U.S. Fish & Wildlife Service

American Woodcock

Population Status, 2016

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U.S. Fish and Wildlife Service
Division of Migratory Bird Management
Population and Habitat Assessment Branch
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Cover photograph: Woodcock captured at TamarracNational Wildlife Refuge, Minnesota by Kyle Daly.

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AMERICAN WOODCOCK POPULATION STATUS, 2016

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Abstract: American Woodcock Singing-ground Survey data for 2016 indicated that the index for singing American woodcock (*Scolopax minor*) males in both the Eastern and Central Management Regions were not significantly different from 2015. The 10-year (2006-2016) trends in the Eastern Management Region (-0.74%/year) and Central Management Region (-0.25%/year) were not significantly different from zero, suggesting stationary populations. Both regions had a significant long-term (1968-16) declining trend (-0.93%/year for the Eastern Management Region and -0.68 %/year for the Central Management Region). The 2015 recruitment index for the U.S. portion of the Eastern Region (1.38 immatures per adult female) was 7.3% less than the 2014 index and 15.4% less than the long-term regional index, while the recruitment index for the U.S. portion of the Central Region (1.19 immatures per adult female) was 14.1% less than the 2014 index and was 23.0% less than the long-term regional index. Estimates from the Harvest Information Program indicated that U.S. woodcock hunters in the Eastern Region spent 115,500 days afield and harvested 54,500 woodcock during the 2015-16 season, while in the Central Region, hunters spent 284,200 days afield and harvested 145,700 woodcock.

INTRODUCTION

The American woodcock is a popular game bird throughout eastern North America. The management objective of the U.S. Fish and Wildlife Service (FWS) is to increase populations of woodcock to levels consistent with the demands of consumptive and non-consumptive users (U.S. Fish and Wildlife Service 1990). Reliable annual population estimates, harvest estimates, and information on recruitment and distribution are essential for comprehensive woodcock management. Unfortunately, this information is difficult and often impractical to obtain. Woodcock are difficult to find and count because of their cryptic coloration, small size, and preference for areas with dense vegetation. The Singing-ground Survey (SGS) was developed to provide indices to changes in abundance. The Wing-collection Survey (WCS) provides annual indices of woodcock recruitment. The Harvest Information Program (HIP) utilizes a sampling frame of woodcock hunters to estimate harvest and days spent afield.

This report summarizes the results of these surveys and presents an assessment of the population status of woodcock as of early June 2016. The report is intended to assist managers in regulating the sport harvest of woodcock and to draw attention to areas where management actions are needed. Historical woodcock hunting regulations are summarized in Appendix A.

The primary purpose of this report is to facilitate the prompt distribution of timely information. Results are preliminary and may change with the inclusion of additional data.

METHODS

Woodcock Management Regions

Woodcock are managed on the basis of two regions or populations, Eastern and Central, as recommended by Owen et al. (1977; Fig. 1). Coon et al. (1977) reviewed the concept of management units for woodcock and recommended the current configuration over several alternatives. This configuration was biologically justified because analysis of band recovery data indicated that there was little crossover between the regions (Krohn et al. 1974, Martin et al. 1969). Furthermore, the boundary between the two regions conforms to the boundary between the Atlantic and Mississippi Flyways. The results of the Wing-collection and Singing-ground surveys, as well as the Harvest Information Program, are reported by state or province, and management region. Although state and province level results are included in this report, analyses are designed to support management decisions made at the management region scale.

Singing-ground Survey

The Singing-ground Survey was developed to exploit the conspicuous courtship display of the male woodcock. Early studies demonstrated that counts of singing males provide indices to woodcock populations and could be used to monitor annual changes (Mendall and Aldous 1943, Goudy 1960, Duke 1966, and Whitcomb 1974). Before 1968, counts were conducted on non-randomly-located routes. Beginning in 1968, routes were relocated along lightly-traveled secondary roads in the center of randomly-chosen 10-minute

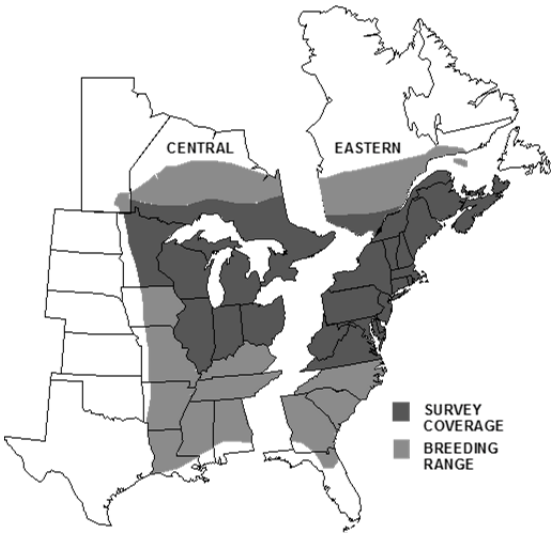

Fig. 1. Woodcock management regions, breeding range, and Singing-ground Survey coverage.

degree blocks within each state and province in the central and northern portions of the woodcock's breeding range (Fig. 1). Data collected prior to 1968 are not included in this report.

Each route was 3.6 miles (5.4 km) long and consisted of 10 listening points. The routes were surveyed shortly after sunset by an observer who drove to each of the 10 stops and recorded the number of woodcock heard peenting (the vocalization by displaying male woodcock on the ground). Acceptable dates for conducting the survey were assigned by latitude to coincide with peaks in courtship behavior of local woodcock. In most states and provinces, the peak of courtship activity (including local woodcock and woodcock still migrating) occurred earlier in the spring and local reproduction may have already been underway when the survey was conducted. However, it was necessary to conduct the survey during the designated survey dates in order to minimize the counting of migrating woodcock. Because adverse weather conditions may affect courtship behavior and/or the ability of observers to hear woodcock, surveys were only conducted when wind, precipitation, and temperature conditions were within prescribed limits.

The survey consists of about 1,500 routes. To avoid expending unnecessary resources and funds, approximately two-thirds of these routes are to be surveyed each year. The remaining routes are carried as "constant zero" routes. Routes for which no woodcock are heard for 2 consecutive years enter this constant zero status and are not run for the next 5 years. If woodcock are heard on a constant zero route during its next survey, the route reverts to normal status and is surveyed again each year. Data from constant zero routes are included in the analysis only for the years they were actually surveyed. Sauer and Bortner (1991) reviewed the implementation and analysis of the Singing-ground Survey in more detail.

Trends were estimated using a hierarchical model. Sauer et al. (2008) describe a hierarchical log-linear model for estimation of population change from SGS data. In practice, the hierarchical modeling approach provides trend and annual index values that are generally comparable to the estimates provided by the previously used route regression approach (see Link and Sauer 1994 for more information on the route regression approach). The hierarchical model, however, has a more rigorous and realistic theoretical basis than the weightings used in the route regression approach.

With the hierarchical model, the log of the expected value of the counts is modeled as a linear combination of strata-specific intercepts and year effects, a random effect for each unique combination of route and observer, a start-up effect on the route for first year counts by new observers, and overdispersion. In the hierarchical model, the parameters of interest are treated as random and are assumed to follow distributions that are governed by additional parameters. The hierarchical model is fit using Bayesian methods. Markov-chain Monte Carlo methods are used to iteratively produce sequences of parameter estimates which can be used to describe the distribution of the parameters of interest. After an initial "burn-in" period, means, medians, and credible (or Bayesian confidence) intervals (CI) for the parameters can be estimated from the replicates. Annual indices are defined as exponentiated strata, underlying trend, and year effects, which are then weighted by the proportion of routes where at least 1 woodcock was observed between 1968 and the present. Trends are defined as ratios of the indices at the start and end of the interval of interest, taken to the appropriate power to estimate a yearly change (Sauer et al. 2008). Trend estimates are expressed as percent change per year, while indices are expressed as the number of singing males per route. Annual indices were calculated for the 2 regions and each state and province, while short-term (2015-16), 10-year (2006-16) and long-term (1968-2016) trends were evaluated for each region as well as for each state or province.

Credible Intervals are used to describe uncertainty around the estimates when fitting hierarchical models. If the CI does not overlap 0 for a trend estimate, the trend is considered significant. We present the median and 95% CIs of 10,000 estimates (i.e., we simulated 10,000 replicates and thinned by 2), which were calculated after an initial 20,000 iterations to allow the series to converge. Refer to Sauer et al. 2008) and Link and Sauer (2002) for a detailed description of the statistical model and fitting process.

The reported sample sizes are the number of routes on which trend estimates are based, which includes any route on which woodcock were ever encountered. Each route was to be surveyed during the peak time of daily singing activity. For editing purposes, "acceptable" times were between 22 and 58 minutes after sunset (or, between 15 and 51 minutes after sunset on overcast evenings). Due to observer error, some stops on some routes were surveyed before or after the peak times of singing activity. Earlier analysis revealed that routes with 8 or fewer acceptable stops tended to be biased low. Therefore, only route observations with at least 9 acceptable stops were included in the analysis. Routes for which data were received after 25 July 2016 were not included in this analysis but will be included in future trend estimates.

Wing-collection Survey

The primary objective of the Wing-collection Survey is to provide data on the reproductive success of woodcock. The survey is administered as a cooperative effort between woodcock hunters, the FWS, and state wildlife agencies. Participants in the 2015 survey included hunters who either: (1) participated in past surveys; (2) were a subset of hunters that indicated on the Harvest Information Program Survey that they hunted woodcock, or (3) contacted the FWS to volunteer for the survey.

Wing-collection Survey participants were provided with prepaid mailing envelopes and asked to submit one wing from each woodcock they bagged. Hunters were asked to record the date of the hunt as well as the state and county where the bird was shot. Hunters were not asked to submit envelopes for unsuccessful hunts. The age and gender of birds were determined by examining plumage characteristics (Martin 1964, Sepik 1994) during the annual woodcock wingbee conducted by state, federal, and private biologists.

The ratio of immature birds per adult female in the harvest provides an index to recruitment of young into the population. The 2015 recruitment index for each state with $\geq$ 125 submitted wings was calculated as the number of immatures per adult female. The regional indices for 2015 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2014.

Harvest Information Program

The Harvest Information Program (HIP) was cooperatively developed by the FWS and state wildlife agencies to provide reliable annual estimates of hunter activity and harvest for all migratory game birds (Elden et al. 2002). In the past, the annual FWS migratory bird harvest survey (Mail Questionnaire Survey) was based on a sampling frame that consisted solely of hunters who purchased a federal duck stamp. However, people that hunt only non-waterfowl species such as woodcock and doves were not required to purchase a duck stamp, and therefore were not included in that sampling frame. The HIP sampling frame consists of all migratory game bird hunters, thus providing more reliable estimates of woodcock hunter numbers and harvest than we have had in the past. Under this program, state wildlife agencies collect the name, address, and additional information from each migratory bird hunter in their state, and send that information to the FWS. The FWS then selects random samples of those hunters and asks them to voluntarily provide detailed information about their hunting activity. For example, hunters selected for the woodcock harvest survey are asked to complete a daily diary about their woodcock hunting and harvest during the current year's hunting season. Their responses are then used to develop nationwide woodcock harvest estimates. HIP survey estimates of woodcock harvest have been available for woodcock since 1999. Although estimates from 1999-2002 have been finalized, the estimates from 2003-15 should be considered preliminary as refinements are still being made in the sampling frame and estimation techniques. Canadian hunter and harvest estimates, which were obtained through the Canadian National Harvest Survey Program, are presented in Appendix B (Gendron and Smith 2016).

RESULTS AND DISCUSSION

Singing-ground Survey

Data for 820 routes were submitted by 25 July 2016 (Table 1). Short-term, 10-year (2006-16), and long-term (1968-2016) trends were estimated using data from 787 routes in the Eastern Region and 740 routes in the Central Region. Short-term analysis indicated that the number of woodcock heard singing during the 2016 Singing-ground Survey was not significantly different from last year for the Eastern or Central Management Regions (Table 1). Trends for individual states and provinces are reported in Table 1. Consistency in route coverage over time is a critical component of precision in estimation of population change. Low precision of 2-year change estimates reflect the low numbers of routes surveyed by the same observer in both years. Ensuring that observers participate for several years on the same route would greatly enhance the quality of the results.

The 10-year trend (2006-2016) showed no significant decline in the Eastern or Central Management Regions (Table 1, Fig. 2). Last year the 10-year trend (2005-2015) showed a significant decline in the Eastern but not the Central Management Region.

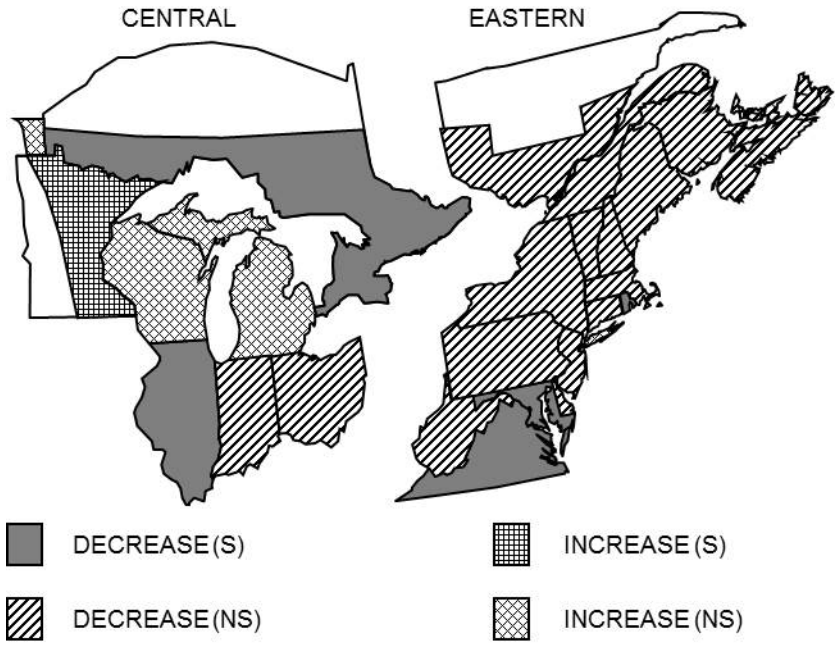

Fig. 2. Ten-year trends in the number of American woodcock heard on the Singing-ground Survey, 2006-2016, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. Note, Minnesota is the only state or province that had a significant increasing trend.

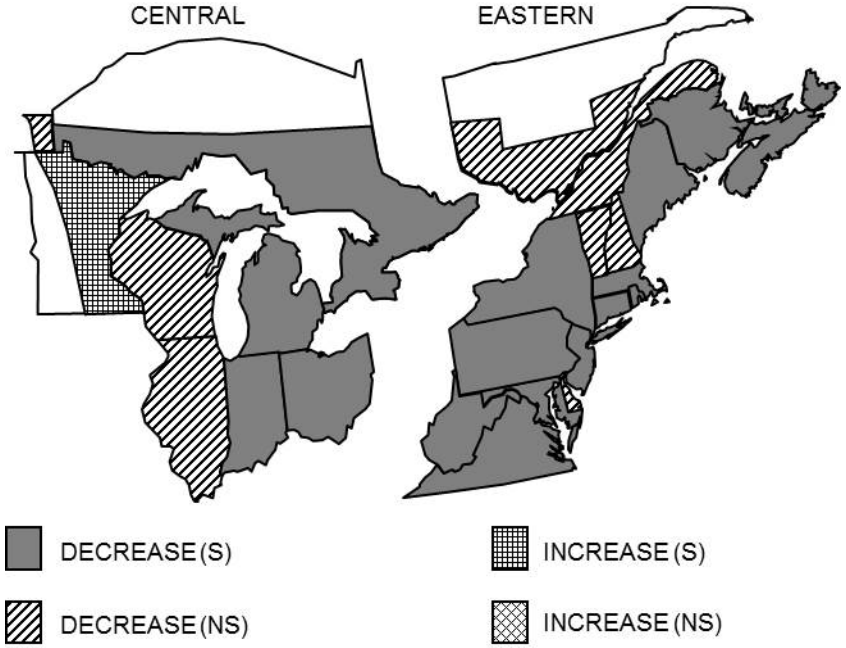

Fig. 3. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968-2016, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. Note, Minnesota is the only state or province that had a significant increasing trend.

Many states and/or provinces in both management regions have experienced significant long-term (1968-2016) declines as measured by the Singing-ground Survey (Table 1, Fig. 3). The long-term trend estimate, rounded to the nearest hundredth of a percent, was -0.93 %/year for the Eastern Management Region, while it was -0.68%/year for the Central Management Region (Table 1).

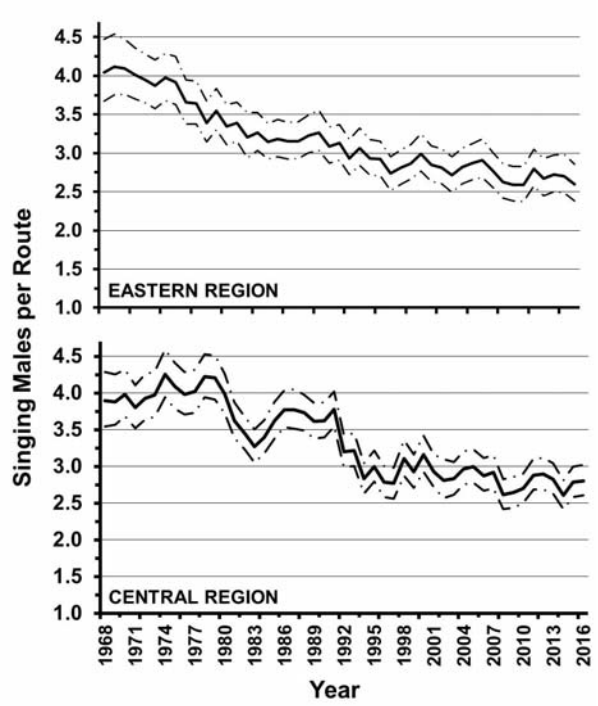

Fig. 4. Annual indices of the number of woodcock heard during the Singing-ground Survey, 1968-2016 as estimated using hierarchical modeling. The dashed lines represent the 95% credible interval of the estimate.

In the Eastern Region, the 2016 index was 2.58 singing males per route, while it was 2.81 in the Central Management Region (Figure 4, Table 2). Annual indices (1968-2016) by state, province, or region are available in Table 2.

Wing-collection Survey

A total of 1,109 woodcock hunters (Table 3) from states with a woodcock season sent in a total of 11,330 usable woodcock wings for the 2015 Wing-collection Survey (Table 4).

The 2015 recruitment index in the U.S. portion of the Eastern Region (1.38 immatures per adult female) was 7.3% less than the 2014 index of 1.49, and 15.4% less than the long-term (1963-14) regional average of 1.63 (Table 4, Fig 5). In the Central Region, the 2015 recruitment index (1.19 immatures per adult female) was 14.1% less than the 2014 index of 1.39 and was 23.0% less than the long-term regional average of 1.55 (Table 4, Fig 5). Percent change for all comparisons was calculated using unrounded recruitment indices.

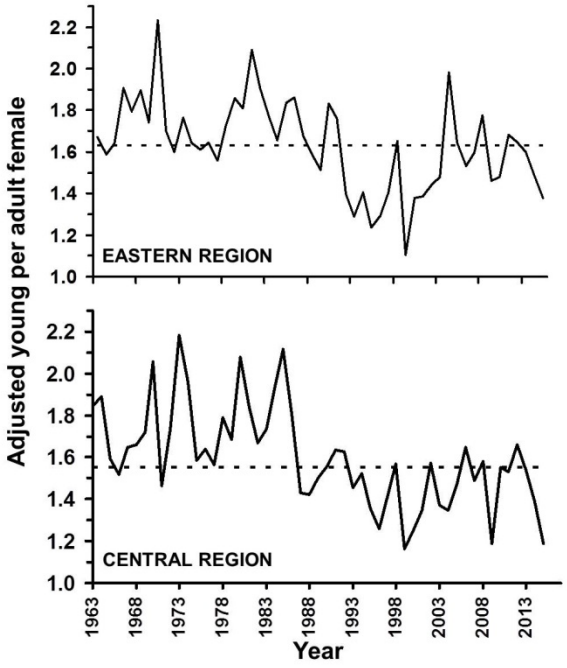

Fig. 5. Weighted annual indices of recruitment (U.S.), 1963-2015. The dashed line is the 1963-2014 average.

Harvest Information Program

Estimates of woodcock harvest, number of active hunters, days afield, and seasonal hunting success from the 2015-16 HIP survey are provided in Table 5. In the Eastern Management Region, woodcock hunters spent an estimated 115,500 days afield (Figure 6) and harvested 54,500 birds (Figure 7) during the 2015-16 hunting season. Harvest in 2015-16 was 34.9% less than the long-term (1999-2014) average (83,769 birds/year) and 7.0% less than last year (58,600 birds) in the Eastern Region. Woodcock hunters in the Central Region spent an estimated 284,200 days afield (Figure 6) and harvested 145,700 birds (Figure 7) during the 2015-16 hunting season. Harvest in 2015-16 was 33.1% less than the long-term (1999-2014) average (217,669 birds/year), but 3.0% greater than last year (141,500 birds) in the Central Region.

Although HIP provides statewide estimates of woodcock hunter numbers, it is not possible to develop regional estimates due to the occurrence of some hunters being registered for HIP in more than one state. Therefore, regional estimates of seasonal hunting success rates cannot be determined on a per hunter basis. All estimates have been rounded to the nearest hundred.

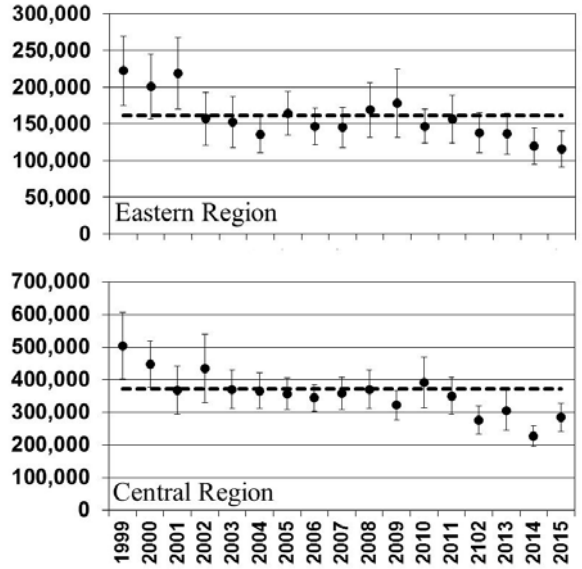

Fig. 6. Harvest Information Program Survey estimates of days spent afield by U.S. woodcock hunters, 1999-2015. The dashed line represents the 1999-2014 average and error bars represent the 95% confidence interval of the point estimate.

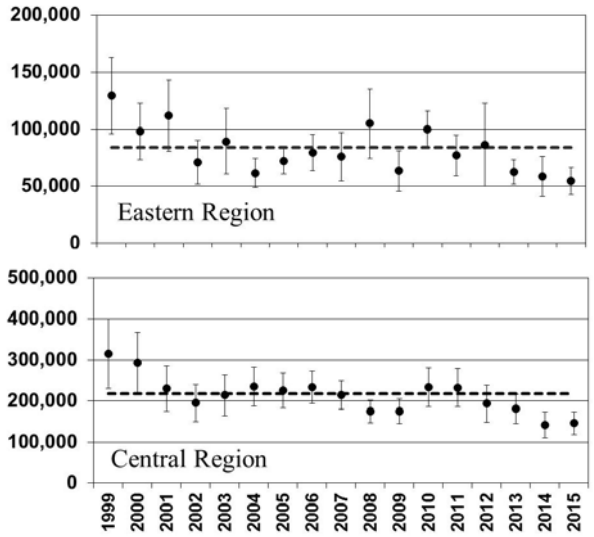

Fig. 7. Harvest Information Program Survey estimates of U.S. woodcock harvest, 1999-2015. The dashed line represents the 1999-2014 average and the error bars represent the 95% confidence interval of the point estimate.

Data from Canada show a long-term decline in both the number of successful woodcock hunters and harvest (Appendix B). The most recent data available indicate that an estimated 4,286 successful hunters harvested 25,619 woodcock during the 2015-16 season in Canada (Gendron and Smith 2016; Appendix B).

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Table 1. Short-term (2015-16), 10-year (2006-2016), and long-term (1968-2016) trends (% change per year[a]) in the number of American woodcock heard during the Singing-ground Survey as determined by using the hierarchical log-linear modeling technique (Sauer et al. 2008).

State, Province, or Region	Number of routes[b]	2015-2016				2006-2016			1968-2016		
				95% CI[d]			95% CI[d]			95% CI[d]	
		n[c]	% change	lower	upper	% change	lower	upper	% change	lower	upper
CT	5	11	1.44	-33.95	74.57	-1.51	-5.49	5.40	-2.75	-4.64	-0.86
DE[e]	1	3	------	------	------	-3.29	-21.03	18.74	-3.91	-9.46	1.27
ME	53	73	12.92	-4.85	36.06	-0.82	-2.64	1.18	-1.04	-1.55	-0.55
MD	5	26	-3.65	-26.31	29.03	-4.04	-7.05	-1.19	-3.89	-5.39	-2.44
MA	8	22	-4.01	-28.82	23.83	-2.33	-5.16	0.77	-2.39	-3.39	-1.39
NB	54	72	7.60	-12.11	31.96	-1.32	-3.41	0.80	-0.75	-1.54	-0.05
NH	11	18	4.43	-19.44	42.45	-0.60	-3.41	2.25	-0.47	-1.48	0.53
NJ	3	19	6.52	-38.27	112.55	-5.72	-11.09	0.46	-6.05	-7.60	-4.43
NY	72	115	-2.39	-16.74	14.30	-0.21	-1.82	1.65	-0.74	-1.19	-0.28
NS	45	63	7.28	-11.44	32.60	-0.11	-2.19	2.20	-0.90	-1.61	-0.22
PA	29	82	1.84	-20.67	31.92	-0.40	-2.97	2.50	-0.99	-1.70	-0.25
PEI	9	13	-12.28	-43.37	19.78	-2.84	-7.56	0.68	-1.46	-2.82	-0.11
QUE	14	111	0.72	-13.01	20.45	-0.48	-2.04	1.40	-0.61	-1.35	0.16
RI[e]	1	3	------	------	------	-12.05	-21.29	-1.69	-11.88	-17.76	-6.34
VT	18	24	17.18	-14.35	63.66	-1.31	-4.49	1.97	-0.60	-1.53	0.38
VA	18	75	-5.21	-39.59	50.10	-5.98	-10.60	-1.85	-5.66	-6.83	-4.60
WV	19	57	-0.62	-19.12	26.89	-2.21	-4.37	0.47	-2.36	-3.17	-1.57
Eastern	365	787	3.81	-3.19	12.10	-0.74	-1.50	0.08	-0.93	-1.21	-0.65
IL	29	46	-45.24	-80.98	50.60	-10.54	-20.16	-1.03	-1.17	-3.86	1.75
IN	11	62	1.27	-38.08	77.46	-3.03	-7.66	2.81	-4.07	-5.28	-2.92
MB[f]	19	30	-7.89	-33.67	23.96	0.86	-2.54	4.78	-0.15	-1.92	1.56
MI	115	155	-3.79	-14.71	8.77	0.11	-1.24	1.53	-0.75	-1.11	-0.37
MN	73	122	16.42	-0.92	36.94	2.43	0.67	4.27	0.80	0.23	1.44
OH	40	73	-6.27	-27.09	17.58	-1.56	-4.15	1.04	-1.50	-2.20	-0.77
ON	89	161	-0.75	-14.66	15.32	-1.85	-3.59	-0.10	-0.93	-1.39	-0.47
WI	79	121	1.17	-14.01	19.09	0.43	-1.37	2.30	-0.35	-0.84	0.14
Central	455	740	0.82	-6.18	8.24	-0.25	-1.10	0.57	-0.68	-0.93	-0.44
Continent	820	1,527	2.27	-2.77	7.74	-0.48	-1.07	0.08	-0.81	-1.00	-0.62

[a] Median of route trends estimated used hierarchical modeling. To estimate the total percent change over several years, use: $(100((\%\ change/100)+1)^{y})-100$, where y is the number of years. Note: extrapolating the estimated trend statistic (% change per year) over time (e.g., 30 years) may exaggerate the total change over the period.
[b] Total number of routes surveyed in 2016 for which data were received by 25 July 2016.
[c] Number of routes with at least one year of non-zero data between 1968 and 2016.
[d] 95% credible interval, if the interval overlaps zero, the trend is considered non-significant.
[e] Insufficient data to calculate trends.
[f] Manitoba began participating in the Singing-ground Survey in 1992.

Table 2. Breeding population indices (singing-males per route) for American woodcock from the Singing-ground Survey, 1968-2016. These indices are based on 1968-2016 trends that were estimated using hierarchical modeling techniques. Dashes indicate no data were available for that year.

State, Province, or Region	Year															
	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Eastern Region																
CT	-----	2.58	2.71	2.40	2.59	2.36	2.36	2.41	1.90	1.93	1.62	1.72	1.71	1.71	1.91	1.66
DE	1.08	0.87	1.14	0.72	0.90	1.08	0.94	1.69	0.50	0.67	0.49	0.54	0.68	0.64	0.62	0.97
ME	6.23	6.17	6.82	6.21	6.14	6.33	6.56	6.82	6.39	5.35	5.25	5.80	5.02	5.75	4.46	4.94
MD	1.86	1.85	1.73	1.68	1.60	1.55	1.49	1.44	1.32	1.30	1.26	1.21	1.21	1.15	1.09	1.01
MA	-----	3.33	3.32	3.34	3.01	3.28	3.08	2.70	2.65	2.64	2.57	2.66	2.38	2.51	2.29	2.13
NB	-----	8.68	8.54	7.85	7.80	7.24	7.84	8.36	6.47	7.78	5.91	6.42	5.39	6.13	6.70	5.91
NH	-----	3.96	4.22	3.75	4.26	3.57	4.08	3.86	3.82	3.84	3.75	3.63	3.98	3.86	3.33	3.42
NJ	4.62	4.42	4.65	5.94	4.28	5.26	4.86	3.98	2.84	2.86	2.36	2.87	2.12	1.98	1.84	1.94
NY	4.32	4.49	3.93	4.29	4.11	4.21	4.28	3.81	3.88	3.86	3.48	3.80	4.14	3.96	3.58	3.88
NS	4.31	3.78	3.22	3.87	3.62	3.81	3.98	3.77	3.70	3.62	3.92	3.43	3.40	3.14	2.99	3.27
PA	1.97	1.84	2.07	1.99	1.96	1.94	1.69	1.75	1.75	1.73	1.65	1.84	1.55	1.52	1.50	1.53
PEI	-----	5.26	5.24	5.90	4.81	4.82	5.04	6.07	5.20	4.98	4.76	4.85	4.10	3.89	3.97	4.48
QUE	-----	-----	-----	5.99	6.05	5.87	5.91	5.84	5.73	5.68	5.89	5.90	5.84	5.64	5.59	5.66
RI	-----	2.00	1.75	2.08	1.62	1.45	1.20	1.02	0.89	0.79	0.64	0.60	0.53	0.45	0.44	0.37
VT	-----	3.30	3.99	3.59	4.06	3.53	3.93	4.19	4.31	4.36	3.32	3.60	3.37	2.97	2.25	2.91
VA	-----	1.39	1.41	1.19	1.10	0.93	1.17	1.02	0.96	0.93	0.80	0.78	0.66	0.73	0.72	0.63
WV	1.54	1.54	1.43	1.39	1.45	1.37	1.32	1.32	1.26	1.20	1.09	1.17	1.12	1.18	1.11	1.08
Region	**4.04**	**4.12**	**4.10**	**4.02**	**3.95**	**3.87**	**3.97**	**3.92**	**3.66**	**3.64**	**3.39**	**3.55**	**3.35**	**3.39**	**3.21**	**3.26**
Central Region																
IL	-----	-----	0.23	0.46	0.41	0.30	0.43	0.34	0.21	0.29	0.46	0.31	0.24	0.45	0.28	0.79
IN	1.48	1.06	1.03	0.83	1.18	1.07	0.95	0.80	0.82	0.75	0.77	0.94	0.75	0.83	0.59	0.62
MB	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
MI	7.38	7.33	7.30	6.84	6.90	7.16	8.02	8.04	7.63	7.16	7.70	7.58	7.30	6.43	6.75	5.74
MN	-----	2.90	2.83	3.20	3.03	3.45	4.06	3.63	3.70	3.81	4.04	3.66	4.28	3.73	3.75	3.25
OH	-----	-----	1.61	1.50	1.49	1.37	1.52	1.32	1.49	1.41	1.33	1.20	1.25	1.35	1.17	1.21
ON	8.06	8.92	9.46	8.62	9.41	9.11	9.19	8.76	8.84	9.11	9.34	9.67	9.06	8.28	7.05	7.01
WI	3.50	3.54	4.06	3.84	3.83	4.04	4.09	4.19	3.80	4.21	4.36	4.55	3.70	3.14	3.30	3.16
Region	**3.90**	**3.88**	**3.99**	**3.80**	**3.93**	**3.98**	**4.26**	**4.09**	**3.98**	**4.02**	**4.22**	**4.21**	**3.99**	**3.62**	**3.45**	**3.28**
Continent	**3.97**	**4.01**	**4.04**	**3.91**	**3.94**	**3.93**	**4.11**	**4.01**	**3.82**	**3.83**	**3.81**	**3.88**	**3.67**	**3.51**	**3.33**	**3.27**

Table 2. Continued

State,Province, or Region	Year															
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Eastern Region																
CT	1.55	1.58	1.65	1.43	1.67	1.31	1.33	1.36	1.25	1.12	1.19	1.26	1.26	1.11	1.08	1.16
DE	0.49	0.51	0.53	0.51	0.50	0.48	0.60	0.32	0.32	0.41	0.40	0.38	0.41	0.39	0.58	0.30
ME	4.98	5.11	5.44	5.76	5.26	5.47	4.38	4.97	4.27	4.60	4.27	4.36	3.72	4.00	3.97	4.32
MD	0.99	0.95	0.89	0.86	0.83	0.81	0.77	0.74	0.69	0.69	0.66	0.63	0.62	0.58	0.54	0.52
MA	2.24	2.22	2.14	2.12	2.06	1.94	1.90	1.88	1.76	1.72	1.71	1.68	1.63	1.64	1.58	1.75
NB	5.33	5.58	4.76	5.17	5.97	7.08	6.02	5.59	5.48	6.51	6.64	6.22	5.41	6.06	6.04	6.86
NH	3.26	3.50	4.35	3.72	3.65	3.58	3.37	3.65	3.35	3.35	3.37	3.72	3.62	3.57	3.54	3.76
NJ	2.01	1.86	1.66	1.91	1.43	1.36	1.30	1.15	1.03	0.93	0.80	0.94	0.89	0.70	0.76	0.80
NY	3.42	3.85	3.60	3.45	3.71	3.32	3.73	3.76	3.48	3.42	3.06	3.14	3.02	3.09	3.14	3.20
NS	3.04	3.27	3.37	2.97	3.25	3.22	2.98	3.23	3.22	3.26	2.95	3.15	3.17	2.96	3.04	3.38
PA	1.59	1.51	1.58	1.51	1.46	1.42	1.55	1.74	1.43	1.51	1.35	1.46	1.42	1.36	1.53	1.41
PEI	4.51	4.45	4.72	3.99	4.49	4.70	4.13	4.06	4.00	3.84	3.60	3.81	4.15	4.00	3.80	3.54
QUE	5.56	5.49	5.47	5.52	5.63	5.67	5.44	5.34	5.34	5.43	5.34	5.16	4.96	5.04	5.23	5.15
RI	0.33	0.28	0.24	0.22	0.19	0.17	0.15	0.13	0.12	0.10	0.09	0.08	0.07	0.06	0.05	0.05
VT	2.91	2.68	2.88	3.26	3.54	3.43	3.20	3.31	2.43	2.75	2.63	2.61	2.53	2.63	2.89	3.28
VA	0.83	0.50	0.54	0.52	0.46	0.41	0.43	0.40	0.41	0.38	0.35	0.30	0.29	0.31	0.26	0.27
WV	1.04	1.00	0.99	0.97	0.94	0.91	0.93	0.87	0.86	0.83	0.82	0.84	0.78	0.77	0.74	0.74
Region	**3.15**	**3.18**	**3.15**	**3.16**	**3.23**	**3.26**	**3.09**	**3.13**	**2.93**	**3.07**	**2.93**	**2.92**	**2.74**	**2.81**	**2.87**	**2.99**
Central Region																
IL	0.39	0.75	0.62	1.14	0.34	0.54	0.27	0.57	0.35	0.48	0.29	0.23	0.28	0.23	0.28	0.36
IN	0.60	0.58	0.66	0.61	0.54	0.49	0.61	0.58	0.54	0.45	0.44	0.40	0.38	0.37	0.44	0.39
MB	-----	-----	-----	-----	-----	-----	-----	-----	5.46	5.51	5.73	5.98	5.17	3.73	4.53	4.48
MI	6.51	6.64	6.91	6.47	6.88	6.61	6.67	7.34	5.76	5.84	5.20	5.72	5.48	5.31	6.27	5.27
MN	3.25	3.56	3.71	3.72	4.13	3.41	4.10	4.00	3.37	3.44	3.12	3.19	3.11	2.83	3.27	3.39
OH	1.24	1.15	1.13	1.11	1.18	1.02	1.26	1.16	1.15	1.06	1.05	1.02	1.04	0.91	1.04	0.89
ON	7.01	7.83	8.02	7.86	7.96	8.03	7.60	7.70	7.19	6.96	6.03	6.56	5.43	6.06	6.38	5.90
WI	3.50	3.44	3.93	3.99	3.72	3.80	3.60	3.62	2.94	3.08	2.70	2.79	2.75	2.63	2.81	3.18
Region	**3.39**	**3.62**	**3.78**	**3.77**	**3.73**	**3.62**	**3.63**	**3.78**	**3.20**	**3.22**	**2.83**	**3.00**	**2.79**	**2.77**	**3.10**	**2.93**
Continent	**3.27**	**3.40**	**3.46**	**3.46**	**3.48**	**3.44**	**3.36**	**3.45**	**3.07**	**3.14**	**2.88**	**2.96**	**2.76**	**2.79**	**2.99**	**2.96**

Table 2. Continued

State, Province, or Region	Year															
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Eastern Region																
CT	1.03	0.96	0.89	0.90	0.87	0.84	0.79	0.80	0.81	0.77	0.75	0.84	0.82	0.73	0.75	0.67
DE	0.42	0.28	0.30	0.27	0.28	0.27	0.22	0.22	0.22	0.22	0.21	0.20	-----	0.18	0.17	-----
ME	4.47	3.98	3.70	4.00	4.10	4.18	4.06	3.73	3.76	3.65	3.91	3.98	3.94	3.86	3.68	3.32
MD	0.52	0.52	0.47	0.46	0.44	0.42	0.42	0.39	0.38	0.36	0.35	0.33	0.32	0.31	0.30	0.28
MA	1.59	1.49	1.49	1.45	1.50	1.36	1.36	1.26	1.33	1.29	1.22	1.18	1.11	1.09	1.08	1.13
NB	6.35	6.73	6.45	7.04	7.01	7.72	6.93	6.31	6.05	5.46	7.09	6.60	7.23	6.73	6.33	5.64
NH	3.30	3.39	3.35	3.62	3.63	3.60	3.38	2.88	2.94	3.42	3.40	3.05	3.37	3.29	3.37	3.02
NJ	0.70	0.66	0.54	0.59	0.46	0.41	0.41	0.42	0.36	0.41	0.26	0.33	0.36	0.31	0.28	0.21
NY	3.03	2.96	2.91	3.03	3.24	2.98	3.08	2.88	2.76	2.99	3.21	2.95	3.06	3.07	2.90	3.09
NS	3.36	3.17	2.91	2.88	3.16	2.98	2.83	2.82	2.70	2.68	3.09	2.74	3.10	3.38	3.11	2.61
PA	1.14	1.36	1.35	1.34	1.37	1.40	1.27	1.23	1.39	1.37	1.47	1.28	1.15	1.09	1.24	1.20
PEI	3.81	3.60	3.07	3.17	3.18	3.28	3.55	3.42	2.97	3.17	2.99	3.14	3.49	3.12	3.50	3.04
QUE	4.95	4.98	4.90	4.92	4.93	5.03	4.81	4.77	4.71	4.77	4.72	4.70	4.58	4.77	4.57	4.54
RI	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	-----	-----	-----
VT	3.38	2.67	2.46	2.64	2.68	2.85	2.84	2.43	2.25	2.39	2.48	2.34	2.54	2.34	2.11	2.13
VA	0.25	0.21	0.21	0.21	0.20	0.18	0.17	0.16	0.16	0.13	0.13	0.14	0.12	0.13	0.12	0.10
WV	0.72	0.69	0.67	0.68	0.64	0.62	0.61	0.61	0.60	0.58	0.56	0.57	0.56	0.52	0.53	0.49
Region	**2.85**	**2.82**	**2.71**	**2.82**	**2.87**	**2.91**	**2.78**	**2.63**	**2.59**	**2.59**	**2.80**	**2.67**	**2.73**	**2.70**	**2.60**	**2.48**
Central Region																
IL	0.27	0.35	0.26	0.61	0.65	0.18	0.41	0.19	0.20	0.17	0.20	0.18	0.11	0.11	0.13	0.25
IN	0.35	0.37	0.30	0.29	0.33	0.32	0.27	0.26	0.25	0.25	0.27	0.22	0.23	0.21	0.21	0.20
MB	4.80	4.86	4.02	4.76	4.40	5.27	4.49	4.71	4.49	4.77	4.78	5.53	5.19	4.58	4.74	5.37
MI	5.62	5.26	5.38	5.54	5.60	5.45	5.09	5.01	4.71	4.72	4.83	5.24	5.31	5.51	5.27	5.35
MN	3.82	3.49	2.95	3.01	3.13	3.47	3.32	3.38	3.04	3.31	3.86	3.83	3.75	3.26	2.83	3.63
OH	0.93	0.91	0.88	0.85	1.08	0.98	0.94	0.76	0.80	0.92	0.90	0.88	0.85	0.86	0.80	0.86
ON	7.02	6.18	6.36	5.70	6.13	6.45	6.20	6.47	5.56	5.37	5.04	5.61	5.67	5.44	5.39	5.19
WI	2.99	2.89	2.48	2.67	2.72	3.05	2.83	3.25	2.79	2.82	2.85	3.15	3.23	3.27	2.57	2.92
Region	**3.16**	**2.93**	**2.81**	**2.83**	**2.97**	**3.00**	**2.88**	**2.92**	**2.62**	**2.64**	**2.70**	**2.88**	**2.89**	**2.83**	**2.61**	**2.79**
Continent	**3.01**	**2.88**	**2.76**	**2.83**	**2.92**	**2.96**	**2.83**	**2.77**	**2.60**	**2.62**	**2.75**	**2.78**	**2.81**	**2.77**	**2.61**	**2.63**

Table 2. Continued

State, Province, or Region	Year
	2016
Eastern Region	
CT	0.70
DE	0.16
ME	3.76
MD	0.28
MA	1.07
NB	6.07
NH	3.16
NJ	0.23
NY	3.01
NS	2.81
PA	1.22
PEI	2.63
QUE	4.59
RI	0.01
VT	2.49
VA	0.09
WV	0.49
Region	**2.58**
Central Region	
IL	0.13
IN	0.20
MB	4.92
MI	5.15
MN	4.23
OH	0.81
ON	5.15
WI	2.95
Region	**2.81**
Continent	**2.69**

Table 3. The number of U.S. hunters by state that submitted woodcock wings for the 2014-15 and 2015-16 Wing-collection Surveys.

State of residence	Number of Hunters who submitted woodcock wings[a]	
	2014-15 Season	2015-16 Season
Alabama	2	0
Arkansas	1	1
Connecticut	21	17
Delaware	2	1
Florida	0	0
Georgia	5	5
Illinois	1	1
Indiana	11	15
Iowa	4	4
Kansas	0	0
Kentucky	3	1
Louisiana	12	14
Maine	114	102
Maryland	8	14
Massachusetts	34	42
Michigan	233	237
Minnesota	84	95
Mississippi	2	4
Missouri	19	13
Nebraska	0	0
New Hampshire	59	66
New Jersey	19	17
New York	86	98
North Carolina	9	10
North Dakota	0	0
Ohio	18	15
Oklahoma	2	0
Pennsylvania	62	63
Rhode Island	1	2
South Carolina	8	12
Tennessee	4	3
Texas	0	1
Vermont	56	59
Virginia	13	16
West Virginia	14	11
Wisconsin	189	170
Total	**1,096**	**1,109**

[a] Number of hunters that submitted envelopes in current year. This number may include a small number of hunters that were sent envelopes in prior years and who subsequently submitted wings from birds shot in current survey year. In addition, some hunters hunted and submitted wings from more than one state.

Table 4. Number of woodcock wings received from hunters, and indices of recruitment in the U.S. Recruitment indices for individual states with ≥125 submitted wings were calculated as the ratio of immatures per adult female. The regional indices for 2015 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2014.

State or Region of harvest	Wings received						Recruitment index	
	Total		Adult females		Immatures			
	1963-14	2015	1963-14	2015	1963-14	2015	1963-14	2015
Eastern Region								
CT	15,139	171	3,377	46	9,242	96	2.7	2.1
DE	505	7	79	0	346	6	4.4	
FL	678	0	153	0	422	0	2.8	
GA	3,284	51	1,030	13	1,398	22	1.4	
ME	88,552	936	26,156	307	44,257	414	1.7	1.3
MD	4,797	119	1,175	24	2,713	74	2.3	
MA	24,906	434	7,774	150	12,048	206	1.5	1.4
NH	36,814	691	11,961	236	17,064	320	1.4	1.4
NJ	27,180	205	6,271	56	16,069	114	2.6	2.0
NY	64,266	623	21,725	239	29,081	230	1.3	1.0
NC	4,231	114	1,341	46	2,025	43	1.5	
PA	33,392	353	10,570	118	15,404	161	1.5	1.4
RI	2,463	4	476	0	1,629	4	3.4	
SC	3,603	201	1,135	65	1,638	86	1.4	1.3
VT	28,666	393	9,408	133	13,064	162	1.4	1.2
VA	5,815	213	1,534	53	3,119	122	2.0	2.3
WV	6,436	62	1,943	16	3,230	30	1.7	
Region	**350,727**	**4,577**	**106,108**	**1,502**	**172,749**	**2,090**	**1.63**	**1.38**
Central Region								
AL	1,013	0	282	0	462	0	1.6	
AR	553	2	176	2	228	0	1.3	
IL	1,505	3	352	1	844	2	2.4	
IN	8,555	68	2,177	20	4,736	40	2.2	
IA	1,355	19	441	4	606	12	1.4	
KS	50	0	9	0	26	0		
KY	1,179	1	290	0	608	0	2.1	
LA	33,501	195	7,480	58	21,690	106	2.9	1.8
MI	139,977	2,781	45,952	987	68,424	1,235	1.5	1.3
MN	42,625	1,232	15,062	500	18,345	444	1.2	0.9
MS	1,948	23	543	8	989	9	1.8	
MO	4,442	53	1,164	25	2,179	15	1.9	
NE	13	0	5	0	6	0		
ND	4	0	3	0	1	0		
OH	15,225	105	4,677	25	7,167	49	1.5	
OK	174	0	38	0	92	0	2.4	
TN	1,347	3	356	2	689	1	1.9	
TX	1,055	2	295	1	528	1	1.8	
WI	91,202	2,266	30,817	905	42,900	895	1.4	1.0
Region	**345,723**	**6,753**	**110,119**	**2,538**	**170,520**	**2,809**	**1.55**	**1.19**

Table 5. Preliminary estimates of woodcock harvest, hunter numbers, days afield, and hunter success from the 2015-16 Harvest Information Program (note: all estimates rounded to the nearest 100 for harvest, hunters, and days afield).

	Harvest		Active woodcock hunters		Days afield		Season harvest per hunter	
Eastern	**Total**	**+/- 95% CI[a]**	**Total**	**+/- 95% CI**	**Total**	**+/- 95% CI**	**Total**	**+/- 95% CI**
CT	700	40	800	29	3,900	36	0.88	49
DE	100	103	100	47	300	71	1.25	113
FL	0	----	0	193	100	193	0	----
GA	1,700	76	700	69	3,400	70	2.34	102
ME	4,700	55	2,100	48	9,000	50	2.21	73
MD	1,100	63	1,100	91	2,300	83	1.02	110
MA	1,800	31	1,000	30	6,600	44	1.74	43
NH	9,100	52	2,100	32	14,700	43	4.25	61
NJ	4,700	147	700	59	4,300	97	7.17	158
NY	8,600	36	3,900	28	18,300	32	2.2	45
NC	7,100	90	3,900	108	10,100	81	1.83	140
PA	5,400	45	5,000	42	17,700	43	1.07	61
RI	100	130	100	92	200	54	1.42	160
SC	1,900	97	2,800	104	13,900	131	0.69	142
VT	3,400	47	1,200	31	6,000	36	2.73	56
VA	3,200	55	1,000	86	3,200	47	3.28	102
WV	700	52	400	56	1,200	40	2.09	77
Region	**54,500**	**22**	**na[b]**		**115,500**	**21**	**na[b]**	
Central								
AL	6,100	182	1,000	187	5,100	183	6.18	260
AR	7,300	189	1,200	188	4,800	190	5.96	266
IL	200	114	1,000	170	1,300	133	0.18	205
IN	600	56	400	99	1,100	83	1.4	114
IA	300	108	1,400	95	2,500	90	0.23	144
KS	300	196	1,400	97	2,800	103	0.25	218
KY	600	57	700	161	2,600	136	0.79	171
LA	3,500	112	2,800	87	12,300	123	1.26	142
MI	63,200	23	26,000	18	124,700	21	2.43	29
MN	25,600	42	13,500	34	47,600	40	1.9	54
MS	3,600	147	600	176	2,300	140	6.16	229
MO	400	110	100	42	600	63	3	118
NE	0	----	0	----	0	0	0	----
OH	2,100	85	1,900	80	7,500	95	1.13	117
OK	0	----	1,800	137	1,800	137	0	----
TN	0	----	0	----	0	0	0	----
TX	900	169	100	73	600	112	6.5	184
WI	31,000	25	14,700	27	66,600	29	2.11	37
Region	**145,700**	**19**	**na[b]**		**284,200**	**16**	**na[b]**	
Total	**200,200**	**15**	**na[b]**		**399,700**	**13**	**na[b]**	

[a] All 95% Confidence Intervals are expressed as a % of the point estimate.

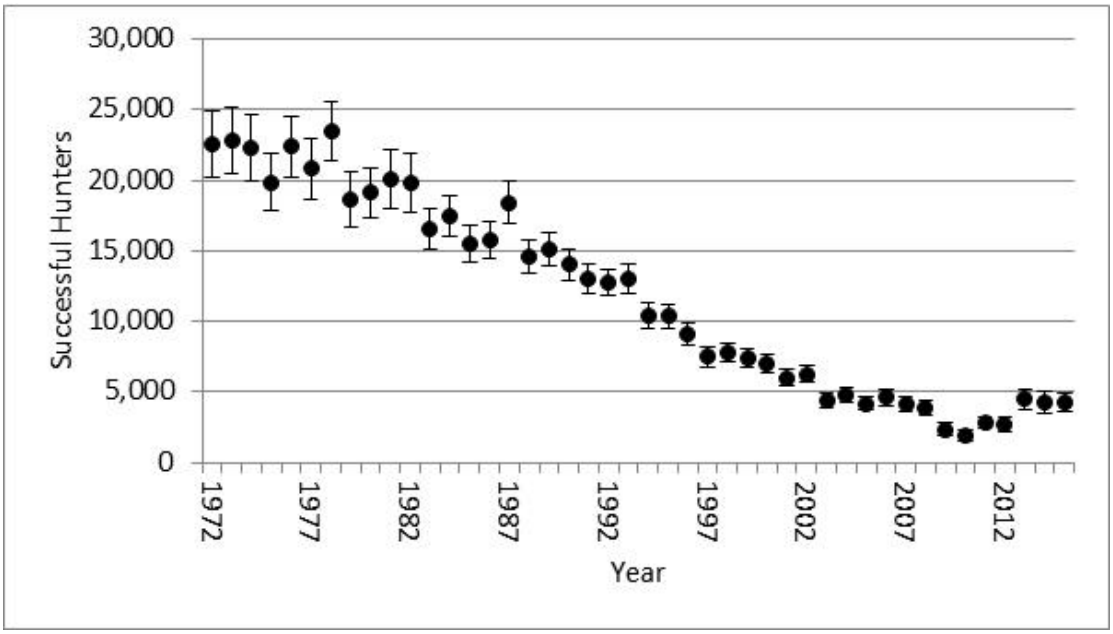
[b] Regional estimates of hunter numbers and hunter success cannot be obtained due to the occurrence of individual hunters being registered in the Harvest Information Program in more than one state.

Appendix A. History of federal framework dates, season lengths, and daily bag limits for hunting American woodcock in the U.S. portion of the Eastern and Central Regions, 1918 - 2016.

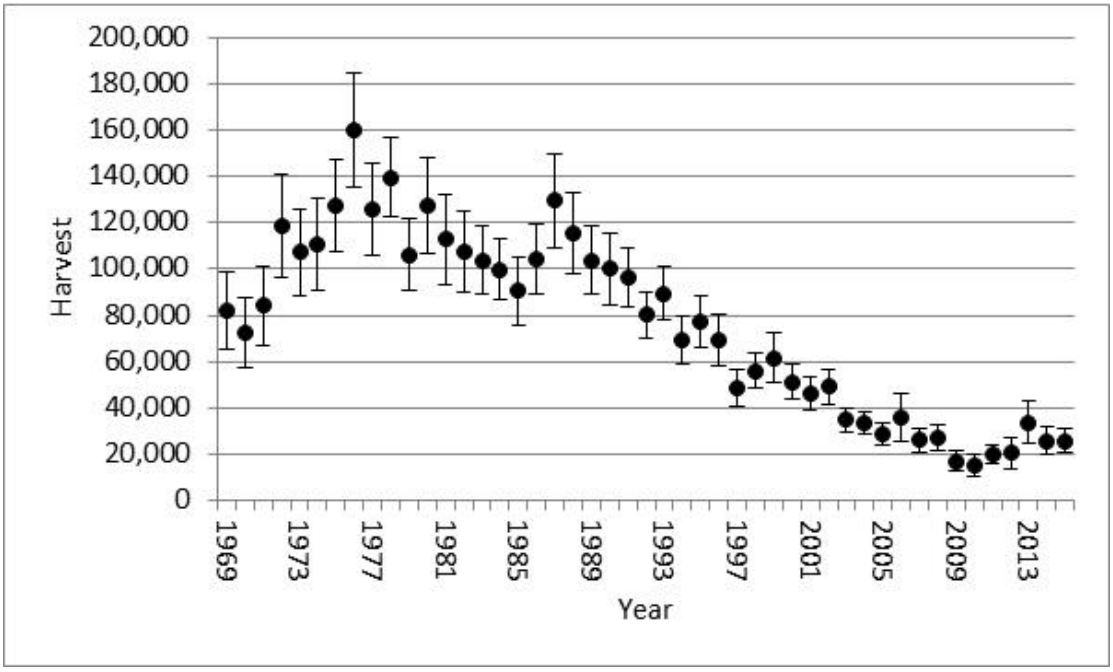
Eastern Region				Central Region			
Year (s)	Outside dates	Season length	Daily bag limit	Year (s)	Outside dates	Season length	Daily bag limit
1918-26	Oct. 1 - Dec. 31	60	6	1918-26	Oct. 1 - Dec. 31	60	6
1927	Oct. 1 - Dec. 31	60	4	1927	Oct. 1 - Dec. 31	60	4
1928-39	Oct. 1 - Dec. 31	30	4	1928-39	Oct. 1 - Dec. 31	30	4
1940-47	Oct. 1 - Jan. 6	15	4	1940-47	Oct. 1 - Jan. 6	15	4
1948-52	Oct. 1 - Jan. 20	30	4	1948-52	Oct. 1 - Jan. 20	30	4
1953	Oct. 1 - Jan. 20	40	4	1953	Oct. 1 - Jan. 20	40	4
1954	Oct. 1 - Jan. 10	40	4	1954	Oct. 1 - Jan. 10	40	4
1955-57	Oct. 1 - Jan. 20	40	4	1955-57	Oct. 1 - Jan. 20	40	4
1958-60	Oct. 1 - Jan. 15	40	4	1958-60	Oct. 1 - Jan. 15	40	4
1961-62	Sep. 1 - Jan. 15	40	4	1961-62	Sep. 1 - Jan. 15	40	4
1963-64	Sep. 1 - Jan. 15	50	5	1963-64	Sep. 1 - Jan. 15	50	5
1965-66	Sep. 1 - Jan. 30	50	5	1965-66	Sep. 1 - Jan. 30	50	5
1967-69	Sep. 1 - Jan. 31	65	5	1967-69	Sep. 1 - Jan. 31	65	5
1970-71	Sep. 1 - Feb. 15	65	5	1970-71	Sep. 1 - Feb. 15	65	5
1972-81	Sep. 1 - Feb. 28	65	5	1972-90	Sep. 1 - Feb. 28	65	5
1982	Oct. 5 - Feb. 28	65	5	1991-96	Sep. 1 - Jan. 31	65	5
1983-84	Oct. 1 - Feb. 28	65	5	1997-2016	Sep. 22[a] - Jan. 31	45	3
1985-96	Oct. 1 - Jan. 31	45	3				
1997-01	Oct. 6 - Jan. 31	30	3				
2002-10	Oct. 1 - Jan. 31	30	3				
2011-16	Oct. 1 - Jan. 31	45	3				

[a] Saturday nearest September 22nd will be September 24th for the 2016 season.

Appendix B. Estimates for the number of successful woodcock hunters and woodcock harvest in Canada 1969-2015 (Gendron and Smith 2016).



Estimated number of successful woodcock hunters in Canada and associated 95% confidence intervals, 1972-2015.



Estimated woodcock harvest in Canada and associated 95% confidence intervals, 1969-2015.

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