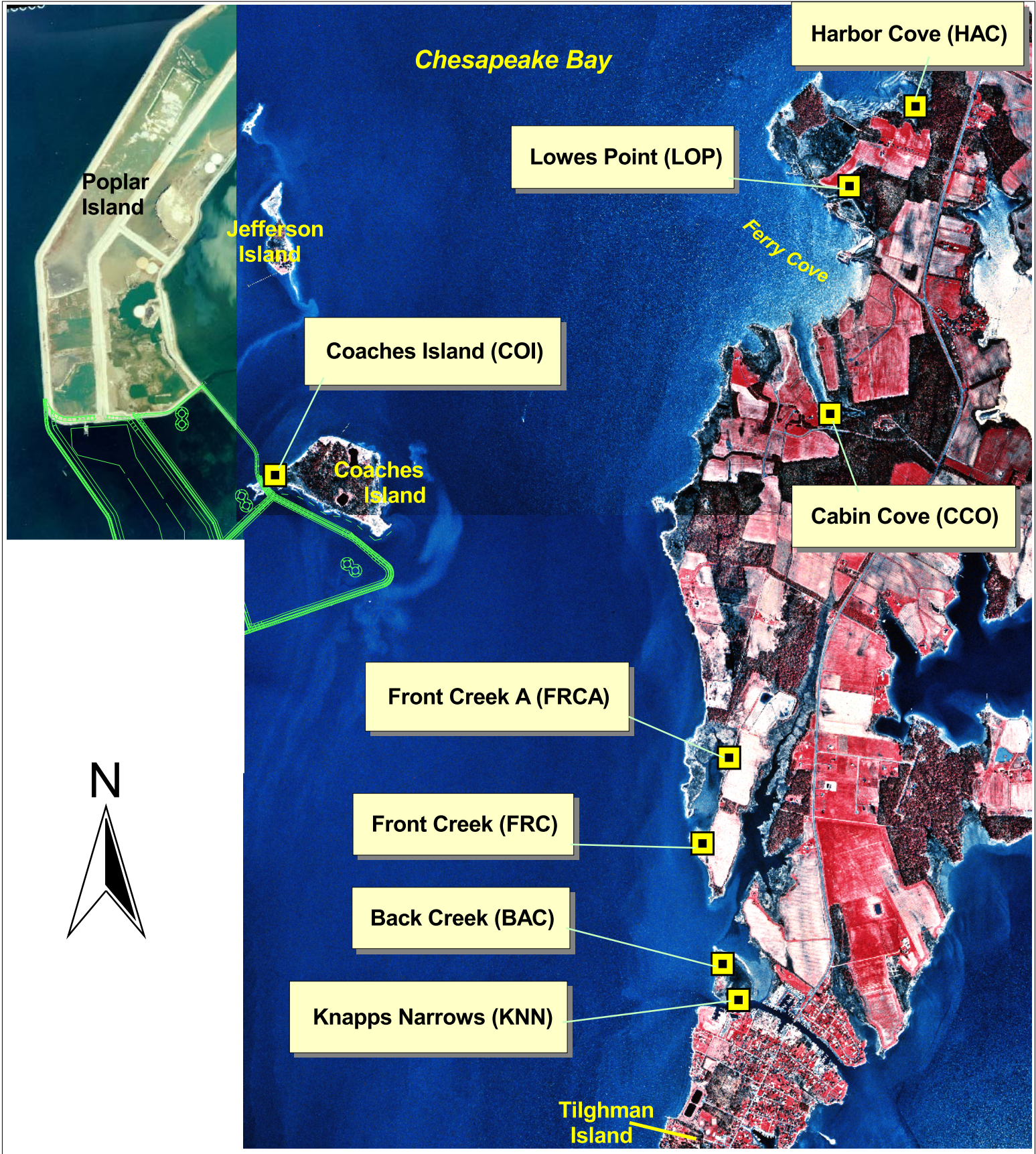


Figure 2. Location of wetland vegetation monitoring reference marshes

0 0.5 1 1.5 2 Miles

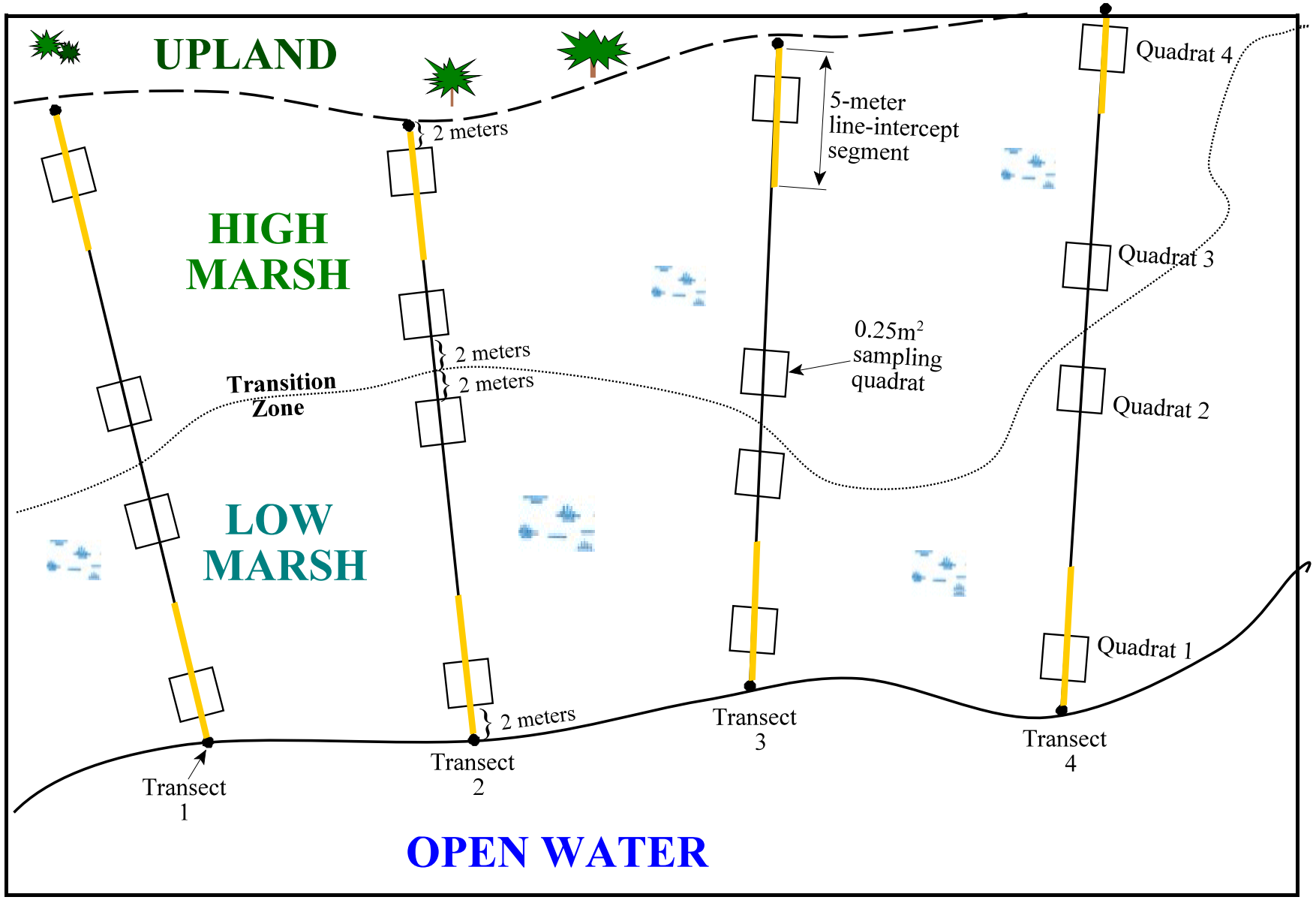


Figure 3. Idealized representation of spatial relationship between sampling features and wetland elevations. Features are not drawn to scale.

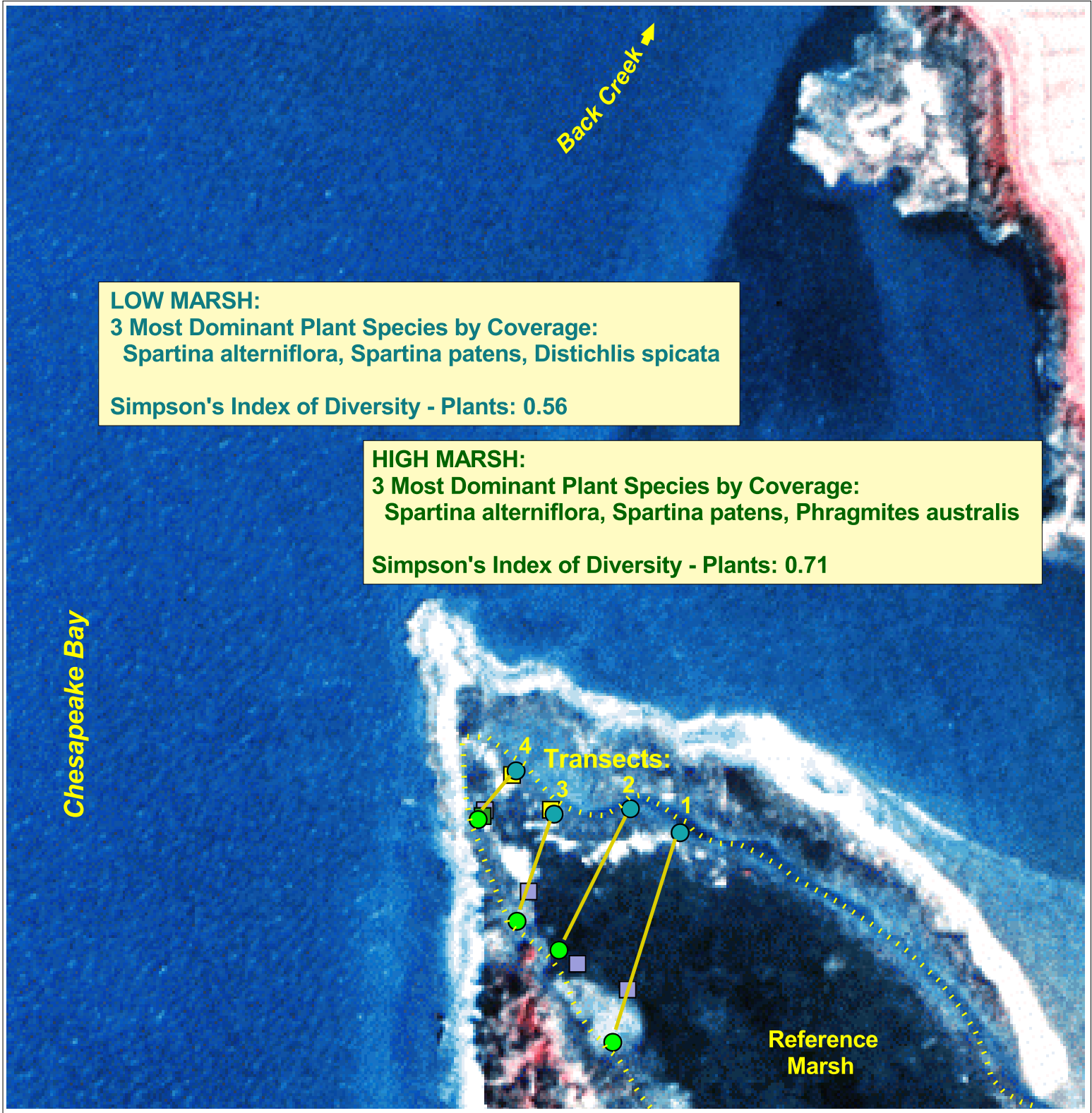


Figure 4. Back Creek Wetland Vegetation Monitoring Site

0 100 200 300 400 Feet

N

Transect Points*:
- Water Terminus
- Quadrat 1
- Quadrat 2
- Quadrat 3
- Upland Terminus

*not all features displayed

Figure 5. Cabin Cove Wetland Vegetation Monitoring Site.

0 200 400 600 800 Feet

N

Transect Points*:
- Water Terminus
- Quadrat 1
- Quadrat 2
- Quadrat 3
- Upland Terminus

*not all features displayed

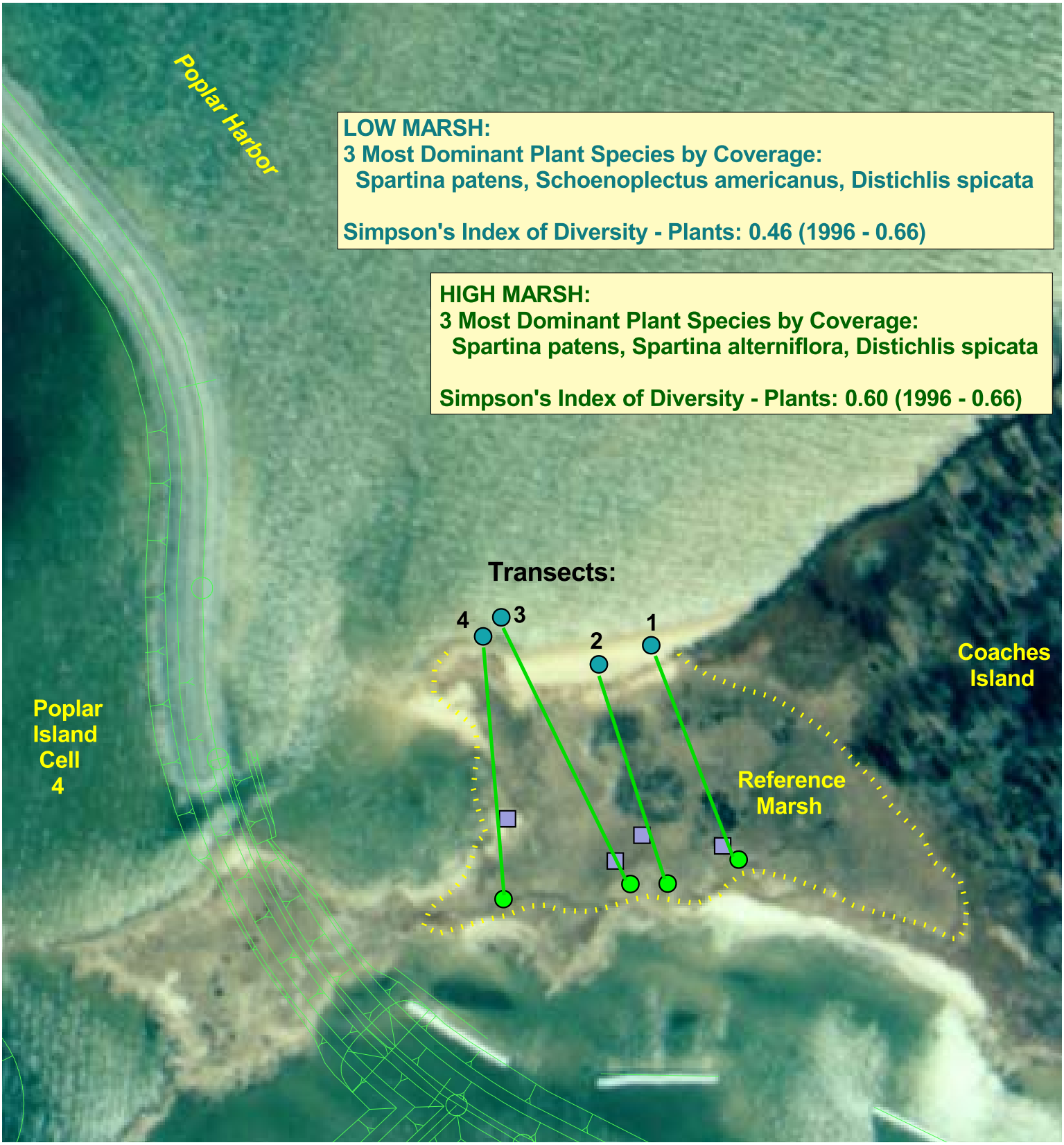


Figure 6. Coaches Island Wetland Vegetation Monitoring Site

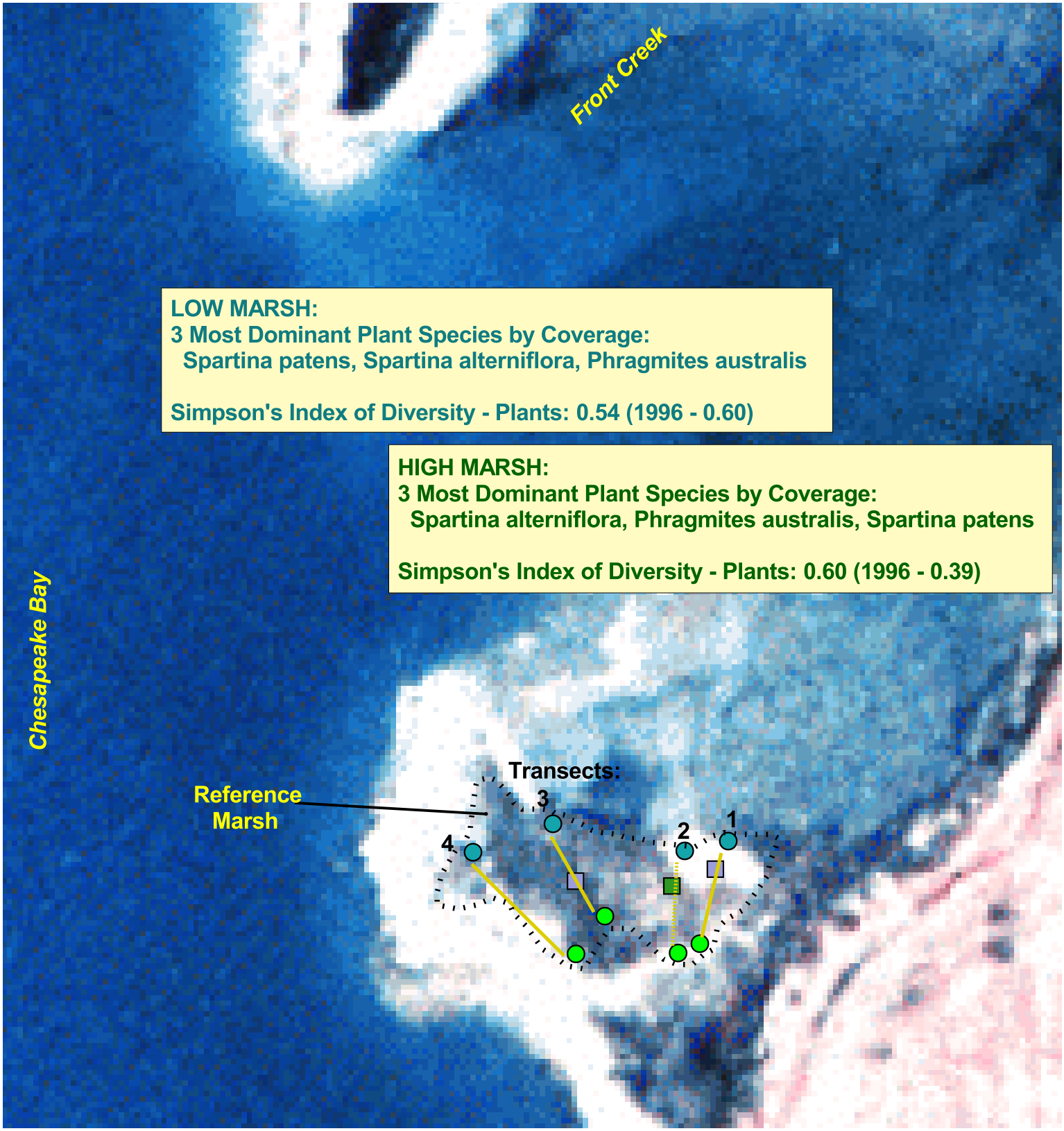


Figure 7. Front Creek Wetland Vegetation Monitoring Site

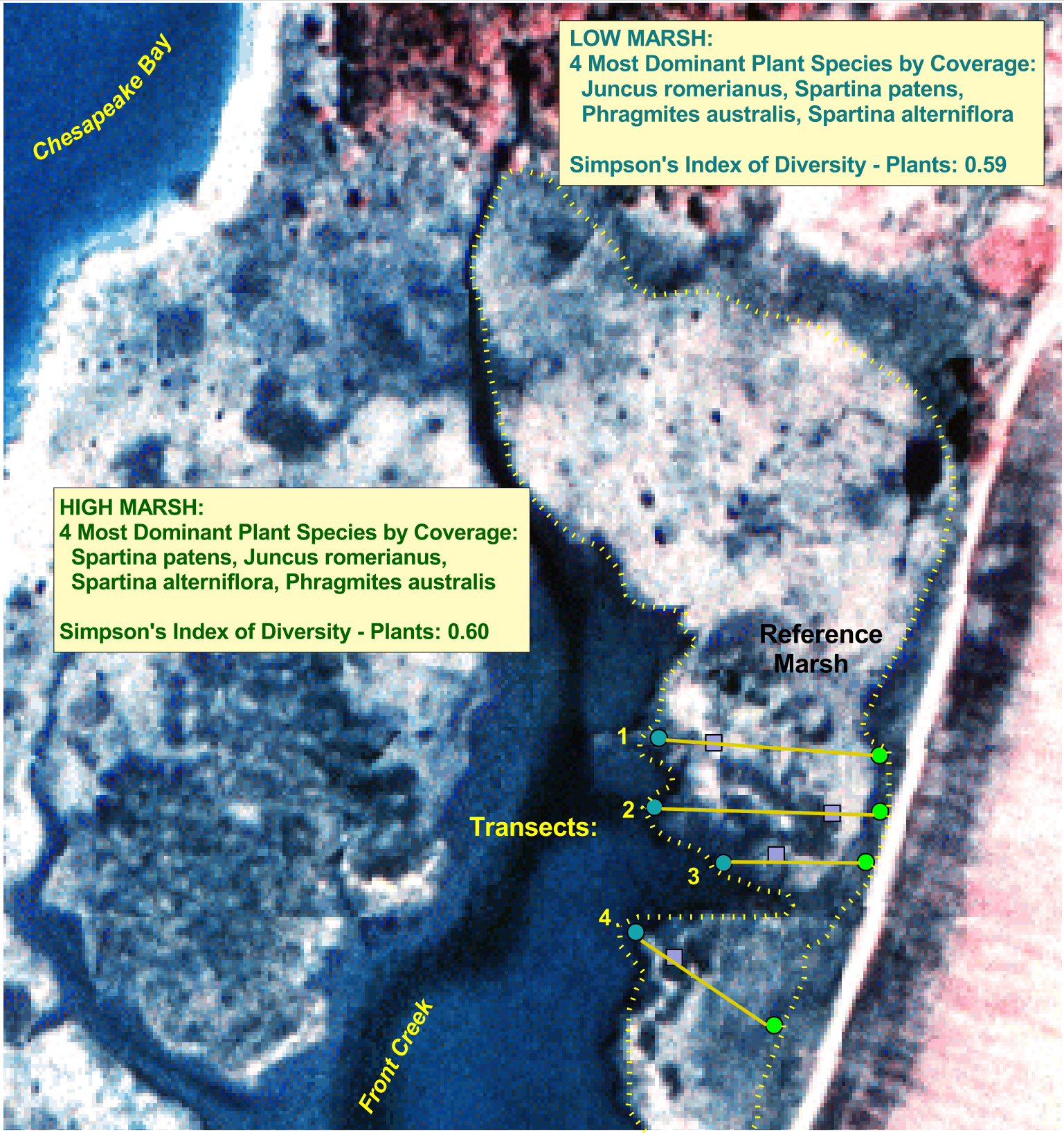


Figure 8. Front Creek "A" Wetland Vegetation Monitoring Site

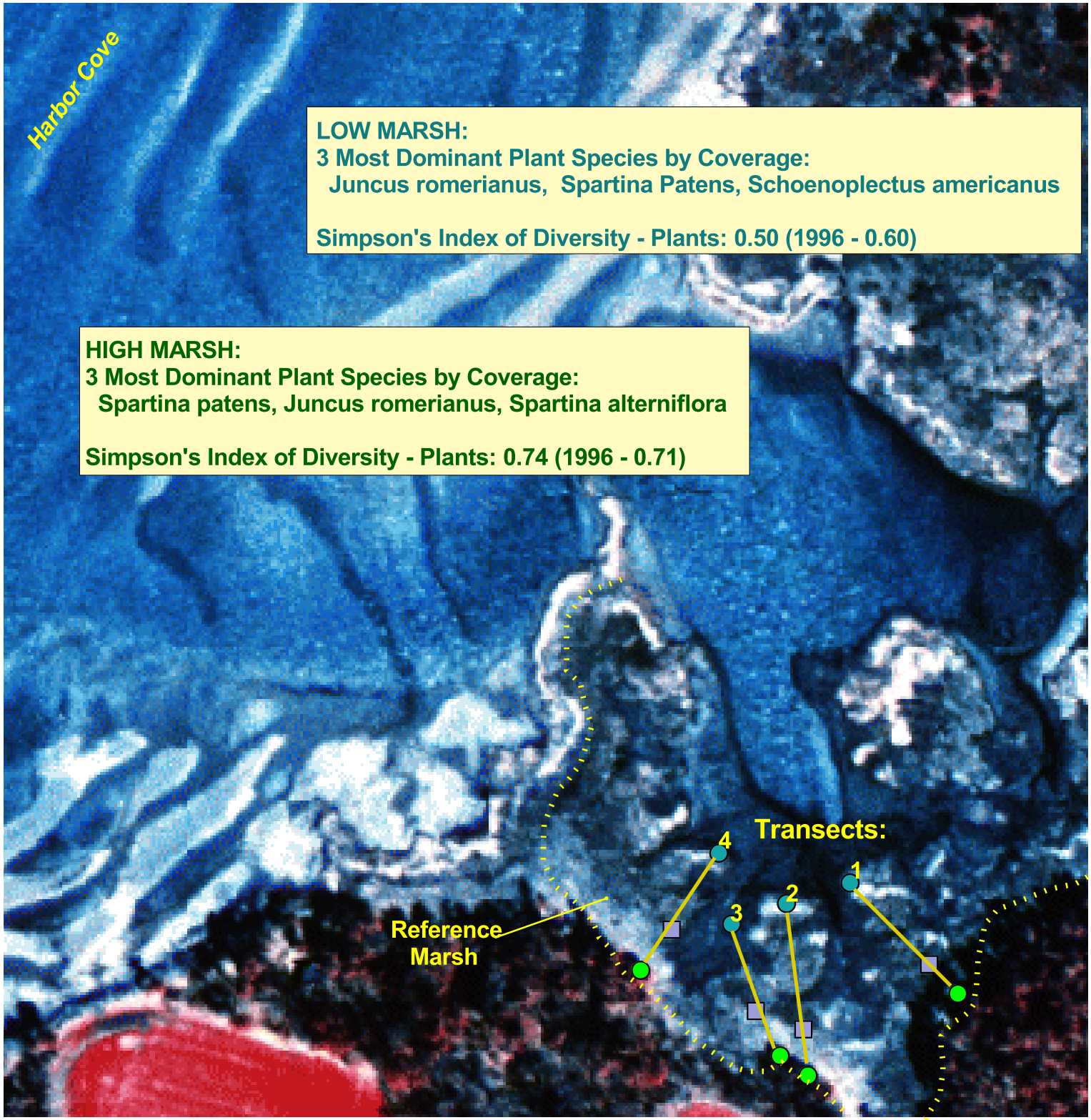


Figure 9. Harbor Cove Wetland Vegetation Monitoring Site

0 200 400 600 800 Feet

N

Transect Points*:
- Water Terminus
- Quadrat 1
- Quadrat 2
- Quadrat 3
- Upland Terminus

*not all features displayed

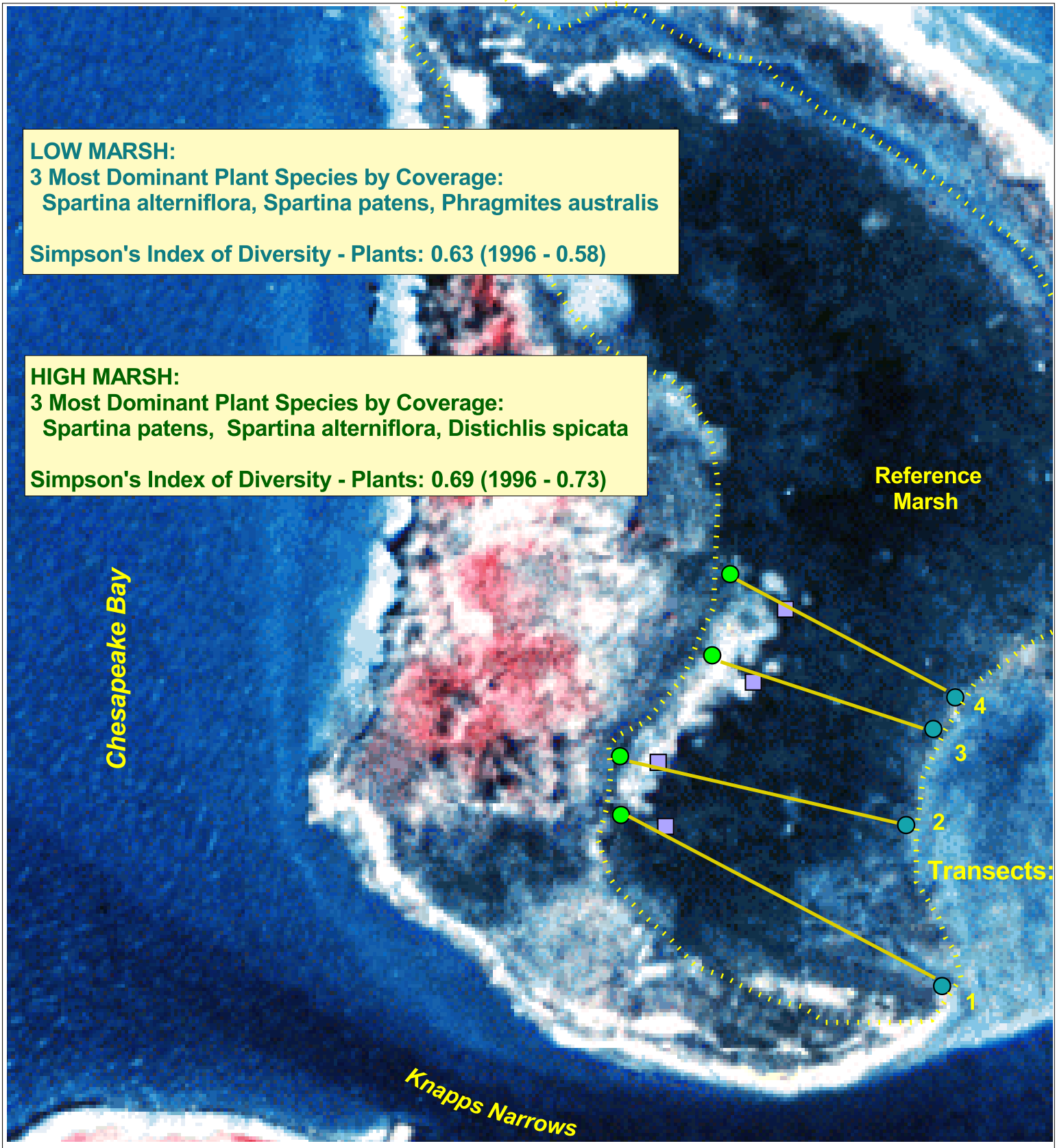


Figure 10. Knapps Narrows Wetland Vegetation Monitoring Site

0 100 200 300 400 Feet

N

Transect Points*:
- Water Terminus
- Quadrat 1
- Quadrat 2
- Quadrat 3
- Upland Terminus

*not all features displayed

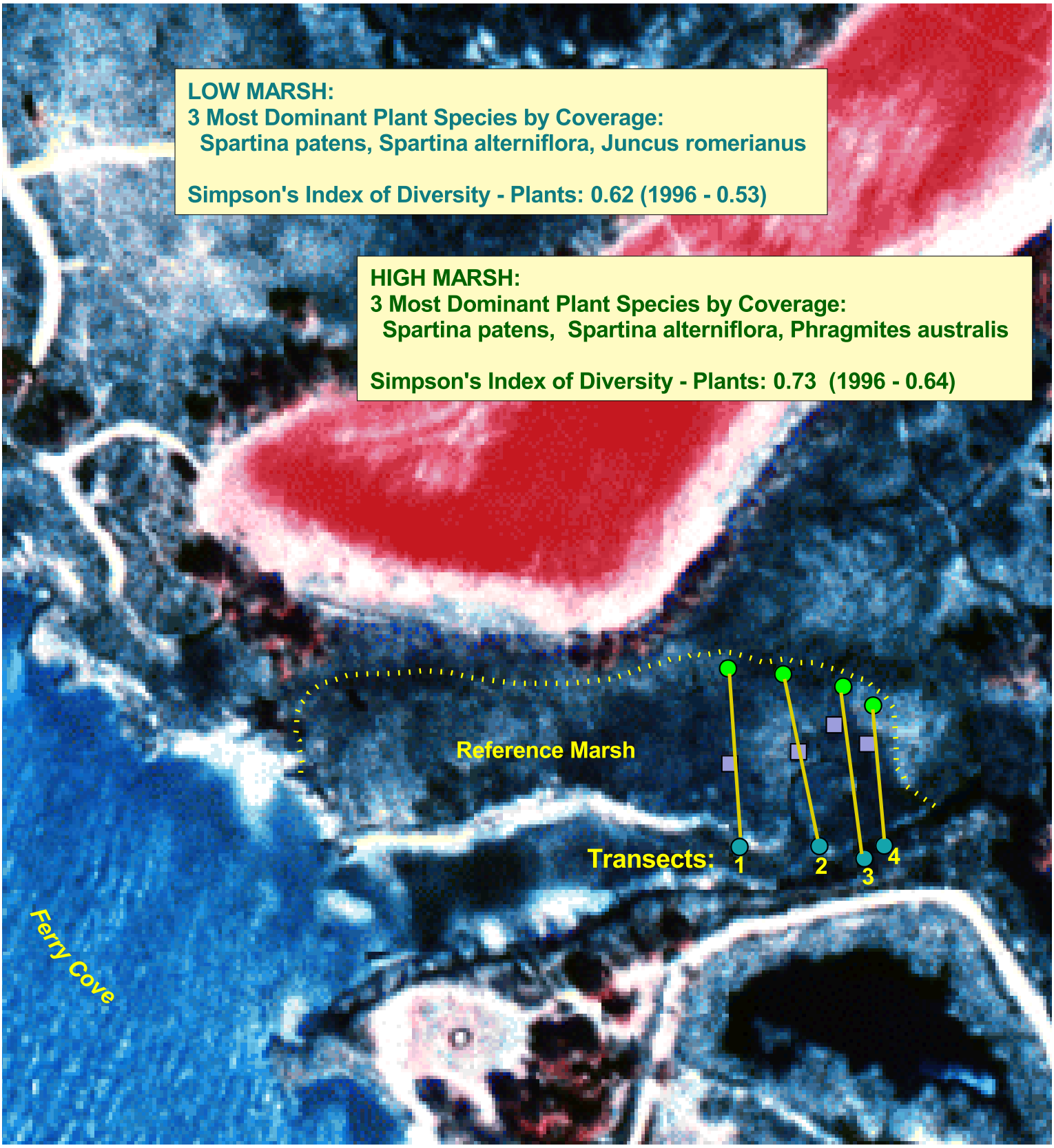


Figure 11. Lowes Point Wetland Vegetation Monitoring Site

0 100 200 300 400 500 Feet

N

Transect Points*:
- Water Terminus
- Quadrat 1
- Quadrat 2
- Quadrat 3
- Upland Terminus

*not all features displayed

Figure 12. Plant species diversity by line-intercept segment for 2001 wetland vegetation monitoring

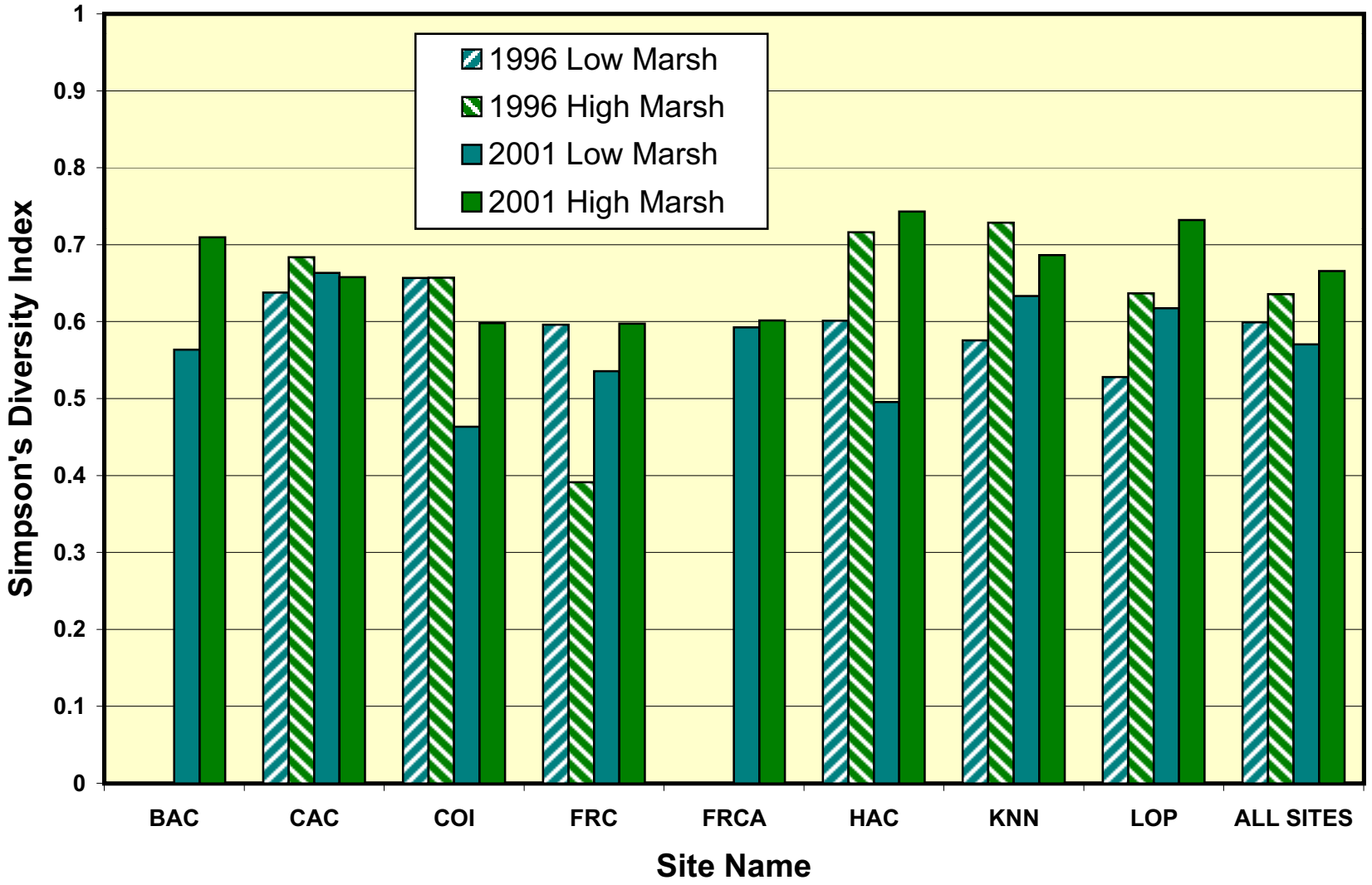
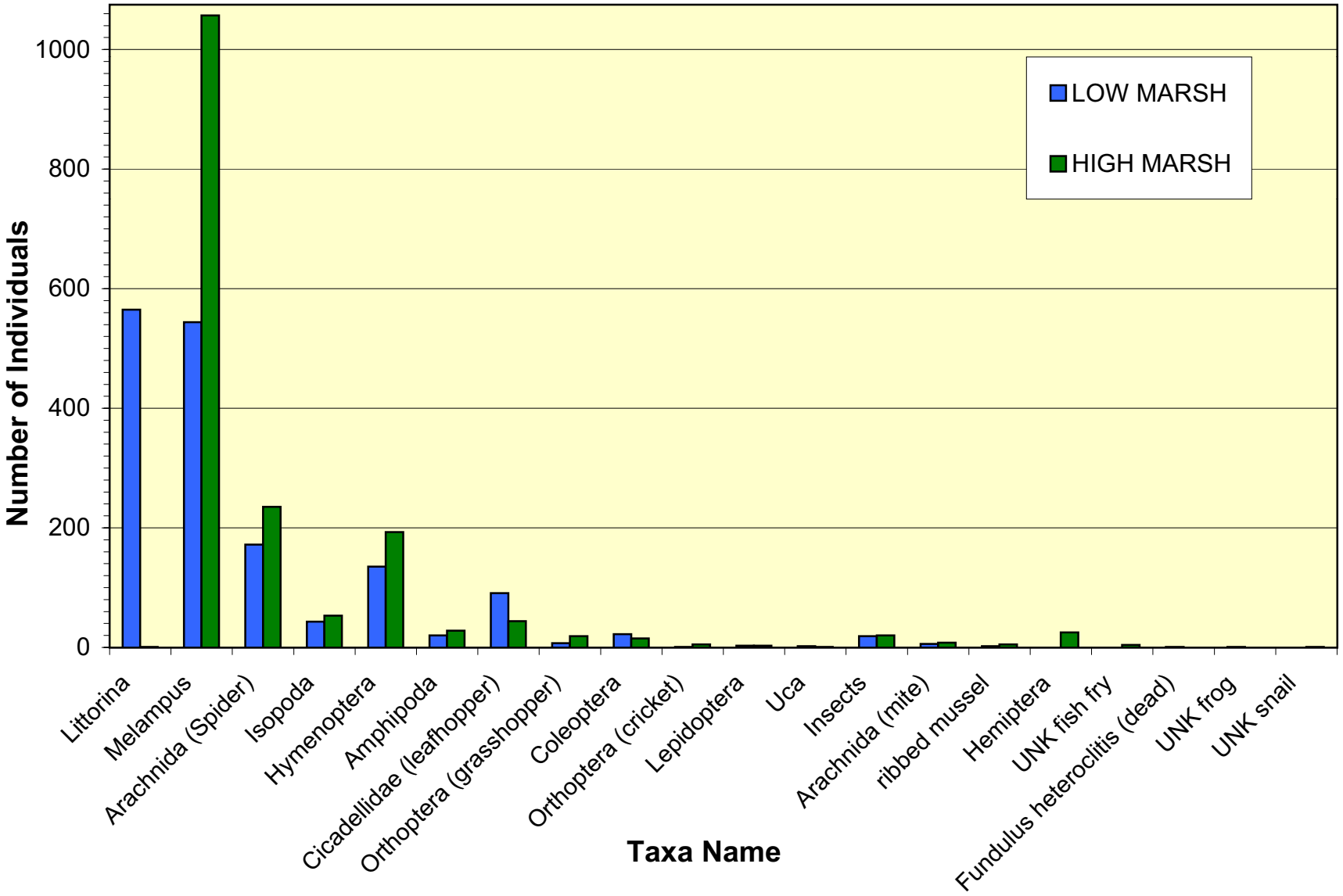


Figure 13. Faunal taxa frequency for 2001 wetland vegetation monitoring



APPENDIX A

GPS coordinates of transect locations for 2001 Vegetation Monitoring

GPS Locations for Marsh Monitoring Transects as Sampled Summer 2001

Site Name	Transect #	Water Terminus		Upland Terminus		Quadrat 1		Quadrat 2		Quadrat 3	
		Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude
Back Creek	1	-76.33757	38.72352	-76.33787	38.72280			-76.33780	38.72298		
	2	-76.33778	38.72360	-76.33810	38.72312			-76.33802	38.72307		
	3	-76.33812	38.72358	-76.33828	38.72322	-76.33813	38.72360	-76.33823	38.72332		
	4	-76.33828	38.72373	-76.33845	38.72357	-76.33830	38.72372	-76.33842	38.72360	-76.33843	38.72358
Cabin Creek	1	-76.32915	38.75630	-76.32903	38.75607			-76.32915	38.75623		
	2	-76.32942	38.75632	-76.32915	38.75582			-76.32933	38.75615		
	3	-76.32957	38.75623	-76.32930	38.75567			-76.32948	38.75608		
	4	-76.32973	38.75630	-76.32948	38.75558			-76.32965	38.75612		
Coaches Island	1	-76.37153	38.75323	-76.37115	38.75248			-76.37122	38.75253		
	2	-76.37177	38.75317	-76.37147	38.75240			-76.37158	38.75257		
	3	-76.37220	38.75333	-76.37163	38.75240			-76.37170	38.75248		
	4	-76.37228	38.75327	-76.37220	38.75235			-76.37218	38.75263		
Front Creek Mouth	1	-76.33970	38.73085	-76.33977	38.73067			-76.33973	38.73080		
	2	-76.33980	38.73083	-76.33982	38.73065					-76.33983	38.73077
	3	-76.34010	38.73088	-76.33998	38.73072			-76.34005	38.73078		
	4	-76.34028	38.73083	-76.34005	38.73065						
Front Creek Interior ("A")	1	-76.33787	38.73623	-76.33712	38.73618			-76.33768	38.73622		
	2	-76.33788	38.73605	-76.33712	38.73603			-76.33728	38.73603		
	3	-76.33765	38.73590	-76.33717	38.73590			-76.33747	38.73592		
	4	-76.33795	38.73572	-76.33748	38.73547			-76.33782	38.73565		
Harbor Cove	1	-76.32280	38.77470	-76.32235	38.77433			-76.32247	38.77443		
	2	-76.32307	38.77463	-76.32298	38.77407			-76.32300	38.77422		
	3	-76.32330	38.77457	-76.32310	38.77413			-76.32320	38.77428		
	4	-76.32335	38.77480	-76.32368	38.77442			-76.32355	38.77455		
Knapps Narrows	1	-76.33670	38.72102	-76.34617	38.72157			-76.33763	38.72145		
	2	-76.33682	38.72145	-76.33778	38.72163			-76.33765	38.72162		
	3	-76.33672	38.72170	-76.33747	38.72190			-76.33733	38.72183		
	4	-76.33665	38.72178	-76.33740	38.72212			-76.33722	38.72202		
Lowes Point	1	-76.32835	38.76948	-76.32838	38.76995			-76.32838	38.76970		
	2	-76.32808	38.76948	-76.32820	38.76993			-76.32815	38.76973		
	3	-76.32793	38.76945	-76.32800	38.76990			-76.32803	38.76980		
	4	-76.32787	38.76948	-76.32790	38.76985			-76.32792	38.76975		

APPENDIX B

Photomonitoring log
(all views from transects' water terminus toward upland edge of marsh)

Back Creek (BAC) Reference Marsh Photomonitoring - 2001

Back Creek Transect #1 8/23/01

Back Creek Transect #2 8/23/01

Back Creek Transect #3 8/23/01

Back Creek Transect #4 8/23/01

Cabin Cove (CAC) Reference Marsh Photomonitoring - 2001

Cabin Cove Transect #1 8/9/01

Cabin Cove Transect #2 8/9/01

Cabin Cove Transect #3 8/9/01

Cabin Cove Transect #4 8/9/01

Coaches Island (COI) Reference Marsh Photomonitoring - 2001

Coaches Island Transect #1 8/22/01

Coaches Island Transect #2 8/22/01

Coaches Island Transect #3 8/22/01

Coaches Island Transect #4 8/22/01

Front Creek (FRC) Reference Marsh Photomonitoring - 2001

Front Creek Transect #1 8/20/01

Front Creek Transect #2 8/20/01

Front Creek Transect #3 8/20/01

Front Creek Transect #4 8/20/01

Front Creek "A" (FRCA) Reference Marsh Photomonitoring - 2001

Front Creek "A" Transect #1 8/24/01

Front Creek "A" Transect #2 8/24/01

Front Creek "A" Transect #3 8/24/01

Front Creek "A" Transect #4 8/24/01

Harbor Cove (HAC) Reference Marsh Photomonitoring - 2001

Harbor Cove Transect #1 8/15/01

Harbor Cove Transect #2 8/15/01

Harbor Cove Transect #3 8/15/01

Harbor Cove Transect #4 8/15/01

Knapps Narrows (KNN) Reference Marsh Photomonitoring - 2001

Knapps Narrows Transect #1 8/16/01

Knapps Narrows Transect #2 8/16/01

Knapps Narrows Transect #3

Knapps Narrows Transect #4 8/16/01

Lowes Point (LOP) Reference Marsh Photomonitoring - 2001

Lowes Point Transect #1 8/14/01

Lowes Point Transect #2 8/14/01

Lowes Point Transect #3 8/14/01

Lowes Point Transect #4 8/14/01

APPENDIX C

Vegetation Data: Raw percent cover and vegetation community composition data

Vegetation/Quadrat Data: Raw percent cover data

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Quadrat Data

Species' Presence in # of Quadrat Squares (out of 25)

SITE NAME	Transect #	Quadrat #	alterniflora	% Cover	patens	% Cover	Distichlis	% Cover	Juncus r.	% Cover	Iva	% Cover	Phrag	% Cover	Scirpus r.	% Cover	Solidago s.	% Cover	Scirpus o.	% Cover	Aster t.	% Cover	Atriplex	% Cover	Amaranthus c.	% Cover	Salicornia	% Cover	Limonium	% Cover	Pluchea	% Cover	Lythrum	% Cover	Teucrium	% Cover	cynosuroides	% Cover	Kosteletzkya	% Cover	bare ground	% Cover	log	% Cover	dead Phrag.	% Cover
BACK CREEK 8/23/01	T1	Q1	21	84																			10	40	10	40	1	4																
		Q2	17	68	11	44	2	8			1	4									1	4																				
		Q3	2	8			25	100			2	8																														
		Q4			5	20	5	20					6	24			1	4																								
	T2	Q1	22	88																			9	36	4	16																
		Q2	18	72	1	4	3	12			2	8									1	4																				
		Q3	4	16	22	88	4	16					6	24																												
		Q4			24	96					2	8	4	16																												
	Low		42		31.5		19.5		0		3.5		8		0		0.5		0		1		9.5		7		0.5		0		0		0		0		0		0		0	
	T3	Q1	16	64																	4	16			2	8													7	28			
		Q2	21	84																																						
		Q3	18	72	23	92																																				
		Q4	11	44							4	16	5	20																												
	T4	Q1	23	92																	7	28	5	20																		
		Q2	25	100																																						
		Q3	7	28	25	100							2	8																												
		Q4			24	96							7	28																												
	High		60.5		36		0		0		2		7		0		0		0		5.5		2.5		1		0		0		0		0		0		0		3.5		0	
	Site		61.75		41.625		14.63		0		3.625		9.5		0		0.38		0		3.5		8.38		5.75		0.4		0		0		0		0		0		1.8		0	
CABIN COVE 8/9/01 & 8/14/01	T1	Q1	5	20	22	88	1	4			5	20									1	4											3	12								
		Q2	3	12	18	72	5	20	5	20	3	12											1	4																		
		Q3			23	92	8	32													4	16																				
		Q4					24	96			5	20	5	20			11	44																								
	T2	Q1	13	52	6	24	2	8													1	4							4	16												
		Q2					1	4	25	100																																		
		Q3			25	100	11	44																																			
		Q4			10	40	19	76			4	16	1	4																												
	Low		10.5		52		35.5		15		8.5		3		0		5.5		0		3		0.5		0		0		2		0		1.5		0		0		0		0	
	T3	Q1	4	16	25	100																																				
		Q2	15	60	25	100	16	64													1	4					1	4			3	12										
		Q3			25	100	22	88																																			
		Q4			10	40	10	40					20	80																	1	4										
	T4	Q1	15	60	24	96	3	12	10	40																																
		Q2	23	92	22	88																							8	32	4	16										
		Q3			25	100	7	28			1	4																														
		Q4					25	100					1	4			23	92																								
	High		28.5		78		41.5		5		0.5		10.5		0		11.5		0		0.5		0		0		0.5		4		4		0		0		0		0		0	
	Site		22.13		78		47.38		13.75		6.625		7.5		0		9.88		0		2.5		0.38		0		0.3		3.5		2		1.1		0		0		0		0	

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Quadrat Data

Species' Presence in # of Quadrat Squares (out of 25)

SITE NAME	Transect #	Quadrat #	alterniflora	% Cover	patens	% Cover	Distichlis	% Cover	Juncus r.	% Cover	Iva	% Cover	Phrag	% Cover	Scirpus r.	% Cover	Solidago s.	% Cover	Scirpus o.	% Cover	Aster t.	% Cover	Atriplex	% Cover	Amaranthus c.	% Cover	Salicornia	% Cover	Limonium	% Cover	Pluchea	% Cover	Lythrum	% Cover	Teucrium	% Cover	cynosuroides	% Cover	Kosteletzkya	% Cover	bare ground	% Cover	log	% Cover	dead Phrag.	% Cover
COACHES ISLAND 8/22/01. note: T1Q1 & T2Q2 on sandy dune. T1Q4 also sandy	T1	Q1			6	24							19	76																														
		Q2			23	92	11	44											1	4																								
		Q3			17	68	4	16											25	100											3	12												
		Q4			22	88																											1	4										
	T2	Q1			3	12							8	32																														
		Q2			25	100	14	56																																				
		Q3			11	44													19	76											5	20												
		Q4			25	100	19	76											16	64																								
	Low		0		66		24		0		0		13.5		0		0		30.5		0		0		0		0		0		4		0		0.5		0		0		0		0	
	T3	Q1	25	100																																								
		Q2			13	52	13	52																																				
		Q3			17	68	4	16																																	5	20			
		Q4			16	64													16	64																								
	T4	Q1			20	80							10	40																											5	20			
		Q2	13	52																																								
		Q3			22	88							3	12																														
		Q4			20	80	1	4					4	16																														
	High		19		54		9		0		0		8.5		0		0		8		0		0		0		0		0		0		0		0		0		0		5		0		0	
	Site		9.5		76.5		22.5		0		0		14.4		0		0		26.9		0		0		0		0		0		3		0		0.4		0		0		2.5		0		0	
FRONT CREEK 8/20/01. Note: T1Q2, T1Q3, T2Q3, T3Q2 had 2-6" water	T1	Q1	7	28	4	16							7	28																														
		Q2	22	88									7	28																														
		Q3	11	44	21	84																																						
		Q4			25	100	4	16					7	28									2	8																				
	T2	Q1	1	4	5	20							5	20																											7	28			
		Q2	3	12							4	16	1	4	1	4																												
		Q3	12	48	15	60	11	44																																				
		Q4			25	100	5	20					1	4																														
	LOW		28		47.5		10		0		2		14		0.5		0		0		0		1		0		0		0		0		0		0		0		0		3.5		0		0	
	T3	Q1	25	100	5	20																																						
		Q2	25	100																			3	12																				
		Q3	5	20	6	24							9	36									4	16																				
		Q4			4	16							15	60																														
	T4	Q1	25	100																																								
		Q2																																										
		Q3																																										
		Q4	25	100									4	16																														
	HIGH		52.5		7.5		0		0		0		14		0		0		0		0		3.5		0		0		0		0		0		0		0		0		0		0		0	
	SITE		47.25		39.375		7.5		0		1.5		17.5		0.38		0		0		0		2.5		0		0		0		0		0		0		0		0		2.6		0		0	

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Quadrat Data

Species' Presence in # of Quadrat Squares (out of 25)

SITE NAME	Transect #	Quadrat #	alterniflora	% Cover	patens	% Cover	Distichlis	% Cover	Juncus r.	% Cover	Iva	% Cover	Phrag	% Cover	Scirpus r.	% Cover	Solidago s.	% Cover	Scirpus o.	% Cover	Aster t.	% Cover	Atriplex	% Cover	Amaranthus c.	% Cover	Salicornia	% Cover	Limonium	% Cover	Pluchea	% Cover	Lythrum	% Cover	Teucrium	% Cover	cynosuroides	% Cover	Kosteletzkya	% Cover	bare ground	% Cover	log	% Cover	dead Phrag.	% Cover
FRONT CREEK "A" 8/24/01 & 8/27/01. Note:T3Q1 had 6" water, T4Q1 had 3"	T1	Q1	17	68																	13	52																						
		Q2							25	100	1	4	2	8																														
		Q3			21	84	19	76			1	4					2	8																										
		Q4											16	64			5	20																										
	T2	Q1	20	80																	2	8							3	12							6	24						
		Q2							25	100																																		
		Q3			22	88	5	20																																				
		Q4											20	80																														
	LOW		18.5		21.5		12		25		1		19		0		3.5		0		7.5		0		0		0		1.5		0		0		0		3		0		0		0		0	
	T3	Q1	25	100																	4	16																						
		Q2	16	64	24	96			17	68																																		
		Q3			25	100	8	32					12	48			2	8																										
		Q4									3	12	25	100																														
	T4	Q1	18	72	16	64	4	16													3	12							1	4														
		Q2							25	100																																		
		Q3							20	80			3	12			1	4																										
		Q4											18	72																														
	HIGH		29.5		32.5		6		31		1.5		29		0		1.5		0		3.5		0		0		0		0.5		0		0		0		0		0		0		0	
	SITE		28.63		32.375		12		34.25		1.5		28.8		0		3.38		0		7.38		0		0		0		1.4		0		0		0		2.25		0		0		0	
HARBOR COVE 8/15/01. Note: T1Q1-Q3 & T2Q1 had 2-6" water	T1	Q1							25	100					3	12																												
		Q2							25	100																																		
		Q3	10	40	12	48			3	12									7	28																								
		Q4			18	72							2	8					13	52																								
	T2	Q1							22	88					5	20																												
		Q2							25	100							5	20																										
		Q3	7	28	19	76															7	28																						
		Q4			25	100	4	16	3	12																																		
	LOW		8.5		37		2		51.5		0		1		4		2.5		10		3.5		0		0		0		0		0		0		0		0		0		0		0	
	T3	Q1	21	84	4	16															1	4			1	4																		
		Q2							25	100																																		
		Q3			20	80	9	36	2	8							9	36																										
		Q4			17	68					1	4	10	40			11	44																										
	T4	Q1	4	16	21	84			6	24											10	40							2	8			1	4										
		Q2			19	76	2	8	15	60									12	48	8	32											1	4										
		Q3			25	100	2	8											7	28	2	8																						
		Q4			17	68	11	44					14	56																														
	HIGH		12.5		61.5		12		24		0.5		12		0		10		9.5		10.5		0		0.5		0		1		0		1		0		0		0		0		0	
	SITE		12.63		58.5		7.5		50.63		0.25		6.75		3		6.88		12.3		7.88		0		0.25		0		0.5		0		0.5		0		0		0		0		0	

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Quadrat Data

Species' Presence in # of Quadrat Squares (out of 25)

SITE NAME	Transect #	Quadrat #	alterniflora	% Cover	patens	% Cover	Distichlis	% Cover	Juncus r.	% Cover	Iva	% Cover	Phrag	% Cover	Scirpus r.	% Cover	Solidago s.	% Cover	Scirpus o.	% Cover	Aster t.	% Cover	Atriplex	% Cover	Amaranthus c.	% Cover	Salicornia	% Cover	Limonium	% Cover	Pluchea	% Cover	Lythrum	% Cover	Teucrium	% Cover	cynosuroides	% Cover	Kosteletzkya	% Cover	bare ground	% Cover	log	% Cover	dead Phrag.	% Cover
KNAPPS NARROWS 8/16/01. Q1 of T2, T3, T4 had 6" water. T1Q4 covered w/ woody debris	T1	Q1	3	12									17	68	1	4																												
		Q2	11	44	20	80					2	8											1	4			1	4																
		Q3	13	52	18	72					5	20											1	4																				
		Q4	12	48							1	4																																
	T2	Q1	24	96																	4	16	9	36																				
		Q2	23	92																							2	8																
		Q3	12	48	15	60																																						
		Q4			8	32	9	36			3	12	4	16																													
	LOW		49		30.5		4.5		0		5.5		10.5		0.5		0		0		2		5.5		0		1.5		0		0		0		0		0		0		0		0	
	T3	Q1	15	60																			1	4	2	8																		
		Q2	21	84	13	52																																						
		Q3	12	48	24	96															1	4																						
		Q4	8	32	14	56					1	4	1	4	1	4																												
	T4	Q1	17	68																																								
		Q2	8	32			25	100			1	4											1	4	1	4	3	12																
		Q3	5	20	21	84	15	60			1	4									2	8																						
		Q4			25	100					2	8	6	24																														
	HIGH		43		48.5		20		0		2.5		3.5		0.5		0		0		1.5		1		1.5		1.5		0		0		0		0		0		0		0		0	
	SITE		58.25		47.125		13.38		0		5.375		9.63		0.63		0		0		2.25		4.63		0.75		1.9		0		0		0		0		0		0		0		0	
LOWES POINT 8/14/01	T1	Q1	15	60																																					14	56		
		Q2	13	52	22	88					2	8																																
		Q3	2	8	25	100	3	12																																				
		Q4	10	40	9	36	14	56			8	32	3	12																													
	T2	Q1	16	64	2	8															8	32																						
		Q2			13	52			25	100																																		
		Q3	1	4	25	100	2	8																																				
		Q4	9	36							2	8	7	28																	6	24												
	LOW		33		48		9.5		12.5		6		5		0		0		0		4		0		0		0		0		3		0		0		0		0		7		0	
	T3	Q1											6	24																									1	4		22	88
		Q2	10	40	21	84					3	12	3	12									2	8																				
		Q3			25	100	4	16																																				
		Q4			25	100					3	12	4	16																														
	T4	Q1	6	24			2	8			1	4	14	56																													
		Q2	19	76	25	100					1	4																																
		Q3			25	100					2	8	3	12																														
		Q4			20	80					3	12	3	12																											1	4			
	HIGH		17.5		70.5		3		0		6.5		16.5		0		0		0		0		1		0		0		0		0		0		0		0		0.5		0.5		0		11	
	SITE		33.5		71.25		8.625		9.375		7.75		12		0		0		0		3		0.5		0		0		0		2.3		0		0		0		0.3		0.3		5.3		5.5	
Grand Totals:			1631		2612.3		759		600		146.6		631		20.5		126		213		154		89.9		36.8		15		32		40		9.1		1.9		11.3		1.8		45		26		39	88
% of 3200			0.510		0.816		0.237		0.188		0.046		0.197		0.006		0.039		0.067		0.048		0.028		0.011		###		###		###		###		###		0.004		###		###		###		###	

Vegetation/Segment Data: Raw vegetation community composition data

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Segment Data

Site Name	Transect #	Segment	Spp. Intercepted on 5-meter Segments. Values are # of Decimeter Subsegments Intercepting a spp. (out of 50 possible)																													PER SITE	
			alterniflora	patens	Distichlis	Juncus r.	Iva	Phrag	Scirpus r.	Solidago s.	Scirpus o.	Aster t.	Atriplex	Ameranthus c.	Salicornia	Limonium	Pluchea	Lythrum	Teucrium	cynosuroides	Kosteletzkya	Setaria parvaflora	dodder	Ammoph. brevil.	Hibiscus m.	Germander	Ipomoea s.	switch grass	Baccharis	Loblolly pine	N(N-1)	SUM ni(ni-1)	Simpson's Diver. Index		Avg. S.D.I LowMarsh	Avg. S.D.I HighMarsh
Back Creek 8/23/01	T1	Low	48									6	16	20	1															8190	2906	0.645177			
		High		27	21		26	23		4																				10100	2290	0.7732673			
	T2	Low	47										43	13																10506	4124	0.6074624			
		High		44	7		18	20					2																	8190	2622	0.6798535			
	T3	Low	47									8	19	12																7310	2692	0.6317373			
		High	49	22	10		10	23																						12882	3500	0.7283031			
	T4	Low	52									1	12									2								4422	2786	0.3699683		0.56359	0.709704
		High	25	48				29					2																	10712	3670	0.6573936	BAC		0.636645
Cabin Cove 8/9/01	T1	Low	24	35	6	20	12					10				3		5												13110	2400	0.8169336			
		High		20	30		18	49		41		3				4							2							27722	5568	0.7991487			
	T2	Low	42	42	12	13	8									4														14520	3800	0.738292			
		High			41		13	9		6																				4692	1898	0.5954817			
	T3	Low	23	39												1														3906	1988	0.4910394			
		High		36	41		21	16									1													13110	3560	0.7284516			
	T4	Low	25	41	8	1											2													5852	2298	0.6073137		0.66339	0.657902
		High			47		7	6		9																				4692	2306	0.5085251	CCO		0.660648
Coaches Island 8/22/01	T1	Low		20				35																	1					3080	1570	0.4902597			
		High		48	4		7	2			16															5				6642	2572	0.6127672			
	T2	Low		15				35																12						3782	1532	0.5949233			
		High		48	43						5																			9120	4082	0.5524123			
	T3	Low	35					4																						1482	1202	0.1889339			
		High		48				7			39								4											9506	3792	0.601094			
	T4	Low		30			5	26																						3660	1540	0.579235		0.46334	0.598221
		High		45			19	19												2										7140	2666	0.6266106	CI		0.53078

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Segment Data

Site Name	Transect #	Segment	Spp. Intercepted on 5-meter Segments. Values are # of Decimeter Subsegments Intercepting a spp. (out of 50 possible)																														PER SITE	
			alterniflora	patens	Distichlis	Juncus r.	Iva	Phrag	Scirpus r.	Solidago s.	Scirpus o.	Aster t.	Atriplex	Ameranthus c.	Salicornia	Limonium	Pluchea	Lythrum	Teucrium	cynosuroides	Kosteletzkya	Setaria parvaflora	dodder	Ammoph. brevil.	Hibiscus m.	Germander	Ipomoea s.	switch grass	Baccharis	Loblolly pine	N(N-1)	SUM ni(ni-1)	Simpson's Diver. Index		Avg. S.D.I LowMarsh	Avg. S.D.I HighMarsh
Front Creek 8/20/01	T1	Low	34	7				20																							3660	1544	0.5781421			
		High		49	21			23					3																		9120	3284	0.6399123			
	T2	Low	17	3	6		24	18																							4556	1166	0.7440737			
		High		50	33			17																							9900	3778	0.6183838			
	T3	Low	50	26																											5700	3100	0.4561404			
		High	11	8			7	24					2														4				3080	774	0.7487013			
	T4	Low	50	11																											3660	2560	0.3005464		0.51973	0.597494
		High	36					12																							2256	1392	0.3829787	FRC		0.55861
Front Creek "A" 8/24 & 27/01	T1	Low	43				1					28				3															5550	2568	0.5372973			
		High		13	13		24	35		24																					11772	2606	0.7786273			
	T2	Low	46	6			15					11				13				9											9900	2648	0.7325253			
		High		2			22	50																							5402	2914	0.4605702			
	T3	Low	45	1	3							19				2															4830	2330	0.5175983			
		High	1	21	2		28	50																							10302	3628	0.6478354			
	T4	Low	50	25	1							9				2															7482	3124	0.5824646		0.59247	0.601497
		High					29	50					4																		6806	3274	0.5189539	FRCA		0.596984
Harbor Cove 8/15/01	T1	Low				45					2																				2162	1982	0.0832562			
		High		34	1			28			40																	5			11556	3458	0.7007615			
	T2	Low	5			36			22			2		1																	4290	1744	0.5934732			
		High		47	34		13			5																			7		11130	3502	0.6853549			
	T3	Low	29	31								3																			3906	1748	0.5524834			
		High		38	1		25	31		14			3																1		12656	3124	0.7531606			
	T4	Low	28	30		29						13				3															10506	2600	0.7525224		0.49543	0.701412
		High		50	30		1	22		2		1																		1	11342	3784	0.6663728	HAC		0.598423

Poplar Island Marsh Monitoring, Summer 2001: Vegetation/Segment Data

Site Name	Transect #	Segment	Spp. Intercepted on 5-meter Segments. Values are # of Decimeter Subsegments Intercepting a spp. (out of 50 possible)																														PER SITE	
			alterniflora	patens	Distichlis	Juncus r.	Iva	Phrag	Scirpus r.	Solidago s.	Scirpus o.	Aster t.	Atriplex	Ameranthus c.	Salicomia	Limonium	Pluchea	Lythrum	Teucrium	cynosuroides	Kosteletzkya	Setaria parvaflora	dodder	Ammoph. brevil.	Hibiscus m.	Germander	Ipomoea s.	switch grass	Baccharis	Loblolly pine	N(N-1)	SUM ni(ni-1)	Simpson's Diver. Index		Avg. S.D.I LowMarsh	Avg. S.D.I HighMarsh
Knapps Narrows 8/16/01	T1	Low	34				18	30	6																					7656	2328	0.6959248			
		High	31	21			16	6																						5402	1620	0.7001111			
	T2	Low	40									3	10	10																3906	1746	0.5529954			
		High		35	20		12	12																						6162	1834	0.7023694			
	T3	Low	39									1	15	17																5112	1964	0.6158059			
		High	18	50	5		23	23																						14042	3788	0.7302379			
	T4	Low	47									8	20	21																9120	3018	0.6690789		0.63345	0.6865
		High	13	48			11	11																						6806	2632	0.6132824	KNN		0.659976
Lowes Point 8/14/01	T1	Low	47	17			1		3																					4556	2440	0.4644425			
		High		29	13		9	8	11																					4830	1206	0.7503106			
	T2	Low	38	26			14					17																		8930	2510	0.718925			
		High	20	24			22	27	2								8													10506	2154	0.7949743			
	T3	Low	1	17			44	14																						5700	2346	0.5884211			
		High		49	9		20	19																						9312	3146	0.6621564			
	T4	Low	28	20	3		1	29																						6480	1954	0.6984568		0.61756	0.731955
		High		46	9		32	33		3																				15006	4196	0.7203785	LOP		0.674758

Avg. for all LowMarsh trans.-->	0.56862
Avg. for all HighMarsh transects-->	0.660586

	Low	High	Site
BAC	0.5636	0.7097	0.636645
CAC	0.6634	0.6579	0.660648
COI	0.4633	0.59822	0.53078
FRC	0.5356	0.59749	0.566565
FRCA	0.5925	0.6015	0.596984
HAC	0.4954	0.74304	0.619239
KNN	0.6335	0.6865	0.659976
LOP	0.6176	0.73195	0.674758
ALL SITES	***0.5706***	***0.66579***	***0.6182***

APPENDIX E

Faunal/Quadrat Data: Raw faunal community diversity data

Poplar Island Marsh Monitoring, Summer 2001: Fauna/Quadrat Data

SITE NAME	Transect #	Quadrat #	Number of Individuals per Quadrat																												N(N-1)	SUM ni(ni-1)	Simpson's Diver. Index		SITE AVG. By QUAD #			
			Littorina	Melampus	Arachnid (Spider)	Isopod	Hymenoptera	Amphipod	Leafhopper	(Orthoptera)Grass	Coleoptera A	Coleoptera B	Coleoptera C	Coleoptera D	Coleoptera E	Coleoptera F	Coleoptera G	(Orthoptera) Crick	Lepidoptera	Uca	Un-ID'd Insect	Un-ID'd Insect A	Un-ID'd Insect B	Arachnid (mite)	Ribbed Mussel	Hemiptera	Fish fry	*heterociltis* (dead)	Unknown Frog	Unknown Snail					Quadrat #1	Quadrat #2	Quadrat #3	Quadrat #4
BACK CREEK 8/23/01	T1	Q1	4		1																1										30	12	0.6					
		Q2		14	3												1														306	188	0.3856					
		Q3		29	2		1	1	1																						1122	814	0.2745					
		Q4			4		3			1								1	2												110	20	0.8182					
	T2	Q1			2																										2	2	0					
		Q2		35	3		5																								1806	1216	0.3267					
		Q3		24	5			1										1													930	572	0.3849					
		Q4		7			7																								182	84	0.5385					
	T3	Q1	5		1																										30	20	0.3333					
		Q2		7	3		1	2																							156	50	0.6795					
		Q3		25	2		2																								812	604	0.2562					
		Q4		10			2																								132	92	0.303					
	T4	Q1		2	3	2				1																					56	10	0.8214					
		Q2		15	4	1	1		2																						506	224	0.5573					
		Q3			4	1	6			2							1														182	44	0.7582					
		Q4			1		1			2																					12	2	0.8333	BAC	0.43869	0.487277	0.418464	0.623252
CABIN COVE 8/9/01 & 8/14/01	T1	Q1	13	62	1	3	4															1			1						7140	3956	0.4459					
		Q2		45	7		1	1																							2862	2022	0.2935					
		Q3		23	1		1	1														1		1	2						870	508	0.4161					
		Q4		77	1	1	5	1		1																					7310	5872	0.1967					
	T2	Q1	13																												156	156	0					
		Q2		5	2																										42	22	0.4762					
		Q3																													0	0	0					
		Q4		8	2		5	2																							272	80	0.7059					
	T3	Q1	12	8	1																										420	188	0.5524					
		Q2		24	1				3															1							812	558	0.3128					
		Q3		21	1			1																	1						552	420	0.2391					
		Q4		25				2																							702	602	0.1425					
	T4	Q1	15				3	1	5		4																				756	248	0.672					
		Q2		25			3																								756	606	0.1984					
		Q3		12	1																				1						182	132	0.2747					
		Q4		9	1	1	4	1			1																				272	84	0.6912	CCO	0.417569	0.320228	0.232487	0.434056

Poplar Island Marsh Monitoring, Summer 2001: Fauna/Quadrat Data

SITE NAME	Transect #	Quadrat #	Number of Individuals per Quadrat																													N(N-1)	SUM ni(ni-1)	Simpson's Diver. Index		SITE AVG. By QUAD #			
			Littorina	Melampus	Arachnid (Spider)	Isopod	Hymenoptera	Amphipod	Leafhopper	(Orthoptera)Grass	Coleoptera A	Coleoptera B	Coleoptera C	Coleoptera D	Coleoptera E	Coleoptera F	Coleoptera G	(Orthoptera) Crick	Lepidoptera	Uca	Un-ID'd Insect	Un-ID'd Insect A	Un-ID'd Insect B	Arachnid (mite)	Ribbed Mussel	Hemiptera	Fish fry	*heterocilitis* (dead)	Unknown Frog	Unknown Snail					Quadrat #1	Quadrat #2	Quadrat #3	Quadrat #4
COACHES ISLAND 8/22/01. note: T1Q1 & T2Q2 on sandy dune. T1Q4 also sandy	T1	Q1			13		1																								182	156	0.1429					
		Q2			9	1			11																						420	182	0.5667					
		Q3			5		3																								56	26	0.5357					
		Q4					13																								156	156	0					
	T2	Q1			4		3																								42	18	0.5714					
		Q2			2				2																						12	4	0.6667					
		Q3		4	2			2																							56	16	0.7143					
		Q4			8			1	1							1															110	56	0.4909					
	T3	Q1																													0	0	0					
		Q2			8				2																						90	58	0.3556					
		Q3			9					1																	25	4			1482	684	0.5385					
		Q4			3	1																									12	6	0.5					
	T4	Q1				7	7			3																					272	90	0.6691					
		Q2			9	2	45	6																							3782	2084	0.449					
		Q3			2	1	6										1														90	32	0.6444					
		Q4			4		1		1	1							1														56	12	0.7857	CI	0.345851	0.509464	0.608226	0.444156
FRONT CREEK 8/20/01. Note: T1Q2, T1Q3, T2Q3, T3Q2 had 2-6" water	T1	Q1					14	6																							380	212	0.4421					
		Q2		18	4				7														2								930	362	0.6108					
		Q3		13	3		1		4																						420	174	0.5857					
		Q4		74	6	1	7	3	4														1								9120	5492	0.3978					
	T2	Q1					4																								12	12	0					
		Q2		17	4	25	7											1													2862	926	0.6765					
		Q3		4	14				5												1		3								702	220	0.6866					
		Q4		22	2	1	2		1															1							812	466	0.4261					
	T3	Q1		10	1	1		1	3												1										272	96	0.6471					
		Q2	1	11	5		1														1		1								380	130	0.6579					
		Q3		25	13	9	10			3																					3540	924	0.739					
		Q4		2	4	1	16			1																					552	254	0.5399					
	T4	Q1		10	1			1	3																						210	96	0.5429					
		Q2																													0	0	0					
		Q3																													0	0	0					
		Q4		1			3	1																							20	6	0.7	FRC	0.408005	0.486274	0.502827	0.515943

Poplar Island Marsh Monitoring, Summer 2001: Fauna/Quadrat Data

SITE NAME	Transect #	Quadrat #	Number of Individuals per Quadrat																												N(N-1)	SUM ni(ni-1)	Simpson's Diver. Index		SITE AVG. By QUAD #			
			Littorina	Melampus	Arachnid (Spider)	Isopod	Hymenoptera	Amphipod	Leafhopper	(Orthoptera)Grass	Coleoptera A	Coleoptera B	Coleoptera C	Coleoptera D	Coleoptera E	Coleoptera F	Coleoptera G	(Orthoptera) Crick	Lepidoptera	Uca	Un-ID'd Insect	Un-ID'd Insect A	Un-ID'd Insect B	Arachnid (mite)	Ribbed Mussel	Hemiptera	Fish fry	*heteroclitis* (dead)	Unknown Frog	Unknown Snail					Quadrat #1	Quadrat #2	Quadrat #3	Quadrat #4
FRONT CREEK "A" 8/24/01 & 8/27/01. Note:T3Q1 had 6" water, T4Q1 had 3"	T1	Q1	36						1																						1332	1260	0.0541					
		Q2		8	4				1	1																						182	68	0.6264					
		Q3		34	1	7		1									1														1892	1164	0.3848					
		Q4		5	3	4	13												1													650	194	0.7015					
	T2	Q1	53																												2756	2756	0					
		Q2			4				1												1										30	12	0.6					
		Q3		27	4																										930	714	0.2323					
		Q4		16			1	1																							306	240	0.2157					
	T3	Q1	110		1				8																						14042	12046	0.1421					
		Q2		4	19		2		2																						702	358	0.49					
		Q3		16	6		5		2												1										870	292	0.6644					
		Q4		50			11			1																					3782	2560	0.3231					
	T4	Q1	65	15					2																						6642	4372	0.3418					
		Q2		29			7												1												1332	854	0.3589					
		Q3		45	11		7	1		2								2													4556	2136	0.5312					
		Q4		8	1	1		4		1																					210	68	0.6762	FRCA	0.134491	0.518815	0.453143	0.479131
HARBOR COVE 8/15/01. Note: T1Q1-Q3 & T2Q1 had 2-6" water	T1	Q1	39		1																										1560	1482	0.05					
		Q2			3					1											1										20	6	0.7					
		Q3		2	2				1																						20	4	0.8					
		Q4			4		2		1	1				1																	72	14	0.8056					
	T2	Q1	5	2																											42	22	0.4762					
		Q2		2	4															1											42	14	0.6667					
		Q3		34		1	2																								1332	1124	0.1562					
		Q4		1	13	12	2	1	2				1																		992	292	0.7056					
	T3	Q1	33	1	2				3																						1482	1064	0.2821					
		Q2		6	5		2												1												182	52	0.7143					
		Q3		7	3			1																							110	48	0.5636					
		Q4		8	8	10	6		2																						1122	234	0.7914					
	T4	Q1	27		2																										812	704	0.133					
		Q2		15	3				1	1																					380	216	0.4316					
		Q3		22	17		1																	2	1						1806	736	0.5925					
		Q4		11	8		4		1	1											2										702	180	0.7436	HAC	0.235312	0.628133	0.528066	0.761559

Poplar Island Marsh Monitoring, Summer 2001: Fauna/Quadrat Data

SITE NAME	Transect #	Quadrat #	Number of Individuals per Quadrat																												N(N-1)	SUM ni(ni-1)	Simpson's Diver. Index		SITE AVG. By QUAD #			
			Littorina	Melampus	Arachnid (Spider)	Isopod	Hymenoptera	Amphipod	Leafhopper	(Orthoptera)Grass	Coleoptera A	Coleoptera B	Coleoptera C	Coleoptera D	Coleoptera E	Coleoptera F	Coleoptera G	(Orthoptera) Cricket	Lepidoptera	Uca	Un-ID'd Insect	Un-ID'd Insect A	Un-ID'd Insect B	Arachnid (mite)	Ribbed Mussel	Hemiptera	Fish fry	*heteroclitis* (dead)	Unknown Frog	Unknown Snail					Quadrat #1	Quadrat #2	Quadrat #3	Quadrat #4
KNAPPS NARROWS 8/16/01. Q1 of T2, T3, T4 had 6" water. T1Q4 covered w/ woody debris	T1	Q1			2		1		1																						12	2	0.8333					
		Q2		10	5				7																			1			506	152	0.6996					
		Q3		38	4		1		1	1																					1980	1418	0.2838					
		Q4			10																										90	90	0					
	T2	Q1	26																												650	650	0					
		Q2		24	1		1		6																						992	582	0.4133					
		Q3		12	3				3																						306	144	0.5294					
		Q4		10	1	1			1																						156	90	0.4231					
	T3	Q1	22																												462	462	0					
		Q2		4	5				8														8								600	144	0.76					
		Q3		35	5				3				1		1								4								2352	1228	0.4779					
		Q4		13	4				1														1								342	168	0.5088					
	T4	Q1	4																												12	12	0					
		Q2		14	3		1	1	4																						506	200	0.6047					
		Q3		11	4			1	3																						342	128	0.6257					
		Q4		29	5		2											1													1332	834	0.3739	KNN	0.208333	0.619414	0.479218	0.326431
LOWES POINT 8/14/01	T1	Q1	23	8			3																	1	1						1260	568	0.5492					
		Q2		14	2		1					13								1									1		992	340	0.6573					
		Q3		9	8		1		5															1							552	148	0.7319					
		Q4	1	24	1		28	1																3							3306	1314	0.6025					
	T2	Q1	42	1	1		2		1															3							2450	1730	0.2939					
		Q2	4	6	3		11		2																						650	160	0.7538					
		Q3		16	3															1		5									600	266	0.5567					
		Q4		33			1																								1122	1056	0.0588					
	T3	Q1	11	18	2	1	2					1	1																		1260	420	0.6667					
		Q2		40	1		2															2									1980	1564	0.2101					
		Q3		31	3		3		1				4																		1722	954	0.446					
		Q4		37																											1332	1332	0					
	T4	Q1	2	7	2								2						1												182	48	0.7363					
		Q2		8	5			1	5															1							380	96	0.7474					
		Q3		3			1					1										1								1	42	6	0.8571					
		Q4		55	3		3																								3660	2982	0.1852	LOP	0.561504	0.592143	0.647922	0.211653
Grand Totals:			566	1601	407	96	328	48	135	26	5	15	9	1	1	1	5	6	6	3	9	10	20	14	7	25	4	1	1	1								
																																		Avg S.D.I. for ALL SITES, by QUAD #			
																																	Q1	Q2	Q3	Q4
																																ALL SI	0.343719	0.520219	0.483794	0.474522
																											Avg. All Sites, All Quads -->			0.4556					

APPENDIX F

List of plant species observed during 2001 wetland vegetation monitoring

List of Plants Observed During 2001 Poplar Island Marsh Monitoring

Line Intercept Data		Quadrat Data	
Species	**Common Name**	***Species***	**Common Name**
Ameranthus cannabinis	waterhemp	*Ameranthus cannabinis*	waterhemp
Ammoph. brevil.		*Aster tennuifolius*	perennial saltmarsh aster
Aster tennuifolius	perennial saltmarsh aster	*Atriplex patula*	marsh orach
Atriplex patula	marsh orach	*Distichlis spicata*	saltgrass
Baccharis halimifolia	salt bush, groundsel tree	*Iva frutescens*	high tide bush, marsh elder
Cuscuta gronovii	dodder	*Juncus romerianus*	black needlerush
Distichlis spicata	saltgrass	*Kosteletzkya virginica*	marsh mallow / seaside mall.
Germander	Germander	*Limonium carolinianum*	sea lavender
Hibiscus moscheutos	rose mallow	*Lythrum lineare*	saltmarsh loostrife
Ipomoea sagittata	arrowleaf morning glory	*Phragmites australis*	common reed
Iva frutescens	high tide bush, marsh elder	*Pluchea purpurescens*	saltmarsh fleabane
Juncus romerianus	black needlerush	*Salicornia sp.*	glasswort
Kosteletzkya virginica	marsh mallow / seaside mall.	*Schoenoplectus americanus*	Olney's three-square
Limonium carolinianum	sea lavender	*Scirpus robustus*	saltmarsh bulrush
Lythrum lineare	saltmarsh loostrife	*Solidago sempivirens*	seaside goldenrod
Panicum virgatum	switchgrass	*Spartina alterniflora*	saltmarsh cordgrass
Phragmites australis	common reed	*Spartina cynosuroides*	big cordgrass
Pinus taeda	loblolly pine	*Spartina patens*	saltmeadow hay
Pluchea purpurescens	saltmarsh fleabane	*Teucrium canadense*	wood sage
Salicornia sp.	glasswort		
Setaria parviflora	knotroot foxtail		
Schoenoplectus americanus	Olney's three-square		
Scirpus robustus	saltmarsh bulrush		
Solidago sempivirens	seaside goldenrod		
Spartina alterniflora	saltmarsh cordgrass		
Spartina cynosuroides	big cordgrass		
Spartina patens	saltmeadow hay		
Teucrium canadense	wood sage		