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American Woodcock Population Status, 2006

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AMERICAN WOODCOCK POPULATION STATUS, 2006

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Abstract: Singing-ground Survey data indicated that the numbers of displaying American woodcock (*Scolopax minor*) in the Eastern Region in 2006 was unchanged from 2005; however, the Central Region experienced an 8% decline. There was no significant trend in woodcock heard in either the Eastern or Central Region during 1996-06. This represents the third consecutive year since 1992 that the 10-year trend estimate did not indicate a significant decline. There were long-term (1968-06) declines of 1.9% per year in the Eastern Region and 1.8% per year in the Central Region. The 2005 recruitment index for the U.S. portion of the Eastern Region (1.6 immatures per adult female) was 17% lower than the 2004 index (2.0 immatures per adult female), and 1% lower than the long-term regional average. The 2005 recruitment index for the U.S. portion of the Central Region (1.5 immatures per adult female) was 9% higher than the 2004 index (1.3 immatures per adult female), but was 9% below the long-term regional average. The preliminary 2005 recruitment index for eastern Canada was 2.2 immatures per adult female. The Harvest Information Program indicated that U.S. woodcock hunters in the Eastern Region spent 164,200 days afield and harvested 72,200 birds during the 2005-06 season. In the Central Region, U.S. hunters spent 356,100 days afield and harvested 225,000 woodcock. In Canada, 4,200 successful woodcock hunters harvested 28,500 birds during the 2005-06 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 early June 2006. 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.

The cover picture "Spring Woodcock" is used with permission of Bob White, Whitefish Studio, Marine on St. Croix, Minnesota.

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

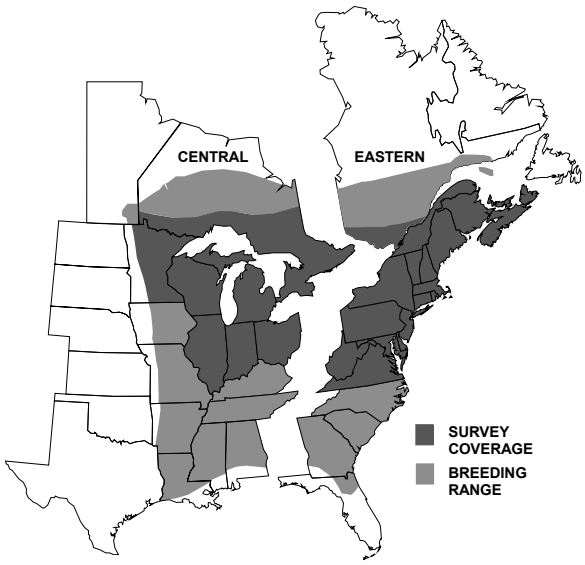

Fig. 1. Woodcock management regions, breeding range, and Singing-ground Survey coverage.

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 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 (2005-06), 10-year (1996-06) and long-term (1968-06) 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 2005-06 analysis, routes that did not meet this requirement during the interval of interest were not included in the sample. For the 2005-06 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 2006 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 1968-2006 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 gamebird 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 2005 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 2005-06 hunting season received through 1 March 2006 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 2005 recruitment index for each state with ≥125 submitted wings was calculated as the number of immatures per adult female. The regional indices for 2005 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2004.

Daily and seasonal bags of successful hunters that participated in the Wing-collection Survey in both 2004 and 2005 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 successful 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.

RESULTS AND DISCUSSION

Singing-ground Survey

Trend Estimation.— The number of woodcock heard displaying during the 2006 Singing-ground Survey in the Eastern Region was not significantly different from 2005 levels; however, the Central Region experienced an 8% decline (Table 1, Fig. 4). Trends for individual states and provinces are reported in Table 1.

Trends for 1996-2006 were computed for 357 routes in the Eastern Region and 381 routes in the Central Region. Eastern and Central Region populations were unchanged during this period (Table 1). This represents the third consecutive year since 1992 that the 10-year trend estimate did not indicate a significant decline.

Long-term (1968-2006) trends were estimated for 625 routes in the Eastern Region and 631 routes in the Central Region. There were long-term declines 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 -1.9 and -1.8% per year for the Eastern and Central regions, respectively.

Annual Breeding Population Indices.—In the Eastern Region, the 2006 breeding population index of 1.69 singing-males per route was lower than the predicted value of 1.73 (Table 2, Fig. 2). The Central Region population index of 2.00 males per route was lower than the predicted value of 2.05.

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 (Dessecker and McAuley 2001, Dwyer et al. 1983, Owen et al. 1977, Straw et al. 1994). In an effort to halt such declines, the Migratory Shore and Upland Game Bird Working Group of the Association of Fish and Wildlife Agencies has created a Woodcock Task Force to develop a woodcock conservation plan.

Wing-collection Survey

A total of 1,979 potential woodcock hunters in states with woodcock seasons were contacted and asked to participate in the 2005 Wing-collection Survey. Sixty percent (Table 3) cooperated by sending in 12,379 usable woodcock wings (Table 4).

Recruitment.— The 2005 recruitment index in the U.S. portion of the Eastern Region (1.6 immatures per adult female) was 17% lower than the 2004 index (2.0), and 1% lower than the long-term (1963-04) regional average (Table 4, Fig 3; percent change calculated using un-rounded estimates). In the Central Region, the 2005 recruitment index (1.5 immatures per adult female) was 9% higher than the 2004 index (1.3), but was 9% below the long-term regional average of 1.6. Harvest age ratio information was not available from Quebec when this report was prepared. The preliminary 2005 recruitment index for Ontario, New Brunswick, and Nova Scotia (combined) was 2.2 immatures per adult female (n = 709 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 2005-06 (Appendix 1). The 2005 Wing-collection Survey index of daily hunting success in the Eastern Region (1.8 woodcock per successful hunt) declined from the 2004 index of 2.0. (Table 5). The index of seasonal hunting success in the Eastern Region decreased from 8.9 woodcock per successful hunter in 2004 to 8.4 in 2005. In the Central Region, the 2005 daily success index (2.1 woodcock per successful hunt) was the same as the 2004 index. Central Region hunters experienced an increase in the seasonal success index, from 11.6 woodcock per successful hunter in 2004 to 12.9 woodcock per hunter in 2005.

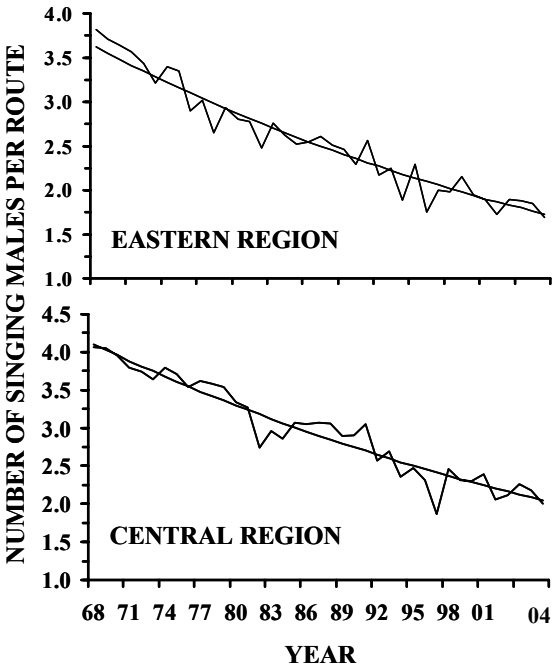

Fig. 2. Long-term trends (smooth line) and annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2006.

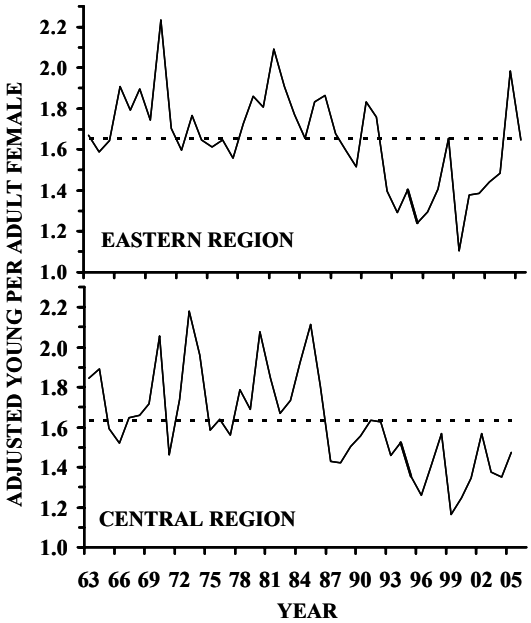

Fig. 3. Weighted annual indices of recruitment (U.S.), 1963-2005. The dashed line is the 1963-2004 average.

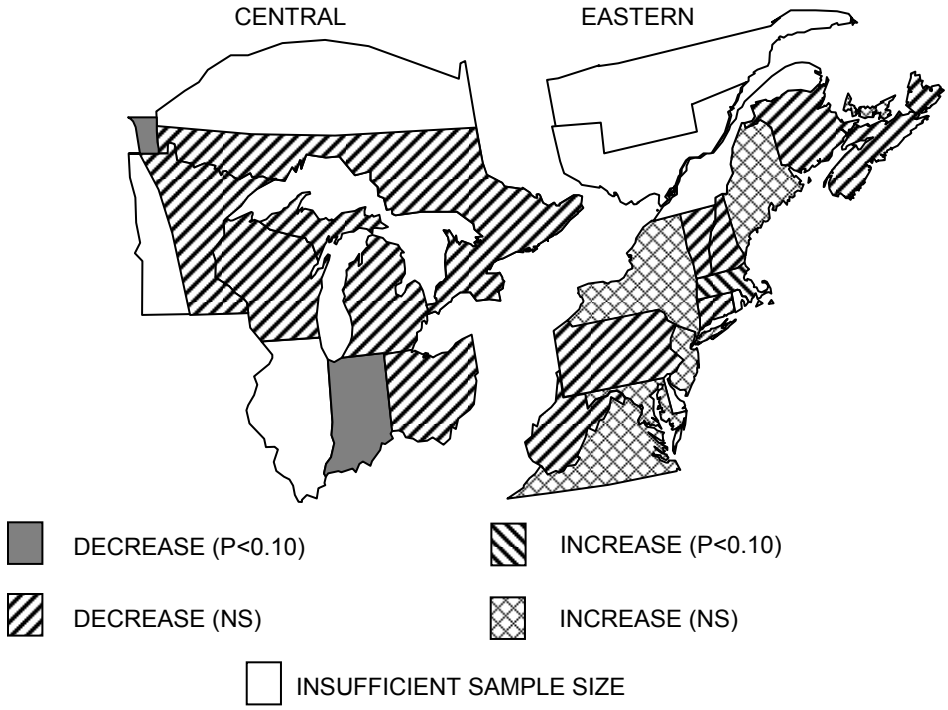

Fig. 4. Short-term trends in the number of American woodcock heard on the Singing-ground Survey, 2005-2006.

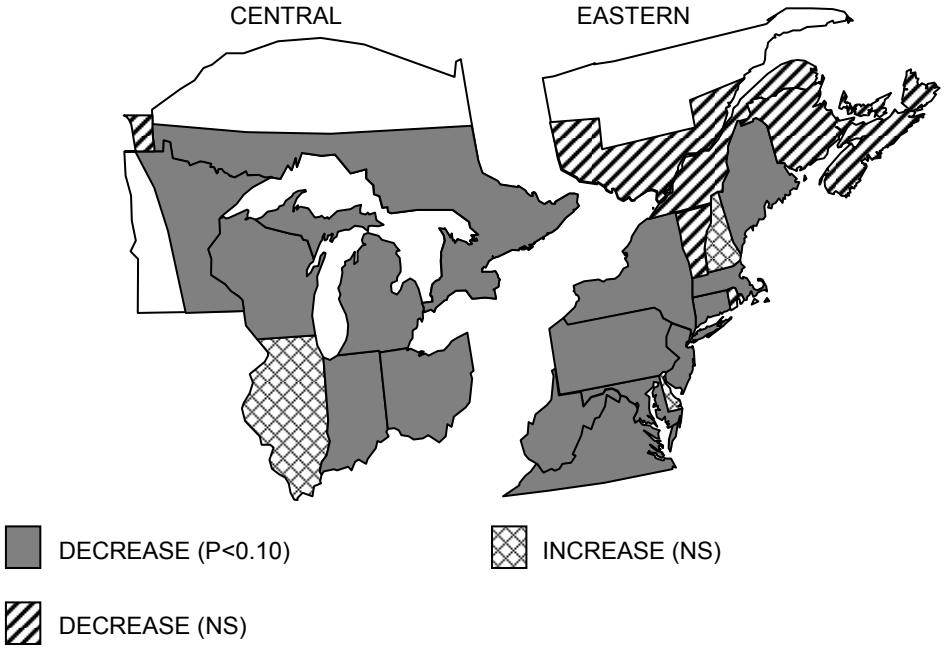

Fig. 5. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968-2006.

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 woodcock harvest, number of active hunters, days afield, and seasonal hunting success from the 2005-06 HIP survey are provided in Table 6. In the Eastern Region woodcock hunters spent approximately 164,200 days afield and harvested 72,200 birds during 2005-06. Woodcock hunters in the Central Region spent 356,100 days afield and harvested 225,000 birds during the 2005-06 season. 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, 4,200 successful woodcock hunters spent 80,500 days afield and harvested 28,500 birds during the 2005-06 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 1968-2006, as determined by the estimating equations technique (Link and Sauer 1994).

State, Province, or Region	Number of routes[b]	2005-2006				1996-2006				1968-2006			
		n[c]	% change	90%	CI	n	% change	90%	CI	n	% change	90%	CI
CT	3	2	-26.9	-55.9	2.1	4	-13.7	-43.0	15.7	9	-10.4 ** [d]	-17.1	-3.8
DE	2	0				2	-13.4 *	-16.4	-10.4	2	2.9	-8.5	14.2
ME	43	28	13.0	-6.4	32.5	51	1.0	-0.4	2.5	66	-1.9 ***	-2.8	-1.1
MD	9	4	560.6	-862.4	1983.7	6	-27.3	-71.3	16.7	21	-9.7 **	-16.9	-2.5
MA	11	2	64.7*	49.7	79.6	9	1.9	-4.7	8.6	20	-4.6 *	-8.7	-0.5
NB	12	10	-4.3	-24.6	15.9	52	4.3***	2.1	6.6	64	-0.5	-1.5	0.6
NH	14	11	-18.7	-38.0	0.5	13	0.4	-3.1	3.8	18	1.2	-0.9	3.3
NJ	3	2	3.9	-109.7	117.5	5	-13.8	-26.0	-1.7	17	-8.9 ***	-10.9	-7.0
NY	58	37	26.5	-19.6	72.7	75	-2.5	-7.0	2.1	107	-2.5 ***	-3.5	-1.4
NS	32	16	-25.6	-51.6	0.5	43	-4.3	-14.0	5.4	60	-0.2	-1.8	1.3
PA	28	11	-30.1	-61.3	1.0	27	-0.2	-5.5	5.0	58	-3.4 ***	-5.3	-1.5
PEI	5	3	2.2	-18.5	23.0	7	-8.0	-18.3	2.3	12	-1.6	-3.3	0.1
QUE	4	0				16	7.6***	4.1	11.1	56	-1.3	-4.4	1.7
RI	1	0				0				2	-16.3	-23.9	-8.6
VT	15	11	-4.2	-29.8	21.5	17	0.9	-1.8	3.7	21	-0.7	-2.4	0.9
VA	12	4	102.1	-514.9	719.2	11	-16.9 **	-26.5	-7.3	47	-11.1 ***	-14.9	-7.3
WV	19	10	-6.2	-33.0	20.5	19	-7.2	-15.8	1.4	45	-2.7 ***	-4.1	-1.2
Eastern	271	152	4.3	-12.4	21.1	357	0.0	-1.8	1.7	625	-1.9 ***	-2.4	-1.4
IL	8	0				5	13.2	-13.2	39.6	25	24.5	-7.2	56.2
IN	16	2	-96.1***	-97.0	-95.2	7	-5.1	-22.2	12.0	39	-7.1 **	-12.1	-2.0
MB[e]	11	4	-27.4*	-46.2	-8.5	21	0.0	-4.0	4.0	22	-2.4	-5.5	0.8
MI	95	68	-7.9	-18.8	3.0	108	-1.0	-3.0	1.1	147	-1.7 ***	-2.5	-0.9
MN	74	52	-8.3	-19.3	2.6	79	0.5	-1.7	2.8	102	-1.0 *	-1.8	-0.1
OH	32	15	-12.7	-39.6	14.3	27	-6.7	-14.4	0.9	57	-6.2 ***	-9.1	-3.3
ON	31	12	-5.5	-29.6	18.5	60	3.1	-0.3	6.4	138	-1.9 ***	-2.7	-1.1
WI	68	47	-5.2	-22.5	12.2	74	0.1	-1.9	2.1	101	-1.9 ***	-2.5	-1.2
Central	335	201	-8.0**	-14.5	-1.5	381	-0.1	-1.2	1.0	631	-1.8 ***	-2.3	-1.4
Continent	606	353	-4.9	-11.2	1.5	738	-0.1	-1.0	0.9	1256	-1.9 ***	-2.2	-1.5

[a] Mean of weighted route trends within each state, province or region. 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 2006 for which data were received by 1 June.

[c] Number of comparable routes (2005 versus 2006) 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/provinces 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, 1968-2006. These indices are based on the 1968-2006 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	Year																			
or Region	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]	8.82	8.79	6.80	8.29	6.05	5.85	6.20	3.39	3.96	2.39	2.38	2.08	2.82	3.49	2.67	1.76	1.49	2.17	1.00
DE[a]	0.57	0.44	0.52	0.37	0.44	0.73	0.68	1.14	0.37	0.48	0.46	0.39	--	--	--	1.56	0.58	0.59	--	--
ME	5.01	5.16	5.43	4.94	4.66	5.03	5.00	5.36	4.70	4.25	3.94	4.34	3.80	4.20	2.89	3.70	3.72	3.78	3.93	4.30
MD	9.01	8.00	7.13	6.68	5.63	6.23	4.55	4.85	3.30	3.17	3.39	2.69	3.35	2.85	2.83	1.90	1.52	1.54	1.35	1.09
MA	--	4.19	4.91	5.73	4.20	5.63	4.55	2.61	3.45	2.64	3.07	3.36	2.41	2.44	2.09	1.54	2.71	2.13	2.13	2.17
NB	--	4.96	5.28	5.22	5.45	4.85	5.39	6.12	4.50	5.62	4.01	4.47	4.02	4.09	4.21	4.41	3.63	3.90	3.28	3.91
NH	--	2.58	2.97	2.42	3.08	2.41	3.33	2.84	3.53	2.96	2.96	3.04	3.71	3.89	2.30	2.70	2.40	2.55	4.37	3.17
NJ	6.29	5.49	6.94	8.59	5.23	7.38	7.41	5.56	3.56	3.93	2.29	3.93	2.41	1.88	1.96	2.24	2.65	1.94	1.93	2.23
NY	4.96	5.48	4.22	4.77	4.47	4.53	4.77	4.01	3.96	4.10	3.25	3.68	4.25	3.86	3.15	3.64	2.93	3.72	3.18	2.93
NS	3.53	2.57	2.19	2.71	2.59	2.52	3.16	2.70	2.40	2.43	2.83	2.28	2.18	2.02	1.81	2.25	2.18	2.18	2.54	2.28
PA	3.15	2.97	3.27	2.79	2.55	2.84	2.06	2.31	2.27	2.24	1.82	2.08	1.90	1.91	1.60	1.83	1.95	1.55	1.72	1.71
PEI[a]	--	4.10	3.03	5.59	3.25	2.59	3.44	5.25	4.38	3.87	3.10	3.84	2.85	2.13	2.25	3.57	4.09	2.96	3.90	2.73
QUE[a]	--	--	--	4.43	4.18	3.19	3.79	3.82	2.64	2.94	3.60	3.65	4.02	3.15	3.10	3.88	3.01	3.69	3.51	3.69
RI[a]	--	4.01	4.01	7.53	5.68	5.68	4.23	3.28	3.28	--	1.09	1.89	1.89	1.09	4.46	3.11	2.68	0.89	0.89	--
VT	--	2.28	3.88	3.02	3.40	3.03	2.99	3.54	3.22	3.87	2.99	2.89	2.63	2.35	1.78	2.61	2.69	2.12	2.71	2.99
VA	--	5.90	6.12	4.88	4.23	3.03	4.43	3.77	3.10	2.92	2.23	2.45	2.07	2.00	1.89	1.43	2.07	1.04	1.08	1.11
WV	1.53	1.71	1.23	1.19	1.45	1.16	1.11	1.28	1.12	1.13	0.79	1.14	0.94	1.29	1.14	1.18	0.97	0.92	0.89	1.03
Region	3.82	3.71	3.64	3.56	3.44	3.21	3.40	3.35	2.90	3.02	2.65	2.93	2.80	2.78	2.48	2.76	2.62	2.52	2.55	2.61
Central Region																				
IL	--	--	0.01	0.01	0.02	0.02	0.02	0.04	0.03	0.05	0.05	0.06	0.07	0.11	0.09	0.14	0.16	0.29	0.24	0.36
IN	3.14	2.71	2.56	1.96	2.35	2.40	1.72	1.63	1.58	1.52	1.36	1.67	1.21	1.25	0.91	0.95	0.92	0.76	0.99	0.72
MB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MI	6.47	6.32	6.02	5.81	5.50	5.64	6.55	6.58	6.05	5.54	5.85	5.75	5.67	4.74	5.01	4.36	4.80	5.03	5.09	4.73
MN	--	4.74	4.08	4.39	3.73	4.26	4.96	4.30	4.33	4.30	4.32	4.27	4.73	4.35	3.93	3.59	3.20	3.83	4.03	3.86
OH	--	--	3.89	3.94	3.30	2.73	3.51	2.64	2.85	3.25	2.58	2.00	1.97	2.24	1.60	2.03	1.86	1.60	1.24	1.35
ON	6.63	7.24	6.85	6.49	7.22	6.39	6.82	5.98	5.71	6.21	6.71	6.41	6.52	6.04	4.56	4.72	4.94	5.08	5.00	5.21
WI	4.44	4.38	4.73	4.20	4.00	4.07	4.17	4.04	3.86	4.19	4.41	4.32	3.70	3.14	3.08	3.09	3.38	3.11	3.67	3.68
Region	4.06	4.05	3.95	3.80	3.74	3.64	3.80	3.71	3.54	3.62	3.59	3.54	3.34	3.27	2.74	2.96	2.86	3.07	3.05	3.07
Continent	3.94	3.89	3.78	3.68	3.58	3.42	3.59	3.53	3.21	3.31	3.08	3.22	3.06	3.02	2.61	2.86	2.75	2.79	2.79	2.84

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

[b] Insufficient data.

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	2005	2006
Eastern Region																			
CT[a]	2.53	1.06	0.91	0.96	0.66	0.54	0.67	0.87	0.78	0.69	0.67	1.43	0.96	0.36	0.33	0.32	0.29	0.25	0.23
DE[a]	--[b]	--	0.79	0.39	0.24	--	--	--	0.85	0.85	1.56	0.46	1.02	0.46	0.73	0.73	0.73	0.73	0.73
ME	4.08	4.18	2.88	3.65	2.97	3.28	2.89	3.07	2.35	2.59	2.43	3.11	3.12	2.58	2.48	2.67	2.65	2.85	2.73
MD	1.14	1.29	1.04	0.87	0.36	0.66	0.66	0.40	0.56	0.64	0.30	0.40	0.48	0.81	0.37	0.27	0.26	0.19	0.24
MA	2.18	1.71	1.57	1.88	1.56	1.30	1.48	1.12	1.37	1.46	1.35	2.11	1.41	1.24	1.25	1.33	1.57	0.91	1.01
NB	4.21	5.48	4.33	4.14	3.92	5.24	5.08	4.30	3.88	4.76	3.92	4.91	4.50	4.82	3.87	4.80	4.73	4.48	4.59
NH	3.15	3.28	2.89	3.79	2.32	2.95	2.41	4.96	3.82	4.13	3.90	4.99	3.37	3.50	3.77	4.12	5.24	4.21	4.37
NJ	1.71	1.66	1.14	1.12	0.88	0.81	0.39	0.94	1.11	0.22	0.86	0.82	0.74	0.69	0.46	0.53	0.26	0.35	0.31
NY	3.42	2.66	3.18	3.44	2.94	2.34	2.38	2.49	2.32	2.30	2.38	2.32	2.12	2.19	1.98	2.07	2.24	1.96	2.00
NS	2.49	2.69	1.90	2.31	2.53	2.77	2.09	2.57	2.61	2.06	2.41	2.43	2.83	2.62	2.11	2.27	2.43	2.30	1.98
PA	1.69	1.24	1.67	1.86	1.39	1.43	0.76	1.43	1.14	1.25	1.38	1.10	0.72	0.97	0.99	1.00	0.93	1.05	0.85
PEI[a]	4.41	4.18	3.41	2.53	2.42	2.27	2.31	2.81	3.20	2.63	3.05	2.39	2.96	2.83	0.85	1.36	1.38	2.56	2.85
QUE[a]	2.89	3.92	2.93	4.07	3.25	3.81	2.93	3.51	1.27	2.48	2.68	3.24	2.57	2.30	2.45	2.56	2.80	3.40	2.10
RI[a]	1.34	1.34	--	0.25	--	--	--	--	--	0.06	--	--	--	--	0.07	0.02	0.02	0.02	0.04
VT	3.54	3.33	3.18	3.13	2.04	2.23	2.22	2.46	1.87	2.48	2.73	2.79	3.69	2.44	2.00	2.29	2.23	2.68	2.44
VA	0.75	0.66	0.67	0.64	0.47	0.57	0.41	0.32	0.27	0.37	0.27	0.28	0.24	0.20	0.18	0.17	0.17	0.15	0.14
WV	0.82	0.83	0.89	0.81	0.80	0.72	0.63	1.09	0.67	0.76	0.64	0.70	0.81	0.66	0.56	0.71	0.57	0.54	0.54
Region	2.51	2.46	2.29	2.56	2.17	2.25	1.89	2.29	1.75	2.00	1.98	2.15	1.95	1.90	1.73	1.90	1.88	1.85	1.69
Central Region																			
IL	0.38	0.46	0.41	0.63	0.86	1.03	1.11	1.00	3.36	1.50	--	2.34	3.42	5.67	4.15	6.89	8.81	8.77	13.13
IN	0.65	0.66	0.72	0.74	0.55	0.61	0.52	0.56	0.46	0.35	0.70	0.47	0.39	0.43	0.24	0.27	0.31	0.30	0.22
MB	--	--	--	--	3.01	3.96	2.92	3.25	2.92	1.70	2.17	2.00	2.21	2.90	1.74	2.31	1.83	2.63	1.76
MI	5.16	4.91	4.78	5.60	4.03	4.04	3.67	3.95	3.78	3.67	4.38	3.51	3.72	3.44	3.56	3.59	3.49	3.55	3.21
MN	4.32	3.74	4.32	4.04	3.42	3.66	3.19	3.48	3.15	2.76	3.40	3.39	3.62	3.83	2.84	3.07	3.12	3.35	3.04
OH	1.60	1.10	1.44	1.14	0.96	1.00	0.83	0.86	0.90	0.65	0.71	0.52	0.61	0.57	0.52	0.49	0.70	0.58	0.51
ON	5.11	5.40	5.07	5.03	4.83	4.33	3.77	4.65	3.38	3.90	3.88	3.66	4.52	3.65	5.72	3.38	3.66	3.71	3.86
WI	3.67	3.40	3.30	3.36	2.69	2.63	2.45	2.46	2.58	2.41	2.36	2.83	2.59	2.35	2.17	2.30	2.25	2.49	2.18
Region	3.06	2.90	2.91	3.05	2.57	2.69	2.36	2.47	2.32	1.87	2.46	2.31	2.30	2.39	2.06	2.11	2.26	2.18	2.00
Continent	2.78	2.68	2.59	2.81	2.37	2.47	2.12	2.39	2.03	1.93	2.22	2.23	2.13	2.14	1.90	2.01	2.07	2.02	1.85

[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 2004 and 2005 Wing-collection Surveys.

State of residence	Number of hunters contacted[a]		Number of hunters that submitted wings[b]		Percent that submitted wings	
	2004	2005	2004	2005	2004	2005
AL	5	7	1	0	20	0
AR	4	2	1	1	25	50
CT	58	45	33	27	57	60
DE	3	3	0	0	0	0
FL	7	16	1	1	14	6
GA	8	10	6	5	75	50
IL	24	38	16	18	67	47
IN	53	47	31	31	58	66
IA	13	11	6	7	46	64
KS	0	4	0	1	0	25
KY	6	8	4	3	67	38
LA	21	28	14	18	67	64
ME	84	123	60	73	71	59
MD	11	22	8	12	73	55
MA	144	154	92	90	64	58
MI	333	368	237	257	71	70
MN	108	167	80	98	74	59
MS	5	7	1	2	20	29
MO	28	19	19	15	68	79
NE	3	5	0	1	0	20
NH	58	70	45	44	78	63
NJ	71	70	33	38	46	54
NY	123	183	82	114	67	62
NC	11	9	5	6	45	67
ND	1	1	0	1	0	100
OH	48	48	32	32	67	67
OK	3	6	0	0	0	0
PA	88	105	56	61	64	58
RI	9	15	6	7	67	47
SC	27	36	8	9	30	25
TN	6	10	4	4	67	40
TX	2	8	0	1	0	13
VT	52	70	35	54	67	77
VA	35	52	17	19	49	37
WV	21	30	15	15	71	50
WI	168	182	119	132	71	73
Total	1,641	1,979	1,067	1,197	65	60

[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 status reports published prior to 2004. Numbers in this table refer only to hunters that were sent wing envelopes in the respective survey year. Status reports prior to 2004 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 2005 were weighted by the relative contribution of each state to the cumulative number of adult female and immature wings received during 1963-2004.

State or Region of harvest	Wings received						Recruitment index	
	Total		Adult females		Immatures			
	1963-04	2005	1963-04	2005	1963-04	2005	1963-04	2005
Eastern Region								
CT	13,353	117	2,933	41	8,161	63	2.8	
DE	438	1	59	0	304	1	5.2	
FL	660	0	150	0	410	0	2.7	
GA	3,016	37	912	6	1,294	19	1.4	
ME	76,058	1,087	22,172	315	37,610	520	1.7	1.7
MD	3,972	30	986	7	2,198	13	2.2	
MA	20,569	523	6,185	182	9,949	236	1.6	1.3
NH	29,437	632	9,311	182	13,326	309	1.4	1.7
NJ	25,056	294	5,775	53	14,645	209	2.5	3.9
NY	53,967	1,049	17,645	391	24,587	401	1.4	1.0
NC	3,196	33	940	11	1,569	18	1.7	
PA	28,870	421	8,991	134	13,121	190	1.5	1.4
RI	2,283	38	426	7	1,534	26	3.6	
SC	2,554	81	751	21	1,181	28	1.6	
VT	21,944	733	6,894	257	9,908	303	1.4	1.2
VA	4,353	134	1,045	44	2,392	63	2.3	1.4
WV	5,409	128	1,625	51	2,686	48	1.7	0.9
Region	295,135	5,338	88,120	1,702	147,030	2,447	1.7	1.6
Central Region								
AL	911	0	243	0	425	0	1.7	
AR	522	0	165	0	211	0	1.3	
IL	1,348	39	305	17	756	16	2.5	
IN	7,221	232	1,785	52	3,937	141	2.2	2.7
IA	1,013	45	329	9	435	24	1.3	
KS	45	0	9	0	23	0		
KY	1,112	14	255	3	570	6	2.2	
LA	29,829	394	6,614	90	19,091	247	2.9	2.7
MI	108,771	3,220	34,344	1102	52,774	1,465	1.5	1.3
MN	30,728	1,117	10,229	399	13,341	454	1.3	1.1
MS	1,721	4	488	2	875	2	1.8	
MO	3,136	147	749	50	1,495	55	2.0	1.1
NE	13	0	5	0	6	0		
ND	0	2	0	2	0	0		
OH	14,131	135	4,237	50	6,639	45	1.6	0.9
OK	172	0	38	0	91	0	2.4	
TN	1,042	18	257	7	528	9	2.1	
TX	987	3	262	0	501	2	1.9	
WI	66,530	1,671	21,344	592	31,565	736	1.5	1.2
Region	269,232	7,041	83,749	2,375	135,900	3,202	1.6	1.5

Table 5. State and regional indices of daily and seasonal woodcock hunting success in the U.S. during 2004 and 2005. 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		Total woodcock bagged in successful hunts		Woodcock per successful hunt		Woodcock per season	
		2004	2005	2004	2005	2004	2005	2004	2005
Eastern Region									
CT	11	31	45	46	89	1.5	2.0	4.2	8.1
DE	1	2	1	3	1				
FL	0	0	0	0	0				
GA	3	13	16	35	35				
ME	69	334	347	711	761	2.1	2.2	10.3	11.0
MD	3	6	6	12	15				
MA	43	150	210	243	395	1.6	1.9	5.7	9.2
NH	56	284	254	561	514	2.0	2.0	10.0	9.2
NJ	17	74	89	159	217	2.1	2.4	9.4	12.8
NY	74	355	350	674	696	1.9	2.0	9.1	9.4
NC	3	13	17	26	29				
PA	40	152	160	319	322	2.1	2.0	8.0	8.1
RI	1	1	3	1	6				
SC	5	22	18	37	40				
VT	48	262	238	569	514	2.2	2.2	11.9	10.7
VA	8	41	50	89	98				
WV	9	30	37	63	87				
Region	391	1,770	1,841	3,548	3,819	2.0	1.8	8.9	8.4
Central Region									
AL	0	0	0	0	0				
AR	0	0	0	0	0				
IL	3	3	7	6	21				
IN	14	51	84	108	172	2.1	2.0	7.7	12.3
IA	5	18	26	27	41				
KS	0	0	0	0	0				
KY	1	8	5	24	11				
LA	13	113	131	273	328	2.4	2.5	21.0	25.2
MI	228	1,182	1,230	2,405	2,544	2.0	2.1	10.5	11.2
MN	62	332	381	690	827	2.1	2.2	11.1	13.3
MS	0	0	0	0	0				
MO	14	55	71	125	141	2.3	2.0	8.9	10.1
NE	0	0	0	0	0				
OH	14	62	54	136	107	2.2	2.0	9.7	7.6
OK	0	0	0	0	0				
TN	2	5	7	11	17				
TX	0	0	0	0	0				
WI	111	578	638	1,210	1,372	2.1	2.2	10.9	12.4
Region	467	2,407	2,634	5,015	5,581	2.1	2.1	11.6	12.9

Table 6. Preliminary estimates of woodcock harvest, hunter numbers, days afield, and hunter success from the 2005-06 Harvest Information Program survey.

	Harvest	Active woodcock hunters	Days afield	Seasonal harvest per hunter
Eastern Region				
CT	4,000 ±64%	1,300 ± 28%	6,800 ±32%	3.1 ±70%
DE	300 ± 195%	100 ± 137%	200 ±145%	2.0 ±238%
FL	300 ± 126%	1,000 ±166%	1,800 ±103%	0.3 ±208%
GA	1,800 ±108%	400 ±66%	2,500 ±93%	4.3 ± 127%
ME	9,100 ± 29%	5,800 ± 34%	25,200 ± 39%	1.6 ± 45%
MD	500 ± 66%	500 ±129%	1,400 ±90%	1.0 ±145%
MA	2,300 ± 27%	1,300 ± 22%	7,100 ± 28%	1.7 ± 35%
NH	5,200 ± 28%	2,200 ± 23%	10,600 ± 27%	2.4 ± 36%
NJ	2,400 ± 40%	1,400 ± 30%	4,900 ± 32%	1.7 ± 50%
NY	10,700 ± 29%	4,300 ± 23%	16,700 ± 26%	2.5 ± 37%
NC	1,800 ±163%	1,800 ±161%	2,100 ±141%	1.0 ±229%
PA	19,200 ± 29%	11,300 ± 26%	56,800 ± 34%	1.7 ± 39%
RI	200 ± 143%	200 ± 93%	800 ±104%	0.8 ±170%
SC	3,000 ± 145%	1,700 ± 82%	3,900 ± 72%	1.7 ±166%
VT	6,500 ± 57%	1,500 ± 40%	10,000 ± 54%	4.5 ± 69%
VA	4,100 ± 142%	1,400 ± 79%	11,800 ± 147%	2.8 ± 163%
WV	1,000 ± 43%	400 ± 66%	1,500 ± 65%	2.5 ± 79%
Region	72,200 ± 16%	na[a]	164,200 ± 18%	na
Central Region				
AL	100 ±157%	<50 ±107%	200 ±165%	4.0 ±190%
AR	1,500 ±115%	3,800 ± 107%	9,200 ±99%	0.4 ±157%
IL	3,900 ± 196%	2,100 ± 79%	5,300 ± 89%	1.8 ±211%
IN	4,400 ±91%	2,100 ±55%	7,400 ±69%	2.1 ±106%
IA	1,000 ±115%	800 ± 82%	2,200 ±77%	1.3 ±141%
KS	0	0	0	0
KY	800 ±99%	1,000 ±141%	2,900 ±98%	0.9 ±172%
LA	18,100 ±89%	5,500 ± 65%	16,700 ± 74%	3.3 ±110%
MI	106,800 ± 27%	28,000 ± 13%	151,200 ± 17%	3.8 ± 30%
MN	42,200 ± 54%	12,000 ± 31%	60,200 ± 42%	3.5 ± 62%
MS	0	0	0	0
MO	1,300 ±48%	1,200 ±109%	5,000 ±107%	1.1 ±119%
NE	0	300 ± 196%	300 ±196%	0
OH	6,900 ±83%	4,700 ± 65%	15,800 ±79%	1.5 ±105%
OK	0	0	0	0
TN	400 ± 159%	200 ± 95%	500 ±108%	2.5 ±185%
TX	0	6,200 ±193%	6,300 ±188%	0
WI	37,600 ± 28%	15,600 ± 25%	73,100 ± 31%	2.4 ± 38%
Region	225,000 ± 19%	na	356,100 ± 14%	na
U.S. Total	297,200 ± 15%	na	520,300 ± 11%	na

[a]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 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, 1918-2005.

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
2002-05	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

* Saturday nearest September 22.