



BIRD MONITORING REPORT, 2017-2019

SOUTHERN MARYLAND IMPORTANT BIRD AREAS

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What are Important Bird Areas?

Audubon’s Important Bird Areas (IBAs) are sites that support significant populations of birds considered vulnerable to habitat loss and degradation. Vulnerable birds include not just rare, threatened, and endangered species, but also a variety of species still fairly common and widespread. These species can be vulnerable for two principal reasons: 1) they may be *habitat specialists*, requiring a particular type of habitat, such as forest or marsh, and 2) they may spend part of the year in dense aggregations, such as nesting colonies or migrating/winter flocks. IBAs are identified using scientifically rigorous criteria based on these categories of birds.¹

Audubon has identified over 2,600 IBAs in 47 states in the U.S. as part of a global conservation initiative coordinated by BirdLife International. As of 2015, 43 Important Bird Areas have been identified in Maryland and their boundaries mapped using a Geographic Information System (GIS). The goal of the IBA program is to maintain a network of sites that will provide for the long-term conservation of these birds and thus prevent the need for their future listing as rare, threatened, or endangered. IBAs can assist land use planning in several ways, including prioritizing zoning locations, targeting lands for protection, educating the public, and securing state funding.

Southern Maryland is one of the most heavily forested regions of the state and contains some of the state’s best forest and forested wetland sites for vulnerable bird species. The counties of Charles, St. Mary’s and Calvert contain seven Important Bird Area, totaling 96,814 acres, which provide essential habitat for Forest Interior Dwelling Birds² (FIDS) such as Wood Thrush,

¹ <http://md.audubon.org/important-bird-areas-2>

² Critical Area Commission for the Chesapeake and Atlantic Coastal Bays (CAC). 2001. A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area, prepared by Jones, C., J. McCann, & S. McConville. 63 p.

Kentucky Warbler, and Scarlet Tanager. There are 25 species (and one subspecies) defined as FIDS in Maryland.

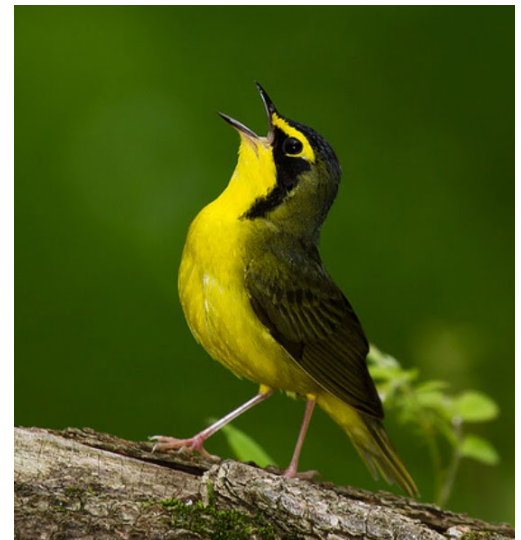
Threats to Birds

Unfortunately, these forest and wetland habitats face many threats. The Maryland State Wildlife Action Plan, updated by Maryland Department of Natural Resources in 2015, describes one of the greatest threats to birds and other wildlife as the loss and fragmentation of habitat due to development.³ The region's proximity to the nation's capital makes this area particularly vulnerable to development. Forests in several of the region's IBAs have been lost in recent years to new residential developments, resulting in habitat fragmentation, which increases pollution, disturbances, and other harmful edge effects. These combined impacts have caused population declines in many habitat-specialist birds because these species tend to require larger areas of contiguous habitat than do generalists. Forest Interior Dwelling Birds (FIDS) are one such specialist assemblage – these birds need large areas of intact forest to breed successfully. The larger the area and the higher the ecological quality of a forest, the higher the number of FIDS species it will support. Breeding Bird Atlas data show that between the 1980s and the 2000s the distribution of two formerly widespread species, Kentucky Warbler and Eastern Whip-poor-will, shrank in Maryland by 38% and 57% respectively.⁴

Monitoring IBAs

In 2017, Audubon Maryland-DC (Audubon) and the Maryland Bird Conservation Partnership (MBCP) implemented a program of bird monitoring at several IBAs across Maryland, with funding from Maryland Department of Natural Resources and individual donors. The goal of the monitoring was to provide managers with data on bird abundance and location and to provide a current baseline against which to measure population trends in the future. In 2018, the Cove Point Natural Heritage Trust awarded a grant to continue this work at four IBAs in southern Maryland with the following objectives:

1. Collect bird population data at four IBAs in 2018 (2019 is also included in this report) and provide the data and interpretive summaries to land managers.
2. Engage up to 30 volunteers as citizen scientists to monitor bird populations at IBAs.
3. Educate the wider public about the importance of IBAs to birds and habitat conservation.



*The Kentucky warbler requires high-quality wet woods with a robust natural understory. Sprawl development and associated forest fragmentation and deer browsing have led to a 70% decline in this species in Maryland over the past 49 years.
Photo: Frode Jacobsen*

³ Maryland Department of Natural Resources. 2016. Maryland State Wildlife Action Plan. Annapolis, Maryland. https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/SWAP_home.aspx

⁴ Ellison, W. G. 2010. 2nd Atlas of the Breeding Birds of Maryland and the District of Columbia. Johns Hopkins University Press.

Methods

Four IBAs were selected for monitoring (Figure 1) — Chapman State Park, Mattawoman Creek, Parkers Creek, and South River Greenway. Two years of data were collected (2018 and 2019) at all four sites. In addition, data collected in 2017 at Parkers Creek and South River Greenway were included in the analysis. Birds were monitored using point count surveys conducted during the height of the bird breeding season, 21 May through 30 June. Each point count location was surveyed twice each year with the two replicate surveys at least one week apart. A total of 270 forest points and 10 marsh point were surveyed during 2017-2019 (Table 1). Observers were instructed to conduct the first survey before 11 June and the second survey on 11 June or later. Surveys were completed during the first four hours after sunrise generally between 0600 and 1000 EST. Weather and wind conditions were recorded during each count following the Beaufort scale and standard weather codes. Surveys were not conducted during high wind conditions (> 12 mph) or during dense fog, steady drizzle, or prolonged rain.



Figure 1. Important Bird Areas in Southern Maryland. IBAs to be monitored through this proposal are circled in red.

There were 13 forest habitat routes and one marsh route in Parkers Creek. Counts on forest routes were 5 minutes in duration, with counts split between an initial 3-minute period and the following 2-minute period. The division into two time periods can provide a measure of how detectable each species is within a given timeframe. All birds seen or heard up to an unlimited distance were counted – we did not ask observers to estimate distance to birds because observers generally vary greatly in their ability to do this accurately.

Survey locations were divided into routes that could each be easily covered by an observer in a single morning. To reduce the probability that individual birds were counted more than once (from two points) survey locations were selected using ArcGIS so that a minimum of 300 meters separated points. The volunteer observers were assigned a route and navigated to survey locations using the Avenza maps app on smart phones, which eliminated the need for flagging each point.

On the survey route in open marsh habitat, the SHARP (Saltmarsh Habitat & Avian Research Program) bird survey protocol was used (see www.tidalmarshbirds.org). This method uses a 12-minute survey which includes the broadcast of vocalizations of seven species of secretive marshbirds. The marsh route was accessed by kayak by the same volunteer in 2017 and 2018.

Observers recorded birds during surveys on field datasheets designed by Audubon and MBCP, and, after surveys were completed, entered data into the computer on Excel spreadsheet templates also provided by Audubon and MBCP. MBCP and Audubon staff combined and summarized the individual datasets submitted by observers.

Table 1. Bird survey sites, routes, and points surveyed from 2017-2019.

Site	Route	Habitat	# Pts	# Points Surveyed		
				2017	2018	2019
Parkers Creek	A	Forest	8	8	8	8
Parkers Creek	B	Forest	9	9	9	9
Parkers Creek	C	Forest	9	9	8	9
Parkers Creek	D	Forest	8		8	8
Parkers Creek	E	Forest	9	9	9	9
Parkers Creek	F	Forest	8	8	8	8
Parkers Creek	G	Forest	8	8	8	8
<i>Parkers Creek</i>	<i>H</i>	<i>Marsh</i>	5	5	5	--
South River Greenway	A	Forest	7	7	7	7
South River Greenway	B	Forest	8	8	8	8
South River Greenway	C	Forest	7	6	7	--
Chapman State Park	A	Forest	7	--	7	7
Mattawoman Creek	NEA	Forest	7	--	7	7
Mattawoman Creek	Upper	Forest	8	--	8	8
		Forest	103	72	102	96
		<i>Marsh</i>	5	5	5	--

Results – Forest Routes

A total of 83 species were detected during 2017-2019 forest point count surveys, 21 (**25.3%**) of which were FIDS. However, 3774 of the 7895 total detections (**47.8%**) were FIDS. 2157 detections were made of 68 species in 2017, 2889 detections of 69 species in 2018, and 2849 detections of 74 species in 2019 (Table 2; see Table 6 for results listing of all species). The number of detections does not equate directly to the number of individual birds detected because some birds may have been detected on both survey visits. There are 25 FIDS specialist species in Maryland. A total of 21 FIDS, 84% of FIDS species in the state, were detected during the 2017-2019 surveys. The total number of detections in 2017 was 25% less than in 2018 and 24% less than in 2019. However, the proportion of species and detections for both FIDS and Species of Greatest Conservation Need (SGCN) were higher in 2017 than in 2018 or 2019.

Three FIDS species—Brown Creeper, Cerulean Warbler, and Veery—had one detection each. The 2nd Breeding Bird Atlas shows a small number of blocks with probable or confirmed nesting of these species in the Maryland Coastal Plain. It is not clear if these were migrant individuals or possible breeders. The high species richness of breeding FIDS (21 species) reflects the high quality of the Southern Maryland ecosystem for forest specialist birds. The four most abundant species on the forest survey routes (Acadian Flycatcher, Red-eyed Vireo, Wood Thrush, Ovenbird) were all FIDS (Table 3). Another measure of the high conservation value of this site for FIDS is that while the proportion of FIDS species was 25.3%, 47.5% of all bird detections and 47.8% of the mean number of birds detected per point were of FIDS.

Table 2. Summary of total detections and mean relative abundance (detections/point) at the four survey sites (combined; forest routes only). Summaries are given for Forest Interior Dwelling Birds (FIDS) and Species of Greatest Conservation Need (SGCN). *Count* is the number of detections during 5-minute counts. *Mean* is the mean number of detections per 5-minute count. Including data from the Parkers Creek marsh route (see Table 5) increased the total number of species

	2017		2018		2019		2017-2019	
	Count	Mean	Count	Mean	Count	Mean	Count	Mean
TOTALS	2157	16.29	2889	14.10	2849	14.66	7895	14.88
<i># Species</i>	<i>68</i>		<i>69</i>		<i>74</i>		<i>83</i>	
FIDS TOTALS	1134	8.52	1310	6.44	1330	6.78	3774	7.11
<i># FIDS Species</i>	<i>20</i>		<i>18</i>		<i>19</i>		<i>21</i>	
Proportion FIDS	52.6%	52.3%	45.3%	45.7%	46.7%	46.2%	47.8%	47.8%
<i>Proportion FIDS Species</i>	<i>29.4%</i>		<i>26.1%</i>		<i>25.7%</i>		<i>25.3%</i>	
SGCN TOTALS	896	6.70	996	4.91	1025	5.21	2917	5.49
<i># SGCN Species</i>	<i>21</i>		<i>18</i>		<i>19</i>		<i>24</i>	
Proportion SGCN	41.5%	41.2%	34.5%	34.8%	36.0%	35.5%	36.9%	36.9%
<i>Proportion SGCN Species</i>	<i>30.9%</i>		<i>26.1%</i>		<i>25.7%</i>		<i>28.9%</i>	
<i># FIDS and SGCN</i>	<i>15</i>		<i>13</i>		<i>14</i>		<i>16</i>	
<i>Total # Species-Forest & Marsh</i>	73		73		74		86	

Results – Marsh Route

The marshbird community in the open marshes flanking Parkers Creek is very limited. Only one marsh specialist bird (Marsh Wren) was detected even though call-playbacks were used to solicit responses by secretive marshbirds. In 1999 several marshbird species were recorded in surveys conducted by Leslie Starr, who also was one of the observers in 2017. These included Least Bittern, Black Rail, Virginia Rail, and Clapper Rail. Virginia Rail and Least Bittern were also recorded here during the fieldwork period of the 2nd Maryland-DC Breeding Bird Atlas (2002-2006).

On the single survey route of five points in open marsh habitat, 412 detections were made of 44 bird species in 2017 and 2018 (Table 5). The marsh habitat at Parkers Creek is of limited extent, and many of the birds detected from these marsh points were forest birds in adjacent uplands. The two most abundant species were Red-winged Blackbird and Common Yellowthroat, both of which are wetland species that can also be found in grassy and early successional habitats in uplands.

The Parkers Creek marsh route added an additional four species to the total for the combined sites in each of 2017 (Barn Swallow, Canada Goose, Northern Rough-winged Swallow, Tree Swallow) and 2018 (Barn Swallow, Marsh Wren, Northern Rough-winged Swallow, Wood Duck). When combining all species from the marsh route and the 13 forest routes for all three years, Barn, Northern Rough-winged, and Tree Swallows were the only birds detected only on the marsh route, bringing the overall species count to 86 for all sites in 2017-2019.

Discussion and Recommendations

The data collected in 2017-2019 can inform the conservation management of Southern Maryland IBA forest birds in several ways:

1. The data provide a baseline against which future bird survey data can be compared to examine population trends, as long as the same survey methodology is used in the future.
2. The data provide an indicator of habitat quality of these sites.
3. Examination of the spatial distribution of the occurrence of certain species may provide information useful for making habitat management decisions.

The 2017-2019 bird survey data show that one of the most significant ornithological features of these IBAs is the high abundance and diversity of the Forest Interior Dwelling Birds assemblage. The 21 species of FIDS detected may not be the full complement of FIDS at the site because Eastern Whip-poor-will was not detected and may in fact be present; it was recorded in 1999 during nocturnal visits at Parkers Creek. High abundance and diversity of FIDS is a reflection of unfragmented condition and well-managed forest habitats.

The occurrence of Hooded Warbler and Kentucky Warbler indicates a healthy vertical structural diversity of forest vegetation where they are found, which was predominantly Parkers Creek. These two species nest and forage in the shrub understory layer and have disappeared from many Maryland forests over recent decades as the understory has become denuded by excessive deer browsing. The shrub understory at Parkers Creek has been successfully maintained by effective deer management. Similar management should be encouraged at all IBAs with mature forest.

Table 3. Most detected species. Abundance ranks of 10 most detected species. “# Ind” indicates the total number of detections for the species. **FIDS** are in **bold** font.

Species	Abundance Rank					Rank Comparison		
	2017	2018	2019	2017-2019	# Ind	Mean A (2017/2018)	Mean B (2018/2019)	Mean A-Mean B
Acadian Flycatcher	1	1	1	1	809	1	1	0
Red-eyed Vireo	2	2	2	2	759	2	2	0
Wood Thrush	3	4	3	3	567	3.5	3.5	0
Ovenbird	4	5	5	4	481	4.5	5	-0.5
Tufted Titmouse	6	3	7	5	476	4.5	5	-0.5
Eastern Wood-Pewee	5	8.5	4	6	425	6.75	6.25	0.5
Northern Cardinal	9	6	6	7	368	7.5	6	1.5
Carolina Wren	13	8.5	8	8.5	304	10.75	8.25	2.5
Red-bellied Woodpecker	10	7	9	8.5	304	8.5	8	0.5
Scarlet Tanager	7	11	12	10	261	9	11.5	-2.5
American Crow	8	12	11	11.5	231	10	11.5	-1.5
Northern Parula	11	10	10	11.5	231	10.5	10	0.5

Table 4. FIDS Abundance ranks.

Species	Abundance Rank					Rank Comparison		
	2017	2018	2019	2017-2019	Obs/Point	Mean A (2017/2018)	Mean B (2018/2019)	Mean A-Mean B
Acadian Flycatcher	1	1	1	1	1.52	1	1	0
Red-eyed Vireo	2	2	2	2	1.44	2	2	0
Wood Thrush	3	3	3	3	1.08	3	3	0
Ovenbird	4	4	4	4	0.88	4	4	0
Scarlet Tanager	5	6	6	5	0.48	5.5	6	-0.5
Northern Parula	6	5	5	6	0.43	5.5	5	0.5
Worm-eating Warbler	8	8.5	7	7	0.23	8.25	7.75	0.5
Hooded Warbler	7	8.5	8	8	0.22	7.75	8.25	-0.5
Pileated Woodpecker	9	7	10	9	0.19	8	8.5	-0.5
Louisiana Waterthrush	11	10	9	10	0.19	10.5	9.5	1
Yellow-throated Vireo	10	11	11	11	0.17	10.5	11	-0.5
Kentucky Warbler	12	12	12	12	0.11	12	12	0
Hairy Woodpecker	14	13	13	13	0.06	13.5	13	0.5
Red-shouldered hawk	16	16.5	14	14	0.03	16.25	15.25	1
Prothonotary Warbler	16	16.5	15	15	0.03	16.25	15.75	0.5
American Redstart	13	15	18	16	0.02	14	16.5	-2.5
Black-and-white Warbler	16	14	16	17	0.02	15	15	0

Nocturnal FIDS (Barred Owl) excluded because it was greatly under-represented on surveys.

Brown Creeper, Cerulean Warbler, and Veery excluded. They had one detection each over three years.

The rank of the 12 most detected species between years (Table 3) did not differ significantly. In fact, the abundance ranks were significantly correlated. A Spearman rank correlation test showed the assemblage of species were strongly ($\rho=0.93$) and significantly ($p=0.00001$) correlated between years. A Spearman rank correlation test of FIDS abundance ranks (Table 4) was even stronger ($\rho=0.976$) and more significant ($p= 2.387^{-11}$). This indicates the combined species diversity and abundance did not vary at these four IBAs across years. Additional monitoring in future years will help elucidate potential changes in habitat structure and quality.

The North American avifauna has decreased by almost three billion birds (29%) since 1970.⁵ Among the declines are birds breeding in eastern forests (-17%), aerial insectivores (-32%), and long-distance migrants (-28%). Of the 17 FIDS species with more than 5 detections, seven have experienced population declines in the U.S. since 1970 (Table 7). Maryland has > 1% of the world's population of five of these. More significantly, the Maryland Coastal Plain alone (the portion of Bird Conservation Region 30⁶ in Maryland) supports > 1% of three of these: Acadian Flycatcher (2.31%), Wood Thrush (1.08%), and Worm-eating Warbler (1.67%). Acadian Flycatcher was the most detected species and was observed at *every* survey point every year. Wood Thrush was the third most detected species and was found at 87% of the survey points.

The IBAs in southern Maryland are especially valuable for Wood Thrush, with a mean of 1.08 detections per survey point. Wood Thrush populations have declined 60% overall since 1970 and by 52% in Maryland. These thrushes reach their highest population densities in extensive mature moist predominantly deciduous forest with an ample understory. Continued management to retain understory vegetation (e.g., reduce deer over browse) in these mature forests is crucial to maintaining the high density of Wood Thrush in the future. Acadian Flycatchers, the most detected species on the surveys, have declined 10% in North America since 1970. However, their population has increased 83% in Maryland and the Maryland Coastal Plain has an estimated 2.3% of the world's population. Acadian Flycatchers inhabit mature moist forest, often in stream valleys. The extensive presence of Acadian Flycatcher in these IBAs an indication of the health of these forests, and potentially the water quality of streams in the riparian forests. Preservation of riparian forest will continue to allow this species to thrive in Maryland.

The Climate Impact column of Table 7 is taken from Appendix 6e of the Maryland State Wildlife Action Plan, *Predictions of Species-Specific Habitat Shift due to Climate Change in the Northeast*. Five FIDS are predicted to have a large decrease of species-specific habitat in the future, including Wood Thrush. The protection of large, contiguous blocks of interior forest will be critical to sustaining and enhancing populations of FIDS. The four IBAs in this report, and possibly all forested IBAs in Maryland, will need sustained management of forests to maintain not only mature trees but also a vibrant understory.

⁵ Rosenberg, K. V. et al. 2019. Decline of the North American Avifauna. *Science* 365(6461). doi: 10.1126/science.aaw1313.

⁶ Bird Conservation Regions are defined by the North American Bird Conservation Initiative, <https://nabci-us.org/resources/bird-conservation-regions-map/>

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Supplemental Data

The file “CPNHT bird monitoring report_Supplemental Data.docx” contains:

1. Individual summary tables for South River Greenway, Parkers Creek, Mattawoman Creek, and Chapman State Park IBAs.
2. Maps with routes for each IBA.

Data associated with this report

The following data associated with this report are available:

1. Field data sheets containing raw data collected by volunteers are stored at the offices of Audubon Maryland-DC.
2. Bird survey data were entered into an Excel database by the observers who collected the data. Individual Excel spreadsheets were combined and summarized by pivot tables for each site. The resulting pivot table data was summarized by a pivot table of these combined site pivot tables. All Excel spreadsheets are held by Audubon Maryland-DC and by Maryland Bird Conservation Partnership
3. A GIS shapefile of bird survey point locations is held by Audubon Maryland-DC and by Maryland Bird Conservation Partnership.

Table 5. Marsh survey summary. Total detections and mean relative abundance (detections/point) of each species observed at 5 survey points in open **MARSH** habitat at Parkers Creek IBA in 2017 and 2018. Each point was surveyed twice. Marsh specialist birds as defined by Maryland-DC IBA Program Criteria for site selection; available online at <http://md.audubon.org/conservation/important-bird-areas-0>

Species	Habitat Specialist	2017		2018		2017 & 2018	
		Count	Mean	Count	Mean	Count	Mean
Acadian Flycatcher*	FIDS	5	0.50	2	0.20	7	0.35
American Crow		12	1.20	11	1.10	23	1.15
American Goldfinch				1	0.10	1	0.05
Bald Eagle*				3	0.30	3	0.15
Barn Swallow		2	0.20	1	0.10	3	0.15
Belted Kingfisher		2	0.20			2	0.10
Blue Grosbeak		1	0.10	2	0.20	3	0.15
Blue Jay		12	1.20	7	0.70	19	0.95
Brown-headed Cowbird				2	0.20	2	0.10
Canada Goose		3	0.30	12	1.20	15	0.75
Carolina Chickadee				1	0.10	1	0.05
Carolina Wren		7	0.70	7	0.70	14	0.70
Chimney Swift*				2	0.20	2	0.10
Common Grackle		2	0.20			2	0.10
Common Yellowthroat		22	2.20	23	2.30	45	2.25
Eastern Wood-Pewee		6	0.60	3	0.30	9	0.45
Great Blue Heron*		3	0.30			3	0.15
Great Crested Flycatcher		2	0.20	2	0.20	4	0.20
Indigo Bunting		1	0.10	3	0.30	4	0.20
Louisiana Waterthrush*	FIDS			2	0.20	2	0.10
Marsh Wren*	MARSH	3	0.30	5	0.50	8	0.40
Mourning Dove		9	0.90	3	0.30	12	0.60
Northern Cardinal		7	0.70	9	0.90	16	0.80
Northern Parula*	FIDS			2	0.20	2	0.10
Northern Rough-winged Swallow		2	0.20	6	0.60	8	0.40
Orchard Oriole				1	0.10	1	0.05
Osprey		1	0.10	4	0.40	5	0.25
Ovenbird*	FIDS	1	0.10	2	0.20	3	0.15
Pileated Woodpecker	FIDS	1	0.10	7	0.70	8	0.40
Red-bellied Woodpecker		7	0.70	8	0.80	15	0.75
Red-eyed Vireo	FIDS	7	0.70	5	0.50	12	0.60
Red-shouldered Hawk	FIDS			2	0.20	2	0.10
Red-winged Blackbird		45	4.50	41	4.10	86	4.30
Ruby-throated Hummingbird		1	0.10			1	0.05
Scarlet Tanager*	FIDS	4	0.40	5	0.50	9	0.45
Summer Tanager				2	0.20	2	0.10
Tree Swallow		1	0.10			1	0.05
Tufted Titmouse		9	0.90	10	1.00	19	0.95
White-eyed Vireo	SHRUB	4	0.40	5	0.50	9	0.45

Species	Habitat Specialist	2017		2018		2017 & 2018	
		Count	Mean	Count	Mean	Count	Mean
Wild Turkey		5	0.50			5	0.25
Wood Duck				3	0.30	3	0.15
Wood Thrush*	FIDS	8	0.80	6	0.60	14	0.70
Yellow-billed Cuckoo		1	0.10			1	0.05
Yellow-throated Vireo*	FIDS	5	0.50	1	0.10	6	0.30
TOTALS		201	20.10	211	21.10	412	20.60
<i># Species</i>		<i>33</i>		<i>37</i>		<i>44</i>	
SGCN TOTALS		29	2.90	30	3.00	59	2.95
<i># SGCN Species</i>		<i>7</i>		<i>10</i>		<i>11</i>	
Proportion SGCN		14.4%		14.2%		14.3%	
<i>Proportion SGCN Species</i>		<i>21.2%</i>		<i>27.0%</i>		<i>25.0%</i>	

Combined species from the Marsh route and the 13 Forest routes:

TOTAL # SPECIES – ALL ROUTES		72		73		86	
<i># Species Forest Routes Only</i>		<i>39</i>		<i>36</i>		<i>42</i>	
<i># Species Marsh Route Only</i>		<i>4</i>		<i>4</i>		<i>3</i>	
<i>Both Forest AND Marsh Routes</i>		<i>29</i>		<i>33</i>		<i>41</i>	

Table 6. Total detections and mean relative abundance (detections/point) of each species observed at the four survey sites (combined; forest routes only). Forest Interior Dwelling Birds (FIDS) are denoted in **bold** font; Species of Greatest Conservation Need (SGCN) are denoted by *. *Count* is the number of detections during 5-minute counts. *Mean* is the mean number of detections per 5-minute count. A mean of *P* indicates a species that was only detected outside of the 5-minutes count periods.

Species	Habitat Specialist	2017		2018		2019		2017-2019	
		Total	Mean	Total	Mean	Total	Mean	Total	Mean
Acadian Flycatcher*	FIDS	227	1.72	291	1.41	291	1.49	809	1.52
American Crow		77	0.61	73	0.36	81	0.42	231	0.45
American Goldfinch		35	0.23	36	0.16	18	0.09	89	0.15
American Redstart*	FIDS	6	0.04	6	0.03	1	0.01	13	0.02
American Robin		5	0.03	7	0.03	7	0.03	19	0.03
Bald Eagle*		1	0.01	5	0.03	4	0.02	10	0.02
Baltimore Oriole		1	0.01	2	0.01			3	0.01
Barred Owl	FIDS	1	0.01	1	0.00	1	0.01	3	0.01
Belted Kingfisher		1	0.01			2	0.01	3	0.01
Black Vulture			0.00	1	0.01			1	0.00
Black-and-white Warbler*	FIDS	1	0.01	7	0.03	2	0.01	10	0.02
Blue Grosbeak		2	0.01	6	0.02			8	0.01
Blue Jay		32	0.25	55	0.28	54	0.29	141	0.27
Blue-gray Gnatcatcher		26	0.23	64	0.32	78	0.40	168	0.33
Brown Creeper*	FIDS		0.00			1	0.01	1	0.00
Brown Thrasher		3	0.04	3	0.01	4	0.02	10	0.02
Brown-headed Cowbird		15	0.10	60	0.25	22	0.12	97	0.16
Canada Goose				1	0.01	23	0.14	24	0.05
Carolina Chickadee		26	0.20	56	0.26	54	0.28	136	0.25
Carolina Wren		44	0.32	130	0.65	130	0.70	304	0.58
Cedar Waxwing				1	0.01	7	0.04	8	0.01
Cerulean Warbler*	FIDS	1	0.01					1	0.00
Chimney Swift*		4	0.02	9	0.04	13	0.07	26	0.05
Chipping Sparrow		8	0.05	5	0.02	2	0.01	15	0.03
Common Grackle		5	0.06	7	0.03	17	0.09	29	0.06
Common Yellowthroat		21	0.14	15	0.06	21	0.10	57	0.09
Downy Woodpecker		38	0.29	43	0.21	38	0.20	119	0.23
Eastern Bluebird		2	0.01	7	0.04	8	0.04	17	0.03
Eastern Kingbird		3	0.02	2	0.01	6	0.03	11	0.02
Eastern Phoebe						2	0.01	2	0.00
Eastern Towhee	SHRUB	8	0.06	7	0.03	6	0.03	21	0.04
Eastern Wood-Pewee		133	1.00	130	0.66	162	0.85	425	0.81
European Starling						1	0.01	1	0.00
Field Sparrow		7	0.04	11	0.03	6	0.02	24	0.03
Fish Crow				3	0.02	5	0.03	8	0.02

Species	Habitat Specialist	2017		2018		2019		2017-2019	
		Total	Mean	Total	Mean	Total	Mean	Total	Mean
Gray Catbird		7	0.05	8	0.04	8	0.04	23	0.04
Great Blue Heron*		3	0.02	1	0.01	3	0.02	7	0.01
Great Crested Flycatcher		18	0.16	40	0.20	41	0.21	99	0.19
Green Heron			0.00			3	0.02	3	0.01
Hairy Woodpecker	FIDS	3	0.03	11	0.05	17	0.09	31	0.06
Hooded Warbler*	FIDS	35	0.28	36	0.20	39	0.20	110	0.22
House Finch						1	0.01	1	0.00
House Wren				2	0.01			2	0.00
Indigo Bunting		23	0.18	25	0.11	26	0.13	74	0.13
Kentucky Warbler*	FIDS	12	0.13	22	0.10	21	0.10	55	0.11
Louisiana Waterthrush*	FIDS	25	0.21	34	0.17	35	0.18	94	0.19
Mallard						2	0.01	2	0.00
Marsh Wren*	MARSH	1	0.01					1	0.00
Mourning Dove		61	0.47	50	0.25	43	0.21	154	0.29
Northern Cardinal		73	0.55	151	0.72	144	0.74	368	0.68
Northern Flicker		6	0.04	5	0.03	6	0.03	17	0.03
Northern Mockingbird		1	0.01	1	0.00	1	0.01	3	0.01
Northern Parula*	FIDS	65	0.48	78	0.39	88	0.44	231	0.43
Orchard Oriole		1	0.01	8	0.02	6	0.02	15	0.02
Osprey		1	0.01	5	0.03	8	0.05	14	0.03
Ovenbird*	FIDS	153	1.08	171	0.82	157	0.79	481	0.88
Pileated Woodpecker	FIDS	32	0.24	42	0.19	32	0.17	106	0.19
Pine Warbler		6	0.04	6	0.02	5	0.02	17	0.03
Prairie Warbler*		2	0.01					2	0.00
Prothonotary Warbler*	FIDS	1	0.01	4	0.02	10	0.06	15	0.03
Red-bellied Woodpecker		70	0.58	136	0.67	98	0.53	304	0.59
Red-eyed Vireo	FIDS	213	1.62	273	1.35	273	1.39	759	1.44
Red-headed Woodpecker*			<i>P</i>	1	0.00		<i>P</i>	1	0.00
Red-shouldered hawk	FIDS	1	0.01	4	0.02	12	0.06	17	0.03
Red-winged Blackbird		17	0.11	46	0.24	45	0.26	108	0.21
Ruby-throated Hummingbird		3	0.03	4	0.02	8	0.04	15	0.03
Scarlet Tanager*	FIDS	104	0.75	77	0.37	80	0.40	261	0.48
Summer Tanager		23	0.21	20	0.10	30	0.16	73	0.15
Tufted Titmouse		132	0.95	209	1.06	135	0.70	476	0.90
Turkey Vulture				3	0.02	8	0.03	11	0.02
Veery*	FIDS	1	0.01					1	0.00
White-breasted Nuthatch		37	0.28	57	0.28	33	0.17	127	0.24
White-eyed Vireo	SHRUB	8	0.06	17	0.08	9	0.05	34	0.07
Wild Turkey		4	0.02	1	0.01	1	0.01	6	0.01

Species	Habitat Specialist	2017		2018		2019		2017-2019	
		Total	Mean	Total	Mean	Total	Mean	Total	Mean
Willow Flycatcher*						1	0.00	1	0.00
Wood Duck						4	0.02	4	0.01
Wood Thrush*	FIDS	190	1.44	191	0.96	186	0.95	567	1.08
Worm-eating Warbler*	FIDS	34	0.26	36	0.19	53	0.26	123	0.23
Yellow Warbler		2	0.03			2	0.01	4	0.01
Yellow-billed Cuckoo		14	0.11	34	0.16	45	0.23	93	0.17
Yellow-breasted Chat*		1	0.01	1	0.00	9	0.03	11	0.01
Yellow-throated Vireo*	FIDS	29	0.22	26	0.14	31	0.17	86	0.17
Yellow-throated Warbler		12	0.08	9	0.04	23	0.09	44	0.07
TOTALS		2157	16.29	2889	14.10	2849	14.66	7895	14.88
<i># Species</i>		<i>68</i>		<i>69</i>		<i>74</i>		<i>83</i>	
FIDS TOTALS		1134	8.52	1310	6.44	1330	6.78	3774	7.11
<i># FIDS Species</i>		<i>20</i>		<i>18</i>		<i>19</i>		<i>21</i>	
Proportion FIDS		52.6%	52.3%	45.3%	45.7%	46.7%	46.2%	47.8%	47.8%
<i>Proportion FIDS Species</i>		<i>29.4%</i>		<i>26.1%</i>		<i>25.7%</i>		<i>25.3%</i>	
SGCN TOTALS		896	6.70	996	4.91	1025	5.21	2917	5.49
<i># SGCN Species</i>		<i>21</i>		<i>18</i>		<i>19</i>		<i>24</i>	
Proportion SGCN		41.5%	41.2%	34.5%	34.8%	36.0%	35.5%	36.9%	36.9%
<i>Proportion SGCN Species</i>		<i>30.9%</i>		<i>26.1%</i>		<i>25.7%</i>		<i>28.9%</i>	
<i># FIDS and SGCN</i>		<i>15</i>		<i>13</i>		<i>14</i>		<i>16</i>	
<i>FIDS between points only</i>		<i>0</i>		<i>0</i>		<i>0</i>		<i>0</i>	
<i>SGCN between points only</i>		<i>1</i>		<i>0</i>		<i>1</i>		<i>0</i>	

Single observation (heard singing) of Blackpoll Warbler on 5/24/2018 at Parkers Creek excluded as likely migrant.

Table 7. FIDS Total detections and mean relative abundance (detections/point) of Forest Interior Dwelling Birds with > 5 detections. “% Pts” shows the percentage of 103 total points surveyed in which the species was detected.

Species	% Pts	2017		2018		2019		2017-2019		U.S. Pop Trend ³	MD Pop Trend ²	MD % of Global Pop	Climate Impact ¹
		Count	Mean	Count	Mean	Count	Mean	Count	Mean				
Acadian Flycatcher	100%	227	1.72	291	1.41	291	1.49	809	1.52	-10%	83%	3.56%	↑↑
American Redstart	10%	6	0.04	6	0.03	1	0.01	13	0.02	-12%	34%		↓↓
Black-and-white Warbler	9%	1	0.01	7	0.03	2	0.01	10	0.02	-27%	?		↓↓
Hairy Woodpecker	21%	3	0.03	11	0.05	17	0.09	31	0.06	54%	?		
Hooded Warbler	42%	35	0.28	36	0.20	39	0.20	110	0.22	103%	269%		↑↑
Kentucky warbler	27%	12	0.13	22	0.10	21	0.10	55	0.11	-29%	-71%		↑↑
Louisiana Waterthrush	47%	25	0.21	34	0.17	35	0.18	94	0.19	34%	160%	1.93%	
Northern Parula	79%	65	0.48	78	0.39	88	0.44	231	0.43	62%	131%		↑↑
Ovenbird	82%	153	1.08	171	0.82	157	0.79	481	0.88	0%	173%		↓↓
Pileated Woodpecker	65%	32	0.24	42	0.19	32	0.17	106	0.19	?	2283% ⁴		
Prothonotary Warbler	10%	1	0.01	4	0.02	10	0.06	15	0.03	-38%	59%		↑↑
Red-eyed Vireo	99%	213	1.62	273	1.35	273	1.39	759	1.44	43%	81%		↓↓
Red-shouldered hawk	12%	1	0.01	4	0.02	12	0.06	17	0.03	>200%	?		↑↑
Scarlet Tanager	84%	104	0.75	77	0.37	80	0.40	261	0.48	-7%	58%	1.19%	
Wood Thrush	87%	190	1.44	191	0.96	186	0.95	567	1.08	-60%	-52%	2.31%	↓↓
Worm-eating Warbler	58%	34	0.26	36	0.19	53	0.26	123	0.23	26%	?	3.51%	↑
Yellow-throated Vireo	49%	29	0.22	26	0.14	31	0.17	86	0.17	62%	56%		↑↑
TOTALS		1131	8.50	1309	6.44	1328	6.77	3768	7.10	Trend< 0	Trend< 0		
<i>Total # Species</i>		<i>17</i>		<i>17</i>		<i>17</i>		<i>17</i>		7	2		

¹**U.S. Population Trend.** Source: Partners in Flight Populations Estimates database, 1970-2014 (<http://pif.birdconservancy.org/PopEstimates/>).

²**MD Population Trend.** Source: Breeding Bird survey data, 1966-2018 (<https://www.pwrc.usgs.gov/bbs/>).

³**Climate Impact.** Data from SWAP Appendix 6e (MD DNR 2016).

	Shaded indicates agreement among the majority of the 8 model/scenarios considered
↑ ↓	Moderate expected increase/decrease of species-specific habitat abundance in the region
↑↑ ↓↓	Large expected increase/decrease of species-specific habitat abundance in the region

⁴Pileated Woodpecker BBS detections increased from 6 to 143 (+2283%) from 1966-2018. Detections increased from 128 to 143 (+64%) from 1994-2018.

Table 8. FIDS with < 5 detections. Total detections and mean relative abundance (detections/point) of Barred Owl, Brown Creeper, Cerulean Warbler, and Veery. “% Pts” shows the percentage of 103 total points surveyed in which the species was detected.

Species	% Pts	2017		2018		2019		2017-2019		U.S. Pop Trend ³	MD Pop Trend ²	Climate Impact ¹
		Total	Mean	Total	Mean	Total	Mean	Total	Mean			
Barred Owl	3%	1	0.01	1	0.00	1	0.01	3	0.01	99%	?	
Brown Creeper*	1%		0.00			1	0.01	1	0.00	30%	?	↓
Cerulean Warbler*	1%	1	0.01					1	0.00	-72%	?	↑
Veery*	1%	1	0.01					1	0.00	-40%	-63%	↓↓

¹**U.S. Population Trend.** Source: Partners in Flight Populations Estimates database, 1970-2014 (<http://pif.birdconservancy.org/PopEstimates/>).

²**MD Population Trend.** Source: Breeding Bird survey data, 1966-2018 (<https://www.pwrc.usgs.gov/bbs/>).

³**Climate Impact.** Data from SWAP Appendix 6e (MD DNR 2016), Predictions of Species-Specific Habitat Shift due to Climate Change in the Northeast. KEY:

	Shaded indicates agreement among the majority of the 8 model/scenarios considered
↑ ↓	Moderate expected increase/decrease of species-specific habitat abundance in the region
↑↑ ↓↓	Large expected increase/decrease of species-specific habitat abundance in the region

Table 9. List of IBA Priority Species. FIDS are shown in **bold** font. Species of Greatest Conservation Need (SGCN) are designated with “*”.

American Redstart*	Cerulean Warbler*	Northern Parula*
Barred Owl	Chuck-will's-widow*	Prairie Warbler*
Black-and-white Warbler*	Common Nighthawk*	Prothonotary Warbler*
Black-billed Cuckoo	Eastern Whip-poor-will*	Red-headed Woodpecker*
Blue-winged Warbler*	Hooded Warbler*	Summer Tanager
Broad-winged Hawk*	Kentucky Warbler*	Wood Thrush*
Brown Creeper*	Louisiana Waterthrush*	Worm-eating Warbler*