

A YEAR-ROUND CENSUS

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Changes occurring in a bird community over the course of an entire year at one particular site are seldom documented. Fortunately, I had the time available to conduct such a year-long census in a natural area in southeastern New York State from March 1978 until March 1979. The study has some important practical applications in that it provides baseline data for use by interested birders in predicting the composition of the bird population at the site at any one point during the year. Finally, seeing that a natural area's ecological value is often narrowly determined on the basis of a sampling of its wildlife resources during only one particular time of the year, I decided that a broader, more sophisticated view of these resources was needed for a proper evaluation of the site's ecology.

SITE DESCRIPTION

The study site is located in Hastings-on-Hudson in suburban Westchester County, just north of New York City. The major natural features bordering this small village are the Hudson River to the west and the Saw Mill River valley to the east. In the northeast corner of Hastings is found one of the very few natural areas of any appreciable size remaining in this well-developed residential community. This wildlife haven consists of two contiguous parcels of land: undeveloped property belonging to Children's Village (a private organization) and Hastings' own Hillside Park. Centered on Hillside Park, a particular 45-acre section of this 100-acre tract was chosen as the study site for the wide range of habitats it represented, as well as its accessibility to the observer.

Lying to the east and northeast of the main body of the study site, the Children's Village property (hereafter CV for short) consists mostly of open oak woodland. The section within the study area includes not only a representative of this woodland, but also a small sumac grove, thickets of cat brier associated with second-growth oaks, maples and ashes, and a $\frac{1}{4}$ -acre vernal pond. An interesting glacial remnant, the vernal pond habitat includes such vegetation as willow, locust and phragmites, which are rare elsewhere in the study site. A great diversity of birds was recorded here including a "Brewster's" Warbler, a male Summer Tanager, and a Great Horned Owl. In fact, the whole CV section of the study site proved to be very productive for birds at all seasons. The heterogeneity of the vegetation in this section, producing a substantial "edge effect," is most likely the cause of this.

The remaining 38 acres or so of the study site are located to the west,

downslope of the topographically high CV section. On the upper eastern edge are found thickets similar to the ones noted above. They form the eastern border of a four-acre field known locally to birders and teenagers alike as "The Meadow." It is a very attractive open area with bayberry, sassafras, young oak, and maple saplings slowly succeeding the grasses which once formed the dominant vegetation. Farther to the west down a moderate slope lies a mature, mixed oak/beech forest. A lack of diversity of vegetation was responsible for the occurrence of few species of birds other than thrushes and woodpeckers in this section. At the base of this incline is a small stream flowing from springs to the north. Here the stream forms a delightful bottomland swamp with red maples and tulip trees overshadowing a diverse understory of dogwood, ironwood, birch and wild azalea. Lush patches of skunk cabbage and various ferns form the ground cover.

Following the stream south one comes upon a one-acre man-made body of water called Sugar Pond. Over 75 species of birds were recorded at this highly eutrophic pond during the course of the study, including a Prothonotary Warbler and a Common Snipe. To the south of the pond the stream flows into a remnant hemlock ravine and then out of the study site. The remainder of the study site includes the grassy areas surrounding an elementary school and a mature oak woodland.

STUDY METHODS

In order to adequately document the bird population occurring at this site over the course of the year, an intensive surveying program was undertaken. From 11 March 1978 through 10 March 1979 the study site was regularly censused by the author exactly 170 times, totalling 395 hours in the field. The distribution of the study days over the course of each month is indicated in Table 1. Censusing was performed more frequently during the fall and spring migration periods than during the summer and winter months, as more frequent coverage was required when relatively greater changes were occurring in the bird population. Sight and sound were both used in censusing the birds. The species, numbers of individuals and sex of the birds were recorded, as well as any incidental observations made on behavior or ecology—courtship displays, foraging substrate and interspecific relations. Wind speed and direction, cloud cover and temperature at the start and end of each study day were also noted.

A route of approximately 1.3 miles in length was carefully established, taking advantage of the preexisting trail system to allow full coverage of the study area. The route was followed once in the same direction from the same starting point each study day. Days on which it was raining or snowing heavily were consistently avoided because of reduced visibility. The time of starting each day was rigidly fixed—always

Figure 1--Monthly Species Totals

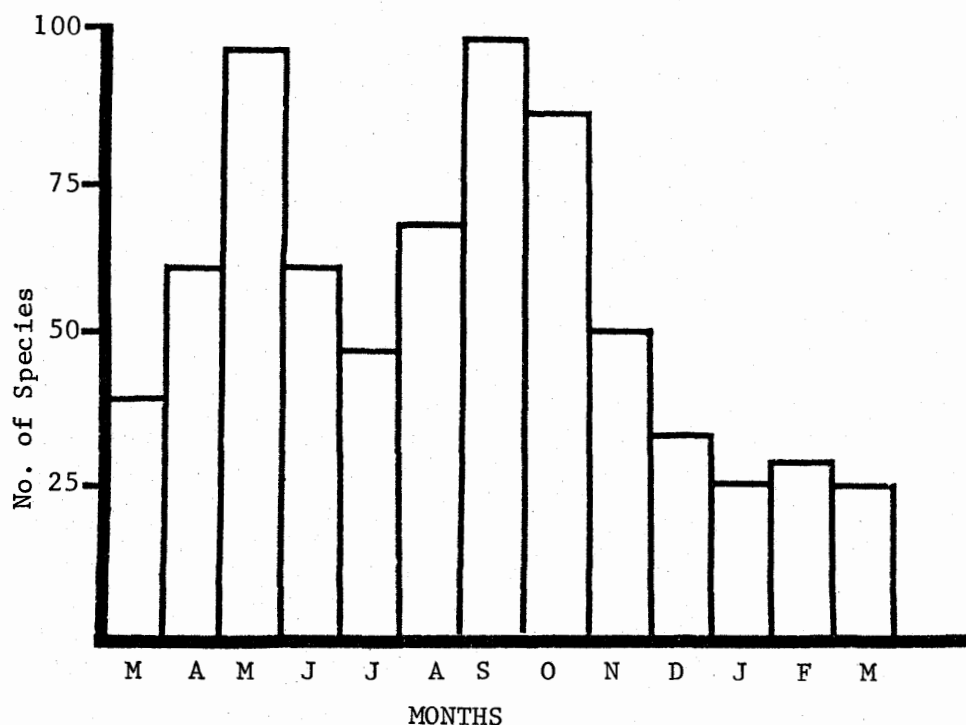


TABLE 1 — SUMMARY OF SPECIES OBSERVED
VS. NUMBER OF OBSERVATION DAYS

Month	M	A	M	J	J	A	S	O	N	D	J	F	M
No. Study Days	8	23	25	13	8	7	21	23	16	9	8	6	3
Total No. Species	39	61	96	61	46	67	97	86	50	33	25	27	25
Max. No. Species Per Study Day	29	38	58	39	35	46	47	42	31	20	18	17	22
Avg. No. Species Per Study Day	25	31	39	33	31	37	34	31	24	18	14	15	21

at dawn as soon as it was light enough to see. The amount of time spent thereafter in the field depended on the birds—the longer it took to adequately census them, the more time spent. A constant traversing speed was therefore not kept. An average of 2¼ hours was spent censusing on each study day. Minor deviations from the standard route were occasionally made as needed (such as when packs of wild dogs stood in the path), yet the order in which the various sections of the site were censused and the degree of coverage each received day to day were not altered.

RESULTS

A total of 139 species of birds plus one hybrid was recorded at the site during the study period. Three additional species—Kentucky Warbler, Cerulean Warbler and Philadelphia Vireo—reported during the study period by others frequenting the site were missed by the author. The largest number of species detected on a single day was 58 on 20 May 1978. The low of 11 species was recorded on both 3 January and 27 February 1979. These species per study day figures were combined to give monthly cumulative species values illustrated in Figure 1. The changes in species numbers indicated here are rather predictable, with peaks occurring during the spring and fall migration months and lows during the summer and winter months. The monthly maximum and average number of species detected per study day are included in Table 1. Plots of both these sets of figures closely follow the relationship with time shown by the plot of cumulative species detected per month in Figure 1. This indicates that the pattern of peaks and troughs exhibited in Figure 1 are not a mere artifact of census effort. The changes in species numbers are real, following a pattern which is intuitively correct.

The total number of individual birds detected was tallied for each study day. The figures for March through July were surprisingly similar, averaging 160 birds per study day. From August through November the figures were consistently higher than the previous five months, here averaging 270 birds per study day. This increase in numbers from earlier in the year is almost wholly due to the very large numbers of Red-winged Blackbirds passing over the site during this period. The highest count by far for the entire study period, recorded on 11 November 1978, was of 1,214 birds, including an estimated 988 Red-winged Blackbirds! Compare this with the study period average of 172 birds per study day. Finally, the months of December through February averaged 84 birds per study day, with the lowest study period count of 38 birds occurring on the cold, blustery morning of 18 January 1979. These low numbers are attributable to the movement of most birds out of the site by late November with the onset of winter conditions.

Table 2 illustrates the monthly occurrence of each of the 139 species. A small "y" after some of the species' names indicates if young or immatures were observed during the breeding season. The number in parentheses after each bird is the number of study days on which it was detected out of a maximum of 170. Note that even though these figures give no information about numbers of individuals recorded, they are very useful as indicators of the relative frequency of occurrence of a particular species during the course of the year.

One thing to keep in mind when using these figures, however, is that because censusing was limited exclusively to the morning hours, those birds most active during other times of the day may have been subject to under-representation. Those particularly affected are some hawks, active mostly later during the day especially during migration, and nocturnal birds such as nighthawks and owls. Another problem bird is the woodcock, usually detected only if flushed from very short distances. Finally the detection or identification of some birds was solely a function of calling rate. Those subject to this type of problem include the Fish Crow, *Empidonax* flycatchers and Ring-necked Pheasants. Unless they called, they usually were not counted.

DISCUSSION

A wide variety of birds was supported by the site during the course of the year. Each of the habitats attracted different birds during different seasons. Waterfowl made use of the limited open water at the site during migration and winter; shorebirds and herons frequented the muddy pond edges during the warmer months; woodpeckers worked dead trees in the swamp throughout the year; insectivorous birds found insects in the vegetation especially along the edges of habitats from spring through fall; and seedeaters searched the field and thicket areas, especially during winter. No two months of the year were ever alike, as the avian community was in an almost constant state of flux all year.

The spring migration began around 15 March, peaked sharply in May and effectively ended by mid-June. A handful of species such as the Wood Duck, Ring-necked Duck, Belted Kingfisher, Eastern Phoebe, Red-winged Blackbird, Rufous-sided Towhee and Fox Sparrow began arriving by the end of March, getting the migration off to a modest start. The first day during the migration period in which over 30 species were recorded was 5 April. The migration proceeded less slowly from there, with new arrivals occurring most frequently later in the month.

The first week of May did not differ greatly from the last week of April. Activity during the rest of May, however, was decidedly more intense than during the previous 5 or 6 weeks, with waves of numerous species invading the area, especially during mid-month. The center of activity at this time was Sugar Pond, with its abundance of insects both

in the water and in the surrounding vegetation attracting the mainly insectivorous migrants. By 31 May the monthly tally had reached 96 species. Migration continued on a diminished scale through early June with three new species and one hybrid bird being recorded for the season.

During the breeding season, the year-round resident birds were joined by twenty more species of birds, giving a total of 38 summer resident species. The birds were found to be more evenly distributed among the different habitats during the summer than during any other time of year. Between 15 June and 7 August young or immatures of 16 out of a total 38 or so species of possible breeding status were observed. This information, indicated in Table 2 by a small "y" following each of the 16 species' names, almost certainly indicates that these birds were nesting at the site. In addition active nests of two of these birds—Blue-winged Warbler and Black-and-white Warbler—were found.

The copulation of four species—Canada Goose, Yellow-billed Cuckoo, Tufted Titmouse and Scarlet Tanager—were recorded during the study period. The sequence observed with the Yellow-billed Cuckoos was particularly fascinating, being an excellent example of courtship feeding in birds. One of the pair of birds was first heard calling loudly in an ash tree near the border of Sugar Pond and the swamp. The pair of birds, both very quiet, was then observed in a large sassafras tree along the edge of the pond. The male, holding a large green insect larva in his beak, mounted the female there. During this 30-second copulation period the two held the larva jointly in their beaks. The female was left with the juicy larva to eat after the male dismounted.

A final point of interest concerning the breeding season is the occurrence of several species of "summer visitants." These six birds were: Green-backed Heron, Spotted Sandpiper, Black-billed Cuckoo, Belted Kingfisher, Barn Swallow and Northern Rough-winged Swallow. Occurring only once or twice during the breeding season, these birds were most likely wanderers from nearby breeding sites.

This study revealed some very interesting differences between the fall and spring migration periods. As noted earlier, the spring migration reached a sharp peak during the month of May. The fall migration, however, was characterized by a double peak of 97 species in September and 86 in October. This difference was due to the fact that many migrant species were present at the site for a longer period of time during the fall than during the spring. This point is especially well illustrated by the warblers, most of which were recorded during only a two or three-week period during the spring in May. During the fall, many of the same species were recorded over a five-week or even six-week period.

Another point of interest is the lesser degree to which different

species collected together at one point in time during the fall. This difference is evident in the study day counts. The concentrations of 50 or more species noted on several study days during May were never recorded during the fall. Instead, figures in the 40's and upper 30's were the case. These results can all be explained by the greater differential in departure dates occurring during the fall compared with the spring. This is partly due to the fact that newly-hatched immature birds and adults present during the fall often migrate at somewhat different times. Also, during the spring the drive for all species to reach the breeding grounds as soon as possible tends to collect the birds together during a short time interval. During the fall, no such drive to concentrate in this way seems to exist, with different species lingering longer than others before migrating south.

All these factors then helped produce a more protracted migration during the fall than during the spring. This did not make the fall less interesting, however. As expected, greater numbers and kinds of raptors were recorded during the fall than during the spring, due to seasonal differences in migration patterns. Also, surprises such as a White-eyed Vireo in the sumac grove in September, a Bufflehead and a Lincoln's Sparrow at Sugar Pond in October, and a Turkey Vulture stopping briefly in the trees near "The Meadow" in November, made the fall migration period exciting throughout.

The winter season turned out to be much more dynamic than anticipated. The year-round residents and a few winter residents (e.g., Dark-eyed Junco, White-throated Sparrow, and Field Sparrow) were joined sporadically throughout the season by an unexpectedly large number of non-resident wanderers. The Red-tailed Hawk, American Kestrel, Common Snipe, Great Horned Owl, Hermit Thrush, House Finch, and American Tree Sparrow are among the 15 winter visitants occurring irregularly at the site during this time. Presumably the need for birds to range over larger areas than normal, due to the increased difficulty of finding food during the winter, is the explanation. Some of the birds such as the Red-tailed Hawk undoubtedly traveled farther than others such as the House Finch, which probably wandered in from much shorter distances (such as one of the backyard feeders adjacent to the study site).

Sporadic appearances were also made by a few species of waterfowl. Their presence was dependent mainly on the availability of open water at the site, with nearby water bodies such as the Hudson River providing alternative resting and feeding sites. Finally, cyclically occurring invaders from the north such as the Common Redpoll and Pine Siskin were present at the site during one of the winters (1978) but not the other (1979). In short, any notion that the winter bird population at the site is fixed and unchanging was decidedly challenged by the results of this study.

CONCLUSION

Year-round monitoring provides one with a comprehensive view of a community of birds. Seasonal fluctuations in habitat use and differences between the fall and spring migration periods, for example, are revealed and best studied by using such an approach. Anyone visiting the site only occasionally would almost certainly have missed most of these phenomena and would therefore have a very limited understanding of the site's ecology.

Ecological assessment can be done only by considering the whole picture, not a partial one. The study produced many surprises, providing the author with a much deeper understanding of this small area. By the end of the period the study site had become a very special place indeed. Full appreciation of the value of something cannot come about without understanding it. To know intimately is to care intimately.

ACKNOWLEDGMENTS

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TABLE 2 — SPECIES RECORDED AT
HASTINGS-ON-HUDSON, NY 1978-1979

Species	No. Days	Month												
		M	A	M	J	J	A	S	O	N	D	J	F	M
Common Loon	(11)		X	X	X			X						
Double-crested Cormorant	(2)			X					X					
Mute Swan	(1)		X											
Canada Goose	(50)	X	X	X	X			X	X	X			X	X
Mallard	(75)	X	X	X	X			X	X	X	X	X		X
American Black Duck	(48)	X	X	X	X		X	X	X	X				X
Wood Duck	(43)	X	X	X			X	X	X	X				
Ring-necked Duck	(3)	X												
Bufflehead	(1)								X					
Turkey Vulture	(1)									X				
Sharp-shinned Hawk	(19)		X					X	X	X				
Northern Harrier	(5)			X				X	X					
Red-tailed Hawk	(6)							X			X	X	X	
Red-shouldered Hawk	(5)								X	X				
Broad-winged Hawk	(6)		X					X	X					
Osprey	(3)							X	X					
Merlin	(2)							X	X					
American Kestrel	(14)	X	X					X	X			X		
Ring-necked Pheasant	(42)	X	X	X				X			X			
Great Blue Heron	(4)		X	X			X							
Green-backed Heron	(2)				X	X								
Solitary Sandpiper	(3)			X										
Spotted Sandpiper	(6)			X		X								
Lesser Yellowlegs	(1)							X						
American Woodcock	(5)								X	X	X			
Common Snipe	(2)								X		X			
Herring Gull	(2)	X			X									
Ring-billed Gull	(96)	X	X	X	X	X	X	X	X	X	X	X	X	X
Rock Dove	(63)	X	X	X	X	X	X	X	X	X			X	X
Mourning Dove	(106)	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow-billed Cuckoo	(19)			X	X	X	X	X						
Black-billed Cuckoo	(9)			X	X			X						
Eastern Screech-Owl	(3)						X	X	X					
Great Horned Owl	(5)								X	X	X			
Common Nighthawk	(1)						X							
Chimney Swift	(48)		X	X	X	X	X	X	X					

Species	No. Days	Month												
		M	A	M	J	J	A	S	O	N	D	J	F	M
Ruby-throated Hummingbird	(6)			X			X	X						
Belted Kingfisher	(11)	X	X		X	X		X	X	X				
Common Flicker	(122)	X	X	X	X	X	X	X	X	X	X	X	X	
Pileated Woodpecker	(4)		X					X						
Red-bellied Woodpecker	(16)	X	X					X	X				X	X
Yellow-bellied Sapsucker	(4)							X	X					
Hairy Woodpecker	(79)	X	X	X	X	X	X	X	X	X	X		X	
Downy Woodpecker	(125)	X	X	X	X	X	X	X	X	X	X	X	X	X
Eastern Kingbird	(8)			X	X	X	X							
Great Crested Flycatcher	(35)			X	X	X	X	X						
Eastern Phoebe	(34)	X	X	X				X	X					
Least Flycatcher	(3)				X		X							
Eastern Wood-Pewee	(20)			X	X	X	X	X						
Olive-sided Flycatcher	(2)				X			X						
Barn Swallow	(23)		X	X		X	X							
Tree Swallow	(5)		X	X			X	X						
Northern Rough-wg. Swallow	(1)					X								
Blue Jay — y	(169)	X	X	X	X	X	X	X	X	X	X	X	X	X
American Crow	(170)	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Crow	(2)													X
Black-capped Chickadee	(140)	X	X	X	X	X	X	X	X	X	X	X	X	X
Tufted Titmouse — y	(151)	X	X	X	X	X	X	X	X	X	X	X	X	X
White-breasted Nuthatch	(130)	X	X	X	X	X	X	X	X	X	X	X	X	X
Brown Creeper	(23)	X	X					X	X	X	X			
House Wren — y	(63)			X	X	X	X	X	X					
Winter Wren	(24)		X					X	X	X				
Northern Mockingbird	(75)	X	X	X	X	X			X	X	X	X	X	X
Gray Catbird — y	(84)			X	X	X	X	X	X	X				
Brown Thrasher — y	(122)		X	X	X	X	X	X	X	X	X	X	X	
American Robin — y	(151)	X	X	X	X	X	X	X	X	X	X	X	X	X
Wood Thrush	(51)			X	X	X	X	X	X					
Hermit Thrush	(37)		X	X					X	X		X		
Swainson's Thrush	(27)			X	X		X	X	X					
Gray-cheeked Thrush	(3)			X					X					
Veery — y	(47)			X	X	X	X	X	X					
Eastern Bluebird	(3)		X							X				
Blue-gray Gnatcatcher	(11)		X	X			X	X						
Golden-crowned Kinglet	(11)	X	X						X	X				
Ruby-crowned Kinglet	(58)		X	X				X	X	X				

Species	No. Days	Month												
		M	A	M	J	J	A	S	O	N	D	J	F	M
Cedar Waxwing	(45)			X	X		X	X	X	X	X			
European Starling — y	(170)	X	X	X	X	X	X	X	X	X	X	X	X	X
Solitary Vireo	(17)		X	X				X	X					
White-eyed Vireo	(2)							X						
Yellow-throated Vireo	(3)			X										
Red-eyed Vireo	(51)			X	X	X	X	X	X					
Black-and-white Warbler — y	(70)		X	X	X	X	X	X	X					
Prothonotary Warbler	(1)		X											
Worm-eating Warbler	(3)			X			X							
Blue-winged Warbler — y	(43)			X	X	X	X	X						
["Brewster's" Warbler]	(2)				X									
Tennessee Warbler	(19)			X			X	X	X					
Nashville Warbler	(7)			X			X	X	X					
Northern Parula	(12)			X			X	X	X					
Yellow Warbler	(11)			X	X		X							
Magnolia Warbler	(21)			X	X		X	X	X					
Cape May Warbler	(3)			X				X						
Yellow-rumped Warbler	(61)		X	X				X	X	X				
Black-throated Green Warbler	(25)			X			X	X	X					
Black-throated Blue Warbler	(7)			X				X	X					
Blackburnian Warbler	(17)			X			X	X	X					
Chestnut-sided Warbler	(19)			X			X	X	X					
Bay-breasted Warbler	(8)			X				X	X					
Blackpoll Warbler	(29)			X	X		X	X	X					
Pine Warbler	(1)							X						
Prairie Warbler	(10)			X			X	X						
Palm Warbler	(28)		X	X				X	X					
Ovenbird	(28)			X	X		X	X						
Northern Waterthrush	(23)			X	X		X	X						
Common Yellowthroat	(68)			X	X	X	X	X	X					
Yellow-breasted Chat	(2)							X	X					
Mourning Warbler	(3)			X	X		X							
Hooded Warbler	(1)			X										
Wilson's Warbler	(9)			X				X						
Canada Warbler	(20)			X			X	X						
American Redstart	(46)			X	X		X	X	X					
House Sparrow	(75)	X	X	X	X	X	X	X	X	X	X		X	X
Bobolink	(1)			X										

Species	No. Days	Month												
		M	A	M	J	J	A	S	O	N	D	J	F	M
Red-winged Blackbird	(95)	X	X	X	X	X	X		X	X	X	X		X
Rusty Blackbird	(7)							X	X	X				
Common Grackle — y	(115)	X	X	X	X	X	X	X	X	X			X	X
Brown-headed Cowbird	(66)		X	X	X	X	X	X						
Northern Oriole — y	(44)			X	X	X	X	X						
Scarlet Tanager	(35)			X	X	X	X	X						
Summer Tanager	(1)			X										
Northern Cardinal — y	(166)	X	X	X	X	X	X	X	X	X	X	X	X	X
Rose-breasted Grosbeak — y	(33)			X	X	X	X	X						
Evening Grosbeak	(9)			X					X	X	X	X		
Indigo Bunting	(19)			X	X	X								
Purple Finch	(26)							X	X	X	X			
House Finch	(25)		X	X	X	X		X	X	X			X	
Common Redpoll	(5)	X												
Pine Siskin	(15)	X	X	X										
American Goldfinch	(149)	X	X	X	X	X	X	X	X	X	X	X	X	X
Rufous-sided Towhee — y	(113)	X	X	X	X	X	X	X	X					
Vesper Sparrow	(1)								X					
Dark-eyed Junco	(101)	X	X					X	X	X	X	X	X	X
American Tree Sparrow	(4)									X	X			
Chipping Sparrow	(23)		X	X				X	X	X				
Field Sparrow	(43)		X	X	X				X	X	X	X	X	
White-throated Sparrow	(118)	X	X	X			X	X	X	X	X	X	X	X
Fox Sparrow	(29)	X	X						X	X				
Lincoln's Sparrow	(1)								X					
Swamp Sparrow	(29)		X	X				X	X	X				
Song Sparrow — y	(127)	X	X	X	X	X	X	X	X	X	X	X	X	X
TOTAL SPECIES		39	61	96	61	46	67	97	86	50	33	25	27	25