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Population Status, 2004

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AMERICAN WOODCOCK POPULATION STATUS, 2004

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Abstract: Singing-ground and Wing-collection surveys were conducted to assess the population status of the American woodcock (*Scolopax minor*). Singing-ground Survey data indicated that the numbers of displaying woodcock in the Eastern and Central Regions in 2004 were unchanged from 2003 (*P*>0.1). There was not a significant trend in woodcock heard on the Singing-ground Survey in either the Eastern or Central Region during 1995-04. This represents the first time since 1992 that the 10-year trend estimate for either region was not a significant decline. There were long-term (1968-04) declines of 2.1% per year in the Eastern Region and 1.8% per year in the Central Region. The 2003 recruitment index for the U.S. portion of the Eastern Region (1.5 immatures per adult female) was slightly higher than the 2002 index (1.4 immatures per adult female), but was 12% below the long-term regional average. The 2003 recruitment index for the U.S. portion of the Central Region (1.4 immatures per adult female) was 19% below the 2002 index (1.7 immatures per adult female), and 16% below the long-term regional average. The preliminary 2003 recruitment index for eastern Canada (Ontario, New Brunswick, and Nova Scotia combined) was 3.0 immatures per adult female, which was 18% higher than the 2002 index. The Harvest Information Program indicated that U.S. woodcock hunters in the Eastern Region spent 152,300 days afield and harvested 89,200 birds during the 2003-04 season. In the Central Region, U.S. hunters spent 369,900 days afield and harvested 213,500 woodcock. In Canada, 4,388 successful woodcock hunters harvested 34,654 birds during the 2003-04 season.

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. Up until the recent advent of the Harvest Information Program, a sampling frame for woodcock hunters had been lacking. Because of these difficulties, the Wing-collection Survey and the Singing-ground Survey were developed to provide indices of recruitment, hunting success and changes in abundance.

This report summarizes the results of these surveys and presents an assessment of the population status of woodcock as of June 2004. 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.

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.

Cover picture by Pamela Denmon, U.S. Fish and Wildlife Service.

METHODS

Woodcock Management Units

Woodcock are managed on the basis of 2 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 2 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 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 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 blocks within each state and province in the central and northern portions of the
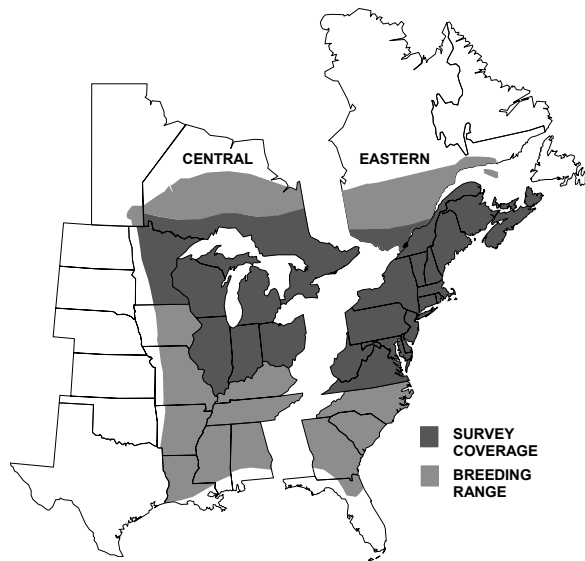
Fig. 1. Woodcock management regions, breeding range, and Singing-ground Survey coverage.

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 avoid counting 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 acceptable.

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 zeros." 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.

Trend Estimation.—Trends were estimated for each route by solving a set of estimating equations (Link and Sauer 1994). Observer data were used as covariables to adjust for differences in observers' ability to hear woodcock. To estimate state and regional trends, a weighted average from individual routes was calculated for each area of interest as described by Geissler (1984). Regional estimates were weighted by state and provincial land areas. Variances associated with the state, provincial, and regional slope estimates were estimated using a bootstrap procedure (Efron 1982). Trend estimates were expressed as percent change per year and trend significance was assessed using normal-based confidence intervals. Short-term (2003-04), intermediate-term (1995-04) and long-term (1968-04) trends were evaluated.

The reported sample sizes are the number of routes on which trend estimates are based. These numbers may be less than the actual number of routes surveyed for several reasons. The estimating equations approach requires at least 2 non-zero counts by the same observer for a route to be used. With the exception of the 2003-04 analysis, routes that did not meet this requirement during the interval of interest were not included in the sample size. For the 2003-04 analysis, a constant of 0.1 was added to counts of low-abundance routes to allow their use in the analysis. 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 1 June 2004 were not included in this analysis but will be included in future trend estimates.

Annual indices.—Annual indices were calculated for the 2 regions and each state and province by finding the deviation between the observed count on each route and that predicted by the 1968-2004 regional or state/provincial trend estimate. These residuals were averaged by year and added to the fitted trend to produce annual indices of abundance for each region, state and province. Yearly variation in woodcock abundance was superimposed on the long-term fitted trends (see Sauer and Geissler 1990). Thus, the indices calculated with this method portray year-to-year variation around the predicted trend line, which can be useful for exploratory data analysis (e.g., observing periods of departure from the long-term trend). However, the indices should be viewed in a descriptive context. They are not used to assess statistical significance and a change in the indices over a subset of years does not necessarily represent a

significant change. Observed patterns must be verified using trend estimation methods to examine the period of interest (Sauer and Geissler 1990, Link and Sauer 1994).

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 are 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 some 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. These estimates should be considered preliminary as refinements are still being made in the sampling frame and estimation techniques.

Wing-collection Survey

The Wing-collection Survey was incorporated into a national webless migratory game bird wing-collection survey in 1997. Only data on woodcock will be presented in this report. As with the old survey, the primary objective of the Wing-collection Survey is to provide data on the reproductive success of woodcock. The survey also produces information on the chronology and distribution of the harvest and data on hunting success. The survey is administered as a cooperative effort between woodcock hunters, the FWS and state wildlife agencies. Participants in the 2003 survey included hunters who either: (1) participated in the 2002 survey; (2) indicated on the 2002-03 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 and federal biologists. Wings from the 2003-04 hunting season were accepted through 23 April 2004.

The ratio of immature birds per adult female in the harvest provides an index to recruitment of young into the population. The 2003 recruitment index for each state with ≥125 submitted wings was calculated as the number of immatures per adult female. The regional indices for 2003 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2002.

Daily and seasonal bags of successful hunters that participated in the Wing-collection Survey in both 2002 and 2003 were used as indices of hunter success. A successful hunt was defined as any envelope returned with complete information in which ≥1 woodcock wing was received. Indices were calculated only for those states represented by ≥10 hunters that participated in the Wing-collection Survey both years. Regional indices of daily and seasonal bag were weighted to adjust for each included state's proportion of the total estimated annual woodcock harvest for those states, as determined by the Harvest Information Program. This year's weighting procedure represents a departure from procedures used in past status reports. Previously, the Mail Questionnaire Survey was used to estimate harvest of woodcock by purchasers of federal duck stamps in each state. Because duck stamp purchasers did not include all potential woodcock hunters, duck stamp sales in each state was divided into the total number of hunting license holders in that state. State weighting factors were developed by adjusting the estimated harvest of woodcock per duck stamp purchasers by the number of license holders per duck stamp purchaser in that state. Hunter success information was also adjusted to a base-year value (1969) for comparison with previous years (Clark 1970, 1973). The Mail Questionnaire Survey was discontinued after 2001, and historical (1964-2001) estimates of woodcock harvest and duck stamp buyers that hunted woodcock were presented in last year's status report (Kelley 2003). Conversion to the Harvest Information Program has provided more reliable estimates of woodcock hunters and harvest. However, due to the loss of comparable weighting factors used during 1969-2001, we have discontinued the base-year approach of adjusting hunter success data.

RESULTS AND DISCUSSION

Singing-ground Survey

Trend Estimation.— The number of woodcock heard displaying during the 2004 Singing-ground Survey in the Eastern and Central Regions was not significantly different (*P*>0.1) from the 2003 levels (Table 1, Fig. 4). Trends for individual states and provinces are reported in Table 1.

Trends for 1995-2004 were computed for 339 routes in the Eastern Region and 397 routes in the Central Region. Eastern and Central Region populations were unchanged (*P*>0.10) during this period (Table 1). This represents the first time since 1992 that the 10-year trend estimate for either region was not significantly declining.

Long-term (1968-2004) trends were estimated for 614 routes in the Eastern Region and 618 routes in the Central Region. There were long-term declines (P<0.10) in the breeding population throughout most states and provinces in the Eastern and Central Regions (Table 1, Fig. 5). The long-term trend estimates were -2.1 and -1.8% per year (*P*<0.01) for the Eastern and Central regions, respectively.

Annual Breeding Population Indices.—In the Eastern Region, the 2004 breeding population index of 1.84 singing-males per route was higher than the predic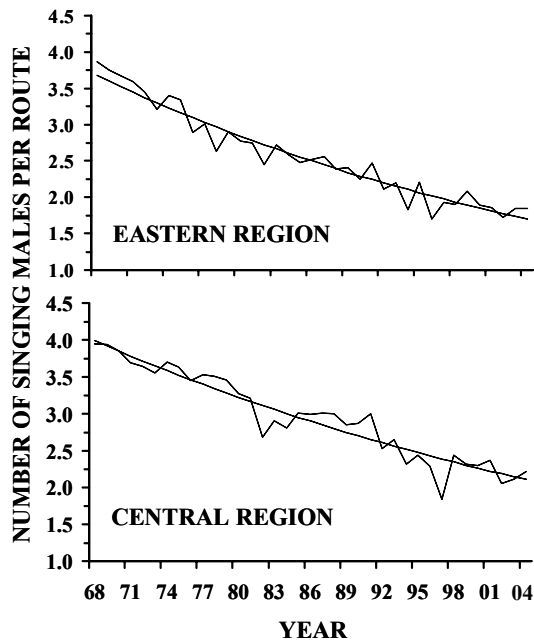ted value of 1.70 (Table 2, Fig. 2). The Central Region population index of 2.22 males per route was higher than the predicted value of 2.11.

The major causes of long-term declines are thought to be degradation and loss of suitable habitat on both the breeding and wintering grounds, resulting from forest succession and various human uses (Dwyer et al. 1983, Owen et al. 1977, Straw et al. 1994). If current trends in land use practices persist, continued long-term population declines are likely. In an effort to halt such declines, the International Association of Fish and Wildlife Agencies has created a Woodcock Task Force to develop a woodcock conservation plan.

Wing-collection Survey

A total of 2,062 potential woodcock hunters in states with woodcock seasons were contacted and asked to participate in the 2003 Wing-collection Survey. Fifty-three percent (Table 3) cooperated by sending in 11,180 usable woodcock wings (Table 4).

Recruitment.—The 2003 recruitment index in the U.S. portion of the Eastern Region (1.5 immatures per adult female) was slightly higher than the 2002 index (1.4), but was 12% below the long-term (1963-02) regional average of 1.7 immatures per adult female (Table 4, Fig 3). In the Central Region the 2003 recruitment index (1.4 immatures per adult female) was 19% below the 2002 index (1.6), and 16% below the long-term regional average.

Fig. 2. Long-term trends (smooth line) and annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2004.
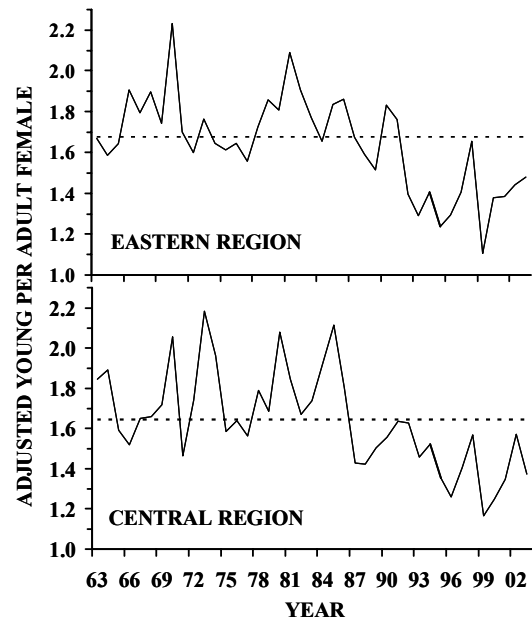

Fig. 3. Weighted annual indices of recruitment (U.S.), 1963-2003. The dashed line is the 1963-2002 average.
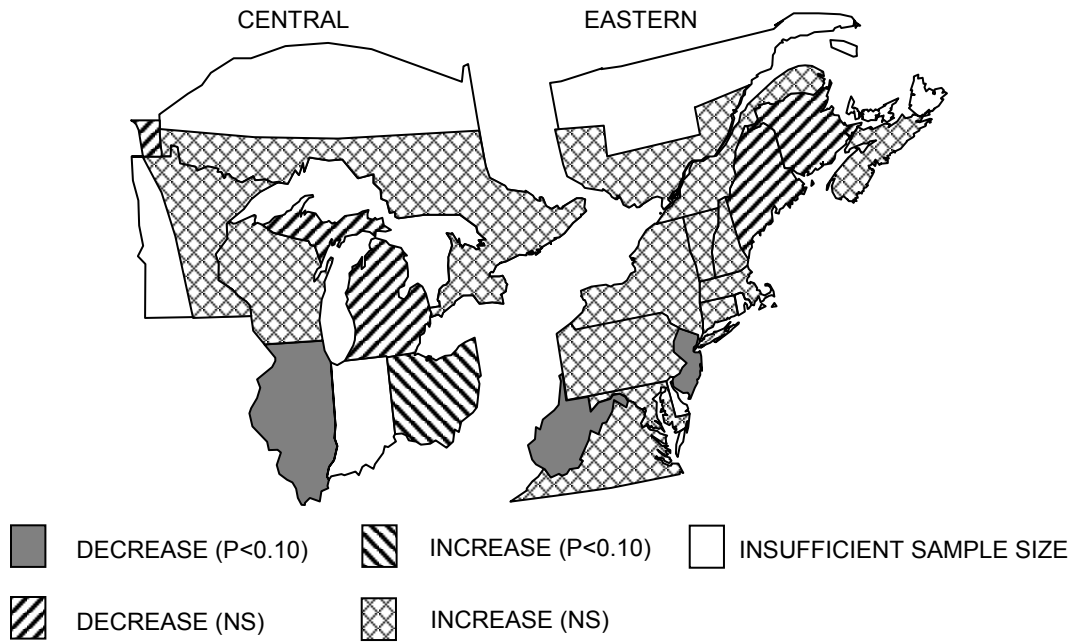
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Fig. 4. Short-term trends in the number of American woodcock heard on the Singing-ground Survey, 2003-2004.
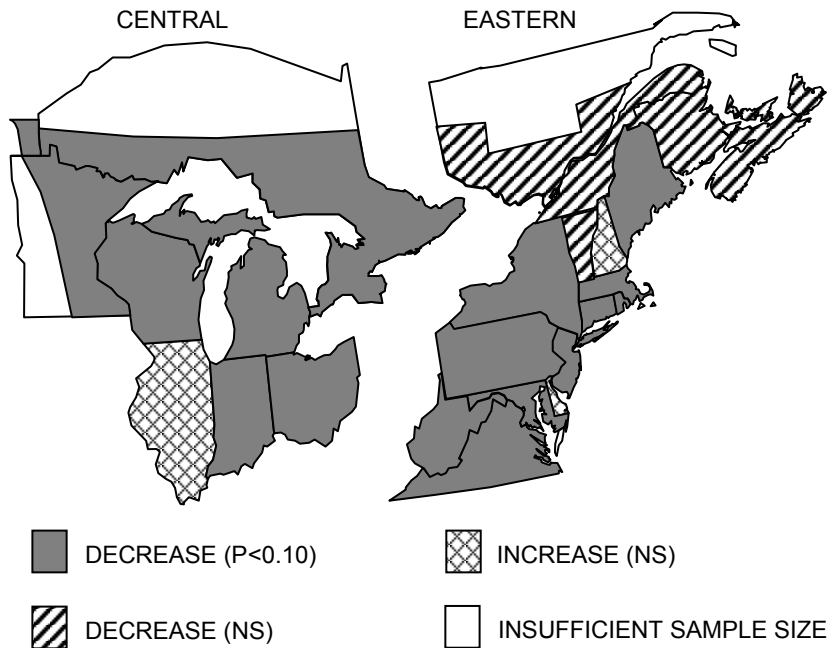

Fig. 5. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968-2004.

The preliminary 2003 recruitment index for eastern Canada (Ontario, New Brunswick, and Nova Scotia combined) was 3.0 immatures per adult female (n = 767 wings; Canadian Wildlife Service, unpublished data).

Hunting Success.— There were no changes made to federal frameworks for woodcock hunting seasons in the U.S. during 2003-04 (Appendix 1). The 2003 Wing-collection Survey index of daily hunting success in the Eastern Region (2.1 woodcock per successful hunt) was similar to the 2002 index (Table 5). The index of seasonal hunting success in the Eastern Region increased from 8.9 woodcock per successful hunter in 2002 to 9.7 in 2003. In the Central Region, the 2003 daily success index (2.1 woodcock per successful hunt) was slightly lower than the 2002 index. Central Region hunters experienced an increase in the seasonal success index from 11.4 woodcock per successful hunter in 2002 to 11.8 woodcock per hunter in 2003.

It should be noted that the Wing-collection Survey is intended primarily to provide information on woodcock recruitment. Information on hunter success derived from the Wing-collection Survey should be interpreted cautiously because of the non-random sampling procedure by which survey participants were selected, and the fact that data from unsuccessful hunts is not included. By including data only from woodcock hunters that were successful in 2 consecutive years, the sample is biased towards more successful hunters. More reliable information on hunter success is provided by the Harvest Information Program.

Harvest Information Program

Estimates of active woodcock hunters, days afield, and woodcock harvest from the 2002-03 and 2003-04 HIP surveys are provided in Table 6. In the Eastern Region woodcock hunters spent approximately 152,300 days afield and harvested 89,200 birds during 2003-04. This represents a daily hunter success rate of 0.6 birds/day. Woodcock hunters in the Central Region spent 369,900 days afield and harvested 213,500 birds during the 2003-04 season, which represents a daily hunter success rate of 0.6 birds/day. Although HIP provides statewide estimates of woodcock hunter numbers (Table 6), 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.

In Canada, 4,388 successful woodcock hunters harvested 34,654 birds during the 2003-04 season (Canadian Wildlife Service, unpublished data).

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Table 1. Trends (% change per year[a]) in the number of American woodcock heard in the Singing-ground Survey during 1968-2004, as determined by the estimating equations technique (Link and Sauer 1994).

State, Province or Region	No. of routes[b]	2003-2004				1995-2004				1968-2004			
		n[c]	% change	90% CI		n	% change	90% CI		n	% change	90% CI	
CT	4	2	15.3	-98.3	129.0	4	-9.5	-37.3	18.2	9	-10.2 ** [d]	-17.0	-3.4
DE	1	0				2	-9.0 *	-17.3	-0.7	2	3.4	-11.7	18.5
ME	43	26	-4.9	-17.5	7.7	50	-0.4	-2.1	1.3	65	-2.2 ***	-3.0	-1.4
MD	5	3	0.2	-33.0	33.5	6	-6.0	-35.5	23.5	21	-10.4 **	-17.9	-2.9
MA	7	6	44.3	-29.1	117.7	9	4.2	-0.7	9.1	20	-3.7 *	-7.4	-0.1
NB	41	25	-14.1	-33.1	4.9	51	2.6**	0.6	4.7	62	-0.5	-1.7	0.7
NH	14	10	6.6	-33.3	46.4	13	1.8	-2.0	5.6	18	1.3	-1.4	3.9
NJ	6	3	-95.8***	-97.9	-93.7	5	-7.8	-21.0	5.5	17	-10.4 ***	-14.2	-6.6
NY	57	41	10.6	-3.1	24.4	71	-0.5	-2.5	1.5	105	-2.7 ***	-3.8	-1.7
NS	28	16	16.9	-14.2	47.9	37	3.0*	0.3	5.6	56	-0.2	-1.7	1.2
PA	30	13	1.2	-36.1	38.5	25	0.0	-5.4	5.4	56	-4.2 ***	-6.5	-1.9
PEI	7	0				7	-5.5	-13.4	2.4	12	-1.7	-3.3	0.0
QUE	16	5	59.9	-36.2	156.1	14	-0.6	-3.5	2.3	56	-1.3	-4.3	1.6
RI	3	0				0				2	-16.5 ***	-24.1	-8.8
VT	15	14	3.4	-33.0	39.8	17	1.0	-1.8	3.8	21	-1.1	-2.8	0.5
VA	21	6	4.1	-39.8	48.0	12	-10.5 **	-18.2	-2.8	48	-11.0 ***	-14.9	-7.7
WV	23	12	-58.0***	-89.1	-26.9	16	-9.4 ***	-13.9	-5.0	44	-2.5 ***	-4.1	-1.0
Eastern	321	184	1.4	-6.9	9.8	339	0.4	-0.5	1.3	614	-2.1 ***	-2.6	-1.6
IL	17	4	-11.9**	-20.6	-3.2	6	14.2	-15.2	43.7	24	25.1	-19.2	69.5
IN	10	0				6	-3.9	-15.7	7.8	38	-7.0 **	-12.6	-1.4
MB[e]	15	9	-6.0	-35.7	23.8	21	-3.7	-7.6	0.2	21	-3.5 **	-6.2	-0.9
MI	89	55	-4.2	-16.7	8.3	109	-1.0	-2.5	0.4	144	-1.7 ***	-2.5	-0.9
MN	72	54	1.2	-13.8	16.2	76	0.1	-1.4	1.5	100	-1.1 **	-2.0	-0.2
OH	21	12	133.6*	21.1	246.1	25	-5.1*	-9.4	-0.6	55	-6.4 ***	-9.7	-3.0
ON	40	9	15.9	-14.1	45.8	81	1.5	-1.0	3.9	136	-1.8 ***	-2.5	-1.0
WI	65	46	15.2	-0.1	30.5	73	-0.2	-2.1	1.7	100	-1.9 ***	-2.7	-1.1
Central	329	190	4.8	-3.2	12.9	397	-0.3	-1.2	0.5	618	-1.8 ***	-2.2	-1.4
Continent	650	374	3.6	-2.5	9.7	736	-0.1	-0.7	0.6	1232	-1.9 ***	-2.2	-1.6

[a] Mean of weighted route trends within each state, province or region. 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 2004 for which data were received by 1 June.

[c] Number of comparable routes (2003 versus 2004) with at least 2 non-zero counts.

[d] Indicates slope is significantly different from zero: * P<0.10, ** P<0.05, *** P <0.01; significance levels are approximate for states where n<10.

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

Table 2. Breeding population indices for American woodcock from the Singing-ground Survey, 1968-2004. These indices are based on the 1968-2004 trend and should be used for exploratory data analysis only. Observed patterns should be verified using trend estimation methods (Sauer and Geissler 1990).

State, Province or Region	Year																			
	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern Region																				
CT[a]	--[b]	7.87	7.85	6.08	7.42	5.42	5.25	5.57	3.05	3.56	2.15	2.14	1.87	2.53	3.14	2.41	1.59	1.35	1.97	0.91
DE[a]	0.70	0.54	0.63	0.45	0.51	0.85	0.80	1.28	0.41	0.54	0.51	0.43	--	--	--	1.74	0.60	0.60	--	--
ME	5.18	5.34	5.61	5.09	4.80	5.15	5.11	5.46	4.85	4.41	4.07	4.44	3.91	4.30	2.96	3.79	3.80	3.85	3.99	4.36
MD	9.92	8.76	7.79	7.24	6.07	6.73	4.77	5.06	3.43	3.27	3.47	2.74	3.39	2.89	2.85	1.90	1.50	1.52	1.33	1.05
MA	--	3.56	4.18	4.90	3.60	4.87	3.93	2.31	3.06	2.40	2.80	3.06	2.20	2.28	1.94	1.45	2.57	2.01	2.06	2.14
NB	--	4.99	5.31	5.24	5.46	4.86	5.39	6.12	4.50	5.61	4.01	4.47	4.01	4.06	4.21	4.41	3.60	3.88	3.27	3.89
NH	--	2.61	3.01	2.45	3.11	2.44	3.37	2.87	3.58	2.99	3.00	3.08	3.76	3.94	2.33	2.73	2.43	2.58	4.42	3.21
NJ	7.66	6.62	8.26	10.26	6.06	8.52	8.45	6.29	3.78	4.17	2.41	4.12	2.55	1.96	1.98	2.31	2.73	1.94	1.89	2.22
NY	5.01	5.53	4.24	4.79	4.49	4.53	4.77	3.99	3.94	4.06	3.22	3.64	4.20	3.82	3.10	3.57	2.88	3.64	3.10	2.85
NS	3.54	2.58	2.19	2.71	2.60	2.52	3.16	2.71	2.40	2.43	2.82	2.28	2.18	2.02	1.81	2.25	2.16	2.17	2.54	2.27
PA	3.43	3.19	3.51	3.05	2.71	2.97	2.15	2.41	2.34	2.32	1.85	2.12	1.94	1.93	1.59	1.80	1.91	1.51	1.73	1.65
PEI[a]	--	4.03	2.97	5.48	3.18	2.54	3.37	5.15	4.30	3.80	3.04	3.77	2.79	2.09	2.21	3.51	4.02	2.91	3.83	2.68
QUE[a]	--	--	--	4.38	4.14	3.16	3.76	3.78	2.62	2.91	3.56	3.61	3.98	3.12	3.01	3.75	2.98	3.66	3.51	3.68
RI[a]	--	3.31	3.30	6.21	4.70	4.70	3.50	2.71	2.71	--	0.90	1.57	1.57	0.90	3.69	2.56	2.21	0.74	0.74	--
VT	--	2.40	4.08	3.15	3.55	3.15	3.10	3.64	3.31	3.96	3.05	2.94	2.65	2.36	1.78	2.61	2.68	2.11	2.69	2.92
VA	--	5.87	6.09	4.85	4.20	3.01	4.40	3.74	3.08	2.92	2.21	2.43	2.05	1.99	1.87	1.42	2.05	1.03	1.07	1.10
WV	1.63	1.83	1.31	1.27	1.55	1.24	1.20	1.38	1.20	1.22	0.85	1.23	1.01	1.39	1.23	1.28	1.06	1.00	0.96	1.11
Region	3.86	3.75	3.67	3.59	3.45	3.21	3.40	3.35	2.89	3.01	2.63	2.90	2.77	2.75	2.45	2.72	2.58	2.48	2.52	2.56
Central Region																				
IL	--	--	0.01	0.02	0.02	0.03	0.02	0.05	0.04	0.06	0.06	0.07	0.08	0.13	0.11	0.17	0.20	0.35	0.29	0.44
IN	2.83	2.44	2.31	1.78	2.13	2.17	1.57	1.49	1.46	1.40	1.25	1.55	1.12	1.15	0.84	0.89	0.86	0.71	0.92	0.67
MB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MI	6.35	6.20	5.90	5.70	5.40	5.54	6.43	6.46	5.94	5.44	5.75	5.65	5.57	4.66	4.92	4.29	4.72	4.94	5.00	4.64
MN	--	4.65	3.99	4.28	3.64	4.15	4.82	4.18	4.21	4.18	4.19	4.13	4.59	4.21	3.80	3.46	3.08	3.69	3.88	3.72
OH	--	--	3.60	3.65	3.06	2.53	3.25	2.45	2.65	3.02	2.40	1.86	1.83	2.09	1.50	1.89	1.75	1.51	1.18	1.28
ON	6.47	7.07	6.72	6.37	7.05	6.28	6.72	5.90	5.65	6.14	6.64	6.36	6.48	6.02	4.55	4.71	4.93	5.08	4.98	5.21
WI	4.38	4.32	4.67	4.14	3.94	4.01	4.11	3.98	3.81	4.14	4.35	4.26	3.63	3.09	3.02	3.03	3.31	3.05	3.59	3.59
Region	3.95	3.94	3.85	3.69	3.64	3.55	3.70	3.63	3.45	3.53	3.51	3.46	3.27	3.21	2.68	2.90	2.81	3.01	2.99	3.01
Continent	3.88	3.83	3.73	3.63	3.53	3.37	3.54	3.48	3.15	3.26	3.03	3.17	3.01	2.97	2.56	2.81	2.70	2.74	2.75	2.78

[a] Annual indices are unreliable due to small sample size.

[b] Insufficient data.

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Table 2. Continued.

State, Province or Region	Year																
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Eastern Region																	
CT[a]	2.30	0.96	0.83	0.88	0.60	0.49	0.61	0.79	0.72	0.63	0.61	1.30	0.88	0.33	0.30	0.30	0.27
DE[a]	--[b]	--	0.65	0.36	0.22	--	--	--	0.66	0.66	1.29	0.38	0.85	0.59	0.65	0.65	0.65
ME	4.11	4.21	2.89	3.63	3.01	3.26	2.88	3.05	2.34	2.59	2.44	3.10	3.11	2.64	2.48	2.71	2.62
MD	1.10	1.25	1.00	0.80	0.34	0.67	0.61	0.36	0.51	0.58	0.27	0.39	0.42	0.71	0.33	0.22	0.21
MA	2.15	1.69	1.55	1.87	1.55	1.32	1.50	1.12	1.41	1.51	1.38	2.15	1.47	1.30	1.33	1.42	1.65
NB	4.19	5.44	4.30	4.12	3.90	5.23	5.05	4.26	3.88	4.74	3.96	4.91	4.47	4.83	3.89	4.83	4.84
NH	3.18	3.29	2.88	3.76	2.36	2.99	2.48	5.02	3.95	4.13	4.01	5.04	3.42	3.59	3.86	4.22	5.53
NJ	1.65	1.58	1.07	1.01	0.83	0.78	0.34	0.79	0.95	0.20	0.65	0.82	0.60	0.58	0.37	0.40	0.19
NY	3.32	2.57	3.08	3.33	2.84	2.30	2.30	2.39	2.24	2.21	2.28	2.24	2.00	2.08	1.86	1.91	2.10
NS	2.47	2.69	1.85	2.30	2.52	2.76	2.08	2.57	2.64	2.00	2.35	2.34	2.78	2.60	2.10	2.24	2.30
PA	1.63	1.18	1.57	1.75	1.29	1.39	0.69	1.30	1.05	1.14	1.23	1.00	0.66	0.83	0.88	0.92	0.81
PEI[a]	4.33	4.10	3.34	2.48	2.40	2.26	2.30	2.81	3.19	2.63	3.04	2.39	2.98	2.90	0.86	1.37	2.06
QUE[a]	2.43	3.93	3.07	3.87	3.20	3.81	2.94	3.54	1.29	2.49	2.56	3.23	2.65	2.45	2.87	2.70	3.50
RI[a]	1.11	1.11	--	0.21	--	--	--	--	--	0.08	--	--	--	--	0.06	0.02	0.02
VT	3.46	3.23	3.09	3.03	1.98	2.12	2.13	2.40	1.82	2.39	2.65	2.69	3.59	2.35	1.98	2.24	2.18
VA	0.76	0.67	0.67	0.64	0.46	0.57	0.42	0.32	0.27	0.37	0.28	0.29	0.25	0.20	0.19	0.17	0.17
WV	0.88	0.91	0.96	0.88	0.87	0.79	0.68	1.18	0.74	0.83	0.69	0.75	0.87	0.71	0.62	0.76	0.56
Region	2.39	2.41	2.25	2.47	2.11	2.20	1.83	2.21	1.70	1.93	1.90	2.08	1.89	1.86	1.72	1.84	1.84
Central Region																	
IL	0.46	0.56	0.50	0.76	1.05	1.26	1.35	1.22	4.09	1.83	0.00	2.84	4.15	6.89	5.03	8.36	9.82
IN	0.62	0.62	0.68	0.70	0.53	0.59	0.50	0.53	0.44	0.33	0.66	0.45	0.38	0.42	0.24	0.26	0.26
MB	--	--	--	--	2.65	3.50	2.54	2.81	2.53	1.49	1.85	1.77	1.92	2.46	1.51	1.97	1.56
MI	5.07	4.83	4.71	5.53	3.96	3.97	3.61	3.88	3.72	3.63	4.32	3.48	3.64	3.38	3.49	3.53	3.33
MN	4.15	3.59	4.14	3.87	3.28	3.50	3.05	3.31	3.00	2.63	3.23	3.22	3.49	3.60	2.73	2.97	3.01
OH	1.52	1.04	1.36	1.08	0.91	0.96	0.81	0.82	0.85	0.62	0.71	0.57	0.64	0.55	0.49	0.46	0.68
ON	5.13	5.42	5.10	5.06	4.87	4.37	3.75	4.72	3.43	3.98	3.96	3.86	4.57	3.76	5.83	3.65	4.05
WI	3.59	3.32	3.23	3.28	2.62	2.57	2.40	2.41	2.52	2.36	2.29	2.77	2.54	2.32	2.17	2.25	2.33
Region	3.00	2.85	2.87	3.00	2.53	2.65	2.32	2.44	2.29	1.84	2.44	2.32	2.30	2.37	2.05	2.11	2.22
Continent	2.69	2.63	2.55	2.74	2.32	2.43	2.08	2.34	1.99	1.89	2.17	2.21	2.10	2.12	1.89	1.99	2.04

[a] Annual indices are unreliable due to small sample size.

[b] Insufficient data.

Table 3. Distribution of U.S. hunters contacted and number of hunters that submitted woodcock wings in the 2002 and 2003 Wing-collection Surveys.

State of residence	Number of hunters contacted[a]		Number of hunters that submitted wings[b]		Percent that submitted wings	
	2002	2003	2002	2003	2002	2003
AL	5	7	0	0	0	0
AR	3	3	1	2	33	67
CT	66	51	31	28	47	55
DE	6	2	0	0	0	0
FL	14	14	0	0	0	0
GA	7	11	5	5	71	45
IL	46	27	14	14	30	52
IN	59	57	38	36	64	63
IA	14	13	6	8	43	62
KS	1	3	0	0	0	0
KY	4	13	1	3	25	23
LA	28	40	14	15	50	38
ME	120	130	73	63	61	48
MD	14	20	7	8	50	40
MA	149	172	94	97	63	56
MI	288	371	183	215	64	58
MN	144	127	76	80	53	63
MS	4	1	0	1	0	100
MO	39	34	12	23	31	68
NE	13	9	0	0	0	0
NH	89	107	49	51	55	48
NJ	64	80	28	35	44	44
NY	148	168	81	90	55	54
NC	15	15	7	7	47	47
ND	1	0	0	0	0	
OH	55	54	25	33	45	61
OK	4	0	0	0	0	
PA	131	114	64	61	49	54
RI	16	15	7	6	44	40
SC	14	21	10	8	71	38
TN	9	8	4	5	44	63
TX	10	6	0	0	0	0
VT	71	66	37	30	52	45
VA	57	57	20	18	35	32
WV	19	28	13	14	68	50
WI	231	218	142	127	61	58
Total	1,958	2,062	1,042	1,083	53	53

[a] Number of hunters that were sent new envelopes and asked to participate in the survey year indicated. The definition of "number of hunters contacted" differs from previous status reports. Numbers in this table refer only to hunters that were sent wing envelopes in the respective survey year. Previous status reports defined "number of hunters contacted" as any woodcock hunter that had ever been contacted to participate in the survey.

[b] 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 2003 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2002.

State or Region of harvest	Wings received						Recruitment index	
	Total		Adult females		Immatures		Recruitment index	
	1963-02	2003	1963-02	2003	1963-02	2003	1963-02	2003
Eastern Region								
CT	13,238	48	2,928	5	8,123	38	2.8	
DE	421	14	54	5	296	8	5.5	
FL	660	0	150	0	410	0	2.7	
GA	2,956	23	911	1	1,277	17	1.4	
ME	74,265	921	21,868	304	37,153	457	1.7	1.5
MD	3,885	49	974	12	2,169	29	2.2	
MA	19,681	554	5,962	223	9,732	217	1.6	1.0
NH	28,158	636	9,103	208	13,030	296	1.4	1.4
NJ	24,579	287	5,720	55	14,436	209	2.5	3.8
NY	52,076	1,030	17,226	419	24,207	380	1.4	0.9
NC	3,072	92	920	20	1,519	50	1.7	
PA	27,940	502	8,814	177	12,923	198	1.5	1.1
RI	2,259	16	422	4	1,527	7	3.6	
SC	2,417	67	737	14	1,146	35	1.6	
VT	20,768	556	6,686	208	9,691	217	1.4	1.0
VA	4,069	156	995	50	2,318	74	2.3	1.5
WV	5,232	91	1,594	31	2,643	43	1.7	
Region	285,676	5,042	85,064	1,736	142,600	2,275	1.7	1.5
Central Region								
AL	910	0	243	0	425	0	1.7	
AR	515	4	165	0	207	4	1.3	
IL	1,307	27	297	8	740	16	2.5	
IN	6,957	128	1,754	31	3,863	74	2.2	2.4
IA	958	25	323	6	423	12	1.3	
KS	44	1	9	0	22	1		
KY	1,033	48	244	11	539	31	2.2	
LA	29,212	285	6,543	71	18,922	169	2.9	2.4
MI	102,859	3,007	33,213	1131	51,442	1,332	1.5	1.2
MN	29,142	766	9,932	297	13,023	318	1.3	1.1
MS	1,719	0	488	0	875	0	1.8	
MO	2,787	189	690	59	1,405	90	2.0	1.5
NE	13	0	5	0	6	0		
OH	13,766	205	4,171	66	6,535	104	1.6	1.6
OK	172	0	38	0	91	0	2.4	
TN	1,018	13	252	5	521	7	2.1	
TX	987	0	262	0	501	0	1.9	
WI	63,735	1,440	20,797	547	30,921	644	1.5	1.2
Region	257,134	6,138	79,426	2,232	130,461	2,802	1.6	1.4

Table 5. State and regional indices of daily and seasonal woodcock hunting success in the U.S. during 2002 and 2003. State and regional indices were calculated only for states represented by ≥10 successful hunters that participated in the Wing-collection Survey in both years. Regional indices were weighted by each included state's proportion of total woodcock harvest for those states, as determined by the Harvest Information Program (Table 6). Indices in this table are biased due to the exclusion of unsuccessful hunters and unsuccessful hunts. A more representative estimate of seasonal hunting success is derived from the Harvest Information Program.

State of harvest	No. of successful hunters	No. of successful hunts		Woodcock bagged per successful hunt		Woodcock per successful hunt		Woodcock per season	
		2002	2003	2002	2003	2002	2003	2002	2003
Eastern Region									
CT	10	26	24	50	38	1.9	1.6	5.0	3.8
DE	1	1	2	3	3				
FL	0	0	0	0	0				
GA	3	10	8	26	18				
ME	76	319	337	690	719	2.2	2.1	9.1	9.5
MD	6	14	15	30	32				
MA	47	188	203	347	391	1.8	1.9	7.4	8.3
NH	56	304	250	630	500	2.1	2.0	11.3	8.9
NJ	18	70	78	156	174	2.2	2.2	8.7	9.7
NY	66	328	325	648	697	2.0	2.1	9.8	10.6
NC	4	28	33	62	83				
PA	41	141	168	304	370	2.2	2.2	7.4	9.0
RI	5	8	8	13	14				
SC	6	31	30	68	57				
VT	39	185	222	373	469	2.0	2.1	9.6	12.0
VA	10	56	62	113	136	2.0	2.2	11.3	13.6
WV	8	28	33	61	72				
Region	396	1,737	1,798	3,574	3,773	2.1	2.1	8.9	9.7
Central Region									
AL	0	0	0	0	0				
AR	0	0	0	0	0				
IL	2	9	7	15	7				
IN	18	60	57	108	107	1.8	1.9	6.0	5.9
IA	4	16	11	28	19				
KS	0	0	0	0	0				
KY	2	12	21	23	47				
LA	12	99	96	282	263	2.8	2.7	23.5	21.9
MI	185	979	1,073	1,973	2,194	2.0	2.0	10.7	11.9
MN	60	245	299	502	624	2.0	2.1	8.4	10.4
MS	0	0	0	0	0				
MO	10	37	35	84	81	2.3	2.3	8.4	8.1
NE		0	0	0	0				
OH	12	48	53	107	121	2.2	2.3	8.9	10.1
OK	0	0	0	0	0				
TN	2	5	8	7	13				
TX	0	0	0	0	0				
WI	120	428	583	912	1,194	2.1	2.0	7.6	10.0
Region	427	1,938	2,243	4,041	4,670	2.2	2.1	11.4	11.8

Table 6. Preliminary state and regional estimates of woodcock hunter numbers, days afield, and harvest from the 2002-03 and 2003-04 Harvest Information Program surveys.

	Active woodcock hunters		Days afield		Harvest	
	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04
Eastern Region						
CT	1,600 ± 37%	1,400 ± 34%	9,300 ± 67%	6,300 ± 36%	4,600 ± 39%	2,400 ± 43%
DE	400 ± 122%	400 ± 77%	600 ± 82%	1,600 ± 85%	500 ± 139%	400 ± 163%
FL	1,000 ± 184%	800 ± 43%	2,000 ± 187%	2,500 ± 60%	100 ± 138%	900 ± 80%
GA	2,500 ± 179%	400 ± 95%	5,400 ± 168%	1,500 ± 119%	600 ± 130%	1,900 ± 158%
ME	4,400 ± 57%	6,600 ± 47%	15,900 ± 46%	21,400 ± 41%	17,000 ± 77%	31,000 ± 81%
MD	600 ± 150%	1,600 ± 79%	1,100 ± 89%	3,000 ± 84%	600 ± 81%	3,500 ± 107%
MA	1,100 ± 35%	1,200 ± 25%	5,300 ± 36%	6,100 ± 27%	3,000 ± 23%	4,000 ± 34%
NH	1,500 ± 35%	1,900 ± 49%	7,200 ± 23%	5,400 ± 32%	5,400 ± 20%	3,900 ± 48%
NJ	900 ± 70%	1,000 ± 44%	5,000 ± 87%	4,000 ± 51%	2,900 ± 57%	4,000 ± 78%
NY	5,600 ± 36%	5,700 ± 29%	30,700 ± 47%	21,400 ± 31%	16,600 ± 64%	14,500 ± 55%
NC	900 ± 67%	900 ± 68%	8,700 ± 105%	4,000 ± 100%	1,900 ± 132%	4,700 ± 135%
PA	9,600 ± 44%	9,500 ± 35%	40,200 ± 58%	48,400 ± 56%	9,000 ± 43%	8,400 ± 35%
RI	200 ± 82%	100 ± 129%	800 ± 73%	700 ± 153%	500 ± 88%	100 ± 167%
SC	2,300 ± 129%	2,100 ± 97%	4,900 ± 122%	14,100 ± 123%	3,900 ± 164%	1,800 ± 72%
VT	1,100 ± 45%	800 ± 36%	6,400 ± 57%	4,100 ± 29%	1,900 ± 31%	2,700 ± 31%
VA	1,900 ± 97%	3,000 ± 58%	7,600 ± 105%	7,200 ± 64%	1,200 ± 40%	4,700 ± 93%
WV	100 ± 23%	200 ± 89%	400 ± 33%	500 ± 70%	400 ± 38%	400 ± 56%
Region	na [a]	na	151,500 ± 23%	152,300 ± 23%	69,900 ± 27%	89,200 ± 32%
Central Region						
AL	2,700 ± 106%	4,000 ± 62%	13,300 ± 109%	14,300 ± 79%	3,800 ± 177%	4,200 ± 95%
AR	1,900 ± 175%	1,800 ± 124%	2,800 ± 123%	4,600 ± 123%	600 ± 119%	600 ± 118%
IL	3,000 ± 90%	2,400 ± 79%	6,400 ± 88%	12,200 ± 112%	9,000 ± 110%	2,200 ± 90%
IN	1,700 ± 114%	700 ± 97%	24,200 ± 172%	6,000 ± 134%	6,900 ± 161%	1,800 ± 31%
IA	1,100 ± 122%	1,500 ± 71%	6,800 ± 144%	4,200 ± 91%	2,100 ± 174%	900 ± 145%
KS	2,800 ± 96%	100 ± 195%	4,200 ± 111%	600 ± 195%	2,800 ± 137%	200 ± 195%
KY	2,200 ± 124%	1,500 ± 122%	10,300 ± 127%	2,000 ± 91%	3,000 ± 136%	2,600 ± 148%
LA	3,300 ± 147%	1,600 ± 129%	23,400 ± 165%	7,400 ± 136%	21,100 ± 138%	10,400 ± 119%
MI	25,200 ± 18%	35,100 ± 14%	135,400 ± 23%	159,000 ± 18%	78,300 ± 26%	121,500 ± 30%
MN	8,200 ± 66%	14,300 ± 38%	49,300 ± 92%	48,700 ± 43%	9,200 ± 31%	29,900 ± 84%
MS	2,800 ± 186%	2,000 ± 92%	6,200 ± 172%	3,400 ± 93%	1,000 ± 68%	400 ± 53%
MO	3,200 ± 125%	1,700 ± 87%	5,500 ± 114%	8,000 ± 105%	700 ± 40%	2,100 ± 145%
NE	< 50 ± 60%	400 ± 184%	100 ± 82%	900 ± 165%	200 ± 83%	100 ± 79%
OH	5,200 ± 108%	3,400 ± 88%	23,200 ± 138%	10,300 ± 86%	3,100 ± 45%	2,500 ± 78%
OK	2,500 ± 135%	1,300 ± 182%	6,300 ± 136%	15,400 ± 191%	2,600 ± 184%	2,800 ± 176%
TN	4,300 ± 183%	100 ± 136%	5,300 ± 151%	1,200 ± 165%	8,500 ± 185%	1,000 ± 144%
TX	18,600 ± 137%	5,900 ± 192%	46,500 ± 140%	6,000 ± 189%	700 ± 195%	0
WI	17,600 ± 30%	16,100 ± 30%	58,900 ± 26%	65,600 ± 33%	33,900 ± 34%	30,300 ± 35%
Region	na	na	428,200 ± 26%	369,900 ± 16%	187,500 ± 24%	213,500 ± 23%

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

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Appendix 1. 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, 1918-2003.

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	Oct. 1 - Jan. 31	30	3	2000	*Sep. 23 - Jan. 31	45	3
2003	Oct. 1 - Jan. 31	30	3	2001	*Sep. 22 - Jan. 31	45	3
				2002	*Sep. 21 - Jan. 31	45	3
				2003	*Sep. 20 - Jan. 31	45	3

* Saturday nearest September 22.