



Monitoring Salt Marsh Vegetation and Nekton at Fire Island National Seashore

2011 Summary Report

Natural Resource Data Series NPS/NCBN/NRDS—2012/397



ON THE COVER

Salt marsh at Fire Island National Seashore.

Photograph by: Mary-Jane James-Pirri

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Erika L. Nicosia

National Park Service
Northeast Coastal and Barrier Network
University of Rhode Island
1 Greenhouse Rd
Kingston, RI 02881

Penelope S. Pooler

National Park Service
Northeast Coastal and Barrier Network
University of Rhode Island
1 Greenhouse Rd
Kingston, RI 02881

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The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

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.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. 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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Contents

	Page
Figures.....	v
Tables.....	v
Abstract.....	vii
Acknowledgments.....	ix
Introduction.....	1
Methods.....	3
Permanent Site Selection	3
Nekton Sampling Station Selection and Data Collection	3
Vegetation Plot Selection and Data Collection	4
Data Summary	6
Nekton.....	6
Vegetation	6
Results.....	8
Nekton.....	8
Vegetation.....	8
Literature Cited	15
Appendix A: Coordinates for nekton stations at FIIS in 2011.....	19
Appendix B: Coordinates for vegetation plots at FIIS in 2011	23
Appendix C: Nekton density summarized by site.....	29
Appendix D: Nekton species richness summarized by site and sampling event	31
Appendix E: Nekton species and community composition summarized by site and sampling event	33
Appendix F: Vegetation frequency summarized by site.....	35
Appendix G: Vegetation relative percent cover summarized by site	37

Figures

	Page
Figure 1. Locations of permanent nekton and vegetation monitoring sites established by NCBN at Fire Island National Seashore (FIIS) in 2009.	3

Tables

	Page
Table 1. Sampling dates and total number of nekton stations at five marsh sites at FIIS in 2011.	4
Table 2. Sampling dates and number of vegetation plots sampled at six marsh sites at FIIS in 2011.	5
Table 3. Definition of standard cover type categories used in the Northeast Coastal and Barrier Network salt marsh vegetation monitoring protocol	5
Table 4. Modified Braun-Blanquet scale and corresponding midpoint values for determining percent cover of salt marsh vegetation.	6
Table 5. (a) Average density and standard error [individuals per 1 m ² ± SE (total count)] of nekton captured at FIIS in 2011.	8
Table 6. Nekton species richness (No. of Species) at FIIS in 2011.	9
Table 7. Nekton species and community composition (% catch) at FIIS in 2011.	9
Table 8. (a) Average length [mm ± SE (no. measured)] of nekton at FIIS in 2011.	11
Table 9. Average water temperature, depth, and salinity [Average ± SE (no. of stations)] at nekton sampling stations at FIIS in 2011.	12
Table 10. Average percent cover (Average % Cover ± SE), frequency, and relative percent prevalence of each plant species and non-vegetation cover type observed at FIIS in 2011.	13

Abstract

The Northeast Coastal and Barrier Network (NCBN) began monitoring salt marsh vegetation and nekton at Fire Island National Seashore (FIIS) in 2009. This report summarizes the second year of data collected at six permanent monitoring sites during the summer of 2011. Monitoring will continue on a biennial basis.

Approximately fifty vegetation plots were sampled at each of the six marsh sites (total = 300 plots) in July of 2011. The percent cover of each vegetation species and non-vegetation cover type within each 1 m² plot was visually estimated using a revised Braun-Blanquet method. Nineteen vegetation species and four non-vegetation cover types (wrack & litter, trash, bare ground, and water) were recorded.

A total of 59 nekton stations were established (on ditches and pools/pannes) in 2011. Each station was sampled twice during the summer—once in late June / early July, and again in August. Sampling stations located on pools/pannes were sampled using a 1 m² aluminum throw trap. Stations located along tidal ditches were sampled with ditch nets. There were five species of nekton recorded at FIIS in 2011, including three fish, one crab, and one shrimp species. Examination of percent catch data indicates that one species—*Fundulus heteroclitus* (common mummichog)—accounts for approximately 77% of all nekton captured on Fire Island in 2011.

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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 Fire Island National Seashore in 2011, 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

Six permanent 5-8 hectare salt marsh sites were selected for monitoring at FIIS (Fig. 1). The number of sites chosen within the park was based on available habitat and the logistics and feasibility of sampling. Marsh sites were chosen randomly from all salt marsh within a park, so that statistical inference could be extended to the entire park. 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).

Vegetation sampling is being conducted at all six sites and nekton sampling is conducted at five of these sites. Monitoring began in 2009 and will continue on a biennial basis.



Figure 1. Six permanent nekton and vegetation monitoring sites were established by NCBN at Fire Island National Seashore (FIIS) in 2009. These six sites will continue to be monitored biennially.

Nekton Sampling Station Selection and Data Collection

While monitoring sites remain permanent from year to year, nekton stations within each site are re-randomized each sampling year. Ten ditch net stations were established at five of the

permanent monitoring sites. If pools were present, all fishable pools within each site were sampled. Nekton stations were randomly located along the length of each ditch or along the perimeter of a pool. Although we indicate if a ditch is obstructed, sampling of ditch habitat was not stratified by whether or not ditches were obstructed because, in many cases, obstructions may be transient and differences between these two types of ditches is not a focus of the nekton monitoring program. Nekton stations were sampled twice, once in early summer and again in late summer (Table 1). A list of all nekton stations and their respective Universal Transverse Mercator (UTM) coordinates is provided in Appendix A.

Nekton in ditches were sampled using a ditch net, an enclosure gear designed to sample tidal ditches and smaller tidal creeks up to 1 m wide and 1 m deep (James-Pirri et al. 2010). All nekton were collected from the net and density was calculated by measuring the area of water the net sampled. Nekton in pools or flooded pannes were sampled using a 1 m² 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 1 mm mesh dip net.

For each net or trap, 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.

Table 1. Sampling dates and total number of nekton stations at five marsh sites at FIIS in 2011. Sampling stations are displayed by habitat type. ‘*’ one station was not sampled during Event 1 because the pool was dry. ‘-’ habitat not present

Site	Event	Dates	Habitat			Total
			Ditch		Pool/Panne	
			Unobstructed	Obstructed		
1	1	6/24/2011	5	5	-	10
	2	8/12/2011	5	5	-	10
2	1	6/27/2011	9	1	-	10
	2	8/4/2011	9	1	-	10
3	1	6/28/2011, 7/5/2011	10	0	5	15
	2	8/17/2011	10	0	5	15
4	1	6/21/2011	3	7	3*	13
	2	8/5/2011	3	7	4	14
5	1	6/22/2011	3	7	-	10
	2	8/3/2011	3	7	-	10

Vegetation Plot Selection and Data Collection

Vegetation sampling was conducted once at each of the six marsh sites (Table 2). Ten transects extending from bay 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 50 points along this total length. This combination of systematic transects and replicate

plots is necessary to ensure interspersed 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 3), 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 2. Sampling dates and number of vegetation plots sampled at six marsh sites at FIIS in 2011. Typically, vegetation at each site is sampled in a single day; however inclement weather and poor boating conditions resulted in a few sites being sampled over several days.

Site	Dates	Total
1	7/3, 7/13, 7/25, 7/28/2011	49
2	7/15, 7/18/2011	50
3	7/11/2011	50
4	7/14/2011	49
5	7/12, 7/13/2011	52
6	7/20/2011	50

Table 3. 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 by species (herbaceous and shrubs).
Standing non-living vascular plants	Identified by species (<i>e.g.</i> , <i>S. alterniflora</i> 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 (<i>e.g.</i> , 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 (<i>e.g.</i> , <i>Fucus</i> , <i>Ascophyllum</i>). Microalgae (<i>e.g.</i> , 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.

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 environmental variables (water temp, salinity, and depth) calculated for each habitat type during each sampling event. 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 4) as described in Wikum and Shanholtzer (1978).

Table 4. 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. A detailed description of the analyses and formulae are presented in the salt marsh vegetation protocol (James-Pirri et al. In Review).

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 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 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 is available online (USDA 2012). Information about plants listed by the state of New York as exotic or invasive is available online (Invasive Plant Council of New York 2007). In addition, plants listed as threatened, endangered, or rare can be obtained from the rare plant list edited by Young (2008) for the New York Natural Heritage Program.

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

Results

Nekton

The average nekton density at FIIS is presented in Tables 5a and b. A total of five nekton species were captured (Table 6). Common mummichog (*F. heteroclitus*), Atlantic silverside (*M. menidia*), and daggerblade grass shrimp (*P. pugio*) account for approximately 94% of all nekton captured in 2011 (Table 7). The average, maximum, and minimum lengths for each species are presented in Table 8. Additional tables summarizing data by site are provided in the Appendices.

Environmental variables at each nekton sampling station were recorded during each sampling event. These measures provide limited insight into differences between habitats that may affect nekton (Table 9). Currently, these data are collected in a manner that may help to explain anomalies in nekton observed at a particular location during a specific sampling event. 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

Nineteen vegetation species and four non-vegetation cover types (bare ground, wrack & litter, water, and trash) were recorded at six marsh sites at FIIS in 2011 (Table 11). Species are grouped by salinity tolerances (USDA 2012). 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. Tables summarizing vegetation data by site are provided in the Appendices.

One of the vegetation species, *Limonium carolinianum*, is listed by the State of New York as exploitably vulnerable (USDA 2012, Young 2008). *Phragmites australis*, is listed by the state of New York as invasive (Invasive Plant Council of New York 2007).

Table 5. (a) Average density and standard error [individuals per 1 m² ± SE (total count)] of nekton captured at FIIS in 2011. Data are summarized for each sampling event and both events combined. (b) Number of nekton stations sampled at FIIS in 2011. ‘*’ one pool station was dry during Event 1.

(a)

Habitat	Average Density [individuals per 1 m ² ± SE (no. of nekton)]		
	Event 1	Event 2	Events 1 & 2
Unobstructed Ditch	22.1 ± 15.8 (526)	12.6 ± 5.2 (184)	17.3 ± 8.1 (710)
Obstructed Ditch	0.9 ± 0.6 (16)	7.1 ± 2 (62)	4.0 ± 1.1 (78)
Pool / Panne	2.6 ± 0.7 (21)	0.7 ± 0.4 (6)	1.4 ± 0.4 (27)
All	12.1 ± 8.2 (563)	8.9 ± 2.8 (252)	10.2 ± 4.1 (815)

(b)

Habitat	No. of Stations		
	Event 1	Event 2	Events 1 & 2
Unobstructed Ditch	30	30	30
Obstructed Ditch	20	20	20
Pool / Panne*	8	9	10
All	58	59	60

Table 6. Nekton species richness (No. of Species) at FIIS in 2011. Data are summarized for each sampling event and both events combined. “*” one pool station was dry during Event 1.

Event	No. of Stations	No. of Species
1	58*	5
2	59	5
1 & 2	60	5

Table 7. Nekton species and community composition at FIIS in 2011. Data are summarized for each sampling event and both events combined. n = total number of nekton captured.

Life History Group/Species	Common Name	Group/Species Composition (%)		
		Event 1 (n = 563)	Event 2 (n = 252)	Events 1 & 2 (n = 815)
Resident Fish		97.0	47.2	81.6
<i>Fundulus heteroclitus</i>	common mummichog	92.7	40.9	76.7
<i>Cyprinodon variegatus</i>	sheepshead minnow	4.3	6.3	4.9
Resident Shrimp		0.4	22.2	7.1
<i>Palaemonetes pugio</i>	daggerblade grass shrimp	0.4	22.2	7.1
Transient Crustaceans		0.2	2.4	0.9
<i>Callinectes sapidus</i>	blue crab	0.2	2.4	0.9
Transient Fish		2.5	28.2	10.4
<i>Menidia menidia</i>	Atlantic silverside	2.5	28.2	10.4

Table 8. (a) Average length [mm $\pm$ SE (no. measured)] of nekton at FIIS in 2011. Length data for each species is summarized over all stations sampled during each event and both events combined. (b) Minimum and maximum length (mm) of each nekton species at FIIS in 2011.

(a)

Life History Group/Species	Common Name	Average Length [mm ± SE (no. measured)]		
		Event 1	Event 2	Events 1 & 2
Resident Fish				
<i>Cyprinodon variegatus</i>	sheepshead minnow	16.7 ± 1.3 (24)	29.4 ± 2.0 (16)	21.8 ± 1.5 (40)
<i>Fundulus heteroclitus</i>	common mummichog	25.0 ± 1.0 (127)	33.8 ± 1.0 (99)	28.8 ± 0.8 (226)
Resident Shrimp				
<i>Palaemonetes pugio</i>	daggerblade grass shrimp	12.5 ± 2.5 (2)	27.1 ± 0.9 (45)	26.4 ± 1.0 (47)
Transient Crustaceans				
<i>Callinectes sapidus</i>	blue crab	75.0 (1)	81.2 ± 5.3 (6)	80.3 ± 4.5 (7)
Transient Fish				
<i>Menidia menidia</i>	Atlantic silverside	18.6 ± 1.3 (14)	41.3 ± 1.3 (37)	35.0 ± 1.8 (51)

(b)

Life History Group/Species	Common Name	Event 1		Event 2		Events 1 & 2	
		Min.	Max.	Min.	Max.	Min.	Max.
Resident Fish							
<i>Cyprinodon variegatus</i>	sheepshead minnow	6	31	14	41	6	41
<i>Fundulus heteroclitus</i>	common mummichog	10	69	12	81	10	81
Resident Shrimp							
<i>Palaemonetes pugio</i>	daggerblade grass shrimp	10	15	17	51	10	51
Transient Crustaceans							
<i>Callinectes sapidus</i>	blue crab	75	75	72	106	72	106
Transient Fish							
<i>Menidia menidia</i>	Atlantic silverside	11	32	23	64	11	64

Table 9. Average water temperature, depth, and salinity [Average $\pm$ SE (no. of stations)] at nekton sampling stations at FIIS in 2011. Data are summarized over all stations for each sampling event.

Habitat	Average $\pm$ SE (no. of stations)					
	Event 1			Event 2		
	Ditch		Pool/Panne	Ditch		Pool/Panne
	Unobstructed	Obstructed		Unobstructed	Obstructed	
Temp ($^{\circ}$ C)	23.1 $\pm$ 0.4 (30)	24.1 $\pm$ 0.7 (20)	29.2 $\pm$ 0.3 (8)	24.9 $\pm$ 0.3 (30)	26.7 $\pm$ 0.6 (20)	33.4 $\pm$ 0.6 (9)
Depth (cm)	28.6 $\pm$ 1.9 (30)	20.8 $\pm$ 1.6 (20)	9.9 $\pm$ 1.2 (8)	50.6 $\pm$ 2.8 (30)	37.2 $\pm$ 4.0 (20)	11.6 $\pm$ 1.0 (9)
Salinity (ppt)	24.5 $\pm$ 0.8 (29)	23.6 $\pm$ 0.7 (20)	27 $\pm$ 0.8 (8)	26.8 $\pm$ 0.6 (30)	29.4 $\pm$ 0.7 (20)	27.4 $\pm$ 2.3 (9)

Table 10. Average percent cover (Average % Cover $\pm$ SE), frequency, and relative percent prevalence of each plant species and non-vegetation cover type observed at FIIS in 2011. Data were summarized over all 300 plots. Percent cover was estimated using the midpoint values of Braun-Blanquet percent ranges (Table 4). (NL) indicates standing non-living vegetation. ⁺ species listed as exploitably vulnerable in New York State (USDA 2012, Young 2008). ^{*} species listed as invasive or exotic in New York State (Invasive Plant Council of New York 2007). [†] *S. virginica*, an invalid synonym was used on the field data sheet; the accepted synonym *S. depressa* was retrieved on 17 September 2012 (www.itis.gov).

Cover Type						
Salinity Tolerance						
Species	Common Name	Avg. % Cover $\pm$ SE	Frequency	Rel. % Cover	Rel. % Freq.	Rel. % Prevalence
Vegetation		109.3 $\pm$ 3.2	296	69.7	76.6	73.2
High Salinity Tolerance		106.5 $\pm$ 3.3	295	68.0	71.7	69.8
<i>Spartina alterniflora</i>	saltmarsh cordgrass	32.2 $\pm$ 1.5	257	20.5	16.8	18.6
<i>Spartina alterniflora</i> (NL)	saltmarsh cordgrass (NL)	18.4 $\pm$ 1.4	219	11.8	14.3	13.1
<i>Spartina patens</i>	salt meadow cordgrass	18.7 $\pm$ 1.6	166	12.0	10.8	11.4
<i>Spartina patens</i> (NL)	salt meadow cordgrass (NL)	24.6 $\pm$ 2.0	146	15.7	9.5	12.6
<i>Distichlis spicata</i>	spikegrass	5.3 $\pm$ 0.7	107	3.4	7.0	5.2
<i>Distichlis spicata</i> (NL)	spikegrass (NL)	5.4 $\pm$ 1.0	89	3.4	5.8	4.6
<i>Salicornia maritima</i>	glasswort	0.4 $\pm$ 0.1	44	0.2	2.9	1.6
<i>Salicornia maritima</i> (NL)	glasswort (NL)	< 0.05	4	< 0.05	0.3	0.2
<i>Salicornia depressa</i> [#]	Virginia glasswort	0.1 $\pm$ 0.1	23	0.1	1.5	0.8
<i>Salicornia depressa</i> [#] (NL)	Virginia glasswort (NL)	< 0.05	3	< 0.05	0.2	0.1
<i>Iva frutescens</i>	marsh elder	0.4 $\pm$ 0.3	6	0.3	0.4	0.4
<i>Iva frutescens</i> (NL)	marsh elder (NL)	0.1 $\pm$ 0.1	5	0.1	0.3	0.2
<i>Solidago sempervirens</i>	seaside goldenrod	0.1 $\pm$ 0.1	10	0.1	0.7	0.4
<i>Juncus gerardii</i>	black grass	0.1 $\pm$ 0.1	6	0.1	0.4	0.2
<i>Juncus gerardii</i> (NL)	black grass (NL)	0.4 $\pm$ 0.3	3	0.3	0.2	0.2
<i>Limonium carolinianum</i> ⁺	sea lavender	0.1 $\pm$ 0.1	3	< 0.05	0.2	0.1
<i>Limonium carolinianum</i> ⁺ (NL)	sea lavender (NL)	< 0.05	2	< 0.05	0.1	< 0.05
<i>Ruppia maritima</i>	widgeon grass	0.1 $\pm$ 0.1	3	< 0.05	0.2	0.1
<i>Atriplex patula</i>	spear saltbush	< 0.05	1	< 0.05	0.1	< 0.05
Medium Salinity Tolerance		0.2 $\pm$ 0.2	2	0.1	0.4	0.2
<i>Baccharis halimifolia</i>	Eastern baccharis	0.1 $\pm$ 0.1	1	0.1	0.1	0.1
<i>Calystegia sepium</i>	hedge bindweed	< 0.05	1	< 0.05	0.1	< 0.05
<i>Toxicodendron radicans</i>	poison ivy	< 0.05	1	< 0.05	0.1	< 0.05
<i>Typha angustifolia</i>	narrowleaf cattail	< 0.05	2	< 0.05	0.1	< 0.05

Table 10 (continued). Average percent cover (Average % Cover $\pm$ SE), frequency, and relative percent prevalence of each plant species and non-vegetation cover type observed at FIIS in 2011. Data were summarized over all 300 plots. Percent cover was estimated using the midpoint values of Braun-Blanquet percent ranges (Table 4). (NL) indicates standing non-living vegetation. [†] species listed as exploitably vulnerable in New York State (USDA 2012, Young 2008). ^{*} species listed as invasive or exotic in New York State (Invasive Plant Council of New York 2007). [#] *S. virginica*, an invalid synonym was used on the field data sheet; the accepted synonym *S. depressa* was retrieved on 17 September 2012 (www.itis.gov).

Cover Type		Common Name	Avg. % Cover $\pm$ SE	Frequency	Rel. % Cover	Rel. % Freq	Rel. % Prevalence
Salinity Tolerance							
Species							
Low Salinity Tolerance			1.9 $\pm$ 0.5	31	1.2	4.1	2.6
<i>Phragmites australis</i> *		common reed	1.3 $\pm$ 0.3	28	0.8	1.8	1.3
<i>Phragmites australis</i> * (NL)		common reed (NL)	0.4 $\pm$ 0.1	26	0.3	1.7	1.0
<i>Pluchea odorata</i>		marsh fleabane	0.2 $\pm$ 0.1	8	0.1	0.5	0.3
<i>Hibiscus moscheutos</i>		rose mallow	< 0.05	1	< 0.05	0.1	< 0.05
Unknown Salinity Tolerance			0.7 $\pm$ 0.4	3	0.4	0.4	0.4
<i>Eleocharis</i> sp.		spikerush	0.1 $\pm$ 0.1	3	0.1	0.2	0.2
<i>Eleocharis</i> sp. (NL)		spikerush (NL)	0.6 $\pm$ 0.4	3	0.4	0.2	0.3
Non-Vegetation			41.1 $\pm$ 2.3	216	26.2	16.2	21.2
water		water	35.8 $\pm$ 2.3	178	22.9	11.6	17.2
bare ground		bare ground	5.3 $\pm$ 0.9	70	3.4	4.6	4.0
Incidental Cover			6.3 $\pm$ 1.0	94	4.0	7.4	5.7
Wrack & litter		wrack & litter	5.9 $\pm$ 1.0	93	3.7	6.1	4.9
trash		garbage / trash	0.4 $\pm$ 0.2	20	0.3	1.3	0.8

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Appendix A: Coordinates for nekton stations at FIIS in 2011

Table A-1. Coordinates for nekton stations sampled at FIIS site 1 in 2011, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
F1D1_2011	Unobstructed Ditch	675999	4509976
F1D15_2011	Unobstructed Ditch	676025	4510062
F1D17_2011	Unobstructed Ditch	676056	4509829
F1D2_2011	Unobstructed Ditch	675983	4510012
F1D20_2011	Unobstructed Ditch	676063	4509842
F1D21_2011	Obstructed Ditch	675991	4509849
F1D23_2011	Obstructed Ditch	676106	4509837
F1D24_2011	Obstructed Ditch	676010	4509944
F1D3_2011	Obstructed Ditch	676082	4509837
F1D8_2011	Obstructed Ditch	676040	4510034

Table A-2. Coordinates for nekton stations sampled at FIIS site 2 in 2011, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
F2D10_2011	Unobstructed Ditch	676704	4509940
F2D11_2011	Unobstructed Ditch	676628	4509918
F2D15_2011	Unobstructed Ditch	676672	4509918
F2D18_2011	Unobstructed Ditch	676678	4509952
F2D20_2011	Unobstructed Ditch	676648	4509909
F2D3_2011	Unobstructed Ditch	676582	4509887
F2D4_2011	Unobstructed Ditch	676604	4509973
F2D5_2011	Unobstructed Ditch	676616	4509897
F2D6_2011	Obstructed Ditch	676560	4509871
F2D8_2011	Unobstructed Ditch	676731	4509951

Table A-3. Coordinates for nekton stations sampled at FIIS site 3 in 2011, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
F3D1_2011	Unobstructed Ditch	676342	4510253
F3D11_2011	Unobstructed Ditch	676238	4510032
F3D12_2011	Unobstructed Ditch	676164	4510052
F3D13_2011	Unobstructed Ditch	676224	4510064
F3D2_2011	Unobstructed Ditch	676394	4510138
F3D3_2011	Unobstructed Ditch	676381	4510169
F3D4_2011	Unobstructed Ditch	676284	4510082
F3D6_2011	Unobstructed Ditch	676141	4510106
F3D7_2011	Unobstructed Ditch	676354	4510081
F3D9_2011	Unobstructed Ditch	676200	4510121
F3P013_2011	Pool / Panne	676410	4510047
F3P014_2011	Pool / Panne	676386	4510077
F3P015_2011	Pool / Panne	676288	4510023
F3P016_2011	Pool / Panne	676267	4510026
F3P018_2011	Pool / Panne	676213	4510022
F3P17_2011	Pool / Panne	676313	5410054

Table A-4. Coordinates for nekton stations sampled at FIIS site 4 in 2011, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
F4D1_2011	Obstructed Ditch	670689	4506917
F4D11_2011	Obstructed Ditch	670651	4506889
F4D12_2011	Unobstructed Ditch	670800	4507039
F4D13_2011	Unobstructed Ditch	670858	4507062
F4D14_2011	Obstructed Ditch	670628	4506934
F4D2_2011	Obstructed Ditch	670628	4506877
F4D4_2011	Obstructed Ditch	670682	4506972
F4D6_2011	Obstructed Ditch	670678	4507042
F4D7_2011	Obstructed Ditch	670735	4507064
F4D8_2011	Unobstructed Ditch	670747	450963
F4P007_2011	Pool / Panne	670705	4506927
F4P009_2011	Pool / Panne	670706	4506959
F4P010_2011	Pool / Panne	670722	4506973
F4P011_2011	Pool / Panne	670701	4506991

Table A-5. Coordinates for nekton stations sampled at FIIS site 5 in 2011, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
F5D12_2011	Obstructed Ditch	675490	4509451
F5D15_2011	Unobstructed Ditch	675704	4509596
F5D17_2011	Unobstructed Ditch	675665	4509540
F5D18_2011	Obstructed Ditch	675471	4509434
F5D21_2011	Obstructed Ditch	675655	4509562
F5D23_2011	Obstructed Ditch	675466	4509525
F5D24_2011	Unobstructed Ditch	675596	4509536
F5D3_2011	Obstructed Ditch	675457	4509552
F5D4_2011	Obstructed Ditch	675477	4509498
F5D9_2011	Obstructed Ditch	675496	4509456

Appendix B: Coordinates for vegetation plots at FIIS in 2011

Table B-1. Coordinates for vegetation plots sampled at FIIS site 1 in 2011, UTM, Zone 18, NAD 83, meters. '+' a species listed as exploitably vulnerable by New York state was present. '*' a species listed as invasive or exotic in New York State was present.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
F1V1011_2011	676047	4509933	F1V3411_2011	676050	4509883
F1V1111_2011	676016	4509847	F1V3511_2011	676018	4509797
F1V1211_2011	675995	4509865	F1V3611_2011	675954	4510102
F1V1311_2011	676035	4509800	F1V3711_2011 *	676073	4509911
F1V1411_2011	676030	4509858	F1V3811_2011	676017	4510059
F1V1511_2011	676038	4509958	F1V411_2011	676012	4509988
F1V1611_2011	676021	4509967	F1V4011_2011	675978	4510035
F1V1711_2011	675955	4510015	F1V4111_2011	676024	4509830
F1V1811_2011	676005	4510006	F1V4211_2011	675962	4509994
F1V1911_2011	675992	4509912	F1V4311_2011	675987	4510098
F1V211_2011	676023	4509952	F1V4411_2011 +	675967	4509977
F1V2011_2011	675940	4510097	F1V4511_2011	676057	4509858
F1V2211_2011	676036	4510010	F1V4611_2011	676064	4509929
F1V2311_2011 *	676108	4509763	F1V4711_2011	676009	4509866
F1V2411_2011	675911	4510046	F1V4811_2011	676026	4509907
F1V2511_2011	676074	4509775	F1V4911_2011	676045	4509767
F1V2611_2011	676029	4509895	F1V511_2011	675980	4509897
F1V2711_2011	676027	4509943	F1V5011_2011	676022	4510053
F1V2811_2011	676059	4509863	F1V5111_2011	676085	4509833
F1V2911_2011	676059	4509818	F1V5211_2011	675987	4509925
F1V311_2011	676017	4509976	F1V611_2011 *	676058	4509733
F1V3011_2011	675944	4510084	F1V711_2011	676041	4509867
F1V3111_2011	676113	4509799	F1V811_2011	676088	4509781
F1V3211_2011 *	676062	4509724	F1V911_2011 *	676130	4509798
F1V3311_2011	676031	4509893			

Appendix B: Coordinates for vegetation plots at FIIS in 2011 (continued)

Table B-2. Coordinates for vegetation plots sampled at FIIS site 2 in 2011, UTM, Zone 18, NAD 83, meters. '*' a species listed as invasive or exotic in New York State was present.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
F2V111_2011*	676458	4509780	F2V3311_2011	676555	4509864
F2V1011_2011	676594	4509796	F2V3411_2011	676630	4509902
F2V1111_2011	676673	4509909	F2V3511_2011	676507	4509867
F2V1211_2011*	676616	4509842	F2V3611_2011*	676511	4509774
F2V1311_2011*	676461	4509775	F2V3711_2011	676640	4509966
F2V1411_2011	676667	4510000	F2V3811_2011	676496	4509877
F2V1511_2011	676703	4509942	F2V3911_2011*	676583	4509814
F2V1611_2011	676455	4509786	F2V411_2011	676680	4509978
F2V1711_2011	676700	4510031	F2V4011_2011	676661	4509926
F2V1811_2011	676449	4509796	F2V4111_2011*	676589	4509805
F2V1911_2011	676583	4509986	F2V4211_2011*	676529	4509827
F2V211_2011	676720	4509999	F2V4311_2011	676608	4509853
F2V2011_2011*	676747	4509862	F2V4411_2011	676626	4509825
F2V2111_2011	676530	4509908	F2V4511_2011	676654	4509950
F2V2211_2011	676585	4509980	F2V4611_2011	676665	4509837
F2V2411_2011	676603	4509948	F2V4711_2011	676559	4509939
F2V2511_2011	676686	4509885	F2V4811_2011*	676506	4509775
F2V2611_2011*	676543	4509801	F2V4911_2011	676712	4510011
F2V2711_2011	676639	4509973	F2V511_2011	676621	4509918
F2V2811_2011	676662	4509845	F2V5011_2011	676645	4509957
F2V2911_2011	676615	4509928	F2V5211_2011	676697	4509951
F2V311_2011	676547	4509877	F2V611_2011	676611	4509937
F2V3011_2011	676594	4509880	F2V711_2011	676737	4509885
F2V3111_2011*	676469	4509759	F2V811_2011*	676578	4509818
F2V3211_2011	676715	4509921	F2V911_2011	676685	4509971

Appendix B: Coordinates for vegetation plots at FIIS in 2011 (continued)

Table B-3. Coordinates for vegetation plots sampled at FIIS site 3 in 2011, UTM, Zone 18, NAD 83, meters. '+' a species listed as exploitably vulnerable by New York state was present. '*' a species listed as invasive or exotic in New York State was present.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
F3V111_2011	676224	4510113	F3V3211_2011	676357	4510122
F3V1011_2011	676396	4510078	F3V3311_2011	676344	4510190
F3V1111_2011	676213	4510033	F3V3411_2011	676387	4510124
F3V1211_2011	676297	4510021	F3V3511_2011	676340	4510223
F3V1311_2011	676401	4510058	F3V3611_2011	676263	4510046
F3V1411_2011	676251	4510111	F3V3711_2011	676259	4510212
F3V1511_2011	676230	4510093	F3V3811_2011	676254	4510227
F3V1611_2011	676206	4510059	F3V3911_2011	676314	4510219
F3V1711_2011	676369	4510063	F3V411_2011	676303	4510118
F3V1811_2011	676204	4510070	F3V4011_2011	676314	4510214
F3V1911_2011	676233	4510058	F3V4111_2011 *	676330	4510088
F3V211_2011	676386	4510133	F3V4211_2011	676335	4510248
F3V2011_2011	676347	4510178	F3V4311_2011	676292	4510038
F3V2111_2011	676308	4510249	F3V4411_2011	676292	4510044
F3V2211_2011	676334	4510251	F3V4511_2011	676322	4510161
F3V2311_2011	676295	4510036	F3V4611_2011	coordinates not recorded	
F3V2411_2011	676391	4510099	F3V4711_2011	676362	4510111
F3V2511_2011	676345	4510047	F3V4811_2011	676339	4510219
F3V2611_2011	676233	4510063	F3V4911_2011	676393	4510089
F3V2711_2011	676388	4510116	F3V511_2011	676332	4510121
F3V2811_2011	676243	4510151	F3V5011_2011	676392	4510100
F3V2911_2011	676204	4510074	F3V611_2011	676319	4510041
F3V311_2011 +	676288	4510205	F3V711_2011	676259	4510206
F3V3011_2011	676306	4510124	F3V811_2011	676268	4510156
F3V3111_2011	676254	4510225	F3V911_2011	676140	4510115

Appendix B: Coordinates for vegetation plots at FIIS in 2011 (continued)

Table B-4. Coordinates for vegetation plots sampled at FIIS site 4 in 2011, UTM, Zone 18, NAD 83, meters. '*' a species listed as invasive or exotic in New York State was present.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
F4V111_2011	670645	4507038	F4V3711_2011	670788	4507063
F4V1111_2011	670857	4507055	F4V3811_2011	670673	4506909
F4V1211_2011	670784	4506989	F4V3911_2011	670783	4506986
F4V1311_2011	670822	4507022	F4V411_2011 *	670847	4506912
F4V1411_2011	670892	4506995	F4V4011_2011	670889	4506980
F4V1511_2011	670780	4506965	F4V4111_2011	670717	4507043
F4V1611_2011	670646	4507028	F4V4311_2011	670642	4506964
F4V1711_2011	670791	4507115	F4V4411_2011	670783	4506999
F4V1811_2011	670888	4506973	F4V4511_2011	670885	4506943
F4V1911_2011	670789	4507041	F4V4611_2011	670857	4507029
F4V2011_2011	670817	4506958	F4V4711_2011	670647	4507038
F4V2111_2011	670710	4506958	F4V4811_2011	670858	4507014
F4V2211_2011	670750	4507016	F4V511_2011	670857	4507041
F4V2411_2011	670673	4506934	F4V5011_2011	670822	4507057
F4V2511_2011	670828	4507101	F4V5111_2011	670898	4507110
F4V2711_2011	670785	4506998	F4V5211_2011	670722	4507102
F4V2811_2011	670747	4506979	F4V5311_2011	670681	4507057
F4V2911_2011 *	670779	4506917	F4V5411_2011	670683	4507050
F4V311_2011	670757	4507104	F4V5511_2011 *	670742	4506919
F4V3011_2011	670682	4507041	F4V5611_2011	670820	4507025
F4V3211_2011	670894	4507059	F4V611_2011	670647	4507036
F4V3311_2011	670853	4507015	F4V711_2011	670895	4507065
F4V3411_2011	670822	4507057	F4V811_2011	670786	4507035
F4V3511_2011	670856	4507012	F4V911_2011	670675	4506926
F4V3611_2011	670896	4507087			

Appendix B: Coordinates for vegetation plots at FIIS in 2011 (continued)

Table B-5. Coordinates for vegetation plots sampled at FIIS site 5 in 2011, UTM, Zone 18, NAD 83, meters. '*' a species listed as invasive or exotic in New York State was present.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
F5V111_2011	675561	4509527	F5V3311_2011	675681	4509525
F5V1011_2011	675597	4509531	F5V3411_2011	675432	4509436
F5V1111_2011	675519	4509592	F5V3511_2011	675653	4509508
F5V1211_2011	675574	4509513	F5V3611_2011 *	675483	4509418
F5V1311_2011	675574	4509511	F5V3711_2011	675436	4509432
F5V1411_2011	675505	4509442	F5V3811_2011	675444	4509587
F5V1511_2011	675480	4509475	F5V3911_2011	675655	4509507
F5V1611_2011	675561	4509754	F5V411_2011	675412	4509460
F5V1711_2011	675665	4509549	F5V4011_2011	675456	4509513
F5V1811_2011	675677	4509587	F5V4111_2011	675526	4509523
F5V1911_2011	675458	4509454	F5V4211_2011	675624	4509606
F5V211_2011	675522	4509529	F5V4311_2011	675659	4509502
F5V2011_2011	675489	4509632	F5V4411_2011	675675	4509535
F5V2111_2011	675510	4509546	F5V4511_2011 *	675723	4509522
F5V2211_2011 *	675733	4509508	F5V4611_2011	675445	4509580
F5V2311_2011	675544	4509612	F5V4711_2011 *	675556	4509484
F5V2411_2011	675591	4509652	F5V4811_2011	675476	4509593
F5V2511_2011	675524	4509638	F5V4911_2011	675464	4509558
F5V2611_2011	675504	4509665	F5V511_2011	675586	4509662
F5V2711_2011 *	675520	4509476	F5V5011_2011	675606	4509636
F5V2811_2011	675551	4509764	F5V5611_2011	675489	4509573
F5V2911_2011	675553	4509537	F5V611_2011 *	675563	4509472
F5V311_2011 *	675589	4509491	F5V6011_2011	675508	4509551
F5V3011_2011	675596	4509536	F5V711_2011	675434	4509487
F5V3111_2011	675549	4509658	F5V811_2011	675508	4509551
F5V3211_2011	675473	4509434	F5V911_2011 *	675684	4509521

Appendix B: Coordinates for vegetation plots at FIIS in 2011 (continued)

Table B-6. Coordinates for vegetation plots sampled at FIIS site 6 in 2011, UTM, Zone 18, NAD 83, meters. '+' a species listed as exploitably vulnerable by New York state was present.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
F6V111_2011	687196	4514785	F6V3211_2011	687074	4514687
F6V1011_2011	686976	4514749	F6V3311_2011	687285	4514770
F6V1111_2011 +	687438	4514843	F6V3411_2011	687154	4514725
F6V1211_2011 +	687496	4514854	F6V3511_2011	687458	4514872
F6V1311_2011	686959	4514730	F6V3611_2011	687062	4514802
F6V1411_2011	687351	4514794	F6V3711_2011	686993	4514709
F6V1511_2011	687351	4514794	F6V3811_2011	687028	4514758
F6V1611_2011	686969	4514675	F6V3911_2011	687018	4514740
F6V1711_2011	687355	4514801	F6V411_2011	687153	4514726
F6V1811_2011	687087	4514702	F6V4011_2011	687400	4514861
F6V1911_2011	687150	4514720	F6V4111_2011	687151	4514789
F6V211_2011	687369	4514816	F6V4211_2011	687314	4514811
F6V2011_2011	687121	4514814	F6V4311_2011	687445	4514849
F6V2111_2011	687097	4514781	F6V4411_2011	687298	4514788
F6V2211_2011	687234	4514835	F6V4511_2011	687223	4514818
F6V2311_2011	687184	4514768	F6V4611_2011	687077	4514756
F6V2411_2011	687316	4514881	F6V4711_2011	687080	4514692
F6V2511_2011	687357	4514801	F6V4811_2011	687123	4514752
F6V2611_2011	687444	4514849	F6V4911_2011	687134	4514767
F6V2711_2011	687028	4514756	F6V511_2011	687022	4514749
F6V2811_2011	686986	4514695	F6V5011_2011	687194	4514849
F6V2911_2011	687439	4514845	F6V611_2011	687352	4514864
F6V311_2011 +	687314	4514877	F6V711_2011	687303	4514862
F6V3011_2011	687169	4514747	F6V811_2011	687280	4514829
F6V3111_2011	687349	4514789	F6V911_2011	687025	4514749

Appendix C: Nekton density summarized by site

Table C-1. Average density and standard error [individuals per 1 m² ± SE (total count)] of nekton captured at FIIS in 2011. Data were summarized for each site and sampling event as well as both events combined.

Site	Average Density [individuals per 1 m ² ± SE (total count)]		
	Event 1	Event 2	Events 1 & 2
1	1.1 ± 1.1 (7)	5.4 ± 2.1 (26)	3.2 ± 1.3 (33)
2	10.4 ± 3.9 (105)	7.3 ± 2.8 (43)	8.9 ± 2.3 (148)
3	38.4 ± 31.5 (442)	3.0 ± 1.5 (25)	20.7 ± 15.8 (467)
4	0.8 ± 0.2 (8)	4.2 ± 1.6 (23)	2.6 ± 0.9 (31)
5	0.2 ± 0.2 (1)	29.3 ± 14.5 (135)	14.7 ± 7.8 (136)

Appendix D: Nekton species richness summarized by site and sampling event

Table D-1. (i) Species richness (observed number of species) at FIIS in 2011. Data were summarized by site. (ii) Species richness (observed number of species) at FIIS in 2011. Data are summarized by site and sampling event.

(i)

Site	No. of Stations	Observed No. of Species
1	10	5
2	10	5
3	16	5
4	14	2
5	10	5

(ii)

Site	Event	No. of Stations	Observed No. of Species
1	1	10	1
1	2	10	5
2	1	10	5
2	2	10	2
3	1	15	4
3	2	15	4
4	1	13	2
4	2	14	2
5	1	10	1
5	2	10	5

Appendix E: Nekton species and community composition summarized by site and sampling event

Table E-1. (i) Nekton species and community composition at FIIS in 2011. Data were summarized by site. n = total number of nekton captured. '-' species or community was not present. (ii) Nekton species and community composition at FIIS in 2011. Data were summarized by site and sampling event. n = total number of nekton captured. '-' species or community was not present.

(i)

Life History Group/Species	Common Name	Group/Species Composition (%)				
		Site1 (n = 33)	Site 2 (n = 148)	Site 3 (n = 467)	Site 4 (n = 31)	Site 5 (n = 136)
Resident Fish		78.8	89.9	96.4	100.0	18.4
<i>Fundulus heteroclitus</i>	common mummichog	63.6	86.5	91.9	77.4	16.9
<i>Cyprinodon variegatus</i>	sheepshead minnow	15.2	3.4	4.5	22.6	1.5
Resident Shrimp		12.1	7.4	0.9	-	28.7
<i>Palaemonetes pugio</i>	daggerblade grass shrimp	12.1	7.4	0.9	-	28.7
Transient Crustacean		6.1	0.7	0.4	-	1.5
<i>Callinectes sapidus</i>	blue crab	6.1	0.7	0.4	-	1.5
Transient Fish		3.0	2.0	2.4	-	51.5
<i>Menidia menidia</i>	Atlantic silverside	3.0	2.0	2.4	-	51.5

Appendix E: Nekton species and community composition summarized by site and sampling event (continued)

Table E-1. (i) Nekton species and community composition at FIIS in 2011. Data were summarized by site. n = total number of nekton captured. '-' species or community was not present. (ii) Nekton species and community composition at FIIS in 2011. Data were summarized by site and sampling event. n = total number of nekton captured. '-' species or community was not present.

(ii)

Life History Group/Species	Common Name	Group/Species Composition (%)					
		Site 1		Site 2		Site 3	
		Event 1 (n = 7)	Event 2 (n = 26)	Event 1 (n = 105)	Event 2 (n = 43)	Event 1 (n = 442)	Event 2 (n = 25)
Resident Fish		100	73.1	95.2	76.7	97.3	80.0
<i>Fundulus heteroclitus</i>	common mummichog	100	53.8	90.5	76.7	94.3	48.0
<i>Cyprinodon variegatus</i>	sheepshead minnow	-	19.2	4.8	-	2.9	32.0
Resident Shrimp		-	15.4	1.0	23.3	0.2	12.0
<i>Palaemonetes pugio</i>	daggerblade grass shrimp	-	15.4	1.0	23.3	0.2	12.0
Transient Crustacean		-	7.7	1.0	-	-	8.0
<i>Callinectes sapidus</i>	blue crab	-	7.7	1.0	-	-	8.0
Transient Fish		-	3.8	2.9	-	2.5	-
<i>Menidia menidia</i>	Atlantic silverside	-	3.8	2.9	-	2.5	-

Life History Group/Species	Common Name	Group/Species Composition (%)			
		Site 4		Site 5	
		Event 1 (n = 8)	Event 2 (n = 23)	Event 1 (n = 1)	Event 2 (n = 135)
Resident Fish		100	100	100	17.8
<i>Fundulus heteroclitus</i>	common mummichog	25.0	95.7	100	16.3
<i>Cyprinodon variegatus</i>	sheepshead minnow	75.0	4.3	-	1.5
Resident Shrimp		-	-	-	28.9
<i>Palaemonetes pugio</i>	daggerblade grass shrimp	-	-	-	28.9
Transient Crustacean		-	-	-	1.5
<i>Callinectes sapidus</i>	blue crab	-	-	-	1.5
Transient Fish		-	-	-	51.9
<i>Menidia menidia</i>	Atlantic silverside	-	-	-	51.9

Appendix F: Vegetation frequency summarized by site

Table F-1. Frequency of each plant species and non-vegetation cover type observed at FIIS in 2011. Data were summarized for each site and over all 300 plots. (NL) indicates standing non-living vegetation. '-' species or community not present '+' species listed as exploitably vulnerable in New York State (USDA 2012, Young 2008). '*' species listed as invasive / exotic in New York State (Invasive Plant Council of New York 2007). [#] *S.virginica*, an invalid synonym was used on the field data sheet; the accepted synonym *S. depressa* was retrieved on 17 September 2012 (www.itis.gov).

Cover Type		Site (no. of plots)						
Salinity Tolerance		1	2	3	4	5	6	All
Species	Common Name	(49)	(50)	(50)	(49)	(52)	(50)	(300)
Vegetation		49	49	50	46	52	50	296
High Salinity Tolerance		49	49	50	46	51	50	295
<i>Spartina alterniflora</i>	saltmarsh cordgrass	44	29	49	43	42	50	257
<i>Spartina alterniflora</i> (NL)	saltmarsh cordgrass (NL)	39	25	34	43	34	44	219
<i>Spartina patens</i>	salt meadow cordgrass	37	37	21	20	29	22	166
<i>Spartina patens</i> (NL)	salt meadow cordgrass (NL)	34	30	19	18	24	21	146
<i>Limonium carolinianum</i> +	sea lavender	-	-	-	-	-	3	3
<i>Limonium carolinianum</i> (NL) +	sea lavender (NL)	1	-	1	-	-	-	2
<i>Salicornia depressa</i> #	Virginia glasswort	6	5	-	3	6	3	23
<i>Salicornia depressa</i> (NL) #	Virginia glasswort (NL)	1	-	-	2	-	-	3
<i>Salicornia maritima</i>	glasswort	7	3	8	15	9	2	44
<i>Salicornia maritima</i> (NL)	glasswort (NL)	-	-	-	4	-	-	4
<i>Atriplex patula</i>	spear saltbush	-	-	-	-	1	-	1
<i>Distichlis spicata</i>	spikegrass	23	35	21	6	22	-	107
<i>Distichlis spicata</i> (NL)	spikegrass (NL)	16	32	18	3	20	-	89
<i>Iva frutescens</i>	marsh elder	2	2	1	1	-	-	6
<i>Iva frutescens</i> (NL)	marsh elder (NL)	4	1	-	-	-	-	5
<i>Juncus gerardii</i>	black grass	1	3	-	1	1	-	6
<i>Juncus gerardii</i> (NL)	black grass (NL)	-	3	-	-	-	-	3
<i>Ruppia maritima</i>	widgeon grass	-	1	1	-	1	-	3
<i>Solidago sempervirens</i>	seaside goldenrod	-	9	-	1	-	-	10
Medium Salinity Tolerance		-	-	-	1	1	-	2
<i>Baccharis halimifolia</i>	Eastern baccharis	-	-	-	1	-	-	1
<i>Calystegia sepium</i>	hedge bindweed	-	-	-	1	-	-	1
<i>Toxicodendron radicans</i>	poison ivy	-	-	-	1	-	-	1
<i>Typha angustifolia</i>	narrowsleaf cattail	-	-	-	1	1	-	2
Low Salinity Tolerance		6	12	1	3	9	-	31
<i>Hibiscus moscheutos</i>	rose mallow	-	-	-	-	1	-	1
<i>Phragmites australis</i> *	common reed	5	12	1	2	8	-	28
<i>Phragmites australis</i> (NL) *	common reed (NL)	5	9	1	3	8	-	26
<i>Pluchea odorata</i>	marsh fleabane	2	1	-	-	5	-	8

Appendix F: Vegetation frequency summarized by site (continued)

Table F-1 (continued). Frequency of each plant species and non-vegetation cover type observed at FIIS in 2011. Data were summarized for each site and over all 300 plots. (NL) indicates standing non-living vegetation. '-' species or community not present '+' species listed as exploitably vulnerable in New York State (USDA 2012, Young 2008). '*' species listed as invasive / exotic in New York State (Invasive Plant Council of New York 2007). ^{##} *S.virginica*, an invalid synonym was used on the field data sheet; the accepted synonym *S. depressa* was retrieved on 17 September 2012 (www.itis.gov).

Cover Type		Site (no. of plots)						
Salinity Tolerance								
Species	Common Name	1 (49)	2 (50)	3 (50)	4 (49)	5 (52)	6 (50)	All (300)
Unknown Salinity Tolerance		-	3	-	-	-	-	3
<i>Eleocharis sp.</i>	spikerush	-	3	-	-	-	-	3
<i>Eleocharis sp.</i> (NL)	spikerush (NL)	-	3	-	-	-	-	3
Non-Vegetation		29	42	33	38	24	50	216
water	water	21	39	24	31	19	44	178
bare ground	bare ground	13	8	14	13	11	11	70
Incidental Cover		14	16	8	20	20	16	94
Wrack & litter	wrack & litter	14	16	8	20	19	16	93
trash	garbage / trash	3	3	1	4	8	1	20

Appendix G: Vegetation relative percent cover summarized by site

Table G-1. Relative percent cover of each plant species and non-vegetation cover type observed at FIIS in 2011. Data were summarized for each site and over all 300 plots. (NL) indicates standing non-living vegetation. '-' species or community not present '+' species listed as exploitably vulnerable in New York State (USDA 2012, Young 2008). '*' species listed as invasive or exotic in New York State (Invasive Plant Council of New York 2007). '#' *S. virginica*, an invalid synonym was used on the field data sheet; the accepted synonym *S. depressa* was retrieved on 17 September 2012 (www.itis.gov).

Cover Type		Relative % Cover						
Salinity Tolerance		Site (No. of Plots)						
Species	Common Name	1 (49)	2 (50)	3 (50)	4 (49)	5 (52)	6 (50)	All (300)
Vegetation		84.1	67.1	73.9	70.4	76.2	49.1	69.7
High Salinity Tolerance		82.3	63.3	73.6	69.4	73.1	49.1	68.0
<i>Spartina alterniflora</i>	saltmarsh cordgrass	20.4	9.7	23.5	26.0	17.8	28.3	20.5
<i>Spartina alterniflora</i> (NL)	saltmarsh cordgrass (NL)	15.3	7.8	10.6	18.4	12.4	7.3	11.8
<i>Spartina patens</i>	salt meadow cordgrass	18.1	10.8	12.4	10.5	15.7	4.9	12.0
<i>Spartina patens</i> (NL)	salt meadow cordgrass (NL)	22.6	15.3	18.1	13.0	17.6	8.2	15.7
<i>Distichlis spicata</i>	spikegrass	3.1	6.9	4.6	0.2	5.1	-	3.4
<i>Distichlis spicata</i> (NL)	spikegrass (NL)	1.4	10.5	3.0	0.1	4.0	-	3.4
<i>Iva frutescens</i>	marsh elder	0.7	0.1	0.9	< 0.05	-	-	0.3
<i>Iva frutescens</i> (NL)	marsh elder (NL)	0.3	< 0.05	-	-	-	-	0.1
<i>Juncus gerardii</i>	black grass	< 0.05	0.2	-	< 0.05	< 0.05	-	0.1
<i>Juncus gerardii</i> (NL)	black grass (NL)	-	1.4	-	-	-	-	0.3
<i>Salicornia maritima</i>	glasswort	0.2	< 0.05	0.3	0.5	0.3	0.1	0.2
<i>Salicornia maritima</i> (NL)	glasswort (NL)	-	-	-	0.2	-	-	< 0.05
<i>Salicornia depressa</i> [#]	Virginia glasswort	0.1	0.1	-	0.3	0.1	< 0.05	0.1
<i>Salicornia depressa</i> [#] (NL)	Virginia glasswort (NL)	< 0.05	-	-	< 0.05	-	-	< 0.05
<i>Solidago sempervirens</i>	seaside goldenrod	-	0.4	-	< 0.05	-	-	0.1
<i>Atriplex patula</i>	spear saltbush	-	-	-	-	< 0.05	-	< 0.05
<i>Limonium carolinianum</i> ⁺	sea lavender	-	-	-	-	-	0.3	< 0.05
<i>Limonium carolinianum</i> ⁺ (NL)	sea lavender (NL)	< 0.05	-	< 0.05	-	-	-	< 0.05
<i>Ruppia maritima</i>	widgeon grass	-	0.2	< 0.05	-	< 0.05	-	< 0.05

Appendix G: Vegetation relative percent cover summarized by site (continued)

Table G-1 (continued). Relative percent cover of each plant species and non-vegetation cover type observed at FIIS in 2011. Data were summarized for each site and over all 300 plots. (NL) indicates standing non-living vegetation. '-' species or community not present '+' species listed as exploitably vulnerable in New York State (USDA 2012, Young 2008). '*' species listed as invasive or exotic in New York State (Invasive Plant Council of New York 2007). '#' *S. virginica*, an invalid synonym was used on the field data sheet; the accepted synonym *S. depressa* was retrieved on 17 September 2012 (www.itis.gov).

Cover Type		Relative % Cover						
Salinity Tolerance		Site (No. of Plots)						
Species	Common Name	1 (49)	2 (50)	3 (50)	4 (49)	5 (52)	6 (50)	All (300)
Medium Salinity Tolerance		-	-	-	0.6	< 0.05	-	0.1
<i>Baccharis halimifolia</i>	Eastern baccharis	-	-	-	0.5	-	-	0.1
<i>Calystegia sepium</i>	hedge bindweed	-	-	-	< 0.05	-	-	< 0.05
<i>Toxicodendron radicans</i>	poison ivy	-	-	-	< 0.05	-	-	< 0.05
<i>Typha angustifolia</i>	narrowleaf cattail	-	-	-	< 0.05	< 0.05	-	< 0.05
Low Salinity Tolerance		1.9	1.6	0.3	0.4	3.1	-	1.2
<i>Phragmites australis</i> *	common reed	1.3	1.4	0.2	0.3	1.7	-	0.8
<i>Phragmites australis</i> * (NL)	common reed (NL)	0.5	0.2	< 0.05	0.1	0.8	-	0.3
<i>Pluchea odorata</i>	marsh fleabane	0.1	< 0.05	-	-	0.7	-	0.1
<i>Hibiscus moscheutos</i>	rose mallow	-	-	-	-	< 0.05	-	< 0.05
Unknown Salinity Tolerance		-	2.2	-	-	-	-	0.4
<i>Eleocharis sp.</i>	spikerush	-	0.4	-	-	-	-	0.1
<i>Eleocharis sp.</i> (NL)	spikerush (NL)	-	1.8	-	-	-	-	0.4
Non-Vegetation		11.1	30.9	24.3	23.4	15.5	49.3	26.2
water	water	7.8	30.0	19.9	20.5	12.1	43.6	22.9
bare ground	bare ground	3.3	0.9	4.5	2.9	3.4	5.7	3.4
Incidental Cover		4.7	2.0	1.8	6.2	8.3	1.6	4.0
Wrack & litter	wrack & litter	4.4	1.9	1.5	6.1	7.3	1.6	3.7
trash	garbage / trash	0.3	0.1	0.2	0.1	1.0	< 0.05	0.3