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American Woodcock Population Status, 2008

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U. S. Fish and Wildlife Service

American Woodcock

Population Status, 2008

In Memory Of:

Dr. George Andrew (Andy) Ammann, Sr. was born in Philadelphia and grew up in rural New Jersey where he developed a love of nature, especially birds. He received B.A. and M.S. degrees in zoology from the University of Iowa in 1933 and a Ph.D. at the University of Michigan in 1938, researching the life history of the Yellow-headed Blackbird. After two years with the Fish and Wildlife Service and two with the U.S. Army, he was hired as a game biologist with the Michigan Department of Natural Resources in 1944. His responsibilities included all species of grouse (Ruffed Grouse, Sharp-tailed grouse, Spruce Grouse, and Prairie Chicken) as well as woodcock and snipe. Years ago, new biologists in Michigan were encouraged to own a dog. This was exactly what Andy wanted to hear. Andy loved his dogs and was well known and respected for the breeding and training of bird dogs. "Woodcock seemed to be a neglected species," he said "I saw the potential of the resource and how it wasn't being looked at seriously." He wanted to change that. Andy discovered that pointing dogs could be used to help gather basic information about woodcock. He wrote, *A Guide to Capturing and Banding American Woodcock Using Pointing Dogs*, published by the Ruffed Grouse Society, which describes the methods and techniques of capturing and banding woodcock. Over 35,000 woodcock have been banded in Michigan using this technique. He was the author of numerous research articles and books. Andy retired in 1974 from the Michigan DNR, and remained active in game bird investigations and hunting, especially banding woodcock until about 2000. He made a friend out of everyone, and never met a stranger. Andy died May 22, 2008 at age 98. He is missed by family and friends.

~ By John Urbain, Michigan Department of Natural Resources, Retired ~

Andy doing what he loved, watching his dogs and banding woodcock!

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AMERICAN WOODCOCK POPULATION STATUS, 2008

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Abstract: Singing-ground Survey data for 2008 indicated that the numbers of displaying American woodcock (*Scolopax minor*) in the Central Region declined 9.2 % from 2007; however, the Eastern Region was unchanged. There was no significant 10-year trend for woodcock heard in the Eastern Region during 1998-2008, while there was a significant decline in the Central Region. This represents the fifth consecutive year that the 10-year trend estimate did not indicate a significant decline in the Eastern Region, while it marks the first time since 2003 that the Central Region has had a declining 10-year trend. There were long-term (1968-08) declines of -1.2 % per year in the Eastern Region and -1.1 % per year in the Central Region. The 2007 recruitment index for the U.S. portion of the Eastern Region (1.6 immatures per adult female) was 4.2 % greater than the 2006 index and 3.6 % lower than the long-term regional index. The 2007 recruitment index for the U.S. portion of the Central Region (1.5 immatures per adult female) was 9.7 % lower than the 2006 index and was 7.6 % lower than the long-term regional index. The Harvest Information Program indicated that U.S. woodcock hunters in the Eastern Region spent 144,979 days afield and harvested 75,882 woodcock during the 2007-08 season, while in the Central Region, hunters spent 358,480 days afield and harvested nearly 214,162 woodcock.

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 2008. 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. A history of woodcock hunting regulations is summarized in Appendix A.

METHODS

Woodcock Management Units

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.

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

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.

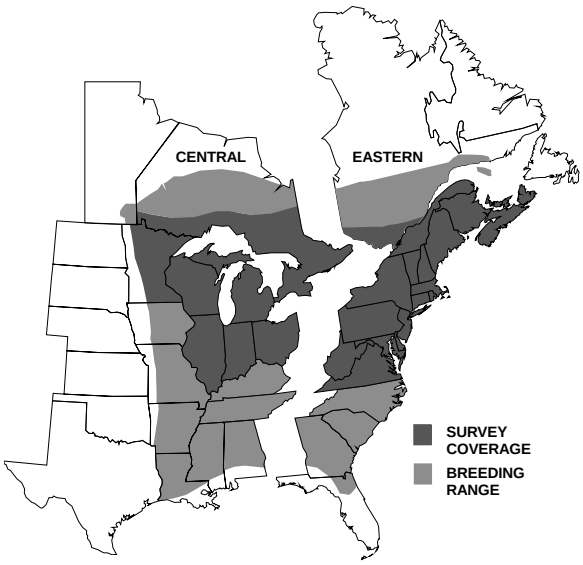

Fig. 1. Woodcock management regions, breeding range, and Singing-ground Survey coverage.

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 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, 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 manpower 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.

For the first time, trends were estimated using only hierarchical log-linear modeling methods. 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 the same data are used to calculate each.

With the hierarchical model, the log of the expected value of the counts is modeled as a linear combination of strata-specific intercepts and trends, a random effect for each unique combination of route and observer, a year effect, a start-up effect on the route for first year counts of new observers, and overdispersion. Most of these factors are treated as random effects, in that the regional estimates are assumed to follow a distribution. The hierarchical model is fit using Markov-chain Monte Carlo methods, an iterative process in which sequences of parameter estimates over time converge to a series which follows the distribution of the parameters of interest. Once the convergence occurs, means, medians, and credible (or Bayesian confidence) intervals for the parameters can be estimated from the replicates. Annual indices are defined as exponentiated year and trend 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. 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 (2007-08), 10-year (1998-08) and long-term (1968-08) trends were evaluated for each region as well as for each state or province.

Credible Intervals (CI) 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 called significant. We present the median and 95th

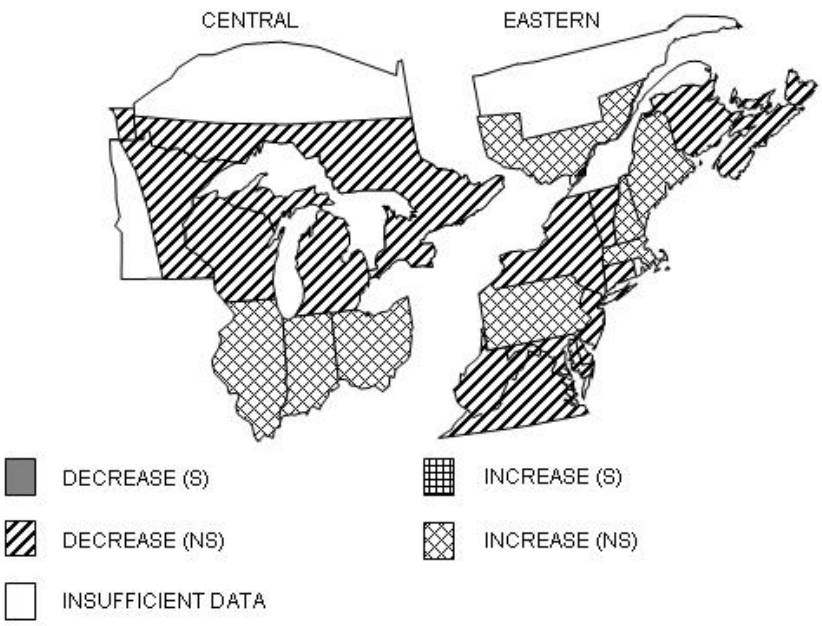

Fig. 2. Short-term trends in the number of American woodcock heard on the Singing-ground Survey, 2007-2008, as determined by the hierarchical modeling method. A significant trend (S) does not include 0 in the 95% credible interval, while a non-significant (NS) trend does include 0.

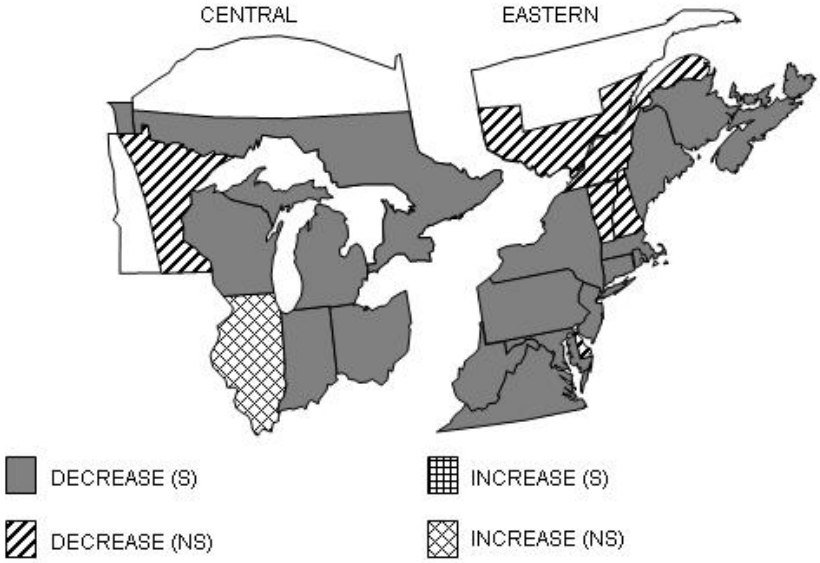

Fig. 3. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968-2008, as determined by the hierarchical modeling method. A significant trend (S) does not include 0 in the 95% credible interval, while a non-significant (NS) trend does include 0.

percentile credible intervals of 10,000 estimates (i.e., we simulated 80,000 replicates and thinned by 8), which were calculated after an initial 720,000 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 with > 2 years of data. Each route was to be surveyed during the peak time of 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 28 May 2008 were not included in this analysis but will be included in future trend estimates.

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 2003-07 should be considered preliminary as refinements are still being made in the sampling frame and estimation techniques.

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 2007 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 to be included in 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 sex of the birds were determined by examining plumage characteristics (Martin 1964, Sepik 1994) during the annual woodcock wingbee conducted by state, federal, and private biologists. Information from wings from the 2007-08 hunting season received through 1 March 2008 was included in analyses. Wings received after 1 March were processed for inclusion in the permanent database.

The ratio of immature birds per adult female in the harvest provides an index to recruitment of young into the population. The 2007 recruitment index for each state with ≥125 submitted wings was calculated as the number of immatures per adult female. The regional indices for 2007 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2006.

RESULTS AND DISCUSSION

Singing-ground Survey

Data for 733 routes were submitted by 28 May 2008 (Table 1). Short-term, 10-year, and long-term trends were estimated using data from 638 routes in the Eastern Region and 637 routes in the Central Region. Short-term analysis indicated that the number of woodcock heard displaying during the 2008 Singing-ground Survey in the Central Region declined 9.2% from 2007 levels; however, the Eastern Region was unchanged (Table 1, Fig. 2). Trends for individual states and provinces are reported in Table 1.

The 10-year trend (1998-2008) remained unchanged for the Eastern Region, while there was a

decline of -1.5% per year for the Central Region (Table 1). This marks the fifth straight year the Eastern trend has remained stable, while the first time since 2003 that the Central Region has shown a significant decline in the 10-year trend.

There were significant long-term declines in the breeding population throughout most states and provinces in the Eastern and Central Regions (Table 1, Fig. 3). The long-term trend estimates were -1.2 and -1.1% per year for the Eastern and Central regions, respectively.

In the Eastern Region, the 2008 breeding population index using hierarchical methods was 2.5 singing-males per route, which was the same as the 2007 index (Fig. 4). In the Central Region, the 2008 breeding population index was 2.6 singing-males per route, which was lower than the 2007 index of 2.8 singing-males per route (Fig. 4). For annual indices (1968-2008) by state, province, or region see Table 2.

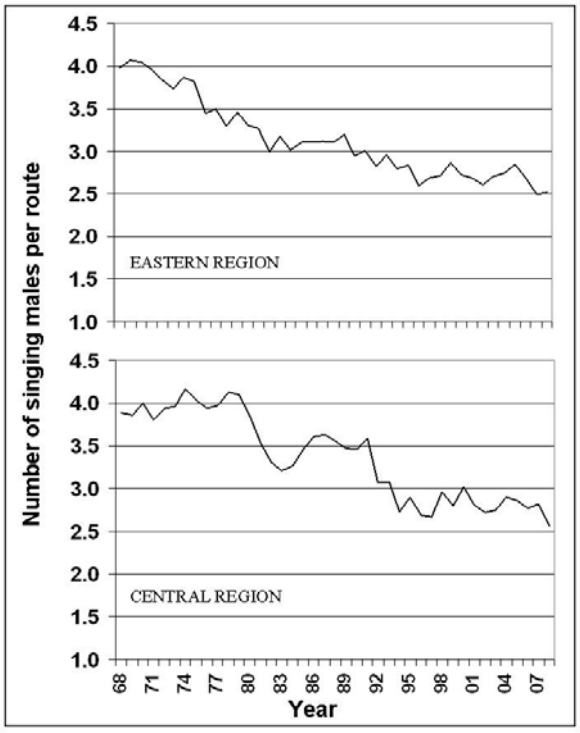

Fig. 4. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2008 as estimated using hierarchical modeling.

Wing-collection Survey

A total of 1,562 woodcock hunters (Table 3) from states with woodcock seasons sent in a total of 12,803 usable woodcock wings for the 2007 Wing-collection Survey (Table 4).

The 2007 recruitment index in the U.S. portion of the Eastern Region (1.6 immatures per adult female) was 4.2% higher than the 2006 index (1.5), and 3.6 % lower than the long-term (1963-06) regional average (Table 4, Fig 5). In the Central Region, the 2007 recruitment index (1.5 immatures per adult female) was 9.7 % lower than the 2006 index (1.6) and was 7.6 % lower than the long-term regional average (Table 4, Fig 5). Percent change for all comparisons was calculated using un-rounded estimates.

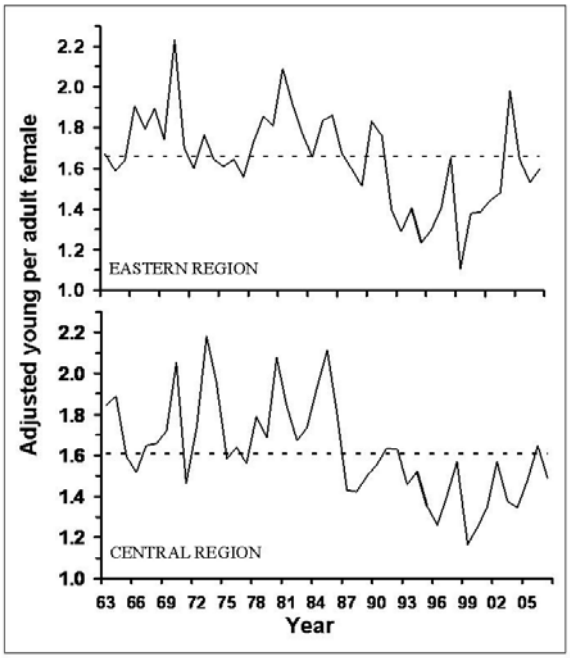

Fig. 5. Weighted annual indices of recruitment (U.S.), 1963-2007. The dashed line is the 1963-2006 average.

Harvest Information Program

Estimates of woodcock harvest, number of active hunters, days afield, and seasonal hunting success from the 2007-08 HIP survey are provided in Table 8. In the Eastern Region, woodcock hunters spent approximately 144,979 days afield and harvested 75,882 birds during the 2007-08 hunting season (Table 5). Woodcock hunters in the Central Region spent 358,480 days afield and harvested 214,162 birds during the 2007-08 hunting season (Table 5). 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. Harvest and days afield estimates for 2007 were below the 1999-2007 mean for both management regions (Fig. 6 and 7). All days afield and harvest estimates from 2003-2007 are preliminary.

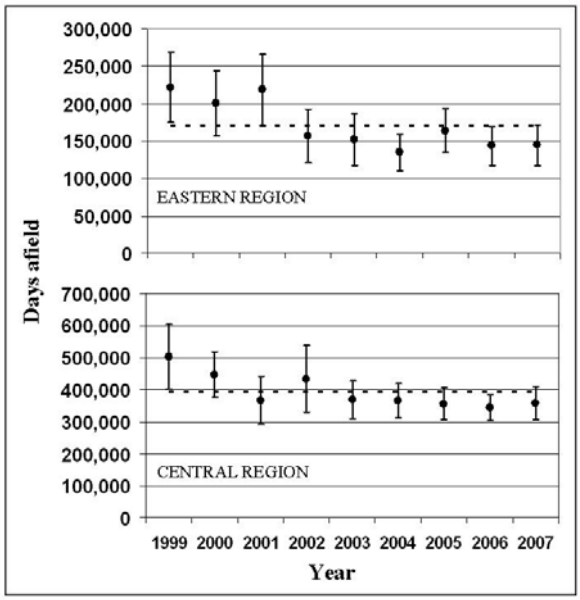

Fig. 6. Estimated days afield hunting woodcock as estimated by the HIP survey, 1999-2007. Dashed line represents the 1999-2007 mean and error bars represent the 95% CI of the point estimate.

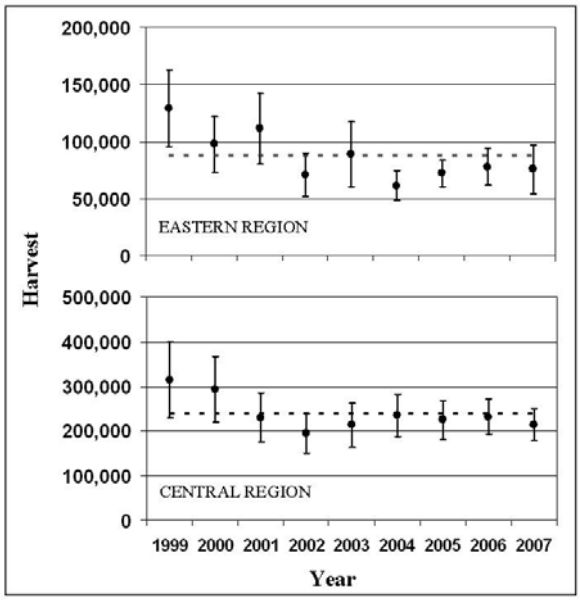

Fig. 7. Estimated woodcock harvest as estimated by the HIP survey, 1999-2007. Dashed line represents the 1999-2007 mean and error bars represent the 95% CI of the point estimate.

Acknowledgements

Personnel from the FWS, Canadian Wildlife Service (CWS), U. S. Geological Survey (USGS), many state and provincial agencies and other individuals assisted in collecting the Singing-ground Survey data and processing wings at the woodcock wingbee. Special thanks to J. Austin (VT FWD), R. Boyd (PA GC), K. Connor (NB DNRE), B. Crose (OH DNR), R. Dibblee (PEI WD), M. DiBona (DE DNREC), L. Fendrick (OH DNR), V. Frawley (MI DNR), J. Garris (NJ FW), B. Harvey (MD NR), J. Hayden (ON MNR), M. Huang (CT DEP), J. Hughes (ON MNR), R. Marshalla (IL DNR), R. Milton (NS DNR), M. Murphy (NY DEC), E. Robinson (NH FGD), D. Scarpitti (MA DFW), A. Stewart (MI DNR), B. Tefft (RI DFWS), B. Veverka (IN DNR), S. Wilson (WV DNR), M. Gendron, A. MacFarlane, J. B. Pollard, E. Reed, J. Rodrigue, and M. Schuster (CWS), and C. Dwyer, S. Kelly, M. Mills, and D. Schwab (FWS), for help in coordinating the Singing-ground Survey. K. Magruder (FWS) provided invaluable assistance with data management and entry. Special appreciation is extended to R. Applegate (TN WRA) and T. Edwards (USFWS) for coordinating local logistics and hosting the 2008 wingbee held at Henry Horton State Park in Tennessee. Individuals that participated in the wingbee were: R. Stonebraker (IN DNR), E. Harper (KY DFWR), F. Kimmel and M. Olinde (LA DWF), E. Johnson (MN DNR), A. Stewart and V. Frawley (MI DNR), T. Sutter (NY DEC), L. Fendrick (OH DNR), R. Applegate (TN WRA), D. McAuley (USGS), and T. Cooper, P. Denmon, T. Edwards, C. Ferrell, J. Kelley, L. Landowski, R. Rau, L. Stevenson, and A. Weik (USFWS). We especially thank all woodcock hunters that sent in wings. 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 of woodcock harvest (special thanks to K. Richkus, H. Spriggs, and S. Williams, K. Wilkins). R. Maruthalingam (USFWS) assisted in maintaining the website for the Singing-ground Survey. J. Sauer (USGS) developed computer programs for calculating trends and indices from Singing-ground Survey data and conducted this year's analyses. M. Koneff, G. Zimmerman, J. Kelley, K. Richkus, K. Wilkins, and J. Sauer reviewed a draft of parts or all of this report and provided helpful comments. Portions of this report were copied in whole or in part from previous woodcock status reports.

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Table 1. Short-term (2007-08), 10-year (1998-2008), and long-term (1968-2008) 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]		2007-2008			1998-2008			1968-2008		
		n[c]	% change	95%	CI[d]	% change	95%	CI[d]	% change	95%	CI[d]
CT	4	9	-1.4	-32.2	67.0	-3.6	-7.4	2.7	-3.9	-5.9	-1.7
DE	1	2	-1.9	-86.1	576.5	-6.4	-25.8	6.3	-1.2	-7.3	4.4
ME	48	67	4.2	-14.7	28.3	-0.1	-2.2	2.3	-1.3	-1.9	-0.7
MD	7	21	-3.9	-24.8	24.3	-3.9	-6.3	-0.4	-4.0	-5.4	-2.3
MA	10	20	4.6	-19.0	61.3	-1.9	-4.4	2.5	-2.4	-3.3	-1.3
NB	51	69	-4.7	-22.8	17.8	-0.5	-2.8	1.9	-1.3	-2.2	-0.4
NH	15	18	2.4	-22.5	40.0	-1.4	-5.1	1.5	-0.6	-1.7	0.6
NJ	5	18	-9.4	-46.8	47.4	-6.8	-11.6	-1.4	-6.4	-8.0	-4.6
NY	70	111	-3.2	-16.0	10.9	-1.6	-3.1	-0.1	-1.6	-2.0	-1.1
NS	40	60	-1.7	-18.7	17.9	-0.9	-2.8	1.1	-1.1	-1.9	-0.4
PA	34	58	4.7	-14.3	39.4	-1.4	-3.8	1.2	-1.3	-2.1	-0.5
PEI	9	12	-11.4	-46.4	21.9	-2.6	-7.1	0.9	-1.8	-3.3	-0.6
QUE	7	56	3.7	-23.7	51.5	0.1	-3.3	3.7	-0.2	-1.5	1.2
RI[e]	0	2	--	--	--	--	--	--	-12.6	-17.7	-6.4
VT	12	22	-8.7	-39.1	34.4	-2.9	-6.9	0.9	-1.1	-2.3	0.2
VA	35	48	-1.7	-31.5	53.4	-4.5	-7.9	0.2	-5.1	-6.2	-3.5
WV	16	45	-3.0	-23.3	23.8	-2.6	-4.8	0.3	-2.7	-3.6	-1.6
Eastern	**364**	**638**	**0.7**	**-10.4**	**16.6**	**-0.7**	**-2.0**	**0.7**	**-1.2**	**-1.6**	**-0.8**
IL	21	25	0.6	-55.8	128.3	-0.7	-10.4	9.1	1.2	-1.6	4.1
IN	14	40	0.4	-41.5	81.8	-5.4	-11.6	-0.4	-4.3	-5.9	-2.8
MB[f]	12	23	-5.5	-34.3	32.1	-2.7	-6.0	1.2	-3.3	-5.6	-1.0
MI	114	148	-5.7	-17.1	7.3	-2.8	-4.3	-1.4	-1.3	-1.7	-0.9
MN	70	102	-6.1	-21.0	10.4	-0.3	-2.1	1.5	-0.2	-0.8	0.5
OH	31	57	0.8	-20.7	34.3	-2.9	-5.9	-0.6	-2.3	-3.3	-1.5
ON	35	139	-13.1	-29.4	5.4	-1.2	-3.2	1.0	-0.8	-1.4	-0.2
WI	72	103	-14.2	-28.9	2.9	-0.1	-2.1	2.0	-0.7	-1.3	-0.2
Central	**369**	**637**	**-9.2**	**-17.2**	**-0.3**	**-1.5**	**-2.5**	**-0.5**	**-1.1**	**-1.4**	**-0.9**
Continent	**733**	**1275**	**-4.4**	**-11.5**	**4.3**	**-1.1**	**-1.9**	**-0.2**	**-1.1**	**-1.4**	**-0.8**

[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 2008 for which data was received by 28 May.

[c] Number of routes that could be used for trend analysis, routes with < 2 years of data were not used.

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

[e] Short-term and 10-year trends not estimated.

[f] Manitoba began participating in the Singing-ground Survey in 1990.

Table 2. Breeding population indices (singing-males per route) for American woodcock from the Singing-ground Survey, 1968-2008. These indices are based on the 1968-2008 trend that was estimated using hierarchical modeling techniques.

State, Province, or Region	Year															
	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Eastern Region																
CT	3.32	3.19	3.25	2.90	3.02	2.75	2.73	2.70	2.24	2.24	1.93	1.98	1.92	1.87	1.97	1.78
DE	0.83	0.69	0.86	0.60	0.76	0.92	0.83	1.72	0.45	0.65	0.46	0.53	0.70	0.69	0.69	1.13
ME	5.63	5.53	6.11	5.54	5.46	5.64	5.85	6.08	5.63	4.72	4.57	5.02	4.29	4.93	3.78	4.22
MD	1.97	1.95	1.81	1.77	1.68	1.62	1.55	1.50	1.38	1.35	1.31	1.25	1.24	1.18	1.12	1.04
MA	3.48	3.42	3.49	3.48	3.11	3.42	3.22	2.75	2.71	2.71	2.61	2.72	2.41	2.56	2.30	2.14
NB	6.46	8.58	8.27	7.68	7.42	6.96	7.50	7.99	6.06	7.33	5.61	5.98	4.94	5.59	5.30	5.31
NH	3.63	3.63	3.86	3.46	3.90	3.31	3.75	3.55	3.52	3.55	3.45	3.38	3.69	3.58	3.11	3.21
NJ	5.69	5.35	5.38	6.37	4.84	5.59	5.13	4.32	3.36	3.31	2.73	3.14	2.45	2.26	2.10	2.21
NY	4.01	4.08	3.68	3.90	3.76	3.78	3.79	3.48	3.48	3.43	3.16	3.34	3.54	3.37	3.13	3.28
NS	3.85	3.56	3.21	3.57	3.37	3.49	3.57	3.43	3.34	3.31	3.43	3.16	3.13	2.98	2.88	3.02
PA	2.14	2.03	2.18	2.11	2.04	2.04	1.82	1.84	1.85	1.82	1.75	1.82	1.64	1.63	1.58	1.61
PEI	5.09	4.87	4.81	5.33	4.40	4.35	4.53	5.35	4.62	4.40	4.22	4.30	3.62	3.43	3.49	3.89
QUE	6.21	6.19	6.17	6.23	6.10	5.78	6.18	6.06	5.30	5.60	6.15	6.48	6.71	6.04	5.77	6.35
RI	3.84	2.96	2.66	2.87	2.30	2.04	1.66	1.41	1.26	1.09	0.87	0.81	0.70	0.59	0.58	0.48
VT	3.69	3.07	3.85	3.38	3.89	3.31	3.78	4.15	4.28	4.50	3.15	3.35	3.13	2.69	1.89	2.75
VA	1.70	1.60	1.60	1.37	1.27	1.11	1.32	1.17	1.13	1.07	0.93	0.90	0.79	0.85	0.83	0.75
WV	1.60	1.60	1.48	1.43	1.49	1.40	1.35	1.34	1.28	1.21	1.09	1.17	1.11	1.16	1.10	1.06
Region	**3.98**	**4.07**	**4.05**	**3.96**	**3.84**	**3.74**	**3.87**	**3.82**	**3.45**	**3.50**	**3.30**	**3.46**	**3.30**	**3.27**	**3.00**	**3.18**
Central Region																
IL	0.55	0.56	0.47	0.65	0.62	0.52	0.61	0.70	0.51	0.58	0.72	0.52	0.45	0.65	0.45	1.07
IN	1.87	1.29	1.23	0.97	1.41	1.26	1.12	0.94	0.99	0.92	0.92	1.13	0.88	1.02	0.69	0.76
MB	16.00	15.34	14.70	14.12	13.64	13.01	12.60	11.95	11.57	11.12	10.72	10.24	9.85	9.47	9.07	8.78
MI	6.65	6.52	6.56	6.17	6.21	6.42	7.11	7.09	6.76	6.31	6.71	6.61	6.26	5.58	5.83	4.96
MN	3.92	3.37	3.34	3.65	3.41	3.77	4.28	3.86	3.91	4.00	4.17	3.82	4.35	3.89	3.80	3.49
OH	1.92	1.88	1.93	1.80	1.78	1.64	1.76	1.57	1.72	1.67	1.51	1.43	1.44	1.53	1.33	1.39
ON	7.90	8.79	9.29	8.54	9.34	9.06	9.08	8.65	8.83	9.07	9.35	9.61	8.99	8.11	6.89	6.83
WI	3.47	3.50	4.00	3.73	3.73	3.89	3.95	4.02	3.66	4.07	4.17	4.32	3.51	2.98	3.13	3.02
Region	**3.89**	**3.86**	**4.00**	**3.81**	**3.94**	**3.96**	**4.17**	**4.03**	**3.94**	**3.97**	**4.13**	**4.10**	**3.86**	**3.53**	**3.31**	**3.21**
Continent	**3.94**	**3.97**	**4.02**	**3.89**	**3.89**	**3.85**	**4.02**	**3.93**	**3.69**	**3.73**	**3.71**	**3.78**	**3.58**	**3.40**	**3.16**	**3.20**

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	1.65	1.62	1.64	1.46	1.59	1.32	1.29	1.28	1.18	1.08	1.09	1.12	1.09	0.98	0.94	0.97
DE	0.55	0.60	0.67	0.66	0.66	0.66	0.93	0.45	0.49	0.63	0.63	0.63	0.69	0.68	1.09	0.54
ME	4.24	4.35	4.63	4.90	4.50	4.62	3.66	4.13	3.59	3.84	3.54	3.63	3.07	3.29	3.26	3.55
MD	1.02	0.97	0.91	0.88	0.84	0.82	0.79	0.75	0.70	0.69	0.66	0.63	0.61	0.58	0.55	0.53
MA	2.28	2.24	2.15	2.12	2.07	1.93	1.90	1.89	1.76	1.70	1.69	1.66	1.61	1.64	1.56	1.76
NB	4.85	5.08	4.22	4.69	5.43	6.46	5.46	5.07	4.92	5.92	6.03	5.63	4.91	5.57	5.44	6.32
NH	3.14	3.27	4.02	3.46	3.43	3.36	3.18	3.43	3.17	3.16	3.18	3.52	3.44	3.40	3.37	3.58
NJ	2.15	1.99	1.79	1.94	1.53	1.45	1.37	1.27	1.11	0.99	0.88	0.96	0.90	0.74	0.77	0.77
NY	2.97	3.21	2.99	2.92	3.05	2.78	3.00	2.99	2.81	2.75	2.52	2.58	2.47	2.47	2.48	2.49
NS	2.88	2.98	3.03	2.78	2.93	2.90	2.75	2.88	2.86	2.88	2.67	2.76	2.77	2.63	2.66	2.84
PA	1.63	1.55	1.60	1.53	1.50	1.45	1.53	1.65	1.42	1.46	1.29	1.42	1.37	1.32	1.43	1.34
PEI	3.89	3.81	4.02	3.39	3.80	3.90	3.49	3.37	3.28	3.14	2.95	3.07	3.29	3.20	3.01	2.82
QUE	5.82	6.35	6.58	6.57	6.27	6.64	6.00	6.24	6.08	6.30	5.95	6.06	5.49	5.70	5.85	6.07
RI	0.42	0.35	0.30	0.27	0.23	0.20	0.18	0.15	0.13	0.12	0.10	0.09	0.08	0.07	0.06	0.05
VT	2.63	2.36	2.58	3.05	3.33	3.25	2.97	3.10	2.15	2.48	2.36	2.37	2.24	2.38	2.66	3.04
VA	0.92	0.60	0.63	0.61	0.54	0.50	0.51	0.47	0.48	0.45	0.41	0.36	0.35	0.37	0.31	0.32
WV	1.01	0.97	0.96	0.93	0.90	0.88	0.88	0.82	0.81	0.78	0.76	0.78	0.72	0.72	0.68	0.68
Region	**3.02**	**3.11**	**3.10**	**3.12**	**3.11**	**3.19**	**2.94**	**3.01**	**2.82**	**2.96**	**2.80**	**2.83**	**2.59**	**2.69**	**2.71**	**2.86**
Central Region																
IL	0.62	0.90	0.80	1.32	0.58	0.82	0.55	0.90	0.65	0.80	0.66	0.58	0.75	0.65	0.80	0.84
IN	0.72	0.66	0.78	0.73	0.64	0.58	0.76	0.71	0.62	0.53	0.52	0.49	0.45	0.43	0.54	0.46
MB	8.38	8.07	7.73	7.46	7.13	6.85	6.60	6.29	5.94	6.28	5.98	6.08	5.19	3.80	4.37	4.35
MI	5.57	5.67	5.89	5.52	5.81	5.59	5.62	6.11	4.86	4.94	4.37	4.80	4.58	4.44	5.20	4.39
MN	3.38	3.69	3.85	3.85	4.20	3.56	4.17	4.01	3.48	3.53	3.23	3.36	3.22	2.91	3.24	3.32
OH	1.37	1.27	1.24	1.21	1.27	1.13	1.32	1.21	1.19	1.12	1.09	1.06	1.05	0.94	1.04	0.91
ON	6.88	7.69	7.90	7.81	7.83	7.90	7.46	7.57	7.06	6.82	5.87	6.45	5.28	6.00	6.27	5.80
WI	3.29	3.20	3.64	3.68	3.46	3.49	3.32	3.36	2.71	2.84	2.51	2.60	2.55	2.43	2.57	2.88
Region	**3.27**	**3.46**	**3.61**	**3.63**	**3.56**	**3.47**	**3.46**	**3.59**	**3.07**	**3.08**	**2.73**	**2.90**	**2.69**	**2.67**	**2.96**	**2.80**
Continent	**3.14**	**3.29**	**3.36**	**3.37**	**3.34**	**3.33**	**3.20**	**3.30**	**2.95**	**3.02**	**2.77**	**2.87**	**2.64**	**2.68**	**2.84**	**2.84**

Table 2. Continued

State, Province, or Region	Year								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Eastern Region									
CT	0.87	0.82	0.76	0.75	0.72	0.72	0.67	0.66	0.66
DE	0.79	0.53	0.60	0.59	0.58	0.59	0.52	0.51	0.50
ME	3.67	3.25	3.03	3.30	3.34	3.44	3.38	3.11	3.25
MD	0.52	0.51	0.47	0.45	0.43	0.41	0.40	0.38	0.37
MA	1.58	1.47	1.46	1.42	1.50	1.33	1.35	1.23	1.31
NB	5.80	6.21	5.90	6.47	6.43	6.99	6.30	5.43	5.18
NH	3.15	3.21	3.20	3.48	3.50	3.45	3.29	2.82	2.91
NJ	0.69	0.63	0.55	0.56	0.46	0.44	0.43	0.42	0.38
NY	2.38	2.32	2.28	2.33	2.41	2.28	2.29	2.18	2.11
NS	2.79	2.67	2.57	2.55	2.66	2.62	2.48	2.48	2.44
PA	1.13	1.29	1.26	1.25	1.26	1.28	1.18	1.17	1.24
PEI	2.98	2.83	2.43	2.47	2.53	2.70	2.77	2.65	2.30
QUE	5.82	5.72	5.74	5.76	5.96	6.35	5.98	5.62	5.86
RI	0.04	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.01
VT	3.15	2.43	2.18	2.38	2.43	2.63	2.69	2.16	1.96
VA	0.30	0.26	0.25	0.25	0.24	0.22	0.20	0.20	0.20
WV	0.66	0.63	0.60	0.61	0.57	0.55	0.54	0.54	0.52
Region	**2.73**	**2.68**	**2.61**	**2.70**	**2.75**	**2.84**	**2.70**	**2.50**	**2.52**
Central Region									
IL	0.73	0.86	0.74	1.31	1.46	0.69	1.01	0.73	0.74
IN	0.41	0.45	0.35	0.33	0.40	0.40	0.32	0.30	0.30
MB	4.46	4.48	3.57	4.06	3.62	4.15	3.45	3.55	3.34
MI	4.59	4.34	4.43	4.56	4.59	4.48	4.20	4.13	3.90
MN	3.71	3.46	2.98	3.05	3.13	3.43	3.31	3.35	3.14
OH	0.93	0.92	0.88	0.84	1.02	0.93	0.90	0.76	0.77
ON	7.02	6.02	6.37	5.64	6.10	6.34	6.02	6.43	5.59
WI	2.74	2.64	2.30	2.46	2.49	2.79	2.59	2.97	2.55
Region	**3.02**	**2.81**	**2.72**	**2.75**	**2.90**	**2.86**	**2.77**	**2.82**	**2.56**
Continent	**2.88**	**2.75**	**2.67**	**2.73**	**2.83**	**2.86**	**2.74**	**2.66**	**2.54**

Table 3. The number of U.S. hunters by state that submitted woodcock wings in the 2006 and 2007 Wing-collection Surveys.

State of residence	Number of Hunters that Submitted woodcock wings[a]	
	2006-07 Season	2007-08 Season
AL	1	2
AR	1	1
CT	37	31
DE	0	4
FL	1	0
GA	5	4
IL	22	5
IN	24	26
IA	11	6
KS	1	0
KY	2	3
LA	20	28
ME	79	145
MD	15	11
MA	94	74
MI	201	332
MN	113	140
MS	0	3
MO	20	20
NE	0	0
NH	54	77
NJ	29	21
NY	122	133
NC	5	5
ND	1	1
OH	30	17
OK	0	0
PA	79	84
RI	6	2
SC	11	8
TN	3	4
TX	0	0
VT	47	54
VA	20	20
WV	23	23
WI	178	278
Total	1,255	1,562

[a] Number of hunters that submitted envelopes in current year. This number may include a small number of hunters that we sent envelopes to in prior years and who subsequently submitted wings from birds shot in current survey year.

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 2007 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2006.

State or Region of harvest	Wings received						Recruitment index	
	Total		Adult females		Immatures			
	1963-06	2007	1963-06	2007	1963-06	2007	1963-06	2007
Eastern Region								
CT	13,639	139	3,014	28	8,375	89	2.8	3.2
DE	445	9	61	2	312	5	5.1	
FL	663	0	151	0	412	0	2.7	
GA	3,078	25	948	11	1,328	7	1.4	
ME	78,255	1,149	23,090	390	39,101	547	1.7	1.4
MD	4,062	68	1,015	24	2,267	33	2.2	
MA	21,697	410	6,667	130	10,639	201	1.6	1.5
NH	30,914	668	9,978	274	14,305	261	1.4	1.0
NJ	25,586	154	5,913	24	15,120	101	2.6	4.2
NY	56,419	956	18,904	361	25,883	378	1.4	1.0
NC	3,276	52	981	25	1,626	18	1.7	
PA	29,975	462	9,476	178	13,841	192	1.5	1.1
RI	2,349	27	443	11	1,577	10	3.6	
SC	2,763	54	835	25	1,285	15	1.5	
VT	23,505	515	7,636	199	10,862	207	1.4	1.0
VA	4,624	162	1,163	50	2,572	79	2.2	1.6
WV	5,703	130	1,736	30	2,869	66	1.7	2.2
Region	**306,953**	**4,980**	**92,011**	**1,762**	**152,374**	**2,209**	**1.7**	**1.6**
Central Region								
AL	914	3	245	2	426	1	1.7	
AR	526	3	166	2	217	1	1.3	
IL	1,406	17	326	2	789	11	2.4	
IN	7,634	148	1,939	40	4,208	81	2.2	2.0
IA	1,126	31	359	9	520	14	1.4	
KS	45	1	9	0	23	1		
KY	1,129	13	270	7	590	3	2.2	
LA	30,736	389	6,897	79	19,894	251	2.9	3.2
MI	115,014	3,282	37,408	1,127	56,983	1,461	1.5	1.3
MN	33,080	1,134	11,350	470	14,685	404	1.3	0.9
MS	1,725	9	490	5	878	2	1.8	
MO	3,462	125	901	36	1,705	53	1.9	1.5
NE	13	0	5	0	6	0		
ND	2	1	2	1	0	0		
OH	14,372	109	4,386	37	6,794	41	1.5	
OK	172	0	38	0	91	0	2.4	
TN	1,071	25	274	6	547	13	2.0	
TX	990	1	262	0	503	0	1.9	
WI	70,688	2,532	23,304	909	33,990	1,133	1.5	1.2
Region	**284,105**	**7,823**	**88,631**	**2,732**	**142,849**	**3,470**	**1.6**	**1.5**

Table 5. Preliminary estimates of woodcock harvest, hunter numbers, days afield, and hunter success from the 2007-08 Harvest Information Program.

	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	1,661	76	790	45	3,157	44	2.1	88
DE	1,644	134	422	75	1,706	92	3.9	154
FL	5,615	165	2,920	107	4,756	98	1.9	197
GA	7,802	196	1,560	196	6,242	196	5.0	277
ME	13,695	43	5,164	36	22,581	41	2.7	56
MD	371	54	993	121	2,711	130	0.4	132
MA	2,071	38	949	27	5,035	34	2.2	47
NH	5,383	28	2,329	25	11,483	37	2.3	37
NJ	1,551	57	831	58	3,387	56	1.9	81
NY	9,753	31	4,984	24	23,133	27	2.0	39
NC	7,487	67	2,421	90	11,161	84	3.1	112
PA	11,141	59	10,599	31	41,070	44	1.1	67
RI	170	193	68	135	136	152	2.5	236
SC	1,153	89	695	141	1,503	70	1.7	167
VT	1,991	28	680	28	2,997	31	2.9	40
VA	2,648	117	521	98	2,429	86	5.1	153
WV	1,745	87	414	53	1,494	54	4.2	102
Region	**75,882**	**28**	**na[b]**		**144,979**	**19**	**na[b]**	
Central								
AL	708	98	101	57	718	72	7.0	113
AR	10,541	116	2,642	121	9,258	105	4.0	167
IL	3,819	149	3,111	73	7,644	72	1.2	166
IN	1,203	53	1,788	71	3,342	58	0.7	89
IA	80	56	1,109	89	4,635	117	0.1	105
KS	9	174	618	137	3,132	173	0.0	221
KY	277	105	837	164	3,419	127	0.3	195
LA	21,726	90	4,774	62	17,223	73	4.6	110
MI	86,825	17	28,412	13	138,881	15	3.1	21
MN	34,400	38	15,295	29	62,810	36	2.2	48
MS	585	75	583	163	1,836	155	1.0	179
MO	858	55	191	30	889	45	4.5	62
NE	162	122	509	168	13,763	186	0.3	208
OH	2,598	68	2,611	73	9,259	72	1.0	100
TN	836	108	139	95	418	105	6.0	144
TX	1,509	196	604	129	2,113	144	2.5	235
WI	48,027	31	17,258	23	79,139	31	2.8	39
Region	**214,162**	**16**	**na[b]**		**358,480**	**14**	**na[b]**	
U.S. Total	**290,045**	**14**	**na[b]**		**503,459**	**12**	**na[b]**	

[a] 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, 1918-2007.

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	*Sep. 20 - Jan. 31	45	3
1985-96	Oct. 1 - Jan. 31	45	3	1998	*Sep. 19 - Jan. 31	45	3
1997-01	Oct. 6 - Jan. 31	30	3	1999	*Sep. 25 - Jan. 31	45	3
2002-07	Oct. 1 - Jan. 31	30	3	2000	*Sep. 23 - Jan. 31	45	3
				2001	*Sep. 22 - Jan. 31	45	3
				2002	*Sep. 21 - Jan. 31	45	3
				2003	*Sep. 20 - Jan. 31	45	3
				2004	*Sep. 25 - Jan. 31	45	3
				2005	*Sep. 24 - Jan. 31	45	3
				2006	*Sep. 23 - Jan. 31	45	3
				2007	*Sep. 22 - Jan. 31	45	3

* Saturday nearest September 22.