U.S. Fish & Wildlife Service

American Woodcock

Population Status, 2014

Suggested report citation:

Cooper, T.R., and R.D. Rau. 2014. American woodcock population status, 2014. U.S. Fish and Wildlife Service, Laurel, Maryland. 16 pp.

All Division of Migratory Bird Management reports are available at:
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AMERICAN WOODCOCK POPULATION STATUS, 2014

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Abstract: American Woodcock Singing-ground Survey data for 2014 indicate that the index for singing American woodcock (*Scolopax minor*) males in the Eastern Management Region was not significantly different from 2013; while there was a significant decline of 7.3% in the Central Management Region. There was a significant declining 10-year trend for woodcock heard in both Management Regions during 2004-14. This marks first time in 10 years that there has been a declining 10-year trend in the Eastern Management Region and the first time in 3 years there has been a declining 10-year trend in the Central Management Region. Both regions have a significant, long-term (1968-14) declining trend (-1.0%/year for the Eastern Management Region and -0.9%/year for the Central Management Region). The 2013 recruitment index for the U.S. portion of the Eastern Region (1.60 immatures per adult female) was 3.2% less than the 2012 index and 2.3% less than the long-term regional index, while the recruitment index for the U.S. portion of the Central Region (1.54 immatures per adult female) was 7.2% less than the 2012 index and was 1.4% less than the long-term regional index. Estimates from the Harvest Information Program indicated that U.S. woodcock hunters in the Eastern Region spent 136,700 days afield and harvested 62,500 woodcock during the 2013-14 season, while in the Central Region, hunters spent 306,100 days afield and harvested 180,600 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 2014. 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

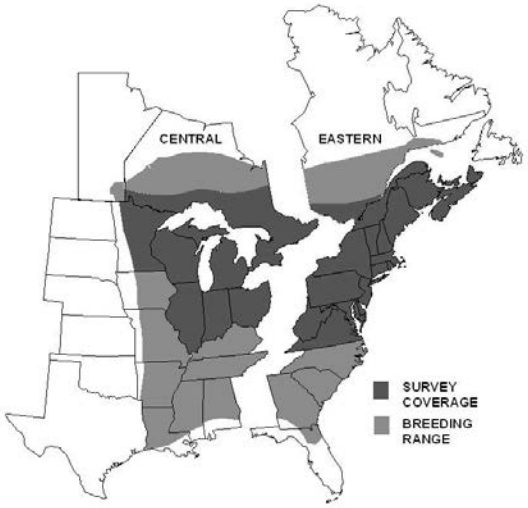

Fig. 1. Woodcock management regions, breeding range, and Singing-ground Survey coverage.

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. In order to avoid expending unnecessary resources and funds, approximately one-half 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 when it is next run, the route reverts to normal status and is run 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, and the indices and trends are directly comparable as trends are calculated directly from the indices.

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 of 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 year effects, and trends are defined as ratios of the year effects 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 (2013-14), 10-year (2004-14) and long-term (1968-2014) 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 using Bayesian methods. 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 3 June 2014 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 2013 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 2013 recruitment index for each state with $\geq$ 125 submitted wings was calculated as the number of immatures per adult female. The regional indices for 2013 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2012.

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 2003-13 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 786 routes were submitted by 3 June 2014 (Table 1). Short-term, 10-year, and long-term (1968-2014) trends were estimated using data from 781 routes in the Eastern Region and 729 routes in the Central Region. Short-term analysis indicated that the number of woodcock heard singing during the 2014 Singing-ground Survey was not significantly different from last year for the Eastern Management Region, while it was 7.3 % lower for the Central Management Region (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 (2004-2014) showed a significant decline for both Management Regions (Table 1, Fig. 2). This marks the first time in ten years that the trend in the Eastern Region has shown a decline and the first time in three years that the trend has shown a decline in the Central Region.

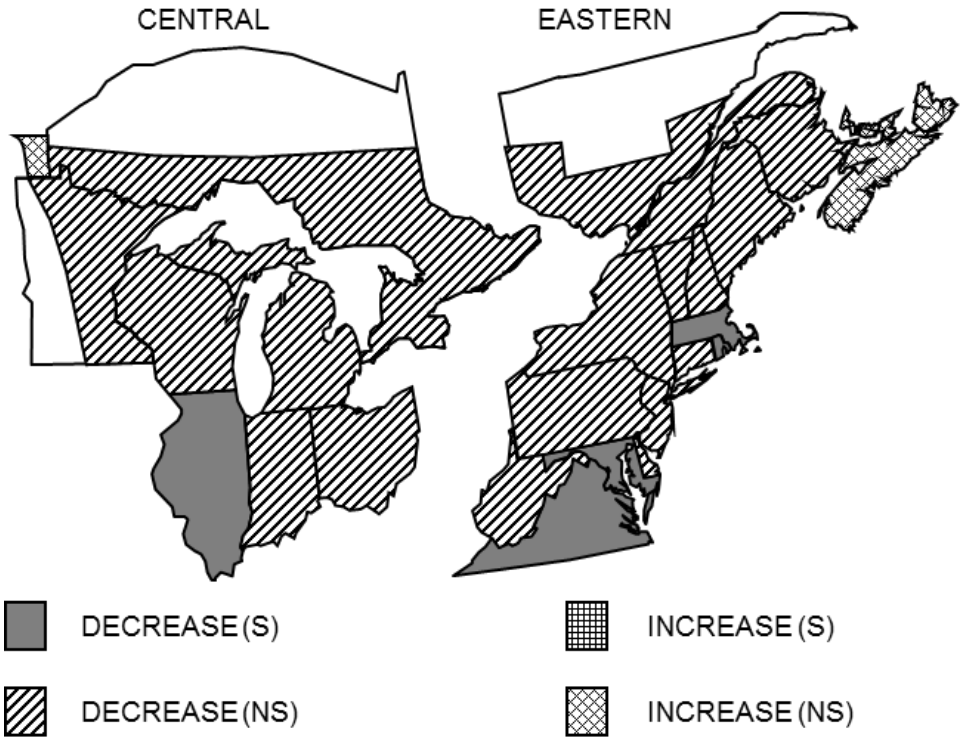

Fig. 2. Ten-year trends in the number of American woodcock heard on the Singing-ground Survey, 2004-2014, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. Note, no state or province has a significant increasing trend.

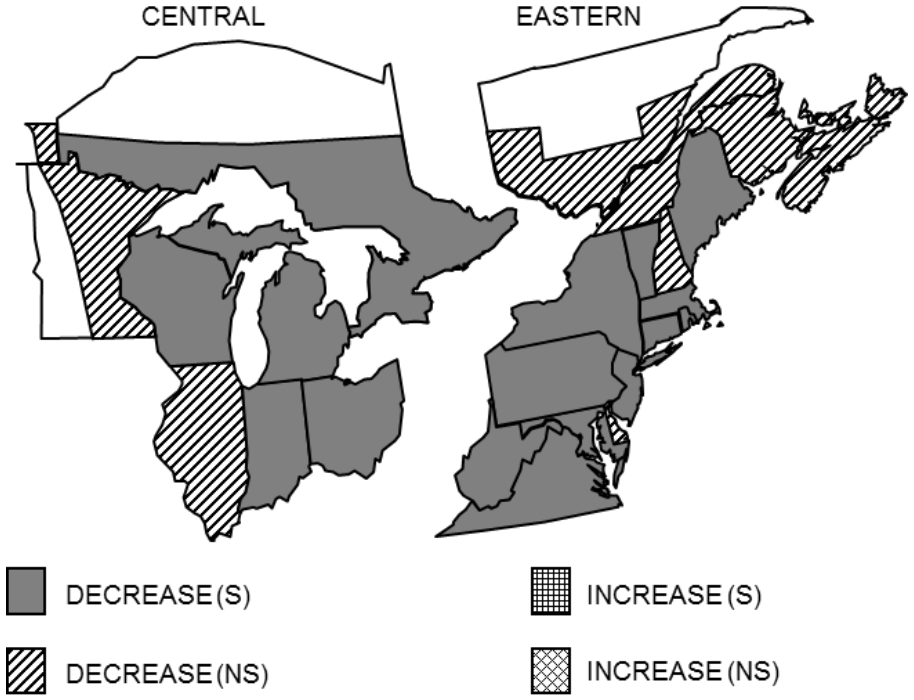

Fig. 3. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968-2014, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. Note, no state or province has a significant or non-significant long-term increase.

Many states and/or provinces in both management regions have experienced significant long-term (1968-2014) 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 -1.01 %/year for the Eastern Management Region, while it was -0.90%/year for the Central Management Region (Table 1).

In the Eastern Region, the 2014 index was 2.54 singing males per route, while it was 2.57 in the Central Management Region (Figure 4, Table 2). Annual indices (1968-2014) by state, province, or region are available in Table 2.

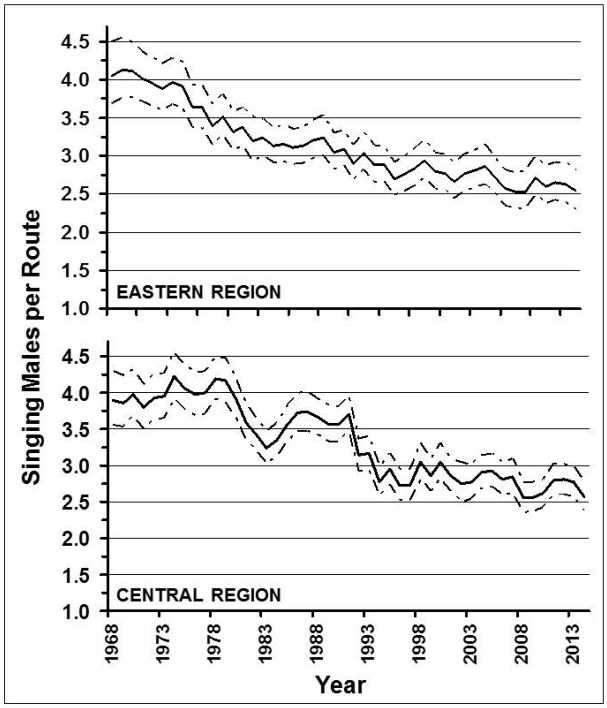

Fig. 4. Annual indices of the number of woodcock heard during the Singing-ground Survey, 1968-2014 as estimated using hierarchical modeling. The dashed lines represent the 95% credible interval of the estimate.

Wing-collection Survey

A total of 1,146 woodcock hunters (Table 3) from states with a woodcock season sent in a total of 13,363 usable woodcock wings for the 2013 Wing-collection Survey (Table 4).

The 2013 recruitment index in the U.S. portion of the Eastern Region (1.60 immatures per adult female) was 3.2% less than the 2012 index of 1.65, and 2.3% less than the long-term (1963-12) regional average of 1.63 (Table 4, Fig 5). In the Central Region, the 2013 recruitment index (1.54 immatures per adult female) was 7.2% less than the 2012 index of 1.66 and was 1.4% less than the long-term regional average of 1.56 (Table 4, Fig 5). Percent change for all comparisons was calculated using unrounded recruitment indices.

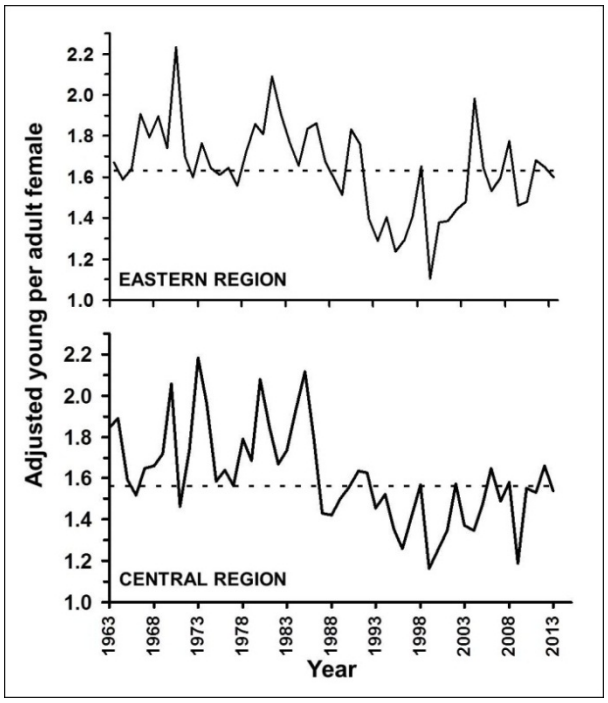

Fig. 5. Weighted annual indices of recruitment (U.S.), 1963-2013. The dashed line is the 1963-2012 average.

Harvest Information Program

Estimates of woodcock harvest, number of active hunters, days afield, and seasonal hunting success from the 2013-14 HIP survey are provided in Table 5. In the Eastern Management Region, woodcock hunters spent an estimated 136,700 days afield (Figure 6) and harvested 62,500 birds (Figure 7) during the 2013-14 hunting season. Harvest in 2013-14 was 26.9% less than the long-term (1999-2013) average (85,447 birds/year) and 27.7% less than last year (86,400 birds) in the Eastern Region. Woodcock hunters in the Central Region spent an estimated 306,100 days afield (Figure 6) and harvested 180,600 birds (Figure 7) during the 2013-14 hunting season. Harvest in 2013-14 was 18.9% less than the long-term (1999-2013) average (222,747 birds/year) and 6.5% less than last year (193,100 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 HIP estimates from 1999-2002 are final, while those from 2003-2013 are preliminary. All estimates have been rounded to the nearest hundred.

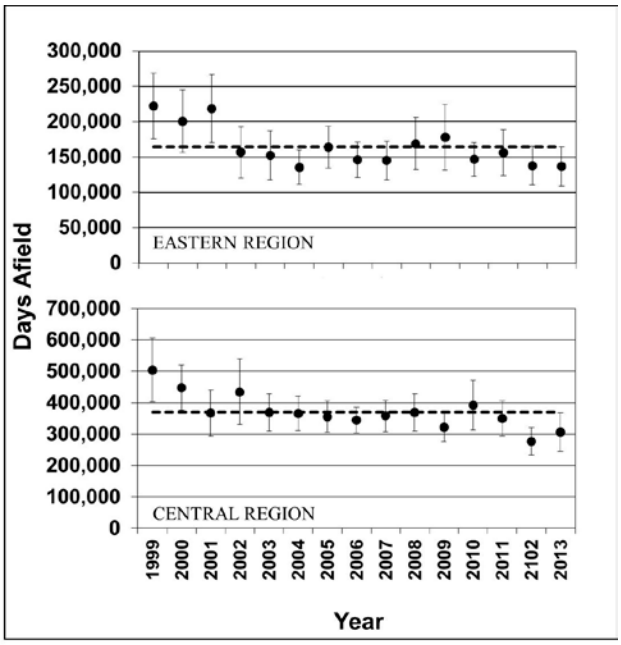

Fig. 6. Harvest Information Program Survey estimates of days spent afield by U.S. woodcock hunters, 1999-2013. The dashed line represents the 1999-2013 average and error bars represent the 95% confidence interval of the point estimate.

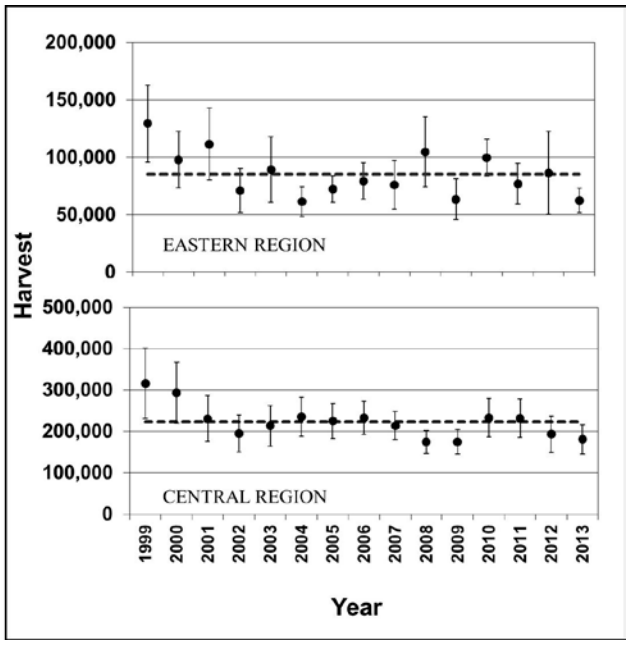

Fig. 7. Harvest Information Program Survey estimates of U.S. woodcock harvest, 1999-2013. The dashed line represents the 1999-2013 average and the error bars represent the 95% confidence interval of the point estimate.

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 2,718 successful hunters harvested 20,341 woodcock during the 2012 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), K. Bordeau, M. Ellingwood (NH), J. Garris (NJ), T. Sutter (NY), G. Parsons (NS), B. Crose, L. Fendrick, and N. Stricker (OH), J. Hayden (ON), M. Weaver (PA), B. Potter (PEI), B. Tefft (RI), D. Sausville (VT), T. Engelmeyer (VA), S. Wilson (WV), B. Stewart, K. Jones (BSC), M. Gendron, A. Hicks, J. B. Pollard, E. Reed, J. Rodrigue, and M. Schuster, C. Sharp (CWS), and C. Dwyer, S. Kelly, and M. Mills (FWS), for providing state, provincial, regional Singing-ground Survey coordination.

Special appreciation is extended to Shaun Oldenburger and Mike Frisbie from Texas Parks and Wildlife Department for coordinating local logistics and hosting the 2014 wingbee, which was held at Caddo Lake State Park in Texas. Other individuals who participated in the wingbee were: M Poteet, S. Willis, B. Adams, R. Randle, R. Mize, L. Speight, J. Laing, V. Adams, and A. Terry (TX); C. Baranski (NC); M. Olinde and J. Duguay (LA); L. Fendrick and M. Wiley (OH); E. Johnson and G. Hoch (MN); A. Stewart (MI; Andy Weik (Ruffed Grouse Society), D. McAuley (USGS); B. Allen, T. Edwards, K. Daly, W. Brininger, B. Rau, K. Sturm, R. Brown, and T. Cooper (USFWS). 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 B.Raftovich, B. West,H. Spriggs, K. Wilkins, and T. Ceaser). 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. Zimpher (USFWS) assisted in the development of SQL queries in Program R. K. Magruder (USFWS) provided invaluable assistance with data management and entry. 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 (2013-14), 10-year (2004-2014), and long-term (1968-2014) 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]		2013-2014			2004-2014			1968-2014		
				95% CI[d]			95% CI[d]			95% CI[d]	
		n[c]	% change	lower	upper	% change	lower	upper	% change	lower	upper
CT	4	11	-0.64	-35.27	65.75	-1.75	-5.74	5.23	-2.73	-4.68	-0.75
DE	1	3	-3.23	-86.05	553.86	-4.02	-22.10	13.58	-3.59	-8.92	1.61
ME	55	72	-5.46	-20.98	12.69	-1.24	-3.09	0.66	-1.23	-1.76	-0.69
MD	4	26	-4.10	-26.55	23.89	-4.07	-6.75	-1.32	-4.03	-5.52	-2.57
MA	11	22	-1.60	-23.20	30.67	-3.07	-6.57	-0.71	-2.55	-3.58	-1.51
NB	47	72	-4.74	-21.47	15.97	-0.95	-3.12	1.19	-0.75	-1.53	0.02
NH	14	18	1.60	-21.95	34.46	-0.55	-3.53	2.20	-0.13	-1.17	0.92
NJ	6	19	-9.04	-49.64	60.47	-4.53	-9.98	2.76	-5.77	-7.44	-4.10
NY	73	115	-4.09	-16.89	10.36	-1.26	-2.79	0.28	-1.09	-1.52	-0.62
NS	45	62	-5.53	-22.12	14.32	0.23	-1.94	2.70	-0.57	-1.30	0.12
PA	36	80	17.71	-8.49	62.26	-0.70	-3.34	2.23	-1.05	-1.83	-0.25
PEI	10	13	5.72	-22.80	53.69	0.33	-2.81	5.61	-0.86	-2.16	0.57
QUE	12	109	-4.16	-23.85	10.55	-0.91	-2.90	0.84	-0.76	-1.60	0.11
RI[e]	0	3	-------	-------	------	-12.08	-22.93	-1.39	-11.93	-18.25	-6.34
VT	19	24	-10.84	-35.68	22.29	-2.47	-5.93	0.88	-1.08	-2.06	-0.10
VA	21	75	-7.98	-40.92	37.82	-4.96	-8.66	-0.74	-5.14	-6.19	-4.01
WV	20	57	0.52	-17.44	34.42	-1.95	-4.07	1.11	-2.23	-3.08	-1.39
Eastern	**378**	**781**	**-3.25**	**-11.06**	**3.95**	**-1.01**	**-1.82**	**-0.22**	**-1.01**	**-1.32**	**-0.71**
IL	12	46	19.68	-66.36	328.50	-14.12	-24.85	-4.19	-1.04	-4.28	2.32
IN	15	60	2.89	-38.43	85.69	-3.99	-9.53	1.26	-4.13	-5.49	-2.88
MB[f]	18	30	4.44	-22.17	43.40	1.09	-2.18	5.36	-0.31	-2.23	1.75
MI	95	153	-4.36	-15.81	8.59	-0.53	-1.93	0.95	-0.77	-1.17	-0.38
MN	76	120	-7.86	-22.19	8.57	-0.43	-2.19	1.38	-0.09	-0.68	0.53
OH	30	73	-3.61	-27.17	26.80	-2.61	-5.80	0.08	-1.58	-2.38	-0.78
ON	82	157	-2.55	-16.80	14.45	-1.43	-3.22	0.42	-0.90	-1.38	-0.39
WI	80	120	-22.21	-34.41	-7.81	-0.64	-2.50	1.29	-0.76	-1.27	-0.24
Central	**408**	**729**	**-7.26**	**-14.02**	**-0.02**	**-1.22**	**-2.08**	**-0.36**	**-0.90**	**-1.16**	**-0.65**
Continent	**786**	**1,510**	**-5.35**	**-10.42**	**-0.26**	**-1.12**	**-1.70**	**-0.53**	**-0.95**	**-1.16**	**-0.76**

[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 2014 for which data were received by 3 June, 2014.
[c] Number of routes with at least one year of non-zero data between 1968 and 2014.
[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 2014.
[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, 1968-2014. These indices are based on 1968-2014 trends that were estimated using hierarchical modeling techniques. Blanks 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	------	2.61	2.72	2.41	2.59	2.37	2.38	2.43	1.92	1.95	1.65	1.75	1.73	1.72	1.92	1.67
DE	1.03	0.86	1.03	0.74	0.89	1.00	0.90	1.60	0.51	0.67	0.50	0.55	0.66	0.63	0.62	0.92
ME	6.16	6.04	6.67	6.05	6.04	6.19	6.41	6.67	6.23	5.37	5.11	5.60	4.87	5.58	4.32	4.80
MD	1.91	1.89	1.77	1.72	1.65	1.58	1.51	1.47	1.35	1.32	1.28	1.22	1.21	1.16	1.09	1.02
MA	------	3.35	3.40	3.38	3.08	3.30	3.13	2.74	2.68	2.68	2.59	2.66	2.40	2.52	2.29	2.15
NB	------	8.86	8.67	7.98	7.89	7.33	7.89	8.41	6.48	7.81	5.92	6.42	5.23	6.13	6.70	5.80
NH	------	3.81	4.01	3.58	4.09	3.47	3.97	3.75	3.72	3.76	3.66	3.58	3.91	3.80	3.32	3.41
NJ	4.50	4.29	4.55	5.87	4.24	5.23	4.82	3.95	2.80	2.81	2.31	3.01	2.11	1.91	1.81	1.82
NY	4.31	4.42	3.94	4.24	4.07	4.17	4.19	3.79	3.83	3.80	3.48	3.72	4.00	3.83	3.52	3.73
NS	4.25	3.74	3.19	3.83	3.57	3.78	3.96	3.79	3.61	3.60	3.90	3.34	3.38	3.17	3.00	3.31
PA	1.97	1.83	2.07	1.98	1.93	1.94	1.67	1.68	1.72	1.69	1.62	1.72	1.50	1.50	1.45	1.48
PEI	------	5.13	5.17	5.76	4.75	4.73	4.97	5.93	5.16	4.93	4.74	4.89	4.11	3.86	4.01	4.50
QUE	------	------	6.25	6.11	6.19	5.99	6.02	5.93	5.87	5.74	5.99	6.01	5.95	5.73	5.68	5.75
RI	------	1.99	1.74	2.14	1.63	1.48	1.20	1.02	0.89	0.79	0.63	0.60	0.53	0.44	0.45	0.37
VT	------	3.35	4.12	3.64	4.12	3.56	3.97	4.25	4.36	4.50	3.38	3.55	3.39	3.00	2.25	3.02
VA	------	1.41	1.39	1.20	1.12	0.96	1.16	1.03	0.97	0.93	0.82	0.80	0.69	0.75	0.74	0.66
WV	1.52	1.53	1.41	1.37	1.44	1.36	1.31	1.32	1.25	1.19	1.08	1.17	1.12	1.18	1.13	1.07
Region	**4.05**	**4.13**	**4.11**	**4.02**	**3.95**	**3.88**	**3.96**	**3.91**	**3.65**	**3.64**	**3.39**	**3.52**	**3.32**	**3.37**	**3.20**	**3.24**
Central Region																
IL	------	------	0.23	0.46	0.41	0.30	0.44	0.34	0.22	0.29	0.47	0.31	0.22	0.43	0.27	0.82
IN	1.49	1.05	1.03	0.82	1.18	1.06	0.94	0.78	0.81	0.77	0.77	0.93	0.73	0.85	0.58	0.61
MB	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
MI	7.43	7.23	7.33	6.90	6.95	7.17	8.05	8.07	7.70	7.17	7.70	7.53	7.26	6.42	6.85	5.75
MN	------	2.96	2.88	3.24	3.03	3.43	3.95	3.56	3.61	3.69	4.00	3.54	4.01	3.65	3.62	3.17
OH	------	------	1.61	1.49	1.51	1.34	1.54	1.29	1.51	1.42	1.29	1.24	1.22	1.35	1.13	1.19
ON	7.99	8.93	9.43	8.56	9.39	9.06	9.16	8.73	8.89	9.10	9.32	9.69	9.05	8.22	6.97	6.89
WI	3.47	3.48	4.00	3.77	3.75	3.94	4.01	4.07	3.70	4.12	4.26	4.43	3.58	3.04	3.22	3.09
Region	**3.89**	**3.86**	**3.98**	**3.79**	**3.93**	**3.95**	**4.23**	**4.06**	**3.98**	**3.99**	**4.19**	**4.17**	**3.92**	**3.59**	**3.42**	**3.24**
Continent	**3.98**	**4.00**	**4.05**	**3.91**	**3.94**	**3.91**	**4.09**	**3.99**	**3.81**	**3.82**	**3.79**	**3.84**	**3.62**	**3.48**	**3.31**	**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	1.59	1.58	1.66	1.44	1.67	1.32	1.34	1.36	1.25	1.13	1.18	1.26	1.25	1.12	1.08	1.15
DE	0.50	0.51	0.54	0.52	0.51	0.49	0.60	0.34	0.35	0.42	0.41	0.40	0.42	0.40	0.59	0.32
ME	4.84	4.96	5.28	5.59	5.15	5.31	4.25	4.78	4.19	4.48	4.13	4.25	3.57	3.86	3.83	4.16
MD	0.99	0.95	0.89	0.86	0.83	0.80	0.77	0.74	0.69	0.68	0.65	0.62	0.61	0.58	0.54	0.52
MA	2.26	2.21	2.13	2.10	2.05	1.93	1.89	1.87	1.75	1.70	1.69	1.65	1.61	1.61	1.55	1.69
NB	5.29	5.53	4.68	5.12	5.93	7.06	6.01	5.54	5.39	6.46	6.61	6.17	5.36	5.99	5.98	6.80
NH	3.37	3.48	4.25	3.69	3.65	3.61	3.42	3.67	3.42	3.42	3.43	3.78	3.69	3.69	3.64	3.86
NJ	1.99	1.85	1.65	1.91	1.40	1.38	1.31	1.22	1.04	0.92	0.78	0.92	0.88	0.69	0.77	0.80
NY	3.37	3.70	3.44	3.33	3.54	3.19	3.52	3.54	3.32	3.24	2.92	3.02	2.87	2.93	2.96	2.99
NS	3.09	3.26	3.40	2.98	3.25	3.22	2.99	3.25	3.24	3.33	2.96	3.11	3.21	3.00	3.08	3.43
PA	1.55	1.49	1.53	1.46	1.41	1.37	1.51	1.68	1.38	1.45	1.20	1.40	1.37	1.28	1.47	1.35
PEI	4.54	4.45	4.71	4.04	4.52	4.73	4.21	4.11	4.09	3.92	3.71	3.92	4.23	4.09	3.92	3.67
QUE	5.62	5.57	5.54	5.58	5.71	5.76	5.49	5.42	5.37	5.49	5.37	5.15	4.95	5.01	5.26	5.17
RI	0.33	0.27	0.24	0.22	0.18	0.16	0.15	0.13	0.11	0.10	0.09	0.08	0.07	0.06	0.05	0.05
VT	2.90	2.67	2.87	3.29	3.54	3.43	3.21	3.31	2.43	2.73	2.61	2.58	2.49	2.62	2.87	3.27
VA	0.84	0.52	0.56	0.54	0.48	0.44	0.46	0.42	0.43	0.40	0.37	0.32	0.31	0.34	0.28	0.29
WV	1.04	1.00	0.99	0.97	0.94	0.92	0.93	0.87	0.86	0.83	0.82	0.85	0.79	0.78	0.74	0.75
Region	**3.13**	**3.16**	**3.12**	**3.13**	**3.20**	**3.24**	**3.05**	**3.09**	**2.90**	**3.04**	**2.89**	**2.88**	**2.69**	**2.76**	**2.83**	**2.95**
Central Region																
IL	0.43	0.73	0.62	1.12	0.34	0.55	0.27	0.59	0.36	0.49	0.30	0.23	0.29	0.23	0.30	0.38
IN	0.60	0.56	0.65	0.61	0.52	0.48	0.62	0.58	0.54	0.44	0.43	0.40	0.36	0.36	0.44	0.38
MB	------	------	------	------	------	------	------	------	5.29	5.42	5.54	5.77	5.00	3.53	4.34	4.29
MI	6.45	6.60	6.87	6.43	6.81	6.57	6.61	7.18	5.70	5.79	5.13	5.65	5.42	5.24	6.18	5.20
MN	3.13	3.42	3.57	3.59	3.93	3.29	3.90	3.77	3.22	3.29	2.99	3.09	3.00	2.73	3.13	3.20
OH	1.24	1.12	1.09	1.08	1.16	0.98	1.25	1.13	1.12	1.03	1.04	0.98	1.02	0.87	1.00	0.85
ON	6.90	7.79	8.00	7.96	7.95	8.02	7.57	7.69	7.14	6.92	5.97	6.52	5.33	6.11	6.33	5.85
WI	3.38	3.32	3.79	3.85	3.59	3.65	3.46	3.49	2.82	2.96	2.59	2.67	2.63	2.52	2.69	3.03
Region	**3.34**	**3.56**	**3.72**	**3.73**	**3.67**	**3.56**	**3.56**	**3.70**	**3.14**	**3.16**	**2.78**	**2.95**	**2.73**	**2.73**	**3.04**	**2.86**
Continent	**3.24**	**3.36**	**3.42**	**3.43**	**3.43**	**3.40**	**3.31**	**3.39**	**3.02**	**3.10**	**2.83**	**2.92**	**2.71**	**2.75**	**2.94**	**2.90**

Table 2. Continued

State, Province, or Region	Year														
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Eastern Region															
CT	1.03	0.96	0.89	0.89	0.87	0.85	0.81	0.81	0.82	0.78	0.76	0.85	0.83	0.74	0.75
DE	0.43	0.29	0.31	0.29	0.30	0.29	0.24	0.24	0.23	0.24	0.24	0.23	------	0.20	0.19
ME	4.26	3.84	3.57	3.87	3.95	4.01	3.93	3.61	3.63	3.55	3.75	3.85	3.78	3.69	3.49
MD	0.51	0.51	0.46	0.45	0.43	0.41	0.41	0.38	0.37	0.35	0.34	0.32	0.31	0.30	0.29
MA	1.54	1.45	1.44	1.40	1.45	1.32	1.31	1.22	1.27	1.24	1.17	1.13	1.07	1.06	1.05
NB	6.29	6.71	6.41	6.96	6.97	7.68	6.86	6.20	5.93	5.37	6.96	6.47	7.15	6.63	6.33
NH	3.42	3.51	3.49	3.75	3.78	3.73	3.55	3.08	3.15	3.60	3.59	3.26	3.58	3.50	3.57
NJ	0.71	0.65	0.54	0.60	0.46	0.41	0.42	0.43	0.36	0.42	0.26	0.34	0.37	0.32	0.29
NY	2.85	2.78	2.72	2.82	2.97	2.78	2.81	2.65	2.55	2.72	2.87	2.66	2.73	2.73	2.61
NS	3.42	3.21	2.95	2.92	3.18	3.04	2.88	2.88	2.76	2.73	3.15	2.77	3.11	3.46	3.27
PA	1.07	1.30	1.28	1.27	1.30	1.34	1.20	1.17	1.31	1.29	1.39	1.20	1.09	1.03	1.21
PEI	3.92	3.73	3.22	3.31	3.32	3.44	3.68	3.57	3.13	3.33	3.16	3.32	3.67	3.27	3.49
QUE	4.94	4.96	4.87	4.92	4.91	5.03	4.77	4.74	4.65	4.74	4.67	4.65	4.52	4.72	4.47
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	3.34	2.63	2.41	2.59	2.63	2.79	2.76	2.37	2.18	2.35	2.44	2.30	2.51	2.30	2.05
VA	0.27	0.23	0.23	0.23	0.22	0.20	0.19	0.18	0.18	0.15	0.15	0.16	0.14	0.14	0.13
WV	0.73	0.70	0.68	0.69	0.65	0.62	0.62	0.62	0.61	0.60	0.57	0.58	0.58	0.53	0.54
Region	**2.80**	**2.77**	**2.67**	**2.77**	**2.81**	**2.86**	**2.72**	**2.57**	**2.53**	**2.53**	**2.72**	**2.60**	**2.65**	**2.63**	**2.54**
Central Region															
IL	0.29	0.36	0.27	0.63	0.67	0.19	0.43	0.21	0.22	0.18	0.22	0.19	0.12	0.12	0.15
IN	0.34	0.37	0.29	0.28	0.32	0.32	0.26	0.25	0.25	0.25	0.26	0.22	0.23	0.21	0.21
MB	4.58	4.62	3.79	4.52	4.15	4.98	4.25	4.46	4.22	4.50	4.59	5.29	4.96	4.46	4.66
MI	5.51	5.16	5.27	5.45	5.48	5.33	4.99	4.90	4.59	4.59	4.68	5.09	5.16	5.43	5.20
MN	3.61	3.30	2.81	2.87	2.97	3.28	3.14	3.19	2.90	3.12	3.63	3.59	3.55	3.09	2.85
OH	0.88	0.87	0.84	0.80	1.04	0.93	0.90	0.71	0.75	0.88	0.85	0.84	0.81	0.83	0.80
ON	6.76	6.12	6.33	5.66	6.11	6.40	6.18	6.47	5.57	5.31	5.01	5.59	5.59	5.43	5.29
WI	2.86	2.77	2.38	2.55	2.60	2.91	2.70	3.10	2.65	2.66	2.71	2.99	3.08	3.13	2.44
Region	**3.05**	**2.86**	**2.75**	**2.77**	**2.90**	**2.93**	**2.81**	**2.85**	**2.55**	**2.56**	**2.61**	**2.80**	**2.80**	**2.77**	**2.57**
Continent	**2.92**	**2.82**	**2.71**	**2.78**	**2.86**	**2.90**	**2.77**	**2.71**	**2.55**	**2.55**	**2.67**	**2.70**	**2.73**	**2.70**	**2.56**

Table 3. The number of U.S. hunters by state that submitted woodcock wings for the 2012-13 and 2013-14 Wing-collection Surveys.

State of residence	Number of Hunters who submitted woodcock wings[a]	
	2012-13 Season	2013-14 Season
AL	1	2
AR	1	1
CT	29	25
DE	3	2
FL	0	0
GA	4	5
IL	1	1
IN	11	10
IA	5	4
KS	0	1
KY	2	2
LA	13	12
ME	146	120
MD	10	7
MA	44	41
MI	285	253
MN	89	83
MS	2	1
MO	15	10
NE	0	0
NH	74	64
NJ	26	17
NY	119	99
NC	6	7
ND	0	1
OH	9	11
OK	0	0
PA	64	55
RI	2	2
SC	8	9
TN	2	5
TX	0	2
VT	71	66
VA	14	9
WV	11	16
WI	239	203
Total	**1,306**	**1,146**

[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 in 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 2013 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2012.

State or Region of harvest	Wings received						Recruitment index	
	Total		Adult females		Immatures			
	1963-12	2013	1963-12	2013	1963-12	2013	1963-12	2013
Eastern Region								
CT	14,752	198	3,266	61	9,047	92	2.8	1.5
DE	487	8	71	4	340	3	4.8	
FL	678	0	153	0	422	0	2.8	
GA	3,211	30	1,003	8	1,372	10	1.4	
ME	86,366	1,054	25,550	280	43,124	560	1.7	2.0
MD	4,578	112	1,138	22	2,579	68	2.3	
MA	24,006	455	7,465	163	11,672	209	1.6	1.3
NH	35,250	828	11,467	243	16,312	417	1.4	1.7
NJ	26,764	200	6,166	60	15,846	106	2.6	1.8
NY	62,673	958	21,153	327	28,421	419	1.3	1.3
NC	3,960	143	1,236	58	1,914	54	1.5	0.9
PA	32,667	376	10,325	119	15,081	183	1.5	1.5
RI	2,456	5	472	3	1,627	1	3.4	
SC	3,374	110	1,046	45	1,545	40	1.5	
VT	27,458	696	8,994	242	12,561	296	1.4	1.2
VA	5,425	141	1,423	41	2,920	60	2.1	1.5
WV	6,303	76	1,906	20	3,165	41	1.7	
Region	**340,408**	**5,390**	**102,834**	**1,696**	**167,948**	**2,559**	**1.63**	**1.60**
Central Region								
AL	967	31	266	12	441	12	1.7	
AR	543	3	172	1	226	0	1.3	
IL	1,495	4	346	4	843	0	2.4	
IN	8,410	67	2,137	19	4,650	39	2.2	
IA	1,300	29	420	13	588	9	1.4	
KS	49	1	9	0	26	0		
KY	1,168	7	288	1	602	4	2.1	
LA	32,640	428	7,286	89	21,158	278	2.9	3.1
MI	134,087	3,358	43,990	1,076	65,648	1,629	1.5	1.5
MN	40,163	1,231	14,121	481	17,382	456	1.2	0.9
MS	1,860	65	515	18	962	18	1.9	
MO	4,249	86	1,111	26	2,083	36	1.9	
NE	13	0	5	0	6	0		
ND	3	1	3	0	0	1		
OH	14,979	112	4,598	36	7,039	58	1.5	
OK	172	0	38	0	91	0	2.4	
TN	1,298	12	340	4	665	4	2.0	
TX	1,052	3	293	2	528	0	1.8	
WI	86,166	2,535	28,975	936	40,671	1,116	1.4	1.2
Region	**330,614**	**7,973**	**104,913**	**2,718**	**163,609**	**3,660**	**1.56**	**1.54**

Table 5. Preliminary estimates of woodcock harvest, hunter numbers, days afield, and hunter success from the 2013-14 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	1,200	52	800	31	3,600	33	1.5	61
DE	200	103	<100	93	200	109	4.3	139
FL	1,000	148	1,800	184	3,800	119	0.6	236
GA	800	97	800	79	2,500	89	1.0	126
ME	5,800	43	2,200	46	8,800	35	2.6	63
MD	1,900	107	1,200	96	2,000	81	1.6	143
MA	2,400	44	900	39	4,800	34	2.6	59
NH	8,000	29	2,600	29	13,000	25	3.0	41
NJ	7,400	71	2,000	37	11,000	48	3.7	80
NY	11,700	38	3,900	31	15,300	29	3.0	49
NC	1,400	95	1,900	134	8,200	106	0.7	164
PA	8,200	42	6,400	37	29,600	41	1.3	56
RI	300	58	100	27	400	40	4.0	64
SC	2,100	177	3,000	109	13,000	127	0.7	208
VT	4,100	39	1,400	34	8,600	56	3.0	51
VA	5,700	80	2,200	65	11,300	112	2.5	103
WV	300	58	200	92	600	60	1.6	109
Region	**62,500**	**17**	**na[b]**		**136,700**	**20**	**na[b]**	
Central								
AL	1,400	129	1,000	175	1,500	121	1.4	217
AR	100	195	100	137	300	140	0.5	238
IL	1,000	142	1,600	128	3,400	119	0.7	191
IN	1,400	84	700	77	1,600	58	2.0	114
IA	4,200	80	1,800	85	8,300	118	2.3	117
KS	0	183	400	192	1,100	193	0.0	265
KY	2,800	196	1,000	193	1,900	194	3.0	275
LA	7,400	169	2,500	165	2,500	165	2.9	236
MI	79,300	28	30,000	19	123,700	24	2.6	34
MN	18,600	57	10,900	37	74,700	62	1.7	68
MS	2,600	164	1,200	127	2,600	131	2.2	207
MO	7,700	176	2,900	91	8,500	117	2.6	198
NE	0	---	600	196	600	196	0.0	---
OH	8,600	85	3,000	63	8,600	64	2.9	106
OK	300	129	<100	68	200	121	8.4	146
TN	1,300	185	1,200	192	1,300	179	1.0	267
TX	5,500	174	4,900	194	5,200	182	1.1	260
WI	38,400	24	14,500	27	60,000	31	2.6	36
Region	**180,600**	**20**	**na[b]**		**306,100**	**20**	**na[b]**	
Total	**243,100**	**15**	**na[b]**		**442,800**	**15**	**na[b]**	

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

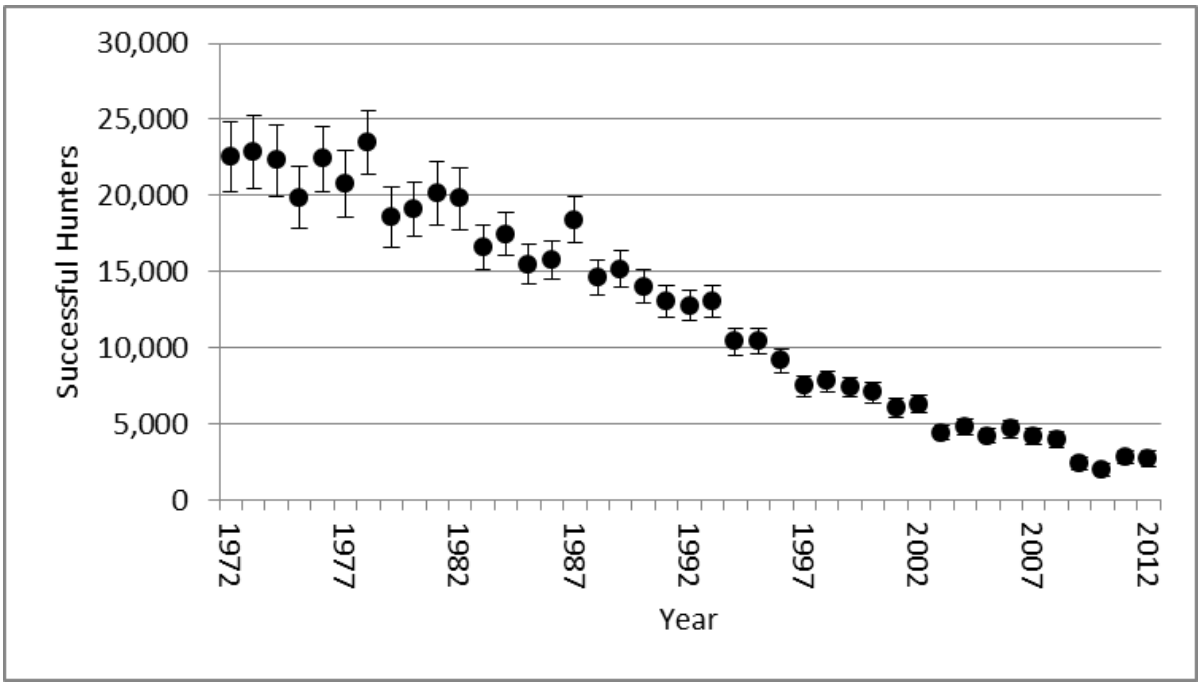
[b] Regional estimates of hunter numbers and hunter success cannot be obtained due to the occurrence of individual hunters being registered in the Harvest Information Program in more than one state.

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 - 2013.

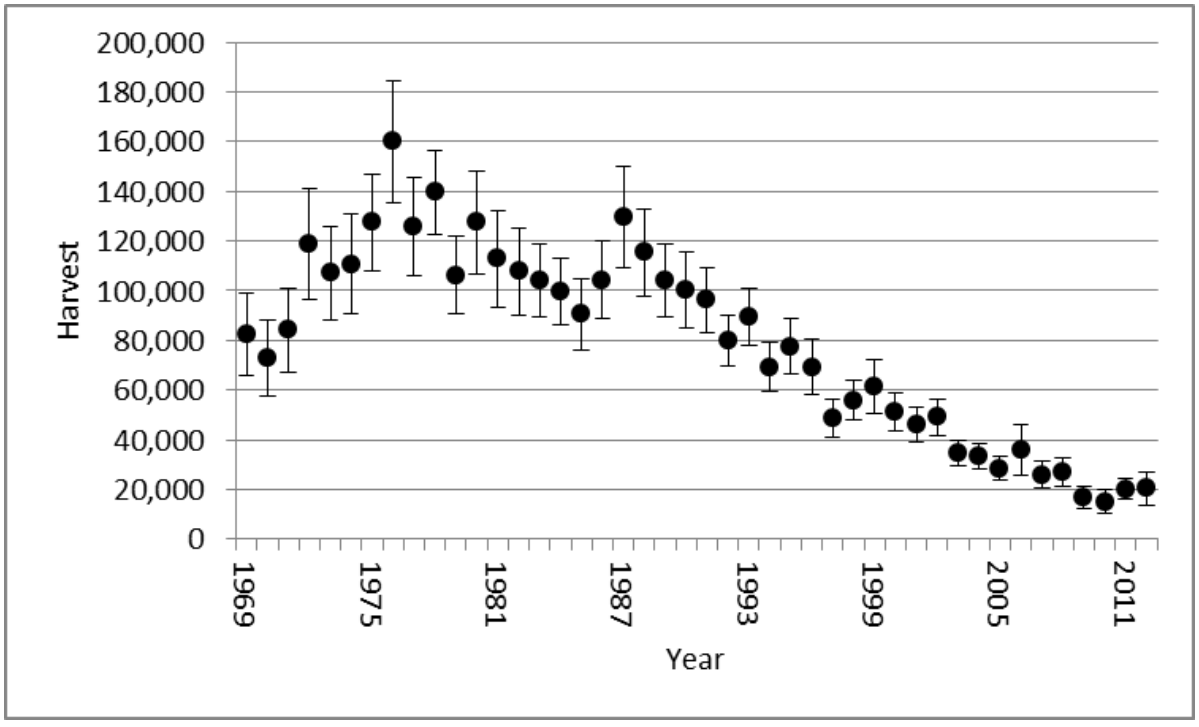
Eastern Region				Central Region			
Year (s)	Outside dates	Season length	Daily bag limit	Year (s)	Outside dates	Season length	Daily bag limit
1918-26	Oct. 1 - Dec. 31	60	6	1918-26	Oct. 1 - Dec. 31	60	6
1927	Oct. 1 - Dec. 31	60	4	1927	Oct. 1 - Dec. 31	60	4
1928-39	Oct. 1 - Dec. 31	30	4	1928-39	Oct. 1 - 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	1997-2013	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				
2011-13	Oct. 1 - Jan. 31	45	3				

[a] Saturday nearest September 22nd, which was September 21st for the 2013 season.

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



Estimated number of successful woodcock hunters in Canada and associated 95% confidence intervals, 1972-2012.



Estimated woodcock harvest in Canada and associated 95% confidence intervals, 1969-2012.

U.S. Fish and Wildlife Service
Division of Migratory Bird Management
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June 2014

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