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American Woodcock

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AMERICAN WOODCOCK POPULATION STATUS, 2013

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Abstract: Singing-ground Survey data for 2013 indicate that indices for singing American woodcock (*Scolopax minor*) males in the Eastern and Central Management Regions are not significantly different from 2012. There was no significant 10-year trend for woodcock heard in the Eastern or Central Management Regions during 2003-13. This marks the tenth consecutive year that the 10-year trend estimate was not significant in the Eastern Region and the third year that the 10-year trend in the Central Management Region was non-significant. Both regions have a long-term (1968-13) declining trend (-1.0 for the Eastern Management Region and -0.8 for the Central Management Region). The 2012 recruitment index for the U.S. portion of the Eastern Region (1.65 immatures per adult female) was 1.9% less than the 2011 index and 0.8% greater than the long-term regional index, while the recruitment index for the U.S. portion of the Central Region (1.66 immatures per adult female) was 8.0% greater than the 2011 index and was 5.7% greater than the long-term regional index. Estimates from the Harvest Information Program indicated that U.S. woodcock hunters in the Eastern Region spent 137,800 days afield and harvested 86,400 woodcock during the 2012-13 season, while in the Central Region, hunters spent 276,900 days afield and harvested 193,100 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 2013. 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

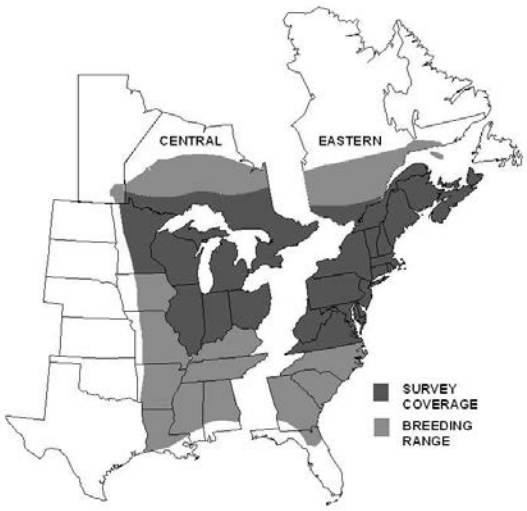

Fig. 1. Woodcock management regions, breeding range, and Singing-ground Survey coverage.

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 (2012-13), 10-year (2003-13) and long-term (1968-2013) 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 5 June 2013 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 2012 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 and 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 2012 recruitment index for each state with $\geq$ 125 submitted wings was calculated as the number of immatures per adult female. The regional indices for 2012 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2011.

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 2003-12 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 2011).

RESULTS AND DISCUSSION

Singing-ground Survey

Data for 801 routes were submitted by 5 June 2013 (Table 1). Short-term, 10-year, and long-term (1968-2013) trends were estimated using data from 774 routes in the Eastern Region and 722 routes in the Central Region. Short-term analysis indicated that the number of woodcock heard singing during the 2013 Singing-ground Survey was not significantly different from last year for both 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 (2003-2013) was not significant for either Management Region (Table 1, Fig. 1). This marks the tenth straight year that the trend in the Eastern Region has remained stable, while it is the third year the trend was stable in the Central Region.

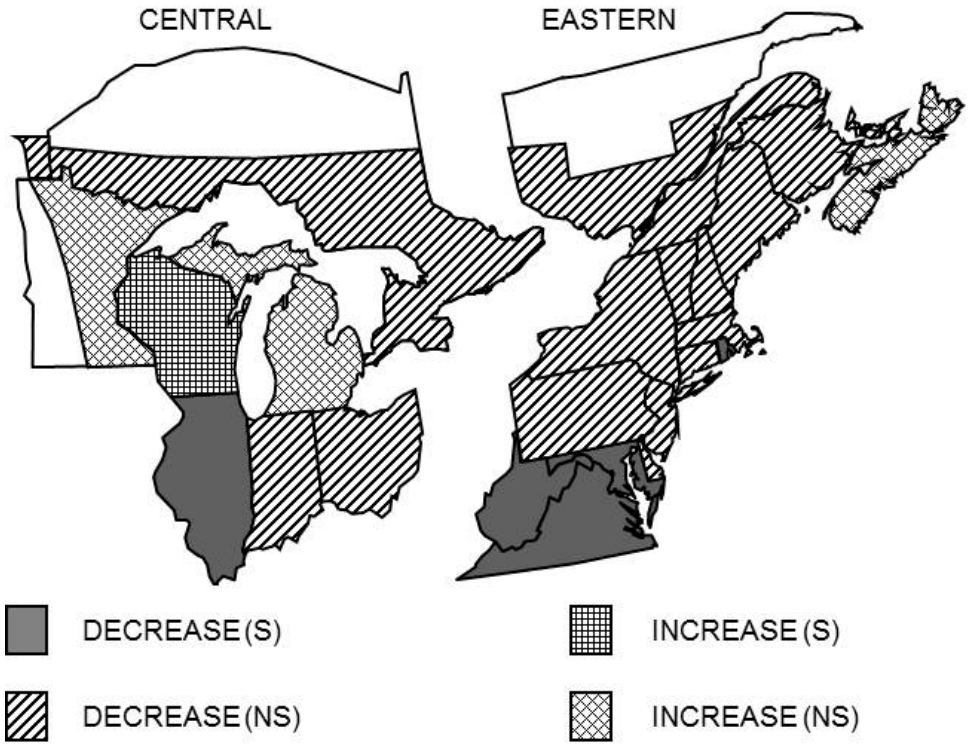

Fig. 2. Ten-year trends in the number of American woodcock heard on the Singing-ground Survey, 2003-2013, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero.

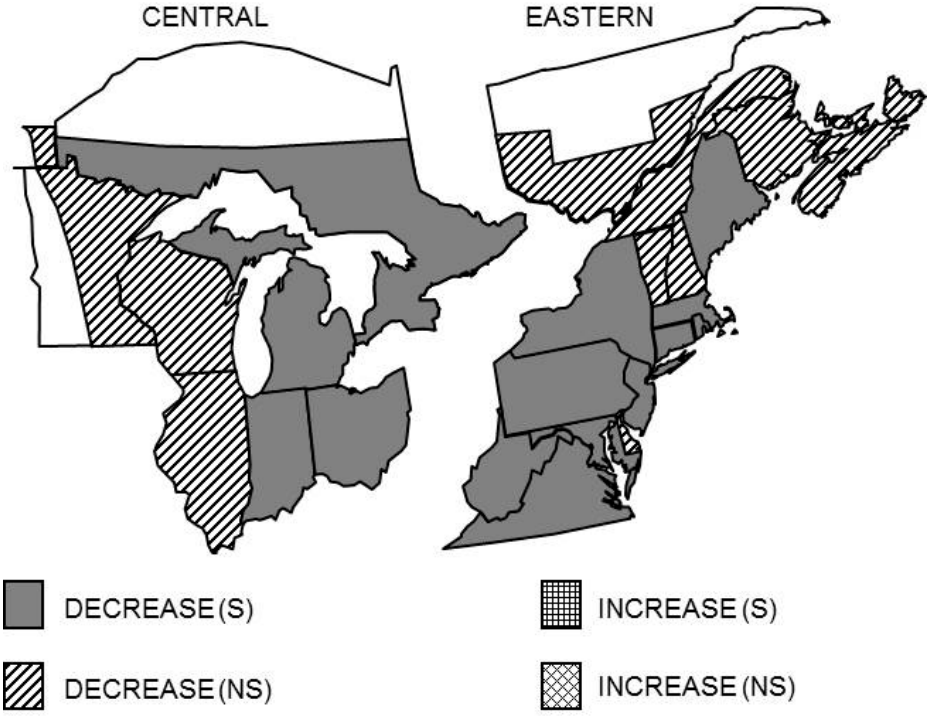

Fig. 3. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968-2013, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. Note, no state 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 (1968-2013) 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 -0.98 %/year for the Eastern Management Region and -0.80 for the Central Management Region (Table 1).

In the Eastern Region, the 2013 index was 2.62 singing males per route, which is 0.8% less than the 2012 index of 2.64 (Fig. 4). In the Central Region, the 2013 index was 2.70 singing males per route, which was 1.1% less than the 2012 index of 2.73 (Fig. 4). Percent difference was determined using indices rounded to the nearest hundredth. Annual indices (1968-2013) by state, province, or region are available in Table 2.

Note, both the index and trend in the Eastern Region decreased compared to estimates contained in last year's report (Cooper and Rau 2012) primarily due to the addition of historic data from Quebec. On-going coordination efforts between the FWS and Canadian Wildlife Service (CWS) allowed the inclusion of these historic data for many routes for the first time. The inclusion of these data increased the number of Quebec routes included in the analysis from 67 routes to 104 routes. Although the estimates decreased, the 95% CIs tightened around the estimates.

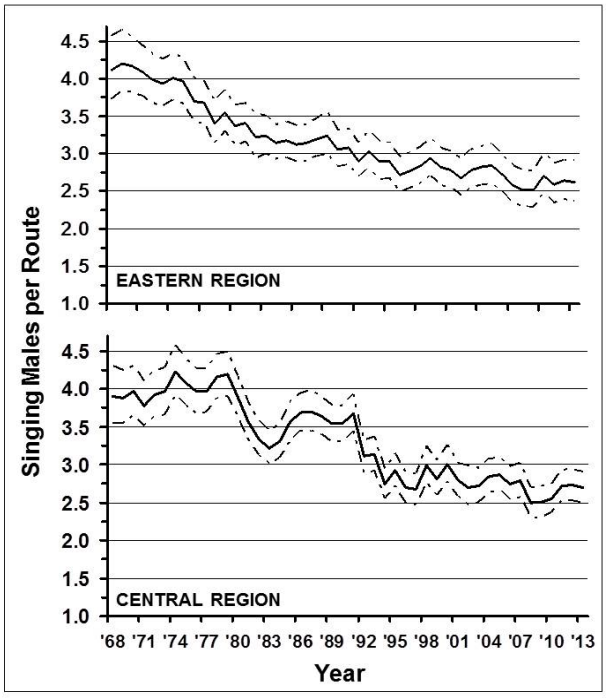

Fig. 4. Annual indices of the number of woodcock heard during the Singing-ground Survey, 1968-2013 as estimated using hierarchical modeling. The dashed lines represent the 95% credible interval.

Wing-collection Survey

A total of 1,306 woodcock hunters (Table 3) from states with woodcock seasons sent in a total of 14,739 usable woodcock wings for the 2012 Wing-collection Survey (Table 4).

The 2012 recruitment index in the U.S. portion of the Eastern Region (1.65 immatures per adult female) was 1.9% less than the 2011 index (1.68), and 0.8% greater than the long-term (1963-11) regional average of 1.64 (Table 4, Fig 5). In the Central Region, the 2012 recruitment index (1.66 immatures per adult female) was 8.0% greater than the 2011 index (1.53) and was 5.7% greater than the long-term regional average of 1.57 (Table 4, Fig 5). Percent change for all comparisons was calculated using unrounded recruitment indices.

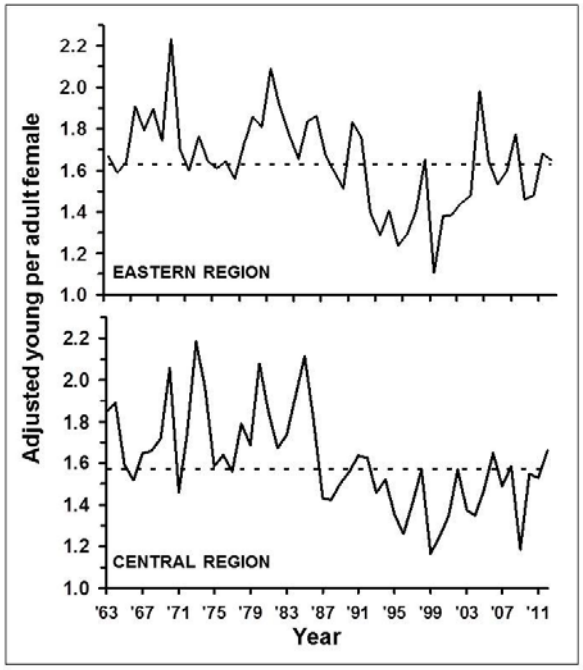

Fig. 5. Weighted annual indices of recruitment (U.S.), 1963-2012. The dashed line is the 1963-2011 average.

Harvest Information Program

Estimates of woodcock harvest, number of active hunters, days afield, and seasonal hunting success from the 2012-13 HIP survey are provided in Table 5. In the Eastern Management Region, woodcock hunters spent an estimated 137,800 days afield (Figure 6) and harvested 86,400 birds (Figure 7) during the 2012-13 hunting season. Harvest in 2012 was 0.8% less than the long-term (1999-2012) average and 12.2% more than last year in the Eastern Region. Woodcock hunters in the Central Region spent an estimated 276,900 days afield (Figure 6) and harvested 193,100 birds (Figure 7) during the 2012-13 hunting season.

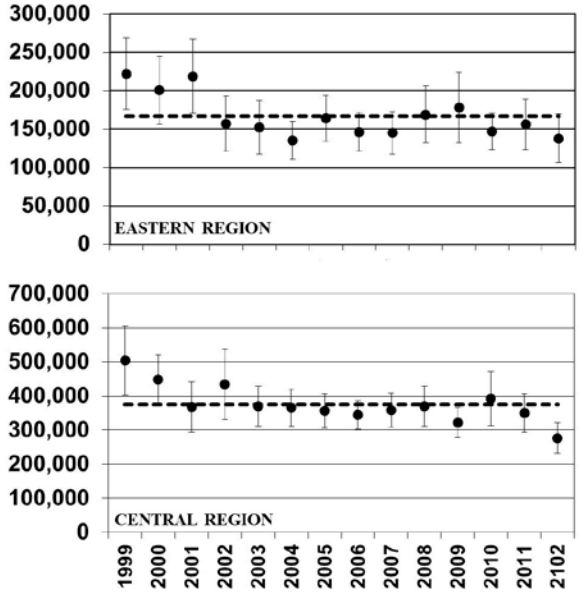

Fig. 6. Harvest Information Program Survey estimates of days spent afield by U.S. woodcock hunters, 1999-2012. The dashed line represents the 1999-2012 average and error bars represent the 95% confidence interval of the point estimate.

Harvest in 2012 was 14.5% less than the long-term (1999-2012) average and 16.7% less than last year 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 2003-2012 are preliminary.

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 2,835 successful hunters harvested 20,141 woodcock during the 2011 season in Canada (Gendron and Smith 2012; Appendix B).

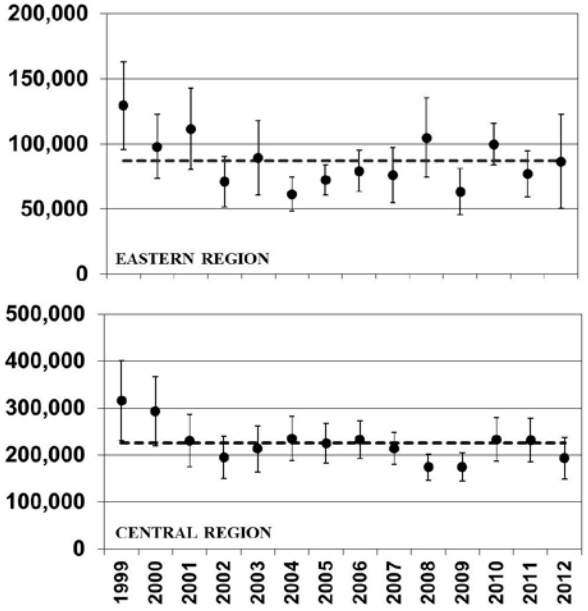

Fig. 7. Harvest Information Program Survey estimates of U.S. woodcock harvest, 1999-2012. The dashed line represents the 1999-2012 average and the error bars represent the 95% confidence interval of the point estimate.

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Table 1. Short-term (2012-13), 10-year (2003-2013), and long-term (1968-2013) 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]	2012-2013				2003-2013				1968-2013			
		n[c]	% change	95%	CI[d]	% change	95%	CI[d]		% change	95%	CI[d]	
CT	7	11	-8.39	-47.81	35.83	-2.14	-6.28	4.85		-2.88	-4.85	-0.87	
DE	2	3	-8.41	-90.35	561.97	-3.52	-21.41	16.66		-3.34	-9.05	2.20	
ME	45	72	-0.84	-17.47	18.84	-0.26	-2.24	1.81		-1.07	-1.61	-0.52	
MD	4	25	-4.46	-26.52	23.17	-4.18	-6.88	-1.19		-4.11	-5.57	-2.62	
MA	11	22	-1.46	-24.04	30.95	-2.64	-5.64	0.06		-2.47	-3.47	-1.44	
NB	46	72	-8.15	-24.72	11.40	-0.73	-2.96	1.56		-0.70	-1.52	0.05	
NH	16	18	-1.96	-25.24	26.46	-0.62	-3.52	1.96		-0.20	-1.25	0.85	
NJ	5	19	-12.38	-51.90	51.02	-5.82	-11.41	0.26		-5.55	-7.18	-3.76	
NY	68	115	-0.67	-14.32	14.98	-0.34	-1.88	1.41		-1.04	-1.49	-0.57	
NS	40	62	9.91	-8.74	34.82	1.70	-0.56	4.41		-0.45	-1.12	0.23	
PA	35	79	1.33	-20.58	32.40	-1.42	-4.11	1.12		-1.27	-2.04	-0.50	
PEI	11	13	-9.87	-39.31	20.89	-0.56	-3.91	4.00		-1.38	-2.70	0.02	
QUE	14	104	3.04	-9.32	28.95	-0.72	-2.36	1.17		-0.78	-1.63	0.13	
RI[e]	0	3	------	------	------	-11.99	-21.78	-1.14		-11.50	-17.26	-6.31	
VT	20	24	-6.52	-32.09	27.13	-0.97	-4.22	2.49		-0.67	-1.67	0.37	
VA	6	75	1.99	-28.28	64.57	-4.82	-8.39	-0.14		-5.03	-6.10	-3.88	
WV	22	57	-7.33	-33.70	11.59	-2.68	-5.60	-0.46		-2.41	-3.29	-1.56	
Eastern	**352**	**774**	**-0.72**	**-7.51**	**7.44**	**-0.58**	**-1.39**	**0.24**		**-0.98**	**-1.29**	**-0.66**	
IL	30	45	-0.85	-65.62	182.06	-15.10	-24.14	-6.46		-1.28	-4.17	1.77	
IN	18	60	-7.26	-47.09	55.63	-2.95	-7.74	3.08		-4.17	-5.56	-2.92	
MB[f]	19	30	-11.90	-39.33	24.19	-0.10	-3.57	3.70		-0.45	-2.60	1.80	
MI	106	151	5.73	-6.58	19.54	0.05	-1.32	1.49		-0.72	-1.11	-0.33	
MN	75	120	-12.89	-26.13	2.58	0.74	-1.04	2.54		-0.03	-0.62	0.60	
OH	34	72	1.35	-20.53	31.74	-0.12	-2.64	3.77		-1.55	-2.29	-0.77	
ON	87	156	-3.64	-17.59	12.68	-0.57	-2.50	1.47		-0.89	-1.38	-0.40	
WI	80	118	2.06	-13.36	20.32	1.96	0.10	4.03		-0.28	-0.79	0.26	
Central	**449**	**722**	**-1.13**	**-8.14**	**6.48**	**-0.08**	**-0.97**	**0.80**		**-0.80**	**-1.06**	**-0.55**	
Continent	**801**	**1496**	**0.89**	**-5.81**	**4.62**	**-0.33**	**-0.93**	**0.28**		**-0.89**	**-1.09**	**-0.68**	

[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 2013 for which data was received by 5 June, 2013.
[c] Number of routes with at least one year of non-zero data between 1968 and 2013.
[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 2013.
[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, 1968-2013. These indices are based on 1968-2013 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		2.78	2.90	2.58	2.76	2.51	2.52	2.58	2.02	2.03	1.72	1.82	1.80	1.79	2.01	1.73
DE	1.02	0.81	1.00	0.68	0.85	1.04	0.91	1.88	0.45	0.65	0.44	0.50	0.65	0.64	0.63	1.09
ME	6.15	6.05	6.69	6.18	5.89	6.24	6.42	6.68	6.26	5.27	5.03	5.61	4.84	5.56	4.22	4.76
MD	1.94	1.91	1.79	1.74	1.65	1.59	1.52	1.47	1.34	1.31	1.28	1.22	1.21	1.15	1.09	1.01
MA		3.39	3.42	3.42	3.10	3.33	3.15	2.77	2.72	2.71	2.63	2.71	2.43	2.55	2.33	2.18
NB		8.97	8.75	8.03	7.87	7.42	7.87	8.38	6.50	7.74	5.86	6.37	5.35	6.17	6.74	5.66
NH		3.79	3.99	3.61	4.07	3.48	3.93	3.72	3.70	3.73	3.65	3.57	3.89	3.76	3.31	3.41
NJ	4.59	4.34	4.59	5.95	4.29	5.28	4.86	3.99	2.79	2.82	2.32	2.89	2.10	1.95	1.80	2.04
NY	4.30	4.42	3.91	4.21	4.05	4.11	4.15	3.76	3.80	3.77	3.38	3.72	4.00	3.78	3.46	3.68
NS	4.30	3.76	3.25	3.85	3.57	3.80	3.96	3.78	3.65	3.61	3.84	3.39	3.43	3.18	3.05	3.27
PA	1.97	1.86	2.04	1.97	1.91	1.93	1.69	1.73	1.78	1.70	1.64	1.72	1.54	1.53	1.49	1.51
PEI		5.24	5.20	5.78	4.80	4.79	4.98	5.86	5.08	4.84	4.63	4.72	4.04	3.85	3.90	4.36
QUE			6.59	6.45	6.51	6.30	6.36	6.23	6.16	6.07	6.22	6.25	6.19	5.95	5.88	5.93
RI		2.01	1.76	2.20	1.68	1.51	1.23	1.04	0.91	0.82	0.65	0.61	0.55	0.45	0.47	0.38
VT		3.26	3.98	3.59	4.06	3.53	3.93	4.25	4.34	4.48	3.38	3.55	3.41	2.98	2.24	2.99
VA		1.39	1.38	1.19	1.10	0.95	1.14	1.00	0.96	0.91	0.81	0.79	0.68	0.73	0.72	0.63
WV	1.55	1.56	1.43	1.38	1.45	1.37	1.32	1.32	1.25	1.19	1.08	1.18	1.11	1.18	1.11	1.07
Region	**4.12**	**4.20**	**4.17**	**4.09**	**3.98**	**3.94**	**4.01**	**3.96**	**3.70**	**3.67**	**3.40**	**3.55**	**3.36**	**3.41**	**3.22**	**3.24**
Central Region																
IL			0.22	0.45	0.40	0.29	0.42	0.34	0.21	0.29	0.45	0.31	0.23	0.44	0.28	0.83
IN	1.48	1.06	1.02	0.82	1.18	1.06	0.94	0.79	0.81	0.75	0.77	0.94	0.74	0.85	0.58	0.61
MB																
MI	7.42	7.28	7.28	6.82	6.90	7.17	8.02	7.99	7.61	7.12	7.51	7.62	7.09	6.32	6.55	5.58
MN		2.99	2.90	3.25	3.07	3.46	4.00	3.59	3.65	3.72	3.91	3.59	4.05	3.65	3.44	3.22
OH			1.58	1.51	1.52	1.38	1.51	1.35	1.52	1.42	1.31	1.22	1.25	1.35	1.18	1.20
ON	8.09	9.02	9.51	8.62	9.48	9.19	9.26	8.93	8.94	9.14	9.53	9.77	9.09	8.25	7.03	6.97
WI	3.43	3.44	3.95	3.72	3.69	3.89	3.97	4.03	3.64	4.01	4.17	4.34	3.51	2.99	3.14	3.01
Region	**3.90**	**3.88**	**3.97**	**3.78**	**3.92**	**3.97**	**4.23**	**4.08**	**3.97**	**3.97**	**4.16**	**4.19**	**3.89**	**3.56**	**3.34**	**3.22**
Continent	**4.01**	**4.04**	**4.07**	**3.94**	**3.96**	**3.95**	**4.12**	**4.02**	**3.83**	**3.82**	**3.78**	**3.87**	**3.63**	**3.49**	**3.28**	**3.23**

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	1.65	1.73	1.50	1.73	1.35	1.37	1.40	1.28	1.15	1.21	1.28	1.28	1.14	1.10	1.17
DE	0.48	0.50	0.54	0.53	0.51	0.49	0.68	0.31	0.32	0.43	0.42	0.41	0.45	0.43	0.70	0.32
ME	4.74	4.92	5.26	5.57	5.12	5.28	4.19	4.72	4.12	4.41	4.08	4.18	3.53	3.80	3.79	4.13
MD	0.98	0.93	0.88	0.85	0.81	0.79	0.76	0.72	0.67	0.66	0.63	0.60	0.59	0.56	0.52	0.50
MA	2.30	2.25	2.17	2.13	2.11	1.97	1.93	1.90	1.80	1.75	1.73	1.70	1.65	1.66	1.59	1.74
NB	5.06	5.49	4.63	5.08	5.90	7.03	5.98	5.44	5.38	6.50	6.63	6.17	5.39	6.04	5.98	6.85
NH	3.34	3.46	4.22	3.68	3.62	3.59	3.36	3.65	3.39	3.39	3.40	3.74	3.67	3.63	3.60	3.82
NJ	1.95	1.84	1.65	1.91	1.43	1.37	1.31	1.23	1.06	0.94	0.80	0.96	0.91	0.70	0.78	0.82
NY	3.31	3.66	3.38	3.30	3.50	3.14	3.47	3.49	3.28	3.18	2.86	2.98	2.81	2.85	2.89	2.94
NS	3.13	3.29	3.41	3.03	3.27	3.24	3.01	3.27	3.25	3.34	2.99	3.16	3.20	3.00	3.09	3.48
PA	1.57	1.48	1.54	1.48	1.43	1.39	1.50	1.65	1.39	1.45	1.26	1.39	1.36	1.31	1.45	1.34
PEI	4.35	4.29	4.49	3.84	4.27	4.42	3.96	3.85	3.69	3.62	3.41	3.57	3.84	3.71	3.54	3.31
QUE	5.91	5.78	5.68	5.69	5.76	5.85	5.64	5.51	5.46	5.56	5.47	5.32	5.17	5.13	5.38	5.22
RI	0.35	0.28	0.25	0.23	0.19	0.17	0.15	0.13	0.12	0.11	0.09	0.08	0.07	0.06	0.06	0.05
VT	2.95	2.69	2.89	3.32	3.60	3.45	3.23	3.27	2.49	2.77	2.64	2.63	2.51	2.71	2.92	3.27
VA	0.81	0.52	0.55	0.53	0.47	0.43	0.45	0.41	0.42	0.39	0.36	0.31	0.30	0.32	0.27	0.28
WV	1.03	0.99	0.98	0.96	0.93	0.90	0.92	0.85	0.85	0.82	0.80	0.83	0.77	0.77	0.72	0.73
Region	**3.14**	**3.18**	**3.12**	**3.14**	**3.20**	**3.24**	**3.06**	**3.08**	**2.90**	**3.03**	**2.89**	**2.90**	**2.72**	**2.77**	**2.83**	**2.94**
Central Region																
IL	0.38	0.74	0.62	1.12	0.35	0.55	0.28	0.58	0.36	0.50	0.31	0.24	0.30	0.24	0.31	0.39
IN	0.60	0.56	0.65	0.61	0.52	0.48	0.60	0.57	0.52	0.44	0.43	0.39	0.37	0.36	0.44	0.38
MB									5.14	5.35	5.41	5.63	4.84	3.25	4.07	4.07
MI	6.25	6.47	6.68	6.35	6.65	6.43	6.47	7.11	5.58	5.68	5.01	5.55	5.29	5.11	6.03	5.06
MN	3.11	3.46	3.59	3.61	3.96	3.29	3.89	3.74	3.21	3.26	2.95	3.05	2.92	2.62	2.98	3.06
OH	1.25	1.14	1.11	1.12	1.15	0.99	1.22	1.12	1.11	1.04	1.02	0.98	1.02	0.87	0.99	0.86
ON	7.00	7.93	8.05	7.87	8.01	8.09	7.63	7.75	7.18	6.97	6.00	6.54	5.37	6.07	6.35	5.88
WI	3.32	3.26	3.74	3.77	3.51	3.58	3.43	3.46	2.76	2.90	2.54	2.65	2.58	2.45	2.63	2.97
Region	**3.30**	**3.56**	**3.69**	**3.70**	**3.64**	**3.54**	**3.54**	**3.68**	**3.11**	**3.13**	**2.75**	**2.92**	**2.69**	**2.68**	**2.99**	**2.81**
Continent	**3.22**	**3.37**	**3.41**	**3.42**	**3.42**	**3.39**	**3.30**	**3.38**	**3.01**	**3.08**	**2.82**	**2.91**	**2.71**	**2.72**	**2.91**	**2.88**

Table 2. Continued

State, Province, or Region	Year													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Eastern Region														
CT	1.04	0.97	0.89	0.90	0.87	0.86	0.81	0.81	0.82	0.79	0.76	0.86	0.84	0.75
DE	0.48	0.31	0.34	0.31	0.32	0.31	0.25	0.24	0.25	0.26	0.25	0.25	0.23	0.21
ME	4.27	3.80	3.53	3.84	3.91	4.00	3.90	3.59	3.61	3.50	3.70	3.78	3.77	3.74
MD	0.49	0.49	0.44	0.43	0.41	0.39	0.39	0.37	0.35	0.34	0.32	0.30	0.29	0.28
MA	1.59	1.50	1.49	1.45	1.50	1.37	1.35	1.26	1.32	1.28	1.21	1.19	1.12	1.11
NB	6.37	6.80	6.46	7.07	7.06	7.74	6.93	6.22	5.92	5.40	7.02	6.57	7.15	6.56
NH	3.37	3.47	3.45	3.72	3.74	3.70	3.49	3.04	3.11	3.58	3.57	3.23	3.55	3.47
NJ	0.71	0.66	0.55	0.60	0.47	0.42	0.43	0.44	0.38	0.44	0.27	0.35	0.38	0.33
NY	2.78	2.72	2.66	2.75	2.91	2.71	2.76	2.59	2.48	2.66	2.84	2.61	2.68	2.66
NS	3.41	3.19	2.97	2.96	3.20	3.07	2.91	2.93	2.80	2.74	3.15	2.78	3.18	3.51
PA	1.11	1.29	1.27	1.27	1.29	1.32	1.20	1.17	1.28	1.26	1.34	1.18	1.08	1.09
PEI	3.50	3.33	2.88	2.94	2.93	3.04	3.23	3.12	2.71	2.89	2.74	2.86	3.16	2.81
QUE	5.07	5.05	4.99	5.01	5.00	4.99	4.82	4.81	4.67	4.74	4.70	4.67	4.48	4.68
RI	0.04	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	3.43	2.69	2.47	2.65	2.68	2.87	2.84	2.43	2.24	2.44	2.52	2.37	2.57	2.40
VA	0.26	0.22	0.22	0.22	0.21	0.19	0.18	0.17	0.17	0.14	0.14	0.15	0.13	0.14
WV	0.71	0.67	0.65	0.66	0.62	0.60	0.60	0.60	0.59	0.57	0.55	0.56	0.55	0.50
Region	**2.82**	**2.78**	**2.67**	**2.78**	**2.82**	**2.84**	**2.72**	**2.58**	**2.52**	**2.51**	**2.70**	**2.59**	**2.64**	**2.62**
Central Region														
IL	0.30	0.37	0.28	0.65	0.68	0.21	0.44	0.22	0.23	0.19	0.23	0.20	0.13	0.13
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	0.22	0.21
MB	4.33	4.42	3.49	4.31	3.89	4.81	4.01	4.24	4.00	4.32	4.36	5.19	4.86	4.26
MI	5.33	5.00	5.12	5.30	5.33	5.19	4.83	4.76	4.45	4.45	4.57	4.97	5.04	5.33
MN	3.44	3.15	2.68	2.73	2.81	3.13	2.97	3.00	2.74	2.97	3.43	3.38	3.37	2.93
OH	0.88	0.87	0.85	0.80	1.01	0.91	0.89	0.71	0.75	0.86	0.83	0.82	0.79	0.80
ON	6.86	6.15	6.35	5.67	6.13	6.42	6.18	6.49	5.56	5.34	5.04	5.59	5.56	5.36
WI	2.79	2.70	2.31	2.48	2.52	2.85	2.62	3.00	2.55	2.56	2.62	2.86	2.95	3.01
Region	**3.00**	**2.80**	**2.70**	**2.72**	**2.85**	**2.87**	**2.75**	**2.79**	**2.49**	**2.50**	**2.55**	**2.72**	**2.73**	**2.70**
Continent	**2.91**	**2.79**	**2.69**	**2.75**	**2.83**	**2.86**	**2.73**	**2.68**	**2.51**	**2.51**	**2.63**	**2.66**	**2.68**	**2.66**

Table 3. The number of U.S. hunters by state that submitted woodcock wings for the 2011-12 and 2012-13 Wing-collection Surveys.

State of residence	Number of Hunters who submitted woodcock wings[a]	
	2011-12 Season	2012-13 Season
AL	1	1
AR	1	1
CT	26	29
DE	1	3
FL	0	0
GA	3	4
IL	2	1
IN	12	11
IA	4	5
KS	0	0
KY	3	2
LA	16	13
ME	152	146
MD	11	10
MA	57	44
MI	294	285
MN	95	89
MS	1	2
MO	13	15
NE	0	0
NH	77	74
NJ	24	26
NY	123	119
NC	7	6
ND	0	0
OH	18	9
OK	0	0
PA	60	64
RI	2	2
SC	7	8
TN	3	2
TX	2	0
VT	78	71
VA	15	14
WV	23	11
WI	238	239
Total	**1,369**	**1,306**

[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 2012 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2011.

State or Region of harvest	Wings received						Recruitment index	
	Total		Adult females		Immatures			
	1963-11	2012	1963-11	2012	1963-11	2012	1963-11	2012
Eastern Region								
CT	14,490	262	3,205	61	8,891	156	2.8	2.6
DE	476	11	67	4	333	7	5.0	
FL	678	0	153	0	422	0	2.8	
GA	3,188	23	994	9	1,366	6	1.4	
ME	85,070	1,296	25,166	384	42,492	632	1.7	1.6
MD	4,447	131	1,108	30	2,498	81	2.3	2.7
MA	23,569	437	7,302	163	11,484	188	1.6	1.2
NH	34,344	906	11,163	304	15,898	414	1.4	1.4
NJ	26,569	195	6,129	37	15,728	118	2.6	3.2
NY	61,638	1,035	20,791	362	28,015	406	1.3	1.1
NC	3,762	198	1,174	62	1,821	93	1.6	1.5
PA	32,149	518	10,193	132	14,834	247	1.5	1.9
RI	2,449	7	469	3	1,625	2	3.5	
SC	3,280	94	1,017	29	1,502	43	1.5	
VT	26,775	683	8,764	230	12,285	276	1.4	1.2
VA	5,253	172	1,367	56	2,843	77	2.1	1.4
WV	6,263	40	1,887	19	3,149	16	1.7	
Region	**334,400**	**6,008**	**100,949**	**1,885**	**165,186**	**2,762**	**1.64**	**1.65**
Central Region								
AL	957	10	262	4	440	1	1.7	
AR	539	4	170	2	225	1	1.3	
IL	1,493	2	346	0	841	2	2.4	
IN	8,339	71	2,127	10	4,599	51	2.2	
IA	1,290	10	417	3	585	3	1.4	
KS	49	0	9	0	26	0		
KY	1,161	7	285	3	599	3	2.1	
LA	32,451	189	7,256	30	21,022	136	2.9	4.5
MI	130,456	3,631	42,762	1,228	63,974	1,674	1.5	1.4
MN	38,759	1,404	13,596	525	16,860	522	1.2	1.0
MS	1,806	54	507	8	926	36	1.8	
MO	4,106	143	1,082	29	2,011	72	1.9	2.5
NE	13	0	5	0	6	0		
ND	3	0	3	0	0	0		
OH	14,914	65	4,582	16	7,001	38	1.5	
OK	172	0	38	0	91	0	2.4	
TN	1,249	49	325	15	640	25	2.0	
TX	1,052	0	293	0	528	0	1.8	
WI	83,074	3,092	27,849	1126	39,349	1,322	1.4	1.2
Region	**321,883**	**8,731**	**101,914**	**2,999**	**159,723**	**3,886**	**1.57**	**1.66**

Table 5. Preliminary estimates of woodcock harvest, hunter numbers, days afield, and hunter success from the 2012-13 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	1,700	38	700	24	3,800	29	2.5	44
DE	800	121	300	80	1,000	90	2.7	145
FL	12,600	187	4,900	134	14,800	134	2.6	230
GA	800	80	1,500	145	5,700	151	0.5	166
ME	9,600	56	3,400	41	16,100	58	2.9	70
MD	2,400	153	1,300	86	2,200	95	1.8	176
MA	1,900	27	800	26	4,200	22	2.3	37
NH	3,800	29	1,100	36	6,900	31	3.4	46
NJ	3,100	65	1,200	59	5,800	65	2.6	88
NY	8,400	33	4,800	36	22,900	50	1.7	48
NC	13,400	168	1,000	69	8,200	114	14.0	181
PA	13,500	68	6,900	33	28,500	39	2.0	75
RI	300	91	100	98	1,200	137	2.3	134
SC	7,900	128	2,500	129	5,500	115	3.2	182
VT	3,000	62	700	51	5,100	45	4.1	80
VA	1,200	42	600	101	2,600	90	2.0	109
WV	2,000	46	700	32	3,200	44	2.8	56
Region	**86,400**	**42**	**na[b]**		**137,800**	**23**	**na[b]**	
Central								
AL	3,500	136	2,300	131	4,900	139	1.5	189
AR	4,200	194	1,100	180	3,200	190	3.7	265
IL	1,900	160	900	175	3,500	172	2.2	237
IN	600	84	400	119	1,500	122	1.5	146
IA	0	-----	900	149	4,400	161	0.0	-----
KS	1,300	139	1,300	86	5,100	101	1.0	163
KY	200	159	19	121	300	135	11.5	200
LA	20,000	115	4,800	67	11,000	74	4.1	133
MI	74,100	28	25,700	17	121,400	22	2.9	33
MN	31,000	59	11,200	36	40,400	34	2.8	70
MS	200	117	100	65	200	79	2.5	134
MO	900	110	1,300	162	2,000	112	0.7	196
NE	1,300	196	600	196	4,500	196	2.0	277
OH	1,500	80	600	115	2,600	83	2.5	140
OK	600	187	1,100	136	3,400	144	0.5	231
TN	1,500	115	100	94	700	103	16.8	149
TX	9,900	192	4,900	195	9,800	195	2.0	273
WI	40,400	37	13,700	28	58,000	33	3.0	47
Region	**193,100**	**23**	**na[b]**		**276,900**	**16**	**na[b]**	
Total	**279,500**	**21**	**na[b]**		**414,700**	**13**	**na[b]**	

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

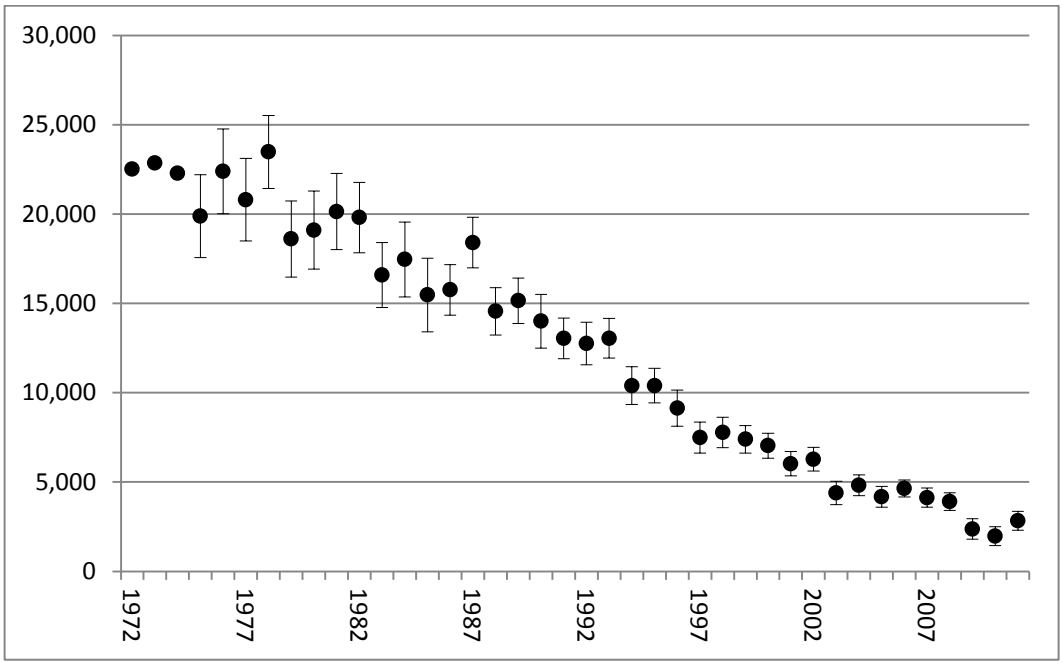
[b] Regional estimates of hunter numbers and hunter success cannot be obtained due to the occurrence of individual hunters being registered in the Harvest Information Program in more than one state.

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 - 2012.

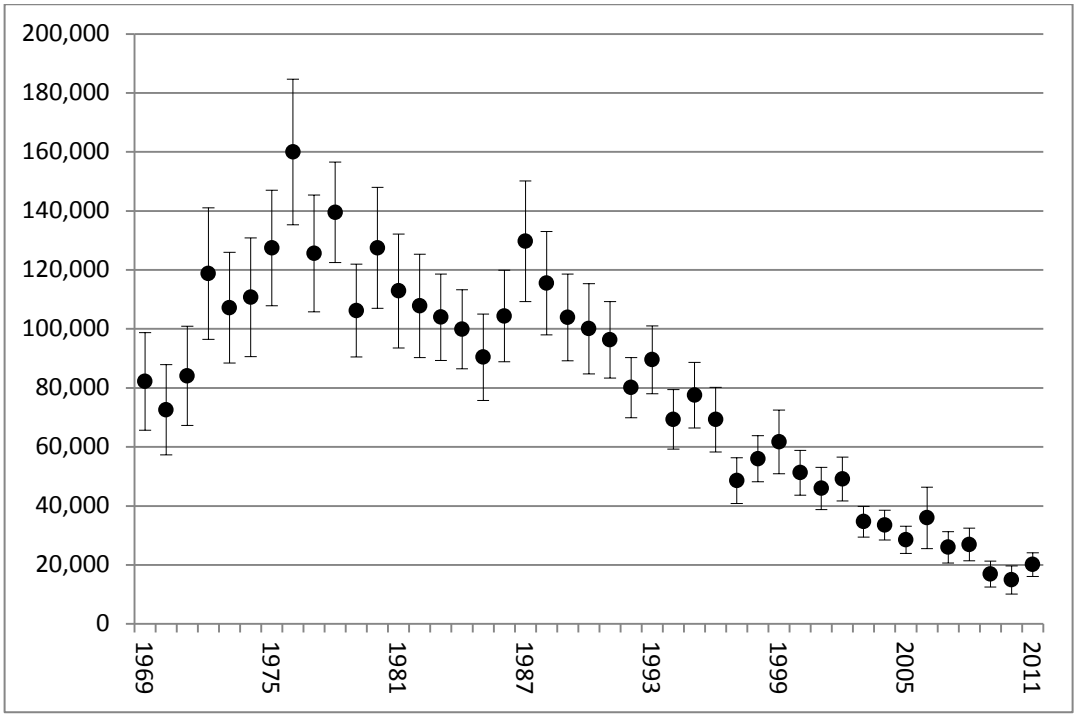
Eastern Region				Central Region			
Year (s)	Outside dates	Season length	Daily bag limit	Year (s)	Outside dates	Season length	Daily bag limit
1918-26	Oct. 1 - Dec. 31	60	6	1918-26	Oct. 1 - Dec. 31	60	6
1927	Oct. 1 - Dec. 31	60	4	1927	Oct. 1 - Dec. 31	60	4
1928-39	Oct. 1 - Dec. 31	30	4	1928-39	Oct. 1 - 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	1997-2012	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				
2011-12	Oct. 1 - Jan. 31	45	3				

[a] Saturday nearest September 22nd, which was September 22nd for the 2012 season.

Appendix B. Estimates for the number of successful woodcock hunters and woodcock harvest in Canada (Gendron and Smith 2012). Data from the 2012 hunting season were not available before this report was completed.



Estimated number of successful woodcock hunters in Canada and associated 95% confidence intervals, 1972-2011.



Estimated woodcock harvest in Canada and associated 95% confidence intervals, 1969-2011.

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