

# Petty's Island State of the Birds Report: 2018-2019 Biodiversity Monitoring Results



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## HIGHLIGHTS

- Over 1,735 individuals of 105 species were observed during survey visits between 31 August 2018 – 15 July 2019.
- The cumulative bird list from all survey years (2014-2019) contains 134, with three species added this year: Blue-winged Warbler, Brown Thrasher, and Merlin.
- During the 2018-2019 surveys, we observed two state-Endangered species (Bald Eagle and Red-shouldered Hawk), two state-Threatened species (American Kestrel and Osprey), and eleven species that are of Special Concern.
- Bald Eagles (state-listed Endangered) continue to be observed regularly at the site, including at sightings during 2018/2019 winter surveys. In addition, a distressed adult Bald Eagle was found along the trail during a New Jersey Audubon program. It was determined this individual suffered lead poisoning, but it's not known whether this was one of the adults from the local pair.
- Red-shouldered Hawk (state-listed Endangered) also continues to be regularly observed at the site, including sightings during fall 2018 and winter 2018/2019 surveys. This species was not observed during the 2018/2019 breeding season, but has been observed in previous breeding season surveys.
- In 2019, a pair of American Kestrels was observed along the north end of the island throughout spring migration, breeding, and early fall migration surveys. One to three individuals were repeatedly observed in the same location – along wires near along the road just after crossing the bridge onto the island from April to September. Although our surveys are not designed to confirm breeding, the presence of a pair throughout the season suggests possible breeding on site. As grassland restoration continues it is possible that they could be attracted to open habitats on the island, given availability of cavities for nesting.
- A wide variety of migrant warblers and other songbirds continue to use the forested habitats on the island during spring and fall migration. Migratory and resident waterfowl, as well as other waterbird and shorebird species continue to use the Delaware River interior wetland habitats.
- Birding checklists for Petty's Island are beginning to appear on eBird.org facilitated by guided bird walks led by New Jersey Audubon staff. These will be monitored moving forward to provide supplemental information about bird species usage of the site.

## GOALS AND OBJECTIVES

Petty's Island is a 304-acre island in the Delaware River between Camden, New Jersey and Philadelphia, Pennsylvania with a long history of industrial use. In 2009, the property was donated by Citgo to the New Jersey Natural Lands Trust (NJNLT) for the purposes of environmental conservation and education. The gift included a \$3 million fund in support of these goals. A container shipping facility continued to operate on the northern portion of the island until its lease ran out in 2017, after which work began to remove shipping containers and restore areas of asphalt to grassland habitat. New Jersey Audubon (NJA) has partnered with the NJNLT to provide educational programming, stewardship guidance, and wildlife monitoring at the site. Currently, the primary area of focus is the 76 forested acres at the southwestern end of the island. For the purposes of this report, NJA's goal is 1) to collect and evaluate information on wildlife populations on the island and surrounding habitat, 2) use this information to guide future management and aid in designing educational programming, and 3) assess the effects of stewardship activities at the site. NJA commenced regular surveys in the 76-acre woodland at the southern tip of the island in July 2014. In July 2019, we completed the fifth full year of year-round baseline monitoring surveys there. The focus has been on birds, but we also recorded information on any amphibians, reptiles, mammals, or unusual plant species encountered during site visits. This report summarizes the third full year of surveys; results from previous years are available elsewhere (Allen and Tsipoura 2015, 2016, 2017, Mylecraine and Allen 2019).

## INTRODUCTION

New Jersey Audubon (NJ A) is a privately supported, not-for profit, statewide membership organization that aims to foster environmental awareness and a conservation ethic among citizens; protect New Jersey's birds and other wildlife, especially endangered and threatened species; and promote the preservation of natural habitats. These objectives are realized through Education and Programming, Research and Wildlife Monitoring, Conservation, Stewardship, and Environmental Advocacy. The New Jersey Natural Lands Trust (NJNLT) is an independent agency created in 1968 and affiliated with the state Department of Environmental Protection. Its primary purpose is the acquisition of open space for environmental conservation and public enjoyment. NJNLT acquired Petty's Island through a donated conservation easement from Citgo in 2009, to be fully restored and transferred to the trust by 2020. Citgo committed \$2 million to NJNLT for stewardship and restoration of the island, and \$1 million for an environmental center near the site. NJNLT has contracted with NJ A to provide educational programming, as well as stewardship and wildlife monitoring guidance at the site.

Due to its size, isolation, and location within the Delaware River on the Atlantic Flyway, Petty's Island supports an impressive diversity of birds and other wildlife. Contributing to this is a diverse array of habitats including grasslands, forests, wetlands, several large ponds, and a 140-acre fringe of tidal flats that host migratory shorebirds and several rare plant species (NJNLT 2015). Its location within a large urbanized landscape increases its value to migrating birds which may have few other options for stopover and refueling sites (Pennington et al. 2008, Seewagen et al. 2010). Bald Eagles nested on Petty's Island until recently, and continue to nest nearby and to use the island for roosting and foraging (McCort et al. 2010, Allen and Tsipoura 2015, 2016, 2017 ; Mylecraine and Allen 2018).

Petty's urban surroundings and industrial history make its current ecological importance both surprising and encouraging. Its proximity to the large urban centers of Camden, New Jersey and Philadelphia, Pennsylvania also makes this a unique opportunity to connect large numbers of people with nature who may not have otherwise had the chance. In recent years, NJ A has led numerous public tours and litter clean-ups on the island, partnered with local community groups, and assessed the site for its restoration potential.

In July 2014, NJ A began conducting bird surveys on the site throughout the year within the 76 acres of forest and wetlands at the southwestern end of the island. Other animal and plant sightings were also recorded. Surveys were initiated to obtain baseline data on the existing natural resources at the site, similar to a monitoring program NJ A has been conducting at another urban reserve (Linden's Hawk Rise Sanctuary) since 2010 (Munaf o and Tsipoura 2011, Allen and Mylecraine 2017) as well as at other urban sites (Mizrahi et al. 2007, Tsipoura and Mylecraine 2010). As NJNLT continues to move forward with the restoration of Petty's Island, robust and repeatable baseline survey data will be valuable for comparisons with post-management data to determine the impact of stewardship activities on wildlife populations. Surveys could also aid in identifying areas in need of additional restoration and will provide guidance for educational and interpretive activities on the site. A sixth year of surveys is ongoing, but here we mainly present results from the fifth full year of the survey, covering the period August 2018 to July 2019.



# **METHODOLOGY**

## **Bird Survey Methods**

Surveys were conducted using a combination of standardized point count and line transect surveys. Following standardized and scientifically rigorous protocols allows for repeatability of surveys through time and detailed analyses. In addition, all surveys include methods that will allow for future distance analyses, occupancy modeling and/or time removal sampling to account and adjust data for imperfect detectability. Spring migration and breeding season bird surveys were conducted following standard point count methodology (Ralph et al. 1995). During these time periods, birds are vocalizing and are therefore likely to be more detectable on point counts than other time periods. Winter and fall migration surveys were conducted using 200-meter line transect surveys (Buckland et al. 2006). Line transect surveys may be more effective for migration surveys (Wilson et al. 2000), and are particularly useful during fall and winter surveys when birds are less vocal. Detailed survey methodologies for point count and transect surveys are presented below. All surveys were performed by two New Jersey Audubon staff observers (M. Allen and K. Mylecraine).

### **Point and transect locations**

Spring and breeding season point count locations were established based on standard protocols for avian surveys (Ralph et al. 1995). We initially created a 300 m x 300 m grid of points, rotated to allow a maximum number of points to fall within the 76-acre wooded area at the southwestern end of the island. Points were then moved as needed to avoid edges or inaccessible flooded areas while maintaining a spacing of at least 200 m to avoid duplicate counting of individuals (Ralph et al. 1995; Table 1 and Figures 1 and 2). A total of 7 survey points were mapped covering a variety of upland and wetland forested habitats. Fall and winter transects were established based on the existing point count locations where possible. Some transects were then moved slightly to maximize coverage area and avoid flooded areas. A total of six transects were established, each 200 m long (Table 1 and Figures 1 and 2). All survey locations have remained in the same locations throughout the study.

### **Survey methodology**

Point count and transect surveys were conducted following standard protocols (Ralph et al. 1995, Buckland 2006). All surveys were conducted between one half hour before sunrise and four hours after sunrise, on days with no precipitation and wind speeds less than 12 mph (Beaufort 3).

During spring migration and breeding season surveys, observers conducted 10-minute point counts at each location, recording all birds heard or seen. We conducted three surveys during spring migration 2019 between 1 April and 15 May, and three surveys during the 2019 breeding season between 25 May and 15 July (see Table 2 for list of survey dates). To account for biases in population measures resulting from imperfect detectability, data collection methods were designed to allow future distance sampling (Buckland et al. 2001) and time-depletion (removal) analyses (Farnsworth et al. 2002). Repeated surveys will also allow the use of occupancy modeling (MacKenzie et al. 2006) in future analyses. Observers recorded all birds heard or seen in ten one-minute intervals, and measured exact distance, when possible, using a laser rangefinder.

Transect surveys were conducted four times during 2018 fall migration between 15 August and 15 November, and four times during winter 2018-2019 between 15 December and 31 March (see Table 2 for list of survey dates). Data collection methods were designed to allow future distance analyses (Buckland et al. 2001, Buckland 2006). Observers walked along the transect line, and recorded exact distance, when possible, and direction to each bird. During both point count and transect surveys, observers also recorded observation type (heard, seen, heard and seen, or over-flight) for each detection, as well as basic weather information (wind speed, temperature, sky condition) and time of day.

## **Data Analysis**

Results presented here are a simple tabulation and summary of observations, but the data collection methods used will also allow more detailed analyses that take into account detection probabilities, such as occupancy modeling (MacKenzie et al. 2006), distance (Buckland et al. 2001) and removal analyses (Farnsworth et al. 2002).

At the site level, we created a list of all bird species observed during 2018-2019 fall migration, winter, spring migration, and breeding season surveys. We calculated species richness, including the total number of species observed, and total number of state Endangered, Threatened, and Special Concern species observed during each season. For each species and season, we also calculated frequency of occurrence by point, total number of individuals observed per point, and relative abundance. Frequency of occurrence by point was calculated as the number of points at which a species was observed divided by the total number of points surveyed. Relative abundance was calculated as the total number of observations of the species of interest divided by the total number of observations for all species combined. The total number of observations represents the sum of all individuals counted at each point/transect, across all surveys and locations. We also tabulated the number of birds observed during each survey, and calculated the maximum number of individuals recorded, across all points/transects, on any one survey.

## RESULTS AND DISCUSSION

### **2018-2019 Bird Survey Results**

A total of 105 bird species were observed by New Jersey Audubon research staff at Petty's Island between August 2018 and July 2019. We counted 1,735 individuals of 86 species on point count and transect surveys, and observed an additional 19 species incidentally, outside of official surveys (Tables 2 and 3). Survey data for each season in 2018-2019, by point/transect and survey, are presented in Tables 4-15. Year four of the survey brings our total 2014-2019 list of bird species to 134, with the following three species added this year: Blue-winged Warbler, Brown Thrasher, and Merlin (Table 16).

Two other sources exist to supplement our knowledge of the island's recent birdlife: a report by Herpetological Associates, Inc. (McCort et al. 2010), and data from a relatively recent 'hotspot' created in eBird.org ('Petty Island') where birdwatchers can submit checklists of species seen (Sullivan et al. 2014). The eBird hotspot contains eleven complete checklists in the period 2014-2019, as well as a partial checklist from a reliable source that reported American Bittern on May 2, 2018. While these are not standardized data, the observations are included in Table 16 to fill in gaps, labeled 'e' so they can be easily distinguished from survey data. Nine species (American Bittern, Black Vulture, Caspian Tern, House Sparrow, Lesser Yellowlegs, Northern Harrier, Pine Warbler, Rock Pigeon, and White-winged Scoter) have been reported to eBird that have not been recorded during our survey visits. Six of these (Black Vulture, Caspian Tern, House Sparrow, Lesser Yellowlegs, Pine Warbler, and Rock Pigeon) were reported by McCort et al. (2010), but American Bittern, Northern Harrier and White-winged Scoter are new records for the site. The Herpetological Associates, Inc. survey encompassed the entire island (and surrounding wetlands/water) and took place over eight full days in March-June 2010. The result was a list of 141 avian species, and included 25 species not found on our list, primarily spring migrants and species typical of non-forested habitats (i.e., the river and the northern two-thirds of the island; see Table 17; McCort et al. 2010). Thus, the grand total of bird species from all three sources (our surveys, eBird, and the 2010 report) from spring 2010 to summer 2019 is 168 species.

### **State-listed Species**

During the 2018-2019 surveys, we observed two state-Endangered species (Bald Eagle and Red-shouldered Hawk), and two state-Threatened species (American Kestrel and Osprey; Table 3). We observed eleven species that are of Special Concern during the breeding season: Black-throated Blue Warbler, Black-throated Green Warbler, Brown Thrasher, Canada Warbler, Cooper's Hawk, Great Blue Heron, Northern Parula, Spotted Sandpiper, Veery, Winter Wren and Wood Thrush (Table 3). Of these, Great Blue Heron and Spotted Sandpiper have a history of breeding on the island (McCort et al 2010). In previous years we also observed Least Flycatcher (SC, Spring 2018), Nashville Warbler (SC, Spring 2018), Pied-billed Grebe (Endangered, Winter 2015/2016, 2018), Semipalmated Sandpiper (SC, Fall 2014), and Sharp-shinned Hawk (SC, Fall 2015, Fall 2017). eBird users have also reported American Bittern (Spring 2018) and Northern Harrier (Spring 2019), both listed as endangered during the breeding season and species of special concern during non-breeding period.

Red-shouldered Hawks are considered state-Endangered during the breeding season and of Special Concern during the non-breeding seasons. We have encountered them on the island during 14 of the 21 consecutive seasons we have surveyed (Table 16), including multiple observations of calling and territorial adults (e.g., chasing a Red-tailed Hawk) and possible begging calls by juveniles (Allen and Tsipoura 2015, 2016). In 2018-2019, we observed them calling and flying in multiple locations during Fall Migration and Winter surveys. Two individuals were seen perched and calling near T03 on 1 September; a single individual was observed near T03 on 16 September; and a single individual was recorded on T04 on 6 February (Tables 4-9). This species was not recorded during 2019 Spring Migration or Breeding Season survey visits, but has been recorded in previous years during this time period. Though we have not found a nest, the territorial behavior observed in previous years, coupled with repeated observations during the summer months is strong evidence of potential breeding on the island or on the nearby mainland where they have also been heard calling (Allen and Tsipoura 2015, 2016). McCort et al. (2010) did not find Red-shouldered Hawk during their 2010 survey, but cited an observation on the island sometime during 2004-2006.

Bald Eagles are considered state-Endangered during the breeding season and Threatened during the non-breeding season. They are known to nest on the New Jersey shore of the Delaware River directly across from Petty's Island, after having previously nested in a tree on the island (McCort et al. 2010). We have encountered them on the island during 11 of the 21 consecutive seasons we have surveyed (Table 16). The relatively low frequency of sightings (Table 16) despite a known nest in the vicinity is likely due to their large home range and the fact that our surveys take place in the forest with few clear views of the river from the transect lines and points. In 2018-2019, we had sightings of Bald Eagles on the island on 13 March (adult seen flying along the river) and 29 March (adult perched on north end of island, seen driving out; Tables 4-15). In addition, a distressed adult Bald Eagle was found along the trail during a New Jersey Audubon program. It was determined this individual suffered lead poisoning, but it's not known whether this was one of the adults from the local pair.

Pied-billed Grebe, an endangered species in New Jersey during the breeding season and of special concern in the non-breeding season, has been recorded previously on the island but not in 2018-2019. One was recorded in spring 2016 (18 March), though no evidence of nesting was found (Allen and Tsipoura 2016). In 2018, we observed another individual on 8 April, but again did not find evidence of nesting or presence later in the season. However, this and other secretive and/or nocturnal marsh species cannot be ruled out as nesters, especially as the large interior pond complex (e.g., between transects 02 and 03) represents potentially suitable nesting habitat (e.g., see NJDEP habitat description: <http://www.state.nj.us/dep/fgw/ensp/pdf/end-thrtened/pbgrebe.pdf>).

American Bittern and Northern Harrier are both endangered during the breeding season and special concern during non-breeding periods, and have been recorded by eBird observers, but not on survey visits. Northern Harrier is a species that prefers open habitats such as marshes, grasslands and agricultural fields. As a breeding species in New Jersey, it occupies open marsh habitats, and is more widely distributed during migration (<https://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/harrier.pdf>). This species was recorded by eBird observers during 2019 spring migration. American Bittern is a secretive species that

inhabits emergent marsh habitats (<https://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/ambittern.pdf>). Because of their secretive nature, American Bittern and other secretive marsh birds may be overlooked during passive point count surveys, and are often surveyed using a playback protocol designed specifically for marsh birds. American Bittern was observed by eBird users during 2018 spring migration.

American Kestrel is a threatened species in New Jersey throughout the year. This species was previously recorded as an incidental encounter during the winter of 2016/2017. In 2018, a female was observed on the north end of the island on 18 June, perched on the wires along the road. In 2019, a pair was observed along the north end of the island throughout spring migration, breeding, and early fall migration surveys. One to three individuals were repeatedly observed in the same location – along wires near along the road just after crossing the bridge onto the island. This species was observed on 17 April (2 individuals), 16 May (1 individual), 29 May (2 individuals), July 12 (2 individuals), 1 September (2 individuals), and 9 September (3 individuals). This species are cavity nesters and prefers large open areas with short vegetation (<https://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/kestrel.pdf>). Although our surveys are not designed to confirm breeding, the presence of a pair throughout the season suggests possible breeding on site. They were not recorded during McCort's survey (McCort et al. 2010); however, as restoration continues it is possible that they could be attracted to open habitats on the island, given availability of cavities for nesting.

Osprey is a threatened species in New Jersey during the breeding season, and inhabits coastal and inland rivers and other bodies of water that support adequate fish populations (<https://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/osprey.pdf>). This species was previously recorded by McCort et al. (2010), and as incidental encounters during our spring 2015, fall 2017 and breeding season 2018 surveys. In 2018/2019, we observed a single Osprey along the river on 1 September.

Of the wide variety of state species of concern recorded during the 2014-2019 surveys, the majority are likely to be transients due to the season they were observed in and the ranges and habitat requirements of the species (Walsh et al. 1999, Boyle 2011). Only three of these special concern species have a history of breeding on the island. Great-blue Heron, a state species of special concern during the breeding season with a history of breeding at the site, was previously sighted in low numbers (one or two) in all four survey seasons in 2015-2016 (Allen and Tsipoura 2016), during fall, winter and spring of 2016-2017, and during fall, spring and breeding seasons in 2017-2018. During the 2018/2019 surveys, we observed this species during 2018 fall migration and the 2019 breeding season, but did not observe evidence of breeding. Historically, Great Blue Heron was confirmed nesting in trees within the ponds on the site in 2004 (5 nests) and 2010 (2 nests; McCort et al. 2010). We observed no evidence of nesting on the site in 2014-2019 despite active searches. Spotted Sandpiper, another species of special concern during the breeding season, was previously observed foraging at an interior pond on August 17, 2014 and as an incidental encounter during spring 2018, between the parking area and point 07. In 2019, we again observed a Spotted Sandpiper along the river's edge during spring migration. In none of these instances were we able to confirm breeding status. McCort et al. (2010) confirmed a nest along an access road in the oil tank field. We have also found no direct evidence for nesting by Cooper's Hawks in 2014-2019, despite presumed nesting on the site in 2010 (McCort et al.

2010). In 2018/2019, we recorded Cooper's Hawk during 2019 spring migration. Previously, this species was recorded during winter 2014/2015 and fall 2015 surveys, and by an eBird observer during 2017 fall migration. In 2019, we observed a singing male Black-throated Blue Warbler during the breeding season, on 20 June. Breeding status was not determined, and it's likely this was an unpair male.

### **Fall Migration**

During four 2018 fall migration visits, we recorded a total of 613 individual birds of 52 different species on transect surveys (Tables 4 and 5) and observed seven additional species at the site outside of the surveys (Table 6). Notable observations include a variety of migrant warblers and other songbirds, waterfowl and state-listed raptors, including American Kestrel, Red-shouldered Hawk and Osprey. In addition, we observed Merlin at the site for the first time during our survey period.

Nine species were observed at the greatest frequency during fall migration, occurring at all six of the surveyed transects: American Goldfinch, American Robin, Carolina Wren, Downy Woodpecker, Golden-crowned Kinglet, Northern Cardinal, Northern Flicker, Red-bellied Woodpecker, and White-throated Sparrow (Table 4). Three other species were recorded at 5 of the 6 transects: Gray Catbird, Warbling Vireo, and Yellow-rumped Warbler; three species were recorded at 4 of the 6 transects: Eastern Towhee, House Wren, and Ruby-crowned Kinglet; and the remaining species were recorded at 3 (50%) or fewer transects. The most abundant species recorded was White-throated Sparrow (206 individuals recorded). Other abundant species included Yellow-rumped Warbler (47), Golden-crowned Kinglet (35), American Robin (32), Carolina Wren (27), Canada Goose (26) and Northern Cardinal (26). The number of species observed per transect ranged from 16 at PETT\_T01 to 27 at PETT\_T05 (Table 4, Figure 4).

### **Winter**

During the four winter 2018-2019 visits, we recorded 462 individual birds of 37 different species on transect surveys (Tables 7 and 8). We observed 9 additional species during site visits between transect surveys (Table 9). Notable sightings included the Red-shouldered Hawk observed at transect 04 on 6 February, Bald Eagle observed on 13 March and 29 March, three Yellow-bellied Sapsuckers seen on 29 March, and several species of waterfowl both in the Delaware River and the interior ponds: American Wigeon, Bufflehead, Canada Goose, Common Merganser, Gadwall, Green-winged Teal, Mallard, and Wood Duck (Tables 7-9).

American Robin, Canada Goose, Carolina Wren, and Downy Woodpecker were observed at the greatest transect frequency, occurring at all six transects (100% frequency). Three additional species were observed at 5 of the 6 survey transects (Carolina Chickadee, Northern Cardinal, and Red-bellied Woodpecker; Table 7); and three species observed at 4 of the 5 survey transects (American Goldfinch, Eastern Phoebe, and Song Sparrow; Table 7). Canada Goose accounted for the greatest number of individuals observed (66) and was followed by Ring-billed Gull (59), White-throated Sparrow (58), and American Robin (39; Table 8). The number of species observed per transect (across the four surveys) ranged from 11, recorded at PETT\_T01, to 19 species, recorded at PETT\_T06 (Table 7 and Figure 5).

## **Spring Migration**

During three site visits in spring 2019, we recorded 367 individual birds of 50 different species on point count surveys (Tables 10 and 11). An additional 19 species were observed at the site, but not recorded during point count surveys (Table 12), for a total of 69 species. Notable sightings included 11 species of wood warblers (including Blue-winged Warbler, new to our species list), several other neotropical migrants, Brown Thrasher, a new species for the survey, Great Horned Owl, American Kestrel and Spotted Sandpiper (see ‘State-listed Species’ above).

American Robin, Baltimore Oriole, Blue-gray Gnatcatcher, Carolina Wren, House Wren, and Yellow Warbler were observed at the greatest point frequency, occurring at all seven of the points surveyed (100% frequency); followed by Gray Catbird and Northern Parula, recorded at 6 of 7 survey points; American Goldfinch, Brown-headed Cowbird, Canada Goose, Downy Woodpecker, Northern Cardinal, Red-bellied Woodpecker, Red-winged Blackbird, and Warbling Vireo, recorded at 5 of 6 points; and Tree Swallow and White-throated Sparrow each recorded at 4 points (Table 10). The most abundant species recorded were Canada Goose (53 observations), American Robin (24), Yellow Warbler (22), Carolina Wren (17), and Gray Catbird (17). The number of species observed per point ranged from 20 at PETT\_01 and PETT\_06 to 25 at PETT\_02 and PETT\_05 (Table 10 and Figure 6).

## **Breeding Season**

A total of 293 individual birds of 33 species were counted on the three point count survey visits in the summer breeding season in 2019 (Tables 13 and 14). Fourteen additional species were observed at the site, but not recorded on point count surveys (Table 15). Notable sightings included state-listed American Kestrel, Black-throated Blue Warbler, and Great Blue Heron (as discussed above), and Yellow-billed Cuckoo at six of the seven points (Table 15). Yellow-billed Cuckoo was also heard during the breeding 2014, 2017, and 2018 surveys and could potentially breed at the site.

In the 2019 breeding season, American Robin, Carolina Wren, Gray Catbird, House Wren, and Yellow Warbler were found at the greatest frequency, each occurring at all 7 of the survey points (100%). American Goldfinch, Cedar Waxwing, Downy Woodpecker, Northern Cardinal, Warbling Vireo, and Yellow-billed Cuckoo were recorded on 6 of the 7 survey points; Baltimore Oriole, Blue-gray Gnatcatcher, Canada Goose, and Red-bellied Woodpecker at 5 of 7 points; and Carolina Chickadee at 4 of 7 points (Table 13). The most abundant species recorded were American Robin (40 total observations), Yellow Warbler (31), Gray Catbird (29), House Wren (19), and Cedar Waxwing (18). The number of species observed per point ranged from 12 at PETT\_05 to 24 at PETT\_02 (Table 13 and Figure 7). We did not attempt to confirm breeding status of any species, though we did find direct evidence of breeding by the following species during the survey visits (2014-2018): American Robin, Canada Goose, Gray Catbird, House Finch, Northern Cardinal, and Yellow Warbler. In 2018, we also recorded Yellow-billed Cuckoo possibly carrying nesting material.

## **Other wildlife observations**

Throughout the 2014-2019 survey visits, NJA staff kept records of other wildlife species observed on site; however, systematic surveys were not conducted, and this is not a full representation of wildlife using the site. In the current year, we found evidence for four of the six species of mammal that we had previously documented at the site (Allen and Tsipoura 2015, 2016, 2017, Mylecraine and Allen 2019): Eastern Gray Squirrel (*Sciurus carolinensis*; sightings), Red Fox (*Vulpes Vulpes*), Groundhog (*Marmota monax*), and White-tailed Deer (*Odocoileus virginianus*; many sightings). Raccoon (*Procyon lotor*) and American Beaver (*Castor canadensis*; evidence: chewed trees), have also been documented in previous years. Reptile and amphibian observations in 2018/2019 include: American Toad (*Anaxyrus americanus*), Bullfrog (*Lithobates catesbeiana*), Fowler's Toad (*Anaxyrus fowleri*), Green Frog (*Lithobates clamitans*), Northern Gray Tree Frog (*Hyla versicolor*), Spring Peeper (*Pseudacris crucifer*). Previous observations also include Common Snapping Turtle (*Chelydra serpentina*), Painted Turtle (*Chrysemys picta*), and Redbelly Turtle (*Pseudemys rubriventris*). McCort et al. (2010) surveyed intensively for reptile and amphibian species and present a more inclusive list, although they did not observe Northern Gray Tree Frog or Spring Peeper. The newly-discovered Atlantic Coast Leopard Frog (*Rana kauffeldi*) should be searched for in future visits as Petty's Island is within its currently known range (Feinberg et al. 2014).

Two native plants of note that have been encountered in the interior wetlands of the survey site include Rosy Meadowsweet (*Spiraea tomentosa*) and an unidentified species of Lady's Tresses Orchid (*Spiranthes* sp.; Allen and Tsipoura 2015). The orchid was only seen by us in September 2014. Seven flowering individuals of *Spiranthes vernalis* were found growing in a ditch on the northern part of the island by McCort et al. (2010), and this could be the same species.



## CONCLUSIONS

Petty's Island contains multiple habitat types, from extensive forested wetlands to dry grasslands, within its approximately 300-acre boundaries plus an additional 140+ acres of ecologically important tidal mudflats and marshes surrounding it. Its potential importance for connecting the urban population centers of Camden and Philadelphia to nature is also highly significant. This report summarizes the third year of standardized bird surveys at the site. As NJNLT and partners move forward with habitat restoration at the site, these data, along with the fifth year of surveys already begun, will serve as a valuable baseline. Continued post-management surveys, performed in a consistent and similarly rigorous manner, will be useful to detect any changes in bird use. Ultimately, the use of analyses that correct for observer biases (e.g., occupancy modeling, distance analysis) will enhance our ability to identify any changes through time.

Our primary survey area, the 76-acre forested southwestern end, contains significant areas of wetlands and is home to a diverse bird community typical of riparian forest and wetlands. During the breeding season, songbirds such as Yellow Warbler and Warbling Vireo are common, while in migration the island is host to an array of warblers and other neotropical migrants, wetland-dependent migrants such as Rusty Blackbird and Northern Waterthrush, and other forest generalists. The state-listed American Kestrel (threatened) was observed throughout the 2019 breeding season, and may possibly be breeding in open areas on this island. Red-shouldered Hawk (endangered) was observed during fall 2018 and winter 2018/2019 surveys. In previous years, multiple observations during the nesting season suggest possible breeding on site or nearby. The Great Blue Heron (a species of special concern) formerly bred at the site and has been observed multiple times during the late spring and summer months. Numerous waterfowl, including Pied-billed Grebe, American Wigeon, Blue-winged Teal, Green-winged Teal, Hooded Merganser, American Black Duck, Wood Duck, and Gadwall, frequent the central ponds during migration, while other, deeper-water species such as Bufflehead, Common Loon, Scaup, and Common Merganser occur along the shorelines. Spotted Sandpipers (a state species of special concern) forage in the mud of the ponds and have bred at the site (McCort et al. 2010). The state of these forested wetlands is remarkable given the location within a large urbanized landscape, and even more so considering that historical aerial photos show the area was heavily disturbed and partially non-existent (a yet-to-be filled area of the river) as recently as the 1930s (Figure 1).

The recovery of the forested area since the 1930s speaks to the great potential for forest and grassland restoration efforts on the remaining two-thirds of the island. While these areas were not surveyed in the first three years of the study due to safety concerns, we observed numerous species of wildlife using the area while travelling across the island. A pair of American Kestrels was observed throughout the 2019 season, suggesting possible breeding in the more open areas on the northern end of the island. Red-tailed Hawks and Red Foxes have also frequently been observed hunting grassy areas. Wild Turkey, Eastern Kingbird, and large mixed flocks of blackbirds were also seen in this habitat, and McCort et al. (2010) even found obligate-grassland species during migration, including Grasshopper Sparrow and Bobolink (Table 17). Overall, we believe there is great potential for ongoing grassland and restoration efforts planned in these areas (NJNLT 2015).

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**TABLE 1.** Survey point (a) and transect (b) coordinates, and number of surveys conducted between August 2018 and July 2019 at the south end of Petty’s Island, Pennsauken, NJ. See also Figure 2.

a. Point Count Locations (Spring Migration and Breeding Surveys)

Point ID	Latitude	Longitude	# of Surveys	
			Spring	Breeding
PETT_01	39.96141	-75.10546	3	3
PETT_02	39.96191	-75.10934	3	3
PETT_03	39.96338	-75.11151	3	3
PETT_04	39.96525	-75.11117	3	3
PETT_05	39.96432	-75.11401	3	3
PETT_06	39.96267	-75.11664	3	3
PETT_07	39.96214	-75.11367	3	3

b. Transect Locations (Winter and Fall Migration Surveys)

Transect ID	'A' End		'B' End		# of Surveys	
	Latitude	Longitude	Latitude	Longitude	Winter	Fall
PETT_T01	39.96178	-75.10471	39.96103	-75.10621	4	4
PETT_T02	39.96122	-75.10933	39.96260	-75.10934	4	4
PETT_T03	39.96453	-75.11083	39.96324	-75.11149	4	4
PETT_T04	39.96458	-75.11272	39.96383	-75.11424	4	4
PETT_T05	39.96268	-75.11621	39.96235	-75.11447	4	4
PETT_T06	39.96222	-75.11273	39.96185	-75.11100	4	4

**TABLE 2.** Summary of surveys conducted at Petty’s Island, Pennsauken, NJ, August 2018 through July 2019, including a) a tabulation of winter, spring and fall migration and breeding bird surveys, and b) a list of survey dates.

a.

	<b>Fall 2018</b>	<b>Winter 2018 - 2019</b>	<b>Spring 2019</b>	<b>Breeding 2019</b>	<b>Total 2018-19</b>
Points/transects surveyed	0/6	0/6	7/0	7/0	7/6
# of survey visits	4	4	3	3	14
Species recorded on point/transect counts	52	37	50	33	86
Total species observed	59	46	69	47	105
T&E species	3	2	1	1	4
Special Concern species	4	0	8	2	11
Total individuals counted	613	462	367	293	1,735

b.

	<b>Fall 2018</b>	<b>Winter 2018- 2019</b>	<b>Spring 2019</b>	<b>Breeding 2019</b>
	9/1/2018	1/4/2019	4/17/2019	5/29/2019
Survey Dates	9/16/2018	2/6/2019	5/3/2019	6/20/2019
	10/25/2018	3/13/2019	5/16/2019	7/12/2019
	11/1/2018	3/29/2019		

**TABLE 3.** Full list of bird species observed at Petty’s Island, Pennsauken, NJ between August 2018 and July 2019, during winter, spring and fall migration, and breeding season surveys. “Obs” refers to species only observed during travel between survey points/transects. State-listed species are in red (Endangered), blue (Threatened), or green (Special Concern).

	Fall 2018		Winter 2018-2019		Spring 2019		Breeding 2019	
	Survey	Obs	Survey	Obs	Survey	Obs	Survey	Obs
American Black Duck		x						
American Crow	x		x					x
American Goldfinch	x		x		x		x	
American Kestrel		x				x		x
American Redstart	x				x			x
American Robin	x		x		x		x	
American Wigeon			x					
American Woodcock			x					
Bald Eagle <sup>Br, T(NB)</sup>				x				
Baltimore Oriole	x				x		x	
Belted Kingfisher	x			x		x		
Black Vulture								x
Black-and-White Warbler	x				x			
Blackpoll Warbler					x			
Black-throated Blue Warbler <sup>Br</sup>	x				x		x	
Black-throated Green Warbler <sup>Br</sup>					x			
Blue Jay	x			x	x		x	
Blue-gray Gnatcatcher					x		x	
Blue-winged Warbler						x		
Brown Creeper	x		x					
Brown Thrasher <sup>Br</sup>						x		
Brown-headed Cowbird			x		x		x	
Bufflehead				x				
Canada Goose	x		x		x		x	
Canada Warbler <sup>Br</sup>						x		
Carolina Chickadee	x		x		x		x	
Carolina Wren	x		x		x		x	
Cedar Waxwing					x		x	
Chimney Swift							x	
Common Grackle							x	
Common Merganser				x		x		
Common Yellowthroat	x				x		x	
Cooper's Hawk <sup>Br</sup>					x			
Double-crested Cormorant	x					x		x
Dark-eyed Junco	x		x					
Downy Woodpecker	x		x		x		x	
Eastern Kingbird								x
Eastern Phoebe	x		x			x		
Eastern Towhee	x				x			
Eastern Wood-Pewee					x		x	
European Starling	x		x					
Fish Crow				x	x			
Gadwall	x		x					
Golden-crowned Kinglet	x		x					
Gray Catbird	x				x		x	
Gray-cheeked Thrush	x				x			
Great Black-backed Gull				x				
Great Blue Heron <sup>Br</sup>	x							x
Great Crested Flycatcher	x				x		x	
Great Egret	x							x
Green Heron		x			x		x	

TABLE 3. (cont'd)

	Fall 2018		Winter 2018-2019		Spring 2019		Breeding 2019	
	Survey	Obs	Survey	Obs	Survey	Obs	Survey	Obs
Great Horned Owl						x		
Greater Yellowlegs						x		
Green-winged Teal	x			x				
Hairy Woodpecker	x		x		x			x
Hermit Thrush	x		x			x		
Herring Gull			x					x
House Finch			x		x			
House Wren	x				x		x	
Indigo Bunting							x	
Killdeer								x
Laughing Gull	x				x			
Mallard	x		x		x		x	
Merlin	x							
Mourning Dove	x							
Northern Cardinal	x		x		x		x	
Northern Flicker	x		x		x			x
Northern Mockingbird			x					
Northern Parula <sup>Br</sup>					x			
Northern Rough-winged Swallow						x		
Northern Shoveler			x					
Northern Waterthrush					x			
Orchard Oriole						x	x	
Osprey <sup>Br</sup>		x						
Ovenbird	x				x			
Red-bellied Woodpecker	x		x		x		x	
Red-breasted Nuthatch	x					x		
Red-eyed Vireo					x		x	
Red-shouldered Hawk <sup>Br, SC(NB)</sup>	x		x					
Red-tailed Hawk		x			x		x	
Red-winged Blackbird	x		x		x		x	
Ring-billed Gull		x	x			x		
Rose-breasted Grosbeak						x		
Ruby-crowned Kinglet	x				x			
Ruby-throated Hummingbird					x			
Rusty Blackbird					x			
Scarlet Tanager						x		
Song Sparrow	x		x					
Spotted Sandpiper <sup>Br</sup>						x		
Swamp Sparrow			x					
Tree Swallow			x		x			x
Tufted Titmouse	x				x		x	
Veery <sup>Br</sup>	x							
Warbling Vireo	x				x		x	
White-breasted Nuthatch	x		x					
White-throated Sparrow	x		x		x			
Wild Turkey	x		x			x		x
Willow Flycatcher							x	
Winter Wren <sup>Br</sup>	x							
Wood Duck		x		x	x			
Wood Thrush <sup>Br</sup>					x			
Yellow Warbler					x		x	
Yellow-bellied Sapsucker			x					
Yellow-billed Cuckoo							x	
Yellow-rumped Warbler	x		x		x			

<sup>Br</sup> = Breeding status only; <sup>SC(NB)</sup> = Special Concern status in non-breeding season; <sup>T(NB)</sup> = Threatened status in non-breeding season

**TABLE 4.** Total species list and number of individuals observed during 2018 fall migration transect surveys at Petty’s Island, Pennsauken, NJ, by transect. Frequency (freq.) is the proportion of transects at which a species was observed. Relative abundance is the number of individuals of that species divided by the total number of individuals of all species. State-listed species are in red (E), blue (T), or green (SC).

	# of Transects	Freq	Transect ID						Total	Relative Abundance
			01	02	03	04	05	06		
American Crow	2	0.33		4			6	10	0.016	
American Goldfinch	6	1.00	1	3	4	1	3	2	14	0.023
American Redstart	2	0.33		1		1			2	0.003
American Robin	6	1.00	2	6	4	3	10	7	32	0.052
Baltimore Oriole	1	0.17	1						1	0.002
Belted Kingfisher	2	0.33			1			1	2	0.003
Black-and-White Warbler	3	0.50		1		2	1		4	0.007
Black-throated Blue Warbler <sup>Br</sup>	2	0.33				1	1		2	0.003
Blue Jay	1	0.17				1			1	0.002
Brown Creeper	1	0.17		2					2	0.003
Canada Goose	3	0.50	2	2	22				26	0.042
Carolina Chickadee	3	0.50	3			1	3		7	0.011
Carolina Wren	6	1.00	4	4	3	4	6	6	27	0.044
Common Yellowthroat	1	0.17					2		2	0.003
Dark-eyed Junco	1	0.17					1		1	0.002
Double-crested Cormorant	1	0.17		1					1	0.002
Downy Woodpecker	6	1.00	2	2	1	1	3	3	12	0.020
Eastern Phoebe	1	0.17						1	1	0.002
Eastern Towhee	4	0.67		1		1	2	1	5	0.008
European Starling	1	0.17						6	6	0.010
Gadwall	1	0.17			2				2	0.003
Golden-crowned Kinglet	6	1.00	20	3	2	3	2	5	35	0.057
Gray Catbird	5	0.83		1	2	3	2	1	9	0.015
Gray-cheeked Thrush	1	0.17		1					1	0.002
Great Blue Heron <sup>Br</sup>	1	0.17			2				2	0.003
Great Crested Flycatcher	2	0.33			1			1	2	0.003
Great Egret	1	0.17			1				1	0.002
Green-winged Teal	1	0.17			15				15	0.024
Hairy Woodpecker	2	0.33				1		2	3	0.005
Hermit Thrush	3	0.50	1			1		3	5	0.008
House Wren	4	0.67		1	2	2	2		7	0.011
Laughing Gull	1	0.17	4						4	0.007
Mallard	1	0.17			9				9	0.015
Merlin	1	0.17		2					2	0.003
Mourning Dove	1	0.17		4					4	0.007
Northern Cardinal	6	1.00	4	7	3	5	3	4	26	0.042
Northern Flicker	6	1.00	1	1	2	1	1	3	9	0.015
Ovenbird	1	0.17				1			1	0.002
Red-bellied Woodpecker	6	1.00	2	3	1	3	2	4	15	0.024
Red-breasted Nuthatch	2	0.33					1	2	3	0.005
Red-shouldered Hawk <sup>Br, SC(NB)</sup>	1	0.17			2				2	0.003
Red-winged Blackbird	1	0.17				8			8	0.013
Ruby-crowned Kinglet	4	0.67	3	1		2	3		9	0.015
Song Sparrow	3	0.50			1	2	1		4	0.007
Tufted Titmouse	2	0.33				1	1		2	0.003
Veery <sup>Br</sup>	1	0.17						1	1	0.002
Warbling Vireo	5	0.83	1	4		1	2	2	10	0.016
White-breasted Nuthatch	2	0.33		2			2		4	0.007



TABLE 4. (cont'd)

	# of	Freq	Transect ID						Total	Relative Abundance
	Transects		01	02	03	04	05	06		
White-throated Sparrow	6	1.00	23	69	17	16	39	42	206	0.336
Wild Turkey	2	0.33		1			2		3	0.005
Winter Wren <sup>Br</sup>	3	0.50		1			1	1	3	0.005
Yellow-rumped Warbler	5	0.83		1	21	14	5	6	47	0.077
Unknown Warbler	1	0.17		1					1	0.002
<b>Total Individuals</b>			<b>74</b>	<b>130</b>	<b>118</b>	<b>80</b>	<b>107</b>	<b>104</b>	<b>613</b>	
<b>Total Species</b>			<b>16</b>	<b>27</b>	<b>22</b>	<b>26</b>	<b>27</b>	<b>22</b>	<b>52</b>	

<sup>Br</sup> = breeding season status only

<sup>SC(NB)</sup> = Special Concern status in non-breeding season

**TABLE 5.** Total species list and number of individuals observed during 2018 Fall Migration transect surveys at Petty’s Island, Pennsauken, NJ, by survey. Maximum represents the maximum number of individuals observed on any one survey (across all points). State-listed species are in red (E), blue (T), or green (SC).

	Survey Date				Total	Max per Survey
	9/1/2018	9/16/2018	10/25/2018	11/1/2018		
American Crow			10		10	10
American Goldfinch	4	3	3	4	14	4
American Redstart	1	1			2	1
American Robin	3	5	18	6	32	18
Baltimore Oriole	1				1	1
Belted Kingfisher				2	2	2
Black-and-White Warbler	2	2			4	2
Black-throated Blue Warbler <sup>Br</sup>	1	1			2	1
Blue Jay				1	1	1
Brown Creeper			2		2	2
Canada Goose			26		26	26
Carolina Chickadee			3	4	7	4
Carolina Wren	4	8	7	8	27	8
Common Yellowthroat		2			2	2
Dark-eyed Junco			1		1	1
Double-crested Cormorant			1		1	1
Downy Woodpecker	4	2	2	4	12	4
Eastern Phoebe			1		1	1
Eastern Towhee			4	1	5	4
European Starling		3		3	6	3
Gadwall				2	2	2
Golden-crowned Kinglet			7	28	35	28
Gray Catbird	2	6		1	9	6
Gray-cheeked Thrush		1			1	1
Great Blue Heron <sup>Br</sup>		1		1	2	1
Great Crested Flycatcher	1	1			2	1
Great Egret	1				1	1
Green-winged Teal				15	15	15
Hairy Woodpecker	1		1	1	3	1
Hermit Thrush			4	1	5	4
House Wren	3	3		1	7	3
Laughing Gull		4			4	4
Mallard			7	2	9	7
Merlin	2				2	2
Mourning Dove	2	2			4	2
Northern Cardinal	9	11	5	1	26	11
Northern Flicker	1		6	2	9	6
Ovenbird	1				1	1
Red-bellied Woodpecker	3	4	3	5	15	5
Red-breasted Nuthatch	1	1		1	3	1
Red-shouldered Hawk <sup>Br, SC(NB)</sup>	2				2	2
Red-winged Blackbird				8	8	8
Ruby-crowned Kinglet			2	7	9	7
Song Sparrow			1	3	4	3
Tufted Titmouse	1	1			2	1
Veery <sup>Br</sup>		1			1	1
Warbling Vireo		10			10	10
White-breasted Nuthatch		1	2	1	4	2

TABLE 5. (cont'd)

	Survey Date				Total	Max per Survey
	9/1/2018	9/16/2018	10/25/2018	11/1/2018		
White-throated Sparrow			80	126	206	126
Wild Turkey	2		1		3	2
Winter Wren <sup>Br</sup>				3	3	3
Yellow-rumped Warbler			29	18	47	29
Unidentified Warbler		1			1	1
<b>Total Individuals</b>	<b>52</b>	<b>75</b>	<b>226</b>	<b>260</b>	<b>613</b>	
<b>Total Species</b>	<b>23</b>	<b>23</b>	<b>25</b>	<b>29</b>	<b>52</b>	

<sup>Br</sup> = Breeding season status only

<sup>SC(NB)</sup> = Special Concern status in non-breeding season

**TABLE 6.** Additional species observed at Petty’s Island, Pennsauken, NJ during 2018 Fall Migration surveys, but not recorded on transect surveys. State-listed species are in red (E), blue (T), or green (SC).

<b>Species</b>	<b>Notes</b>
American Black Duck	In river on 9/16/2018
American Kestrel	Two individuals seen on wires near bridge on 9/1/2018; three individuals at same location on 11/1/2018
Osprey <sup>Br</sup>	Seen along river on 9/1/2018
Green Heron	In pond between T02 and T03 on 9/1/2018 and 9/16/2018
Red-tailed Hawk	Along trail on 10/25/2018
Ring-billed Gull	Numerous in river on 9/16/2018, 10/25/2018, and 11/1/2018
Wood Duck	In river on 9/1/2018

<sup>Br</sup> = breeding season status only

**TABLE 7.** Total species list and number of individuals observed during Winter 2018-2019 transect surveys at Petty’s Island, Pennsauken, NJ, by transect. Frequency (freq.) was calculated as the number of points at which a species was observed divided by the total number of points surveyed. Relative abundance was calculated as the number of individuals of that species divided by the total number of individuals of all species. State-listed species are in red (E), blue (T), or green (SC).

	# of Transects	Freq	Transect ID						Total	Relative Abundance	
			01	02	03	04	05	06			
American Crow	2	0.33		6				1	7	0.015	
American Goldfinch	4	0.67	4	4	1	2			11	0.024	
American Robin	6	1.00	5	4	1	11	13	5	39	0.084	
American Wigeon	1	0.17			5				5	0.011	
American Woodcock	2	0.33						1	1	2	0.004
Brown Creeper	2	0.33						1	1	2	0.004
Brown-headed Cowbird	3	0.50	1			1	3		5	0.011	
Canada Goose	6	1.00	2	3	48	6	2	5	66	0.143	
Carolina Chickadee	5	0.83		1	2	3	1	3	10	0.022	
Carolina Wren	6	1.00	1	5	4	3	8	4	25	0.054	
Dark-eyed Junco	3	0.50	20			2		2	24	0.052	
Downy Woodpecker	6	1.00	1	2	1	3	2	1	10	0.022	
Eastern Phoebe	4	0.67	1		1	3		1	6	0.013	
European Starling	1	0.17						1	1	0.002	
Gadwall	1	0.17			3				3	0.006	
Golden-crowned Kinglet	1	0.17		1					1	0.002	
Hairy Woodpecker	2	0.33				1		1	2	0.004	
Hermit Thrush	1	0.17	1						1	0.002	
Herring Gull	1	0.17						2	2	0.004	
House Finch	2	0.33				1	5		6	0.013	
Mallard	2	0.33			4	2			6	0.013	
Northern Cardinal	5	0.83	2	4	1	3	4		14	0.030	
Northern Flicker	2	0.33			1			1	2	0.004	
Northern Mockingbird	1	0.17		1					1	0.002	
Northern Shoveler	1	0.17			2				2	0.004	
Red-bellied Woodpecker	5	0.83		3	1	4	2	3	13	0.028	
Red-shouldered Hawk <sup>Br, SC(NB)</sup>	1	0.17				1			1	0.002	
Red-winged Blackbird	3	0.50		4	1			5	10	0.022	
Ring-billed Gull	2	0.33		4				55	59	0.128	
Song Sparrow	4	0.67		1	2	7	4		14	0.030	
Swamp Sparrow	2	0.33				1	1		2	0.004	
Tree Swallow	2	0.33			1	2			3	0.006	
White-breasted Nuthatch	1	0.17			1				1	0.002	
White-throated Sparrow	3	0.50		40			12	6	58	0.126	
Wild Turkey	2	0.33	11				15		26	0.056	
Yellow-bellied Sapsucker	1	0.17						3	3	0.006	
Yellow-rumped Warbler	3	0.50		6			1	5	12	0.026	
Unidentified Gull	1	0.17		3					3	0.006	
Unknown duck	1	0.17			4				4	0.009	
<b>Total Individuals</b>			<b>49</b>	<b>92</b>	<b>84</b>	<b>56</b>	<b>76</b>	<b>105</b>	<b>462</b>		
<b>Total Species</b>			<b>11</b>	<b>16</b>	<b>18</b>	<b>18</b>	<b>17</b>	<b>19</b>	<b>37</b>		

<sup>Br</sup> = Breeding season status only

<sup>SC(NB)</sup> = Special Concern status in non-breeding season

**TABLE 8.** Total species list and number of individuals observed during winter 2018-2019 transect surveys at Petty’s Island, Pennsauken, NJ, by survey. Maximum represents the maximum number of individuals observed on any one survey (across all points). State-listed species are in red (E), blue (T), or green (SC).

	Survey Date				Total	Max per Survey
	1/4/2019	2/6/2019	3/13/2019	3/29/2019		
American Crow		6	1		7	6
American Goldfinch	2		6	3	11	6
American Robin		2	5	32	39	32
American Wigeon				5	5	5
American Woodcock			1	1	2	1
Brown Creeper				2	2	2
Brown-headed Cowbird			2	3	5	3
Canada Goose	2	6	13	45	66	45
Carolina Chickadee	1	3	3	3	10	3
Carolina Wren	4	5	6	10	25	10
Dark-eyed Junco				24	24	24
Downy Woodpecker	1	1	5	3	10	5
Eastern Phoebe		1	1	4	6	4
European Starling				1	1	1
Gadwall			1	2	3	2
Golden-crowned Kinglet				1	1	1
Hairy Woodpecker	1	1			2	1
Hermit Thrush				1	1	1
Herring Gull		2			2	2
House Finch			4	2	6	4
Mallard			2	4	6	4
Northern Cardinal	3	1	5	5	14	5
Northern Flicker	1	1			2	1
Northern Mockingbird		1			1	1
Northern Shoveler				2	2	2
Red-bellied Woodpecker	3	2	5	3	13	5
Red-shouldered Hawk <sup>Br, SC (NB)</sup>		1			1	1
Red-winged Blackbird			3	7	10	7
Ring-billed Gull		15	44		59	44
Song Sparrow	2	7	3	2	14	7
Swamp Sparrow			1	1	2	1
Tree Swallow				3	3	3
White-breasted Nuthatch				1	1	1
White-throated Sparrow	9	20	17	12	58	20
Wild Turkey	25		1		26	25
Yellow-bellied Sapsucker				3	3	3
Yellow-rumped Warbler			8	4	12	8
Unidentified Gull			3		3	3
Unidentified Duck	4				4	4
<b>Total Individuals</b>	<b>58</b>	<b>75</b>	<b>140</b>	<b>189</b>	<b>462</b>	
<b>Total Species</b>	<b>12</b>	<b>17</b>	<b>22</b>	<b>29</b>	<b>37</b>	

<sup>Br</sup> = Breeding season status only

<sup>SC(NB)</sup> = Special Concern status in non-breeding season

**TABLE 9.** Additional species (a) observed at Petty’s Island, Pennsauken, NJ during winter 2018 - 2019, but not encountered on transect surveys. State-listed species are in red (E), blue (T), or green (SC).

<b>Species</b>	<b>Notes</b>
Bald Eagle <sup>Br, T(NB)</sup>	Adult seen flying along river on 3/13/2019 and perched on north end of island on 3/29/19
Belted Kingfisher	Heard along river on 3/13/2019
Blue Jay	Observed near T05 on 2/6/2019
Bufflehead	Small groups seen in river on 2/6/2019, 3/13/2019 and 3/29/2019
Common Merganser	Two individuals seen in river on 2/6/2019
Fish Crow	Heard on 3/29/2019
Great Black-backed Gull	Seen in river on 2/6/2019
Green-winged Teal	Seen in pond between T02 and T03 on 3/13/2019
Wood Duck	Seen in pond between T02 and T03 on 3/13/2019

TABLE 10. Total species list and number of individuals observed during 2019 Spring Migration surveys at Petty’s Island, Pennsauken, NJ, by transect. Frequency (freq.) was calculated as the number of transects at which a species was observed divided by the total number of transects surveyed. Relative abundance was calculated as the number of individuals of that species divided by the total number of individuals of all species. State-listed species are in red (E), blue (T), or green (SC).

	# of Points	Freq	Point ID							Total	Relative Abundance
			01	02	03	04	05	06	07		
American Goldfinch	5	0.71	6		3	2	1	3		15	0.041
American Redstart	3	0.43	1	2	1					4	0.011
American Robin	7	1.00	2	2	6	1	3	4	6	24	0.065
Baltimore Oriole	7	1.00	2	2	1	2	1	2	2	12	0.033
Black-and-White Warbler	3	0.43				1	1		1	3	0.008
Blackpoll Warbler	1	0.14				1				1	0.003
Black-throated Blue Warbler <sup>Br</sup>	3	0.43					1	1	1	3	0.008
Black-throated Green Warbler <sup>Br</sup>	1	0.14		1						1	0.003
Blue Jay	1	0.14		1						1	0.003
Blue-gray Gnatcatcher	7	1.00	2	3	2	2	2	3	2	16	0.044
Brown-headed Cowbird	5	0.71	1	5		3	1	1		11	0.030
Canada Goose	5	0.71		4	25	20	1		3	53	0.144
Carolina Chickadee	3	0.43	1		1	1				3	0.008
Carolina Wren	7	1.00	3	3	1	2	2	3	3	17	0.046
Cedar Waxwing	2	0.29				4	2			6	0.016
Common Yellowthroat	3	0.43				1	1	1		3	0.008
Cooper's Hawk <sup>Br</sup>	1	0.14	1							1	0.003
Downy Woodpecker	5	0.71	1	1	1			1	2	6	0.016
Eastern Towhee	1	0.14							1	1	0.003
Eastern Wood-Pewee	2	0.29		1					1	2	0.005
Fish Crow	1	0.14			2					2	0.005
Gray Catbird	6	0.86	4	2	5	1	1	4		17	0.046
Gray-cheeked Thrush	1	0.14					1			1	0.003
Great Crested Flycatcher	2	0.29		2					2	4	0.011
Green Heron	1	0.14			1					1	0.003
Hairy Woodpecker	1	0.14							1	1	0.003
House Finch	3	0.43					2	2	2	6	0.016
House Wren	7	1.00	2	3	1	1	2	2	5	16	0.044
Laughing Gull	1	0.14		8						8	0.022
Mallard	2	0.29			2				1	3	0.008
Northern Cardinal	5	0.71		2	1	1	1	2		7	0.019
Northern Flicker	2	0.29		1	2					3	0.008
Northern Parula <sup>Br</sup>	6	0.86	2		2	1	1	1	3	10	0.027
Northern Waterthrush	2	0.29		1				2		3	0.008
Ovenbird	3	0.43	1	1					1	3	0.008
Red-bellied Woodpecker	5	0.71	1	1	1			2	3	8	0.022
Red-eyed Vireo	3	0.43	1			1	1			3	0.008
Red-tailed Hawk	1	0.14					1			1	0.003
Red-winged Blackbird	5	0.71	2	4	6	1	1			14	0.038
Ruby-crowned Kinglet	1	0.14							1	1	0.003
Ruby-throated Hummingbird	1	0.14						1		1	0.003
Rusty Blackbird	1	0.14					1			1	0.003
Tree Swallow	4	0.57		4	2	1	3			10	0.027
Tufted Titmouse	2	0.29	1						1	2	0.005
Warbling Vireo	5	0.71	2	1		2		2	2	9	0.025
White-throated Sparrow	4	0.57		11			1	2	1	15	0.041
Wood Duck	1	0.14			8					8	0.022



TABLE 10. (continued)

	# of Points	Freq	Point ID							Total	Relative Abundance	
			01	02	03	04	05	06	07			
Wood Thrush <sup>Br</sup>	1	0.14								1	1	0.003
Yellow Warbler	7	1.00	6	3	3	1	2	4	3	22		0.060
Yellow-rumped Warbler	1	0.14							2	2		0.005
Unidentified Warbler	1	0.14							1	1		0.003
<b>Total Individuals</b>			<b>42</b>	<b>69</b>	<b>77</b>	<b>50</b>	<b>36</b>	<b>42</b>	<b>51</b>	<b>367</b>		
<b>Total Species</b>			<b>20</b>	<b>25</b>	<b>22</b>	<b>21</b>	<b>25</b>	<b>20</b>	<b>24</b>	<b>50</b>		

<sup>Br</sup> = breeding season status only

**TABLE 11.** Total species list and number of individuals observed during 2019 Spring Migration point count surveys at Petty’s Island, Pennsauken, NJ, by survey. Maximum represents the maximum number of individuals observed on any one survey (across all transects). State-listed species are in red (E), blue (T), or green (SC).

	Survey Date			Total	Max per Survey
	4/17/2019	5/3/2019	5/16/2019		
American Goldfinch	8	2	5	15	8
American Redstart			4	4	4
American Robin	9	6	9	24	9
Baltimore Oriole		7	5	12	7
Black-and-White Warbler		2	1	3	2
Blackpoll Warbler			1	1	1
Black-throated Blue Warbler <sup>Br</sup>		2	1	3	2
Black-throated Green Warbler <sup>Br</sup>			1	1	1
Blue Jay			1	1	1
Blue-gray Gnatcatcher	5	8	3	16	8
Brown-headed Cowbird	7	4		11	7
Canada Goose	30	12	11	53	30
Carolina Chickadee	1	1	1	3	1
Carolina Wren	5	6	6	17	6
Cedar Waxwing			6	6	6
Common Yellowthroat		1	2	3	2
Cooper's Hawk <sup>Br</sup>	1			1	1
Downy Woodpecker	3	2	1	6	3
Eastern Towhee	1			1	1
Eastern Wood-Pewee			2	2	2
Fish Crow	2			2	2
Gray Catbird		8	9	17	9
Gray-cheeked Thrush			1	1	1
Great Crested Flycatcher		2	2	4	2
Green Heron		1		1	1
Hairy Woodpecker	1			1	1
House Finch	6			6	6
House Wren	2	8	6	16	8
Laughing Gull		8		8	8
Mallard		2	1	3	2
Northern Cardinal	1	2	4	7	4
Northern Flicker	1	1	1	3	1
Northern Parula <sup>Br</sup>		7	3	10	7
Northern Waterthrush	1	1	1	3	1
Ovenbird		1	2	3	2
Red-bellied Woodpecker	3	3	2	8	3
Red-eyed Vireo			3	3	3
Red-tailed Hawk		1		1	1
Red-winged Blackbird	7	3	4	14	7
Ruby-crowned Kinglet	1			1	1
Ruby-throated Hummingbird		1		1	1
Rusty Blackbird	1			1	1
Tree Swallow	9	1		10	9
Tufted Titmouse	1	1		2	1
Warbling Vireo		5	4	9	5
White-throated Sparrow	13	2		15	13
Wood Duck	7	1		8	7

TABLE 11. (continued)

	Survey Date			Total	Max per Survey
	4/17/2019	5/3/2019	5/16/2019		
Wood Thrush <sup>Br</sup>			1	1	1
Yellow Warbler		12	10	22	12
Yellow-rumped Warbler		2		2	2
Unidentified Warbler		1		1	1
<b>Total Individuals</b>	<b>126</b>	<b>127</b>	<b>114</b>	<b>367</b>	
<b>Total Species</b>	<b>25</b>	<b>34</b>	<b>33</b>	<b>50</b>	

<sup>Br</sup> = breeding season status only

**TABLE 12.** Additional species observed at Petty’s Island, Pennsauken, NJ during 2019 spring migration surveys, but not encountered on point count surveys. State-listed species are in red (E), blue (T), or green (SC).

Species	Notes
American Kestrel	Pair observed on wires near bridge on 4/17/2019; single individual observed in same location on 5/16/2019
Belted Kingfisher	Observed along river on 4/17/2019 and 5/16/2019
Blue-winged Warbler	Observed in multiple locations on 5/3/2019
Brown Thrasher <sup>Br</sup>	Seen between points 07 and 06 on 5/3/2019, and in same location on 5/16/2019
Canada Warbler <sup>Br</sup>	Female seen between points 02 and 03 on 5/16/2019
Common Merganser	Small group of females observed in river on 4/17/2019
Double-crested Cormorant	In river on 4/17/2019
Eastern Phoebe	Seen between points 02 and 03 on 4/17/2019
Great Horned Owl	Flushed between points 01 and 02 on 4/17/2019
Greater Yellowlegs	Seen along river on 5/3/2019
Hermit Thrush	Observed in multiple locations on 4/17/2019
Northern Rough-winged Swallow	Observed along river on 4/17/2019
Orchard Oriole	Observed along trail on 5/16/19
Red-breasted Nuthatch	Heard walking along trail on 5/3/2019
Ring-billed Gull	Observed in river, multiple visits
Rose-breasted Grosbeak	Observed between points 02 and 03 on 5/16/2019
Scarlet Tanager	Observed along trail on 5/16/19
Spotted Sandpiper <sup>Br</sup>	Seen along river edge on 5/16/2019
Wild Turkey	Multiple individuals seen along access road on 4/17/2019 and 5/16/2019

<sup>Br</sup> = breeding season status only

**TABLE 13.** Total species list and number of individuals observed during 2019 Breeding Season surveys at Petty’s Island, Pennsauken, NJ, by transect. Frequency (freq.) was calculated as the number of transects at which h a species was observed divided by the total number of transects surveyed. Relative abundance was calculated as the number of individuals of that species divided by the total number of individuals of all species. State-listed species are in red (E), blue (T), or green (SC).

	# of Points	Freq	Point ID							Total	Relative Abundance
			01	02	03	04	05	06	07		
American Goldfinch	6	0.86	1		1	2	2	2	1	9	0.031
American Robin	7	1.00	3	10	9	1	8	6	3	40	0.137
Baltimore Oriole	5	0.71	1	1	1	1		2		6	0.020
Black-throated Blue Warbler <sup>Br</sup>	1	0.14				1				1	0.003
Blue Jay	2	0.29		1		1				2	0.007
Blue-gray Gnatcatcher	5	0.71	2	3	1	4			1	11	0.038
Brown-headed Cowbird	2	0.29		1				1		2	0.007
Canada Goose	5	0.71	1		1	5		4	2	13	0.044
Carolina Chickadee	4	0.57		1	1		1	1		4	0.014
Carolina Wren	7	1.00	2	2	3	1	3	3	2	16	0.055
Cedar Waxwing	6	0.86	1	11	1		2	2	1	18	0.061
Chimney Swift	1	0.14			1					1	0.003
Common Grackle	1	0.14		1						1	0.003
Common Yellowthroat	1	0.14						1		1	0.003
Downy Woodpecker	6	0.86		1	2	1	1	1	2	8	0.027
Eastern Wood-Pewee	2	0.29	1						3	4	0.014
Gray Catbird	7	1.00	8	4	4	2	5	5	1	29	0.099
Great Crested Flycatcher	3	0.43		1	1	1				3	0.010
Green Heron	1	0.14			2					2	0.007
House Wren	7	1.00	1	3	4	1	2	4	4	19	0.065
Indigo Bunting	1	0.14		1						1	0.003
Mallard	1	0.14		2						2	0.007
Northern Cardinal	6	0.86	2	2	3	1		3	1	12	0.041
Orchard Oriole	2	0.29		1	1					2	0.007
Red-bellied Woodpecker	5	0.71		1	1		1	2	2	7	0.024
Red-eyed Vireo	3	0.43	2			1			1	4	0.014
Red-tailed Hawk	1	0.14						2		2	0.007
Red-winged Blackbird	3	0.43		4	8	1				13	0.044
Tufted Titmouse	1	0.14		1						1	0.003
Warbling Vireo	6	0.86	3	3	1	2	4		4	17	0.058
Willow Flycatcher	1	0.14		1						1	0.003
Yellow Warbler	7	1.00	5	7	4	3	4	5	3	31	0.106
Yellow-billed Cuckoo	6	0.86	1	3	1		3	1	1	10	0.034
<b>Total Individuals</b>			<b>34</b>	<b>66</b>	<b>51</b>	<b>29</b>	<b>36</b>	<b>45</b>	<b>32</b>	<b>293</b>	
<b>Total Species</b>			<b>15</b>	<b>24</b>	<b>21</b>	<b>17</b>	<b>12</b>	<b>17</b>	<b>16</b>	<b>33</b>	

<sup>Br</sup> = breeding season status only

**TABLE 14.** Total species list and number of individuals observed during 2019 Breeding Season point count surveys at Petty’s Island, Pennsauken, NJ, by survey. Maximum represents the maximum number of individuals observed on any one survey (across all transects). State-listed species are in red (E), blue (T), or green (SC).

	Survey Date			Total	Max per Survey
	5/29/2019	6/20/2019	7/12/2019		
American Goldfinch	1	5	3	9	5
American Robin	7	4	29	40	29
Baltimore Oriole	3	2	1	6	3
Black-throated Blue Warbler <sup>Br</sup>		1		1	1
Blue Jay	2			2	2
Blue-gray Gnatcatcher	5	3	3	11	5
Brown-headed Cowbird	1		1	2	1
Canada Goose	7	3	3	13	7
Carolina Chickadee		2	2	4	2
Carolina Wren	7	5	4	16	7
Cedar Waxwing	18			18	18
Chimney Swift			1	1	1
Common Grackle	1			1	1
Common Yellowthroat		1		1	1
Downy Woodpecker	2	2	4	8	4
Eastern Wood-Pewee	1	1	2	4	2
Gray Catbird	10	11	8	29	11
Great Crested Flycatcher	2		1	3	2
Green Heron		1	1	2	1
House Wren	6	6	7	19	7
Indigo Bunting			1	1	1
Mallard	2			2	2
Northern Cardinal	5	2	5	12	5
Orchard Oriole		2		2	2
Red-bellied Woodpecker	2	2	3	7	3
Red-eyed Vireo	3		1	4	3
Red-tailed Hawk	1		1	2	1
Red-winged Blackbird	4	6	3	13	6
Tufted Titmouse			1	1	1
Warbling Vireo	5	5	7	17	7
Willow Flycatcher	1			1	1
Yellow Warbler	15	12	4	31	15
Yellow-billed Cuckoo	4	4	2	10	4
<b>Total Individuals</b>	<b>115</b>	<b>80</b>	<b>98</b>	<b>293</b>	
<b>Total Species</b>	<b>25</b>	<b>21</b>	<b>25</b>	<b>33</b>	

<sup>Br</sup> = breeding season status only

**TABLE 15.** Additional species observed at Petty’s Island, Pennsauken, NJ during 2019 breeding season, but not encountered on point count surveys. State-listed species are in red (E), blue (T), or green (SC).

<b>Species</b>	<b>Notes</b>
American Crow	Heard in distance on 6/20/2019
American Kestrel	Pair observed on wires by bridge on 5/29/2019 and 7/12/2019
American Redstart	Heard along access road on 6/20/2019
Black Vulture	Seen perched on pole along access road on 7/12/2019
Double-crested Cormorant	Seen in river on 7/12/2019
Eastern Kingbird	Observed along access road on 6/20/2019
Great Blue Heron <sup>Br</sup>	Seen along river on 7/12/2019
Great Egret	Seen along river on 7/12/2019
Hairy Woodpecker	Observed between points 03 and 01 on 6/20/2019
Herring Gull	Observed along river on 7/21/2019
Killdeer	Heard near parking area on 6/20/2019
Northern Flicker	Observed between points 03 and 04 on 5/29/2019
Tree Swallow	Observed between points 03 and 04 on 5/29/2019
Wild Turkey	Observed between points 02 and 03 on 5/29/2019

<sup>Br</sup> = breeding season status only

**TABLE 16.** Full list of bird species observed at Petty’s Island, Pennsauken, NJ during the first five years of baseline surveys (2014-2019). State-listed species are in red (E), blue (T), or green (SC) text. ‘x’ indicates detection during a point count or transect survey, “\*” denotes incidental detections between surveys, and “e” denotes a report from the Petty Island eBird hotspot (two checklists<sup>1</sup> from late April 2016 and 2017; five checklists<sup>2</sup> between fall 2017 and breeding 2018; and five checklists<sup>3</sup> from April 2019).

Species	Breeding 14	Fall 14	Winter 14/15	Spring 15	Breeding 15	Fall 15	Winter 15/16	Spring 16	Breeding 16	Fall 16	Winter 16/17	Spring 17	Breeding 17	Fall 17	Winter 17/18	Spring 18	Breeding 18	Fall 18	Winter 18/19	Spring 19	Breeding 19	
American Black Duck		x	*	*			x	*	*		x	*		*	*	e		*				
American Bittern <sup>Br,SC(NB)</sup>																e						
American Crow		x	*			*					x				x	e	*	x	x	e	*	
American Goldfinch	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American Kestrel											*						*	*			*	*
American Redstart		x		*	x	x		x	x			x	x	x		x	x	x		x	*	
American Robin	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
American Wigeon											*								x			
American Woodcock			*																x			
Bald Eagle <sup>Br, T(NB)</sup>		*	*			*			*	*	*	*	*	x	x	e			*	e		
Baltimore Oriole		x		x	x	x		x	x	x		x	x	x		x	x	x		x	x	
Barn Swallow						x						x				e				e		
Belted Kingfisher		x		x										x		*		x	*	*		
Black Vulture																e					*	
Black-and-White Warbler		x		x				x				*		x		x		x		x		
Blackburnian Warbler												*				x						
Blackpoll Warbler				x												x				x		
Black-throated Blue Warbler <sup>Br</sup>				*		*		x				x				x		x		x	x	
Black-throated Green Warbler <sup>Br</sup>																x				x		
Blue Jay		x		*		x	x	x				x	x	x		x		x	*	x	x	
Blue-gray Gnatcatcher	x	*		x	x			x	x	*		x	x	x		x	x			x	x	
Blue-winged Teal				*				*														
Blue-winged Warbler																					*	
Brown Creeper		x												x	x	e		x	x			
Brown Thrasher <sup>Br</sup>																				*		
Brown-headed Cowbird	x	x	x	x	x	x	x	x	x		x	x	x		x	x	x		x	x	x	
Bufflehead			*				*				*				*	*			*			
Canada Goose	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Canada Warbler <sup>Br</sup>														x						*		
Canvasback															x							
Carolina Chickadee	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x



TABLE 16. (continued)

Species	Breeding 14	Fall 14	Winter 14/15	Spring 15	Breeding 15	Fall 15	Winter 15/16	Spring 16	Breeding 16	Fall 16	Winter 16/17	Spring 17	Breeding 17	Fall 17	Winter 17/18	Spring 18	Breeding 18	Fall 18	Winter 18/19	Spring 19	Breeding 19	
Carolina Wren	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Caspian Tern														e								
Cedar Waxwing		x		x	x		x	x	x		*	x	x	x			x				x	x
Chimney Swift					*	x				x		x	x				*				e	x
Chuck-wills-widow																*						
Common Grackle	*				x	x		*	x	x		x	x	*			x				e	x
Common Loon			*																			
Common Merganser			*	*			*				*									*	*	
Common Raven		x		x	x	*								x								
Common Tern		*																				
Common Yellowthroat		x		x	*	*		x	x			x	x	x		x	x	x			x	x
Cooper's Hawk <sup>Br</sup>			x			x								e							x	
Dark-eyed Junco		x	x	*		x	x	*		x	x			x	x	x		x	x			
Double-crested Cormorant	*	x	x	*	*	*				*		x	*	x		e		x			*	*
Downy Woodpecker	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Eastern Kingbird	x			x	x			*	x			*	x			*	x				e	*
Eastern Phoebe		x	*				x	x	x		x			x		x		x	x		*	
Eastern Towhee		x						x		x				x		e		x			x	
Eastern Wood-Pewee		x			x	x			x				x	x			x				x	x
European Starling	*	*		*		*	x	x		*	x		*	*	x	x	x	x	x	x	e	
Field Sparrow							*									e	x				e	
Fish Crow				x	x								x		*				*		x	
Forster's Tern												e		*								
Gadwall			*								x				x			x	x			
Golden-crowned Kinglet		x	x			x	x			x	x			x	x	x		x	x			
Gray Catbird	x	x		x	x	x		x	x	x		x	x	x		x	x	x			x	x
Gray-cheeked Thrush																*		x			x	
Great Black-backed Gull			x			*	*		*		*			*	*	e			*			
Great Blue Heron <sup>Br</sup>	*	x	x	*		x	x	*	*	x	x	*		x		x	x	x			e	*
Great Crested Flycatcher	x	x		x	x	x		x	x			x	x			x	x	x			x	x
Great Egret		*				x				*				*			*	x				
Great Horned Owl															x		x				*	
Greater Yellowlegs																x					e	
Green Heron		*			*	x				*				x		*		*			x	x
Green-winged Teal		x	*	*		x	x	*		x	x			x	x	*		x	*			

TABLE 16. (continued)

Species	Breeding 14	Fall 14	Winter 14/15	Spring 15	Breeding 15	Fall 15	Winter 15/16	Spring 16	Breeding 16	Fall 16	Winter 16/17	Spring 17	Breeding 17	Fall 17	Winter 17/18	Spring 18	Breeding 18	Fall 18	Winter 18/19	Spring 19	Breeding 19	
Hairy Woodpecker		x	x	x		x	x		*	x	x	x	x	x	x	x	x	x	x	x	x	*
Hermit Thrush		x	x	*		x		x		x				x		e		x	x	x	*	
Herring Gull	*	x	x	*		*	*		*	*	x			x	x		x		x	x	e	*
Hooded Merganser		x																				
House Finch	*	x	x	x		x	x	x	x	x	x	x	x	x	x	*	x		x	x	x	
House Sparrow																					e	
House Wren	x	x		x	x	x		x	x	x		x	x	x		x	x	x		x	x	x
Indigo Bunting	x																					x
Killdeer	*	x						*		*				e		*					e	*
Laughing Gull		x		x	x			x		*		x		e		e		x		x	x	
Least Flycatcher <sup>Br</sup>																x						
Least Sandpiper						x								e								
Lesser Scaup											*				x							
Lesser Yellowlegs																					e	
Magnolia Warbler		x		x												x						
Mallard		x	x	*	*	x	x	x		x	x	*	*	e	x	x	*	x	x	x	x	x
Merlin																			x			
Mourning Dove	*	x			*	*			*	x	x		x		x		*	x				
Nashville Warbler <sup>Br</sup>																*						
Northern Cardinal	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Northern Harrier <sup>Br, SC non-Br</sup>																					e	
Northern Flicker	*	x	x		x	x	x	x	x	x	x	x		x	x	x		x	x	x	x	*
Northern Mockingbird		*		*				*		x			*		x	e	x		x			
Northern Parula <sup>Br</sup>				*				*				x		x		x					x	
Northern Rough-winged Swallow					*					x						e					*	
Northern Shoveler															*				x			
Northern Waterthrush				*				x				*				x					x	
Orchard Oriole	*			x				x	*			x	x			x					*	x
Osprey <sup>Br</sup>				*										*		e	*	*			e	
Ovenbird		x						x				x		x		x		x		x	x	
Palm Warbler				*										x		x					e	
Prairie Warbler												*				x						
Pied-billed Grebe <sup>Br, SC(NB)</sup>							*									*						
Pine Siskin		x																				
Pine Warbler																e						

TABLE 16. (continued)

Species	Breeding 14	Fall 14	Winter 14/15	Spring 15	Breeding 15	Fall 15	Winter 15/16	Spring 16	Breeding 16	Fall 16	Winter 16/17	Spring 17	Breeding 17	Fall 17	Winter 17/18	Spring 18	Breeding 18	Fall 18	Winter 18/19	Spring 19	Breeding 19
Red-bellied Woodpecker	x	x	x	x	x	x	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Red-breasted Merganser							x														
Red-breasted Nuthatch										x								x		*	
Red-eyed Vireo		x		x								x	x	e		*	x			x	x
Red-shouldered Hawk <sup>Br, SC(NB)</sup>	x	x		x		x	*		x		x	x	x		x	x	*	x	x		
Red-tailed Hawk		x	x						x		x		x			*		*		x	x
Red-winged Blackbird	x	x	x	x	x		x	x	x		x	x	*	x	x	x	x	x	x	x	x
Ring-billed Gull		*	x	*		x	x		x	*	x	x		x	x	x		*	x	*	
Ring-necked Duck			*												*						
Rock Pigeon																e					
Rose-breasted Grosbeak		x						x				x		e		x				*	
Royal Tern		*																			
Ruby-crowned Kinglet		x					x	x		x	x			x	x	*		x		x	
Ruby-throated Hummingbird													x						e	x	
Rusty Blackbird				x				x												x	
Scarlet Tanager																x				*	
Semipalmated Sandpiper <sup>Br</sup>		*																			
Sharp-shinned Hawk						*								x							
Solitary Sandpiper		x				x								x							
Song Sparrow	x	x	x	x	x	*	x	x	x	x	x	*	x	x	x	x		x	x	e	
Sora		x																			
Spotted Sandpiper <sup>Br</sup>		*														*				*	
Swainson's Thrush				x								*		x		x					
Swamp Sparrow		x		x		*										*			x		
Tree Swallow		*		x	x		x	x				x	x			x			x	x	*
Tufted Titmouse		x	x		x	x	x	x		x	x	x	x	x	x	e	x	x		x	x
Turkey Vulture																*				e	
Veery <sup>Br</sup>						x	*			x						*		x		e	
Warbling Vireo	x	x		x	x	x		x	x	x		x	x	x		x	x	x	x	x	x
White-breasted Nuthatch		x	*		*					x	x							x	x		
White-eyed Vireo								x													
White-throated Sparrow		x	x	*		x	x	x	x	x	x	x		x	x	x		x	x	x	
White-winged Scoter																				e	
Wild Turkey	*	x	x			x	x	x	*	x	x	*	*	x	x	*	*	x	x	*	*
Willow Flycatcher					x				x				x	e			*				x

TABLE 16. (continued)

Species	Breeding 14	Fall 14	Winter 14/15	Spring 15	Breeding 15	Fall 15	Winter 15/16	Spring 16	Breeding 16	Fall 16	Winter 16/17	Spring 17	Breeding 17	Fall 17	Winter 17/18	Spring 18	Breeding 18	Fall 18	Winter 18/19	Spring 19	Breeding 19
Winter Wren <sup>Br</sup>		x				x	x				*							x			
Wood Duck	x	x	x	x	*		*	x	x	x	x	x	*	x	x	*	x	*	*	x	
Wood Thrush <sup>Br</sup>		x										*								x	
Yellow Warbler	x			x	x			x	x			x	x			x	x			x	x
Yellow-bellied Sapsucker														x					x		
Yellow-billed Cuckoo	x	x		x				*				x	*	e		*	x				x
Yellow-rumped Warbler		x	x	x		x	x	x		x	x	x		x	x	x		x	x	x	

<sup>1</sup> Thank you to Fred Lambert for submitting the first two checklists at the site.

<sup>2</sup> 2017-2018 eBird checklists submitted by Kyle Gallagher, David Weber, Shayna Marchese, Beth Freiday, and Doryce Wheeler.

<sup>3</sup> 2019 eBird checklists submitted by Barb Bassett, Etan Zeller MacLean, Ann Marie Morrison, Kelly Wenzel (NJIA staff), and Emily Wilmoth

<sup>4</sup> The breeding season of 2014 was a partial season with only one survey visit in mid-July

<sup>Br</sup> = breeding season status only

<sup>T(NB)</sup> = Threatened status in non-breeding season

<sup>SC(NB)</sup> = Special Concern status in non-breeding season

**TABLE 17.** Additional bird species observed by McCort et al. (2010) during eight surveys in March-June 2010, but not recorded on our surveys or eBird checklists during the 2014-2019 time period.

<b>Species</b>	
Alder Flycatcher	Mourning Warbler
Bank Swallow	Northern Bobwhite
Bay-breasted Warbler	Peregrine Falcon <sup>Br, SC(NB)</sup>
Black Vulture	Purple Martin
Blue-headed Vireo <sup>Br</sup>	Ruddy Duck
Bobolink <sup>Br, SC(NB)</sup>	Savannah Sparrow <sup>Br</sup>
Chestnut-sided Warbler	Snow Goose
Chipping Sparrow	Tennessee Warbler
Cliff Swallow <sup>Br</sup>	Wilson's Snipe
Grasshopper Sparrow <sup>Br, SC(NB)</sup>	Wilson's Warbler
Great Cormorant	Yellow-bellied Flycatcher
Iceland Gull	Yellow-throated Vireo
Lincoln's Sparrow	

**FIGURE 1.** Aerial photos of Petty's Island, Pennsauken, NJ showing the industrial history of the island (top: 1930s; bottom: 2013). Bird survey locations are shown for reference (see Figure 2).

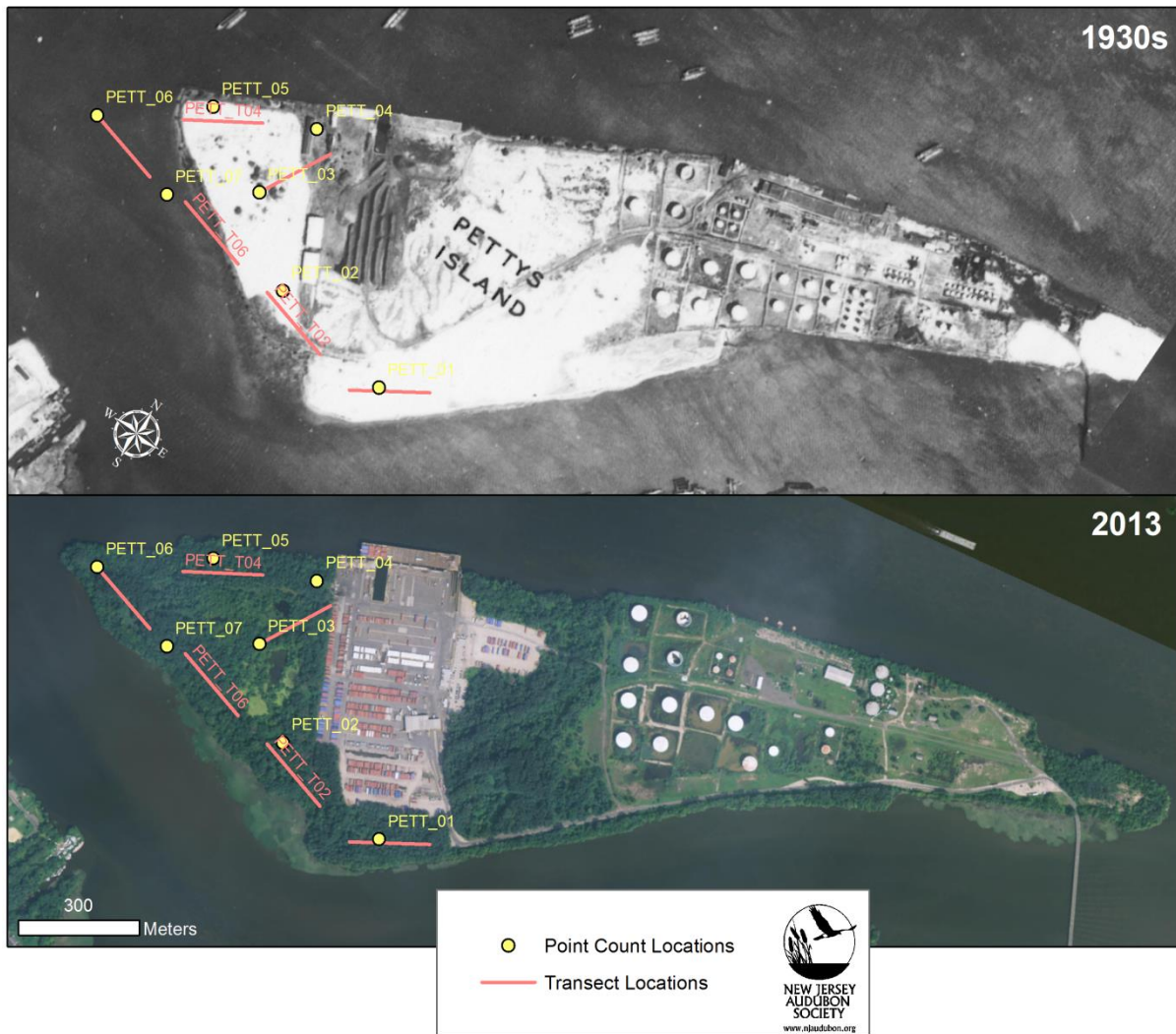


Figure 2. Petty's Island following removal of oil tanks and restoration of former container shipping area (May 2019, Google Earth Image).



**FIGURE 3.** Bird survey point and transect locations at Petty's Island, Pennsauken, NJ. Transects (red lines) were surveyed during 2018 fall migration surveys and 2018-2019 winter surveys. Points (yellow circles) were surveyed during 2019 spring migration and breeding season surveys.





**FIGURE 4.** Bird species richness (total number of species observed), by transect, during fall 2018 bird surveys at Petty's Island, Pennsauken, NJ.



**FIGURE 5.** Bird species richness (total number of species observed), by transect, during 2018-2019 winter bird surveys at Petty's Island, Pennsauken, NJ.



**FIGURE 6.** Total bird species richness (total number of species observed), by point, during 2019 spring migration bird surveys at Petty's Island, Pennsauken, NJ.



**FIGURE 7.** Bird species richness (total number of species observed), by point, during 2019 breeding season bird surveys at Petty's Island, Pennsauken, NJ.

