U. S. Fish and Wildlife Service

# American Woodcock

## Population Status, 2001

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# AMERICAN WOODCOCK POPULATION STATUS, 2001

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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 number of displaying woodcock in the Eastern Region was unchanged ($P$>0.1) from 2000 levels, although the point estimate of the trend was negative. In the Central Region, there was a 12.9% decrease in the number of woodcock heard displaying ($P$<0.01) compared to 2000 levels. Trends from the Singing-ground Survey during 1991-01 were negative (-2.6 and –2.5% per year for the Eastern and Central regions, respectively; $P$<0.01). There were long-term (1968-01) declines ($P$<0.01) of 2.5% per year in the Eastern Region and 1.6% per year in the Central Region. The 2000 recruitment index for the Eastern Region (1.4 immatures per adult female) was 27% higher than the 1999 index, but was 18% below the long-term regional average. The 2000 recruitment index for the Central Region (1.2 immatures per adult female) was unchanged from the 1999 index, but was 29% below the long-term regional average. The index of daily hunting success in the Eastern Region decreased from 2.1 woodcock per successful hunt in 1999 to 2.0 woodcock per successful hunt in 2000, and seasonal hunting success decreased 10%, from 9.3 to 8.4 woodcock per successful hunter in 1999 and 2000, respectively. In the Central Region, the daily success index decreased 5% from 2.1 woodcock per successful hunt in 1999 to 2.0 in 2000; and seasonal hunting success decreased 2% from 10.6 to 10.4 woodcock per successful hunter.

The American woodcock is a popular game bird throughout eastern North America that provides an estimated 3.4 million days of recreational hunting annually (U. S. Department of Interior 1988). 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. Also, although a sampling frame for woodcock hunters is currently being developed as part of the Harvest Information Program, no comprehensive sampling frame for woodcock hunters is currently available. 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 2001. 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 art used with permission of David Maass, Wild Wings, Inc. and the Ruffed Grouse Society.**

## 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 regional boundaries conform to the boundary between the Atlantic and Mississippi flyways. The results of the Wing-collection and Singing-ground surveys are reported by state or province, and region.

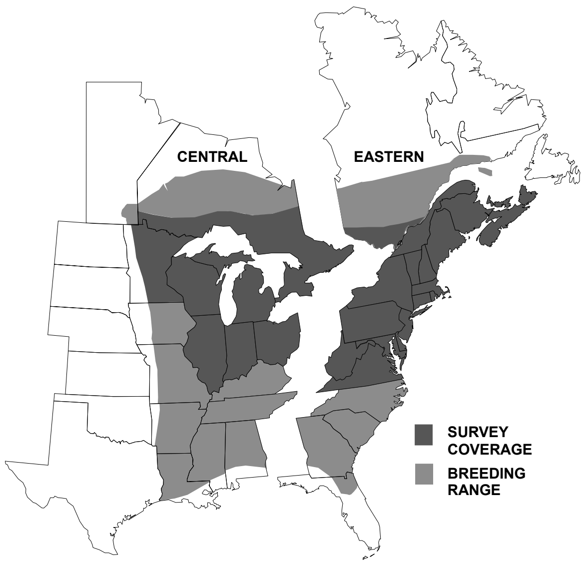


Fig. 1. Woodcock management regions, breeding range, and Singing-ground Survey coverage.

## 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 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 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 (2000-01), intermediate-term (1991-01) and long-term (1968-01) 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 2000-01 analysis, routes that did not meet this requirement during the interval of interest were not included in the sample size. For the 2000-01 analysis, a constant of 0.1 was added to counts of low-abundance routes to allow their use in the analysis. Each route should 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 30 May 2001 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 1968-01 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).

## 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 2000 survey included hunters who either: (1) participated in the 1999 survey; or (2) indicated on the 1999-00 Annual Questionnaire Survey of U. S. Waterfowl Hunters or Harvest Information Program Survey that they hunted woodcock. 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, a cooperative work session. Wings were accepted through 23 April 2001.

The ratio of immature birds per adult female in the harvest provided an index to recruitment of young into the population. The 2000 recruitment indices were compared to long-term (1963-99) averages. Annual indices were calculated as the average number of immatures per adult female in each state, weighted by the relative contribution of each state to the total number of wings received during 1963-99 (to maintain comparability between years).

Daily and seasonal bags of hunters who participated in the Wing-collection Survey in both 1999 and 2000 were used as indices of hunter success. These indices were weighted to compensate for changes in the proportion of the estimated woodcock harvest attributed to each state and adjusted to a base-year value (1969) for comparison with previous years (Clark 1970, 1972, 1973). Only data on successful hunts from prior years were used so that they would be comparable to data from the new survey. A successful hunt was defined as any envelope returned with complete information in which $\geq$1 woodcock wing was received.

# RESULTS AND DISCUSSION

## Singing-ground Survey

*Trend Estimation*.— The number of woodcock displaying during the 2001 Singing-ground Survey in the Eastern Region was not significantly different ($P$>0.1) from the 2000 level, although the point estimate of the trend was negative (Table 1, Fig. 2). The number of woodcock displaying in the Central Region decreased ($P$<0.05) 12.9% from 2000 levels. Trends for all states and provinces are reported in Table 1, but results based on fewer than 10 routes should be considered unreliable.

Trends for the 1991-01 period were computed for 345 routes in the Eastern Region and 421 routes in the Central Region. Eastern and Central region breeding populations declined ($P$<0.01) 2.6 and 2.5% per year, respectively, during this period (Table 1).

Long-term (1968-01) trends were estimated for 604 routes in the Eastern Region and 605 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. 3). The long-term trend estimates were -2.5 and -1.6% per year ($P$<0.01) for the Eastern and Central regions, respectively.

*Annual Breeding Population Indices*.—In the Eastern Region, the 2001 breeding population index of 1.70 singing-males per route was higher than the predicted value of 1.66 (Table 2, Fig. 4). The Central Region population index of 2.22 males per route was slightly lower than the predicted value of 2.24.

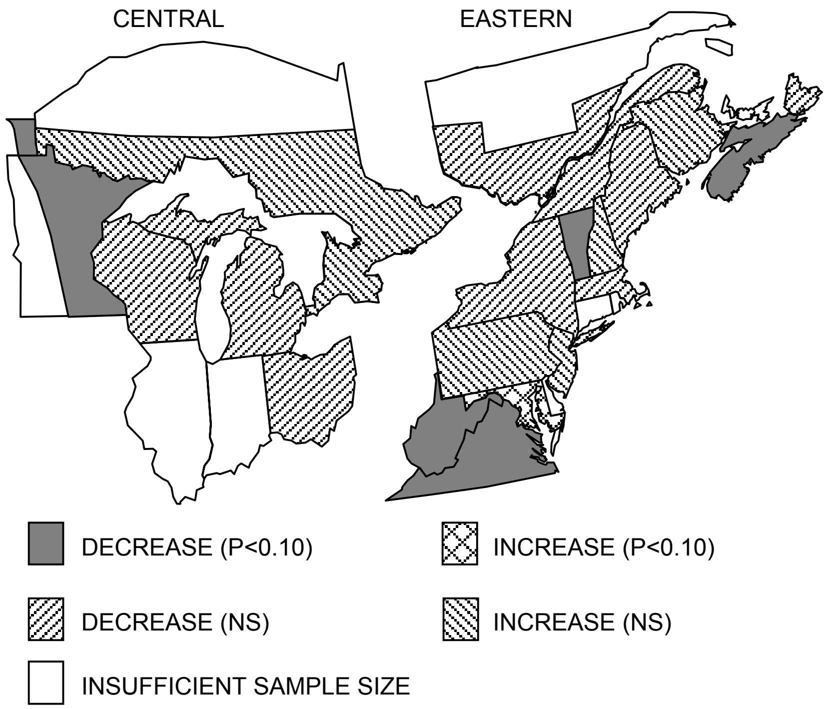


Fig. 2. Short-term trends in the number of American woodcock heard on the Singing-ground Survey, 2000-2001.

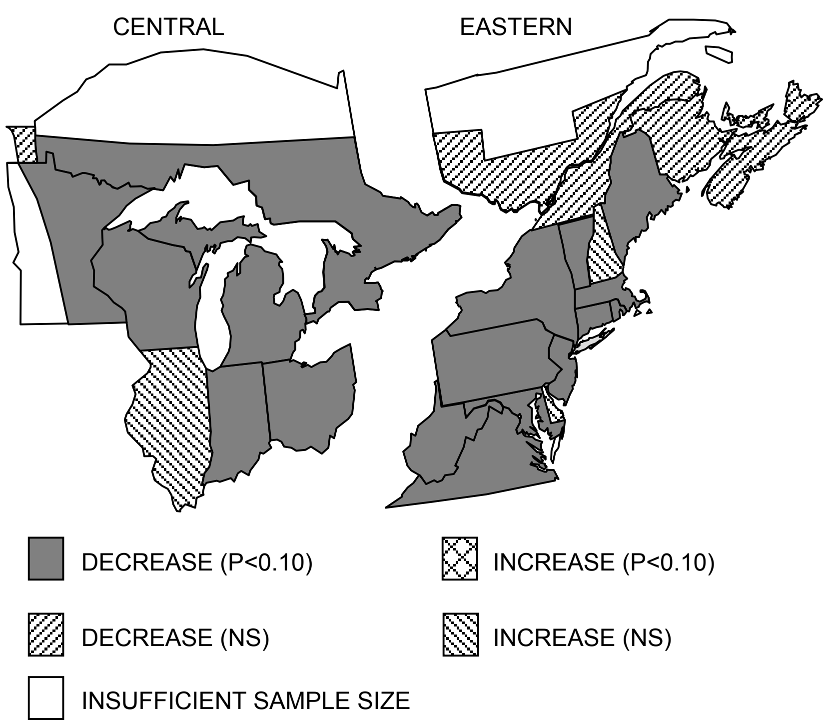


Fig. 3. Long-term trends in the number of American woodcock heard on the Singing-ground Survey, 1968-2001.

The major causes of these 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.

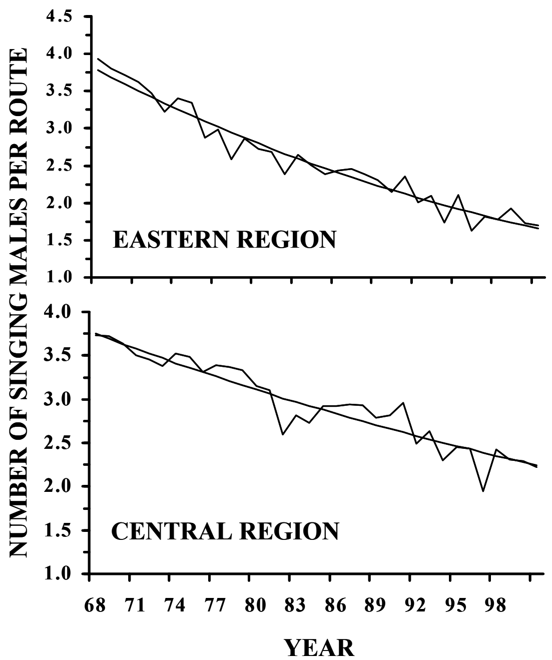


Fig. 4. Long-term trends (smooth line) and annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2001.

## Wing-collection Survey

A total of 5,525 potential woodcock hunters in states with woodcock seasons were contacted and asked to participate in the 2000 Wing-collection Survey. Twenty percent (Table 3) cooperated by sending in 9,627 woodcock wings (Table 4).

*Recruitment*.—The 2000 recruitment index in the Eastern Region (1.4 immatures per adult female) was 27% higher than the 1999 index, but was 18% below the long term (1963-99) regional average (Table 4, Fig 5). In the Central Region the 2000 recruitment index (1.2 immatures per adult female) was similar to the 1999 index, but was 29% below the long-term regional average of 1.7 immatures per adult female.

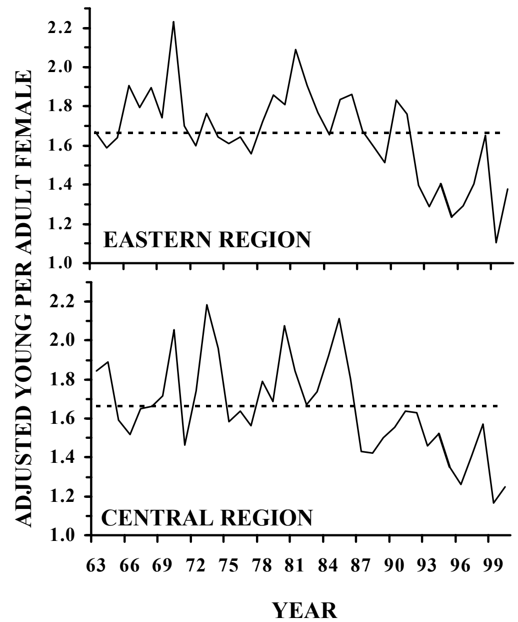


Fig. 5. Adjusted annual indices of recruitment, 1963-2000. The dashed line is the 1963-99 average**.**

*Hunting Success*.— There were no changes in Federal frameworks for woodcock hunting seasons during 2000-01 (Appendix 1). The 2000 index of daily hunting success in the Eastern Region (2.0 woodcock per successful hunt) was 5% lower than during the 1999 season (2.1 woodcock per successful hunt) (Table 5). The index of seasonal hunting success in the Eastern Region decreased 10%, from 9.3 to 8.4 woodcock per successful hunter. In the Central Region, the 2000 daily success index (2.0 woodcock per successful hunt) was 5% lower than the 1999 index (2.1 woodcock per successful hunt). Central Region hunters experienced a 2% decrease in the seasonal success index from 10.6 woodcock per successful hunter in 1999 to 10.4 woodcock per hunter in 2000. Base-year adjusted indices of daily and seasonal hunting success were below long-term averages in both regions (Figs. 6 and 7).

Indices to seasonal hunting success indicate that the annual woodcock harvest has been declining among participants in the survey for over a decade. This is consistent with the results of the Annual Questionnaire Survey of U.S. Waterfowl Hunters (Martin 1979, and FWS unpublished data, Division of Migratory Bird Management, Laurel, Maryland), which indicates that the woodcock harvest and the number of woodcock hunters have generally declined since the early 1980s (Fig. 8).

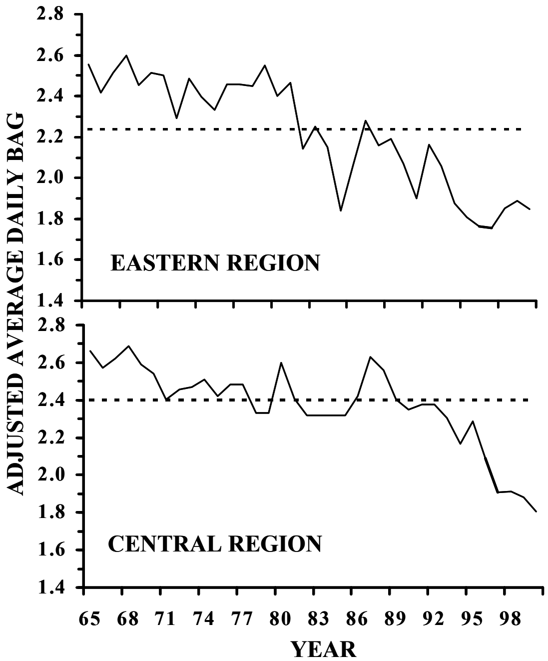


Fig. 6. Base-year adjusted indices of daily hunting success, 1965-00. The base year is 1969; the dashed line is the 1965-99 average.

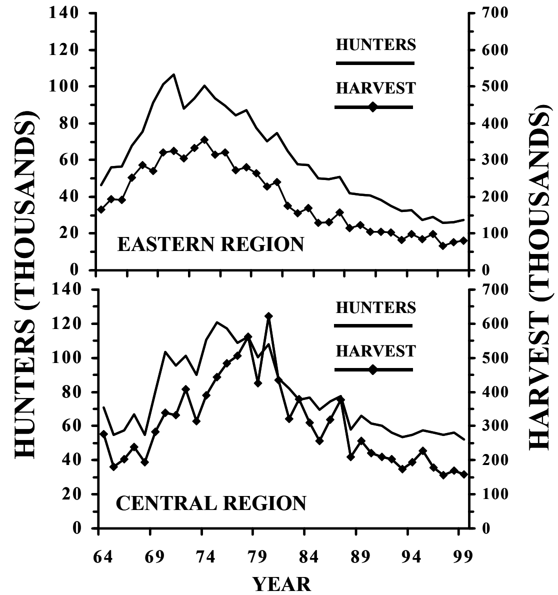


Fig. 8. U. S. harvest of American woodcock by duck stamp purchasers, and hunter numbers, 1964-99 (Martin 1979, and FWS unpublished data, Division of Migratory Bird Management, Laurel, Maryland).

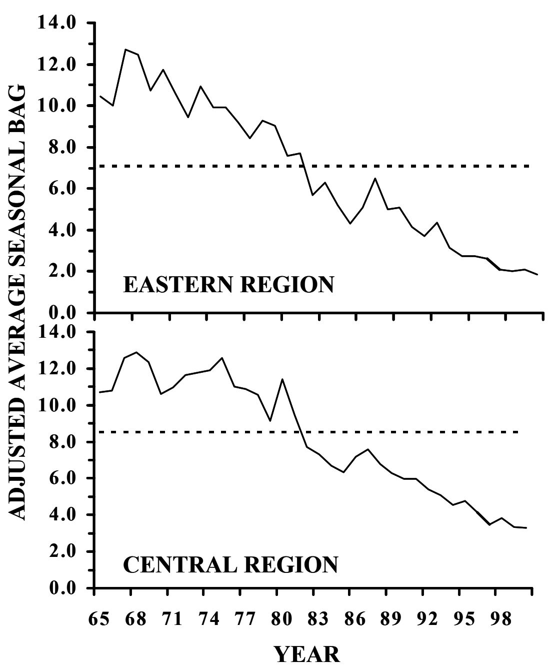


Fig. 7. Base-year adjusted indices of seasonal hunting success, 1965-00. The base year is 1969; the dashed line is the 1965-99 average.

These results should be interpreted cautiously because of the limitations of both of these surveys. A comprehensive critique of these limitations is beyond the scope of this report; interested readers should see Owen et al. (1977), Martin (1979), and Straw et al. (1994). Briefly, indices based on the Wing-collection Survey are potentially biased because of the non-random sampling procedure by which survey participants were selected. Because the Annual Questionnaire Survey of U. S. Waterfowl Hunters does not provide information on the woodcock harvest by non-waterfowl hunters, it does not provide an estimate of total harvest or the total number of hunters. Nevertheless, results from this survey should at least approximate trends in harvest and hunter participation. The Harvest Information Program currently being implemented by the FWS and state wildlife agencies is, in part, designed to address the problems with these, and other migratory bird surveys. Within the next several years, the Harvest Information Program will provide estimates of the total woodcock harvest, more comprehensive information on hunter effort and success, and larger samples of wings where needed.

## ACKNOWLEDGEMENTS

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## LITERATURE CITED

Clark, E. R. 1970. Woodcock status report, 1969. U. S. Fish and Wildl. Serv., Spec. Sci. Rep.—Wildl. 133. 35pp.

_____. 1972. Woodcock status report, 1971. U. S. Fish and Wildl. Serv. Spec. Sci. Rep.—Wildl. 153. 47pp.

_____. 1973. Woodcock status report, 1972. U. S. Fish and Wildl. Serv. Spec. Sci. Rep.—Wildl. 169. 50pp.

Coon, R. A., T. J. Dwyer, and J. W. Artmann. 1977. Identification of harvest units for the American woodcock. Proc. American Woodcock Symp. 6:147-153.

Duke, G. E. 1966. Reliability of censuses of singing male woodcock. J. Wildl. Manage. 30:697-707.

Dwyer, T. J., D. G. McAuley, and E. L. Derleth. 1983. Woodcock singing-ground counts and habitat changes in the northeastern United States. J. Wildl. Manage. 47:772-779.

Efron, B. 1982. The jackknife, the bootstrap and other resampling plans. Society for Industrial Applied Mathematics, Philadelphia, PA. 92pp.

Geissler, P. H. 1984. Estimation of animal population trends and annual indices from a survey of call counts or other indicators. Proceedings American Statistical Assoc., Section on Survey Research Methods, 472-477.

Goudy, W. H. 1960. Factors affecting woodcock spring population indexes in southern Michigan. M. S. Thesis. Michigan State Univ., E. Lansing. 44pp.

Krohn, W. B., F. W. Martin, and K. P. Burnham. 1974. Band recovery distribution and survival estimates of Maine woodcock. 8pp. *In* Proc. Fifth American Woodcock Workshop, Athens, GA.

Link, W. A., and J. R. Sauer. 1994. Estimating equations estimates of trends. Bird Populations 2:23-32.

Martin, E. M. 1979. Hunting and harvest trends for migratory game birds other than waterfowl: 1964-

76. U. S. Fish and Wildl. Serv. Spec. Sci. Rep. Wildl. 218. 37pp.

Martin, F. W. 1964. Woodcock age and sex determination from wings. J. Wildl. Manage. 28:287-293.

_____, S. O. Williams III, J. D. Newsom, and L. L. Glasgow. 1969. Analysis of records of Louisiana-banded woodcock. Proc. 3rd Annu. Conf. Southeastern Assoc. Game and Fish Comm. 23:85-96.

Mendall, H. L., and C. M. Aldous. 1943. The ecology and management of the American woodcock. Maine Coop. Wildl. Res. Unit. Univ. Maine, Orono. 201pp.

Owen, R. B., Jr., J. M. Anderson, J. W. Artmann, E. R. Clark, T. G. Dilworth, L. E. Gregg, F. W. Martin, J. D. Newsom, and S. R. Pursglove, Jr. 1977. American woodcock (*Philohela minor* = *Scolopax minor* of Edwards 1974), Pages 149-186 *in* G. C. Sanderson, ed. Management of migratory shore and upland game birds in North America. Int. Assoc. of Fish and Wildl. Agencies, Washington, D. C.

Sauer, J. R., and J. B. Bortner. 1991. Population trends from the American Woodcock Singing-ground Survey, 1970-88. J. Wildl. Mange. 55:300-312.

_____, and P. H. Geissler. 1990. Estimation of annual indices from roadside surveys. Pages 58-62 *in* J. R. Sauer and S. Droege, eds. Survey designs and statistical methods for the estimation of avian population trends. U. S. Fish and Wildl. Serv., Biol. Rep. 90(1). 166pp.

Sepik, G. F. 1994. A woodcock in the hand. Ruffed Grouse Soc., Coraopolis, PA. 12pp.

Straw, J. A., D. G. Krementz, M. W. Olinde, and G. F. Sepik. 1994. American woodcock. Pages 97-114 *in* T. C. Tacha and C. E. Braun, eds. Migratory Shore and Upland Game Bird Management in North America. Int. Assoc. of Fish and Wildl. Agencies, Washington, D. C.

U. S. Department of Interior. 1988. 1985 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. U. S. Govt. Printing Office, Washington, D. C. 167pp.

U. S. Fish and Wildlife Service. 1990. American woodcock management plan. U. S. Fish and Wildl. Serv., Washington, D. C. 11pp.

Whitcomb, D. A. 1974. Characteristics of an insular woodcock population. Mich. Dept. Nat Resour., Wildl. Div. Rep. 2720. 78pp.

Table 1. Trends (% change per year[a]) in the number of American woodcock heard in the Singing-ground Survey as determined by the estimating equations technique (Link and Sauer 1994), 1968-2001.

| State, Province or Region | No. of routes[b] | 2000-2001 | | | | 1991-2001 | | | | 1968-2001 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n[c] | % change | 90% | CI | n | % change | 90% | CI | n | % change | 90% | CI |
| CT | 6 | | | | | 3 | 7.5 ***[d] | 6.8 | 8.1 | 9 | -9.1 ** | -15.0 | -3.3 |
| DE | 2 | | | | | 2 | 25.2 | -0.3 | 50.7 | 2 | 5.1 | -8.9 | 19.2 |
| ME | 49 | 28 | -5.0 | -17.2 | 7.12 | 52 | -1.1 | -3.1 | 0.8 | 63 | -2.2 *** | -3.2 | -1.3 |
| MD | 3 | 2 | 20.8 * | 0.5 | 41.1 | 7 | 45.4 | -4.6 | 95.4 | 21 | -11.3 ** | -18.6 | -4.1 |
| MA | 7 | 4 | -10.6 | -119.9 | 98.7 | 13 | 6.7 ** | 2.0 | 11.5 | 20 | -4.4 * | -8.1 | -0.7 |
| NB | 39 | 23 | 17.9 | -5.4 | 41.2 | 53 | 0.0 | -2.44 | 2.4 | 62 | -1.0 | -2.2 | 0.1 |
| NH | 14 | 9 | 39.4 | -12.4 | 91.1 | 12 | 1.6 | -2.2 | 5.3 | 18 | 0.3 | -2.6 | 3.2 |
| NJ | 10 | 4 | 4.1 | -82.2 | 90.3 | 6 | -20.8 ** | -37.3 | -4.3 | 17 | -11.3 *** | -15.0 | -7.7 |
| NY | 65 | 33 | -7.6 | -26.0 | 10.9 | 69 | -4.9 *** | -7.3 | -2.4 | 104 | -3.1 *** | -4.3 | -1.9 |
| NS | 31 | 17 | -17.8 * | -34.0 | -1.5 | 35 | 1.7 | -1.6 | 5.0 | 55 | -0.4 | -1.8 | 0.9 |
| PA | 35 | 9 | 15.7 | -35.6 | 67.0 | 26 | -4.7 * | -9.3 | -0.1 | 56 | -5.5 *** | -7.8 | -3.2 |
| PEI | 5 | 2 | -32.6 | -65.3 | 0.1 | 7 | 1.9 | -4.4 | 8.1 | 12 | -0.9 | -2.4 | 0.7 |
| QUE | 13 | 2 | -15.2 | -35.1 | 4.7 | 13 | -3.9 *** | -5.8 | -2.0 | 54 | -0.1 | -1.4 | 1.3 |
| RI | 1 | | | | | | | | | 2 | -17.0 *** | -24.8 | -9.3 |
| VT | 15 | 8 | -50.1 *** | -70.4 | -29.9 | 18 | 1.4 | -2.1 | 4.8 | 21 | -1.7 * | -3.3 | -0.1 |
| VA | 31 | 5 | -60.1 *** | -97.5 | -22.8 | 12 | -6.2 | -17.6 | 5.2 | 45 | -10.3 *** | -14.0 | -6.6 |
| WV | 21 | 8 | -36.9 * | -70.0 | -3.7 | 17 | -5.4 | -12.2 | 1.4 | 43 | -2.5 ** | -4.6 | -0.5 |
| Eastern | 347 | 155 | -5.9 | -14.5 | 2.8 | 345 | -2.6 *** | -3.8 | -1.4 | 604 | -2.5 *** | -3.0 | -1.9 |
| IL | 13 | | | | | 6 | 7.6 | -2.9 | 18.1 | 23 | 26.1 | -19.0 | 71.2 |
| IN | 23 | | | | | 8 | -8.0 | -18.4 | 2.3 | 38 | -6.2 * | -12.0 | -0.5 |
| MB[e] | 21 | 10 | -26.3 ** | -44.2 | -8.4 | 18 | -3.6 | -7.7 | 0.5 | 18 | -3.7 | -8.1 | 0.7 |
| MI | 86 | 49 | -16.5 | -38.9 | 5.9 | 114 | -2.9 *** | -4.6 | -1.2 | 141 | -1.5 *** | -2.1 | -0.8 |
| MN | 75 | 42 | -14.0 ** | -24.4 | -3.6 | 77 | -2.0 ** | -3.6 | -0.4 | 97 | -1.1 ** | -2.0 | -0.2 |
| OH | 31 | 10 | -24.3 | -58.6 | 10.0 | 29 | -6.5 | -14.5 | 1.5 | 54 | -6.4 *** | -10.4 | -2.4 |
| ON | 46 | 12 | 2.8 | -25.8 | 31.3 | 97 | -3.1 ** | -5.3 | -1.0 | 135 | -1.4 *** | -2.2 | -0.7 |
| WI | 69 | 34 | -7.0 | -22.0 | 8.0 | 72 | -1.5 * | -3.0 | -0.1 | 99 | -1.7 *** | -2.6 | -0.9 |
| Central | 364 | 159 | -12.9 ** | -22.7 | -3.2 | 421 | -2.5 *** | -3.3 | -1.6 | 605 | -1.6 *** | -1.9 | -1.2 |
| Continent | 711 | 314 | -11.2 ** | -18.4 | -4.0 | 766 | -2.4 *** | -3.1 | -1.8 | 1209 | -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: $(100(((\% \text{ change}/100)+1)^{y})-100$ 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 2001 for which data were received by 31 May.

[c] Number of comparable routes 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 Sing-ground Survey, 1968-2001. These indices are based on the 1968-2001 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 |
| Eastern Region | | | | | | | | | | | | | | | | | |
| CT[a] | --[b] | 6.13 | 6.14 | 4.80 | 5.94 | 4.42 | 4.36 | 4.66 | 2.55 | 3.00 | 1.82 | 1.84 | 1.61 | 2.17 | 2.78 | 2.14 | 1.48 |
| DE[a] | 0.59 | 0.47 | 0.55 | 0.40 | 0.50 | 0.84 | 0.77 | 1.44 | 0.46 | 0.62 | 0.60 | 0.51 | -- | -- | -- | 2.03 | 0.88 |
| ME | 5.21 | 5.38 | 5.65 | 5.13 | 4.83 | 5.15 | 5.11 | 5.46 | 4.85 | 4.38 | 4.03 | 4.40 | 3.88 | 4.25 | 2.92 | 3.76 | 3.76 |
| MD | 9.62 | 8.44 | 7.48 | 6.90 | 5.74 | 6.37 | 4.37 | 4.60 | 3.12 | 2.93 | 3.10 | 2.42 | 2.98 | 2.54 | 2.49 | 1.64 | 1.28 |
| MA | -- | 3.68 | 4.31 | 5.04 | 3.69 | 4.96 | 4.00 | 2.33 | 3.08 | 2.37 | 2.75 | 3.01 | 2.16 | 2.20 | 1.88 | 1.39 | 2.46 |
| NB | -- | 5.33 | 5.62 | 5.47 | 5.69 | 5.03 | 5.57 | 6.30 | 4.63 | 5.73 | 4.10 | 4.54 | 4.04 | 4.07 | 4.25 | 4.44 | 3.58 |
| NH | -- | 2.99 | 3.46 | 2.80 | 3.51 | 2.73 | 3.72 | 3.15 | 3.90 | 3.16 | 3.21 | 3.28 | 3.99 | 4.16 | 2.44 | 2.85 | 2.54 |
| NJ | 8.81 | 7.53 | 9.31 | 11.59 | 6.78 | 9.51 | 9.35 | 6.91 | 3.92 | 4.32 | 2.53 | 4.34 | 2.70 | 2.03 | 1.98 | 2.35 | 2.70 |
| NY | 5.24 | 5.77 | 4.41 | 4.97 | 4.64 | 4.66 | 4.90 | 4.09 | 4.02 | 4.12 | 3.25 | 3.66 | 4.21 | 3.81 | 3.09 | 3.54 | 2.85 |
| NS | 3.78 | 2.74 | 2.33 | 2.88 | 2.76 | 2.67 | 3.34 | 2.86 | 2.52 | 2.51 | 2.90 | 2.37 | 2.24 | 2.07 | 1.84 | 2.30 | 2.22 |
| PA | 3.83 | 3.49 | 3.83 | 3.32 | 2.93 | 3.13 | 2.26 | 2.52 | 2.44 | 2.41 | 1.91 | 2.15 | 1.97 | 1.93 | 1.54 | 1.73 | 1.83 |
| PEI[a] | -- | 3.46 | 2.64 | 4.91 | 2.91 | 2.33 | 3.13 | 4.76 | 4.04 | 3.57 | 2.85 | 3.52 | 2.62 | 1.99 | 2.13 | 3.38 | 3.85 |
| QUE[a] | -- | -- | -- | 3.80 | 3.51 | 2.71 | 3.32 | 3.36 | 2.34 | 2.61 | 3.22 | 3.30 | 3.64 | 2.86 | 2.81 | 3.51 | 2.86 |
| RI[a] | -- | 2.90 | 2.92 | 5.44 | 4.03 | 4.03 | 3.01 | 2.33 | 2.33 | -- | 0.78 | 1.34 | 1.34 | 0.78 | 3.16 | 2.27 | 1.90 |
| VT | -- | 2.58 | 4.38 | 3.33 | 3.75 | 3.32 | 3.24 | 3.76 | 3.41 | 4.07 | 3.11 | 2.99 | 2.65 | 2.36 | 1.77 | 2.59 | 2.62 |
| VA | -- | 4.37 | 4.53 | 3.62 | 3.16 | 2.28 | 3.34 | 2.85 | 2.38 | 2.30 | 1.74 | 1.91 | 1.62 | 1.61 | 1.52 | 1.18 | 1.70 |
| WV | 1.59 | 1.80 | 1.28 | 1.24 | 1.51 | 1.21 | 1.16 | 1.34 | 1.17 | 1.18 | 0.81 | 1.19 | 0.98 | 1.35 | 1.20 | 1.25 | 1.03 |
| Region | 3.93 | 3.80 | 3.71 | 3.62 | 3.47 | 3.22 | 3.40 | 3.34 | 2.87 | 2.98 | 2.59 | 2.86 | 2.73 | 2.69 | 2.39 | 2.65 | 2.51 |
| Central Region | | | | | | | | | | | | | | | | | |
| IL | -- | -- | 0.02 | 0.03 | 0.03 | 0.04 | 0.03 | 0.08 | 0.06 | 0.08 | 0.08 | 0.10 | 0.11 | 0.18 | 0.15 | 0.23 | 0.27 |
| IN | 2.29 | 1.98 | 1.88 | 1.46 | 1.76 | 1.80 | 1.32 | 1.27 | 1.25 | 1.21 | 1.09 | 1.36 | 0.99 | 1.03 | 0.75 | 0.79 | 0.77 |
| MB | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MI | 5.87 | 5.75 | 5.49 | 5.30 | 5.03 | 5.17 | 6.02 | 6.06 | 5.59 | 5.13 | 5.43 | 5.35 | 5.28 | 4.42 | 4.67 | 4.08 | 4.50 |
| MN | -- | 4.71 | 4.04 | 4.32 | 3.68 | 4.18 | 4.86 | 4.24 | 4.26 | 4.22 | 4.23 | 4.17 | 4.63 | 4.25 | 3.84 | 3.49 | 3.11 |
| OH | -- | -- | 3.49 | 3.54 | 2.97 | 2.46 | 3.16 | 2.37 | 2.57 | 2.93 | 2.33 | 1.81 | 1.78 | 2.03 | 1.46 | 1.85 | 1.70 |
| ON | 6.11 | 6.70 | 6.37 | 6.06 | 6.73 | 6.01 | 6.46 | 5.69 | 5.47 | 5.96 | 6.46 | 6.22 | 6.37 | 5.92 | 4.49 | 4.66 | 4.90 |
| WI | 4.15 | 4.10 | 4.44 | 3.94 | 3.76 | 3.84 | 3.93 | 3.81 | 3.66 | 3.98 | 4.16 | 4.06 | 3.49 | 2.99 | 2.92 | 2.95 | 3.22 |
| Region | 3.73 | 3.72 | 3.64 | 3.50 | 3.46 | 3.38 | 3.52 | 3.48 | 3.31 | 3.39 | 3.37 | 3.33 | 3.15 | 3.10 | 2.60 | 2.82 | 2.73 |
| Continent | 3.76 | 3.71 | 3.61 | 3.51 | 3.41 | 3.26 | 3.42 | 3.38 | 3.06 | 3.16 | 2.94 | 3.07 | 2.92 | 2.88 | 2.49 | 2.73 | 2.62 |

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

[b] Insufficient data.

Table 2. Continued.

| State, Province or Region | Year | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| Eastern Region | | | | | | | | | | | | | | | | | |
| CT[a] | 1.29 | 1.85 | 0.88 | 2.20 | 0.93 | 0.83 | 0.89 | 0.60 | 0.50 | 0.63 | 0.82 | 0.74 | 0.66 | 0.62 | 1.33 | 0.87 | 0.35 |
| DE[a] | 0.92 | -- | -- | -- | -- | 1.52 | 0.76 | 0.50 | -- | -- | -- | 1.54 | 1.54 | 3.00 | 0.88 | 1.97 | 1.63 |
| ME | 3.82 | 3.95 | 4.32 | 4.08 | 4.18 | 2.87 | 3.60 | 3.02 | 3.26 | 2.87 | 3.03 | 2.33 | 2.60 | 2.45 | 3.09 | 3.01 | 2.59 |
| MD | 1.29 | 1.12 | 0.86 | 0.92 | 1.04 | 0.82 | 0.73 | 0.28 | 0.54 | 0.49 | 0.33 | 0.44 | 0.45 | 0.24 | 0.30 | 0.27 | 0.55 |
| MA | 1.92 | 1.97 | 2.05 | 2.04 | 1.60 | 1.46 | 1.75 | 1.45 | 1.22 | 1.34 | 0.96 | 1.30 | 1.39 | 1.28 | 1.91 | 1.27 | 1.39 |
| NB | 3.70 | 3.27 | 3.87 | 4.14 | 5.37 | 4.22 | 4.02 | 3.86 | 5.15 | 4.95 | 4.16 | 3.70 | 4.55 | 3.71 | 4.76 | 4.21 | 4.60 |
| NH | 2.69 | 4.56 | 3.25 | 3.23 | 3.32 | 2.86 | 3.89 | 2.25 | 2.76 | 2.35 | 4.66 | 3.78 | 4.08 | 3.78 | 4.50 | 3.16 | 3.33 |
| NJ | 1.92 | 1.84 | 2.12 | 1.60 | 1.45 | 1.01 | 0.91 | 0.73 | 0.70 | 0.31 | 0.69 | 0.66 | 0.18 | 0.56 | 0.56 | 0.45 | 0.40 |
| NY | 3.60 | 3.05 | 2.79 | 3.22 | 2.48 | 3.00 | 3.23 | 2.73 | 2.23 | 2.23 | 2.31 | 2.14 | 2.12 | 2.18 | 2.15 | 1.89 | 1.96 |
| NS | 2.21 | 2.62 | 2.36 | 2.57 | 2.79 | 1.92 | 2.31 | 2.60 | 2.81 | 2.12 | 2.63 | 2.70 | 2.06 | 2.37 | 2.38 | 2.82 | 2.70 |
| PA | 1.41 | 1.61 | 1.52 | 1.52 | 1.08 | 1.41 | 1.56 | 1.13 | 1.26 | 0.63 | 1.16 | 0.95 | 0.94 | 1.01 | 0.82 | 0.53 | 0.65 |
| PEI[a] | 2.83 | 3.72 | 2.60 | 4.14 | 3.97 | 3.25 | 2.40 | 2.36 | 2.25 | 2.30 | 2.69 | 3.06 | 2.62 | 2.85 | 2.41 | 2.81 | 2.92 |
| QUE[a] | 3.53 | 3.40 | 3.58 | 3.11 | 3.90 | 3.07 | 4.06 | 3.30 | 3.91 | 3.05 | 3.68 | 1.34 | 2.61 | 2.74 | 3.42 | 2.82 | 2.62 |
| RI[a] | 0.63 | 0.63 | -- | 0.95 | 0.95 | -- | 0.15 | -- | -- | -- | -- | -- | 0.05 | -- | -- | -- | -- |
| VT | 2.07 | 2.62 | 2.80 | 3.32 | 3.08 | 2.94 | 2.88 | 1.88 | 1.97 | 1.99 | 2.25 | 1.70 | 2.21 | 2.43 | 2.31 | 3.08 | 2.14 |
| VA | 0.88 | 0.90 | 0.93 | 0.66 | 0.59 | 0.58 | 0.58 | 0.46 | 0.51 | 0.41 | 0.31 | 0.30 | 0.37 | 0.27 | 0.27 | 0.24 | 0.20 |
| WV | 0.97 | 0.93 | 1.07 | 0.85 | 0.88 | 0.93 | 0.85 | 0.85 | 0.75 | 0.65 | 1.13 | 0.72 | 0.80 | 0.65 | 0.70 | 0.77 | 0.64 |
| Region | 2.39 | 2.44 | 2.46 | 2.39 | 2.31 | 2.15 | 2.36 | 2.01 | 2.10 | 1.74 | 2.11 | 1.63 | 1.82 | 1.78 | 1.93 | 1.73 | 1.70 |
| Central Region | | | | | | | | | | | | | | | | | |
| IL | 0.47 | 0.39 | 0.59 | 0.60 | 0.73 | 0.63 | 0.97 | 1.30 | 1.57 | 1.60 | 1.50 | 4.73 | 2.12 | -- | 3.41 | 4.64 | 5.29 |
| IN | 0.63 | 0.84 | 0.61 | 0.58 | 0.58 | 0.65 | 0.67 | 0.53 | 0.56 | 0.48 | 0.50 | 0.42 | 0.33 | 0.67 | 0.43 | 0.37 | 0.37 |
| MB | -- | -- | -- | -- | -- | -- | -- | 2.36 | 3.48 | 2.20 | 2.59 | 2.33 | 1.33 | 1.66 | 1.59 | 1.78 | 1.92 |
| MI | 4.71 | 4.80 | 4.45 | 4.85 | 4.64 | 4.54 | 5.36 | 3.82 | 3.84 | 3.49 | 3.76 | 3.59 | 3.51 | 4.16 | 3.38 | 3.51 | 3.33 |
| MN | 3.71 | 3.89 | 3.73 | 4.17 | 3.63 | 4.15 | 3.89 | 3.28 | 3.49 | 3.06 | 3.35 | 3.08 | 2.61 | 3.21 | 3.18 | 3.46 | 3.40 |
| OH | 1.47 | 1.15 | 1.25 | 1.49 | 1.02 | 1.40 | 1.06 | 0.94 | 0.95 | 0.80 | 0.81 | 0.87 | 0.65 | 0.70 | 0.55 | 0.61 | 0.53 |
| ON | 5.01 | 4.98 | 5.20 | 5.12 | 5.48 | 5.15 | 5.12 | 4.93 | 4.47 | 3.87 | 4.84 | 3.54 | 4.08 | 4.07 | 4.05 | 4.77 | 4.06 |
| WI | 2.98 | 3.50 | 3.48 | 3.48 | 3.23 | 3.15 | 3.17 | 2.53 | 2.51 | 2.35 | 2.37 | 2.48 | 2.35 | 2.28 | 2.79 | 2.54 | 2.27 |
| Region | 2.92 | 2.92 | 2.94 | 2.93 | 2.79 | 2.82 | 2.96 | 2.49 | 2.63 | 2.30 | 2.45 | 2.43 | 1.95 | 2.42 | 2.31 | 2.29 | 2.22 |
| Continent | 2.65 | 2.68 | 2.71 | 2.67 | 2.56 | 2.48 | 2.67 | 2.27 | 2.38 | 2.03 | 2.31 | 2.03 | 1.91 | 2.11 | 2.15 | 2.03 | 1.99 |

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

[b] Insufficient data.

Table 3. Distribution of hunters contacted and hunters who submitted woodcock wings in the 2000-01 Wing-collection Survey.

| State of residence | No. of hunters Contacted | No. of hunters who submitted wings | Percent who submitted wings |
|---|---|---|---|
| AL | 24 | 0 | 0 |
| AR | 22 | 1 | 5 |
| CT | 156 | 22 | 14 |
| DE | 17 | 0 | 0 |
| FL | 92 | 0 | 0 |
| GA | 73 | 4 | 5 |
| IL | 118 | 15 | 13 |
| IN | 92 | 24 | 26 |
| IA | 56 | 3 | 5 |
| KS | 12 | 0 | 0 |
| KY | 30 | 1 | 3 |
| LA | 164 | 16 | 10 |
| ME | 340 | 83 | 24 |
| MD | 69 | 8 | 12 |
| MA | 311 | 71 | 23 |
| MI | 672 | 218 | 32 |
| MN | 444 | 95 | 21 |
| MS | 18 | 0 | 0 |
| MO | 115 | 13 | 11 |
| NE | 26 | 0 | 0 |
| NH | 165 | 47 | 28 |
| NJ | 119 | 20 | 17 |
| NY | 375 | 82 | 22 |
| NC | 92 | 6 | 7 |
| ND | 6 | 0 | 0 |
| OH | 159 | 35 | 22 |
| OK | 33 | 1 | 3 |
| PA | 414 | 72 | 17 |
| RI | 35 | 5 | 14 |
| SC | 66 | 8 | 12 |
| TN | 68 | 7 | 10 |
| TX | 65 | 1 | 2 |
| VT | 136 | 35 | 26 |
| VA | 112 | 19 | 17 |
| WV | 23 | 8 | 35 |
| WI | 806 | 168 | 21 |
| Total | 5,525 | 1,088 | 20 |

Table 4. Numbers of woodcock wings received from hunters, and indices of recruitment. Recruitment indices for individual states were calculated as the ratio of immatures per adult female. The regional indices for 2000 were calculated as the average of the state values, adjusted for comparability with the 1963-99 average. Recruitment indices were not calculated for states where the sample of wings was <125.

| State or Region of harvest | Wings received: Total 1963-99 | Total 2000 | Adult females 1963-99 | Adult females 2000 | Immatures 1963-99 | Immatures 2000 | Recruitment index 1963-99 | Recruitment index 2000 |
|---|---|---|---|---|---|---|---|---|
| **Eastern Region** | | | | | | | | |
| CT | 12,981 | 88 | 2,875 | 20 | 7,962 | 53 | 2.8 | |
| DE | 411 | 2 | 54 | 0 | 288 | 2 | 5.3 | |
| FL | 660 | 0 | 150 | 0 | 410 | 0 | 2.7 | |
| GA | 2,913 | 7 | 896 | 2 | 1,266 | 0 | 1.4 | |
| ME | 71,236 | 952 | 20,958 | 254 | 35,665 | 473 | 1.7 | 1.9 |
| MD | 3,775 | 42 | 940 | 13 | 2,114 | 18 | 2.2 | |
| MA | 18,709 | 240 | 5,622 | 98 | 9,317 | 99 | 1.7 | 1.0 |
| NH | 26,115 | 653 | 8,466 | 198 | 12,053 | 306 | 1.4 | 1.5 |
| NJ | 24,085 | 122 | 5,594 | 24 | 14,177 | 63 | 2.5 | |
| NY | 50,051 | 699 | 16,519 | 255 | 23,325 | 300 | 1.4 | 1.2 |
| NC | 2,869 | 70 | 840 | 21 | 1,431 | 33 | 1.7 | |
| PA | 26,804 | 369 | 8,417 | 128 | 12,499 | 138 | 1.5 | 1.1 |
| RI | 2,223 | 8 | 415 | 2 | 1,504 | 6 | 3.6 | |
| SC | 2,173 | 77 | 653 | 32 | 1,056 | 25 | 1.6 | |
| VT | 19,316 | 578 | 6,157 | 200 | 9,081 | 244 | 1.5 | 1.2 |
| VA | 3,674 | 147 | 858 | 48 | 2,163 | 50 | 2.5 | 1.0 |
| WV | 5,070 | 55 | 1,542 | 18 | 2,575 | 23 | 1.7 | |
| Region | 273,065 | 4,109 | 80,956 | 1,313 | 136,886 | 1,833 | 1.7 | 1.4 |
| **Central Region** | | | | | | | | |
| AL | 910 | 0 | 243 | 0 | 425 | 0 | 1.7 | |
| AR | 510 | 0 | 163 | 0 | 207 | 0 | 1.3 | |
| IL | 1,246 | 9 | 279 | 5 | 710 | 4 | 2.5 | |
| IN | 6,548 | 151 | 1,627 | 54 | 3,684 | 58 | 2.3 | 1.1 |
| IA | 878 | 11 | 296 | 1 | 388 | 7 | 1.3 | |
| KS | 44 | 0 | 9 | 0 | 22 | 0 | | |
| KY | 948 | 31 | 225 | 5 | 491 | 18 | 2.2 | |
| LA | 28,244 | 414 | 6,318 | 99 | 18,353 | 221 | 2.9 | 2.2 |
| MI | 95,576 | 2,517 | 30,805 | 864 | 48,044 | 1,100 | 1.6 | 1.3 |
| MN | 27,006 | 812 | 9,100 | 310 | 12,251 | 287 | 1.3 | 0.9 |
| MS | 1,716 | 0 | 486 | 0 | 875 | 0 | 1.8 | |
| MO | 2,604 | 29 | 639 | 7 | 1,312 | 14 | 2.1 | |
| NE | 10 | 0 | 4 | 0 | 5 | 0 | | |
| OH | 13,216 | 240 | 4,007 | 78 | 6,287 | 93 | 1.6 | 1.2 |
| OK | 166 | 2 | 38 | 0 | 85 | 2 | 2.2 | |
| TN | 960 | 23 | 235 | 9 | 494 | 9 | 2.1 | |
| TX | 945 | 0 | 239 | 0 | 488 | 0 | 2.0 | |
| WI | 59,943 | 1,279 | 19,438 | 467 | 29,320 | 506 | 1.5 | 1.1 |
| Region | 241,470 | 5,518 | 74,151 | 1,899 | 123,441 | 2,319 | 1.7 | 1.2 |

Table 5. State and regional indices of daily and seasonal woodcock hunting success in 1999 and 2000. State and regional indices were calculated for states represented by ≥10 hunters who participated in the Wing-collection Survey both years. Regional indices were weighted as described by Clark (1970).

| State of harvest | No. of successful hunters | No. of successful hunts | | Woodcock bagged | | Woodcock per successful hunt | | Woodcock per season | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1999 | 2000 | 1999 | 2000 | 1999 | 2000 | 1999 | 2000 |
| **Eastern Region** | | | | | | | | | |
| CT | 13 | 22 | 35 | 29 | 49 | 1.3 | 1.4 | 2.2 | 3.8 |
| DE | 1 | 1 | 1 | 1 | 2 | | | | |
| GA | 2 | 6 | 2 | 10 | 6 | | | | |
| ME | 61 | 262 | 245 | 553 | 520 | 2.1 | 2.1 | 9.1 | 8.5 |
| MD | 5 | 14 | 10 | 27 | 21 | | | | |
| MA | 20 | 103 | 76 | 202 | 145 | 2.0 | 1.9 | 10.1 | 7.3 |
| NH | 36 | 209 | 215 | 433 | 448 | 2.1 | 2.1 | 12.0 | 12.4 |
| NJ | 15 | 68 | 45 | 148 | 90 | 2.2 | 2.0 | 9.9 | 6.0 |
| NY | 61 | 334 | 292 | 645 | 548 | 1.9 | 1.9 | 10.6 | 9.0 |
| NC | 6 | 23 | 33 | 34 | 70 | | | | |
| PA | 46 | 124 | 140 | 259 | 276 | 2.1 | 2.0 | 5.6 | 6.0 |
| RI | 2 | 4 | 4 | 7 | 6 | | | | |
| SC | 4 | 23 | 15 | 50 | 33 | | | | |
| VT | 40 | 176 | 212 | 385 | 469 | 2.2 | 2.2 | 9.6 | 11.7 |
| VA | 10 | 63 | 48 | 151 | 108 | 2.4 | 2.3 | 15.1 | 10.8 |
| WV | 3 | 17 | 20 | 35 | 45 | | | | |
| Region | 325 | 1,449 | 1,393 | 2,969 | 2,836 | 2.1 | 2.0 | 9.3 | 8.4 |
| **Central Region** | | | | | | | | | |
| IL | 4 | 9 | 5 | 15 | 7 | | | | |
| IN | 6 | 24 | 45 | 52 | 103 | | | | |
| KY | 2 | 13 | 16 | 19 | 31 | | | | |
| LA | 15 | 88 | 121 | 220 | 363 | 2.5 | 3.0 | 14.7 | 24.2 |
| MI | 199 | 1,006 | 1,043 | 2,041 | 2,025 | 2.0 | 1.9 | 10.3 | 10.2 |
| MN | 73 | 346 | 334 | 693 | 706 | 2.0 | 2.1 | 9.5 | 9.7 |
| MO | 4 | 6 | 7 | 9 | 10 | | | | |
| OH | 13 | 90 | 97 | 219 | 212 | 2.4 | 2.2 | 16.8 | 16.3 |
| TN | 2 | 5 | 13 | 5 | 22 | | | | |
| WI | 134 | 578 | 519 | 1,190 | 990 | 2.1 | 1.9 | 8.9 | 7.4 |
| Region | 455 | 2,171 | 2,204 | 4,478 | 4,479 | 2.1 | 2.0 | 10.6 | 10.4 |

Appendix 1. History of framework dates, season lengths, and daily bag limits for hunting American woodcock in the Eastern and Central Regions, 1918-2000.

| 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 |
| 1997-00 | Oct. 6 - Jan. 31 | 30 | 3 | 1999 | *Sep. 25 - Jan. 31 | 45 | 3 |
| | | | | 2000 | *Sep. 23 - Jan. 31 | 45 | 3 |

* Saturday nearest September 22.