



Salt Marsh Vegetation and Nekton Community Monitoring at William Floyd Estate, Fire Island National Seashore

2009 Summary Report

Natural Resource Report NPS/NCBN/NRDS—2010/070



ON THE COVER

Salt marsh edge at William Floyd Estate, Fire Island National Seashore
Photo courtesy of Fire Island National Seashore

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Executive Summary

The Northeast Coastal and Barrier Network (NCBN) is one of 32 networks of parks created by the Inventory and Monitoring Program (I&M Program) of the National Park Service. 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 Network parks. 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 *Vital Signs* 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 a protocol was developed for collecting long-term data on salt marsh vegetation and nekton (James-Pirri In Development-a,b).

This annual report summarizes the first year of data collected at William Floyd Estate, Fire Island National Seashore (WIFL) located in New York. Approximately fifty vegetation plots and a subset of pools and ditches were sampled for nekton at three marshes in July and August of 2009. Monitoring data is to be collected at these same marsh sites biennially. Nekton in marsh pools were sampled with a 1m² aluminum throw trap (Kushlan 1981, Sogard & Able 1991, Raposa and Roman 2001). Nekton in ditches were sampled using ditch nets (James-Pirri et al. 2010) Vegetation was monitored using 1m² plots and a revised Braun-Blanquet method (Kent and Coker 1992) to estimate percent cover of each vegetation species and non-vegetation cover type within each plot.

At the three WIFL sites, 14 vegetation species along with 4 non-vegetation cover types were recorded during vegetation sampling in 2009. One of the identified vegetation species in the sample plots at WIFL, *Limonium carolinianum* and is listed by both by the USDA and the State of New York as exploitably vulnerable (USDA 2010, Young 2008). One of the identified vegetation species in the sample plots, *Phragmites australis*, is listed by the state of New York as highly invasive (Invasive Plant Council of New York 2007). Non-vegetation cover types recorded included wrack and litter, bare ground, water, and trash.

Nine species of nekton were recorded at three sites at WIFL in 2009, including 5 fish species, 3 crab species, and 1 shrimp species. Examination of percent catch data indicates that one nekton species, daggerblade grass shrimp (*Palaemonetes pugio*), accounts for approximately 89% of all nekton captured. The second most prevalent species, Common Mummichog (*Fundulus heteroclitus*), accounts for approximately 8% of all nekton recorded.

The information collected through this long-term monitoring program will equip park managers with scientific data to make informed decisions on both the aquatic and terrestrial resources they manage. This report summarizes the 2009 baseline data for WIFL salt marshes. Changes in salt marsh condition will be examined following data collection in 2011. By understanding the changes or trends occurring in salt marsh vegetation and nekton communities, managers will be able to better adapt and respond to these changes through their management practices.

Acknowledgments

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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 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.

The William Floyd Estate (WIFL), former home of General William Floyd, a signer of the Declaration of Independence, was donated by the Nichols family to the National Park Service in 1965. WIFL is located on the southern shore of Long Island in Mastic Beach, Suffolk County New York and is managed by the National Park Service as a detached unit of Fire Island National Seashore (FIIS). This annual report summarizes salt marsh vegetation and nekton community data collected at WIFL in 2009 according to two protocols developed by Pirri et al., *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 Development-a,b).

The objective of salt marsh vegetation and nekton monitoring is to identify long-term trends in the structure of these communities, which in turn should provide a better understanding of the current status and condition of salt marsh within the parks. These data will assist park managers in making informed decisions regarding the management and continued protection of this rare and valuable coastal resource.

Methods

Permanent Site Selection

Three permanent 5-8 hectare salt marsh sites were selected for monitoring at WIFL (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 and Nekton Protocols (James-Pirri et al. In Development-a,b).

Vegetation and nekton sampling were conducted at all three marsh sites. In future years, vegetation and nekton sampling will be conducted at these three marshes every 2 years. In addition, we hope to augment current salt marsh monitoring at WIFL to include sediment elevation data in the future.

Nekton Sampling Station Selection and Data Collection

Depending on available habitat, between 8 and 12 nekton sampling stations were established at each marsh site. Habitat types sampled included marsh pools/pannes, and ditches that were either obstructed or not. Because there were relatively few pools, all fishable pools within each site were sampled. In addition to the pool stations sampled, station locations were randomly selected from all available ditch habitat with each site. Some ditch habitat sampled was obstructed and some was not. 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. All nekton sampling stations were randomly located along the perimeter of a pool or the length of each ditch so that inference can apply to all fishable water within each site and can be biologically extended to the site as a whole. Nekton stations were sampled twice, once in early summer (early July) and once in late summer (August) (Table 1).

Nekton in marsh pools less than 1m deep were sampled with a 1m² 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 0.5m in height and 1m square, and the sides are covered with 3mm (1/8 in) wire mesh. All nekton were collected from the trap with a 1mm mesh dip net that fit snugly within the opposite sides of the trap.

Ditches were sampled using a ditch net, an enclosure gear designed to sample narrow mosquito ditches and smaller tidal creeks up to 1 m wide and 1 m deep (James-Pirri et al. In Press). All nekton were collected from the net and density is calculated by measuring the area of water the net samples.

All fish and decapods were identified and enumerated. A representative number (up to 15 individuals) of each species collected was 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.



Figure 1. Locations of permanent nekton and vegetation monitoring sites established by NCBN at William Floyd estate, Fire Island National Seashore (WIFL). These six sites will be monitored biennially.

Table 1. Sampling dates and total number of nekton sampling stations at three marsh sites at WIFL in 2009. Sampling stations are displayed by habitat type.

Site	Visit	Dates	Habitat			Total
			Ditch		Pool/Panne	
			Unobstructed	Obstructed		
1	1	7/8/2009	6	2	3	11
	2	8/17/2009	6	2	0	8
2	1	7/6/2009	7	1	0	8
	2	8/18/2009	7	1	0	8
3	1	7/7/2009	5	3	4	12
	2	8/19/2009	5	3	4	12

Vegetation Plot Selection and Data Collection

Vegetation sampling was conducted at each of the three permanent marsh sites during July. Ten transects, extending from creek bank to upland, were randomly located within each marsh and approximately 50 1m² plots were randomly placed along these transects. Each plot was visited once during the summer sampling season (Table 2).

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 total number of vegetation plots sampled at three marsh sites at WIFL in 2009.

Site	Dates	Total
1	7/24/2009	51
2	7/23/2009	47
3	7/23/2009	50

Table 3. Definition of standard cover type categories used in the Northeast Coastal and Barrier Network salt marsh vegetation monitoring program. (James-Pirri et al. In Development-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.

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 in the data 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%	0.5%
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 which is the average of the relative percent cover and the relative percent frequency.

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

species and non-vegetation cover types present. The sum of the relative percent frequency values for all species is 100%.

Taking the average of the relative percent cover and the relative percent frequency gives the relative percent prevalence for each species, or non-vegetation cover type present. 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. We also report the average percent cover of each species for all plots combined.

Lastly, 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 table. 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 state of New York as exotic or invasive is available online (Invasive Plant Council of New York 2007). 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 (2008) for the New York Natural Heritage Program.

If any species found in the sample plots are noted as being from one of these categories, plots with those categories of vegetation present will be noted in Appendix 4, the list of all vegetation sample plots and their respective Universal Transverse Mercator (UTM) coordinates.

Results

Nekton

Nine nekton species consisting of 5 fish and 4 decapod species were captured at WIFL during the summer of 2009 on three salt marsh sites in pools and ditches. Examination of nekton species and composition (% catch) indicates that 1 decapod species, daggerblade grass shrimp (*Palaemonetes pugio*), accounts for approximately 88% of all nekton recorded during summer sampling at WIFL in 2009 (Table 5). The second most prevalent species, Common Mummichog (*Fundulus heteroclitus*), accounts for approximately 8% of all nekton caught. Community composition percentages show that during the first visit, decapods comprised 55% of all nekton caught. In contrast, during the second visit decapods comprised approximately 96% of all nekton caught.

The average density of each species and community for each sampling visit is presented in Table 6. Daggerblade grass shrimp (*P. pugio*) had the highest density of all species captured in 2009, with Common Mummichog (*F. heteroclitus*) following respectively. From what is known about the life history of fish and decapods, differences between sampling visits are expected, and this is the primary reason for sampling the nekton community twice each summer. Species and community densities for each sampling visit at each site can be found in Appendix 1.

Table 7 shows species and community density by sampling visit and habitat type (pool/panne or ditch). Daggerblade grass shrimp (*P. pugio*) were found almost exclusively in ditch habitat with only a couple of individuals being found in pool habitat during the second sampling visit. The remaining three decapod species were also found only in ditch habitat. Although the five fish species recorded were found in much lower numbers, they were prevalent in both pools and ditches during the first sampling visit and were also present in both habitats during the second sampling visit.

Table 5. Nekton species and community composition (% catch) at WIFL in 2009. Data are shown for each visit separately and both visits combined. n = total number of nekton caught during that visit. '-' indicates that a species was not present. '*' indicates that the genus or family could be identified, but that the species identification was not confirmed.

Community/Species	Common Name	Community/Species Composition (%)		
		Visit 1 (n = 317)	Visit 2 (n = 1694)	Visits 1 & 2 (n = 2011)
Fish		44.9	4.3	10.8
<i>Fundulus heteroclitus</i>	Common Mummichog	30.0	3.5	7.7
<i>Cyprinodon variegatus</i>	Sheepshead Minnow	11.7	0.8	2.5
<i>Menidia menidia</i>	Atlantic Silverside	1.6	-	0.3
<i>Fundulus majalis</i>	Striped Killifish	1.0	-	0.2
<i>Fundulus lucia</i>	Spotfin Killifish	0.6	-	0.1
Decapods		55.2	95.7	89.4
<i>Palaemonetes pugio</i>	Daggerblade Grass Shrimp	53.9	95.3	88.8
<i>Callinectes sapidus</i>	Blue Crab	1.0	0.3	0.4
<i>Uca species*</i>	Fiddler Crab Species*	0.3	-	0.1
<i>Xanthidae species*</i>	Xanthidae species*	-	0.1	0.1

Table 6. Average density and standard deviation [individuals per 1 m² ± SD (total count)] of nekton captured at WIFL in 2009. n = number of nekton stations sampled. Most stations were sampled during both visits. The difference in the number of stations sampled between visits was due to some stations being dry. '-' indicates that a species was not present. '*' indicates that the genus or family could be identified, but that the species identification was not confirmed.

Community/Species	Common Name	Average Density [individuals per 1 m ² ± SD (total count)]		
		Visit 1 (n = 31)	Visit 2 (n = 28)	Visits 1 & 2 (n = 31)
Fish		5.2 ± 8.6 (142)	3 ± 5.3 (74)	4.4 ± 6.2 (216)
<i>Fundulus heteroclitus</i>	Common Mummichog	3.6 ± 7.3 (95)	2.4 ± 4.3 (60)	3.1 ± 4.7 (155)
<i>Cyprinodon variegatus</i>	Sheepshead Minnow	1.2 ± 3.3 (37)	0.6 ± 1.4 (14)	1.2 ± 3.1 (51)
<i>Menidia menidia</i>	Atlantic Silverside	0.2 ± 0.4 (5)	-	0.1 ± 0.2 (5)
<i>Fundulus majalis</i>	Striped Killifish	0.1 ± 0.7 (3)	-	0.1 ± 0.4 (3)
<i>Fundulus lucia</i>	Spotfin Killifish	0.1 ± 0.5 (2)	-	< 0.05 (2)
		5.6 ± 12.7 (175)	72 ± 185.8 (1620)	37.7 ± 92 (1795)
Decapods				
	Daggerblade Grass	5.4 ± 12.6 (171)		37.4 ± 91.9 (1785)
<i>Palaemonetes pugio</i>	Shrimp		71.8 ± 185.7 (1614)	
<i>Callinectes sapidus</i>	Blue Crab	0.1 ± 0.5 (3)	0.2 ± 0.6 (5)	0.2 ± 0.3 (8)
<i>Uca species*</i>	Fiddler Crab Species*	0.1 ± 0.3 (1)	-	< 0.05 (1)
<i>Xanthidae species*</i>	Xanthidae species*	-	0 ± 0.2 (1)	< 0.05 (1)
		10.8 ± 14.3 (317)	75.1 ± 186 (1694)	42.1 ± 91.5 (2011)
Total nekton				

Another summary measure we examined for these data, species richness, provided additional information about the two visits samplings. Although there was an increase in nekton density from visit 1 to visit 2, this increase was due primarily to one decapod species. Consequently we see a decrease in species richness from visit 1 to visit 2 (Table 8). Because the majority of the data were collected at identical locations within each site, variability due to microhabitat differences has been minimized and these results represent a best estimate of difference between visits. This decrease in species richness between the two sampling visits provides a baseline for future trend analyses at WIFL. Species richness information for each site at WIFL, summarized over both visits, can be found in Appendix 2.

Table 7. Average density and standard deviation [individuals per 1 m² ± SD (total count)] of nekton captured for each habitat type at WIFL in 2009. n = number of nekton stations sampled. The difference in the number of stations sampled between visits was due to some stations being dry. '-' indicates that a species was not present. '*' indicates that the genus or family could be identified, but that the species identification was not confirmed.

Community/Species	Common Name	Average Density [individuals per 1 m ² ± SD (total count)]					
		Visit 1			Visit 2		
		Ditch		Pool/Panne	Ditch		Pool/Panne
		Unobstructed	Obstructed		Unobstructed	Obstructed	
Fish		4.8 ± 9.2 (76)	5.3 ± 8.8 (24)	6.0 ± 7.9 (42)	3.5 ± 6.2 (54)	3.6 ± 4.9 (15)	0.8 ± 1 (5)
<i>Fundulus heteroclitus</i>	Common Mummichog	4.1 ± 8.4 (64)	4.2 ± 8.5 (19)	1.7 ± 2.2 (12)	3.0 ± 5.1 (46)	2.8 ± 3.3 (12)	0.3 ± 0.5 (2)
<i>Cyprinodon variegatus</i>	Sheepshead Minnow	0.5 ± 1.2 (8)	-	4.1 ± 6.0 (29)	0.5 ± 1.5 (8)	0.8 ± 1.9 (3)	0.5 ± 0.8 (3)
<i>Menidia menidia</i>	Atlantic Silverside	0.2 ± 0.5 (4)	-	0.1 ± 0.4 (1)	-	-	-
<i>Fundulus majalis</i>	Striped Killifish	-	0.7 ± 1.6 (3)	-	-	-	-
<i>Fundulus lucia</i>	Spotfin Killifish	-	0.4 ± 1.1 (2)	-	-	-	-
Decapods		9.0 ± 15.9 (167)	1.7 ± 2.8 (8)	-	117.0 ± 231.3 (1578)	9.0 ± 14.3 (40)	0.3 ± 0.5 (2)
<i>Palaemonetes pugio</i>	Daggerblade Grass Shrimp	8.9 ± 15.8 (165)	1.3 ± 2.8 (6)	-	116.5 ± 231.1 (1572)	9.0 ± 14.3 (40)	0.3 ± 0.5 (2)
<i>Callinectes sapidus</i>	Blue Crab	0.2 ± 0.5 (2)	0.2 (1)	-	0.3 ± 0.7 (5)	-	-
<i>Uca species*</i>	Fiddler Crab Species*	-	0.3 ± 0.7 (1)	-	-	-	-
<i>Xanthidae species*</i>	Xanthidae species*	-	-	-	0.1 ± 0.2 (1)	-	-
Total nekton		13.9 ± 17.0 (243)	7.0 ± 8.6 (32)	6.0 ± 7.9 (42)	120.5 ± 231.2 (1632)	12.6 ± 15.7 (55)	1.2 ± 1.3 (7)

Table 8. Estimated nekton species richness (species richness ± SD) summarized by sampling visit at WIFL in 2009.

Visit	No. of Stations	Observed No. of Species	Est. Species Richness ± SD
1	31	8	10.9 ± 2.9
2	28	5	6.0 ± 1.0

Average length of each species, is summarized in Table 9. Both fish species present during both sampling visits, *C. variegatus* and *F. heteroclitus* showed a substantial increase in average length. (Table 9). In contrast, the two decapod species present during both visits, *C. sapidus* and *P. pugio*, showed a decrease in length from sampling visit 1 to 2. There were relatively few of the *C. sapidus* caught during each sampling visit, so this difference may not provide reliable baseline data. The estimated decrease in average length of the *P. pugio*, however, is based on a large number of individuals measured during each sampling visit and does provide reliable baseline data to which future years can be compared (Table 9).

Table 9. Average length [mm $\pm$ SD (no. measured)] of nekton during each sample visit at WIFL in 2009. Length data for each species was summarized over all stations sampled during each visit. '-' indicates that a species was not present. '*' indicates that the genus or family could be identified, but that the species identification was not confirmed.

Community/Species	Common Name	Average Length [mm $\pm$ SD (no. measured)]	
		Visit 1	Visit 2
Fish			
<i>Cyprinodon variegatus</i>	Sheepshead Minnow	13.9 $\pm$ 4.7 (35)	25.2 $\pm$ 6.1 (14)
<i>Fundulus heteroclitus</i>	Common Mummichog	24.4 $\pm$ 8.1 (77)	34.1 $\pm$ 11.8 (54)
<i>Fundulus lucia</i>	Spotfin Killifish	35.5 $\pm$ 3.5 (2)	-
<i>Fundulus majalis</i>	Striped Killifish	28.7 $\pm$ 8.5 (3)	-
<i>Menidia menidia</i>	Atlantic Silverside	20 $\pm$ 7.9 (5)	-
Decapods			
<i>Callinectes sapidus</i>	Blue Crab	70.7 $\pm$ 16 (3)	48 $\pm$ 35.2 (5)
<i>Palaemonetes pugio</i>	Daggerblade Grass Shrimp	33.8 $\pm$ 4.9 (85)	22.9 $\pm$ 4.3 (179)
<i>Uca species*</i>	Fiddler Crab Species*	11.0 (1)	-
<i>Xanthidae species*</i>	Xanthidae species*	-	11.0 (1)

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 10). 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 over the course of the field season in order to lend any real insight into observed changes in the nekton community.

Table 10. Average values for physical characteristics [Average $\pm$ SD (no. of stations)] at nekton sampling stations at WIFL in 2009. Data are summarized over all three marshes for each habitat type within each visit separately.

Variable	Average $\pm$ SD (no. of stations)					
	Visit 1			Visit 2		
	Ditch		Pool/Panne	Ditch		Pool/Panne
	Unobstructed	Obstructed		Unobstructed	Obstructed	
Depth (cm)	31.5 $\pm$ 10.9 (18)	32 $\pm$ 9.5 (18)	14.7 $\pm$ 3.4 (18)	38 $\pm$ 9.5 (18)	32.8 $\pm$ 15.1 (18)	21.8 $\pm$ 16 (18)
Temperature (°C)	27.2 $\pm$ 1.3 (6)	27 $\pm$ 1.7 (6) 21.5 $\pm$ 4.5	29.1 $\pm$ 1.4 (6)	26.4 $\pm$ 1.9 (6)	28.1 $\pm$ 4.5 (5)	26 $\pm$ 0.7 (5)
Salinity (ppt)	23 $\pm$ 2.8 (7)	(7)	23.6 $\pm$ 2.6 (7)	26.2 $\pm$ 2.8 (4)	25 $\pm$ 0.7 (4)	25 $\pm$ 0.8 (4)

Vegetation

Fourteen vegetation species along with four non-vegetation cover types were recorded at three salt marsh sites during vegetation sampling at WIFL in 2009 (Table 11). Non-vegetation cover types recorded included bare ground, water, wrack and litter, and trash. The average percent cover and the relative percent prevalence of each species or non-vegetation cover type are also shown.

One of the identified vegetation species in the sample plots at WIFL, *Limonium carolinianum*, is listed by both by the USDA and the State of New York as exploitably vulnerable (USDA 2010, Young 2008). One of the identified vegetation species in the sample plots, *Phragmites australis*, is listed by the state of New York as highly invasive (Invasive Plant Council of New York 2007).

Data are sorted by average percent cover of living vegetation species. Average percent cover of non-living vegetation is also shown by species. As explained in the Data Summary section, the relative percent prevalence combines information about how much of each site each species or cover type covers relative to all other cover types present and how frequently it appears throughout the site relative to all other cover types present. *S. alterniflora* has the highest living percent cover, 47.0 ± 36.7 , but has a substantially lower relative percent prevalence, 23.2. This is an indication that the patchy growing pattern of *S. alterniflora*, which has been documented to thrive in low marsh zones closer to coastal waters, (Bertness 1991) decreased its overall relative percent prevalence. Almost all of the species recorded at WIFL have relative percent prevalence values that are lower than their average percent covers indicating that they are fairly patchy in distribution.

Table 11. Average percent cover (Average Cover % $\pm$ SD) and relative percent prevalence of each plant species and non-vegetation cover type at WIFL in 2009. Data were summarized over all 148 plots. Percent cover was estimated using the midpoint values of Braun-Blanquet percent ranges (Table 4). (NL) indicates standing non-living vegetation. '*' indicates an invasive or exotic species. '+' indicates a species listed as exploitably vulnerable by New York State.

Species/Cover Type	Common Name	Average Cover % $\pm$ SD	Relative Prevalence %
<i>Spartina alterniflora</i>	Saltmarsh Cordgrass	47.0 $\pm$ 36.7	23.2
<i>S. alterniflora</i> (NL)	Saltmarsh Cordgrass (NL)	21.8 $\pm$ 26.2	14.0
Water		27.4 $\pm$ 34.6	15.4
<i>Spartina patens</i>	Salt Meadow Cordgrass	13.8 $\pm$ 25.5	7.8
<i>S. patens</i> (NL)	Salt Meadow Cordgrass (NL)	8.1 $\pm$ 19.5	5.3
<i>Distichlis spicata</i>	Spikegrass	12.1 $\pm$ 24.4	8.0
<i>D. spicata</i> (NL)	Spikegrass (NL)	5.2 $\pm$ 13.2	5.3
Wrack/Litter		6.4 $\pm$ 19.3	4.0
* <i>Phragmites australis</i>	Common Reed	4.4 $\pm$ 16.3	2.9
* <i>P. australis</i> (NL)	Common Reed (NL)	1.0 $\pm$ 4.4	1.7
<i>Juncus gerardii</i>	Black Grass	3.6 $\pm$ 16.1	1.9
<i>J. gerardii</i> (NL)	Black Grass (NL)	0.4 $\pm$ 3.4	0.4
Bare Ground		1.3 $\pm$ 8.1	1.2
<i>Salicornia species</i>	Glasswort Species	1.1 $\pm$ 4.0	4.6
<i>Salicornia species</i> (NL)	Glasswort Species (NL)	0.1 $\pm$ 0.5	0.4
<i>Iva frutescens</i>	Marsh Elder	0.9 $\pm$ 4.9	0.8
<i>I. frutescens</i> (NL)	Marsh Elder (NL)	0.3 $\pm$ 3.1	0.2
<i>Pluchea odorata</i>	Marsh Fleabane	0.8 $\pm$ 4.7	0.8
+ <i>Limonium carolinianum</i>	Sea Lavender	0.5 $\pm$ 2.8	0.7
+ <i>L. carolinianum</i> (NL)	Sea Lavender (NL)	< 0.05	0.1
<i>Solidago sempervirens</i>	Seaside Goldenrod	0.3 $\pm$ 3.1	0.4
Unidentified Plant		0.2 $\pm$ 1.3	0.3
<i>Baccharis halimifolia</i>	Sea Myrtle	0.1 $\pm$ 1.3	0.1
Trash		< 0.05	0.3
<i>Aster tenuifolius</i>	Saltmarsh Aster	< 0.05	0.1
<i>Cuscuta species</i>	Dodder species	< 0.05	0.1

Discussion

Nekton

The data summarized above show that the WIFL salt marsh provides habitat for a thriving nekton community. The most notable results of the 2009 sampling season were the decreases in nekton densities and species richness values from the first to the second sampling visit and the overwhelming abundance of one nekton species, *p. pugio* during the second sampling visit. Seasonal differences are to be expected, but the extent of change in density between visits will be one of the variables monitored over time in looking for trends. Extent of seasonal change in abundance, species richness and nekton community structure is subject to variability due to expected year to year climate differences. This annual variability will make trends difficult to isolate in the short term. Long term trends in sea-level rise associated with climate change, however, are likely to result in identifiable changes in the extent of seasonal difference in nekton density and species richness as well as differences in the variables themselves. With this goal in mind, the extensive nekton data collected at WIFL in 2009 provide an informative baseline to which future data will be compared.

Vegetation

This first year of vegetation monitoring at WIFL provides essential information about the species present and how prevalent they are. These data also include information about non-vegetation cover types such as bare ground and standing water which will be important to monitor over time. 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 spatial distribution of some species will be important primary indicators of change in salt marsh condition. Trends in the spatial distribution of vegetation species 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 sea-level rise and climate change.

This first year of data at WIFL establishes a baseline for monitoring trends in vegetation community structure and spatial distribution of both vegetation species and non-vegetation cover types. Long-term monitoring of salt marsh vegetation will allow us to test hypotheses about whether apparent changes are due to year to year variability or represent significant trends.

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Appendix 1: Nekton species and community density at WIFL in 2009 summarized by site and visit

Table 1. Average density and standard deviation [individuals per 1 m² ± SD (total count)] of nekton captured for each site and visit at WIFL in 2009. ‘*’ indicates that the genus or family could be identified, but that the species identification was not confirmed. ‘-’ indicates that a species was not present.

Community/Species	Common Name	Average Density [individuals per 1 m ² ± SD (total count)]					
		Site 1		Site 2		Site 3	
		Visit 1	Visit 2	Visit 1	Visit 2	Visit 1	Visit 2
Fish		6.5 ± 8.4 (64)	2.7 ± 4.0 (20)	4.0 ± 3.7 (27)	1.8 ± 1.8 (11)	4.7 ± 11.2 (51)	4.0 ± 7.5 (43)
<i>Fundulus heteroclitus</i>	Common Mummichog	3.3 ± 6.2 (30)	1.9 ± 2.6 (14)	3.6 ± 3.0 (25)	1.8 ± 1.8 (11)	3.8 ± 10.3 (40)	3.4 ± 6.2 (35)
<i>Cyprinodon variegatus</i>	Sheepshead Minnow	2.4 ± 5.2 (26)	0.9 ± 1.9 (6)	0.4 ± 1.0 (2)	-	0.8 ± 1.4 (9)	0.7 ± 1.5 (8)
<i>Menidia menidia</i>	Atlantic Silverside	0.3 ± 0.6 (3)	-	-	-	0.2 ± 0.4 (2)	-
<i>Fundulus majalis</i>	Striped Killifish	0.4 ± 1.2 (3)	-	-	-	-	-
<i>Fundulus lucia</i>	Spotfin Killifish	0.2 ± 0.8 (2)	-	-	-	-	-
Decapods		8.4 ± 15.2 (101)	182.5 ± 298.3 (1350)	9.3 ± 16.8 (69)	11.7 ± 17.9 (69)	0.6 ± 2.0 (5)	20.3 ± 37.3 (201)
<i>Palaemonetes pugio</i>	Daggerblade Grass Shrimp	8.1 ± 15.4 (99)	182.0 ± 298.1 (1346)	8.9 ± 16.6 (67)	11.7 ± 17.9 (69)	0.6 ± 2.0 (5)	20.0 ± 37.2 (199)
<i>Callinectes sapidus</i>	Blue Crab	0.1 ± 0.4 (1)	0.4 ± 0.8 (3)	0.4 ± 0.7 (2)	-	-	0.2 ± 0.5 (2)
<i>Uca species*</i>	Fiddler Crab Species*	0.1 ± 0.4 (1)	-	-	-	-	-
<i>Xanthidae species*</i>	Xanthidae species*	-	0.1 ± 0.4 (1)	-	-	-	-
Total nekton		14.9 ± 14.2 (165)	185.2 ± 297.7 (1370)	13.3 ± 17.5 (96)	13.5 ± 18.1 (80)	5.3 ± 11.1 (56)	24.3 ± 43.3 (244)

Appendix 2: Nekton species richness at WIFL IN 2009 summarized by site

Table 1. Estimated nekton species richness (Est. Species Richness $\pm$ SD) summarized by site at WIFL in 2009.

Site	No. of Stations	Observed No. of Species	Est. Species Richness $\pm$ SD
1	11	9	12.7 $\pm$ 2.7
2	8	4	4.9 $\pm$ 0.9
3	12	5	5.0

Appendix 3: Coordinates for nekton station locations at WIFL in 2009

Table 1. Coordinates for nekton station locations sampled at WIFL site 1 in 2009, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
WF1P5_86_2009	Pool/Panne	683777	4514447
WF1P6_124_2009	Pool/Panne	683783	4514452
WF1P7_280_2009	Pool/Panne	683723	4514451
WF1D3_2009	Unobstructed Ditch	683857	4514357
WF1D4_2009	Unobstructed Ditch	683873	4514331
WF1D5_2009	Unobstructed Ditch	683923	4514253
WF1D7_2009	Unobstructed Ditch	683940	4514227
WF1D8_2009	Unobstructed Ditch	683907	4514279
WF1D26_2009	Unobstructed Ditch	683890	4514305
WF1D13_2009	Obstructed Ditch	683776	4514356
WF1D25_2009	Obstructed Ditch	683749	4514358

Table 2. Coordinates for nekton station locations sampled at WIFL site 2 in 2009, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
WF2D10_2009	Unobstructed Ditch	684223	4514791
WF2D11_2009	Unobstructed Ditch	684260	4514605
WF2D13_2009	Unobstructed Ditch	684258	4514725
WF2D20_2009	Unobstructed Ditch	684268	4514769
WF2D22_2009	Unobstructed Ditch	684301	4514629
WF2D23_2009	Unobstructed Ditch	684307	4514643
WF2D24_2009	Unobstructed Ditch	684284	4514664
WF2D6_2009	Obstructed Ditch	684261	4514685

Table 3. Coordinates for nekton station locations sampled at WIFL site 3 in 2009, UTM, Zone 18, NAD 83, meters.

Station ID	Habitat	UTM X (east)	UTM Y (north)
WF3P8_81_2009	Pool/Panne	683950	4514621
WF3P9_200_2009	Pool/Panne	683961	4514602
WF3P10_120_2009	Pool/Panne	683987	4514514
WF3P11_281_2009	Pool/Panne	683971	4514518
WF3D1_2009	Unobstructed Ditch	683960	4514575
WF3D10_2009	Unobstructed Ditch	684078	4514462
WF3D13_2009	Unobstructed Ditch	684097	4514507
WF3D18_2009	Unobstructed Ditch	684099	4514484
WF3D29_2009	Unobstructed Ditch	684052	4514549
WF3D14_2009	Obstructed Ditch	683987	4514538
WF3D15_2009	Obstructed Ditch	683934	4514550
WF3D19_2009	Obstructed Ditch	683864	4514562

Appendix 4: Coordinates for vegetation plot locations at WIFL in 2009

Table 1. Coordinates for vegetation plot locations sampled WIFL site 1 in 2009, UTM, Zone 18, NAD 83, meters. ‘**’ indicates that invasive or exotic species is present at that sample plot location. ‘+’ indicates a species listed as exploitably vulnerable by New York state is present at that sample plot location.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
* FIIS_WF1_WF1V109_2009	683790.2874	4514397.244	* FIIS_WF1_WF1V3009_2009	683772.3125	4514352.673
* FIIS_WF1_WF1V209_2009	683729.5476	4514383.548	FIIS_WF1_WF1V3109_2009	683739.7104	4514354.261
FIIS_WF1_WF1V309_2009	683737.7434	4514359.929	FIIS_WF1_WF1V3209_2009	683913.1313	4514231.993
FIIS_WF1_WF1V409_2009	683599.9688	4514378.367	* FIIS_WF1_WF1V3309_2009	683700.0428	4514468.574
FIIS_WF1_WF1V509_2009	683828.5829	4514381.381	FIIS_WF1_WF1V3409_2009	683714.6311	4514521.068
FIIS_WF1_WF1V609_2009	683685.2903	4514511.087	FIIS_WF1_WF1V3509_2009	683923.1942	4514202.671
* FIIS_WF1_WF1V709_2009	683726.5971	4514392.05	* FIIS_WF1_WF1V3609_2009	683705.6159	4514452.513
FIIS_WF1_WF1V809_2009	683620.2779	4514415.088	FIIS_WF1_WF1V3709_2009	683777.8959	4514433.166
FIIS_WF1_WF1V909_2009	683656.2402	4514406.015	* FIIS_WF1_WF1V3909_2009	683676.324	4514441.41
FIIS_WF1_WF1V1009_2009	683819.8738	4514406.938	* FIIS_WF1_WF1V4009_2009	683651.3116	4514420.182
FIIS_WF1_WF1V1109_2009	683672.6691	4514358.791	FIIS_WF1_WF1V4109_2009	683799.418	4514370.774
* FIIS_WF1_WF1V1209_2009	683694.4696	4514484.634	FIIS_WF1_WF1V4209_2009	683608.7416	4514352.832
FIIS_WF1_WF1V1309_2009	683670.8657	4514552.655	FIIS_WF1_WF1V4309_2009	683671.3548	4514362.569
* FIIS_WF1_WF1V1409_2009	683652.5752	4514510.439	FIIS_WF1_WF1V4409_2009	683716.9897	4514323.21
FIIS_WF1_WF1V1509_2009	683631.7896	4514382.035	FIIS_WF1_WF1V4509_2009	683777.1733	4514338.483
FIIS_WF1_WF1V1609_2009	683739.5832	4514448.223	* FIIS_WF1_WF1V4609_2009	683588.9216	4514410.522
* + FIIS_WF1_WF1V1709_2009	683656.4791	4514499.092	FIIS_WF1_WF1V4709_2009	683689.2243	4514499.75
FIIS_WF1_WF1V2009_2009	683724.958	4514396.774	FIIS_WF1_WF1V4809_2009	683900.7963	4514267.935
FIIS_WF1_WF1V2109_2009	683825.3573	4514390.847	FIIS_WF1_WF1V4909_2009	683868.2576	4514264.955
FIIS_WF1_WF1V2209_2009	683611.341	4514345.266	FIIS_WF1_WF1V5009_2009	683688.2408	4514502.584
+ FIIS_WF1_WF1V2309_2009	683705.9437	4514451.569	FIIS_WF1_WF1V5109_2009	683856.6455	4514299.031
* FIIS_WF1_WF1V2409_2009	683634.8827	4514467.406	FIIS_WF1_WF1V5309_2009	683832.1311	4514370.969
* + FIIS_WF1_WF1V2609_2009	683666.2389	4514470.724	FIIS_WF1_WF1V5409_2009	683660.1832	4514394.681
FIIS_WF1_WF1V2709_2009	683913	4514240	FIIS_WF1_WF1V5509_2009	683743.3166	4514343.869
* FIIS_WF1_WF1V2809_2009	683719.057	4514413.779	FIIS_WF1_WF1V5609_2009	683581.4719	4514337.33
FIIS_WF1_WF1V2909_2009	683848.5815	4514322.695			

Table 2. Coordinates for vegetation plot locations sampled WIFL site 2 in 2009, UTM, Zone 18, NAD 83, meters. ‘*’ indicates that invasive or exotic species is present at that sample plot location. ‘+’ indicates a species listed as exploitably vulnerable by New York state is present at that sample plot location.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
FIIS_WF2_WF2V109_2009	684286.6463	4514663.843	* FIIS_WF2_WF2V3309_2009	684186.7206	4514720.763
FIIS_WF2_WF2V209_2009	684202.3257	4514757.766	FIIS_WF2_WF2V3409_2009	684331.6384	4514660.487
FIIS_WF2_WF2V309_2009	684318.4174	4514599.893	FIIS_WF2_WF2V3509_2009	684152.1307	4514625.749
* FIIS_WF2_WF2V409_2009	684171.9131	4514775.089	FIIS_WF2_WF2V3609_2009	684165.4706	4514641.055
FIIS_WF2_WF2V509_2009	684315.1513	4514669.93	FIIS_WF2_WF2V3709_2009	684322.7811	4514551.404
FIIS_WF2_WF2V709_2009	684270.0288	4514695.775	FIIS_WF2_WF2V3809_2009	684260.2066	4514633.067
FIIS_WF2_WF2V809_2009	684230.5713	4514672.816	FIIS_WF2_WF2V3909_2009	684203.4416	4514779.997
+ FIIS_WF2_WF2V909_2009	684322.7615	4514597.418	FIIS_WF2_WF2V4109_2009	684365.1489	4514550.295
FIIS_WF2_WF2V1009_2009	684232.7733	4514694.531	FIIS_WF2_WF2V4209_2009	684277.583	4514623.164
FIIS_WF2_WF2V1309_2009	684314.0733	4514602.369	FIIS_WF2_WF2V4309_2009	684224.9062	4514721.62
FIIS_WF2_WF2V1409_2009	684265.3258	4514653.013	FIIS_WF2_WF2V4509_2009	684341.3545	4514678.577
FIIS_WF2_WF2V1609_2009	684359.1629	4514599.548	* FIIS_WF2_WF2V4609_2009	684217.9819	4514794.591
FIIS_WF2_WF2V1709_2009	684287.6425	4514731.839	FIIS_WF2_WF2V4709_2009	684209.6113	4514638.89
* FIIS_WF2_WF2V1809_2009	684140.7353	4514769.831	FIIS_WF2_WF2V4809_2009	684255.2749	4514773.185
FIIS_WF2_WF2V1909_2009	684316.6798	4514600.884	FIIS_WF2_WF2V4909_2009	684241.3933	4514712.177
FIIS_WF2_WF2V2109_2009	684247.0797	4514663.41	FIIS_WF2_WF2V5009_2009	684305.8715	4514721.413
FIIS_WF2_WF2V2209_2009	684275.7521	4514647.073	FIIS_WF2_WF2V5109_2009	684237.2955	4514760.634
+ FIIS_WF2_WF2V2409_2009	684387.7409	4514537.427	FIIS_WF2_WF2V5209_2009	684228.9292	4514650.892
FIIS_WF2_WF2V2509_2009	684303.2674	4514722.902	FIIS_WF2_WF2V5309_2009	684154.7376	4514624.264
+ FIIS_WF2_WF2V2709_2009	684380.1228	4514518.725	FIIS_WF2_WF2V5409_2009	684223.5141	4514630.971
FIIS_WF2_WF2V2809_2009	684303.1216	4514700.354	FIIS_WF2_WF2V5509_2009	684344.5014	4514539.026
FIIS_WF2_WF2V2909_2009	684156.4755	4514623.274	FIIS_WF2_WF2V5609_2009	684350.5831	4514535.56
FIIS_WF2_WF2V3009_2009	684214.4933	4514727.584	FIIS_WF2_WF2V5709_2009	684176.2936	4514726.703
FIIS_WF2_WF2V3109_2009	684265.6901	4514698.26			

Table 3. Coordinates for vegetation plot locations sampled WIFL site 3 in 2009, UTM, Zone 18, NAD 83, meters. ‘*’ indicates that invasive or exotic species is present at that sample plot location. ‘+’ indicates a species listed as exploitably vulnerable by New York state is present at that sample plot location.

Plot ID	UTM X (east)	UTM Y (north)	Plot ID	UTM X (east)	UTM Y (north)
FIIS_WF3_WF3V109_2009	684049.7155	4514514.78	FIIS_WF3_WF3V2909_2009	683832.7442	4514548.141
FIIS_WF3_WF3V209_2009	683802.0263	4514562.715	FIIS_WF3_WF3V3009_2009	684023.5084	4514527.197
FIIS_WF3_WF3V309_2009	683981.5114	4514500.76	FIIS_WF3_WF3V3109_2009	684033.768	4514568.594
FIIS_WF3_WF3V409_2009	684111.702	4514462.388	FIIS_WF3_WF3V3209_2009	684050.4332	4514444.858
FIIS_WF3_WF3V509_2009	683888.858	4514590.996	FIIS_WF3_WF3V3409_2009	684054.0471	4514443.143
FIIS_WF3_WF3V609_2009	684229.0751	4514360.1	FIIS_WF3_WF3V3509_2009	684066.8856	4514506.645
FIIS_WF3_WF3V709_2009	683981.5517	4514524.007	FIIS_WF3_WF3V3609_2009	683964.1865	4514601.57
FIIS_WF3_WF3V809_2009	683864.055	4514579.635	FIIS_WF3_WF3V3709_2009	684166.8351	4514436.285
FIIS_WF3_WF3V909_2009	683941.595	4514612.276	FIIS_WF3_WF3V3909_2009	684045.197	4514516.921
FIIS_WF3_WF3V1009_2009	684018.6014	4514553.018	FIIS_WF3_WF3V4009_2009	684239.2895	4514332.608
FIIS_WF3_WF3V1209_2009	684245.3375	4514352.385	FIIS_WF3_WF3V4109_2009	684053.8803	4514536.392
FIIS_WF3_WF3V1309_2009	684037.3826	4514566.881	FIIS_WF3_WF3V4209_2009	684012.664	4514532.335
FIIS_WF3_WF3V1409_2009	683984.2221	4514499.474	* FIIS_WF3_WF3V4309_2009	683893.7686	4514611.846
FIIS_WF3_WF3V1609_2009	683987.8365	4514497.761	FIIS_WF3_WF3V4409_2009	683856.2344	4514536.996
FIIS_WF3_WF3V1709_2009	684113.4344	4514438.211	FIIS_WF3_WF3V4509_2009	683787.5708	4514569.574
FIIS_WF3_WF3V1809_2009	684250.1376	4514327.477	FIIS_WF3_WF3V4609_2009	684267.9242	4514341.668
FIIS_WF3_WF3V1909_2009	684120.2036	4514481.382	FIIS_WF3_WF3V4709_2009	683989.168	4514543.468
* FIIS_WF3_WF3V2009_2009	684003.9473	4514582.726	FIIS_WF3_WF3V4809_2009	683943.5208	4514588.4
FIIS_WF3_WF3V2109_2009	684003.2435	4514513.737	FIIS_WF3_WF3V4909_2009	683871.5934	4514529.709
+ FIIS_WF3_WF3V2209_2009	684257.3696	4514324.057	FIIS_WF3_WF3V5009_2009	683955.3075	4514513.184
FIIS_WF3_WF3V2309_2009	684095.4332	4514470.09	FIIS_WF3_WF3V5109_2009	683931.8144	4514524.322
FIIS_WF3_WF3V2509_2009	684001.4358	4514514.593	FIIS_WF3_WF3V5209_2009	683936.3607	4514545.403
FIIS_WF3_WF3V2609_2009	683965.2469	4514508.471	* FIIS_WF3_WF3V5309_2009	683946.3027	4514540.695
FIIS_WF3_WF3V2709_2009	684070.1262	4514482.072	FIIS_WF3_WF3V5409_2009	684039.19	4514566.024
FIIS_WF3_WF3V2809_2009	684215.7855	4514343.723	* FIIS_WF3_WF3V5509_2009	683940.8798	4514543.263

