



U.S. Fish & Wildlife Service

American Woodcock

Population Status, 2015



Suggested report citation:

Cooper, T.R., and R.D. Rau. 2015. American woodcock population status, 2015. U.S. Fish and Wildlife Service, Laurel, Maryland. 16 pp.

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AMERICAN WOODCOCK POPULATION STATUS, 2015

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Abstract: American Woodcock Singing-ground Survey data for 2015 indicate that the index for singing American woodcock (*Scolopax minor*) males in both the Eastern and Central Management Regions was not significantly different from 2014. The Eastern Management Region had a significant, declining 10-year (2005-2015) trend of -1.56%/year, which marks the second year in a row there has been a declining 10-year trend. The 10-year trend in the Central Management Region was not significant after showing a decline last year. Both regions have a significant, long-term (1968-15) declining trend (-1.1%/year for the Eastern Management Region and -0.7 %/year for the Central Management Region). The 2014 recruitment index for the U.S. portion of the Eastern Region (1.49 immatures per adult female) was 6.9% less than the 2013 index and 8.9% less than the long-term regional index, while the recruitment index for the U.S. portion of the Central Region (1.39 immatures per adult female) was 9.6% less than the 2013 index and was 10.6% less than the long-term regional index. Estimates from the Harvest Information Program indicated that U.S. woodcock hunters in the Eastern Region spent 119,700 days afield and harvested 58,600 woodcock during the 2014-15 season, while in the Central Region, hunters spent 227,600 days afield and harvested 141,500 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 2015. 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

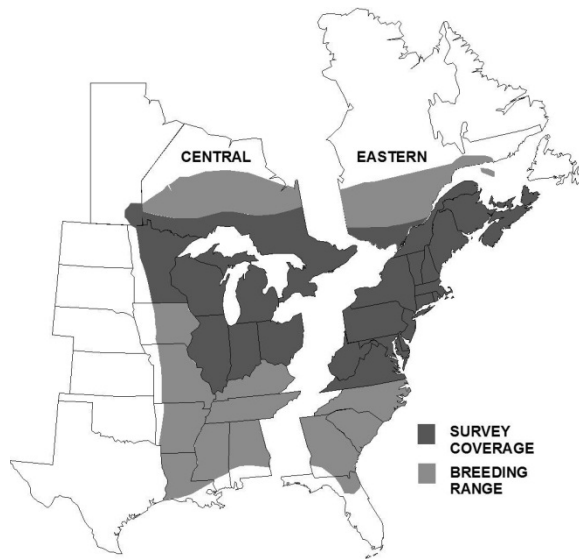


Fig. 1. Woodcock management regions, breeding range, degree blocks within each state and province in the central and northern portions of the woodcock’s breeding range (Fig. 1). Data collected prior to 1968 are not included in this report.

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 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 (2014-15), 10-year (2005-15) and long-term (1968-2015) 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 5 June 2015 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 2014 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 2014 recruitment index for each state with ≥ 125 submitted wings was calculated as the number of immatures per adult female. The regional indices for 2014 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2013.

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 2003-14 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 2013).

RESULTS AND DISCUSSION

Singing-ground Survey

Data for 821 routes were submitted by 5 June 2015 (Table 1). Short-term, 10-year (2005-15), and long-term (1968-2015) trends were estimated using data from 786 routes in the Eastern Region and 735 routes in the Central Region. Short-term analysis indicated that the number of woodcock heard singing during the 2015 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 (2005-2015) showed a significant decline for the Eastern Management Region, while there was no significant trend for the Central Management Region. (Table 1, Fig. 2). This marks the second year in a row that there has been a significant declining trend in the Eastern Region.

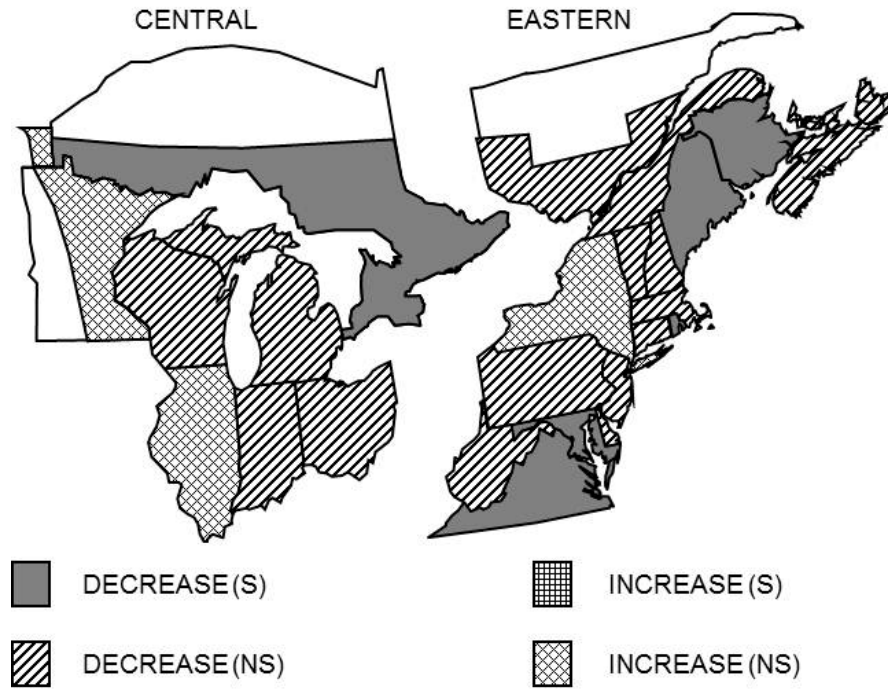


Fig. 2. Ten-year trends in the number of American woodcock heard on the Singing-ground Survey, 2005-2015, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. Note, no state or province has a significant increasing trend.

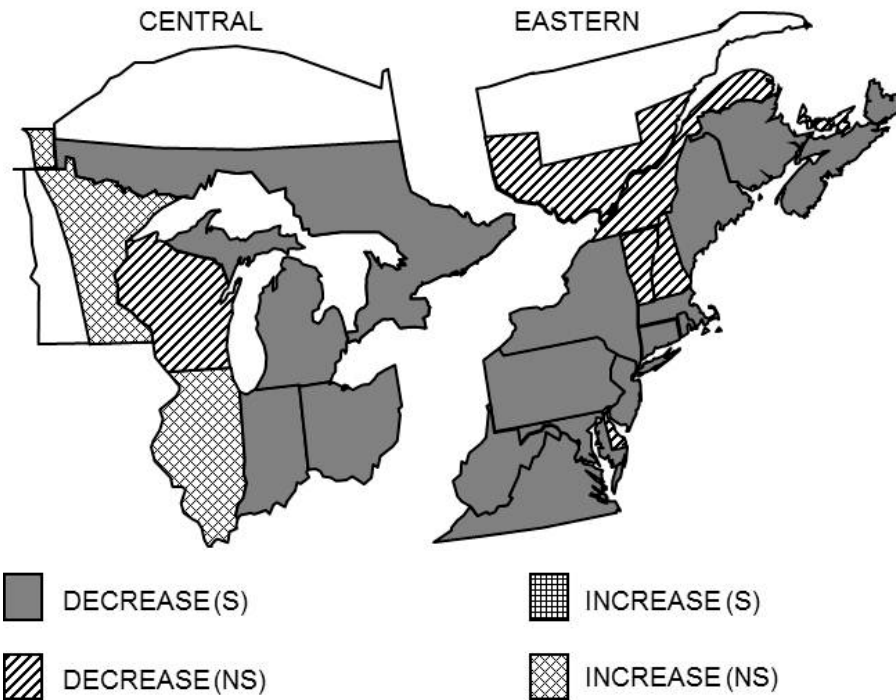


Fig. 3. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968-2015, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. Note, no state or province has a significant long-term increase.

Many states and/or provinces in both management regions have experienced significant long-term (1968-2015) 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 -1.06 %/year for the Eastern Management Region, while it was -0.71%/year for the Central Management Region (Table 1).

In the Eastern Region, the 2015 index was 2.45 singing males per route, while it was 2.76 in the Central Management Region (Figure 4, Table 2). Annual indices (1968-2015) by state, province, or region are available in Table 2.

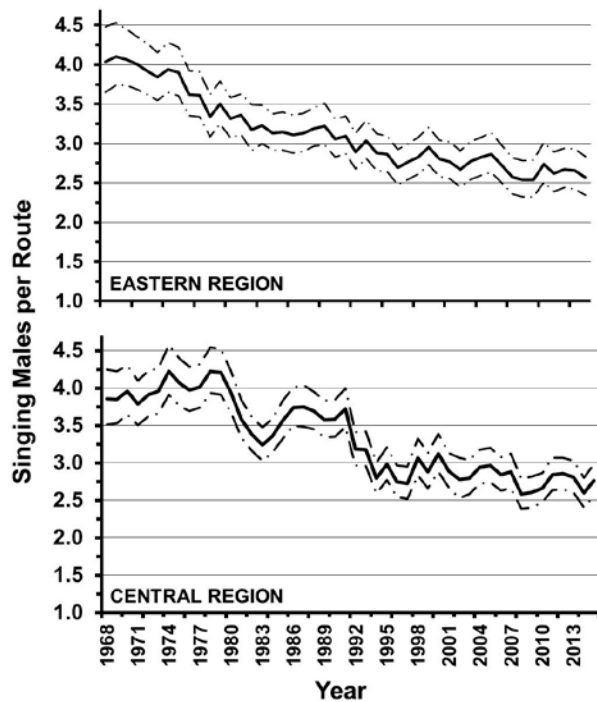


Fig. 4. Annual indices of the number of woodcock heard during the Singing-ground Survey, 1968-2015 as estimated using hierarchical modeling. The dashed lines represent the 95% credible interval of the estimate.

Wing-collection Survey

A total of 1,096 woodcock hunters (Table 3) from states with a woodcock season sent in a total of 12,065 usable woodcock wings for the 2014 Wing-collection Survey (Table 4).

The 2014 recruitment index in the U.S. portion of the Eastern Region (1.49 immatures per adult female) was 6.9% less than the 2013 index of 1.60, and 8.9% less than the long-term (1963-13) regional average of 1.63 (Table 4, Fig 5). In the Central Region, the 2014 recruitment index (1.39 immatures per adult female) was 9.7% less than the 2013 index of 1.54 and was

10.6% 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.

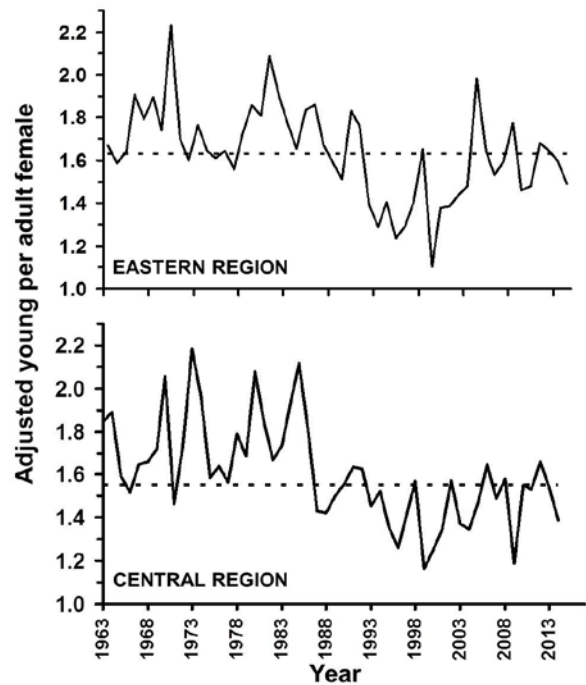


Fig. 5. Weighted annual indices of recruitment (U.S.), 1963-2014. The dashed line is the 1963-2014 average.

Harvest Information Program

Estimates of woodcock harvest, number of active hunters, days afield, and seasonal hunting success from the 2014-15 HIP survey are provided in Table 5. In the Eastern Management Region, woodcock hunters spent an estimated 119,700 days afield (Figure 6) and harvested 58,600 birds (Figure 7) during the 2014-15 hunting season. Harvest in 2014-15 was 31.4% less than the long-term (1999-2013) average (85,447 birds/year) and 6.2% less than last year (62,500 birds) in the Eastern Region. Woodcock hunters in the Central Region spent an estimated 227,600 days afield (Figure 6) and harvested 141,500 birds (Figure 7) during the 2014-15 hunting season. Harvest in 2014-15 was 36.5% less than the long-term (1999-2013) average (222,747 birds/year) and 21.7% less than last year (180,600 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.

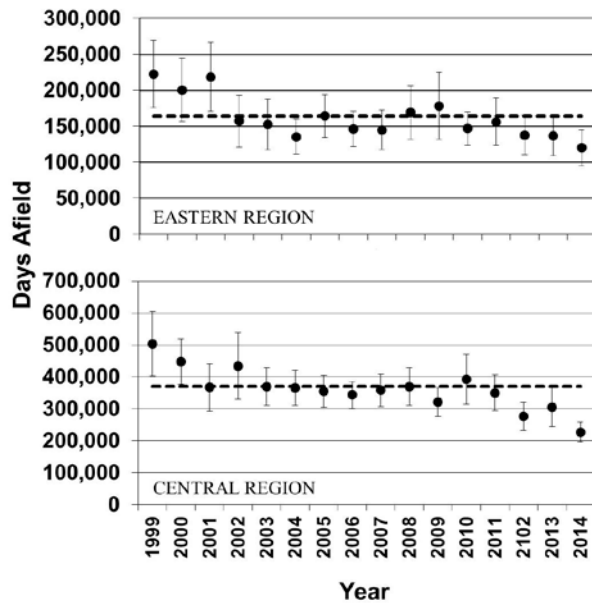


Fig. 6. Harvest Information Program Survey estimates of days spent afield by U.S. woodcock hunters, 1999-2014. The dashed line represents the 1999-2013 average and error bars represent the 95% confidence interval of the point estimate.

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 4,487 successful hunters harvested 33,533 woodcock during the 2013 season in Canada (Gendron and Smith 2013; Appendix B).

Acknowledgements

Personnel from the FWS, CWS, U. S. Geological Survey (USGS), Bird Studies Canada (BSC), and many state and provincial agencies and other individuals assisted with collecting Singing-ground Survey data and processing wings at the woodcock wingbee. Special thanks to M. Huang (CT); M. DiBona (DE); R. Smith (IL); B. Veverka (IN); B. Harvey, H. Walbridge (MD); D. Scarpitti (MA); L. Sargent, A. Stewart (MI); K. Connor (NB); J. Carloni (NH); J. Garris (NJ); G. Somogie, T. Sutter (NY); G. Parsons (NS); B. Crose, L. Fendrick, and N. Stricker (OH); J. Hayden (ON); M. Weaver (PA); G. Gregory (PEI); B. Tefft (RI); D. Sausville (VT); T. Engelmeyer (VA); M. Peters (WV); B. Stewart, K. Jones (BSC); M. Gendron, A. Hicks, J. B. Pollard, J. Rodrigue, and M. Schuster (CWS); and C. Dwyer, S. Kelly, and M. Mills (USFWS) for providing state, provincial and regional Singing-ground Survey coordination. We thank all observers who conducted Singing-ground Survey routes.

Special appreciation is extended to Ken Sturm, Missisquoi NWR (USFWS), J. Murdoch, A. Strong (UVM) and the Vermont Fish and Wildlife Department for coordinating local logistics and hosting the 2015

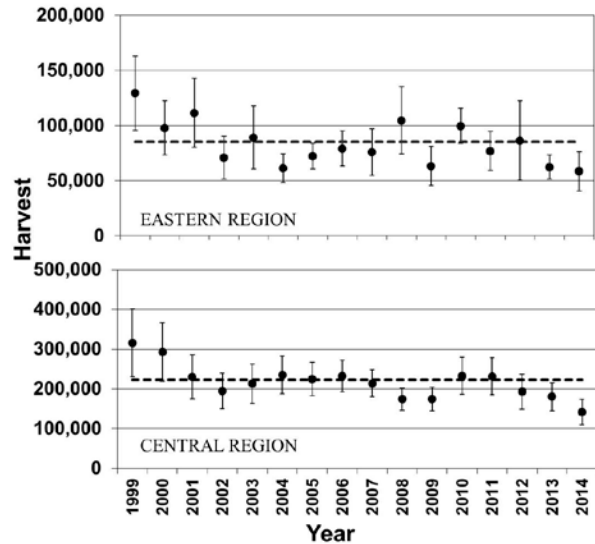


Fig. 7. Harvest Information Program Survey estimates of U.S. woodcock harvest, 1999-2014. The dashed line represents the 1999-2013 average and the error bars represent the 95% confidence interval of the point estimate.

wingbee, which was held at the University of Vermont in Burlington, VT. Other individuals who participated in the wingbee were: M. Olinde and J. Duguay (LA); A. Stewart (MI); A. Roth (MTU); L. Shartell (MN); J. O'Conner, T. Sutter (NY); L. Fendrick, M. Wiley (OH); L. Williams (PA); A. Weik (Ruffed Grouse Society); W. Bringer, R. Brown, T. Cooper, R. Crehan, K. Daly, E. Edwards, T. Edwards, R. Rau, M. Seamans, J. Sefchick-Edwards, C. Smith, D. Tilton, B. West (USFWS); D. McAuley (USGS); A. Alfieri, J. Austin, J. Mlcuch, D. Morin, D. Sausville (VT); K. Krantz (WV). We especially thank all the woodcock hunters who sent in wings for the survey.

The Branch of Harvest Surveys within the Division of Migratory Bird Management (USFWS) mailed Wing-collection Survey materials, organized wing submissions, assisted with data management, and provided Harvest Information Program estimates (special thanks to T. Ceasar, S. Chandler, S. Finucane, L. Heckstall, P. Mathias, B. Raftovich, B. West and K. Wilkins). R. Maruthalingam (USFWS) assisted in maintaining the website and the development of management applications for the Singing-ground Survey and wingbee. To streamline data processing

steps, N. Zimpfer (USFWS) developed SQL queries in Program R. J. Sauer (USGS) developed computer programs for calculating trends and indices from Singing-ground Survey data and conducted this year's analyses for the survey. G. Zimmerman, J. Kelley, K. Richkus, K. Wilkins, B. Raftovich, and J. Sauer reviewed a draft of parts or all of this report and provided helpful comments.

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Table 1. Short-term (2014-15), 10-year (2005-2015), and long-term (1968-2015) 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	n ^c	2014-2015			2005-2015			1968-2015		
			% change	95% CI ^d		% change	95% CI ^d		% change	95% CI ^d	
				lower	upper		lower	upper		lower	upper
CT	5	11	-6.46	-45.47	37.16	-2.33	-6.29	3.07	-2.83	-4.71	-0.88
DE ^e	0	3	-0.88	-----	-----	-3.70	-22.10	16.16	-3.53	-9.21	2.15
ME	57	73	-9.52	-24.63	7.66	-2.22	-4.05	-0.38	-1.36	-1.88	-0.86
MD	4	26	-3.83	-25.16	24.43	-3.86	-6.40	-0.52	-3.97	-5.42	-2.49
MA	7	22	1.73	-19.21	43.28	-2.09	-4.59	1.39	-2.37	-3.36	-1.31
NB	39	72	-12.39	-29.01	7.70	-3.21	-5.34	-1.12	-1.03	-1.84	-0.25
NH	13	18	-10.29	-36.58	15.79	-1.59	-5.16	1.11	-0.52	-1.57	0.55
NJ	6	19	-26.60	-65.11	28.91	-6.23	-12.10	0.00	-6.36	-7.99	-4.71
NY	74	115	7.26	-6.92	25.66	0.28	-1.33	2.08	-0.79	-1.25	-0.33
NS	45	63	-16.11	-32.89	1.87	-1.22	-3.52	0.95	-1.00	-1.78	-0.31
PA	33	82	-0.68	-24.34	30.17	-1.08	-3.77	1.67	-0.97	-1.70	-0.23
PEI	9	13	-7.42	-35.71	19.69	-0.96	-4.05	2.77	-1.08	-2.38	0.25
QUE	16	110	-0.33	-15.76	18.51	-0.91	-2.99	0.62	-0.64	-1.40	0.15
RI ^e	0	3	-12.43	-----	-----	-12.07	-22.62	-1.08	-11.78	-17.85	-6.24
VT	18	24	1.49	-27.15	42.89	-2.81	-6.48	0.62	-0.98	-1.96	0.03
VA	31	75	-21.13	-56.62	22.92	-6.31	-11.27	-1.89	-5.68	-6.90	-4.57
WV	24	57	-5.97	-30.11	13.35	-2.34	-4.65	0.07	-2.44	-3.28	-1.62
Eastern	381	786	-4.62	-11.59	2.87	-1.56	-2.40	-0.79	-1.06	-1.35	-0.77
IL	13	46	79.98	-44.49	577.55	3.16	-7.62	16.21	0.27	-2.45	3.43
IN	18	61	-6.78	-47.11	56.86	-4.74	-10.26	0.09	-4.19	-5.47	-3.00
MB ^f	23	30	14.79	-12.71	55.89	0.33	-3.00	3.77	0.11	-1.51	1.94
MI	109	153	-0.86	-12.91	12.89	-0.25	-1.65	1.17	-0.69	-1.07	-0.31
MN	75	121	28.12	8.39	51.50	0.53	-1.17	2.31	0.40	-0.20	1.03
OH	41	73	8.98	-15.76	45.27	-0.80	-3.62	2.25	-1.25	-2.00	-0.47
ON	80	160	-3.98	-17.55	11.63	-2.25	-4.02	-0.50	-0.95	-1.42	-0.46
WI	81	121	16.65	-2.21	39.02	-0.21	-2.07	1.68	-0.34	-0.85	0.19
Central	440	735	6.32	-1.29	14.66	-0.72	-1.54	0.11	-0.71	-0.95	-0.47
Continent	821	1,521	0.81	-4.32	6.38	-1.13	-1.71	-0.56	-0.88	-1.07	-0.69

^a Median of route trends estimated used hierarchical modeling. To estimate the total percent change over several years, use: $(100((\% \text{ change}/100)+1)^y)-100$, 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 2015 for which data were received by 5 June, 2015.

^c Number of routes with at least one year of non-zero data between 1968 and 2015.

^d 95% credible interval, if the interval overlaps zero, the trend is considered non-significant.

^e Short-term trend not estimated since all routes were in CZ status during 2015.

^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, 1968-2015. These indices are based on 1968-2015 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	----	2.64	2.73	2.45	2.61	2.41	2.40	2.44	1.97	1.99	1.72	1.81	1.78	1.77	1.93	1.72
DE	1.05	0.86	1.12	0.72	0.88	1.02	0.92	1.63	0.52	0.68	0.51	0.56	0.68	0.65	0.63	0.95
ME	6.19	6.07	6.71	6.09	6.04	6.19	6.47	6.71	6.28	5.31	5.15	5.67	4.91	5.62	4.36	4.84
MD	1.88	1.87	1.75	1.70	1.62	1.57	1.50	1.45	1.33	1.31	1.27	1.22	1.21	1.15	1.09	1.02
MA	-----	3.29	3.30	3.30	3.00	3.23	3.05	2.68	2.62	2.62	2.55	2.67	2.35	2.48	2.26	2.11
NB	-----	8.85	8.61	8.05	7.83	7.37	7.83	8.37	6.47	7.77	5.93	6.39	5.41	6.13	6.72	5.78
NH	-----	3.83	4.06	3.63	4.14	3.46	3.97	3.74	3.70	3.74	3.63	3.54	3.88	3.80	3.25	3.34
NJ	4.54	4.36	4.62	6.09	4.31	5.39	4.97	4.01	2.76	2.79	2.17	2.92	2.06	1.92	1.77	1.87
NY	4.25	4.40	3.82	4.23	4.05	4.09	4.19	3.79	3.81	3.78	3.36	3.71	4.04	3.83	3.50	3.83
NS	4.27	3.76	3.24	3.84	3.64	3.78	3.95	3.75	3.61	3.60	3.76	3.42	3.40	3.19	3.04	3.30
PA	1.97	1.85	2.07	1.99	1.93	1.93	1.69	1.74	1.74	1.72	1.64	1.76	1.54	1.53	1.49	1.52
PEI	-----	5.21	5.20	5.67	4.86	4.86	5.02	5.81	5.16	4.94	4.78	4.78	4.24	4.12	4.15	4.55
QUE	-----	-----	-----	5.96	6.03	5.84	5.87	5.82	5.72	5.63	5.84	5.88	5.82	5.62	5.56	5.65
RI	-----	1.88	1.65	2.14	1.61	1.45	1.17	0.98	0.87	0.78	0.61	0.58	0.52	0.43	0.45	0.37
VT	-----	3.32	4.04	3.62	4.10	3.58	3.98	4.26	4.38	4.53	3.39	3.54	3.29	2.99	2.23	3.00
VA	-----	1.40	1.42	1.19	1.09	0.90	1.19	1.02	0.96	0.93	0.79	0.78	0.65	0.73	0.73	0.64
WV	1.55	1.56	1.43	1.39	1.45	1.38	1.33	1.33	1.27	1.20	1.09	1.18	1.12	1.19	1.12	1.08
Region	4.03	4.10	4.07	4.01	3.92	3.84	3.94	3.90	3.62	3.61	3.34	3.50	3.31	3.36	3.18	3.23
Central Region																
IL	-----	-----	0.24	0.46	0.40	0.30	0.43	0.34	0.21	0.29	0.46	0.31	0.25	0.43	0.27	0.80
IN	1.50	1.06	1.03	0.82	1.19	1.08	0.95	0.79	0.82	0.75	0.78	0.95	0.74	0.86	0.59	0.62
MB	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
MI	7.30	7.19	7.18	6.77	6.83	7.08	7.96	7.97	7.66	7.18	7.54	7.57	7.19	6.38	6.57	5.64
MN	-----	2.94	2.87	3.19	3.02	3.41	3.93	3.56	3.61	3.75	3.94	3.59	4.11	3.71	3.60	3.23
OH	-----	-----	1.61	1.48	1.50	1.33	1.51	1.30	1.50	1.45	1.30	1.25	1.23	1.37	1.17	1.20
ON	7.96	8.93	9.39	8.66	9.42	9.12	9.20	8.77	8.91	9.04	9.60	9.72	9.06	8.12	7.00	6.89
WI	3.48	3.51	4.05	3.83	3.81	4.03	4.09	4.18	3.75	4.24	4.42	4.54	3.66	3.10	3.26	3.16
Region	3.86	3.85	3.96	3.79	3.91	3.96	4.23	4.07	3.98	4.01	4.22	4.21	3.94	3.58	3.38	3.24
Continent	3.95	3.98	4.02	3.90	3.92	3.90	4.09	3.98	3.80	3.81	3.78	3.85	3.63	3.47	3.28	3.24

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	1.63	1.62	1.69	1.50	1.68	1.37	1.38	1.40	1.29	1.19	1.23	1.29	1.28	1.16	1.11	1.18
DE	0.48	0.52	0.55	0.53	0.52	0.49	0.62	0.34	0.34	0.43	0.41	0.40	0.43	0.41	0.60	0.32
ME	4.91	5.00	5.31	5.61	5.16	5.34	4.28	4.80	4.18	4.48	4.15	4.22	3.64	3.90	3.86	4.20
MD	1.00	0.95	0.90	0.87	0.83	0.81	0.78	0.74	0.69	0.69	0.66	0.63	0.61	0.58	0.55	0.53
MA	2.23	2.19	2.11	2.07	2.03	1.91	1.87	1.85	1.74	1.69	1.68	1.63	1.61	1.62	1.55	1.70
NB	5.30	5.52	4.70	5.11	5.92	7.01	6.04	5.59	5.38	6.43	6.57	6.11	5.34	5.96	5.93	6.83
NH	3.27	3.40	4.25	3.64	3.58	3.52	3.31	3.57	3.23	3.29	3.32	3.67	3.58	3.56	3.51	3.74
NJ	2.00	1.82	1.63	1.92	1.39	1.34	1.28	1.29	1.01	0.89	0.76	0.92	0.88	0.67	0.76	0.80
NY	3.31	3.72	3.44	3.38	3.59	3.20	3.58	3.62	3.37	3.29	2.92	3.01	2.89	2.94	2.99	3.05
NS	3.10	3.28	3.39	3.06	3.25	3.23	3.00	3.25	3.21	3.31	2.98	3.15	3.18	3.00	3.07	3.40
PA	1.59	1.52	1.57	1.50	1.46	1.41	1.56	1.72	1.43	1.51	1.26	1.45	1.42	1.37	1.53	1.41
PEI	4.55	4.49	4.68	4.13	4.52	4.64	4.22	4.15	4.11	3.97	3.78	3.94	4.21	4.06	3.90	3.72
QUE	5.52	5.48	5.45	5.50	5.60	5.66	5.42	5.32	5.32	5.43	5.33	5.08	4.93	4.97	5.22	5.13
RI	0.33	0.27	0.24	0.22	0.19	0.16	0.15	0.13	0.11	0.10	0.09	0.08	0.07	0.06	0.05	0.05
VT	2.93	2.69	2.87	3.32	3.55	3.45	3.21	3.31	2.43	2.73	2.62	2.60	2.52	2.62	2.88	3.29
VA	0.95	0.49	0.54	0.53	0.45	0.41	0.44	0.40	0.42	0.39	0.35	0.29	0.29	0.33	0.26	0.27
WV	1.04	1.00	0.99	0.97	0.93	0.92	0.92	0.86	0.86	0.83	0.81	0.84	0.78	0.77	0.74	0.74
Region	3.13	3.14	3.11	3.13	3.19	3.22	3.06	3.09	2.90	3.03	2.88	2.86	2.70	2.77	2.83	2.95
Central Region																
IL	0.38	0.74	0.60	1.09	0.34	0.53	0.27	0.56	0.35	0.48	0.30	0.23	0.29	0.23	0.29	0.37
IN	0.60	0.56	0.66	0.61	0.54	0.49	0.62	0.59	0.55	0.45	0.44	0.40	0.38	0.37	0.44	0.39
MB	-----	-----	-----	-----	-----	-----	-----	-----	5.02	5.37	5.46	5.73	4.97	3.50	4.30	4.25
MI	6.43	6.52	6.88	6.42	6.84	6.55	6.62	7.25	5.72	5.81	5.13	5.73	5.44	5.26	6.22	5.23
MN	3.13	3.49	3.62	3.63	3.99	3.33	3.96	3.84	3.26	3.35	3.05	3.15	3.04	2.78	3.18	3.27
OH	1.25	1.12	1.09	1.07	1.16	0.99	1.28	1.15	1.28	1.04	1.05	1.01	1.05	0.88	1.04	0.87
ON	6.97	7.78	8.04	7.95	7.93	8.00	7.54	7.67	7.15	6.89	5.95	6.49	5.31	5.94	6.32	5.82
WI	3.47	3.40	3.87	3.95	3.68	3.75	3.56	3.59	2.90	3.04	2.66	2.76	2.70	2.58	2.76	3.13
Region	3.35	3.57	3.74	3.74	3.69	3.58	3.59	3.73	3.18	3.18	2.79	2.98	2.75	2.73	3.07	2.88
Continent	3.25	3.36	3.42	3.44	3.44	3.40	3.32	3.41	3.04	3.11	2.84	2.92	2.72	2.75	2.95	2.92

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	1.06	1.00	0.93	0.94	0.91	0.88	0.84	0.84	0.85	0.82	0.79	0.87	0.85	0.76	0.77	0.71
DE	0.45	0.30	0.32	0.29	0.30	0.29	0.24	0.24	0.24	0.25	0.24	0.23	-----	0.20	0.20	-----
ME	4.35	3.87	3.60	3.90	3.98	4.05	3.96	3.63	3.67	3.56	3.79	3.89	3.83	3.73	3.58	3.24
MD	0.52	0.51	0.47	0.46	0.44	0.42	0.41	0.39	0.38	0.36	0.35	0.32	0.32	0.31	0.29	0.28
MA	1.55	1.46	1.45	1.41	1.45	1.33	1.32	1.23	1.28	1.25	1.19	1.15	1.08	1.07	1.05	1.09
NB	6.26	6.64	6.35	6.91	6.91	7.60	6.81	6.17	5.90	5.33	6.94	6.44	7.06	6.62	6.26	5.49
NH	3.26	3.37	3.32	3.60	3.63	3.59	3.36	2.87	2.94	3.44	3.43	3.05	3.39	3.29	3.41	3.02
NJ	0.70	0.64	0.53	0.59	0.44	0.40	0.40	0.42	0.36	0.42	0.25	0.33	0.37	0.32	0.29	0.21
NY	2.89	2.81	2.76	2.87	3.06	2.84	2.90	2.71	2.59	2.80	3.01	2.76	2.86	2.85	2.72	2.92
NS	3.37	3.18	2.93	2.90	3.17	3.01	2.86	2.85	2.73	2.71	3.11	2.79	3.12	3.44	3.18	2.66
PA	1.13	1.36	1.34	1.32	1.35	1.39	1.25	1.22	1.37	1.36	1.46	1.28	1.14	1.08	1.25	1.25
PEI	3.91	3.73	3.34	3.39	3.38	3.47	3.67	3.56	3.19	3.34	3.20	3.30	3.57	3.25	3.47	3.16
QUE	4.93	4.95	4.87	4.89	4.90	5.01	4.78	4.73	4.67	4.75	4.69	4.67	4.53	4.75	4.56	4.54
RI	0.04	0.04	0.04	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	2.42	2.61	2.65	2.82	2.80	2.39	2.20	2.36	2.45	2.31	2.51	2.32	2.08	2.12
VA	0.25	0.21	0.21	0.21	0.20	0.18	0.17	0.16	0.17	0.13	0.13	0.14	0.12	0.13	0.12	0.09
WV	0.72	0.68	0.66	0.67	0.64	0.61	0.61	0.60	0.60	0.58	0.56	0.57	0.56	0.52	0.52	0.48
Region	2.81	2.77	2.67	2.78	2.83	2.87	2.73	2.58	2.54	2.54	2.74	2.62	2.67	2.66	2.57	2.45
Central Region																
IL	0.28	0.35	0.27	0.62	0.65	0.19	0.42	0.20	0.21	0.18	0.21	0.19	0.12	0.12	0.15	0.27
IN	0.35	0.38	0.30	0.28	0.33	0.33	0.27	0.26	0.25	0.25	0.27	0.22	0.23	0.21	0.22	0.20
MB	4.56	4.60	3.78	4.53	4.16	5.02	4.27	4.46	4.23	4.53	4.57	5.31	4.99	4.34	4.52	5.20
MI	5.52	5.20	5.33	5.49	5.55	5.40	5.04	4.96	4.65	4.66	4.77	5.19	5.29	5.51	5.31	5.27
MN	3.69	3.38	2.88	2.94	3.04	3.36	3.21	3.26	2.95	3.20	3.73	3.69	3.60	3.16	2.76	3.53
OH	0.91	0.90	0.86	0.82	1.12	0.99	0.95	0.73	0.78	0.94	0.91	0.90	0.86	0.89	0.83	0.91
ON	7.02	6.11	6.32	5.62	6.07	6.39	6.14	6.40	5.50	5.27	4.97	5.52	5.55	5.34	5.30	5.09
WI	2.95	2.85	2.43	2.63	2.69	3.03	2.81	3.23	2.76	2.79	2.83	3.14	3.23	3.28	2.54	2.97
Region	3.12	2.89	2.78	2.80	2.94	2.97	2.85	2.88	2.58	2.61	2.66	2.84	2.85	2.81	2.60	2.76
Continent	2.96	2.83	2.73	2.79	2.89	2.92	2.79	2.73	2.56	2.57	2.70	2.73	2.76	2.74	2.58	2.60

Table 3. The number of U.S. hunters by state that submitted woodcock wings for the 2013-14 and 2014-15 Wing-collection Surveys.

State of residence	Number of Hunters who submitted woodcock wings ^a	
	2013-14 Season	2014-15 Season
Alabama	2	2
Arkansas	1	1
Connecticut	25	21
Delaware	2	2
Florida	0	0
Georgia	5	5
Illinois	1	1
Indiana	10	11
Iowa	4	4
Kansas	1	0
Kentucky	2	3
Louisiana	12	12
Maine	120	114
Maryland	7	8
Massachusetts	41	34
Michigan	253	233
Minnesota	83	84
Mississippi	1	2
Missouri	10	19
Nebraska	0	0
New Hampshire	64	59
New Jersey	17	19
New York	99	86
North Carolina	7	9
North Dakota	1	0
Ohio	11	18
Oklahoma	0	2
Pennsylvania	55	62
Rhode Island	2	1
South Carolina	9	8
Tennessee	5	4
Texas	2	0
Vermont	66	56
Virginia	9	13
West Virginia	16	14
Wisconsin	203	189
Total	1,146	1,096

^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 2014 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2013.

State or Region of harvest	Wings received						Recruitment index	
	Total		Adult females		Immatures		1963-13	2014
	1963-13	2014	1963-13	2014	1963-13	2014		
Eastern Region								
CT	14,950	189	3,327	50	9,139	103	2.7	2.1
DE	495	10	75	4	343	3	4.6	
FL	678	0	153	0	422	0	2.8	
GA	3,241	43	1,011	19	1,382	16	1.4	
ME	87,420	1,132	25,830	326	43,684	573	1.7	1.8
MD	4,690	107	1,160	15	2,647	66	2.3	
MA	24,461	445	7,628	146	11,881	167	1.6	1.1
NH	36,078	736	11,710	251	16,729	335	1.4	1.3
NJ	26,964	216	6,226	45	15,952	117	2.6	2.6
NY	63,631	635	21,480	245	28,840	241	1.3	1.0
NC	4,103	128	1,294	47	1,968	57	1.5	1.2
PA	33,043	349	10,444	126	15,264	140	1.5	1.1
RI	2,461	2	475	1	1,628	1	3.4	
SC	3,484	119	1,091	44	1,585	53	1.5	
VT	28,154	512	9,236	172	12,857	207	1.4	1.2
VA	5,566	249	1,464	70	2,980	139	2.0	2.0
WV	6,379	57	1,926	17	3,206	24	1.7	
Region	345,798	4,929	104,530	1,578	170,507	2,242	1.63	1.49
Central Region								
AL	998	15	278	4	453	9	1.6	
AR	546	7	173	3	226	2	1.3	
IL	1,499	6	350	2	843	1	2.4	
IN	8,477	78	2,156	21	4,689	47	2.2	
IA	1,329	26	433	8	597	9	1.4	
KS	50	0	9	0	26	0		
KY	1,175	4	289	1	606	2	2.1	
LA	33,068	433	7,375	105	21,436	254	2.9	2.4
MI	137,445	2,532	45,066	886	67,277	1,147	1.5	1.3
MN	41,394	1,231	14,602	460	17,838	507	1.2	1.1
MS	1,925	23	533	10	980	9	1.8	
MO	4,335	107	1,137	27	2,119	60	1.9	
NE	13	0	5	0	6	0		
ND	4	0	3	0	1	0		
OH	15,091	134	4,634	43	7,097	70	1.5	1.6
OK	172	2	38	0	91	1	2.4	
TN	1,310	37	344	12	669	20	1.9	
TX	1,055	0	295	0	528	0	1.8	
WI	88,701	2,501	29,911	906	41,787	1,113	1.4	1.2
Region	338,587	7,136	107,631	2,488	167,269	3,251	1.55	1.39

Table 5. Preliminary estimates of woodcock harvest, hunter numbers, days afield, and hunter success from the 2014-15 Harvest Information Program (note: all estimates rounded to the nearest 100 for harvest, hunters, and days afield).

Eastern	Harvest		Active woodcock hunters		Days afield		Season harvest per hunter	
	Total	+/- 95% CI ^a	Total	+/- 95% CI	Total	+/- 95% CI	Total	+/- 95% CI
CT	1,000	45	600	31.8	2,600	41.8	1.61	55.2
DE	100	105	200	155	300	119	0.42	187
FL	500	192	< 100	192	300	192	18	272
GA	1,900	131	3,700	106	8,100	106	0.5	168
ME	10,400	61	2,300	45.2	9,600	47	4.58	76.2
MD	500	48	1,100	98.7	3,200	93.7	0.43	110
MA	2,100	28	1,100	27.7	5,400	32.6	1.88	39.7
NH	5,600	40	1,700	34.7	9,000	39.9	3.27	52.7
NJ	3,600	119	400	93.5	3,800	137	9.42	151
NY	8,400	30	4,700	23.7	22,300	32.1	1.79	38.5
NC	8,200	174	3,200	125	11,500	135	2.55	215
PA	6,600	52	5,000	38.3	20,000	43.5	1.31	64.6
RI	400	118	200	69.7	900	70	1.64	137
SC	4,400	130	3,800	93	8,000	93.9	1.14	160
VT	3,000	32	1,200	27.4	5,800	32.2	2.4	42.2
VA	1,900	67	1,400	80.1	8,200	90.8	1.41	105
WV	200	84	300	74.1	800	85.3	0.7	112
Region	58,600	31	na^b		119,700	21	na^b	
Central								
AL	800	124	100	91	400	125	15	154
AR	200	139	200	95.9	400	102	1.25	169
IL	300	132	800	169	2,600	162	0.34	214
IN	700	43	300	99.7	900	88.1	2.51	109
IA	100	92	500	137	1,000	134	0.3	165
KS	0	183	1,000	111	1,000	107	0.01	214
KY	100	188	< 100	188	0	188	5	266
LA	9,400	132	2,700	87.3	5,800	95.4	3.49	158
MI	53,500	29	19,400	21.1	87,500	19.1	2.76	36
MN	23,900	45	13,500	33.5	47,500	31.8	1.77	56
MS	800	113	1,600	109	5,400	135	0.47	157
MO	600	66	1,300	123	2,200	112	0.47	139
NE	1,400	196	400	196	1,100	196	4	277
OH	300	90	1,600	85.4	4,500	94.2	0.17	124
OK	100	88	< 100	63.9	100	78.1	2.83	109
TN	100	192	100	93.9	400	117	0.5	214
TX	< 100	192	100	73.4	200	99	0.4	205
WI	49,300	45	16,200	25	66,400	26.9	3.05	51.8
Region	141,500	23	na^b		227,600	13.6	na^b	
Total	200,100	18	na^b		347,400	11.5	na^b	

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

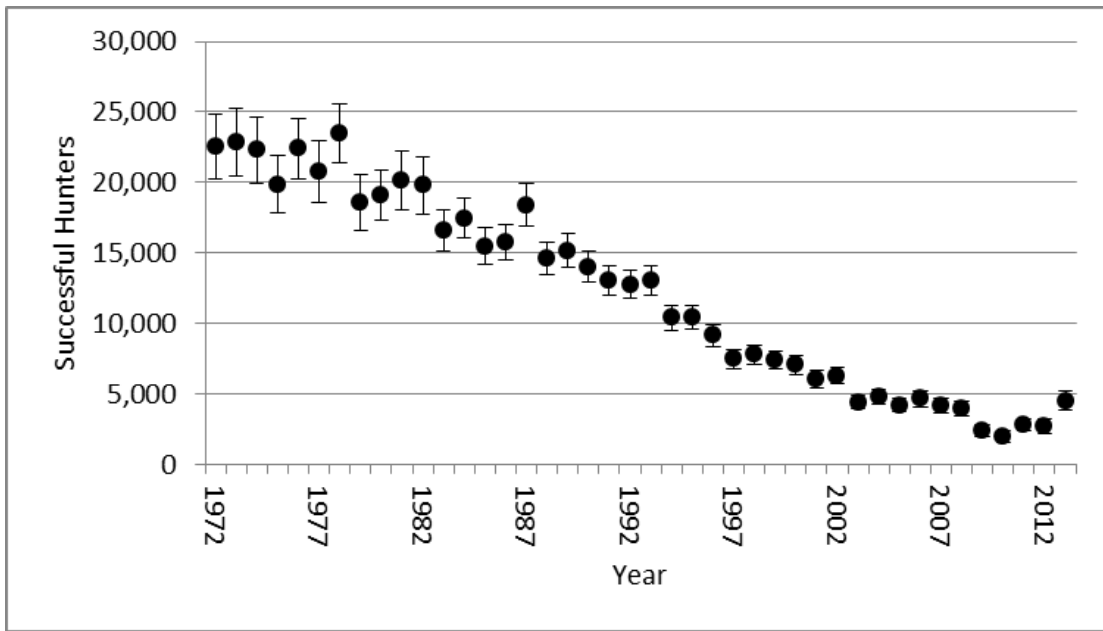
^b Regional estimates of hunter numbers and hunter success cannot be obtained due to the occurrence of individual hunters being registered in the Harvest Information Program in more than one state.

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 - 2014.

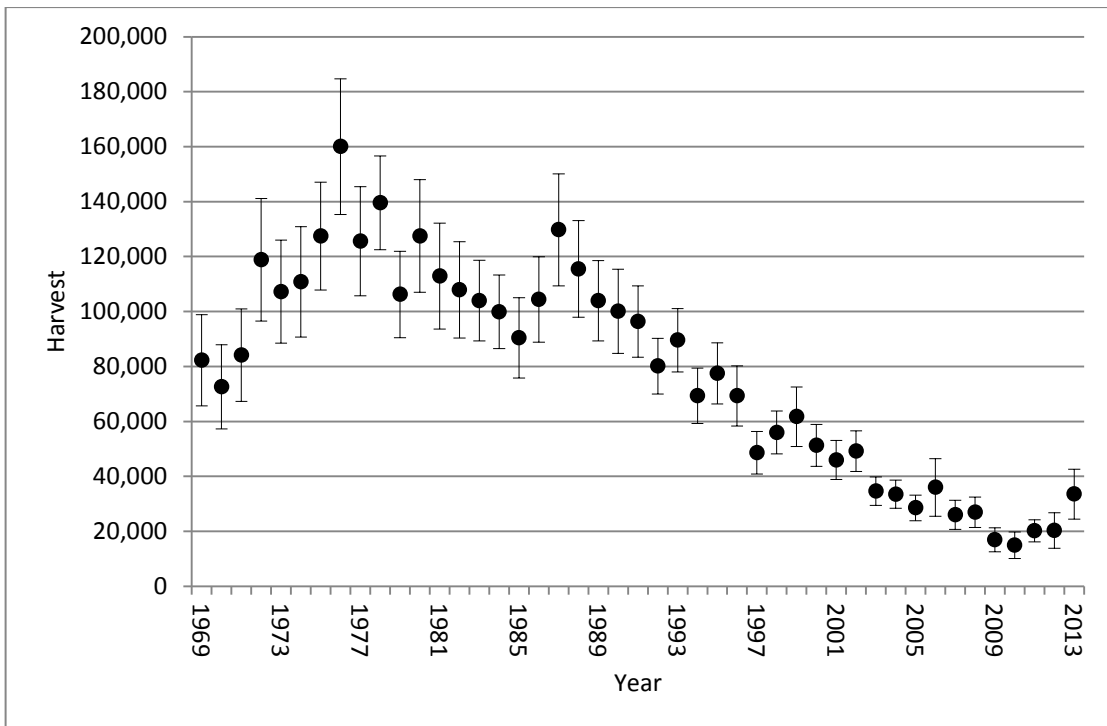
Eastern Region				Central Region			
Year (s)	Outside dates	Season length	Daily bag limit	Year (s)	Outside dates	Season length	Daily bag limit
1918-26	Oct. 1 - Dec. 31	60	6	1918-26	Oct. 1 - Dec. 31	60	6
1927	Oct. 1 - Dec. 31	60	4	1927	Oct. 1 - Dec. 31	60	4
1928-39	Oct. 1 - Dec. 31	30	4	1928-39	Oct. 1 - 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	1997-2014	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				
2011-14	Oct. 1 - Jan. 31	45	3				

^a Saturday nearest September 22nd, which was September 20th for the 2014 season.

Appendix B. Estimates for the number of successful woodcock hunters and woodcock harvest in Canada (Gendron and Smith 2013). Data from the 2014 hunting season were not available before this report was completed.



Estimated number of successful woodcock hunters in Canada and associated 95% confidence intervals, 1972-2013.



Estimated woodcock harvest in Canada and associated 95% confidence intervals, 1969-2013.

U.S. Fish and Wildlife Service
Division of Migratory Bird Management
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June 2015

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