



Breeding Bird Surveys for Gateway National Recreation Area

Natural Resource Technical Report NPS/NCBN/NRTR—2013/739



ON THE COVER

The most abundant species in our study, Red-winged Blackbird (*Agelaius phoeniceus*), at Gateway National Recreation Area.
Photograph by Steve Mattan

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Natural Resource Technical Report NPS/NCBN/NRTR—2013/739

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Executive Summary

Gateway National Recreation Area (GATE) is 26,645 acres of coastal uplands, freshwater ponds, marshes, bays and mudflats that include Sandy Hook, New Jersey; parts of the south shore of Staten Island, New York; and most of Jamaica Bay, New York; including the adjacent Rockaway Peninsula. The rich food resources found throughout the diversity of habitats within the park make it regionally important for a wide variety of avian species. The extensive salt marsh and upland islands in Jamaica Bay provide nesting habitats for gulls, terns, waterfowl, herons, rails, and several passerine species, much of this within park boundaries, while upland sites in the park provide nesting habitat for passerine species. Breezy Point at the western tip of the Rockaway peninsula, consists predominantly of dune/beach shoreline habitat, but also includes a central marsh area surrounded by scrub shrub that provides cover for birds. This area supports some of the highest concentrations of beach-nesting birds in the New York/ New Jersey Bight coastal region, including Piping Plovers (*Charadrius melodus*) and gulls and terns. Floyd Bennett Field is a historic civic aviation facility dominated by human-made structures and runways but with extensive areas of open space between the runways, including a grassland area restored and maintained by the National Park Service that supports grassland bird populations (Elbin and Koontz 1998), as well as scrub/shrub habitats whose bird use is not as well known.

Sandy Hook is the only undeveloped barrier beach area at the northern end of the New Jersey coastline and includes wetlands, uplands, and near shore waters of the adjacent Raritan and Sandy Hook Bays that are critical for migratory species. A maritime holly forest is also found here. Finally, not much is known about the avifauna of the natural areas that are within GATE on Staten Island. These include shallow estuarine open water habitats, sandy beach, maritime forest, salt marsh, mudflats, and riparian forest.

We conducted baseline studies to determine abundance and distribution patterns of passerines and secretive marsh birds during the breeding season, determine patterns of species diversity within particular species groups, and investigate habitat and site differences that underlie avian abundance, distribution, and diversity patterns. Using point count methodology, 205 points were surveyed parkwide. Using a sub-set of these points, we surveyed for secretive marsh birds using taped calls at 53 points with available habitat, 32 in Jamaica Bay Wildlife Refuge, 10 in Staten Island and 11 in Sandy Hook.

A total of 14,094 individual birds of 111 species were counted in the Gateway National Recreation area during the surveys. Of these, ten species are State Endangered, Threatened or Special Concern, including Black Skimmer (*Rynchops niger*, E, NJ), Black-crowned Night-Heron (*Nycticorax nycticorax*, T, NJ), Common Tern (*Sterna hirundo*, T, NY), Least Bittern (*Ixobrychus exilis*, T, NY), Least Tern (*Sterna antillarum*, E, NJ; T, NY), Northern Harrier (*Circus cyaneus*, E, NY/NJ), Osprey (*Pandion haliaetus*, T, NJ), Peregrine Falcon (*Falco peregrinus*, T, NY; E, NJ), Red Knot (*Calidris canutus*, T, NJ), and Yellow-crowned Night-Heron (*Nyctanassa violacea*, T, NJ).

The most frequently observed species in the entire survey area was the Red-winged Blackbird (*Agelaius phoeniceus*), seen at 89% of the points, followed by the Common Yellowthroat (*Geothlypis trichas*) and Gray Catbird (*Dumetella carolinensis*), seen at 73% and 71% of the points respectively. Eastern Towhee (*Pipilo erythrophthalmus*), Yellow Warbler (*Dendroica*

petechia), Song Sparrow (*Melospiza melodia*), and American Robin (*Turdus migratorius*) were all seen at greater than 50% of the points.

Clapper Rail (*Rallus longirostris*) was the only secretive marsh bird species recorded during the callback surveys. They were encountered at 53 % of the 53 points surveyed. Rails were seen at 20 points (38%) during the pre-callback survey period and responded to callbacks at 23 points (43%). Clapper Rails were seen at only two points at Sandy Hook, one individual during the first survey and two during the second survey. The rest of the sightings were from surveys at Jamaica Bay. A total of 100 Clapper Rails were reported in the callback survey, 59 during the passive listening period and 41 during callbacks.

Red-winged Blackbird and Gray Catbird were the species with the highest breeding densities across the entire survey area followed by Common Yellowthroat. For these three species there were no differences in densities among sites. Eastern Towhee occurred at significantly higher densities at Sandy Hook than at all other sites while American Robin occurred at significantly lower densities at Jamaica Bay.

The majority of bird sightings at Jamaica Bay, Breezy Point, and Floyd Bennett Field, where habitat was recorded, were made in scrub/shrub habitats. The largest number of species was also seen at scrub/shrub habitats at all three sites for which habitat was recorded. This pattern persists when looking at only the passerine bird species. However, these results may simply be the result of existing habitat at Gateway National Recreation Areas, and we do not know how the bird distribution relates to the habitat availability at the surveyed points.

Finally, we created maps for individual species to illustrate ways in which the data can be presented. This can be important for habitat management purposes as areas slated for habitat alteration can be compared to those sites that support high densities of species of interest.

Introduction

Gateway National Recreation Area (GATE) consists of 26,645 acres of coastal uplands, freshwater ponds, marshes, bays and mudflats. Established in 1972, this National Park Service natural area is divided into three geographically separate units that constitute some of the largest and most significant natural areas remaining in the metropolitan NY/NJ Harbor area (Fabre 2003). They include the Jamaica Bay/Breezy Point Unit (Riis Park, Fort Tilden, Breezy Point Tip, Floyd Bennett Field, Plumb Beach, north shore of Jamaica Bay and the 9,155 acre Jamaica Bay Wildlife Refuge), the Staten Island Unit (Great Kills Park, Miller Field, Fort Wadsworth, and adjacent islands) and the Sandy Hook Unit (Fabre 2003). Sandy Hook is in New Jersey, but all other units are located within NY City, specifically within the boroughs of Staten Island, Brooklyn, and Queens.

The rich food resources found throughout the diversity of habitats within the park make it regionally important for a wide variety of avian species. The largest area within the GATE is Jamaica Bay Wildlife Refuge, where extensive salt marsh and upland islands provide nesting habitats for gulls, terns, waterfowl, herons, rails, and several passerine species. Upland sites provide nesting habitat for passerine species. Breezy Point is at the western tip of the Rockaway peninsula and consists predominantly of dune/beach shoreline habitat, but also includes a central marsh area surrounded by scrub shrub that provides cover for migrating and breeding birds. Breezy Point supports some of the highest concentrations of beach-nesting birds in New York New Jersey Bight coastal region, including the federally endangered Piping Plover (*Charadrius melodus*), NY state threatened Least Tern (*Sterna antillarum*), Black Skimmer (*Rhynchops niger*), as well as other gulls and terns (USFWS 1997).

Floyd Bennett Field is a historic civic aviation facility dominated by human-made structures and runways but with extensive areas of open space between the runways, including a grassland area restored and maintained by the National Park Service that support grassland bird populations (Elbin and Koontz 1998), as well as scrub/shrub habitats whose bird use is not as well known.

The Staten Island Unit supports an unusual diversity of habitat types that include shallow estuarine open waters, sandy beach, maritime forest, salt marsh, mudflats, and riparian forest. These habitats provide nesting opportunities to a wide variety of avian species not found in other parts of the park. However, a checklist of birds for the Staten Island Unit does not appear to exist, and bird surveys in Staten Island are typically across the entire borough, including large areas outside the park limits and not specific to the NPS site (Mizrahi 2004).

Sandy Hook is the only undeveloped barrier beach area at the northern end of the New Jersey coastline. The wetlands, uplands, and near shore waters of the adjacent Raritan and Sandy Hook Bays are critical for migratory species. Maritime holly forests, which occur at only a few other locations in the region are important roosting and nesting locations for a variety of birds, such as Great Blue Heron (*Ardea herodias*), Black-crowned Night Heron (*Nycticorax nycticorax*), Osprey (*Pandion haliaetus*), and several passerine species (Fabre 2003).

A recent review of literature pertinent to avian resources in the park suggests that the abundance and distribution of several species groups are not well understood (Mizrahi 2004). For example, solitary nesting waterbird species, like rails and bitterns, have received very little inventory and

monitoring attention at Gateway. Many are secretive and enigmatic, nesting and foraging in dense stands of marsh grass (e.g., *Spartina sp.*). This makes them difficult to detect by most observers during Breeding Bird Atlases and Breeding Bird Surveys. Consequently, patterns of distribution and abundance are poorly understood, and thus, there is a need for more thorough information. Several solitary-nesting waterbird species known to breed at Gateway, such as Pied-billed Grebe (*Podilymbus podiceps*), Clapper Rail (*Rallus longirostris*), American Bittern (*Limosa haemastica*), and Least Bittern (*Ixobrychus exilis*) are considered conservation priorities (Dettmers and Rosenberg 2000, Watts 1999).

Similarly, a review of NatureBib resources revealed five references for passerines or near-passerines (e.g., hummingbirds, woodpeckers) for Gateway. An additional 11 citations were identified by Fabre (2003) as relevant to land birds/passerines use of the park. Most of these reports represent general inventories of various intensity (e.g. checklists *versus* systematic surveys). Seven of these are more than 25 years old, and the others are all at least 10 years old (Mizrahi 2004).

Clearly, a need to conduct baseline abundance and distribution studies, and develop focused monitoring programs for breeding land bird populations at GATE exists. In the appropriate habitats, information on several state-listed species, and high priority species could be obtained. For example, Seaside Sparrow (*Ammodramus maritimus*), Saltmarsh Sharp-tailed Sparrow (*A. caudacutus*), and Prairie Warbler (*Dendroica discolor*) are identified as high continental concern, high regional responsibility species in the mid-Atlantic and New England coastal plains (Dettmers and Rosenberg 2000, Watts 1999), and are known to nest in GATE. Other species known to breed at GATE, like Brown Thrasher (*Toxostoma rufum*), Eastern Towhee (*Pipilo erythrophthalmus*), and Field Sparrow (*Spizella pusilla*), are also listed as "priority" species (Dettmers and Rosenberg 2000, Watts 1999).

Goals and Objectives

The goal of this project is to develop baseline inventory data on the abundance and distribution of several avian species breeding in Gateway National Recreation Area. Specifically, our objectives are to (1) determine abundance and distribution patterns of passerines and secretive marsh birds during the breeding season, (2) determine patterns of species diversity within particular species groups, and (3) investigate habitat and site differences that underlie avian abundance, distribution, and diversity patterns.

Methods

Data Collection

We followed avian survey protocols outlined in standard wildlife inventory and monitoring procedure guidelines for birds (Ralph et al. 1995). Avian surveys were conducted from point locations approximately every two weeks during migration and the breeding season, and once per month during the non-breeding season. We also conducted "callback" surveys designed to detect the presence of secretive marsh species (e.g., rails, bitterns), which followed standard protocols describe by Conway (2007).

Site and Survey Point Selection

A consequence of its location within the greater New York City metropolitan area, Gateway National Recreation Area is a mosaic of several types of habitats, both natural and disturbed. We used a Geographic Information System (GIS) and the most current land use/land cover data available to identify representative habitat types within each park unit. Even though Jamaica Bay Wildlife Refuge, Breezy Point, and Floyd Bennett Field are all part of the Jamaica Bay Unit they are separated from each other and each has its own character. Therefore, we explored avian abundance patterns in each of these areas separately. Note that land use/land cover data provided by the National Park Service for preparation of this report is from 1976, so may not accurately reflect current conditions throughout the park.

We chose the following 5 study sites so that our surveys could be done within homogeneous areas: Breezy Point--Includes Breezy Point Tip, West Beach, and Fort Tilden (see map in Appendix 4). Floyd Bennett--Includes Floyd Bennett Field, Plumb Beach, and the North Shore of Jamaica Bay (Appendix 3). Jamaica Bay--Includes the saltmarsh islands and Rulers Bar Hassock, all of which are within Jamaica Bay Wildlife Refuge (Appendix 5). Sandy Hook--Includes the entire peninsula, from the northern tip to Plum Island at the south end (Appendix 1). Staten Island--Includes Great Kills Park, Miller Field, Fort Wadsworth, Hoffman Island, and Swinburne Island (Appendix 2). The above-mentioned 5 study-site names are used throughout this paper, and include all the traditional place names (e.g. DSC 1979) that are described above.

For each park unit we used a GIS to generate a grid of survey points 300 m apart and also were at least 25 meters from adjacent non-contiguous habitats to avoid possible edge effects caused by ecotones. Specifically, we used Animal Movement, Version 2 (Hooge and Eichenlaub 1997), a software program that can generate a series of random survey points for individual polygons (i.e., site) and latitude/longitude coordinates for each point (see Table 1). The 300m distance between points is slightly greater than the recommended distance (i.e., 250 m) needed to avoid duplicate counting of individuals (Ralph et al. 1995). We decided to use 300 m to avoid duplicate counting of secretive marsh birds (e.g., rail species, bitterns, etc.) during tape call playback surveys (see *Survey Methods* below).

We generated over 300 survey point locations. Initial random points were field verified to determine accessibility. For various reasons, particularly on marsh sites, a number of points were inaccessible (e.g., impenetrable vegetation, no road access, no boat access). When possible, inaccessible points were moved to the closest accessible locations within the same tract following suggested minimum distance criteria (Ralph et al. 1995). Some points were mapped where there was no appropriate habitat (for example, the points were located on the beach or in a

developed area) and these points were eliminated. Additional points were eliminated at Breezy Point and Jamaica Bay because they were located in the midst of the gull and tern colonies and could not be surveyed effectively. Finally, for many locations such as Canarsie Pol, Ruffle Bar, Little Egg Marsh, and Jo Co Marsh in Jamaica Bay Wildlife Refuge, the only access or the only way to conduct surveys was by boat, or by accessing locations by boat. Some of these points were submerged during high tide and they were also eliminated.

Table 1. Location and coordinates of all points surveyed in the Gateway National Recreation Area.

Site	Point	UTM Zone 18N		Decimal degrees		Comment
		X	Y	Longitude	Latitude	
Sandy Hook	SH02	583422.991	4480953.854	-74.0158	40.4751	
Sandy Hook	SH03	583723.150	4480953.633	-74.0123	40.4750	
Sandy Hook	SH04B	584038.303	4480914.288	-74.0086	40.4747	Secretive Marshbird Survey
Sandy Hook	SH05B	583478.681	4480568.568	-74.0152	40.4716	Secretive Marshbird Survey
Sandy Hook	SH06B	583710.440	4480667.038	-74.0125	40.4725	Secretive Marshbird Survey
Sandy Hook	SH07	584023.505	4480652.681	-74.0088	40.4723	
Sandy Hook	SH08	584323.670	4480653.081	-74.0053	40.4723	
Sandy Hook	SH09B	584632.442	4480656.567	-74.0016	40.4723	Secretive Marshbird Survey
Sandy Hook	SH11B	583731.560	4480364.743	-74.0123	40.4697	
Sandy Hook	SH12	584323.408	4480353.523	-74.0053	40.4696	
Sandy Hook	SH13B	584644.979	4480352.389	-74.0015	40.4695	
Sandy Hook	SH14	584923.083	4480053.603	-73.9983	40.4668	
Sandy Hook	SH15	584623.551	4479753.632	-74.0018	40.4641	
Sandy Hook	SH16	584922.843	4479754.045	-73.9983	40.4641	Secretive Marshbird Survey
Sandy Hook	SH17B	584940.844	4479450.526	-73.9981	40.4614	
Sandy Hook	SH18	585223.065	4479153.583	-73.9949	40.4587	
Sandy Hook	SH19B	584539.963	4478858.194	-74.0029	40.4561	Secretive Marshbird Survey
Sandy Hook	SH20B	584915.979	4478995.850	-73.9985	40.4573	
Sandy Hook	SH22	585523.537	4478853.881	-73.9913	40.4560	
Sandy Hook	SH23	584623.470	4478553.627	-74.0020	40.4533	
Sandy Hook	SH25B	585365.030	4478591.822	-73.9933	40.4536	
Sandy Hook	SH26B	585523.597	4478569.810	-73.9914	40.4534	
Sandy Hook	SH27B	585786.937	4478535.900	-73.9883	40.4531	
Sandy Hook	SH28B	584604.447	4478224.082	-74.0023	40.4504	Secretive Marshbird Survey
Sandy Hook	SH29	584923.044	4478252.700	-73.9985	40.4506	
Sandy Hook	SH30	585223.307	4478253.134	-73.9950	40.4506	
Sandy Hook	SH31	585523.576	4478252.984	-73.9914	40.4505	
Sandy Hook	SH32	585823.847	4478253.442	-73.9879	40.4505	
Sandy Hook	SH33B	586034.192	4478159.975	-73.9854	40.4496	
Sandy Hook	SH34B	584898.710	4478031.480	-73.9988	40.4486	Secretive Marshbird Survey
Sandy Hook	SH35	585223.083	4477952.981	-73.9950	40.4479	

Table 1. Location and coordinates of all points surveyed in the Gateway National Recreation Area (continued).

Site	Point	UTM Zone 18N		Decimal degrees		Comment
		X	Y	Longitude	Latitude	
Sandy Hook	SH36B	585463.155	4477886.635	-73.9922	40.4472	
Sandy Hook	SH37	585823.640	4477953.289	-73.9879	40.4478	
Sandy Hook	SH38	586123.006	4477953.748	-73.9844	40.4478	
Sandy Hook	SH39	585523.595	4477653.875	-73.9915	40.4451	
Sandy Hook	SH40B	585815.713	4477652.452	-73.9881	40.4451	
Sandy Hook	SH41	586123.273	4477653.601	-73.9844	40.4451	
Sandy Hook	SH42	585523.382	4477353.722	-73.9916	40.4424	
Sandy Hook	SH43B	585903.002	4477301.490	-73.9871	40.4419	
Sandy Hook	SH44	586123.091	4477352.851	-73.9845	40.4424	
Sandy Hook	SH45	585523.631	4477052.979	-73.9916	40.4397	
Sandy Hook	SH45B	585563.328	4477083.209	-73.9911	40.4400	
Sandy Hook	SH46B	586019.410	4477030.666	-73.9857	40.4395	
Sandy Hook	SH48B	585517.530	4476750.378	-73.9917	40.4370	
Sandy Hook	SH49	585823.286	4476753.278	-73.9881	40.4370	
Sandy Hook	SH50	586123.155	4476753.742	-73.9846	40.4370	
Sandy Hook	SH51B	585532.833	4476446.234	-73.9916	40.4343	
Sandy Hook	SH52B	585462.287	4476048.207	-73.9924	40.4307	Secretive Marshbird Survey
Sandy Hook	SH53B	585831.906	4476159.629	-73.9881	40.4317	
Sandy Hook	SH54B	586122.850	4476146.887	-73.9846	40.4315	
Sandy Hook	SH54C	586101.559	4476138.306	-73.9849	40.4314	
Sandy Hook	SH55	585823.133	4475852.827	-73.9882	40.4289	
Sandy Hook	SH56	586123.757	4475553.148	-73.9847	40.4262	
Sandy Hook	SH57B	585367.396	4475029.954	-73.9937	40.4215	
Sandy Hook	SH58B	585368.825	4474824.510	-73.9937	40.4197	
Sandy Hook	SH59	586134.832	4474945.830	-73.9847	40.4207	Secretive Marshbird Survey
Sandy Hook	SH60B	586098.542	4474657.769	-73.9851	40.4181	
Sandy Hook	SH61	586423.309	4473453.166	-73.9815	40.4072	Secretive Marshbird Survey
Sandy Hook	SH62	586722.862	4473453.051	-73.9779	40.4072	
Sandy Hook	SH63B	586689.550	4473144.775	-73.9784	40.4044	
Staten Island	NYS01B	579866.835	4495455.021	-74.0560	40.6061	
Staten Island	NYS02B	579854.916	4495169.630	-74.0561	40.6035	
Staten Island	NYS03	579897.730	4494902.095	-74.0557	40.6011	
Staten Island	NYS04B	579533.439	4494627.226	-74.0600	40.5986	
Staten Island	NYS14B	575809.670	4491692.327	-74.1044	40.5725	
Staten Island	NYS15B	576884.585	4491029.193	-74.0917	40.5665	
Staten Island	NYS23	573898.431	4489801.403	-74.1272	40.5557	
Staten Island	NYS29	573597.964	4489501.862	-74.1307	40.5530	

Table 1. Location and coordinates of all points surveyed in the Gateway National Recreation Area (continued).

Site	Point	UTM Zone 18N		Decimal degrees		Comment
		X	Y	Longitude	Latitude	
Staten Island	NYS31	574198.479	4489501.259	-74.1237	40.5530	
Staten Island	NYS35B	573599.250	4489233.293	-74.1308	40.5506	Secretive Marshbird Survey
Staten Island	NYS36B	573898.689	4489179.083	-74.1272	40.5501	Secretive Marshbird Survey
Staten Island	NYS37	574198.284	4489201.112	-74.1237	40.5502	Secretive Marshbird Survey
Staten Island	NYS38B	574531.370	4489235.399	-74.1198	40.5505	Secretive Marshbird Survey
Staten Island	NYS40B	573047.557	4488931.301	-74.1373	40.5479	
Staten Island	NYS41B	573284.244	4488884.194	-74.1345	40.5475	Secretive Marshbird Survey
Staten Island	NYS42B	573610.369	4488935.046	-74.1307	40.5479	Secretive Marshbird Survey
Staten Island	NYS43B	574049.351	4488965.591	-74.1255	40.5481	Secretive Marshbird Survey
Staten Island	NYS44B	574192.183	4488900.907	-74.1238	40.5475	
Staten Island	NYS45B	574413.891	4488898.946	-74.1212	40.5475	Secretive Marshbird Survey
Staten Island	NYS46B	574788.343	4488931.871	-74.1168	40.5478	Secretive Marshbird Survey
Staten Island	NYS47	573898.504	4488601.422	-74.1273	40.5449	
Staten Island	NYS48B	574502.681	4488650.903	-74.1202	40.5453	Secretive Marshbird Survey
Staten Island	NYS49	573897.842	4488301.273	-74.1273	40.5422	
Staten Island	NYS51	573898.536	4488001.731	-74.1274	40.5395	
Staten Island	NYS52	572998.015	4487400.922	-74.1381	40.5341	
Staten Island	NYS53B	573333.897	4487390.517	-74.1341	40.5340	
Staten Island	NYS54	572998.218	4487101.378	-74.1381	40.5314	
Staten Island	NYS55	573298.108	4487101.933	-74.1346	40.5314	
Staten Island	NYS60	580081.818	4492471.290	-74.0538	40.5792	
Staten Island	NYS61	580410.328	4491019.925	-74.0501	40.5661	
Floyd Bennett	FBN-4	596587.337	4500977.610	-73.8575	40.6540	
Floyd Bennett	FBN-5	596887.337	4500977.610	-73.8540	40.6540	
Floyd Bennett	FBN-6	597187.337	4500977.610	-73.8504	40.6539	
Floyd Bennett	FBN-11	596887.337	4500677.610	-73.8540	40.6513	
Floyd Bennett	FBN-19	597187.337	4500377.610	-73.8506	40.6485	
Floyd Bennett	FBN-21	598087.337	4500377.610	-73.8399	40.6484	
Floyd Bennett	FBN-29	597187.337	4500077.610	-73.8506	40.6458	
Floyd Bennett	FBN-30	597487.337	4500077.610	-73.8470	40.6458	
Floyd Bennett	FBN-31	597787.337	4500077.610	-73.8435	40.6458	
Floyd Bennett	FBN-32	598087.337	4500077.610	-73.8399	40.6457	
Floyd Bennett	FBN-44	594487.337	4498577.610	-73.8827	40.6326	
Floyd Bennett	FBN-45	593887.337	4497977.610	-73.8899	40.6273	
Floyd Bennett	FBN-46	593587.337	4497677.610	-73.8935	40.6246	
Floyd Bennett	FBN-49	593587.337	4496177.610	-73.8937	40.6111	
Floyd Bennett	FBN-51	593587.337	4495877.610	-73.8937	40.6084	

Table 1. Location and coordinates of all points surveyed in the Gateway National Recreation Area (continued).

Site	Point	UTM Zone 18N		Decimal degrees		Comment
		X	Y	Longitude	Latitude	
Floyd Bennett	FBS-1	593841.074	4495347.161	-73.8908	40.6036	
Floyd Bennett	FBS-2	594141.074	4495347.161	-73.8873	40.6036	
Floyd Bennett	FBS-3	594441.074	4495347.161	-73.8837	40.6036	
Floyd Bennett	FBS-4	593241.074	4495047.161	-73.8980	40.6010	
Floyd Bennett	FBS-5	593541.074	4495047.161	-73.8944	40.6010	
Floyd Bennett	FBS-6	593841.074	4495047.161	-73.8909	40.6009	
Floyd Bennett	FBS-7	594141.074	4495047.161	-73.8873	40.6009	
Floyd Bennett	FBS-8	594441.074	4495047.161	-73.8838	40.6008	
Floyd Bennett	FBS-10	592941.074	4494747.161	-73.9016	40.5983	
Floyd Bennett	FBS-11	593241.074	4494747.161	-73.8980	40.5983	
Floyd Bennett	FBS-13	593841.074	4494747.161	-73.8909	40.5982	
Floyd Bennett	FBS-15	594441.074	4494747.161	-73.8838	40.5981	
Floyd Bennett	FBS-17	592941.074	4494447.161	-73.9016	40.5956	
Floyd Bennett	FBS-19	593541.074	4494447.161	-73.8945	40.5955	
Floyd Bennett	FBS-20	593841.074	4494447.161	-73.8910	40.5955	
Floyd Bennett	FBS-21	592641.074	4494147.161	-73.9052	40.5929	
Floyd Bennett	FBS-25	592641.074	4493547.161	-73.9053	40.5875	
Floyd Bennett	FBS-28	591741.074	4492947.161	-73.9160	40.5822	
Floyd Bennett	FBS-29	592041.074	4492947.161	-73.9124	40.5822	
Floyd Bennett	FBS-30	593541.074	4492947.161	-73.8947	40.5820	
Floyd Bennett	FBS-31	593541.074	4492647.161	-73.8948	40.5793	
Floyd Bennett	FBS-32	593841.074	4492647.161	-73.8912	40.5793	
Breezy Point	BP-11	592495.715	4490750.987	-73.9074	40.5624	
Breezy Point	BP-12	592795.715	4490750.987	-73.9039	40.5623	
Breezy Point	BP-13	593095.715	4490750.987	-73.9003	40.5623	
Breezy Point	BP-14	593395.715	4490750.987	-73.8968	40.5623	
Breezy Point	BP-15	593695.715	4490750.987	-73.8932	40.5622	
Breezy Point	BP-16	593995.715	4490750.987	-73.8897	40.5622	
Breezy Point	BP-17	594295.715	4490750.987	-73.8861	40.5622	
Breezy Point	BP-20	592495.715	4490450.987	-73.9074	40.5597	
Breezy Point	BP-22	593095.715	4490450.987	-73.9004	40.5596	
Breezy Point	BP-23	593395.715	4490450.987	-73.8968	40.5596	
Breezy Point	BP-24	593695.715	4490450.987	-73.8933	40.5595	
Breezy Point	BP-30	590095.715	4489850.987	-73.9359	40.5545	
Breezy Point	BP-35	590095.715	4489550.987	-73.9359	40.5518	
Breezy Point	BP-39	590095.715	4489250.987	-73.9360	40.5491	
Breezy Point	BP-40	590395.715	4489250.987	-73.9324	40.5491	

Table 1. Location and coordinates of all points surveyed in the Gateway National Recreation Area (continued).

Site	Point	UTM Zone 18N		Decimal degrees		Comment
		X	Y	Longitude	Latitude	
Breezy Point	BP-43	590095.715	4488950.987	-73.9360	40.5464	
Jamaica Bay	JB-3	599237.582	4498934.865	-73.8265	40.6353	
Jamaica Bay	JB-4	599537.582	4498934.865	-73.8229	40.6353	
Jamaica Bay	JB-5	598937.582	4498634.865	-73.8301	40.6326	
Jamaica Bay	JB-6	599237.582	4498634.865	-73.8265	40.6326	
Jamaica Bay	JB-7	598937.582	4498334.865	-73.8301	40.6299	
Jamaica Bay	JB-8	599237.582	4498334.865	-73.8266	40.6299	
Jamaica Bay	JB-11	599837.582	4498034.865	-73.8195	40.6271	Secretive Marshbird Survey
Jamaica Bay	JB-15	595637.582	4497734.865	-73.8692	40.6249	
Jamaica Bay	JB-19	599837.582	4497734.865	-73.8196	40.6244	Secretive Marshbird Survey
Jamaica Bay	JB-22	595037.582	4497434.865	-73.8764	40.6223	
Jamaica Bay	JB-23	595337.582	4497434.865	-73.8728	40.6223	
Jamaica Bay	JB-24	595637.582	4497434.865	-73.8693	40.6222	
Jamaica Bay	JB-27	598637.582	4497434.865	-73.8338	40.6219	Secretive Marshbird Survey
Jamaica Bay	JB-28	598937.582	4497434.865	-73.8303	40.6218	
Jamaica Bay	JB-29	599237.582	4497434.865	-73.8267	40.6218	Cr Bay Blvd; one survey attempted
Jamaica Bay	JB-30	599537.582	4497434.865	-73.8232	40.6218	
Jamaica Bay	JB-32	600137.582	4497434.865	-73.8161	40.6217	Secretive Marshbird Survey
Jamaica Bay	JB-34	601037.582	4497434.865	-73.8054	40.6216	Secretive Marshbird Survey
Jamaica Bay	JB-35	601937.582	4497434.865	-73.7948	40.6215	nesting birds; one survey attempted
Jamaica Bay	JB-39	595037.582	4497134.865	-73.8764	40.6196	nesting birds; one survey attempted
Jamaica Bay	JB-40	595337.582	4497134.865	-73.8729	40.6195	nesting birds; one survey attempted
Jamaica Bay	JB-41	595637.582	4497134.865	-73.8693	40.6195	nesting birds; one survey attempted
Jamaica Bay	JB-44	598637.582	4497134.865	-73.8339	40.6192	
Jamaica Bay	JB-45	599237.582	4497134.865	-73.8268	40.6191	
Jamaica Bay	JB-46	599537.582	4497134.865	-73.8232	40.6191	
Jamaica Bay	JB-47	601037.582	4497134.865	-73.8055	40.6189	Secretive Marshbird Survey
Jamaica Bay	JB-48	601337.582	4497134.865	-73.8020	40.6188	Secretive Marshbird Survey
Jamaica Bay	JB-52	595037.582	4496834.865	-73.8765	40.6169	nesting birds; one survey attempted
Jamaica Bay	JB-53	595337.582	4496834.865	-73.8729	40.6168	nesting birds; one survey attempted
Jamaica Bay	JB-54	599237.582	4496834.865	-73.8268	40.6164	
Jamaica Bay	JB-60	602537.582	4496834.865	-73.7878	40.6160	no access; one survey was attempted
Jamaica Bay	JB-62	599537.582	4496534.865	-73.8233	40.6137	
Jamaica Bay	JB-63	599837.582	4496534.865	-73.8198	40.6136	Secretive Marshbird Survey
Jamaica Bay	JB-64	600137.582	4496534.865	-73.8162	40.6136	Secretive Marshbird Survey
Jamaica Bay	JB-65	601637.582	4496534.865	-73.7985	40.6134	Secretive Marshbird Survey
Jamaica Bay	JB-67	602837.582	4496534.865	-73.7843	40.6132	Secretive Marshbird Survey

Table 1. Location and coordinates of all points surveyed in the Gateway National Recreation Area (continued).

Site	Point	UTM Zone 18N		Decimal degrees		Comment
		X	Y	Longitude	Latitude	
Jamaica Bay	JB-69	597137.582	4496234.865	-73.8517	40.6112	Secretive Marshbird Survey
Jamaica Bay	JB-70	597737.582	4496234.865	-73.8446	40.6112	Secretive Marshbird Survey
Jamaica Bay	JB-72	600137.582	4496234.865	-73.8163	40.6109	Secretive Marshbird Survey
Jamaica Bay	JB-73	601937.582	4496234.865	-73.7950	40.6107	Secretive Marshbird Survey
Jamaica Bay	JB-75	602537.582	4496234.865	-73.7879	40.6106	Secretive Marshbird Survey
Jamaica Bay	JB-76	596837.582	4495934.865	-73.8553	40.6086	Secretive Marshbird Survey
Jamaica Bay	JB-77	597137.582	4495934.865	-73.8518	40.6085	Secretive Marshbird Survey
Jamaica Bay	JB-78	597737.582	4495934.865	-73.8447	40.6085	Secretive Marshbird Survey
Jamaica Bay	JB-79	598637.582	4495934.865	-73.8341	40.6084	underwater
Jamaica Bay	JB-80	601337.582	4495934.865	-73.8021	40.6080	Secretive Marshbird Survey
Jamaica Bay	JB-81	601637.582	4495934.865	-73.7986	40.6080	Secretive Marshbird Survey
Jamaica Bay	JB-84	597737.582	4495634.865	-73.8447	40.6058	Secretive Marshbird Survey
Jamaica Bay	JB-85	598037.582	4495634.865	-73.8412	40.6057	Secretive Marshbird Survey
Jamaica Bay	JB-86	598637.582	4495634.865	-73.8341	40.6057	underwater
Jamaica Bay	JB-87	601337.582	4495634.865	-73.8022	40.6053	Secretive Marshbird Survey
Jamaica Bay	JB-88	601637.582	4495634.865	-73.7986	40.6053	Secretive Marshbird Survey
Jamaica Bay	JB-91	596237.582	4495034.865	-73.8626	40.6005	
Jamaica Bay	JB-92	596537.582	4495034.865	-73.8590	40.6005	nesting birds; one survey attempted
Jamaica Bay	JB-93	596837.582	4495034.865	-73.8555	40.6005	nesting birds; one survey attempted
Jamaica Bay	JB-94	600437.582	4495034.865	-73.8129	40.6000	nesting birds; one survey attempted
Jamaica Bay	JB-96	596537.582	4494734.865	-73.8591	40.5978	
Jamaica Bay	JB-97	596837.582	4494734.865	-73.8555	40.5978	Secretive Marshbird Survey
Jamaica Bay	JB-99	599237.582	4494734.865	-73.8272	40.5975	Secretive Marshbird Survey
Jamaica Bay	JB-100	599537.582	4494734.865	-73.8236	40.5974	Secretive Marshbird Survey
Jamaica Bay	JB-103	598937.582	4494434.865	-73.8307	40.5948	Secretive Marshbird Survey
Jamaica Bay	JB-104	599237.582	4494434.865	-73.8272	40.5948	Secretive Marshbird Survey
Jamaica Bay	JB-107	598037.582	4494134.865	-73.8414	40.5922	Secretive Marshbird Survey
Jamaica Bay	JB-108	598637.582	4494134.865	-73.8343	40.5921	Secretive Marshbird Survey

A final set of 205 points were surveyed, 62 at Jamaica Bay, 37 at Floyd Bennett Field, 16 at Breezy Point, 60 at Sandy Hook, and 30 at the Staten Island Unit (Table 1, Appendices 1-5). All survey points were marked and coordinates recorded using a Global Positioning System (GPS). This allowed observers to return to exact survey locations throughout the study. Each point was surveyed three times during the survey, the first survey being approximately between May 15th and June 10th, the second between June 10th and July 3rd, and the third between July 3rd and July 28th. Sandy Hook and Staten Island points were surveyed in 2005 and the rest of the points were surveyed in 2007.

At 53 of these points we surveyed for secretive marsh birds, using callbacks (Table 1). These included 10 points in Staten Island, 11 points in Sandy Hook, and 32 points in Jamaica Bay. A total of three callback surveys were conducted at each point. Surveys at Sandy Hook and the Staten Island Unit took place between May 20, 2005 and July 24, 2005, while surveys at Breezy Point, Floyd Bennett, and Jamaica Bay took place between May 17, 2007 and July 28, 2007. Each point was surveyed three times, the first one between May 22nd and June 10th, the second between June 12th and June 29th and the third between July 11th and July 24th.

Survey Methodology

Point Counts

Bird surveys began at sunrise and continued for approximately four hours, following point count survey protocol established by Ralph et al. (1995). Surveys were conducted during suitable weather conditions, avoiding steady precipitation or winds greater than 10 mph. Each point count was a total of ten minutes long. During that period data were collected during three time segments, 0-3 minutes, 4-5 minutes, and 5-10 minutes following standard protocols that will allow comparison with similar surveys conducted in other locations. Data were recorded for each of these segments, but birds heard during a previous segment were not recorded again during subsequent segments. Observers recorded the distance of visually detected individual(s) using a Bushnell Laser Range Finder Yardage Pro 500, and their direction (i.e., relative to North) by using a digital compass. If birds could not be seen, observers recorded the distance as discrete categories (e.g., 0-25 m, 26-50 m, 51-75 m, 76-100 m, > 100 m) from the survey point. This technique, known as variable circular plot method, (Reynolds et al. 1980) allows estimates of breeding densities to be derived. Using a distance sampling protocol also provides a means to assess detection probabilities that, when applied to abundance measures, generate better estimates of breeding density (Buckland et al. 2001).

Marsh Bird Callbacks

Callback surveys followed methodology outlined by Conway (2007). All callback surveys began 30 minutes before sunrise and concluded approximately four hours after sunrise. The same weather condition protocols as the point count surveys were followed. No evening call back surveys were conducted, as Conway's (2007) survey protocol recommends either a dawn or dusk survey and evening surveys were deemed especially difficult and potentially dangerous in the Gateway study area.

We used taped calls of target species to elicit vocal responses from birds that are typically difficult to detect visually. Calls of eight marsh bird species were played in the following order: Common Moorhen (*Gallinula chloropus*), American Coot (*Fulica Americana*), Clapper Rail, Virginia Rail (*Rallus limicola*), Black Rail (*Laterallus jamaicensis*), Pied-billed Grebe, American Bittern, Least Bittern.

At each callback survey point, data first were recorded during an initial five minute passive listening period. Then we played species-specific calls, each approximately 30 seconds long. Interspersed between each call was 30 seconds of silence. Detected birds were recorded only once, either during the 5 minutes passive listening period or the call-playback period. For every detected bird, we also recorded the approximate distance and direction at which it was heard.

Data Analysis

Point Count Data

We included all bird observations in the analysis of bird abundance and frequency of occurrence. While birds flying over a certain site may not be associated with that particular site at that specific time, we decided to include those observations in our general calculations, given the fact that appropriate habitats are limited within the broader NY/NJ Harbor area, and that Gateway NRA may provide the only potential habitat for these species.

We determined the number of points and number of sites where each species was observed and calculated relative frequency of occurrence for each species observed as the number of point locations each species was observed divided by the total number of point locations surveyed. We also determined the total number of individuals of a given species seen over the entire study period, across all three survey periods. We calculated the relative abundance of each species observed by site using the equation: total number of individuals of species $\times$ observed/total number of individuals of all species observed.

We include information on the maximum number of individuals of each species recorded at one point and on the maximum number of individuals of each species summed across all points at a site during one survey period. For territorial passerines this metric most likely is a fairly accurate representation of the maximum number present in the Gateway study area at one time. We considered this metric because it is likely a more realistic measure of abundance than total count of individuals over the entire study period, as many individuals most likely were recorded during more than one of the three surveys conducted at each point.

Marsh Bird Callback Survey

We calculated total numbers of secretive marsh birds recorded during the five minute passive listening period (5 minute pre-survey), and the callbacks for each of the three surveys conducted at each point. We also calculated percentage of points where secretive marsh birds were seen.

Breeding Bird Density

We used DISTANCE 5.0, a software program designed for the analysis of distance sampling data (Thomas et al. 2005), to estimate songbird breeding density while taking into account imperfect detection. We bracketed based on the distance of each observation, into 5 distance intervals, 0-25m, 25-50m, 50-75m, 75-100m, and 100-150m. In some cases we collapsed distance intervals when sufficient numbers were not seen at every distance interval. We fit detection functions for uniform models with cosine and simple polynomial expansions, hazard-rate models with cosine and simple polynomial expansions and half-normal models with cosine and hermite polynomial expansions, as recommended by Buckland et al. (2001). We used the mean of clusters in the model when clusters of individuals were recorded at point. We selected the best-fitting model based on Akaike's information criterion (AICc; Burnham and Anderson 2002). In addition, we looked at the coefficient of variation and eliminated models that had CVs greater than 20%. When two or more models were equivalent, we averaged the models as recommended by Thomas et al. (2005). Because a minimum number of 60–100 detections are recommended to estimate density with a reasonable degree of accuracy using program DISTANCE, we estimated density for the most abundant species in our study, which were Red-winged Blackbird (*Agelaius phoeniceus*), Gray Catbird (*Dumetella carolinensis*), Eastern Towhee, Song Sparrow (*Melospiza melodia*), American Robin (*Turdus migratorius*), Common

Yellowthroat (*Geothlypis trichas*), and Yellow Warbler (*Dendroica petechia*). We used data from all three counts for each species in the model. We modeled density for the entire study area and separately for each site.

Habitat Use

Data were collected during the field surveys in 2007 at Jamaica Bay, Breezy Point, and Floyd Bennett Field on the habitat type where each bird was recorded, directly providing information on habitat use. Based on this, we investigated species richness (number of species) and bird abundance at each habitat type. Bird abundance was calculated using the largest of the three survey counts of individuals of each species recorded at the different habitat type to get a clear idea of bird maximum use at each habitat without double-counting. In addition we calculated the average and the standard error of the three counts and divided that over the total number of points at each site to compare among sites and habitats.

Mapping Bird Abundance and Distribution

We created several different maps on bird distribution and abundance using a Geographic Information System (GIS), including maps of raptor and grassland bird occurrence and maps of abundance of common species: Red-winged Blackbird, Eastern Towhee, Gray Catbird, Common Yellowthroat, and Yellow Warbler. Shapefiles were created using a GIS (ArcMap 9.1) by developing attribute tables based on the analyzed data. Analysis of the data was performed in Microsoft Excel, including calculations for frequency of occurrence, maximum total individuals observed, maximum total number of breeding individuals observed and total maximum number of non-breeding individuals observed. Generation of shapefile attribute tables for both individual and groups of species provides a visual representation of the data. Mapping the pre-determined survey points where a focal bird species is observed, by showing locations and abundance symbols on aerial photographs of the Gateway NRA landscape, gives an easily understood representation of abundance and distribution in relation to habitat type.

Results and Discussion

Point Count Survey

A total of 14,094 individual birds of 111 species were counted in the Gateway National Recreation area during the surveys (Table 2, 3). Of these, ten species are State Endangered, Threatened or Special Concern in either New York, New Jersey or both (Table 4).

The most frequently observed species in the entire survey area was the Red-winged Blackbird, seen at 89% of the points, followed by the Common Yellowthroat and Gray Catbird, seen at 73% and 71% of the points respectively (Table 5). Eastern Towhee, Yellow Warbler, Song Sparrow, and American Robin were all seen at greater than 50% of the points (Table 5).

Red-winged Blackbirds were the passerine species recorded in greatest numbers, with over 1,200 counted during the 3 survey period, followed by Gray Catbird, Eastern Towhee, and Common Yellowthroat with over 450 individuals counted (Table 2). The maximum number of Red-winged Blackbirds summed at all points during one cycle was 569 (Table 3), or approximately 2.8 individuals per point. The maximum number of Gray Catbirds counted was 255, or approximately 1.25 individuals per point, while 188 and 186 Eastern Towhees and Common Yellowthroats were recorded respectively, about 0.9 individuals per point.

In addition to Common Yellowthroat, eight other species of warblers were recorded with Yellow Warbler and American Redstart (*Setophaga ruticilla*) being the most abundant with 305 and 89 counts respectively (Table 2) and seen across all sites. Other warblers seen were Ovenbird (*Seiurus aurocapillus*), Yellow-breasted Chat (*Icteria virens*), Black-throated Green Warbler (*Dendroica virens*), Magnolia Warbler (*D. magnolia*), Blackburnian Warbler (*D. fusca*), and Wilson's Warbler (*Wilsonia pusilla*). Of these, the last three were most likely late migrants or non-breeding individuals. Seven sparrow species were seen, with Song Sparrow being the most abundant (400 sightings), followed by House Sparrow (*Passer domesticus*, 67 sightings) and Field Sparrow (41 sightings). Other sparrows seen were Chipping Sparrow (*Spizella passerina*), Swamp Sparrow (*Melospiza georgiana*), Savannah Sparrow (*Passerculus sandwichensis*), and Seaside Sparrow.

Three vireo species were seen during the survey. White-eyed Vireo (*Vireo griseus*) was the most abundant with 28 sightings, but there were also a small number of sightings of Red-eyed (*V. olivaceus*) and Warbling Vireo (*V. gilvus*; Table 2). While American Robin was the most abundant thrush species with 310 counted, Wood (*Hylocichla mustelina*), Swainson's (*Catharus ustulatus*) and Hermit Thrush (*Catharus guttatus*) were also recorded, but in small numbers. In addition, both Black-billed (*Coccyzus erythrophthalmus*) and Yellow-billed Cuckoo (*Coccyzus americanus*) were recorded in small numbers. Six flycatcher species were recorded. Willow Flycatcher (*Empidonax traillii*) was by far the most abundant with 203 sightings across all sites, and a maximum of 95 summed across all points during one cycle. Smaller numbers of Eastern Kingbirds (*Tyrannus tyrannus*) were also recorded at all sites, and small numbers of Great-crested Flycatchers (*Myiarchus crinitus*) were counted at all sites except for Floyd Bennett Field.

As expected, a large number of colonial water birds that breed at Gateway were recorded during the survey. Herring gull (*Larus argentatus*) was the most abundant species recorded during the entire survey with over 2,000 individuals counted, while Laughing Gull (*L. atricilla*) and

Common Tern (*Sterna hirundo*) were the third and fourth most abundant species overall (Table 2). Those three species were represented at more than 25% of the points each (Table 5). For long-legged waterbirds, there were more than 50 sightings of Glossy Ibis (*Plegadis falcinellus*), which was seen at about 20% of the points. Black-crowned Night-Heron, Great Egret (*Ardea alba*) and Snowy Egret (*Egretta thula*), were seen at more than 10% of the points each (Table 2, 5). Finally, small flocks of several species of shorebird were observed, including Red Knot (*Calidris canutus*), Dunlin (*C. alpina*), Ruddy Turnstone (*Arenaria interpres*), and 222 locally breeding American Oystercatchers (*Haematopus palliatus*) were counted (Tables 2, 3). However, the purpose of our study was to look at abundance and distribution of passerine secretive marsh bird species, so, while we report the numbers on gulls, terns, long-legged waders, and shorebirds, these data were collected incidentally and not in a manner to assess their populations.

Frequently Observed State-listed and PIF Priority Species

During the survey, a total of 1,170 individuals of ten (10) species that are endangered or threatened were recorded (Table 4). Species were only counted as T&E or SC in the state in which they are listed – that is a species that is threatened in NJ was not counted under threatened if recorded in NY. These were Black Skimmer (*Rynchops niger*, E, NJ), Black-crowned Night-Heron (T, NJ), Common Tern (T, NY), Least Bittern (T, NY), Least Tern (E, NJ; T, NY), Northern Harrier (*Circus cyaneus*, E, NY/NJ), Osprey (T, NJ), Peregrine Falcon (*Falco peregrinus*, T, NY; E, NJ), Red Knot (T, NJ), and Yellow-crowned Night-Heron (*Nyctanassa violacea*, T, NJ). In addition, thirty seven (37) individuals of six (6) Special Concern (SC) species were recorded: Common Loon (*Gavia immer*, SC NY), Great Blue Heron (SC NJ), Seaside Sparrow (SC NY), Spotted Sandpiper (*Actitis macularia*, SC NJ), and Yellow-breasted Chat (SC NJ&NY), and Wood Thrush (SC NJ) (Table 4).

Furthermore, 668 individuals of an additional four (4) species that are considered High Priority in the Bird Conservation Region 30 Plan (BCR 30, a synthesis of Partners in Flight PIF, mid-Atlantic Coastal Plain and Southern New England plans, (Rosenberg et al. 2002, Mizrahi 2004) were recorded. These were American Black Duck (*Anas rubripes*), American Oystercatcher, Atlantic Brant (*Branta bernicla*), and Ruddy Turnstone. American Oystercatcher likely nests in barrier island and open beach habitats across GATE and was the 15th most abundant species reported during the survey (Table 4). While our survey was not designed in a way to assess oystercatcher populations in the park, the high numbers counted may be evidence of a thriving population.

Brown Thrasher, Eastern Towhee, and Field Sparrow, listed as "priority" species (Mizrahi 2004, Dettmers and Rosenberg 2000) were all recorded during the survey. Towhee, a species found in scrub/shrub habitats and open woods, was the third most abundant passerine species recorded during the survey (Tables 2, 3), and was seen in large numbers in the Sandy Hook, where a maximum of 188 were recorded, almost four individuals per point. Brown Thrasher, another species that uses secondary growth habitat, was recorded in all five sites and was also especially abundant in Sandy Hook. Field Sparrow was counted in smaller numbers and was not recorded in Jamaica Bay.

Finally, Clapper Rails, a species considered "high regional responsibility" in the BCR 30 was recorded in good numbers in Jamaica Bay, with very few sightings elsewhere.

Table 2. Total number of birds counted during three point count bird surveys conducted at 205 points in the Gateway National Recreation Area, averaged across points (average of all points for each of the 5 survey areas). Surveys at Sandy Hook and the Staten Island took place between May 20, 2005 and July 24, 2005, while surveys at Breezy Point, Floyd Bennett, and Jamaica Bay took place between May 17, 2005 and July 28, 2007. Table is arranged in order of total number of birds counted in the entire Gateway survey area.

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Herring Gull		20	135	97	2112	2,364
Red-winged Blackbird	433	148	218	93	405	1,297
Laughing Gull	7		181	89	725	1,002
Common Tern	18	7	65	509	300	899
Gray Catbird	227	135	137	76	101	676
Eastern Towhee	324	41	53	25	35	478
Common Yellowthroat	194	62	101	43	65	465
Double-crested Cormorant		371	18	2	64	455
European Starling	20	160	187	26	33	426
Song Sparrow	148	95	71	34	52	400
American Robin	68	84	105	29	24	310
Yellow Warbler	50	51	71	36	97	305
Atlantic Brant	2		142		96	240
Great Black-backed Gull	1	4	32	82	104	223
American Oystercatcher		2	14	11	195	222
Willow Flycatcher	43	63	44	23	30	203
Mourning Dove	71	75	8	19	4	177
Barn Swallow	3	8	69	47	43	170
Least Tern	2		19	95	38	154
Tree Swallow	6	5	40	16	87	154
Cedar Waxwing	53	16	55	28	1	153
Northern Mockingbird	47	41	22	14	26	150
House Wren	108	36	3		1	148
Canada Goose	6		58	16	61	141
Willet	1		17	10	110	138
Northern Cardinal	39	47	20	14	17	137
American Goldfinch	60	46	23		2	131
Mallard	7	17	21	17	68	130
Clapper Rail	3		1		115	119
Ruddy Turnstone	2		6		108	116
Glossy Ibis		20	11		83	114
American Crow	41	2	26	18	26	113
Common Grackle	33	30	14	3	30	110
Short-billed Dowitcher			10		96	106
American Redstart	55	14	11	3	6	89
Brown Thrasher	44	14	17	7	6	88

Table 2. Total number of birds counted during three point count bird surveys conducted at 205 points in the Gateway National Recreation Area, averaged across points (continued).

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Semipalmated Sandpiper					87	87
Rock Dove		78	8			86
Semipalmated Plover					86	86
Black-bellied Plover					67	67
Black-crowned Night-Heron		42	5		20	67
Brown-headed Cowbird		28	22	8	9	67
House Sparrow		5	35	19	8	67
House Finch	44	5	2	2	4	57
Great Egret	2	23	9	1	21	56
Carolina Wren	47	6			2	55
Snowy Egret	2	20	6	1	22	51
Boat-tailed Grackle	19	14	9		8	50
Red Knot					50	50
Dunlin	2				45	47
Fish Crow	7	2	13	5	18	45
Field Sparrow	35	1	1	4		41
Marsh Wren			5	2	33	40
Osprey	4		4		26	34
Black-capped Chickadee	14	1	9	7		31
White-eyed Vireo	23	4		1		28
Least Sandpiper					27	27
American Black Duck	1		5		19	25
Blue Jay	15	8			1	24
Great-crested Flycatcher	13	3		3	3	22
Northern Flicker		21				21
Spotted Sandpiper	1				19	20
Eastern Kingbird	2	6	4	1	4	17
Killdeer		7		2	8	17
Ring-necked Pheasant		8	8	1		17
Yellow-billed Cuckoo	12	2				14
Downy Woodpecker	1	9	1			11
Forster's Tern			2	1	8	11
Lesser Yellowlegs					11	11
Wood Thrush	9	1				10
Ring-billed Gull			3		6	9
Little Blue Heron					8	8
Eastern Wood-Pewee	6	1				7
Green Heron	5	2				7
Mute Swan					7	7
Black Skimmer			1	3	2	6

Table 2. Total number of birds counted during three point count bird surveys conducted at 205 points in the Gateway National Recreation Area, averaged across points (continued).

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Chimney Swift			1	4	1	6
Great-blue Heron	1		1		4	6
Red-bellied Woodpecker	1	5				6
Red-eyed Vireo	5		1			6
Seaside Sparrow	2	1			3	6
Eastern Phoebe			4		1	5
Baltimore Oriole	1	3				4
Greater Yellowlegs	4					4
Peregrine Falcon				1	3	4
Yellow-breasted Chat	4					4
Yellow-crowned Night Heron			1		3	4
Black-billed Cuckoo	3					3
Chipping Sparrow		1	2			3
Magnolia Warbler	2			1		3
Swamp Sparrow		3				3
Black-throated Green Warbler			1		1	2
Hermit Thrush			1		1	2
Savannah Sparrow			1	1		2
Warbling Vireo		2				2
Alder Flycatcher	1					1
Blackburnian Warbler	1					1
Blue Grosbeak		1				1
Blue-gray Gnatcatcher					1	1
Common Loon	1					1
Gadwall					1	1
Indigo Bunting		1				1
King Eider	1					1
Least Bittern	1					1
Northern Harrier					1	1
Ovenbird		1				1
Palm Warbler			1			1
Peep	1					1
Red-tailed Hawk					1	1
Ruby-crowned Kinglet			1			1
Swainson's Thrush	1					1
White-breasted Nuthatch	1					1
Wilson's Warbler	1					1
Grand Total	2,409	1,929	2,191	1,550	6,015	14,094

Table 3. Maximum number of individuals of each species counted during bird surveys conducted at 205 points in the Gateway National Recreation Area. Surveys at Sandy Hook and the Staten Island took place between May 20, 2005 and July 24, 2005, while surveys at Breezy Point, Floyd Bennett, and Jamaica Bay took place between May 17, 2005 and July 28, 2007. Table is arranged in species alphabetical order.

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Alder Flycatcher	1					1
American Black Duck	1		3		19	23
American Crow	17	2	15	12	24	70
American Goldfinch	22	18	11		1	52
American Oystercatcher		2	6	9	69	86
American Redstart	23	8	7	2	3	43
American Robin	24	34	39	10	11	118
Atlantic Brant	2		136		95	233
Baltimore Oriole	1	3				4
Barn Swallow	2	6	43	22	20	93
Black Skimmer			1	3	2	6
Black-bellied Plover					67	67
Black-billed Cuckoo	3					3
Blackburnian Warbler	1					1
Black-capped Chickadee	6	1	8	7		22
Black-crowned Night-Heron		35	5		9	49
Black-throated Green Warbler			1		1	2
Blue Grosbeak		1				1
Blue Jay	11	4			1	16
Blue-gray Gnatcatcher					1	1
Boat-tailed Grackle	15	6	9		4	34
Brown Thrasher	21	8	8	3	2	42
Brown-headed Cowbird		19	11	5	4	39
Canada Goose	3		57	11	47	118
Carolina Wren	20	3			2	25
Cedar Waxwing	31	10	28	23	1	93
Chimney Swift			1	2	1	4
Chipping Sparrow		1	2			3
Clapper Rail	0		1		58	59
Common Grackle	21	13	7	2	15	58
Common Loon	1					1
Common Tern	14	7	38	260	109	428
Common Yellowthroat	72	25	36	17	36	186
Double-crested Cormorant		196	9	1	44	250
Downy Woodpecker	1	5	1			7
Dunlin	2				45	47
Eastern Kingbird	2	3	3	1	2	11

Table 3. Maximum number of individuals of each species counted during bird surveys conducted at 205 points in the Gateway National Recreation Area (continued).

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Eastern Phoebe			3		1	4
Eastern Towhee	118	19	22	11	18	188
Eastern Wood-Pewee	1	4				5
European Starling	92	19	114	11	15	251
Field Sparrow	1	16	1	2		20
Fish Crow	1	3	6	3	8	21
Forster's Tern			2	1	8	11
Gadwall					1	1
Glossy Ibis	19		5		42	66
Gray Catbird	51	79	49	30	46	255
Great Black-backed Gull	2	1	19	45	57	124
Great Egret	15	1	4	1	9	30
Great-blue Heron		1	1		2	4
Great-crested Flycatcher	2	8		2	1	13
Greater Yellowlegs		4				4
Green Heron	2	2				4
Hermit Thrush			1		1	2
Herring Gull	10		65	53	1341	1469
House Finch	3	22	2	1	3	31
House Sparrow	4		13	10	6	33
House Wren	14	43	3		1	61
Indigo Bunting	1					1
Killdeer	3			1	8	12
King Eider		1				1
Laughing Gull		7	92	60	292	451
Least Bittern		1				1
Least Sandpiper					23	23
Least Tern		2	10	65	15	92
Lesser Yellowlegs					11	11
Magnolia Warbler		2		1		3
Mallard	8	4	17	9	30	68
Marsh Wren			4	2	15	21
Mourning Dove	32	34	6	9	3	84
Mute Swan					4	4
Northern Cardinal	18	15	8	6	10	57
Northern Flicker	11					11
Northern Harrier					1	1
Northern Mockingbird	17	21	12	9	10	69
ORIOLE SP			1		1	2
Osprey		3	2		14	19

Table 3. Maximum number of individuals of each species counted during bird surveys conducted at 205 points in the Gateway National Recreation Area (continued).

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Ovenbird	1					1
Palm Warbler			1			1
Peep		1				1
Peregrine Falcon				1	2	3
Red Knot					50	50
Red-bellied Woodpecker	3	1				4
Red-eyed Vireo		4	1			5
Red-tailed Hawk					1	1
Red-winged Blackbird	58	153	87	44	227	569
Ring-billed Gull			3		4	7
Ring-necked Pheasant	4		7	1		12
Rock Dove	70		6			76
Ruby-crowned Kinglet			1			1
Ruddy Turnstone		2	6		108	116
Savannah Sparrow			1	1		2
Seaside Sparrow	1	2			3	6
Semipalmated Plover					66	66
Semipalmated Sandpiper					85	85
Short-billed Dowitcher			10		95	105
Snowy Egret	14	1	3	1	16	35
Song Sparrow	38	62	25	12	23	160
Spotted Sandpiper		1			12	13
Swamp Sparrow	2					2
Tree Swallow	5	4	18	7	39	73
Unknown crow		2				2
Unknown owl		0				0
Warbling Vireo	2					2
White-breasted Nuthatch		1				1
White-eyed Vireo	2	8		1		11
Willet		1	7	4	73	85
Willow Flycatcher	31	20	20	11	13	95
Wilson's Warbler		1				1
Wood Thrush	1	7				8
Yellow Warbler	29	22	30	13	38	132
Yellow-billed Cuckoo	2	7				9
Yellow-breasted Chat		2				2
Yellow-crowned Night Heron			1		2	3
Grand Total	999	1031	1175	818	3552	7575

Table 4. Total numbers of birds counted during three point count bird surveys conducted at 205 points in the Gateway National Recreation Area. Surveys at Sandy Hook and the Staten Island took place between May 20, 2005 and July 24, 2005, while surveys at Breezy Point, Floyd Bennett, and Jamaica Bay took place between May 17, 2005 and July 28, 2007. Table is arranged by species in alphabetical order. E=Endangered, T=Threatened, SC=Special Concern, BCR 30 HH=Mid-Atlantic/Southern New England Bird Conservation Region Highest Priority Species.

Species	Sandy Hook	Staten Island	Floyd Bennet	Breezy Point	Jamaica Bay	Entire Survey Area
American Black Duck (BCR30, HH)	1		5		19	25
American Oystercatcher (BCR 30, HH)		2	14	11	195	222
Atlantic Brant (BCR 30, HH)	2		141		95	238
Black Skimmer (E, NJ; SC, NY)			1	3	2	6
Black-crowned Night-Heron (T, NJ)		42	5		20	67
Common Loon (SC, NY)	1					1
Common Tern (T, NY; SC, NJ)	18	7	65	509	300	899
Great-blue Heron (SC, NJ)	1		1		4	6
Least Bittern (T, NY)	1					1
Least Tern (E, NJ; T, NY)	2		19	95	38	154
Northern Harrier (E, NY/NJ)					1	1
Osprey (SC, NY; T, NJ)	4		4		26	34
Peregrine Falcon (T, NY; E, NJ)				1	3	4
Red Knot (T, NJ; BCR30, HH)					50	50
Ruddy Turnstone (BCR30, HH)	2		6		108	116
Seaside Sparrow (SC, NY; BCR30, HH)	2	1			3	6
Spotted Sandpiper (SC, NJ)	1				19	20
Wood Thrush (SC, NJ; BCR30, HH)	9	1				10
Yellow-breasted Chat (SC, NY&NJ)	4					4
Yellow-crowned Night Heron (T, NJ)			1		3	4
TOTAL	48	53	262	619	886	1868

Table 5. Frequency of occurrence of bird species observed (# of points where a species was recorded/total # of points) during point count bird surveys conducted in the Gateway National Recreation Area. Surveys at Sandy Hook and the Staten Island took place between May 20, 2005 and July 24, 2005, while surveys at Breezy Point, Floyd Bennett, and Jamaica Bay took place between May 17, 2005 and July 28, 2007. Table is arranged in order of frequency of occurrence in the Entire Gateway survey area.

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Red-winged Blackbird	0.867	0.767	0.919	1.000	0.935	0.893
Common Yellowthroat	0.883	0.633	0.919	0.938	0.468	0.732
Gray Catbird	0.800	0.900	0.730	0.875	0.484	0.712
Eastern Towhee	0.833	0.500	0.622	0.688	0.339	0.585
Yellow Warbler	0.417	0.733	0.784	0.875	0.484	0.585
Song Sparrow	0.600	0.733	0.568	0.625	0.435	0.566
American Robin	0.583	0.733	0.811	0.750	0.194	0.541
Willow Flycatcher	0.450	0.567	0.649	0.750	0.339	0.493
Northern Mockingbird	0.417	0.600	0.405	0.438	0.242	0.390
Northern Cardinal	0.400	0.700	0.351	0.375	0.177	0.366
Herring Gull	0.000	0.100	0.676	0.750	0.468	0.337
Mourning Dove	0.617	0.567	0.135	0.375	0.032	0.327
American Goldfinch	0.583	0.600	0.270	0.000	0.032	0.317
Laughing Gull	0.033	0.000	0.514	0.500	0.548	0.307
Brown Thrasher	0.483	0.333	0.324	0.313	0.081	0.298
Cedar Waxwing	0.500	0.300	0.405	0.313	0.016	0.293
House Wren	0.700	0.467	0.054	0.000	0.016	0.288
American Crow	0.433	0.033	0.351	0.375	0.161	0.273
European Starling	0.117	0.467	0.486	0.375	0.161	0.268
Common Tern	0.067	0.033	0.243	0.875	0.403	0.259
Tree Swallow	0.033	0.100	0.405	0.500	0.403	0.259
Common Grackle	0.250	0.433	0.189	0.125	0.210	0.244
Barn Swallow	0.033	0.100	0.378	0.688	0.274	0.229
American Redstart	0.383	0.200	0.216	0.188	0.065	0.215
Brown-headed Cowbird	0.000	0.567	0.378	0.313	0.113	0.210
Glossy Ibis	0.000	0.067	0.216	0.000	0.516	0.205
Willet	0.017	0.000	0.270	0.188	0.452	0.205
American Oystercatcher	0.000	0.033	0.162	0.188	0.500	0.200
Carolina Wren	0.483	0.167	0.000	0.000	0.032	0.176
Great Black-backed Gull	0.017	0.033	0.297	0.500	0.258	0.180
Double-crested Cormorant	0.000	0.100	0.270	0.063	0.323	0.166
House Finch	0.400	0.133	0.027	0.125	0.032	0.161
Clapper Rail	0.033	0.000	0.027	0.000	0.468	0.156
Mallard	0.083	0.233	0.108	0.188	0.210	0.156
Great Egret	0.033	0.067	0.189	0.063	0.258	0.137

Table 5. Frequency of occurrence of bird species observed (# of points where a species was recorded/total # of points) during point count bird surveys conducted in the Gateway National Recreation Area (continued).

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Fish Crow	0.100	0.067	0.162	0.125	0.177	0.132
Snowy Egret	0.033	0.133	0.135	0.063	0.177	0.112
Boat-tailed Grackle	0.133	0.167	0.081	0.000	0.097	0.107
Osprey	0.050	0.000	0.108	0.000	0.242	0.107
Black-crowned Night-Heron	0.000	0.133	0.135	0.000	0.194	0.102
Canada Goose	0.050	0.000	0.162	0.125	0.161	0.102
Least Tern	0.017	0.000	0.135	0.563	0.097	0.102
Black-capped Chickadee	0.150	0.033	0.108	0.375	0.000	0.098
Field Sparrow	0.250	0.033	0.027	0.125	0.000	0.093
Marsh Wren	0.000	0.000	0.108	0.063	0.210	0.088
White-eyed Vireo	0.250	0.067	0.000	0.063	0.000	0.088
Great-crested Flycatcher	0.150	0.067	0.000	0.188	0.048	0.083
House Sparrow	0.000	0.100	0.216	0.125	0.065	0.083
Blue Jay	0.183	0.133	0.000	0.000	0.016	0.078
Northern Flicker	0.000	0.500	0.000	0.000	0.000	0.073
Atlantic Brant	0.017	0.000	0.189	0.000	0.065	0.068
Ring-necked Pheasant	0.000	0.267	0.162	0.063	0.000	0.073
Eastern Kingbird	0.033	0.133	0.054	0.063	0.032	0.054
Yellow-billed Cuckoo	0.133	0.067	0.000	0.000	0.000	0.049
Downy Woodpecker	0.017	0.233	0.027	0.000	0.000	0.044
Spotted Sandpiper	0.017	0.000	0.000	0.000	0.129	0.044
Eastern Wood-Pewee	0.100	0.033	0.000	0.000	0.000	0.034
Forster's Tern	0.000	0.000	0.027	0.063	0.081	0.034
Killdeer	0.000	0.100	0.000	0.063	0.048	0.034
Rock Dove	0.000	0.067	0.135	0.000	0.000	0.034
Wood Thrush	0.100	0.033	0.000	0.000	0.000	0.034
Red-eyed Vireo	0.083	0.000	0.027	0.000	0.000	0.029
Semipalmated Plover	0.000	0.000	0.000	0.000	0.097	0.029
Eastern Phoebe	0.000	0.000	0.081	0.000	0.016	0.020
Green Heron	0.050	0.033	0.000	0.000	0.000	0.020
Seaside Sparrow	0.033	0.033	0.000	0.000	0.016	0.020
Semipalmated Sandpiper	0.000	0.000	0.000	0.000	0.065	0.020
Yellow-crowned Night Heron	0.000	0.000	0.027	0.000	0.048	0.020
American Black Duck	0.017	0.000	0.027	0.000	0.048	0.024
Black-bellied Plover	0.000	0.000	0.000	0.000	0.081	0.024
Great-blue Heron	0.017	0.000	0.027	0.000	0.048	0.024
Least Sandpiper	0.000	0.000	0.000	0.000	0.081	0.024
Little Blue Heron	0.000	0.000	0.000	0.000	0.081	0.024
Red-bellied Woodpecker	0.017	0.133	0.000	0.000	0.000	0.024

Table 5. Frequency of occurrence of bird species observed (# of points where a species was recorded/total # of points) during point count bird surveys conducted in the Gateway National Recreation Area (continued).

Species	Sandy Hook	Staten Island	Floyd Bennett	Breezy Point	Jamaica Bay	Entire Gateway NRA
Ring-billed Gull	0.000	0.000	0.054	0.000	0.048	0.024
Ruddy Turnstone	0.017	0.000	0.027	0.000	0.048	0.024
Baltimore Oriole	0.017	0.033	0.000	0.000	0.000	0.010
Black-throated Green Warbler	0.000	0.000	0.027	0.000	0.016	0.010
Chipping Sparrow	0.000	0.033	0.027	0.000	0.000	0.010
Dunlin	0.017	0.000	0.000	0.000	0.016	0.010
Hermit Thrush	0.000	0.000	0.027	0.000	0.016	0.010
Lesser Yellowlegs	0.000	0.000	0.000	0.000	0.032	0.010
Savannah Sparrow	0.000	0.000	0.027	0.063	0.000	0.010
Black Skimmer	0.000	0.000	0.027	0.063	0.016	0.015
Black-billed Cuckoo	0.050	0.000	0.000	0.000	0.000	0.015
Chimney Swift	0.000	0.000	0.027	0.063	0.016	0.015
Magnolia Warbler	0.033	0.000	0.000	0.063	0.000	0.015
Peregrine Falcon	0.000	0.000	0.000	0.063	0.032	0.015
Red Knot	0.000	0.000	0.000	0.000	0.048	0.015
Short-billed Dowitcher	0.000	0.000	0.027	0.000	0.032	0.015
Yellow-breasted Chat	0.050	0.000	0.000	0.000	0.000	0.015
Alder Flycatcher	0.017	0.000	0.000	0.000	0.000	0.005
Blackburnian Warbler	0.017	0.000	0.000	0.000	0.000	0.005
Blue Grosbeak	0.000	0.033	0.000	0.000	0.000	0.005
Blue-gray Gnatcatcher	0.000	0.000	0.000	0.000	0.016	0.005
Common Loon	0.017	0.000	0.000	0.000	0.000	0.005
Gadwall	0.000	0.000	0.000	0.000	0.016	0.005
Greater Yellowlegs	0.017	0.000	0.000	0.000	0.000	0.005
Indigo Bunting	0.000	0.033	0.000	0.000	0.000	0.005
King Eider	0.017	0.000	0.000	0.000	0.000	0.005
Least Bittern	0.017	0.000	0.000	0.000	0.000	0.005
Mute Swan	0.000	0.000	0.000	0.000	0.016	0.005
Northern Harrier	0.000	0.000	0.000	0.000	0.016	0.005
Peep	0.017	0.000	0.000	0.000	0.000	0.005
Palm Warbler	0.000	0.000	0.027	0.000	0.000	0.005
Ovenbird	0.000	0.033	0.000	0.000	0.000	0.005
Red-tailed Hawk	0.000	0.000	0.000	0.000	0.016	0.005
Ruby-crowned Kinglet	0.000	0.000	0.027	0.000	0.000	0.005
Swainson's Thrush	0.017	0.000	0.000	0.000	0.000	0.005
Swamp Sparrow	0.000	0.033	0.000	0.000	0.000	0.005
Warbling Vireo	0.000	0.033	0.000	0.000	0.000	0.005
White-breasted Nuthatch	0.017	0.000	0.000	0.000	0.000	0.005
Wilson's Warbler	0.017	0.000	0.000	0.000	0.000	0.005

Sandy Hook

A total of 2,409 sightings of 69 species were recorded during the three surveys at Sandy Hook. Common Yellowthroat, Red-winged Blackbird, Eastern Towhee, and Gray Catbird were the most frequently observed bird species seen at over 80% of the points surveyed (Table 6). Red-winged Blackbird and Eastern Towhee were the most abundant with 433 and 324 recorded respectively. The maximum number recorded during one survey period across all points was 153 for Red-winged Blackbird and 118 for Eastern Towhee, or approximately 2.5 and 2 individuals per point respectively.

Some of the highlights of bird species recorded include Yellow-breasted Chat, Magnolia, Blackburnian, and Wilson's Warbler, and Alder Flycatcher (*Empidonax alnorum*). In addition, several state listed and priority species were reported at Sandy Hook, including American Black Duck, Atlantic Brant, Osprey, Common and Least Tern, Least Bittern, Spotted Sandpiper, and Seaside Sparrow.

Review of the NPS species database and the information necessary to complete all fields did not reveal obvious gaps in information for the Sandy Hook (Mizrahi 2004). No new species were recorded during the survey. See Appendix 6 for Sandy Hook species list (from Mizrahi 2004), with species observed during the field survey in bold.

Table 6. Summary statistics for bird species recorded during point count bird surveys conducted in the Sandy Hook of Gateway National Recreation Area between May 20, 2005 and July 24, 2005. Table is arranged in order of frequency of occurrence. A total of 60 points were surveyed in Sandy Hook.

Species	# of Points observed	Frequency occurrence by point^a	Total number of birds recorded^b	Relative abundance^c	Max # recorded at one point	Max total # recorded during one survey period
Common Yellowthroat	53	0.883	194	0.0805	4	72
Red-winged Blackbird	52	0.867	433	0.1797	10	153
Eastern Towhee	50	0.833	324	0.1345	6	118
Gray Catbird	48	0.800	227	0.0942	9	79
House Wren	42	0.700	108	0.0448	3	43
Mourning Dove	37	0.617	71	0.0295	7	34
Song Sparrow	36	0.600	148	0.0614	4	62
American Goldfinch	35	0.583	60	0.0249	3	22
American Robin	35	0.583	68	0.0282	3	24
Cedar Waxwing	30	0.500	53	0.0220	4	31
Brown Thrasher	29	0.483	44	0.0183	2	21
Carolina Wren	29	0.483	47	0.0195	2	20
Willow Flycatcher	27	0.450	43	0.0178	2	20
American Crow	26	0.433	41	0.0170	4	17
Northern Mockingbird	25	0.417	47	0.0195	3	21
Yellow Warbler	25	0.417	50	0.0208	2	22
House Finch	24	0.400	44	0.0183	4	22
Northern Cardinal	24	0.400	39	0.0162	3	15
American Redstart	23	0.383	55	0.0228	3	23

Table 6. Summary statistics for bird species recorded during point count bird surveys conducted in the Sandy Hook of Gateway National Recreation Area between May 20, 2005 and July 24, 2005 (continued).

Species	# of Points observed	Frequency occurrence by point^a	Total number of birds recorded^b	Relative abundance^c	Max # recorded at one point	Max total # recorded during one survey period
Common Grackle	15	0.250	33	0.0137	6	21
Field Sparrow	15	0.250	35	0.0145	3	16
White-eyed Vireo	15	0.250	23	0.0095	2	8
Blue Jay	11	0.183	15	0.0062	3	11
Black-capped Chickadee	9	0.150	14	0.0058	3	6
Great-crested Flycatcher	9	0.150	13	0.0054	2	8
Boat-tailed Grackle	8	0.133	19	0.0079	6	15
Yellow-billed Cuckoo	8	0.133	12	0.0050	2	7
European Starling	7	0.117	20	0.0083	7	19
Eastern Wood-Pewee	6	0.100	6	0.0025	1	4
Fish Crow	6	0.100	7	0.0029	2	3
Wood Thrush	6	0.100	9	0.0037	2	7
Mallard	5	0.083	7	0.0029	2	4
Red-eyed Vireo	5	0.083	5	0.0021	1	4
Common Tern	4	0.067	18	0.0075	13	14
Black-billed Cuckoo	3	0.050	3	0.0012	1	3
Canada Goose	3	0.050	6	0.0025	3	3
Green Heron	3	0.050	5	0.0021	1	2
Osprey	3	0.050	4	0.0017	2	3
Yellow-breasted Chat	3	0.050	4	0.0017	1	2
Barn Swallow	2	0.033	3	0.0012	2	2
Clapper Rail	2	0.033	3	0.0012	2	2
Eastern Kingbird	2	0.033	2	0.0008	1	2
Great Egret	2	0.033	2	0.0008	1	1
Laughing Gull	2	0.033	7	0.0029	6	7
Magnolia Warbler	2	0.033	2	0.0008	1	2
Seaside Sparrow	2	0.033	2	0.0008	1	2
Snowy Egret	2	0.033	2	0.0008	1	1
Tree Swallow	2	0.033	6	0.0025	2	4
Alder Flycatcher	1	0.017	1	0.0004	1	1
American Black Duck	1	0.017	1	0.0004	1	1
Atlantic Brant	1	0.017	2	0.0008	2	2
Baltimore Oriole	1	0.017	1	0.0004	1	1
Blackburnian Warbler	1	0.017	1	0.0004	1	1
Common Loon	1	0.017	1	0.0004	1	1
Downy Woodpecker	1	0.017	1	0.0004	1	1
Dunlin	1	0.017	2	0.0008	2	2
Great Black-backed Gull	1	0.017	1	0.0004	1	1
Great-blue Heron	1	0.017	1	0.0004	1	1

Table 6. Summary statistics for bird species recorded during point count bird surveys conducted in the Sandy Hook of Gateway National Recreation Area between May 20, 2005 and July 24, 2005 (continued).

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Greater Yellowlegs	1	0.017	4	0.0017	4	4
King Eider	1	0.017	1	0.0004	1	1
Least Bittern	1	0.017	1	0.0004	1	1
Least Tern	1	0.017	2	0.0008	2	2
Peep	1	0.017	1	0.0004	1	1
Red-bellied Woodpecker	1	0.017	1	0.0004	1	1
Ruddy Turnstone	1	0.017	2	0.0008	2	2
Spotted Sandpiper	1	0.017	1	0.0004	1	1
Swainson's Thrush	1	0.017	1	0.0004	1	1
White-breasted Nuthatch	1	0.017	1	0.0004	1	1
Willet	1	0.017	1	0.0004	1	1
Wilson's Warbler	1	0.017	1	0.0004	1	1
Grand Total			2,409			

^aNumber of points a species was observed/ total number of points surveyed

^bTotal number of individuals of a given species seen over the study period

^cTotal individuals of a given species/ total individuals of all species

Staten Island

A total of 1,929 sightings of 61 species were recorded during the three surveys in the Staten Island of the Gateway National Recreation Area. Gray Catbird and Red-winged Blackbird were the most frequently observed bird species seen at over 75% of the points surveyed (Table 7). These were also the most abundant species with a total 135 and 148 recorded respectively. The maximum total number recorded during one survey period across all points was 58 for Red-winged Blackbird and 51 for Gray Catbird, or approximately 2 and 1.7 individuals per point respectively. Staten Island species list can be seen in Appendix 7.

A good diversity of less commonly observed species were recorded in the Staten Island, including Blue Grosbeak (*Passerina caerulea*), Indigo Bunting (*Passerina cyanea*), Field, Swamp, and Seaside Sparrow, and Warbling Vireo. These species thrive in open brushy areas and edge habitats and/or wetlands. Furthermore, several state-listed and priority species that use wetland habitats were reported here, including Black-crowned Night-Heron, Common Tern, and American Oystercatcher. This high diversity of birds in Staten Island is probably supported not only by the existing natural areas in the NRA Unit, but also by other natural areas within the landscape, such as the Staten Island 'Bluebelt' and other parkland.

Table 7. Summary statistics for bird species recorded during three point count bird surveys conducted in the Staten Island of Gateway National Recreation Area between May 20, 2005 and July 24, 2005. Table is arranged in order of frequency of occurrence. A total of 30 points were surveyed in Staten Island.

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Gray Catbird	27	0.900	135	0.0700	6	51
Red-winged Blackbird	23	0.767	148	0.0767	6	58
American Robin	22	0.733	84	0.0435	6	34
Song Sparrow	22	0.733	95	0.0492	4	38
Yellow Warbler	22	0.733	51	0.0264	2	29
Northern Cardinal	21	0.700	47	0.0244	3	18
Common Yellowthroat	19	0.633	62	0.0321	5	25
American Goldfinch	18	0.600	46	0.0238	5	18
Northern Mockingbird	18	0.600	41	0.0213	2	17
Brown-headed Cowbird	17	0.567	28	0.0145	5	19
Mourning Dove	17	0.567	75	0.0389	15	32
Willow Flycatcher	17	0.567	63	0.0327	6	31
Eastern Towhee	15	0.500	41	0.0213	4	19
Northern Flicker	15	0.500	21	0.0109	3	11
European Starling	14	0.467	160	0.0829	56	92
House Wren	14	0.467	36	0.0187	3	14
Common Grackle	13	0.433	30	0.0156	6	13
Brown Thrasher	10	0.333	14	0.0073	3	8
Cedar Waxwing	9	0.300	16	0.0083	4	10
Ring-necked Pheasant	8	0.267	8	0.0041	1	4
Downy Woodpecker	7	0.233	9	0.0047	1	5
Mallard	7	0.233	17	0.0088	4	8
American Redstart	6	0.200	14	0.0073	3	8
Boat-tailed Grackle	5	0.167	14	0.0073	3	6
Carolina Wren	5	0.167	6	0.0031	1	3
Black-crowned Night-Heron	4	0.133	42	0.0218	35	35
Blue Jay	4	0.133	8	0.0041	3	4
Eastern Kingbird	4	0.133	6	0.0031	2	3
House Finch	4	0.133	5	0.0026	2	3
Red-bellied Woodpecker	4	0.133	5	0.0026	1	3
Snowy Egret	4	0.133	20	0.0104	10	14
Barn Swallow	3	0.100	8	0.0041	3	6
Double-crested Cormorant	3	0.100	371	0.1923	190	196
Herring Gull	3	0.100	20	0.0104	10	10
House Sparrow	3	0.100	5	0.0026	3	4
Killdeer	3	0.100	7	0.0036	2	3
Tree Swallow	3	0.100	5	0.0026	3	5
Fish Crow	2	0.067	2	0.0010	1	1

Table 7. Summary statistics for bird species recorded during three point count bird surveys conducted in the Staten Island of Gateway National Recreation Area between May 20, 2005 and July 24, 2005 (continued).

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Glossy Ibis	2	0.067	20	0.0104	18	19
Great Egret	2	0.067	23	0.0119	14	15
Great-crested Flycatcher	2	0.067	3	0.0016	1	2
Rock Dove	2	0.067	78	0.0404	70	70
White-eyed Vireo	2	0.067	4	0.0021	2	2
Yellow-billed Cuckoo	2	0.067	2	0.0010	1	2
American Crow	1	0.033	2	0.0010	2	2
American Oystercatcher	1	0.033	2	0.0010	2	2
Baltimore Oriole	1	0.033	3	0.0016	3	3
Black-capped Chickadee	1	0.033	1	0.0005	1	1
Blue Grosbeak	1	0.033	1	0.0005	1	1
Chipping Sparrow	1	0.033	1	0.0005	1	1
Common Tern	1	0.033	7	0.0036	7	7
Eastern Wood-Pewee	1	0.033	1	0.0005	1	1
Field Sparrow	1	0.033	1	0.0005	1	1
Great Black-backed Gull	1	0.033	4	0.0021	2	2
Green Heron	1	0.033	2	0.0010	2	2
Indigo Bunting	1	0.033	1	0.0005	1	1
Ovenbird	1	0.033	1	0.0005	1	1
Seaside Sparrow	1	0.033	1	0.0005	1	1
Swamp Sparrow	1	0.033	3	0.0016	2	2
Warbling Vireo	1	0.033	2	0.0010	2	2
Wood Thrush	1	0.033	1	0.0005	1	1
Grand Total			1,929			

^aNumber of points a species was observed/ total number of points surveyed

^bTotal number of individuals of a given species seen over the study period

^cTotal individuals of a given species/ total individuals of all species

Floyd Bennett

A total of 2,191 individuals of 68 species were recorded during the three surveys at Floyd Bennett. Common Yellowthroat, Red-winged Blackbird, American Robin, and Yellow Warbler were the most frequently observed bird species seen at over 80% of the points surveyed (Table 8). Red-winged Blackbird and Gray Catbird were the most abundant with 218 and 137 individuals recorded respectively. The maximum number recorded during one survey period across all points was 87 for Red-winged Blackbird and 49 for Gray Catbird, or approximately 2.5 and 1.5 individuals per point respectively.

Some of the highlights of bird species recorded include Black-throated Green Warbler, Ruby-crowned Kinglet (*Regulus calendula*), Marsh Wren (*Cistothorus palustris*) and Hermit Thrush.

In addition, several state listed and priority species were reported at Floyd Bennett, including American Black Duck, Atlantic Brant, Osprey, Common and Least Tern, Black-crowned and Yellow-crowned Night-Heron, and American Oystercatcher.

Table 8. Summary statistics for bird species recorded during point count bird surveys conducted in the Floyd Bennett Field of Gateway National Recreation Area between May 17, 2005 and July 28, 2007. Table is arranged in order of frequency of occurrence. A total of 37 points were surveyed at Floyd Bennett.

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Common Yellowthroat	34	0.919	101	0.0461	4	36
Red-winged Blackbird	34	0.919	218	0.0995	8	87
American Robin	30	0.811	105	0.0479	12	39
Yellow Warbler	29	0.784	71	0.0324	3	30
Gray Catbird	27	0.730	137	0.0625	4	49
Herring Gull	25	0.676	135	0.0616	20	65
Willow Flycatcher	24	0.649	44	0.0201	2	20
Eastern Towhee	23	0.622	53	0.0242	3	22
Song Sparrow	21	0.568	71	0.0324	4	25
Laughing Gull	19	0.514	181	0.0826	30	92
European Starling	18	0.486	187	0.0853	100	114
Cedar Waxwing	15	0.405	55	0.0251	8	28
Northern Mockingbird	15	0.405	22	0.0100	2	12
Tree Swallow	15	0.405	40	0.0183	5	18
Barn Swallow	14	0.378	69	0.0315	20	43
Brown-headed Cowbird	14	0.378	22	0.0100	3	11
American Crow	13	0.351	26	0.0119	5	15
Northern Cardinal	13	0.351	20	0.0091	3	8
Brown Thrasher	12	0.324	17	0.0078	2	8
Great Black-backed Gull	11	0.297	32	0.0146	8	19
American Goldfinch	10	0.270	23	0.0105	5	11
Double-crested Cormorant	10	0.270	18	0.0082	4	9
Willet	10	0.270	17	0.0078	3	7
Common Tern	9	0.243	65	0.0297	30	38
American Redstart	8	0.216	11	0.0050	2	7
Atlantic Brant	8	0.216	142	0.0648	40	136
Glossy Ibis	8	0.216	11	0.0050	2	5
House Sparrow	8	0.216	35	0.0160	10	13
Common Grackle	7	0.189	14	0.0064	5	7
Great Egret	7	0.189	9	0.0041	2	4
American Oystercatcher	6	0.162	14	0.0064	3	6
Canada Goose	6	0.162	58	0.0265	50	57

Table 8. Summary statistics for bird species recorded during point count bird surveys conducted in the Floyd Bennett Field of Gateway National Recreation Area (continued).

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Fish Crow	6	0.162	13	0.0059	3	6
Ring-necked Pheasant	6	0.162	8	0.0037	2	7
Black-crowned Night-Heron	5	0.135	5	0.0023	1	5
Least Tern	5	0.135	19	0.0087	7	10
Mourning Dove	5	0.135	8	0.0037	4	6
Rock Dove	5	0.135	8	0.0037	3	6
Snowy Egret	5	0.135	6	0.0027	1	3
Black-capped Chickadee	4	0.108	9	0.0041	4	8
Mallard	4	0.108	21	0.0096	15	17
Marsh Wren	4	0.108	5	0.0023	2	4
Osprey	4	0.108	4	0.0018	1	2
Boat-tailed Grackle	3	0.081	9	0.0041	6	9
Eastern Phoebe	3	0.081	4	0.0018	1	3
Eastern Kingbird	2	0.054	4	0.0018	3	3
House Wren	2	0.054	3	0.0014	2	3
Ring-billed Gull	2	0.054	3	0.0014	2	3
American Black Duck	1	0.027	5	0.0023	3	3
Black Skimmer	1	0.027	1	0.0005	1	1
Black-throated Green Warbler	1	0.027	1	0.0005	1	1
Chimney Swift	1	0.027	1	0.0005	1	1
Chipping Sparrow	1	0.027	2	0.0009	2	2
Clapper Rail	1	0.027	1	0.0005	1	1
Downy Woodpecker	1	0.027	1	0.0005	1	1
Field Sparrow	1	0.027	1	0.0005	1	1
Forster's Tern	1	0.027	2	0.0009	2	2
Great-blue Heron	1	0.027	1	0.0005	1	1
Hermit Thrush	1	0.027	1	0.0005	1	1
House Finch	1	0.027	2	0.0009	2	2
Oriole sp.	1	0.027	1	0.0005	1	1
Palm Warbler	1	0.027	1	0.0005	1	1
Red-eyed Vireo	1	0.027	1	0.0005	1	1
Ruby-crowned Kinglet	1	0.027	1	0.0005	1	1
Ruddy Turnstone	1	0.027	6	0.0027	6	6
Savannah Sparrow	1	0.027	1	0.0005	1	1
Short-billed Dowitcher	1	0.027	10	0.0046	10	10
Yellow-crowned Night Heron	1	0.027	1	0.0005	1	1
Grand Total			2,191			

^aNumber of points a species was observed/ total number of points surveyed

^bTotal number of individuals of a given species seen over the study period

^cTotal individuals of a given species/ total individuals of all species

Breezy Point

A total of 1,550 individuals of 49 species were recorded during the three surveys at Breezy Point. Red-winged Blackbird, Common Yellowthroat, Gray Catbird, and Yellow Warbler were the most frequently observed bird species seen at over 80% of the points surveyed (Table 9). Red-winged Blackbird and Gray Catbird were the most abundant with a total of 93 and 76 records, and a maximum of 44 and 30 counted during one survey period respectively, or approximately 2.7 and 2 individuals recorded per point.

Some of the highlights of bird species recorded include Magnolia Warbler and Chimney Swift (*Chaetura pelagica*). Just like at Jamaica Bay, large numbers of Common (more than 500) and Least Terns and gulls were counted at this site, as would be expected because of the presence of breeding colonies of these beach nesting waterbirds. Forster's Tern (*Sterna forsteri*) was also recorded at this site. In addition to the terns, several other state listed and priority species were reported at Breezy Point, including Black Skimmer, American Oystercatcher and Peregrine Falcon.

Table 9. Summary statistics for bird species recorded during point count bird surveys conducted in the Breezy Point of Gateway National Recreation Area between May 17, 2005 and July 28, 2007. Table is arranged in order of frequency of occurrence. A total of 16 points were surveyed in Breezy Point.

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Red-winged Blackbird	16	1.000	93	0.0600	10	44
Common Yellowthroat	15	0.938	43	0.0277	3	17
Common Tern	14	0.875	509	0.3284	70	260+
Gray Catbird	14	0.875	76	0.0490	5	30
Yellow Warbler	14	0.875	36	0.0232	3	13
American Robin	12	0.750	29	0.0187	2	10
Herring Gull	12	0.750	97	0.0626	20	53
Willow Flycatcher	12	0.750	23	0.0148	2	11
Barn Swallow	11	0.688	47	0.0303	8	22
Eastern Towhee	11	0.688	25	0.0161	2	11
Song Sparrow	10	0.625	34	0.0219	4	12
Least Tern	9	0.563	95	0.0613	20	65
Great Black-backed Gull	8	0.500	82	0.0529	40	45
Laughing Gull	8	0.500	89	0.0574	15	60
Tree Swallow	8	0.500	16	0.0103	3	7
Northern Mockingbird	7	0.438	14	0.0090	2	9
American Crow	6	0.375	18	0.0116	7	12
Black-capped Chickadee	6	0.375	7	0.0045	2	7
European Starling	6	0.375	26	0.0168	8	11
Mourning Dove	6	0.375	19	0.0123	4	9
Northern Cardinal	6	0.375	14	0.0090	3	6
Brown Thrasher	5	0.313	7	0.0045	2	3

Table 9. Summary statistics for bird species recorded during point count bird surveys conducted in the Breezy Point of Gateway National Recreation Area between May 17, 2005 and July 28, 2007 (continued).

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Brown-headed Cowbird	5	0.313	8	0.0052	2	5
Cedar Waxwing	5	0.313	28	0.0181	15	23
American Oystercatcher	3	0.188	11	0.0071	4	9
American Redstart	3	0.188	3	0.0019	1	2
Great-crested Flycatcher	3	0.188	3	0.0019	1	2
Mallard	3	0.188	17	0.0110	9	9
Willet	3	0.188	10	0.0065	4	4
Canada Goose	2	0.125	16	0.0103	8	11
Common Grackle	2	0.125	3	0.0019	2	2
Field Sparrow	2	0.125	4	0.0026	2	2
Fish Crow	2	0.125	5	0.0032	3	3
House Finch	2	0.125	2	0.0013	1	1
House Sparrow	2	0.125	19	0.0123	10	10
Black Skimmer	1	0.063	3	0.0019	3	3
Chimney Swift	1	0.063	4	0.0026	2	2
Double-crested Cormorant	1	0.063	2	0.0013	1	1
Eastern Kingbird	1	0.063	1	0.0006	1	1
Forster's Tern	1	0.063	1	0.0006	1	1
Great Egret	1	0.063	1	0.0006	1	1
Killdeer	1	0.063	2	0.0013	1	1
Magnolia Warbler	1	0.063	1	0.0006	1	1
Marsh Wren	1	0.063	2	0.0013	2	2
Peregrine Falcon	1	0.063	1	0.0006	1	1
Ring-necked Pheasant	1	0.063	1	0.0006	1	1
Savannah Sparrow	1	0.063	1	0.0006	1	1
Snowy Egret	1	0.063	1	0.0006	1	1
White-eyed Vireo	1	0.063	1	0.0006	1	1
Grand Total			1,550			

^aNumber of points a species was observed/ total number of points surveyed

^bTotal number of individuals of a given species seen over the study period

^cTotal individuals of a given species/ total individuals of all species

Jamaica Bay

A total of 6,015 individuals of 78 species were recorded during the three surveys at the Jamaica Bay Unit. Red-winged Blackbird was by far the most frequently observed species seen at over 90% of the points surveyed (Table 10). Among passerine species, Red-winged Blackbird was the most abundant with a total of 405 individuals counted, and a maximum of 227 counted during one survey period, or more than 3.5 individuals recorded per point. This count includes one large

flock of 76 individuals seen on May 20th at Canarsie Pol. Gray Catbird, Yellow Warbler, and Common Yellowthroat were seen at more than 45% of the points surveyed with a total of 101, 97, and 65 total sightings of each species respectively.

Large numbers of gulls, terns, shorebirds and waterbirds were counted at Jamaica Bay. The purpose of the survey was to obtain information on passerine populations in the Gateway National Recreation Area, and the methodology used cannot provide an accurate census of colonial waterbirds in the colonies, so the numbers presented here are underestimates of the total usage of the area by terns and gulls. However, Laughing and Herring Gulls, American Oystercatcher, Glossy Ibis, Willet (*Catoptrophorus semipalmatus*) and Clapper Rail were recorded at more than 45% of the points. Herring Gull was by far the most abundant species with more than 2,000 individuals recorded, followed by Laughing Gull (725 recorded) and Common Tern (300 recorded). Small flocks of more than 40 Red Knot, Dunlin, and Ruddy Turnstone were recorded during the survey at Jamaica Bay. Large numbers of several state listed species were reported, including American Oystercatcher (195), Atlantic Brant (96 Osprey (26), American Black Duck (19), and Spotted Sandpiper (19). Northern Harrier and Peregrine Falcon were also reported at this site.

As mentioned earlier, for the purpose of this study we report separately for Jamaica Bay WR, Breezy Point, and Floyd Bennett. To compare species lists with those reported by Mizrahi (2004), we combined the species recorded in Breezy Point and Jamaica Bay Refuge, resulting in a total of 84 species, seen in blue in Appendix 8. If all three sites are combined, the total number of species recorded rises further to 90. Listed species at these two sites and the specific location where they were observed are presented in Appendix 9.

Table 10. Summary statistics for bird species recorded during point count bird surveys conducted in the Jamaica Bay Unit of Gateway National Recreation Area between May 17, 2005 and July 28, 2007. Table is arranged in order of frequency of occurrence. A total of 62 points were surveyed in Jamaica Bay.

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Red-winged Blackbird	58	0.935	405	0.0673	79	227
Laughing Gull	34	0.548	725	0.1205	100+	292+
Glossy Ibis	32	0.516	83	0.0138	11	42
American Oystercatcher	31	0.500	195	0.0324	20	69
Gray Catbird	30	0.484	101	0.0168	4	46
Yellow Warbler	30	0.484	97	0.0161	4	38
Clapper Rail	29	0.468	115	0.0191	7	58
Common Yellowthroat	29	0.468	65	0.0108	3	36
Herring Gull	29	0.468	2,112	0.3511	250+	1341+
Willet	28	0.452	110	0.0183	20	73
Song Sparrow	27	0.435	52	0.0086	3	23
Common Tern	25	0.403	300	0.0499	30	109
Tree Swallow	25	0.403	87	0.0145	10	39
Eastern Towhee	21	0.339	35	0.0058	3	18

Table 10. Summary statistics for bird species recorded during point count bird surveys conducted in the Jamaica Bay Unit of Gateway National Recreation Area between May 17, 2005 and July 28, 2007 (continued).

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Willow Flycatcher	21	0.339	30	0.0050	2	13
Double-crested Cormorant	20	0.323	64	0.0106	18	44
Barn Swallow	17	0.274	43	0.0071	5	20
Great Black-backed Gull	16	0.258	104	0.0173	20	57
Great Egret	16	0.258	21	0.0035	2	9
Northern Mockingbird	15	0.242	26	0.0043	2	10
Osprey	15	0.242	26	0.0043	5	14
Common Grackle	13	0.210	30	0.0050	5	15
Mallard	13	0.210	68	0.0113	16	30
Marsh Wren	13	0.210	33	0.0055	3	15
American Robin	12	0.194	24	0.0040	3	11
Black-crowned Night-Heron	12	0.194	20	0.0033	3	9
Fish Crow	11	0.177	18	0.0030	4	8
Northern Cardinal	11	0.177	17	0.0028	3	10
Snowy Egret	11	0.177	22	0.0037	5	16
American Crow	10	0.161	26	0.0043	13	24
Canada Goose	10	0.161	61	0.0101	15	47
European Starling	10	0.161	33	0.0055	12	15
Spotted Sandpiper	8	0.129	19	0.0032	10	12
Brown-headed Cowbird	7	0.113	9	0.0015	2	4
Boat-tailed Grackle	6	0.097	8	0.0013	2	4
Least Tern	6	0.097	38	0.0063	15	15
Semipalmated Plover	6	0.097	86	0.0143	45	66
Atlantic Brant	5	0.081	96	0.0160	80	95
Black-bellied Plover	5	0.081	67	0.0111	35	67
Brown Thrasher	5	0.081	6	0.0010	2	2
Forster's Tern	5	0.081	8	0.0013	4	8
Least Sandpiper	5	0.081	27	0.0045	20	23
Little Blue Heron	5	0.081	8	0.0013	3	5
American Redstart	4	0.065	6	0.0010	1	3
House Sparrow	4	0.065	8	0.0013	3	6
Semipalmated Sandpiper	4	0.065	87	0.0145	60	85
American Black Duck	3	0.048	19	0.0032	17	19
Great-blue Heron	3	0.048	4	0.0007	2	2
Great-crested Flycatcher	3	0.048	3	0.0005	1	1
Killdeer	3	0.048	8	0.0013	4	8
Red Knot	3	0.048	50	0.0083	35	50
Ring-billed Gull	3	0.048	6	0.0010	3	4

Table 10. Summary statistics for bird species recorded during point count bird surveys conducted in the Jamaica Bay Unit of Gateway National Recreation Area between May 17, 2005 and July 28, 2007 (continued).

Species	# of Points observed	Frequency occurrence by point ^a	Total number of birds recorded ^b	Relative abundance ^c	Max # recorded at one point	Max total # recorded during one survey period
Ruddy Turnstone	3	0.048	108	0.0180	100	108
Yellow-crowned Night Heron	3	0.048	3	0.0005	1	2
Carolina Wren	2	0.032	2	0.0003	1	2
Eastern Kingbird	2	0.032	4	0.0007	2	2
House Finch	2	0.032	4	0.0007	3	3
Lesser Yellowlegs	2	0.032	11	0.0018	10	11
Mourning Dove	2	0.032	4	0.0007	3	3
Peregrine Falcon	2	0.032	3	0.0005	2	2
Short-billed Dowitcher	2	0.032	96	0.0160	80	95
Black Skimmer	1	0.016	2	0.0003	2	2
Black-throated Green Warbler	1	0.016	1	0.0002	1	1
Blue Jay	1	0.016	1	0.0002	1	1
Blue-gray Gnatcatcher	1	0.016	1	0.0002	1	1
Cedar Waxwing	1	0.016	1	0.0002	1	1
Chimney Swift	1	0.016	1	0.0002	1	1
Dunlin	1	0.016	45	0.0075	45	45
Eastern Phoebe	1	0.016	1	0.0002	1	1
Gadwall	1	0.016	1	0.0002	1	1
Hermit Thrush	1	0.016	1	0.0002	1	1
House Wren	1	0.016	1	0.0002	1	1
Mute Swan	1	0.016	7	0.0012	4	4
Northern Harrier	1	0.016	1	0.0002	1	1
Oriole sp.	1	0.016	1	0.0002	1	1
Red-tailed Hawk	1	0.016	1	0.0002	1	1
Seaside Sparrow	1	0.016	3	0.0005	3	3
Grand Total			6,015			

^aNumber of points a species was observed/ total number of points surveyed

^bTotal number of individuals of a given species seen over the study period

^cTotal individuals of a given species/ total individuals of all species

Marsh Bird Callback Surveys

Although the marsh bird callback surveys and the point count surveys were conducted independently and targeted different suites of species, we conducted them at the same survey point locations, and on the same day, with the callback survey following the 10-minute point count. As described previously, these surveys took place in a subset of 62 points and consisted of two periods: a 5-minute period of passive listening and a 5-minute period when calls were played

in an attempt to elicit responses. Points surveyed were a subset of the points surveyed for other bird species, selected based on habitat.

Clapper Rail was the only secretive marsh bird species recorded during the callback surveys. Rails were encountered at 28 of the 53 points surveyed (53%); at 20 points (38%) they were detected before the playback, while at 23 points (43%) they were heard responding to the taped call (Figure 1). Rails were seen at only two points at Sandy Hook, one individual during the first survey and two during the second one. All the other sightings were from surveys at Jamaica Bay. Specifically, Clapper Rail was recorded at 26 of the 32 points, more than 80% of the points surveyed in Jamaica Bay either during the passive listening period or during callbacks. A total of 100 Clapper Rails were reported, 59 during the passive listening period and 41 during callbacks (Figure 1). An additional 19 observations of Clapper Rails were made during the survey not using the callback methodology. During the first and third survey similar numbers of rails were sighted during both passive and callback periods, but during the second survey three times as many birds were recorded during passive listening (Figure 2). This may be an indication that Clapper Rails are especially active during the second two weeks in June, which was the time period when the second callback survey was conducted.

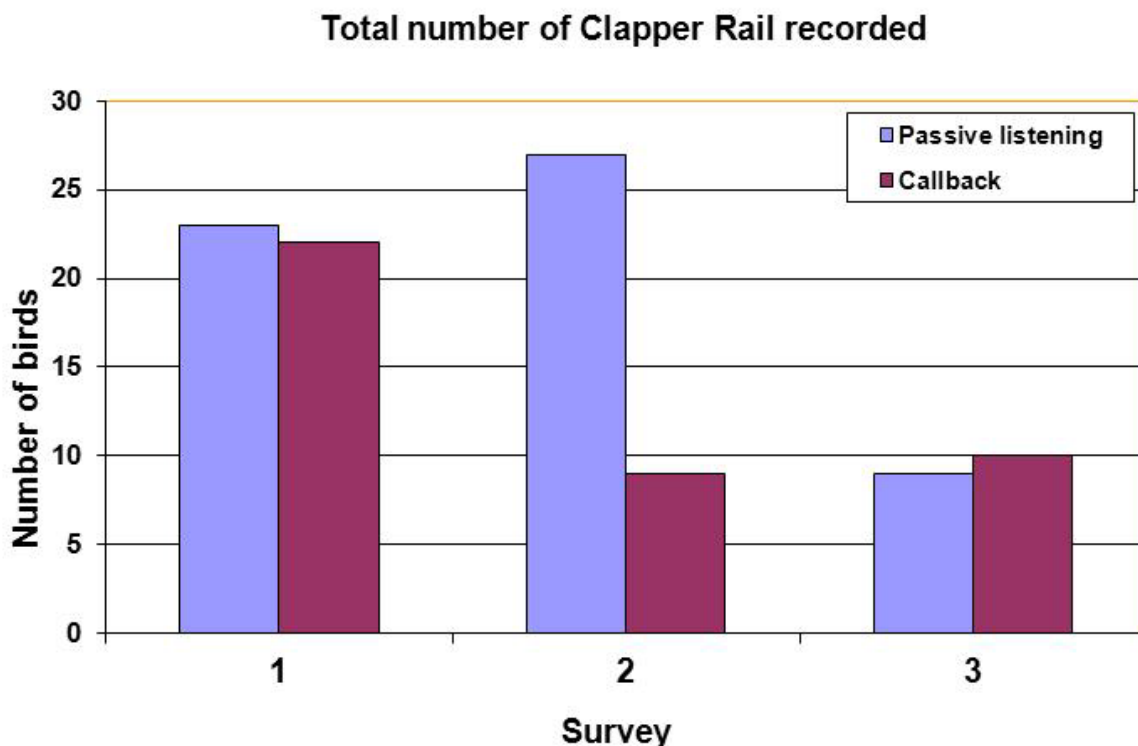


Figure 1. Total number of Clapper Rails recorded during callback surveys at Gateway National Recreation Area. Survey 1: May 22-June10; Survey 2: June 12 - June 29; Survey 3: July 11-July 24.

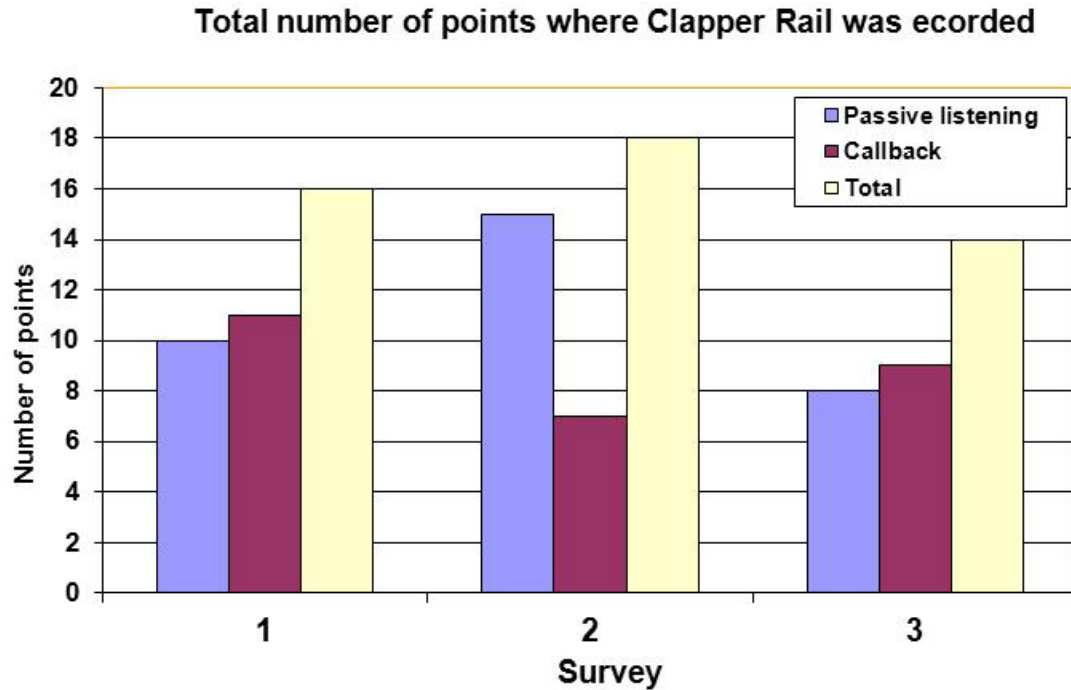


Figure 2. Total number of points where Clapper Rails were recorded during callback surveys at Gateway National Recreation Area. Survey 1: May 22-June10; Survey 2: June 12 - June 29; Survey 3: July 11-July 24.

Breeding Bird Density

We estimated breeding bird density for seven species, Red-winged Blackbird, Gray Catbird, Eastern Towhee, Song Sparrow, American Robin, Common Yellowthroat, and Yellow Warbler. The breeding density by site for these species, along with confidence intervals, can be seen in Table 11. For Red-winged Blackbird we used sightings in all five distance bins and the half normal cosine base model which had the best fit. For Gray Catbird, Common Yellowthroat, and Yellow Warbler the best fit was obtained by excluding sightings of birds at greater than 75 m away and averaging models, specifically uniform model with cosine and simple polynomial expansions, hazard-rate model with cosine and simple polynomial expansions and half-normal model with cosine expansion. For American Robin, Song Sparrow, and Eastern Towhee, we collapsed all distances greater than 75 m into one interval, and therefore ran the analysis based on 4 intervals. For American Robin and Eastern Towhee we used the average of a uniform simple polynomial and half normal cosine models, which had the best fit, to obtain density estimates. For Song Sparrow, the half normal model with cosine expansion had the best fit (Appendix 10).

Red-winged Blackbird and Gray Catbird occurred in the greatest and very similar density across the entire survey area ($X = 5.38$ and 5.36 birds/ha, 95% CI = 4.42 - 6.54 and 3.83 - 7.50 respectively), and there were no differences among sites for these two species (Table 11). Common Yellowthroat had the third highest density ($X = 2.35$ birds/ha, 95% CI = 1.36 - 4.04), and for this species there were also no differences among sites. Eastern Towhee occurred at significantly higher densities at Sandy Hook ($X = 3.04$ birds/ha, 95% CI = 2.24 - 4.13) than at all other sites (overall density for Gateway = 1.29 birds/ha, 95% CI = 0.94 - 1.75 ; Table 11).

American Robin occurred at significantly lower densities at Jamaica Bay ($X = 0.34$ birds/ha, 95% CI = 0.17-0.66) than at all other sites (overall density for Gateway = 1.21 birds/ha, 95% CI = 0.89-1.64; Table 11). Similarly, Song Sparrow was recorded in lower densities at Jamaica Bay ($X = 0.76$ birds/ha, 95% CI = 0.51-1.14) than all other sites except for Breezy Point (overall density for Gateway = 1.79 birds/ha, 95% CI = 1.41-2.27; Table 11). Finally, Yellow Warbler had significantly higher density at Breezy Point ($X = 2.75$ birds/ha, 95% CI = 1.70-4.45) than at Sandy Hook ($X = 1.05$ birds/ha, 95% CI = 0.68-1.63, Table 11), but there were no other differences among sites for this species.

Habitat Use

The majority of bird sighting at Jamaica Bay, Breezy Point, and Floyd Bennett Field were made in scrub/shrub habitats. In Breezy Point, sightings were only from shrub/scrub habitats except for one Red-winged Blackbird seen in *Phragmites*. The largest number of observations was made in scrub/shrub habitats at all sites, followed by low marsh habitats in Jamaica Bay and *Phragmites* habitats in Floyd Bennett Field (Figure 3). The largest number of species was also seen at Scrub/shrub habitats at all three sites for which habitat was recorded. Again, low marsh had the second highest number of species for Jamaica Bay and *Phragmites* had the second highest number of species for Floyd Bennett (Figure 4).

Table 11. Estimated breeding density in number of individuals per hectare of Red-winged Blackbird, Grey Catbird, Common Yellowthroat, Yellow Warbler, Song Sparrow, Eastern Towhee, American Robin recorded during surveys in the Gateway National Recreation Area. Table is arranged from highest to lowest density. Density estimates were obtained using DISTANCE, which incorporates detection probabilities. Best fit models can be seen in Appendix 10). Highlighted values were significantly higher than values in red.

Species	Sandy Hook		Staten Island		Floyd Bennett		Breezy Point		Jamaica Bay		Entire Gateway NRA	
	Density	Confidence Interval	Density	Confidence Interval	Density	Confidence Interval	Density	Confidence Interval	Density	Confidence Interval	Density	Confidence Interval
Grey Catbird (averaged model; observations under 75m only; 3 distance intervals used)	6.44	4.54, 9.13	7.30	4.92, 10.84	5.88	3.82, 9.05	7.46	4.65, 11.95	2.52	1.46, 4.35	5.36	3.83, 7.50
Red-winged Blackbird (half normal cosine model; 5 distance intervals used)	7.56	5.81, 9.84	5.01	3.42, 7.33	4.83	3.71, 6.30	4.82	3.20, 7.28	3.98	3.12, 5.08	5.38	4.42, 6.54
Common Yellowthroat (averaged model; observations under 75m only; 3 distance intervals used)	3.39	1.88, 6.11	2.06	0.99, 4.26	2.79	1.60, 4.86	2.85	1.55, 5.22	1.11	0.62, 2.00	2.35	1.36, 4.04
Yellow Warbler (averaged model; observations under 75m only; 3 distance intervals used)	1.05	0.68, 1.63	2.11	1.46, 3.04	2.33	1.52, 3.56	2.75	1.70, 4.45	1.88	1.10, 3.20	1.83	1.28, 2.61
Song Sparrow (half normal cosine model; 4 distance intervals used)	2.31	1.64, 3.24	2.88	1.98, 4.20	1.75	1.17, 2.61	1.93	1.09, 3.44	0.76	0.51, 1.14	1.79	1.41, 2.27
American Robin (half normal cosine model; 4 distance intervals used)	0.98	0.70, 1.39	2.41	1.58, 3.67	1.94	1.29, 2.93	1.47	0.82, 2.64	0.34	0.17, 0.66	1.21	0.89, 1.64
Eastern Towhee (half normal cosine model; 4 distance intervals used)	3.04	2.24, 4.13	0.7455	0.46, 1.21	0.79	0.47, 1.33	0.86	0.48, 1.55	0.31	0.18, 0.54	1.29	0.94, 1.75

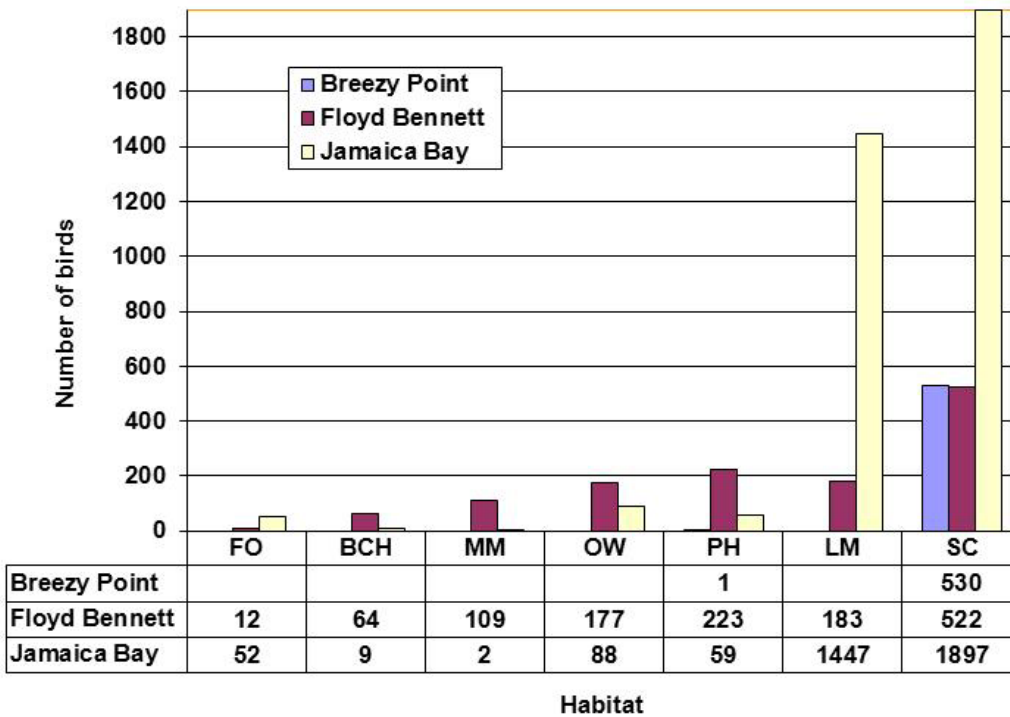


Figure 3. Number of birds recorded at Gateway National Recreation Area between May 17 and July 28, 2007 by habitat types: FO= forest; BCH= beach; MM= man-made; OW= open water; PH= phragmites; LM= low marsh; SC= scrub/shrub.

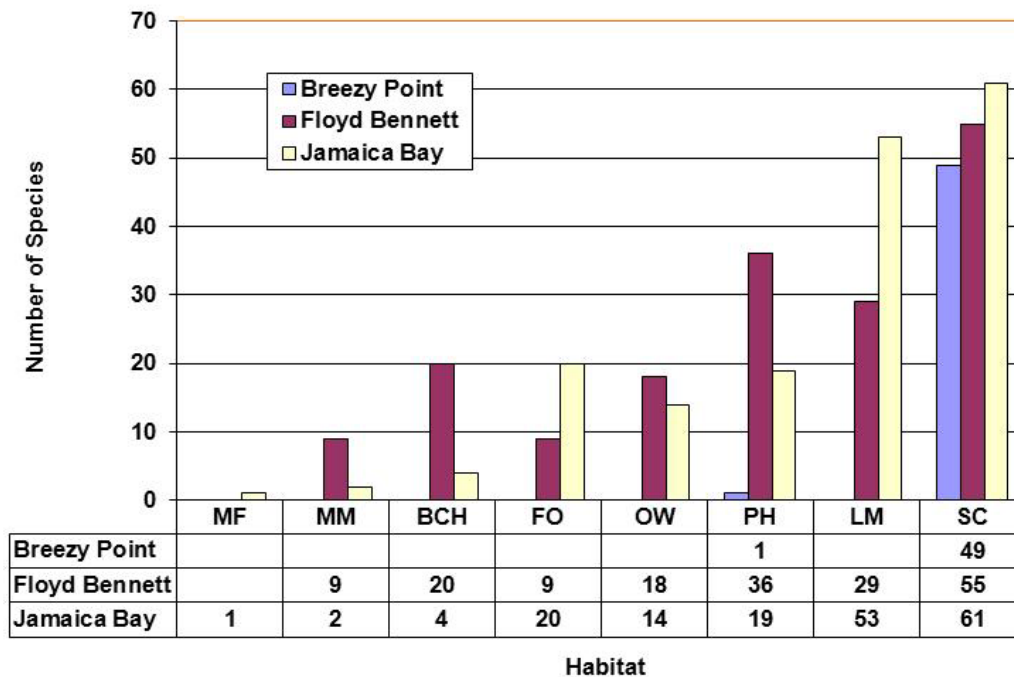


Figure 4. Total number of species recorded at Gateway National Recreation Area between May 17 and July 28, 2007 by habitat types: FO= forest; BCH= beach; MM= man-made; OW= open water; PH= phragmites; LM= low marsh; SC= scrub/shrub.

We created similar analyses by pulling out information for only passerine species. We see the same patterns, with over 350 passerine bird sightings and over 30 species recorded in scrub/shrub habitats at all sites, followed by low marsh in Jamaica Bay and by *Phragmites* in Floyd Bennett with over 150 bird sightings; and 19 species and 24 species seen respectively (Figure 5 and 6). In Jamaica Bay, scrub/shrub and low marsh habitats were followed by *Phragmites* and forest habitat in importance (Figure 5 and 6). At Floyd Bennett Field, observations were made across all habitats, with over 10 species seen in beach and low marsh and 9 species seen in forest. Also at Floyd Bennett, birds used existing ‘man-made’ environments, with over 100 individuals of seven species recorded.

The average number of passerine birds seen per point and per cycle was significantly different at scrub/shrub habitats than those seen at other habitats, and also significantly different among sites, with Breezy Point having the highest number recorded and Jamaica Bay the lowest (Figure 7). Among other habitats, there were significantly more sightings of birds in *Phragmites* than other habitats at Floyd Bennett Field, and significantly more sightings in low marsh in Jamaica Bay, in agreement with our previous more descriptive statistics. There were no differences in average passerine bird numbers in man-made, beach and low marsh habitat at Floyd Bennett (Figure 7).

These results may simply be the result of existing habitat at Gateway National Recreation Areas. Since mapping of the park was not completed by the time the analysis on bird data was undertaken, we do not know how the bird distribution relates to the habitat availability at the surveyed points. A more effective approach to understanding habitat use at these sites would be to use GIS mapping of the sites to look at relationships between habitat type and bird abundance and diversity. Given that those maps are not currently available, however, our field observation can provide information on habitat types and use at Gateway National Recreation Area and in a future date can be used in conjunction with mapping at the sites for more detailed analysis.

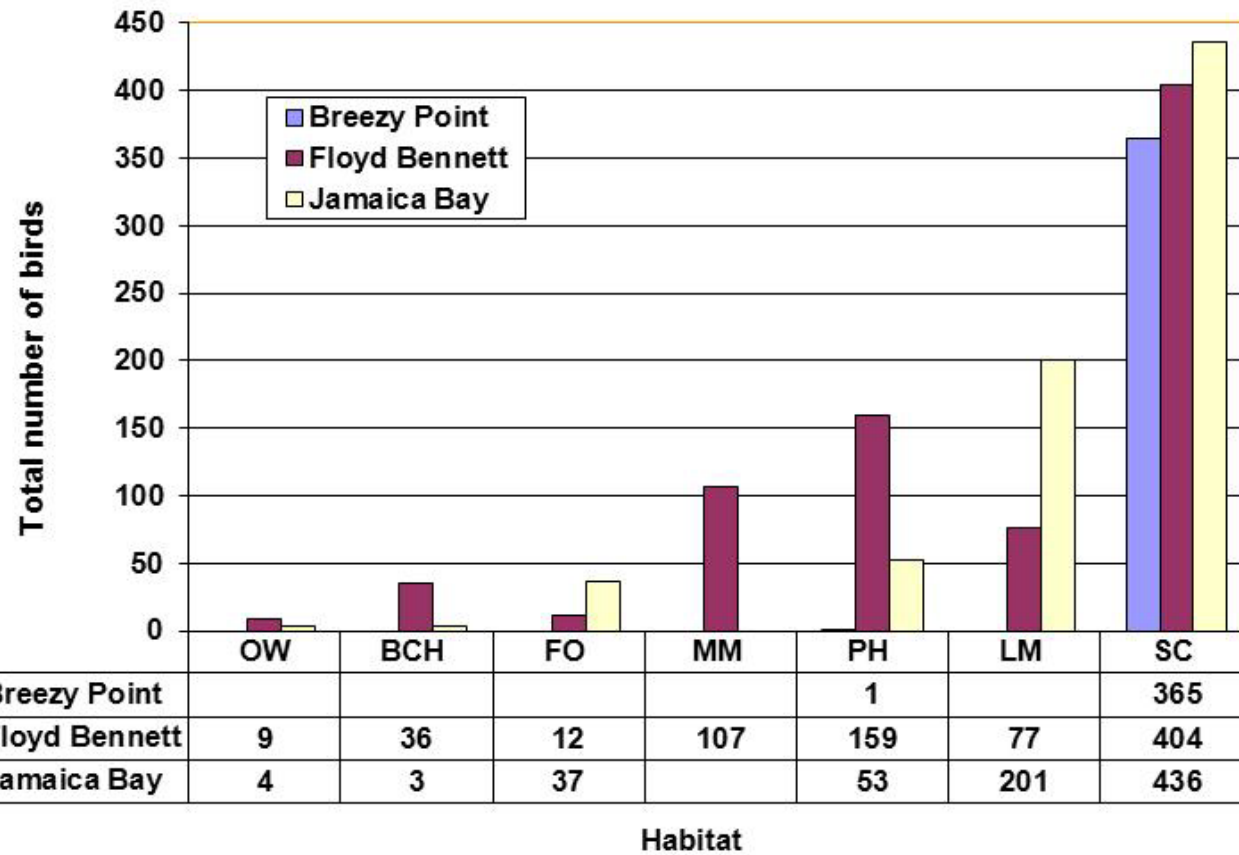


Figure 5. Total number of passerines recorded at Gateway National Recreation Area between May 17 and July 28, 2007 by habitat types: FO= forest; BCH= beach; MM= man-made; OW= open water; PH= phragmites; LM= low marsh; SC= scrub/shrub.

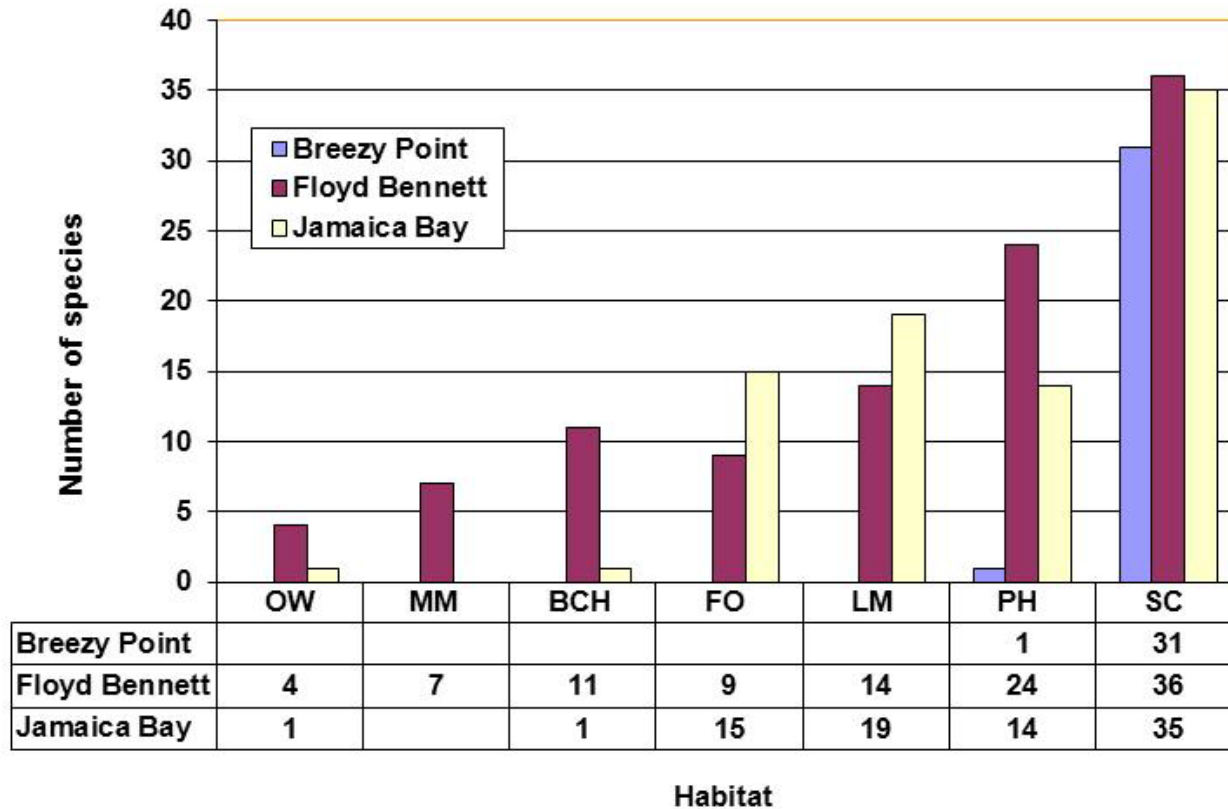


Figure 6. Total number of passerine species recorded at Gateway National Recreation Area between May 17 and July 28, 2007 by habitat types: FO= forest; BCH= beach; MM= man-made; OW= open water; PH= phragmites; LM= low marsh; SC= scrub/shrub.

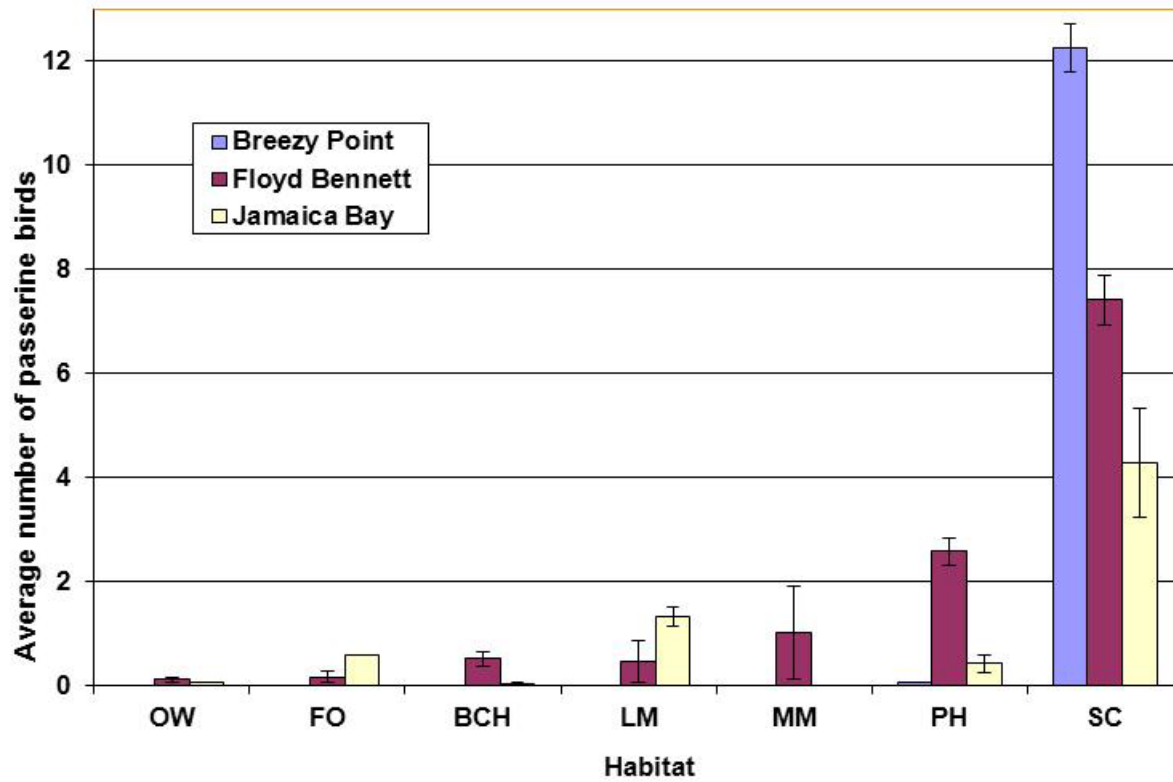


Figure 7. Average number of individuals of passerine birds ($\pm$ SE) recorded during three surveys at Gateway between May 17 and July 28, 2007, by habitat types: OW=open water; BCH=beach; FO=forest; LM=low marsh; PH=Phragmites; MM=man-made; SC=scrub/shrub.

Maps of Bird Distribution

In Figures 8-37 we provide maps of bird distribution to illustrate another potential way of presenting the data from our two year survey. Species specific maps allow us at a glance to see what sites are being used extensively by which species. For the mapping we used the maximum number of individuals of a species seen within 100 meters because that is the best representation of actual site use.

We chose to create maps for individual species as a way to show areas favored by those species. This can be important for habitat management purposes as areas slated for habitat alteration can be compared to those sites that support high densities of species of interest. For example, large concentrations of Gray Catbirds (Figure 25), Eastern Towhees (Figure 19), Common Yellowthroats (Figure 31), and Yellow Warblers (Figure 37) were found in Jamaica Bay, within the main part of the refuge, but were largely absent from other portions of the site. Eastern Towhees (Figure 15) and Common Yellowthroats (Figure 27) were found only within southern portions of Staten Island and were absent from northern locations. Red-winged Blackbirds were found throughout all portions of each site. These maps are meant to illustrate ways in which the data can be presented and are not intended to provide all possible permutations of graphically presenting the data.

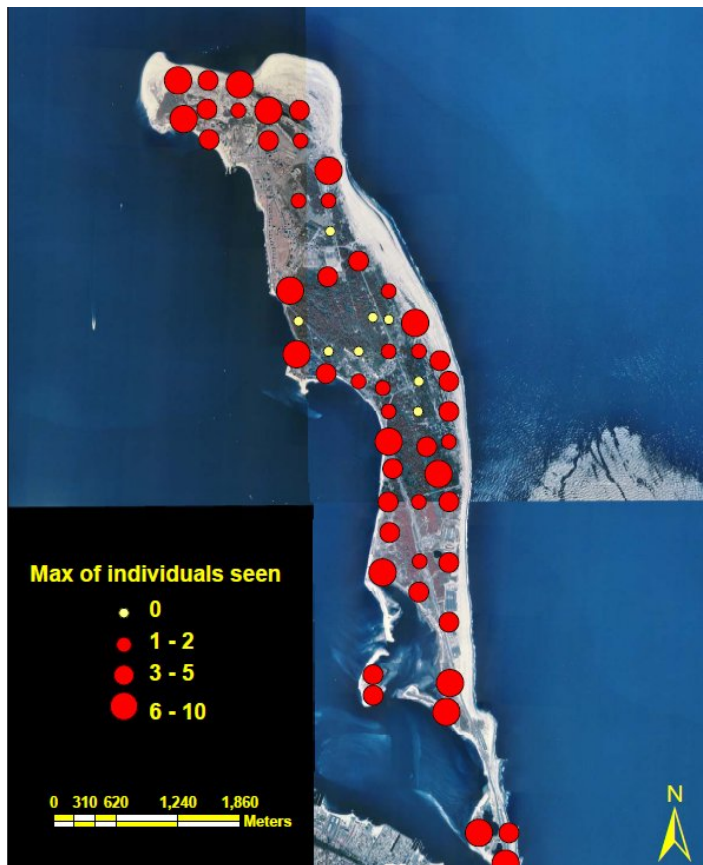


Figure 8. Maximum number of Red-winged Blackbirds observed during three surveys at Sandy Hook survey locations from May 20 to July 24, 2005.

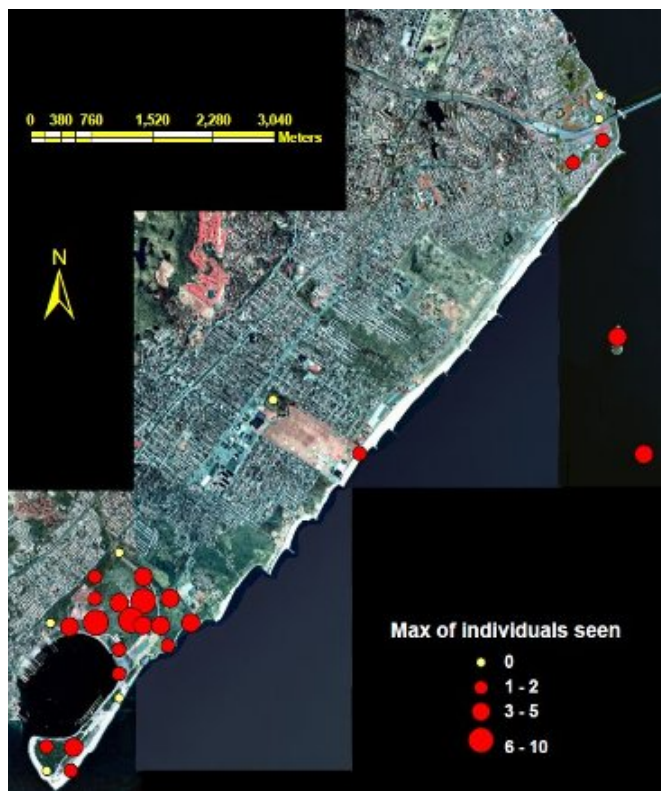


Figure 9. Maximum number of Red-winged Blackbirds observed during three surveys at Staten Island survey locations from May 20 to July 24, 2005.

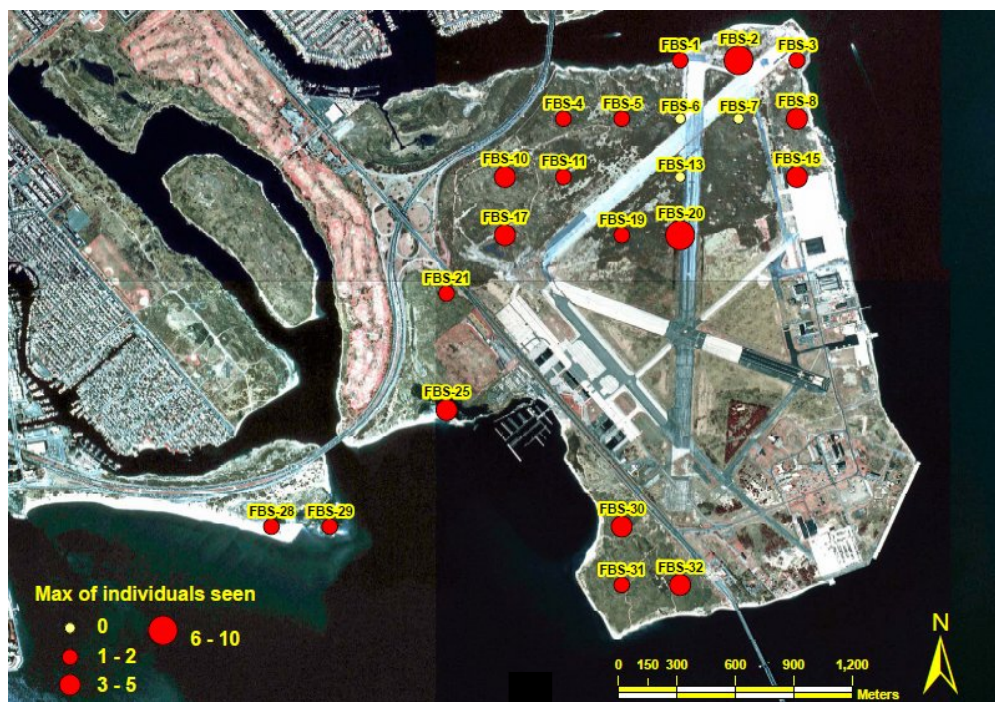


Figure 10. Maximum number of Red-winged Blackbirds observed during three surveys at Floyd Bennett South survey locations from May 17 to July 28, 2007.

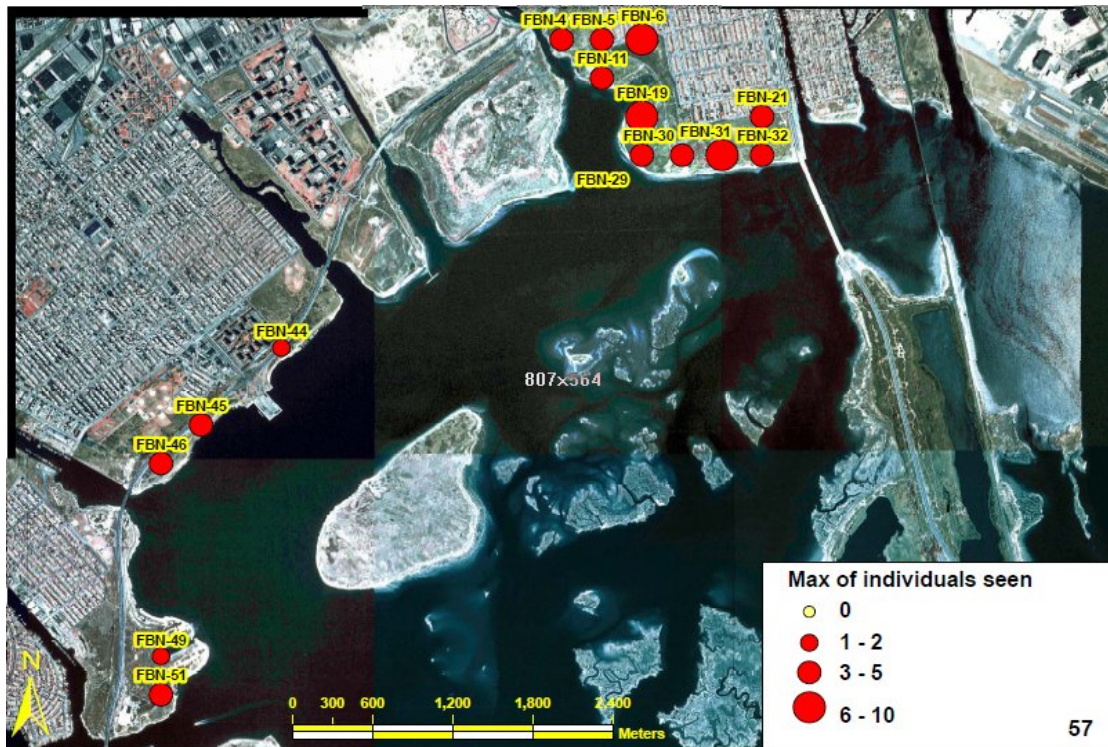


Figure 11. Maximum number of Red-winged Blackbirds observed during three surveys at Floyd Bennett North survey locations from May 17 to July 28, 2007.

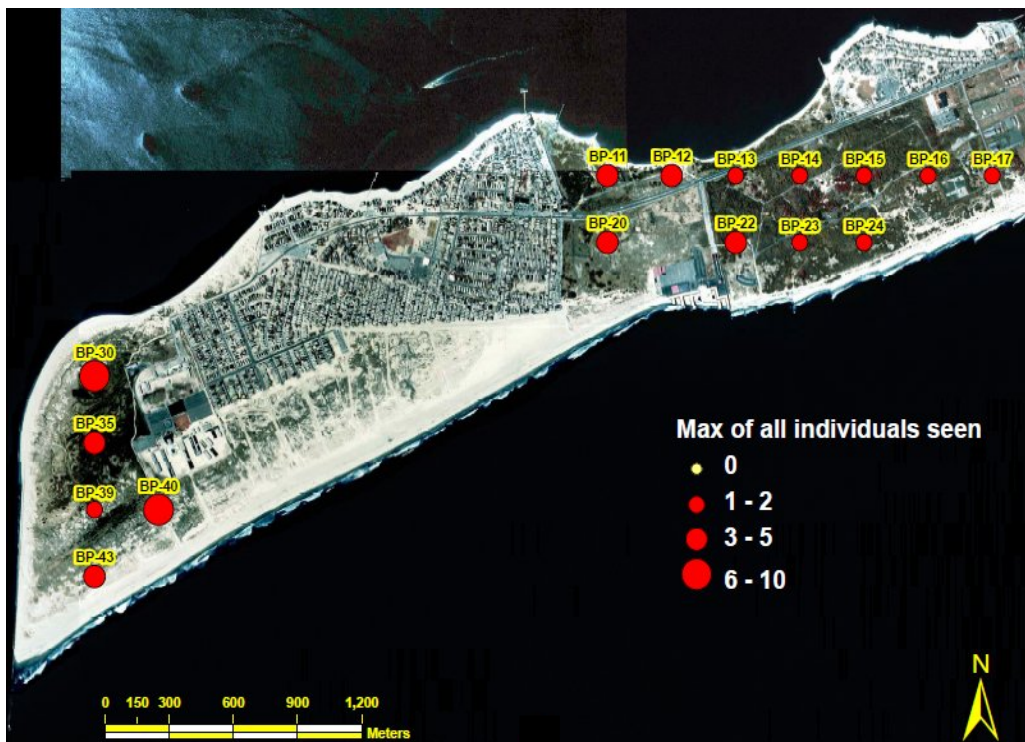


Figure 12. Maximum number of Red-winged Blackbirds observed during three surveys at Breezy Point survey locations from May 17 to July 28, 2007.

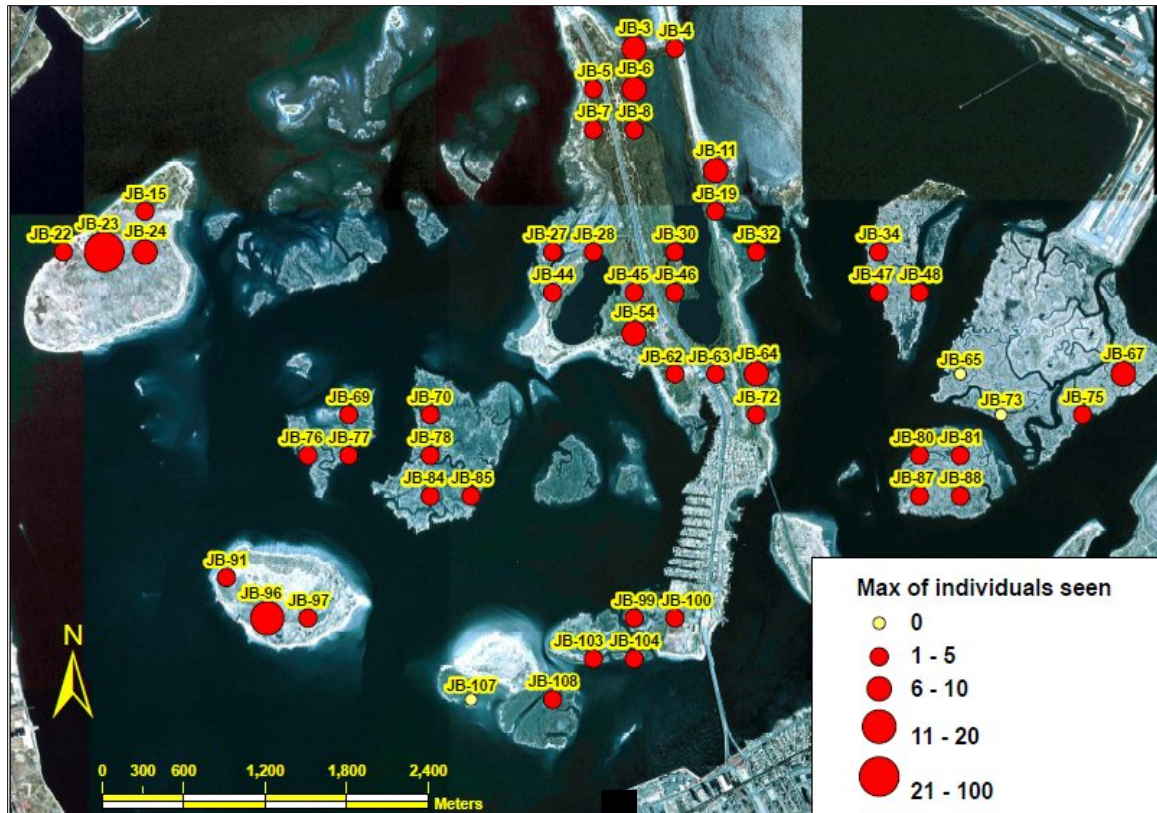


Figure 13. Maximum number of Red-winged Blackbirds observed during three surveys at Jamaica Bay survey locations from May 17 to July 28, 2007.

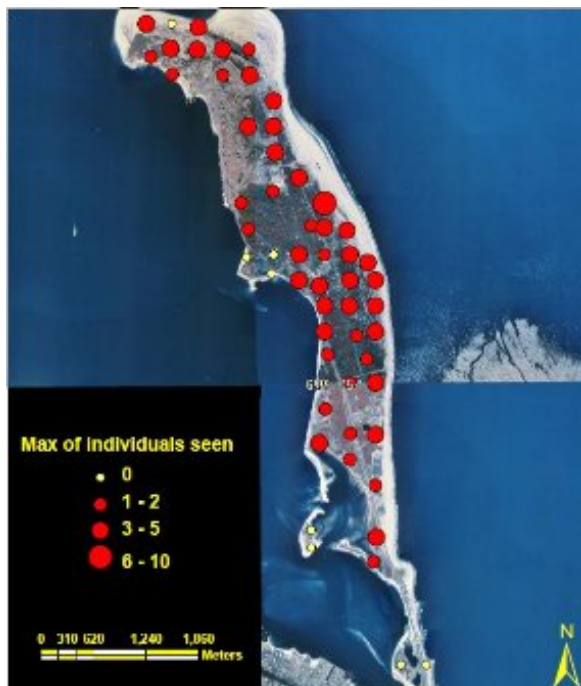


Figure 14. Maximum number of Eastern Towhees observed during three surveys at Sandy Hook survey locations from May 20 to July 24, 2005

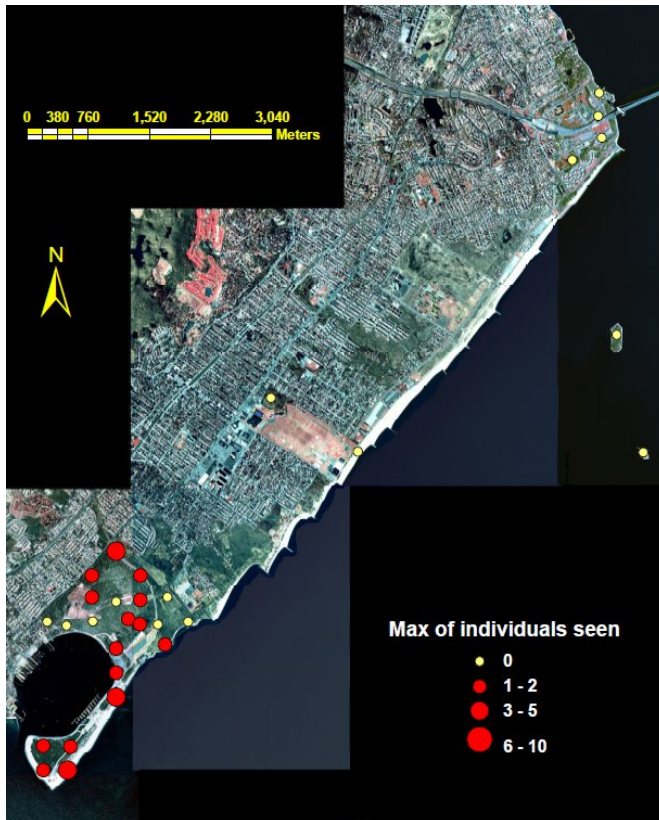


Figure 15. Maximum number of Eastern Towhees observed during three surveys at Staten Island survey locations from May 20 to July 24, 2005.

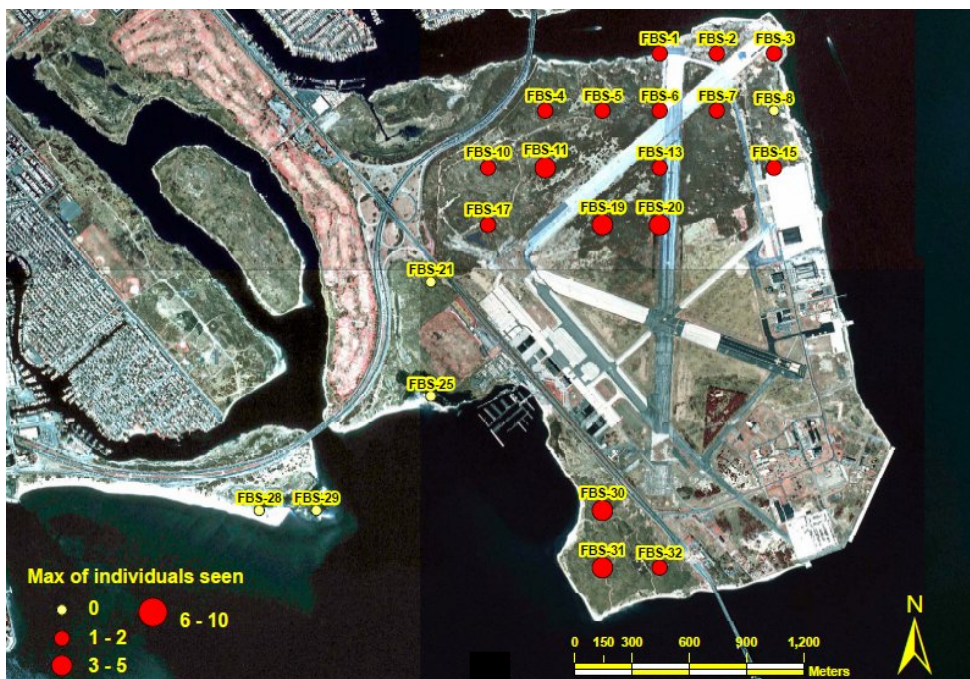


Figure 16. Maximum number of Eastern Towhees observed during three surveys at Floyd Bennett South survey locations from May 17 to July 28, 2007.

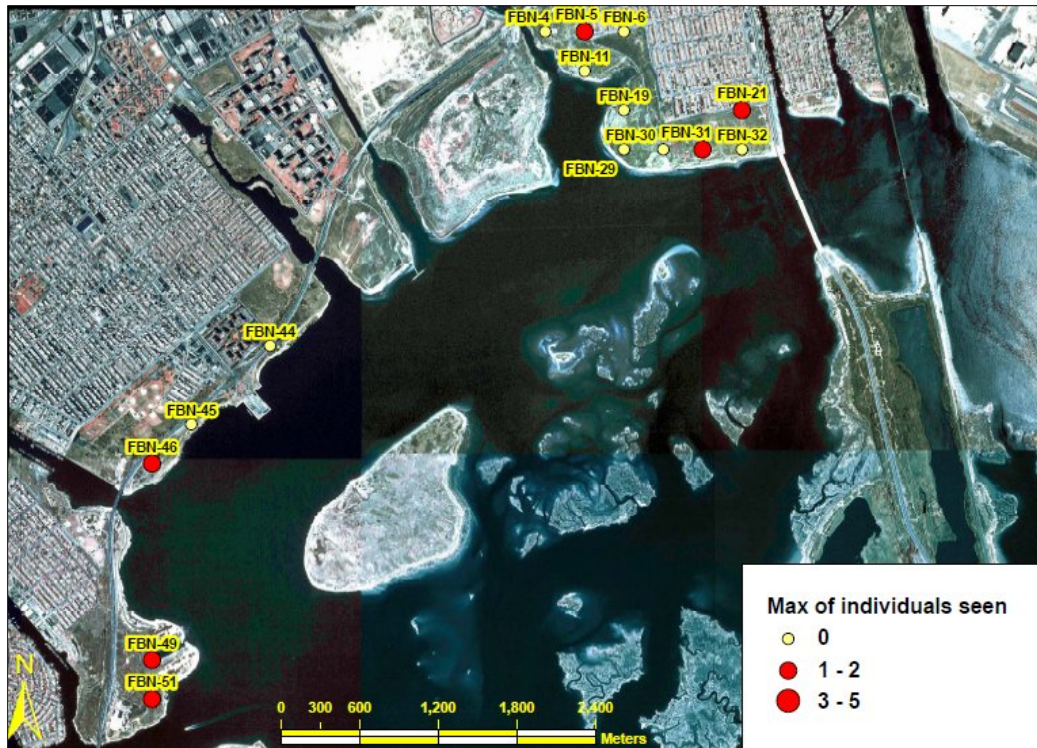


Figure 17. Maximum number of Eastern Towhees observed during three surveys at Floyd Bennett North survey locations from May 17 to July 28, 2007.

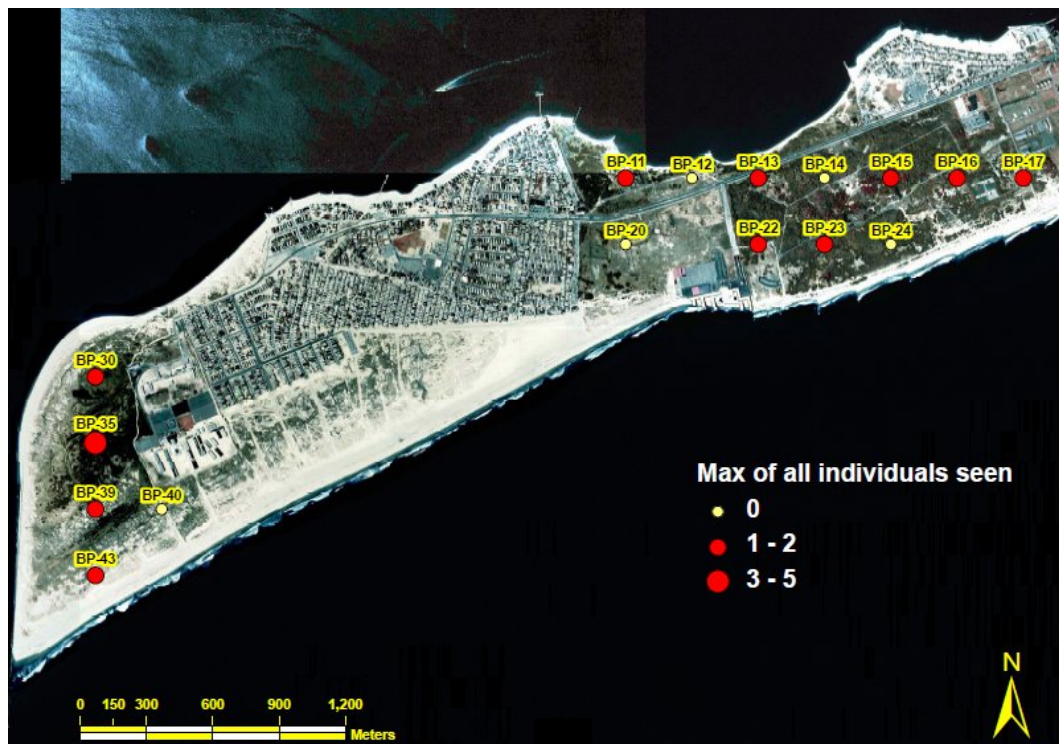


Figure 18. Maximum number of Eastern Towhees observed during three surveys at Breezy Point survey locations from May 17 to July 28, 2007.

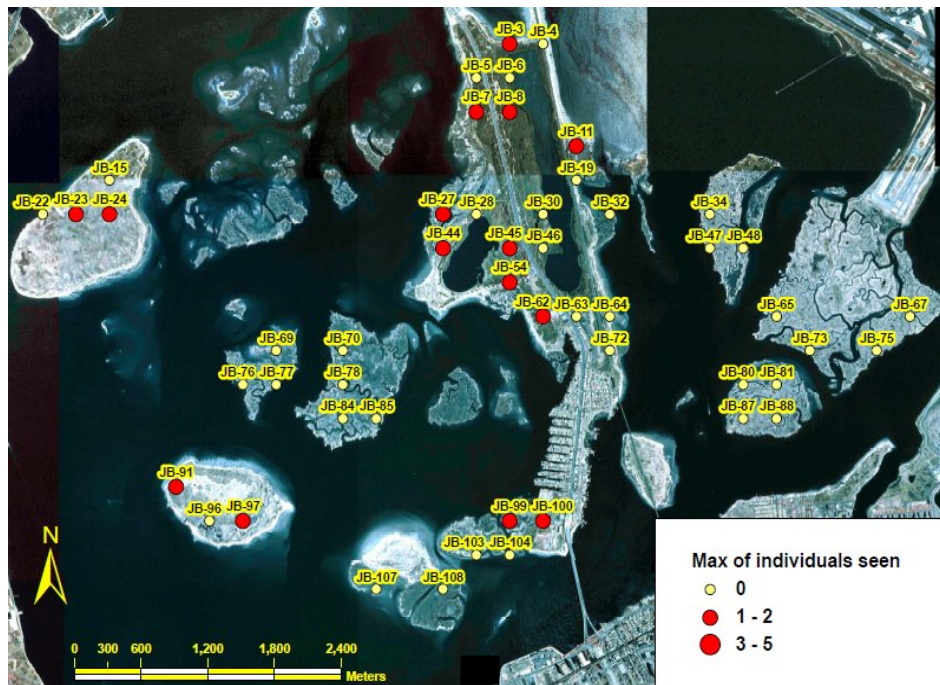


Figure 19. Maximum number of Eastern Towhees observed during three surveys at Jamaica Bay survey locations from May 17 to July 28, 2007.

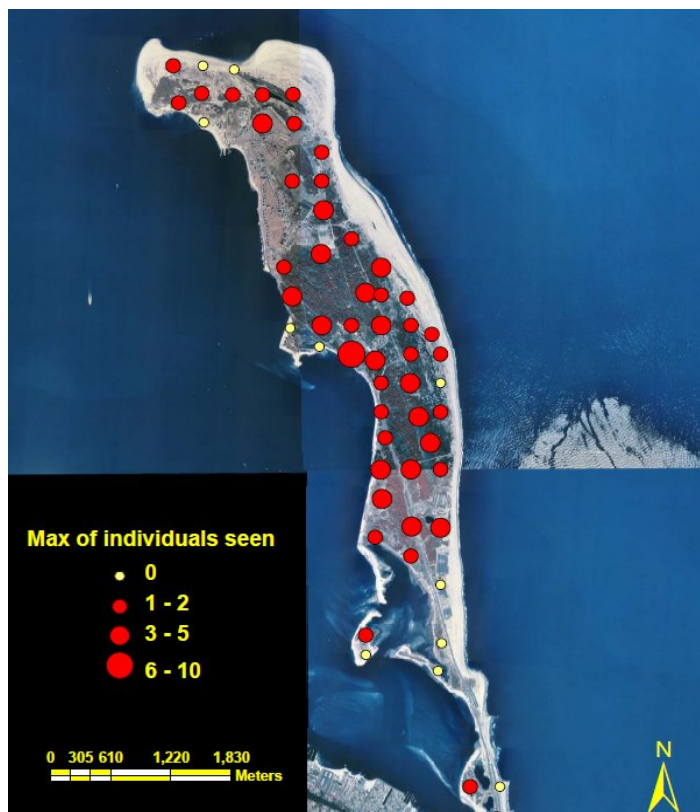


Figure 20. Maximum number of Gray Catbirds observed during three surveys at Sandy Hook survey locations from May 20 to July 24, 2005.



Figure 21. Maximum number of Gray Catbirds observed during three surveys at Staten Island survey locations from May 20 to July 24, 2005.

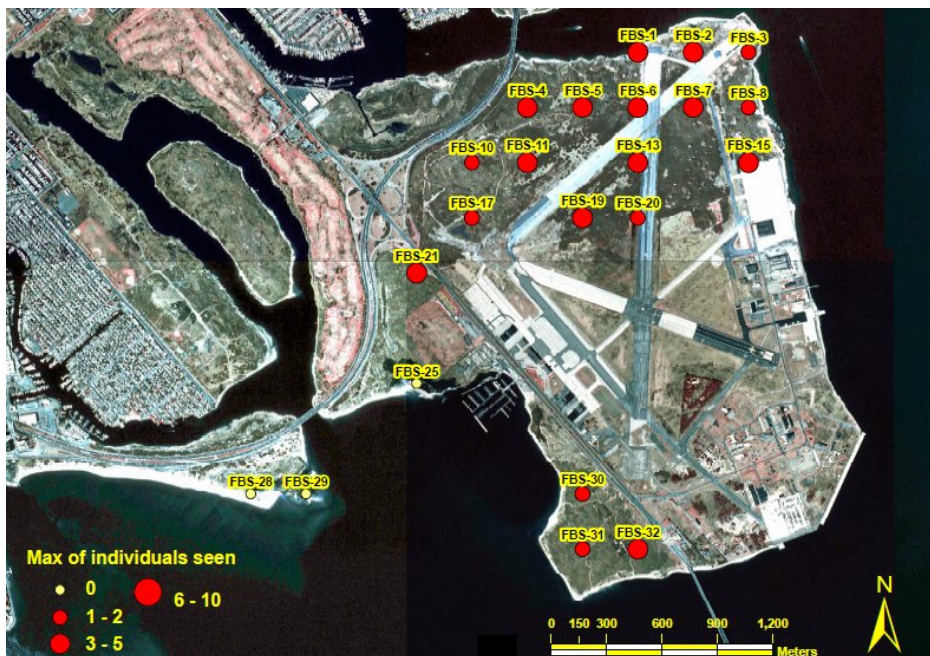


Figure 22. Maximum number of Gray Catbirds observed during three surveys at Floyd Bennett South survey locations from May 17 to July 28, 2007.

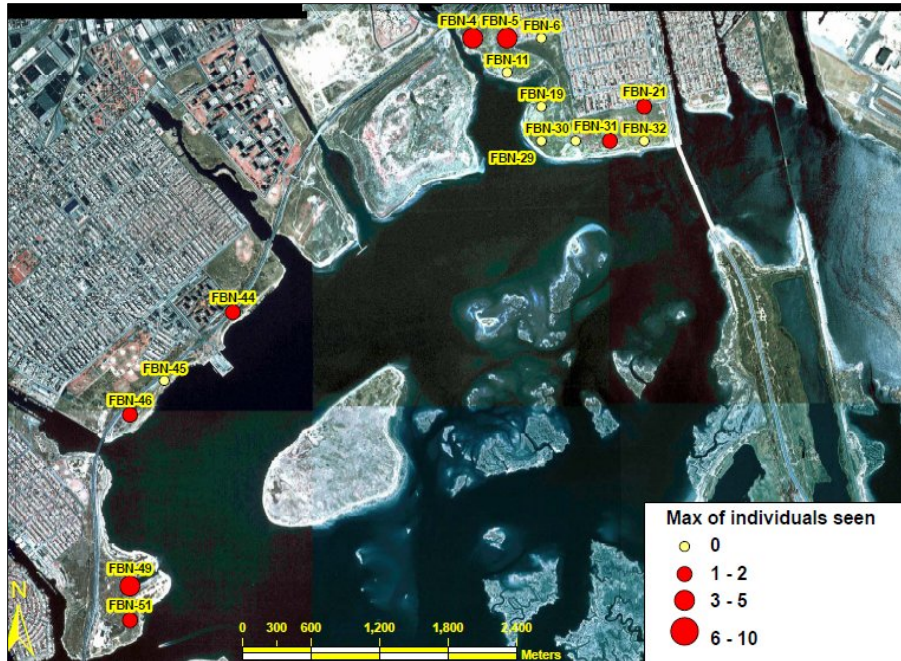


Figure 23. Maximum number of Gray Catbirds observed during three surveys at Floyd Bennett North survey locations from May 17 to July 28, 2007.

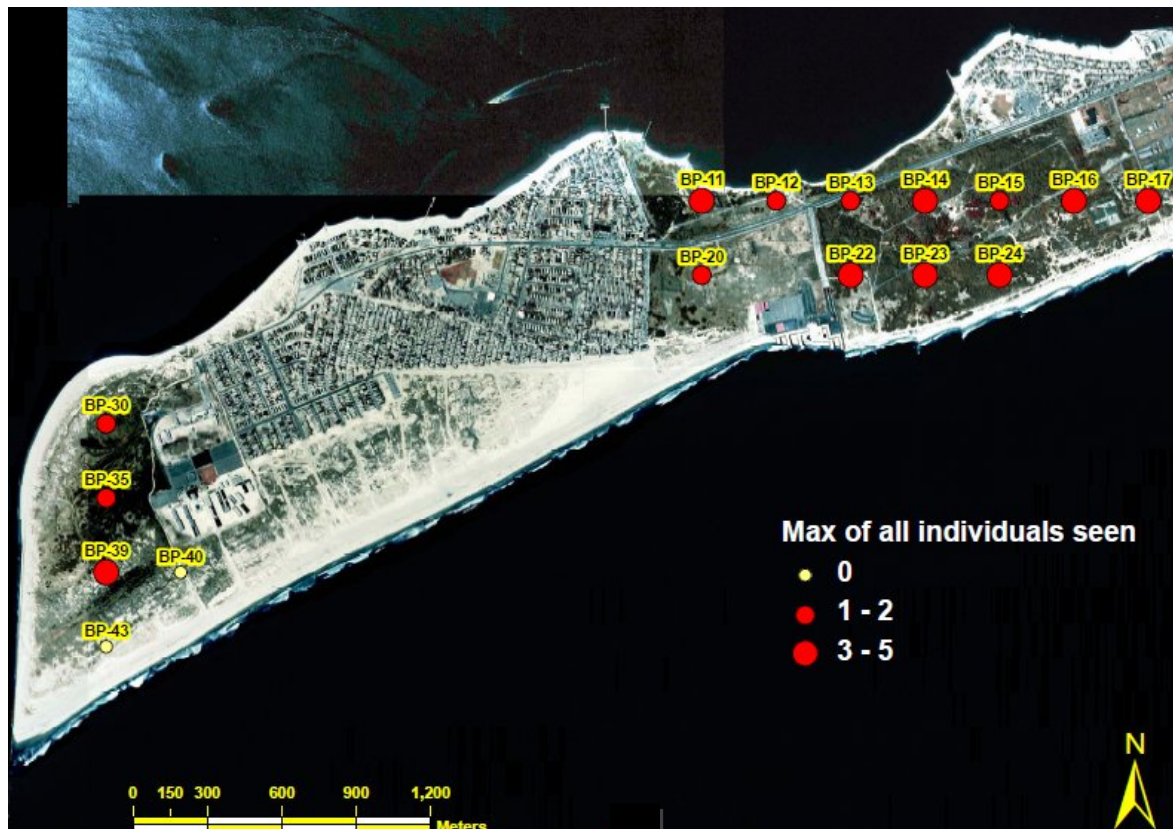


Figure 24. Maximum number of Gray Catbirds observed during three surveys at Breezy Point survey locations from May 17 to July 28, 2007.

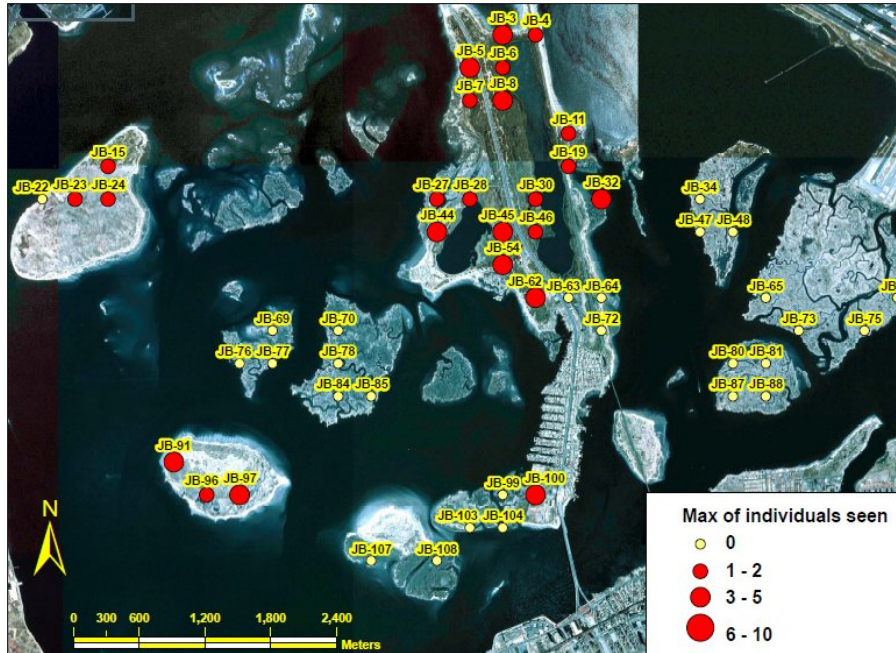


Figure 25. Maximum number of Gray Catbirds observed during three surveys at Jamaica Bay survey locations from May 17 to July 28, 2007.

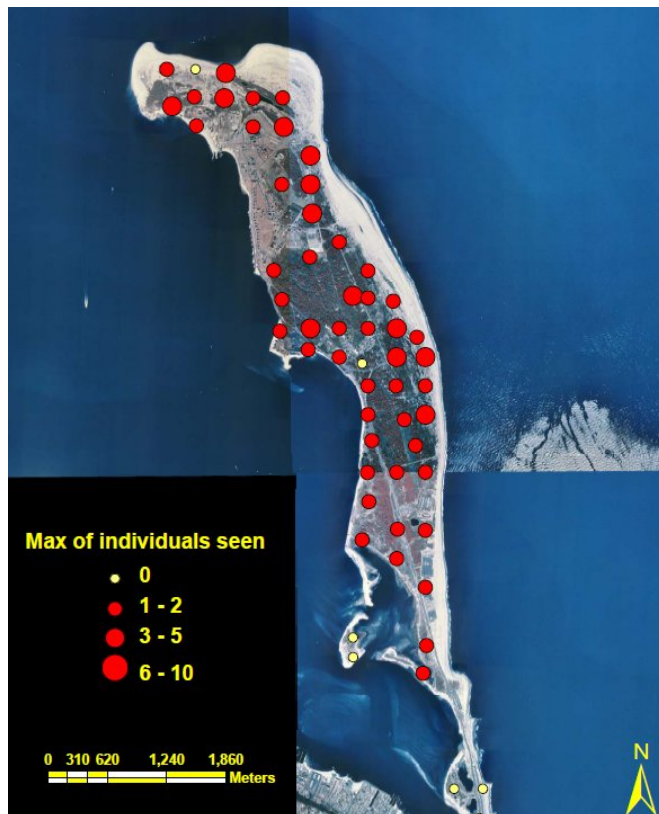


Figure 26. Maximum number of Common Yellowthroats observed during three surveys at Sandy Hook survey locations from May 20 to July 24, 2005

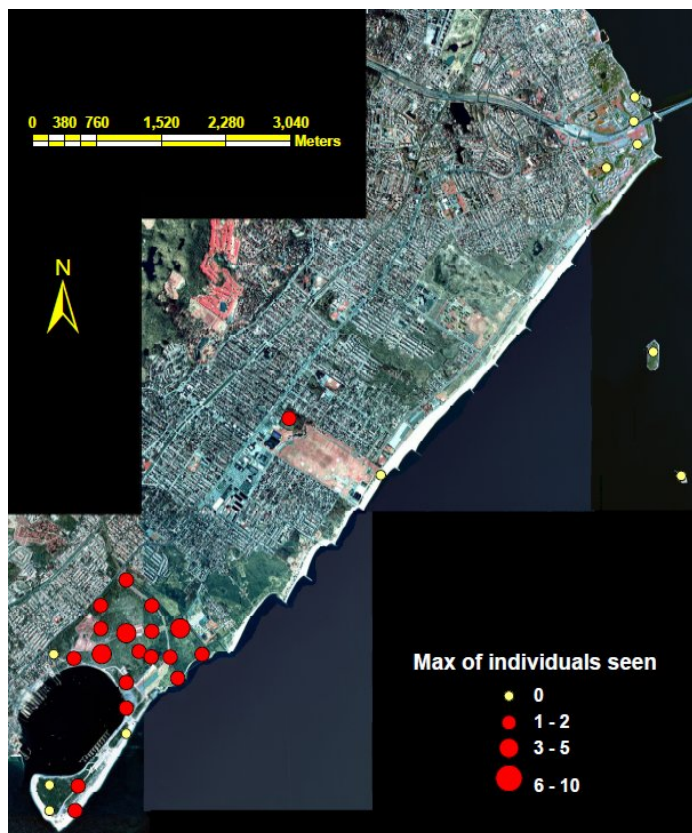


Figure 27. Maximum number of Common Yellowthroats observed during three surveys at Staten Island survey locations from May 20 to July 24, 2005.



Figure 28. Maximum number of Common Yellowthroats observed during three surveys at Floyd Bennett South survey locations from May 17 to July 28, 2007.

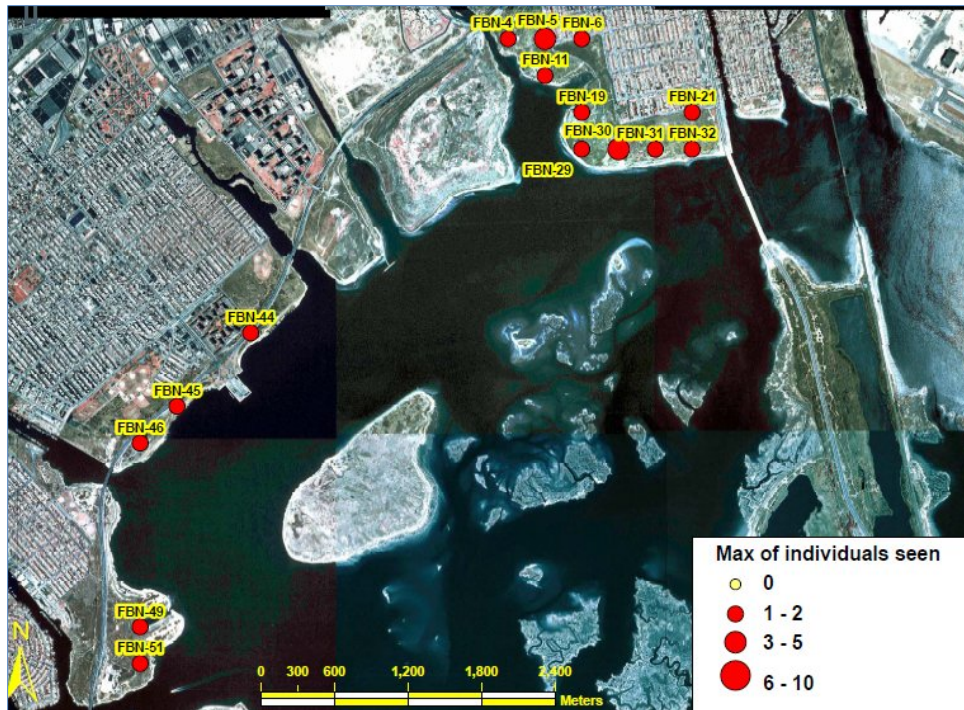


Figure 29. Maximum number of Common Yellowthroats observed during three surveys at Floyd Bennett North survey locations from May 17 to July 28, 2007.

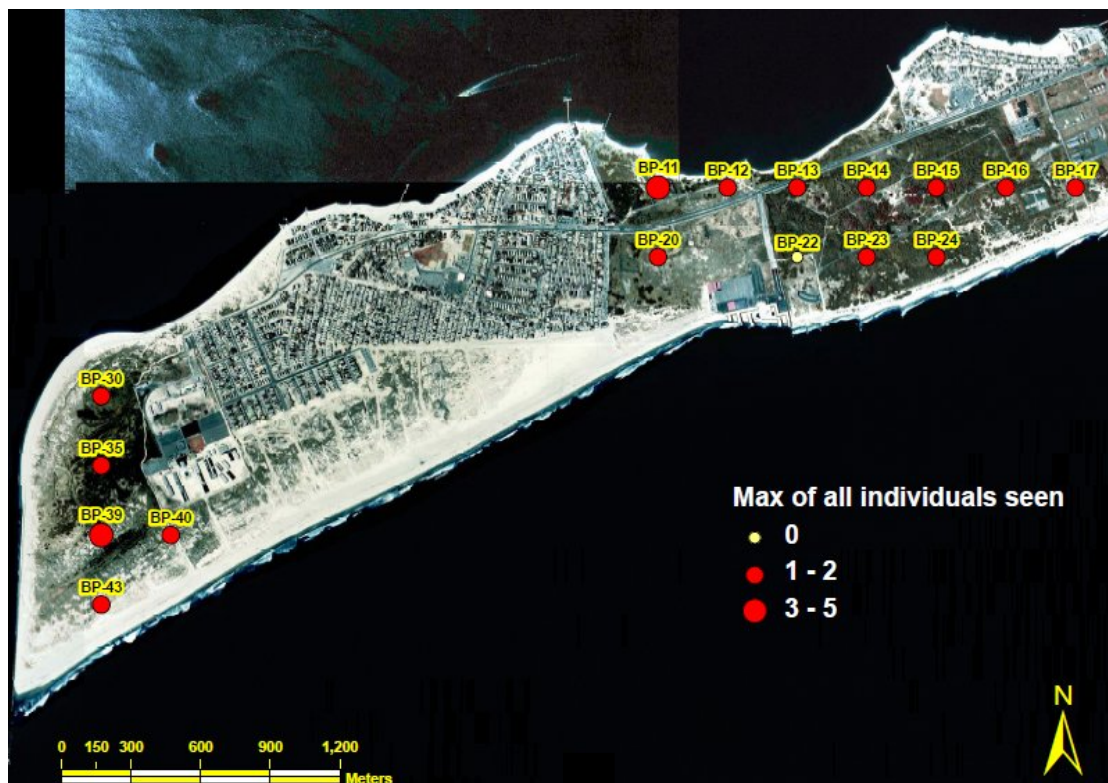


Figure 30. Maximum number of Common Yellowthroats observed during three surveys at Breezy Point survey locations from May 17 to July 28, 2007.

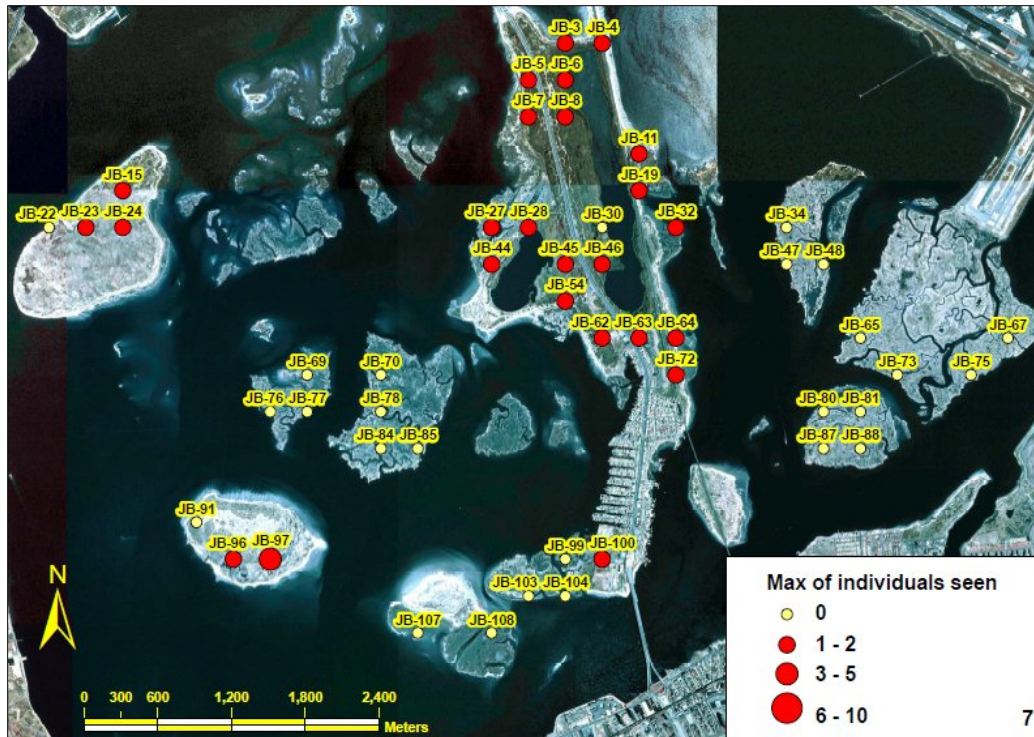


Figure 31. Maximum number of Common Yellowthroats observed during three surveys at Jamaica Bay survey locations from May 17 to July 28, 2007.

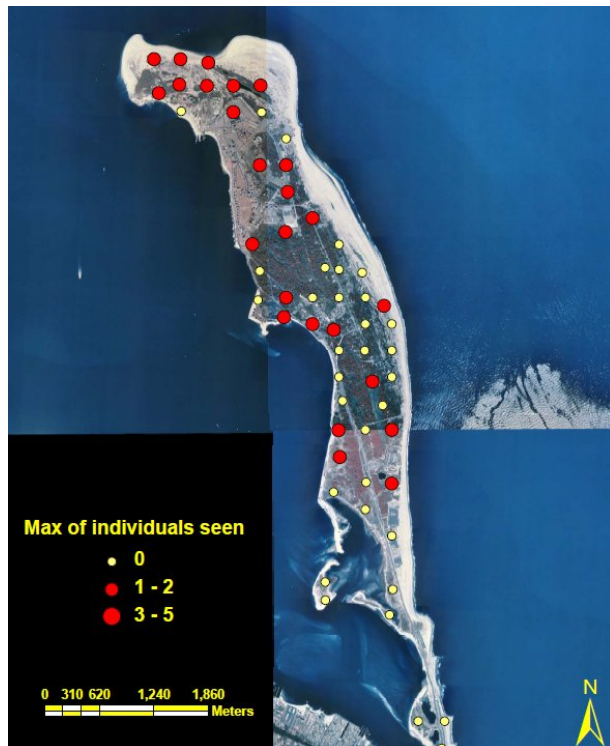


Figure 32. Maximum number of Yellow Warblers observed during three surveys at Sandy Hook survey locations from May 20 to July 24, 2005.

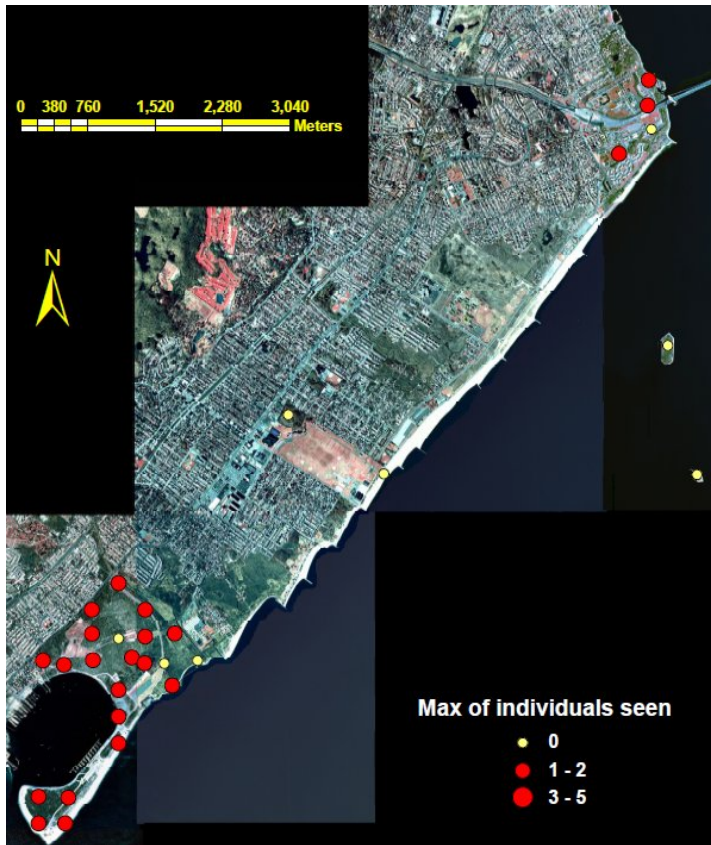


Figure 33. Maximum number of Yellow Warblers observed during three surveys at Staten Island survey locations from May 20 to July 24, 2005.

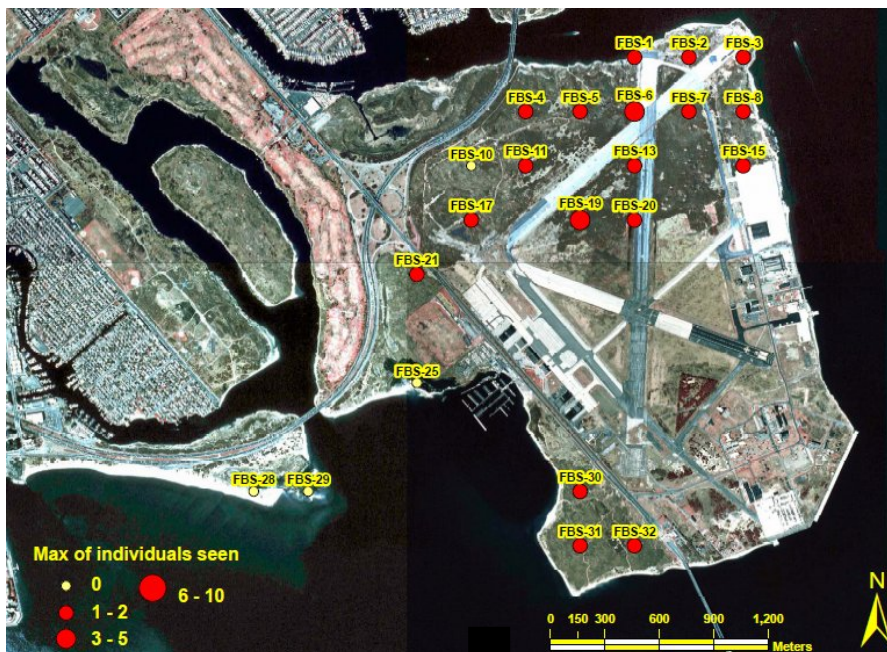


Figure 34. Maximum number of Yellow Warblers observed during three surveys at Floyd Bennett South survey locations from May 17 to July 28, 2007.

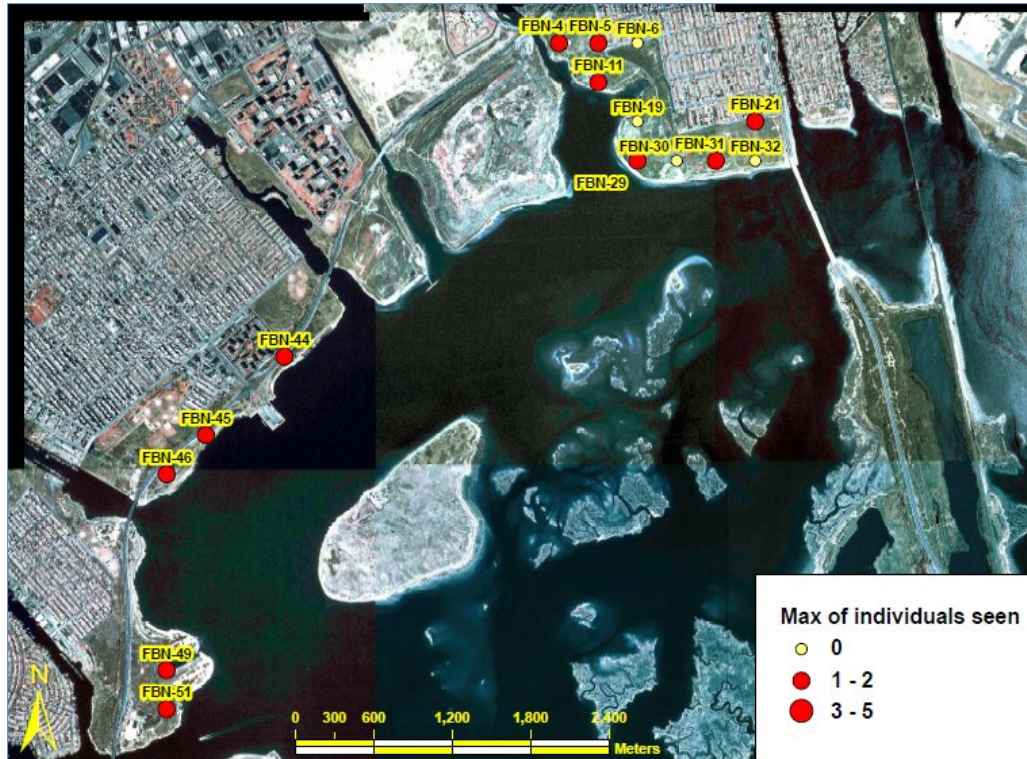


Figure 35. Maximum number of Yellow Warblers observed during three surveys at Floyd Bennett North survey locations from May 17 to July 28, 2007.

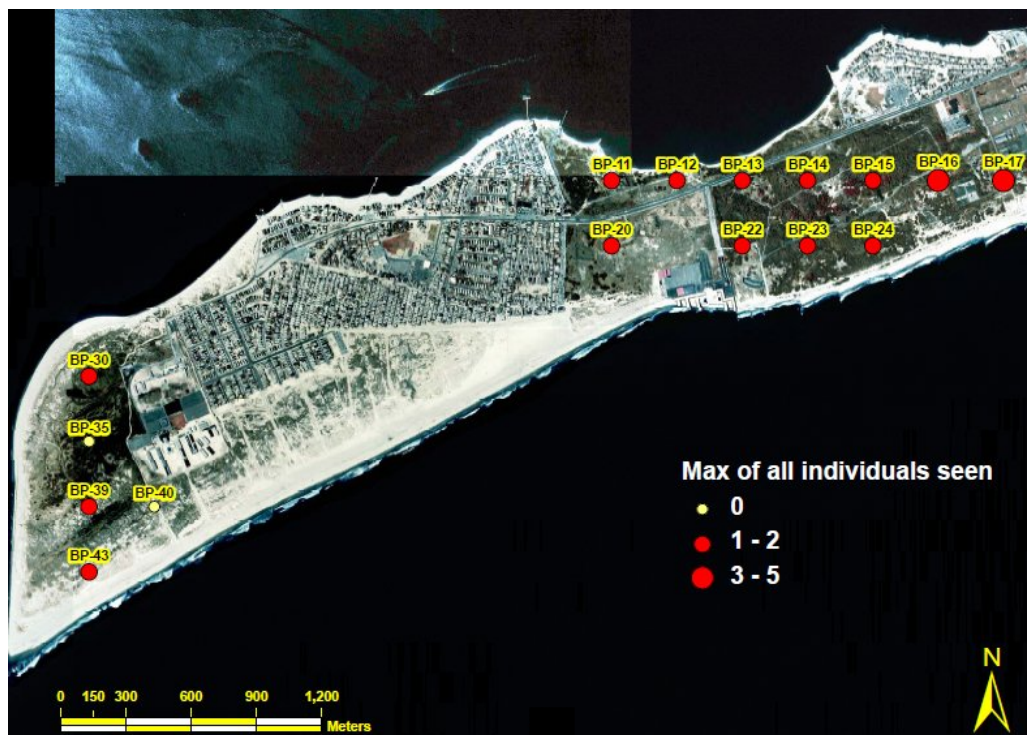


Figure 36. Maximum number of Yellow Warblers observed during three surveys at Breezy Point survey locations from May 17 to July 28, 2007.

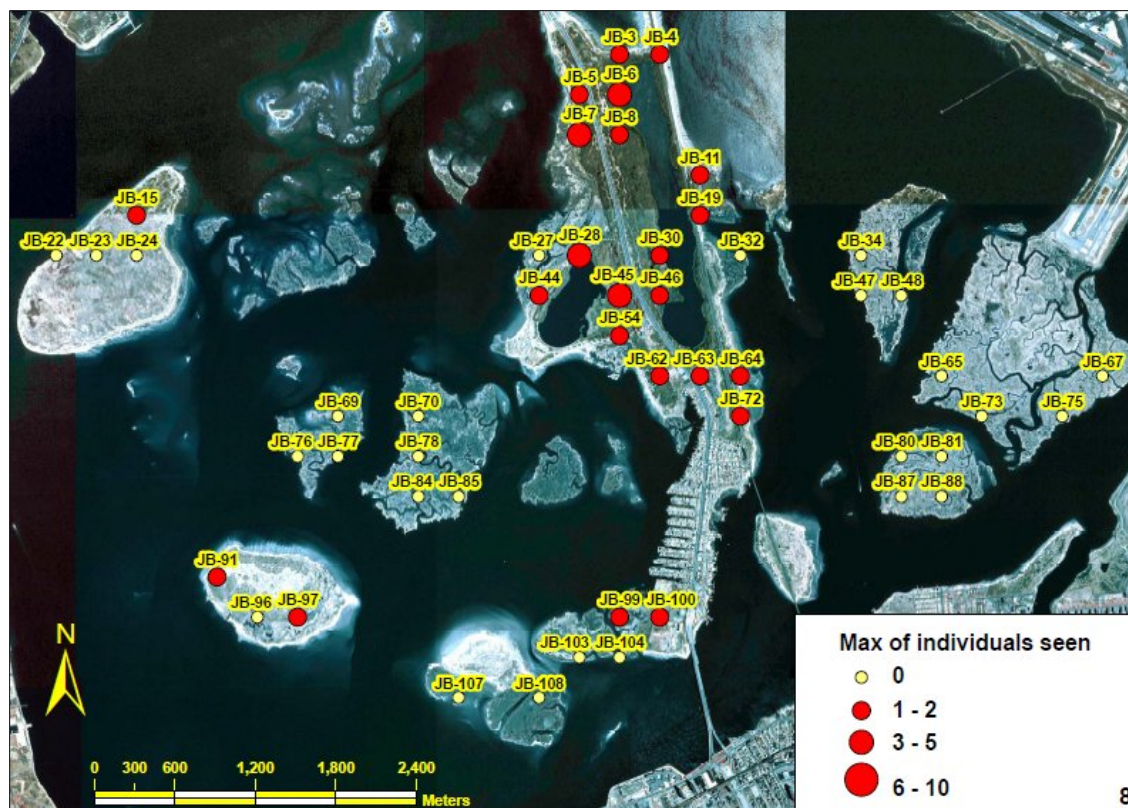


Figure 37. Maximum number of Yellow Warblers observed during three surveys at Jamaica Bay survey locations from May 17 to July 28, 2007.

Conclusions

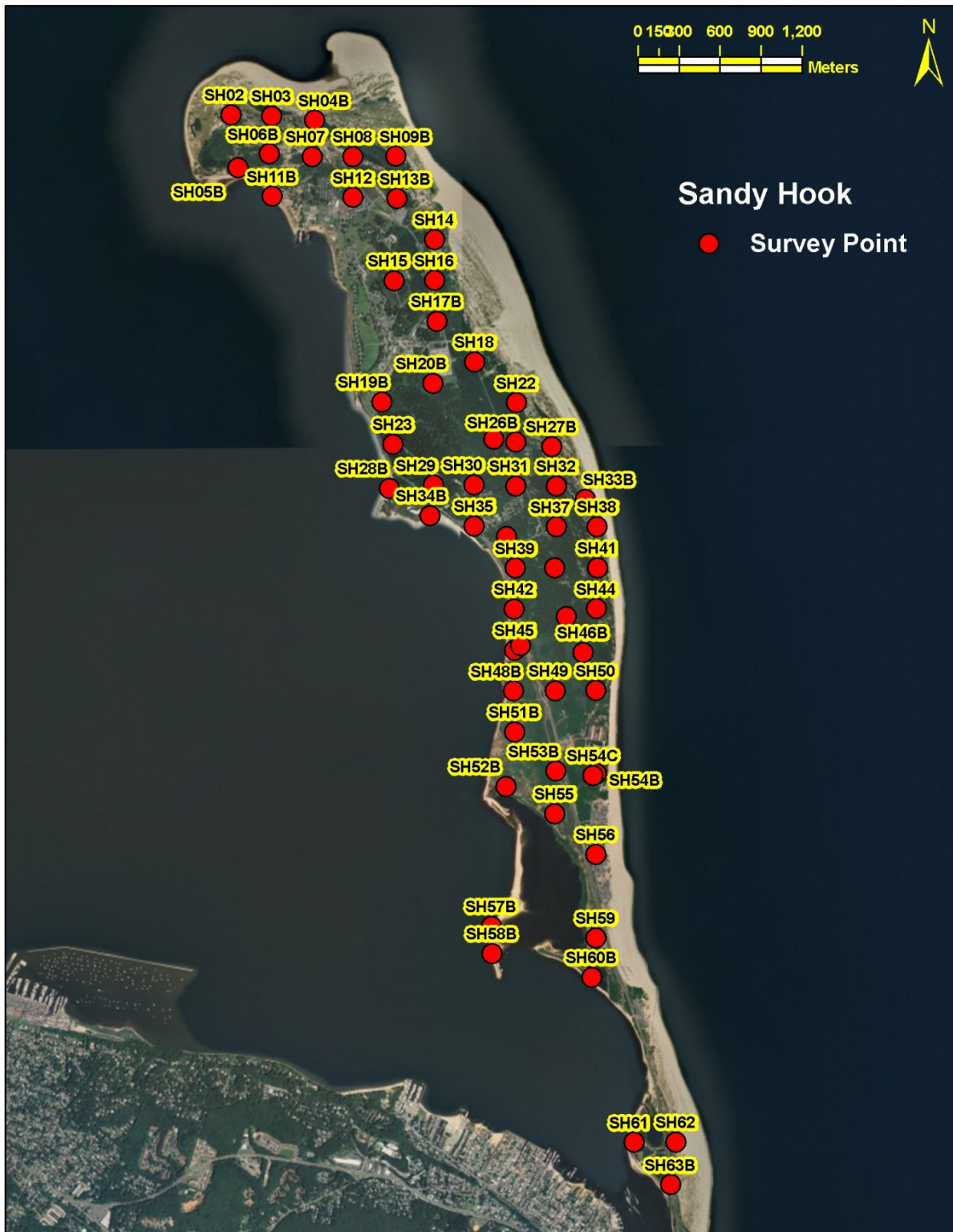
Rigorous surveys have allowed us to collect over 14,000 records of avian species use at Gateway National Recreation Area. While we present several ways in which this data set can be approached, the systematic manner in which they were collected make it possible to analyze the data to answer specific questions on site use and management as they arise. The data can be manipulated and subjected to a variety of qualitative and quantitative analyses to address specific management needs. Furthermore, they provide an appropriate baseline for comparisons of bird use of the surveyed areas in the future.

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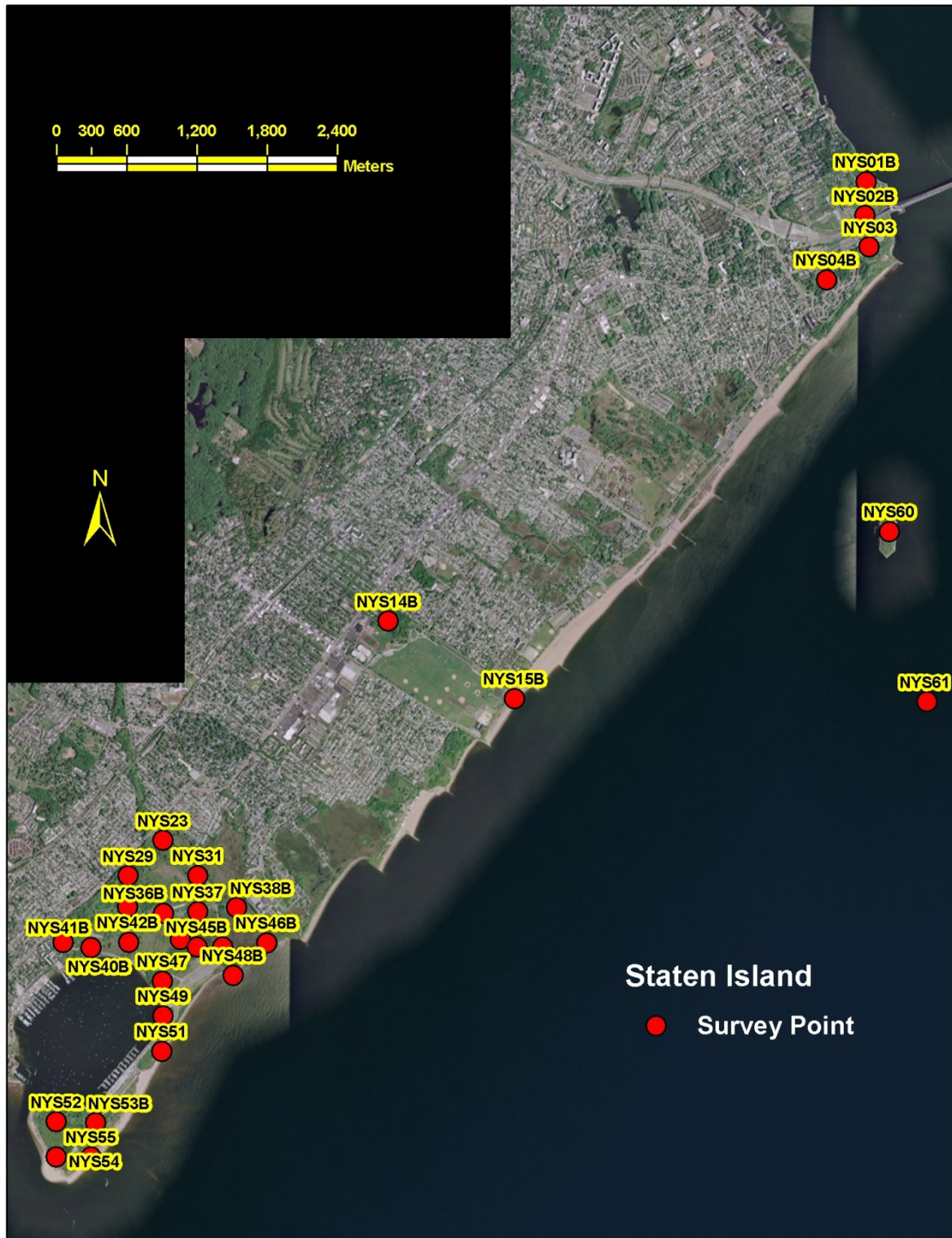
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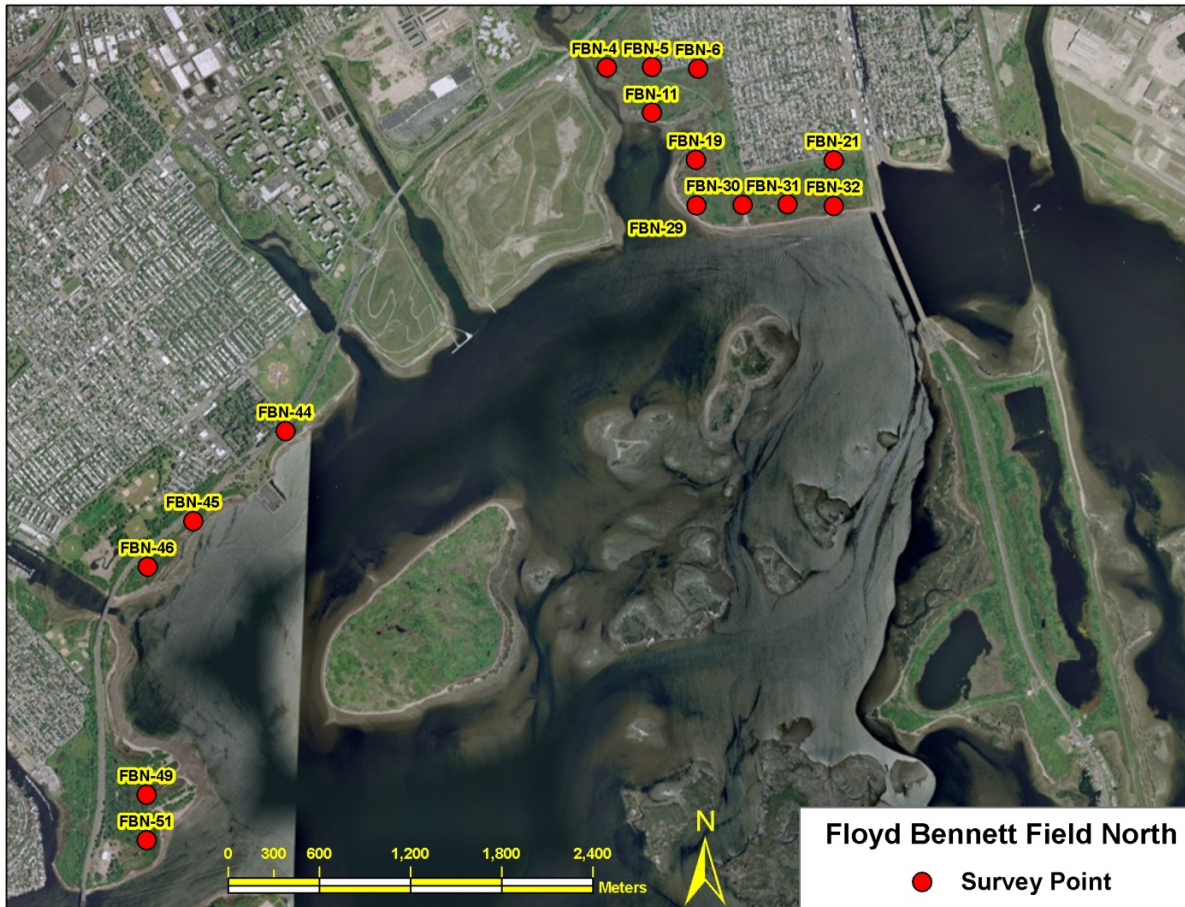
Appendix 1. Map of all survey point locations – Sandy Hook.



Appendix 2. Map of all survey point locations – Staten Island



Appendix 3. Maps of all survey point locations – Floyd Bennett (North and South).

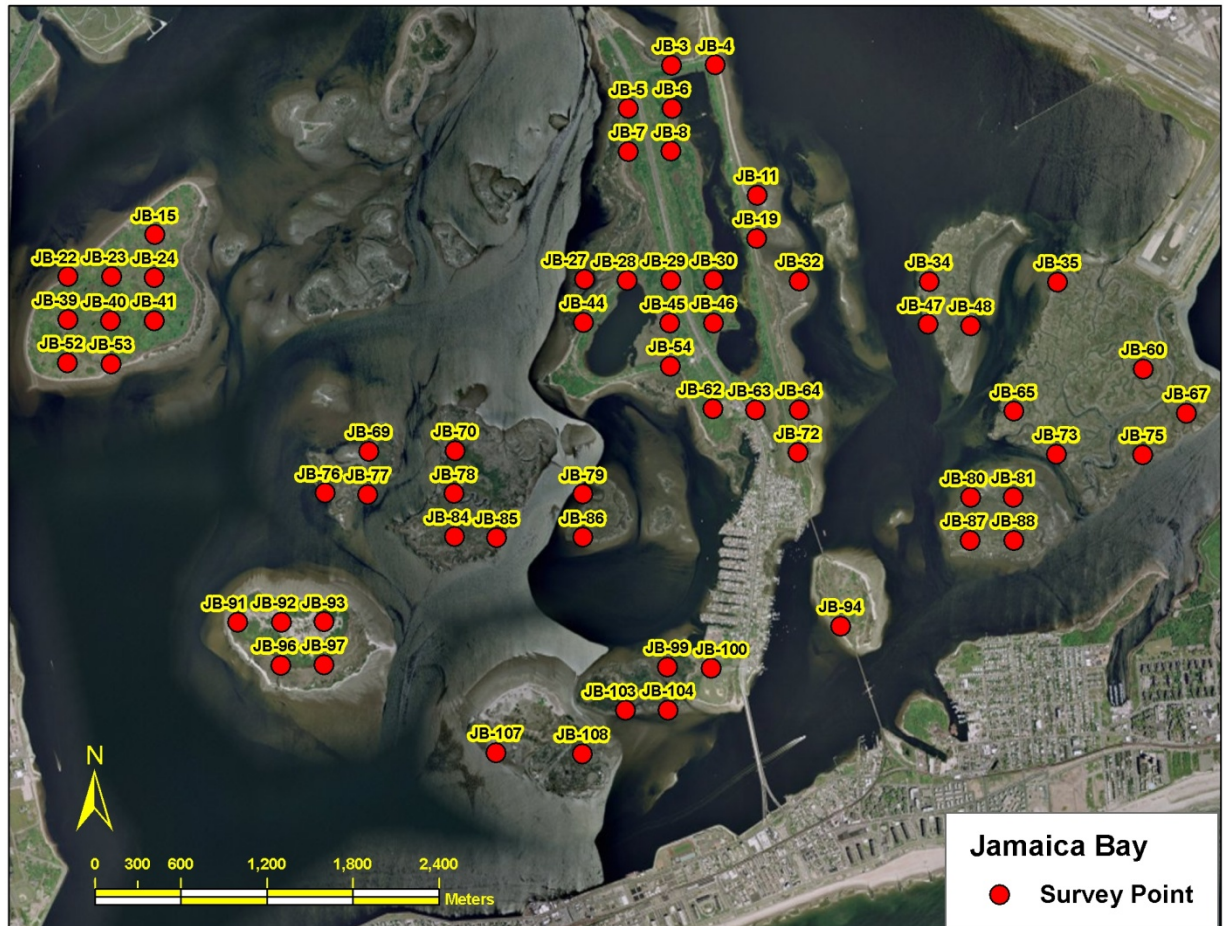




Appendix 4. Maps of all survey point locations – Breezy Point.



Appendix 5. Maps of all survey point locations – Jamaica Bay.



Appendix 6. Sandy Hook Unit Species List

Sandy Hook species list, from Mizrahi (2004). TSN is the taxonomic species number assigned by the Integrated Taxonomic Information System (ITIS). Species in **blue** were recorded during point count surveys. No new species were added to the Sandy Hook species list.

TSN	Full Latin Name	Common Name
-9728174	<i>Seiurus aurocapilla</i>	Ovenbird
-9728173	<i>Bubo scandiaca</i>	Snowy Owl
-9728172	<i>Megascops asio</i>	Eastern Screech-Owl
-9728171	<i>Gallinago delicata</i>	Wilson's Snipe
-9728170	<i>Porphyrio martinica</i>	Purple Gallinule
-501544	<i>Passerina caerulea</i>	Blue Grosbeak
174469	<i>Gavia immer</i>	Common Loon
174474	<i>Gavia stellata</i>	Red-throated Loon
174475	<i>Gavia pacifica</i>	Pacific Loon
174479	<i>Podiceps grisegena</i>	Red-necked Grebe
174482	<i>Podiceps auritus</i>	Horned Grebe
174485	<i>Podiceps nigricollis</i>	Eared Grebe
174505	<i>Podilymbus podiceps</i>	Pied-billed Grebe
174553	<i>Puffinus griseus</i>	Sooty Shearwater
174555	<i>Puffinus puffinus</i>	Manx Shearwater
174650	<i>Oceanites oceanicus</i>	Wilson's Storm-Petrel
174685	<i>Pelecanus occidentalis</i>	Brown Pelican
174704	<i>Sula leucogaster</i>	Brown Booby
174712	<i>Morus bassanus</i>	Northern Gannett
174715	<i>Phalacrocorax carbo</i>	Great Cormorant
174717	<i>Phalacrocorax auritus</i>	Double-crested Cormorant
174755	<i>Anhinga anhinga</i>	Anhinga
174773	<i>Ardea herodias</i>	Great Blue Heron
174793	<i>Butorides virescens</i>	Green Heron
174803	<i>Bubulcus ibis</i>	Cattle Egret
174813	<i>Egretta thula</i>	Snowy Egret
174826	<i>Egretta tricolor</i>	Tricolored Heron
174827	<i>Egretta caerulea</i>	Little Blue Heron
174832	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron
174842	<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron
174846	<i>Ixobrychus exilis</i>	Least Bittern
174856	<i>Botaurus lentiginosus</i>	American Bittern
174924	<i>Plegadis falcinellus</i>	Glossy Ibis
174985	<i>Cygnus olor</i>	Mute Swan
174987	<i>Cygnus columbianus</i>	Tundra Swan
174999	<i>Branta canadensis</i>	Canada Goose
175011	<i>Branta bernicla</i>	Brant
175038	<i>Chen caerulescens</i>	Snow Goose
175063	<i>Anas platyrhynchos</i>	Mallard

TSN	Full Latin Name	Common Name
175068	<i>Anas rubripes</i>	American Black Duck
175073	<i>Anas strepera</i>	Gadwall
175074	<i>Anas acuta</i>	Northern Pintail
175081	<i>Anas crecca</i>	Green-winged Teal
175086	<i>Anas discors</i>	Blue-winged Teal
175092	<i>Anas penelope</i>	Eurasian Wigeon
175094	<i>Anas americana</i>	American Wigeon
175096	<i>Anas clypeata</i>	Northern Shoveler
175122	<i>Aix sponsa</i>	Wood Duck
175125	<i>Aythya americana</i>	Redhead
175128	<i>Aythya collaris</i>	Ring-necked Duck
175129	<i>Aythya valisineria</i>	Canvasback
175130	<i>Aythya marila</i>	Greater Scaup
175134	<i>Aythya affinis</i>	Lesser Scaup
175135	<i>Aythya fuligula</i>	Tufted Duck
175141	<i>Bucephala clangula</i>	Common Goldeneye
175144	<i>Bucephala islandica</i>	Barrow's Goldeneye
175145	<i>Bucephala albeola</i>	Bufflehead
175147	<i>Clangula hyemalis</i>	Long-tailed Duck
175149	<i>Histrionicus histrionicus</i>	Harlequin Duck
175155	<i>Somateria mollissima</i>	Common Eider
175160	<i>Somateria spectabilis</i>	King Eider
175163	<i>Melanitta fusca</i>	White-winged Scoter
175170	<i>Melanitta perspicillata</i>	Surf Scoter
175171	<i>Melanitta nigra</i>	Black Scoter
175175	<i>Oxyura jamaicensis</i>	Ruddy Duck
175183	<i>Lophodytes cucullatus</i>	Hooded Merganser
175185	<i>Mergus merganser</i>	Common Merganser
175187	<i>Mergus serrator</i>	Red-breasted Merganser
175265	<i>Cathartes aura</i>	Turkey Vulture
175272	<i>Coragyps atratus</i>	Black Vulture
175289	<i>Elanoides forficatus</i>	Swallow-tailed Kite
175300	<i>Accipiter gentilis</i>	Northern Goshawk
175304	<i>Accipiter striatus</i>	Sharp-shinned Hawk
175309	<i>Accipiter cooperii</i>	Cooper's Hawk
175350	<i>Buteo jamaicensis</i>	Red-tailed Hawk
175359	<i>Buteo lineatus</i>	Red-shouldered Hawk
175365	<i>Buteo platypterus</i>	Broad-winged Hawk
175367	<i>Buteo swainsoni</i>	Swainson's Hawk
175373	<i>Buteo lagopus</i>	Rough-legged Hawk
175407	<i>Aquila chrysaetos</i>	Golden Eagle
175420	<i>Haliaeetus leucocephalus</i>	Bald Eagle
175430	<i>Circus cyaneus</i>	Northern Harrier

TSN	Full Latin Name	Common Name
175590	<i>Pandion haliaetus</i>	Osprey
175599	<i>Falco rusticolus</i>	Gyr Falcon
175604	<i>Falco peregrinus</i>	Peregrine Falcon
175613	<i>Falco columbarius</i>	Merlin
175622	<i>Falco sparverius</i>	American Kestrel
175863	<i>Colinus virginianus</i>	Northern Bobwhite
175905	<i>Phasianus colchicus</i>	Ring-necked Pheasant
176177	<i>Grus canadensis</i>	Sandhill Crane
176207	<i>Rallus elegans</i>	King Rail
176209	<i>Rallus longirostris</i>	Clapper Rail
176221	<i>Rallus limicola</i>	Virginia Rail
176242	<i>Porzana carolina</i>	Sora
176284	<i>Gallinula chloropus</i>	Common Moorhen
176292	<i>Fulica americana</i>	American Coot
176472	<i>Haematopus palliatus</i>	American Oystercatcher
176506	<i>Charadrius semipalmatus</i>	Semipalmated Plover
176507	<i>Charadrius melodus</i>	Piping Plover
176520	<i>Charadrius vociferus</i>	Killdeer
176564	<i>Pluvialis dominica</i>	American Golden-Plover
176567	<i>Pluvialis squatarola</i>	Black-bellied Plover
176571	<i>Arenaria interpres</i>	Ruddy Turnstone
176580	<i>Scolopax minor</i>	American Woodcock
176599	<i>Numenius phaeopus</i>	Whimbrel
176610	<i>Bartramia longicauda</i>	Upland Sandpiper
176612	<i>Actitis macularia</i>	Spotted Sandpiper
176615	<i>Tringa solitaria</i>	Solitary Sandpiper
176619	<i>Tringa melanoleuca</i>	Greater Yellowlegs
176620	<i>Tringa flavipes</i>	Lesser Yellowlegs
176638	<i>Catoptrophorus semipalmatus</i>	Willet
176642	<i>Calidris canutus</i>	Red Knot
176646	<i>Calidris maritima</i>	Purple Sandpiper
176653	<i>Calidris melanotos</i>	Pectoral Sandpiper
176654	<i>Calidris fuscicollis</i>	White-rumped Sandpiper
176655	<i>Calidris bairdii</i>	Baird's Sandpiper
176656	<i>Calidris minutilla</i>	Least Sandpiper
176661	<i>Calidris alpina</i>	Dunlin
176667	<i>Calidris pusilla</i>	Semipalmated Sandpiper
176668	<i>Calidris mauri</i>	Western Sandpiper
176669	<i>Calidris alba</i>	Sanderling
176675	<i>Limnodromus griseus</i>	Short-billed Dowitcher
176679	<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher
176684	<i>Tryngites subruficollis</i>	Buff-breasted Sandpiper
176686	<i>Limosa fedoa</i>	Marbled Godwit

TSN	Full Latin Name	Common Name
176690	<i>Limosa haemastica</i>	Hudsonian Godwit
176721	<i>Recurvirostra americana</i>	American Avocet
176726	<i>Himantopus mexicanus</i>	Black-necked Stilt
176734	<i>Phalaropus fulicarius</i>	Red Phalarope
176735	<i>Phalaropus lobatus</i>	Red -necked Phalarope
176736	<i>Phalaropus tricolor</i>	Wilson's Phalarope
176792	<i>Stercorarius pomarinus</i>	Pomarine Jaeger
176793	<i>Stercorarius parasiticus</i>	Parasitic Jaeger
176808	<i>Larus hyperboreus</i>	Glaucous Gull
176811	<i>Larus marinus</i>	Iceland Gull
176815	<i>Larus glaucoides</i>	Great Black-backed Gull
176821	<i>Larus fuscus</i>	Lesser Black-backed Gull
176824	<i>Larus argentatus</i>	Herring Gull
176828	<i>Larus thayeri</i>	Thayer's Gull
176830	<i>Larus delawarensis</i>	Ring-billed Gull
176830	<i>Larus ridibundus</i>	Black-headed Gull
176837	<i>Larus atricilla</i>	Laughing Gull
176839	<i>Larus philadelphia</i>	Bonaparte's Gull
176840	<i>Larus minutus</i>	Little Gull
176866	<i>Xema sabini</i>	Sabine's Gull
176875	<i>Rissa tridactyla</i>	Black-legged Kittiwake
176887	<i>Sterna forsteri</i>	Forster's Tern
176888	<i>Sterna hirundo</i>	Common Tern
176890	<i>Sterna paradisaea</i>	Arctic Tern
176891	<i>Sterna dougallii</i>	Roseate Tern
176922	<i>Sterna maxima</i>	Royal Tern
176923	<i>Sterna antillarum</i>	Least Tern
176924	<i>Sterna caspia</i>	Caspian Tern
176926	<i>Sterna nilotica</i>	Gull-billed Tern
176927	<i>Sterna sandvicensis</i>	Sandwich Tern
176958	<i>Chlidonias leucopterus</i>	White-winged Tern
176959	<i>Chlidonias niger</i>	Black Tern
176971	<i>Alca torda</i>	Razorbill
176974	<i>Uria aalge</i>	Common Murre
176978	<i>Uria lomvia</i>	Thick-billed Murre
176982	<i>Alle alle</i>	Dovekie
176985	<i>Cephus grylle</i>	Black Guillemot
177025	<i>Fratercula arctica</i>	Atlantic Puffin
177071	<i>Columba livia</i>	Rock Pigeon
177125	<i>Zenaida macroura</i>	Mourning Dove
177831	<i>Coccyzus americanus</i>	Yellow-billed Cuckoo
177834	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo
177839	<i>Crotophaga sulcirostris</i>	Groove-billed Ani

TSN	Full Latin Name	Common Name
177851	<i>Tyto alba</i>	Barn Owl
177884	<i>Bubo virginianus</i>	Great Horned Owl
177921	<i>Strix varia</i>	Barred Owl
177932	<i>Asio otus</i>	Long-eared Owl
177935	<i>Asio flammeus</i>	Short-eared Owl
177942	<i>Aegolius acadicus</i>	Northern Saw-whet Owl
177960	<i>Caprimulgus carolinensis</i>	Chuck-will's-widow
177961	<i>Caprimulgus vociferus</i>	Whip-poor-will
177979	<i>Chordeiles minor</i>	Common Nighthawk
178001	<i>Chaetura pelagica</i>	Chimney Swift
178032	<i>Archilochus colubris</i>	Ruby-throated Hummingbird
178106	<i>Megaceryle alcyon</i>	Belted Kingfisher (subgenus)
178119	<i>Ceryle alcyon</i>	Belted Kingfisher
178154	<i>Colaptes auratus</i>	Northern Flicker
178186	<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker
178195	<i>Melanerpes carolinus</i>	Red-bellied Woodpecker
178202	<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker
178259	<i>Picoides pubescens</i>	Downy Woodpecker
178262	<i>Picoides villosus</i>	Hairy Woodpecker
178279	<i>Tyrannus tyrannus</i>	Eastern Kingbird
178280	<i>Tyrannus dominicensis</i>	Gray Kingbird
178287	<i>Tyrannus verticalis</i>	Western Kingbird
178293	<i>Tyrannus forficatus</i>	Scissor-tailed Flycatcher
178309	<i>Myiarchus crinitus</i>	Great Crested Flycatcher
178316	<i>Myiarchus cinerascens</i>	Ash-throated Flycatcher
178329	<i>Sayornis phoebe</i>	Eastern Phoebe
178338	<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher
178339	<i>Empidonax virescens</i>	Acadian Flycatcher
178340	<i>Empidonax alnorum</i>	Alder Flycatcher
178341	<i>Empidonax traillii</i>	Willow Flycatcher
178344	<i>Empidonax minimus</i>	Least Flycatcher
178359	<i>Contopus virens</i>	Eastern Wood Pewee
178431	<i>Tachycineta bicolor</i>	Tree Swallow
178436	<i>Riparia riparia</i>	Bank Swallow
178443	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow
178448	<i>Hirundo rustica</i>	Barn Swallow
178455	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
178460	<i>Petrochelidon fulva</i>	Cave Swallow
178464	<i>Progne subis</i>	Purple Martin
178511	<i>Lanius excubitor</i>	Northern Shrike
178515	<i>Lanius ludovicianus</i>	Loggerhead Shrike
178529	<i>Bombycilla garrulus</i>	Bohemian Waxwing
178532	<i>Bombycilla cedrorum</i>	Cedar Waxwing

TSN	Full Latin Name	Common Name
178541	<i>Troglodytes aedon</i>	House Wren
178547	<i>Troglodytes troglodytes</i>	Winter Wren
178581	<i>Thryothorus ludovicianus</i>	Carolina Wren
178605	<i>Cistothorus platensis</i>	Sedge Wren
178608	<i>Cistothorus palustris</i>	Marsh Wren
178620	<i>Mimus polyglottos</i>	Northern Mockingbird
178625	<i>Dumetella carolinensis</i>	Gray Catbird
178627	<i>Toxostoma rufum</i>	Brown Thrasher
178775	<i>Sitta carolinensis</i>	White-breasted Nuthatch
178784	<i>Sitta canadensis</i>	Red-breasted Nuthatch
178803	<i>Certhia americana</i>	Brown Creeper
178844	<i>Mniotilta varia</i>	Black-and-white Warbler
178846	<i>Protonotaria citrea</i>	Prothonotary Warbler
178850	<i>Helminthos vermivorus</i>	Worm-eating Warbler
178852	<i>Vermivora chrysoptera</i>	Golden-winged Warbler
178853	<i>Vermivora pinus</i>	Blue-winged Warbler
178855	<i>Vermivora peregrina</i>	Tennessee Warbler
178856	<i>Vermivora celata</i>	Orange-crowned Warbler
178861	<i>Vermivora ruficapilla</i>	Nashville Warbler
178868	<i>Parula americana</i>	Northern Parula
178878	<i>Dendroica petechia</i>	Yellow Warbler
178886	<i>Dendroica magnolia</i>	Magnolia Warbler
178887	<i>Dendroica tigrina</i>	Cape May Warbler
178888	<i>Dendroica caerulescens</i>	Black-throated Blue Warbler
178891	<i>Dendroica coronata</i>	Yellow-rumped Warbler
178897	<i>Dendroica townsendi</i>	Townsend's Warbler
178898	<i>Dendroica virens</i>	Black-throated Green Warbler
178903	<i>Dendroica cerulea</i>	Cerulean Warbler
178904	<i>Dendroica fusca</i>	Blackburnian Warbler
178905	<i>Dendroica dominica</i>	Yellow-throated Warbler
178911	<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler
178912	<i>Dendroica castanea</i>	Bay-breasted Warbler
178913	<i>Dendroica striata</i>	Blackpoll Warbler
178914	<i>Dendroica pinus</i>	Pine Warbler
178918	<i>Dendroica discolor</i>	Prairie Warbler
178921	<i>Dendroica palmarum</i>	Palm Warbler
178927	<i>Seiurus aurocapillus</i>	Ovenbird
178931	<i>Seiurus noveboracensis</i>	Northern Waterthrush
178935	<i>Seiurus motacilla</i>	Louisiana Waterthrush
178937	<i>Oporornis formosus</i>	Kentucky Warbler
178938	<i>Oporornis agilis</i>	Connecticut Warbler
178939	<i>Oporornis philadelphia</i>	Mourning Warbler
178944	<i>Geothlypis trichas</i>	Common Yellowthroat

TSN	Full Latin Name	Common Name
178964	<i>Icteria virens</i>	Yellow-breasted Chat
178972	<i>Wilsonia citrina</i>	Hooded Warbler
178973	<i>Wilsonia pusilla</i>	Wilson's Warbler
178977	<i>Wilsonia canadensis</i>	Canada Warbler
178979	<i>Setophaga ruticilla</i>	American Redstart
178991	<i>Vireo griseus</i>	White-eyed Vireo
179009	<i>Vireo flavifrons</i>	Yellow-throated Vireo
179010	<i>Vireo solitarius</i>	Blue-headed Vireo
179021	<i>Vireo olivaceus</i>	Red-eyed Vireo
179022	<i>Vireo philadelphicus</i>	Philadelphia Vireo
179023	<i>Vireo gilvus</i>	Warbling Vireo
179032	<i>Dolichonyx oryzivorus</i>	Bobolink
179034	<i>Sturnella magna</i>	Eastern Meadowlark
179043	<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird
179045	<i>Agelaius phoeniceus</i>	Red-winged Blackbird
179064	<i>Icterus spurius</i>	Orchard Oriole
179083	<i>Icterus galbula</i>	Baltimore Oriole
179091	<i>Euphagus carolinus</i>	Rusty Blackbird
179104	<i>Quiscalus quiscula</i>	Common Grackle
179108	<i>Quiscalus major</i>	Boat-tailed Grackle
179112	<i>Molothrus ater</i>	Brown-headed Cowbird
179124	<i>Cardinalis cardinalis</i>	Northern Cardinal
179139	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak
179150	<i>Passerina cyanea</i>	Indigo Bunting
179165	<i>Spiza americana</i>	Dickcissel
179173	<i>Coccothraustes vespertinus</i>	Evening Grosbeak
179186	<i>Carpodacus purpureus</i>	Purple Finch
179191	<i>Carpodacus mexicanus</i>	House Finch
179230	<i>Carduelis flammea</i>	Common Redpoll
179233	<i>Carduelis pinus</i>	Pine Siskin
179236	<i>Carduelis tristis</i>	American Goldfinch
179259	<i>Loxia curvirostra</i>	Red Crossbill
179268	<i>Loxia leucoptera</i>	White-winged Crossbill
179276	<i>Pipilo erythrophthalmus</i>	Eastern Towhee
179314	<i>Passerculus sandwichensis</i>	Savannah Sparrow
179333	<i>Ammodramus savannarum</i>	Grasshopper Sparrow
179340	<i>Ammodramus henslowii</i>	Henslow's Sparrow
179344	<i>Ammodramus caudacutus</i>	Saltmarsh Sharp-tailed Sparrow
179345	<i>Ammodramus leconteii</i>	Le Conte's Sparrow
179346	<i>Ammodramus maritimus</i>	Seaside Sparrow
179366	<i>Pooecetes gramineus</i>	Vesper Sparrow
179371	<i>Chondestes grammacus</i>	Lark Sparrow
179410	<i>Junco hyemalis</i>	Dark-eyed Junco

TSN	Full Latin Name	Common Name
179432	<i>Spizella arborea</i>	American Tree Sparrow
179435	<i>Spizella passerina</i>	Chipping Sparrow
179439	<i>Spizella pallida</i>	Clay-colored Sparrow
179443	<i>Spizella pusilla</i>	Field Sparrow
179455	<i>Zonotrichia leucophrys</i>	White-crowned Sparrow
179462	<i>Zonotrichia albicollis</i>	White-throated Sparrow
179464	<i>Passerella iliaca</i>	Fox Sparrow
179484	<i>Melospiza lincolni</i>	Lincoln's Sparrow
179488	<i>Melospiza georgiana</i>	Swamp Sparrow
179492	<i>Melospiza melodia</i>	Song Sparrow
179494	<i>Melospiza melodia atlantica</i>	Song Sparrow (subspecies)
179526	<i>Calcarius lapponicus</i>	Lapland Longspur
179530	<i>Calcarius ornatus</i>	Chestnut-collared Longspur
179532	<i>Plectrophenax nivalis</i>	Snow Bunting
179628	<i>Passer domesticus</i>	House Sparrow
179637	<i>Sturnus vulgaris</i>	European Starling
179680	<i>Cyanocitta cristata</i>	Blue Jay
179725	<i>Corvus corax</i>	Common Raven
179731	<i>Corvus brachyrhynchos</i>	American Crow
179737	<i>Corvus ossifragus</i>	Fish Crow
179759	<i>Turdus migratorius</i>	American Robin
179777	<i>Hylocichla mustelina</i>	Wood Thrush
179779	<i>Catharus guttatus</i>	Hermit Thrush
179788	<i>Catharus ustulatus</i>	Swainson's Thrush
179793	<i>Catharus minimus</i>	Gray-cheeked Thrush
179796	<i>Catharus fuscescens</i>	Veery
179801	<i>Sialia sialis</i>	Eastern Bluebird
179853	<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher
179865	<i>Regulus satrapa</i>	Golden-crowned Kinglet
179870	<i>Regulus calendula</i>	Ruby-crowned Kinglet
179882	<i>Piranga ludoviciana</i>	Western Tanager
179883	<i>Piranga olivacea</i>	Scarlet Tanager
179888	<i>Piranga rubra</i>	Summer Tanager
203446	<i>Calonectris diomedea</i>	Cory's Shearwater
554031	<i>Ammodramus nelsoni</i>	Nelson's Sharp-tailed Sparrow
554127	<i>Anthus rubescens</i>	American Pipit
554135	<i>Ardea alba</i>	Great Egret
554138	<i>Baeolophus bicolor</i>	Tufted Titmouse
554145	<i>Calidris himantopus</i>	Stilt Sandpiper
554148	<i>Catharus bicknelli</i>	Bicknell's Thrush
554221	<i>Contopus cooperi</i>	Olive-sided Flycatcher
554256	<i>Eremophila alpestris</i>	Horned Lark
554268	<i>Ictinia mississippiensis</i>	Mississippi Kite

TSN	Full Latin Name	Common Name
554382	<i>Poecile atricapillus</i>	Black-capped Chickadee
554383	<i>Poecile carolinensis</i>	Carolina Chickadee
554447	<i>Rynchops niger</i>	Black Skimmer

Appendix 7. Staten Island Unit Species List

Staten Island species list, from Mizrahi (2004). TSN is the taxonomic species number assigned by the Integrated Taxonomic Information System (ITIS). Species in **blue** were recorded during point count surveys. Species in **red** were added to the species list during the surveys.

TSN	Full Latin Name	Common Name
-9728171	<i>Seiurus aurocapilla</i>	Ovenbird
-9728170	<i>Megascops asio</i>	Eastern Screech-Owl
-501544	<i>Passerina caerulea</i>	Blue Grosbeak
174651	<i>Oceanites oceanicus oceanicus</i>	Wilson's Storm-Petrel (subspecies)
174717	<i>Phalacrocorax auritus</i>	Double-crested Cormorant
174773	<i>Ardea herodias</i>	Great Blue Heron
174793	<i>Butorides virescens</i>	Green Heron
174803	<i>Bubulcus ibis</i>	Cattle Egret
174813	<i>Egretta thula</i>	Snowy Egret
174826	<i>Egretta tricolor</i>	Tricolored Heron
174827	<i>Egretta caerulea</i>	Little Blue Heron
174832	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron
174842	<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron
174924	<i>Plegadis falcinellus</i>	Glossy Ibis
174985	<i>Cygnus olor</i>	Mute Swan
174999	<i>Branta canadensis</i>	Canada Goose
175063	<i>Anas platyrhynchos</i>	Mallard
175068	<i>Anas rubripes</i>	American Black Duck
175073	<i>Anas strepera</i>	Gadwall
175081	<i>Anas crecca</i>	Green-winged Teal
175086	<i>Anas discors</i>	Blue-winged Teal
175122	<i>Aix sponsa</i>	Wood Duck
175304	<i>Accipiter striatus</i>	Sharp-shinned Hawk
175309	<i>Accipiter cooperii</i>	Cooper's Hawk
175430	<i>Circus cyaneus</i>	Northern Harrier
175590	<i>Pandion haliaetus</i>	Osprey
175604	<i>Falco peregrinus</i>	Peregrine Falcon
175622	<i>Falco sparverius</i>	American Kestrel
175905	<i>Phasianus colchicus</i>	Ring-necked Pheasant
176136	<i>Meleagris gallopavo</i>	Wild Turkey
176209	<i>Rallus longirostris</i>	Clapper Rail
176221	<i>Rallus limicola</i>	Virginia Rail
176284	<i>Gallinula chloropus</i>	Common Moorhen
176292	<i>Fulica americana</i>	American Coot
176472	<i>Haematopus palliatus</i>	American Oystercatcher
176520	<i>Charadrius vociferus</i>	Killdeer
176580	<i>Scolopax minor</i>	American Woodcock
176610	<i>Bartramia longicauda</i>	Upland Sandpiper

TSN	Full Latin Name	Common Name
176612	<i>Actitis macularia</i>	Spotted Sandpiper
176638	<i>Catoptrophorus semipalmatus</i>	Willet
176815	<i>Larus marinus</i>	Great Black-backed Gull
176824	<i>Larus argentatus</i>	Herring Gull
176837	<i>Larus atricilla</i>	Laughing Gull
176888	<i>Sterna hirundo</i>	Common Tern
177071	<i>Columba livia</i>	Rock Pigeon
177125	<i>Zenaidura macroura</i>	Mourning Dove
177693	<i>Nandayus nenday</i>	Black-hooded Parakeet
177723	<i>Myiopsitta monachus</i>	Monk Parakeet
177831	<i>Coccyzus americanus</i>	Yellow-billed Cuckoo
177834	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo
177851	<i>Tyto alba</i>	Barn Owl
177884	<i>Bubo virginianus</i>	Great Horned Owl
177961	<i>Caprimulgus vociferus</i>	Whip-poor-will
177979	<i>Chordeiles minor</i>	Common Nighthawk
178001	<i>Chaetura pelagica</i>	Chimney Swift
178032	<i>Archilochus colubris</i>	Ruby-throated Hummingbird
178119	<i>Ceryle alcyon</i>	Belted Kingfisher
178154	<i>Colaptes auratus</i>	Northern Flicker
178195	<i>Melanerpes carolinus</i>	Red-bellied Woodpecker
178259	<i>Picoides pubescens</i>	Downy Woodpecker
178262	<i>Picoides villosus</i>	Hairy Woodpecker
178279	<i>Tyrannus tyrannus</i>	Eastern Kingbird
178309	<i>Myiarchus crinitus</i>	Great-crested Flycatcher
178341	<i>Empidonax traillii</i>	Willow Flycatcher
178359	<i>Contopus virens</i>	Eastern Wood Pewee
178431	<i>Tachycineta bicolor</i>	Tree Swallow
178436	<i>Riparia riparia</i>	Bank Swallow
178443	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow
178448	<i>Hirundo rustica</i>	Barn Swallow
178511	<i>Lanius excubitor</i>	Northern Shrike
178532	<i>Bombycilla cedrorum</i>	Cedar Waxwing
178541	<i>Troglodytes aedon</i>	House Wren
178581	<i>Thryothorus ludovicianus</i>	Carolina Wren
178608	<i>Cistothorus palustris</i>	Marsh Wren
178620	<i>Mimus polyglottos</i>	Northern Mockingbird
178625	<i>Dumetella carolinensis</i>	Gray Catbird
178627	<i>Toxostoma rufum</i>	Brown Thrasher
178775	<i>Sitta carolinensis</i>	White-breasted Nuthatch
178844	<i>Mniotilta varia</i>	Black-and-white Warbler
178878	<i>Dendroica petechia</i>	Yellow Warbler
178891	<i>Dendroica coronata</i>	Yellow-rumped Warbler

TSN	Full Latin Name	Common Name
178898	<i>Dendroica virens</i>	Black-throated Green Warbler
178914	<i>Dendroica pinus</i>	Pine Warbler
178944	<i>Geothlypis trichas</i>	Common Yellowthroat
178964	<i>Icteria virens</i>	Yellow-breasted Chat
178979	<i>Setophaga ruticilla</i>	American Redstart
178991	<i>Vireo griseus</i>	White-eyed Vireo
179021	<i>Vireo olivaceus</i>	Red-eyed Vireo
179023	<i>Vireo gilvus</i>	Warbling Vireo
179032	<i>Dolichonyx oryzivorus</i>	Bobolink
179034	<i>Sturnella magna</i>	Eastern Meadowlark
179045	<i>Agelaius phoeniceus</i>	Red-winged Blackbird
179083	<i>Icterus galbula</i>	Baltimore Oriole
179104	<i>Quiscalus quiscula</i>	Common Grackle
179108	<i>Quiscalus major</i>	Boat-tailed Grackle
179112	<i>Molothrus ater</i>	Brown-headed Cowbird
179124	<i>Cardinalis cardinalis</i>	Northern Cardinal
179139	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak
179150	<i>Passerina cyanea</i>	Indigo Bunting
179186	<i>Carpodacus purpureus</i>	Purple Finch
179191	<i>Carpodacus mexicanus</i>	House Finch
179236	<i>Carduelis tristis</i>	American Goldfinch
179276	<i>Pipilo erythrophthalmus</i>	Eastern Towhee
179314	<i>Passerculus sandwichensis</i>	Savannah Sparrow
179344	<i>Ammodramus caudacutus</i>	Saltmarsh Sharp-tailed Sparrow
179346	<i>Ammodramus maritimus</i>	Seaside Sparrow
179432	<i>Spizella arborea</i>	American Tree Sparrow
179435	<i>Spizella passerina</i>	Chipping Sparrow
179443	<i>Spizella pusilla</i>	Field Sparrow
179462	<i>Zonotrichia albicollis</i>	White-throated Sparrow
179464	<i>Passerella iliaca</i>	Fox Sparrow
179488	<i>Melospiza georgiana</i>	Swamp Sparrow
179492	<i>Melospiza melodia</i>	Song Sparrow
179628	<i>Passer domesticus</i>	House Sparrow
179637	<i>Sturnus vulgaris</i>	European Starling
179680	<i>Cyanocitta cristata</i>	Blue Jay
179731	<i>Corvus brachyrhynchos</i>	American Crow
179737	<i>Corvus ossifragus</i>	Fish Crow
179759	<i>Turdus migratorius</i>	American Robin
179777	<i>Hylocichla mustelina</i>	Wood Thrush
179779	<i>Catharus guttatus</i>	Hermit Thrush
179796	<i>Catharus fuscescens</i>	Veery
179865	<i>Regulus satrapa</i>	Golden-crowned Kinglet
179870	<i>Regulus calendula</i>	Ruby-crowned Kinglet

TSN	Full Latin Name	Common Name
554135	<i>Ardea alba</i>	Great Egret
554138	<i>Baeolophus bicolor</i>	Tufted Titmouse
554256	<i>Eremophila alpestris</i>	Horned Lark
554382	<i>Poecile atricapillus</i>	Black-capped Chickadee

Appendix 8. Jamaica Bay/Breezy Point Species List

Jamaica Bay/Breezy Point Unit species list, from Mizrahi (2004). TSN is the taxonomic species number assigned by the Integrated Taxonomic Information System (ITIS). Species in **blue** were recorded during point count surveys. No new species were added to this species list.

TSN	Full Latin Name	Common Name
-9728173	<i>Seiurus aurocapilla</i>	Ovenbird
-9728172	<i>Bubo scandiacus</i>	Snowy Owl
-9728171	<i>Gallinago delicata</i>	Wilson's Snipe
-9728170	<i>Porphyrio martinica</i>	Purple Gallinule
-501544	<i>Passerina caerulea</i>	Blue Grosbeak
-501473	<i>Chlidonias niger surinamensis</i>	Black Tern (subspecies)
174469	<i>Gavia immer</i>	Common Loon
174474	<i>Gavia stellata</i>	Red-throated Loon
174475	<i>Gavia pacifica</i>	Pacific Loon
174479	<i>Podiceps grisegena</i>	Red-necked Grebe
174481	<i>Podiceps grisegena holboellii</i>	Red-necked Grebe (subspecies)
174482	<i>Podiceps auritus</i>	Horned Grebe
174485	<i>Podiceps nigricollis</i>	Eared Grebe
174505	<i>Podilymbus podiceps</i>	Pied-billed Grebe
174553	<i>Puffinus griseus</i>	Sooty Shearwater
174684	<i>Pelecanus erythrorhynchos</i>	White Pelican
174685	<i>Pelecanus occidentalis</i>	Brown Pelican
174712	<i>Morus bassanus</i>	Northern Gannett
174715	<i>Phalacrocorax carbo</i>	Great Cormorant
174717	<i>Phalacrocorax auritus</i>	Double-crested Cormorant
174763	<i>Fregata magnificens</i>	Magnificent Frigatebird
174773	<i>Ardea herodias</i>	Great Blue Heron
174793	<i>Butorides virescens</i>	Green Heron
174803	<i>Bubulcus ibis</i>	Cattle Egret
174813	<i>Egretta thula</i>	Snowy Egret
174824	<i>Egretta rufescens</i>	Reddish Egret
174826	<i>Egretta tricolor</i>	Tricolored Heron
174827	<i>Egretta caerulea</i>	Little Blue Heron
174832	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron
174842	<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron
174846	<i>Ixobrychus exilis</i>	Least Bittern
174856	<i>Botaurus lentiginosus</i>	American Bittern
174897	<i>Mycteria americana</i>	Wood Stork
174924	<i>Plegadis falcinellus</i>	Glossy Ibis
174926	<i>Plegadis chihi</i>	White-faced Ibis
174985	<i>Cygnus olor</i>	Mute Swan
174987	<i>Cygnus columbianus</i>	Tundra Swan
174999	<i>Branta canadensis</i>	Canada Goose
175011	<i>Branta bernicla</i>	Brant

TSN	Full Latin Name	Common Name
175020	<i>Anser albifrons</i>	Greater White-fronted Goose
175038	<i>Chen caerulescens</i>	Snow Goose
175044	<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-Duck
175046	<i>Dendrocygna bicolor</i>	Fulvous Whistling-Duck
175063	<i>Anas platyrhynchos</i>	Mallard
175068	<i>Anas rubripes</i>	American Black Duck
175073	<i>Anas strepera</i>	Gadwall
175074	<i>Anas acuta</i>	Northern Pintail
175081	<i>Anas crecca</i>	Green-winged Teal
175086	<i>Anas discors</i>	Blue-winged Teal
175089	<i>Anas cyanoptera</i>	Cinnamon Teal
175092	<i>Anas penelope</i>	Eurasian Wigeon
175094	<i>Anas americana</i>	American Wigeon
175096	<i>Anas clypeata</i>	Northern Shoveler
175122	<i>Aix sponsa</i>	Wood Duck
175125	<i>Aythya americana</i>	Redhead
175128	<i>Aythya collaris</i>	Ring-necked Duck
175129	<i>Aythya valisineria</i>	Canvasback
175130	<i>Aythya marila</i>	Greater Scaup
175134	<i>Aythya affinis</i>	Lesser Scaup
175135	<i>Aythya fuligula</i>	Tufted Duck
175141	<i>Bucephala clangula</i>	Common Goldeneye
175145	<i>Bucephala albeola</i>	Bufflehead
175147	<i>Clangula hyemalis</i>	Long-tailed Duck
175149	<i>Histrionicus histrionicus</i>	Harlequin Duck
175155	<i>Somateria mollissima</i>	Common Eider
175160	<i>Somateria spectabilis</i>	King Eider
175163	<i>Melanitta fusca</i>	White-winged Scoter
175170	<i>Melanitta perspicillata</i>	Surf Scoter
175171	<i>Melanitta nigra</i>	Black Scoter
175175	<i>Oxyura jamaicensis</i>	Ruddy Duck
175183	<i>Lophodytes cucullatus</i>	Hooded Merganser
175185	<i>Mergus merganser</i>	Common Merganser
175187	<i>Mergus serrator</i>	Red-breasted Merganser
175265	<i>Cathartes aura</i>	Turkey Vulture
175272	<i>Coragyps atratus</i>	Black Vulture
175289	<i>Elanoides forficatus</i>	Swallow-tailed Kite
175300	<i>Accipiter gentilis</i>	Northern Goshawk
175304	<i>Accipiter striatus</i>	Sharp-shinned Hawk
175309	<i>Accipiter cooperii</i>	Cooper's Hawk
175350	<i>Buteo jamaicensis</i>	Red-tailed Hawk
175359	<i>Buteo lineatus</i>	Red-shouldered Hawk
175365	<i>Buteo platypterus</i>	Broad-winged Hawk

TSN	Full Latin Name	Common Name
175373	<i>Buteo lagopus</i>	Rough-legged Hawk
175407	<i>Aquila chrysaetos</i>	Golden Eagle
175420	<i>Haliaeetus leucocephalus</i>	Bald Eagle
175430	<i>Circus cyaneus</i>	Northern Harrier
175590	<i>Pandion haliaetus</i>	Osprey
175599	<i>Falco rusticolus</i>	Gyr Falcon
175604	<i>Falco peregrinus</i>	Peregrine Falcon
175613	<i>Falco columbarius</i>	Merlin
175622	<i>Falco sparverius</i>	American Kestrel
175863	<i>Colinus virginianus</i>	Northern Bobwhite
175905	<i>Phasianus colchicus</i>	Ring-necked Pheasant
176207	<i>Rallus elegans</i>	King Rail
176209	<i>Rallus longirostris</i>	Clapper Rail
176221	<i>Rallus limicola</i>	Virginia Rail
176242	<i>Porzana carolina</i>	Sora
176259	<i>Coturnicops noveboracensis</i>	Yellow Rail
176263	<i>Laterallus jamaicensis</i>	Black Rail
176284	<i>Gallinula chloropus</i>	Common Moorhen
176292	<i>Fulica americana</i>	American Coot
176472	<i>Haematopus palliatus</i>	American Oystercatcher
176506	<i>Charadrius semipalmatus</i>	Semipalmated Plover
176507	<i>Charadrius melodus</i>	Piping Plover
176517	<i>Charadrius wilsonia</i>	Wilson's Plover
176520	<i>Charadrius vociferus</i>	Killdeer
176564	<i>Pluvialis dominica</i>	American Golden-Plover
176567	<i>Pluvialis squatarola</i>	Black-bellied Plover
176571	<i>Arenaria interpres</i>	Ruddy Turnstone
176580	<i>Scolopax minor</i>	American Woodcock
176599	<i>Numenius phaeopus</i>	Whimbrel
176610	<i>Bartramia longicauda</i>	Upland Sandpiper
176612	<i>Actitis macularia</i>	Spotted Sandpiper
176615	<i>Tringa solitaria</i>	Solitary Sandpiper
176619	<i>Tringa melanoleuca</i>	Greater Yellowlegs
176620	<i>Tringa flavipes</i>	Lesser Yellowlegs
176621	<i>Tringa erythropus</i>	Spotted Redshank
176638	<i>Catoptrophorus semipalmatus</i>	Willet
176642	<i>Calidris canutus</i>	Red Knot
176644	<i>Calidris canutus rufa</i>	Red Knot (subspecies)
176646	<i>Calidris maritima</i>	Purple Sandpiper
176652	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper
176653	<i>Calidris melanotos</i>	Pectoral Sandpiper
176654	<i>Calidris fuscicollis</i>	White-rumped Sandpiper
176655	<i>Calidris bairdii</i>	Baird's Sandpiper

TSN	Full Latin Name	Common Name
176656	<i>Calidris minutilla</i>	Least Sandpiper
176659	<i>Calidris ruficollis</i>	Red-necked Stint
176659	<i>Calidris ruficollis</i>	Rufous-necked Stint
176660	<i>Calidris ferruginea</i>	Curlew Sandpiper
176661	<i>Calidris alpina</i>	Dunlin
176667	<i>Calidris pusilla</i>	Semipalmated Sandpiper
176668	<i>Calidris mauri</i>	Western Sandpiper
176669	<i>Calidris alba</i>	Sanderling
176670	<i>Calidris minuta</i>	Little Stint
176675	<i>Limnodromus griseus</i>	Short-billed Dowitcher
176679	<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher
176684	<i>Tryngites subruficollis</i>	Buff-breasted Sandpiper
176686	<i>Limosa fedoa</i>	Marbled Godwit
176690	<i>Limosa haemastica</i>	Hudsonian Godwit
176695	<i>Philomachus pugnax</i>	Ruff
176700	<i>Gallinago gallinago</i>	Common Snipe
176721	<i>Recurvirostra americana</i>	American Avocet
176726	<i>Himantopus mexicanus</i>	Black-necked Stilt
176734	<i>Phalaropus fulicarius</i>	Red Phalarope
176735	<i>Phalaropus lobatus</i>	Red-necked Phalarope
176736	<i>Phalaropus tricolor</i>	Wilson's Phalarope
176792	<i>Stercorarius pomarinus</i>	Pomarine Jaeger
176793	<i>Stercorarius parasiticus</i>	Parasitic Jaeger
176808	<i>Larus hyperboreus</i>	Glaucous Gull
176811	<i>Larus glaucoides</i>	Iceland Gull
176815	<i>Larus marinus</i>	Great Black-backed Gull
176821	<i>Larus fuscus</i>	Lesser Black-backed Gull
176824	<i>Larus argentatus</i>	Herring Gull
176825	<i>Larus argentatus smithsonianus</i>	Herring Gull (subspecies)
176830	<i>Larus delawarensis</i>	Ring-billed Gull
176835	<i>Larus ridibundus</i>	Black-headed Gull
176837	<i>Larus atricilla</i>	Laughing Gull
176839	<i>Larus philadelphia</i>	Bonaparte's Gull
176840	<i>Larus minutus</i>	Little Gull
176875	<i>Rissa tridactyla</i>	Black-legged Kittiwake
176877	<i>Rissa tridactyla tridactyla</i>	Black-legged Kittiwake (subspecies)
176887	<i>Sterna forsteri</i>	Forster's Tern
176888	<i>Sterna hirundo</i>	Common Tern
176889	<i>Sterna hirundo hirundo</i>	Common Tern (subspecies)
176890	<i>Sterna paradisaea</i>	Arctic Tern
176891	<i>Sterna dougallii</i>	Roseate Tern
176894	<i>Sterna fuscata</i>	Sooty Tern
176922	<i>Sterna maxima</i>	Royal Tern

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176923	<i>Sterna antillarum</i>	Least Tern
176924	<i>Sterna caspia</i>	Caspian Tern
176926	<i>Sterna nilotica</i>	Gull-billed Tern
176959	<i>Chlidonias niger</i>	Black Tern
176971	<i>Alca torda</i>	Razorbill
176978	<i>Uria lomvia</i>	Thick-billed Murre
176985	<i>Cepphus grylle</i>	Black Guillemot
177071	<i>Columba livia</i>	Rock Pigeon
177125	<i>Zenaida macroura</i>	Mourning Dove
177723	<i>Myiopsitta monachus</i>	Monk Parakeet
177831	<i>Coccyzus americanus</i>	Yellow-billed Cuckoo
177834	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo
177851	<i>Tyto alba</i>	Barn Owl
177884	<i>Bubo virginianus</i>	Great Horned Owl
177896	<i>Nyctea scandiaca</i>	Snowy Owl
177932	<i>Asio otus</i>	Long-eared Owl
177935	<i>Asio flammeus</i>	Short-eared Owl
177942	<i>Aegolius acadicus</i>	Northern Saw-whet Owl
177961	<i>Caprimulgus vociferus</i>	Whip-poor-will
177979	<i>Chordeiles minor</i>	Common Nighthawk
178001	<i>Chaetura pelagica</i>	Chimney Swift
178032	<i>Archilochus colubris</i>	Ruby-throated Hummingbird
178119	<i>Ceryle alcyon</i>	Belted Kingfisher
178154	<i>Colaptes auratus</i>	Northern Flicker
178156	<i>Colaptes auratus luteus</i>	Northern Flicker (subspecies)
178186	<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker
178195	<i>Melanerpes carolinus</i>	Red-bellied Woodpecker
178202	<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker
178259	<i>Picoides pubescens</i>	Downy Woodpecker
178262	<i>Picoides villosus</i>	Hairy Woodpecker
178279	<i>Tyrannus tyrannus</i>	Eastern Kingbird
178287	<i>Tyrannus verticalis</i>	Western Kingbird
178309	<i>Myiarchus crinitus</i>	Great Crested Flycatcher
178329	<i>Sayornis phoebe</i>	Eastern Phoebe
178338	<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher
178339	<i>Empidonax virescens</i>	Acadian Flycatcher
178340	<i>Empidonax alnorum</i>	Alder Flycatcher
178341	<i>Empidonax traillii</i>	Willow Flycatcher
178344	<i>Empidonax minimus</i>	Least Flycatcher
178359	<i>Contopus virens</i>	Eastern Wood Pewee
178431	<i>Tachycineta bicolor</i>	Tree Swallow
178436	<i>Riparia riparia</i>	Bank Swallow
178443	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow

TSN	Full Latin Name	Common Name
178448	<i>Hirundo rustica</i>	Barn Swallow
178455	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
178460	<i>Petrochelidon fulva</i>	Cave Swallow
178464	<i>Progne subis</i>	Purple Martin
178511	<i>Lanius excubitor</i>	Northern Shrike
178515	<i>Lanius ludovicianus</i>	Loggerhead Shrike
178532	<i>Bombycilla cedrorum</i>	Cedar Waxwing
178541	<i>Troglodytes aedon</i>	House Wren
178547	<i>Troglodytes troglodytes</i>	Winter Wren
178581	<i>Thryothorus ludovicianus</i>	Carolina Wren
178605	<i>Cistothorus platensis</i>	Sedge Wren
178608	<i>Cistothorus palustris</i>	Marsh Wren
178620	<i>Mimus polyglottos</i>	Northern Mockingbird
178625	<i>Dumetella carolinensis</i>	Gray Catbird
178627	<i>Toxostoma rufum</i>	Brown Thrasher
178654	<i>Oreoscoptes montanus</i>	Sage Thrasher
178699	<i>Parus atricapillus</i>	Black-capped Chickadee
178700	<i>Parus atricapillus atricapillus</i>	Black-capped Chickadee (subspecies)
178775	<i>Sitta carolinensis</i>	White-breasted Nuthatch
178784	<i>Sitta canadensis</i>	Red-breasted Nuthatch
178803	<i>Certhia americana</i>	Brown Creeper
178844	<i>Mniotilta varia</i>	Black-and-white Warbler
178846	<i>Protonotaria citrea</i>	Prothonotary Warbler
178850	<i>Helmitheros vermivorus</i>	Worm-eating Warbler
178852	<i>Vermivora chrysoptera</i>	Golden-winged Warbler
178853	<i>Vermivora pinus</i>	Blue-winged Warbler
178855	<i>Vermivora peregrina</i>	Tennessee Warbler
178856	<i>Vermivora celata</i>	Orange-crowned Warbler
178861	<i>Vermivora ruficapilla</i>	Nashville Warbler
178868	<i>Parula americana</i>	Northern Parula
178878	<i>Dendroica petechia</i>	Yellow Warbler
178879	<i>Dendroica petechia aestiva</i>	Yellow Warbler (subspecies)
178886	<i>Dendroica magnolia</i>	Magnolia Warbler
178887	<i>Dendroica tigrina</i>	Cape May Warbler
178888	<i>Dendroica caerulescens</i>	Black-throated Blue Warbler
178891	<i>Dendroica coronata</i>	Yellow-rumped Warbler
178896	<i>Dendroica nigrescens</i>	Black-throated Gray Warbler
178897	<i>Dendroica townsendi</i>	Townsend's Warbler
178898	<i>Dendroica virens</i>	Black-throated Green Warbler
178903	<i>Dendroica cerulea</i>	Cerulean Warbler
178904	<i>Dendroica fusca</i>	Blackburnian Warbler
178905	<i>Dendroica dominica</i>	Yellow-throated Warbler
178911	<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler

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178912	<i>Dendroica castanea</i>	Bay-breasted Warbler
178913	<i>Dendroica striata</i>	Blackpoll Warbler
178914	<i>Dendroica pinus</i>	Pine Warbler
178918	<i>Dendroica discolor</i>	Prairie Warbler
178921	<i>Dendroica palmarum</i>	Palm Warbler
178922	<i>Dendroica palmarum palmarum</i>	Palm Warbler (subspecies)
178923	<i>Dendroica palmarum hypochrysea</i>	Palm Warbler (subspecies)
178927	<i>Seiurus aurocapillus</i>	Ovenbird
178931	<i>Seiurus noveboracensis</i>	Northern Waterthrush
178935	<i>Seiurus motacilla</i>	Louisiana Waterthrush
178937	<i>Oporornis formosus</i>	Kentucky Warbler
178938	<i>Oporornis agilis</i>	Connecticut Warbler
178939	<i>Oporornis philadelphia</i>	Mourning Warbler
178944	<i>Geothlypis trichas</i>	Common Yellowthroat
178964	<i>Icteria virens</i>	Yellow-breasted Chat
178972	<i>Wilsonia citrina</i>	Hooded Warbler
178973	<i>Wilsonia pusilla</i>	Wilson's Warbler
178977	<i>Wilsonia canadensis</i>	Canada Warbler
178979	<i>Setophaga ruticilla</i>	American Redstart
178991	<i>Vireo griseus</i>	White-eyed Vireo
179009	<i>Vireo flavifrons</i>	Yellow-throated Vireo
179010	<i>Vireo solitarius</i>	Blue-headed Vireo
179010	<i>Vireo solitarius</i>	Solitary Vireo
179021	<i>Vireo olivaceus</i>	Red-eyed Vireo
179022	<i>Vireo philadelphicus</i>	Philadelphia Vireo
179023	<i>Vireo gilvus</i>	Warbling Vireo
179032	<i>Dolichonyx oryzivorus</i>	Bobolink Eastern
179034	<i>Sturnella magna</i>	Meadowlark
179043	<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird
179045	<i>Agelaius phoeniceus</i>	Red-winged Blackbird
179064	<i>Icterus spurius</i>	Orchard Oriole
179083	<i>Icterus galbula</i>	Baltimore Oriole
179091	<i>Euphagus carolinus</i>	Rusty Blackbird
179104	<i>Quiscalus quiscula</i>	Common Grackle
179108	<i>Quiscalus major</i>	Boat-tailed Grackle
179112	<i>Molothrus ater</i>	Brown-headed Cowbird
179124	<i>Cardinalis cardinalis</i>	Northern Cardinal
179139	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak
179150	<i>Passerina cyanea</i>	Indigo Bunting
179165	<i>Spiza americana</i>	Dickcissel
179173	<i>Coccothraustes vespertinus</i>	Evening Grosbeak
179186	<i>Carpodacus purpureus</i>	Purple Finch
179191	<i>Carpodacus mexicanus</i>	House Finch

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179205	<i>Pinicola enucleator</i>	Pine Grosbeak
179226	<i>Carduelis carduelis</i>	European Goldfinch
179230	<i>Carduelis flammea</i>	Common Redpoll
179233	<i>Carduelis pinus</i>	Pine Siskin
179236	<i>Carduelis tristis</i>	American Goldfinch
179259	<i>Loxia curvirostra</i>	Red Crossbill
179268	<i>Loxia leucoptera</i>	White-winged Crossbill
179269	<i>Loxia leucoptera leucoptera</i>	White-winged Crossbill (subspecies)
179276	<i>Pipilo erythrophthalmus</i>	Eastern Towhee
179277	<i>Pipilo erythrophthalmus erythrophthalm</i>	Eastern Towhee (subspecies)
179312	<i>Calamospiza melanocorys</i>	Lark Bunting
179314	<i>Passerculus sandwichensis</i>	Savannah Sparrow
179315	<i>Passerculus sandwichensis princeps</i>	Ipswich Sparrow
179317	<i>Passerculus sandwichensis savanna</i>	Savannah Sparrow (subspecies)
179333	<i>Ammodramus savannarum</i>	Grasshopper Sparrow
179340	<i>Ammodramus henslowii</i>	Henslow's Sparrow
179344	<i>Ammodramus caudacutus</i>	Saltmarsh Sharp-tailed Sparrow
179346	<i>Ammodramus maritimus</i>	Seaside Sparrow
179366	<i>Pooecetes gramineus</i>	Vesper Sparrow
179371	<i>Chondestes grammacus</i>	Lark Sparrow
179410	<i>Junco hyemalis</i>	Dark-eyed Junco
179432	<i>Spizella arborea</i>	American Tree Sparrow
179433	<i>Spizella arborea arborea</i>	American Tree Sparrow (subspecies)
179435	<i>Spizella passerina</i>	Chipping Sparrow
179439	<i>Spizella pallida</i>	Clay-colored Sparrow
179443	<i>Spizella pusilla</i>	Field Sparrow
179455	<i>Zonotrichia leucophrys</i>	White-crowned Sparrow
179462	<i>Zonotrichia albicollis</i>	White-throated Sparrow
179464	<i>Passerella iliaca</i>	Fox Sparrow
179488	<i>Melospiza georgiana</i>	Swamp Sparrow
179490	<i>Melospiza georgiana georgiana</i>	Swamp Sparrow (subspecies)
179492	<i>Melospiza melodia</i>	Song Sparrow
179494	<i>Melospiza melodia atlantica</i>	Song Sparrow (subspecies)
179526	<i>Calcarius lapponicus</i>	Lapland Longspur
179532	<i>Plectrophenax nivalis</i>	Snow Bunting
179628	<i>Passer domesticus</i>	House Sparrow
179637	<i>Sturnus vulgaris</i>	European Starling
179680	<i>Cyanocitta cristata</i>	Blue Jay
179731	<i>Corvus brachyrhynchos</i>	American Crow
179737	<i>Corvus ossifragus</i>	Fish Crow
179759	<i>Turdus migratorius</i>	American Robin
179769	<i>Turdus iliacus</i>	Redwing
179777	<i>Hylocichla mustelina</i>	Wood Thrush

TSN	Full Latin Name	Common Name
179779	<i>Catharus guttatus</i>	Hermit Thrush
179788	<i>Catharus ustulatus</i>	Swainson's Thrush
179793	<i>Catharus minimus</i>	Gray-cheeked Thrush
179796	<i>Catharus fuscescens</i>	Veery
179801	<i>Sialia sialis</i>	Eastern Bluebird
179824	<i>Myadestes townsendi</i>	Townsend's Solitaire
179853	<i>Polioptila caerulea</i>	Blue-gray Gnatcatcher
179865	<i>Regulus satrapa</i>	Golden-crowned Kinglet
179870	<i>Regulus calendula</i>	Ruby-crowned Kinglet
179882	<i>Piranga ludoviciana</i>	Western Tanager
179883	<i>Piranga olivacea</i>	Scarlet Tanager
179888	<i>Piranga rubra</i>	Summer Tanager
202310	<i>Ammodramus maritimus maritimus</i>	Seaside Sparrow (subspecies)
554127	<i>Anthus rubescens</i>	American Pipit
554135	<i>Ardea alba</i>	Great Egret
554138	<i>Baeolophus bicolor</i>	Tufted Titmouse
554145	<i>Calidris himantopus</i>	Stilt Sandpiper
554221	<i>Contopus cooperi</i>	Olive-sided Flycatcher
554256	<i>Eremophila alpestris</i>	Horned Lark
554268	<i>Ictinia mississippiensis</i>	Mississippi Kite
554382	<i>Poecile atricapillus</i>	Black-capped Chickadee
554447	<i>Rynchops niger</i>	Black Skimmer

Appendix 9. Point locations where threatened, endangered and species of special concern were recorded at GATE.

Point count locations were recorded during three point count bird surveys conducted at 205 points in the Gateway National Recreation Area. Surveys at Sandy Hook and the Staten Island took place between May 20, 2005 and July 24, 2005, while surveys at Breezy Point, Floyd Bennett, and Jamaica Bay took place between May 17, 2007 and July 28, 2007.

Site	Point	Black Skimmer	Black-crowned Night-Heron	Common Loon	Common Tern	Great Blue Heron	Least Bittern	Least Tern	Northern Harrier	Osprey	Peregrine Falcon	Seaside Sparrow	Spotted Sandpiper	Wood Thrush	Yellow-breasted Chat	Yellow-crowned Night Heron
Sandy Hook	SH03				15			2								
	SH05B													1		
	SH08				1											
	SH09B				1											
	SH11B									2						
	SH15														1	
	SH16													1		
	SH17B													1	2	
	SH28B			1												
	SH29													1		
	SH32													1		
	SH34B					1				1			1			
	SH38											1			1	
	SH40B											1				
	SH43B													4		
	SH52B									1						
	SH60B						1									
	SH61				1											
Staten Island	NYS15B				7											
	NYS23											1				
	NYS29													1		

[illegible]

Site	Point	Black Skimmer	Black-crowned Night-Heron	Common Loon	Common Tern	Great Blue Heron	Least Bittern	Least Tern	Northern Harrier	Osprey	Peregrine Falcon	Seaside Sparrow	Spotted Sandpiper	Wood Thrush	Yellow-breasted Chat	Yellow-crowned Night Heron
Breezy Point	BP16				2											
	BP17				1											
	BP20				21			11			1					
	BP24				5			3								
	BP30				61			20								
	BP35				61			10								
	BP39				53			5								
	BP40				135			20								
	BP43	3			135			12								
Jamaica Bay	JB100		1						1							
	JB103				36	2										
	JB104	2			30								1			
	JB107				6											
	JB108				1								1			
	JB11				8											
	JB19				15											
	JB23												1			
	JB27		1			1						3				1
	JB28												1			
	JB3				3											
	JB32		3													
	JB34		1		33			15		1						
	JB35				30											
	JB4		4		20											
	JB44									1						
	JB45		3		3											
	JB46		1		1											
	JB47				3					1						

Site	Point	Black Skimmer	Black-crowned Night-Heron	Common Loon	Common Tern	Great Blue Heron	Least Bittern	Least Tern	Northern Harrier	Osprey	Peregrine Falcon	Seaside Sparrow	Spotted Sandpiper	Wood Thrush	Yellow-breasted Chat	Yellow-crowned Night Heron
Jamaica Bay	JB48									1						
	JB62		2		1											
	JB63							1								
	JB64				1											
	JB65							15								
	JB70				25					2						
	JB72				1											
	JB73				20			1		2						
	JB75				15											
	JB76				1											
	JB77									1						
	JB78				1	1				4			3			
	JB80				35					5	1					1
	JB81		1					2		2						
	JB84				5					2			10			
	JB85		1		5								1			1
	JB87										2		1			
	JB88		1							1						
	JB91				1					1						
	JB93									1						
	JB97									1						
	JB99		1					4								

Appendix 10. Candidate models in program DISTANCE to describe breeding density of Gateway NRA breeding passerine birds.

Delta AIC values reflect the difference in score between the models, and the best fitting model is in **bold**. Where averaged, the models used in the average are shown in **red**.

Species	Model ID	average	half normal cosine	half normal hermite polynomial	hazard rate cosine	hazard rate simple polynomial	uniform cosine	uniform simple polynomial	Comments
Red-winged Blackbird	# paramaters	N/A	4	1	2	4	4	3	
	Delta AIC	N/A	0	371.066	74.994	0.018	44.053	90.038	
	CV	N/A	0.08	0.066	0.094	3.759	0.09	0.066	
Gray Catbird	# paramaters	2	2	1	2	2	2	2	Birds recorded beyond 75 m not included in model
	Delta AIC	0	0	40.127	0	0	1.907	0	
	CV	0.01	0.085	0.076	0.126	0.126	0.076	0.075	
Common Yellowthroat	# paramaters	2	2	1	2	2	2	2	Birds recorded beyond 75 m not included in model
	Delta AIC	0	0	21.131	0	0	0	0	
	CV	0.09	0.107	0.083	0.206	0.206	0.092	0.087	
Yellow Warbler	# paramaters	2	1	2	2	2	2	2	Birds recorded beyond 75 m not included in model
	Delta AIC	0	0	8.151	0	0	0	0	
	CV	0.15	0.13	0.106	0.149	0.149	0.107	0.109	
Song Sparrow	# paramaters	N/A	3	1	3	3	1	2	
	Delta AIC	N/A	0	48.948	0	0	154.78	51.635	
	CV	N/A	0.122	0.098	0.835	0.777	0.089	0.094	
Eastern Towhee	# paramaters	3	3	1	3	3	3	3	
	Delta AIC	0	0	12.842	10.725	0	7.869	0	
	CV	0.12	0.136	0.09	0.115	0.256	0.141	0.122	
American Robin	# paramaters	3	3	1	3	3	3	3	Birds recorded beyond 75 m not included in model
	Delta AIC	0	0	17.611	19.563	0	19.563	0	
	CV	0.13	0.149	0.109	0.167	1.653	0.167	0.133	

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

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