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

2011 Summary Report

Natural Resource Data Series NPS/NCBN/NRDS—2012/398

ON THE COVER
Salt marsh at Sagamore Hill National Historic Site.
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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Abstract

The Northeast Coastal and Barrier Network (NCBN) began monitoring salt marsh vegetation and nekton at Sagamore Hill National Historic Site (SAHI) in 2009. This report summarizes the second year of data collected during the summer of 2011. Monitoring will continue on a biennial basis.

Fifty vegetation plots were sampled on August 8, 2011. The percent cover of each vegetation species and non-vegetation cover type within each 1 m^2 plot was visually estimated using a revised Braun-Blanquet method. Eleven vegetation species and four non-vegetation cover types (bare ground, wrack & litter, trash, and water) were observed.

Fifteen nekton stations were established along Eel Creek in 2011. Each station was sampled using a 1m^2 aluminum throw trap. Nekton sampling occurred twice during the summer (July 7 and August 8). Four species of nekton (*Fundulus heteroclitus*, common mummichog; *Menidia menida*, Atlantic silverside; *Palaemonetes pugio*, daggerblade grass shrimp; and *Callinectes sapidus*, blue crab) were recorded. Examination of percent catch data indicates that *F. heteroclitus* (51%) and *P. pugio* (38%) account for approximately 89% of all nekton captured at SAHI in 2011.

Acknowledgments

We would like to thank our 2011 salt marsh field crew—Erica Brown, Casey Nolan, and Guthrie Bridge for battling the mosquitoes and slogging through the muck this summer.

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 will allow park managers to take steps in restoring or maintaining the ecological health of park resources.

The Northeast Coastal and Barrier Network (NCBN) consists of eight parks extending along the Northeast Atlantic Coast. Vital Signs chosen as part of the Network's monitoring plan include salt marsh vegetation communities, nekton communities, essential estuarine water quality parameters, and specific coastal geomorphologic features (Stevens et al. 2005). Detailed monitoring protocols have been developed and implemented in the eight parks. This annual report summarizes salt marsh vegetation and nekton community data collected at Sagamore Hill National Historic Site (SAHI), according to two protocols—*Monitoring Nekton in Salt Marshes: A Protocol for the National Park Service's Long-Term Monitoring Program, Northeast Coastal and Barrier Network* (James-Pirri et al. 2012) and *Monitoring Salt Marsh Vegetation: A Protocol for the National Park Service's Long-Term Monitoring Program, Northeast Coastal and Barrier Network* (James-Pirri et al. In Review).

Methods

Permanent Site Selection

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

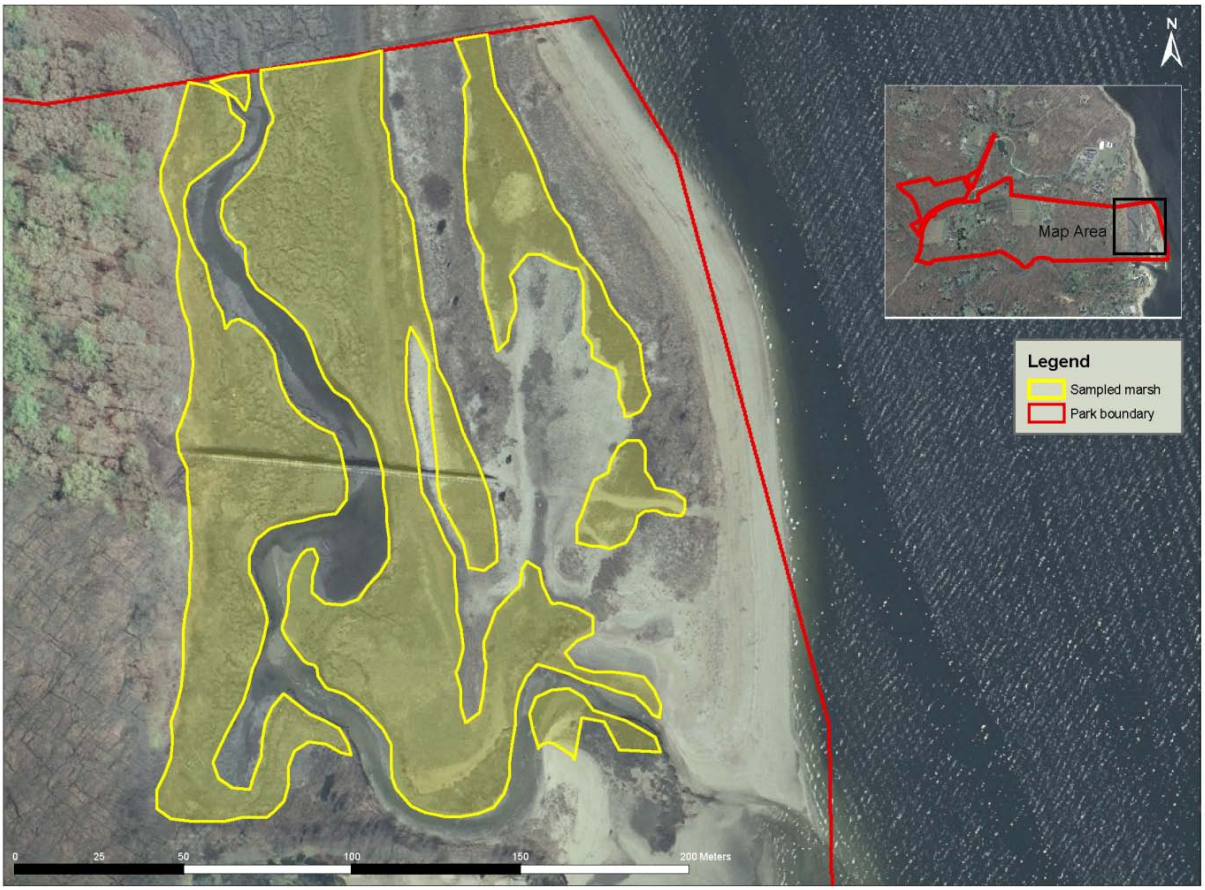

Figure 1. Aerial view and location of the permanent monitoring site (yellow shaded area) established by NCBN at Sagamore Hill National Historic Site (SAHI), New York in 2009. This site will be monitored biennially.

Nekton Sampling Station Selection and Data Collection

Nekton stations are re-randomized each sampling year using GIS. Fifteen nekton sampling stations were randomly located along Eel Creek. Each station was sampled once on July 7 and again on August 8, 2011. A list of all nekton stations and their respective Universal Transverse Mercator (UTM) coordinates is provided in Appendix A.

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

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

Vegetation Plot Selection and Data Collection

Vegetation sampling was conducted on August 8, 2011. Ten transects extending from creek bank to upland were systematically placed based on a single random start. Plots were located by treating the total length of all transects as a single transect and randomly selecting 50 points along this total length. This combination of systematic transects and replicate plots is necessary to ensure interspersion of the plots throughout the marsh study area, thus providing a representative sample of all salt marsh communities (*e.g.*, low marsh, high marsh).

For each plot, all vegetation species and non-vegetation cover types were recorded (Table 1), and the estimated percent cover was determined using a modified Braun-Blanquet cover scale (0: 0%; 1: <1%; 2: 1-5%; 3: 6-25%; 4: 26-50%; 5: 51-75%; 6: 76-100%), (Kent and Coker 1992).

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

Live vascular plants	Identified by species (herbaceous and shrubs).
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 error were all calculated using standard formulae. The same is true of the average values of the physical characteristics calculated for each habitat type during each visit. Details can be found in the Analysis and Reporting Standard Operating Procedure of James-Pirri et al. (2012).

Vegetation

Vegetation data were recorded using the modified Braun-Blanquet scale as described above (Kent and Coker 1992). For summary purposes, each Braun-Blanquet value was converted to the midpoint of the percent range it represented (Table 2) as described in Wikum and Shanholtzer (1978). A detailed description of the analyses and formulae are presented in the salt marsh vegetation protocol (James-Pirri et al. In Review).

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

BB Value	Percent Cover	Midpoint
0	0%	0%
1	< 1%	0.50%
2	1 - 5%	3%
3	6 - 25%	15.50%
4	26 - 50%	38%
5	51 - 75%	63%
6	76 - 100%	88%

Wikum and Shanholtzer (1978) outline a method for calculating an importance value for each species. So as not to confuse this value with ecological importance, we refer to it as a 'relative prevalence' value. Although Wikum and Shanholtzer (1978) present their importance value as a sum of the percent frequency and percent cover values, we have chosen to average these values so that relative prevalence is on a more readily interpretable percent scale. We present the relative percent prevalence for each species and non-vegetation cover type as the average of the relative percent cover and the relative percent frequency.

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

In addition to relative percent prevalence, we also report the average percent cover of each species and non-vegetation cover type for all plots combined. Because the relative percent prevalence incorporates both percent frequency and percent cover, it provides information about how a species is distributed (*i.e.*, its 'patchiness') throughout the salt marsh and may differ

substantially from the average percent cover for a given species. If any identified vegetation species in the sample plots are listed by the United States Department of Agriculture (USDA) or the state of New York as exotic, invasive, threatened, endangered, or rare, these species are noted in the vegetation data summary. Information about plants listed by each state as exotic, invasive, threatened, endangered, or rare is available online (USDA 2012). 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.

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

Results

Nekton

The average nekton density at SAHI in 2011 was approximately 46.9 ± 14.8 individuals per m^2 (Table 3). A total of four nekton species (Table 4) consisting of 2 fish, 1 decapod and 1 crab species were captured (Table 5). Common mummichog (*F. heteroclitus)* and Daggerblade grass shrimp (*P. pugio)* account for approximately 89% of all nekton captured in 2011 (Table 5). The average, maximum, and minimum lengths for each species observed in 2011 are presented in Table 6.

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

Vegetation

Eleven vegetation species and four non-vegetation cover types were recorded at SAHI in 2011 (Table 8). One of the vegetation species observed at SAHI in 2011, *Limonium carolinianum*, is listed by the State of New York as exploitably vulnerable (USDA 2012, Young 2008).

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.

Table 3. (a) Average density and standard error [individuals per 1 m^2 ± SE (total count)] of nekton captured at SAHI in 2011. (b) Number of nekton stations sampled at SAHI in 2011.

(a)

	Average Density [individuals per 1 m^2 ± SE (total count)]		
Habitat	**Event 1**	**Event 2**	**Events 1 & 2**
Tidal Creek	25.5 ± 7.3 (382)	68.3 ± 27.6 (1025)	46.9 ± 14.8 (1407)

(b)

	No. of Stations		
Habitat	**Event 1**	**Event 2**	**Events 1 & 2**
Tidal Creek	15	15	15

Table 4. Nekton species richness (No. of Species) summarized by sampling visit at SAHI in 2011.

Event	No. of Stations	No. of Species
1	15	3
2	15	4
1 & 2	15	4

Table 5. Nekton species and community composition (% catch) at SAHI in 2011. Data are shown for each visit separately and both visits combined. n = total number of nekton caught during that visit. '-' species or community was not present.

Life History Group *Species*	Common Name	Group/Species Composition (%)		
		Event 1 (n = 382)	Event 2 (n = 1025)	Events 1 & 2 (n = 1407)
Resident Fish		**70.7**	**44.2**	**51.4**
Fundulus heteroclitus	mummichog	70.7	44.2	51.4
Resident Shrimp		**2.6**	**51.0**	**37.9**
Palaemonetes pugio	daggerblade grass shrimp	2.6	51.0	37.9
Transient Crustacean		**-**	**0.1**	**0.1**
Callinectes sapidus	blue crab	-	0.1	0.1
Transient Fish		**26.7**	**4.7**	**10.7**
Menidia menidia	Atlantic silverside	26.7	4.7	10.7

Table 6. (a) Average length [mm ± SE (no. measured)] of nekton at SAHI in 2011. Length data for each species was summarized over all stations sampled during that event. (b) Minimum and maximum length (mm) of each nekton species at SAHI in 2011.

(a)

Life History Group *Species*	Common Name	Avg Length [mm ± SE (no. measured)]		
		Event 1	Event 2	Events 1 & 2
Resident Fish				
Fundulus heteroclitus	mummichog	17.8 ± 0.5 (135)	27.1 ± 0.5 (164)	22.9 ± 0.4 (299)
Resident Shrimp				
Palaemonetes pugio	daggerblade grass shrimp	36.0 ± 3.3 (10)	22.7 ± 0.5 (88)	24.0 ± 0.7 (98)
Transient Crustacean				
Callinectes sapidus	blue crab	-	14.0 (1)	14.0 (1)
Transient Fish				
Menidia menidia	Atlantic silverside	23.6 ± 0.6 (69)	30.7 ± 0.9 (46)	26.5 ± 0.6 (115)

(b)

Life History Group *Species*	Common Name	Event 1		Event 2		Events 1 & 2	
		Min	Max	Min	Max	Min	Max
Resident Fish							
Fundulus heteroclitus	mummichog	7	39	11	54	7	54
Resident Shrimp							
Palaemonetes pugio	daggerblade grass shrimp	10	45	14	41	10	45
Transient Crustacean							
Callinectes sapidus	blue crab	-	-	14	14	14	14
Transient Fish							
Menidia menidia	Atlantic silverside	11	40	21	49	11	49

Table 7. Average water temperature, depth, and salinity [Average ± SE (no. of stations)] at nekton sampling stations at SAHI in 2011. Data are summarized over all stations for each sampling visit.

	Average ± SE (no. of stations)	
	Event 1	Event 2
Temperature (˚C)	28.1 ± 1.0 (15)	29.4 ± 0.7 (15)
Depth (cm)	17.7 ± 1.3 (15)	18.9 ± 3.1 (15)
Salinity (ppt)	24.7 ± 0.6 (15)	22.1 ± 0.7 (15)

Table 8. Average percent cover (Average % Cover ± SE) and relative percent prevalence of each plant species and non-vegetation cover type at SAHI in 2011. Data were summarized over all 50 plots. Percent cover was estimated using the midpoint values of Braun-Blanquet percent ranges (Table 2). (NL) indicates standing non-living vegetation. '+' indicates a species listed as exploitably vulnerable in New York State (USDA 2012, Young 2008).

Cover Type **Salinity Tolerance** **Species**	**Common Name**	**Avg. Cover % ± SE**	**Frequency**	**Rel. % Cover**	**Rel. % Freq.**	**Rel. % Prevalence**
Vegetation		**66.5 ± 5.4**	**44**	**67.6**	**63.6**	**65.6**
High Salinity Tolerance		**66.2 ± 5.5**	**44**	**67.2**	**61.5**	**64.3**
Spartina alterniflora	saltmarsh cordgrass	36 ± 5.8	26	36.6	18.4	27.5
Spartina alterniflora (NL)	saltmarsh cordgrass (NL)	1.8 ± 1.8	2	1.8	1.4	1.6
Distichlis spicata	spikegrass	7.2 ± 2.4	12	7.3	8.5	7.9
Distichlis spicata (NL)	spikegrass (NL)	5.0 ± 1.7	10	5.0	7.1	6.0
Suaeda maritima	herbaceous seepweed	2.3 ± 1.1	7	2.4	5.0	3.7
Suaeda maritima (NL)	herbaceous seepweed (NL)	0.2 ± 0.1	3	0.2	2.1	1.2
Spartina patens	salt meadow cordgrass	3.0 ± 1.5	4	3.1	2.8	3.0
Spartina patens (NL)	salt meadow cordgrass (NL)	4.0 ± 2.1	4	4.1	2.8	3.4
Limonium carolinianum^{+}	sea lavender	1.1 ± 0.5	7	1.1	5.0	3.0
Solidago sempervirens	seaside goldenrod	1.1 ± 0.5	5	1.1	3.5	2.3
Iva frutescens	marsh elder	1.4 ± 1.3	3	1.4	2.1	1.8
Ulva lactuca	sea lettuce	1.8 ± 1.8	2	1.8	1.4	1.6
Ruppia maritima	widgeon grass	1.3 ± 1.3	1	1.3	0.7	1.0
Ammophila breviligulata	American beachgrass	0.1 ± 0.1	1	0.1	0.7	0.4
Medium Salinity Tolerance		**0.4 ± 0.3**	**3**	**0.4**	**2.1**	**1.2**
Atriplex cristata	crested saltbush	0.4 ± 0.3	3	0.4	2.1	1.2
Non-Vegetation		**25.6 ± 5.1**	**30**	**26.0**	**22.7**	**24.4**
bare ground	bare ground	14.2 ± 4.0	23	14.4	16.3	15.4
water	water	11.4 ± 4.1	9	11.6	6.4	9.0
Incidental Cover		**6.3 ± 2.2**	**18**	**6.4**	**13.5**	**9.9**
Wrack & litter	wrack & litter	6.2 ± 2.2	17	6.3	12.1	9.2
trash	garbage / trash	0.1 ± 0.1	2	0.1	1.4	0.8

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Appendix A. Coordinates for nekton stations at SAHI in 2011

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

Station ID	Habitat	UTM X (east)	UTM Y (north)
SAG1C_1_2011	Tidal Creek	627113	4527125
SAG1C_2_2011	Tidal Creek	627123	4527081
SAG1C_3_2011	Tidal Creek	627187	4527066
SAG1C_4_2011	Tidal Creek	627118	4527110
SAG1C_5_2011	Tidal Creek	627139	4527044
SAG1C_8_2011	Tidal Creek	627140	4527131
SAG1C_9_2011	Tidal Creek	627190	4527084
SAG1C_11_2011	Tidal Creek	627172	4527043
SAG1C_12_2011	Tidal Creek	627138	4527115
SAG1C_13_2011	Tidal Creek	627097	4527207
SAG1C_14_2011	Tidal Creek	627099	4527063
SAG1C_15_2011	Tidal Creek	627112	4527073
SAG1C_16_2011	Tidal Creek	627134	4527109
SAG1C_17_2011	Tidal Creek	627105	4527235
SAG1C_21_2011	Tidal Creek	627134	4527152

Appendix B: Coordinates for vegetation plots at SAHI in 2011

Table B-1. Coordinates for vegetation plots sampled at SAHI site in 2011, UTM, Zone 18, NAD 83, meters. '+' indicates a species listed as exploitably vulnerable by New York State (USDA 2012, Young 2008).

	Station ID	UTM X (east)	UTM Y (north)		Station ID	UTM X (east)	UTM Y (north)
+	S1V111_2011	627165	4527210		S1V3211_2011	627177	4527071
	S1V1011_2011	627121	4527090	+	S1V3311_2011	627154	4527048
	S1V1111_2011	627186	4527071		S1V3411_2011	627134	4527187
+	S1V1211_2011	627187	4527212		S1V3511_2011	627205	4527142
	S1V1311_2011	627193	4527071		S1V3611-2011	627125	4527186
	S1V1411_2011	627083	4527232		S1V3711_2011	627099	4527093
	S1V1511_2011	627106	4527069		S1V3811_2011	627096	4527208
	S1V1611_2011	627110	4527069		S1V3911_2011	627213	4527075
	S1V1711_2011	627080	4527161		S1V411_2011	627105	4527254
	S1V1811_2011	627080	4527208		S1V4011_2011	627078	4527140
	S1V1911_2011	627088	4527136		S1V4111_2011	627192	4527073
	S1V211_2011	627115	4527254		S1V4211_2011	627127	4527233
	S1V2011_2011	627095	4527208		S1V4311_2011	627141	4527216
	S1V2111_2011	627127	4527162		S1V4411_2011	627098	4527184
	S1V2211_2011	627205	4527190	+	S1V4511_2011	627183	4527213
	S1V2311_2011	627086	4527158	+	S1V4611_2011	627168	4527211
	S1V2411_2011	627169	4527096		S1V4711_2011	627164	4527186
	S1V2511_2011	627173	4527185	+	S1V4811_2011	627153	4527118
	S1V2611_2011	627137	4527215		S1V4911_2011	627140	4527091
	S1V2711_2011	627170	4527234		S1V511_2011	627136	4527071
	S1V2811_2011	627114	4527207		S1V5011_2011	627151	4527094
	S1V2911_2011	627102	4527141		S1V611_2011	627113	4527141
	S1V311_2011	627105	4527046		S1V711_2011	627159	4527160
	S1V3011_2011	627070	4527047		S1V811_2011	627128	4527233
+	S1V3111_2011	627175	4527212		S1V911_2011	627145	4527093