



U.S. Fish & Wildlife Service

American Woodcock

Population Status, 2022



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U.S. Fish and Wildlife Service
Division of Migratory Bird Management
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11510 American Holly Drive
Laurel, MD 20708-4002

August 2022

Cover photograph: American woodcock, Minnesota. Photo by Deanne Endrizzi.

Suggested citation:

Seamans, M.E., and R.D. Rau. 2022. American woodcock population status, 2022. U.S. Fish and Wildlife Service, Laurel, Maryland.

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AMERICAN WOODCOCK POPULATION STATUS, 2022

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Abstract: The American Woodcock (*Scolopax minor*) Singing-ground Survey data for 2022 indicate that the index for singing males was similar to that of 2021 in the Eastern and Central Management Regions. Both regions had a significant negative trend over the most recent 10-years (2012–2022): Eastern = -1.07%/year; Central = -1.85%/year. Both regions had a significant, long-term (1968-22) negative trend; Eastern = -0.84%/year; Central -0.62%/year. The 2021 recruitment index in the U.S. portion of the Eastern Region (1.38 immatures per adult female) was 13.8% less than the 2020 index, and 14.5% less than the long-term regional average, while the recruitment index in the Central Region (1.51 immatures per adult female) was 38.4% more than the 2020 index, and 1.4% greater than the long-term regional average. Estimates from the Harvest Information Program indicated that U.S. woodcock hunters in the Eastern Region spent 153,600 days afield and harvested 73,500 woodcock during the 2021–22 season, while in the Central Region hunters spent 273,100 days afield and harvested 141,300 woodcock.

INTRODUCTION

The American woodcock is a popular game bird throughout eastern North America. The management objective of the U.S. Wildlife Service (USFWS) is to stabilize woodcock populations, while ultimately returning the population to a level that occurred in the early 1970s (Kelley et al. 2008). 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 Parts-collection Survey (PCS) provides annual indices of woodcock recruitment. The Harvest Information Program (HIP) utilizes a sampling frame of woodcock hunters to estimate harvest and hunter 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 2022. 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 (Fig. 1), as recommended by Owen et al. (1977). Coon et al. (1977) reviewed the concept of management regions 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 PCS and SGS, 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 SGS 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, 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 degree blocks within each state and province in the central

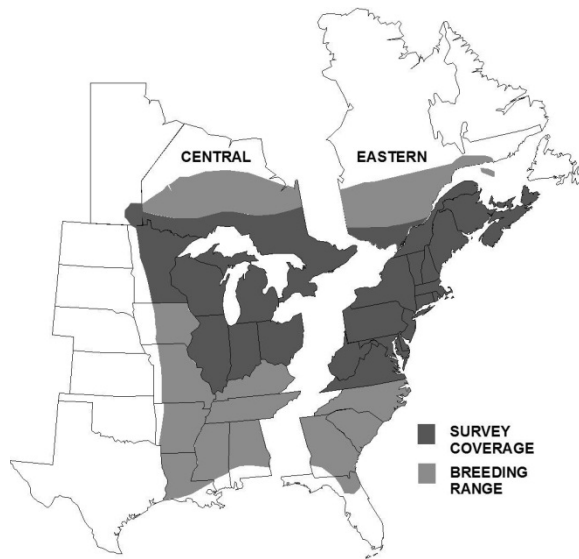


Fig. 1. Woodcock management regions, breeding range, and Singing-ground Survey coverage.

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 were selected for survey each year. The remaining routes were carried as “constant zero” routes. Routes for which no woodcock were heard for 2 consecutive years enter this constant zero status and were not surveyed for the next 5 years. If woodcock were heard on a constant zero route during its next survey, the route reverted to normal status and was surveyed again each year. Data from constant zero routes were included in the analysis only

for the years they were actually surveyed. Sauer and Bortner (1991) reviewed the implementation and analysis of the SGS in more detail.

Trends in the number of male woodcock heard were estimated using a hierarchical model. Sauer et al. (2008) describe a hierarchical log-linear model for estimation of population change from SGS data. Sauer et al. (2021) compared the Sauer et al. (2008) model with a model with additional forms for year effects and the distribution of overdispersion effects, and concluded that population change is best modeled as the difference in expected counts between successive years (their ‘D’ model). We used this new D model for inference in this report. The two model forms are similar except in how year effects are modeled: the old approach (denoted as the ‘S’ in Sauer et al. 2021) modeled year effects as random effects in the context of a slope parameter to estimate population change, whereas the D model describes population change as the difference in expected counts between successive years. The D model provides population trend and annual index values that are generally comparable to the estimates provided by the previous model, except that the D model provides slightly less extreme estimates of trend.

For the hierarchical model, the log of the expected value of the counts was 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. The parameters of interest were treated as random and were assumed to follow distributions that were governed by additional parameters. The hierarchical model is fit using Bayesian methods. Markov-chain Monte Carlo methods were used to iteratively produce sequences of parameter estimates which were 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 were estimated from the replicates. Annual indices for a stratum (state or province) are a function of year effects, defined as exponentiated random strata and year effects. Population trends were 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. 2021). Trend estimates were expressed as percent change per year, while indices were 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 (2021–22), 10-year (2012–22) and long-term (1968–2022) trends were evaluated for each region as well as for each state and province.

Due to SARS-CoV-2 (i.e., coronavirus) related restrictions in Canada and the U.S. only a portion of the SGS ($n=329$ routes) was conducted in 2020. Indices for

states and provinces with little or no data for 2020 were estimated with the hierarchical model using strata-specific intercepts and year effects that were calculated from the limited 2020 data and the long-term dataset.

Credible intervals were used to describe uncertainty around the estimates when fitting hierarchical models. If the CI did not overlap 0 for a trend estimate, the trend was considered significant. We present the median and 95% CIs of 10,000 samples (i.e., we simulated 20,000 replicates and thinned by 2), which were calculated after an initial burn-in of 20,000 iterations to allow the series to converge. Refer to Link and Sauer (2002) and Sauer et al. (2008, 2021) 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. Each route was to be surveyed during the peak time of daily singing activity. For editing purposes, “acceptable” stops were surveyed between 22 and 58 minutes after sunset (or between 15 and 51 minutes after sunset on overcast evenings). Due to observer error or road conditions, 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. Beginning with data from 1988, only route observations with at least 9 acceptable stops were included in the analysis. Route observations prior to 1988 are used regardless of the number of acceptable stops. Routes for which data were received after 18 July 2022 were not included in this analysis but will be included in future trend estimates.

Parts-collection Survey

The primary objective of the PCS is to provide data on the reproductive success of woodcock. The survey is administered as a cooperative effort between woodcock hunters, the USFWS, and state wildlife agencies. Participants in the 2021 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 USFWS to volunteer for the survey.

Parts-collection Survey participants were provided with prepaid mailing envelopes and asked to submit one wing from each woodcock they harvested. 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). An in-person wingbee could not be held in 2022 due to SARS-CoV-2 (i.e., coronavirus) restrictions. Wings were mailed to a subset of state and federal biologists that have annually attended the wingbee prior to 2020.

The ratio of immature birds per adult female in the harvest provides an index to recruitment of young into the population. The 2021 recruitment index for each state with ≥ 125 submitted wings was calculated as the number of immatures per adult female. The regional indices for 2021 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963–2020.

Harvest Information Program

The Harvest Information Program (HIP) was cooperatively developed by the USFWS and state wildlife agencies to provide reliable annual estimates of hunter activity and harvest for all migratory game birds (Elden et al. 2002). The HIP sampling frame consists of all migratory game bird hunters. 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 USFWS. The USFWS then selects stratified 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 since 1999. Although estimates from 1999–2002 have been finalized, the estimates from 2003–2021 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 2019).

RESULTS AND DISCUSSION

Singing-ground Survey

Data for 853 routes were submitted by 18 July 2022 (Table 1). Analysis of the most recent 2 years of data indicated that the number of woodcock heard singing during the 2022 SGS showed no significant change from last year for the Eastern and 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.

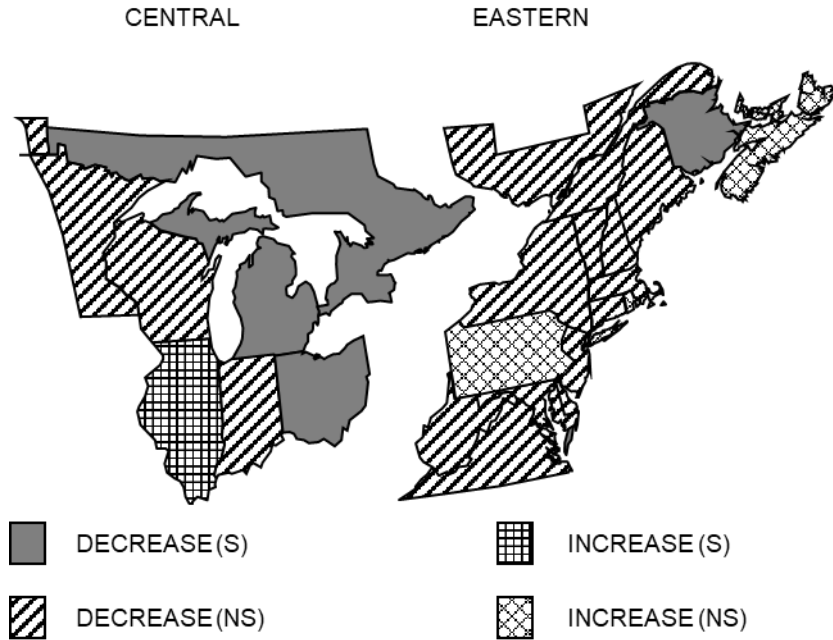


Fig. 2. Ten-year trends in the number of American woodcock heard on the Singing-ground Survey, 2012–2022, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero.

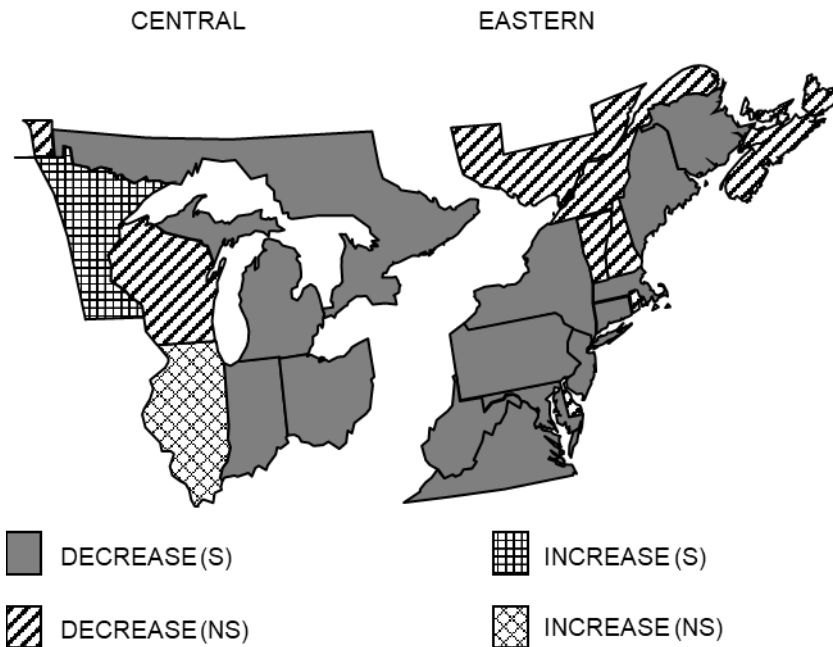


Fig. 3. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968–2022, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero.

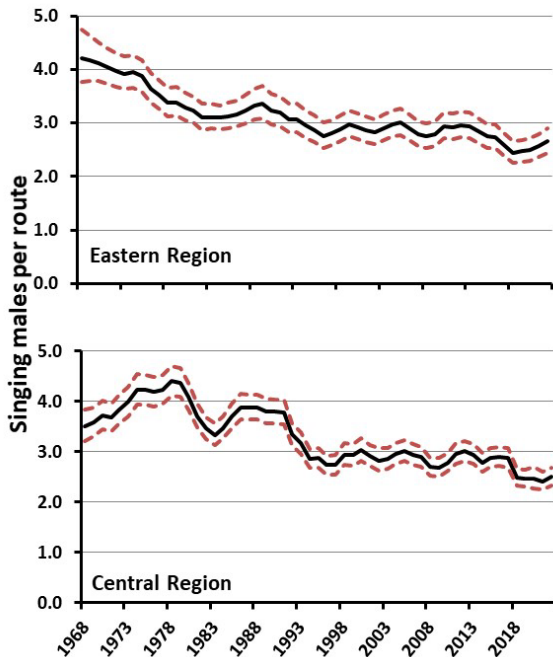


Fig. 4. Annual indices of the number of woodcock heard during the Singing-ground Survey, 1968–2022 as estimated using hierarchical modeling. The red dashed lines represent the 95% credible interval for the estimate.

The 10-year trend (2012–2022) showed a significant decline in both the Eastern and Central Management Regions (Table 1, Fig. 2). Many states and provinces in both management regions have experienced significant long-term (1968–2022) declines as measured by the SGS (Table 1, Fig. 3). The long-term trend estimate was $-0.84\%/year$ in the Eastern Management Region and $-0.62\%/year$ in the Central Management Region (Table 1).

In the Eastern Region, the 2022 index was 2.66 singing males per route, while it was 2.50 in the Central Management Region (Figure 4, Table 2). Annual indices (1968–2022) by state, province, and region are available in Table 2.

Parts-collection Survey

A total of 868 woodcock hunters (Table 3) from states with a woodcock season sent in a total of 8,084 usable woodcock wings for the 2021 PCS (Table 4).

The 2021 recruitment index in the U.S. portion of the Eastern Region (1.38 immatures per adult female) was 14.0% less than the 2020 index of 1.60, and 13.8% less than the long-term (1963–20) regional average of 1.62 (Table 4, Fig 5). In the Central Region, the 2021 recruitment index (1.51 immatures per adult female) was 38.4% greater than the 2020 index of 1.09 and was 1.4% greater than the long-term regional average of

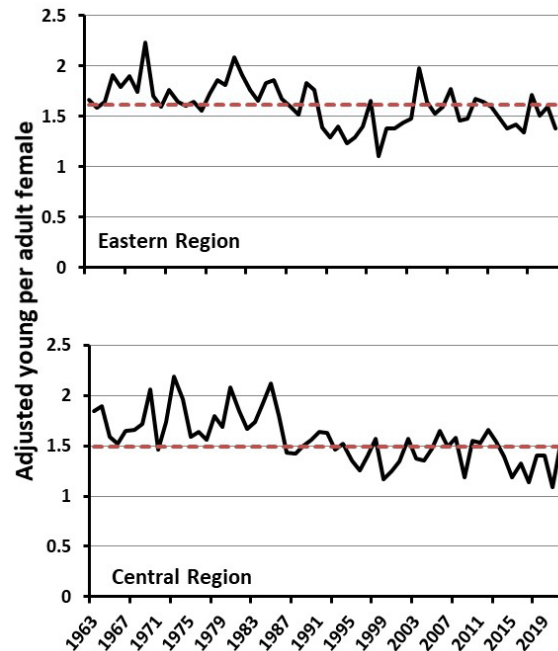


Fig. 5. Annual indices of recruitment (U.S.), 1963–2021. The red dashed line is the 1963–2020 average.

1.49 (Table 4, Fig 5). Percent change for all comparisons was calculated using unrounded recruitment indices.

Harvest Information Program

Estimates of woodcock harvest, number of active hunters, days afield, and seasonal hunting success from the 2021–22 HIP survey are provided in Table 5. In the Eastern Management Region, woodcock hunters spent an estimated 153,600 days afield (Figure 6) and harvested 73,500 birds (Figure 7) during the 2021–22 hunting season. In the Eastern Region, harvest in 2021–22 was 1.3% less than the long-term (1999–2020) average (74,400 birds/year) and 43.8% greater than last year (51,100 birds). Woodcock hunters in the Central Region spent an estimated 273,100 days afield (Figure 6) and harvested 141,300 birds (Figure 7) during the 2021–22 hunting season. In the Central Region, harvest in 2021–22 was 28.0% less than the long-term (1999–2020) average (196,300 birds/year) and 14.3% greater than last year (123,700 birds).

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. Data from Canada indicate that the annual number of successful hunters and annual harvest have been similar

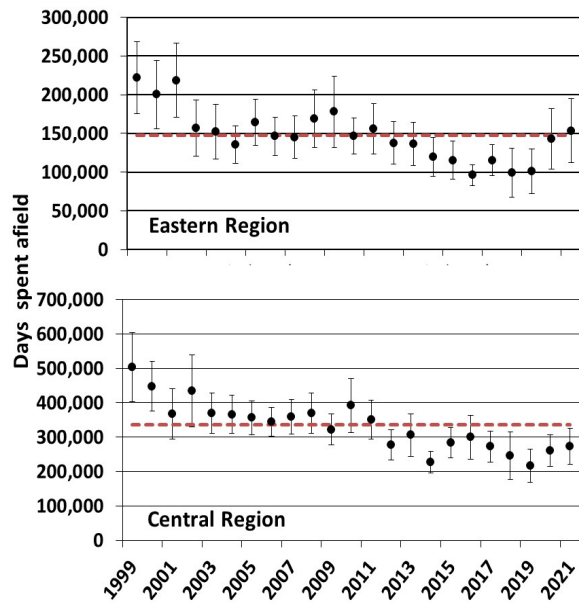


Fig. 6. Harvest Information Program Survey estimates of days spent afield by U.S. woodcock hunters, 1999–2021. The dashed line represents the 1999–2020 average and error bars represent the 95% confidence interval of the point estimate.

since 2009 (Appendix B). The most recent data available indicate that an estimated 3,237 successful hunters harvested 20,554 woodcock during the 2019 season in Canada (Gendron and Smith 2019; Appendix B).

Acknowledgements

Personnel from the USFWS, CWS, U.S. Forest Service (USFS), U. S. Geological Survey (USGS), Birds Canada, many state and provincial agencies, and other individuals assisted with collecting SGS data. Special thanks to M. Huang (CT), R. Smith (IL), A. Phelps (IN), H. Walbridge (MD), D. Scarpitti (MA), D. Avers (MI), K. Connor (NB), J. Carloni (NH), J. Sloan (NJ), G. Somogie (NY), J. Cyr (NS), L. Fendrick (OH), D. Adams (PA), M. Ginn (PEI), A. Fish (RI), D. Sausville (VT), D. Garst (VA), M. Peters (WV), K. Jones (Birds Canada), A. Hicks, J. B. Pollard, M. Tetreault, C. Roy, and M. Schuster (CWS), and M. Mills and K. VanBeek (USFWS) for providing state, province, and regional SGS coordination this year. We especially thank all observers who conducted SGS routes.

A special thanks to individuals who analyzed wings to collect age and gender data: J. Duguay (LA), M. Olinde (retired LA), B. Barlow (MI), A. Stewart (retired MI), L. Shartell (MN), E. Johnson (retired MN), L. Fendrick (OH), T. Edwards and L. Stevenson (retired USFWS), D. Kremetz (retired U of AR), D. Andersen (U of MN), A. Weik, N. Leffel, and R. Brown, T.

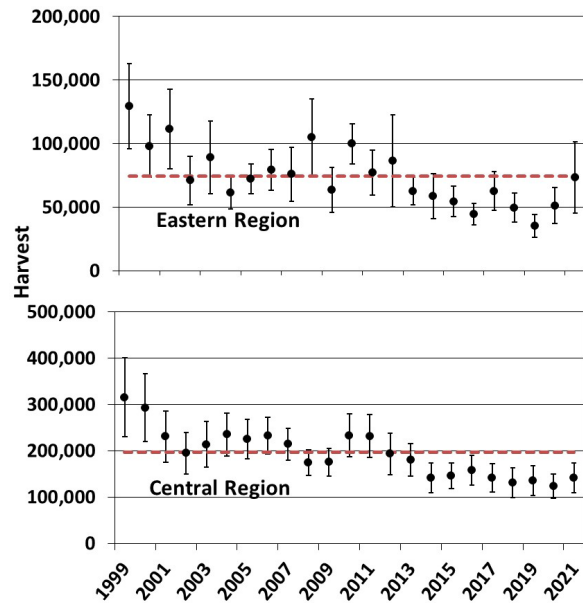


Fig. 7. Harvest Information Program Survey estimates of U.S. woodcock harvest, 1999–2021. The dashed line represents the 1999–2020 average and the error bars represent the 95% confidence interval of the point estimate.

Cooper, K. Daly, P. Denmon, D. Fronczak, K. Holcomb, H. Kruckman, C. Manera, N. Palaia, R. Rau, N. Schwarz, and K. Sturm (USFWS).

We especially thank all the woodcock hunters who sent in wings for the survey.

The Branch of Monitoring and Data Management within the Division of Migratory Bird Management (USFWS) mailed PCS materials, organized wing submissions, assisted with data management and provided Harvest Information Program estimates (special thanks to S. Catino, T. Ceaser II, S. Chandler, S. Finucane, K. Fleming, L. Heckstall, P. Mathias, and R. Raftovich). IRTM (USFWS) assisted in general maintenance for the SGS data entry website. 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 SGS data and conducted this year’s analyses for the survey. P. Devers, J. Hostetler, and D. Scott reviewed earlier drafts of this report and provided helpful comments.

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Table 1. Short-term (2021–22), 10-year (2012–2022), and long-term (1968–2022) trends (% change per year^a) in the number of American woodcock heard during the Singing-ground Survey. Trends and 95% credible intervals (CI) were estimated using a hierarchical log-linear modeling technique (Sauer et al. 2021).

State, Province, or Region	Routes 2021 ^b	Routes 2022 ^c	n ^d	Short-Term % change	Short-term lower 95% CI	Short-term upper 95% CI	10-year % change	10-year lower 95% CI	10-year upper 95% CI	Long-term % change	Long-term lower 95% CI	Long-term upper 95% CI
CT	5	6	11	1.07	-22.08	32.31	-1.06	-5.94	3.63	-2.09	-3.74	-0.62
DE	0	0	3	0.09	-31.93	47.51	-1.15	-14.94	9.16	-1.70	-7.66	0.88
ME	55	56	76	2.88	-10.35	18.22	-1.22	-3.09	0.77	-0.88	-1.34	-0.41
MD	6	5	26	-2.93	-26.09	25.93	-1.79	-8.39	4.53	-3.13	-4.80	-1.68
MA	10	9	23	4.43	-15.07	31.93	-2.12	-5.77	1.85	-2.38	-3.37	-1.41
NB	54	54	75	8.83	-5.47	26.85	-2.49	-4.38	-0.62	-1.10	-1.67	-0.55
NH	14	13	19	3.17	-14.86	27.36	-1.91	-5.28	1.42	-0.58	-1.48	0.33
NJ	5	3	19	9.69	-23.07	66.00	-3.37	-10.91	4.55	-4.25	-5.91	-2.61
NY	80	80	118	0.14	-9.83	11.67	-1.11	-2.74	0.48	-0.70	-1.12	-0.30
NS	40	40	66	9.10	-4.22	26.70	0.53	-1.49	2.69	-0.29	-0.90	0.30
PA	36	33	86	1.25	-13.97	19.72	0.79	-2.03	4.08	-0.75	-1.42	-0.09
PEI	11	10	13	-0.22	-20.02	22.40	1.24	-2.29	4.80	-0.46	-1.50	0.62
QUE	39	35	152	1.76	-10.06	16.88	-0.79	-3.39	1.81	-0.25	-0.99	0.53
RI	1	2	5	3.21	-30.26	66.46	2.14	-8.26	18.62	-2.66	-5.80	0.11
VT	19	19	24	13.66	-8.53	43.99	-0.29	-3.45	2.94	-0.54	-1.43	0.34
VA	26	20	75	-1.51	-29.40	33.40	-0.88	-7.56	6.53	-4.12	-5.36	-2.94
WV	25	18	59	-2.43	-19.79	16.06	-2.80	-6.58	0.61	-2.13	-3.04	-1.29
Eastern	426	403	850	3.87	-1.38	9.65	-1.07	-1.94	-0.18	-0.84	-1.10	-0.59
IL	19	29	51	25.27	-20.10	117.01	10.32	1.44	20.43	0.28	-1.48	2.40
IN	13	14	63	-0.84	-28.00	35.78	-3.42	-10.56	3.42	-3.85	-5.23	-2.51
MB ^e	10	4	31	-4.69	-25.36	17.81	-0.95	-5.20	2.74	-0.48	-2.90	1.71
MI	114	113	161	9.65	-1.51	22.49	-1.84	-3.11	-0.58	-0.76	-1.09	-0.43
MN	92	76	126	0.08	-11.72	13.70	-0.79	-2.44	0.84	0.85	0.33	1.39
OH	35	37	74	-3.84	-20.94	16.62	-5.59	-8.91	-2.50	-2.08	-2.82	-1.38
ON	72	83	175	-0.77	-12.21	12.34	-3.21	-4.88	-1.64	-1.16	-1.58	-0.74
WI	103	94	132	1.83	-10.02	15.32	-1.17	-2.82	0.52	-0.08	-0.50	0.34
Central	458	450	782	3.36	-2.48	9.70	-1.85	-2.61	-1.09	-0.62	-0.83	-0.42
Continent	884	853	1,632	3.65	-0.31	7.80	-1.45	-2.02	-0.86	-0.74	-0.91	-0.58

Table 1. Continued.

^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 2021.

^c Total number of routes surveyed in 2022 for which data were received by 18 July, 2022.

^d Number of routes with at least one year of non-zero data between 1968 and 2022.

^e 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, 1968–2022. These indices are based on 1968–2022 trends that were estimated using hierarchical modeling techniques. Dashes indicate no data were available for that year.

State, Province, or Region	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
CT	----	3.16	3.19	3.02	2.96	2.71	2.54	2.32	1.91	1.69	1.47	1.42	1.42	1.47	1.54	1.49
DE	0.77	0.76	0.78	0.76	0.78	0.80	0.80	0.79	0.68	0.64	0.60	0.60	0.61	0.63	0.64	0.65
MA	----	3.84	3.96	3.97	3.75	3.77	3.41	2.86	2.59	2.45	2.36	2.34	2.14	2.07	1.88	1.75
MD	1.79	1.83	1.75	1.72	1.65	1.60	1.52	1.45	1.31	1.30	1.31	1.33	1.35	1.29	1.16	1.01
ME	6.57	6.65	7.03	6.75	6.69	6.92	7.20	7.29	6.72	5.84	5.51	5.60	5.21	5.33	4.67	4.82
NB	----	10.33	9.66	8.73	8.30	7.85	8.06	8.14	6.93	7.14	6.11	5.94	5.35	5.57	5.42	5.23
NH	----	3.88	3.94	3.77	3.88	3.58	3.73	3.62	3.53	3.48	3.38	3.32	3.35	3.15	2.87	2.83
NJ	4.12	4.29	4.84	5.73	5.30	5.76	5.34	4.30	3.16	2.75	2.41	2.43	2.03	1.83	1.75	1.83
NS	4.72	4.30	3.92	4.12	4.12	4.27	4.38	4.26	4.08	3.99	3.94	3.60	3.38	3.14	3.00	3.08
NY	4.53	4.55	4.30	4.41	4.36	4.38	4.32	4.02	3.93	3.83	3.68	3.89	4.13	4.05	3.83	3.84
PA	2.09	2.07	2.17	2.14	2.08	1.98	1.81	1.74	1.71	1.65	1.60	1.56	1.44	1.38	1.35	1.35
PEI	----	4.99	5.07	5.24	4.89	4.89	5.18	5.58	5.22	4.82	4.46	4.16	3.64	3.40	3.49	3.83
QUE	----	----	----	----	----	4.91	4.96	4.97	5.00	5.11	5.44	5.64	5.67	5.53	5.52	5.64
RI	----	1.38	1.45	1.63	1.53	1.38	1.18	0.99	0.85	0.74	0.64	0.59	0.55	0.52	0.52	0.49
VA	----	1.36	1.34	1.17	1.04	0.96	1.09	1.04	0.98	0.92	0.81	0.76	0.70	0.75	0.77	0.75
VT	----	3.44	3.87	3.96	4.29	4.16	4.53	4.92	5.03	4.83	3.94	3.55	3.11	2.63	2.22	2.44
WV	1.58	1.56	1.48	1.44	1.47	1.40	1.33	1.28	1.17	1.08	0.99	1.04	1.06	1.11	1.08	1.02
Eastern Region	4.21	4.18	4.13	4.04	3.98	3.93	3.96	3.88	3.64	3.53	3.38	3.39	3.29	3.24	3.10	3.11
IL	----	----	0.25	0.30	0.30	0.28	0.30	0.27	0.24	0.28	0.33	0.31	0.31	0.41	0.44	0.77
IN	1.39	1.10	0.99	0.90	1.07	1.03	0.92	0.80	0.77	0.76	0.80	0.90	0.82	0.80	0.64	0.60
MB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MI	6.95	6.91	6.90	6.63	6.76	7.19	8.04	8.23	7.92	7.53	7.87	7.83	7.31	6.59	6.47	5.84
MN	----	2.35	2.44	2.71	2.89	3.33	3.87	3.86	3.95	4.09	4.36	4.15	4.44	4.06	3.83	3.54
OH	----	----	1.62	1.54	1.52	1.44	1.49	1.42	1.48	1.42	1.30	1.24	1.22	1.26	1.16	1.14
ON	7.41	8.14	8.65	8.54	9.06	9.12	9.22	9.06	9.23	9.57	9.89	9.97	9.26	8.24	7.13	6.90
WI	3.36	3.51	3.88	3.90	3.99	4.19	4.32	4.38	4.24	4.52	4.67	4.63	3.93	3.41	3.37	3.36
Central Region	3.50	3.58	3.71	3.68	3.84	3.99	4.24	4.23	4.19	4.24	4.40	4.37	4.10	3.71	3.46	3.33
Continent	3.86	3.89	3.93	3.87	3.91	3.96	4.10	4.05	3.92	3.89	3.89	3.88	3.69	3.48	3.28	3.23

Table 2. Continued

State, Province, or Region	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CT	1.44	1.44	1.46	1.39	1.37	1.22	1.15	1.10	1.03	0.99	1.03	1.09	1.11	1.07	1.04	1.01
DE	0.63	0.63	0.62	0.62	0.62	0.62	0.62	0.59	0.59	0.60	0.62	0.62	0.62	0.62	0.62	0.57
MA	1.80	1.81	1.77	1.73	1.66	1.55	1.48	1.42	1.34	1.30	1.31	1.33	1.38	1.47	1.57	1.76
MD	0.93	0.83	0.74	0.67	0.64	0.61	0.58	0.55	0.51	0.51	0.51	0.49	0.48	0.46	0.43	0.44
ME	5.03	5.28	5.67	5.91	5.68	5.47	4.75	4.77	4.40	4.38	4.16	4.03	3.68	3.76	3.87	4.15
NB	4.92	4.85	4.48	4.77	5.43	6.07	5.66	5.40	5.39	5.96	6.12	5.86	5.48	5.78	6.01	6.53
NH	2.86	3.17	3.68	3.55	3.44	3.33	3.22	3.28	3.21	3.29	3.45	3.80	3.95	4.00	4.03	4.04
NJ	1.92	1.89	1.83	1.86	1.60	1.45	1.33	1.21	1.05	0.92	0.85	0.88	0.87	0.83	0.87	0.90
NS	3.07	3.17	3.21	3.04	3.10	3.09	3.05	3.19	3.28	3.34	3.22	3.32	3.37	3.35	3.49	3.76
NY	3.64	3.76	3.62	3.55	3.64	3.52	3.71	3.70	3.50	3.29	3.00	2.93	2.84	2.86	2.91	2.94
PA	1.38	1.37	1.38	1.37	1.36	1.40	1.50	1.58	1.49	1.45	1.36	1.40	1.41	1.42	1.46	1.39
PEI	4.07	4.23	4.37	4.23	4.45	4.52	4.25	4.07	3.89	3.73	3.62	3.80	4.01	3.96	3.79	3.56
QUE	5.68	5.78	5.97	6.27	6.58	6.76	6.53	6.31	6.21	6.15	5.86	5.45	5.16	5.21	5.40	5.35
RI	0.47	0.44	0.42	0.41	0.41	0.40	0.41	0.41	0.41	0.42	0.42	0.41	0.39	0.37	0.36	0.35
VA	0.83	0.60	0.57	0.53	0.47	0.43	0.44	0.43	0.44	0.42	0.38	0.33	0.31	0.32	0.28	0.27
VT	2.53	2.60	2.89	3.37	3.72	3.73	3.52	3.29	2.71	2.65	2.57	2.55	2.60	2.81	3.19	3.63
WV	0.97	0.93	0.91	0.88	0.86	0.85	0.85	0.81	0.80	0.79	0.80	0.82	0.78	0.76	0.73	0.71
Eastern Region	3.10	3.13	3.16	3.23	3.32	3.36	3.24	3.19	3.08	3.07	2.96	2.87	2.76	2.81	2.89	2.98
IL	0.79	0.96	0.99	1.04	0.67	0.62	0.50	0.59	0.52	0.52	0.44	0.36	0.36	0.35	0.39	0.43
IN	0.59	0.59	0.64	0.63	0.59	0.59	0.66	0.67	0.62	0.54	0.48	0.43	0.40	0.41	0.43	0.41
MB	----	----	----	----	----	----	6.14	6.16	6.17	6.24	6.03	5.80	4.99	4.08	4.13	4.17
MI	6.34	6.62	6.88	6.65	6.91	6.84	6.90	7.12	5.94	5.66	5.17	5.44	5.32	5.30	5.84	5.34
MN	3.51	3.78	3.99	4.11	4.35	3.95	4.34	4.19	3.70	3.58	3.30	3.29	3.18	3.03	3.36	3.60
OH	1.13	1.07	1.03	1.02	1.06	1.03	1.17	1.15	1.13	1.05	1.01	0.96	0.93	0.85	0.85	0.79
ON	7.06	7.74	8.03	8.02	8.14	8.16	7.85	7.75	7.24	6.73	5.96	5.92	5.30	5.56	5.80	5.85
WI	3.58	3.70	4.07	4.18	4.03	3.98	3.79	3.62	3.13	2.99	2.71	2.67	2.62	2.60	2.75	2.99
Central Region	3.47	3.70	3.88	3.88	3.89	3.80	3.80	3.78	3.35	3.17	2.87	2.87	2.73	2.73	2.94	2.93
Continent	3.29	3.42	3.52	3.56	3.60	3.58	3.52	3.49	3.21	3.12	2.91	2.87	2.75	2.77	2.92	2.95

Table 2. Continued

State, Province, or Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CT	0.93	0.86	0.81	0.79	0.79	0.79	0.80	0.84	0.89	0.94	1.00	1.10	1.13	1.11	1.09	1.06
DE	0.55	0.51	0.49	0.46	0.44	0.42	0.40	0.38	0.37	0.37	0.36	0.35	0.34	0.33	0.33	0.32
MA	1.73	1.67	1.69	1.72	1.76	1.69	1.65	1.62	1.64	1.61	1.52	1.42	1.32	1.29	1.30	1.33
MD	0.47	0.50	0.47	0.47	0.46	0.46	0.47	0.46	0.45	0.44	0.41	0.39	0.39	0.38	0.37	0.38
ME	4.30	4.03	3.87	4.05	4.25	4.38	4.32	4.11	4.12	4.14	4.41	4.57	4.61	4.54	4.32	4.03
NB	6.56	6.73	6.78	7.17	7.34	7.66	7.13	6.60	6.27	6.07	7.05	7.11	7.42	7.05	6.57	5.98
NH	3.77	3.75	3.79	3.99	4.01	3.84	3.47	3.07	3.07	3.36	3.44	3.34	3.48	3.46	3.38	3.07
NJ	0.85	0.78	0.69	0.66	0.57	0.53	0.53	0.55	0.53	0.54	0.48	0.51	0.55	0.52	0.47	0.39
NS	3.79	3.62	3.38	3.33	3.42	3.32	3.19	3.12	3.07	3.17	3.48	3.50	3.82	4.03	3.78	3.39
NY	2.87	2.83	2.85	2.99	3.15	3.11	3.12	3.03	3.02	3.24	3.43	3.39	3.46	3.49	3.45	3.59
PA	1.28	1.34	1.38	1.41	1.46	1.48	1.44	1.45	1.55	1.59	1.59	1.42	1.28	1.23	1.29	1.34
PEI	3.45	3.16	2.86	2.80	2.86	3.03	3.16	3.11	2.95	2.99	3.03	3.22	3.45	3.40	3.48	3.21
QUE	5.16	5.09	5.01	5.06	5.12	5.16	4.94	4.81	4.74	4.76	4.73	4.71	4.68	4.77	4.66	4.60
RI	0.35	0.34	0.33	0.31	0.30	0.29	0.29	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27
VA	0.25	0.22	0.21	0.21	0.20	0.19	0.18	0.17	0.17	0.15	0.15	0.16	0.16	0.16	0.15	0.12
VT	3.67	3.20	2.92	2.97	3.07	3.18	3.10	2.78	2.59	2.62	2.68	2.62	2.66	2.51	2.33	2.35
WV	0.69	0.65	0.62	0.62	0.59	0.57	0.58	0.60	0.62	0.63	0.64	0.66	0.66	0.62	0.61	0.58
Eastern Region	2.92	2.87	2.83	2.91	2.98	3.01	2.91	2.79	2.76	2.79	2.94	2.93	2.97	2.95	2.85	2.75
IL	0.45	0.49	0.54	0.69	0.68	0.45	0.39	0.27	0.21	0.17	0.16	0.14	0.11	0.10	0.12	0.14
IN	0.38	0.36	0.32	0.31	0.32	0.31	0.29	0.27	0.27	0.27	0.27	0.25	0.24	0.22	0.22	0.21
MB	4.31	4.28	4.02	4.22	4.23	4.50	4.36	4.41	4.42	4.61	4.88	5.28	5.20	4.90	4.90	5.24
MI	5.37	5.18	5.28	5.44	5.51	5.36	5.01	4.85	4.60	4.62	4.84	5.29	5.56	5.74	5.59	5.56
MN	3.93	3.63	3.18	3.16	3.28	3.55	3.51	3.50	3.32	3.59	4.10	4.16	3.98	3.57	3.28	4.00
OH	0.78	0.78	0.79	0.83	0.97	0.96	0.90	0.79	0.82	0.92	0.97	0.98	0.97	0.95	0.90	0.89
ON	6.34	6.09	6.01	5.81	6.02	6.29	6.27	6.22	5.58	5.20	5.02	5.35	5.47	5.28	5.14	4.98
WI	2.94	2.81	2.58	2.66	2.80	3.05	3.06	3.29	3.09	3.10	3.21	3.48	3.62	3.56	3.10	3.26
Central Region	3.04	2.92	2.83	2.87	2.96	3.02	2.93	2.89	2.69	2.69	2.79	2.96	3.01	2.94	2.78	2.88
Continent	2.98	2.89	2.83	2.89	2.98	3.02	2.92	2.84	2.73	2.74	2.87	2.94	2.99	2.95	2.82	2.81

Table 2. Continued

State, Province, or Region	2016	2017	2018	2019	2020	2021	2022
CT	1.06	1.04	1.03	1.00	1.00	1.00	1.01
DE	0.31	0.31	0.30	0.30	0.30	0.30	0.30
MA	1.26	1.14	1.06	1.02	0.99	1.02	1.07
MD	0.38	0.38	0.36	0.35	0.34	0.33	0.32
ME	4.15	3.67	3.44	3.64	3.72	3.97	4.08
NB	5.82	4.97	4.65	5.23	5.26	5.28	5.76
NH	2.89	2.60	2.48	2.44	2.60	2.76	2.85
NJ	0.37	0.34	0.32	0.32	0.34	0.35	0.39
NS	3.38	3.29	3.24	3.34	3.37	3.69	4.03
NY	3.56	3.51	3.17	3.11	3.08	3.08	3.09
PA	1.36	1.36	1.36	1.35	1.36	1.37	1.39
PEI	2.98	3.09	3.08	3.21	3.55	3.92	3.91
QUE	4.59	4.47	4.26	4.11	4.17	4.24	4.32
RI	0.27	0.28	0.29	0.30	0.31	0.32	0.33
VA	0.12	0.12	0.13	0.14	0.14	0.15	0.15
VT	2.54	2.41	2.35	2.09	2.04	2.27	2.59
WV	0.57	0.57	0.55	0.54	0.52	0.51	0.49
Eastern Region	2.74	2.58	2.44	2.47	2.50	2.56	2.66
IL	0.13	0.14	0.16	0.19	0.25	0.23	0.29
IN	0.21	0.21	0.20	0.19	0.18	0.17	0.17
MB	5.45	5.88	5.55	5.45	5.20	4.95	4.71
MI	5.29	5.05	4.08	4.23	4.22	4.21	4.61
MN	4.63	4.75	4.23	3.97	3.95	3.67	3.68
OH	0.82	0.74	0.72	0.72	0.64	0.57	0.55
ON	4.85	4.70	4.18	3.95	3.96	3.96	3.93
WI	3.31	3.45	3.02	3.11	3.18	3.16	3.21
Central Region	2.90	2.87	2.49	2.47	2.47	2.42	2.50
Continent	2.82	2.73	2.47	2.47	2.49	2.49	2.58

Table 3. The number of U.S. hunters by state that submitted woodcock wings for the 2020-21 and 2021-22 Parts-collection Surveys. 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 the current survey year. In addition, some hunters hunted and submitted wings from more than one state.

State of Residence	2020-21 Season	2021-22 Season
Alabama	2	3
Arkansas	3	3
Connecticut	14	14
Delaware	4	6
Florida	0	0
Georgia	3	3
Illinois	1	0
Indiana	8	13
Iowa	2	4
Kansas	0	0
Kentucky	3	4
Louisiana	8	9
Maine	97	104
Maryland	7	10
Massachusetts	25	23
Michigan	187	171
Minnesota	96	94
Mississippi	1	1
Missouri	6	10
Nebraska	0	0
New Hampshire	51	43
New Jersey	22	13
New York	51	50
North Carolina	0	8
North Dakota	7	0
Ohio	12	12
Oklahoma	1	0
Pennsylvania	35	41
Rhode Island	2	4
South Carolina	12	7
Tennessee	2	1
Texas	2	1
Vermont	37	34
Virginia	18	24
West Virginia	9	9
Wisconsin	156	149
Total	884	868

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 2021 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963–2020.

State or region of harvest	Total wings 1963-20	Total wings 2021	Adult female wings 1963-20	Adult female wings 2021	Immature wings 1963-20	Immature wings 2021	Recruitment index 1963-20	Recruitment index 2021
CT	15,968	77	3,592	19	9,699	47	2.7	----
DE	596	52	94	11	410	27	4.4	----
FL	678	0	153	0	422	0	2.8	----
GA	3,466	19	1,091	9	1,467	4	1.3	----
ME	93,558	709	27,699	222	46,695	334	1.7	1.5
MD	5,186	64	1,266	17	2,949	38	2.3	----
MA	26,311	218	8,253	72	12,692	107	1.5	1.5
NH	39,718	329	12,911	109	18,384	161	1.4	1.5
NJ	28,206	106	6,515	24	16,695	61	2.6	----
NY	67,300	331	22,900	110	30,247	137	1.3	1.2
NC	4,821	162	1,555	67	2,254	56	1.4	0.8
PA	34,969	216	11,116	78	16,120	86	1.5	1.1
RI	2,498	7	486	1	1,651	6	3.4	----
SC	4,631	118	1,484	42	2,085	49	1.4	----
VT	31,138	315	10,253	96	14,151	140	1.4	1.5
VA	7,238	287	1,910	92	3,905	141	2.0	1.5
WV	6,767	43	2,050	16	3,365	19	1.6	----
Eastern Region	373,049	3,053	113,328	985	183,191	1,413	1.62	1.38
AL	1,065	23	300	12	486	5	1.6	----
AR	607	7	196	5	249	0	1.3	----
IL	1,519	0	358	0	851	0	2.4	----
IN	8,999	92	2,299	26	4,965	49	2.2	----
IA	1,406	17	453	6	629	9	1.4	----
KS	50	0	9	0	26	0	----	----
KY	1,366	21	352	3	687	10	2.0	----
LA	34,513	164	7,794	36	22,246	97	2.9	2.7
MI	153,344	1,646	50,663	519	74,515	825	1.5	1.6
MN	49,783	1,138	17,876	413	21,147	485	1.2	1.2
MS	2,020	8	566	3	1,022	4	1.8	----
MO	4,889	82	1,329	25	2,369	44	1.8	----
NE	13	0	5	0	6	0	----	----
ND	4	0	3	0	1	0	----	----
OH	15,775	79	4,858	20	7,410	44	1.5	----
OK	178	0	39	0	94	0	2.4	----
TN	1,397	5	377	1	703	4	1.9	----
TX	1,139	38	333	14	550	18	1.7	----
WI	103,789	1,711	35,578	650	48,317	726	1.4	1.1
Central Region	381,856	5,031	123,388	1,733	183,533	2,320	1.49	1.51

Table 5. Preliminary estimates of woodcock harvest, hunter numbers, days afield, and hunter success from the 2021–22 Harvest Information Program (note: estimates rounded to the nearest 100 for harvest, hunters, and days afield).

State or Region	Harvest		Active woodcock hunters		Days afield		Season harvest per hunter	Season harvest per hunter SE
	Harvest	SE	Active woodcock hunters	SE	Days afield	SE		SE
CT	500	200	500	200	2,700	700	1.00	0.45
DE	300	200	300	200	1,600	1,300	0.91	0.93
FL ^c								
GA	2,100	1,800	2,400	1,800	9,900	7,100	0.88	0.98
MA	1,100	500	800	200	3,000	700	1.45	0.73
MD	400	100	100	<100	400	100	4.18	1.63
ME	19,600	9,100	6,900	1,400	35,600	8,600	2.82	1.43
NC	9,900	5,900	5,200	2,600	12,600	5,400	1.92	1.51
NH	5,900	2,400	2,600	600	16,000	4,600	2.25	1.08
NJ	1,700	600	1,300	400	5,000	1,900	1.35	0.68
NY	13,000	6,900	2,900	700	20,800	7,000	4.50	2.62
PA	6,300	2,400	4,600	1,500	30,300	14,100	1.37	0.67
RI	100	100	300	100	500	100	0.49	0.31
SC	6,100	4,800	3,400	2,200	4,300	2,300	1.82	1.88
VA	3,300	900	500	100	2,900	600	6.50	2.00
VT	2,600	1,000	1,900	500	7,500	2,100	1.38	0.65
WV	500	100	100	<100	700	100	3.76	0.88
Eastern Region	73,500	14,400	33,800	na^a	153,600	21,000	na^b	na^b
AL	3,400	2,900	1,500	1,400	7,900	7,200	2.19	2.78
AR	3,100	3,100	100	100	1,800	1,800	21.00	29.57
IA	4,100	2,800	1,700	1,100	4,100	3,200	2.41	2.31
IL	200	200	1,500	1,400	1,500	1,400	0.17	0.23
IN	1,700	700	800	500	2,100	800	2.06	1.43
KS	0	0	0	0	0	0	3.00	4.06
KY	300	100	100	<100	400	100	2.25	1.38
LA	4,900	2,400	4,700	1,800	12,700	5,600	1.04	0.66
MI	47,500	6,000	20,100	2,500	93,700	11,100	2.36	0.41
MN	26,300	6,600	11,000	2,300	47,800	10,800	2.39	0.78
MO	4,100	3,000	3,200	1,700	12,900	9,300	1.27	1.17
MS	400	300	1,100	1,000	3,500	3,100	0.32	0.40
NE ^c								
OH	1,400	600	1,500	1,100	9,300	6,500	0.92	0.79
OK	100	100	100	100	200	100	0.67	0.75
TN	100	100	100	100	400	200	1.00	0.90
TX	1,600	900	300	100	2,100	1,100	5.13	3.04
WI	42,400	12,200	12,900	2,200	72,700	15,600	3.28	1.09
Central Region	141,300	16,400	60,700	na^a	273,100	26,900	na^b	na^b
U.S. Total	214,800	21,800	94,500	na^a	426,700	34,000	na^b	na^b

^a Hunter number estimates at the regional and national levels may be biased high because the HIP sample frames are state specific; therefore hunters were counted more than once if they hunted in >1 state. Variance was inestimable.

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

^c No hunters registered for HIP who were sampled for the woodcock survey said they hunted woodcock in the 2021-22 hunting season.

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 – 2022.

Eastern year (s)	Eastern outside dates	Eastern season length	Eastern daily bag limit	Central year (s)	Central outside dates	Central season length	Central 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	1997-20	Sep. 22 ^a - Jan. 31	45	3
1985-96	Oct. 1 - Jan. 31	45	3	2021-22	Sep. 13 - Jan 31	45	3
1997-01	Oct. 6 - Jan. 31	30	3				
2002-10	Oct. 1 - Jan. 31	30	3				
2011-20	Oct. 1 - Jan. 31	45	3				
2021-22	Sep. 13 - Jan 31	45	3				

^a Saturday nearest September 22nd.

Appendix B. Estimates for the number of successful woodcock hunters and woodcock harvest in Canada (Gendron and Smith 2019).

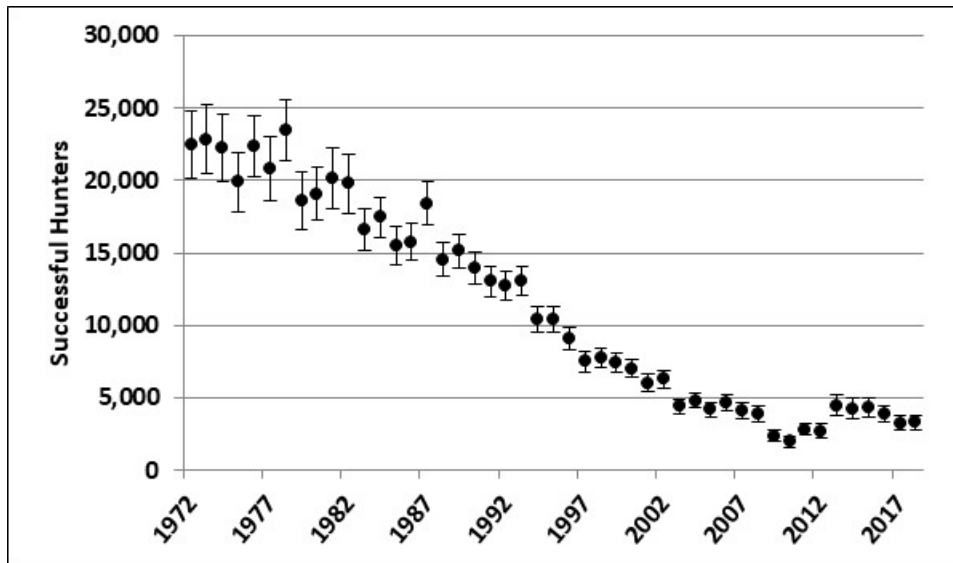


Fig. B1. Estimated number of successful woodcock hunters in Canada and associated 95% confidence intervals, 1972–2018.

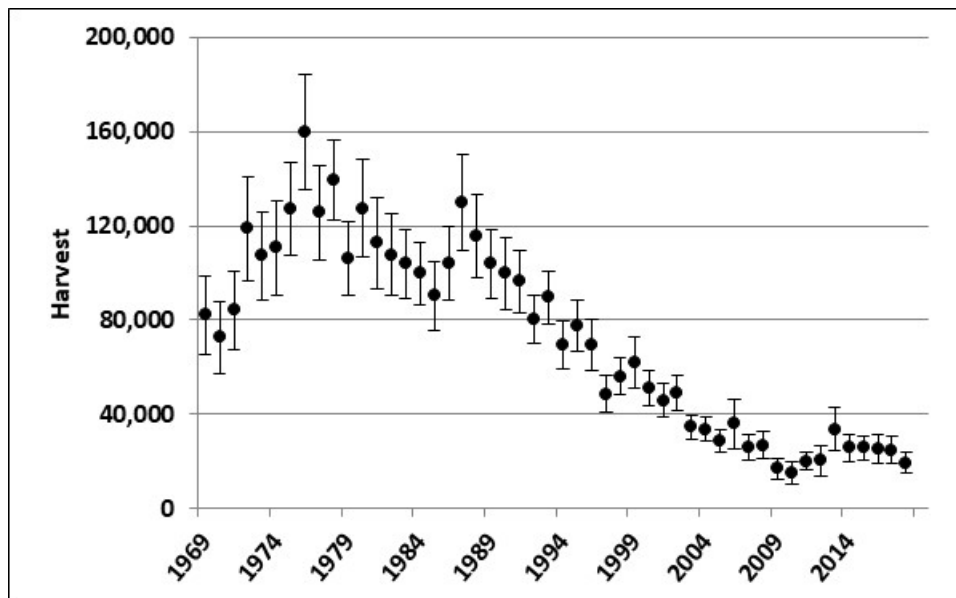


Fig. B2. Estimated woodcock harvest in Canada and associated 95% confidence intervals, 1969–2018.

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August 2022

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