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Monitoring Salt Marsh Vegetation and Nekton at George Washington Birthplace National Monument

2010 Summary Report

Natural Resource Data Series NPS/NCBN/NRDS—2011/133

ON THE COVER
Salt marsh at George Washington Birthplace National Monument.
Photograph by: Brandon Haynes

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Executive Summary

The Northeast Coastal and Barrier Network (NCBN) is one of 32 networks of parks created by the National Park Service (NPS) Inventory and Monitoring Program (I&M Program). The I&M Program has two components, 1) to collect baseline ecological inventory datasets and 2) to implement *Vital Signs* monitoring, a long-term ecological monitoring program, in each of the 32 networks. The Northeast Coastal and Barrier Network consists of eight parks linked by geography and shared ecological characteristics along the Northeastern Atlantic Coast. As part of the I&M Program, each network has developed detailed protocols for monitoring a select number of Vital Signs, or ecological indicators. Because the majority of parks in the NCBN are coastal parks, salt marsh monitoring was chosen as a high priority and protocols were developed for collecting long-term data on salt marsh vegetation and nekton (James-Pirri and Roman In Review-a,b). The objective of monitoring vegetation and nekton is to identify long-term trends in community structure, and to provide resource managers with a better understanding of the current status and condition of the salt marsh resources they manage.

The NCBN protocols for monitoring salt marsh were first implemented at George Washington Birthplace National Monument (GEWA) in Virginia during the summer of 2008. This report summarizes the second year of nekton and vegetation data collected at GEWA in 2010. Monitoring will continue on a biennial basis.

The percent cover of each vegetation species and non-vegetation cover type within each 1 m^2 plot was visually estimated using a revised Braun-Blanquet method (Kent and Coker 1992). Fifty vegetation plots were sampled at GEWA in August 2010. A total of 18 vegetation species and three non-vegetation cover types were recorded. Non-vegetation cover types observed included water, wrack & litter, and bare ground. *Spartina alterniflora* had the largest average percent cover and was one of the most frequently observed species. One species, *Phragmites australis*, is listed as a highly invasive species in the state of Virginia (Virginia Department of Conservation and Recreation 2009).

Nekton were sampled in the tidal creek exclusively. Five nekton species consisting of three fish and two decapod species were captured at GEWA during the summer of 2010. The nekton community in 2010 was clearly dominated by fish, which accounted for 99.7% of all nekton captured, with decapods making up less than 0.5% of the total catch. A single species, *Fundulus heteroclitus* (common mummichog) accounted for approximately 88% of all nekton captured at GEWA in 2010.

Acknowledgments

We would like to thank Charles T. Roman and Mary-Jane James-Pirri for the development of the salt marsh monitoring protocols and Dennis Skidds for his work on the salt marsh monitoring database and data management support. We would also like to thank the 2010 field crew members, Robin Baranowski, Zachary Bourassa, Daphne Forster, Brandon Haynes, and Casey Nolan, for their hard work and, of course, the George Washington National Monument staff for providing support to the NCBN field crew.

Introduction

National Park Service (NPS) managers need accurate information about how, when and why natural systems change over time in order to make sound management decisions. To address this need, the NPS initiated natural resource monitoring through the Natural Resource Challenge funded by Congress in 2000. The Inventory and Monitoring Program (I&M), the key component of this effort, organizes 270 park units into 32 networks tasked with conducting long-term ecological monitoring. Networks were required to develop a monitoring plan addressing the implementation of long-term monitoring of key ecological indicators or "vital signs." Vital signs are defined as measurable, early warning signals that may indicate change in the long-term health of natural systems. Early detection of potential problems allows park managers to take steps in restoring or maintaining ecological health of park resources.

The Northeast Coastal and Barrier Network (NCBN) is made up of eight parks: Assateague Island National Seashore (ASIS, coastal Maryland and Virginia), Thomas Stone National Historic Site (THST, Charles County, MD), Cape Cod National Seashore (CACO, Cape Cod, MA), Gateway National Recreation Area (GATE, New York, NY and Sandy Hook, NJ), Fire Island National Seashore (FIIS, Long Island, NY), Sagamore Hill National Historic Site (SAHI, Oyster Bay, NY), Colonial National Historical Park (COLO, Virginia Peninsula), and George Washington Birthplace National Monument (GEWA, Westmoreland County, VA). Vital Signs chosen as part of the Network's monitoring plan include salt marsh vegetation communities, nekton communities, essential estuarine water quality parameters and specific coastal geomorphologic features (Stevens et al. 2005). Detailed monitoring protocols have been developed and implemented in the eight parks. This annual report summarizes salt marsh nekton and vegetation data collected in 2010 at George Washington Birthplace National Monument (GEWA) according to two protocols developed by James-Pirri and Roman, *Monitoring Nekton in Salt Marshes: A Protocol for the National Park Service's Long-Term Monitoring Program, Northeast Coastal and Barrier Network* and *Monitoring Salt Marsh Vegetation: A Protocol for the National Park Service's Long-Term Monitoring Program, Northeast Coastal and Barrier Network* (In Review-a,b).

The objective of salt marsh monitoring is to identify long-term trends in the vegetation and nekton community structure, which will provide a better understanding of the current status and condition of salt marsh within the parks. Because salt marshes are located in coastal areas and many of the plant species are sensitive to subtle changes in soil salinity and saturation, changes in the percent cover and prevalence of some species will be important primary indicators of change in salt marsh condition. Trends in the percent cover and prevalence of bare ground and water will also provide information about changes in the overall condition of the salt marsh and whether or not it may transition to mud flat due to climate change (*e.g.*, sea level rise, changes in temperature). Long-term monitoring data will provide park managers with the scientific data they need to make informed decisions regarding the management and continued protection of this rare and valuable coastal resource.

Methods

Permanent Site Selection

One permanent salt marsh site (Dancing Marsh) was selected for vegetation and nekton monitoring at GEWA (Figure 1). The number of sites chosen within the park was based on available habitat and the logistics and feasibility of sampling. Detailed information about the site selection process and sampling design can be found in the salt marsh protocols (James-Pirri and Roman In Review-a,b).

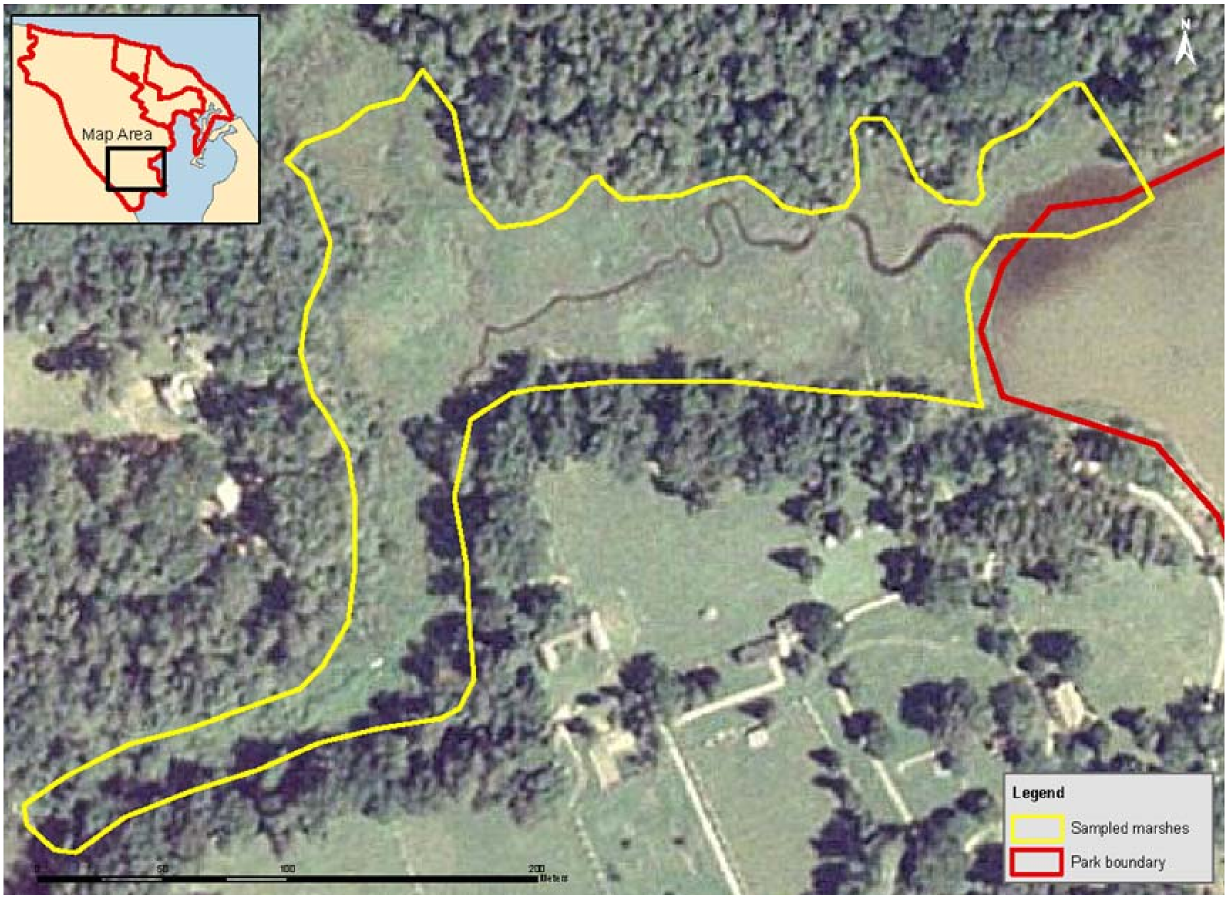

Figure 1. Aerial view and location of permanent nekton and vegetation monitoring site established by NCBN at George Washington Birthplace National Monument (GEWA) in Viginia. This site will continue to be monitored biennially.

Nekton Sampling Station Selection and Data Collection

Twelve nekton stations were randomly located along the tidal creek. Nekton stations were sampled twice, once in early summer on June 29-30th (sampling took two days due to tides), and once in late summer on August 10, 2010. Universal Transverse Mercator (UTM) coordinates for each station are provided in Appendix A.

Nekton in creeks less than 1 m deep were sampled with a 1 m^2 aluminum throw trap (Kushlan 1981, Sogard and Able 1991, Raposa and Roman 2001). The throw trap is an enclosure sampler that has excellent efficiency and provides quantitative, repeatable results (Rozas and Minello 1997). The trap has an open top and bottom, is 0.5 m in height and 1 m square, and the sides are covered with 3 mm (1/8 in) wire mesh. All nekton were collected from the trap with a 1 mm mesh dip net that fit snuggly within the opposite sides of the trap.

All fish and decapods were identified and enumerated. A representative number (up to 15 individuals) of each species collected was measured for length (fish & shrimp – total length; crabs – carapace width). Once identified and measured, all organisms were returned to the location where they were collected.

Vegetation Plot Selection and Data Collection

Vegetation was sampled using randomly located, 1 m^2 plots. Transects—extending from creek bank to upland—were systematically placed throughout the site based on a single random start. Plots were then randomly located by treating all transects as a single transect and randomly selecting approximately 50 points along this total length. This combination of systematic transects and replicate plots is necessary to ensure interspersion of the plots throughout the marsh study area, thus providing a representative sample of all salt marsh communities (e.g., low marsh, high marsh). Universal Transverse Mercator (UTM) coordinates for each vegetation plot are provided in Appendix B.

Vegetation sampling was conducted at GEWA on August 11, 2010. Fifty 1 m^2 plots were sampled. Each plot was visited once during the summer. For each plot, all vegetation species and non-vegetation cover types were recorded (Table 1), and the estimated percent cover was visually estimated using a modified Braun-Blanquet cover scale (0: 0%; 1: <1%; 2: 1-5%; 3: 6-25%; 4: 26-50%; 5: 51-75%; 6: 76-100%), (Kent and Coker 1992).

Data Summary

Nekton

Species composition, average density, average length of nekton, and standard deviations were all calculated using standard formulae. The same is true of the average values of the physical characteristics calculated for each habitat type during each visit. Details can be found in the Analysis and Reporting Standard Operating Procedure of James-Pirri et al. (In Development-a). Species richness was calculated using the algorithm described in Heltshe and Forester (1983). An explanation and example of using the algorithm is provided in the Analysis and Reporting Standard Operating Protocol of James-Pirri et al. (In Development-a).

Vegetation

Vegetation data were recorded using the modified Braun-Blanquet scale as described above (Kent and Coker 1992). For summary purposes, each Braun-Blanquet value was converted to the midpoint of the percent range it represented (Table 2) as described in Wikum and Shanholtzer (1978).

Table 1. Definition of standard cover type categories used in the Northeast Coastal and Barrier Network salt marsh vegetation monitoring protocol (James-Pirri and Roman In Review-b).

Live vascular plants	(Herbaceous and shrubs) identified by species.
Standing non-living vascular plants	Identified by species (e.g., S. alterniflora Not Living). This category only includes standing dead (attached) plants that are from a previous year's growth. There may be some dead leaves from this year's growth (e.g., the ends of leaves or leaves that are being replaced by new growth, etc.). In cases where dead leaves are from the current growing season, plant cover is recorded as live.
Macroalgae	Identified by species. This category generally includes the rockweeds (e.g., Fucus, Ascophyllum). Microalgae (e.g., diatom mats) and fine filamentous algae are not included in this category.
Bare ground	Includes mud, sand, microalgae cover, etc. These are areas that are not flooded with water and are devoid of standing live, standing dead, or macroalgae. There can be a thin film of surface water within the bare ground category.
Water	Permanent standing water is identified in plots that are partly within a creek, ditch, marsh pool, or flooded panne.
Wrack/litter	Wrack is material that has floated into the plot. This is generally dead (not attached) plant material, but could also be trash. Litter is dead plant material that is highly decomposed and is no longer attached.
Trash	Items such as logs, old piers, tires, etc.
Rock	Boulders or rocks can be found on the surface of northern New England marshes.

Table 2. Modified Braun-Blanquet scale and corresponding midpoint values for determining percent cover of each vegetation species and non-vegetation cover type.

BB Value	Percent Cover	Midpoint
0	0%	0%
1	< 1%	0.5%
2	1 - 5%	3%
3	6 - 25%	15.5%
4	26 - 50%	38%
5	51 - 75%	63%
6	76 - 100%	88%

Wikum and Shanholtzer (1978) outline a method for calculating an importance value for each species. So as not to confuse this value with ecological importance, we rename it a ‘relative prevalence’ value. The calculation is essentially identical to that described in Wikum and Shanholtzer’s publication. Although Wikum and Shanholtzer (1978) present their importance value as a sum of the percent frequency and percent cover values, this report takes the average of these values so that relative prevalence is on a more readily interpretable percent scale. We estimated the relative percent prevalence for each species and non-vegetation cover type present, which is equal to the average of the relative percent cover and the relative percent frequency.

Relative percent cover is the percentage of all plots that each species covers relative to all other species present in the plots. The sum of all relative percent cover values for all species and non-vegetation cover types equals 100%. Relative percent frequency is the number of plots where each species is present, relative to all other species observed in the plots. The sum of the relative percent frequency values for all species and non-vegetation cover type equals 100%.

Taking the average of the relative percent cover and the relative percent frequency gives the *relative percent prevalence* for each species and non-vegetation cover type. Because the relative percent prevalence incorporates both percent frequency and percent cover, it is likely to differ substantially from the average percent cover for a given species or non-vegetation cover type. The relative percent prevalence of a species provides information about how a species is distributed (*i.e.*, its ‘patchiness’) throughout the salt marsh. We also report the average percent cover of each species for all plots combined.

Lastly, if any vegetation species observed in the plots are listed by the United States Department of Agriculture (USDA), or the commonwealth of Virginia as exotic, invasive, threatened, endangered, or rare, these species are noted in the vegetation table. Individual plots that were found to contain a species listed as exotic, invasive, threatened, endangered, or rare, will be noted in Appendix B, which includes a table of all vegetation plots and their respective Universal Transverse Mercator (UTM) coordinates. Information about plants listed by each state as exotic, invasive, threatened, endangered, or rare is available online (USDA 2010). In some cases, more specific information may be available on state websites. Information about plants listed by the commonwealth of Virginia as exotic or invasive is available online (Virginia Department of Conservation and Recreation 2009). Information about plants listed by the commonwealth of Virginia as threatened, endangered, or rare can be obtained from an online report produced by the Virginia Department of Conservation and Recreation (Townsend 2009).

Results

Nekton

Five nekton species consisting of three fish and two decapod species were captured at GEWA during the summer of 2010. A single species, *Fundulus heteroclitus* (common mummichog) accounted for approximately 88% of all nekton captured at GEWA in 2010. Fish comprised 100% and 99% of all nekton caught during visit 1 (late-June) and visit 2 (August) respectively (Table 3). No decapods were recorded during visit 1, and comprised less than 1% of all nekton captured during visit 2. *F. heteroclitus* and *Fundulus lucia* (spotfin killifish) were the only species observed in June, comprising approximately 83% and 17% of the community respectively. In August, *F. heteroclitus* accounted for 98% of nekton captured, with *Cyprinodon variegatus* (sheepshead minnow) comprising less than 1%. Differences between sampling visits are expected, and this is the primary reason for sampling the nekton community twice each summer. *F. heteroclitus* had the highest density of all species captured in 2010, with *F. lucia* following respectively (Table 4). Species richness (Table 5) and the average length of each species (Table 6) are also provided below.

Physical characteristics of each nekton sampling station were recorded for each station during each visit. These measures provide limited insight into differences between habitats and visits that may affect nekton (Table 7). These data are collected in an effort to help explain anomalies in nekton observed at a particular location during a specific visit (*e.g.*, presence or absence of a particular species). These parameters would need to be measured over the course of the field season in order to lend any real insight into observed changes in the nekton community.

Table 3. Nekton species and community composition (% catch) at GEWA in 2010. Data are shown for each visit separately and both visits combined. n = total number of nekton caught during that visit. '-' indicates species was not present.

		Community/Species Composition (%)		
Community/Species	**Common Name**	**Visit 1 (n = 408)**	**Visit 2 (n = 220)**	**Visits 1 & 2 (n = 628)**
Fish		**100.0**	**99.1**	**99.7**
Fundulus heteroclitus	Common mummichog	82.8	98.2	88.2
Fundulus lucia	Spotfin Killifish	17.2	-	11.1
Cyprinodon variegatus	Sheepshead minnow	-	0.9	0.3
Decapods		**-**	**0.9**	**0.3**
Callinectes sapidus	Blue crab	-	0.5	0.2
Palaemonetes pugio	Daggerblade grass shrimp	-	0.5	0.2

Table 4. Average density and standard deviation [individuals per 1 m2 ± SD (total count)] of nekton captured at GEWA in 2010. n = number of nekton stations sampled. '-' indicates species was not present.

		Average Density [individuals per 1 m^2 ± SD (total count)]		
Community/Species	**Common Name**	**Visit 1 (n =12)**	**Visit 2 (n = 12)**	**Visits 1 & 2 (n = 12)**
Fish		**34.0 ± 87.7 (408)**	**18.2 ± 23.7 (218)**	**26.1 ± 63.4 (626)**
Fundulus heteroclitus	Common mummichog	28.2 ± 88.2 (338)	18.0 ± 23.7 (216)	23.1 ± 63.4 (554)
Fundulus lucia	Spotfin Killifish	5.8 ± 15.9 (70)	-	2.9 ± 11.4 (70)
Cyprinodon variegatus	Sheepshead minnow	-	0.2 ± 0.6 (2)	0.1 ± 0.4 (2)
Decapods		**-**	**0.2 ± 0.4 (2)**	**0.1 ± 0.3 (2)**
Callinectes sapidus	Blue crab	-	0.1 ± 0.3 (1)	< 0.05
Palaemonetes pugio	Daggerblade grass shrimp	-	0.1 ± 0.3 (1)	< 0.05
Total Nekton		**34.0 ± 87.7 (408)**	**18.3 ± 23.8 (220)**	**26.2 ± 63.4 (628)**

Table 5. Estimated nekton species richness (species richness ± SD) summarized by sampling visit at GEWA in 2010.

Visit	**No. of Stations**	**Observed No. of Species**	**Est. Species Richness ± SD**
1	12	2	2.0
2	12	4	5.8 ± 1.2
1 & 2	12	5	6.8 ± 1.2

Table 6. Average length [mm ± SD (no. measured)] of nekton during each sample visit at GEWA in 2010. Length data for each species was summarized over all stations sampled during each visit. '-' indicates that a species was not present.

		Average Length [mm ± SD (no. measured)]		
Community/Species	**Common Name**	**Visit 1**	**Visit 2**	**Visits 1 & 2**
Fish				
Cyprinodon variegatus	Sheepshead minnow	-	38.5 ± 6.4 (2)	38.5 ± 6.4 (2)
Fundulus heteroclitus	Common mummichog	23.7 ± 7.8 (45)	37.6 ± 10.9 (96)	33.2 ± 11.9 (141)
Fundulus lucia	Spotfin Killifish	32.1 ± 7.7 (30)	-	32.1 ± 7.7 (30)
Decapods				
Callinectes sapidus	Blue crab	-	44.0 (1)	44.0 (1)
Palaemonetes pugio	Daggerblade grass shrimp	-	21.0 (1)	21.0 (1)

Table 7. Average values for physical characteristics [Average ± SD (no. of stations)] at nekton sampling stations at GEWA in 2010. Dissolved oxygen was not measured during visit 2 due to a faulty probe.

	Average ± SD (no. of stations)	
	Visit 1	**Visit 2**
Depth (cm)	27.9 ± 6.3 (12)	36.0 ± 9.0 (12)
Temperature (˚C)	27.5 ± 2.4 (12)	27.2 ± 0.9 (12)
Salinity (ppt)	6.2 ± 0.8 (12)	9.8 ± 1.0 (12)
Dissolved Oxygen (mg/L)	0.6 ± 0.7 (12)	-

Vegetation

Eighteen vegetation species and three non-vegetation cover types (bare ground, water, and wrack and litter) were recorded at GEWA in 2010 (Table 8). The average percent cover, frequency, and the relative percent prevalence of each species or non-vegetation cover type are shown in Table 4. Average percent cover of non-living vegetation (if present) is also shown for each species. As explained in the Data Summary section, the relative percent prevalence combines information about how much area each species covers relative to all other species present, and how frequently it appears throughout the sites relative to all others present. *S. alterniflora* has the highest percent cover at 50.1 ± 36.9, but its relative percent prevalence of 31.7, while still high, is substantially lower. This is an indication that *S. alterniflora* is present in large patches as opposed to being well dispersed throughout the entire marsh. Some of the other frequently observed species include *Amaranthus cannabinus* (tidalmarsh amaranth), *Atriplex patula* (spearscale), *Kosteletzkya virginica* (seashore mallow), and *Schoenoplectus robustus* (saltmarsh bulrush).

None of the vegetation species observed in the 2010 plots are federally listed by the USDA as exotic, invasive, threatened, endangered, or rare (USDA 2010). One of the species, *Phragmites australis*, is listed by the state of Virginia as highly invasive (Virginia Department of Conservation and Recreation 2009). Individual plots that were found to contain *P.* australis, are noted in Appendix B. None of the species observed are listed as threatened, endangered, or rare in Virginia (Townsend 2009).

Table 8. Average percent cover (Average % Cover ± SD), frequency, and relative percent prevalence of each plant species and non-vegetation cover type at GEWA in 2010. Data are summarized over all 50 plots. Average percent cover was estimated using the midpoint values of Braun-Blanquet percent ranges (Table 2). 'NL' indicates standing non-living vegetation. '*' indicates an invasive or exotic species. '+' *Scirpus robustus,* an invalid synonym was used on the field data sheet; the accepted synonym *Schoenoplectus robustus* was retrieved from the ITIS database (www.itis.gov).

	Species/Cover Type	Common Name	Average Percent Cover (% Cover ± SD)	Frequency (no. of plots)	Relative Prevalence %
	Spartina alterniflora	Salt marsh cordgrass	50.1 ± 36.9	37	31.7
	Amaranthus cannabinus	Tidalmarsh amaranth	16.1 ± 14.0	37	16.8
	A. cannabinus (NL)	Tidalmarsh amaranth (NL)	0.1 ± 0.6	3	0.9
	Spartina cynosuroides	Big cordgrass	8.9 ± 24.3	9	6.3
	S. cynosuroides (NL)	Big cordgrass (NL)	0.1 ± 0.6	2	0.6
	Atriplex patula	Spear saltbush	7.8 ± 12.2	28	10.8
	Kosteletzkya virginica	Seashore mallow	6.7 ± 18.3	14	6.6
	Wrack / Litter	Wrack/Litter	5.3 ± 16.2	9	4.7
	Zizania aquatica	Annual wildrice	5.3 ± 21.1	3	3.1
	Typha angustifolia	Narrowleaf cattail	3.4 ± 11.7	5	2.8
	T. angustifolia (NL)	Narrowleaf cattail (NL)	0.1 ± 0.4	1	0.3
	Water	Water	2.2 ± 12.6	4	2.0
+	*Schoenoplectus robustus*	Salt marsh bulrush	1.8 ± 4.2	14	4.5
	S. robustus (NL)	Salt marsh bulrush (NL)	0.1 ± 0.6	2	0.6
	Distichlis spicata	Spikegrass	1.8 ± 12.4	1	1.0
	Bare ground	Bare ground	1.8 ± 6.4	5	2.1
	Baccharis halimifolia	Salt marsh elder	0.8 ± 5.4	1	0.6
	Lythrum lineare	Salt marsh loosestrife	0.7 ± 3.1	3	1.1
	Polygonum arifolium	Halberd-leaved tearthumb	0.4 ± 2.2	2	0.7
	Rumex verticillatus	Swamp dock	0.3 ± 2.2	2	0.7
*	*Phragmites australis*	Common reed	0.3 ± 2.2	1	0.4
	P. australis (NL)	Common reed (NL)	0.1 ± 0.4	1	0.3
	Hibiscus moscheutos	Rose mallow	0.1 ± 0.6	2	0.6
	Hydrocotyle verticillata	Whorled marsh pennywort	0.1 ± 0.4	1	0.3
	Polygonum punctatum	Dotted smartweed	0.1 ± 0.4	1	0.3
	Spartina patens	Salt meadow cordgrass	0.1 ± 0.4	1	0.3

Discussion

This report summarizes the second year of nekton and vegetation data collection conducted at GEWA in 2010. Given the inherent inter-annual variability in the sampling design, it is not informative to make quantitative comparisons between two years of data. Continued monitoring of salt marsh vegetation will allow us to distinguish between inter-annual variability and significant trends in the vegetation community.

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Appendix A: Coordinates for nekton station locations at GEWA in 2010.

Table A-1. Coordinates for nekton station locations sampled at GEWA in 2010, UTM, Zone 18, NAD 83, meters.

Plot ID	UTM X (east)	UTM Y (north)
G1C_100_2010	332074	4228359
G1C_194_2010	332018	4228346
G1C_216_2010	331996	4228338
G1C_228_2010	331982	4228340
G1C_263_2010	331951	4228326
G1C_271_2010	331947	4228318
G1C_306_2010	331937	4228290
G1C_312_2010	331936	4228284
G1C_35_2010	332128	4228357
G1C_57_2010	332101	4228355
G1C_76_2010	332094	4228368
G1C_79_2010	332086	4228368

Appendix B: Coordinates for vegetation station locations at GEWA in 2010.

Table B-1. Coordinates for vegetation plot locations sampled at GEWA in 2010, UTM, Zone 18, NAD 83, meters.

	Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
	G1V110_2010	332056	4228316	G1V3710_2010	332026	4228370
	G1V1110_2010	332032	4228355	G1V3810_2010	331921	4228341
	G1V1210_2010	332096	4228346	G1V3910_2010	332022	4228381
	G1V1310_2010	332144	4228367	G1V4010_2010	331925	4228234
	G1V1410_2010	332092	4228354	G1V410_2010	331939	4228316
	G1V1610_2010	331843	4228160	G1V4110_2010	331931	4228329
	G1V1710_2010	331932	4228222	G1V4210_2010	331972	4228366
	G1V1810_2010	332057	4228314	G1V4310_2010	332053	4228323
	G1V1910_2010	331892	4228406	G1V4410_2010	331985	4228342
	G1V2010_2010	332051	4228320	G1V4510_2010	331919	4228246
	G1V210_2010	332184	4228401	G1V4610_2010	331986	4228331
	G1V2210_2010	331910	4228368	G1V4710_2010	331977	4228357
	G1V2310_2010	331981	4228346	G1V4810_2010	331913	4228361
	G1V2410_2010	332105	4228332	G1V4910_2010	331980	4228351
	G1V2510_2010	332027	4228368	G1V5010_2010	331943	4228311
*	G1V2610_2010	331888	4228301	G1V510_2010	331850	4228165
	G1V2710_2010	332094	4228351	G1V5110_2010	332098	4228349
	G1V2810_2010	332087	4228366	G1V5210_2010	331988	4228330
	G1V2910_2010	332189	4228391	G1V5310_2010	331979	4228357
	G1V3010_2010	332047	4228330	G1V5410_2010	331940	4228207
	G1V310_2010	331991	4228324	G1V5610_2010	332096	4228350
	G1V3210_2010	331845	4228170	G1V5810_2010	331909	4228260
	G1V3310_2010	331911	4228366	G1V610_2010	332182	4228403
	G1V3510_2010	332094	4228353	G1V810_2010	331997	4228315
	G1V3610_2010	332179	4228407	G1V910_2010	332035	4228354