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Monitoring Salt Marsh Vegetation and Nekton at Sagamore Hill National Historic Site

2015 Summary Report

Natural Resource Data Series NPS/NCBN/NRDS—2015/996

ON THE COVER
Salt Marsh at Sagamore Hill National Historic Site.
Photograph by Robin Baranowski

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Abstract

The Northeast Coastal and Barrier Network (NCBN) began monitoring salt marsh vegetation and nekton at Sagamore Hill National Historic Site (SAHI) in 2009. This report summarizes the fourth year of data collected during the summer of 2015. Monitoring will continue on a biennial basis.

Fifty-one vegetation plots were sampled on August 19-20, 2015. Plots established and sampled during the 2009 field season were re-visited in 2015. 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. Twelve vegetation species and four non-vegetation cover types (bare ground, wrack & litter, trash, and water) were observed.

Sixteen nekton stations were established along Eel Creek in 2015. Each station was sampled using a $1m^2$ aluminum throw trap. Nekton sampling occurred twice during the summer (July 7 and August 19-20). A total of eight species (including fish, crabs, and shrimp) were recorded. Examination of percent catch data indicates that *P. pugio* (72.3%), and *F. heteroclitus* (22%), account for approximately 94% of all nekton captured at SAHI in 2015.

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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. 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 'vital signs' monitoring (Fancy et al. 2009). 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 the ecological health of park resources.

The Northeast Coastal and Barrier Network (NCBN) consists of eight parks extending along the Northeast Atlantic Coast. 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 vegetation and nekton community data collected at Sagamore Hill National Historic Site (SAHI) according to two protocols—*Monitoring Nekton in Salt Marshes: A Protocol for the National Park Service's Long-Term Monitoring Program, Northeast Coastal and Barrier Network* (James-Pirri et al. 2012) and *Monitoring Salt Marsh Vegetation: A Protocol for the National Park Service's Long-Term Monitoring Program, Northeast Coastal and Barrier Network* (James-Pirri et al. In Review).

Methods

Permanent Site Selection

Salt marsh at SAHI is limited to the area surrounding Eel Creek (Figure 1). Both vegetation and nekton sampling are conducted at this marsh every 2 years. Detailed information about the site selection process and sampling design can be found in the Salt Marsh Vegetation (James-Pirri et al. In Review) and Nekton Protocols (James-Pirri et al. 2012).

Figure 1. Aerial view and location of the permanent monitoring site (yellow shaded area) established by NCBN at Sagamore Hill National Historic Site (SAHI), New York in 2009. This site will continue to be monitored biennially.

Nekton Sampling Station Selection and Data Collection

Nekton stations are re-randomized each sampling year using GIS. Sixteen nekton sampling stations were randomly located along Eel Creek. Each station was sampled once on July 7 and again on August 19-20, 2015. A list of all nekton stations and their respective Universal Transverse Mercator (UTM) coordinates is provided in Appendix A.

Nekton were sampled with a $1m^2$ aluminum throw trap (Kushlan 1981, Sogard and Able 1991, Raposa and Roman 2001, James-Pirri et al. 2012). All nekton were collected from the trap with a

1mm mesh dip net. All fish and decapods were identified and enumerated. Fifteen haphazardly selected individuals of each species were measured for length (fish – total length; crabs – carapace width; shrimp – total length). Once identified and measured, all organisms were returned to the location where they were collected.

Vegetation Plot Selection and Data Collection

Vegetation sampling (n = 51 plots) was conducted on August 19-20, 2013. Plots established and sampled in 2009 were revisited in 2015 (prior to 2015, between 2009 and 2013, the plots were re-randomized each sampling year). Ten transects extending from creek bank to upland were systematically placed based on a single random start. Plots were located by treating the total length of all transects as a single transect and randomly selecting 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).

For each plot, all vegetation species and non-vegetation cover types were recorded (Table 1), and the estimated percent cover was determined 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).

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

Live vascular plants	Identified to species (herbaceous and shrubs).
Standing non-living vascular plants	Identified to 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 to genus. 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	Standing water is identified in plots that are partly within a creek, ditch, marsh pool, or flooded panne. If water is present, note whether it is a pool, ditch, creek, panne, rivulet, or a low wet area.
Wrack/litter	Wrack is material that has floated into the plot. This is generally dead (not attached) plant material. 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.

Data Summary

Nekton

Species composition, average density, average length of nekton, and standard error 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. (2012).

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). A detailed description of the analyses and formulae are presented in the salt marsh vegetation protocol (James-Pirri et al. In Review).

Table 2. Modified Braun-Blanquet scale and corresponding midpoint values for determining percent cover of salt marsh vegetation.

BB Value	Percent Cover	Midpoint
0	0%	0%
1	< 1%	0.50%
2	1 - 5%	3%
3	6 - 25%	15.50%
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 refer to it as a 'relative prevalence' value. Although Wikum and Shanholtzer (1978) present their importance value as a sum of the percent frequency and percent cover values, we have chosen to average these values so that relative prevalence is on a more readily interpretable percent scale. We present the relative percent prevalence for each species and non-vegetation cover type as 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%.

In addition to relative percent prevalence, we also report the average percent cover of each species and non-vegetation cover type for all plots combined. Because the relative percent prevalence

incorporates both percent frequency and percent cover, it provides information about how a species is distributed (*i.e.*, its 'patchiness') throughout the salt marsh and may differ substantially from the average percent cover for a given species.

If any identified vegetation species in the sample plots are listed by the United States Department of Agriculture (USDA) or the state of New York as exotic, invasive, threatened, endangered, or rare, these species are noted in the vegetation data summary. Information about plants listed by each state as exotic, invasive, threatened, endangered, or rare is available online (USDA 2015). In some cases, more specific information may be available on state websites. Information about plants listed by the state of New York as exotic or invasive is available online via the New York State Invasive Species Info website. Information about plants listed by the state of New York as threatened, endangered, or rare can be obtained from the rare plant list edited by Young (2010) for the New York Natural Heritage Program.

Lastly, if any species from one of the above categories is observed, these plots are noted in Appendix B which includes a list of all vegetation sample plots and their respective Universal Transverse Mercator (UTM) coordinates.

Results

Nekton

The average nekton density at SAHI in 2015 was approximately 96.0 ± 25.7 individuals per m^2 (Table 3). A total of eight species (Table 4) consisting of fish, grass shrimp, and crabs were captured (Table 5). Common mummichog (*F. heteroclitus)* and daggerblade grass shrimp (*P. pugio)* account for approximately 94% of all nekton captured in 2015 (Table 5). The average, maximum, and minimum lengths for each species observed in 2015 are presented in Table 6.

Physical characteristics of each nekton sampling station were recorded during each sampling event. These measures provide limited insight into differences between habitats that may affect nekton (Table 7). Currently, these data are collected in a manner that may help to explain anomalies in nekton observed at a particular location during a specific visit. These parameters would need to be measured continuously over the course of the field season in order to lend any real insight into observed changes in the nekton community.

Vegetation

Twelve vegetation species and four non-vegetation cover types were recorded at SAHI in 2015 (Table 8). None of the vegetation species observed at SAHI in 2015 are listed by the State of New York as invasive, exotic, threatened, or endangered (USDA 2015, Young 2010).

Species are grouped by salinity tolerances (USDA 2015). As explained in the Data Summary section, the relative percent prevalence combines information about how much of each site each species 'covers' relative to all other species present and how frequently it appears throughout the site relative to all other species present.

Table 3. (a) Average density and standard error [individuals per 1 m2 ± SE (total count)] of nekton captured at SAHI in 2015. (b) Number of nekton stations sampled at SAHI in 2015. *indicates 2 stations were not sampled during Event 1 due to tides (water too deep).

(a)

	Average Density [individuals per 1 m^2 ± SE (total count)]		
Habitat	**Event 1**	**Event 2**	**Events 1 & 2**
Tidal Creek	75.2 ± 45.4 (1053)	111.6 ± 28.6 (1785)	96.0 ± 25.7 (2838)

(b)

	No. of Stations		
Habitat	**Event 1**	**Event 2**	**Events 1 & 2**
Tidal Creek	14*	16	16

Table 4. Nekton species richness (No. of Species) summarized by sampling visit at SAHI in 2015. *indicates 2 stations were not sampled during Event 1 due to tides (water too deep).

Event	No. of Stations	No. of Species
1	14*	8
2	16	6
1 & 2	16	8

Table 5. Nekton species and community composition (% catch) at SAHI in 2015. Data are shown for each visit separately and both visits combined. n = total number of nekton captured. '-' species or community was not present.

		Group/Species Composition (%)		
Life History Group/Species	**Common Name**	**Event 1 (n=1053)**	**Event 2 (n=1785)**	**Events 1 & 2 (n=2838)**
Resident Fish		33.4	16.8	22.9
Fundulus heteroclitus	mummichog	33.2	15.4	22.0
Fundulus majalis	striped killifish	0.1	1.3	0.9
Lucania parva	rainwater killifish	0.1	--	<0.05
Resident Shrimp		55.8	82.1	72.3
Palaemonetes pugio	daggerblade grass shrimp	55.8	82.1	72.3
Transient Crustacean		0.2	1.1	0.8
Panopeus herbstii	Atlantic mud crab	0.1	1.1	0.7
Limulus polyphemus	horseshoe crab	0.1	0.1	0.1
Transient Fish		10.3	--	3.8
Menidia menidia	Atlantic silverside	10.3	--	3.8
Other		0.3	0.1	0.1
Hemigrapsus sanguineus	Asian shore crab	0.3	0.1	0.1

Table 6. (a) Average length [mm ± SE (no. measured)] of nekton at SAHI in 2015. Length data for each species was summarized over all stations sampled during that event. (b) Minimum and maximum length (mm) of each nekton species at SAHI in 2015. '-' species or community not present.

(a)

Life History Group/Species	Common Name	Average Length [mm ± SE (no. measured)]		
		Event 1	Event 2	Events 1 & 2
Resident Fish				
Fundulus heteroclitus	mummichog	20.3 ± 1.1 (105)	26.6 ± 0.7 (173)	24.2 ± 0.6 (278)
Fundulus majalis	striped killifish	34.0 (1)	22.7 ± 1.0 (24)	23.2 ± 1.1 (25)
Lucania parva	rainwater killifish	54.0 (1)	--	54.0 (1)
Resident Shrimp				
Palaemonetes pugio	daggerblade grass shrimp	26.4 ± 2.2 (34)	19.7 ± 0.3 (191)	20.7 ± 0.5 (225)
Transient Crustacean				
Limulus polyphemus	horseshoe crab	16.0 (1)	19.0 (1)	17.5 ± 1.5 (2)
Panopeus herbstii	Atlantic mud crab	20.0 (1)	12.2 ± 2.0 (19)	12.6 ± 1.9 (20)
Transient Fish				
Menidia menidia	Atlantic silverside	34.2 ± 1.3 (48)	--	34.2 ± 1.3 (48)
Other				
Hemigrapsus sanguineus	Asian shore crab	21.7 ± 3.5 (3)	15.0 (1)	20.0 ± 3.0 (4)

(b)

Life History Group/Species	Common Name	Event 1		Event 2		Events 1 & 2	
		Min.	Max.	Min.	Max.	Min.	Max.
Resident Fish							
Fundulus heteroclitus	mummichog	4	64	7	68	4	68
Fundulus majalis	striped killifish	34	34	15	36	15	36
Lucania parva	rainwater killifish	54	54	--	--	54	54
Resident Shrimp							
Palaemonetes pugio	daggerblade grass shrimp	4	42	10	42	4	42
Transient Crustacean							
Limulus polyphemus	horseshoe crab	16	16	19	19	16	19
Panopeus herbstii	Atlantic mud crab	20	20	3	35	3	35
Transient Fish							
Menidia menidia	Atlantic silverside	17	57	--	--	17	57
Other							
Hemigrapsus sanguineus	Asian shore crab	16	28	15	15	15	28

Table 7. Average water temperature, depth, and salinity [Average ± SE (no. of stations)] at nekton sampling stations at SAHI in 2015. Data are summarized over all stations for each sampling visit. *indicates 2 stations were not sampled during Event 1 due to tides (water too deep).

	Average ± SE (no. of stations)	
	Event 1*	**Event 2**
Temperature (˚C)	26.6 ± 0.7 (14)	27.5 ± 0.6 (16)
Depth (cm)	15.5 ± 2.9 (14)	11.4 ± 1.4 (16)
Salinity (ppt)	26.0 ± 0.4 (14)	26.5 ± 0.9 (16)

Table 8. Average percent cover (Average % Cover ± SE) and relative percent prevalence of each plant species and non-vegetation cover type at SAHI in 2015. Data were summarized over all 51 plots. Percent cover was estimated using the midpoint values of Braun-Blanquet percent ranges (Table 2). (NL) indicates standing non-living vegetation.

Cover Type **Salinity Tolerance** **Species**	**Common Name**	**Avg. %** **Cover ± SE**	**Frequency**	**Rel. %** **Cover**	**Rel. %** **Freq.**	**Rel. %** **Prevalence**
Vegetation		**58.0 ± 4.6**	**51**	**47.8**	**52.6**	**50.2**
High Salinity Tolerance		**55.5 ± 4.3**	**51**	**45.7**	**47.3**	**46.5**
Spartina alterniflora	saltmarsh cordgrass	34.7 ± 4.2	38	28.5	15.6	22.1
Spartina alterniflora (NL)	saltmarsh cordgrass (NL)	4.8 ± 0.9	32	4.0	13.1	8.6
Spartina patens	salt meadow cordgrass	2.5 ± 1.3	4	2.1	1.6	1.8
Spartina patens (NL)	salt meadow cordgrass (NL)	4.9 ± 2.4	4	4.1	1.6	2.8
Suaeda maritima	herbaceous seepweed	1.5 ± 0.6	9	1.2	3.7	2.5
Ulva lactuca	sea lettuce	1.0 ± 0.4	9	0.8	3.7	2.2
Ulva lactuca (NL)	sea lettuce (NL)	1.2 ± 0.8	5	1.0	2.0	1.5
Distichlis spicata	spikegrass	2.3 ± 1.5	4	1.9	1.6	1.8
Distichlis spicata (NL)	spikegrass (NL)	1.4 ± 0.8	4	1.2	1.6	1.4
Ascophyllum sp.	--	0.2 ± 0.1	3	0.1	1.2	0.6
Solidago sempervirens	seaside goldenrod	0.7 ± 0.7	1	0.6	0.4	0.5
Solidago sempervirens (NL)	seaside goldenrod (NL)	0.1 ± 0.1	1	--	0.4	0.2
Limonium carolinianum	sea lavender	0.1 ± 0.1	1	--	0.4	0.2
Ruppia maritima (NL)	widgeon grass (NL)	0.1 ± 0.1	1	--	0.4	0.2
Medium Salinity Tolerance		**1.9 ± 0.8**	**8**	**1.5**	**4.5**	**3.0**
Lechea maritima	beach pinweed	1.4 ± 0.6	7	1.1	2.9	2.0
Atriplex cristata	crested saltbush	0.2 ± 0.1	3	0.1	1.2	0.6
Panicum amarum	bitter panicgrass	0.3 ± 0.3	1	0.3	0.4	0.4
Unknown Salinity Tolerance		**0.6 ± 0.4**	**2**	**0.5**	**0.8**	**0.6**
dead tree (NL)	dead tree (NL)	0.6 ± 0.4	2	0.5	0.8	0.6
Non-Vegetation		**48.5 ± 4.3**	**49**	**39.9**	**27.9**	**33.9**
bare ground	bare ground	34.7 ± 3.7	47	28.6	19.3	24.0
water	water	13.8 ± 3.6	21	11.3	8.6	9.9
Incidental Cover		**15.0 ± 2.1**	**44**	**12.3**	**19.2**	**15.8**
wrack & litter	wrack/Litter	14.5 ± 2.1	44	12	18	15
trash	garbage	0.4 ± 0.3	3	0.3	1.2	0.8

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Appendix A. Coordinates for nekton stations at SAHI in 2015

Table A-1. Coordinates for nekton stations sampled at SAHI in 2015, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
SAG1C_1_2015	Tidal Creek	627205	4527075
SAG1C_10_2015	Tidal Creek	627165	4527040
SAG1C_11_2015	Tidal Creek	627223	4527062
SAG1C_12_2015	Tidal Creek	627114	4527068
SAG1C_13_2015	Tidal Creek	627090	4527252
SAG1C_14_2015	Tidal Creek	627217	4527077
SAG1C_15_2015	Tidal Creek	627098	4527233
SAG1C_16_2015	Tidal Creek	627170	4527070
SAG1C_2_2015	Tidal Creek	627135	4527117
SAG1C_3_2015	Tidal Creek	627129	4527165
SAG1C_4_2015	Tidal Creek	627093	4527066
SAG1C_5_2015	Tidal Creek	627116	4527111
SAG1C_6_2015	Tidal Creek	627187	4527074
SAG1C_7_2015	Tidal Creek	627129	4527057
SAG1C_8_2015	Tidal Creek	627138	4527070
SAG1C_9_2015	Tidal Creek	627107	4527129

Appendix B. Coordinates for vegetation plots at SAHI in 2015

Table B-1. Coordinates for vegetation plots sampled at SAHI site in 2015, UTM, Zone 18, NAD 83, meters. Plots were established and first sampled in 2009 and revisited in 2015.

Station ID	UTM X (east)	UTM Y (north)
SAG1V1009	627157	4527075
SAG1V1109	627159	4527098
SAG1V1209	627131	4527096
SAG1V1409	627199	4527123
SAG1V1509	627129	4527096
SAG1V1609	627102	4527095
SAG1V1709	627173	4527075
SAG1V1809	627093	4527170
SAG1V1909	627210	4527169
SAG1V2009	627120	4527234
SAG1V209	627141	4527051
SAG1V2109	627114	4527211
SAG1V2209	627135	4527189
SAG1V2309	627141	4527212
SAG1V2409	627072	4527235
SAG1V2509	627108	4527141
SAG1V2609	627115	4527097
SAG1V2709	627095	4527094
SAG1V2809	627147	4527189
SAG1V2909	627105	4527210
SAG1V3009	627098	4527164
SAG1V309	627131	4527234
SAG1V3109	627188	4527099
SAG1V3209	627084	4527232
SAG1V3309	627081	4527190
SAG1V3409	627115	4527142
SAG1V3509	627186	4527099
SAG1V3609	627208	4527077
SAG1V3709	627114	4527100
SAG1V3809	627103	4527239
SAG1V3909	627116	4527211
SAG1V4009	627211	4527169
SAG1V409	627130	4527188
SAG1V4109	627147	4527120
SAG1V4309	627079	4527140
SAG1V4409	627154	4527120
SAG1V4609	627150	4527074
SAG1V4709	627136	4527097
SAG1V4809	627111	4527256
SAG1V4909	627113	4527076
SAG1V509	627140	4527102
SAG1V5109	627129	4527229
SAG1V5209	627115	4527211
SAG1V5309	627080	4527260
SAG1V5409	627147	4527103
SAG1V5509	627103	4527233
SAG1V5709	627136	4527212
SAG1V609	627098	4527095
SAG1V709	627100	4527233
SAG1V809	627166	4527121
SAG1V909	627172	4527052

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
U.S. Department of the Interior

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