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ENVIRONMENTAL IMPACT RESEARCH PROGRAM

TECHNICAL REPORT EL-90-7

AUDITORY SURVEY METHODS

Section 6.3.5, US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL

by

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Final Report

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Prepared for DEPARTMENT OF THE ARMY
US Army Corps of Engineers
Washington, DC 20314-1000
Under EIRP Work Unit 32420

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) Technical Report EL-90-7	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION USAEWES Environmental Laboratory 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) 3909 Halls Ferry Road Vicksburg, MS 39180-6199	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION US Army Corps of Engineers 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code) Washington, DC 20314-1000	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO. EIRP 32420

11. TITLE (Include Security Classification)
Auditory Survey Methods: Section 6.3.5,
US Army Corps of Engineers Wildlife Resources Management Manual

12. PERSONAL AUTHOR(S)
Wakeley, James S.; Roberts, Thomas H.; Martin, Chester O.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final report	FROM _____ TO _____	June 1990	31

16. SUPPLEMENTARY NOTATION
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	See reverse.

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

A report on auditory survey techniques is provided as Section 6.3.5 of the US Army Corps of Engineers Wildlife Resources Management Manual. The report is designed to present an overview of auditory techniques (also known as call counts) used to survey populations of selected avian species. The surveys are generally used to determine the relative abundance of a species rather than to estimate absolute density. Since auditory surveys provide only an index to the size of a population, they are most useful for monitoring trends through time or for comparing abundance among study sites.

Auditory survey procedures are described for the mourning dove (*Zenaida macroura*), American woodcock (*Scolopax minor*), northern bobwhite (*Colinus virginianus*), and ruffed grouse (*Bonasca umbellus*). Information on sampling procedures (including design variation), data analysis, and application to local studies is provided. Cautions and limitations are described for all techniques.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code) / 22c. OFFICE SYMBOL

DD Form 1473, JUN 86 Previous editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

18. SUBJECT TERMS (Continued).

Auditory survey methods	Call counts
Avian population indexes	Mourning dove survey
Avian survey and sampling	Ruffed grouse survey
Bobwhite survey	Woodcock survey

Accession For
NTIS GRA&I ☑
DTIC TAB ☐
Unannounced ☐
Justification
By
Distribution/
Availability Codes
Dist | Avail and/or Special
A-1

PREFACE

This work was sponsored by the Headquarters, US Army Corps of Engineers (HQUSACE), as part of the Environmental Impact Research Program (EIRP), Work Unit 32420, entitled Development of US Army Corps of Engineers Wildlife Resources Management Manual. The Technical Monitors for the study were Dr. John Bushman, Mr. David Buelow, and Mr. Dave Mathis, HQUSACE.

This report was prepared by Dr. James S. Wakeley, Wetlands and Terrestrial Habitat Group (WTHG), and Dr. Thomas H. Roberts and Mr. Chester O. Martin, Resource Analysis Group (RAG), Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES). Mr. Martin, Team Leader, Wildlife Resources Team, RAG, EL, was principal investigator for the work unit. Appreciation is expressed to Mr. Gordon W. Gullion, Forest Wildlife Project Chairman, Minnesota Department of Natural Resources, Cloquet, Minn., and Messrs. David D. Dolton and J. Bradley Bortner, US Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Md., for providing information and review. WES review was provided by Dr. Wilma A. Mitchell, Mr. James W. Teaford, and Mr. H. Roger Hamilton, EL.

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Commander and Director of WES was COL Larry B. Fulton, EN. Technical Director was Dr. Robert W. Whalin.

This report should be cited as follows:

Wakeley, James S., Roberts, Thomas H., and Martin, Chester O. 1990. "Auditory Survey Techniques: Section 6.3.5, US Army Corps of Engineers Wildlife Resources Management Manual," Technical Report EL-90-7, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

NOTE TO READER

This report is designated as Section 6.3.5 in Chapter 6 -- CENSUS AND SAMPLING TECHNIQUES, Part 6.3 -- BIRD SURVEY/CENSUS TECHNIQUES, of the US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL. Each section of the manual is published as a separate Technical Report but is designed for use as a unit of the manual. For best retrieval, this report should be filed according to section number within Chapter 6.

AUDITORY SURVEY METHODS

Section 6.3.5, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

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Auditory surveys (often referred to as call counts) involve the detection and counting of concealed animals by the calls or other sounds they make. Although auditory surveys can be conducted for virtually any species or group of species that produces identifiable sounds, the majority of these surveys involve birds. This report focuses on auditory methods used to monitor the populations of selected game birds. Additional methods for sampling avian populations can be found in other sections of this Manual.

CONCEPT

Auditory surveys are often used to estimate the relative abundance of populations in situations where the absolute densities (number of animals per unit area) are impractical to determine. Although there is considerable variation among auditory techniques, most are based on the number of individuals heard calling (or making some other discernible sound) along a prescribed route or routes. The resulting index to population size is useful for monitoring trends over time or for comparing abundance among populations (e.g., among study areas within a region). Although trend analysis is probably the

most common use of indices, the goal of an auditory survey can be as simple as determining the presence or absence of a species on a study area.

Obtaining indices of abundance requires much less effort than measuring absolute density. However, conducting index surveys requires some standardization of procedures and conditions to improve the accuracy and consistency of results. For example, auditory surveys for some species must be conducted during early morning because singing or calling is often restricted to that period. A survey conducted during the first 2 hours following sunrise would not be comparable to one run during midday. Also, most auditory surveys are restricted to the breeding season when singing or calling is at its peak.

Because auditory surveys for single species are relatively quick and easy to perform, they are widely used by State and Federal agencies. Extensive training is not required; observers can learn to conduct single-species surveys in a few hours, whereas the expertise to conduct a general breeding bird survey may require years of experience in bird-song identification. Procedures for implementing surveys for the mourning dove (*Zenaida macroura*), American woodcock (*Scolopax minor*), northern bobwhite (*Colinus virginianus*), and ruffed grouse (*Bonasa umbellus*) are described in this report. The dove and woodcock surveys illustrate large-scale Federal programs designed to monitor population trends over large regions of the country. The bobwhite and grouse surveys are typical of those run at the State or local levels. Data requirements and sophistication of analysis are generally more stringent with the large-scale surveys. However, because most auditory surveys have the same basic design, they can often be scaled up or down to meet specific needs.

Auditory surveys are also used to sample songbirds, owls, and numerous game species, including prairie chickens (*Tympanuchus cupido* and *T. pallidicinctus*), sage grouse (*Centrocercus urophasianus*), white-winged doves (*Zenaida asiatica*) and other pigeon and dove species, ring-necked pheasants (*Phasianus colchicus*), scaled quail (*Callipepla squamata*), Gambel's quail (*C. gambelii*), clapper rails (*Rallus longirostris*) and other rails, and plain chachalacas (*Ortalis vetula*).

MOURNING DOVE SURVEYS

Each year, the US Fish and Wildlife Service (FWS) determines the status of mourning dove populations by conducting call counts during the active breeding period. Male mourning doves establish territories soon after arrival on the breeding grounds. Their displays around potential nesting areas

include a distinctive flight and the familiar "cooing." This vocalization serves as the basis for the dove surveys.

Sampling Procedures

The surveys are conducted on more than 1,000 randomly selected routes throughout the United States (Dolton 1989). Each route is run on lightly traveled secondary roads along which 20 listening stops are spaced at 1.6-km (1-mile) intervals. Each route is sampled once between May 20 and May 31, although the sampling period may extend to June 5 in the event of bad weather or other unavoidable circumstances. The route is run by a single observer who counts the number of different doves heard calling during a 3-minute listening period at each of the 20 stops. Doves seen by the observer while driving between stops are also recorded. The count begins at the first stop exactly one-half hour before sunrise and is completed about 2 hours later. Because inclement weather can inhibit calling or prevent the observer from hearing all birds, routes are run only on days without rain or snow and when wind velocity is less than 19 km/hour (12 miles/hour).

Since survey routes are randomly chosen, some inevitably fall in areas of low dove density. These routes are still important for an unbiased assessment of population trends and must be included in the analysis.

The FWS mourning dove call-count survey form and instructions for its use are found in Appendix A. The form provides space to record information about the observer and the route, weather conditions, the number of doves heard and seen, and the level of disturbance at each stop that could interfere with the count.

Analysis

If all survey routes were run each year by the same observers under similar conditions, it would be a simple matter to calculate the average number of doves heard or seen per route and determine trends in population size. However, in large-scale surveys, cooperators may change from year to year and may differ in their ability to detect birds. Also, logistical problems or poor weather may result in different routes being run each year. Under these changing conditions, a simple average of the number of birds heard or seen cannot be used to determine population trends.

In 1985, the FWS instituted a method for analysis of call-count survey data that uses regression analysis of the logarithm of annual counts of doves (or other birds) to determine population trends per route (Geissler 1984).

The regression model takes into account differences in the ability of observers to detect birds. Regional population trends are estimated by a weighted average of the trends from individual routes; weighting is by land area and the average number of doves on each route (Dolton 1989). An advantage to this approach is that the variance and confidence intervals can be generated for each state or region using a statistical procedure called bootstrapping (Geissler 1984).

Local Applications

Research has shown that the mourning dove survey is not well suited for use on small areas. Even under acceptable sampling conditions, the number of birds heard along a survey route can vary greatly from day to day. Armbruster et al. (1978) reported an average day-to-day variation of 20.4% (range 3.6% to 50.0%) for mourning doves counted along a single 20-stop route sampled repeatedly between May 1 and August 31 for 2 years. They also found no consistent relationship between the number of doves heard at a stop and the actual population density or number of active nests in the surrounding area. This result may have been due in part to changes in the relative proportions of mated and unmated males in the dove population (the rate of calling by unmated males may be 20 times that of mated birds) (Sayre et al. 1980). These inherent sources of variability may make the call-count survey inappropriate as a means of monitoring the size or productivity of dove populations on localized study areas (Armbruster et al. 1978, Baskett et al. 1978). When information is needed for small areas, line-transect surveys or intensive searches for active nests may be more reliable and repeatable.

WOODCOCK SURVEYS

Woodcock inhabit densely forested areas and are usually difficult to locate. However, during late winter and spring the male performs crepuscular displays over the breeding territory, which is called a singing ground. The aerial portion of the display includes wing twittering and a vocalization described as a "liquid warble." While on the ground, the male gives a distinctive insect-like "peent" call. It is this call that has enabled biologists to develop a procedure for gathering population information.

Breeding populations of American woodcock in the northeastern United States and southeastern Canada are monitored by means of the singing-ground survey. The survey is coordinated by the FWS and since the early 1940's has

been the main source of information on the status of the breeding population. Refer to Section 4.1.2 of this manual (Roberts 1989) for a further discussion of woodcock survey and sampling techniques.

Sampling Procedures

The singing-ground survey is run on 5.8-km (3.6-mile) routes having 10 stops spaced 0.6 km (0.4 mile) apart (Tautin 1983). The observer counts the number of "peenting" males during a 2-minute listening period at each stop. Recommended dates for conducting the survey vary with latitude and are timed to coincide with local peaks of woodcock courtship activity. Counts begin 22 minutes after sunset (15 minutes when cloud cover is greater than 75%) and last about one-half hour. Surveys are conducted only when the temperature exceeds 40° F and there is no rain or strong wind. The FWS woodcock survey form and instructions for its use are provided in Appendix B.

Analysis

From the mid 1960's through 1988 the FWS used a method of "base-year adjustments" to determine trends in woodcock breeding populations from the survey (Tautin et al. 1983). Because cooperators and the number of routes run changed between years, regional population trends were determined by comparing the average number of birds heard along "comparable routes" from one year to the next. Comparable routes were those run two years in succession by the same observer under approximately the same conditions, so that any change in the count was not due to differences in the detectability of birds between years. Using only data from comparable routes, the percentage change in the average number of birds heard per route between consecutive years was calculated. These annual rates of change were then applied to the count of birds in a base year to determine long-term trends in woodcock populations. In 1988 the FWS began using the regression procedure described in the dove survey section to examine trends in the woodcock population, and data were analyzed by both procedures (Bortner 1988). The route-regression method was found to be more reliable and was adopted by the FWS in 1989 (Bortner 1989).

Local Applications

Although the FWS woodcock survey is regional in scope, singing-ground surveys are applicable to smaller areas. Counts of singing males on a 3,400-ha (8,500-acre) area in Maine have been used to evaluate the effectiveness of habitat management (Dwyer et al. 1988). The investigators believed that since they could count all the breeding males on the area, their

year-to-year comparisons were more likely to detect changes in the population than would the national survey. When running a singing-ground survey on small areas, it is desirable to use the same observers from year to year and to run the same routes in a consistent manner.

BOBWHITE QUAIL SURVEYS

Summer counts of whistling males are often used as a means of surveying bobwhite populations. The surveys, which are referred to as "whistling-cock" or "whistle" counts, have not been standardized and vary somewhat among states and wildlife management areas on which quail are censused. Regardless of the exact design, the surveys focus on the territorial call made by males during the breeding season. The call, a whistled "bob-white," is given off-and-on throughout the day, but calling is most vigorous during the first 2 hours following sunrise. Throughout much of the bobwhite's range, calling peaks during June and July, which coincides with the peak in nesting activity.

Sampling Procedures

Procedures for conducting quail surveys are flexible and should be tailored to the size of the area and the precision needed. The only restrictions involve timing and weather; counts should be conducted during the peak calling period and run only on days with light wind and no rain. To enhance the probability of detecting trends in population size, it is desirable to run the surveys at approximately the same time of year and over the same routes.

The survey method formerly used by the state of Kansas (Wells and Sexson 1982) illustrates a procedure designed for large areas. Routes are 14.5 km (9 miles) long with 10 stops per route. An observer listens for 3 minutes at each stop and records the number of different males calling at each stop.

A modification to the basic procedure is to count the total number of "bob-white" calls heard at each stop. Some researchers (Ellis et al. 1972; Ralph W. Dimmick, University of Tennessee, Knoxville, pers. commun., 1989) have recommended this approach because it eliminates the necessity to distinguish the number of individuals at a stop. If as many as 7 males can be heard at 1 stop, calling is virtually continuous (Ellis et al. 1972), making it difficult for most observers to accurately determine the number present. Another factor causing difficulty in counting individual birds is that male bobwhites often call in different directions. This may confuse listeners as the calls made by the same bird do not sound the same.

Although auditory surveys for bobwhites have been conducted for several decades, there is still uncertainty about the usefulness of the procedure. Bennitt (1951), Rosene (1957), and Ellis et al. (1972) found good correlations between summer whistle counts and fall populations. Others reported the opposite and concluded that the counts were poor predictors of fall populations (Norton et al. 1961; Ralph W. Dimmick, pers. commun., 1989). Long-term studies with standardized survey procedures are needed to clarify this relationship. Managers considering the use of whistle counts to predict fall populations should be aware of the potential for error. In spite of uncertainty regarding the use of whistle counts, they do provide an indication of the size of the breeding population, which in itself is useful information.

Local Applications

For surveying local populations, Rosene (1969) recommended spacing the stops 0.8 km (0.5 mile) apart and listening for 8 minutes at each stop. These modifications facilitate a more accurate count of the number of whistling males on an area. If areas are small, for example, 600 ha (1,500 acres) or smaller, it may be possible to count the total number of breeding males. Allowing for driving time, each route requires approximately 2 hours to run. If possible, counts should be conducted on consecutive mornings. An example of a quail whistling-cock survey form designed for local studies is provided in Appendix C.

RUFFED GROUSE SURVEYS

The normally secretive ruffed grouse becomes conspicuous each spring when males advertise their presence and attempt to attract females by "drumming" from atop fallen logs, rocks, or piles of earth. The drumming sound is created by a rapid beating of the wings and has been described as sounding like a tractor motor being started.

Sampling Procedures

Auditory surveys for drumming males are often conducted along secondary roads through areas known to provide suitable grouse habitat. The surveys should be conducted during the peak of drumming activity, generally in April or early May in most regions (Gullion 1966, Crawford 1986). The best times of day to sample are the 2 hours before sunset or from 30 minutes before to 2 hours after sunrise on calm, rain-free days (Hungerford 1953, Petraborg et al. 1953, Gullion 1966, Crawford 1986). Listening stations are usually spaced

0.8 to 1.6 km (0.5 to 1.0 mile) apart. Drumming males should be counted for 4 minutes at each station (Hungerford 1953, Petraborg et al. 1953, Crawford 1986). A variant of this technique is to count the total number of "drums" per stop. This procedure, now widely used in the north-central states, eliminates the problem of the listener having to determine the exact number of drumming males that are present (William E. Berg, Minnesota Department of Natural Resources, pers. commun., 1990). The low-frequency drumming sound is difficult to pinpoint, and persons planning ruffed grouse surveys should consider this approach. Appendix D provides a survey form and instructions for sampling drumming grouse.

Because of numerous potential biases, roadside surveys should not be used to estimate population densities (Hungerford 1953, Dorney et al. 1958, Gullion 1966). A major problem is that drumming intensity varies from bird to bird and year to year, so that only a fraction of the population is detected in any given year. Furthermore, the percentage detected may differ from one year to the next (Gullion 1966). Even if the number of males is known, sex ratios may vary annually. This makes it difficult to extrapolate an estimate of the total population from a count of drumming males.

Local Applications

Drumming counts can be used to estimate the total population of adult males on research areas up to 4,000 ha (10,000 acres) in size (Gullion 1966). One approach is to have a number of observers simultaneously walk a series of parallel transect lines spaced 0.4 km (0.25 mile) apart (James S. Wakeley, personal observation). For each drumming male grouse heard, the observer's location on the transect line is noted along with the compass bearing to the bird. Observers meet later to compare records, plot the approximate location of each bird on a map, and determine which birds were heard by more than one observer. Later, each bird can be approached and its exact location determined. To improve accuracy, the entire procedure should be replicated several times each season.

CAUTIONS AND LIMITATIONS

Because many factors affect the outcome of auditory surveys, caution is required both when running the surveys and when interpreting results (Dawson 1981). Sources of variability inherent in all auditory surveys include (1) reduced detectability of calls during periods of rain and high wind;

(2) variations in the ability of different observers to detect vocalizations; and (3) interference from other noises such as rustling vegetation, calling insects or amphibians, and passing automobiles or aircraft. As much as possible, these influences on the count should be minimized or standardized. Topography and vegetation structure also affect call counts by changing the distance at which calls can be heard. For that reason, auditory counts should not be used to compare the abundance of birds in dissimilar habitats.

Biological factors that, for the most part, cannot be controlled also place limitations on auditory surveys. For example, woodcock populations contain an unknown percentage of nondisplaying males (Sheldon 1967), and percentages of grouse drumming have been found to differ widely between years (Gullion 1966). These and other "problems" likely exist in populations of many species.

Managers need to be aware of the limitations of auditory surveys and to recognize their primary value--to examine trends in the breeding population. Due to variability in summer mortality, especially for young birds, breeding season indices may not correlate highly with fall (hunting season) populations. However, for many game birds, auditory surveys provide the best available data on general population status.

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APPENDIX A

MOURNING DOVE CALL-COUNT SURVEY FORM AND INSTRUCTIONS FOR ITS USE
(Form 3-159, Office of Migratory Bird Management,
US Fish and Wildlife Service, Laurel, Md.)

MOURNING DOVE CALL - COUNT SURVEY

U.S. FISH AND WILDLIFE SERVICE
OFFICE OF MIGRATORY BIRD MANAGEMENT, LAUREL, MD 20708-9619

SURVEY YEAR

STATE | ROUTE NUMBER

LOCATION OF ROUTE | COUNTY | PHYSIOGRAPHIC REGION

AT START - STOP NO. 1

WIND VELOCITY B-
TEMPERATURE °F
% SKY CLOUDED %
VEHICLE MILEAGE

AT FINISH - MILE 20.0

WIND VELOCITY B-
TEMPERATURE °F
% SKY CLOUDED %
VEHICLE MILEAGE

DATE OF SURVEY MONTH DATE

WAS THIS ROUTE RUN BY YOU LAST YEAR? ☐ YES ☐ NO

LOCAL OFFICIAL SUNRISE TIME AM

OBSERVER'S NAME (Print)

AGENCY State ☐ Federal ☐ Other ☐

MAILING ADDRESS

ZIP CODE

Telephone (A/C)

STOP NUMBER	TIME AT STOP	DOVES HEARD		DOVES SEEN						DISTURBANCE				REMARKS
		NO. OF DOVES	TOTAL CALLS	WHILE STOPPED			WHILE DRIVING			NO	LO	MOD	HI	
				SINGLES	IN PAIRS	IN FLOCKS	SINGLES	IN PAIRS	IN FLOCKS					
1														
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FORM 3-150
(Revised October, 1988)

(OVER)

OMB FORM APPROVED NO. 1018-0010
APPROVAL EXPIRES JULY, 1989

INSTRUCTIONS FOR MOURNING DOVE CALL-COUNT SURVEY*

Date of Survey	Routes should be completed between May 20 and May 31, inclusive. When unavoidable, the survey period will be extended to June 5.
Weather Conditions	Do not conduct survey when (1) wind velocities exceed Beaufort 3 (12 mph) or (2) rain or snow is falling.
Starting Time	Start routes exactly 1/2 hour before sunrise. Determine sunrise time from an official source adjusted to route locality.
Observer	When possible, the observer should run the same route in successive years. The vehicle driver is the sole observer. Persons accompanying the driver are not to participate in the collection of dove data. When observer changes are being made and both observers are running the route, each person should record the data independently on separate forms without conferring.
Survey Route	Routes are 20 miles in length, with 20 stops (listening stations) at 1 mile intervals. The route begins at Stop 1 and ends 1 mile past Stop 20.

Procedure

Special Note	Survey requires about 2 hours to complete. Allow exactly 3 minutes for counts at each stop and an average of 3 minutes for recording and travel time between stops.
At Stop #1	Record weather and vehicle mileage. Record wind velocity as B-0, B-1, B-2, or B-3, using Beaufort scale.
At Each Stop	Stop vehicle, turn off ignition, leave vehicle. Listen and observe for exactly 3 minutes while standing away from vehicle. Record: (1) Time of arrival at stop. (2) Total number of individual doves heard calling. (3) Total number of calls (1 call usually consists of a preliminary note and 3 coos). (4) Number of doves seen while stopped (if 3 pairs are seen, enter numeral 6 in column "IN PAIRS"). (5) Disturbance affecting count at each stop. (6) Remarks, if applicable to survey.

* Format slightly modified from FWS Form 3-159.

Between Stops — Maintain driving speed of about 25 to 35 mph between stops.

Record:
(1) Number of doves seen while driving. Enter data on same line as previous stop number.
(2) Total all columns for doves heard and doves seen.

Check form for completeness and accuracy.

Reporting — Immediately after the completion of each route:
(1) Mail the original form directly to Dove Survey, Office of Migratory Bird Management, Patuxent Wildlife Research Center, Laurel, MD 20708-9619.
(2) Mail 1 copy to the State coordinator.
(3) Mail 1 copy of the form, plus the survey route map, to the US Fish and Wildlife Service survey coordinator in the State or Regional Office as indicated in the cover letter.
(4) Retain 1 copy for your personal file.
(5) Use 1 copy as a field form, if preferred.

Estimating Wind Velocity

Beaufort Number	Velocity (mph)	Suggestions for Estimating Wind Velocity
0	Less than 1	Smoke rises vertically.
1	1 to 3	Direction of wind shown by smoke drift, but not by wind vanes.
2	4 to 7	Wind felt on face, leaves rustle, ordinary wind vane moves.
3	8 to 12	Leaves and small twigs in constant motion; wind extends light flag.
4	13 to 18	Raises dust and loose paper; small branches are moved.

Estimating Disturbance

Disturbance	Description	Example
NO	No appreciable effect on count.	Occasional crow calling.
LO	Slightly affecting count.	Distant tractor noise.
MOD	Moderately affecting count.	Intermittent traffic.
HI	Seriously affecting count.	Heavy-continuous traffic.

APPENDIX B

AMERICAN WOODCOCK SINGING GROUND SURVEY FORM AND INSTRUCTIONS FOR ITS USE
(Form 3-156, Office of Migratory Bird Management, US Fish and Wildlife Service, Laurel, Md.)

NORTH AMERICAN WOODCOCK SINGING GROUND SURVEY

U.S. FISH AND WILDLIFE SERVICE,
OFFICE OF MIGRATORY BIRD MANAGEMENT, LAUREL, MARYLAND USA 20708-9619

CANADIAN WILDLIFE SERVICE, DEPARTMENT OF THE ENVIRONMENT
OTTAWA, ONTARIO, CANADA K1A OH3

SURVEY YEAR

STATE OR PROVINCE

COUNTY

ROUTE NUMBER

DATE OF SURVEY

YEAR ____ MONTH ____ DAY ____

OBSERVER'S NAME (PRINT)

AGENCY 1 ☐ STATE 3 ☐ PROV. 5 ☐ FED.. 7 ☐ OTHER

WAS THIS ROUTE RUN BY YOU LAST YEAR? 1 ☐ YES 3 ☐ NO

MAILING ADDRESS STREET ____ CITY ____ STATE/PROVINCE ____ ZIP CODE ____

OFFICIAL SUNSET : PM

ROUTE NAME

SKY CONDITION
0 ☐ CLEAR
1 ☐ 1/4 OVERCAST
3 ☐ 1/2 OVERCAST
5 ☐ 3/4 OVERCAST
ADD 22 MIN. TO SUNSET FOR STARTING TIME
7 ☐ >3/4 OVERCAST - ADD 15 MIN

TEMPERATURE

°F		°C
35-39	☐ 31	2-4
40-49	☐ 41	5-9
50-59	☐ 51	10-15
60+	☐ 60	16+

WIND
1 ☐ CALM
2 ☐ GENTLE (1-3 mph)
3 ☐ LIGHT (4-7 mph)
4 ☐ MODERATE (8-12 mph)
5 ☐ STRONG (>12 mph)

PRECIPITATION
0 ☐ NONE
1 ☐ MIST
3 ☐ SNOW, HEAVY RAIN
5 ☐ FOG
7 ☐ LIGHT RAIN

	STOP NUMBER	ODOMETER READING 1 ☐ MILES OR 3 ☐ KM	TIME	NUMBER HEARD PEENTING	DISTURBANCE (SEE BACK) NO[0]	LOW[1]	MOD[3]	HI[5]	REMARKS
	1		:						
	2		:						
	3		:						
	4		:						
	5		:						
	6		:						
	7		:						
	8		:						
	9		:						
	10		:						
	TOTAL WOODCOCK HEARD PEENTING								

DO NOT WRITE IN THIS LINE

TOTAL STOPS	ACCEPTABLE STOPS	TOTAL WOODCOCK ON ACC. STOPS	ROUTE STATUS	

SUNSET TIMES FOR THIS ROUTE:

DATE
DAYLIGHT SAVINGS TIME
STANDARD TIME

STATE/PROVINCIAL COORDINATOR:

PLEASE READ INSTRUCTIONS ON REVERSE SIDE CAREFULLY AND COMPLETELY.
Main Points to consider are listed below.
(1) Conduct survey within dates shown on map (see reverse).
(2) Make sure to conduct survey at proper time for sky condition.
(3) Stops should be at 0.4 mi (0.6 km) intervals, listen for exactly 2 minutes at each stop.
(4) Do not conduct survey if temperature is below 40°F (5°C), in strong wind, or in heavy precipitation.
(5) Contact your state coordinator promptly if unable to run your route within the designated dates.
(6) Fill out all sections of this form and immediately mail form.

FORM 3-188 (REV. AUG. 1987)

OMB NO. 1018-0019 APPROVAL EXP. AUG 1989

WOODCOCK SURVEY BACKGROUND AND INSTRUCTIONS*

The singing-ground survey provides an index to the relative size of the woodcock breeding population in North America. It is the most important source of data used to guide Federal, state and provincial woodcock programs. As part of their courtship behavior, male woodcock exhibit aerial and vocal displays each evening. They begin by giving calls described as "peents" shortly after sunset. From openings called "singing grounds," birds alternately "peent" and make flight songs. New survey participants should become thoroughly familiar with these woodcock sounds before running routes.

Originally, survey routes were run in areas of prime habitat where woodcock were known to be present, but subsequent studies showed that these counts did not accurately reflect overall woodcock densities. Consequently, new routes were selected randomly so that all habitat types would be surveyed and results would better reflect the status of the overall woodcock population. A normal characteristic of such random surveys is that some routes will fall in unfavorable habitat; so do not become disheartened if you do not hear birds on your route. Your results are still valuable.

Please closely follow the instructions below so that data from your route will be of maximum value. The quality of the survey depends on you.

Observer — It is preferable that the same observer run the same route each year. When this is not possible, it is desirable for both observers (old and new) to run the survey together once so that there is a smooth transition with the new observer becoming thoroughly familiar with survey procedures and local route conditions. Both observers should record their results independently.

Seasonal and Daily Timing — Timing is very important. See the survey map (Figure B1) for survey dates in your area. When spring is early or late, routes conducted up to 5 days outside the survey period will be accepted. Plan to arrive at the start of your route at or shortly after local sunset. If a time card accompanies this form, use it to determine sunset. Otherwise, consult local news media. If the sky is clear or up to and including 3/4 overcast, add 22 minutes to the sunset time to determine the starting time. Add 15 minutes if the sky is more than 3/4 overcast. If your judgment dictates variation from this timing, as in the case of deep valleys, state the facts under "Remarks." Timing is very important! Do not use military time.

Procedure — At Stop 1, shut off your vehicle's engine, step several feet away, and record the time you begin listening. Listen for 2 minutes and record the number of different woodcock heard "peenting." Then proceed rapidly 0.4 mile (0.6 km) to the next stop and repeat the procedure. Continue to do so until all

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* Format modified somewhat from FWS Form 3-156.

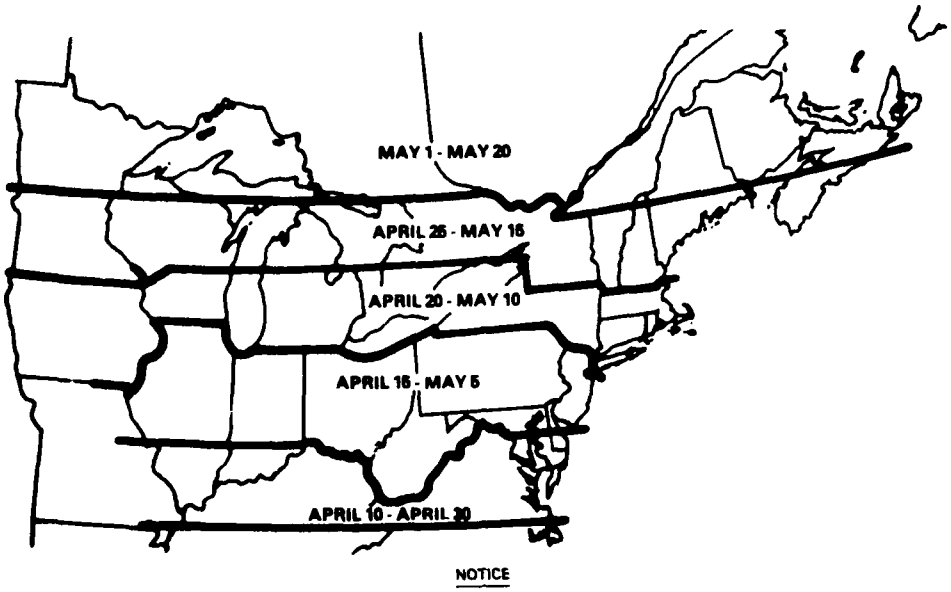

Figure B1. Recommended periods for conducting woodcock singing-ground survey

10 stops have been covered. If a traffic hazard prevents stopping within 100 ft of the 0.4-mile mark, proceed to the next stop and note "no stop-hazardous" in the space for the stop omitted. Be sure to check the survey form's box that indicates if your odometer readings are in miles or kilometers.

Recording Counts

Record the number of different "peenting" woodcock. Do not record birds you hear performing only the flight song, and do not record the number of "peents" heard. When no birds are peenting, record "0" in the appropriate column. When disturbances at a particular stop make a count impossible, note the type of disturbance and proceed to the next stop. Upon completion of the route, record the total number of birds heard.

Estimating Disturbance

Disturbance	Description	Example
NO	No appreciable effect on count.	Occasional crow calling.
LO	Slightly affecting count.	Distant tractor noise.
MOD	Moderately affecting count.	Intermittent traffic.
HI	Seriously affecting count.	Heavy-continuous traffic.

Things to Avoid

Do not run routes when the temperature is below 40° F or in heavy precipitation or strong wind.

Number of Times to Count

Normally, conduct a route only once during the specified period. However, if weather or other factors cause invalid counts at five or more stops, the route should be rerun another evening.

Reporting — Immediately after running your route, mail an original copy of the form to Woodcock Surveys, US Fish and Wildlife Service, Laurel, MD 20708-9619, and mail 2 copies to your coordinator.

APPENDIX C

BOBWHITE QUAIL WHISTLING-COCK COUNT SURVEY FORM AND INSTRUCTIONS FOR ITS USE

BOBWHITE QUAIL WHISTLING COCK COUNT SURVEY*

Route No._____ Observer_____ Date_____

Beginning: Cloud Cover_____ Wind Velocity_____ Temp._____

End: Cloud Cover_____ Wind Velocity_____ Temp._____

Stop Number	Time	Number of Cocks Heard	Comments
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

General instructions: Conduct whistle counts only on days with clear skies and calm winds, or as nearly so as possible (use Beaufort scale to estimate wind velocity). Run route in the same direction each trip starting at 30 min before sunrise. At each stop: (1) shut off engine, (2) step away from vehicle, and (3) listen for 8 min only - counting and mapping the location of each individual male heard. Each route or transect should have 12 stops and cover 6 miles. Stops should be 1/2 mile apart with 2 min during time between stops.

* This form was designed after procedures recommended by Rosene (1969) for surveying local populations.

APPENDIX D

RUFFED GROUSE DRUMMING CENSUS FORM AND INSTRUCTIONS FOR ITS USE
(Courtesy Minnesota Department of Natural Resources,
Division of Fish and Wildlife, St. Paul, Minn.)

RUFFED GROUSE DRUMMING CENSUS

Route No._____ Route Name_____

Date:_____ Observer:_____ County:_____
month day year

Time: Start _____ Wind: Start _____ Ground Condition: Dry ____
End _____ End _____ (check one) Damp ____
Wet ____

Temperature: Start _____ Cloud Cover: Start _____ Dripping Wet ____
End _____ (percentage) End _____ Frost ____
Snow ____

Weather yesterday:_____

Route Location Data: Starts at (place)_____

and proceeds (direction)_____ on (highway, road)_____

to (place)_____ ending at (place)_____

Exact location of first stop on route:_____
(Supply detailed map of new route showing roads, section numbers, etc.)

Overall Evaluation of
Noise Interference (Circle One): Heavy Moderate Light None

Overall Evaluation of
Census Conditions (Circle One): Excellent Good Fair

Stop Number	Exact Mileage	Total drums heard in 4 min.	Cover type and size at stop	Remarks
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
Totals				

INSTRUCTIONS FOR CONDUCTING DRUMMING CENSUS IN MINNESOTA

Run the route on a calm morning during what you believe to be the peak of the drumming period. Temperature should be 25° to 35° F.

Complete the routes according to the following suggested dates:

Inclusive Dates	Area	Time
April 8-30	South	Begin counts at about
April 15-May 5	Central	sunrise depending upon
April 25-May 5	North	temperature.

Make a 4-min stop. Record exact speedometer reading. Walk 15 to 20 ft from the car for listening. Count total drums. Record data. Record cover type and size at stop (for example, pole-sized aspen or alder thicket), if not done on earlier census.

Record weather observations as precisely as possible (actual field temperatures, if possible).

Complete the following phenology observations:

1. Are any trees leafed out: If so, what species?_____
2. Are the catkins of trembling aspen out?_____
3. Can pollen be shaken from alder?_____
4. Are the oak catkins present?_____
5. Other plant phenology_____

Make your own decision as to conditions on each morning a census is made. A census made under poor conditions is worthless. If conditions are poor at start, a half-hour wait may be necessary. Avoid windy and rainy mornings. Fog is permissible. Do not make counts if half the ground is covered by last winter's snow.

When setting up a new route, choose a back road, preferably graveled, which has little traffic. Establish 10 stops in what is apparently good ruffed grouse habitat and mark each stop on a tree, fence post, or power pole with a painted permanent number. Stops should be not less than 1 mile apart, but this distance can be more depending upon habitat. Prepare two maps of route, sending one with your forms and keeping one for your file. Give each route a name. A number will be given later.