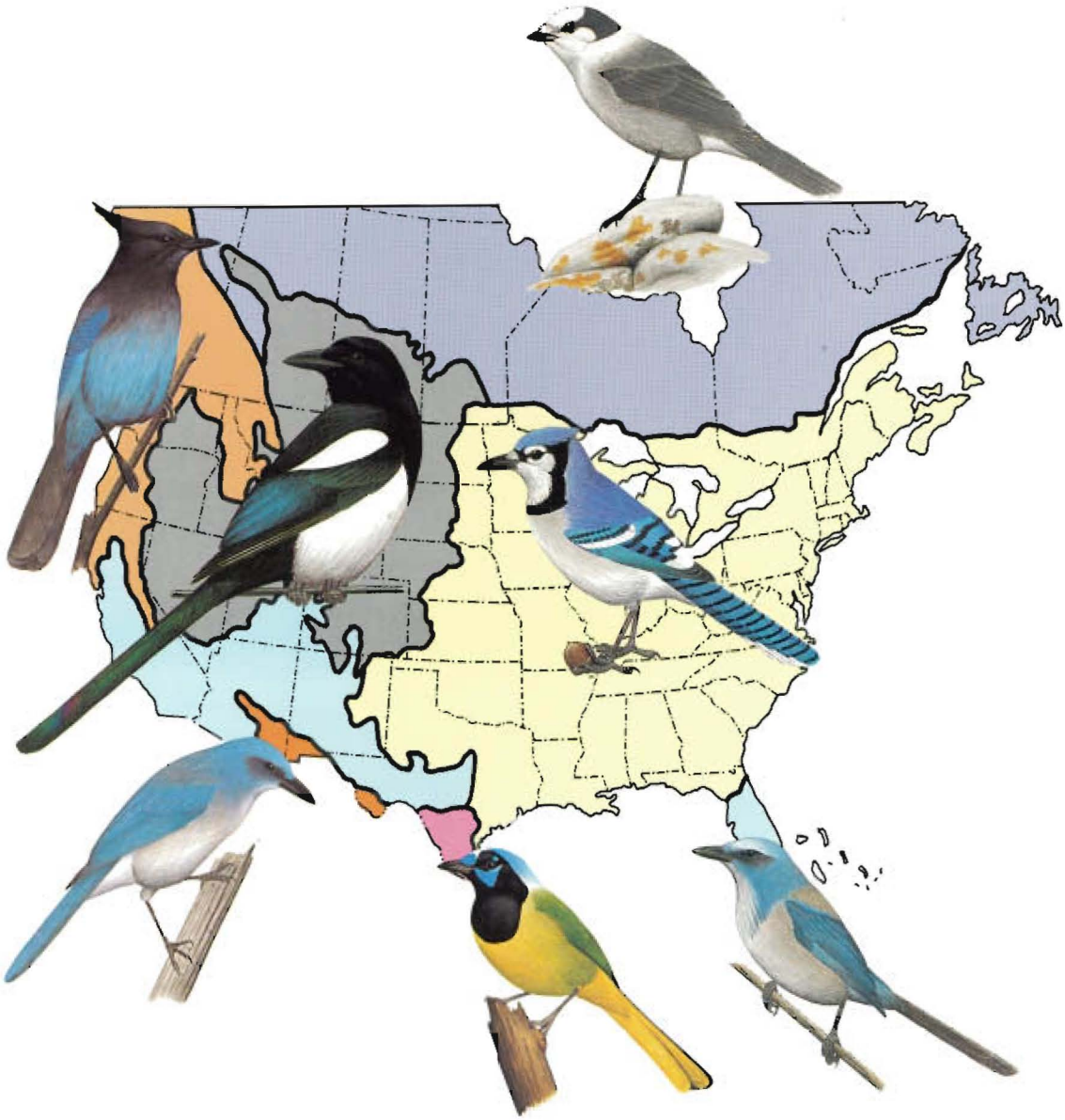
The Breeding Bird Survey: Its First Fifteen Years, 1965–1979



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE / RESOURCE PUBLICATION 157

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Copies of this publication may be obtained from the Publications Unit, U.S. Fish and Wildlife Service, Washington, DC 20240, or may be purchased from National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161.

Library of Congress Cataloging in Publication Data

Robbins, Chandler S.
The breeding bird survey.

(Resource publication / U.S. Fish and Wildlife Service ; 157)
Bibliography: p.
1. Bird populations—United States. 2. Bird populations—Canada. I. Bystrak, Danny. II. Geissler, Paul H. III. Title. IV. Series: Resource publication (U.S. Fish and Wildlife Service) ; 157.
S914.A3 no.157 333.95'4'0973 s 85-600081
[QL682] [598.2'5248'097]

Cover illustration. Every major physiographic region has its own distinctive avifauna, illustrated here by its typical jay or magpie (Family Corvidae). Species, clockwise from the top, are Gray (Canada) Jay, Blue Jay, Scrub Jay, Green Jay, Mexican (Gray-breasted) Jay, Black-billed Magpie, and Steller's Jay. Michael O'Brien, artist.

THE BREEDING BIRD SURVEY: ITS FIRST FIFTEEN YEARS, 1965–1979

By Chandler S. Robbins
Danny Bystrak
Paul H. Geissler

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Resource Publication 157
Washington, D.C. • 1986

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The Breeding Bird Survey: Its First Fifteen Years, 1965–1979

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Abstract

The Breeding Bird Survey (BBS) is an ongoing cooperative program sponsored jointly by the U.S. Fish and Wildife Service and the Canadian Wildlife Service. Its main purpose is to estimate population trends of the many species of birds that nest in North America north of Mexico and that migrate across international boundaries. This survey provides information, both locally by ecological or political regions and on a continental scale, on (1) short-term population changes that can be correlated with specific weather incidents, (2) recovery periods following catastrophic declines, (3) normal year-to-year variations, (4) long-term population trends, and (5) invasions of exotics.

The BBS also permits detailed computer mapping of relative abundance of each species, either year by year to show changes in distribution and relative abundance, or the average over a period of years. It provides base-line data with which more intensive local studies can be compared.

For biogeographic studies it provides uniform sampling of bird populations by major physiographic regions across the continent. In conjunction with the Audubon Christmas Bird Count, it permits comparison of summer and winter distribution of species that winter in the United States.

Most species of North American birds migrate across international boundaries, especially those shared with Canada, Mexico, and the Soviet Union. As part of our responsibility under treaties with these nations, the U.S. Fish and Wildlife Service has developed the BBS to monitor avian population changes so that any adverse trends can be detected early. This provides the opportunity to determine the reasons for any increase or decrease, to define geographic areas in which changes are greatest, to study correlations between avian population changes and land-use changes, and to make recommendations for controlling undesirable bird population trends.

For example, the BBS can be used to detect and estimate the extent of losses resulting from widespread use of pesticides, and to reveal whether major population changes of a given species (e.g., Dickcissel) in certain States are related to a continental decline or are merely a result of population shifts within the breeding range. Effects of urban and suburban expansion are often reflected in the loss of forest interior birds.

Population trends for 230 species as well as several avian genera and families are discussed and graphed in this report. For most of these species, regional and well as continental trends are shown. The three major regions discussed are the Eastern, Central, and Western, bounded by the Mississippi River and the eastern base of the Rocky Mountains. Additional graphs for certain States or physiographic regions are included for selected species of special interest. The following paragraphs summarize general trends in the major bird families.

The native herons in general are maintaining their populations, whereas the exotic Cattle Egret[1] continues its geographic spread and its steady increase. Waterfowl as a group are stable or increasing.

Although most widespread species of hawks are on the increase, the rarer species show evidence of decline.

Among the gallinaceous birds, the greatest change was a sharp drop in Northern Bobwhite as a result of the exceptionally cold winters of 1976–77 and 1977–78 in the Ohio Valley and the Middle Atlantic States. Killdeer populations, except for a minor decline during these two winters, showed strong increases except in the West. American Woodcock were poorly sampled by the BBS because they were relatively inactive during daylight. Common Snipe and the other common shorebirds that nest in the United States and southern Canada exhibited stable or increasing populations, especially in the Eastern and Central regions.

Herring Gull counts varied dramatically and irregularly from year to year. Laughing Gulls increased along the Atlantic coast and Franklin's Gulls declined in the interior of the continent.

The introduced domestic pigeon or Rock Dove continued to increase in the Eastern and Central regions, while the Mourning Dove continued its northward spread and increased, especially in Canada and the adjacent States. Both of the northern cuckoo species increased, probably in response to outbreaks of caterpillars—their chief food.

A downward trend in Common Flicker populations in the Eastern and Central regions is attributed largely to competition for nesting holes from the introduced European Starling. This trend was accentuated by losses during the severely cold winters of 1976–77 and 1977–78. While the Yellow-bellied Sapsucker decreased, the Downy Woodpecker increased, and other woodpecker populations remained stable.

The flycatchers, most of which are highly migratory, did not show any consistent trends. Some species increased, whereas close relatives decreased. Sharpest declines were noted in the Scissor-tailed and Olive-sided Flycatchers. The swallows, which like the flycatchers are insect eaters, showed consistent gains, except for the Bank Swallow.

Jays and magpies showed only minor population changes, but there were increases in Common Ravens and in crows, especially the Fish Crow, which is spreading northward along the Atlantic coast.

The Boreal Chickadee decreased in 1966–79, but the Carolina and Black-capped Chickadees increased in the East during the same period. There was no correlation, however, between the annual BBS totals for Black-capped Chickadees in the Northeastern States and the autumnal irruptions detected at Manomet Bird Observatory on the Massachusetts coast. The eastern population of the Tufted Titmouse declined during 1966–79, despite the fact that it expanded its breeding range dramatically northward into New England.

Striking changes took place in wren populations. The House Wren increased, despite a winterkill in the East in 1976–77 that decimated the Winter Wren. The Bewick's Wren dropped drastically east of the Mississippi and disappeared almost completely from the Appalachian portion of its breeding range. In the West, the Canyon Wren increased, while the Cactus Wren decreased. The Carolina Wren demonstrated its sensitivity to winter weather conditions by increasing during a period of mild winters and then dropping sharply during the severe winters of 1976–77 and 1977–78.

The Northern Mockingbird showed a general decline in continental population despite a dramatic northward expansion into New York and New England. There was a corresponding influx of Gray Catbirds into the Canadian Maritime Provinces, but a sharp decline in Brown Thrashers in the areas newly occupied by Northern Mockingbirds. American Robins registered a gradual increase, correlated with suburban expansion and a decline in the use of persistent pesticides in the United States and Canada. The tropical-wintering woodland thrushes also increased, especially in the East. The upward trend for the Hermit Thrush, which winters in the southern States, was interrupted by the cold winters of 1976–77 and 1977–78, which also caused a serious decline in the Eastern Bluebird.

Both species of kinglets suffered heavy mortality in the severe winter of 1976–77, from which they had barely started to recover by 1979. Loggerhead Shrikes declined in all parts of their range; this insectivorous species appears to be suffering from a combination of factors related to changing land-use practices, including roadside spraying, suburban sprawl, and loss of pastureland and hedgerows. European Starlings decreased in the East, primarily in the severe winters of 1976–77 and 1977–78, but are continuing to spread and increase their numbers in the West.

[1]Scientific names for species mentioned in the present report are given in Appendix A.

Vireo and warbler trends were upward on the whole, especially in the East. This is attributed in part to the extensive outbreak of the spruce budworm in eastern Canada, to the banning of the use of DDT in the United States and Canada, and to the absence of any widespread severe weather conditions during the period most members of these families are in the United States and Canada. Notable exceptions were a sharp drop in Pine Warblers during the prolonged freeze in the Southeast in the winter of 1976–77, and a steady decline in Prairie Warblers and Yellow-breasted Chats that arises from a declining amount of land in early stages of succession.

There was a steady decrease in House Sparrows in the East despite an increase in the acreage occupied by suburbs. Urban populations have declined in the past 60 years as the automobile has replaced the horse, on whose droppings these sparrows feed extensively. Cleaner farming operations and, more recently, competition from newly arrived House Finches in the East also have helped curb the population of this introduced Old World sparrow.

One of the most striking changes quantified by the BBS has been the spread of the alien House Finch in the eastern United States, where it has increased an average of 21% per year from 1966 through 1979. From its release point on Long Island, New York, this species has already spread into nearly every State east of the Mississippi River. Thus far the main concentrations have been in urban and suburban areas where its impact on native species has been minimal. American Goldfinches, however, have declined while House Finches have increased.

The Lark Bunting, a characteristic species of the northern Great Plains, is declining, especially along the eastern border of its range, where grazing land is rapidly being converted to cropland. Among the sparrows, the majority of the trends are downward—especially for the grassland species.

As human populations continue to increase in the Americas and demands for food and fiber accelerate, it will become increasingly important to be aware of population trends in our avian species, especially those that migrate between the United States and other nations. We now have established a firm base for detecting future trends of the great majority of North American species. Over the next decade the continued compilation and analysis of comparable data will enable the detection of cyclic changes, the separation of continuing, long-term trends from temporary ones, and the measurement of effects of changing land use on avian populations both here and on the tropical wintering grounds of these insectivorous migrants.

The purposes of the present report are to (1) describe the Breeding Bird Survey (BBS); (2) discuss the more important population trends detected by the survey in its first 15 years; (3) present base-line data on mean numbers of birds observed per BBS route in each State and Province; (4) indicate areas of greatest relative abundance of each of the more common species; (5) show such other BBS applications as mapping of relative abundance; and (6) acknowledge the participation of thousands of volunteers without whom the BBS would not be possible.

The BBS is a cooperative program for gathering and analyzing quantitative information on populations of breeding birds in North America north of Mexico. The program was developed at the peak of the "pesticide era" to provide a large data set from which population trends of many species could be computed.

Randomly distributed roadside routes have been established within each 1 degree block of latitude and longitude in the United States and southern Canada. The density of routes varies geographically according to the number of qualified observers available, but is basically the same throughout each State or Province.

For each State and Province a coordinator selects qualified amateur and professional observers to run the routes in his or her jurisdiction. He or she endeavors each year to obtain coverage of all the established routes in his or her State or Province.

We summarize herein the methods used for gathering and analyzing the data, show population trends detected by the BBS, and illustrate a variety of other uses of the results of the survey.

Field Procedures

The field procedures and record forms are the same as those shown in the first BBS report (Robbins and Van Velzen 1967). Because this report is now out of print, the procedures are summarized here.

Each observer is sent a packet containing instructions (Appendix B), the route map, a set of field sheets (Appendix C), a summary sheet (Appendix D), and a return envelope.

Each route consists of 50 3-min stops 0.5 mile (0.8 km) apart, and is run one morning each year, at the height of the breeding season, starting at 0.5 h before sunrise. In most of the United States coverage is restricted to the month of June, but late May is permissible in the southern States, as is early July in Canada. At each stop the observer stands near his car and records, on prepared forms, the total number of each bird species heard, as well as those seen within

0.25 mile (400 m). Sky condition, wind speed, and temperature are recorded at the beginning and end of each route. Each route is confined to a single degree block and to a single State or Province and, in most instances, to a single major physiographic region.

Data Processing and Analysis

Data Entry

For each route, the observer submits five field sheets, one for each series of 10 consecutive stops. He also submits a summary sheet, which includes a preprinted label showing the State or Province, route number, latitude and longitude of starting position, and physiographic region code. The observer inserts his name, date of coverage, starting and finishing time, and appropriate weather codes. The summary sheet, like the field sheet, contains a preprinted list of the species expected in the observer's geographic area. Following the species name is a code number (A.O.U. number) that is used for processing the data. After each species, the observer writes the page totals from each of the five field sheets as well as the total individuals for all 50 stops combined. In the final column, the observer records the number of stops at which each species was recorded.

The name of the route, the observer's name, and the numerical data from the summary sheet are keypunched directly onto magnetic tape for subsequent summarization and analysis.

Quality Control

Before entry onto magnetic tape, each summary sheet is edited and compared with the five accompanying field sheets. "Write-in" species not preprinted on the summary sheet receive special attention. Occasional late transients appear on some reports, especially reports made in the first few days of June. If it is almost certain that the transients do not breed in the area, they are deleted from the summary sheet. Observers are encouraged to apend comments regarding any possible nonbreeders on their reports. Occasionally it is necessary to contact observers for additional details.

The editor inserts two other code numbers on the form. One is the continuity code, which is the number of consecutive years the route has been run by the same observer. The coverage code indicates whether the route was properly run in all respects, or whether the observer started too early or too late in the day or season, or under unfavorable weather conditions. These two codes, inserted by the editor, permit the data to be grouped or otherwise manipulated for subsequent analyses.

After keypunching, the data go through a computer edit program that, among other things, checks the addition for each species and counts the total species processed for each route. Any discrepancies are marked for review. Before preparation of State and Province and species summaries, each observer reviews and corrects any errors on a computer printout of the data submitted on his summary sheet.

Computer-generated tables, such as Tables 2 through 4 of this report, provide additional opportunities to detect errors in identification, coding, or keypunching that had not been detected earlier in the process. Finally, for those species that are mapped by computer, any record outside the normal breeding range or any exceptionally high or low number with relation to nearby routes is checked for accuracy.

Machine Listings and Tables

The data from the BBS can be manipulated in many ways. Because of the heavy demand for these data, we describe here the various listings that are customarily produced, together with their usual distribution.

The *Route Listing* is prepared annually for observer verification. One copy is sent to the observer, one to the State or Province coordinator, and another is retained for office use.

In the *State/Province Listing*, species are arranged taxonomically with one line of print listing the summary sheet data for each route. The number of routes included in the summary is given, as well as the mean number of individuals per route of each species for the State. One copy of the State Listing goes to the State or Province coordinator, one is bound and retained for office use, and the third copy is used to answer data requests relating to statewide or provincewide distribution, relative abundance, or population trends.

The *Species Listing* is also prepared in triplicate. One copy is bound and saved for office use; the other two are separated by species and sent on request to persons studying populations of certain species continentwide. Like the two preceding listings, the Species Listing contains the complete record for a year as given on the computer tape. The records are listed alphabetically by State and Province; and the

State and Provincial means are included, as is the species total for that year.

Route Summary. A cumulative summary of the birds that have been counted along each route has been prepared routinely every 2 or 3 years since 1977, and a copy of this summary is sent to the present observer for that route so he will know what species have been found on the route in previous years and inform us of any errors that may be detected. This summary shows the date the route was run each year, the starting and finishing times, weather conditions, the first four letters of the observer's name, and the annual counts for each species. It also gives the name of the route, the latitude and longitude of the starting point, the mean for each species, the total number of species and individuals for each year, and the mean number of individuals for the entire period covered by the summary. It is used by persons who have need for detailed bird population data for specific small areas of the United States or Canada.

State/Province Summary. This summary consists of a series of cumulative tables, one for each species. There is a line in the tables for each route on which the given species has been recorded, and a column for each year covered by the summary. Following the route number, physiographic region (stratum), latitude and longitude and the annual totals and mean are shown for each route. For every year and each State or Province, the total number of individuals of a species is given, and the total number of routes run. The annual mean number of individuals per route (for all routes) and the mean number of individuals per route on which a species was recorded are shown, as are corresponding long-term means. These summary tables are used by researchers interested in distribution, abundance, and trends of one or more species within a State or Province for the entire period covered by the summary.

Species Summary. The species summary is identical in format to the State/Province Summary, but the tables are arranged by species instead of by State. This tabulation is used for studying a species (or group of species) throughout its range or over an area containing several States or Provinces. At present, these three summary tabulations are bound in multivolume sets, and users may request photocopies of specific tables. Because the library of bound BBS volumes now exceeds 500 volumes and is growing at the rate of more than 30 large volumes per year, it may soon be necessary to put most of the older files on microfiche and use alternate means of reproduction.

The 1977 *Totals by Species* are given in Table 1 (Tables 1–5 follow the References). (Nomenclature follows the fifth edition of the A.O.U. *Check-List of North American Birds* [1957] and the 32nd and 33rd Supplements [Auk 90:411–419; 93:875–879].) Similar annual summaries have been published for 1966, 1967, and 1968 (Robbins and Van Velzen 1967, 1969). This table shows the annual sample size for each species in a typical year. These totals are a function of the number of routes covered and are not weighted to compensate for differences in coverage in different States and Provinces or from year to year; consequently, these figures cannot be used to indicate population changes. They are published merely to show the extent to which each species is sampled by the BBS. For example, the Eastern Bluebird is well sampled with 2,000 to 2,500 birds recorded per year, whereas the Western Bluebird is poorly sampled with fewer than 500 birds recorded per year because the sampling density is much less in the West. Of the various birds of prey, the Red-tailed Hawk and American Kestrel (Sparrow Hawk) are the best sampled, whereas the Bald Eagle and most species of owls are poorly sampled. The four species recorded in the largest numbers, Red-winged Blackbird, House Sparrow, Common Grackle, and European Starling, are all conspicuous along roadsides and are common in the Northeastern States where sampling density is the heaviest.

The *State and Provincial Means* for 1965–79 are given in Tables 2, 3, and 4. Annual means for 1966, 1967, and 1968 have been published previously (Robbins and Van Velzen 1969). These tables show the relative conspicuousness of each species in each State and Province expressed in terms of the average number of birds per route rounded to the nearest 0.1. The number of routes on which the average for each State and Province is based is shown at the top of each column. From these tables one can determine immediately which States and Provinces have the greatest breeding densities of the various species.

Statistical Analysis

Statistical programs that analyze the data separately for each physiographic region (stratum) have been developed. Strata for the United States and Canada, together with the code number used for each, are shown in Fig. 1. The strata are identified in Table 5, which also gives the number of routes in each stratum, the total species recorded, the mean number of individuals per route, and the species diversity

index (H′). The area of each stratum within each State and Province has been estimated by planimeter and these areas are used as weighting factors in computing weighted means and standard deviations for each State, Province, and region and for the continent as a whole. The States and Provinces that have been assigned to each region can be identified from Tables 2, 3, and 4.

Two-year Analyses. Annual population changes of 170 of the commonest species have been calculated for each year from 1966 through 1979. These changes have been calculated for each stratum within a State or Province. The mean population for each stratum for each year is multiplied by a weighting factor based on the number of square miles of land area within the stratum to give a weighted mean for each State and Province. The same method is used to calculate means for each entire stratum. These in turn are combined to give weighted means, together with standard deviations and standard errors, for the three major regions and for the continent. The level of statistical significance is indicated for each region and for the continent.

In addition to the 170 individual species, similar analyses are run for groups of closely related species (e.g., herons, flickers, other woodpeckers, hummingbirds, *Dendroica* warblers) to look for trends in some of the less common species.

Similar analyses are performed for certain key habitats by combining data for several species that are typical of a particular habitat, such as pine woods or bottomland forest.

Long-term Trends. The primary goal of the BBS is to detect long-term changes in bird populations, to estimate the rate of change, define the area in which the change is taking place, and, if desirable, suggest ways in which the rate of change may be altered. Traditionally, trends have been computed from annual indices, usually by applying annual ratios over a period of years (Bailey 1967, Erskine 1978). Because the use of ratios tends to exaggerate any large change, particularly when applied over a long span of years, this method has now been abandoned. See "Trend Analysis" (page 13) and Appendix E for details of the alternate method used.

Bias Evaluation

Attempts to monitor bird populations under field conditions are subject to a variety of interacting biases. By standardizing procedures as much as possible, selecting experienced observers, and specifying acceptable weather conditions, many of the potential sources of bias are reduced.

A series of experimental counts in the 1960's in the Northeastern and Southeastern States, in Canada, and in the Great Plains and Rocky Mountains, provided base-line information on the effects of time of day, seasonal variation, and acceptable weather conditions in different geographical and ecological regions. Intensive coverage of 50 Maryland and 10 Delaware BBS routes at a sampling density of 16 routes per 1 degree block of latitude and longitude by members of the Maryland Ornithological Society and Delmarva Ornithological Society in 1965 indicated that the BBS method would be practical and could gain support of amateur field ornithologists.

We are aware of many biases that affect the BBS results (Faanes and Bystrak 1981). Their effects are generally minor, but we are continuing to study them to seek to reduce their effects. Fortunately, most of the bias tends to reduce the ability to detect a change or its magnitude rather than to indicate a false change.

A brief review of potential sources of bias and of efforts to evaluate them or reduce their effects follows.

Weather Conditions

Temperature

Temperature in degrees Fahrenheit is recorded at the beginning and end of each route. During the changeover period from Fahrenheit to Celsius (Canada is already using Celsius temperatures officially), the editors are giving special attention to the temperature blocks on the summary sheet to assure that temperatures are recorded consistently in the same units. When the United States makes the official change to Celsius, all the back records will be converted in a single operation.

Data from experimental BBS routes in Maryland that have been run for many years and by several observers in the same year have been used to study effects of temperature on total species recorded and on numbers of individuals of representative species (Robbins 1981). These preliminary tests have not detected any significant effects of temperature within the range that was experienced on these routes. More detailed analyses are planned, especially to determine if high temperatures cause a greater decline in birds

observed toward the end of the route. To determine the effects of temperature on bird counts, observations are being restricted to relatively small geographic areas to avoid encountering geographic changes in abundance that happen to coincide with geographic changes in mean temperatures.

Wind Speed

Instructions specify that, if possible, the count should be made on mornings when the wind speed is less than 8 mph; the count should not be taken if winds exceed 12 mph (Beaufort 3), except in prairie areas where winds normally exceed this speed. Within this acceptable range we have not yet detected significant correlations between wind speed and total species recorded or numbers of selected species. With higher wind speeds, on the other hand, counts of many song bird species decrease and counts of vultures and hawks increase. Because most routes are run when winds are less than Beaufort 3, we do not make any corrections for wind speed when analyzing BBS data.

Sky Cover

At the beginning and end of each route, sky conditions are coded as either clear, partly cloudy, foggy, drizzle, snow, or showers, by using standard Weather Bureau codes for past weather; codes are supplied with the instructions. Steady rain disqualifies the count except for its value in studying the effect of weather conditions. Showers or drizzle usually do not affect use of the data for statistical analyses.

Effects of fog have not been adequately studied. Sound propagates exceptionally well under calm, foggy conditions, but visibility is decreased and the song period of many species is delayed. Effects of fog on results of a single route may be considerable, but the number of routes covered during foggy conditions is so small that presence of fog is not considered a major problem. Weather conditions are a part of every BBS record so there is ample opportunity for additional study of weather effects on counts of individual species.

Date and Time

Date

Instructions call for routes to be run in June with the following exceptions: in California, Nevada, Arizona, New Mexico, Texas, and Florida routes may be run as early as May at the discretion of the State coordinators. In Canada and bordering States the first week of July is also acceptable. Observers in southern States—particularly in the Southwest—prefer to run their routes in May while many of the permanent resident species are still nesting. This results in recording an unknown number of migrating individuals of other species and may also result in counts being completed before some of the neotropical migrants such as cuckoos have arrived.

To reduce sampling variability as much as possible, observers are instructed to select a date as near as possible to that of the previous year. The U.S. Fish and Wildife Service trend analysis, which is based on a large sample of counts, does not disqualify routes for reason of difference in date as long as they are run within the specified period. Many observers can run routes only on weekends, and some routes, because of traffic conditions or noise of farm or other machinery, should be run on Sundays to gain maximum comparability.

Starting Time

Counts are scheduled to begin at exactly 30 min before local sunrise (or at 0300 h in the far North if sunrise is before 0330 h). Early and late starts are coded as such on the summary forms, but are not disqualified from analysis. In the Canadian Wildlife Service analysis (Erskine 1978), one of the three comparability points assigned to starting and ending time is forfeited if coverage begins more than 10 min before or after the specified starting time; two points are lost by starting 15 to 20 min early or 20 to 40 min late. Greater departures result in disqualification from the Canadian analysis. A late finish also results in a loss of Canadian points. Most routes can be completed in 4 to 4.5 h, but an elapsed time of 6 h results in disqualification from Canadian analysis, because singing activity tends to decrease considerably, or at least to become erratic, as the morning progresses, especially 4 h or more after sunrise (Robbins 1981). It is recognized that some roads, especially in rugged terrain, cannot safely be covered in the specified time, so routes are not disqualified merely on the basis of late completion.

Observers

Number of Observers

Instructions specify that all counting should be done by a single observer, although assistants may be

used as drivers, map followers, recorders, or trainees. The reason for restricting observations to a single person is that two trained observers will invariably find more birds than one person working alone, and on most routes two observers cannot be provided. We have suspected that some assistants have contributed to the counting. Unfortunately, this procedure is impossible to control except by honesty on the part of all observers. We can only stress the importance of comparability and ask that participants adhere strictly to all rules.

Experience

No two observers have the same experience and capability. We are extremely fortunate to have a large number of very competent and experienced field ornithologists participating in the BBS. The very nature of the survey requires a good working knowledge of birds of the local area and the ability to identify them by both sight and sound. Erskine (1978) found that the total number of birds reported on BBS's increased in the second year of an observer's participation. The amount of increase varied geographically between 3 and 11%. In a similar study in Maryland the increase was only about 2%. This factor is no doubt a result of the observer's unfamiliarity with the technique on the first run. We prefer to have the same observer run a route for many years to reduce observer bias. The Canadian comparability code assigns three points when the same observer participates in successive years. The route is excluded from comparison the first year it is run by a new person. We have tested the effects of changing observers (Faanes and Bystrak 1981) and have concluded that the increased sample that results from using all routes results in less variability than the smaller sample of counts conducted by the same observers.

Advancing Age

A gradual reduction of hearing acuity, especially in the upper registers, may start as early as age 30 and becomes much more pronounced after age 60. Most observers realize when they are beginning to have problems with hearing or vision and every year some observers write that for these reasons they must give up their BBS routes. Initial awareness of loss of acuity is not in itself reason for giving up a route, because long experience often permits one to achieve better performance despite physical handicaps. An observer who is becoming aware of problems with vision and hearing should take along a trainee to ultimately take over the route when he becomes more proficient than the first observer. With a fairly constant percentage of routes changing hands each year, it is unlikely that a serious bias will result from the symptoms of advancing age.

Identification

Misidentification

Contrary to initial reaction of many people, we do not consider misidentification a serious problem in the BBS. It is true that observers vary greatly in training and experience and that many of them run routes that, at least initially, are in unfamiliar territory. From a large number of comparisons (among routes, years, and observers on the same route in the same year) we believe that the number of misidentifications is so small as to be negligible except in those instances in which a bird is reported outside its normal range. These instances are brought to our attention when tabulations are prepared by a State or Province or when maps are generated by a computer. The original records are then checked for supporting evidence or comments and, if necessary, the observer is contacted. It is highly desirable that observers be familiar with breeding ranges of birds in their area so they will include verification of unusual records.

Species Not Recognized

A fairly common species that is not recognized by an observer is a much greater problem than a misidentification, because when a zero or a very low count appears in a series of higher counts it greatly increases the variance of the sample. When we become aware that a species that should have been present has not been recorded, we may send an inquiry to the observer. For a new observer we often enclose a copy of the results of that route from a preceding year. In most instances observers appreciate knowing if they have missed a species, and they make a special effort to become familiar with these birds.

Number of Species

There has always been a place on the summary sheet to record the total number of species observed on the route. In the early years of the survey the total species did not become a part of the computerized record because it was considered only of passing interest. More recently the species total has become a

part of the record that has been used routinely in part of the machine edit program. The number of species observed is never in itself used to accept or reject a report. In some arid areas of the West a report containing only 15 species may be acceptable, whereas in some parts of the Northeast a report of 50 species may indicate that an observer is missing some common species (Faanes and Bystrak 1981). We discourage observers from striving for a large species list at the expense of detecting as many individual birds as possible. The BBS is not intended to be a competitive game, as are some forms of bird counts. Year-to-year comparability is much more important to us than the number of species detected.

Birds Detected

Random Roadside Sampling

Some observers express concern over their inability to find, during their 3-min stop, a bird that they know was present. The BBS is not designed to give a complete count of what is present at any stop; rather, it provides a brief sample of the species and the total number of individuals present within each circle of 400 m (0.25 mile) radius. We have conducted several confidential tests that demonstrate that even observers experienced in the BBS technique are unable to detect all the birds that are calling or in sight during the 3-min period.

In one study, a tape recorder kept a continuous record of birds audible from a given spot before, during, and between several 3-min visits by the observer. When the tape was played back the observer heard several birds that he had not detected previously, or at least had not tallied on his field sheet.

In another study, three different pairs of observers simultaneously counted the birds on a single BBS experimental route on different days and compared notes at the end of the route. Observers were evenly matched and had almost identical species totals for the entire 50 stops. Yet, when the results of individual stops on the first day were compared, there was no stop at which the two people observing simultaneously had recorded the same combination of species. On the second attempt, the results were the same. It was not until the third day that identical species lists were obtained at 2 of the 50 stops. Often as many as one-third of the species detected by one observer will be missed by the other. This variability in detection does not in any way detract from the validity of the survey; it simply stresses that the survey is recording only a sample of the species that are present, much the same way a political poll samples only a small portion of the public.

Nonbreeding Birds

An important source of bias is the failure of the BBS method to distinguish between breeding birds and unmated individuals. This fault is shared by almost all other forms of bird censusing and monitoring, and for some species may have serious implications. In many instances a nonbreeding bird may sing more persistently than a mated bird, especially if the nesting season is well advanced. Although a sample of the breeding bird population of most species along the route is included in the BBS sample, an unknown number of unmated birds also is sampled—perhaps better sampled than the breeding individuals. Thus, for some species the trend being detected may be largely a trend of unmated birds rather than of the breeding populations. This is a problem that remains unaddressed for most North American species. When more becomes known about the habits and relative abundance of unmated birds, it may be necessary to reexamine in detail certain portions of the BBS records, such as only records from the first 10 stops or only those routes covered during a brief period at the peak of the breeding season of a particular species.

Threshold of Abundance

For any common species identified by song, there is a threshold number of individuals beyond which the observer cannot detect the presence of additional individuals. For example, one might see all the Turkey Vultures within a 400 m (0.25 mile) circle or hear all the crows in the same area, but it would be impossible to distinguish 50 singing Red-eyed Vireos at a stop in an area of continuous mature forest. When an abundant species reaches the point of vocal saturation, the observer may be incapable of detecting a large increase or decrease at stops where the species is abundant. Change in abundance of common species may still be detectable, perhaps by making comparisons only with those stops at which numbers are small enough to show variations between years. This subject is being given further study.

Fledged Young

For crows, starlings, blackbirds, and other early-nesting species of open country, a problem is often

introduced by the presence of young fledged birds on the wing. For many species it is not possible for the observer to distinguish between young and adult birds, especially when the birds are seen at a distance. For uniformity we have asked that all birds identified be counted, with the exception of downy chicks, broods of small ducks, and other obvious family groups. This bias can be reduced in part by scheduling coverage on as nearly the same day as possible each year, perhaps by making adjustments for lateness of the breeding season when it is possible.

Recordkeeping

Recording in the Field

Several methods are used for recording birds in the field, depending on the preference of the observer. The majority of observers record their tallies directly on the field sheets that are furnished, which is encouraged because these sheets simplify the editing process. It is therefore important that observers become familiar with the field sheets. Some observers have trouble locating bird names on these sheets and have asked for blank forms on which to write in the names of the birds that they see or expect to see. Such blank forms are furnished on request. We do not specify how the birds are to be recorded, but only that a separate tally by species be maintained for each of the 50 stops and that the original field sheets be submitted. Some observers prefer to dictate their birds to an assistant, others prefer to write down the birds themselves. Some prefer to use a tape recorder for dictation. This method has the most shortcomings—it is not only tedious to transfer the data, but transcription errors are easily made, tape recorders can malfunction, and original field data can never be verified. Each method has advantages and disadvantages; therefore, although we strongly encourage the use of our field sheets, we allow a wide variety of recording procedures.

Copying and Summarizing

Instructions ask that the original field sheets be submitted along with the summary sheet because transcribing errors are frequent; numbers on the summary sheets may be put in the wrong column, on the wrong line, or even omitted. Upon receipt, the field sheets are routinely checked against the summary sheet to detect transcribing errors before the summary sheets are keypunched. In the early years of the BBS line-by-line editing of the summary sheet against the field sheets was not attempted, but because of the number of errors found in recent years, we are closely reexamining data from earlier years for errors.

Changes in Routes

Impassable Roads

Over a period of years many observers have encountered roads or bridges rendered impassable by construction, storm damage, or weather conditions. For this reason the instructions give details on dealing with such emergencies, with emphasis on maintaining stops in the same locations as previously. This ensures that alterations in the route will be uniform and that they will not be biased by observer preference. Observers are encouraged to contact us, whenever possible, about alterations before the route is run.

Marking Individual Stops

Observers are requested to mark on their maps (which are returned to the Patuxent Wildlife Research Center at the close of each season) the exact position of each stop so that observers covering the route in the future will know where each stop was made. If the map provided does not lend itself to stop-marking, a list of stop descriptions is recommended. To get comparable results, each stop should be as close to the same position as possible each year. Odometers vary and slight changes in roads may also alter the mileage; hence, recording landmarks for each stop or marking the position directly on the field map is important.

Number of Stops and Minutes Spent at Each Stop

We still adhere to the original procedure of counting for 3 min at each of the 50 stops. Because bird activity decreases gradually toward the end of each route and many observers are fatigued by 50 stops, the question of whether it would be preferable to limit the routes to 30 or 40 stops instead of 50 has been raised. A large sample of routes was examined by 10-stop increments to determine not only the effect of increase in sample size, but also to measure the effect of greater variability toward the end of the 50-stop coverage. It was found, however, that the increased sample size more than compensated for any

increase in variability in later stops. A few routes have been extended experimentally to 60 or 70 stops or even more, but the sample of extra long runs is not sufficiently large to analyze. Without data to demonstrate any advantage of increasing the number of stops, and in consideration of the fatigue factor, no thought has been given to extending the routes beyond the present 50 stops.

Another study resulted from a suggestion that some observers might require more than 3 min to sample a stop adequately. Admittedly, all of the pre-BBS testing was done by experienced observers, so we were eager to run a test to compare results of 50 3-min stops with those of 25 5-min stops on the same route, using both experienced and new observers. In this test, three pairs of observers were used on the same route on different days; all six observers were able field ornithologists, but one member of each pair had had considerable experience running BBS routes and the other had none. Each pair of observers simultaneously ran the experimental route both ways: 50 3-min stops on 1 day and 25 5-min stops another day. When the results were compared, both the experienced and inexperienced observers had recorded more birds with less variability on the standard 50 3-min stops.

In view of the time and expense of driving to a BBS route we are anxious to obtain the best sample of data from that route. Tests thus far have favored the 50 stops of 3 min each that were originally determined to provide the best sample. We are well pleased with the performance by this method, but will continue to test other methods.

Coaxing of Birds

Any method of coaxing birds at a BBS stop is not in keeping with the goals of the survey. Again, we must rely on the honesty of our observers in this matter. "Spishing," "squeaking," and tape playbacks have become very popular in recent years, but, as far as we are aware, observers are not using these methods to encourage response from birds on BBS routes and we continue to strongly discourage it.

Species Poorly Sampled

Although most species with broad geographic distribution are well sampled by the BBS, species that are rare, very local, nocturnal, restricted during the breeding season to high elevations or high latitudes, or are limited to two or three States are not likely to be encountered in sufficient numbers to permit close monitoring by this survey. Likewise some of the colonial nesting species, especially colonial seabirds, cannot be detected from randomly distributed roadside counts. Examples of undersampled species are loons, grebes, pelagic birds, pelicans, cormorants, anhingas, spoonbills, swans, condors, chachalacas, ptarmigans, rails, oystercatchers, arctic nesting shorebirds, some of the gulls and terns, skimmers, the alcids, the tropical doves, anis, the scarcer owls and goatsuckers, southwestern hummingbirds, trogons, tropical kingfishers, endangered species, and birds whose North American breeding range is restricted to Alaska.

Some of the endangered species and colonial waterbirds are monitored periodically by special surveys. BBS methodology, or a modification thereof, could be used on an intensive local scale to monitor many of the other species.

Improvements in Editing and Analysis Techniques

Stratification

Each bird species has its own geographical limits. Within these limits are several zones of abundance representing availability of favored habitats. Mountainous areas tend to be made up of easily recognizable zonal boundaries that result from differences in temperature, precipitation, or wind speed. Typically the abundance of many species of birds changes abruptly across such boundaries. In flat country the boundaries are more obscure or in many instances irregular, often extending for many miles along a stream valley where differences in soil type or moisture support habitats not found a short distance on either side of the stream.

Because bird distribution and abundance, particularly in the breeding season, is so strongly influenced by habitat, we have chosen to use physiographic rather than political boundaries as the major divisions of the North American continent when analyzing BBS results. Our physiographic boundaries (Fig. 1) are based largely on Aldrich's (1963) map of life areas of North America. There have been many minor adjustments in stratum boundaries. Such refinements in the United States have come largely from "Natural Land Use Areas of the United States" published by the Bureau of Agricultural Economics, USDA (1933); "Physiogeography of Eastern United

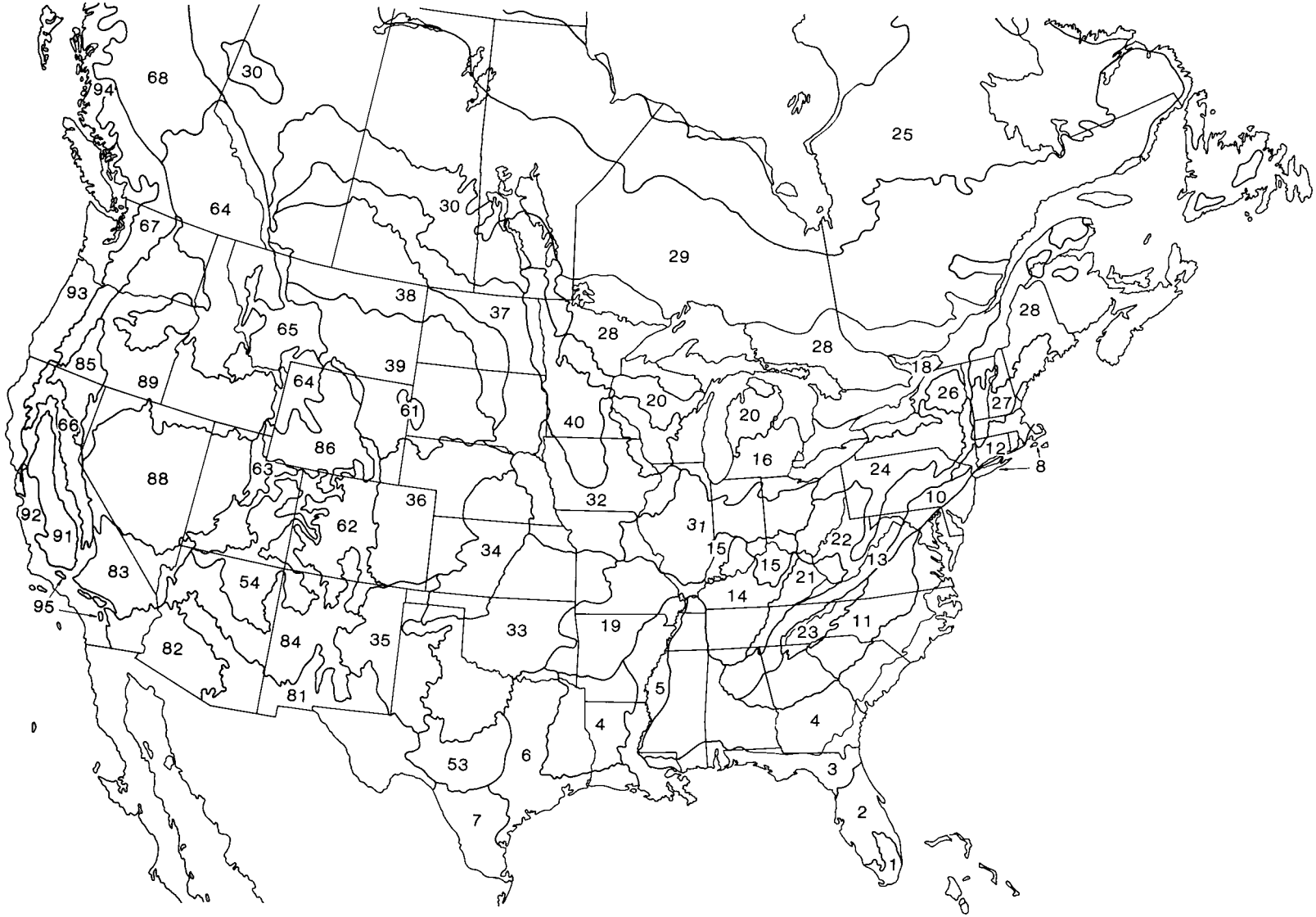


Fig. 1. Breeding Bird Survey stratum boundaries (*see* Table 5 for stratum names).

States" by Fenneman (1938); "Potential Natural Vegetation" by A. W. Küchler (1965); and various publications for individual States. Canadian boundary refinements have come from A. J. Erskine (1978) of the Canadian Wildlife Service and from published maps of individual Provinces.

Trend Analysis

The statistical methods used to analyze the BBS, which have been discussed elsewhere (Robbins et al. 1980; Geissler and Noon 1981), are summarized here. The proportional base year adjustment has often been used to estimate trends over a period of years when it was necessary to adjust for the effects of routes that could not be run every year. We did not use this adjustment because it has been shown to give misleading trends when many of the routes are not run every year. Instead, a proportional trend was estimated for each route by using linear regression on logarithmic trend transformed data. No adjustment for missing data was necessary because a linear regression can be used whenever two or more yearly counts are available on a route. The route trend estimates were weighted by (1) geometric mean counts on the route to estimate the trend of the bird population in an area, (2) a function of number and spacing of the years the route was run to reduce the variance of the trend estimates, and (3) the area represented by each route so that equal areas have equal influence, other factors being equal (see "Slope on logarithmic scale, weighted to reduce variance" *in* Geissler and Noon 1981).

Annual mean counts were used to depict the dispersion about the fitted trends and show possible systematic departure from these trends. These mean counts on all routes run (including those not in the bird's range) in a particular year were weighted by land areas (see "Annual means" *in* Geissler and Noon 1981). Thus the annual mean counts represent a species average density, not the density within suitable habitat. See Appendix E for details of the weighting procedure.

Bird Population Trends

Many of the more interesting species have been selected for discussion of population trends, with emphasis on common species and those for which some especially interesting trend has been recognized.

On each graph the annual weighted means appear as black dots, black squares, or black triangles representing the Eastern, Central, and Western regions, respectively, and as open circles to indicate continental means. For some species, trends appear for additional geographic subdivisions, such as States or strata (see Fig. 1 and Table 5).

For selected species, the 95% confidence limits are indicated, paralleling the mean counts for the individual years. When mean counts are so similar among the different regions that the symbols would overlap appreciably, only the labeled trend lines are shown.

The trend lines are computed as indicated in Appendix E. They closely resemble regression lines drawn from the annual means but, in fact, were computed independently of the annual means. The most conspicuous departures of the trend line from the annual means occur in the very early years of the survey when only small samples were available.

The trend lines for the Eastern region start in 1966, the first year the entire region was covered by the survey. Trends for the Central region start in 1967 and those for the Western region and for the continent start with 1968. None of the trends have been projected backward to years before the survey was conducted in that portion of the continent.

Increases or decreases are indicated as "significant" when the analysis indicates a probability of 95% or more that the trend was real rather than a result of chance alone. Thus the possibility is slight that any particular trend reported here as significant actually was not. Where small sample sizes are involved it is also possible that operational factors such as change of observers, an increase in environmental noise, a gradual increase in expertise of observers, or a gradual loss of hearing acuity could produce an artificial change in the counts. For these reasons, no change was considered significant unless it was based on at least 15 BBS routes.

Rather than repeating the word "significant" in the text, it is used rather sparingly, and is reserved for emphasis where it is needed. When it is stated that a change took place it means a change significant at the 95% level of probability. The word "tendency" is used to designate a change that is not statistically significant.

The three BBS regions are the Eastern region (all States and Provinces east of the Mississippi River), the Central region (between the Rocky Mountains and the Mississippi River), and the Western region (the rest of the continent north of Mexico but excluding Alaska).

The seven subregions referred to in the text are the six U.S. Fish and Wildlife Service Administrative regions as defined in 1979, plus Canada. The "Far Western States" are the three Pacific States plus

Nevada and Idaho. The "Northern Plains States" are Montana, North Dakota, and Iowa south through Utah, Colorado, Kansas, and Missouri. The "Southwest" comprises four States: Arizona, New Mexico, Texas, and Oklahoma; the "Southeast" contains Arkansas, Kentucky, and North Carolina south to the Gulf Coast. The "Great Lakes States" are Minnesota, Wisconsin, Michigan, Illinois, Indiana, and Ohio. The "Northeastern States" are from West Virginia and Virginia north through New York and New England.

When significant trends for a species were detected for an individual State or Province, and at least 15 routes in the State or Province had recorded that species, the trend is mentioned in the text, with the States or Provinces grouped geographically to emphasize the portions of the Continent where the change was most noticeable.

Population changes are potentially most serious when they occur in areas of greatest nesting density. For that reason, and also as a matter of general interest, the strata, States, and Provinces with the highest mean counts for each species are listed in sequence of decreasing abundance. For any species, knowledge of the preferred strata gives more insight into the requirements of the species than does a comparison of relative abundance among States or Provinces. In the text, the strata are referred to by the names in Table 5 rather than by the numerals in Fig. 1. States and Provinces that lie primarily within a single stratum (Nova Scotia, New Brunswick, and Oklahoma) tend to have more species with high counts than do the more diverse areas (Colorado, New York, and Ontario). States along the Mexican border are an exception, however, because of the presence of unique species that do not breed in the more northern States.

For geographic comparisons of relative abundance within a species, see the State and Provincial means in Tables 2, 3, and 4, which include all species that reached a mean count of 0.5 or more birds per route in one or more States or Provinces.

Birds Observed

Herons and Egrets (Fig. 2)

Native colonial herons. Colonial nesting herons are not easily monitored by the BBS because the colonies are locally distributed, are often far from roads, and because the number of individual birds seen on a given route varies greatly from year to year. We therefore examined the heron data in three ways: by analyzing the numbers of each species observed, by analyzing the number of stops at which each species was detected, and by combining all native colonial herons for studying the trend of heron colonies as a whole. The first pair of charts at the top of Fig. 2 shows the trend for all native colonial nesting herons combined, based on number of individuals. All heron species except the Cattle Egret, Green Heron, and the two bitterns are included in these trends. As can be seen from the graphs, the trend lines are virtually flat in all three regions and for the continent as a whole. A few trends become apparent when these counts are broken down by strata. A significant decrease was detected for the southern portion of the Upper Coastal Plain, and there were significant increases for the adjacent southern portion of the Lower Coastal Plain and for the Allegheny Plateau, Southern New England, the St. Lawrence Plain, the Great Lakes Plain, the western portion of the Spruce–Hardwood Forest, and the Central Valley of California.

The Little Blue Heron, with a decrease in the Eastern region, was the only species that showed a significant change in any of the three Regions other than those for which separate graphs were prepared. This decline was significant in both the Northeastern and Southeastern States. Other changes detected by subregions or States were a decrease in Great Egrets in the Southwestern States, a decrease in Black-crowned Night Herons in the Northern Plains States but an increase in the Northeastern States, and a continental increase in White Ibis. The only significant changes in individual States and Provinces were a decline in Little Blue Herons in Alabama, an increase in Yellow-crowned Night Herons in Louisiana, and a decrease in American Bitterns in New Brunswick and New Hampshire.

Trends based on number of stops at which colonial species were observed rather than on the number of individuals seen reduces the year-to-year variability and makes it possible to detect changes in distribution that were obscured by the more variable counts of individual birds. This analysis detected an increase in Least Bitterns in the Eastern region and of White Ibis in the Central region, and it detected the same changes for individual States that were found in the other analysis.

Great Blue Heron. The Great Blue Heron showed a significant increase in the Eastern region, where it was recorded on 753 routes, with a significant increase in the Northeastern States. Illinois was the

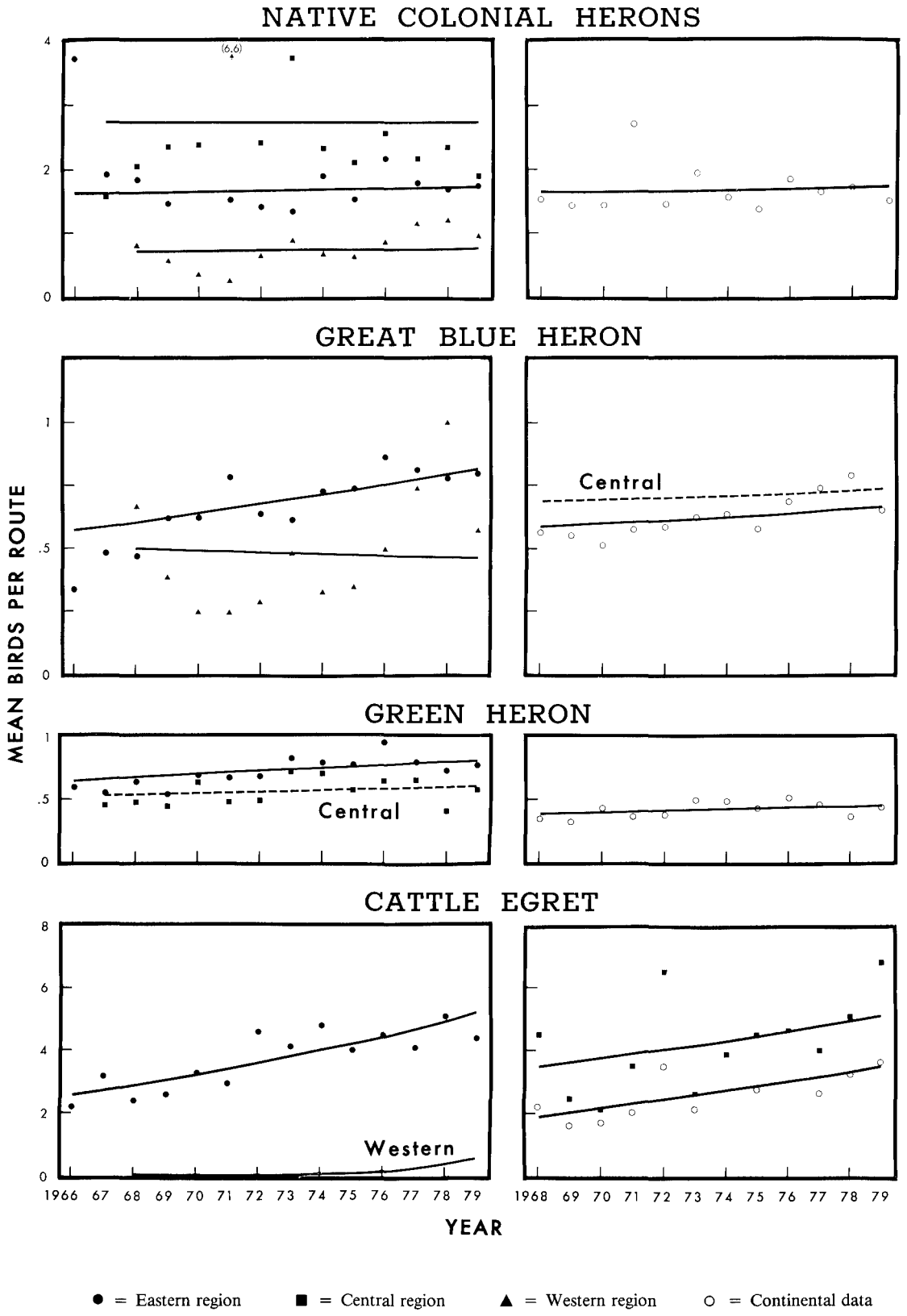


Fig. 2. Trends in heron populations.

only State with a significant decrease, but there were significant increases in Ontario and New Brunswick, and in Oregon, Arkansas, Alabama, Ohio, and New York. The only stratum with a significant decrease was the Drift Prairie, whereas there were increases in the Central Valley of California, the Great Lakes Plain, St. Lawrence Plain, the eastern portion of the Spruce-Hardwood Forest, the Allegheny Plateau, and the southern portion of the Lower Coastal Plain. Numbers detected were greatest on Prince Edward Island and the Florida Peninsula.

Green Heron. The Green Heron showed slight but significant increases in the Central and Eastern regions and also for the continent. There was also a significant increase in the Great Lakes States near the northern limit of the breeding range. No single State or stratum showed a decline for this species, but there were increases in the western portion of the Great Lakes Plain, the central and southern portion of the Upper Coastal Plain, the southern portion of the Lower Coastal Plain, and in California, Texas, Mississippi, Alabama, and Wisconsin. The strata with the highest average counts were the Florida Peninsula and the western portion of the Upper Coastal Plain. Florida and Louisiana had the highest State means.

Cattle Egret. The Cattle Egret, a native of Africa, is believed to have spread into Florida from South America by way of the West Indies. It was first recorded in May 1948 at Clewiston, Florida, but not recognized as an invading species until 4 years later (Sprunt 1953, 1955). Cattle Egrets are still spreading and increasing significantly in the Eastern region and throughout the continent. The increase for the Central region (Fig. 2) was nearly as strong as that in the Eastern region and was significant when the data were analyzed by number of stops, but not when analyzed using total individuals. There was a recent sharp increase in numbers in the Western region (Fig. 2) but the number of routes claiming this species is still very small (five) so the trend is not considered significant. There is every indication that the spectacular spread and increase in numbers will continue. Bearing in mind that the Cattle Egret may be more conspicuous to roadside BBS counters than are other species of herons, it is of interest that in the Eastern and Central regions and for the entire continent, the number of Cattle Egrets recorded exceeded the number of all the other herons and egrets combined. By strata there were significant increases in the Mississippi Alluvial Plain and throughout the Upper and Lower Coastal Plains. The analysis by stops also showed a significant increase in the Florida Peninsula and in the East Texas Prairies. The only significant increases by States were in Louisiana, Mississippi, and Alabama. The highest means were in the Florida Peninsula and in Louisiana.

Waterfowl (Fig. 3)

Because breeding ranges of many waterfowl species extend into the far North where they are not sampled by the BBS, we have selected only four of the more southern nesting species for comment. We have also included two graphs showing trends for all waterfowl in the geographic area sampled by the BBS.

All waterfowl. The data presented in Fig. 3 are the summations of counts of all waterfowl species. Because the Mallard is by far the commonest species in this area, numbering nearly half of the total waterfowl observed, it has an undue influence on the trends for all waterfowl. On the basis of a sample of 981 routes in the Eastern region on which waterfowl were recorded and 1,725 routes for the continent, increases registered were significant. The apparent upward trend for the Central and Western regions is not statistically significant. There was not a single stratum in which a significant decrease in waterfowl was recorded. Those strata with the greatest significant increase were the southern Rocky Mountains, the Black Prairie, the Till Plains, the Great Lakes Plain, the St. Lawrence Plain, Southern New England, the Northern Piedmont, and the Highland Rim. There was no significant change in the strata of greatest abundance—the Glaciated Missouri Plateau, the Drift Prairie, and the Aspen Parklands.

Mallard. A significant increase in the Eastern region was sufficient to cause a significant upward trend for the continent. There was not a single stratum that recorded a decrease, but 13 showed significant increases. The States and Provinces with significant increases were California, Manitoba, Minnesota, Illinois, New York, and Maryland. Areas of greatest density were the Missouri Plateau, the Aspen Parklands, and Saskatchewan.

Black Duck. The significant increase in Black Ducks in the Eastern region and for the continent was strongly influenced by an increase in New Brunswick, which is the area of greatest abundance and the only single area showing a significant increase. Because very few routes in the Central region reported this species, the slope for the continent is essentially the same as that for the Eastern region.

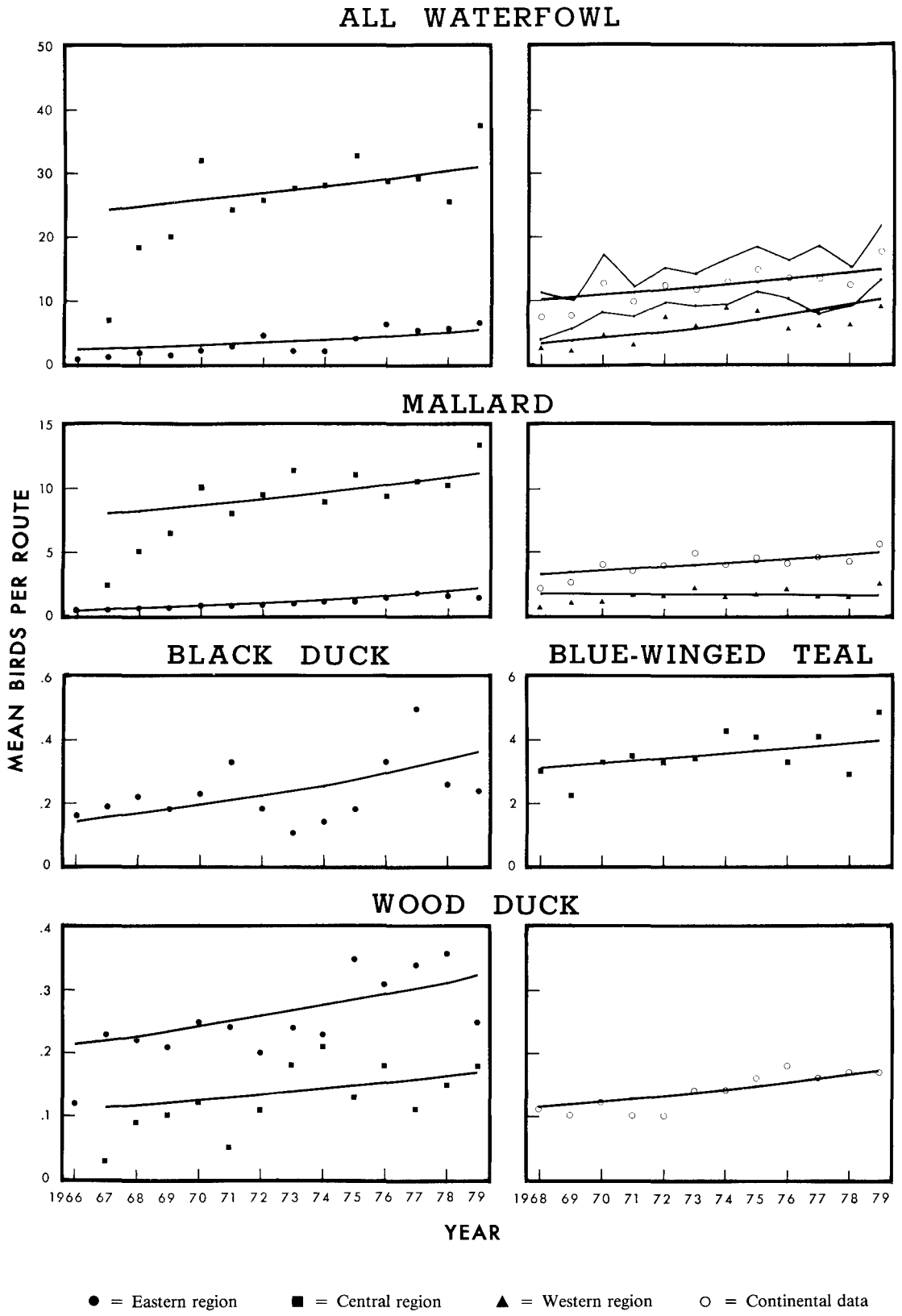


Fig. 3. Trends in waterfowl populations.

Blue-winged Teal. The only significant regional change for the Blue-winged Teal was in the Central region, which recorded an increase. There were increases in the St. Lawrence Plain, the Aspen Parklands, and Saskatchewan. There were no significant decreases. The Drift Prairie had by far the densest population; Saskatchewan had the highest concentration of any State or Province, followed closely by North Dakota.

Wood Duck. This cavity-nesting species had significant increases in both the Eastern and Central regions as well as for the continent. The only stratum to show a decline was the northern section of the Lower Coastal Plain in the Carolinas. Local areas of increase were widely scattered throughout the breeding range, with no particular pattern. The highest densities reported were in the Mississippi Alluvial Plain, the Florida Peninsula, and Minnesota.

Vultures and Hawks (Figs. 4 and 5)

Turkey Vulture. Although the Turkey Vulture has been placed on the Audubon Society's "Blue List" of declining species that deserve special attention (Tate 1981), the BBS indicates that populations of this species are stable. The annual means for the Western region are not shown in Fig. 4 because of some overlap with the continental means. There was no significant change in any of the three regions. The only subregion showing a change was the Great Lakes States, which recorded an increase. The only sign of a decrease was in the Florida Peninsula, resulting in a significant decline for the State. The only State recording an increase was Wisconsin. The Turkey Vulture reached its greatest abundance in the Edwards Plateau, followed closely by the South Texas Brushlands. Black Vultures (not illustrated) also are maintaining their populations, with no regional or State decline detected.

All hawks. Because many species of hawks are not found in numbers large enough to make it feasible to compute trends, all hawk observations were combined to obtain a trend for the total population of hawks. More than half of the hawks recorded on the BBS are either Red-tailed Hawks or American Kestrels; thus trends in these two species have an overriding effect on trends for total hawks. Although Fig. 4 shows a significant increase in hawks in both the Eastern and Western regions and across the continent, the rate of increase in the West and for the continent was considerably lower than the increase in Red-tailed Hawks and American Kestrels, indicating a net decline for the other species of hawks. Only in the Eastern region was the slope for all hawks similar to the combined slope for Red-tailed Hawks and kestrels. No stratum showed a significant decline for total hawks, whereas increases occurred in the Central Valley of California, the Columbia Plateau, the western portion of the Spruce–Hardwood Forest, the Great Lakes Transition, the western portion of the Great Lakes Plain, the St. Lawrence Plain, Southern New England, the Northern Piedmont, the Upper Coastal Plain, and the Ohio Hills and Allegheny Plateau. The only stratum showing a decline was the Till Plains. Hawks reached their greatest abundance in the Central Valley of California.

Mississippi Kite. Based on data obtained from the 93 routes on which Mississippi Kites have been recorded 2 or more years, kite populations were stable throughout their range. The center of abundance was in the Osage Plains, and Oklahoma had the highest State mean.

White-tailed Kite. A significant increase in White-tailed Kites in the Central Valley of California, the area of greatest abundance, was largely responsible for a significant upward trend in the Western region.

Cooper's Hawk. The decline noted by hawk watchers over the last several decades may have reached its low ebb during the period covered by the BBS, as populations now appear to be stabilized. There was much overlap among yearly means for the three regions, so the means were not plotted in Fig. 4. Unfortunately, Cooper's Hawk was observed on so few routes in any one State or stratum that not a single area had a statistically significant change. The number of strata reporting a positive slope was 23 as compared with 24 negative slopes. The highest densities were recorded in the California Foothills and in Idaho.

The Sharp-shinned Hawk (not illustrated), like the Cooper's Hawk, showed no statistically significant trend for the three regions. It showed increasing tendencies in 23 strata compared with decreases in 20, but the only significant changes were an increase in the western portion of the Spruce–Hardwood Forest and in California. The highest recorded densities for the Sharp-shinned Hawk were in the Canadian Rockies, the Cascade Mountains, the Allegheny Plateau, Montana, and British Columbia.

Red-tailed Hawk. This hawk showed a significant increase in the Eastern and Western regions and for the continent. Illinois had the only State decrease, whereas there were significant increases in nearby

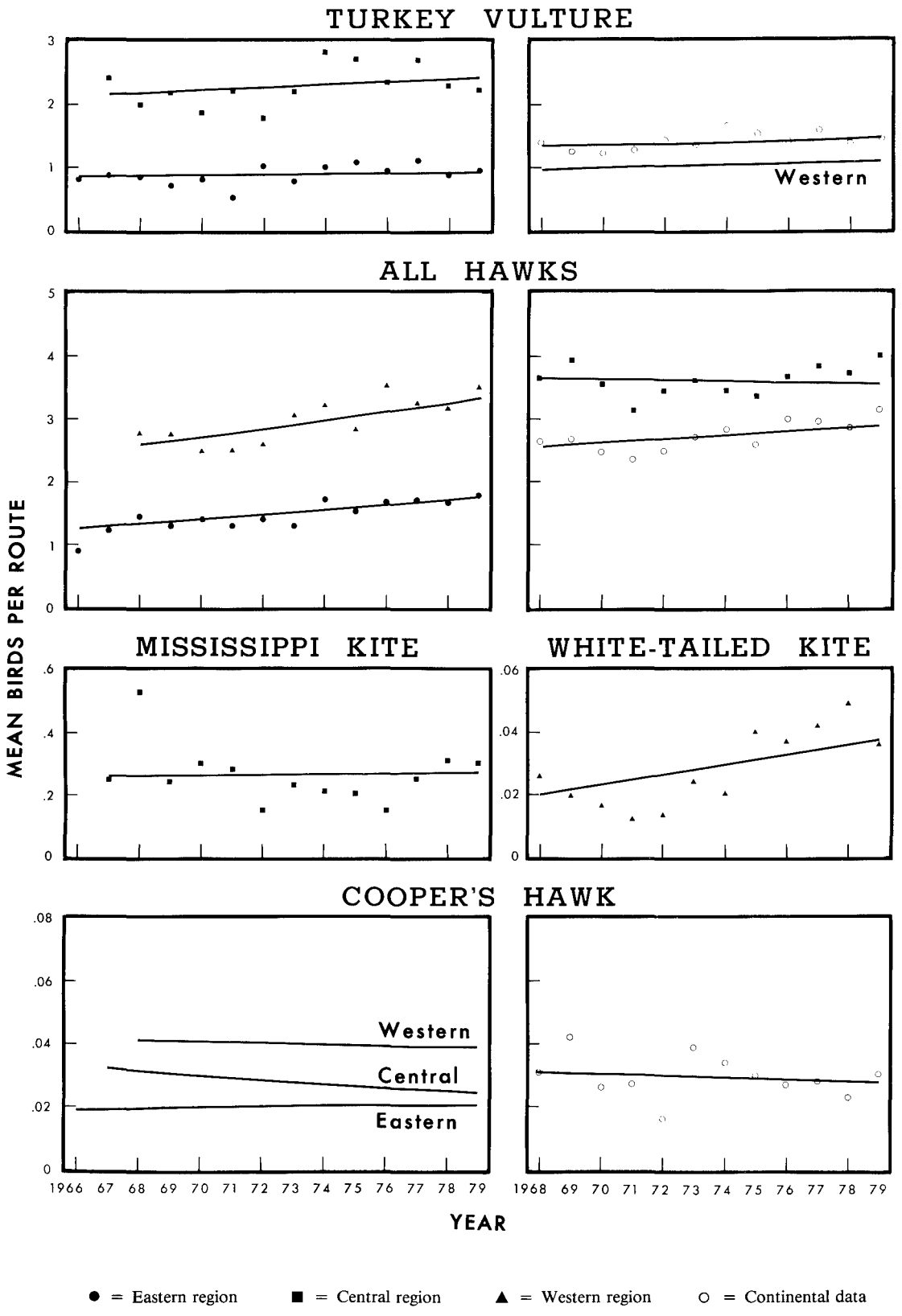
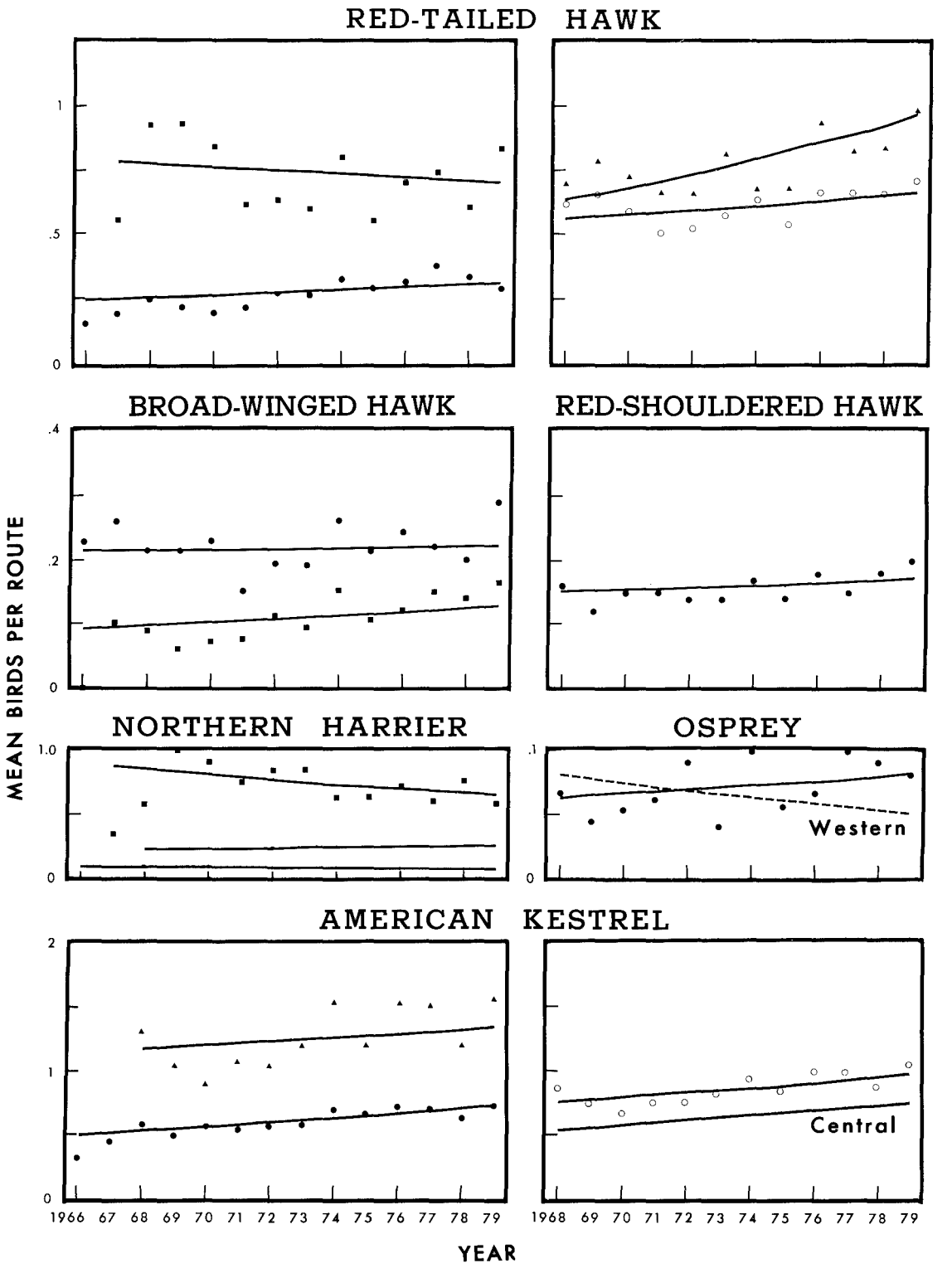


Fig. 4. Trends in vulture and hawk populations.



● = Eastern region ■ = Central region ▲ = Western region ○ = Continental data

Fig. 5. Trends in hawk populations, part 2.

Ohio, Kentucky, Wisconsin, and Minnesota, as well as in California and British Columbia. As can be seen in Fig. 5, populations in the Eastern region were only about half as great as in the Central and Western regions. The highest density by far was in the California Foothills.

Broad-winged Hawk. This species registered a significant increase in the Central region and for the continent (not shown), and there were increases for New York and Massachusetts. The strata with the highest average birds per route were the western portion of the Spruce–Hardwood Forest and the Adirondack Mountains. Rhode Island and New Hampshire had the highest density for this species.

Red-shouldered Hawk. Red-shouldered Hawk populations were stable in all three regions, with only a few significant changes in southeastern strata—an increase in the Upper Coastal Plain and the Southern Piedmont, and a decrease in the Highland Rim. Increases were registered in Alabama, Tennessee, and North Carolina; there were no State decreases. The highest average densities were in the western portion of the Upper Coastal Plain and in Florida.

Northern Harrier. The Northern Harrier registered significant declines for the Eastern and Central regions, but the decrease was offset sufficiently by a slight rising tendency in the Western region so that the continental trend (not shown) was not significant. By subregions there were significant declines in the Southwestern and Northeastern States. All three significant changes by strata were declines, occurring in the Osage Plains, the High Plains Border, and the High Plains. By State this same area showed significant declines in Texas, Oklahoma, and Kansas; a decrease occurred in Minnesota, but an increase occurred in nearby Wisconsin. Highest abundances were in the Glaciated and Unglaciated Missouri Plateau and the Central Valley of California. The Provinces and State with the highest average number of birds per route were Saskatchewan, North Dakota, and Alberta.

Osprey. Ospreys were not common enough in any part of their range to show statistically significant changes. After having experienced a population slump in the Eastern region, however, the present tendency toward higher numbers there is encouraging, although this is offset by a downward tendency in the Western region. Fifteen strata showed positive slopes compared with nine negative slopes. The highest average counts came from the Florida Peninsula and Delaware.

American Kestrel. This common raptor appears to be doing well in all three regions. The continental and regional upward trends are significant except in the Western region, where the annual means are more widely scattered. By subregions the upward trends are significant in the Great Lakes States and the Northeastern States. No stratum showed a significant decline, but 11 showed increases. By State there were increases in Montana, Oregon, Minnesota, Wisconsin, Ohio, Pennsylvania, and Tennessee. Two isolated States showed decreases—Arkansas and Illinois. The Central Valley of California had by far the highest density, but on a statewide basis California was second to Idaho.

Gallinaceous Birds (Fig. 6)

Ruffed Grouse. The cyclic nature of Ruffed Grouse populations makes it unlikely that the BBS would detect a significant trend over a 14-year period by fitting the data to a logarithmic curve (Fig. 6). The only significant trend detected was a decline in the Far Western States. Greatest density was in the Great Lakes Transition and the Aspen Parklands, and in Alberta and British Columbia.

Sharp-tailed Grouse. This species showed a hint of a decline in the Central region, which is the only area in which it occurred in appreciable numbers. The decline was also not significant for any subpopulation of the species. The Missouri Plateau, especially in North Dakota, held the highest density of Sharp-tailed Grouse.

Bobwhite. The Eastern regional trend for the Bobwhite, together with 95% confidence limits, demonstrates the immediate effect of the cold winters of 1976–77 and 1977–78. The decrease in the Eastern region, including the Great Lakes States, the Northeastern States, and Southeastern States was significant, and a decrease also occurred in the Northern Plains States; however, a significant increase occurred in the Southwestern States. The magnitude of the several declines resulted in a significant decrease for the continental population. Fourteen strata showed significant decreases compared with only two that showed significant increases. The only State showing an increase for the period was Texas, but there were 15 States with significant decreases: Kansas, Missouri, Illinois, Indiana, Kentucky, Ohio, Michigan, New York, Pennsylvania, Maryland, Virginia, the Carolinas, Tennessee, and Mississippi. By strata the outstanding abundance was in the South Texas Brushlands. There were also several

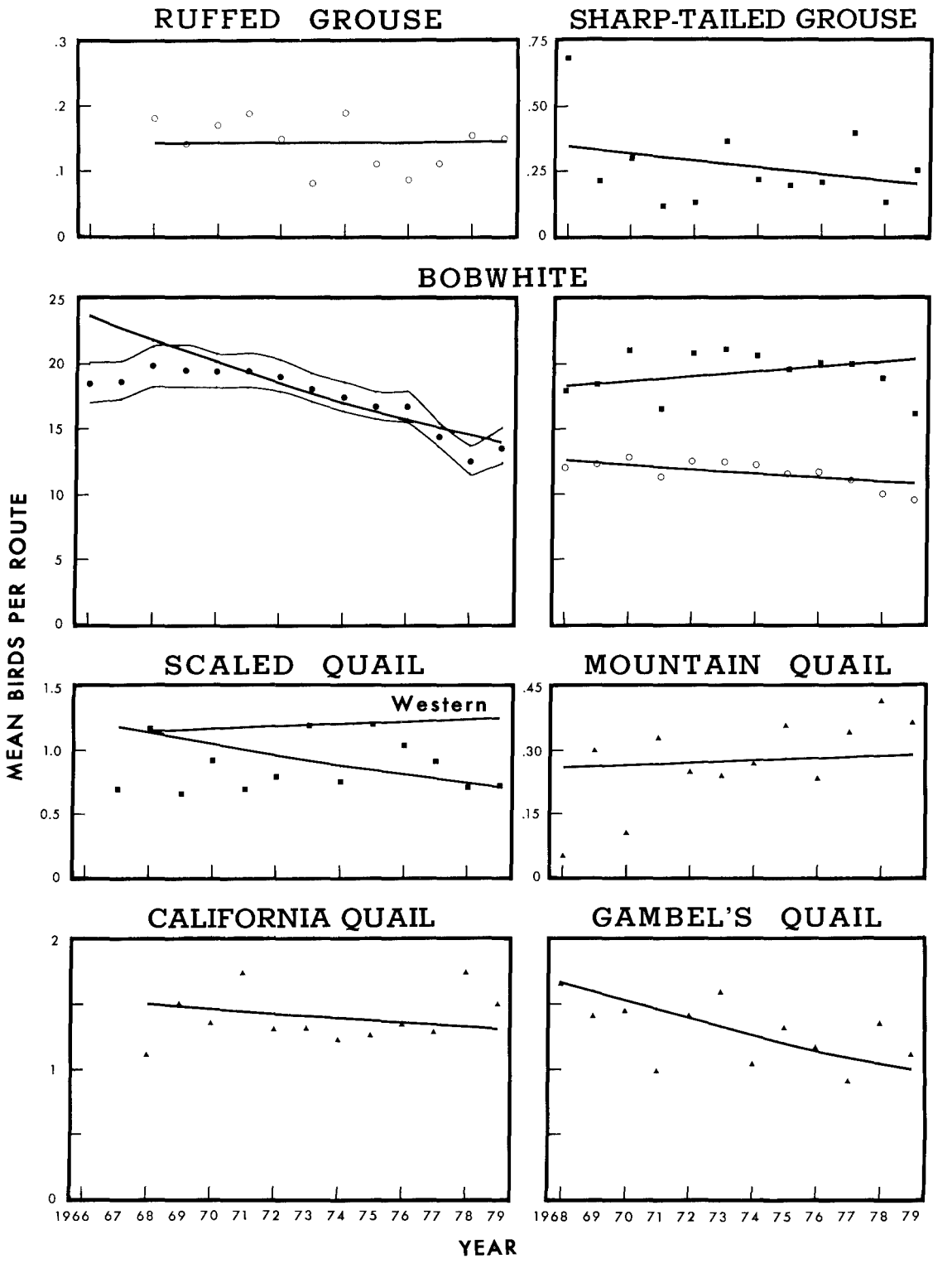


Fig. 6. Trends in gallinaceous bird populations.

States with fairly high average populations: Oklahoma, Missouri, Georgia, Alabama, South Carolina, Delaware, and Texas in declining sequence.

Scaled Quail. The individual annual means for the Western region were not plotted because of the wide scatter and the proximity to the line and points for the Central region. This chart is a good example of the apparent discrepancy that can arise between the weighted means for the individual years and the computer-generated slope, which takes into consideration the number of years each route is run and the time spread of these years, as well as the mean values. The only significant trend for this species was a decline in Texas. Greatest abundance of the Scaled Quail was in the Mexican Highlands and New Mexico.

Mountain Quail. There was too much annual scatter for the Mountain Quail to yield a significant trend, except for an increase in California where the greatest abundance by far occurred in the Los Angeles Ranges.

California Quail. The California Quail also demonstrated no significant trend except for an increase in California. The only area in which it was abundant was the California Foothills.

Gambel's Quail. This desert species registered a significant decline in the Western region, the only region in which it occurs, despite a significant increase in California. The greatest abundance of Gambel's Quail was in the Sonoran Desert and in Arizona.

Shorebirds (Fig. 7)

Shorebird summary. The great majority of North American shorebird species nest in the Arctic and are not monitored by the BBS. The species best sampled by this survey are the Killdeer (representing 54% of the BBS shorebird records), Common Snipe, Upland Sandpiper, Long-billed Curlew, Willet, Spotted Sandpiper, Wilson's Phalarope, Marbled Godwit, American Avocet, and Lesser Yellowlegs. More than 97% of the BBS records for shorebirds relate to these 10 species; graphs for five of them are presented in Fig. 7. Of the remaining five species, only the American Avocet showed a significant regional trend, with an increase in the Central region and the continent.

When all shorebirds were combined into a single trend analysis, the results showed significant increases in both the Eastern and Central regions and for the continent. This trend was strongly influenced by populations of Killdeer, so a separate analysis was run for all shorebirds except Killdeer, which showed significant increases for the Eastern and Central regions and for the continent. The principal species contributing to this analysis were Common Snipe (29%), Upland Sandpiper (17%), Long-billed Curlew (10%), and Willet (9%). This combined analysis revealed decreases in the Central Valley of California, the Till Plains, and the Allegheny Plateau, and increases in the Great Basin, Unglaciated Missouri Plateau, Aspen Parklands, Great Lakes Transition, and the St. Lawrence Plain.

Killdeer. The Killdeer, the most widely distributed shorebird in North America, showed strong increases in the Eastern and Central regions despite a temporary decrease in both regions as a result of the cold winter of 1976–77. By subregions there were significant increases in every part of the continent except the Far Western States. There were no significant decreases in any strata. When analyzed by States and Provinces there were no decreases and 30 increases (the largest number of increases for any species). The highest Killdeer counts came from the Drift Plain, the eastern portion of the Great Lakes Plain, and the St. Lawrence Plain. The highest State and Provincial counts for this species came from South Dakota, North Dakota, and Manitoba.

Common Snipe. There were parallel significant increases in Common Snipe for the Eastern and Central regions, but a decreasing tendency in the Western region kept the trend from being significant for the continent as a whole. By subregions there were significant increases in the Northern Plains States and in the Great Lakes States. The only stratum with a decrease was the Canadian Rocky Mountains, whereas significant increases occurred in the Aspen Parklands, Great Lakes Transition, and St. Lawrence Plain. All of the significant State and Provincial changes were increases. These were reported in North Dakota, Minnesota, and Quebec. The highest densities for this species came from the Dissected Rocky Mountains and the Aspen Parklands. The greatest mean number of birds per route occurred in Idaho and Alberta.

Upland Sandpiper. On the basis of information from 479 routes, the Upland Sandpiper increased in both the Eastern and Central regions and the continent. Increases were significant in the Northern Plains States and in Canada. The only stratum reporting a decline was the Allegheny Plateau, whereas there were increases in the Unglaciated

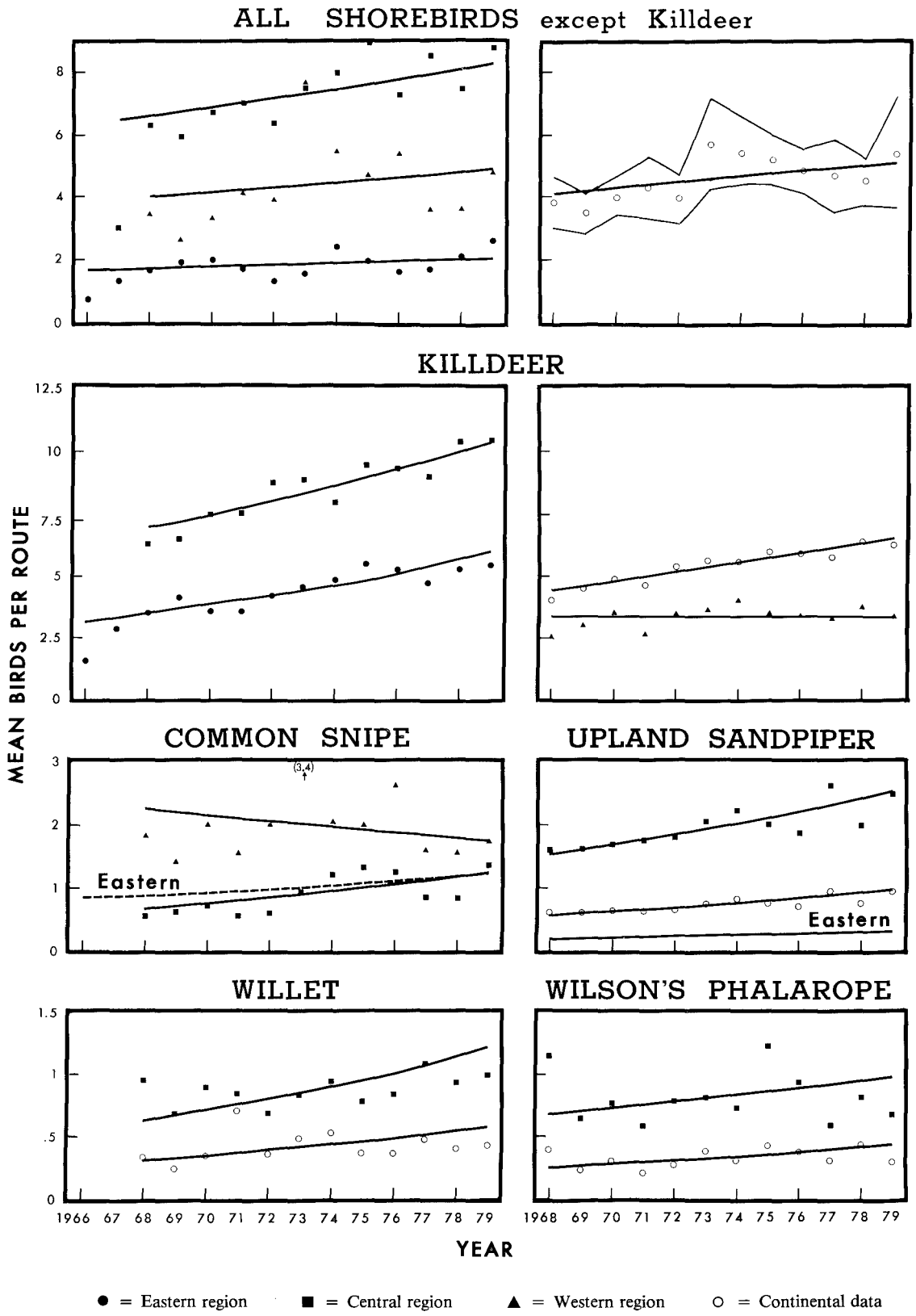


Fig. 7. Trends in shorebird populations.

Missouri Plateau, the Drift Prairie, the western portion of the Spruce–Hardwood Forest, and the St. Lawrence Plain. Illinois and New York registered decreases. Ontario and South Dakota were the only Province and State to show an increase. The highest counts for this species were in the Unglaciated Missouri Plateau and South Dakota.

Willet. Rising tendencies in all three regions resulted in a significant increase at the continental level, even though occurrence was too irregular for significant trends to be detected for any subdivision. The highest average State count came from Delaware, where half of the BBS routes included some tidal marsh. The next highest means came from the Glaciated Missouri Plateau and Alberta and Saskatchewan.

Wilson's Phalarope. A significant increase in the Central region was reflected in the continental figures, largely because two-thirds of the routes that recorded this species were in the Central region and because only one State (North Dakota) showed a significant decline. In the other States and Provinces, either the sample size was less than 15 or the increase was not significant. Except for the Columbia Plateau, where a significant increase was detected, the highest densities came from the Glaciated Missouri Plateau and the Drift Prairie—specifically from Saskatchewan, North Dakota, and Alberta.

Gulls (Fig. 8)

All of the gull trends were computed in two ways: (1) by using total individuals counted at each stop, the same as for all other species (Fig. 8, left column); and (2) by using the number of stops at which the species was observed on each 50-stop route, regardless of how many individuals were detected (right column). This dual approach was used to decrease the extreme annual variability in numbers counted along some routes in the proximity of nesting colonies. All gull trends suffer from difficulty of identification and the exclusion of "gull sp." from individual species analyses.

Herring Gull. The only significant changes detected for the Herring Gull were declines in the western portion of the Spruce–Hardwood Forest and in New Brunswick. Southern New England had the highest average counts of individual birds, but the Spruce–Hardwood Forest of the Maritime Provinces had the highest frequency of occurrence.

Ring-billed Gull. The Ring-billed Gull showed a significant increase in the Eastern region by both methods of analysis (not graphed because of overlap with continental trend). At the subregional level there was an increase in the Northeastern States but a decrease in the Northern Plains States. Only seven strata had 15 or more routes with this species. Of these strata, six showed no change and one, the St. Lawrence Plain, showed an increase. The only significant changes by States and Provinces were increases in New York and Ontario. The highest average counts of individuals were in the eastern portion of the Great Lakes Plain, the Columbia Plateau, and the Aspen Parklands. Frequency of occurrence was highest in the Glaciated Missouri Plateau and the Aspen Parklands.

Laughing Gull. The Laughing Gull showed an increase in the continental trend when analyzed by total individuals, and an increase in the Eastern region when analyzed by stops. At the subregional level there was an increase in the Southeastern States, but small sample size prevented detection of any local changes. Highest counts were recorded in the northern portions of the Upper and the Lower Coastal Plain.

Franklin's Gull. The significant decline in Franklin's Gulls in the Central region, which contains most of the nesting colonies, was very pronounced by both analysis methods, but the continental decline (not graphed) was significant only when the records were analyzed by stops. There were significant declines by strata only in the Glaciated Missouri Plateau and the Drift Prairie, but there is evidence that the decline was, in fact, more widespread. Of the 12 strata in which this species was recorded, all but 2 showed negative tendencies. The Dakotas, Alberta, and Saskatchewan were the only States and provinces with the minimum sample size of 15 routes; all except Saskatchewan showed a negative tendency, but this was statistically significant only in Alberta and South Dakota.

Doves (Fig. 9)

Rock Dove. Although no special interest has been expressed in the Rock Dove, we believe that populations of all common introduced species should be included in the BBS. This survey has revealed a rather surprising significant increase in Rock Doves in the Eastern region (Fig. 9), although a parallel increase in the Central region was not statistically significant. A declining tendency in the Western region was insufficient to prevent the continental trend from increasing significantly. There were significant upward trends in the Far Western States, the Great Lakes

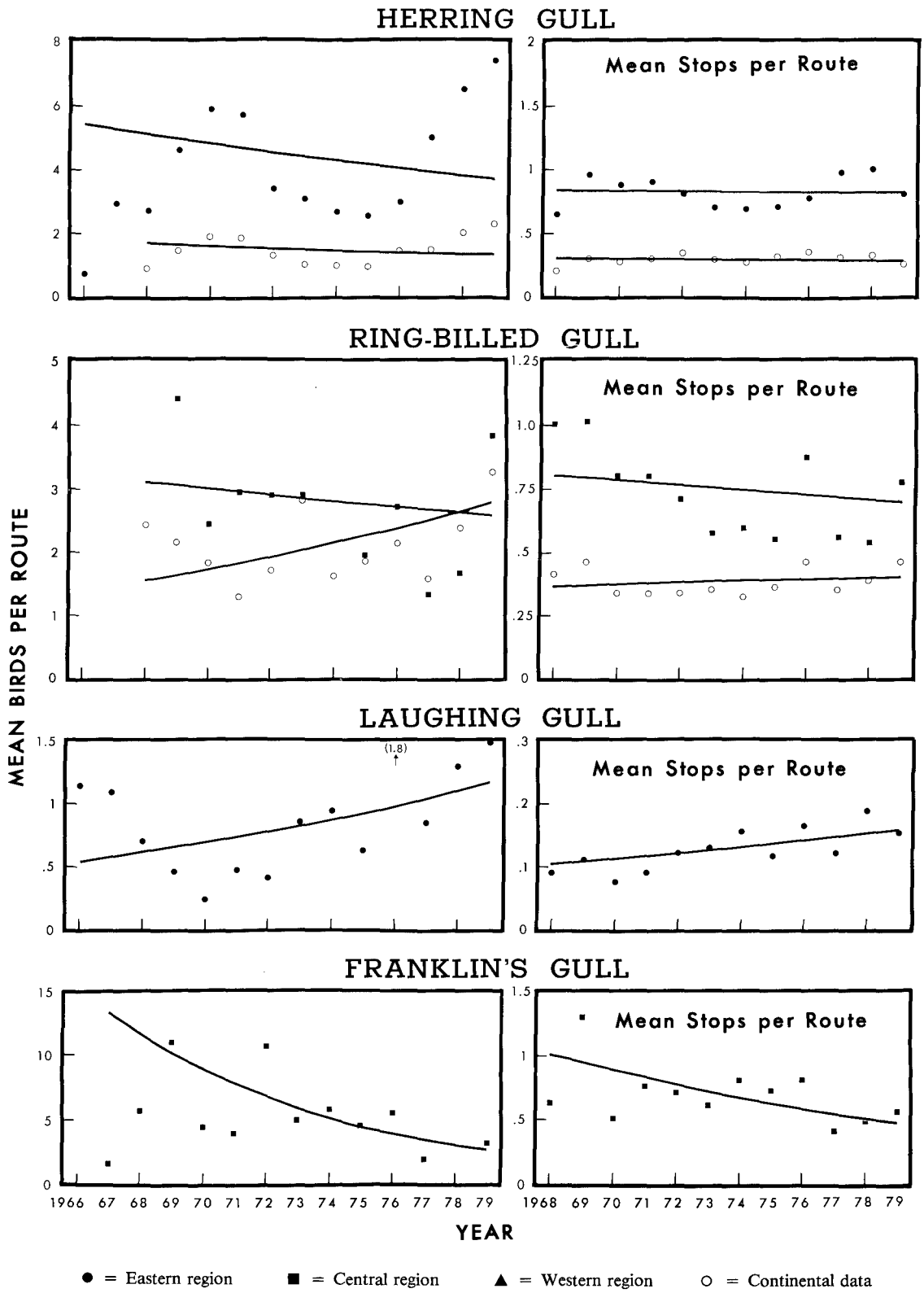


Fig. 8. Trends in gull populations. Graphs in left column show trends in number of birds per route; graphs in right column show trends in number of stops per route at which the species was recorded.

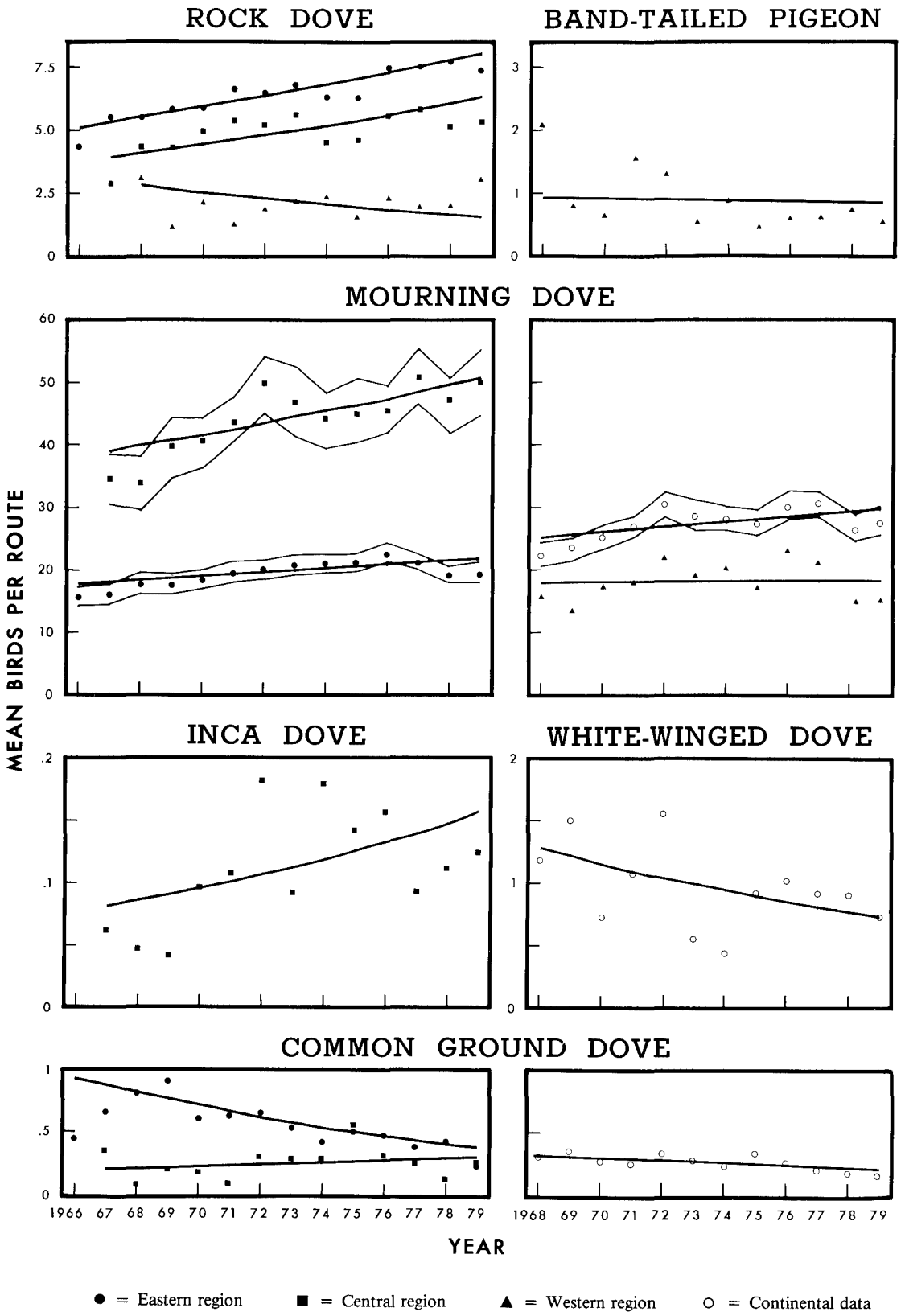


Fig. 9. Trends in dove populations.

States, and the Southeastern and Northeastern States. No State, Province, or stratum showed a significant downward trend, but significant increases were common, occurring in the Central Valley of California and in nine States and Provinces from Arkansas, Oklahoma, and Minnesota east to New Brunswick, Vermont, and West Virginia. The greatest density by stratum was in the Northern Piedmont. The States with the highest mean counts were Maryland, Pennsylvania, and New Jersey; Wisconsin, Iowa, and Rhode Island were close behind. The areas with the fewest Rock Doves per route were the Yukon Territory and Nevada.

Band-tailed Pigeon. Band-tailed Pigeon populations were stable, with no significant change in any State or stratum. The greatest density was in the Pacific Rain Forest of British Columbia and Washington.

Mourning Dove. Significant increases were recorded in the Central and Eastern regions and for the continent. The greatest increases by subregions were in Canada and the Northeastern and Northern Plains States, suggesting that the breeding range may be expanding northward. States and Provinces showed 19 increases and 3 decreases (Oregon, Illinois, and Indiana). The increases were heavily weighted toward the northern States, except for New Mexico and Florida. Most of the increases were from Colorado, Wyoming, and Saskatchewan eastward in a triangle to the Great Lakes and Ontario, then fanning out into the Middle Atlantic States, New York, New England, and New Brunswick. The sharpest increase was in Central New England, including parts of Maine, New Hampshire, and Massachusetts. The effect of the cold winter of 1976–77 can be seen in the graph for the Eastern region, as can the drop the following year in both the Eastern and Central regions. The highest population density was in the High Plains Border, and Kansas had the highest State mean.

Inca Dove. A significant increase in Inca Doves in the South Texas Brushlands, their stratum of greatest abundance, is chiefly responsible for the rising tendency shown in Fig. 9; however, this trend was significant only in that one stratum.

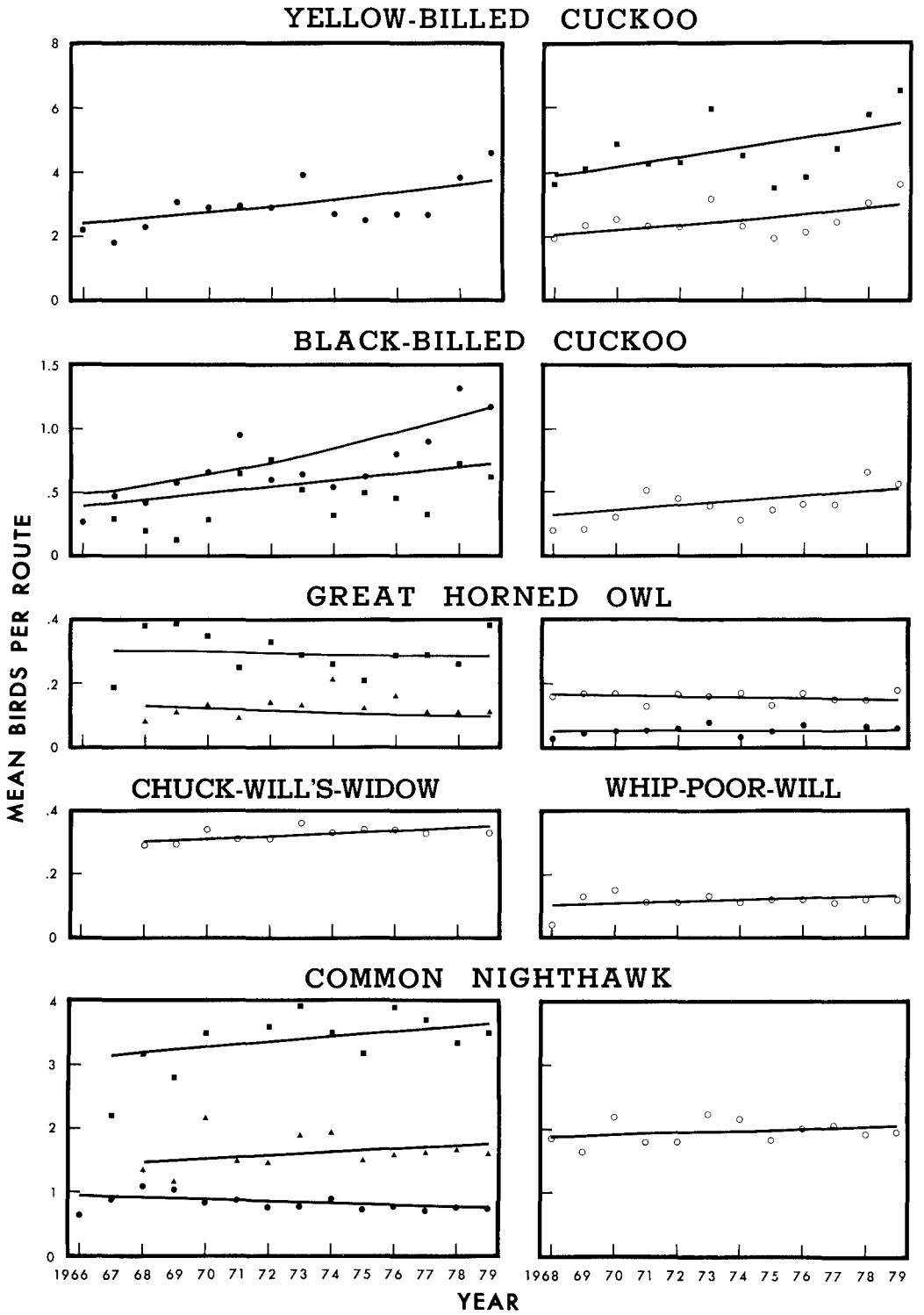
White-winged Dove. A probable (but not significant) decline in the Sonoran Desert of southern Arizona, where most of the U.S. population of White-winged Doves breeds, should be watched during the next few years. The Texas population appears to have been stable during the period covered by the BBS.

Common Ground Dove. A decline in the Common Ground Dove in the Southeastern States was of sufficient magnitude to result in a significant continental decline, despite some indication of a slight increase in the Central region. The only statistically significant statewide trend was a decline in Florida, which had by far the largest mean count for this species. The second highest mean count was in the South Texas Brushlands.

Cuckoos (Fig. 10)

Yellow-billed Cuckoo. The Yellow-billed Cuckoo is one of the few species whose normal spring migration period extends well into mid-June in the middle latitudes. For this reason, numbers at any one particular site may be variable from year to year. We do not believe the late migration of this species causes any appreciable bias in the population trends because birds that have not yet reached the breeding ground are likely to be recorded farther south as migrants. The chief effect of the year-to-year variability at individual sites is to decrease the likelihood of detecting significant trends. Despite these problems, there was a significant increase in Yellow-billed Cuckoos in both the Eastern and Central regions (Fig. 10). In fact, there was a significant increase in all of the subregions as well, except in the Far Western States, where this species is rare, and in Canada, most of which lies north of the breeding grounds. There were increases in 17 strata and decreases in none. Fifteen States showed significant increases and only Connecticut, at the northeastern limit of the breeding range, registered a decline. The increases occurred from Texas, Nebraska, and Missouri east through Pennsylvania and North Carolina, and in Florida. The continental increase also was significant. The highest densities by stratum came from the western portion of the Upper Coastal Plain. The States with the highest mean numbers were Oklahoma, Louisiana, Arkansas, and Missouri, in declining sequence.

Black-billed Cuckoo. The Black-billed Cuckoo, a northern species, showed a significant increase in the Eastern region and across the continent. By subregions, there were significant increases in the Great Lakes States and Canada. The only decline detected was in Southern New England, whereas seven strata posted increases: the Drift Prairie, the Black Prairie, the western section of the Spruce–Hardwood Forest, the Wisconsin Driftless Area, the Highland Rim, Ohio Hills, and Blue Ridge Mountains. The State analysis showed a decrease in Connecticut and increases in North Dakota, Minnesota, Kentucky,



● = Eastern region ■ = Central region ▲ = Western region ○ = Continental data

Fig. 10. Trends in cuckoo, owl, and goatsucker populations.

West Virginia, Ohio, and Ontario. Highest concentrations were in the Great Lakes Transition, in Manitoba, and in Minnesota and Connecticut.

Owls and Goatsuckers (Fig. 10)

These nocturnal birds are poorly sampled by the BBS, as most of them have ceased calling by the time the survey begins at 0.5 h before local sunrise. However, because ornithological literature lacks quantitative information on populations of these species, four of them have been selected for graphs and three others for brief comment.

Great Horned Owl. Because of its abundance and wide distribution, the Great Horned Owl has been recorded on 848 BBS routes. The results, which are plotted for all three regions as well as for the continent, show stable populations throughout (Fig. 10). Two strata showed increases—the Pacific Rain Forest and the Dissected Till Plains. There was a significant decline in the Southwestern States and in South Dakota. As expected, the stratum with the highest average count was the South Texas Brushlands, where the twilight period is short, therefore darkness extends closer to sunrise, and owls may be heard at more BBS stops. The States with the highest densities were Kansas and South Dakota.

Other Owls. Next in frequency of detection after the Great Horned Owl were Barred Owls (516 routes), Screech Owls (257 routes), and Burrowing Owls (232 routes). The Barred Owl, which reached its greatest abundance in Florida and in the western portion of the Upper Coastal Plain, showed increases in Florida and in the Eastern region, as well as in the Northeastern States. The Screech Owl showed negative tendencies in all three regions. This trend was significant in the Western region and the continent. There were no significant trends for individual strata, States, or Provinces. The only significant change for Burrowing Owls was an increase in the Glaciated Missouri Plateau.

Chuck-will's-widow. This species was represented on 393 routes, but the only significant changes detected were an increase in Florida and a decrease in the East Texas Prairies. The highest numbers of birds per route were in the Ozark–Ouachita Plateau and the southern portion of the Upper Coastal Plain. The highest average counts by State came from Arkansas and Alabama, closely followed by Georgia, Mississippi, and Florida.

Whip-poor-will. Another species showing essentially no trend was the Whip-poor-will. There has been concern over loss of habitat for this species, and over scarcity of the large moths on which it feeds, but the only significant decline detected was in the northern portion of the Upper Coastal Plain. This decrease was counteracted by increases in the Great Lakes Transition and in Kentucky. The highest average counts came from southern portions of the range, i.e., the Southern Piedmont, the northern portion of the Upper Coastal Plain, Missouri, Delaware, and Virginia. This should not be interpreted to mean that the Whip-poor-will is more common toward the southern end of its range; rather, the shorter twilight period in the southern States increases the opportunity of hearing these birds on BBS routes.

Common Nighthawk. Although no trend was detected in the three regions, there were increases in the Far West and Northern Plains States, and a decrease in the Southeastern States; Louisiana, Georgia, and Florida all reported significant declines. The States with increases were California and Kansas. By strata, decreases were noted in the southern portion of the Lower Coastal Plain and in the Great Lakes Transition; increases occurred across a wide band in the plains, encompassing the Dissected Till Plains, the High Plains Border, and the Osage Plains, as well as the Edwards Plateau immediately to the south. The highest counts came from the South Texas Brushlands, the East Texas Prairies, and the Florida Peninsula, and from Florida and Texas. The highest counts in Canada came from British Columbia, and New Brunswick.

Swifts (Fig. 11)

Chimney Swift. This species increased very slightly, but significantly, in the Eastern region and over the continent as a whole, with the increase centered primarily in the Great Lakes States (Fig. 11). There were significant increases in the eastern portion of the Great Lakes Plain and in the Blue Ridge Mountains, but significant decreases in the northern portion of the Lower Coastal Plain, the northern portion of the Ridge and Valley, the St. Lawrence Plain, the eastern portion of the Spruce-Hardwood Forest, and the High Plains Border. At the State level, there were significant increases in Indiana and Tennessee, and significant decreases in New Brunswick, New York, and Pennsylvania. Chimney Swifts reached their greatest abundance in the Highland Rim of Kentucky. The other North American swifts did not show significant changes.

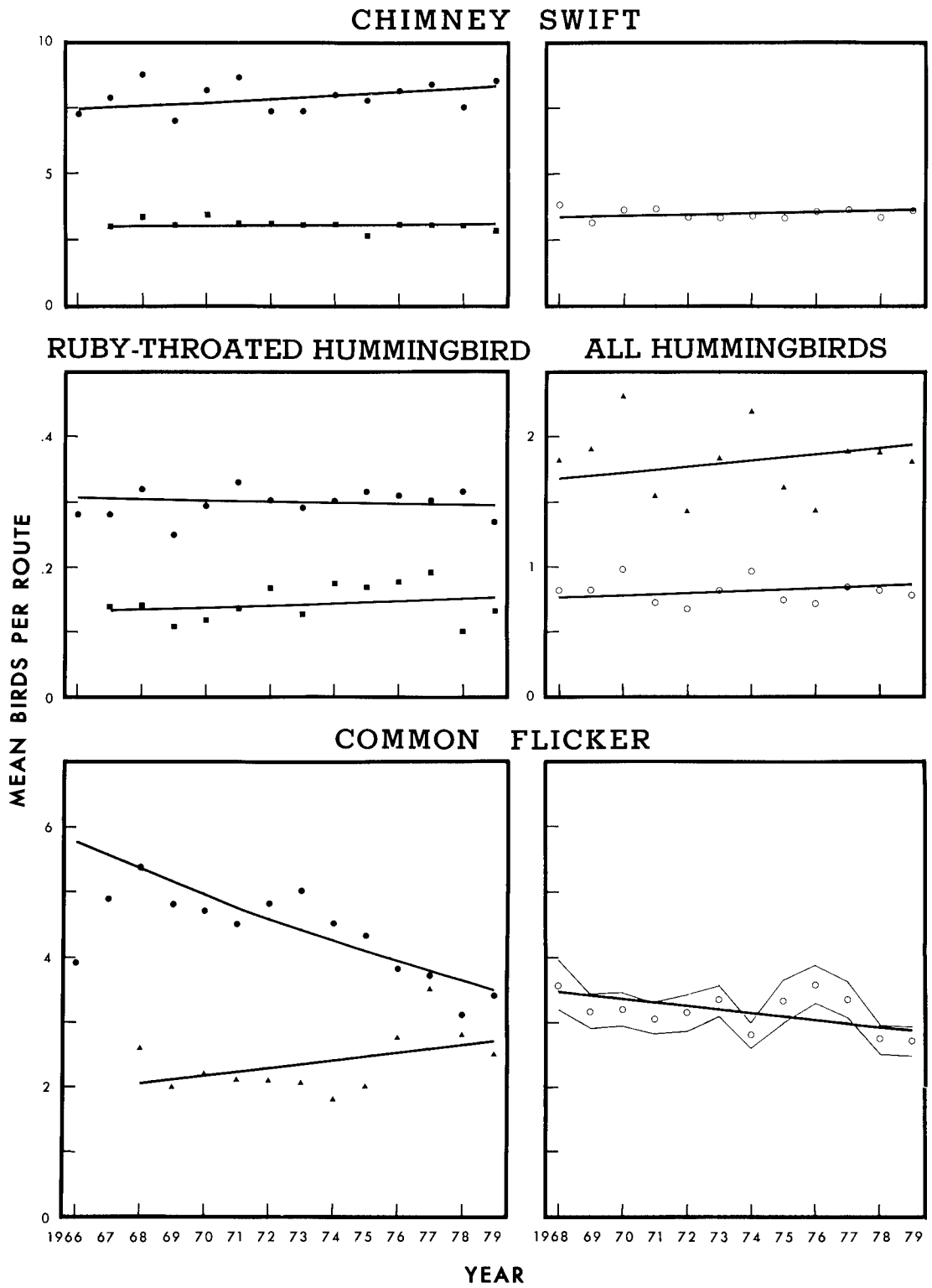


Fig. 11. Trends in swift, hummingbird, and flicker populations.

Hummingbirds (Fig. 11)

Ruby-throated Hummingbird. This hummingbird was found on 1,056 routes, and populations were stable throughout its range (Fig. 11); the only significant change detected was an increase in Ohio. The areas of greatest abundance were the western portion of the Upper Coastal Plain and the adjacent Mississippi Alluvial Plain. The States and Provinces with the highest mean counts, in decreasing order, were Arkansas, South Carolina, Louisiana, New Brunswick, and Kentucky.

The other hummingbirds are confined during the breeding season to the western States and Provinces, and most are very restricted in their distribution and therefore are sampled by only a small number of BBS routes. To search for a trend in populations of hummingbirds in the western States, where the Ruby-throated Hummingbird does not occur, we combined all hummingbirds in a single analysis (Fig. 11). The trend graph for all hummingbird species suggests an increase in populations in the west, but the mean count for the individual years varies so greatly that the trend is not significant.

Kingfishers

Belted Kingfisher. This species (not illustrated) showed no significant long-term trend, although there was a drop in the population as a result of the cold winter of 1976–77 in the East.

Woodpeckers (Figs. 11 and 12)

Common Flicker. During the period covered by the BBS, the A.O.U. Check-list Committee (1973) published Check-list Supplement No. 32 in which the three North American species of flickers were combined into a single species. Because the Yellow-shafted, Red-shafted, and Gilded Flickers can be readily identified by sight in the field, and are largely allopatric, we have continued to separate these birds on the BBS, and include a graph showing the trend recorded for the Yellow-shafted Flicker in the Eastern region and the Red-shafted Flicker in the Western region. The Gilded Flicker's range is so restricted in the arid Southwest that this population was not illustrated. The last graph in Fig. 11 shows the continental annual means and 95% confidence limits for all flickers combined. The highly significant decrease in the Yellow-shafted Flicker in the Eastern and Central regions continued throughout the period covered by the survey and was strong enough to cause a significant decline in the Yellow-shafted Flicker at the continental level as well. The Red-shafted Flicker showed a significant upward trend in the Western region, but indicated no significant change for the continent. The continuing significant decline in flickers in the Eastern and Central regions has been attributed largely to their inability to compete successfully with Starlings for nest holes. Despite the healthy increase in the Western region, the continental curve for all flickers shows a significant decline. Part of this decline was probably a result of the cold winters of 1976–77 and 1977–78; there may be sufficient recovery during the next few years to cancel the significant decline in continental populations. The Yellow-shafted Flickers in the Eastern region seem to have the greatest problem, with significant decreases in all three sections of the Spruce–Hardwood Forest, the Great Lakes Transition, the Wisconsin Driftless Area, the Till Plains, both sections of the Great Lakes Plain, Central and Southern New England, both sections of the Ridge and Valley, the Allegheny Plateau, the Ohio Hills, Blue Ridge Mountains, both the Northern and Southern Piedmont, the northern portion of the Upper Coastal Plain, the Mississippi Alluvial Plain, and the Florida Peninsula. Not a single stratum reported an increase in the Yellow-shafted race. The Red-shafted race showed no decreases, but did show increases in the central Rocky Mountains and the Pinyon–Juniper Woodland. By States and Provinces, the Red-shafted race increased in Arizona, while the Yellow-shafted race decreased in 20 States and Provinces, encompassing Alberta, North Dakota, Iowa, the Great Lakes States, Ontario, Quebec, New Brunswick, Vermont, New York, Pennsylvania, Maryland, Virginia, and West Virginia. Flickers reached their greatest abundance in the northern section of the Ridge and Valley Province, the Wisconsin Driftless Area, and Southern New England, and in Connecticut, Pennsylvania, Massachusetts, Wisconsin, and West Virginia.

All Woodpeckers except Flickers. A trend analysis was conducted for all non-flicker woodpeckers. The results showed stable populations in all parts of the continent, with relatively high counts in the Eastern region and lowest counts in the Western region (Fig. 12). Continental data were not included because there would have been overlap with the data points for the Central region. The greatest concentrations of non-flicker woodpeckers were in the South Texas Brushlands, the California Foothills, the central por-

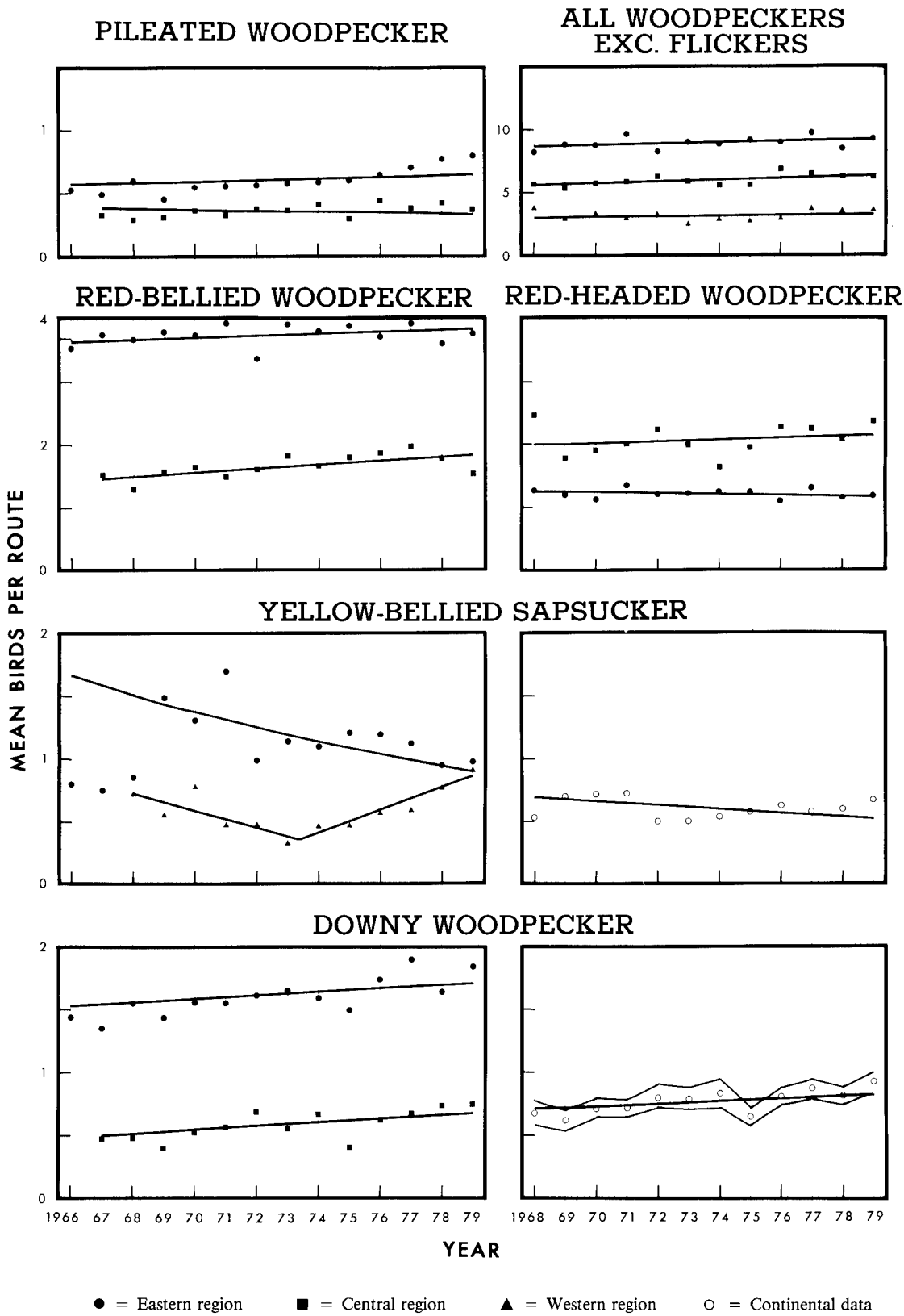


Fig. 12. Trends in woodpecker populations.

tion of the Upper Coastal Plain, and the Florida Peninsula.

Pileated Woodpecker. The Pileated Woodpecker population did not show any significant change for the three regions or the subregions; the population appears to be stable. This species shows some signs of adjusting to suburban expansion as long as some mature woodlands with connecting wooded corridors remain (Christy 1939). Decreases in the Highland Rim and Ohio Hills were more than balanced by increases in the northern section of the Lower Coastal Plain, the Adirondack Mountains, and the western portion of the Spruce–Hardwood Forest. By State, a decrease occurred in Kentucky, but increases occurred in California, New Hampshire, and Ontario. The highest average counts came from the western portion of the Upper Coastal Plain, the Ozark–Ouachita Plateau, and the northern portion of the Lower Coastal Plain. Arkansas and Louisiana support the greatest densities of Pileated Woodpeckers.

Red-bellied Woodpecker. There was a rising tendency throughout the range of the Red-bellied Woodpecker, but this reached significant levels only in the Southeastern States and for the continent (not illustrated). The only significant decreases were in the East Texas Prairies and the northern section of the Lower Coastal Plain, but there were significant increases in the southern portion of the Upper Coastal Plain, the Northern Piedmont, both sections of the Ridge and Valley, the eastern portion of the Great Lakes Plain, the Wisconsin Driftless Area, and the Ozark–Ouachita Plateau. Virginia was the only State showing a decrease, and Arkansas, Alabama, Tennessee, Pennsylvania, and New York showed increases. The highest populations were found in the Florida Peninsula, closely followed by the central and southern portions of the Upper Coastal Plain. Florida led the States, followed by Georgia and South Carolina.

Red-headed Woodpecker. Although populations in the three regions showed no significant trend, there was a significant decrease in the Southeastern States and significant increases in the Northern Plains States and the Northeastern States. Populations of this species had earlier been seriously depleted in areas where the Starling is an abundant competitor. As the Starling continues to increase in numbers in the Southeast, it is bound to exert more pressure on Red-headed Woodpecker populations there. The only significant increases in Red-headed Woodpeckers were recorded in the High Plains Border, the Black Prairie, the Wisconsin Driftless Area, and the Highland Rim, whereas there were decreases in the Drift Prairie, both sections of the Great Lakes Plain, the East Texas Prairies, the central portion of the Upper Coastal Plain, and the southern portion of the Lower Coastal Plain. Significant decreases were detected in South Dakota, Ohio, Louisiana, and Georgia; significant increases were found in Kansas, Iowa, and Wisconsin. The population peak for Red-headed Woodpeckers was in the Dissected Till Plains and in Iowa.

Yellow-bellied Sapsucker. Decreases in populations of Yellow-bellied Sapsuckers in the Northeastern States and in Canada were sufficient to generate a significant decline for the continent. In the Western region there was a significant increase (including populations of the Red-breasted Sapsucker) during 1973–79 that more than compensated for an earlier decline in that region. The decline in the Eastern region from 1976 to 1978 is attributed in large part to the two severe winters; thus it is possible that the decline indicated for this species may be of short duration. There were significant decreases in the St. Lawrence Plain, Central and Southern New England, and the eastern portion of the Spruce–Hardwood Forest, and significant increases in the Aspen Parklands and the Great Lakes Transition. By States and Provinces, there were decreases in New Hampshire, New Brunswick, and Nova Scotia, and an increase only in Washington. The center of abundance was restricted to the Adirondack Mountains and the eastern portion of the Spruce–Hardwood Forest.

Downy Woodpecker. There were significant increases in the Central region, the Great Lakes States, the Southeastern States, and the Northern Plains States, all of which contributed to a significant continental increase. No stratum registered a decrease, and the only State to do so was Kentucky. There were seven well-scattered strata with significant increases, and by States increases were registered in Washington, Oklahoma, Kansas, Minnesota, Illinois, and Tennessee. Highest densities were clustered in the vicinity of the Appalachians: the Highland Rim, the southern portion of the Ridge and Valley, the central portion of the Upper Coastal Plain, and Southern New England. The States supporting the greatest mean densities were Connecticut, Kentucky, and Maryland.

Flycatchers (Figs. 13–15)

The flycatcher family is discussed in greater detail in this report than many other families because many

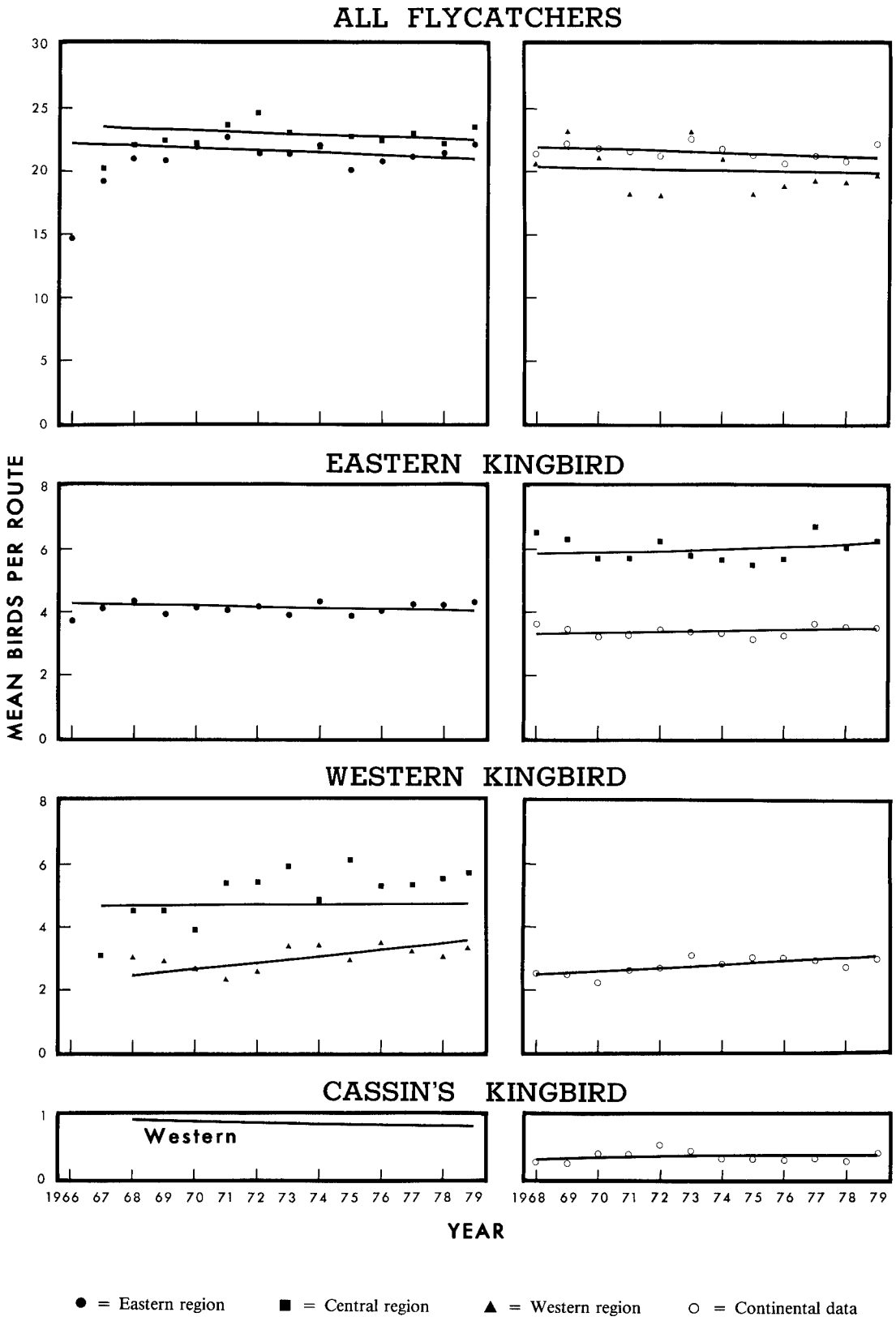


Fig. 13. Trends in flycatcher populations, part 1.

interesting changes were noted. Across the continent there were only three flycatcher species with significant increases as compared with five species showing significant decreases. Therefore we included two summary graphs at the top of Fig. 13 to show trends for the flycatcher family as a whole. As with other family trend graphs, the more common species have an undue influence on family trends. Although some species of flycatchers have been decreasing, our data show that there is no continent-wide problem affecting the flycatcher family. Flycatchers are found in about the same numbers in all three regions.

Eastern Kingbird. This species showed a significant decline through 1975, but since that time a slight upward tendency has reversed this trend. For the entire 14-year survey period the Eastern Kingbird has not shown a significant change in any of the three regions. It did, however, show a decline in the Southeastern States, and increases in the Southwestern States and in Canada. By States and Provinces there were increases in Maine, Pennsylvania, Ontario, and Quebec, and decreases in Maryland, North Carolina, Georgia, Mississippi, and Louisiana. Greatest abundance was in the High Plains Border, the Drift Prairie, and the Northern Plains States of Kansas, North Dakota, Nebraska, and South Dakota.

Western Kingbird. The Western Kingbird, on the other hand, increased in both the Central and Western regions and consequently showed a highly significant increase for the continent. There were no significant decreases except in British Columbia, but there were increases in the Southwestern States, in five strata, and in New Mexico, Texas, and North Dakota. Greatest abundance of this species was in the High Plains Border of Kansas.

Other Kingbirds. The other kingbirds are less widely distributed, but the Cassin's Kingbird is illustrated to represent the Southwestern States. The trend for this species was not significant, except for an increase in the California Foothills. Its peak of abundance was in the Mexican Highlands in Arizona.

Scissor-tailed Flycatcher. This species showed a sharper decrease (Fig. 14) than any of the other flycatchers; there were highly significant declines in the Central region, the Southwestern States, and in the continental population. Its center of abundance is in Texas and Oklahoma (Bystrak 1981), and it showed a significant decline in both of these States, despite an increase in Texas from 1968 to 1972. This species also declined in Kansas at the northern edge of its breeding range. The average rate of decline indicated by the BBS in the Central region was 4.6% per year. The reason for the decline in Scissor-tailed Flycatchers is not clear. No change in land use on its breeding ground has been great enough to cause such a rapid decline; for a possible explanation we should perhaps look to southern Mexico and Central America where this species winters.

Great Crested Flycatcher. The Great Crested Flycatcher increased in the Central region, the Great Lakes States, and across the continent. Decreases were limited to the Ohio Hills, primarily the Ohio portion, and Southern New England, primarily Massachusetts. Greatest abundance was on the Lower Coastal Plain and in Florida.

Ash-throated Flycatcher. The Ash-throated Flycatcher showed an even sharper significant increase in the Central region than the Great Crested Flycatcher, especially in the most recent years of the BBS, but the average count for this region was so low (0.23) that it was not included in the graph. The trend in the Western region was not significant. An area of high abundance stretched along the Mexican border from the California Foothills and Los Angeles Ranges to the Mexican Highlands of Texas.

Eastern Phoebe. The Eastern Phoebe winters primarily in the southern United States, and appeared stable until the severe winter of 1976–77, when a period of continuous subfreezing weather destroyed the population in the northern portion of its winter range. After that severe winter the population has begun a gradual recovery, but the long-term trend is still a significant decline in both the Eastern and Central regions and for the continent (not illustrated). The Eastern Phoebes that breed in the Central region evidently wintered far enough south so that they were not as seriously affected by the cold weather of 1976–77 as were those that nested from Maryland to northern New England. Central New England, specifically New Hampshire and Vermont, supported the highest density of Eastern Phoebes.

Say's Phoebe. The Say's Phoebe showed a sharp and significant increase in the Western region which, together with a rising tendency in the Central region, resulted in a significant increase for the entire continent (not illustrated). This species also increased in the California Foothills and the Unglaciated Missouri Plateau. Greatest abundance was in the Pinyon–Juniper Woodland, which also showed a significant increase.

Yellow-bellied Flycatcher. The Yellow-bellied Flycatcher, which reached its greatest abundance in New

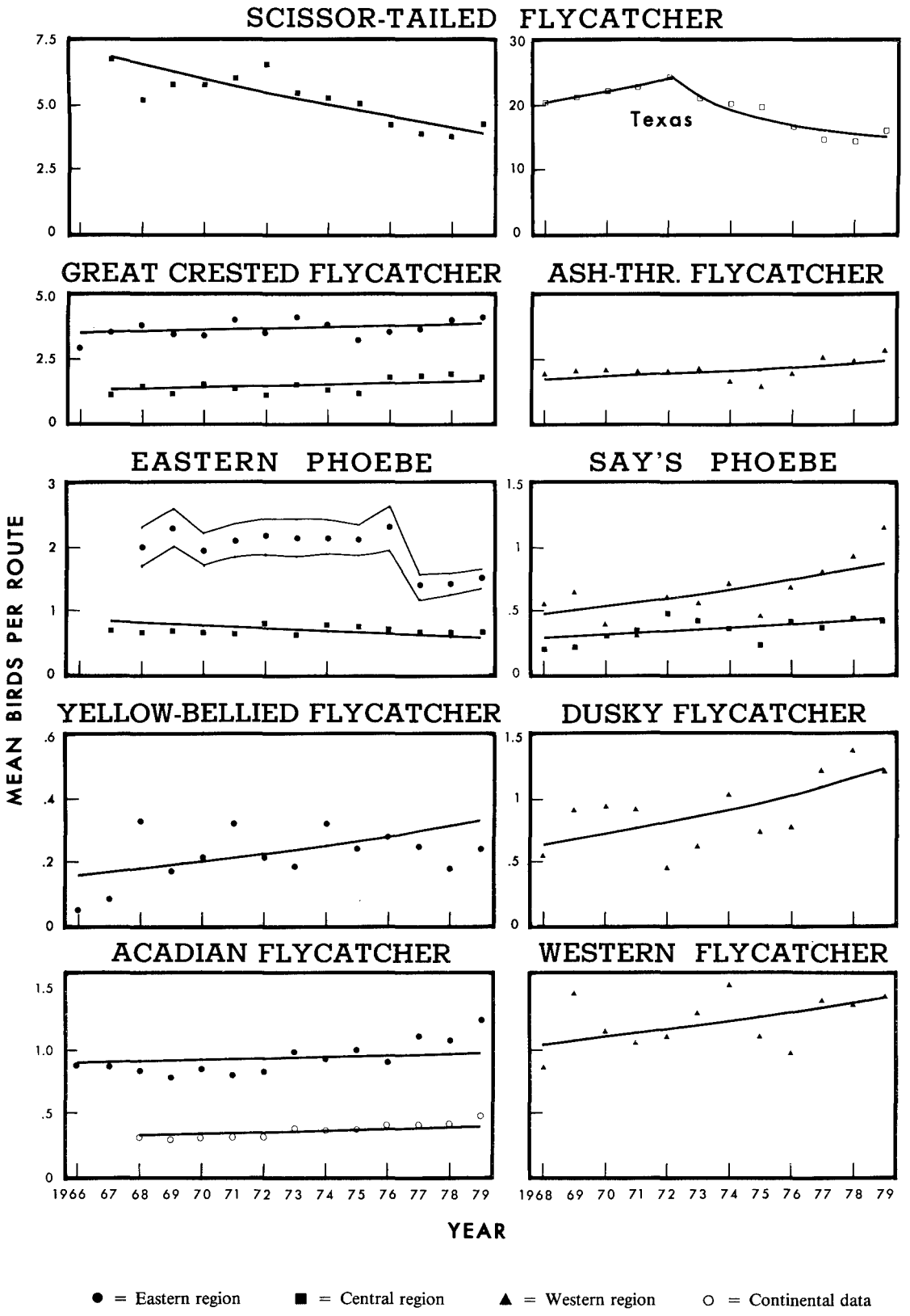


Fig. 14. Trends in flycatcher populations, part 2.

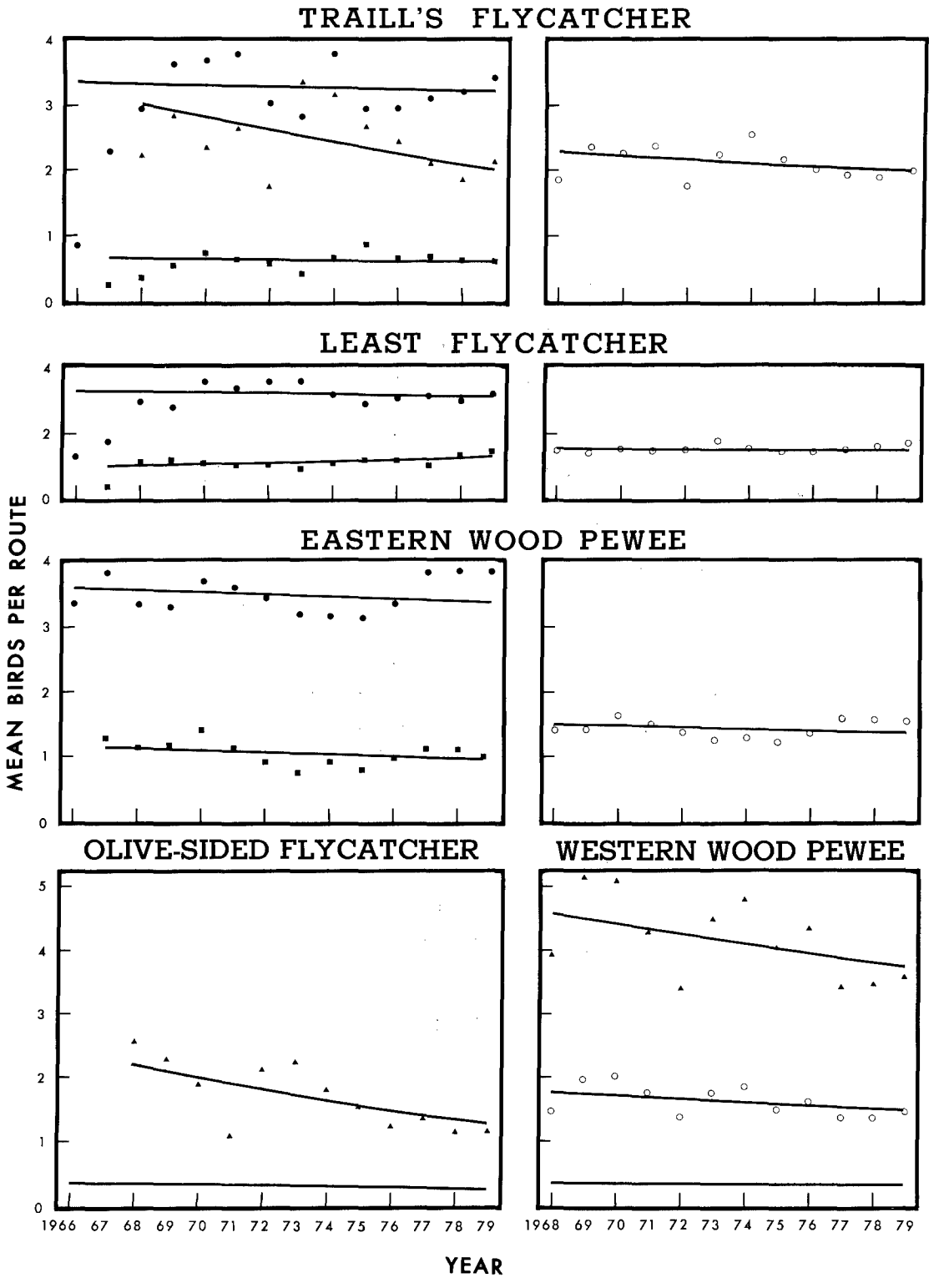


Fig. 15. Trends in flycatcher populations, part 3.

Brunswick, showed a highly significant increase in the Eastern region.

Dusky Flycatcher. The Dusky Flycatcher showed a sharp increase in British Columbia. The Western region did not register a significant increase because of the wide variation in counts from year to year, a continuing problem that results from confusion with the similar Hammond's Flycatcher. These two species are reported as "*Empidonax* sp." by many observers, which adds to the variation. Highest counts for the Dusky Flycatcher were in the Central Rocky Mountains and in Oregon and British Columbia.

Acadian Flycatcher. The Acadian Flycatcher declined slightly for the first half of the period, but has increased slightly in recent years. The increase was not sufficient to register a significant upward trend for the entire period, except in the Ohio Hills and Allegheny Plateau, the southern portion of the Lower Coastal Plain, and in Maryland. The highest nesting densities were in the Cumberland Plateau and in Virginia and West Virginia.

Western Flycatcher. The Western Flycatcher showed much scatter in counts from year to year, which resulted in no significant trend in any region or State. The areas of greatest abundance for this species were the Pacific Rain Forest and Washington.

Willow and Alder Flycatchers. In the early days of the BBS, the Willow and Alder Flycatchers were considered a single species under the name Traill's Flycatcher. Because of considerable overlap in breeding ranges of the two species, it is not possible to separate the older records. Therefore, the trend must be shown for the Traill's Flycatcher superspecies (Fig. 15). The result is a mixed pattern with fairly stable populations in the Eastern and Central regions, but a rather strong decline in the Western region. This complex will be especially interesting to watch in the future because the Willow Flycatcher, of western origin, has been spreading its breeding range eastward and increasing its numbers, possibly at the expense of the Alder Flycatcher. The Willow Flycatcher reached its greatest abundance in the Pacific Rain Forest of Washington and British Columbia, whereas the Alder Flycatcher's concentration area was in the Spruce–Hardwood Forest of Nova Scotia.

Least Flycatcher. The Least Flycatcher seems to be maintaining stable populations throughout its range. However, an analysis by local area indicates decreases in New England and in the midwestern States, balanced by increases farther north in Alberta, Saskatchewan, and Quebec. The Adirondack Mountains and New Hampshire maintained the densest populations of Least Flycatchers.

Wood Pewees. The Eastern and Western Wood Pewees are graphed separately in Fig. 15. Both showed slight but significant declines across the continent. These changes are not related to strong decreases in any particular geographic area and at present are not causing any concern because both species are common and widespread. The Eastern Wood Pewee was most abundant in the Southern Piedmont and in Virginia and West Virginia, and the Western Wood Pewee was most common in the Sierra–Trinity Mountains and the Los Angeles Ranges.

Olive-sided Flycatcher. The Olive-sided Flycatcher appears to be declining sharply in the Western region. Populations in British Columbia in particular showed a significant decline, and decreases occurred in the Spruce–Hardwood Forest of Quebec and in Central New England. However, populations were stable in the Los Angeles Ranges and the Sierra–Trinity Mountains, areas with the greatest abundance.

Larks (Fig. 16)

Horned Lark. This abundant open-country bird had stable populations in the three regions, but showed a decrease in the Northeastern States and an increase in the Southeastern States (Fig. 16). By strata there were significant decreases in the Spruce–Hardwood Forest, the Northern Piedmont, the northern part of the Ridge and Valley, the Ohio Hills, the Allegheny Plateau, and the Pinyon–Juniper Woodland. Increases occurred in the Mexican Highlands, the Mississippi Alluvial Plain, the Black Prairie, and the eastern portion of the Great Lakes Plain. By States and Provinces there were decreases in Kentucky, Pennsylvania, New York, and Quebec; there were no State or Province increases. The long-term slope was essentially flat in the areas of greatest abundance: the High Plains of Colorado and the Glaciated Missouri Plateau of Saskatchewan.

Swallows (Figs. 16 and 17)

Tree Swallow. This species increased in both the Eastern and Central regions (Fig. 16) and across the continent (not illustrated). Significant increases were recorded for the Great Lakes States, the Northeastern States, and for Canada. The only stratum to show a decline was the northern portion of the Upper Coastal Plain. In contrast, there were eight strata with increases. Massachusetts and New Jersey were the two States that registered a decline, whereas the only statewide increases were in Minnesota and

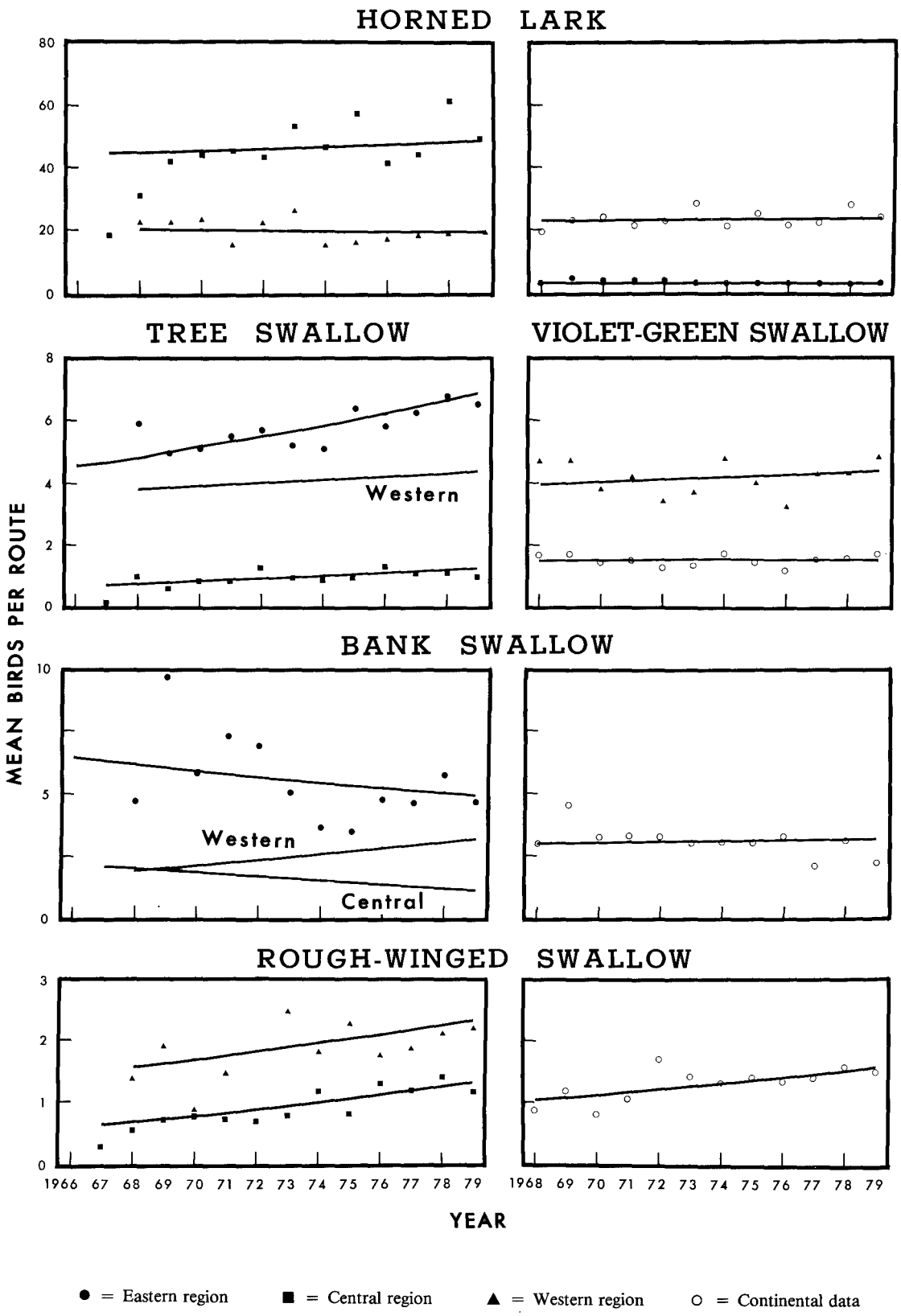


Fig. 16. Trends in lark and swallow populations.

Michigan. The Tree Swallow reached its greatest abundance in Central New England and the Adirondack Mountains. Maine, Vermont, New Hampshire, and New Brunswick had the highest State and Provincial means.

Violet-green Swallow. Populations of the Violet-green Swallow were stable; the only significant change detected was an increase in the Northern Plains States. This species was four times as common in the Los Angeles Ranges as in the next highest stratum, the Pacific Rain Forest; the highest state mean value came from Washington.

Bank Swallow. Annual counts of this highly colonial species vary widely from year to year and make it difficult to detect long-term changes. The graphs (Fig. 16) present an impression of declines in the Eastern and Central regions and an increase in the Western region. Annual weighted means were plotted for the Eastern region; means were not plotted for the other two regions, which would have shown even wider scatter because of the smaller sample sizes. The Allegheny Plateau and the High Plains Border were the only strata for which changes (decreases) could be detected by our usual analysis technique. Because of the high year-to-year variability in numbers of this species recorded, a separate analysis was run by using the number of stops at which the species was found rather than the total individuals. This analysis (not illustrated) flattened the curves for all three regions. None of the regional slopes were statistically significant, but there was an increase in the number of strata that registered significant changes—the Glaciated Missouri Plateau, the Black Prairie, Wisconsin Driftless Area, and the Till Plains all showed decreases. The highest average counts for the Bank Swallow were in Quebec and New Brunswick, and in the St. Lawrence Plain and the eastern portion of the Great Lakes Plain; the eastern portion of the Spruce-Hardwood Forest pushed ahead of the other two strata in frequency of occurrence.

Rough-winged Swallow. In contrast with the Bank Swallow, this species is a solitary nester. The Rough-winged Swallow has been expanding its breeding range northward during the past several decades (Bull 1974), and the BBS provides evidence that this trend is still continuing. There were significant increases in both the Eastern and Central regions and for the continent. By subregions there were increases in the Great Lakes States and in the Northern Plains States. By strata, the only decreases were in the Pacific Rain Forest, the Cumberland Plateau and Blue Ridge Mountains, and the central portion of the Spruce-Hardwood Forest, whereas there were significant increases in the High Plains, High Plains Border, Dissected Till Plains, Wisconsin Driftless Area, the Till Plains, Ozark-Ouachita Plateau, the East Texas Prairies, and the northern portion of the Upper Coastal Plain. There were no States or Provinces showing decreases, but there were increases in California, Texas, Kansas, Nebraska, Iowa, Minnesota, Illinois, and Ontario. Greatest densities were reported in the Sonoran Desert, Idaho, California, and Alabama.

Barn Swallow. The Barn Swallow (Fig. 17) is one of the few species that registered a significant increase in all three regions. All subregions except the Far Western States also showed increases. No stratum showed a decrease, whereas 28 recorded significant increases—more than were found for any other species except Killdeer. These increases were clustered in the central and eastern States as far west as New Mexico, Colorado, Wyoming, and Montana. The Barn Swallow is not only increasing in abundance, but also is extending its range dramatically southward toward the Gulf of Mexico (Bystrak 1979). Increases in Alabama and Texas (Fig. 17) are representative of those occurring in Louisiana and Mississippi as well. By 1979, the number of birds per route in Alabama had equaled the mean for the entire Eastern region. In the top right graph of Fig. 17 the mean number of individuals identified per route is compared with the mean number of stops per route at which the species was detected. The highest Barn Swallow counts came from the St. Lawrence Plain; second highest counts were from the Highland Rim. States registering the greatest numbers of this species were Kentucky, Iowa, and Vermont. The Barn Swallow has definitely benefited from man's activities. At the beginning of the present century most Barn Swallows nested in the shelter of barns, outbuildings, porches, and small bridges (Bent 1942). These birds were subject to disturbances which increased over the years as efforts to make dairy barns more sanitary and to keep birds from nesting directly above parked automobiles were launched. With the advent of massive dams and large superhighway bridges, all with the protection of limited access to the nesting areas, populations of this species have exploded.

Cliff Swallow. The Cliff Swallow showed an increase for the Eastern and Western regions and for the continent. By subregions there were increases in the Far Western States, the Southeastern States, and in Canada. There were no significant decreases by

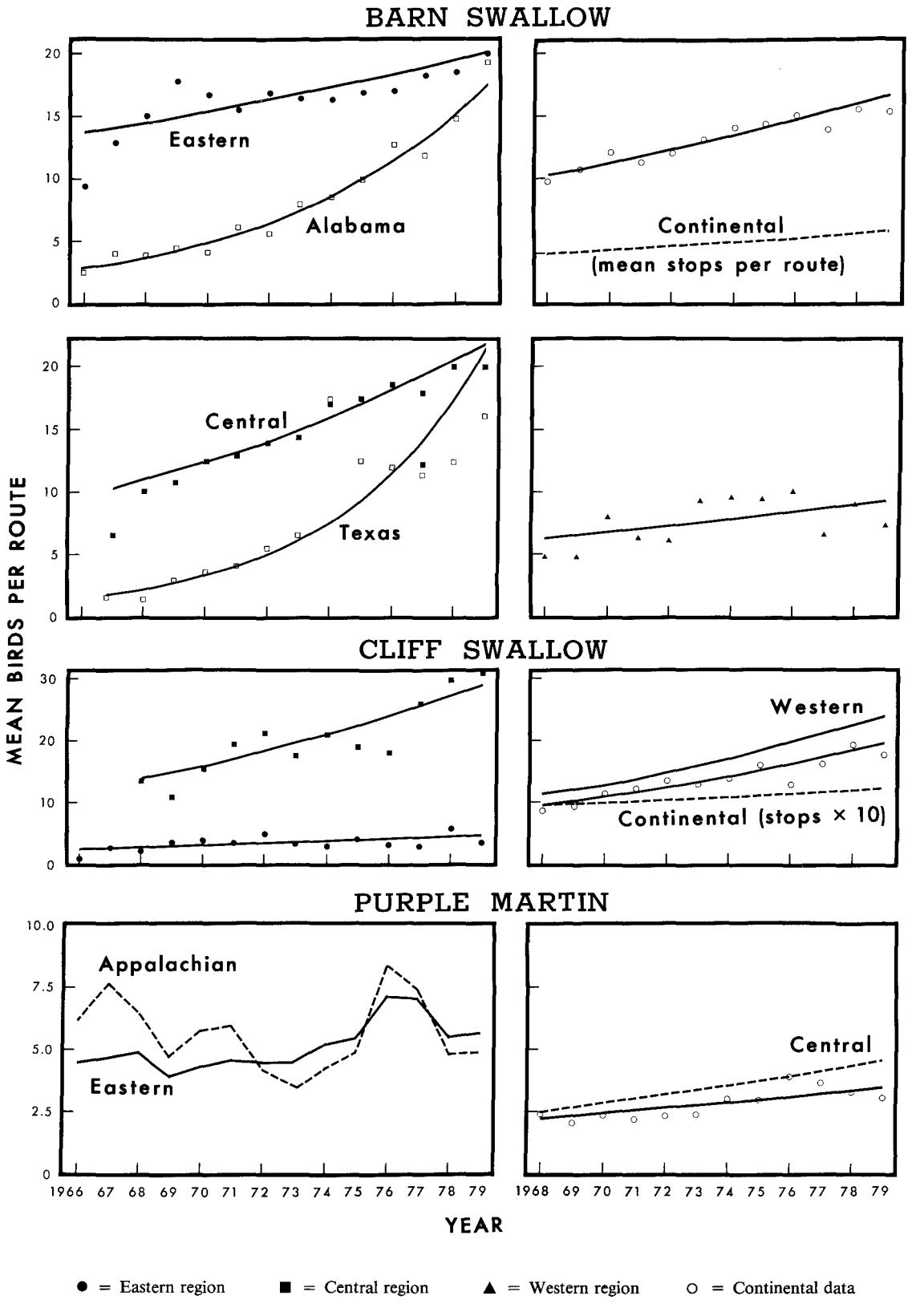


Fig. 17. Trends in swallow populations, part 2.

strata or by States and Provinces, but there were increases in the California Foothills, the Wyoming Basin, Pinyon–Juniper Woodland, the Dissected Rocky Mountains, Aspen Parklands, and the western portion of the Spruce–Hardwood Forest. The areas with significant increases were California, Saskatchewan, and Minnesota. The increase in California is especially important because the average number of birds per route in California was twice as high as in any other State except Texas. The high counts in California were concentrated in the Central Valley. Cliff Swallow populations in the Eastern States declined during the first half of this century when there was a drastic decline in unpainted barns to which they could attach their mud nests under the eaves (Gross 1942). This trend was reversed with the advent of large dams and superhighway bridges, which provided ample sheltered areas to which the birds could attach their nests. Although its increase has not been as dramatic as the spread of the Barn Swallow, the Cliff Swallow has reoccupied much of its original range and is now expanding into areas in the Southeast where it was previously unknown (Patterson 1981; Shuler 1978; Tedards 1965; Sykes 1976, 1979).

Purple Martin. There were increases for Purple Martins in the Eastern region, the Central region, and for the continent. By subregions, the increases were significant only in the Northern Plains States and in the Southeastern States. There were no strata with significant decreases, but there were increases in the Edwards Plateau, the Osage Plains, Ozark–Ouachita Plateau, Mississippi Alluvial Plain, the central and southern portions of the Upper Coastal Plain, the southern portion of the Lower Coastal Plain, and the Florida Peninsula. Nebraska, Indiana, Arkansas, Mississippi, Alabama, and Florida showed significant increases; no State reported a decrease. High counts were concentrated in Louisiana and Alabama, in the western portion of the Upper Coastal Plain, and the southern portion of the Lower Coastal Plain. Prolonged periods of rain at the time Purple Martins have young in the nest can cause heavy mortality of both young and adults, and produce dramatic changes in local populations. Annual mean counts in the Appalachian region are compared with counts for all of the Eastern BBS region (Fig. 17, bottom left). The results of Hurricane Abby in June 1968 and of Hurricane Agnes in June 1972 are clearly apparent. Both of these hurricanes produced several days of continuous rain throughout a large portion of the Appalachian region. The Appalachian graph presented is composed of the means of the counts for the following six strata: Northern Piedmont, Southern Piedmont, Ridge and Valley, Allegheny Plateau, Ohio Hills and Blue Ridge Mountains. Although no June hurricane affected the Appalachian Mountains in 1977 or 1978, a sharp drop in Purple Martins in the 1978 BBS suggests that locally heavy rains in the Piedmont, the Ohio Hills, and the Allegheny Plateau in summer 1977 and early June 1978 had a detrimental effect on the martins. There were additional losses of nestlings in southeastern Pennsylvania as a result of the heavy rainstorm of 3–4 July 1978 (Smith et al. 1978).

Jays, Magpies, and Crows (Figs. 18–25)

Gray Jay. The only significant changes in populations of the Gray Jay were a decrease for the Eastern region and an increase in Nova Scotia. Lack of significant changes was in most instances a direct result of the small number of routes on which this species was detected in any single State, Province, or stratum. The strong upward tendency suggested by the curve for the Western region (Fig. 18) was based on 91 routes. The high year-to-year variability prevented the trend from being significant. The only stratum in which this species was common was the Canadian Rocky Mountains, and the only State or Province with high numbers was the Yukon Territory.

Blue Jay. Blue Jays showed very slight but nevertheless significant changes in the Eastern region (decrease) and the Central region (increase). By subregions, there were significant increases in the Southwestern States and Great Lakes States, and decreases in the Northern Plains States and in Canada. By strata there were decreases in the Drift Prairie, the Dissected Till Plains, the western portion of the Spruce–Hardwood Forest, Southern New England, the Northern Piedmont, the central portion of the Upper Coastal Plain, and the northern portion of the Lower Coastal Plain. The only significant increases detected were in the Osage Plains, the Great Lakes Transition, and the Allegheny Plateau. By States and Provinces, decreases occurred in South Dakota, Missouri, South Carolina, Maryland, New Jersey, and New Brunswick; increases occurred in Texas, Oklahoma, and West Virginia. Greatest abundance was in the central and southern portion of the Upper Coastal Plain in Georgia and Alabama (Fig. 19).

Steller's Jay. The Western region showed no significant trend for the Steller's Jay, although there

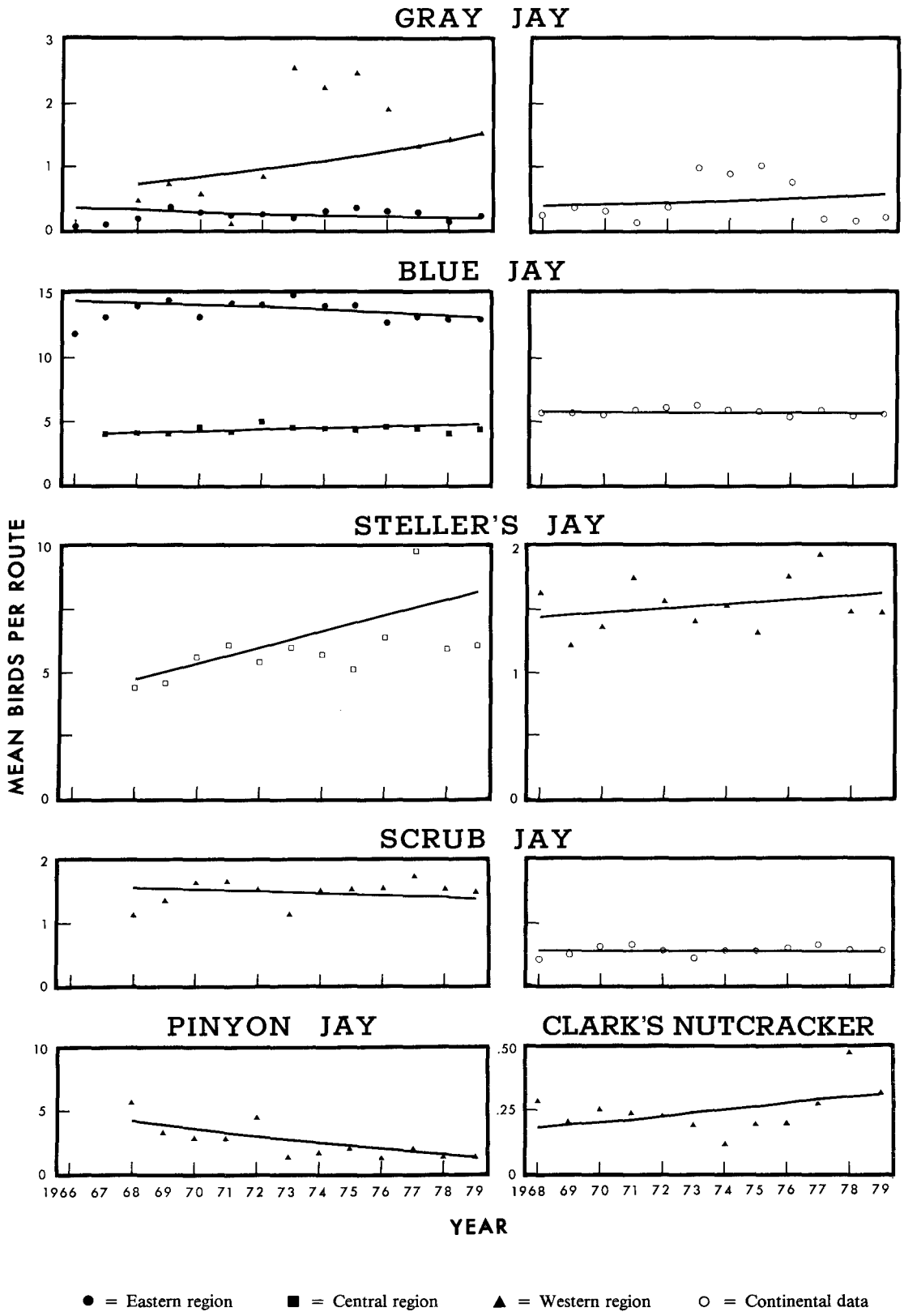


Fig. 18. Trends in jay populations.

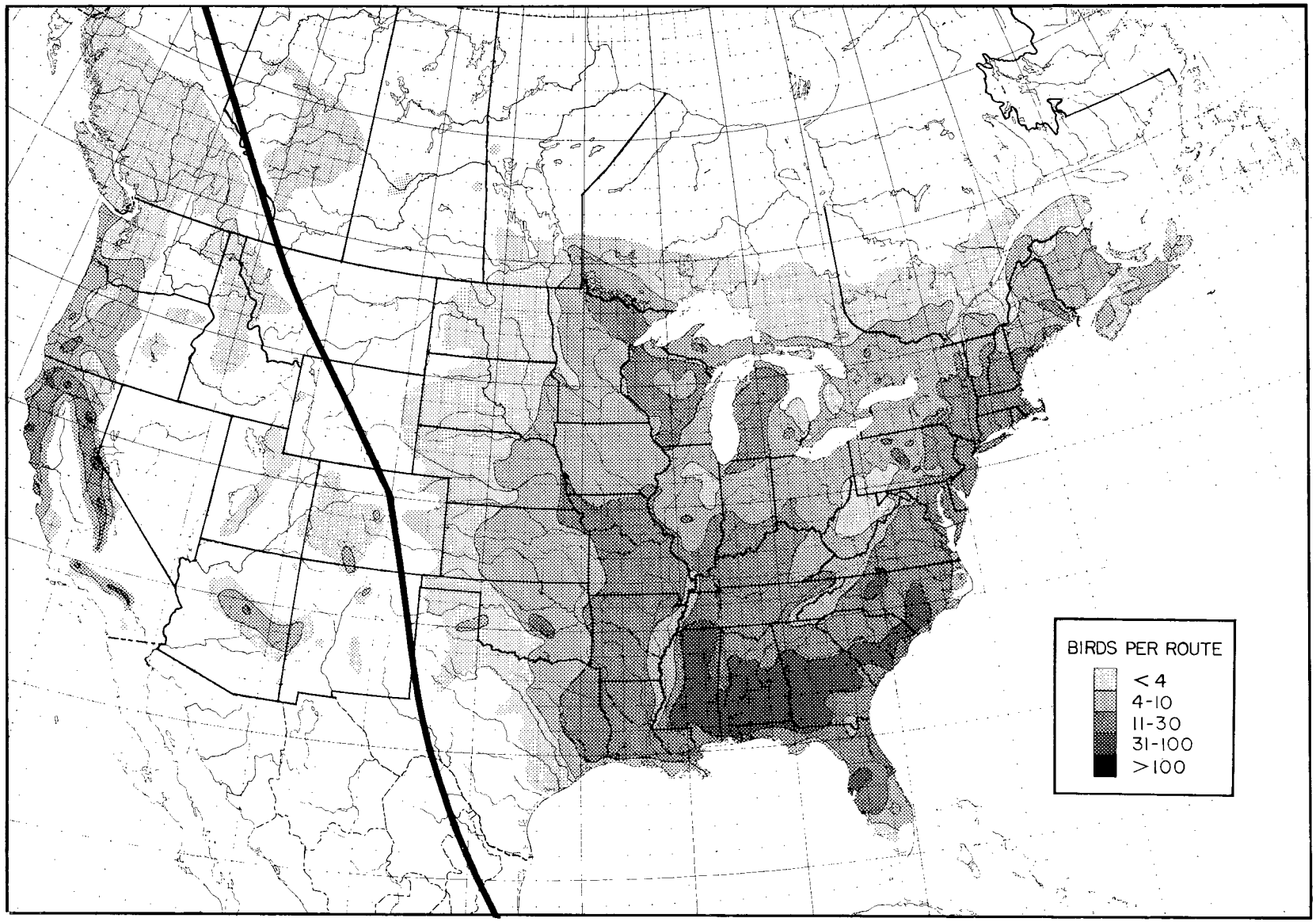


Fig. 19. Mean relative abundance of Blue Jay, 1966–80 (right), and Steller's Jay, 1968–80 (left).

were increases in the Far Western States and in western Canada. These increases were concentrated in the Cascade Mountains and the Pacific Rain Forest; British Columbia was the only Province or State with a significant change. Annual means for the Pacific Rain Forest are plotted in the left-hand graph for this species in Fig. 18. The high counts came from the Los Angeles Ranges and the Sierra–Trinity Mountains (Fig. 19).

Scrub Jay. The Scrub Jay was so locally distributed in the Eastern and Central regions that only trends for the Western region and the continent are illustrated (Fig. 18). Although no significant trends were noted for these areas, there were significant increases in the Klamath Plateau, in the Central Valley of California, and in the Southern Pacific Rain Forest of California. By States and Provinces there were significant increases for Oregon and California, and no decreases. Greatest abundance by far was in California, in the California Foothills and the Los Angeles Ranges (Fig. 20).

Pinyon Jay. This corvid is partial to Pinyon–Juniper Woodland and the Great Basin. Arizona had the highest average statewide density for the Pinyon Jay, which was recorded on only 74 BBS routes continentwide. No significant trend was detected.

Clark's Nutcracker. Clark's Nutcracker was another species for which no significant trend could be detected, partly because of the small number of BBS routes (88) within its limited breeding range. The highest counts by far came from the Los Angeles Ranges. Oregon, Utah, Washington, and Wyoming had the highest species counts (in decreasing order) by State.

Black-billed Magpie. Trends in Black-billed Magpie populations for the three regions (Fig. 21) were essentially level, but there was a significant decrease in the Far Western States. There were no significant increases by strata, but decreases occurred in the Great Basin, Dissected Rocky Mountains, Unglaciated Missouri Plateau, and the High Plains Border. The only significant changes by States and Provinces were decreases in Montana and Alberta, and an increase in British Columbia. Greatest abundance was in the Columbia Plateau, followed by the Wyoming Basin and Southern Rocky Mountains. Highest State and Provincial mean counts were in Idaho, Alberta, Colorado, Utah, Saskatchewan, and Montana. The Yellow-billed Magpie was represented by only 34 routes, and no significant changes were detected. Range maps of both species are given in Fig. 22.

Common Raven. Significant increases in the Common Raven were noted for the Eastern and Western regions and for the continent. By subregions, only the Far Western States showed an increase. There were no decreases by strata, but there were four increases: the California Foothills, Central Rocky Mountains, Great Lakes Transition, and the western portion of the Spruce–Hardwood Forest. Likewise, significant changes by State and Province were all upward for California, British Columbia, Wisconsin, and Ontario. By far the highest means came from the eastern portion of the Spruce–Hardwood Forest, followed by the Pinyon–Juniper Woodland and the California Foothills. Highest mean counts were recorded in New Brunswick (Fig. 23).

Common Crow. The Eastern region showed very slight but significant increases. These increases occurred throughout the region, as shown by subregional increases for the Great Lakes States, the Southeastern States, and the Northeastern States. There was, however, a significant decrease for the Northern Plains States. The only stratum to show a decline was the eastern portion of the Great Lakes Plain, but there were significant increases in eight eastern strata, primarily east of the Appalachian Mountains. Nebraska, South Dakota, and Vermont were the only States with decreases, as compared with increases in British Columbia, California, Texas, Minnesota, Wisconsin, Michigan, Arkansas, Louisiana, Georgia, Virginia, Maryland, Pennsylvania, New Jersey, New York, and Connecticut. The highest mean counts came from the St. Lawrence Plain, the Aspen Parklands, the Northern Piedmont, the western portion of the Upper Coastal Plain and the Great Lakes Transition. Saskatchewan had the highest mean count, followed by Virginia, Wisconsin, West Virginia, and Maryland (Fig. 24).

Fish Crow. The Fish Crow increased significantly and substantially in the Eastern region, specifically in the Southeastern States, and in continental populations. There were significant increases in the Florida Peninsula and in the northern and central sections of the Upper Coastal Plain, but Florida and Mississippi were the only States to show significant increases. The greatest densities were in Florida (Fig. 25).

Northwestern Crow. A resident of the coastal district from southern Alaska to Washington, the Northwestern Crow was recorded on 25 routes, however no significant trend was detected. The center of abundance was the Northern Pacific Rain Forest of British Columbia.

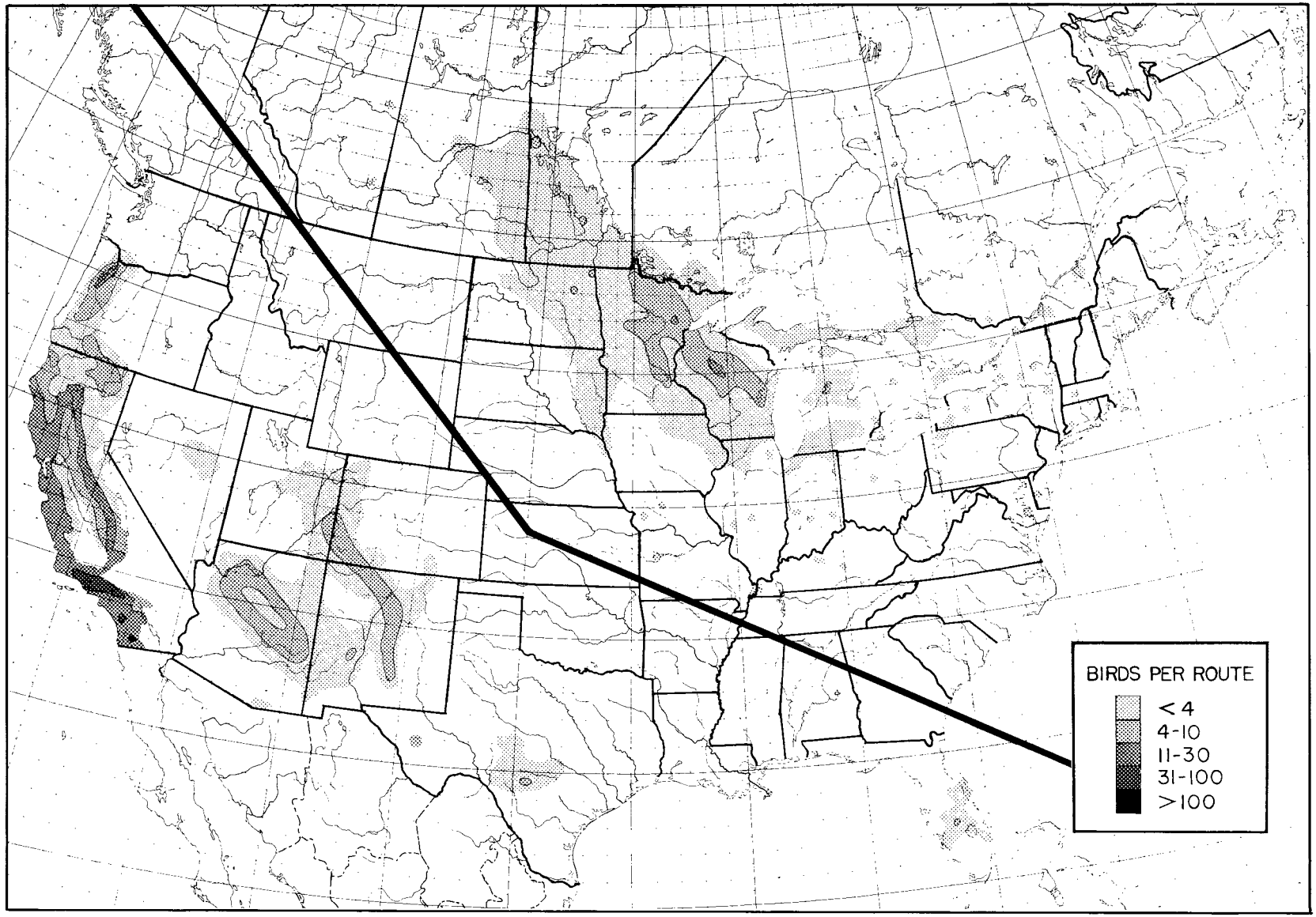


Fig. 20. Mean relative abundance of Scrub Jay (lower) and Short-billed Marsh Wren (upper), 1966–80.

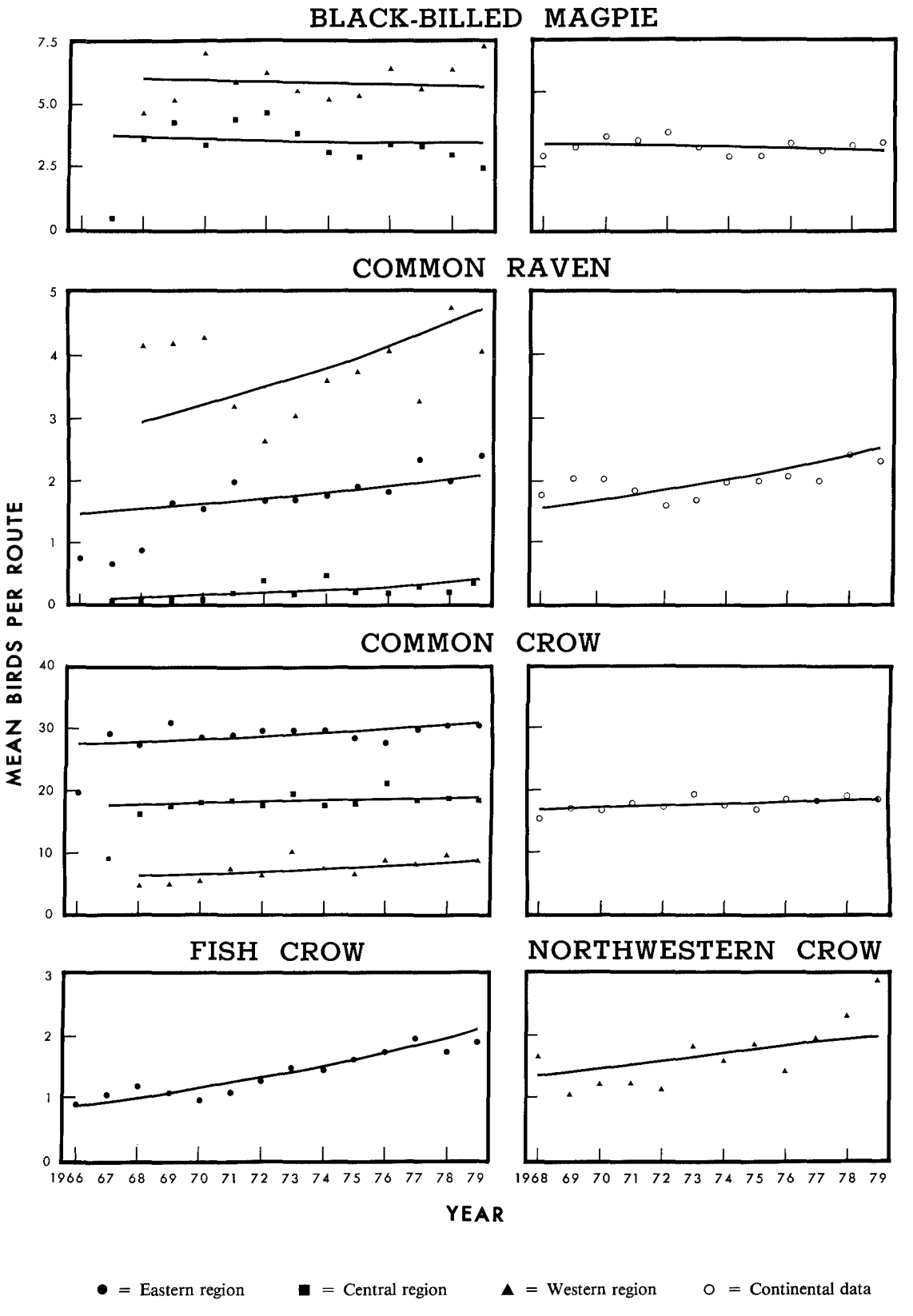


Fig. 21. Trends in magpie, raven, and crow populations.

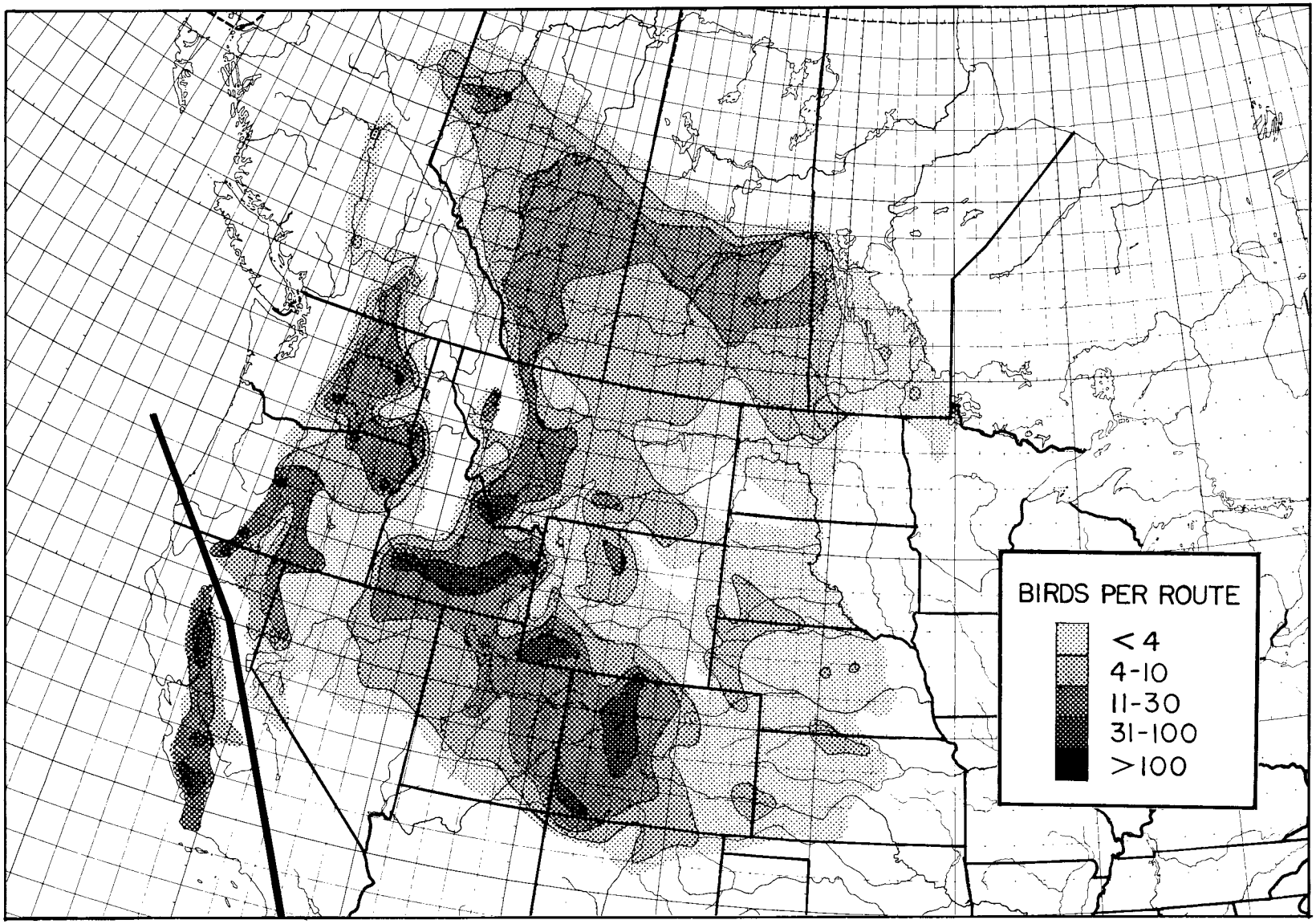


Fig. 22. Mean relative abundance of Black-billed Magpie, 1967–80 (right), and Yellow-billed Magpie, 1968–80 (left).

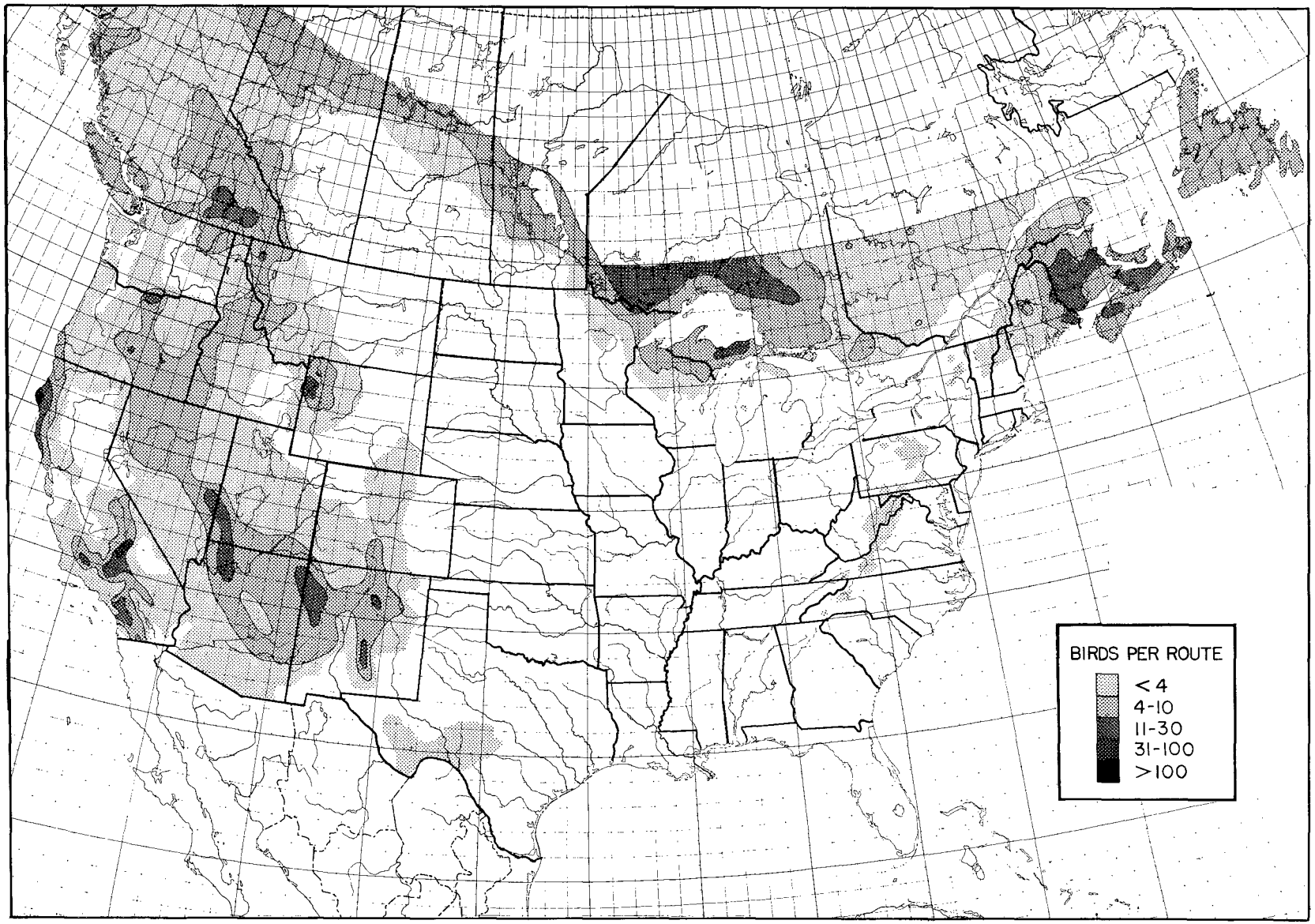


Fig. 23. Mean relative abundance of Common Raven, 1966–80.

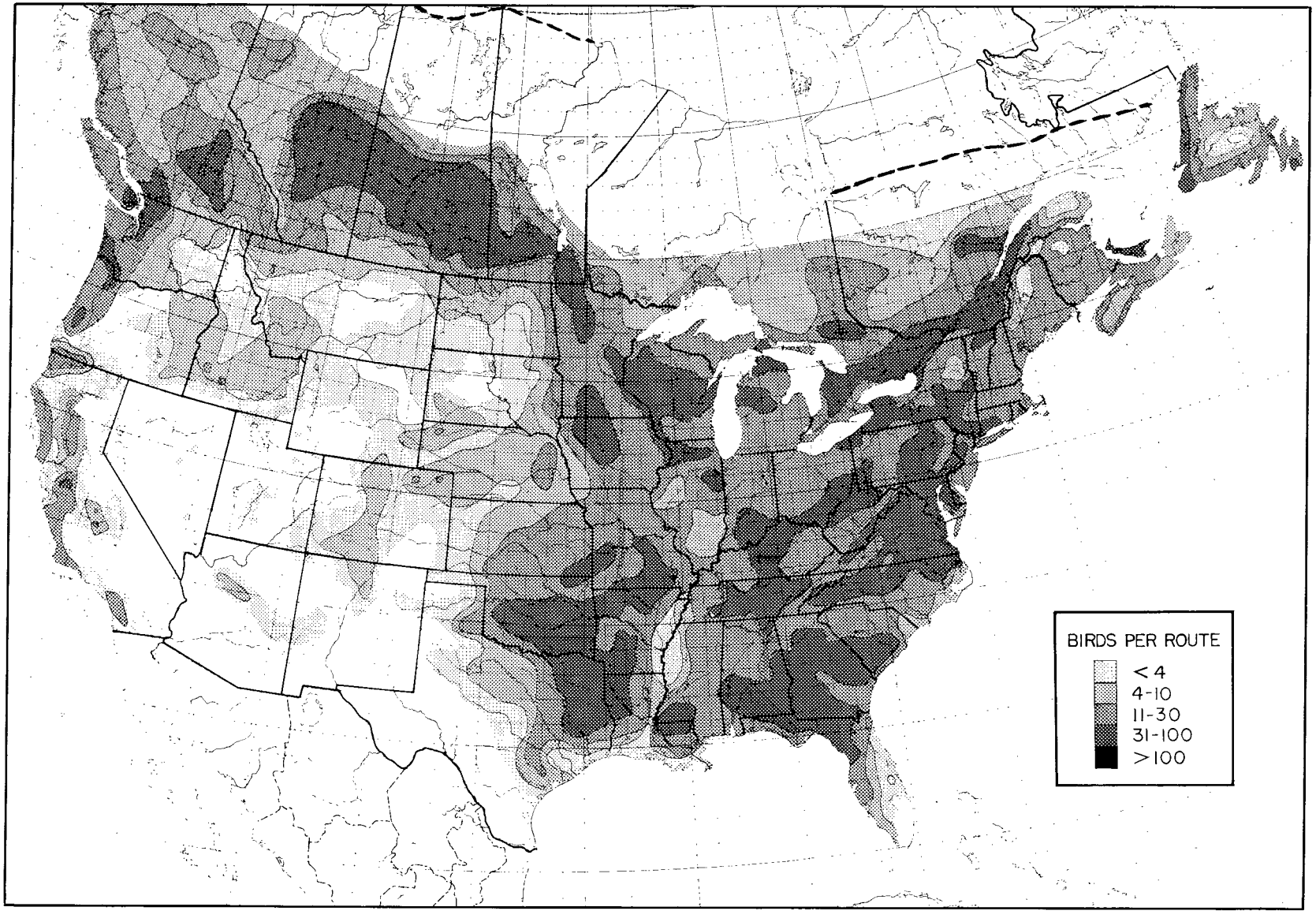


Fig. 24. Mean relative abundance of Common Crow, 1966–80.

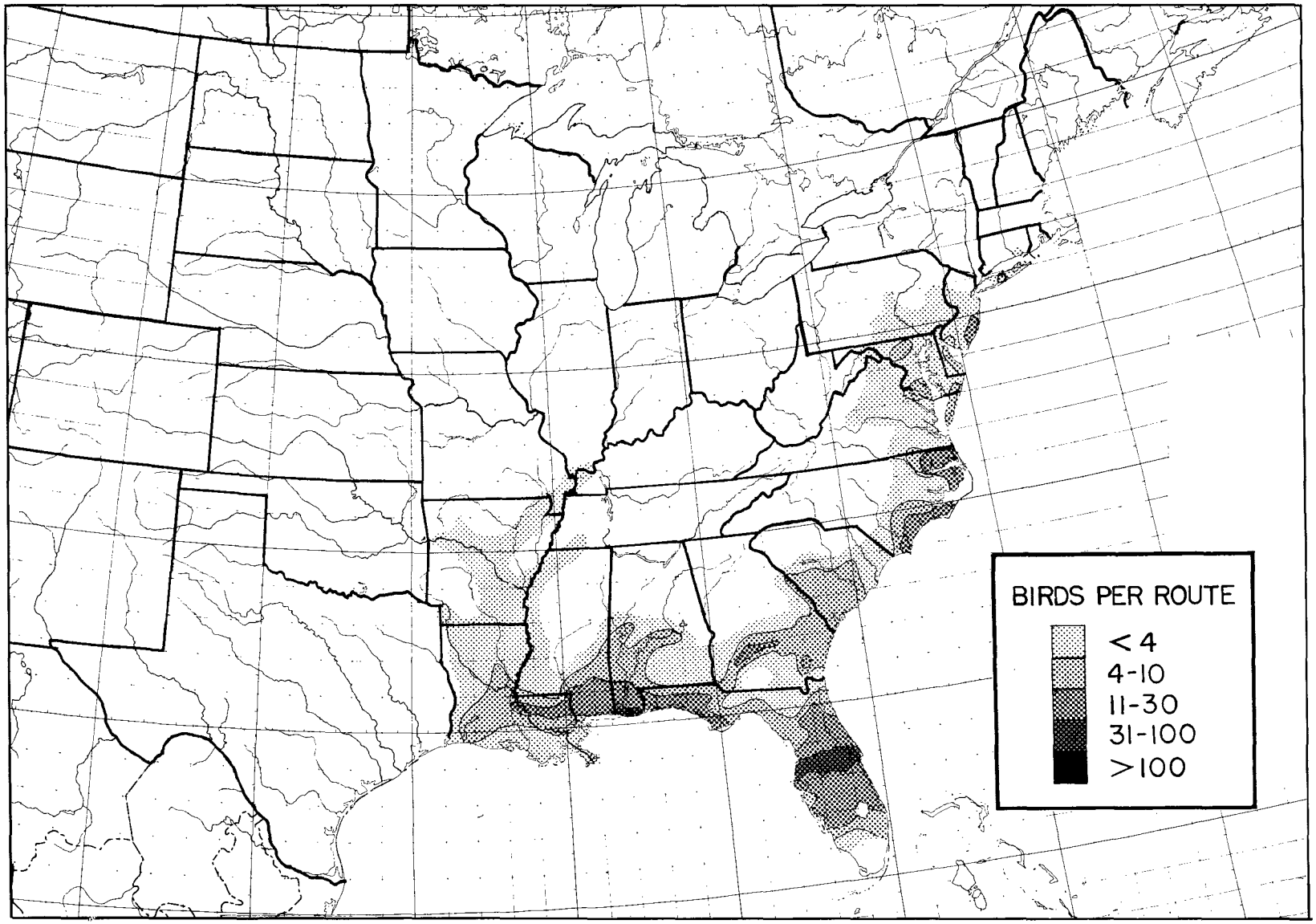


Fig. 25. Mean relative abundance of Fish Crow, 1966–80.

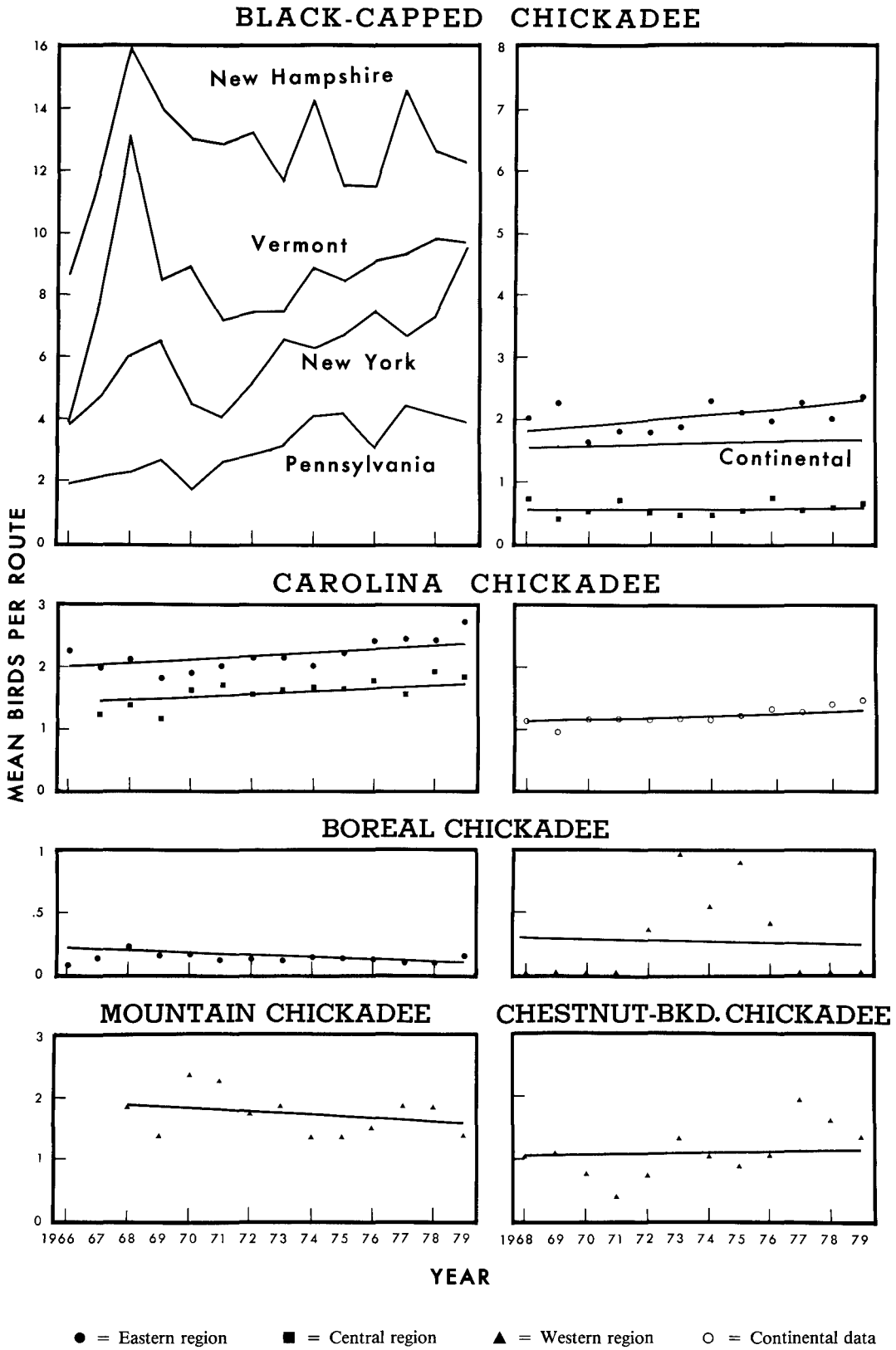


Fig. 26. Trends in chickadee populations.

Chickadees, Titmice, Verdins, and Bushtits
(Figs. 26–30)

Black-capped Chickadee. Black-capped Chickadees increased in the Eastern region, including separate increases for the Great Lakes States and the Northeastern States, but there was a decrease in the Far Western States. No trend was detected for the Central region or for the continent (Fig. 26, center right graph). When examined by strata there were no significant decreases, but there were increases in the western portion of the Spruce–Hardwood Forest, the Great Lakes Transition, the western portion of the Great Lakes Plain, the St. Lawrence Plain, the Adirondack Mountains, Allegheny Plateau, and the Ohio Hills. Washington was the only State that reported a decrease, but there were increases in Minnesota, Wisconsin, Illinois, Pennsylvania, New York, Ontario, and Nova Scotia. Strata with the greatest abundance were Southern New England, the Adirondack Mountains, and Central New England. By States and Provinces the highest average counts were from Massachusetts, New Hampshire, Connecticut, and British Columbia (Fig. 27). Relative abundance and annual fluctuations for four of the Northeastern States are shown in the top left graph of Fig. 26. Significant increases occurred in New York and Pennsylvania. The trend in each of the four States was highly correlated with the trend in neighboring States, but the trend for Pennsylvania was not correlated with the trends in Vermont and New Hampshire. The highest correlations were between Vermont and New York ($r = 0.964$, $P<0.001$) and Vermont and New Hampshire ($r = 0.782$, $P<0.001$). We found no correlation between the breeding populations anywhere in the Northeast and the years in which autumnal irruptions were detected along the coast of Massachusetts by banders at Manomet Bird Observatory, whose seasonal banding records (Lloyd-Evans 1981) showed irruptions in the autumns of 1968, 69, 73, 75, 76, 80, and especially 1971.

Carolina Chickadee. The Carolina Chickadee increased in the Eastern States and the continent, with an upward tendency in the Central region. There were decreases in the Till Plains, the Ohio Hills, and the Highland Rim, and increases in the Osage Plains and the Southern Piedmont. The only changes by States were a decrease in Kentucky and an increase in Tennessee. Greatest abundance was in the Upper Coastal Plain. Louisiana and Alabama had the highest State means (Fig. 28). In marked contrast to the preceding species, the Carolina Chickadee population shows no evidence of strong annual variation in numbers, nor is it known to undergo any irregular dispersal in autumn.

Boreal Chickadee. This northern chickadee declined in the Eastern region, and especially in the Spruce–Hardwood Forest and in Quebec and New Brunswick, where significant drops were detected. The Yukon Territory was the only area in which the Boreal Chickadee was common.

Mountain and Chestnut-backed Chickadees. Although both the Mountain and Chestnut-backed Chickadees were represented on more than 100 BBS routes, no significant population trends were detected at any geographic level. Trends for the Western region, which is the only region in which both species occur, are plotted in Fig. 26 for both species, but it seems apparent from the nearly level slopes of the curves and the high year-to-year variability that no significant change could be detected with our sample size and the relatively short survey period. Centers of abundance for the Mountain Chickadee were in the Los Angeles Ranges and the Sierra–Trinity Mountains of California; Oregon also rated high. The centers of abundance for the Chestnut-backed Chickadee were the Pacific Rain Forests of Washington and of British Columbia (Fig. 28).

Tufted Titmouse. The Tufted Titmouse demonstrates that trends by major regions do not necessarily represent changes within the entire population. A significant decline in the Eastern region could be attributed primarily to a decline in the Great Lakes States, especially in Ohio. The Ohio population had been undergoing a slight downward trend from 1966 through 1977, but the severe winter of 1977–78 caused a sharp drop in populations of this species in Ohio and Indiana, which accentuated the downward tendency. Concurrently, this species had reached a high population in Maryland in 1966, which was reflected in an increase in New Jersey, New York, and Connecticut in 1966–68, and there were additional increases in New York and Massachusetts in 1969–71 (Robbins and Van Velzen 1974*a*). The rapid increase in mean birds per route for Southern New England is compared (Fig. 29, upper left graph) with changes just to the south in the northern portion of the Upper Coastal Plain in New Jersey, Delaware, and Maryland. After once becoming established in southern New England, these birds have taken advantage of feeding stations and have survived the cold winters in that area even though they apparently

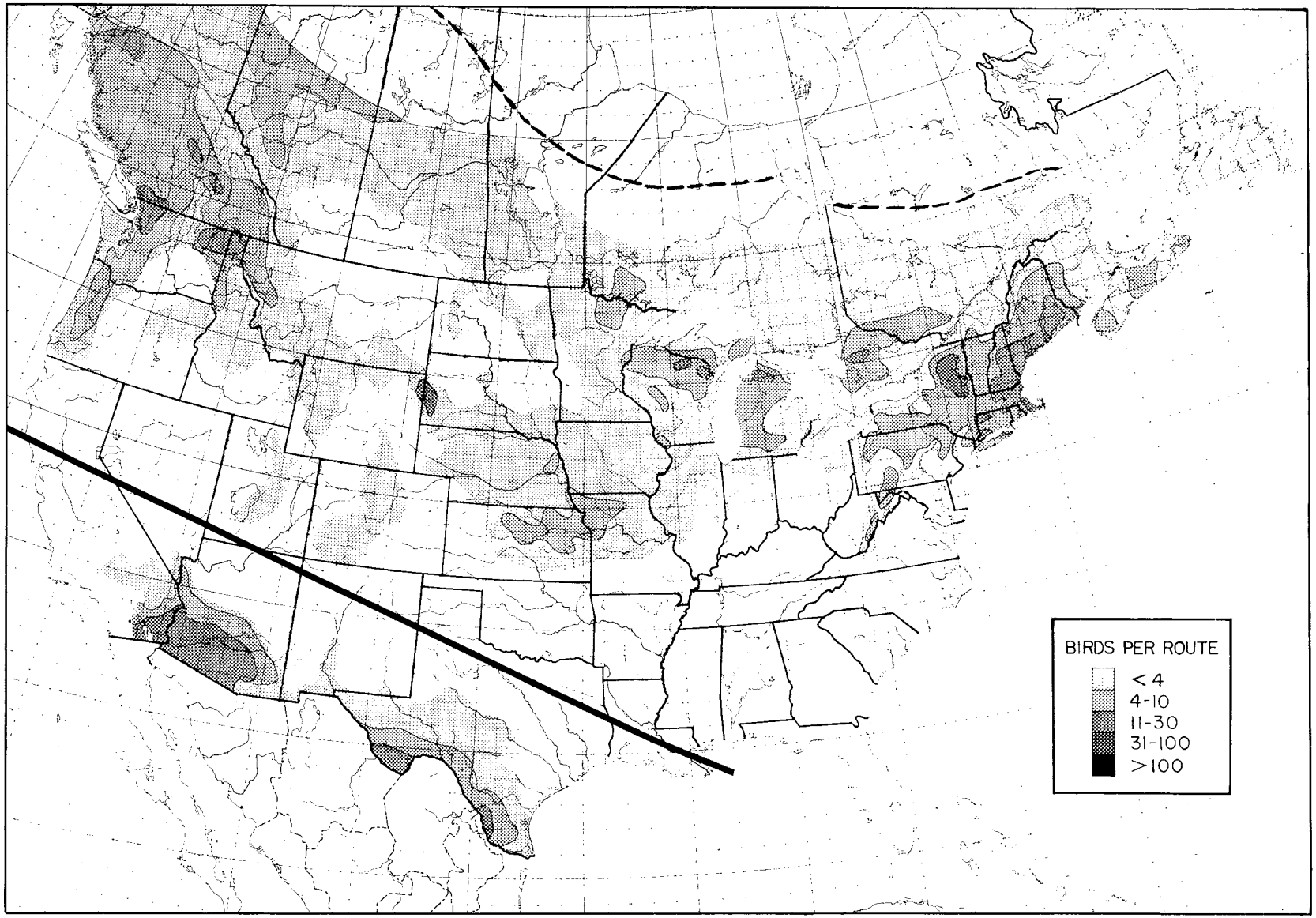


Fig. 27. Mean relative abundance of Black-capped Chickadee, 1966–80 (upper), and Verdin, 1967–80 (lower).

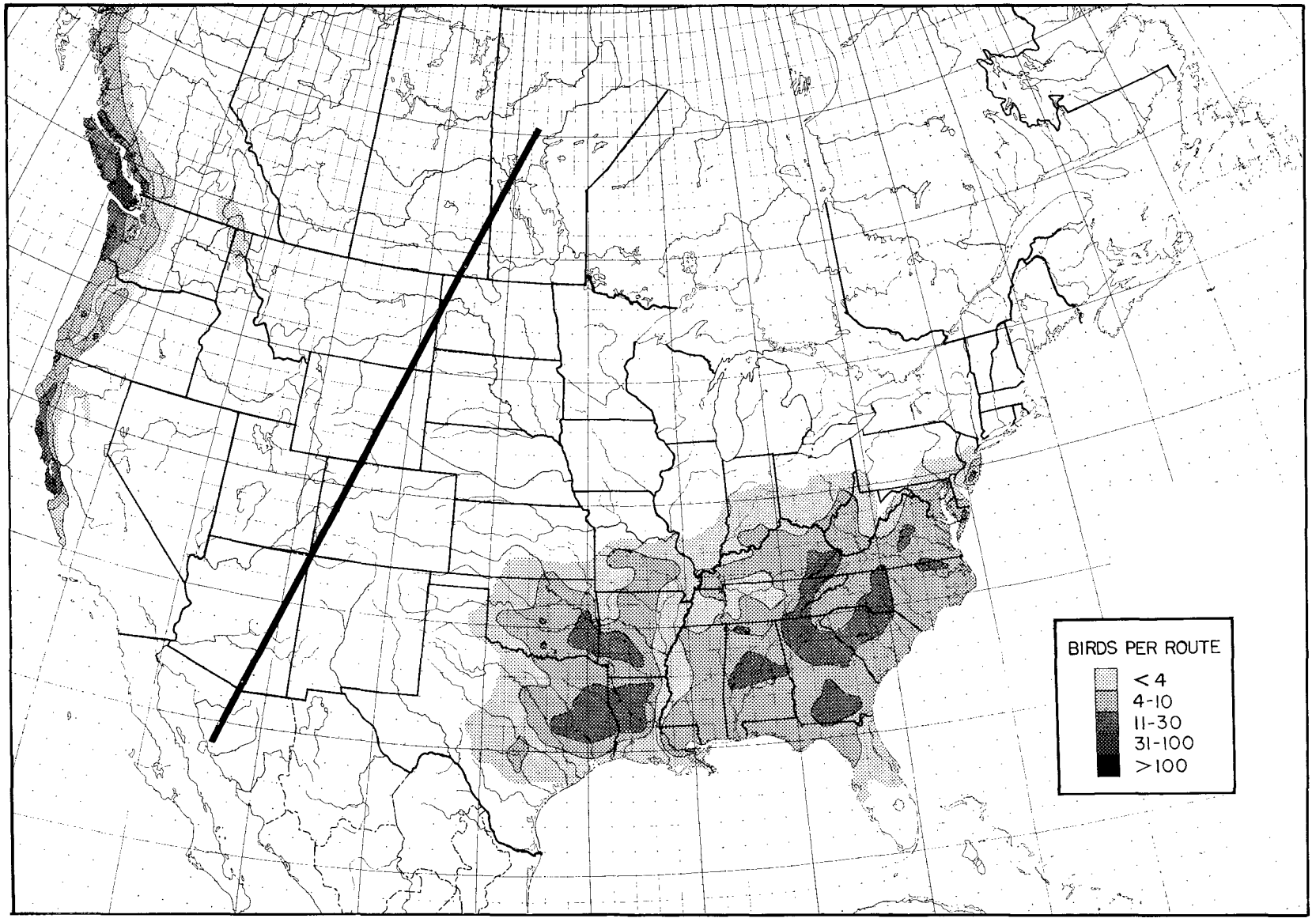


Fig. 28. Mean relative abundance of Carolina Chickadee, 1966–80 (right), and Chestnut-backed Chickadee, 1968–80 (left).

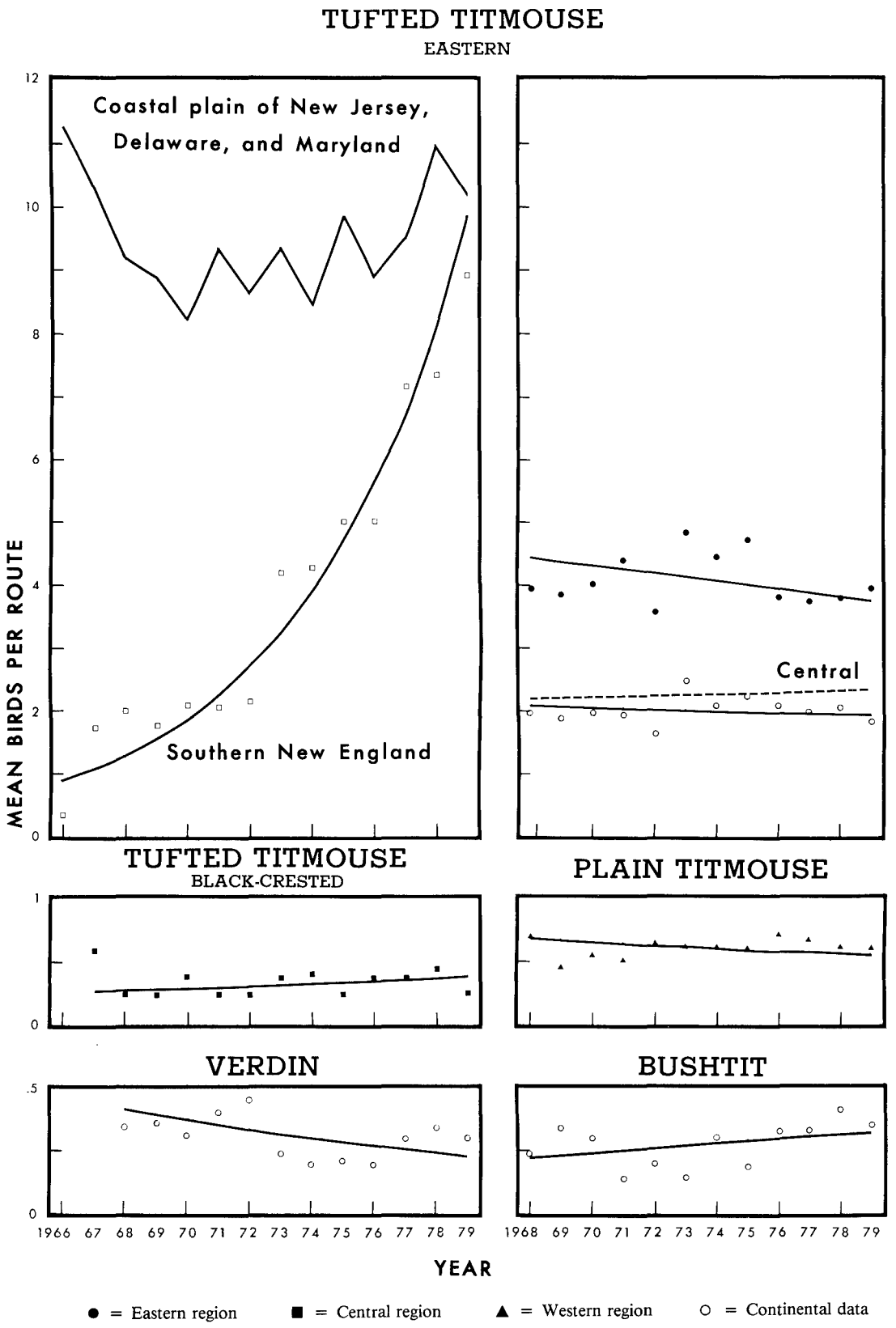


Fig. 29. Trends in titmice, Verdin, and Bushtit populations.

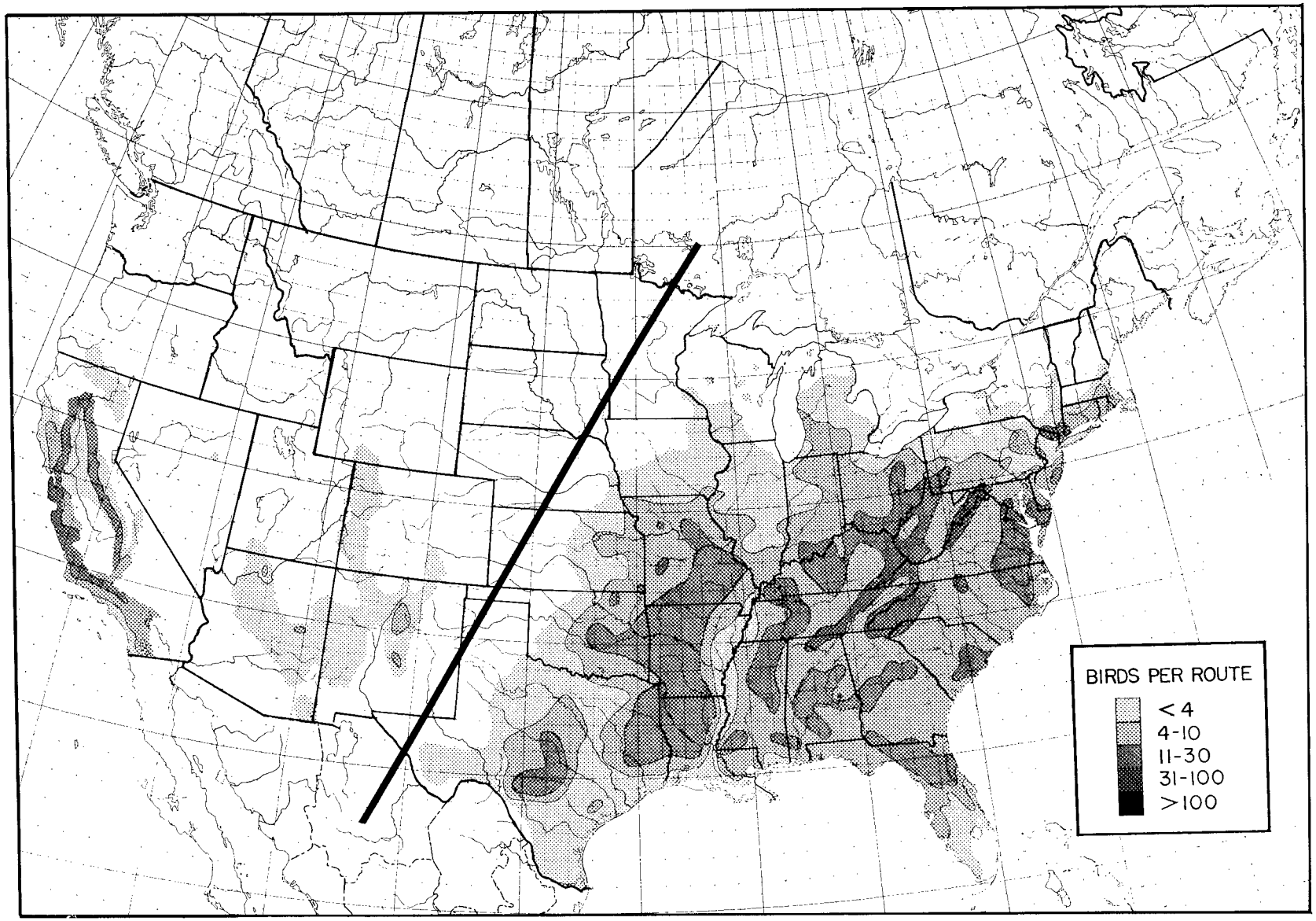


Fig. 30. Mean relative abundance of Tufted Titmouse, 1966–80 (right), and Plain Titmouse, 1968–80 (left).

were unable to survive the very severe cold of 1976–77 in Indiana and Ohio. The trends for the Central region and the continent were not significant. The highest stratum averages for Tufted Titmouse came from the western portion of the Upper Coastal Plain and the Ozark–Ouachita Plateau. West Virginia had the highest State mean, followed by Missouri, Tennessee, Maryland, and Virginia.

The Black-crested race of the Tufted Titmouse was considered a separate species at the beginning of the BBS, and we have continued to keep separate records for this easily identifiable subspecies, which reached its greatest density in the Edwards Plateau of central Texas (Fig. 30). No significant population change was detected.

Plain Titmouse. This species showed no significant population change. Its center of abundance was in the California Foothills (Fig. 30).

Verdin. The Verdin's decline in the Central region was strong enough to give it a significant decrease for the continent, as well as for the South Texas Brushlands, an area second in abundance only to the Sonoran Desert (Fig. 27).

Bushtit. Although no significant change was detected for the Bushtit at any level, there is an indication that it is increasing and spreading in British Columbia. It is most abundant in the California Foothills and the Los Angeles Ranges.

Nuthatches (Figs. 31–32)

White-breasted Nuthatch. There were parallel trends in populations of the White-breasted Nuthatch from all three regions, but only those from the Eastern and Central regions and for the continent represented significant increases (Fig. 31). At the subregional level, significant increases were limited to the Southwestern and Great Lakes States. Except for a decrease in the Sierra–Trinity Mountains, all stratum changes were increases: California Foothills, Osage Plains, Ozark–Ouachita Plateau, Highland Rim, Great Lakes Transition, Blue Ridge Mountains, and Northern Piedmont. By States, there were significant declines in Massachusetts, New York, and Virginia, but significant increases in Oklahoma, Kansas, Missouri, Tennessee, Illinois, and Michigan. The highest counts by strata were in the Los Angeles Ranges, followed by the Sierra–Trinity Mountains, the California Foothills and the Wisconsin Driftless Area. By States, however, the highest average counts were in Connecticut, Missouri, and Massachusetts.

Red-breasted Nuthatch. No significant trend was found for the Red-breasted Nuthatch, whose greatest abundance was in the Sierra–Trinity Mountains of California, and whose highest State density was in Oregon (Fig. 32).

Brown-headed Nuthatch. This bird of the southeastern pine woods increased in the southern portion of the Upper Coastal Plain, but decreased in Florida. Greatest abundance of the Brown-headed Nuthatch was in the southern portion of the Lower Coastal Plain and the adjacent portion of the Upper Coastal Plain. Highest abundance by States occurred in Georgia, South Carolina, and Alabama (Fig. 32).

Pygmy Nuthatch. The Pygmy Nuthatch showed indications of declining in the Western region; however, the only significant change was an increase in California. This species was recorded on fewer than 15 routes in every stratum. The Los Angeles Ranges had the highest breeding density by far, and the State with the highest average count was Arizona.

Creepers and Wrentits (Fig. 31)

Brown Creeper. Although the Brown Creeper was recorded on 340 routes, numbers were very low throughout its range and few significant changes were detected (Fig. 31). There were increases in the Central Rocky Mountains, the Great Lakes States, and Southern New England, and a decrease in the Sierra–Trinity Mountains. State analyses showed decreases for Oregon and New Hampshire, and an increase only for Massachusetts. The only stratum averaging more than three birds per route was the Sierra–Trinity Mountains.

Wrentit. The Wrentit, which is virtually restricted to California, showed a significant increase in that State, but not for the Western region because there were decreases on most of the Oregon routes. The highest average counts were in the Los Angeles Ranges and the California Foothills.

Wrens (Figs. 33–37)

House Wren. House Wrens increased in the Eastern and Central regions and across the continent (Fig. 33) despite a winterkill in the East in 1976–77. There were subregional increases in the Northern Plains States, the Great Lakes States, and the Northeastern States. The only significant declines were in the California Foothills and the western portion of the Spruce–Hardwood Forest. There were increases

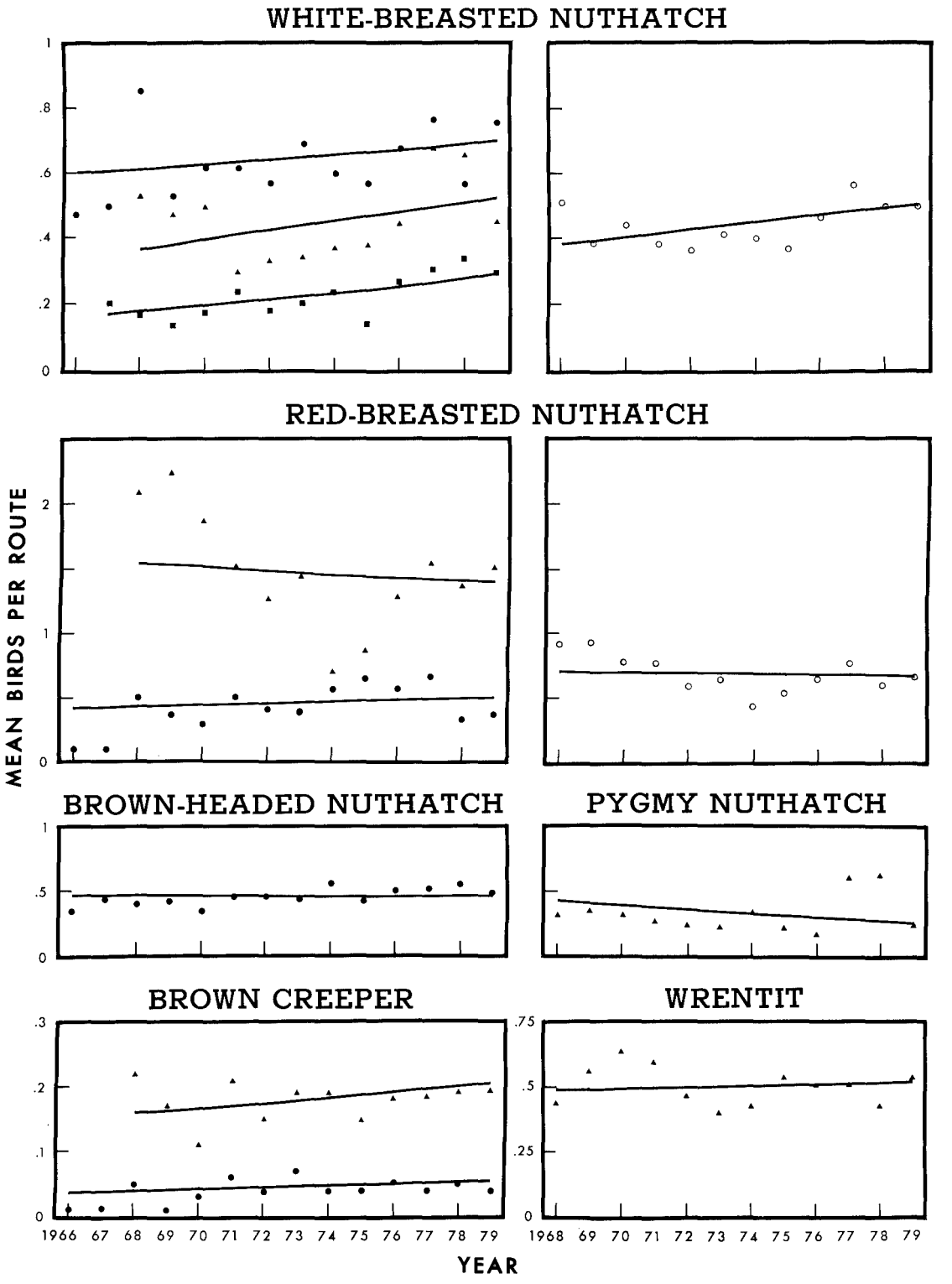


Fig. 31. Trends in nuthatch, creeper, and Wrentit populations.

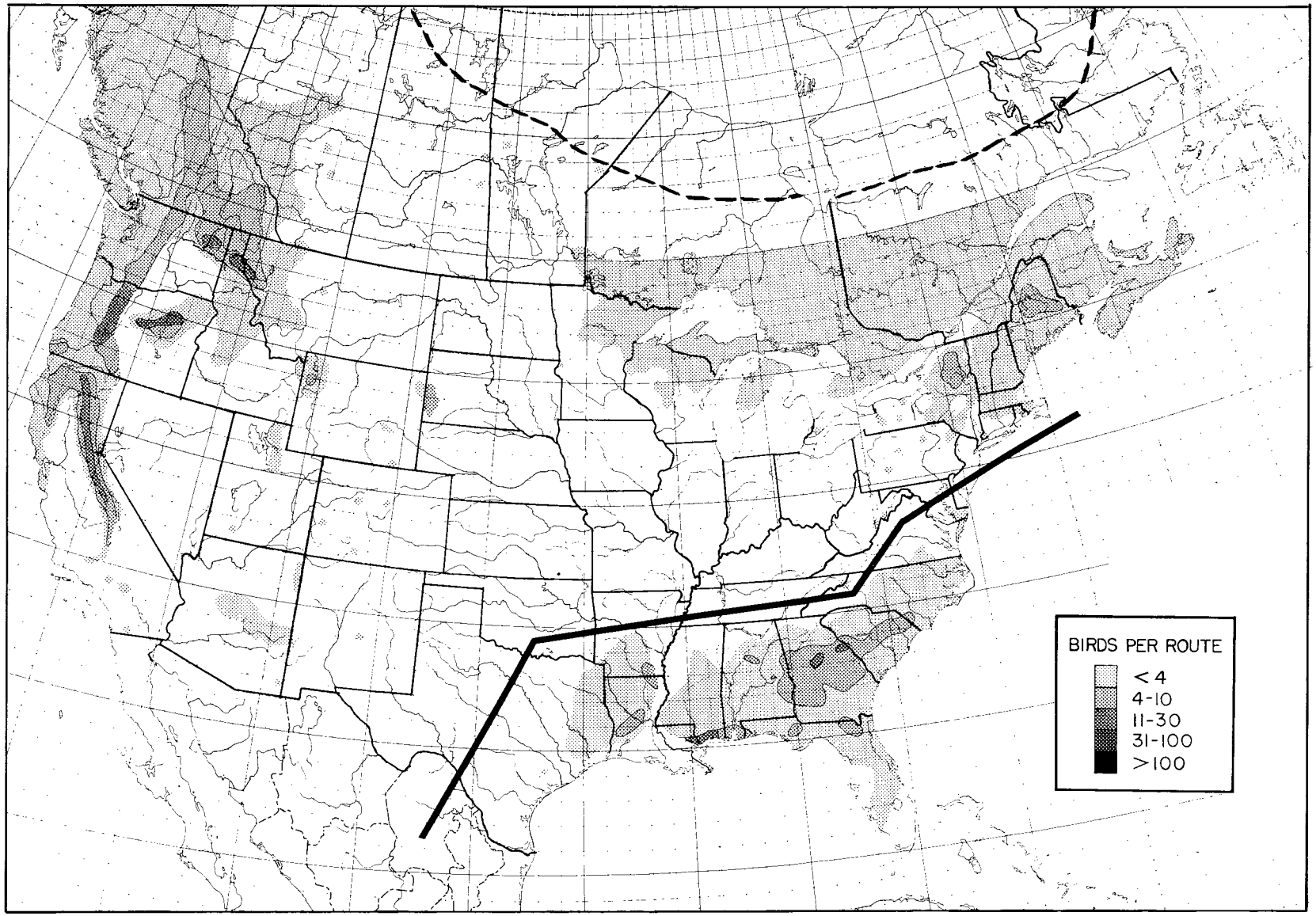
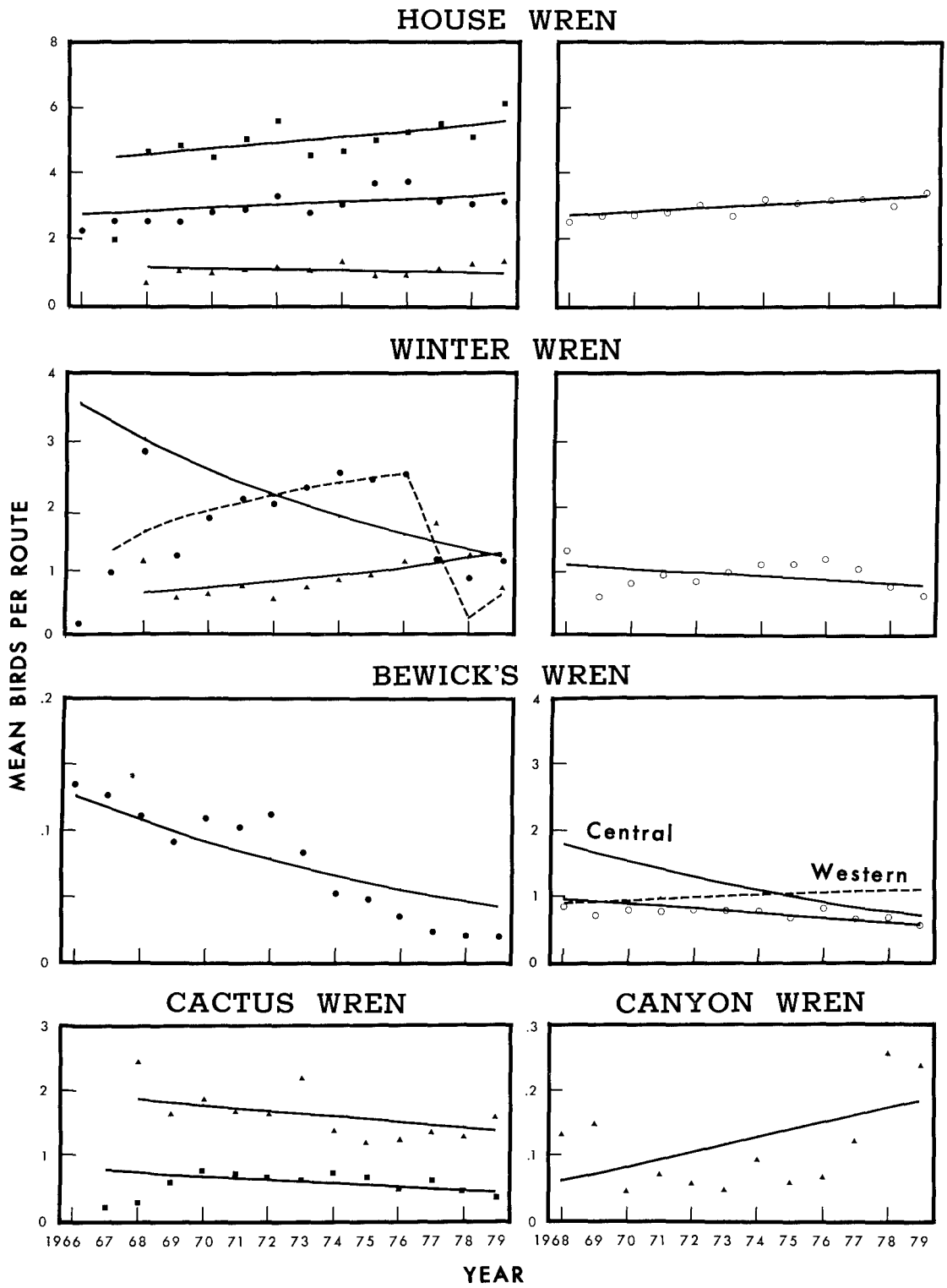


Fig. 32. Mean relative abundance of Red-breasted Nuthatch (upper) and Brown-headed Nuthatch (lower), 1966–80.



● = Eastern region ■ = Central region ▲ = Western region ○ = Continental data

Fig. 33. Trends in wren populations, part 1.

in the Drift Prairie, the High Plains Border, the Ozark-Ouachita Plateau, the Wisconsin Driftless Area, the eastern section of the Great Lakes Plain, the St. Lawrence Plain, Central New England, Allegheny Plateau, and Ohio Hills. There were no State or Provincial decreases, but there were increases in South Dakota, Kansas, Minnesota, Kentucky, Ohio, Pennsylvania, New York, Massachusetts, and New Hampshire. Areas of greatest abundance were the Aspen Parklands, the northern portion of the Ridge and Valley, and the Wisconsin Driftless Area (Fig. 34).

Winter Wren. The Winter Wren was one of the species most vulnerable to the severe winter weather of 1976-77 and 1977-78, and it furnishes an excellent example of how long-term trends (Fig. 33, solid lines) may not reflect actual changes in the population. This species was increasing in the Eastern region (Fig. 33, dashed line) as well as in the Western region through 1976, but the drop in the following 2 years that resulted from two severe winters actually reversed the trend in the Eastern region and caused a significant 14-year decline that exceeded the continued increase in the Western region and produced an overall continental decline for the species. The decline for the Eastern region was composed of a significant decline for the Northeastern States and for the Canadian Provinces, as well as a negative tendency in the Great Lakes States. There was an increase in the Pacific Rain Forest, but there was a decrease in the Spruce-Hardwood Forest. An increase in California and a decrease in Maine were the only State changes, but there were decreases for the three eastern Canadian Provinces of Ontario, Quebec, and New Brunswick. The highest average counts came from the Spruce-Hardwood Forest and the Pacific Rain Forest. Quebec, New Brunswick, and Washington had the highest State and Provincial means. The Winter Wren was one of the species whose populations were most seriously affected by a winter of almost unprecedented severity in Great Britain in January and February 1963. Batten and Marchant (1976) reported that annual monitoring by means of their Common Birds Census showed that at least as many as 11 years after the decline this species was still increasing substantially in numbers.

Bewick's Wren. Bewick's Wren was another species affected by severe weather in the Eastern and Central States. Significant sharp declines in numbers occurred in both the Eastern and Central regions and the continent. The tendency in the Western region was not significant. There were separate significant decreases in the Southwestern States, the Great Lakes States, the Southeastern States, the southern portion of the Upper Coastal Plain, the southern portion of the Ridge and Valley Province, the Highland Rim, the South Texas Brushlands, Ozark-Ouachita Plateau, Osage Plains, and the Edwards Plateau; there was no stratum with an increase. By States there were significant declines in Texas, Oklahoma, Missouri, Kentucky, and Tennessee, and no increases. Although 113 routes in the Eastern region recorded this species during 1966-79, no Bewick's Wrens were recorded from Wisconsin, Illinois, Indiana, Alabama, or Maryland after 1976. This wren was recorded on 49% and 12% of eastern routes within its range in 1966 and 1979, respectively. Note that the scale for the eastern populations of this species (Fig. 33) is very different from the scale for other portions of the continent. The highest mean counts for this species came from the Edwards Plateau, the Los Angeles Ranges, and the South Texas Brushlands. Highest average counts in the East were in the Lexington Plain of Kentucky (Fig. 35). The decline of Bewick's Wrens in the Appalachian Mountains has been reported by Simpson (1978) and Smith (1980). Well-monitored nest boxes would be one way to help this species reverse its downward trend. The Bewick's Wren is certainly in much poorer condition east of the Mississippi River than is the Eastern Bluebird by a ratio of about 30:1.

Cactus Wren. The Cactus Wren decreased in the Central region, in the Southwestern States, in the South Texas Brushlands, and for the continent. Highest counts came from the South Texas Brushlands, the Sonoran Desert, and the Mexican Highlands. Arizona had the highest State mean.

Canyon Wren. This wren increased in the Western region, but no significant change was detected in smaller subdivisions of its range. The highest average counts for the Canyon Wren came from the Wyoming Basin, the California Foothills, and the Sierra-Trinity Mountains; Wyoming, Utah, and Arizona had the highest State counts for this species.

Carolina Wren. Each graph (Fig. 36) for this permanent resident species is subdivided into four main sections reflecting the effects of winter weather conditions—a period of normally cold winters from 1966 through 1970, a period of mild winters from 1971 through 1975, two unusually severe winters in 1976-77 and 1977-78, and a return to normal winter conditions in 1978-79. The Carolina Wren can survive periods of cold weather as long as it is able to

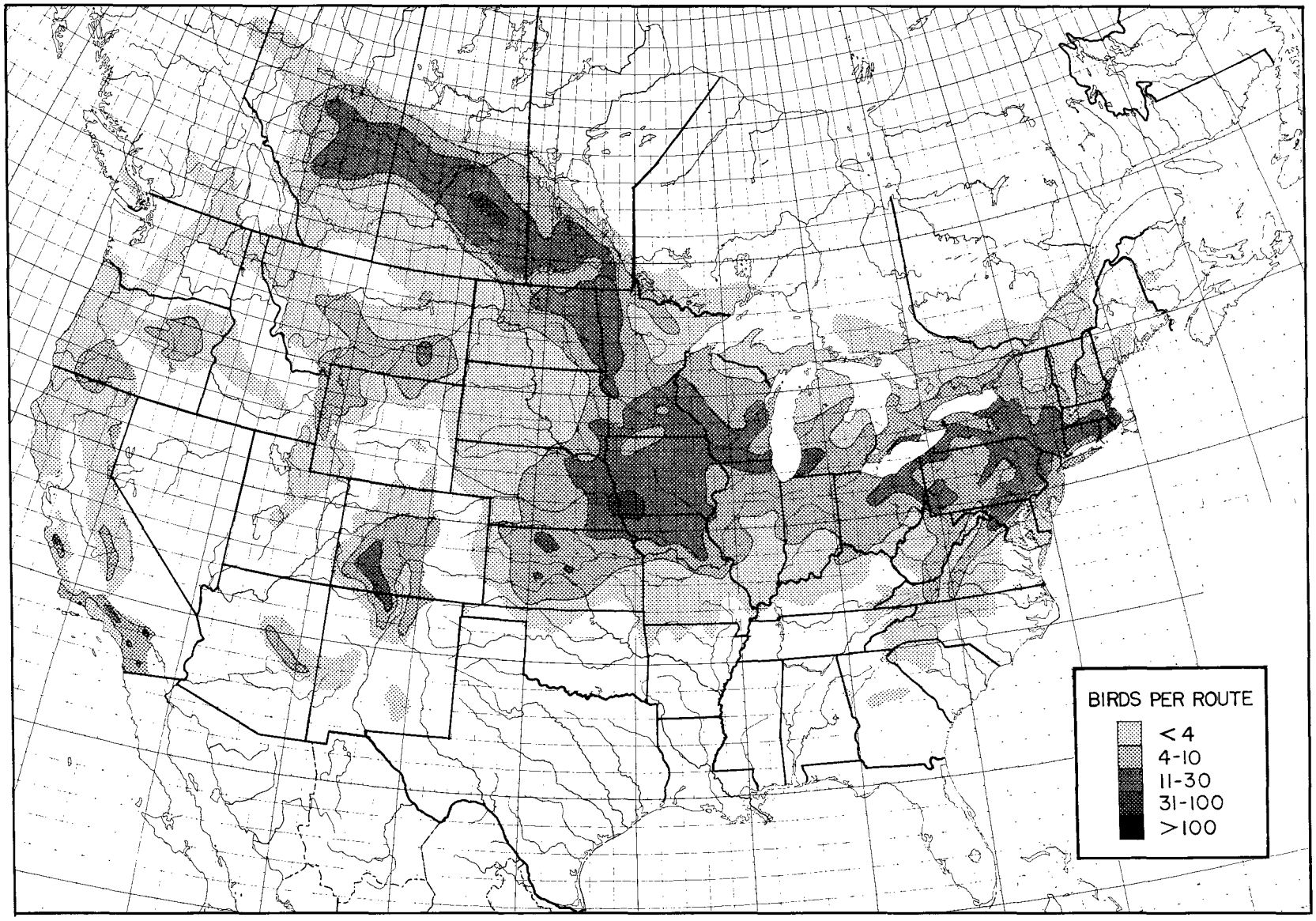


Fig. 34. Mean relative abundance of House Wren, 1966–80.

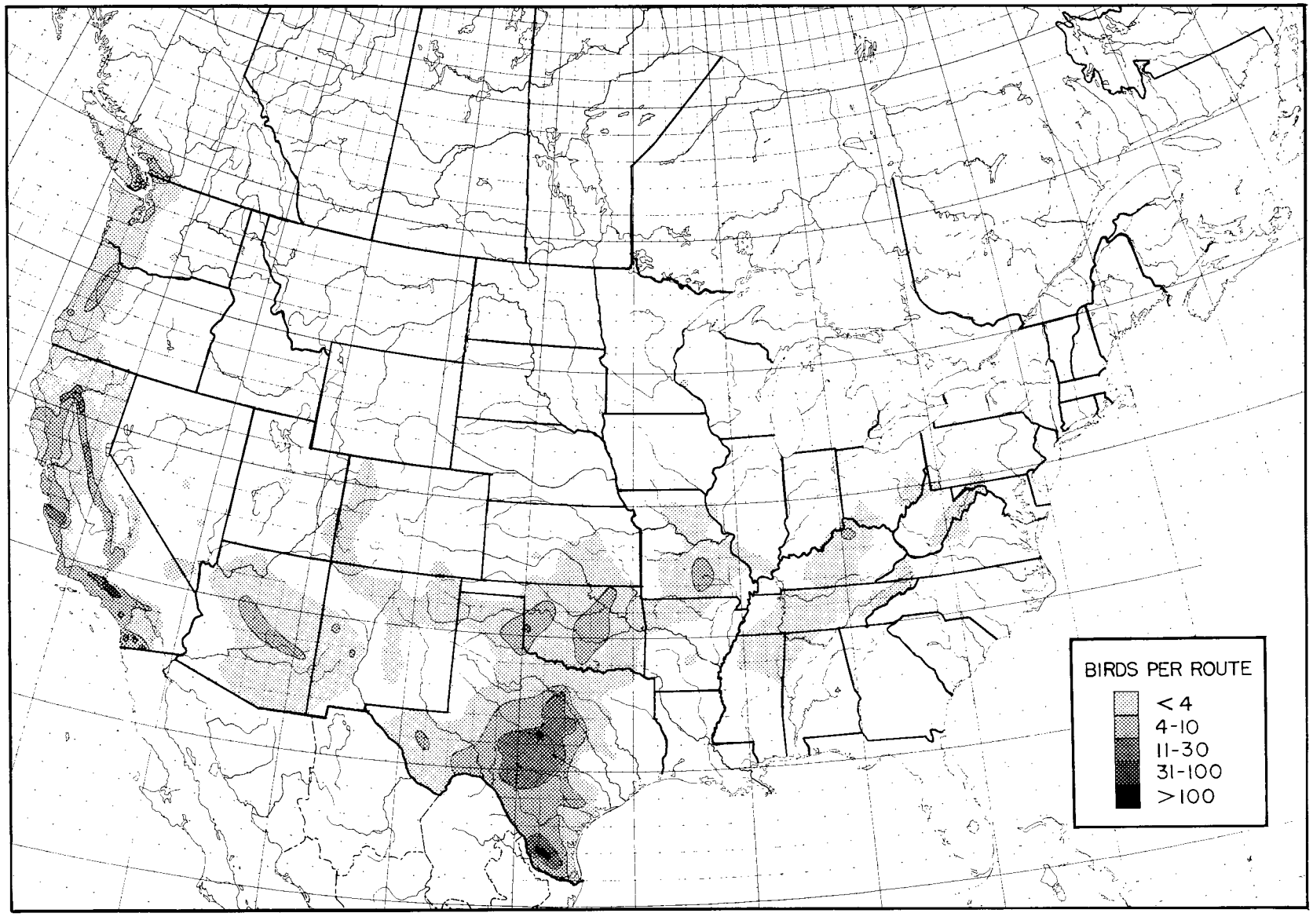


Fig. 35. Mean relative abundance of Bewick's Wren, 1966–80.

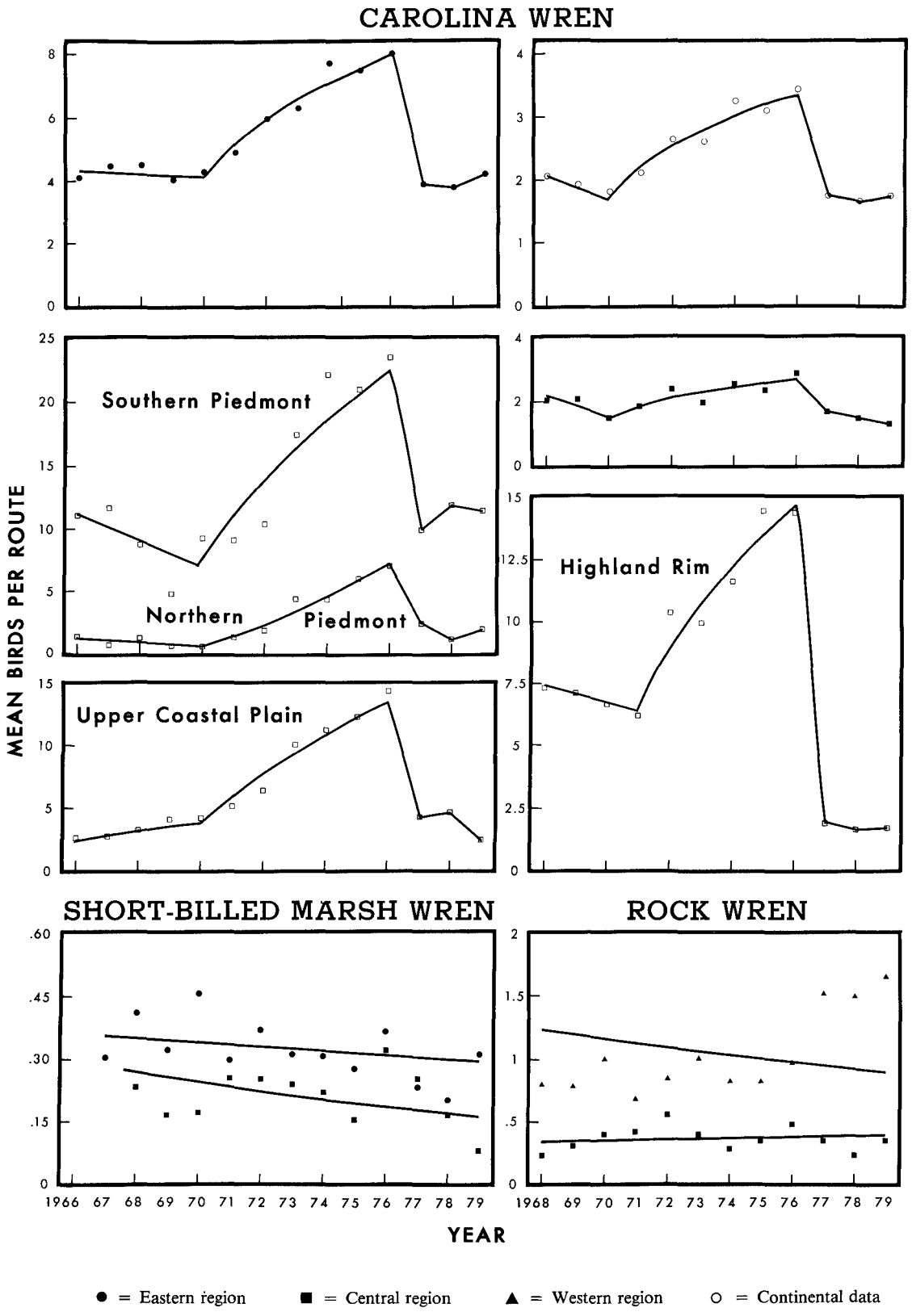


Fig. 36. Trends in wren populations, part 2.

find food. Even where conditions were very severe, some Carolina Wrens survived at feeding stations, whereas nearby populations trying to survive in the wild were decimated. When heavy snow was covered by a hard crust of ice their normal food resources where inaccessible (Tamar 1978). Population trends of Carolina Wrens in the Eastern region have been previously charted in relation to winter temperatures at Washington, D.C., by Bystrak and Robbins (1977) and Bystrak (1979). The mean temperatures for December, January, and February used in those comparisons may not be the best measure of snow and ice cover, but they do give an indication of the relative severity of these three winter months and certainly show a strong correlation with Carolina Wren populations. Separate trends are shown in Fig. 36 for not only the Eastern and Central regions and the continent, but for four separate strata: the Southern Piedmont, Northern Piedmont, Upper Coastal Plain, and the Highland Rim (including the Lexington Plain). Winter weather was most severe in the Ohio River Valley and had a greater effect on populations west of the Appalachian Mountains than on those to the east. The shape of the population curve departs so much from a smooth curve that no significant long-term trend could be detected for the Eastern region. The Central region, however, showed a significant decline for the 14-year period. By strata there were long-term increases in the Southern Piedmont, Southern New England, and the northern and central portions of the Upper Coastal Plain. On the other hand, there were decreases in the Osage Plains, Ozark-Ouachita Plateau, East Texas Prairies, Till Plains, Blue Ridge Mountains, Ohio Hills, and the Highland Rim. By States the only long-term increases occurred in Maryland and North Carolina, whereas significant decreases occurred in Oklahoma, Arkansas, Missouri, Kentucky, Illinois, and Ohio. The highest average counts came from the northern portion of the Lower Coastal Plain, and the western portion of the Upper Coastal Plain. South Carolina, Florida, and Louisiana had the highest State counts for this species (Fig. 37).

Short-billed Marsh Wren. This species declined in the Central region and in the Great Lakes and Northeastern States, as well as across the continent (not illustrated). There was also a decline in the Drift Prairie and in Wisconsin, where the Short-billed Marsh Wren was detected on 63 of 70 routes. Distribution of this species was strongly clustered; birds were especially abundant in sedge meadow habitat. More than half of the birds counted were in the Great Lakes Transition and the Black Prairie. The only States that averaged more than one-half bird per route were Minnesota, Wisconsin, and North Dakota (Fig. 20). More than three birds per route were recorded in Minnesota and Wisconsin.

Rock Wren. The Rock Wren did not show any regional or continental trend but did increase in California. The highest average counts came from Wyoming and from the Pinyon-Juniper Woodland.

Mockingbirds and Thrashers (Figs. 38–43)

Northern Mockingbird. Although expanding its range in the Northeast, the Northern Mockingbird decreased significantly in the three regions and across the continent. Canada and the Far Western States were the only subregions without significant declines. In addition to the usual regional and continental trends, Fig. 38 shows the annual weighted means for the stratum of greatest expansion, Southern New England, in relation to the nearby Ridge and Valley figures, and the very different trend for the Till Plains and Ohio Hills, which were severely affected by cold winter weather in 1976–77 and 1977–78. The only strata with increases were the eastern portion of the Great Lakes Plain, central and southern New England, and the northern portion of the Ridge and Valley. The only significant change in the Western region was a decrease in the Mexican Highlands. All but 1 of the 12 strata in the Central region showed negative tendencies, although only 5 of these were statistically significant. In the Eastern region, increases tended to be in the Northeastern States, and decreases elsewhere. Significant increases in individual States were limited to New York, Connecticut, and Massachusetts, whereas there were declines in Colorado, Kansas, Oklahoma, Texas, Arkansas, Missouri, Illinois, Kentucky, Tennessee, Alabama, Georgia, North and South Carolina, Virginia, and Maryland. The Northern Mockingbird reached its greatest abundance in the South Texas Brushlands, Edwards Plateau, and Florida (Fig. 39).

Gray Catbird. The graph (Fig. 38) for the Gray Catbird in the Eastern region closely parallels that for the Carolina Wren (Fig. 36) except that the population changes for the Gray Catbird were not nearly so severe, probably because the species winters several hundred kilometers farther south and therefore is not so exposed to prolonged, severe cold. There was a slight but significant increase in the Eastern region, particularly the Northeastern States, but the continental trend was not significant. There was a significant increase in the eastern portion of the

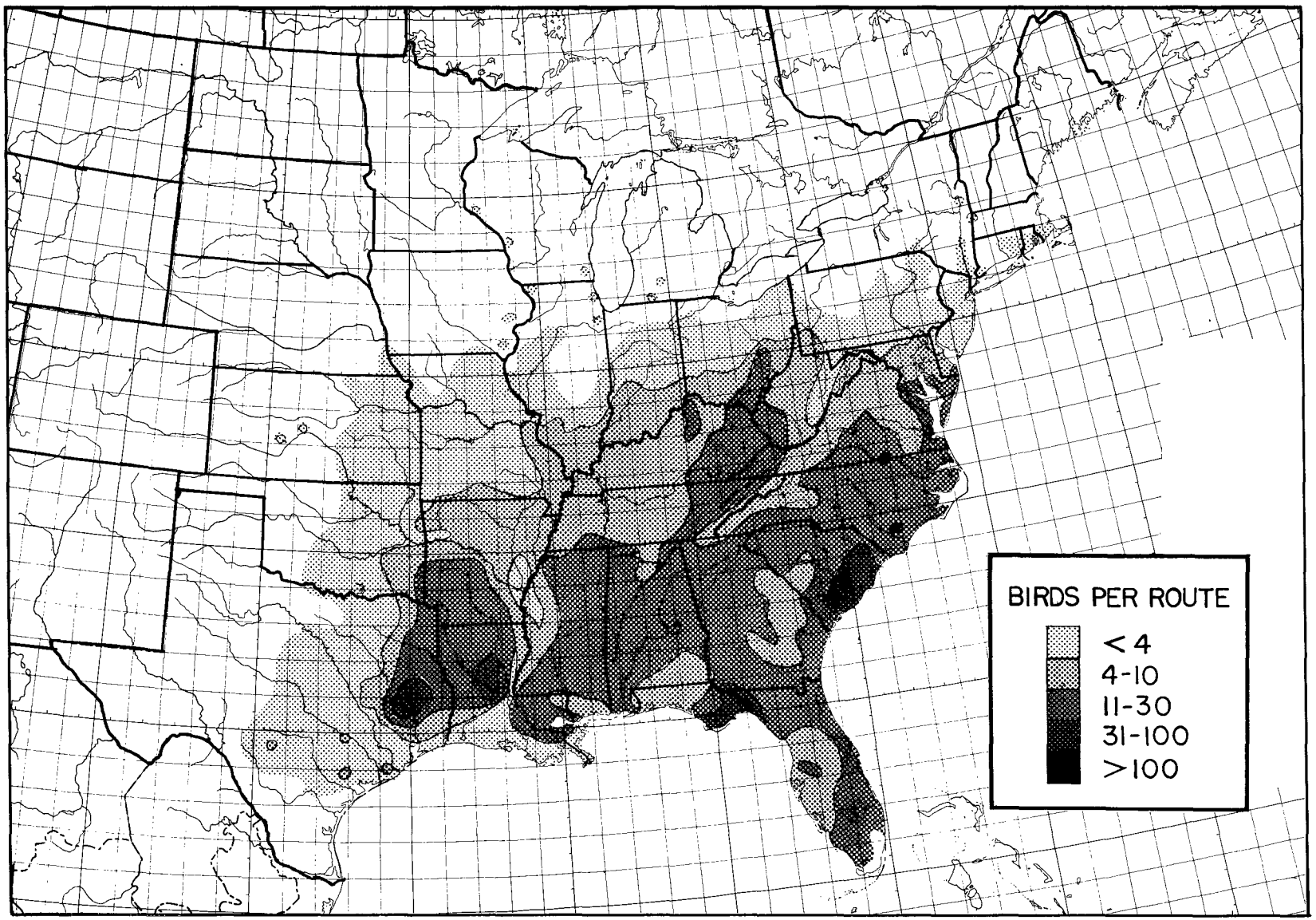


Fig. 37. Mean relative abundance of Carolina Wren, 1966–80.

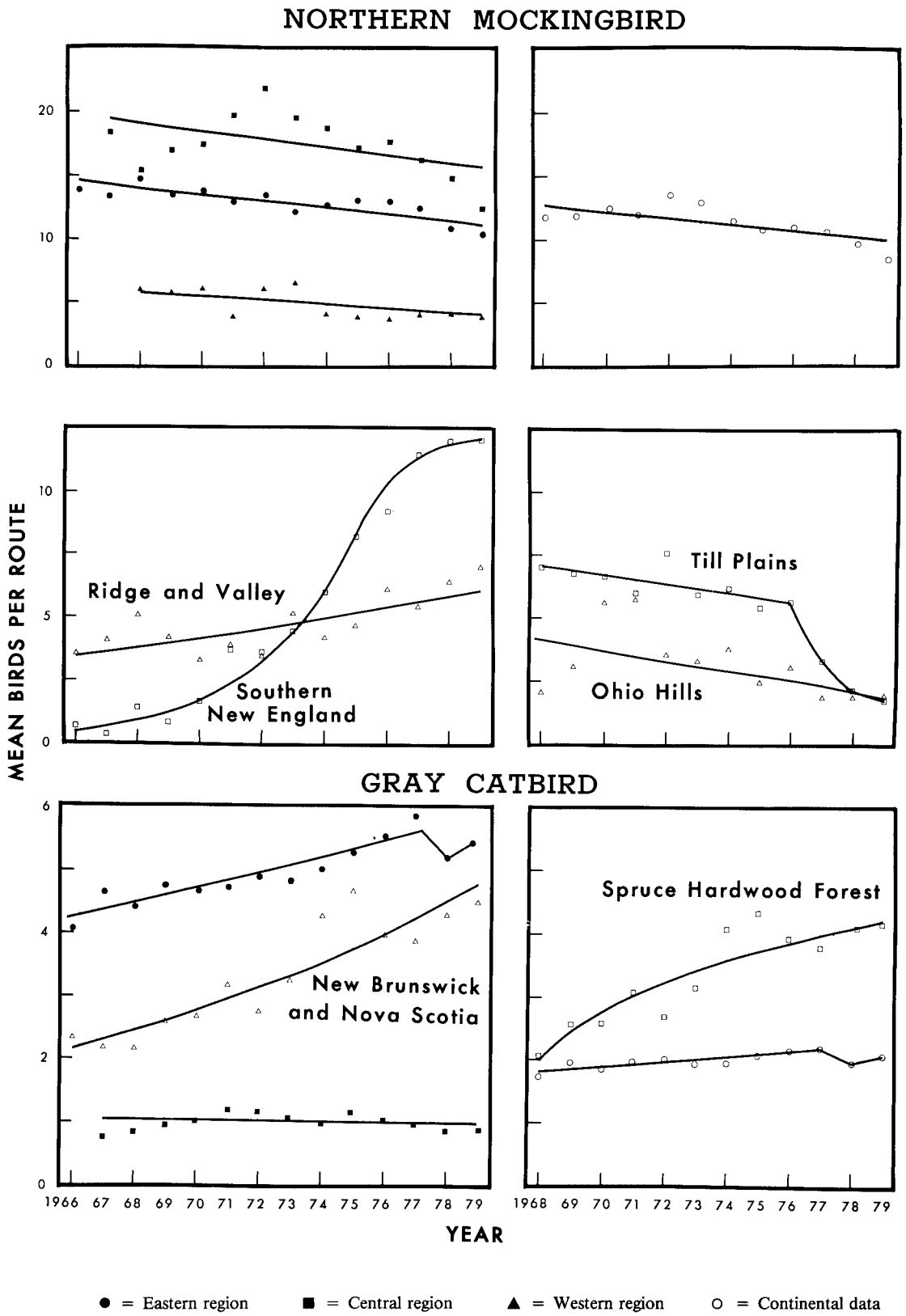


Fig. 38. Trends in mockingbird and catbird populations.

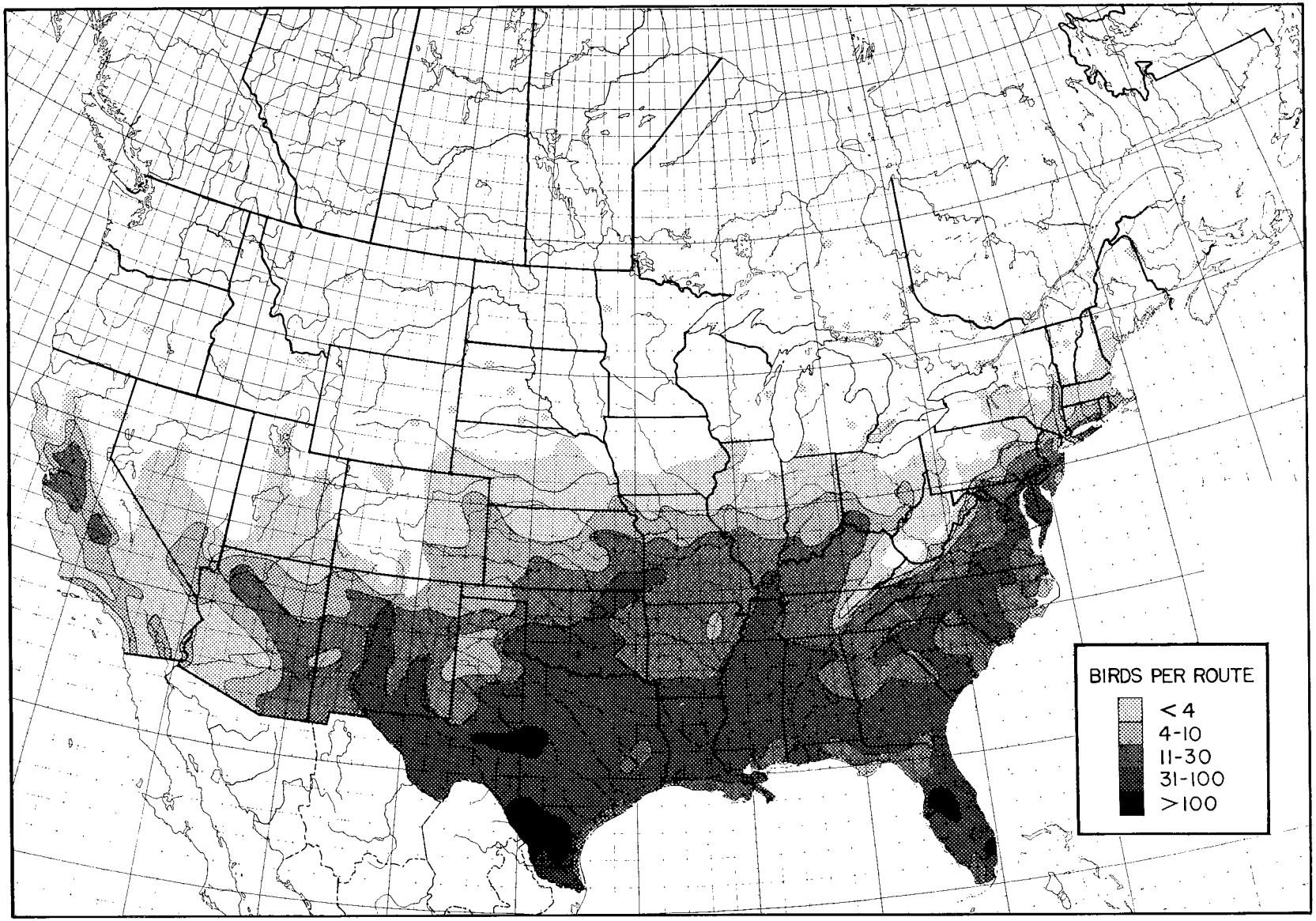


Fig. 39. Mean relative abundance of Northern Mockingbird, 1966–80.

Spruce–Hardwood Forest, and especially in the Provinces of New Brunswick and Nova Scotia—an increase that had not been detected through 1974 by Erskine (1978). Additional increases were in the St. Lawrence Plain, the eastern portion of the Great Lakes Plain, the Allegheny Plateau, Southern Piedmont, and the southern portion of the Upper Coastal Plain. The only strata with decreases were the Central and Dissected Rocky Mountains, the Drift Prairie, and the Mississippi Alluvial Plain. Southern New England and Connecticut had the highest mean counts (Fig. 40).

Brown Thrasher. Although the Brown Thrasher is common and widespread, no long-term trend was detected for any of the three regions (Fig. 41). There were decreases, however, in the Northeastern States and in nine strata; there were no increases. The State analysis was similar, with decreases in Arkansas, West Virginia, Virginia, Maryland, Pennsylvania, New York, and Massachusetts, and no significant increases. The significant downward trend in Southern New England (including the Glaciated Coastal Plain) is shown as a separate graph (Fig. 41, open squares). Greatest average abundance was in the Dissected Till Plains and High Plains Border, and in Kansas, Iowa, and Missouri (Fig. 42).

California Thrasher. The California Thrasher was represented by 72 routes, all in California. No significant trend was detected (Fig. 41). This resident thrasher reached its greatest abundance in the California Foothills and the Los Angeles Ranges.

Curve-billed Thrasher. The Curve-billed Thrasher declined significantly in the Central region, in the Southwestern States, and the continent (Fig. 41), as well as in Texas where more than half of the routes reporting this species were located. Highest average counts were in the Sonoran Desert and the South Texas Brushlands. The greatest statewide mean was from Arizona (Fig. 42).

Sage Thrasher. This is the most widely distributed of the western thrashers, but in most parts of the West it is relatively scarce. There was an increase in the northern Rocky Mountain States, but at the State level only Wyoming recorded a significant increase. No area reported a significant decrease. The highest counts came from the Wyoming Basin, the Great Basin, Nevada, and Wyoming (Fig. 43).

Bendire's Thrasher. The Bendire's, Le Conte's, and Crissal Thrashers were all represented by fewer than 34 BBS routes and no significant trend was detected at any level for any of the three species. To illustrate the low counts and the year-to-year variability, we plotted the weighted means and trend line for the Bendire's Thrasher for the Western region (Fig. 41). The highest densities for Bendire's Thrasher came from the Sonoran Desert and from New Mexico; for Le Conte's Thrasher, from the Mojave Desert of California; and for the Crissal Thrasher, from the Mexican Highlands of Arizona.

Thrushes (Figs. 44–49)

American Robin. This species, possibly in reponse to a decline in pesticide contamination, showed a strong and significant recovery across the continent and in both the Eastern and Central regions (Fig. 44), especially in the Northern Plains, the Great Lakes States, and the Southeastern States. There were 17 strata with increases, and none with a decrease. Likewise, no State or Province showed a decrease, but there were increases in Saskatchewan, North and South Dakota, Oklahoma, Minnesota, Wisconsin, Iowa, Illinois, Indiana, Arkansas, Tennessee, Kentucky, Mississippi, and North Carolina. North Carolina was the only State east of the Appalachian Mountains to register an increase. Highest densities were recorded in the Northern Piedmont and the northern portion of the Ridge and Valley. The highest mean densities were in Massachusetts and Pennsylvania (Fig. 45).

Wood Thrush. A significant decline in the Central region offset in part a significant increase in the Eastern region, but not sufficiently to prevent the continental trend from increasing significantly (Fig. 44). At the subregional level, both the Northeastern States and Canada showed an increase, with the greatest change in Canada. There were significant decreases in the southern portion of the Ridge and Valley and in the Great Lakes Transition, but there were increases in the Dissected Till Plains, the Till Plains, the central and eastern portions of the Spruce–Hardwood Forest, Central New England, the eastern portion of the Great Lakes Plain, the Allegheny Plateau, the Northern Piedmont, and the northern portion of the Upper Coastal Plain. By States and Provinces, there were significant decreases in Arkansas and Virginia, and significant increases in Iowa, New Brunswick, Vermont, New York, Pennsylvania, and North Carolina. Highest densities were recorded in the Cumberland Plateau and the Adiron-

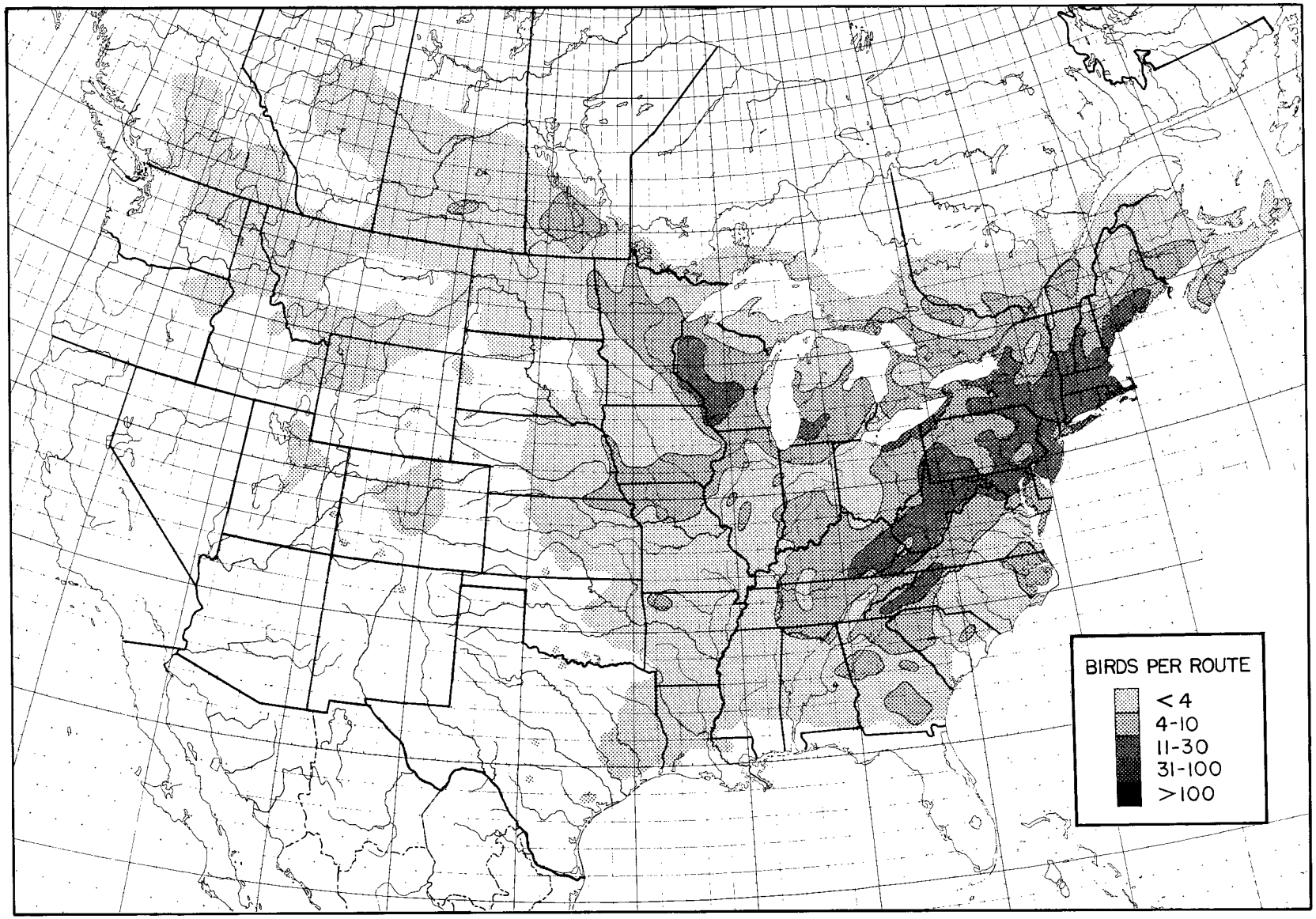


Fig. 40. Mean relative abundance of Gray Catbird, 1966–80.

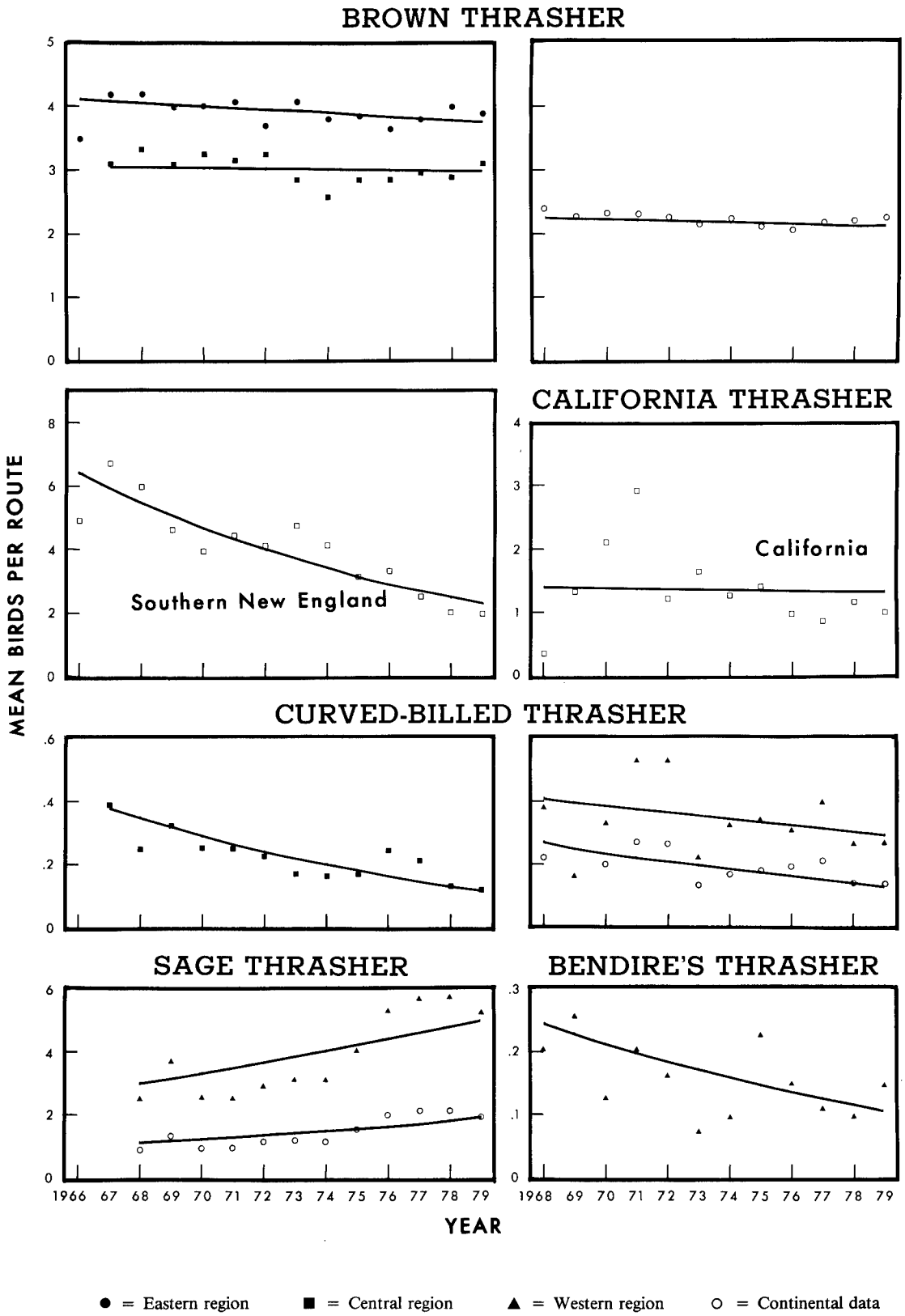


Fig. 41. Trends in thrasher populations.

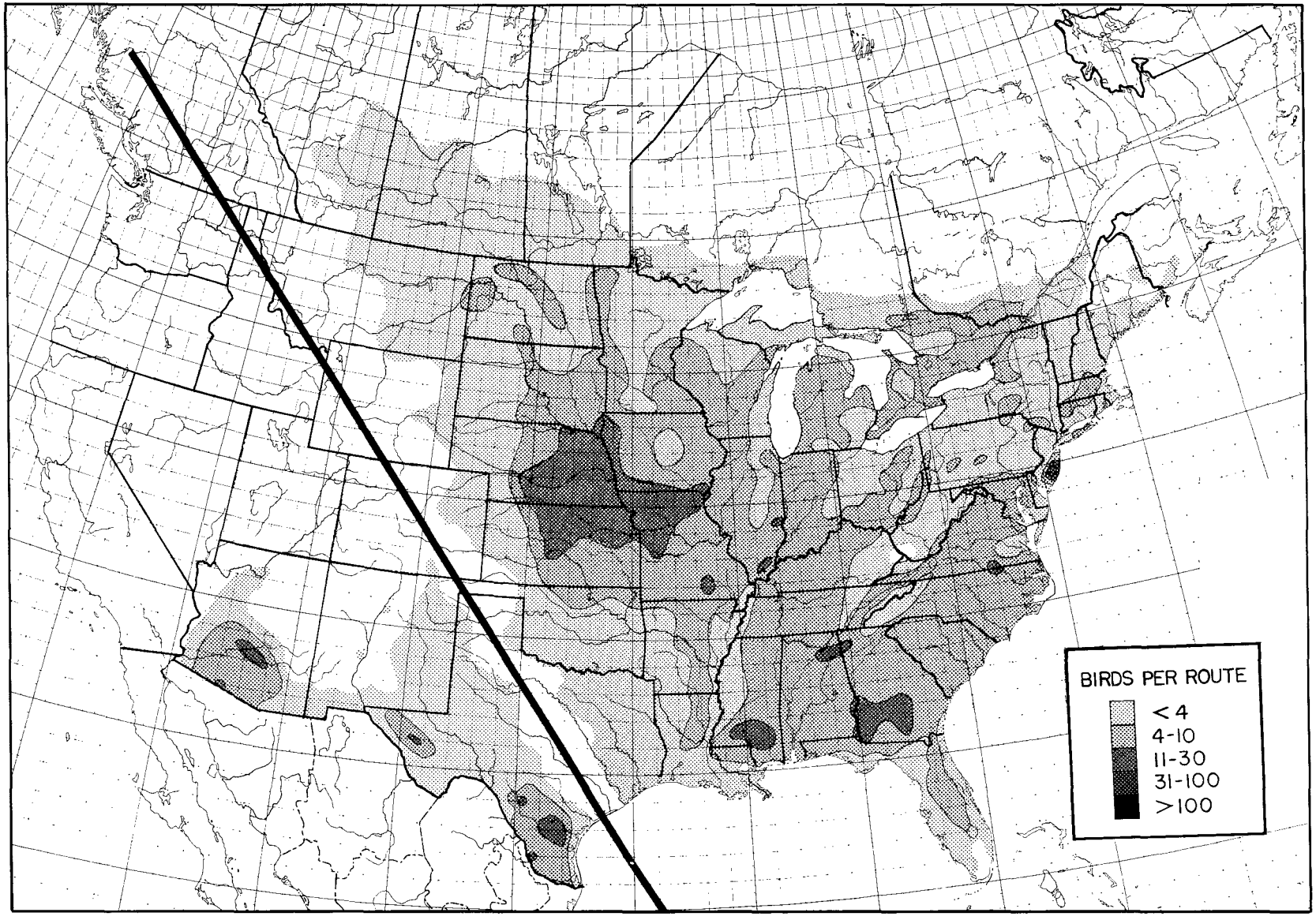


Fig. 42. Mean relative abundance of Brown Thrasher, 1966–80 (right), and Curve-billed Thrasher, 1967–80 (left).

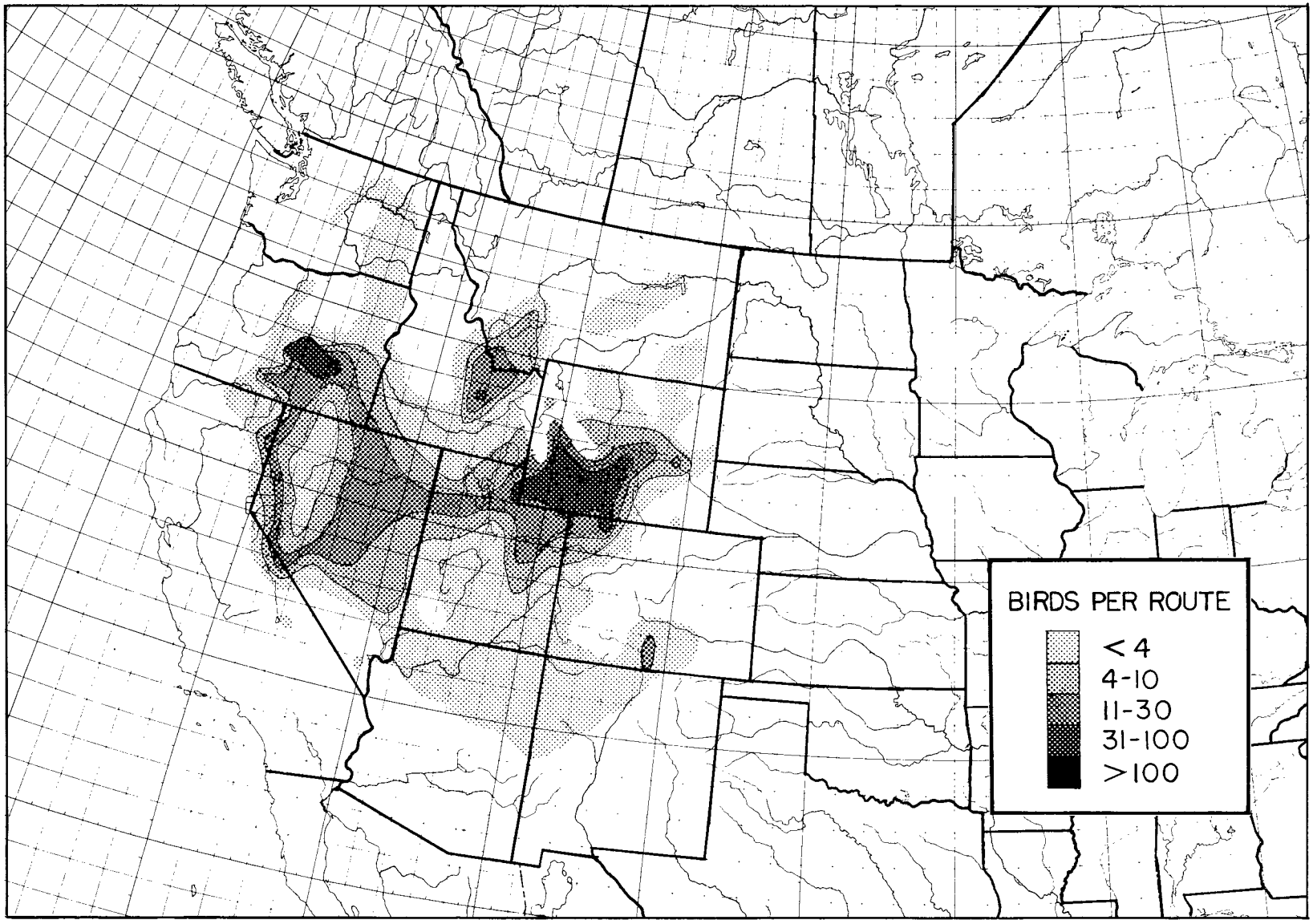


Fig. 43. Mean relative abundance of Sage Thrasher, 1968–80.

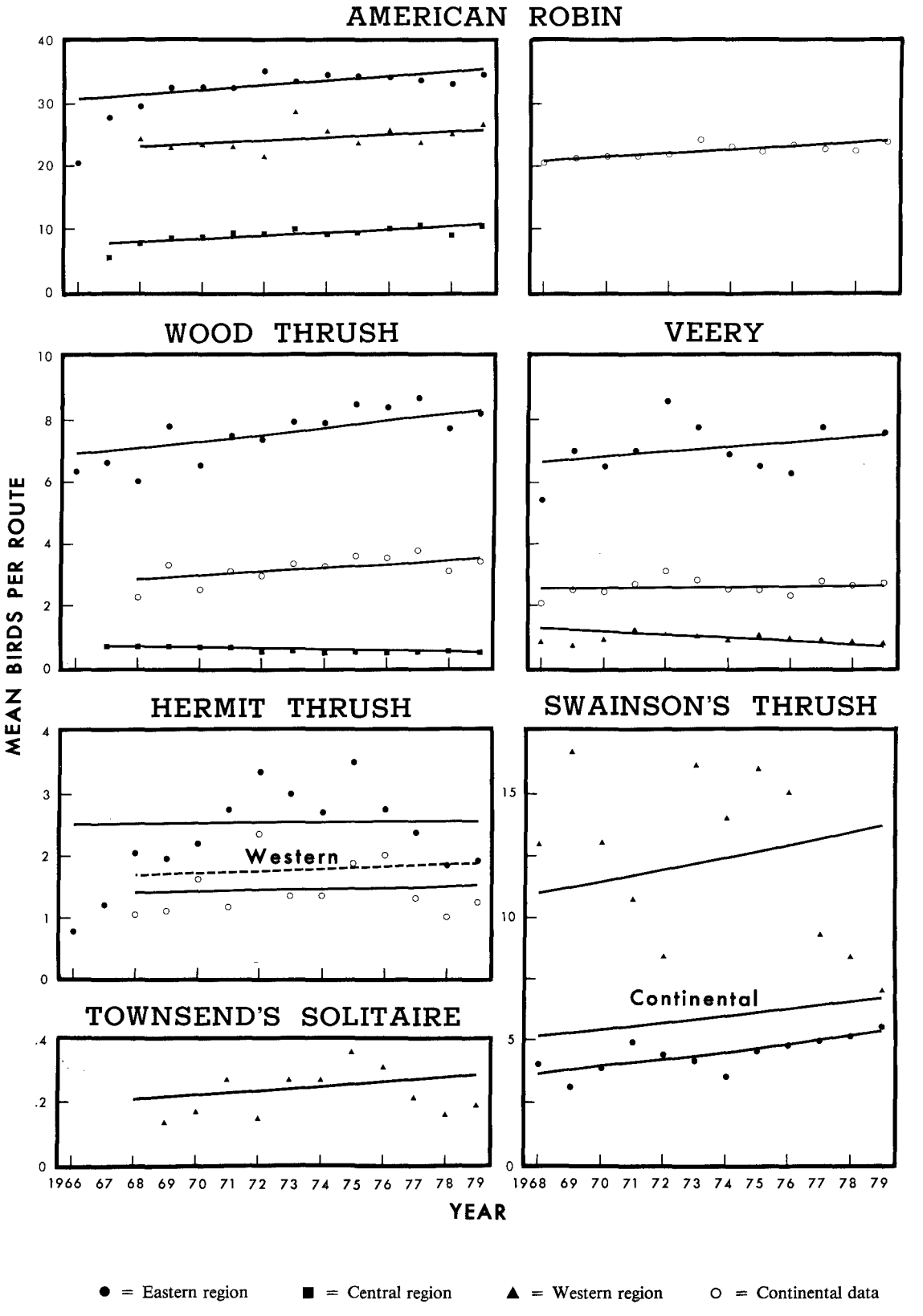


Fig. 44. Trends in robin and thrush populations.

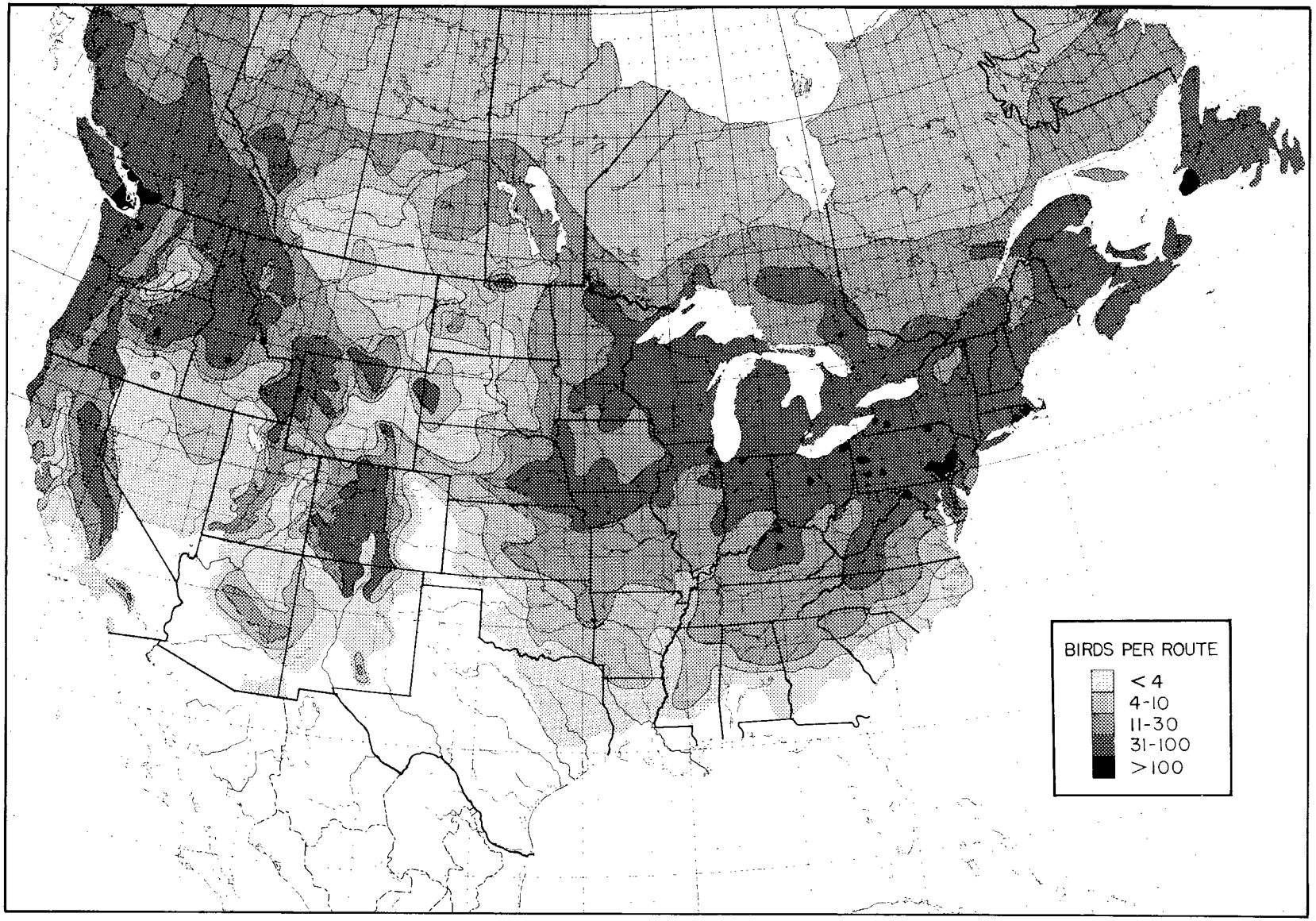


Fig. 45. Mean relative abundance of American Robin, 1966–80.

dack Mountains; New Hampshire, West Virginia, and Virginia led the States (Fig. 46).

Veery. Decreases in the Western region and the Far Western States, an increase in the eastern portion of the Spruce–Hardwood Forest in New Brunswick, an increase in Vermont, and decreases in New Hampshire and Maryland were the only significant changes detected for the Veery. Centers of abundance were in the Adirondack Mountains, the western and central portions of the Spruce–Hardwood Forest, and Central New England. The highest average counts by States and Provinces, in decreasing sequence, were from Ontario, New Hampshire, Vermont, New Brunswick, Maine, and Quebec (Fig. 47).

Hermit Thrush. An increase in the Hermit Thrush in the Eastern region through 1975 was followed by a sharp decline through 1978, attributed in part to the severe winters of 1976–77 and 1977–78; this resulted in no significant trend for the 14-year period. Likewise, there was no significant trend for the Western region (Fig. 44, dashed line) or for the continent. Significant decreases were recorded in the Far Western States and the Northeastern States, and in Maine. There was an increase, however, in nearby Nova Scotia. By strata, there was an increase in the Pacific Rain Forest of British Columbia, and a decrease in Southern New England. The highest means came from the eastern and central portions of the Spruce–Hardwood Forest and in Maine, Nova Scotia, New Brunswick, Quebec, and the Yukon Territory.

Swainson's Thrush. The increase in populations of Swainson's Thrush was significant in the Eastern region, where variability from year to year was relatively slight. In the Western region, however, the annual counts were so variable that the trend was not significant (Fig. 44). The continental trend was parallel to the trend for the Eastern and Western regions but not significant because of annual variability. In the central part of the continent, the southern nesting limit for this species is so far north that it was recorded on fewer than 30 BBS routes. There were no significant changes by subregion or stratum, but three Canadian Provinces showed significant increases—Ontario, Quebec, and Nova Scotia. The highest densities by stratum and State were all from the western portion of the range, in the Northern Pacific Rain Forest, the Canadian Rocky Mountains, the Cascade Mountains, and in the Yukon Territory, British Columbia, and Washington.

Townsend's Solitaire. An increase in Townsend's Solitaire through 1975, followed by a decrease, was indicated on the basis of data from 133 routes, but there was no significant trend for the entire period at any level (Fig. 44). Centers of abundance were in the Los Angeles Ranges and in the Yukon Territory.

Eastern Bluebird. Populations of the Eastern Bluebird have remained low since the harsh winter of 1958 (James 1962). Graphs of Christmas Bird Count data presented by James (1962) show that Eastern Bluebirds reached population peaks in south coastal areas in 1946, and in mid-south latitudes in 1945, and that these peaks were followed by declines through 1961. The BBS picked up the trend from 1966, and showed a significant decline for both the Eastern and Central regions and for the continent (Fig. 48). By subregions, this decline was significant in the Northern Plains States, the Great Lakes States, and the Southeastern States. The only stratum with a significant increase was the Southern Piedmont, whereas there were decreases in the Osage Plains, Dissected Till Plains, Ozark–Ouachita Plateau, Lexington Plain, Highland Rim, Till Plains, Wisconsin Driftless Area, Great Lakes Transition, the western portion of the Great Lakes Plain, the western portion of the Spruce–Hardwood Forest, Central and Southern New England, Ohio Hills, Cumberland Plateau, Blue Ridge Mountains, and the southern portion of the Lower Coastal Plain. In the western section of the Upper Coastal Plain populations were nearly stable. North Carolina and Virginia were the only States with a significant increase, whereas there were decreases in Oklahoma, Arkansas, Kansas, Missouri, Iowa, all of the Great Lakes States, Ontario, New Hampshire, Connecticut, New York, West Virginia, Kentucky, Tennessee, and Florida. The erection and monitoring of many thousands of bluebird boxes under sponsorship of the North American Bluebird Society has certainly benefited populations of this species, whose greatest problem, aside from uncontrollable weather conditions, is competition from introduced House Sparrows and Starlings (Zeleny 1976). Nest-box trails along established BBS routes are absolutely discouraged because such activity could seriously hamper the ability to detect population trends for this species. The highest population densities were recorded from the Highland Rim, the Lexington Plain, and the Ozark–Ouachita Plateau. Kentucky, Tennessee, and Missouri had the highest State means (Fig. 49).

Western Bluebird. In marked contrast to the Eastern Bluebird, the only region with a significant change in Western Bluebirds was the Sierra–Trinity

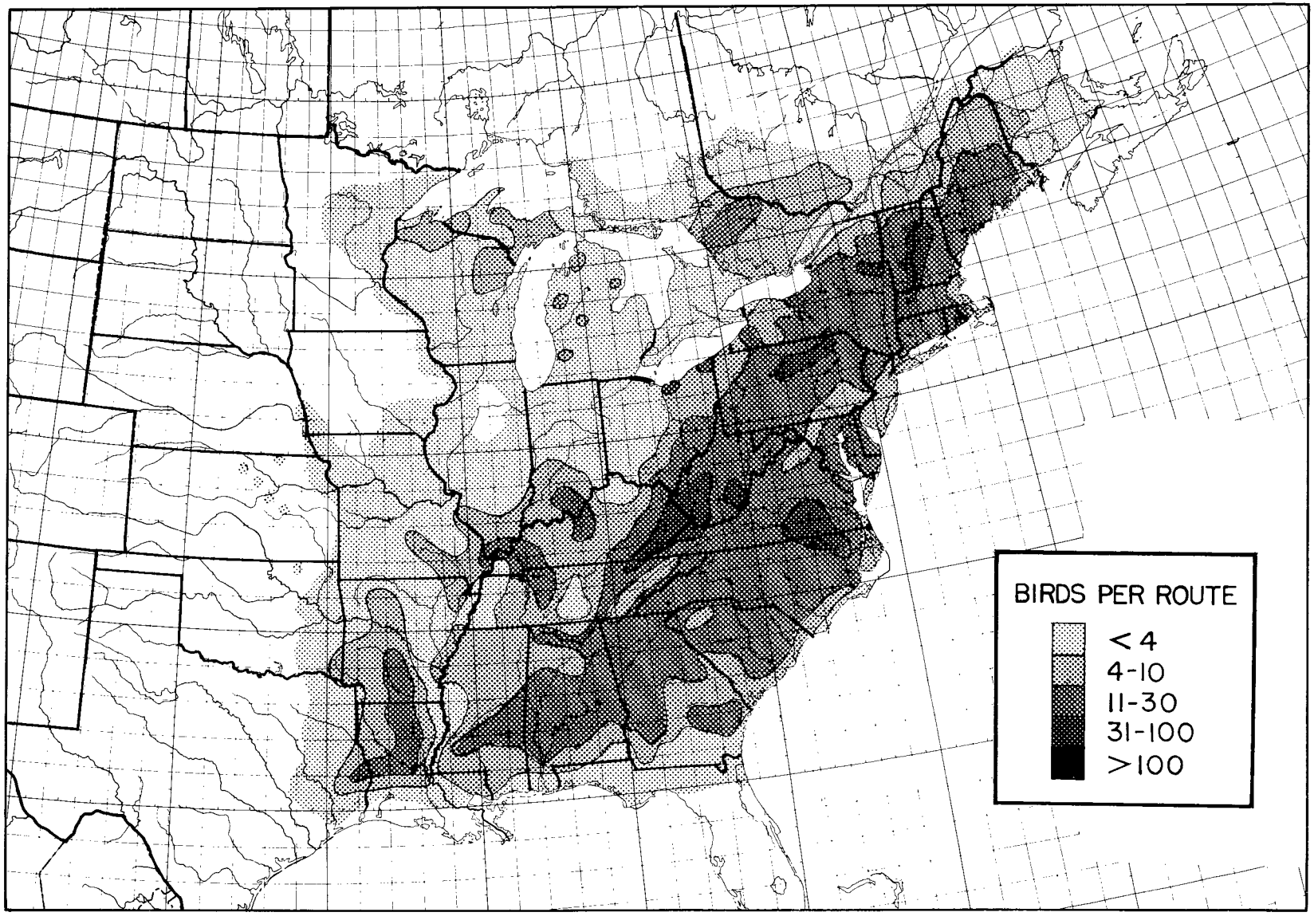


Fig. 46. Mean relative abundance of Wood Thrush, 1966–80.

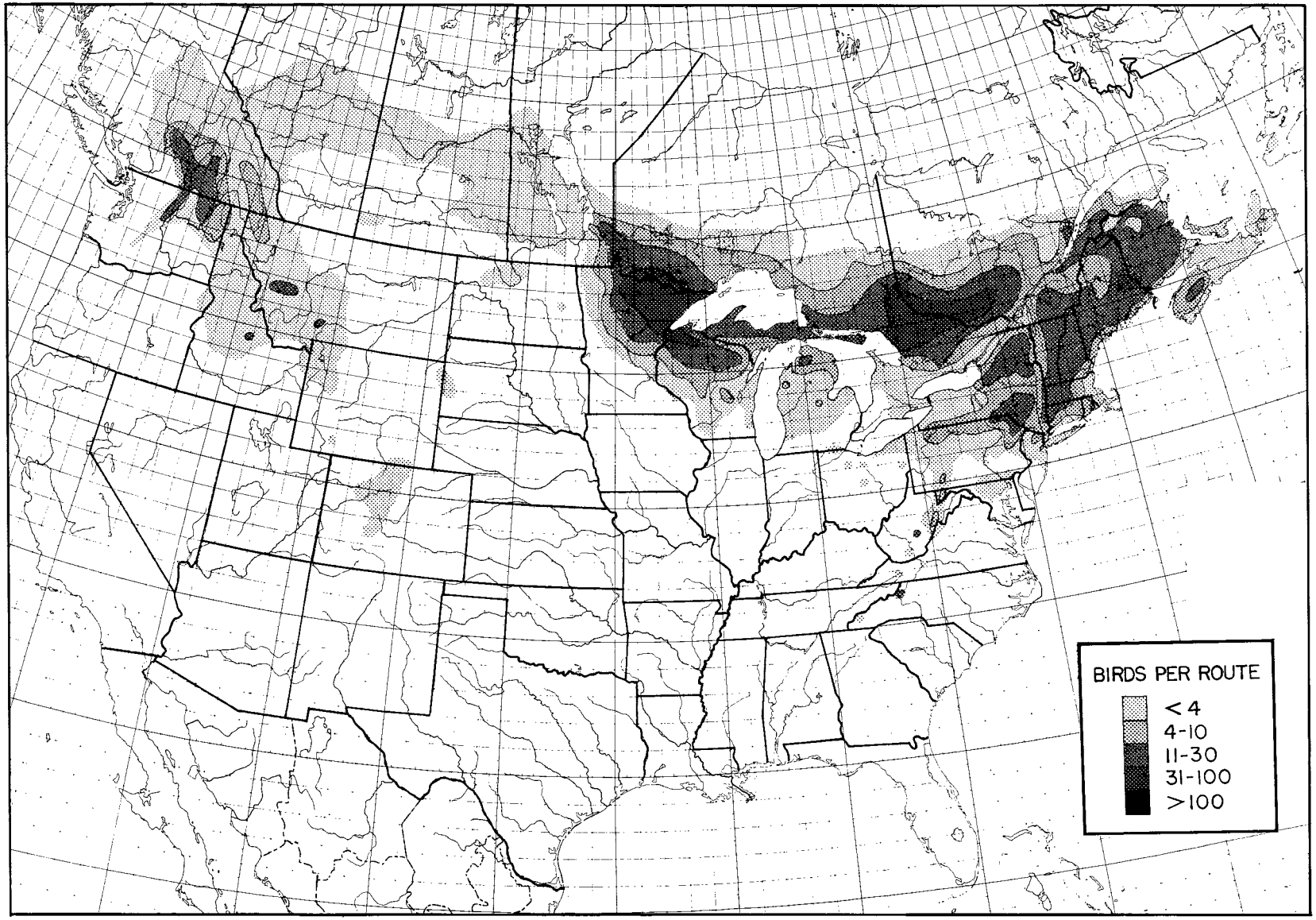


Fig. 47. Mean relative abundance of Veery, 1966–80.

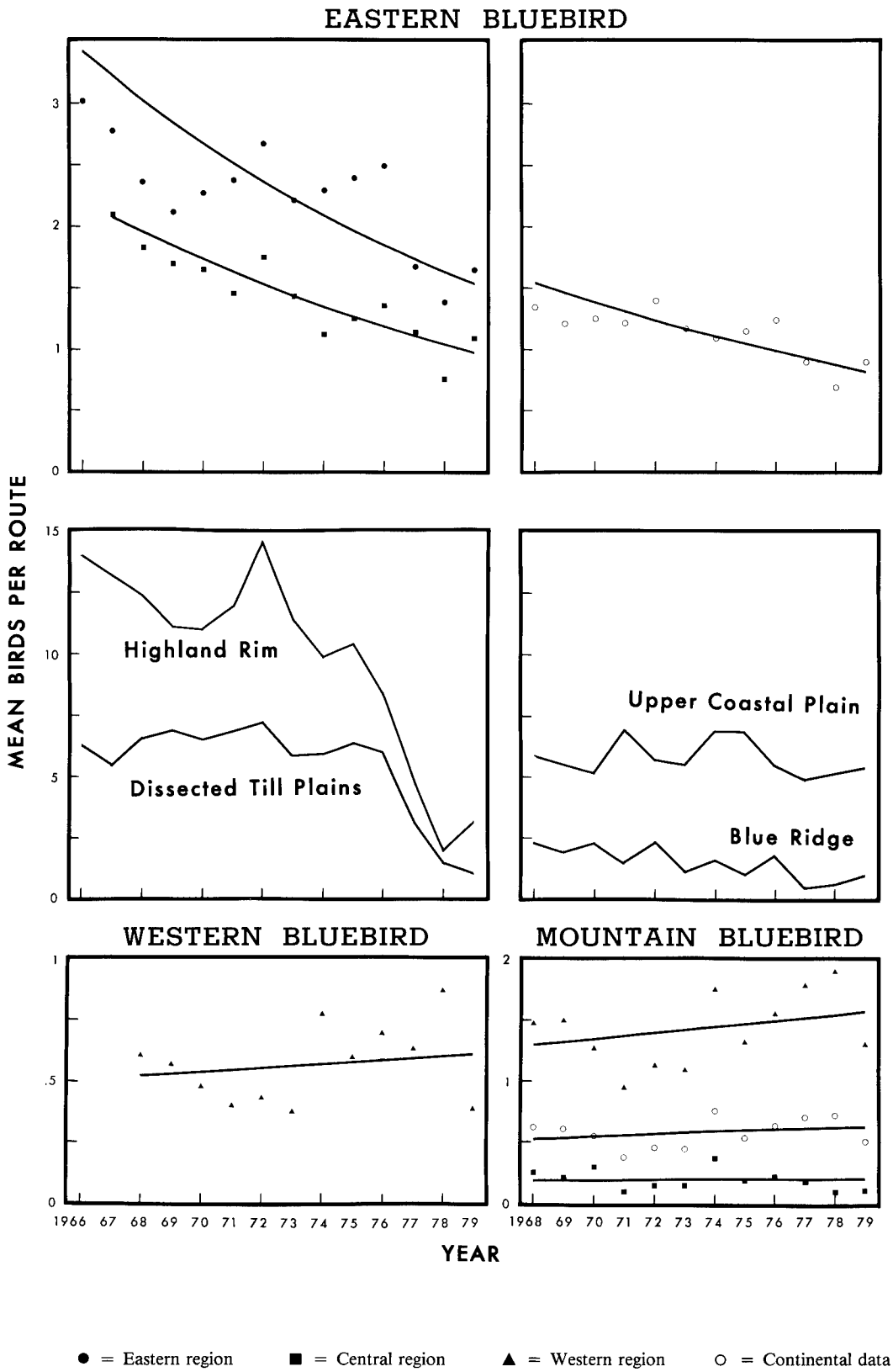


Fig. 48. Trends in bluebird populations.

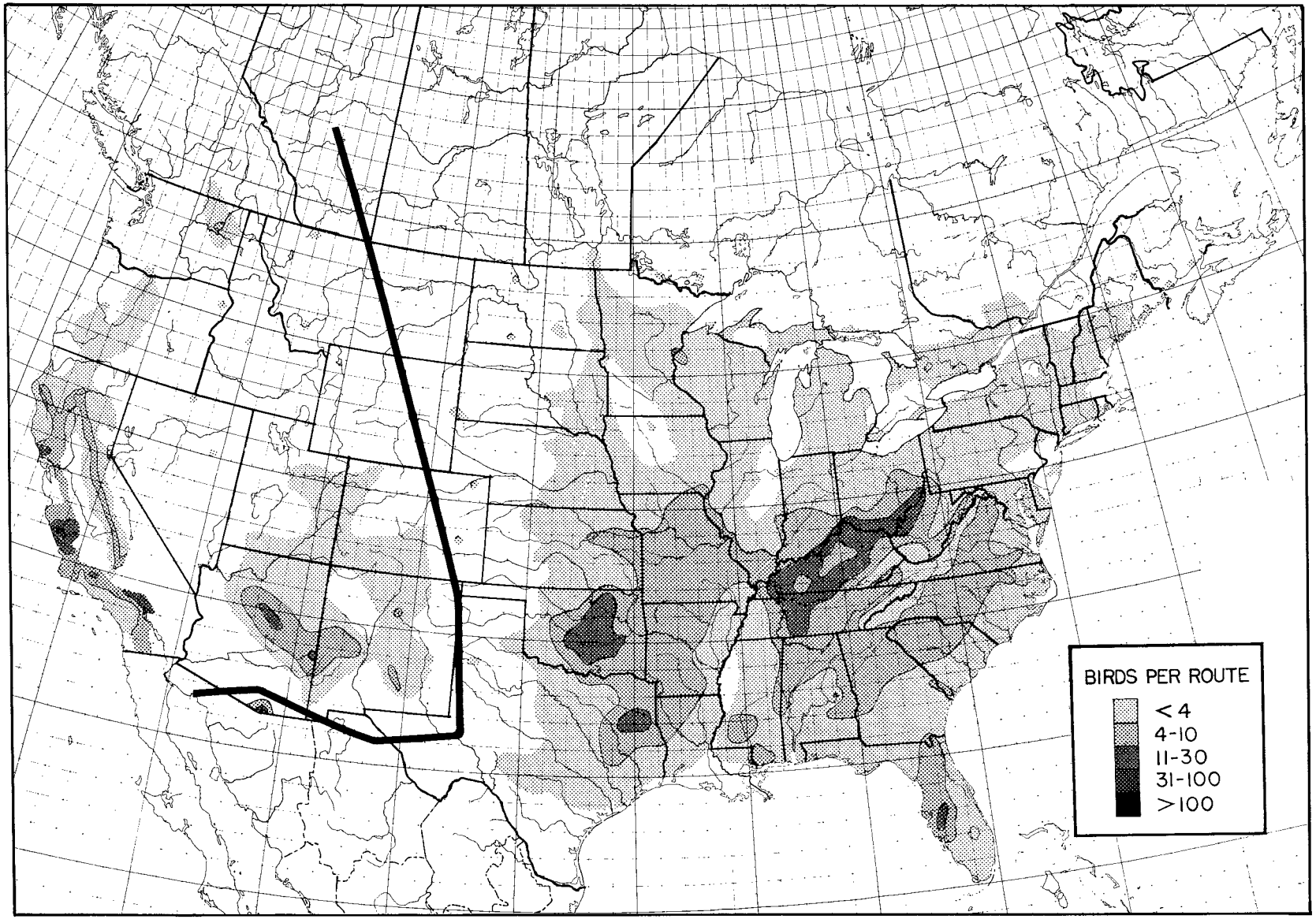


Fig. 49. Mean relative abundance of Eastern Bluebird, 1966–80 (right), and Western Bluebird, 1968–80 (left).

Mountains of California where there was an increase. The greatest nesting density by far was in the Los Angeles Ranges (Fig. 49).

Mountain Bluebird. The few significant changes for this species were all increases. These included the Northern Plains States, the Wyoming Basin and Southern Rocky Mountains, and California and Colorado, all of which showed substantial gains. The highest average counts came from the Black Hills, the Pinyon–Juniper Woodland, and the Southern Rocky Mountains; the average from Oregon was more than double that from the next highest States of New Mexico and Wyoming.

Gnatcatchers and Kinglets (Fig. 50)

Blue-gray Gnatcatcher. The Eastern regional and continental curves for the Blue-gray Gnatcatcher reflect significant increases (Fig. 50); there were also increases in the California Foothills, Southern New England, the northern portion of the Ridge and Valley, the Southern Piedmont, and the central and southern portions of the Upper Coastal Plain. The only significant decrease detected was in the Ohio Hills. Trends in the Central and Western regions were not significant. An increase in Southern New England and occurrence on three routes in Massachusetts, two in New Hampshire, and one in Vermont reflect the recent northward expansion of this species. According to the A.O.U. *Check-list of North American Birds* (1957), this species reached its northern limit in northern New Jersey and Long Island and was "casual in migration and summer along the coasts of New England north to Maine." The strata with the greatest densities were the Cumberland Plateau, Ozark–Ouachita Plateau, and the western portion of the Upper Coastal Plain, and the top-ranking States were West Virginia and Arkansas.

Golden-crowned Kinglet. The eastern population of the Golden-crowned Kinglet reached a sharp peak in 1976, then dropped precipitously as a result of the cold weather the next two winters, as emphasized by the dashed line (Fig. 50) representing the Spruce–Hardwood Forest of Quebec and northern New England. This discontinuity in the population curve prevented detection of any significant change for the period as a whole. The only significant change recorded was an increase in New York. The highest densities were in the Pacific Rain Forest, and Washington and British Columbia.

Ruby-crowned Kinglet. The Ruby-crowned Kinglet also suffered a sharp decline in the East during the winter of 1976–77, resulting in an overall significant decrease for the Eastern region, the Northeastern States, and Canada. In Fig. 50, the three lines in the graph on the left represent the three sections of the Spruce–Hardwood Forest: Maritime Provinces, Quebec and northern New England, and Ontario through Minnesota. The lines in the graph on the right show the trends for the Western and Eastern regions and the continent. There was a significant increase in the Northern Plains States. Changes by strata consisted of a single increase in Central New England and decreases in the eastern and western sections of the Spruce–Hardwood Forest. The highest counts by far were from the eastern section of the Spruce–Hardwood Forest, and from Nova Scotia and New Brunswick.

Waxwings, Shrikes, and Starlings (Fig. 51)

Cedar Waxwing. The widely distributed Cedar Waxwing showed an increase in the Eastern region and in the Northeastern States (Fig. 51). There were local decreases in the Central and Dissected Rocky Mountains and the eastern portion of the Spruce–Hardwood Forest, especially in New Brunswick. There were increases in the western portion of the Great Lakes Plain, the St. Lawrence Plain, Central New England, the Allegheny Plateau, and the Ohio Hills. The erratic wanderings of this flocking species in autumn and winter may explain the erratic distribution of increases and decreases during the breeding season. For example, there was a decrease in Wisconsin but an increase in Ohio, and a decrease in Massachusetts but increases in nearby New Hampshire, Vermont, New York, and Pennsylvania. The Adirondack Mountains of New York had by far the highest breeding density of Cedar Waxwings, even though the State mean for New Hampshire exceeded that for New York. This species was also important in the Far West; Washington ranked third.

Loggerhead Shrike. The Loggerhead Shrike was one of the few species to show a significant decrease in all three regions (Fig. 51). Significant declines were also found in four of the seven subregions—the Southwestern States, Northern Plains States, Canada, and the Southeastern States. Eleven strata, well scattered through the continent, registered significant decreases, but none showed increases. The only State with a significant increase was South Dakota, whereas the following States and Provinces had large enough samples to register significant decreases: Nevada, Texas, Oklahoma, Kansas, North Dakota, Saskatchewan, Ontario, Iowa, Missouri,

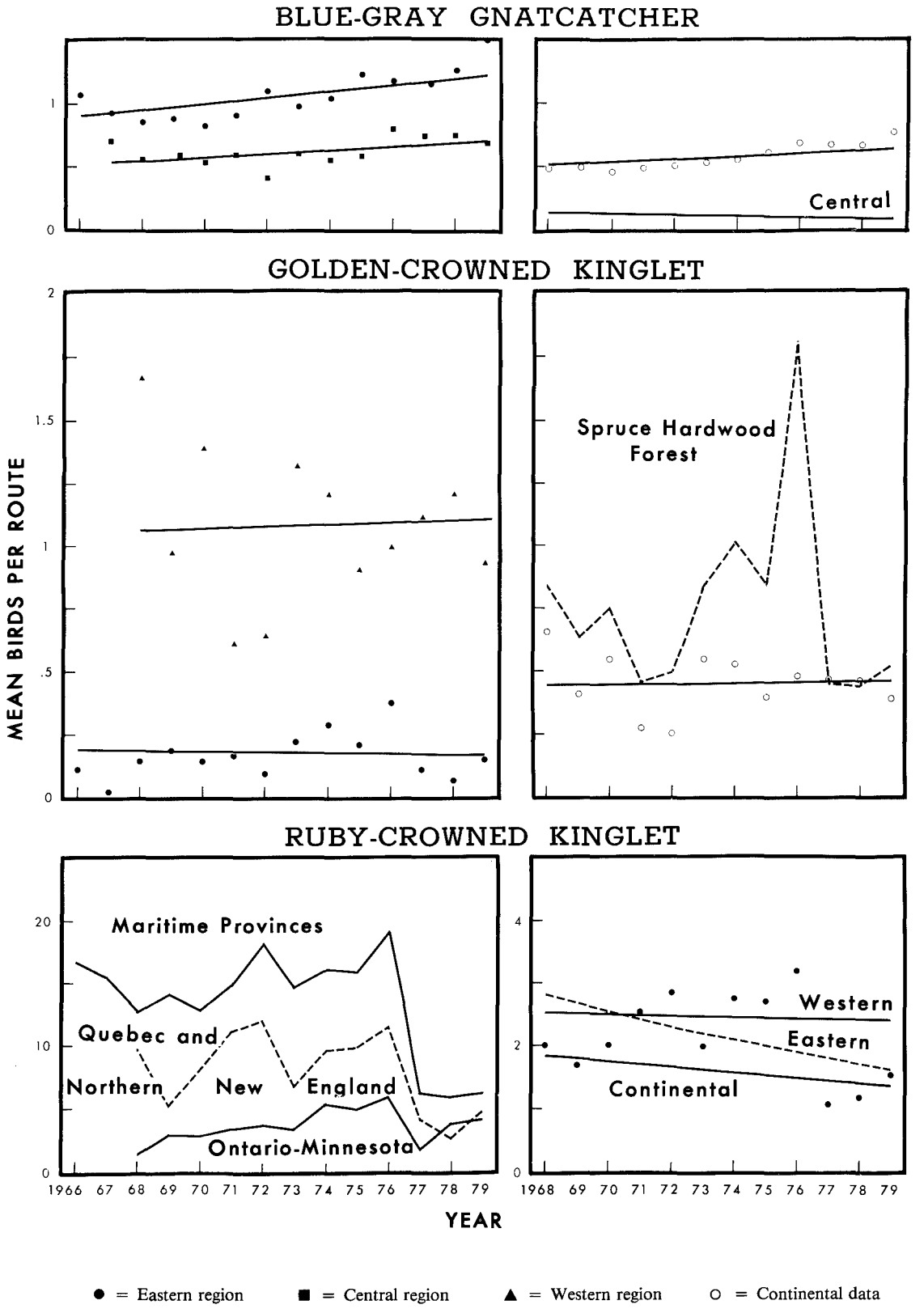


Fig. 50. Trends in gnatcatcher and kinglet populations.

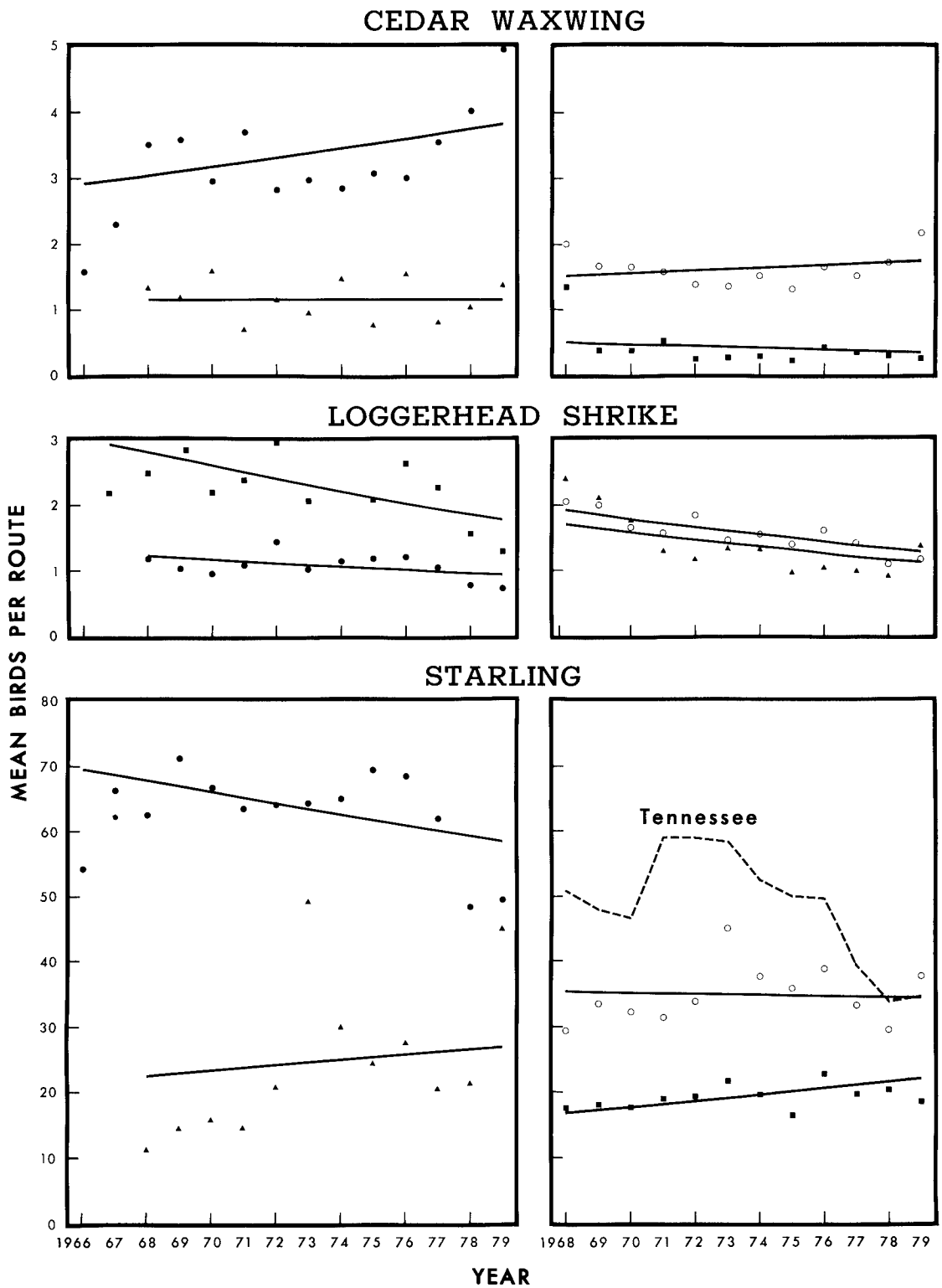


Fig. 51. Trends in waxwing, shrike, and starling populations.

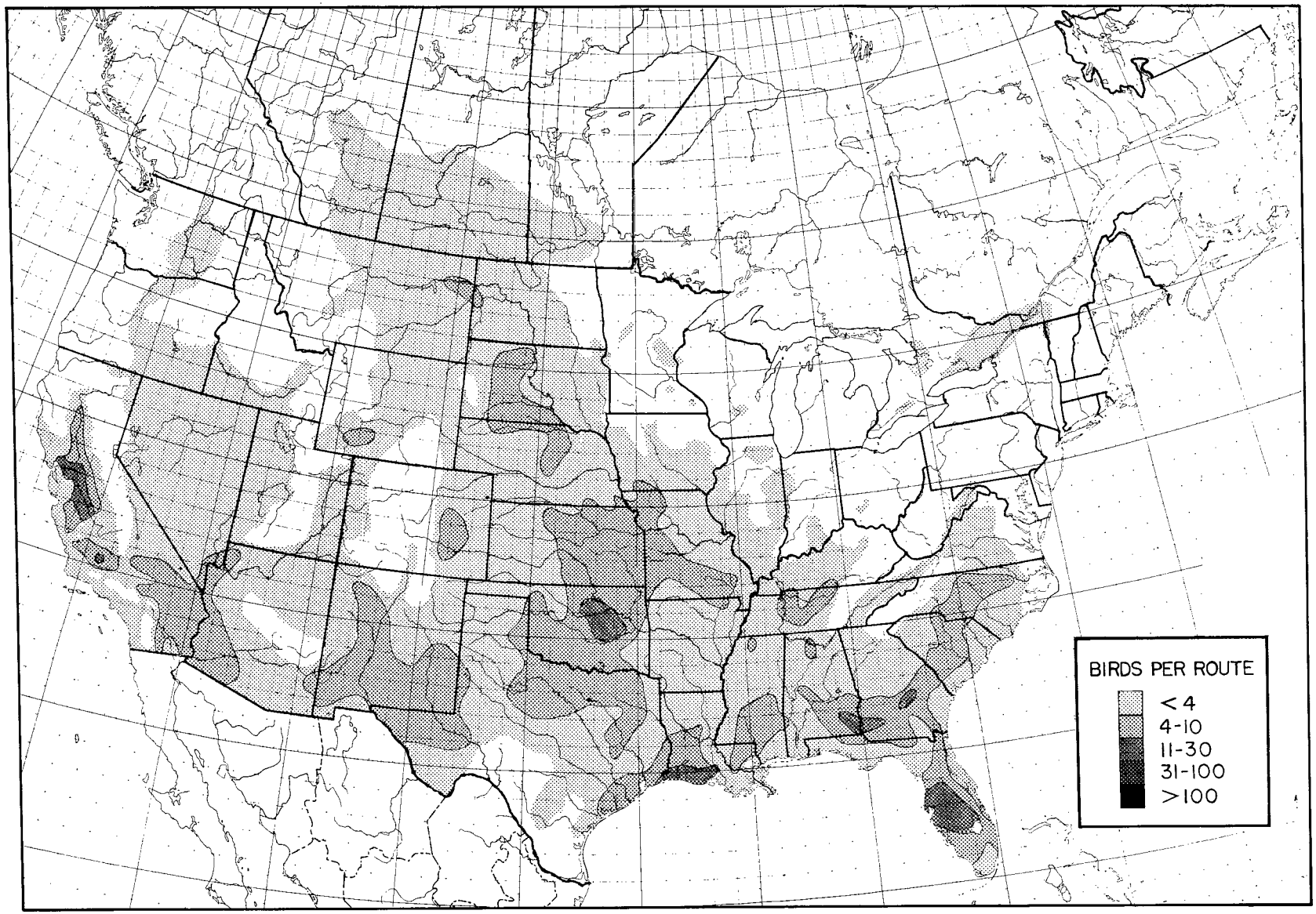


Fig. 52. Mean relative abundance of Loggerhead Shrike, 1966–80.

Arkansas, Mississippi, Tennessee, Kentucky, Georgia, North Carolina, and Virginia. With a diet consisting largely of small mammals and large insects, shrikes are high on the food chain, and the taking of contaminated prey may account in part for the decline. Their sharp decline is also attributed in part to loss of hedgerows and thorn trees in which they prefer to nest, and possibly to loss of pastureland—a preferred feeding habitat. The largest populations are on the Florida Peninsula, and in New Mexico and Oklahoma (Fig. 52).

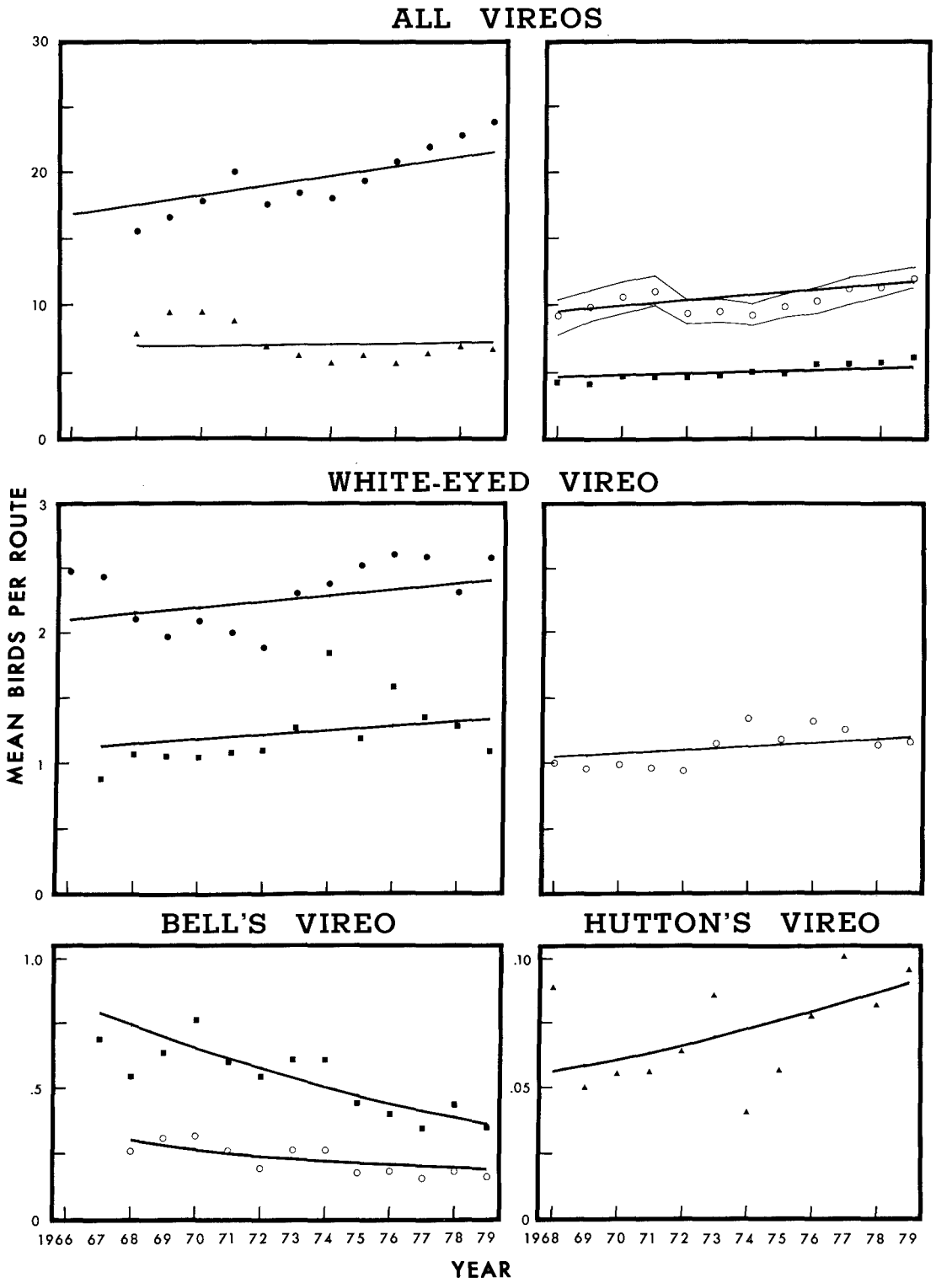
Starling. The severe winters of 1976–77 and 1977–78 demonstrated that natural conditions have an influence on continental Starling populations. The heavy mortality in these two winters contributed greatly to the significant decrease recorded for the Eastern region. The winter of 1976–77 had its greatest effect along the Atlantic slope of the Appalachian Mountains from Quebec and the Maritime Provinces south through the Carolinas. Populations that breed in the northern Great Plains and the Lower Mississippi Valley also were affected. The following winter had its greatest effect on birds that winter in the Great Lakes States, the Ohio Valley, the Appalachian Mountains, the southern Coastal Plain, and the Florida Peninsula. Annual means for Tennessee, which is near the center of the impact area, are plotted in Fig. 51. Western populations showed a sharp increase from 1968 through 1973, then showed signs of stabilizing. There was a significant increase in the Central region, but no detectable change for the continent. By subregions the 14-year trends showed increases in the Southwestern and Northern Plains States, and decreases in Canada and the Northeastern States. When the trends were analyzed by strata, increases tended to be concentrated in the West and decreases in the East. Increases were recorded for the Pinyon–Juniper Woodland, the Black Prairie, Unglaciated Missouri Plateau, Osage Plains, Dissected Till Plains, and the East Texas Prairies; decreases were recorded in the Spruce–Hardwood Forest, the eastern portion of the Great Lakes Plain, Adirondack Mountains, Allegheny Plateau, Ridge and Valley, Southern Piedmont, and the Mississippi Alluvial Plain. By States and Provinces the increases were in California, Oregon, New Mexico, Texas, Wyoming, South Dakota, Iowa, Minnesota, and Florida, and the decreases in Ontario, Quebec, New Brunswick, Maine, Massachusetts, New York, Pennsylvania, and Georgia. Areas of greatest abundance were the eastern portion of the Great Lakes Plain and the Northern Piedmont; the largest numbers were in Ohio, followed by New Jersey, Indiana, New York, Delaware, Maryland, and Rhode Island.

Vireos (Figs. 53 and 54)

The family Vireonidae, although represented by only a dozen species, is one of the most common and widespread families of North American birds. When data for all vireo species were combined, a strong upward trend in the Eastern region, together with a slight rising tendency in the rest of the continent, resulted in an estimated annual continental increase of about 1.5% for the entire family (Fig. 53; narrow lines designate 95% confidence limits around the continental annual means). In the Eastern region all significant trends for individual strata were upward; there was no consistent pattern in the Central region. In the West, many strata showed slight negative tendencies, but only in the Cascade Mountains was the tendency strong enough to be significant. The only abrupt change took place between 1971 and 1972 when a sharp decline in this species was noted in both the Eastern and Western regions; however, a steady increase occurred from 1974 through 1979.

White-eyed Vireo. White-eyed Vireo populations showed a highly significant upward trend (1.2% per year) for the continent, influenced largely by a significant increase of 1% per year for the Eastern region (Fig. 53). The increase was strongest in the Southeastern States and in Maryland; no State registered a significant decrease. The strongest stratum increases were in the Upper Coastal Plain and in Southern New England where the species appeared to be extending its range northeastward. After a major increase from 1972 to 1974, the continental populations seem to have stabilized. Highest population densities were in the western portion of the Upper Coastal Plain and the southern portion of the Lower Coastal Plain. Louisiana and Florida had the highest State averages.

Bell's Vireo. The Bell's Vireo has been showing a sharp decline, especially in the Central region (Fig. 53) which is its center of abundance. Declines were also significant in the Southwestern and Southeastern States, specifically in Oklahoma. In most States sample sizes were too small to determine significant trends. By strata the declines were significant in the East Texas Prairies, South Texas Brushlands, Ozark–Ouachita Plateau, and Osage Plains. Although the two strata with the highest mean counts were in Texas (Edwards Plateau and South Texas



● = Eastern region ■ = Central region ▲ = Western region ○ = Continental data

Fig. 53. Trends in vireo populations, part 1.

Brushlands), the highest State mean was in Oklahoma.

Hutton's Vireo. A strong increase in the Far Western States (Fig. 53) registered as significant only in California because of high year-to-year variability in Hutton's Vireo. The only strata in which this species was commonly reported were the California Foothills, Pacific Rain Forest, and Sierra–Trinity Mountains.

Gray Vireo. Based on findings from a small sample of 19 routes the Gray Vireo (not illustrated) appears to be decreasing. It was found primarily in Arizona and Utah in the Pinyon–Juniper Woodland.

Solitary Vireo. All significant changes in Solitary Vireo populations were increases, which occurred in the Eastern region (Fig. 54), the Northeastern States, the Allegheny Plateau, Southern and Central New England, the eastern and central portions of the Spruce–Hardwood Forest, the California Foothills, and in New Brunswick, Quebec, New Hampshire, Vermont, and Pennsylvania. The highest densities were in the Sierra–Trinity and Adirondack Mountains, and in Maine and Nova Scotia. The highest density for one of the western subspecies was in British Columbia.

Yellow-throated Vireo. Continental and regional populations of the Yellow-throated Vireo were stable (Fig. 54). An increase was recorded in the Great Lakes States—especially in Michigan and Minnesota—and increases were also reported from New York and Pennsylvania. Ohio reported the only significant decrease. The heavily forested Cumberland Plateau and Blue Ridge Mountains were the strata with the highest average counts, and highest State means were in West Virginia and Virginia.

Red-eyed Vireo. The Red-eyed Vireo is by far the commonest woodland bird in the eastern deciduous forest and its populations are doing well, with average Eastern and continental increases (Fig. 54) of 2% per year. Although there were slight upward tendencies in the other regions, they were not significant. Significant increases were noted in 13 strata; the only decrease was in the Osage Plains. There were significant increases in 14 States and Provinces, with significant decreases only in Washington, North Dakota, and Kansas. Larger numbers were found in the Adirondack Mountains than in the western portion of the Spruce–Hardwood Forest, and New Hampshire had the highest State count.

Warbling Vireo. Although there were significant increases in the Warbling Vireo in the Eastern and Central regions, a very slight decrease in the Western region prevented the continental trend from being significant (Fig. 54). Populations were so similar for the Eastern and Central regions that the lines would almost have coincided; for that reason only the Eastern trend was plotted. The only significant decreases reported were from Wisconsin and British Columbia. In the East, the most consistent areas of increase were from Pennsylvania to Ontario and Massachusetts. In the West there were increases in Alberta, Saskatchewan, Montana, and South Dakota. The largest concentrations occurred in the Pacific Rain Forests and the Central Rocky Mountains. British Columbia's mean count was more than double that of second-place Colorado.

Philadelphia Vireo. Although there was a slight negative tendency throughout the range of the Philadelphia Vireo, only 99 comparable routes were available and no significant changes could be detected. The central portion of the Spruce–Hardwood Forest and Quebec were the only areas that supported a mean of greater than one bird per route.

Warblers (Figs. 55–59)

Populations of warblers in general appear to be stable or increasing, especially in the Northeast. This increase is partly attributed to the extensive outbreak of the spruce budworm in eastern Canada, which supplies an abundance of food during the nesting season. Another factor contributing to the increase of warblers and many other songbirds is the banning of the use of DDT in the United States and Canada. An analysis of birds killed at a Tallahassee, Florida, TV tower showed a significant decline in the presence of DDT derivatives in 10 songbird species from 1964 to 1973 (Johnston 1974).

Black-and-white Warbler. Although the annual means suggest an increase in the Black-and-white Warbler in the Eastern region (Fig. 55), the statistical analysis based on properly weighted comparable data shows that there has been no regional population change during the BBS period. There was some suggestion of an increase in the Central region, but it was not strong enough to produce an overall upward continental trend. The only significant changes by State and Province were increases in Nova Scotia,

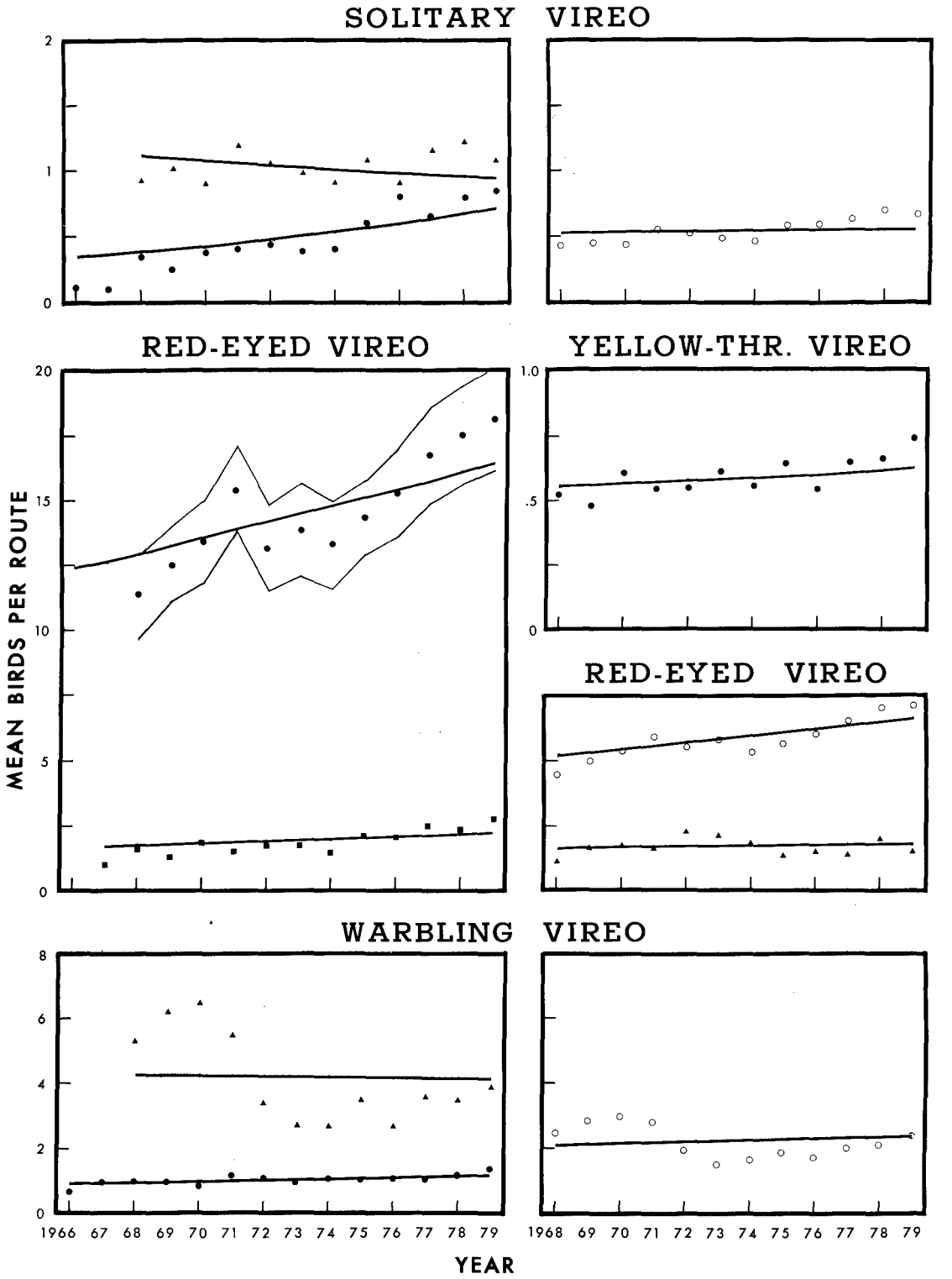


Fig. 54. Trends in vireo populations, part 2.

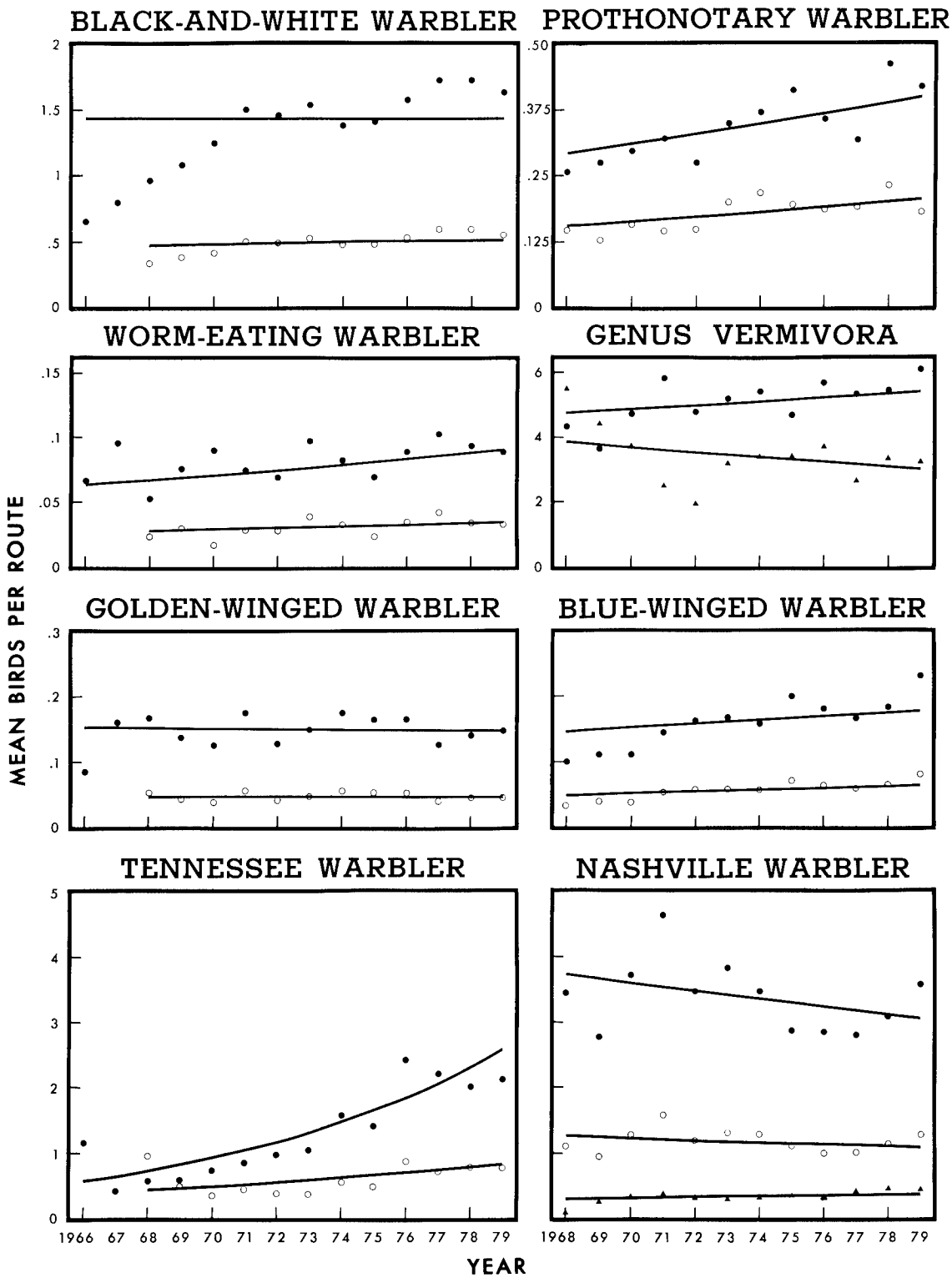


Fig. 55. Trends in warbler populations, part 1.

Maine, Vermont, and Minnesota, and a decrease in Virginia. The Ridge and Valley was the only stratum to show a decrease. The greatest densities were reported from Central New England and the Adirondack Mountains, with New Hampshire, Nova Scotia, and Maine leading the States and Provinces.

Prothonotary Warbler. A strong increase in the Southeast produced a significant rise in the continental population of Prothonotary Warblers (Fig. 55) despite a high degree of irregularity during the last 4 years. Because habitat for this species is restricted to wooded wetland areas, the total numbers recorded in any State were small and no significant State trends were detected. The species was one of the few to reach its greatest density in the Mississippi Alluvial Plain. Largest numbers were recorded in Louisiana.

Swainson's Warbler. Because of the small sample size (66 routes) no graph was prepared for the Swainson's Warbler. The trend for the Eastern region showed an increase; there was also a significant increase in the Southeastern States. Stratum and State means were very low, with largest numbers in the northern portion of the Lower Coastal Plain and in Mississippi.

Worm-eating Warbler. The Worm-eating Warbler is largely restricted to the Eastern region, where an increase occurred that was sufficient to result in a significant increase for the continent (Fig. 55). There were no statistically significant population changes for any State or stratum. The highest mean counts were in the Blue Ridge Mountains and in West Virginia.

Genus Vermivora. This generic summary is influenced primarily by the Nashville and Tennessee Warblers in the Northeast and the Orange-crowned Warbler in the West. In comparison with these three species, the Golden-winged and Blue-winged Warblers in the East and the Virginia's and Lucy's Warblers in the West are scarce and have little effect on the trend for the entire genus. There was no significant continental or regional trend (Fig. 55) for this highly migratory group, and the only trends for individual strata were an increase in the western portion of the Great Lakes Plain and a decrease in the western portion of the Spruce–Hardwood Forest.

Golden-winged Warbler. Despite reports that the Golden-winged Warbler is losing ground in competition with the Blue-winged Warbler (Gill 1980; Confer and Knapp 1981), the Golden-winged Warbler population appears stable across the continent (Fig. 55); the only significant declines were in the Great Lakes subregion and Wisconsin. However, this species was outnumbered by the Blue-winged Warbler in the majority of the eastern States in which both species nest (Table 4); Wisconsin was the only State in which Golden-winged Warbler counts were more than double those of Blue-winged Warblers (except for Virginia and Vermont, where the latter species was found on only one route or none). The highest mean count for Golden-winged Warblers occurred in the Great Lakes Transition, but the highest State average was in West Virginia.

Blue-winged Warbler. The Blue-winged Warbler showed an increase at the continental level (Fig. 55). There also were increases in the Northeastern States and in West Virginia and Tennessee, but there was a decrease in Alabama. Highest mean counts were in Southern New England, the Ohio Hills, and in Connecticut.

Tennessee Warbler. The Tennessee Warbler showed a sharp and significant increase in the Eastern region, correlated with the spruce budworm outbreak in eastern Canada. The eastern and central portions of the Spruce–Hardwood Forest had the highest means, and New Brunswick and Quebec led all other States and Provinces.

Orange-crowned Warbler. No graph was prepared for this species because there was no significant change in any subdivision of the continent. The greatest density of Orange-crowned Warblers was recorded in the Pacific Rain Forest of British Columbia.

Nashville Warbler. A significant decline in Nashville Warblers occurred in the Eastern region (Fig. 55), centered in the Great Lakes States—particularly in Minnesota. Maine and British Columbia reported increases. This species is considerably more common and widespread in the East than in the West. Highest densities were in the central and western parts of the Spruce–Hardwood Forest; the Sierra–Trinity Mountains of California ranked third. Largest numbers occurred in Quebec, Minnesota, New Brunswick, Maine, and Ontario.

Northern Parula. The Northern Parula showed a strong and continuing population increase in the Eastern region (Fig. 56), especially in the Canadian portion of its range and the Adirondack Mountains of New York. This trend was strong enough that the continental trend also was significantly upward. At the Province and State level there were increases in New Brunswick and Maine and a decline in Virginia. This species had two centers of abundance, one in the

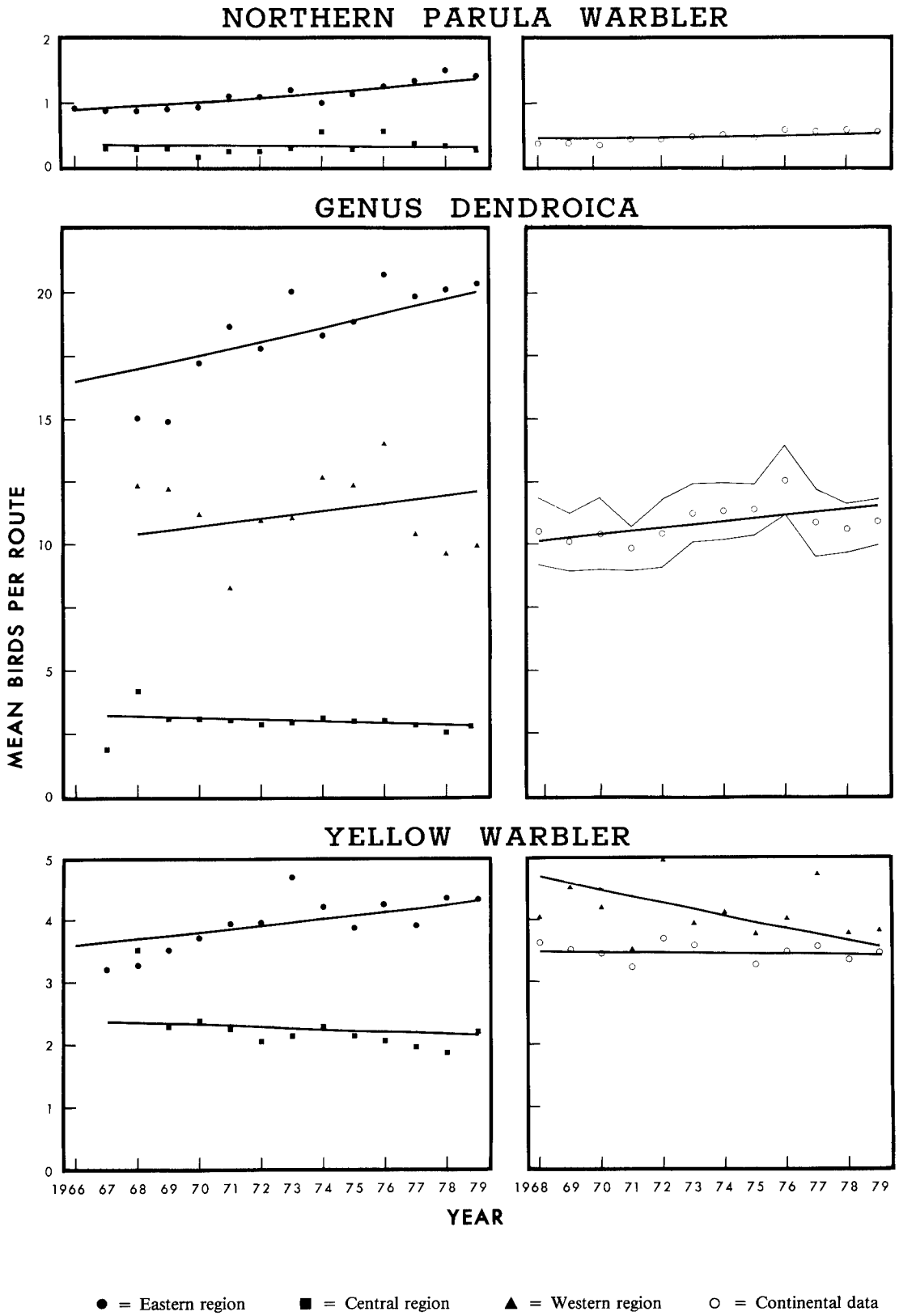


Fig. 56. Trends in warbler populations, part 2.

Lower Coastal Plain, the other in the eastern section of the Spruce–Hardwood Forest. The largest mean numbers were in South Carolina and Maine.

Genus Dendroica. Of the 52 wood warbler species that nest in North America, 21 (40%) belong to the genus *Dendroica*. At least part of the population of all the North American species in this genus is migratory. Although many of the *Dendroica* warblers are common and widespread (many are individually illustrated in Figs. 56–58), a summary for the genus is presented in Fig. 56. Based on a sample of nearly 1,200 routes, an increase for the Eastern region is apparent. In the Western region there is so much scatter among individual years that no trend is detectable. In the Central region there is less scatter, but the slope of the trend is so shallow that no trend is evident. When data for the three regions were combined (right-hand graph; 95% confidence limits) there was evidence of an increase from 1968 through 1976, but this was followed by a drop in all regions in 1977. Thus far we have not been able to identify the cause for the decline in 1977, although it is believed to be partly the result of a winterkill of Pine Warblers in the Southeast during the severe weather of 1976–77. *Dendroica* warblers reached their greatest numerical abundance in the Adirondack Mountains and all three sections of the Spruce–Hardwood Forest.

Yellow Warbler. For several years there was concern about a continuing decrease in Yellow Warblers in the Central region (Fig. 56), but higher counts in 1979 suggest a possible reversal. The only significant trend for the entire period was an increase in the Eastern region, specifically in the Northeastern States. A decline was indicated for the Far Western States, but this decline was not strong enough to register as significant for the Western region. There were increases in North Dakota, Illinois, the Middle Atlantic States from Maryland northward through New York and New Jersey, and also in Connecticut. The only State with a significant decline was Idaho. Yellow Warblers were most abundant in the Allegheny Plateau, the Aspen Parklands, the Central and Dissected Rocky Mountains, and the eastern portion of the Spruce–Hardwood Forest in Nova Scotia. Largest mean numbers were in New Brunswick, West Virginia, New York, and Idaho.

Magnolia Warbler. A spruce-forest bird, the Magnolia Warbler (Fig. 57) showed a rising tendency that was significant only in the Northeastern States, especially in the Adirondack Mountains of New York and the Central New England section of Vermont. Greatest abundance was in the Spruce–Hardwood Forest of Nova Scotia and New Brunswick.

Black-throated Blue Warbler. Here is an example of a species whose population trend line for the Eastern region (Fig. 57) did not fit the annual mean points because of differences in the way in which data were selected for the points and for the trend line. The only significant change detected in the Black-throated Blue Warbler (at the State level) was an increase in Vermont. The heaviest concentration was in the Adirondack Mountains, although State means for Maine and New Hampshire were higher than the mean for New York.

Cape May Warbler. Although the trend for the Cape May Warbler in the Eastern region rose steeply, there was so much scatter among individual years that the trend was not significant for the entire region. It was, however, significant for the Northeastern States, and especially for Maine. This species was most common in the Spruce–Hardwood Forest of New Brunswick and Quebec.

Yellow-throated Warbler. The Yellow-throated Warbler showed a significant rise for the Eastern region (Fig. 57), which was also reflected in the continental trend (not illustrated). The major increases were in the Highland Rim of Kentucky and Tennessee, the Cumberland Plateau, and the central portion of the Upper Coastal Plain in North Carolina. See also Smith (1978) for details about the expansion of this species into West Virginia. The trend in the Central region was not significant. The greatest abundance was in the Cumberland Plateau; Tennessee led the States and Provinces.

Yellow-rumped Warbler. During the present study, the Myrtle Warbler of the East and the Audubon's Warbler of the West were combined into a single species under the ancient name, Yellow-rumped Warbler. Because the Myrtle and Audubon's Warblers are readily identified in the field throughout most of their range, and they are predominantly allopatric, records of these two populations are still kept separate in the BBS study. The Myrtle Warbler showed a steady and significant increase in the Eastern region (Fig. 57), and this trend was reflected in its continental populations (not illustrated). The most consistent increases were reported from the Western Great Lakes States, northern New England, and Nova Scotia. It also commonly breeds in the far Northwest, north of the range of the Audubon's Warbler. The greatest density of this

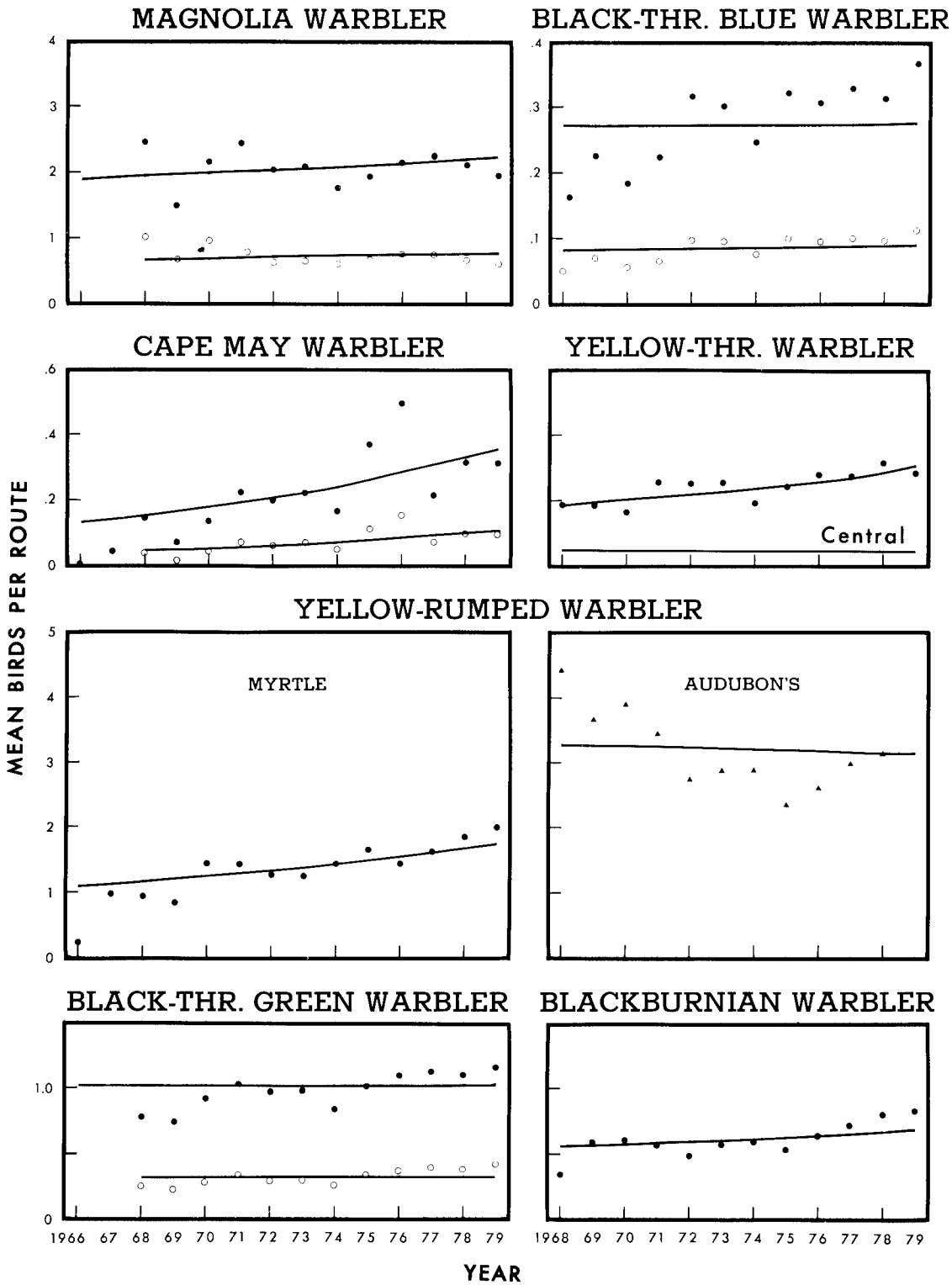


Fig. 57. Trends in warbler populations, part 3.

species was recorded from the Yukon Territory. Nova Scotia was second in abundance, and the top strata were the Adirondack and Canadian Rocky Mountains. Counts of Audubon's Warblers were so variable from year to year that no trend could be detected. The species was most commonly reported from the Sierra-Trinity and Central Rocky Mountains. British Columbia and Oregon reported the highest State and Provincial means.

Black-throated Green Warbler. A decline of the Black-throated Green Warbler in the Southeastern States was countered by an increase in the Northeastern States, resulting in a slope of zero for the Eastern region and for the continent (Fig. 57). Maine was the only State to show a significant increase. This species reached its greatest abundance in the eastern section of the Spruce-Hardwood Forest and in the Adirondack Mountains. Nova Scotia, Maine, and New Brunswick were the leading Provinces and States.

Blackburnian Warbler. An increase in Blackburnian Warblers in the Northeastern States was not sufficient to produce an increase for the Eastern region (Fig. 57). The increases were centered in the Spruce-Hardwood Forest of Maine and New Brunswick and in the Adirondack Mountains. Because this species nests only in the Eastern region, no continental summary was included. Maine was second to the Adirondack Mountains in abundance of Blackburnian Warblers.

Blackpoll Warbler. An increase in this spruce budworm feeder was evident through 1978 (Fig. 58), but a drop in population in 1979 terminated the significant rise and left the Blackpoll Warbler without any significant change either regionally or by State or Province. Its greatest abundance was in the Yukon Territory; Quebec was in second place.

Chestnut-sided Warbler. Any trend for the Chestnut-sided Warbler was too slight (Fig. 58) to register as significant except for increases in the St. Lawrence Plain and in the Great Lakes States, especially in Minnesota. Densest populations, however, were in the Adirondack Mountains, the central portion of Spruce-Hardwood Forest, and Central New England. Ontario and New Hampshire were the top Province and State.

Pine Warbler. The Pine Warbler, like the Carolina Wren (Fig. 33), increased in the warm winters of 1973-75 but dropped sharply in the severe winter of 1976-77, after which it made a rapid recovery. This trend was sharpest in the Eastern region (Fig. 58), but the decline from 1976 to 1977 was also noted in the Central region. Despite the crash in 1977, the trend for the period was an increase in the Eastern region, especially on the Lower Coastal Plain, the Southern Piedmont, and the western portion of the Spruce-Hardwood Forest; there was a decrease in the Central region. These trends cancelled each other so there was no significant overall trend for the continental population (not illustrated). The highest mean counts were from the western portion of the Upper Coastal Plain, the Lower Coastal Plain, and the Southern Piedmont. The leading States were Florida, Alabama, Louisiana, and Virginia.

Prairie Warbler. The Prairie Warbler showed a steady decline in both of the regions in which it occurs—the Eastern and Central regions—causing a decline in the continental population (Fig. 58). This drop is believed to have resulted from a loss of the scrub growth habitats that the species requires. These habitats are under increasing pressure as needs for agriculture and other purposes expand. There was an increase in New York, but the Southeastern States and four individual States (Maryland, North Carolina, Georgia, and Arkansas) showed significant decreases. The highest counts came from the Southern Piedmont and Virginia.

Ovenbird. Despite loss of habitat through fragmentation of forests, the Ovenbird has continued to show an increase in the Eastern region (also reflected in the continental trends) during this study. The greatest increase occurred in eastern Canada, especially New Brunswick, and in adjacent Maine. The areas of greatest abundance were the western portion of the Spruce-Hardwood Forest and Maine, New Brunswick, Ontario, and New Hampshire.

Northern Waterthrush. The Northern Waterthrush has also been increasing in the Eastern region (Fig. 58). A negative tendency in the western population was too erratic to be significant, but it did cancel the eastern increase so that there was no significant change for the continent. There were increases in the Spruce-Hardwood Forest of New Brunswick and in the Great Lakes Transition, but a decline in New Hampshire. The greatest breeding densities were in the Canadian Rocky Mountains of British Columbia and the Spruce-Hardwood Forest of New Brunswick.

Louisiana Waterthrush. The trend for the Louisiana Waterthrush in both the Eastern and Central regions was essentially level. West Virginia and the Blue Ridge Montains had the highest average counts, perhaps because so many of the roads in those areas follow mountain streams.

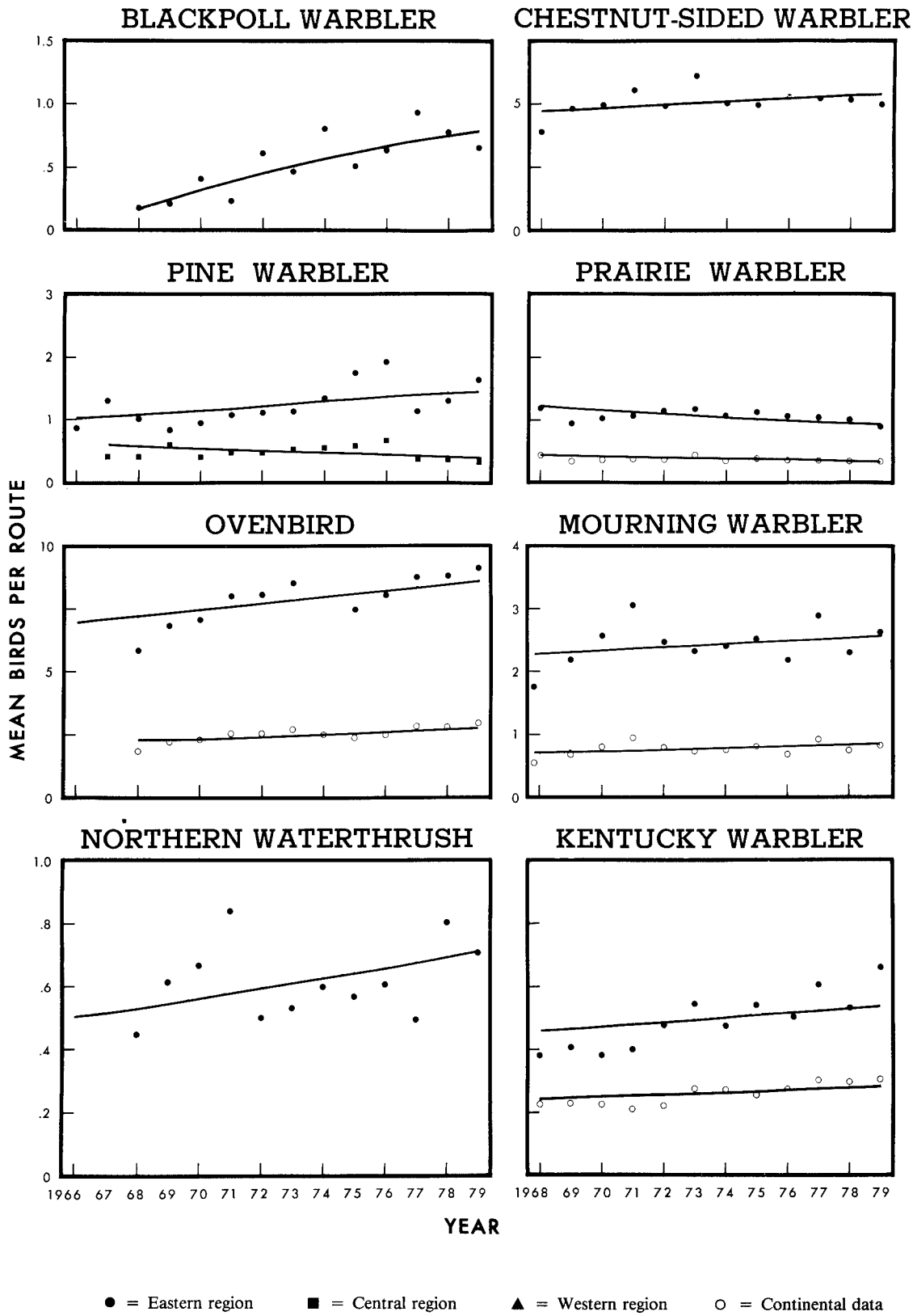


Fig. 58. Trends in warbler populations, part 4.

Mourning Warbler. The Mourning Warbler was found on only 331 routes in the Eastern region (Fig. 58), and no significant trend was detected except for an increase in the St. Lawrence Plain. Highest average counts were in Ontario and in the central portion of the Spruce–Hardwood Forest.

Kentucky Warbler. The Kentucky Warbler was represented by a small sample (411 routes in the East) and, although there is some suggestion of a positive trend (Fig. 58), it was not statistically significant. The population of this floodplain species seems to be stable. Increases were noted in the Great Lakes States, in Kentucky and Mississippi, and in the southern portion of the Upper Coastal Plain. There were declines in the southern portion of the Ridge and Valley and in the western portion of the Upper Coastal Plain, which is second in population density to the Cumberland Plateau. Arkansas had the highest State density.

Common Yellowthroat. A very slight but significant upward trend was recorded for the Common Yellowthroat in the Eastern region and across the continent (Fig. 59). There were increases in California and Saskatchewan, in the Great Lakes States, and from New York and Connecticut south through Maryland. The decreases were all in the South—Oklahoma, Alabama, Georgia, Virginia, and West Virginia. Greatest densities were in the eastern portion of the Spruce–Hardwood Forest and Central New England, especially in Nova Scotia, New Brunswick, and New Hampshire. The second largest numbers, however, were recorded in Iowa.

Yellow-breasted Chat. The chat showed a sharp and steady decrease in the Eastern region (Fig. 59) and a negative, but not significant tendency in the Central region (not illustrated). The continental trend, however, was significantly down. California was the only State showing an upward trend. There were negative trends from Illinois, Ohio, and Pennsylvania, south to Alabama, Georgia, and Virginia. The States with the highest mean counts were Kentucky and Alabama. The top four strata were the Cumberland Plateau, Highland Rim, Lexington Plain, and the Ohio Hills.

Hooded Warbler. The Hooded Warbler increased in the Eastern region (Fig. 59), but there was no significant increase for the continent or for any particular part of the country. The highest mean counts were from the extensive forests in the Cumberland Plateau, the Blue Ridge Mountains, the western portion of the Upper Coastal Plain, and North Carolina.

Wilson's Warbler. Wilson's Warbler showed an increase in the Eastern region (not illustrated) that was centered in Quebec. Populations were too erratic in the West (Fig. 59) for the suggested decline to be statistically significant except in British Columbia, where the two strata in which this species reached its greatest abundance—the Pacific Rain Forest and the Canadian Rocky Mountains—were located.

American Redstart. The American Redstart increased in the Eastern region (Fig. 59) despite a significant decline in the Southeastern States. There were increases in the Northeastern States and Provinces, especially in New York, New Brunswick, and Nova Scotia; there were decreases from the Great Lakes States south to Arkansas and Alabama. Highest counts were from the eastern portion of the Spruce–Hardwood Forest and the Adirondack Mountains. The highest densities were in New Brunswick, Nova Scotia, New Hampshire, and Maine.

Weaver Finch (Fig. 59)

House Sparrow. The House Sparrow declined significantly in the Eastern region, but annual variation was too high in the West for the negative tendency there to be significant (Fig. 59). Likewise, there was no significant continental trend for this species. The declines from 1976 to 1977 in the Central region and from 1977 to 1978 in the Eastern region are believed to have resulted largely from severe winter weather. By State the only significant increases were in Wyoming and Iowa, whereas there were decreases in British Columbia, Oklahoma, Georgia, Pennsylvania, Connecticut, Maine, and New Brunswick. Forbush (1929) was one of the first ornithologists to report a decline in urban populations of House Sparrows in the 1920's, when automobiles began replacing the horses on which the sparrows had relied for much of their winter food supply. A continuing trend toward cleanliness in dairy barns, and to a lesser extent in other farming operations, must be largely responsible for the continuing decrease in this introduced species. The greatest densities of House Sparrows were recorded in the Till Plains and the South Texas Brushlands. Illinois, Indiana, and Ohio were the leading States for this species.

Blackbirds and Orioles (Figs. 60–63)

Bobolink. The increase in Bobolinks shown for the Eastern region (Fig. 60) resulted from increases in the northern part of the range of the species in On-

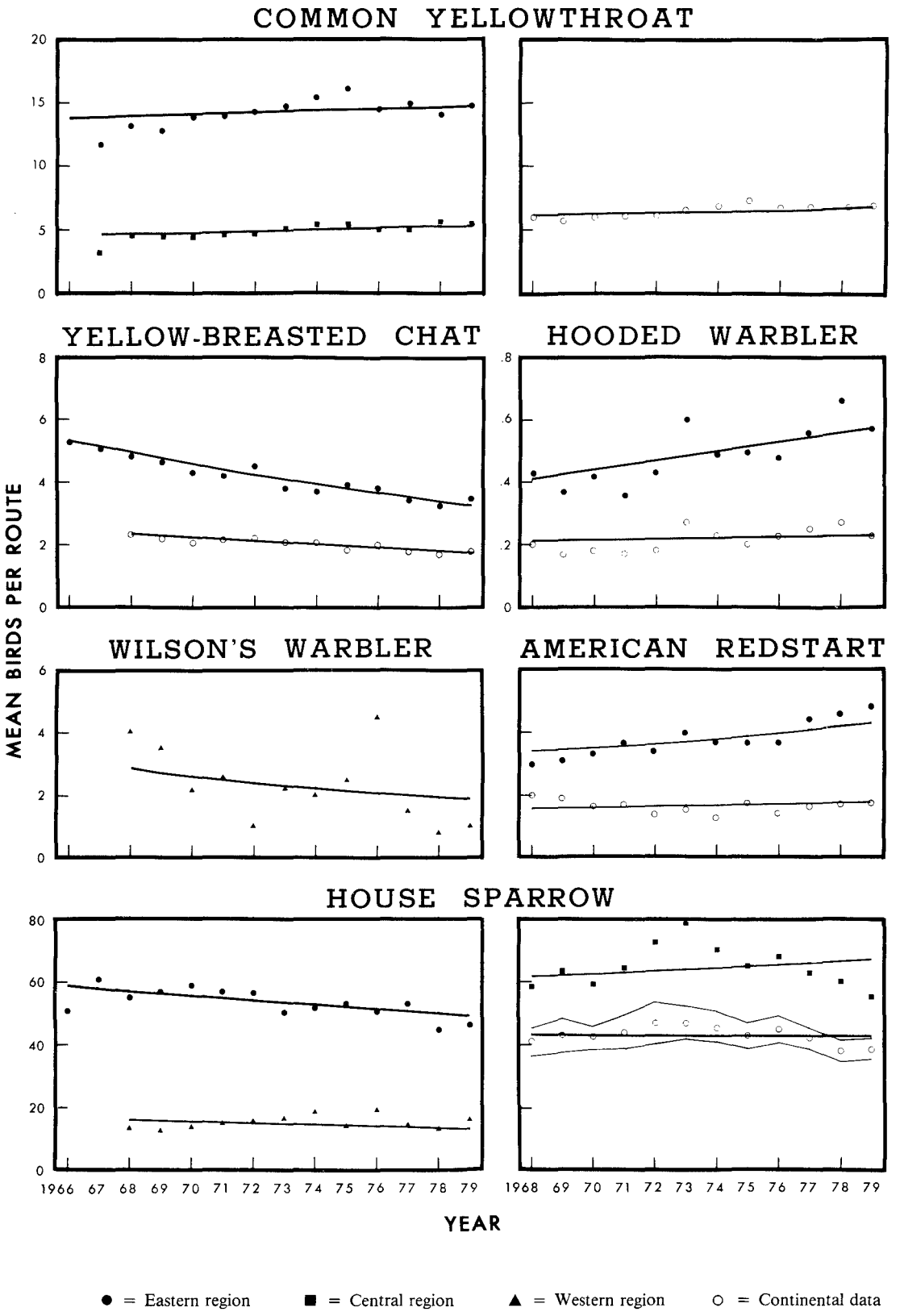


Fig. 59. Trends in warbler (part 5) and House Sparrow populations,

tario, New Brunswick, and Nova Scotia, rather than from any increase detected in the United States. Although a significant decline occurred in the Central region the continental trend showed an increase. There was an increase in Saskatchewan in addition to the increases in the three Provinces already mentioned, but the only significant changes in the United States were decreases in North Dakota, Iowa, Illinois, and Ohio. The greatest nesting density for this species was in the St. Lawrence Plain and in Quebec and Ontario.

Eastern Meadowlark. The Eastern Meadowlark is declining in the Eastern region (Fig. 60), but is increasing in the Central region where the center of abundance was in the East Texas Prairies, Oklahoma, and Missouri. The continental trend was not significant. There was a decrease in Canada and in all of the eastern subregions, but an increase in the Southwestern States. The only State to register an increase was Texas, but there were significant decreases in 20 States, ranging from Iowa and Tennessee east through Maine and Virginia, and also including Florida and Oklahoma. The effect of the severe winter of 1976–77 can be seen in the graph for the Eastern region; this one unusually cold winter accentuated the downward trend for this species, even though it was offset in part by a slight increase in the Central region during the same year. Similarly, a decrease in the Central region in 1978 and 1979 tended to reduce the strong upward trend in that region.

Western Meadowlark. Western Meadowlark populations were more stable than those of the Eastern Meadowlark, but there was a slight, though significant, decline in the Eastern region, and a negative tendency in the Central region (Fig. 60). There were no significant State or Provincial increases, but there were decreases in Alberta, Saskatchewan, California, Nevada, Minnesota, Wisconsin, Iowa, Illinois, and Michigan. The highest populations occurred in the Unglaciated Missouri Plateau and in South Dakota.

Yellow-headed Blackbird. A colonial nesting species, the Yellow-headed Blackbird registered a strong increase in the Central region (Fig. 61), which was also reflected in a significant continental increase. The only significant change for an individual Province or State was an increase in British Columbia. The center of abundance was in the Drift Prairie, where North Dakota's State average was the highest.

Red-winged Blackbird. The only significant regional trend for the Red-winged Blackbird was an increase in the Central region (Fig. 61). There had been an increase in the East, but this trend was reversed in 1975 and is no longer statistically significant. There was a puzzling pattern of increases and decreases across the continent with increases in four Canadian Provinces (Saskatchewan, Ontario, Quebec, and New Brunswick), and in California, Oklahoma, Missouri, Iowa, Wisconsin, Kentucky, and Tennessee. Decreases occurred in Arizona, Idaho, Nebraska, Ohio, New Jersey, New York, and Connecticut. Centers of abundance were in the eastern portion of the Great Lakes Plain and, surprisingly, in the Sonoran Desert—probably because roads there tend to be more common in irrigated farmland. Ohio had the highest of State or Provincial average counts.

Brewer's Blackbird. Stepney and Power (1973) traced the eastward expansion of the breeding range of Brewer's Blackbird east of the Mississippi River. Despite the expected increase in the Eastern region, no single eastern State or Province showed a significant change based on data from 99 routes, partly because this species was found on so few routes in any one eastern State. The only significant changes on a State basis were increases in Colorado and North Dakota, countered by a decrease in Montana. The significant increase in the Eastern region was not graphed because the means were small in comparison with those for the other regions. The highest concentrations were in Montana and in the Central Valley of California.

Boat-tailed and Great-tailed Grackles. At the beginning of the BBS, these two were considered races of a single species, but the A.O.U. Check-list Committee (1976) separated them into two distinct species, with the Boat-tailed Grackle breeding from southeastern Texas eastward along the Gulf Coast, across the Florida peninsula and up the Atlantic coast to New Jersey, and the Great-tailed Grackle breeding along the southwestern Louisiana coast and inland from east-central Texas west through southern New Mexico into southeastern California and western Mexico and north to Colorado and Kansas. Because of the overlapping ranges of these two grackles in Texas and Louisiana, it was not possible to separate the records for the early years for the Central region. In the Eastern region, however, only the Boat-tailed Grackle occurs. The graph in Fig. 62 (top left) shows no change in the population of Boat-tailed Grackles. In the southern Great Plains there has been a phenomenal increase in numbers of Great-tailed Grackles, as well as a conspicuous northward extension of their breeding range—especially in the

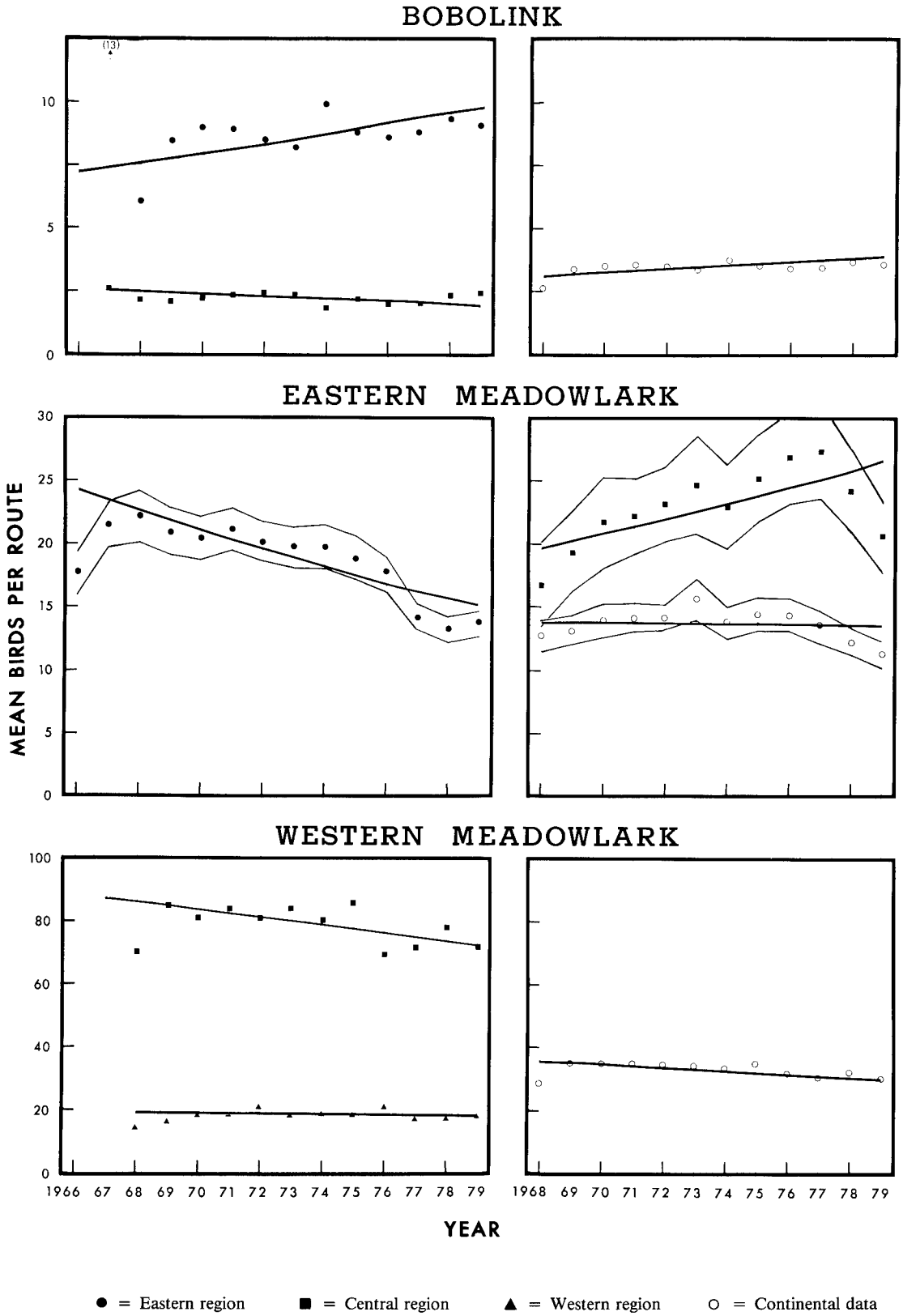


Fig. 60. Trends in Bobolink and meadowlark populations.

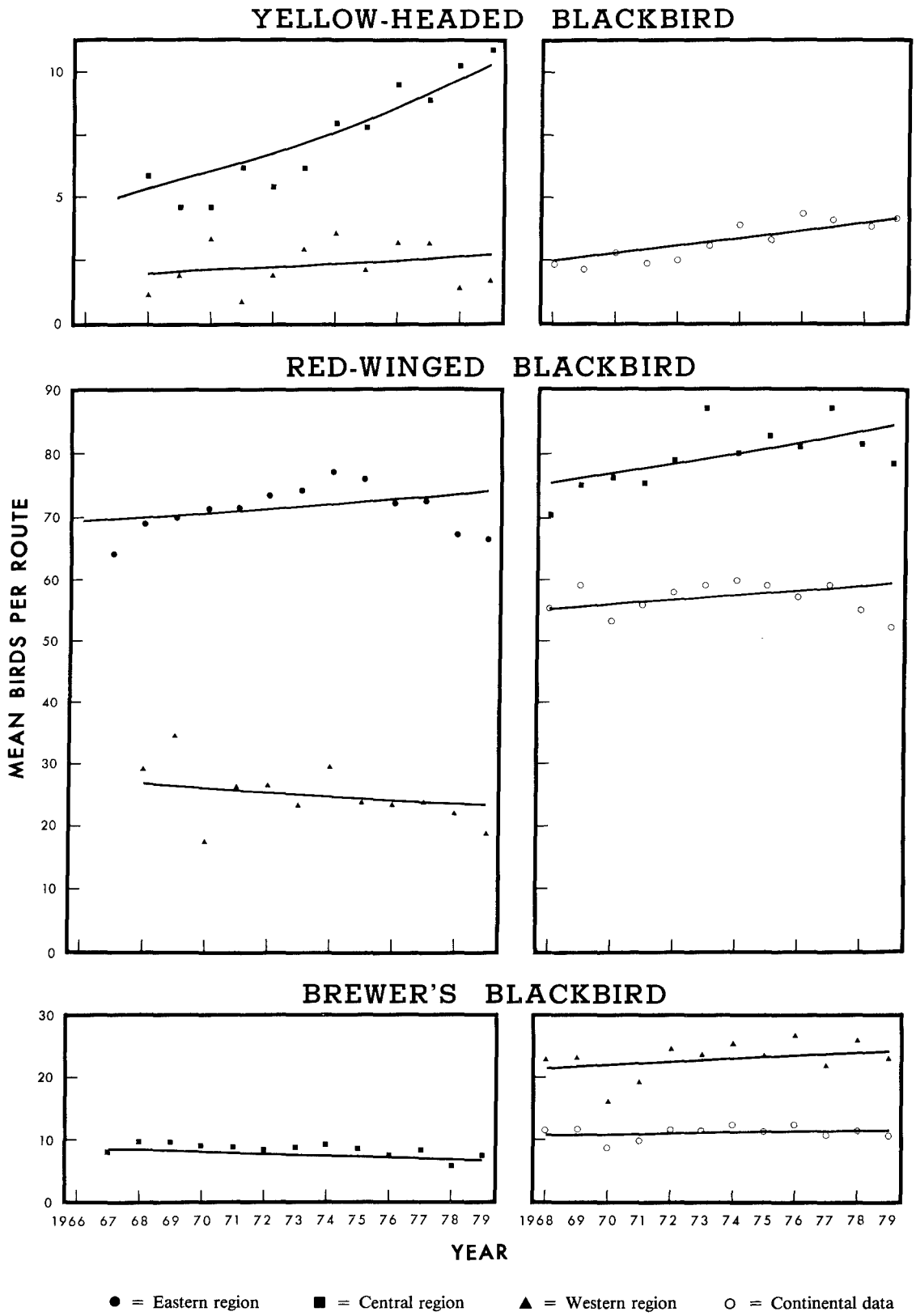


Fig. 61. Trends in blackbird populations.

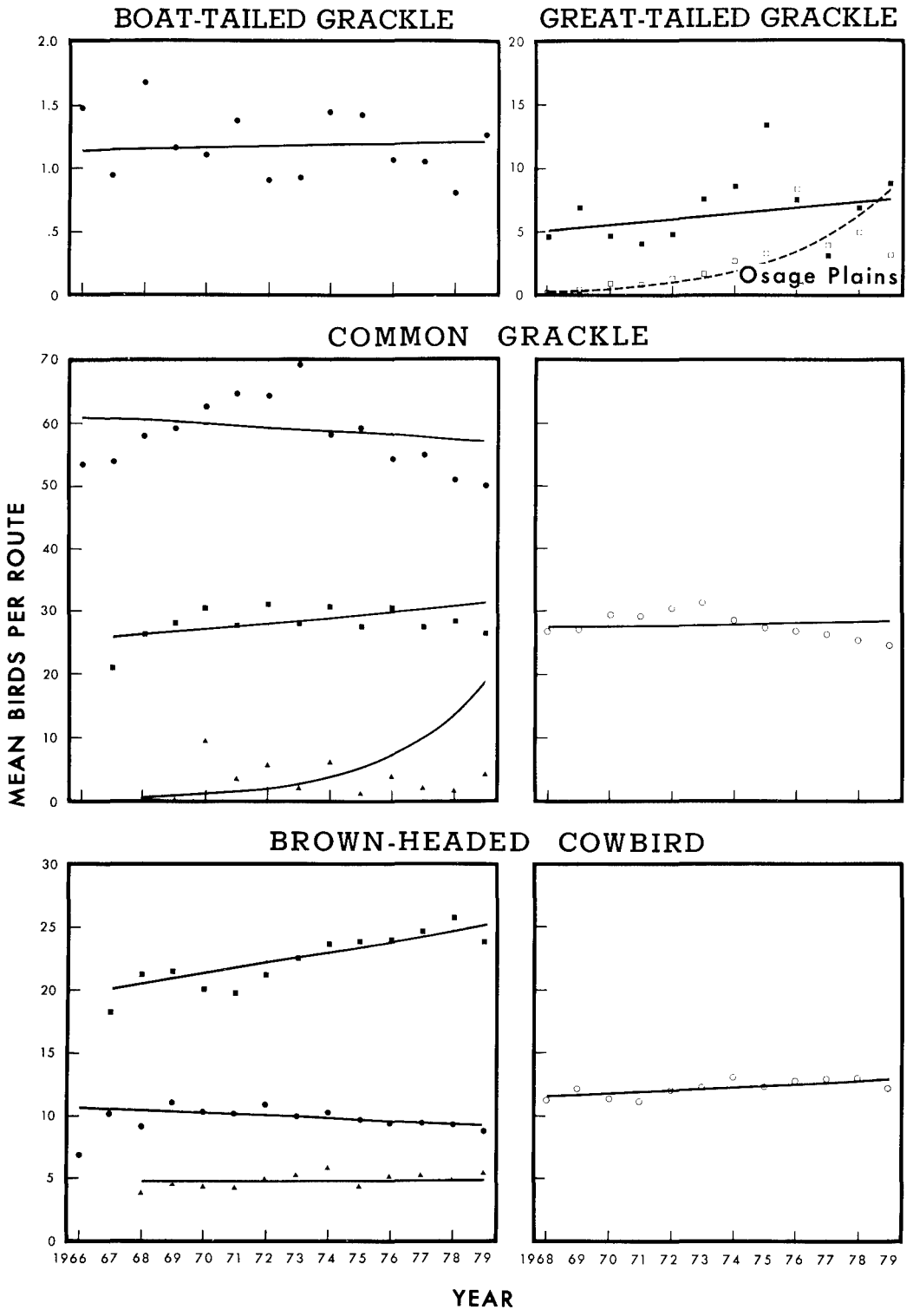


Fig. 62. Trends in grackle and cowbird populations.

Osage Plains of Oklahoma and Kansas and into Nebraska (Schwilling 1971; Davis 1975; Seibel 1978; and Faanes and Norling 1981). Fig. 62 shows the highly significant increase for this species in the Osage Plains. The trend for the entire Central region, however, was not statistically significant.

Common Grackle. In the Eastern region where they are most abundant, Common Grackles built up to a peak in 1975 (Fig. 62), with a drop after the winters of 1975–76 and 1977–78, followed by a continuing decline. The same trend was reflected in the continental populations and in both instances there was no significant net change in populations. The initial increase, which has a parallel in the Central and Western regions, was attributed, at least in part, to the trend toward mechanical harvesting of crops, which leaves more waste grain, and in turn has permitted increased winter survival of grackles and other blackbirds. At least part of the population decline in the East was the direct result of blackbird control operations in a few of the largest winter roosts (Bystrak and Robbins 1977). A modest decline in BBS totals for 1977–79 was insufficient to cancel the significant increase in the Central region. A significant increase in the Western region may have been the result of the planting of shelter belts. The apparent discrepancy in the graph between the mean annual populations in the Western region and the computer-generated trend is the result of the small sample size (27 routes) on which that graph is based. This graph is shown despite the small sample size because of the special interest in this pest species. There were significant increases in Oklahoma and in the Great Lakes States of Minnesota, Indiana, and Ohio. Decreases were noted in Mississippi, Iowa, Illinois, Ontario, Pennsylvania, New Brunswick, and Maryland. Greatest abundance was recorded in the Northern Piedmont and in Delaware, Kentucky, Maryland, Virginia, and Illinois.

Brown-headed Cowbird. The Brown-headed Cowbird was originally a nesting species of the grasslands, but with the clearing of the forests it invaded the Great Lakes States and the Northeastern States during the 19th century. More recently this species has become established in the Southeastern States and also is pushing farther north into Canada. Its spread into the Carolinas and southern Georgia has been documented by Crawford (1974) and Potter and Whitehurst (1981). The BBS shows a continuing significant increase in the Central region and for the continent, despite a significant decrease in the Eastern region (Fig. 62). By subregions, there were significant decreases in the Southwestern and Northeastern States and significant increases in the Southeastern States and Canada. Breaking this down to the State and Province level, there were a few isolated western States with increases (California, Montana, and Colorado), increases in a block of three States in mid-continent (South Dakota, Minnesota, and Iowa), and increases in North Carolina, South Carolina, and Alabama. Decreases were recorded from Michigan and Indiana eastward to West Virginia, Pennsylvania, Connecticut, and New York, and in New Brunswick. The strata of greatest density were the High Plains Border and Drift Prairie; North Dakota and Kansas led the States and Provinces.

Orchard Oriole. Although there was essentially no change in the Eastern region for the Orchard Oriole, a decline in the Central region was sufficiently great to cause a significant decline in the continental population (Fig. 63). The Continental population was not included in the graph because of overcrowding. Declines were limited primarily to the southern States: Kansas, Oklahoma, Arkansas, Louisiana, Iowa, Alabama, and South Carolina. Northern States tended to show increases, but the only State in which a significant increase was recorded was South Dakota. The Orchard Oriole reached its greatest abundance in the Upper Coastal Plain and in Mississippi.

Scott's Oriole. Based on data from 72 western routes (Fig. 63), there was no significant change in populations of Scott's Oriole, nor was any significant change detected for another western species, the Hooded Oriole, based on data from 50 routes.

Northern Oriole. The name Northern Oriole includes the former Baltimore Oriole of the East and the Bullock's Oriole of the West, which are now considered to be only subspecies. Because these two orioles are identifiable on sight, we are continuing to ask observers to separate them on their BBS reports. Despite loss of elm trees to the Dutch elm disease, the Baltimore Oriole increased in both the Eastern and Central regions and also across the continent (Fig. 63). The Central region and continental graphs include Bullock's Orioles as well as Baltimore Orioles. In the Western region, where only the Bullock's Oriole occurs, there was no significant population change. Although most States registered decreases, Baltimore Orioles increased in Saskatchewan, North and South Dakota, Nebraska, Illinois, Indiana, Ontario, and New Hampshire, and

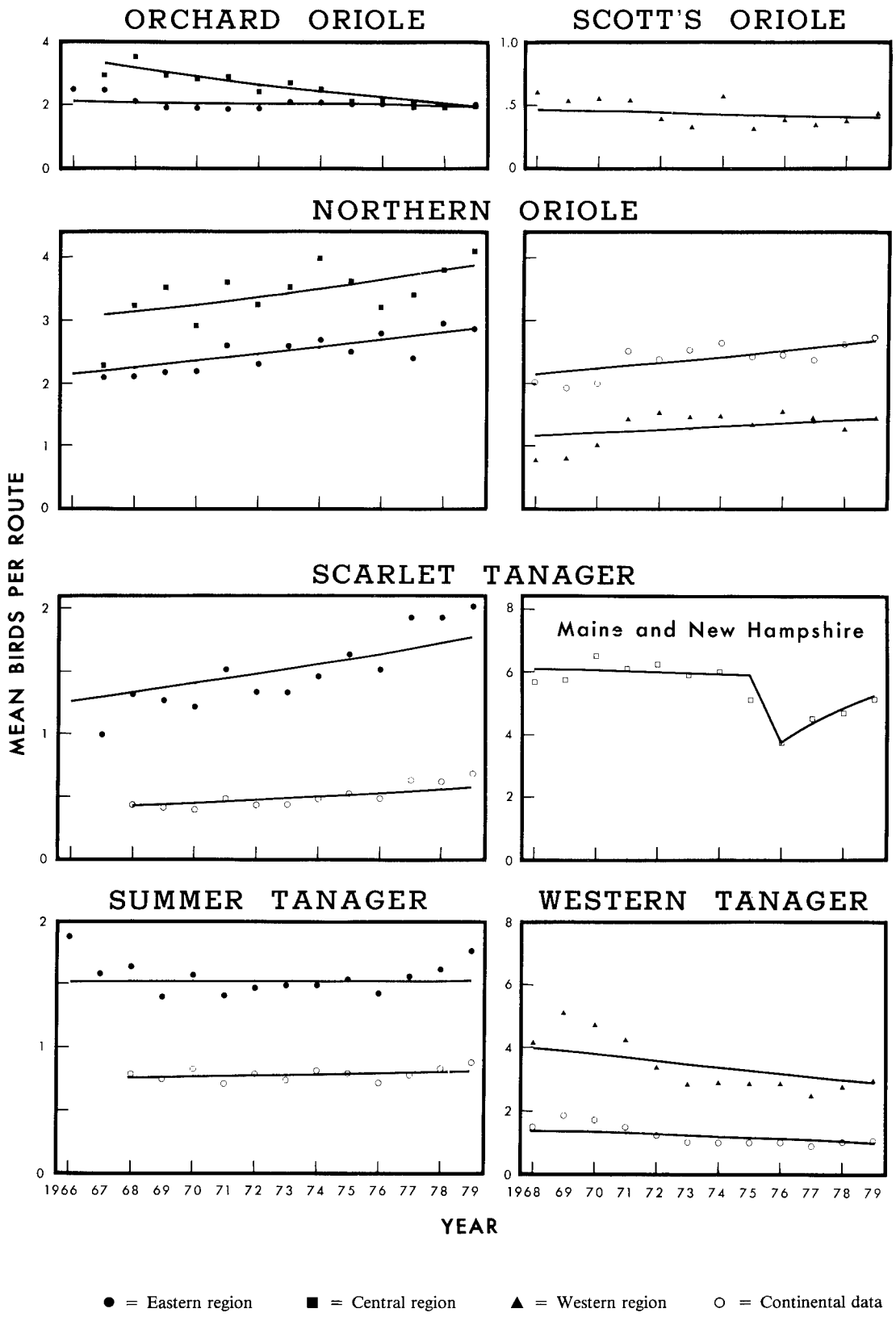


Fig. 63. Trends in oriole and tanager populations.

Bullock's Orioles increased in Colorado. The Baltimore Oriole reached its greatest abundance in Connecticut and Massachusetts, with an area of lesser abundance in Kansas. The strata with the greatest density were Southern New England, the northern portion of the Ridge and Valley, and the High Plains Border. The Bullock's Oriole was most common in the California Foothills and the Los Angeles Ranges. Highest State means were in California and Oregon.

Tanagers (Fig. 63)

Scarlet Tanager. The Scarlet Tanager registered an overall increase in the Eastern region despite migration casualties in northern New England during the 1974 spring migration. Five consecutive days of cold, rainy weather resulted in a massive and much-publicized roadside kill of Scarlet Tanagers on the weekend of May 25–26 (Kent 1974). Although this occurrence depressed the breeding population in Maine and New Hampshire in 1974, as shown in Fig. 63, it was not of sufficient magnitude to affect the trend for the Eastern region. There were significant increases in Scarlet Tanagers in the Great Lakes States and in the Northeastern States. There were no regional or State decreases, but there were increases in Michigan, Ohio, Pennsylvania, West Virginia, and Tennessee. Highest densities were in the Adirondack Mountains, the Allegheny Plateau, the Blue Ridge Mountains, and in Connecticut, West Virginia, Rhode Island, and Pennsylvania.

Summer and Western Tanagers. Populations of Summer Tanagers were stable throughout their breeding range. The center of abundance for this species was in the western portion of the Upper Coastal Plain and the Ozark–Ouachita Plateau, and in South Carolina and Alabama. Western Tanagers declined in the Canadian portion of their breeding range, especially in British Columbia where, coupled with a downward tendency in the Central Rocky Mountains, the decline was sufficient to generate an overall decline for the Western region and hence for the continental population. As can be seen from the last graph in Fig. 63, most of the decline took place before 1973; since 1974 the major States and Provinces in which this species breeds have had stable populations. Oregon has the highest average population density of Western Tanagers, but by far the greatest concentration of the species was in the Sierra–Trinity Mountains of California. A weather-related migration incident in the Rocky Mountains that affected tanagers and other species in the spring of 1975 (Kingery 1975) appeared to have no measurable effect on the BBS results for the Western region.

Grosbeaks and Buntings (Figs. 64 and 65)

Cardinal. Cardinal populations showed a very slight but significant decline in the Eastern region; elsewhere they were stable. Declines in the Southeast, from Florida north through Tennessee and Virginia, were not quite offset by increases from Pennsylvania and New Jersey north into New York and New England, where this species is gradually expanding its range. The most consistent increase, one that proved to be highly significant, took place in Southern New England (Fig. 64, top left); the top right graph shows the increase and subsequent decrease in the Ohio Hills. The center of abundance for Cardinals was in the western portion of the Upper Coastal Plain; Louisiana supported the largest numbers.

Rose-breasted Grosbeak. There is no obvious explanation for the rapid increase in numbers of Rose-breasted Grosbeaks recorded in the Eastern region (Fig. 64), which was strong enough to cause a significant increase in the continental population despite stable populations in the Central region. The only State to register a decrease was Ohio, whereas there were significant increases in Missouri, Illinois, Michigan, Ontario, Quebec, the Maritime provinces, Maine, New Hampshire, Vermont, New York, and Pennsylvania. There was no significant change in the Great Lakes Transition or in Wisconsin, where this species reached its greatest densities.

Black-headed Grosbeak. The Black-headed Grosbeak showed a slight decline in the Western region (Fig. 64), despite the fact that the only significant change for a Province or State was an increase in British Columbia, which also resulted in a significant increase for the Canadian portion of its range. This species' greatest abundance was in the Los Angeles Ranges.

Blue Grosbeak. The Blue Grosbeak showed a significant increase in all three regions (Fig. 64). There were no State declines, but there were significant increases in New Mexico, Florida, Tennessee, Kentucky, Virginia, and Maryland. The center of abundance was in the Southern Piedmont; South Carolina had the highest State mean.

Indigo Bunting. This eastern species, the Indigo Bunting, registered a slight but steady increase throughout its range, with significant increases in the Great Lakes States and the Northeastern States as well as in the Eastern and Central BBS regions

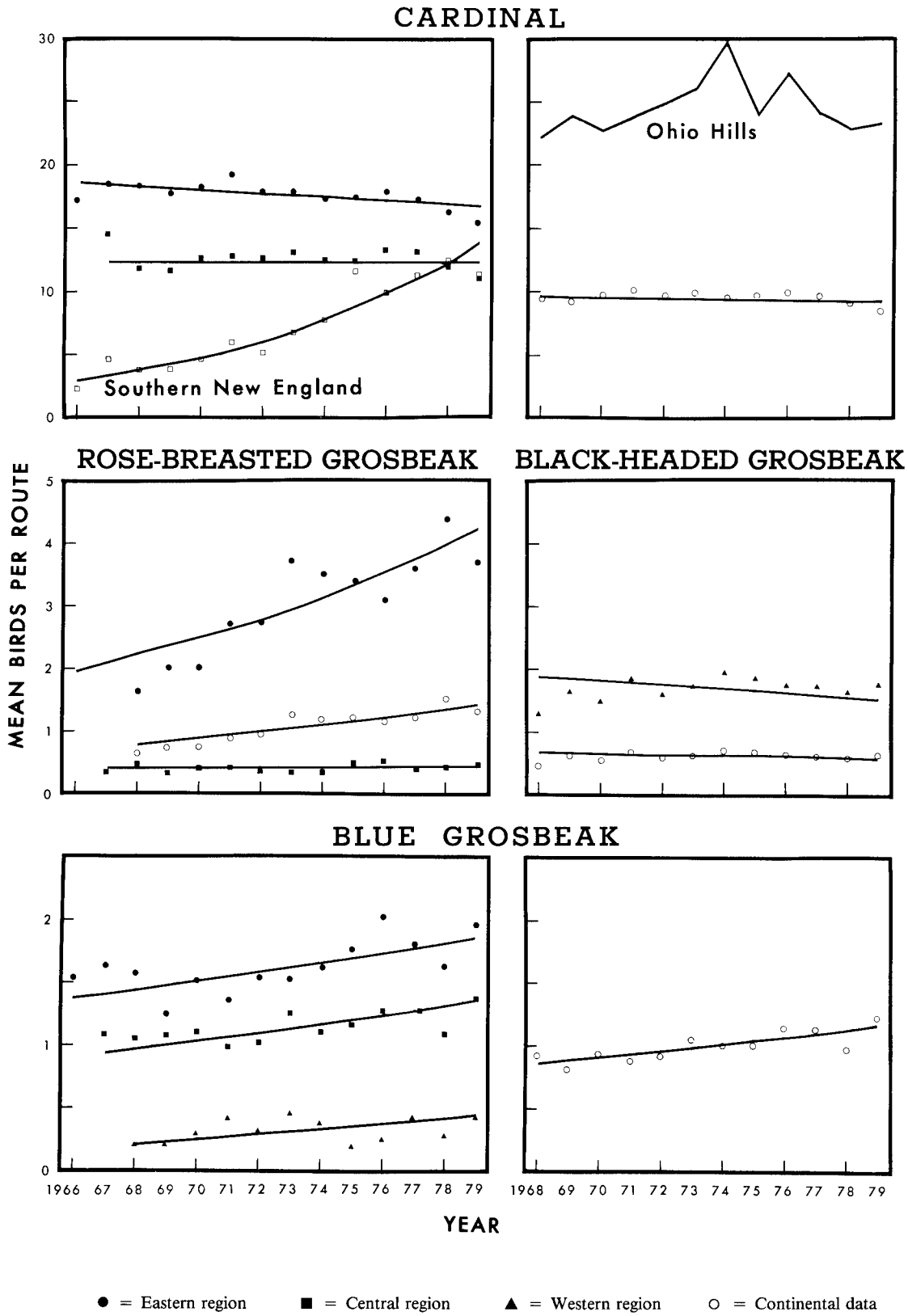


Fig. 64. Trends in cardinal and grosbeak populations.

(Fig. 63); there were no decreases. Significant increases occurred in Arkansas, Minnesota, Illinois, Ohio, Virginia, Maryland, Pennsylvania, New York, and New Hampshire. The Indigo Bunting reached its greatest abundance in the Lexington Plain and Highland Rim; largest numbers were in Kentucky.

Lazuli Bunting. The Lazuli Bunting decreased in the Central region (Fig. 65) and in British Columbia, but there was no significant change in the Western region. The highest densities reported were in the Los Angeles Ranges and in Oregon.

Painted Bunting. The Painted Bunting showed a steady decline in the Central region and a less abrupt but nevertheless significant decrease for the continent (Fig. 65). Declines were significant in Texas and Oklahoma, especially in the East Texas Prairies and the Osage Plains. The greatest density by far was in the South Texas Brushlands and the Edwards Plateau. Largest numbers were in Texas and Oklahoma.

Dickcissel. Dickcissel populations are known for their erratic annual changes, especially shifts in concentrations of heaviest nesting. The years 1967–79 witnessed a steady, significant decline in the Eastern region (Fig. 65). A sudden population drop in 1974 in the Central region contributed heavily to the significant decline for that region. The continental trend also declined significantly. There were decreases in Kansas, Nebraska, and South Dakota, eastward through Ohio and Kentucky (11 States); no States registered increases. The Dickcissel reached its greatest mean abundance in the Dissected Till Plains, and Iowa had the highest State mean. To illustrate the magnitude of the year-to-year changes in some of the more important geographic areas, the mean annual counts for the Dickcissel are plotted for three such areas in Fig. 65 (bottom, right): the Osage Plains, which extend from north-central Texas northeastward into eastern Kansas and western Missouri, the East Texas Prairies, and the Wisconsin Driftless Area.

Finches (Figs. 66 and 67)

Evening Grosbeak. Year-to-year counts for the Evening Grosbeak were so erratic during the first half of the period covered that no significant trends were detected (Fig. 66). The areas of greatest abundance were the Cascade Mountains of Oregon northward into British Columbia, and in New Brunswick.

Purple Finch. Some concern has been expressed over possible competition between the Purple Finch and the House Finch, because the latter has been spreading rapidly through the Northeastern States. Actually, the declining tendency shown for the Purple Finch (Fig. 66) is not statistically significant, and the only areas in which it showed a decline during the BBS period were Wisconsin and New Brunswick—areas in which the House Finch does not yet breed. Some of the heaviest competition between these two species occurs at feeding stations south of the breeding range of the Purple Finch rather than on the breeding grounds. It is possible that well-stocked feeding stations can accommodate both species and that winter food supplies may not become a limiting factor. The highest breeding densities of the Purple Finch were reported from the eastern portion of the Spruce–Hardwood Forest in New Brunswick and Maine, and in the Sierra–Trinity Mountains of California.

House Finch. The outward spread, both geographically and numerically, of House Finches, which were liberated in 1942 into a favorable environment on Long Island, New York, has been well documented by the BBS. Based on reports of this species from 121 routes in the Eastern region, there has been a phenomenal increase, averaging 21% per year, from 1966 to 1979 (Fig. 66). In the Western region, where the species is much more abundant, there has been a nonsignificant declining tendency that has prevented the eastern increase from being reflected in the continental populations. Data from the Central region are too variable to result in a significant trend for that region, although the trend line appears to slope upward. As an example of the successful spread of introduced populations through Southern New England, the annual means for this stratum are plotted (Fig. 66). Counts in the eastern States that had the highest means (Rhode Island with 3.1 birds per route and Connecticut with 1.9), however, were much lower than the mean of 42.4 for California. When the California birds were separated by strata the counts became even more impressive: 76.0 birds per route for the California Foothills and 72.2 for the Central Valley. Easterners undoubtedly can look forward to increasing numbers of House Finches for years to come.

American Goldfinch. American Goldfinch populations have been declining throughout the BBS period in the Eastern and Central regions (Fig. 67). This decline was also reflected as a significant decrease continentally. The only large area reporting stable populations was the Western region. No State or Province reported an increase, but there were 18 decreases: Saskatchewan and Ontario east through

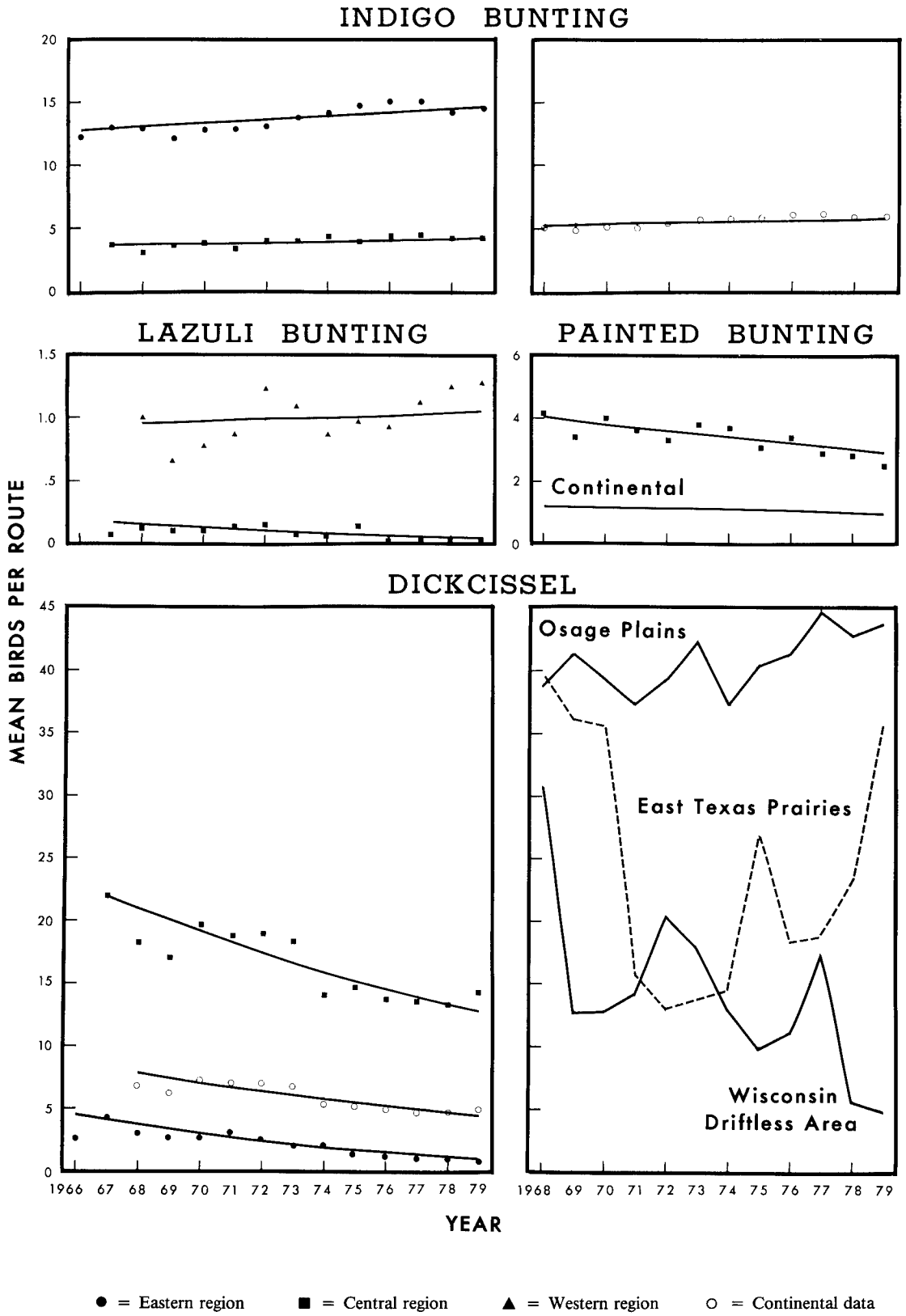


Fig. 65. Trends in bunting and Dickcissel populations.

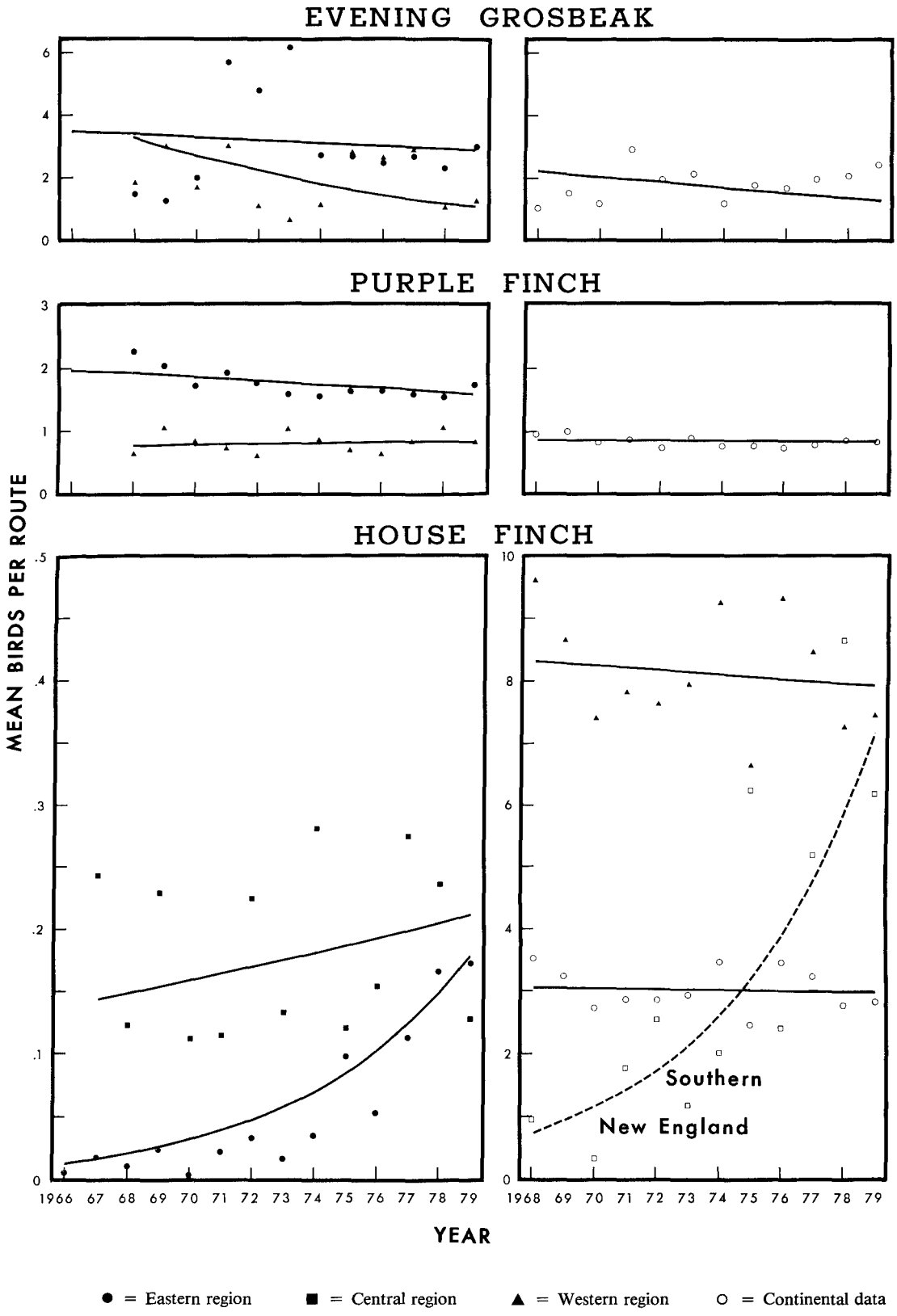


Fig. 66. Trends in Evening Grosbeak, Purple and House Finch populations.

New Brunswick, and North Dakota and Iowa eastward through Vermont, New York, Pennsylvania, Maryland, West Virginia, Kentucky, and Tennessee (except for Illinois and Indiana), and in Maine. The center of abundance was in the St. Lawrence Plain and in New York and Ontario.

Lesser and Lawrence's Goldfinches. No significant trend was detected for the Lesser or Lawrence's Goldfinches, despite what appear to be declines in the Western region (Fig. 67). Sample sizes for these two species in the Western region (183 and 57 routes, respectively) were too small to compensate for the year-to-year variability on individual routes. Centers of population were the California Foothills for the Lesser Goldfinch and the Los Angeles Ranges for the Lawrence's Goldfinch.

Pine Siskin. The erratic Pine Siskin showed no significant change in any region (Fig. 67), State, or Province. Its greatest abundance was in the Canadian Rocky Mountains in British Columbia.

White-winged Crossbill. Based on data from a small sample of 51 routes in the Eastern region, the unpredictable White-winged Crossbill showed a conspicuous decline (Fig. 67) that was centered in the Spruce–Hardwood Forest of Quebec and Ontario. The greatest abundance of this species, however, was in the Yukon Territory thousands of miles to the northwest.

Red Crossbill. This boreal forest species also varies greatly in numbers from year to year in the areas sampled by the BBS. The Western and continental data for the Red Crossbill showed a significant increase (Fig. 67), although there were no significant changes by subregion, State, or Province. Greatest abundance was in the Cascade Mountains of Washington.

Towhees and Sparrows (Figs. 68–73)

Rufous-sided Towhee. The Rufous-sided Towhee exhibited opposing trends of an increase in the West and a decrease in the East, resulting in a slight but significant decrease for the continent (Fig. 68). The only States showing an increase were Montana and Louisiana, but there were significant decreases in Wisconsin, Illinois, Kentucky, and all States from Ohio, New York, and New England south through Georgia. The greatest abundance of this species was in the Lower Coastal Plain; Florida had the highest State mean.

Brown Towhee. The Brown Towhee increased slightly, but significantly, in the Far Western States, but the trend illustrated in Fig. 68 for the Western region was not significant, nor was the continental trend. No State had a significant change for this species, whose highest populations were in the California Foothills.

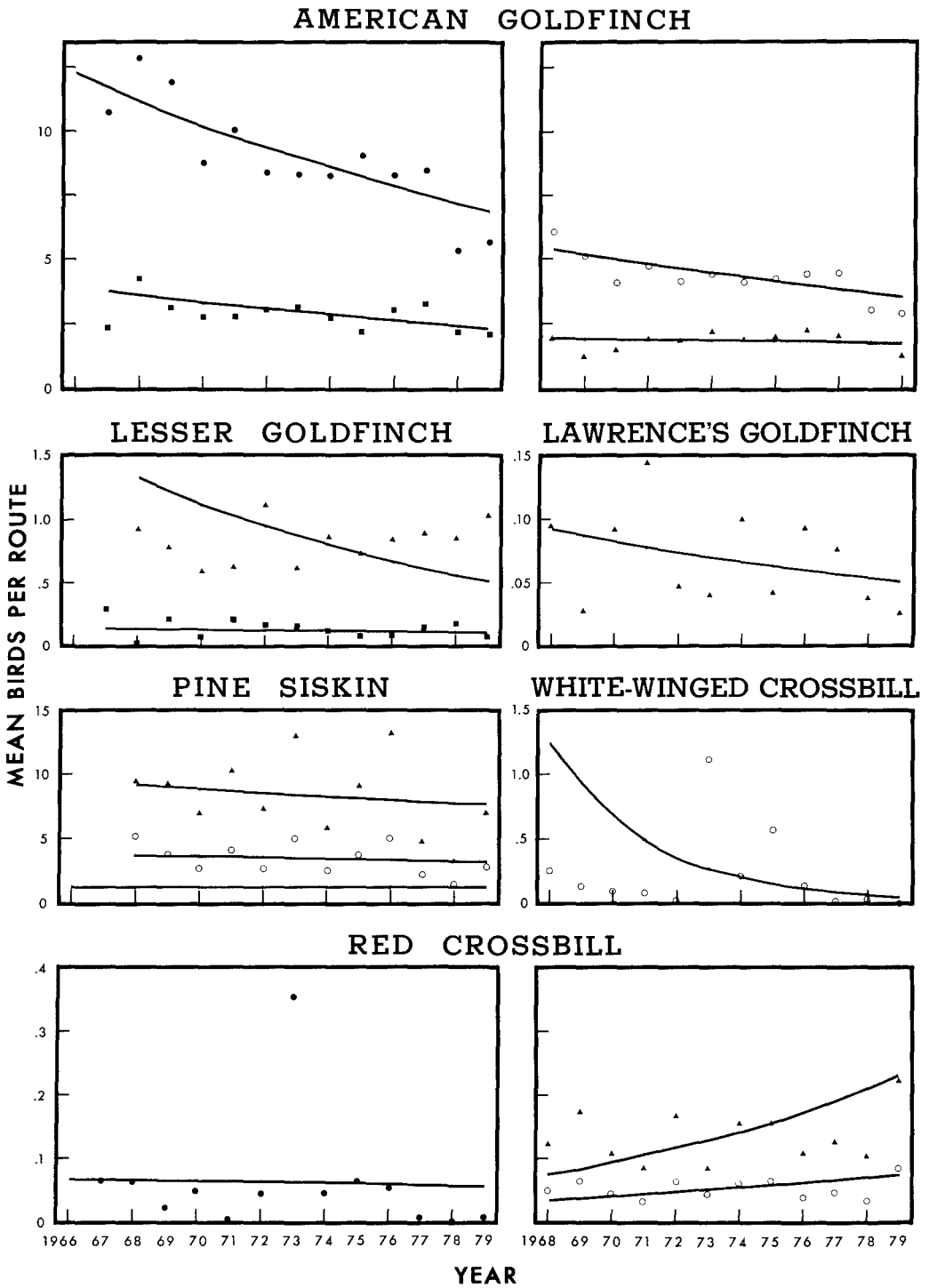
Lark Bunting. The Lark Bunting, a Great Plains species, showed declines virtually throughout its range. These declines were significant for the Central region, the continent, and for North and South Dakota. The drastic decline in the Drift Prairie, which extends from eastern South Dakota northwestward to Alberta is illustrated in Fig. 68 (bottom left). The highest mean counts came from the Unglaciated Missouri Plateau and from South Dakota.

Savannah Sparrow. A species found in northern grasslands and wet meadows, the Savannah Sparrow showed stable populations in all three regions (Fig. 69), although there were local increases in Iowa, Ohio, and Ontario, and local declines in Massachusetts and New Brunswick. Greatest abundance was in the St. Lawrence Plain, and in Quebec and Wisconsin.

Grasshopper Sparrow. The Grasshopper Sparrow showed significant declines throughout its range, including the northern and southern portions of the Eastern and Central regions and the continent (Fig. 69). Only Montana and Texas registered significant increases, whereas 12 States had significant declines—from North and South Dakota and Nebraska east to Maryland and West Virginia (except Iowa and Michigan). Highest populations were in the High Plains Border and in South Dakota.

Lark Sparrow. A decrease in the Lark Sparrow in the Central region was reflected in a significant continental decrease (Fig. 69). At the State level, decreases were recorded for Arizona, Texas, Kansas, and Illinois; the only State reporting an increase was Colorado. The Edwards Plateau of central Texas had a breeding density of nearly 4 times that of any other stratum.

Vesper Sparrow. The Vesper Sparrow is one of many sparrows that appear to be decreasing throughout much of their range (Fig. 69). The Eastern region was the only one that showed a significant decrease, but there were seven States with significant decreases; no States had increases. Decreases were recorded in Wisconsin, West Virginia, Maryland, Pennsylvania, New York, New Hampshire, and Maine. Canadian tendencies were also almost uniformly negative, but were either not significant or were based on sample sizes of fewer than 15 routes. More frequent cutting of hayfields is believed by some observers to be reducing nesting success. Populations in the Black



● = Eastern region ■ = Central region ▲ = Western region ○ = Continental data

Fig. 67. Trends in goldfinch, siskin, and crossbill populations.

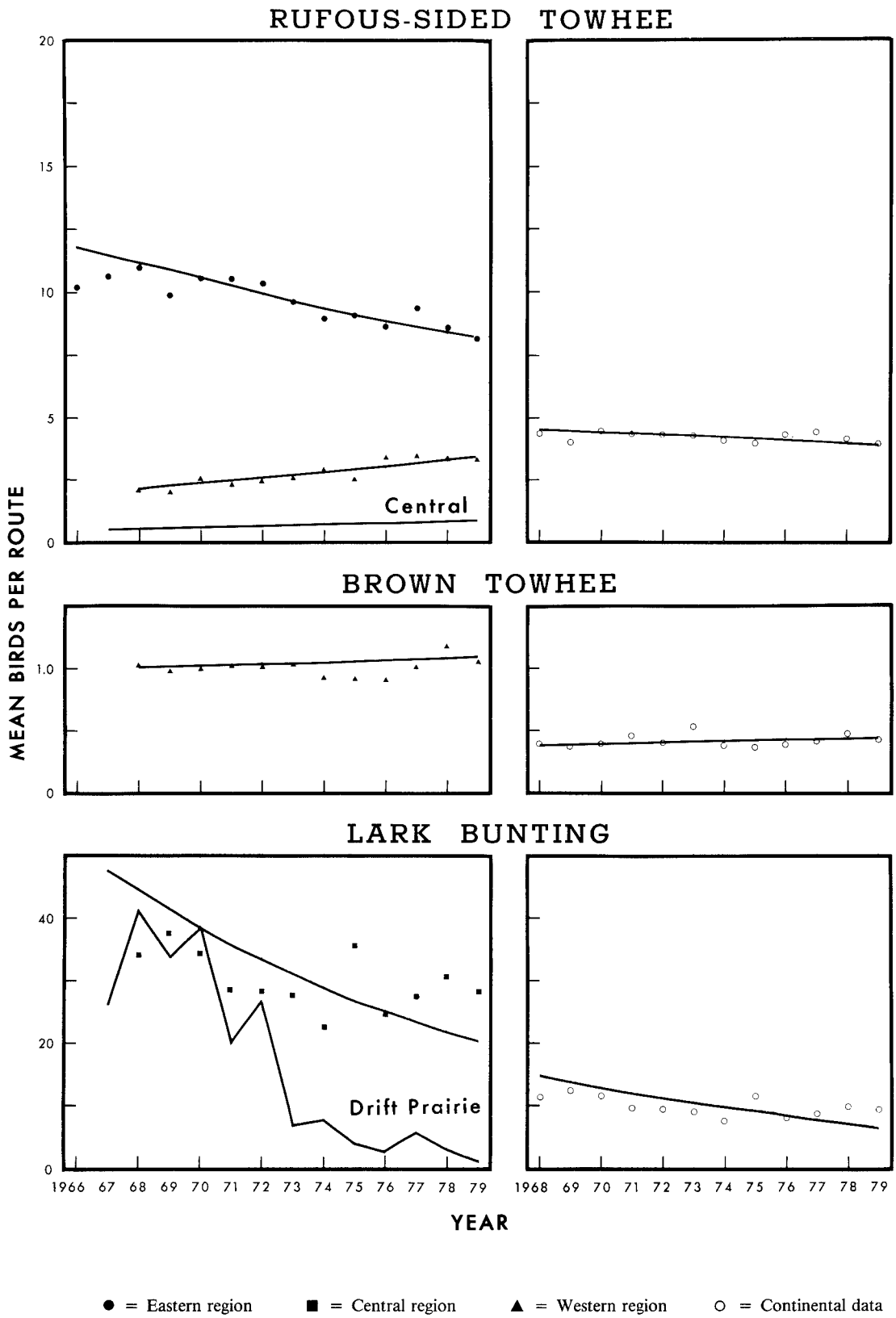


Fig. 68. Trends in towhee and Lark Bunting populations.

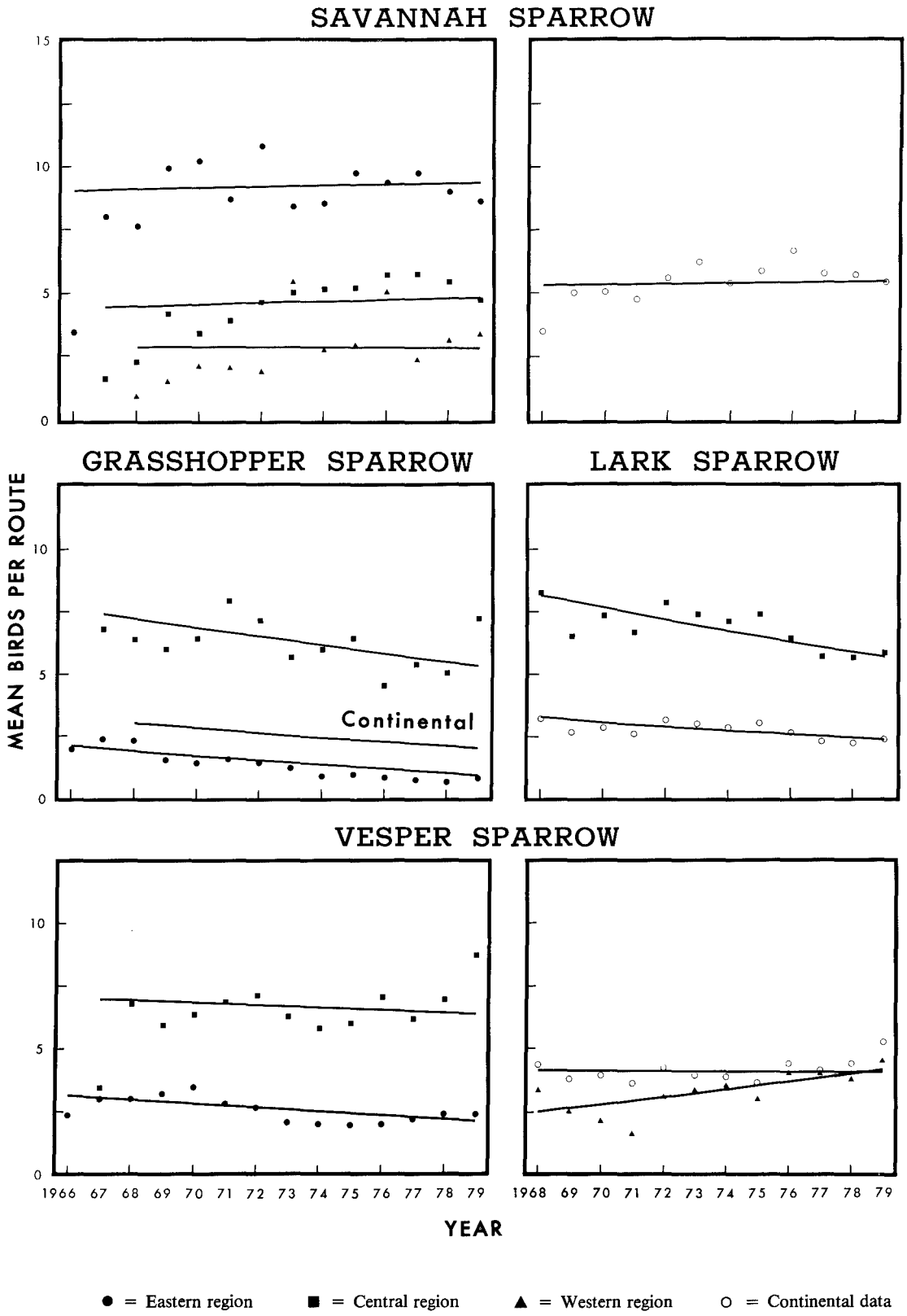


Fig. 69. Trends in sparrow populations, part 1.

Prairie were well above those of the Aspen Parklands and Wisconsin Driftless Area. Montana, Iowa, Saskatchewan, and Manitoba were the leading States and Provinces.

Baird's Sparrow. The Baird's Sparrow, an uncommon species of the northern Great Plains, showed a fairly substantial decline that registered as significant for the continental trend (Fig. 70). Although no State showed a definite trend, there was a significant decrease on the Glaciated Missouri Plateau, which extends northwestward from central South Dakota into southeastern Alberta, and includes the area of greatest abundance of this species. Largest numbers were in North Dakota.

Le Conte's Sparrow. The Le Conte's Sparrow is an uncommon sparrow of the northern plains, with small breeding populations extending eastward to the Great Lakes. The Eastern region showed the only significant change—a decline (Fig. 70). There were no changes for any individual State or stratum. The center of abundance was in the Aspen Parklands. Alberta had the highest mean number of individuals.

Henslow's Sparrow. Henslow's Sparrows deserve special attention because of their preferred nesting habitat: fields that have been idle for several years and are growing up in broomsedge (*Andropogon* sp.), often with a sprinkling of young, woody growth. This habitat is not only transitory but it is becoming less frequent because comparatively few fields are permitted to lie idle for a sufficient number of years. The decreasing tendency shown in Fig. 70, although not statistically significant, is representative. The number of observations was too small in most States and strata to produce significant trend data; however, only 10 States and strata showed an increasing tendency compared with 25 that exhibited a decreasing tendency. The only statistically significant changes were decreases in New York and in the Great Lakes Transition. Although the Henslow's Sparrow could not be called common anywhere, the greatest densities reported were from the western portion of the Great Lakes Plain and from Minnesota.

Cassin's Sparrow. Like all the other sparrows in the genus *Aimophila*, there was no statistically significant population trend for Cassin's Sparrow in any of the three regions or for the continent (Fig. 70). A significant increase in its area of greatest abundance in the South Texas Brushlands, and increasing tendencies in other areas where it is common, such as the Staked Plains, High Plains, and the Mexican Highlands, gave this species' trend lines an upward slope.

Black-throated Sparrow. The Black-throated Sparrow registered a significant decline for both the Central region and the continent (Fig. 70). Likewise, all of the significant changes by strata or States were negative—in the Mojave Desert, Pinyon-Juniper Woodland, and in Arizona and Texas. Greatest density was reached in the Mexican Highlands, the South Texas Brushlands, and in Arizona and Nevada.

Slate-colored Junco. Significant decreases in the Slate-colored Junco in New Brunswick, New Hampshire, and New York contributed to a significant decline in the Eastern region (Fig. 71). Although the heaviest concentrations were reported from the Canadian Rocky Mountains and the Yukon Territory, the number of routes reporting this species from the Western region was too small to warrant a separate graph.

Oregon Junco. Although the Oregon and White-winged Juncos are now considered conspecific with the Slate-colored Junco (A.O.U. 1973), these populations can be separated in the field and thus are recorded separately on the BBS. Because of small sample sizes and considerable year-to-year variability, the annual means are widely scattered and no significant trends could be detected (Fig. 71). Centers of abundance were in the Sierra-Trinity Mountains and in Washington.

Chipping Sparrow. The Chipping Sparrow registered a slight but significant decline in the Eastern region (Fig. 71), but with significant increases in the Northern Plains States and in the Great Lakes States. Continental populations appeared stable. State and Provincial increases were from Missouri northward through Minnesota and Wisconsin into Ontario; most of the decreases were clustered from Arkansas, Alabama, Tennessee and North Carolina northward through New York and Massachusetts. In the West there were isolated decreases in California and British Columbia. The area of greatest abundance was the Black Hills.

Clay-colored Sparrow. A significant increase in Canada, specifically in the Aspen Parklands and Saskatchewan, was counteracted by a decrease in the Northern Plains States. The result was no significant change for the Central region or for the continent (Fig. 71). The greatest abundance by far was in the Aspen Parklands, and the three Prairie provinces of Canada showed high numbers compared with any areas of the United States.

Brewer's Sparrow. The small number of routes (188) reporting the Brewer's Sparrow made it impossible to detect any significant change (Fig. 71) except

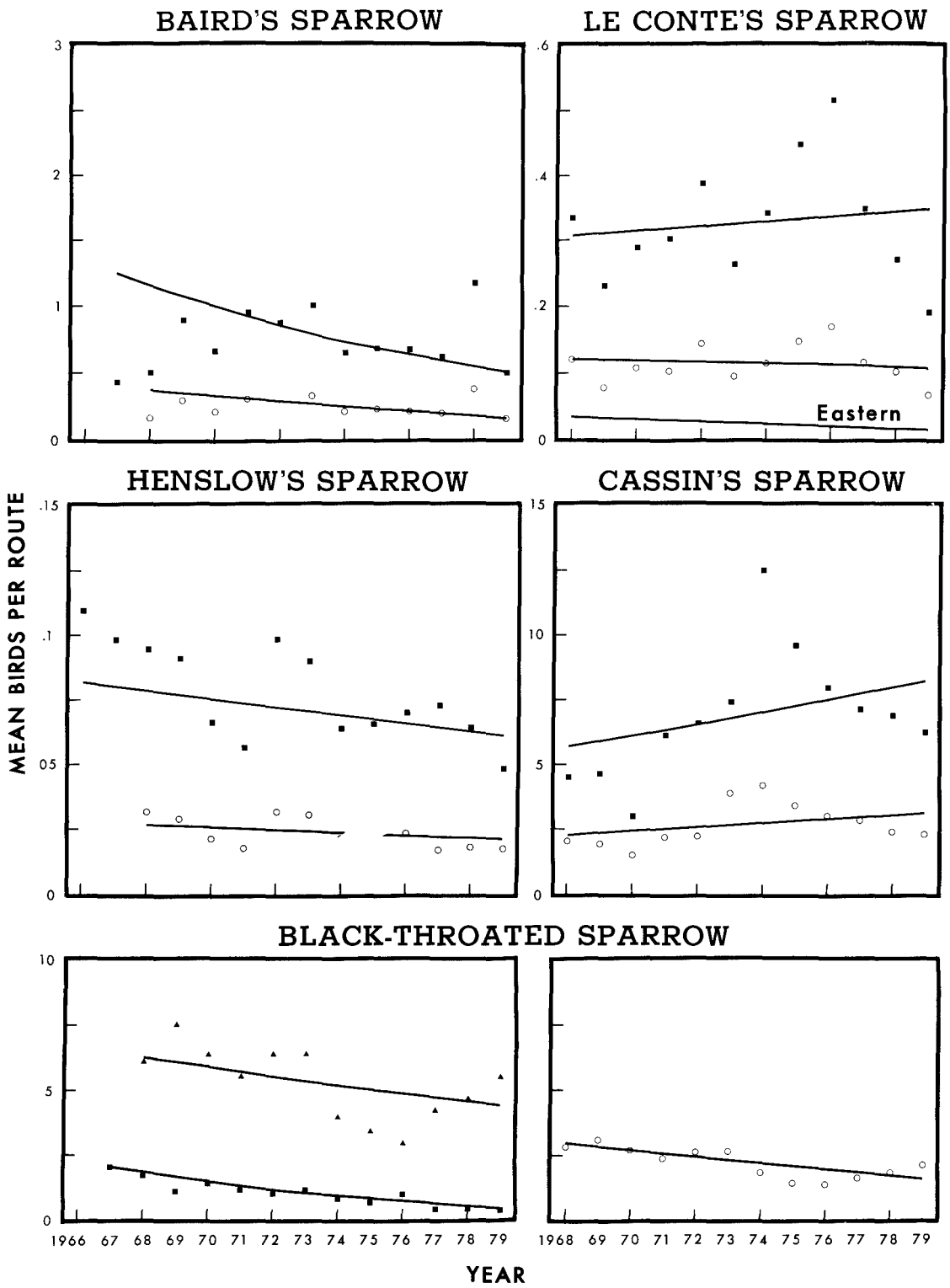


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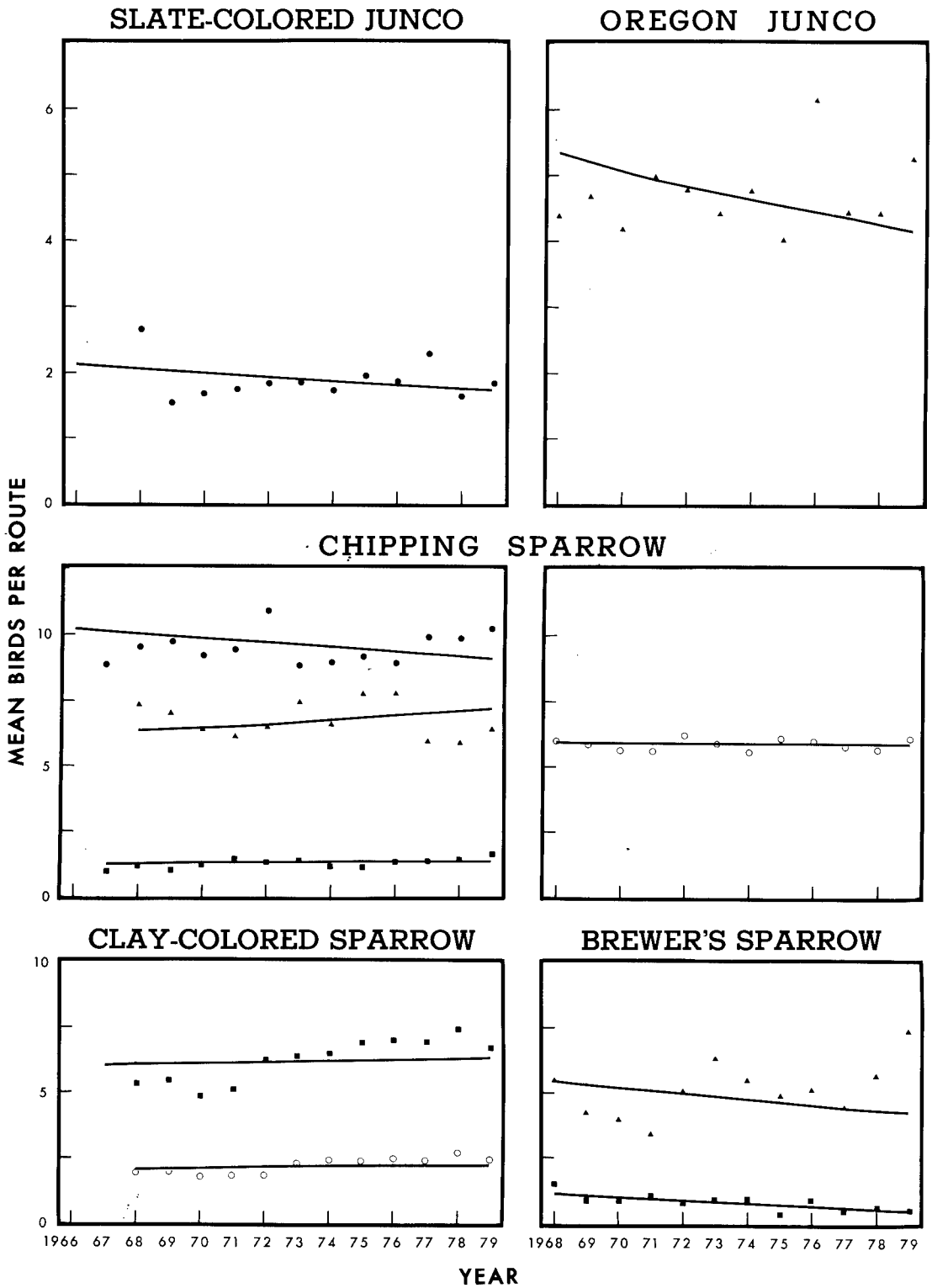
Fig. 70. Trends in sparrow populations, part 2.



● = Eastern region ■ = Central region ▲ = Western region ○ = Continental data

Fig. 71. Trends in sparrow populations, part 3.

in its area of greatest abundance—the Columbia Plateau of the Northwest—where a decrease was registered. The State reporting the greatest density was Wyoming, followed closely by Idaho, Oregon, and Nevada.

Field Sparrow. There were highly significant decreases in the Field Sparrow for the Eastern and Central regions and for the continent (Fig. 72). Declines were widespread except in the Canadian portion of the breeding range, where an increase was recorded. By strata there were significant decreases in all four subdivisions of the Upper Coastal Plain, in the Southern Piedmont, Southern New England, both portions of the Ridge and Valley, the Highland Rim, the western portion of the Great Lakes Plain, the Wisconsin Driftless Area, the Great Lakes Transition, Ohio Hills, Blue Ridge Mountains, Cumberland and Allegheny Plateaus, the Adirondack Mountains, Central New England, the Till Plains, Ozark–Ouachita Plateau, and the Osage Plains. The 25 States that individually registered significant declines extend from Oklahoma, Arkansas, Alabama, and Georgia northward through Wisconsin, Michigan, New York, and all of New England. The center of abundance for this species was in the Lexington Plain and Highland Rim. Kentucky had the highest State mean. The unusually cold winters of 1976–77 and 1977–78 certainly contributed to the overall decline in Field Sparrow populations, but the decrease had begun before these cold winters occurred and probably is related at least in part to more intensive land use and decreasing acreage of reverting fields.

White-crowned Sparrow. Nesting habitat for this primarily western species was poorly sampled by the BBS as shown by the scattering of weighted means in the graph for the White-crowned Sparrow (Fig. 72). By far the greatest abundance was reached in the Yukon Territory, where only seven routes provided information on this species for 2 or more years.

White-throated Sparrow. The White-throated Sparrow was poorly sampled in the early years of the BBS because of the small number of routes covered in northern areas. Because these samples were small they had little effect on the trend line, which showed a significant decline for the Eastern region and for the entire range (Fig. 72). By subregions, this decreasing trend was significant only in the Northeastern States, indicating that the population may be more stable in Canada than in the northern States. The two significant changes by strata, both negative, were from Southern New England and the eastern portion of the Spruce–Hardwood Forest. Population areas in order of decreasing abundance were the eastern and central portions of the Spruce–Hardwood Forest and the Provinces of New Brunswick, Quebec, and Nova Scotia. This species also may have been affected by the abnormally cold winters of 1976–77 and 1977–78.

Bachman's Sparrow. There were no statistically significant trends (Fig. 72) in the Bachman's Sparrow except for a decrease in Florida and in the Lower Coastal Plain. Twice as many States or strata showed declines as showed increases. The areas of highest numbers were in the Lower Coastal Plain and in Florida.

Fox Sparrow. The Fox Sparrow was poorly sampled by the BBS. Because most of the eastern population breeds beyond the road system, the only trends illustrated were for the Western and continental populations (Fig. 72). The annual means for the Western region were widely scattered, therefore no significant trend could be detected for any stratum. The only State showing a significant trend was Oregon, which showed an increase. The greatest density was recorded in the Sierra–Trinity Mountains of California.

Lincoln's Sparrow. Although the Lincoln's Sparrow appeared to be doing well in both the Eastern and Western regions (Fig. 73), only in the Eastern region, New Brunswick, and the Central Rocky Mountains was the upward population trend significant. The highest breeding densities were recorded in the central portion of the Spruce–Hardwood Forest and in Quebec and Nova Scotia.

Swamp Sparrow. After poor sampling in the early years of the BBS, there was an indication of a slight negative tendency, although there was no significant change in the Eastern region or at the continental level (Fig. 73). The Central region (not illustrated) showed a significant increase based on data from only 35 routes, but by State the only significant change was an increase in Michigan. The highest densities recorded were in the western portion of the Spruce–Hardwood Forest and in Ontario and New Hampshire.

Song Sparrow. A significant decline in Song Sparrows in the Eastern region was sufficient to generate a significant decline for the continent because populations were nearly stable in the Central and Western regions (Fig. 73). As with many other species in the BBS, the severe winters of 1976–77 and 1977–78 showed their effect on the Song Sparrow in the Eastern region (both years) and in the Central region (the second year). As highly significant as the decreases are, we believe that they stemmed primarily from

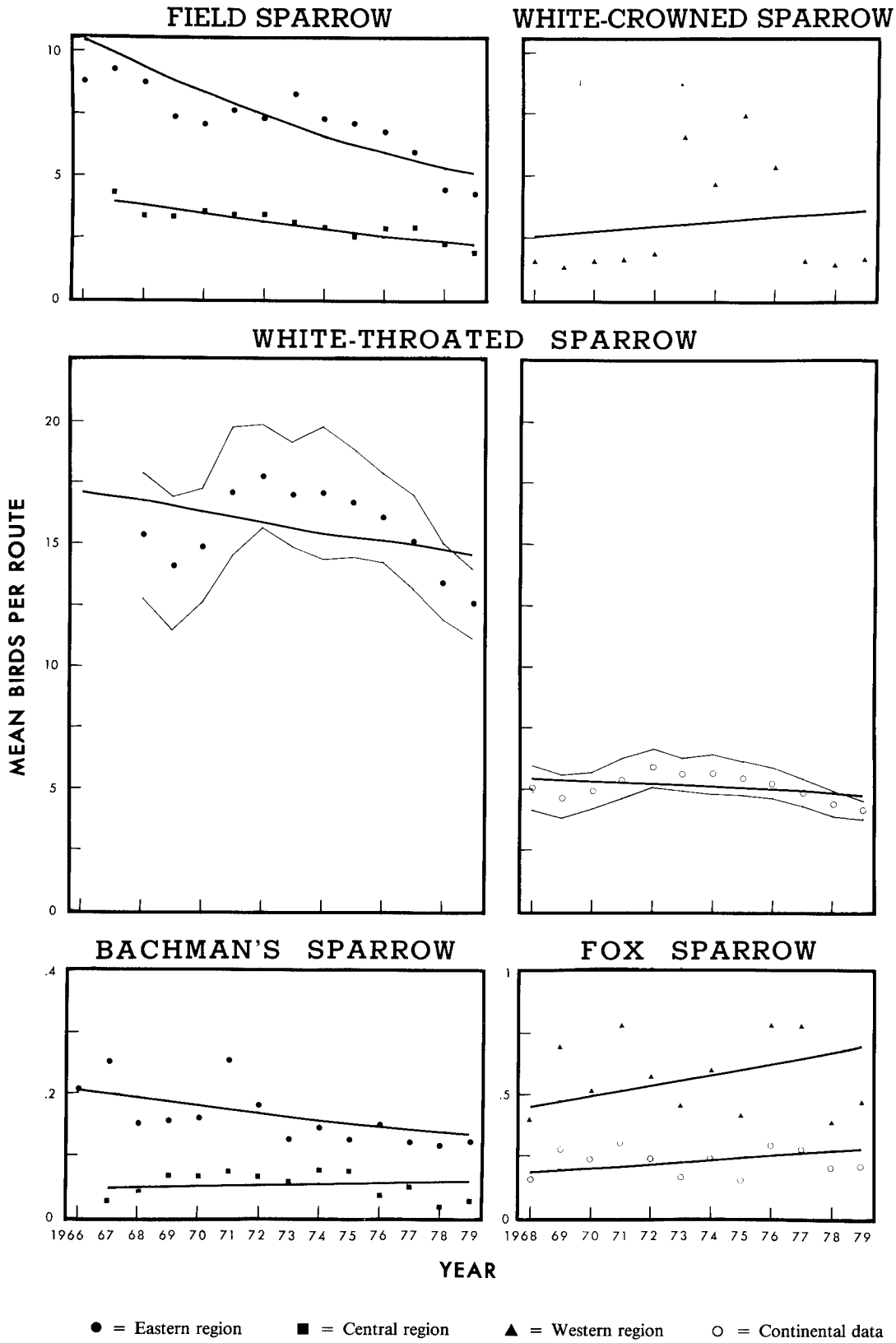
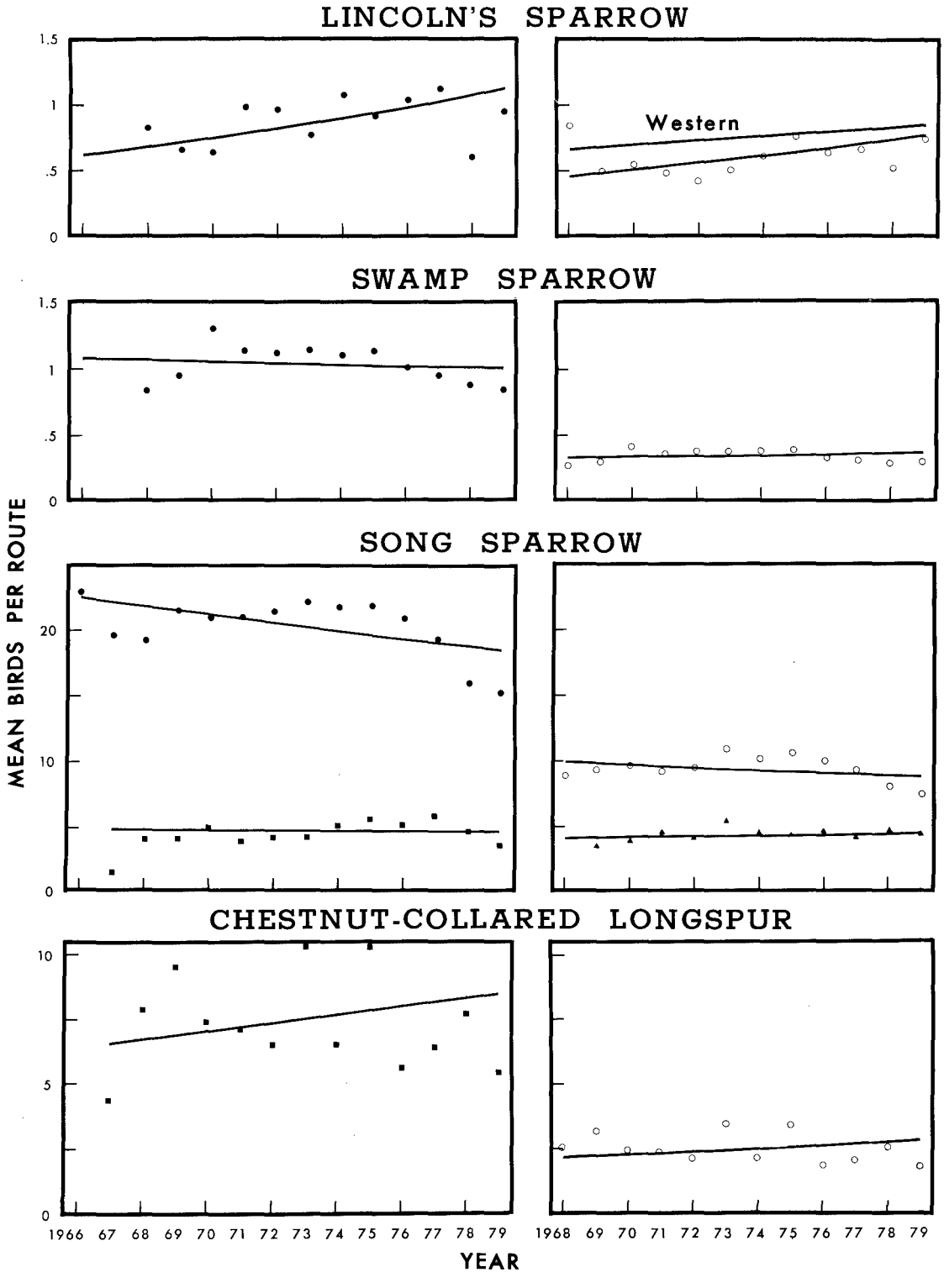


Fig. 72. Trends in sparrow populations, part 4.



● = Eastern region ■ = Central region ▲ = Western region ○ = Continental data

Fig. 73. Trends in sparrow populations, part 5.

winterkill in these two seasons and that the population should recover within the next few years, barring another widespread disaster. The decreases affected primarily the populations that breed in Wisconsin, Michigan, Ontario, New York, Massachusetts, Maine, Quebec, and New Brunswick. Farther West and South there were increases in Missouri, Iowa, Tennessee, North Carolina, and Maryland. The State with the greatest abundance was Ohio. The eastern portion of the Great Lakes Plain was the stratum with the highest density.

Chestnut-collared Longspur. Although the Chestnut-collared Longspur was our best sampled longspur (100 routes) it seems obvious from the graph that the annual means are widely scattered and that no significant trend could be detected, either for the Central region or for the continent (Fig. 73). The heaviest concentrations were reported from the Missouri Plateau of North and South Dakota and from Alberta.

Mapping of Relative Abundance

The present report contains 22 range maps generated from BBS data. The species depicted represent seven passerine families from Corvidae to Laniidae. These families were chosen because they offer a wide variety of species with large enough samples to create meaningful maps, and a good range of geographic distribution. In future publications we hope to present maps for representatives of other families.

Because BBS routes are conducted uniformly throughout North America, the raw data can be used for mapping without any normalization of the counts. For each species, the mean of counts for each route was plotted on a map by computer in the approximate location of the route. Some of the means were based on 15 years, but others on as few as 1, depending on the number of years the route was run. Some updating was done from 1980 data if a new route facilitated mapping in a certain area.

The categories of abundance are arbitrary and consistent with previously published BBS maps (Appendix F). Because they are long-term means, many routes in the periphery of a range recorded a mean of less than one bird. For these maps, such routes were included with the 1–3 level, hence the designation <4. Because these maps are small-scale, extreme detail was not possible; therefore, if one route, for example, had a mean of 4 and was surrounded by routes in the 11–30 range, it was ignored. Such counts were usually from routes in atypical habitat, or were the result of observer or weather influences. Only when several adjacent routes had lower or higher totals than surrounding routes was a separate category warranted.

Based on the five categories of abundance, isopleths were drawn by hand to include routes of similar density. There are two possible ways of displaying such relative density data. The isopleth approach (Bystrak 1971) assumes that abundance of a species decreases evenly from a center of abundance; therefore, given five levels of abundance, only consecutive levels will touch on a finished map and each level is partially dependent on adjacent levels. The patchy approach (Plaza 1978) assumes that, because of differences in habitat availability, population densities are independent of adjacent densities, hence a finished map would show many instances of nonconsecutive levels touching each other. The latter approach is, of course, completely valid, but we believe it is applicable primarily on a more detailed scale. Because of the large geographic area covered by our maps, and the very incomplete sampling (only 0.3% of the land area of North America), we felt it was more appropriate to use the isopleth approach. Because each route spans 24.5 miles (39 km), most habitats available in the area tend to be sampled in about the ratios in which they occur. This, and the fact that long-term means were being used also tended to make the data more suitable to the isopleth approach. The patchy approach is used sparingly when a large number of routes in a level are adjacent to routes in a nonconsecutive level, especially when this occurs at the boundary of two very different strata.

In examining these maps, one should pay particular attention to how well many of the stratum boundaries (Fig. 1) are followed by many species. This accentuates the need to group the data by stratum in our population trend analyses. Unfortunately, each species of bird differs from all others in ways that affect the final count on a BBS. Some species favor roadside habitats; some sing more loudly, and some not at all; some sing continuously, some only once every few minutes; and most differ in their time of peak activity. Because of these factors it is not legitimate to compare the relative abundance of one species with that of another. However, because the above factors are consistent throughout the range of a species, geographic comparisons can be made within a species.

Other Uses of BBS Data

Although the original purpose of the BBS was to follow long- and short-term population trends, because of the unique large volume of uniformly gathered data generated it is possible to use these data for many other purposes. A summary of some of these uses follows. Other uses will undoubtedly arise as the data base becomes larger and better known.

Range Extensions and Contractions

Many important changes in breeding range have been reported in the literature, but until BBS data were available it was seldom possible to view these range extensions and contractions in the context of the entire breeding range of the species. Nor was it possible to link changes in boundaries of breeding range with changes in relative abundance of the continental population of a species. The breeding distribution of the Dickcissel in Wisconsin (Taber 1947; Emlen and Wiens 1965; Wiens and Emlen 1966), for example, has been studied over a period of years without any means of relating changes in this peripheral part of the species' range to major shifts in the central portion of the range or changes in abundance of this species.

The spread of the introduced House Sparrow across North America was well recorded by Barrows (1889), whose voluminous correspondence obtained first records of sightings from hundreds of localities across the continent. Although the first sightings were well documented, no later follow-up was conducted to record the tremendous increase in abundance that followed these introductions. Ironically, not even the Christmas Bird Count supplied numerical data on the spread of this species, because for many years the Christmas Count instructions said not to count the House Sparrow because it was not native. In marked contrast, we can now follow with ease the increase in relative abundance of the House Finch in the entire Eastern region, and the Cattle Egret throughout the United States and Canada, and we can also trace the rates of population increase of these birds in individual strata, States, and Provinces.

Other important, though less dramatic, changes are taking place in the conquest of the West and the far South by the European Starling, the southward expansion of breeding Barn and Cliff Swallows in the central and eastern States, the continued northward movement of Cardinals and Mockingbirds, and local population explosions of some of the blackbirds.

In some instances, range expansions can be directly related to population increases at the extremities of a bird's range. An example is the previously mentioned spread of the Tufted Titmouse into New York and southern New England. A similar increase was noted in the Carolina Wren, whose populations reached an abnormal high during a series of five consecutive mild winters in the Middle Atlantic States, 1972–76.

Effects of Severe Weather

In addition to the Carolina Wren and Tufted Titmouse, several other species were affected by the same sequence of winter weather conditions from the Midwest to the Atlantic Coast. Although population increases of these species were not as pronounced, the disastrous effect of the abnormally cold winter of 1976–77 was well documented by the BBS for species such as the Bobwhite, House Wren, Winter Wren, and Golden- and Ruby-crowned Kinglets.

Unusual weather conditions at other seasons also can be reflected in the BBS. The effects of cold summer rains on Purple Martins have already been discussed.

The previously mentioned disastrous spring migration of Scarlet Tanagers appears to have included other species as well. The magnitude of this incident prompted us to check populations of other insectivorous birds that would have been migrating through that area at the same time. We found there had been a 30% decrease in the swallow population (Tree, Bank, Barn, and Cliff Swallows) in Nova Scotia, Maine, and New Hampshire, and an average drop of 25% in eight species of breeding warblers in New Brunswick. Other late migrants through northern New England, such as the Red-eyed Vireo, Eastern Wood Pewee, and Alder Flycatcher, apparently arrived after the severe weather, as their populations did not show a decrease that year.

Species Composition by Ecological Regions

During the 1970's several authors used Christmas Bird Count data to study diversity and abundance of bird life across the North American continent during the early winter season. As shown by Peterson

(1975), BBS data can be used very effectively for similar studies of breeding bird populations. The breeding season is a more logical time of year than winter for biogeographic studies because it brings about (1) more specific habitat requirements, (2) maximum territoriality, (3) high detectability, and (4) low year-to-year variability. Furthermore, BBS data, which are more highly standardized than the Christmas Bird Counts, and are taken under more uniform weather conditions, can give a more definitive picture of the composition of bird populations across the continent. Table 5 and Figs. 74–77 provide a summary of the physical and ornithological characteristics of the various ecological regions of the continent that are sampled by the BBS.

Habitat Correlations

If breeding bird populations are to be correlated with changes in land use in North America, efficient ways of recording these changes must be found without posing too much of a burden on the BBS cooperators. Information on crop production can be obtained on a county basis from agricultural statistics. Certain habitat information relating specifically to BBS stops also can be obtained from aerial photos taken every few years by the Soil Conservation Service. Even more up-to-date habitat information can be obtained from satellite imagery. One advantage of this method is that up-to-date data can be obtained from anywhere in the continent. The digital printouts from satellite imagery with which we have worked are to the same scale as standard 7 1/2 min topographic maps, which makes it possible to get a rapid assessment of percentage of certain habitats at each BBS stop (within a circle of 400 m radius). Certain habitats, however, such as narrow hedgerows, are not detected by the satellite imagery we have used, which has a resolution of 60 m.

Field studies were started along some of the Maryland BBS routes in 1977 in which 30 habitat variables were recorded at each BBS stop. These data have been analyzed to determine which habitat factors have the greatest influence on bird populations. The objective of this research was to develop a simple means whereby cooperators could make a rapid standardized appraisal of habitat conditions at stops along their BBS routes. Those BBS cooperators who wished to cooperate by providing habitat data along their routes were given that opportunity starting in 1981.

Environmental Evaluations

One of the most frequent uses of BBS data is in environmental assessments. We receive many requests for data on relative abundance of breeding birds in relation to individual counties, river systems, other wetlands, etc. In some instances, data from individual BBS stops that happen to coincide with the proposed changes in land use can be provided. In most situations, however, the greatest value of BBS data for environmental evaluations is as a base with which more intensive studies of a specific area can be compared. BBS data even from a specific locality of concern cannot be used to provide a complete list of all breeding birds or to answer such questions as, "does the area contain any endangered species?"

Island Biogeography Applications

With the continuing expansion of human populations, and the related need for more intensive land use for crops and timber products, those bird species that are dependent on forest interior habitats during the breeding season are disappearing from many areas. The BBS has been a prime source of data for correlating the presence and abundance of forest interior birds with the amount of contiguous area of woodlands present at sample counting points. Preliminary correlations (Robbins 1979) show that many of the area-sensitive bird species (specifically, the neotropical migrants) do not nest in isolated woodlots of less than 200 ha and that the effect of fragmentation may be felt on some areas of as many as 2,000 ha. This dependence of many neotropical migrant species on extensive woodlands is related to the inability of the forest interior specialists to reproduce successfully under edge conditions where predation, cowbird parasitism, and competition are high (Whitcomb et al. 1981).

Breeding Bird Atlases

Atlases showing detailed breeding bird distribution throughout a nation have been published for Great Britain and Ireland, Denmark, Netherlands, France, West Germany, Switzerland, and New Zealand during the 1970's, and work on similar atlases is in progress in many other countries in Europe and Africa and in several parts of the United States and Canada. These atlases differ from the range maps shown in

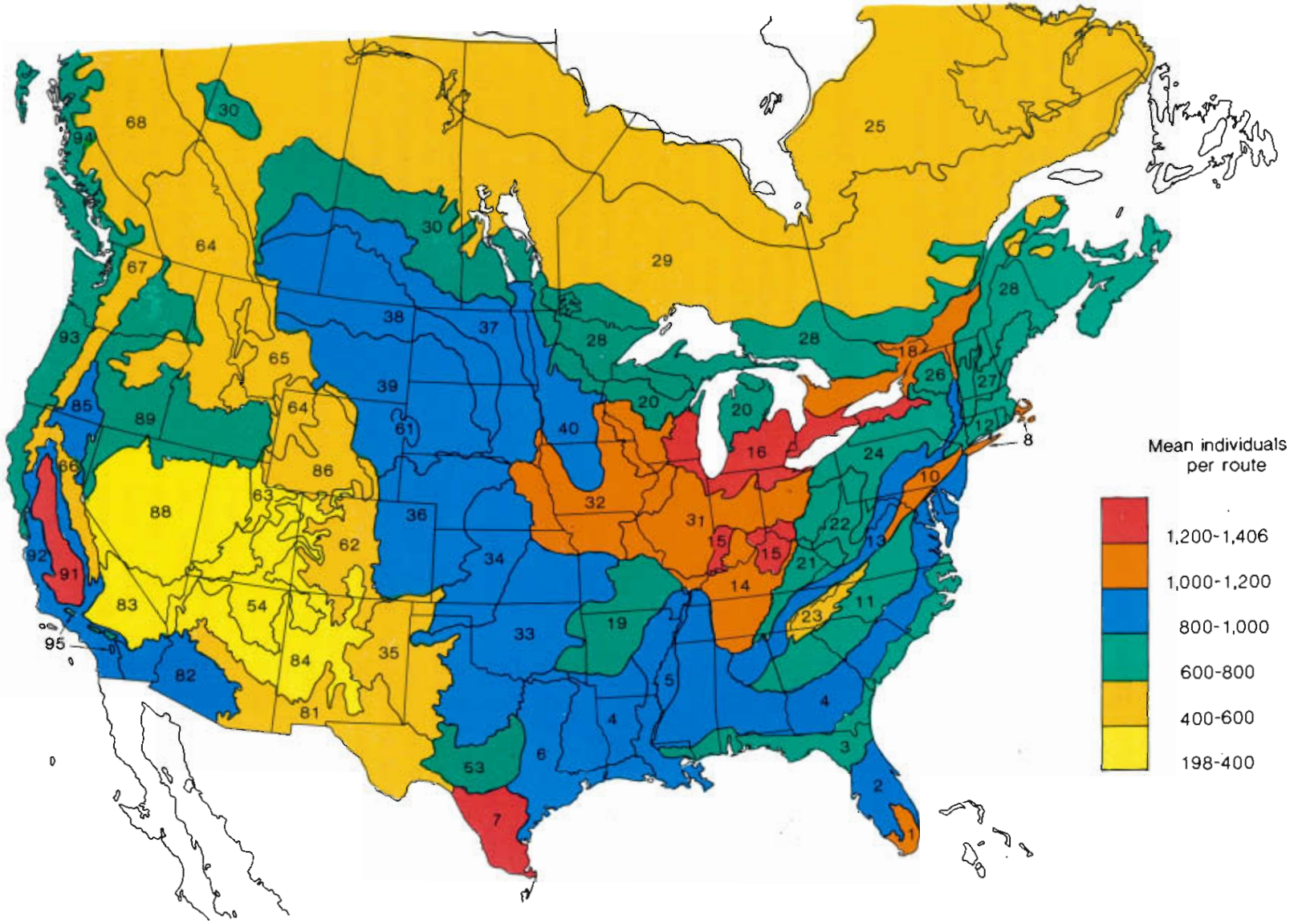


Fig. 74. Relative abundance of breeding birds across North America by physiographic regions, expressed as mean number of individuals recorded per 50-stop BBS route, 1965–80.

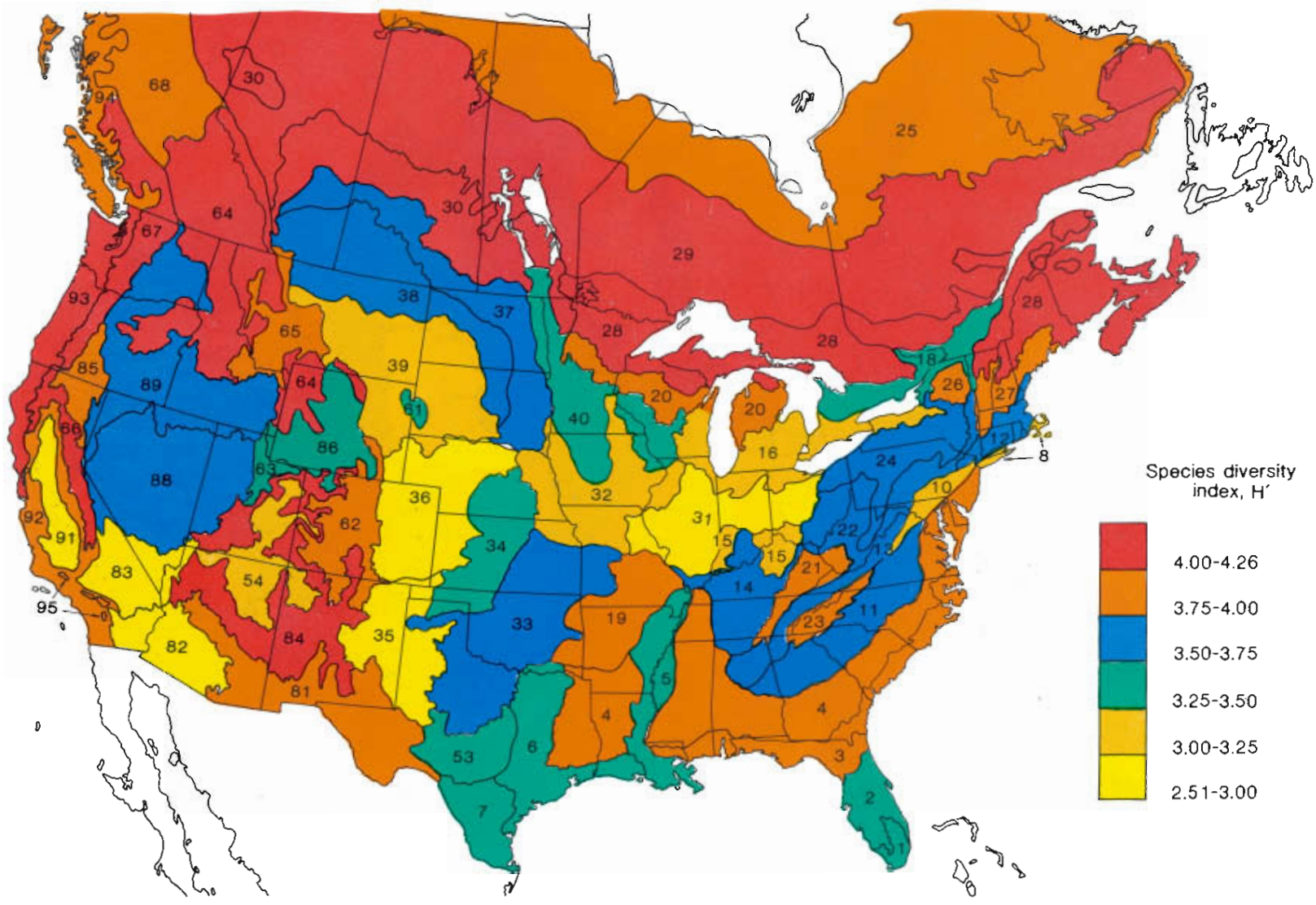


Fig. 75. Species diversity index (H′) by physiographic regions, based on BBS data, 1966–79. $H' = -\Sigma p_i \ln p_i$, where p_i is the proportion of all the birds that belong to the ith species.

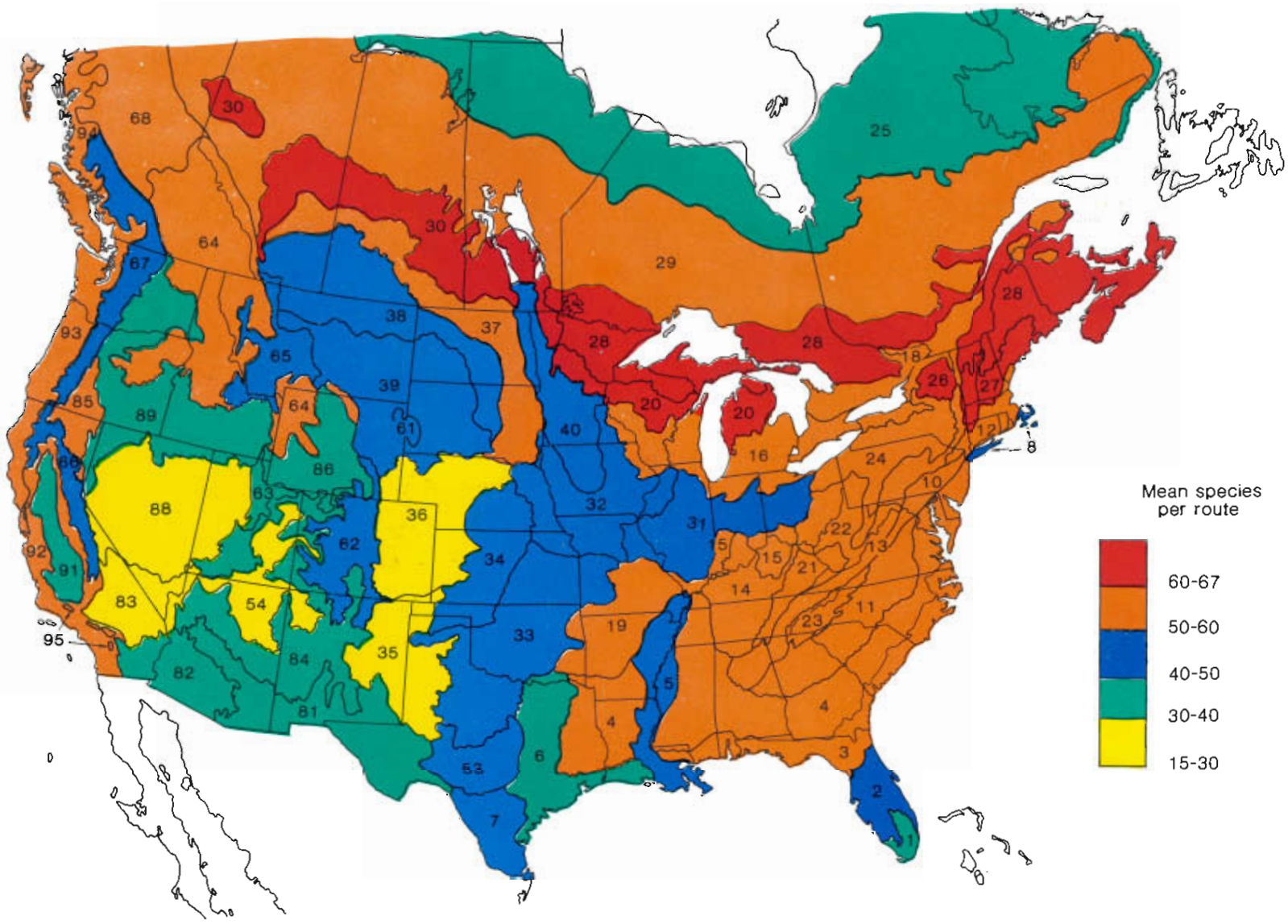


Fig. 76. Mean number of species per 50-stop BBS route by physiographic regions in 1979.

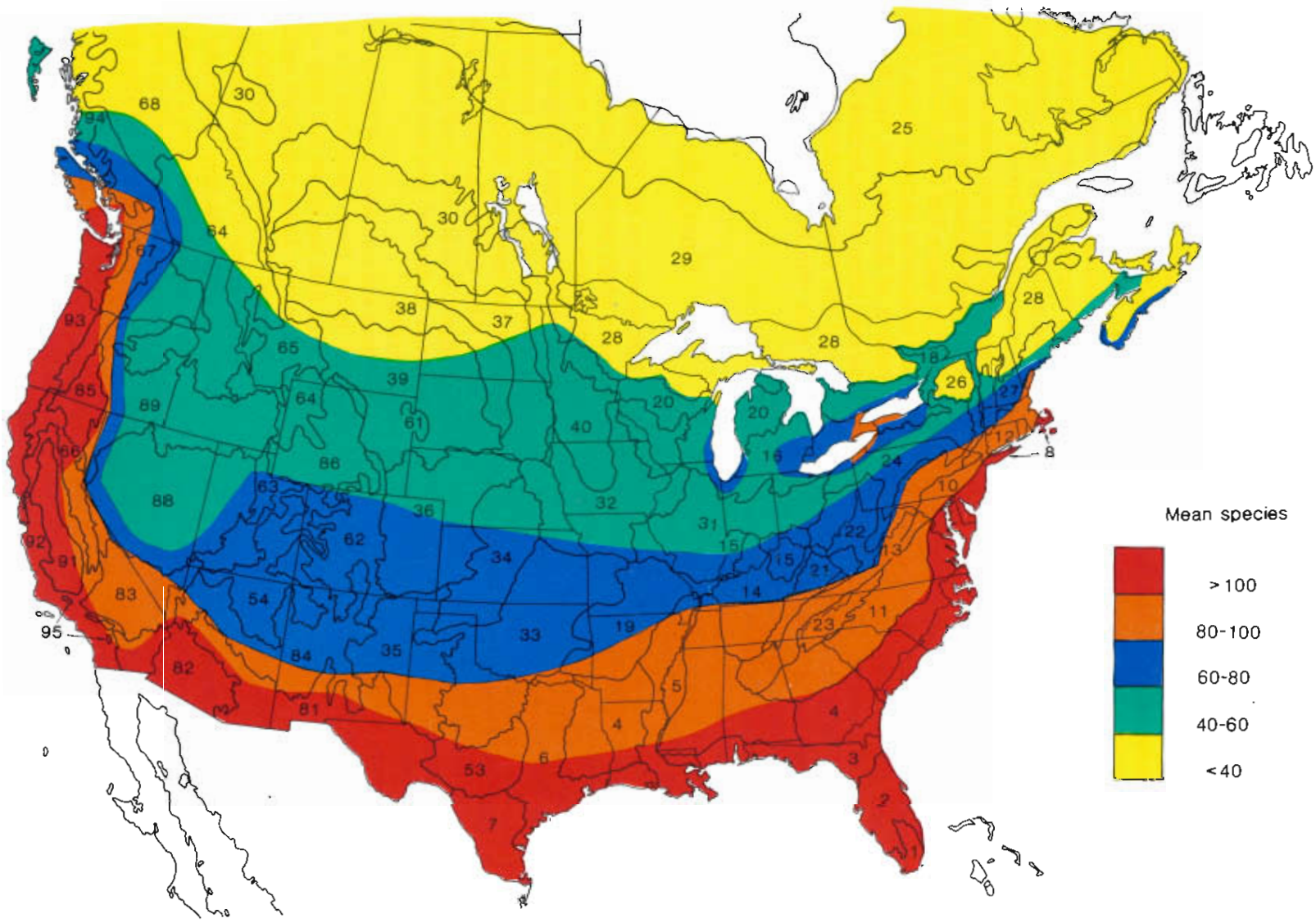


Fig. 77. Mean number of species per Christmas Bird Count, 1979, for comparison with species distribution during the breeding season (Fig. 76).

several State and Provincial bird books in that the entire country or State is divided into a fine grid and an effort is made to visit each segment of this grid to determine presence or absence of each bird species. In most of the European countries the grid measures either 5 or 10 km on each side, making an area of 25 or 100 km^2, respectively. In some atlas projects an effort is made to obtain numerical estimates (by powers of ten) of the population of each species present.

Most atlas projects in the United States are using a grid of 2 1/2 min of latitude by 3 3/4 min of longitude which gives an area of about 25 km^2 at our middle latitudes. The size of these blocks decreases slightly from south to north as the meridians come closer together.

To provide a base for determining relative abundance in conjunction with atlas studies, Bystrak (Klimkiewicz and Solem 1978) has devised the Miniroute technique. Experiments with 25-stop BBS routes that, instead of being distributed at random, were packed end-to-end on all passable secondary roads within the area to be sampled, have been done in three Maryland counties. Each route was covered twice, once forward and once in reverse, on different days to eliminate most of the bias resulting from differences in activity at different times of the day. This technique not only is a quick way to gather Atlas data, but it also yields a useful numerical data base. Other variations are possible, some with advantages over the 25-stop method (Bystrak 1980).

By using fewer than the standard 50 stops, many participants are able to cover a Miniroute before work and to complete it before traffic becomes a problem. Results of the Miniroutes can be plotted to show relative abundance of each species over the area of concern. These results can also be correlated with differences in elevation, soil type, vegetative cover, and land use, depending on the specific goals of a study.

Continental Bird Population Estimates

Because computerized numerical information on bird populations is available, estimates of total continental population of individual species are occasionally requested. We are reluctant to make such estimates because too few studies have been completed on the percentage of the bird population that is recorded at BBS stops in different habitats in different parts of the country. Some estimates of sample efficiency of the BBS have been made by Robbins and Van Velzen (1970) and by Wallace (1970) but these relate to only a very few species and in only one or two habitats.

For some purposes even a rough estimate of abundance may be better than none at all. The only statewide breeding bird population estimates of which we are aware are those for Illinois published by Graber and Graber (1963) and for North Dakota by Stewart and Kantrud (1972). The North Dakota estimates were based on extensive field work in summer 1967. For a species that breeds fairly commonly in North Dakota, one might take the ratio between the mean birds per route in North Dakota from Table 3 of the present report and the State estimate of Stewart and Kantrud and then estimate the proportion of breeding birds of the species that nest in North Dakota and compute a continental estimate. North Dakota data from Table 3 of Robbins and Van Velzen (1969) would be even better to use because they cover 1967 (the year of the Stewart–Kantrud study) and 1968 (the next year, with better BBS sampling of North Dakota).

Conclusions

The BBS permits for the first time the monitoring of changes in a high percentage of the breeding birds of the North American continent north of Mexico. For species undergoing rapid changes it allows close monitoring of rate of change and recognition of the areas where the most rapid changes are occurring. For many other species that are undergoing more subtle change it calls attention to changes that would not otherwise be detected, and thus serves as an early warning system.

Expansions and contractions of breeding range are quantified rather than based only on anecdotal evidence. The BBS has shown that range expansions can take place even during population declines (e.g., Tufted Titmouse, Cardinal, Mockingbird).

Continental centers of abundance for each species are detected for the first time, geographic shifts in these centers can be followed over a period of years, and local changes in abundance can be evaluated by their importance to the overall breeding population of the species.

Although not sufficiently fine-grained to serve directly for environmental impact assessments, the BBS provides baseline data on relative abundance from more than 2,000 locations across the continent.

By making a series of similar 3-min counts in a specific area of concern, the local results can be compared with nearby, State or Provincial, or Regional averages, providing the means to place the specific area in proper perspective.

For the first time it is possible to record not only the severity of weather-induced casualties, but also the recovery time following the incident.

For biographic research, the BBS presents a brand new and unique resource. There is no other form of wildlife for which comparative data are available on a continental scale. Habitat correlations are still in their infancy, but there is excellent potential for research in this field using BBS results.

The first step in management of bird populations is to measure the present resource and detect and monitor population trends. The second step is to determine the reasons for the trends, and the third is to take appropriate action, when needed, to reverse or slow the trends. The BBS completes the first step for all but the rarest species and those that are primarily nocturnal or crepuscular. Reasons for some of the BBS trends are already apparent. With additional research and a longer period of BBS records, still other correlations will emerge, and the information needed for management will be available.

Acknowledgments

The BBS is truly a cooperative effort. It involves cooperation between amateurs and professionals, between Americans and Canadians, between coordinators and observers, and between biologists and biometricians. No one realizes more than the authors that the BBS owes its very existence to the continued dedication of many hundreds of the most capable amateur ornithologists on this continent. Everyone who uses the BBS results is indebted to this large corps of devoted and experienced participants, who are acknowledged individually in Appendix G.

Our special thanks are extended to the State and Provincial coordinators, past and present (Appendix H), who have been instrumental in enlisting observers and obtaining continued coverage of the routes under their jurisdiction.

A. J. Erskine of the Canadian Wildlife Service has worked closely with us in development and improvement of the BBS program. We are indebted to him and to others in the CWS for collaboration in this international program.

Ceil (Agnes C.) Nalley has assisted with the clerical aspects of the program from its inception, with help from Debbie Cornelison, Carol Jones, and other staff members. Willet T. Van Velzen helped with editing and other technical matters during the first 6 years, as did D. Daniel Boone during 1975–79.

Michael Hellmann of the U.S. Geological Survey wrote the computer program for estimating population changes between consecutive years. The Data Processing Section at the Patuxent Wildlife Research Center, under the direction of William G. Bauer, provided the keypunching and computer analyses; we owe special thanks to D. Gayle Campbell, Margaret Farmer, John McDaniel, and Joan Stevens of his staff.

Romell Decker and Kathleen Hall typed the manuscript. We thank colleagues R. Michael Erwin, Mark Fuller, and Marshall A. Howe, editors Debra Harris, Ruth McNeal, Paul A. Opler, and Daniel Q. Thompson, and two anonymous reviewers for their constructive suggestions. Michael O'Brien painted the front cover and the colored maps were prepared by Barbara Dowell and Anita Allen.

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Table 1. *Total individuals and number of routes (from a total of 1,832) on which they were found in 1977.*

Species	Total birds	Total routes	Species	Total birds	Total routes	Species	Total birds	Total routes
Common Loon	321	114	Common Goldeneye	84	23	Sandhill Crane	324	41
Arctic Loon	36	1	Barrow's Goldeneye	23	6	Limpkin	12	1
Red-necked Grebe	47	13	Bufflehead	70	13	King Rail	23	9
Horned Grebe	29	11	Oldsquaw	31	1	Clapper Rail	13	6
Eared Grebe	443	22	Harlequin Duck	8	2	Virginia Rail	24	17
Western Grebe	449	8	Common Eider	200	3	Sora	285	75
Pied-billed Grebe	157	76	White-winged Scoter	80	2	Purple Gallinule	22	8
White Pelican	384	16	Surf Scoter	20	1	Common Gallinule	131	21
Brown Pelican	66	7	Ruddy Duck	549	3	American Coot	1,747	112
Double-crested			Hooded Merganser	31	8	Black Oystercatcher	6	2
Cormorant	379	45	Common Merganser	97	36	Semipalmated Plover	7	2
Olivaceous Cormorant	7	1	Red-breasted Merganser	12	6	Snowy Plover	2	1
Brandt's Cormorant	9	1	Turkey Vulture	3,271	490	Wilson's Plover	2	1
Pelagic Cormorant	71	4	Black Vulture	551	102	Killdeer	9,479	1,287
Anhinga	92	17	White-tailed Kite	60	25	Mountain Plover	26	10
Magnificent Frigatebird	3	1	Swallow-tailed Kite	11	4	Golden Plover	9	1
Great Blue Heron	1,305	481	Mississippi Kite	152	38	American Woodcock	65	36
Green Heron	1,158	493	Everglade Kite	7	1	Common Snipe	1,394	249
Little Blue Heron	645	97	Goshawk	5	5	Long-billed Curlew	340	46
Cattle Egret	5,582	149	Sharp-shinned Hawk	31	29	Whimbrel	33	1
Great Egret	561	83	Cooper's Hawk	62	53	Upland Sandpiper	1,246	170
Snowy Egret	263	37	Red-tailed Hawk	1,287	588	Spotted Sandpiper	441	203
Louisiana Heron	109	18	Red-shouldered Hawk	309	163	Solitary Sandpiper	9	4
Black-crowned Night			Broad-winged Hawk	181	142	Willet	573	69
Heron	202	51	Swainson's Hawk	321	124	Greater Yellowlegs	24	6
Yellow-crowned Night			Zone-tailed Hawk	2	2	Lesser Yellowlegs	165	21
Heron	75	32	White-tailed Hawk	2	2	Least Sandpiper	2	2
Least Bittern	18	7	Rough-legged Hawk	1	1	Dunlin	1	1
American Bittern	316	108	Ferruginous Hawk	37	21	Short-billed Dowitcher	26	3
Wood Stork	44	10	Harris' Hawk	35	12	Stilt Sandpiper	4	1
Glossy Ibis	5	5	Golden Eagle	54	41	Semipalmated Sandpiper	6	1
White-faced Ibis	74	5	Bald Eagle	20	12	Marbled Godwit	211	40
White Ibis	693	35	Northern Harrier	320	169	Hudsonian Godwit	22	1
Roseate Spoonbill	92	4	Osprey	104	61	American Avocet	365	38
Mute Swan	15	3	Caracara	24	8	Black-necked Stilt	620	21
Trumpeter Swan	12	2	Prairie Falcon	19	19	Wilson's Phalarope	265	45
Canada Goose	1,621	92	Peregrine Falcon	3	3	Northern Phalarope	10	3
Black-bellied Whistling			Merlin	11	10	Parasitic Jaeger	5	1
Duck	125	10	American Kestrel	1,622	665	Glaucous Gull	160	1
Fulvous Whistling Duck	22	7	Blue Grouse	81	24	Glaucous-winged Gull	672	11
Mallard	5,470	438	Spruce Grouse	2	2	Great Black-backed Gull	296	35
Black Duck	234	54	Ruffed Grouse	185	75	Western Gull	276	11
Mottled Duck	179	20	Willow Ptarmigan	2	1	Herring Gull	3,529	129
Gadwall	642	60	Greater Prairie Chicken	56	5	California Gull	1,156	32
Pintail	636	62	Lesser Prairie Chicken	6	2	Ring-billed Gull	2,929	110
Green-winged Teal	135	41	Sharp-tailed Grouse	149	29	Mew Gull	2	1
Blue-winged Teal	1,313	150	Sage Grouse	127	15	Laughing Gull	831	33
Cinnamon Teal	188	30	Bobwhite	25,064	773	Franklin's Gull	749	40
American Wigeon	282	52	Scaled Quail	868	53	Bonaparte's Gull	31	4
Northern Shoveler	320	53	California Quail	1,491	129	Gull-billed Tern	5	3
Wood Duck	475	160	Gambel's Quail	388	32	Forster's Tern	115	24
Redhead	234	35	Mountain Quail	618	53	Common Tern	131	26
Ring-necked Duck	25	9	Ring-necked Pheasant	7,737	470	Arctic Tern	79	2
Canvasback	122	24	Chukar	67	11	Least Tern	84	14
Greater Scaup	10	1	Gray Partridge	81	41	Royal Tern	53	4
Lesser Scaup	830	41	Turkey	97	33	Sandwich Tern	2	1

Table 1. *Continued.*

Species	Total birds	Total routes
Caspian Tern	56	15
Black Tern	879	90
Black Skimmer	27	5
Common Murre	202	3
Pigeon Guillemot	3	2
Marbled Murrelet	1	1
Rhinoceros Auklet	15	2
White-crowned Pigeon	41	1
Band-tailed Pigeon	545	59
Rock Dove	14,550	820
White-winged Dove	863	31
Mourning Dove	54,980	1,546
Spotted Dove	75	5
Ground Dove	432	74
Inca Dove	53	16
White-fronted Dove	1	1
Yellow-billed Cuckoo	5,386	705
Black-billed Cuckoo	735	295
Roadrunner	171	65
Smooth-billed Ani	5	3
Groove-billed Ani	11	5
Barn Owl	8	6
Screech Owl	35	29
Great Horned Owl	285	174
Pygmy Owl	14	11
Burrowing Owl	268	78
Barred Owl	147	101
Long-eared Owl	3	3
Short-eared Owl	39	16
Saw-whet Owl	7	4
Chuck-will's-widow	714	202
Whip-poor-will	355	150
Poor-will	45	26
Pauraque	2	2
Common Nighthawk	2,665	414
Lesser Nighthawk	157	24
Black Swift	57	14
Chimney Swift	11,270	945
Vaux's Swift	62	22
White-throated Swift	341	88
Ruby-throated Hummingbird	387	266
Black-chinned Hummingbird	61	32
Costa's Hummingbird	45	15
Anna's Hummingbird	196	51
Broad-tailed Hummingbird	166	24
Rufous Hummingbird	216	52
Allen's Hummingbird	51	15
Calliope Hummingbird	20	13
Blue-throated Hummingbird	1	1
Coppery-tailed Trogon	1	1
Belted Kingfisher	718	462
Yellow-shafted Flicker	5,253	1,178
Hybrid flicker	10	2
Red-shafted Flicker	1,611	253
Gilded Flicker	18	4
Pileated Woodpecker	905	401
Red-bellied Woodpecker	4,690	583
Golden-fronted Woodpecker	417	31
Gila Woodpecker	149	11
Red-headed Woodpecker	2,521	475
Acorn Woodpecker	1,999	87
Lewis' Woodpecker	42	11
Yellow-bellied Sapsucker	1,044	280
Williamson's Sapsucker	25	11
Hairy Woodpecker	793	445
Downy Woodpecker	2,697	888
Ladder-backed Woodpecker	216	71
Nuttall's Woodpecker	167	47
Arizona Woodpecker	2	1
Red-cockaded Woodpecker	28	8
White-headed Woodpecker	84	20
Black-backed Three-toed Woodpecker	18	9
Northern Three-toed Woodpecker	2	2
Eastern Kingbird	7,458	1,136
Gray Kingbird	21	2
Tropical Kingbird	1	1
Western Kingbird	3,990	353
Cassin's Kingbird	379	40
Thick-billed Kingbird	1	1
Scissor-tailed Flycatcher	2,071	145
Kiskadee Flycatcher	15	4
Sulphur-bellied Flycatcher	1	1
Great Crested Flycatcher	5,002	971
Wied's Crested Flycatcher	152	19
Ash-throated Flycatcher	1,746	169
Olivaceous Flycatcher	23	4
Eastern Phoebe	2,254	716
Black Phoebe	163	54
Say's Phoebe	418	110
Yellow-bellied Flycatcher	138	50
Acadian Flycatcher	1,358	304
Willow Flycatcher	1,318	294
Alder Flycatcher	1,785	265
Least Flycatcher	3,242	484
Hammond's Flycatcher	527	49
Dusky Flycatcher	393	53
Gray Flycatcher	77	14
Western Flycatcher	966	86
Unidentified *Empidonax*	46	17
Eastern Wood Pewee	5,198	938
Western Wood Pewee	2,180	217
Olive-sided Flycatcher	922	205
Vermilion Flycatcher	32	13
Beardless Flycatcher	2	1
Skylark	11	1
Horned Lark	22,572	670
Violet-green Swallow	2,534	162
Tree Swallow	7,700	648
Bank Swallow	4,859	295
Rough-winged Swallow	2,777	546
Barn Swallow	33,735	1,506
Cliff Swallow	24,296	536
Purple Martin	9,423	715
Gray Jay	239	76
Blue Jay	17,586	1,224
Steller's Jay	1,805	134
Scrub Jay	7,210	139
Mexican Jay	72	5
Green Jay	3	1
Black-billed Magpie	2,591	176
Yellow-billed Magpie	734	25
Common Raven	2,913	393
White-necked Raven	400	29
Common Crow	44,054	1,500
Northwestern Crow	509	8
Fish Crow	1,774	164
Pinyon Jay	380	34
Clark's Nutcracker	154	31
Black-capped Chickadee	4,256	659
Carolina Chickadee	3,453	460
Mountain Chickadee	1,574	94
Boreal Chickadee	86	36
Chestnut-backed Chickadee	715	58
Tufted Titmouse	5,886	692
Black-crested Titmouse	236	21
Plain Titmouse	934	69
Bridled Titmouse	48	6
Verdin	365	38
Bushtit	1,158	94
White-breasted Nuthatch	1,817	539
Red-breasted Nuthatch	1,443	272
Brown-headed Nuthatch	460	92
Pygmy Nuthatch	390	31
Brown Creeper	230	87
Wrentit	892	70
Dipper	27	16
House Wren	8,419	896
Winter Wren	1,210	193
Bewick's Wren	1,313	189
Carolina Wren	4,247	467
Cactus Wren	923	65
Long-billed Marsh Wren	355	85
Short-billed Marsh Wren	307	83

Table 1. *Continued.*

Species	Total birds	Total routes
Canyon Wren	73	33
Rock Wren	736	132
Northern Mockingbird	22,914	891
Gray Catbird	9,539	1,045
Brown Thrasher	5,635	1,075
Long-billed Thrasher	25	2
Bendire's Thrasher	33	11
Curve-billed Thrasher	224	36
California Thrasher	171	40
Le Conte's Thrasher	47	9
Crissal Thrasher	20	6
Sage Thrasher	1,357	56
American Robin	54,506	1,512
Varied Thrush	393	41
Wood Thrush	12,081	871
Hermit Thrush	2,277	310
Swainson's Thrush	4,619	259
Gray-cheeked Thrush	30	6
Veery	6,261	455
Eastern Bluebird	2,412	546
Western Bluebird	576	81
Mountain Bluebird	672	100
Townsend's Solitaire	103	39
Blue-gray Gnatcatcher	1,662	389
Black-tailed Gnatcatcher	60	14
Golden-crowned Kinglet	642	102
Ruby-crowned Kinglet	972	193
Water Pipit	4	2
Sprague's Pipit	155	27
Bohemian Waxwing	7	4
Cedar Waxwing	4,234	556
Phainopepla	121	33
Loggerhead Shrike	2,319	535
Starling	96,129	1,575
Black-capped Vireo	3	1
White-eyed Vireo	3,060	430
Hutton's Vireo	138	32
Bell's Vireo	291	79
Gray Vireo	10	5
Yellow-throated Vireo	839	367
Solitary Vireo	1,187	260
Black-whiskered Vireo	8	1
Red-eyed Vireo	17,774	1,052
Philadelphia Vireo	72	27
Warbling Vireo	3,091	649
Black-and-white Warbler	1,741	391
Prothonotary Warbler	432	152
Swainson's Warbler	26	17
Worm-eating Warbler	135	69
Golden-winged Warbler	164	67
Blue-winged Warbler	322	114
Tennessee Warbler	633	90
Orange-crowned Warbler	1,010	127
Nashville Warbler	1,937	239
Virginia's Warbler	83	10
Lucy's Warbler	149	9
Northern Parula Warbler	1,413	309
Olive Warbler	2	2
Yellow Warbler	6,866	889
Magnolia Warbler	1,241	170
Cape May Warbler	95	43
Black-throated Blue Warbler	336	116
Myrtle Warbler	1,062	205
Audubon's Warbler	1,121	114
Black-throated Gray Warbler	411	68
Townsend's Warbler	416	32
Black-throated Green Warbler	1,049	209
Golden-cheeked Warbler	2	1
Hermit Warbler	375	34
Cerulean Warbler	172	59
Blackburnian Warbler	575	137
Yellow-throated Warbler	276	97
Grace's Warbler	65	8
Chestnut-sided Warbler	4,050	368
Bay-breasted Warbler	199	47
Blackpoll Warbler	172	25
Pine Warbler	1,351	263
Prairie Warbler	1,257	288
Palm Warbler	54	14
Ovenbird	7,363	591
Northern Waterthrush	424	139
Louisiana Waterthrush	205	124
Kentucky Warbler	762	217
Connecticut Warbler	38	16
Mourning Warbler	1,174	152
MacGillivray's Warbler	552	86
Common Yellowthroat	18,472	1,307
Yellow-breasted Chat	4,484	523
Red-faced Warbler	26	4
Hooded Warbler	633	167
Wilson's Warbler	761	143
Canada Warbler	485	161
American Redstart	4,067	482
Painted Redstart	15	2
House Sparrow	103,662	1,503
European Tree Sparrow	22	3
Bobolink	9,206	566
Eastern Meadowlark	30,260	1,066
Western Meadowlark	34,268	591
Yellow-headed Blackbird	4,451	176
Red-winged Blackbird	143,285	1,679
Tricolored Blackbird	1,027	15
Orchard Oriole	3,023	543
Black-headed Oriole	4	1
Spotted-breasted Oriole	3	1
Hooded Oriole	23	16
Scott's Oriole	191	38
Baltimore Oriole	5,080	829
Bullock's Oriole	1,602	196
Rusty Blackbird	89	32
Brewer's Blackbird	14,805	383
Great-tailed Grackle	3,349	71
Boat-tailed Grackle	912	30
Common Grackle	83,424	1,348
Brown-headed Cowbird	23,904	1,572
Bronzed Cowbird	213	22
Western Tanager	1,572	167
Scarlet Tanager	2,815	556
Hepatic Tanager	26	8
Summer Tanager	1,877	359
Cardinal	25,860	1,021
Pyrrhuloxia	870	34
Rose-breasted Grosbeak	3,634	551
Black-headed Grosbeak	1,808	167
Blue Grosbeak	2,606	438
Indigo Bunting	19,413	1,044
Lazuli Bunting	660	101
Varied Bunting	1	1
Painted Bunting	1,678	144
Dickcissel	9,629	348
Evening Grosbeak	1,921	136
Purple Finch	1,754	383
Cassin's Finch	452	49
House Finch	8,137	292
Pine Grosbeak	79	11
Common Redpoll	59	4
Pine Siskin	2,187	187
American Goldfinch	12,306	1,153
Lesser Goldfinch	1,363	117
Lawrence's Goldfinch	176	22
Red Crossbill	502	54
White-winged Crossbill	61	12
Olive Sparrow	39	8
Green-tailed Towhee	697	54
Rufous-sided Towhee	13,750	994
Brown Towhee	1,490	103
Abert's Towhee	14	5
Lark Bunting	7,842	94
Savannah Sparrow	11,046	522
Grasshopper Sparrow	3,824	514
Baird's Sparrow	162	27
Le Conte's Sparrow	110	30
Henslow's Sparrow	64	29
Sharp-tailed Sparrow	13	7
Seaside Sparrow	46	7
Vesper Sparrow	5,445	469
Lark Sparrow	3,395	311
Rufous-winged Sparrow	2	1
Rufous-crowned Sparrow	113	28
Bachman's Sparrow	123	38
Botteri's Sparrow	1	1

Table 1. *Continued.*

Species	Total birds	Total routes	Species	Total birds	Total routes	Species	Total birds	Total routes
Cassin's Sparrow	3,088	80	Chipping Sparrow	14,188	1,195	White-throated Sparrow	8,040	325
Black-throated Sparrow	1,994	79	Clay-colored Sparrow	2,281	134	Fox Sparrow	463	47
Sage Sparrow	1,004	46	Brewer's Sparrow	1,633	92	Lincoln's Sparrow	456	83
White-winged Junco	40	3	Field Sparrow	9,184	890	Swamp Sparrow	811	278
Slate-colored Junco	1,416	205	Black-chinned Sparrow	176	19	Song Sparrow	26,741	1,127
Oregon Junco	2,264	155	Harris' Sparrow	2	1	McCown's Longspur	59	11
Gray-headed Junco	121	14	White-crowned Sparrow	1,204	86	Lapland Longspur	2	1
Mexican Junco	8	1	Golden-crowned			Smith's Longspur	6	1
Tree Sparrow	39	6	Sparrow	2	1	Chestnut-collared		
						Longspur	1,680	50

Table 2. *Mean number of birds per route in Western States and Provinces, 1965–79.*

No. of Routes	10	40	26	66	179	23	16	34	18	29	48	13	27	26	7
States and Provinces	Alas	Alta	Ariz	B.C.	Cal	Colo	Ida	Mont	Nev	N Mex	Oreg	Utah	Wash	Wyom	Yuk
Common Loon	0.4	0.1		0.8	+		+	+					+	+	0.5
Red-necked Grebe	0.4	0.9		0.2				0.1							
Horned Grebe	0.1	0.8		0.1				+					0.2		0.1
Eared Grebe		1.5	+	+	0.4	+	+	0.7	2.0	+	1.0		+	+	
Western Grebe		+		0.3	0.9	+	0.4	+	0.2	+	8.0	+	+	+	
Pied-billed Grebe		0.7		0.1	0.1	+	0.2	0.1		+	0.2	+	0.2	0.1	
White Pelican		0.9			0.3		0.2	0.2			1.3	1.3			
Double-crested Cormorant	0.1	0.1	+	+	0.3		+	0.1	0.1	+	0.8	0.2	0.1	0.1	
Brandt's Cormorant					0.2						0.2		+		
Pelagic Cormorant				0.1	0.3						+		0.1		
Great Blue Heron	0.6	0.2	+	0.7	0.8	0.1	0.5	0.7	0.1	+	0.7	0.7	0.9	1.0	
Green Heron			+	+	+					+	0.1		+		
Cattle Egret					0.5										
Great Egret					0.3						0.6				
Snowy Egret			+		0.1	+	0.3		+	0.3	0.1	0.5		+	
Black-crowned Night Heron		0.1	+		0.2	0.2	0.1	+	+	0.1	0.2	0.2	0.6	0.1	
American Bittern		1.2		0.1	0.1	+	+	0.1			0.2		+	+	
Canada Goose	0.2	4.5		1.2	1.5	1.0	1.7	1.0	0.2	+	2.1	0.6	0.3	0.2	
Mallard	1.1	23.4	0.1	2.4	2.1	2.9	4.1	5.7	1.1	0.4	3.1	0.5	2.1	1.8	0.1
Gadwall		3.5		+	0.2	0.1	0.2	1.5	0.2	0.1	0.8	0.2	0.1	0.2	
Pintail	0.4	9.4	0.1	0.2	1.0	0.2	0.4	3.8	1.7	0.1	2.4	0.2	0.1	0.2	0.5
Green-winged Teal		1.6	+	0.1	+	0.2	0.1	0.4	0.1	+	+	0.1	+	0.3	0.1
Blue-winged Teal		6.9	+	0.2	+	0.2	0.5	1.8	+	0.1	0.1		0.2	0.2	
Cinnamon Teal		+	0.1	+	0.6	0.2	0.7	0.2	0.6	0.1	1.6	0.1	0.3	+	
American Wigeon		4.2		0.4	+	+	0.4	1.8	+		0.1		0.1	0.2	0.5
Northern Shoveler	0.2	4.2		+	0.1	0.1	0.2	1.1	+	0.3	1.1		+	+	
Wood Duck				0.1	0.1	+	+				0.1		+		
Redhead		1.2	+	0.1	0.2	+	1.6	0.7	0.3	0.1	0.8	+	0.2	+	
Ring-necked Duck		+		0.1			0.1	0.1			+		+	+	
Canvasback		0.8		+	+		+	0.1	+		0.3				0.2
Greater Scaup	0.1	+		+											3.9
Lesser Scaup		8.4		0.2	0.1		0.2	0.4	+	+	0.1		+	0.1	2.0
Common Goldeneye	0.5	0.3		0.3			0.2	+							0.1
Barrow's Goldeneye		0.1		0.3			0.1	+			+		+	0.1	4.9
Bufflehead		0.5		0.3			+	+			0.3				2.2
Harlequin Duck	0.8	0.2		+	+						+				+
White-winged Scoter	0.9	2.2		+											1.3
Surf Scoter		+		0.3											1.3
Ruddy Duck		0.9	+	0.1	0.4	+	0.2	0.1	0.3	0.1	0.2		+	+	
Common Merganser	2.1	0.1		0.4	0.3	+	0.2	+	+	+	0.2		0.2	0.1	0.9
Red-breasted Merganser				+				+			+		+		0.4
Turkey Vulture			2.6	+	2.0	0.2	0.2	+	0.5	2.3	1.6	0.3	0.2	0.1	
Black Vulture			0.3												
White-tailed Kite					0.3										
Goshawk	0.1	+	+	+	+	+	+	+			+	+		+	0.1
Sharp-shinned Hawk		+	+	0.1	+	+		0.1	+	+	+	+	+	+	+
Cooper's Hawk		0.1	0.1	+	0.1	+	0.1	0.1	+	+	0.1	+	+	+	
Red-tailed Hawk		1.5	1.0	0.3	2.3	0.4	0.4	0.5	0.4	0.6	1.6	0.8	0.7	0.5	0.8
Red-shouldered Hawk					0.1										
Swainson's Hawk		1.6	0.3	+	+	1.4	0.2	0.3	0.1	1.0	0.2	0.4	0.2	0.2	
Ferruginous Hawk		0.2	+		+	0.3	+	0.1	0.1	0.1	+	0.1	+	0.3	
Golden Eagle		+	0.1	+	0.1	0.1	0.2	0.2	0.2	0.1	0.3	0.4	+	0.3	+
Bald Eagle	4.8			0.3	+	+	+	+			+		+		0.1
Northern Harrier		1.4	+	+	0.4	0.5	0.9	1.3	0.1	0.1	0.4	0.6	0.5	0.6	0.2
Osprey		+		0.2	0.1		0.1	0.1			0.1		0.1	+	
Prairie Falcon		+	+		+	+	+	0.1	0.2	0.1	0.1	0.1	+	0.1	
Merlin		0.1		+			0.1	+			+		+	+	0.2
Sparrow Hawk		0.8	1.5	0.7	2.3	1.2	2.5	1.6	1.0	1.4	1.6	2.0	0.1	1.2	0.1
Blue Grouse	1.9	+		1.1	+	0.1	0.1	+			0.2		0.4		0.4
Ruffed Grouse		0.9		0.8			0.1	0.1			+	+	0.2	0.1	
Sharp-tailed Grouse		0.5		+				0.8					+	+	
Sage Grouse		+			+	0.2	0.4	0.5	0.8		0.1	0.2		2.8	
Bobwhite						0.5	0.1			0.2	+		+		

Table 2. *Continued.*

No. of Routes	10	40	26	66	179	23	16	34	18	29	48	13	27	26	7
States and Provinces	Alas	Alta	Ariz	B.C.	Cal	Colo	Ida	Mont	Nev	N Mex	Oreg	Utah	Wash	Wyom	Yuk
Scaled Quail			1.0			0.3				10.5			+		
California Quail				0.3	8.7		0.2		0.1		4.9		1.6		
Gambel's Quail			12.7		1.4		+		0.1	1.8					
Mountain Quail					2.3						0.4		+		
Ring-necked Pheasant		2.4		1.4	3.3	15.1	11.2	17.6	+	0.5	6.7	5.8	5.1	4.9	
Chukar				+	0.1	+	0.7	+	0.4		2.0	1.2	0.2	+	
Gray Partridge		0.5		+			+	0.7	+		+	+	0.1		
Turkey			+		+	+		+		+		0.1		0.1	
Sandhill Crane		0.1		+	0.3		3.0	1.0	+		1.3			0.1	
Sora		2.9		0.1	+	+	0.1	0.4			0.2		+	0.1	
American Coot		4.4	0.2	0.3	1.5	0.7	2.1	1.6	1.6	0.1	4.1	0.7	1.1	0.2	
Killdeer		7.5	0.9	2.5	5.2	6.1	11.3	7.4	1.7	1.5	6.8	1.9	6.4	3.7	
Mountain Plover						1.0	+	+		1.3				0.2	
Common Snipe	1.2	6.6		3.5	0.7	1.2	7.4	3.7	0.2	+	4.0	0.1	0.6	0.6	1.7
Long-billed Curlew		2.0	+	0.1	0.1	1.4	0.5	2.2	0.2	0.6	1.7	3.4	0.3	+	
Upland Sandpiper		0.2				0.7		0.5			+			+	0.2
Spotted Sandpiper	0.4	0.9	+	1.0	0.3	0.3	0.8	0.4	0.1	+	0.9	0.3	0.7	0.6	1.9
Solitary Sandpiper	0.1	+		0.1											
Willet		3.9			0.5		0.5	0.5	+		0.5	2.8		+	
Greater Yellowlegs	0.2	+		0.2											
Lesser Yellowlegs	0.3	0.7		+											4.9
Least Sandpiper															0.1
Marbled Godwit		4.9						0.2						+	
American Avocet		0.9	+		1.1	0.2	+	0.2	0.5	0.2	0.2	0.1	+	+	
Black-necked Stilt			+		2.6		+		0.2	+	+				
Wilson's Phalarope		2.0		+	0.1	0.2	0.9	1.6	0.3	+	0.7	+	0.1	0.3	
Glaucous Gull	24.5														
Glaucous-winged Gull	12.7			4.3	+						+		4.8		
Western Gull					1.2						1.5		0.8		
Herring Gull	24.5			0.1	+	+		0.3			0.2				
California Gull		0.6	+	+	2.1		27.8	0.7	0.8		0.9	27.9	0.2	0.6	
Ring-billed Gull		7.1		+	3.0	+	7.7	1.7	0.1		2.4		9.3	+	
Mew Gull	3.2			0.1											6.9
Franklin's Gull		28.0					6.3	3.5			1.0	5.5			
Bonaparte's Gull		0.1		+											2.5
Forster's Tern		0.1			0.3		0.2	+	+		0.9				
Common Tern		0.3			+			+					+		
Arctic Tern	0.9			+											1.0
Caspian Tern					0.1		+		+		+		0.1		
Black Tern		7.0		0.7	0.1		0.2	0.2			1.2		0.2	+	
Marbled Murrelet	0.4			0.1											
Band-tailed Pigeon			0.3	2.6	1.4	0.4				0.2	1.4	0.1	1.9		
Rock Dove	1.5	4.6	0.6	3.4	4.4	2.4	3.7	4.2	+	2.2	3.2	0.9	3.6	1.2	0.4
White-winged Dove			29.3		0.7					0.1					
Mourning Dove		1.8	49.6	1.2	31.3	51.4	22.9	26.2	23.7	37.4	14.0	26.6	9.0	14.2	
Spotted Dove					0.2										
Ground Dove			0.5		0.1				+						
Inca Dove			0.4												
Yellow-billed Cuckoo			0.1			+		0.1		0.1				+	
Black-billed Cuckoo		+				+		0.2						0.1	
Roadrunner			1.0		0.3	+			+	0.3					
Great Horned Owl	0.1	0.3	0.2	+	0.3	0.2	0.2	0.1	+	0.2	0.3	+	0.3	0.3	
Pygmy Owl				+	0.1					+	+		+		
Burrowing Owl		0.1	0.1		0.7	1.5	0.2	0.1	0.2	0.8	0.1	0.1	0.2	0.1	
Short-eared Owl		0.7		+	+	+	0.2	0.5	+		0.1	0.3	0.1	0.1	
Poor-will			0.1	+	0.1	+	+		0.1	0.1	+		+	0.1	
Common Nighthawk		0.2	1.7	0.7	0.4	2.7	0.7	1.3	2.7	7.1	2.7	1.3	0.6	2.4	
Lesser Nighthawk			1.7		0.3				0.2	0.8					
Black Swift		+		2.5	+		+				+		1.8		
Chimney Swift						0.1								+	
Vaux's Swift				0.5	0.1		0.1	+			0.3		1.1		
White-throated Swift			1.6		1.9	0.3		+	+	+		1.3		+	
Black-chinned Hummingbird			0.4	+	0.1	+	+		+	0.1		0.4	0.1		

Table 2. *Continued.*

No. of Routes	10	40	26	66	179	23	16	34	18	29	48	13	27	26	7
States and Provinces	Alas	Alta	Ariz	B.C.	Cal	Colo	Ida	Mont	Nev	N Mex	Oreg	Utah	Wash	Wyom	Yuk
Costa's Hummingbird			+		0.3				+			+			
Anna's Hummingbird					0.8						+				
Broad-tailed Hummingbird			0.7		+	5.5	+			1.5		2.1		0.1	
Rufous Hummingbird	0.7	0.1		2.4	+		+	+			1.3		3.1		
Allen's Hummingbird					0.4						+				
Calliope Hummingbird		+	+	0.4	+		0.1	+	+		0.1	+	0.4		
Broad-billed Hummingbird			0.1												
Belted Kingfisher	0.5	+	+	0.6	0.2	0.1	0.4	0.2		0.1	0.4	0.1	0.3	0.1	0.2
Yellow-shafted Flicker	0.1	1.6		0.4		+		+						+	4.7
Red-shafted Flicker	0.2	0.2	1.4	3.4	2.8	2.9	2.5	2.9	1.1	0.9	4.5	2.0	3.1	2.6	0.2
Gilded Flicker			1.4		+										
Pileated Woodpecker		+		0.5	0.1		+	+			0.2		0.4		
Gila Woodpecker			3.9		+										
Red-headed Woodpecker						0.1		0.1		+				+	
Acorn Woodpecker			1.2		8.4					0.1	0.4				
Lewis' Woodpecker			0.3	0.1	0.1	0.2	+	+		+	0.4	+	0.7		
Yellow-bellied Sapsucker	0.6	0.7	+	2.1	0.3	0.4	0.3	0.1	+	+	0.5	0.1	0.6	0.4	0.2
Williamson's Sapsucker			+		+	0.2		+		+	0.2	+			
Hairy Woodpecker	0.4	0.1	0.4	0.5	0.4	0.2	0.2	0.1		0.1	1.2	0.2	0.7	0.1	
Downy Woodpecker	0.1	0.2	+	0.4	0.2	+	0.1	0.1		+	0.3	+	0.5	0.2	0.2
Ladder-backed Woodpecker			1.4		0.1	+			+	0.2		+			
Nuttall's Woodpecker					0.9										
White-headed Woodpecker					0.3						+		0.1		
Black-backed Three-toed Woodpecker				0.1	+			+			0.1		+		
Northern Three-toed Woodpecker			+	0.1		0.1		+					+		0.1
Eastern Kingbird		3.4		0.6	+	0.7	1.2	4.3	+	+	0.5		1.8	0.9	
Western Kingbird		0.5	7.2	0.6	8.3	8.1	1.2	1.7	2.5	11.4	3.3	2.7	2.7	0.5	
Cassin's Kingbird			5.6		0.1	0.7		+		4.4				+	
Wied's Crested Flycatcher			1.0												
Ash-throated Flycatcher			11.1		5.3	0.2	+		1.0	3.7	1.0	0.2		0.1	
Olivaceous Flycatcher			0.6												
Eastern Phoebe		1.3		0.2				+							
Black Phoebe			0.1		0.7				+	+	+	+			
Say's Phoebe	0.4	+	1.6	0.1	0.4	1.6	+	0.5	0.6	3.5	0.3	0.1	0.3	2.2	0.1
Willow Flycatcher		0.1		3.6	0.1	0.3	1.8	2.0	+	+	4.2	0.2	9.6	0.6	
Alder Flycatcher	20.4	4.3		2.5											3.9
Least Flycatcher		7.0		2.1			0.1	0.2					+	+	0.1
Hammond's Flycatcher	0.1	+		6.4	0.4	+	0.5	0.8		0.1	1.9		2.7		0.2
Dusky Flycatcher		0.2	+	2.1	0.4	0.3	0.9	0.5		0.1	3.0	0.1	1.5	0.6	
Gray Flycatcher			0.3		0.1	+			0.1	0.2	1.4				
Western Flycatcher	2.2	0.1	0.6	1.5	2.4	1.5	0.9	0.1	+	0.6	2.0	0.4	5.5	0.1	
Western Wood Pewee	0.8	2.8	2.4	6.3	7.4	4.2	1.7	1.4	0.1	2.3	8.2	1.7	8.6	0.7	4.7
Olive-sided Flycatcher	0.5	0.1	0.1	3.4	2.9	0.7	0.3	0.3	+	+	4.6	0.2	3.0	0.1	3.4
Vermilion Flycatcher			0.4												
Beardless Flycatcher			0.1												
Horned Lark		34.2	38.2	0.3	17.5	101.3	28.8	64.5	37.0	68.2	12.6	14.5	38.5	56.3	
Violet-green Swallow	0.4	+	5.1	5.6	4.1	7.6	4.4	0.2	1.3	3.4	5.0	3.5	11.0	0.9	0.7
Tree Swallow	4.3	4.2		12.2	2.0	2.0	6.4	2.7	0.2	0.1	3.7	3.5	3.0	2.5	1.1
Bank Swallow	7.2	2.8	+	2.4	0.6	0.1	11.6	4.3	+	0.2	1.4	1.1	8.0	0.4	11.0
Rough-winged Swallow		0.5	2.3	2.0	3.2	1.2	5.3	1.0	0.9	0.6	2.2	2.6	2.7	0.8	
Barn Swallow	5.7	8.1	0.4	14.3	5.7	8.5	21.1	5.5	0.8	7.2	12.4	3.3	19.1	2.8	0.7
Cliff Swallow	1.6	18.7	6.7	8.6	60.1	23.2	23.2	22.1	1.3	10.3	17.7	9.5	21.8	15.0	9.6
Purple Martin		0.2	1.1	+	0.2	+		+		0.3	+	0.1	+		
Gray Jay	4.1	0.4		1.3	+	0.1	0.1	0.1			0.5	0.1	0.1	0.3	15.1
Blue Jay		0.3				+						+		+	
Steller's Jay	1.4		1.3	0.9	5.8	1.8	0.3	0.2		0.8	4.3	0.6	2.0	+	
Scrub Jay			1.6		9.4	0.5			0.2	2.3	1.5	0.1	+		
Mexican Jay			2.8												
Black-billed Magpie	0.2	15.5	+	2.4	0.9	14.7	17.7	10.8	2.3	2.2	9.6	14.4	8.3	9.5	
Yellow-billed Magpie					4.1										
Common Raven	5.3	0.4	7.4	4.3	5.2	0.9	3.1	0.8	2.9	4.9	4.7	3.2	1.5	2.5	3.7
White-necked Raven			2.0			0.1				5.7					

Table 2. *Continued.*

No. of Routes	10	40	26	66	179	23	16	34	18	29	48	13	27	26	7
States and Provinces	Alas	Alta	Ariz	B.C.	Cal	Colo	Ida	Mont	Nev	N Mex	Oreg	Utah	Wash	Wyom	Yuk
Common Crow		30.5	1.0	21.5	6.3	4.3	11.5	4.7	0.1	0.9	7.9	0.4	14.1	0.6	
Northwestern Crow	2.6			8.2									2.5		
Pinyon Jay			13.3		0.3	0.9		0.4	5.8	6.9	0.7	5.8		0.2	
Clark's Nutcracker		0.1	0.2	0.1	0.2	0.1	0.2	0.3		0.2	0.7	0.6	0.5	0.5	
Black-capped Chickadee	2.0	1.5		7.7		0.2	2.1	1.0			2.0	0.2	5.6	0.5	0.4
Mountain Chickadee		0.1	0.8	1.2	4.3	1.3	0.8	0.8	+	1.0	6.9	1.5	1.8	0.7	
Boreal Chickadee	0.3	0.1		0.1											5.5
Chestnut-backed Chickadee	1.6			3.5	1.9		0.1				0.9		3.6		
Plain Titmouse			1.1		3.8	0.1	+		+	1.3	0.1	0.1			
Bridled Titmouse			0.8												
Verdin			7.2		0.7					0.1					
Bushtit			1.3	0.5	3.8	+			0.1	0.4	1.1	0.3	0.3	+	
White-breasted Nuthatch			1.0	+	1.7	0.3	0.2	0.1		0.3	0.8	0.2	0.9	0.1	
Red-breasted Nuthatch		0.2	0.1	3.4	2.3	0.1	0.7	0.5		+	4.7	0.3	3.0	+	0.2
Pygmy Nuthatch			2.0	+	0.3	0.8	+	+		0.3	0.3	0.7	0.7	+	
Brown Creeper	0.4	+	0.1	0.2	0.8	+	0.1	+			0.6		0.2		
Wrentit					4.5						0.4				
Dipper	0.1			+	0.1	+	0.1	0.1		+	+	0.2	0.1	+	
House Wren		9.1	0.5	0.4	2.1	3.8	1.0	3.0	0.1	0.8	1.8	0.2	1.2	1.0	
Winter Wren	5.8	+		3.1	0.2		0.2	+			0.9		5.6		
Bewick's Wren			4.2	0.8	2.8	0.2		+	0.1	1.1	0.6	0.1	1.0		
Cactus Wren			8.3		2.7				0.4	3.1		+			
Long-billed Marsh Wren		0.2		0.1	0.3		+	0.1			0.4		0.1	0.1	
Canyon Wren			0.3		0.2	0.1	+		+	0.1	0.1	0.3	+	0.4	
Rock Wren		+	2.4	0.2	1.0	1.1	0.9	1.1	0.6	2.5	2.1	0.9	0.6	4.0	
Northern Mockingbird		+	14.0		4.9	2.5	+	+	1.2	29.8	+	0.3	+	+	
Gray Catbird		0.4		0.4		0.3	0.8	1.1	+	+	+	0.2	0.8	0.3	
Brown Thrasher		0.2				0.2		0.6		+				0.1	
Bendire's Thrasher			0.7		0.1				0.1	1.1					
Curve-billed Thrasher			3.4			+			+	0.4					
California Thrasher					1.3										
Le Conte's Thrasher			0.2		1.2										
Crissal Thrasher			0.1		+				+	0.1					
Sage Thrasher			0.8		0.5	2.3	5.6	1.2	20.3	0.1	8.5	3.2	0.2	14.9	
American Robin	23.5	14.6	1.8	50.9	11.7	24.1	37.2	17.7	2.3	6.0	33.7	16.2	53.1	12.9	23.3
Varied Thrush	11.3	0.2		8.5	0.2		0.7	0.3			1.0		2.6		0.7
Hermit Thrush	4.4	0.8	0.7	2.6	1.2	1.8	1.0	0.1	+	0.6	5.7	2.8	1.0	0.2	5.7
Swainson's Thrush	32.6	1.9	+	40.3	1.5	0.1	3.7	3.4	0.1		8.6	1.0	24.3	0.7	43.9
Gray-cheeked Thrush	2.7	+		+											0.2
Veery		0.4		2.2		0.5	1.7	2.2			0.1		3.1	0.2	
Eastern Bluebird			0.3			+				+				+	
Western Bluebird			2.0	+	2.1	0.4	+	+	+	1.2	0.2	0.2	0.6	+	
Mountain Bluebird		0.6	1.3	0.7	0.3	1.8	1.0	1.0	0.9	2.6	5.2	1.5	0.2	2.3	0.9
Townsend's Solitaire		0.2	0.1	0.3	0.1	0.3	0.1	0.4	0.2	+	0.4	0.1	0.1	0.1	0.6
Blue-gray Gnatcatcher			0.4		0.3	0.4			+			0.1			
Black-tailed Gnatcatcher			1.8		0.1				0.1						
Golden-crowned Kinglet	0.7	0.1		3.6	0.8	+	0.3	0.2			1.3		4.0	+	+
Ruby-crowned Kinglet	1.4	0.5	0.1	9.4	0.1	1.4	1.5	1.9		0.2	1.2	0.2	0.3	0.7	1.9
Water Pipit		+		0.1	+										
Sprague's Pipit								0.2						+	
Bohemian Waxwing	0.9			0.3											7.2
Cedar Waxwing		0.8		3.4	0.3		0.3	0.1			1.6	+	7.7	0.1	
Phainopepla			2.1		0.6				0.1	+					
Loggerhead Shrike		0.2	2.7	+	3.8	1.4	0.2	0.8	1.8	6.0	0.7	0.3	0.5	1.0	
Starling	0.3	37.3	4.0	60.1	28.3	11.7	45.3	17.7	2.5	8.8	34.9	11.6	32.1	6.0	16.5
Hutton's Vireo			+	+	0.5						+		0.2		
Bell's Vireo			1.4		+										
Gray Vireo			0.4		+	+				+		1.0			
Solitary Vireo		+	1.3	2.0	1.3	1.0	0.5	0.7	0.1	0.8	1.0	0.3	1.9	0.1	
Red-eyed Vireo		6.1		6.1			3.0	0.6			0.7		5.8	0.1	
Warbling Vireo		1.7	0.4	10.8	2.6	5.0	3.1	4.3	0.1	1.2	2.7	1.8	4.2	3.4	
Tennessee Warbler	0.1	0.6		2.1											0.1

Table 2. *Continued.*

No. of Routes	10	40	26	66	179	23	16	34	18	29	48	13	27	26	7
States and Provinces	Alas	Alta	Ariz	B.C.	Cal	Colo	Ida	Mont	Nev	N Mex	Oreg	Utah	Wash	Wyom	Yuk
Orange-crowned Warbler	5.1	0.1	+	6.4	2.0	0.2	0.3	0.3		0.1	2.3	0.1	4.4	0.2	3.8
Nashville Warbler				0.3	1.6		+	+			0.8		0.9		
Virginia's Warbler			0.7		+	0.5				0.4		+			
Lucy's Warbler			6.2		+				+						
Yellow Warbler	5.5	8.6	0.2	8.1	2.3	5.4	10.0	6.3	0.1	0.8	4.2	2.7	6.9	3.3	1.2
Magnolia Warbler		+		1.4											
Myrtle Warbler	8.2	1.0		0.5											22.7
Audubon's Warbler		0.3	0.9	7.0	2.0	3.4	2.6	3.4	0.1	0.4	5.7	0.7	4.0	2.7	
Black-throated Gray Warbler			0.9	0.6	1.5	0.1	+			0.4	0.8	0.2	2.7		
Townsend's Warbler	0.7	+		2.0			0.9	0.8			0.8		4.3	+	
Hermit Warbler					1.4						2.6		0.6		
Grace's Warbler			1.5			+				0.3					
Blackpoll Warbler	1.4	0.1		1.6											5.9
Ovenbird		0.6	+	+				+						0.4	
Northern Waterthrush	3.5	0.1		4.9				0.2							0.2
Connecticut Warbler		0.2		+											
Mourning Warbler		0.2		+											
MacGillivray's Warbler	0.2	0.1		9.0	0.5	1.6	1.1	1.4		0.3	2.0	0.7	5.9	0.5	0.5
Common Yellowthroat	0.2	3.3	0.2	2.1	0.2	0.2	0.9	2.9	+	0.1	1.1	+	0.7	0.5	1.1
Yellow-breasted Chat			1.8	+	0.6	0.7	0.2	0.8	0.1	+	1.9	0.3	0.7	0.6	
Red-faced Warbler			0.4												
Wilson's Warbler	7.2	0.1	+	7.3	2.0	1.2	0.1	0.2	+	+	1.6	+	5.2	+	0.4
American Redstart		0.1		3.2			0.3	0.6					0.5	0.1	0.2
Painted Redstart			0.2												
House Sparrow		22.4	28.8	5.6	34.4	32.2	50.5	9.5	3.1	14.3	11.4	17.2	41.7	5.1	
Bobolink		0.1		0.2		+	0.1	0.7			+		+	+	
Eastern Meadowlark			3.7							15.7					
Western Meadowlark		26.4	3.2	3.2	26.7	102.7	39.5	103.5	23.3	39.1	44.4	33.7	22.1	61.6	
Yellow-headed Blackbird		8.7	0.2	0.4	3.0	0.3	9.4	3.2	1.6	+	11.5	1.4	2.8	1.4	
Red-winged Blackbird		56.1	69.3	8.1	78.6	42.5	27.8	24.4	8.6	7.4	31.6	4.7	10.9	20.7	0.7
Tricolored Blackbird					14.5						0.1				
Orchard Oriole						0.1				+				+	
Hooded Oriole			0.5		0.1						+				
Scott's Oriole			1.5		1.3				0.4	0.8		+			
Baltimore Oriole		4.7		+		+		+							
Bullock's Oriole		+	0.5	0.3	5.4	1.7	0.9	0.9	0.4	1.8	3.6	0.8	1.5	0.7	
Rusty Blackbird	0.2	0.2		0.7											
Brewer's Blackbird		26.1	1.4	11.6	60.0	25.1	62.2	30.7	11.0	2.1	50.3	26.9	29.9	15.9	
Great-tailed Grackle			1.6		+					0.6					
Common Grackle		1.8				2.6		2.1		0.9		0.1		4.3	
Brown-headed Cowbird		16.6	7.1	7.5	3.9	2.3	5.7	9.5	0.4	2.4	8.8	2.5	12.6	1.1	0.2
Bronzed Cowbird			0.5							+					
Western Tanager		+	0.9	5.6	5.6	2.2	2.0	2.2	+	0.9	9.1	1.1	7.3	1.6	
Hepatic Tanager			0.3							0.1					
Summer Tanager			0.3		+					+					
Cardinal			0.8		+										
Pyrrhuloxia			0.3							0.1					
Rose-breasted Grosbeak		1.1		+											
Black-headed Grosbeak		+	2.1	0.7	7.1	0.9	0.3	0.2	+	1.5	4.6	0.4	1.7	0.5	
Blue Grosbeak			2.1		0.2	0.4			0.1	1.3		0.1		+	
Lazuli Bunting		0.2	+	0.9	1.4	1.0	1.6	0.9	+	0.1	3.9	1.1	2.6	0.3	
Varied Bunting			0.1												
Dickcissel						0.1				+				+	
Evening Grosbeak		+		3.6	0.3	0.2	1.1	6.3		0.1	1.7	0.3	8.9	+	
Purple Finch		0.1		1.7	2.2		+	+			2.1		2.7		0.1
Cassin's Finch				0.5	0.8	0.1	0.2	0.2	0.2	+	2.4	0.8	3.7	0.2	
House Finch			16.9	1.7	42.4	1.7	1.2		1.7	8.2	6.1	1.4	3.0	1.6	
Pine Grosbeak	0.7			0.6	+	+	+			+		+		+	1.1
Common Redpoll	18.8			0.3											7.0
Pine Siskin	7.0	3.5	0.4	29.5	1.0	5.5	3.7	5.7		0.9	3.6	1.6	7.8	1.6	8.5
American Goldfinch		2.7		3.4	1.3	0.5	2.0	2.0			6.2	0.3	8.6	0.6	
Lesser Goldfinch			0.5		5.3	0.4	+		+	0.8	1.4	+		+	

Table 2. *Continued.*

No. of Routes	10	40	26	66	179	23	16	34	18	29	48	13	27	26	7
States and Provinces	Alas	Alta	Ariz	B.C.	Cal	Colo	Ida	Mont	Nev	N Mex	Oreg	Utah	Wash	Wyom	Yuk
Lawrence's Goldfinch					0.6										
Red Crossbill	0.1	0.1	0.5	2.3	0.1	0.3	0.5	0.6		0.3	4.4	0.1	5.4	1.6	0.1
White-winged Crossbill		0.3		0.1											8.4
Green-tailed Towhee			+		1.0	6.2	0.5	0.3	0.6	0.8	1.6	2.7	+	2.8	
Rufous-sided Towhee		+	2.9	2.8	7.9	2.3	0.6	1.6	0.2	1.8	4.7	1.5	8.2	0.4	
Brown Towhee			2.3		6.0	+				1.9	0.1	+			
Abert's Towhee			0.3		+							+			
Lark Bunting		1.9	0.1		+	65.8		56.4		2.0				42.7	
Savannah Sparrow	4.6	19.2	0.1	3.9	0.5	1.1	1.8	5.7	0.1	+	3.5	0.8	5.5	1.0	4.9
Grasshopper Sparrow		0.2	0.3	+	0.1	7.3	0.8	1.9	+	+	0.1	+	0.1	0.3	
Baird's Sparrow		2.2				+		0.8						+	
Le Conte's Sparrow		2.8													
Vesper Sparrow		13.6	2.0	1.4	0.4	3.2	6.1	19.9	1.2	1.9	4.2	2.1	1.9	11.5	
Lark Sparrow		0.1	5.4	+	2.1	2.7	0.4	4.9	1.1	4.5	2.8	2.2	0.5	2.5	
Rufous-crowned Sparrow			0.9		0.1					0.2		0.1			
Botteri's Sparrow			0.1												
Cassin's Sparrow			0.4			13.6				28.6					
Black-throated Sparrow			18.1		7.8	+			18.1	9.6	0.2	0.5			
Sage Sparrow			1.5		1.0	0.1	0.3	0.1	19.4	1.1	5.9	2.1		7.4	
White-winged Junco														0.5	
Slate-colored Junco	12.7	1.2		0.8											57.0
Oregon Junco	2.4	0.7		12.6	6.9		2.6	3.3			7.8	0.1	9.0	2.0	
Gray-headed Junco			0.8			3.6				0.5		1.5		0.1	
Mexican Junco			0.1												
Tree Sparrow	0.6			0.6											3.8
Chipping Sparrow		4.8	2.4	12.7	4.2	2.8	5.3	5.6	0.2	3.9	11.4	4.8	9.0	3.6	11.2
Clay-colored Sparrow		27.0		0.4			0.2	0.7					+	0.1	
Brewer's Sparrow		0.1	0.9	+	1.9	6.3	13.8	5.8	13.2	0.1	13.2	5.2	1.6	17.6	
Black-chinned Sparrow			0.3		0.7					0.1		0.1			
White-crowned Sparrow	23.5	0.9		2.2	1.4	0.4	1.1	1.9	0.1		4.0	0.6	6.5	1.5	31.3
Golden-crowned Sparrow	0.1														
White-throated Sparrow		5.4		1.3											
Fox Sparrow	5.9	0.1		0.6	2.1	0.1	0.2	0.1			2.3	0.1	0.2	0.3	0.3
Lincoln's Sparrow	2.6	1.7		2.2	+	0.9	0.1	0.4	+	+	0.2	+	0.2	0.5	2.9
Song Sparrow	0.9	16.6	0.1	8.2	3.8	2.7	6.1	3.1	0.4	0.6	10.2	4.5	11.9	0.6	
McCown's Longspur		0.6				0.5		1.9						+	
Chestnut-colored Longspur		27.0				0.2		11.8						+	

Table 3. *Mean number of birds per route in Central States and Provinces, 1967–79.*

No. of Routes	29	34	38	25	14	49	37	35	25	34	30	35	117
States and Provinces	Ark	Iowa	Kans	La	Man	Minn	Mo	Nebr	NDak	Okla	Sask	SDak	Tex
Common Loon					0.1	0.9					+		
Red-necked Grebe					+						0.1		
Horned Grebe					0.2			+	0.1		1.7	+	
Eared Grebe		+	+		0.1				0.1		1.7	0.1	+
Western Grebe						+		+	+		4.6	0.1	
Pied-billed Grebe	+	+	+	+	0.8	0.2		0.1	1.7	+	1.5	0.7	0.1
White Pelican		+	2.6		0.1	0.1		0.4	1.2		3.5	0.8	
Double-crested Cormorant			+	0.1		0.1		0.1	0.6		4.6	0.5	+
Olivaceous Cormorant				1.3									+
Anhinga	+			0.2									0.1
Great Blue Heron	0.3	0.1	1.5	0.7	0.2	2.0	0.3	0.2	0.2	0.9	1.5	0.5	0.8
Green Heron	1.5	0.1	0.5	2.6		0.4	0.9	0.1		1.7		+	1.1
Little Blue Heron	1.0		+	5.9			0.9	+		2.5			1.2
Cattle Egret	0.9		+	32.2			0.1			0.6			13.5
Great Egret	0.4	+	+	6.3		0.2	+		+	0.3	+		1.1
Snowy Egret			0.1	11.4			+			0.2			0.2
Louisiana Heron				1.8									0.1
Black-crowned Night Heron	+	+	0.6	0.1	0.1	0.2	+	0.1	0.7	+	0.4	0.6	0.1
Yellow-crowned Night Heron	0.2		+	2.7			+			+			0.1
Least Bittern			+	0.1		+							+
American Bittern			+	+	3.1	1.0	+	0.1	1.7	+	2.5	0.5	+
Wood Stork				0.1									0.1
White-faced Ibis			+	2.0									1.9
White Ibis				3.4									0.3
Roseate Spoonbill				+									0.1
Canada Goose		+	1.0		0.5	0.2	0.1	+	0.1		2.8	0.6	
Black-bellied Tree Duck													0.8
Fulvous Tree Duck				0.1									0.2
Mallard	0.3	0.4	1.6	+	11.5	5.8	0.1	2.7	22.5	0.2	50.4	10.3	0.7
Mottled Duck				1.4									0.9
Gadwall	+		0.3	+	0.3	+	+	0.2	5.0		5.9	4.0	+
Pintail	+	0.1	0.6		3.9	0.1	+	0.3	9.9	+	23.6	3.1	0.2
Green-winged Teal		+	0.1		0.4	0.1	+	+	0.5		1.9	0.4	+
Blue-winged Teal	+	0.3	2.3	0.3	4.3	1.4	0.1	1.1	11.2	+	15.8	6.8	0.3
Cinnamon Teal			+						+		0.1	+	+
American Wigeon			+		0.5	+		+	1.2		7.1	0.4	
Shoveler		+	0.4		0.7	+		0.1	2.7	+	9.5	1.0	0.1
Wood Duck	0.6	0.1	0.1	0.7	+	0.8	0.1	+	0.1	+		+	0.1
Redhead		+	0.3		0.3	0.2		+	2.1		3.9	1.3	0.1
Ring-necked Duck					0.2	0.1			0.1		0.1		
Canvasback					0.6	+		+	0.7		8.2	0.2	
Lesser Scaup		+	+		0.8			0.4	0.6		11.4	+	+
Common Goldeneye					+	+					0.3		
Bufflehead					+						0.3		
White-winged Scoter											0.2		
Ruddy Duck			0.3		0.9	0.1		0.1	2.2		3.5	2.0	+
Turkey Vulture	2.0	0.4	0.8	1.0		+	1.6	0.1		3.7		0.2	10.4
Black Vulture	0.4			1.2						0.1			0.8
Mississippi Kite	0.2		0.3	0.3			+			2.3			0.6
Cooper's Hawk	+	+	+	0.1	0.1	+	+		+	+	0.1		+
Red-tailed Hawk	0.3	0.3	1.6	0.1	1.3	0.2	0.8	0.5	0.6	1.3	1.2	0.4	0.6
Red-shouldered Hawk	0.4		+	0.8		+	+			0.2			0.3
Broad-winged Hawk	0.1	+		0.1	0.1	0.1	+			0.1	+	+	+
Swainson's Hawk			1.2		0.1	+		0.5	0.6	0.7	1.4	0.5	0.7
Ferruginous Hawk			0.1					+	0.4	+	0.1	0.1	+
Harris' Hawk													0.5
Golden Eagle								+	+	+		0.1	+
Northern Harrier		+	0.7		1.1	0.3	+	0.3	1.7	0.3	1.9	1.2	0.1
Caracara													0.1
Sparrow Hawk	0.2	0.4	1.0	0.1	1.2	1.7	0.3	0.6	0.3	0.5	0.2	0.7	0.2
Ruffed Grouse		+			0.2	0.4					0.1		
Greater Prairie Chicken			0.3				0.6	1.3	+	0.5		+	
Sharp-tailed Grouse					0.3	+		0.2	1.5		0.6	0.2	

Table 3. *Continued.*

No. of Routes	29	34	38	25	14	49	37	35	25	34	30	35	117
States and Provinces	Ark	Iowa	Kans	La	Man	Minn	Mo	Nebr	NDak	Okla	Sask	SDak	Tex
Bobwhite	28.6	9.9	31.5	26.0		+	50.1	9.6		50.4		0.1	44.5
Scaled Quail										0.3			5.7
Ring-necked Pheasant		37.9	33.7		+	10.9	1.5	28.6	7.6	0.8	0.7	22.0	0.4
Gray Partridge		0.6			0.1	0.4			0.7		0.4	0.1	
Turkey	0.1	+	+	0.1	+		0.1	+	+	0.2		+	0.3
Sandhill Crane		+			0.3	0.1					0.4		
King Rail	+		+	0.3						+			+
Clapper Rail				+									0.1
Virginia Rail			+	+	+	0.1			0.1		+	+	+
Sora		+			3.6	0.5			2.5		5.2	0.3	
Yellow Rail					0.1	+			+				
Purple Gallinule	+			0.1									+
Common Gallinule				0.3									0.1
American Coot	+	0.1	0.6	0.4	4.6	0.7	+	0.3	9.8	+	19.0	4.7	0.4
Snowy Plover			0.1							+			+
Killdeer	4.2	4.4	7.6	2.5	16.6	9.2	3.0	6.6	15.1	6.6	12.2	18.2	5.7
American Woodcock	+					0.1	+			+			
Common Snipe		+			3.7	1.9		0.1	0.7		1.9	+	
Long-billed Curlew			0.1					2.3	+	0.1	+	1.0	0.5
Upland Sandpiper		0.5	3.7		1.4	0.4	0.7	5.7	5.7	0.3	0.4	14.4	
Spotted Sandpiper		+				0.2	+	+	0.1	+		+	+
Solitary Sandpiper											0.1		
Willet				1.1	0.7			0.1	1.6		3.7	0.5	0.2
Greater Yellowlegs											0.1		
Lesser Yellowlegs					0.2						1.5		
Marbled Godwit			+		1.5	0.2			2.4		3.1	0.4	
American Avocet			1.0	+	0.1			0.1	0.7	+	2.3	0.1	0.3
Black-necked Stilt			+	0.6									0.2
Wilson's Phalarope		+	0.1		0.6	+		0.2	2.2		3.5	0.9	
Herring Gull			+	+	0.4	0.5			+		0.1	+	
Ring-billed Gull		+	0.5	0.1	2.8	0.3		+	4.1		22.1	0.3	+
Laughing Gull				0.3									1.3
Franklin's Gull		0.1	2.6		21.2	1.6		0.2	3.8	+	17.8	5.0	
Bonaparte's Gull											0.1		
Forster's Tern			0.2	0.4	0.1	+		+	+		+	0.1	0.1
Common Tern				+	0.1	+		+	+		2.3	+	+
Least Tern			0.1	0.1						+			+
Black Tern		0.1	0.2		7.1	2.1	+	0.7	7.2		16.0	1.8	
Black Skimmer				0.1									+
Rock Dove	3.2	17.1	3.5	3.3	4.4	13.1	5.7	3.2	2.1	1.4	6.7	3.2	2.6
White-winged Dove													1.5
Mourning Dove	23.9	33.3	87.7	14.4	19.2	30.7	39.5	74.9	49.0	57.7	8.8	66.7	54.6
Ground Dove				0.1									1.3
Inca Dove													0.6
Yellow-billed Cuckoo	13.0	1.4	5.7	13.3	+	0.2	12.4	1.0	+	13.5		0.3	8.8
Black-billed Cuckoo		0.5	0.3		2.9	2.0	0.2	0.4	1.5		1.0	1.0	
Roadrunner	0.1		+	0.1			+			0.4			0.8
Groove-billed Ani													0.1
Great Horned Owl	+	0.2	0.6	0.1	0.3	0.1	0.4	0.3	0.2	0.2	0.4	0.6	0.3
Burrowing Owl			1.8					0.5	0.2	0.1	0.1	0.7	0.5
Barred Owl	0.2	+	+	0.3		+	0.1	+		0.2			0.1
Short-eared Owl		+	+		0.2	+		+	0.5		0.6	0.2	
Chuck-will's-widow	3.4		0.2	0.6			0.8			1.7			0.4
Whip-poor-will	0.3	+	+	+		+	1.5			0.1			+
Poor-will			+							+			0.1
Common Nighthawk	0.5	0.4	3.0	1.9	0.2	0.1	0.2	1.3	0.3	3.6	0.2	2.6	11.3
Lesser Nighthawk													0.9
Chimney Swift	7.2	8.5	4.9	5.8	0.2	2.3	8.6	2.9	0.1	4.0		0.1	4.8
White-throated Swift												0.8	0.1
Ruby-throated Hummingbird	0.7	+	+	0.5	0.1	0.2	0.3	+	+	0.7	+		0.2
Black-chinned Hummingbird													0.3
Belted Kingfisher	0.4	0.2	0.2	0.3	0.1	0.4	0.3	0.2	0.1	0.4	+	0.1	0.2

Table 3. *Continued.*

No. of Routes	29	34	38	25	14	49	37	35	25	34	30	35	117
States and Provinces	Ark	Iowa	Kans	La	Man	Minn	Mo	Nebr	NDak	Okla	Sask	SDak	Tex
Yellow-shafted Flicker	1.8	5.4	4.5	1.5	3.7	5.8	3.3	4.6	2.5	1.0	2.9	3.0	0.2
Red-shafted Flicker			+					0.1	0.1	0.1	0.2	0.8	+
Pileated Woodpecker	2.5	+		2.3		0.1	1.0			0.8			0.5
Golden-fronted Woodpecker										+			4.3
Red-headed Woodpecker	2.6	10.5	4.6	1.9	0.1	3.3	6.4	6.4	0.2	2.6		1.3	0.5
Yellow-bellied Sapsucker					0.2	1.1			+		0.1	+	
Hairy Woodpecker	0.2	0.1	0.2	0.5	0.2	0.4	0.5	0.1	+	0.3	0.1	0.1	+
Downy Woodpecker	2.2	0.8	0.9	1.2	0.1	0.8	2.0	0.4	0.1	1.6	0.1	0.2	0.4
Ladder-backed Woodpecker										+			1.4
Red-cockaded Woodpecker	+			0.1									+
Eastern Kingbird	4.9	8.0	12.7	4.3	8.1	3.3	8.4	10.9	12.0	7.9	6.6	10.0	1.5
Western Kingbird		+	22.3		1.6	0.3	0.1	7.2	9.6	5.8	2.9	8.2	2.9
Cassin's Kingbird			+					+		+			0.6
Scissor-tailed Flycatcher	1.0	+	2.3	0.2			0.3			20.7			20.1
Kiskadee Flycatcher													0.1
Great Crested Flycatcher	4.2	1.3	2.6	3.5	1.5	3.4	4.9	0.2	0.3	6.3	0.2	0.1	1.4
Wied's Crested Flycatcher													1.1
Ash-throated Flycatcher										+			2.2
Eastern Phoebe	1.3	1.0	0.9	+	1.3	0.8	2.1	0.2	0.1	2.1	0.6	+	0.6
Say's Phoebe			0.2					0.4	0.3	+	+	0.6	0.1
Yellow-bellied Flycatcher						0.3					+		
Acadian Flycatcher	1.7	+	+	3.1			0.2			0.2			0.2
Willow Flycatcher	+	0.4	+		+	0.2	0.1	+	1.1	+	0.1	0.3	
Alder Flycatcher					1.8	3.1					1.2		
Least Flycatcher		0.1			7.8	5.6	+	+	2.0		2.9	+	
Western Flycatcher												0.3	
Eastern Wood Pewee	4.7	1.1	0.7	2.6	0.4	1.8	5.4	0.1	0.2	2.6	+	+	1.2
Western Wood Pewee					+			0.1			0.1	0.6	+
Olive-sided Flycatcher						0.2			+		+		
Vermilion Flycatcher													0.3
Horned Lark	4.0	14.7	74.7	0.2	24.3	5.0	7.3	31.5	64.7	7.8	108.5	35.7	14.8
Violet-green Swallow								+			+	0.2	+
Tree Swallow		0.2	+		3.8	4.9	0.1	+	0.3		4.6	0.2	
Bank Swallow	+	1.2	1.3	+	2.1	4.0	0.1	1.0	3.9	0.3	4.9	1.3	0.2
Rough-winged Swallow	1.4	1.2	2.1	0.7	+	1.2	1.5	2.2	0.6	1.8	+	0.8	0.8
Barn Swallow	10.8	32.4	24.9	1.4	18.9	18.0	27.9	18.3	17.9	18.5	16.8	18.1	8.2
Cliff Swallow	0.1	0.8	18.8		12.3	14.1	0.1	14.0	24.3	14.8	7.5	9.5	39.9
Purple Martin	10.3	2.2	1.0	30.3	1.7	3.9	4.7	0.5	0.3	3.0	0.6	0.5	5.1
Gray Jay						0.2						+	
Blue Jay	17.1	6.2	6.5	22.5	0.4	6.2	16.2	4.2	0.4	5.7	+	1.4	3.3
Scrub Jay													0.1
Black-billed Magpie			3.2		4.7	+		1.5	1.1	+	12.0	1.5	
Common Raven					0.6	0.8					0.2		0.3
White-necked Raven			+							0.2			1.6
Common Crow	26.2	22.3	13.1	23.5	35.4	19.5	24.3	6.7	6.5	29.3	53.2	3.9	10.4
Fish Crow	0.4			3.6									+
Pinyon Jay												0.1	
Black-capped Chickadee		1.5	2.5		0.3	1.5	1.9	1.0	0.2		0.3	0.5	
Carolina Chickadee	6.3		0.2	8.8			2.0			5.5			3.1
Tufted Titmouse	9.2	0.7	1.8	9.4		+	11.0	0.1		7.1			2.7
Black-crested Titmouse													1.7
Verdin													1.2
White-breasted Nuthatch	0.7	0.4	0.1	+	0.1	0.7	2.2	0.1	0.1	0.6	+	+	+
Red-breasted Nuthatch						0.5					+	0.2	
Brown-headed Nuthatch	0.2			1.9						+			0.1
House Wren	+	14.9	6.3		13.1	8.4	5.1	6.4	6.0	0.1	14.5	2.9	
Winter Wren						0.6							
Bewick's Wren	0.1		0.1				1.3	+		2.4			5.5
Carolina Wren	10.6	+	0.4	20.1			2.3	+		1.8			3.1
Cactus Wren													4.8
Long-billed Marsh Wren		+	+	+	0.5	0.7		0.1	2.5		0.2	0.5	
Short-billed Marsh Wren		0.2	+		1.4	3.5	0.1	+	0.7		0.1	0.1	

Table 3. *Continued.*

No. of Routes	29	34	38	25	14	49	37	35	25	34	30	35	117
States and Provinces	Ark	Iowa	Kans	La	Man	Minn	Mo	Nebr	NDak	Okla	Sask	SDak	Tex
Canyon Wren												+	0.1
Rock Wren			+					0.2	+	+		0.7	0.1
Northern Mockingbird	23.8	0.2	11.3	41.7	+	+	14.7	0.5		30.6		+	62.8
Gray Catbird	0.8	2.8	1.0	0.2	4.4	3.6	2.8	1.1	1.2	0.2	1.9	0.1	+
Brown Thrasher	3.5	8.6	8.9	2.7	1.6	3.3	8.5	7.8	3.5	2.7	1.7	3.6	0.2
Long-billed Thrasher													0.1
Curve-billed Thrasher			+										1.3
American Robin	7.6	31.4	11.3	0.7	10.5	31.9	22.4	17.7	7.0	4.4	6.2	9.7	0.3
Wood Thrush	4.8	0.1	+	5.3		0.3	1.7	+	+	0.4		+	0.4
Hermit Thrush					+	1.8					+		
Swainson's Thrush					0.1	0.6					0.2	+	
Veery					1.3	13.2			0.4		1.0	+	
Eastern Bluebird	4.0	0.6	1.3	1.7	0.1	0.9	6.5	0.2	0.1	7.5		0.1	1.9
Mountain Bluebird					0.7				+		1.0	0.4	
Blue-gray Gnatcatcher	3.8	+	0.2	1.6		+	2.2			3.0			0.6
Black-tailed Gnatcatcher													0.1
Golden-crowned Kinglet						0.2						+	
Ruby-crowned Kinglet					+	0.4					+	+	
Sprague's Pipit					0.3			0.1	1.9		1.5	0.1	
Cedar Waxwing		0.3			2.1	3.0	0.2	+	0.8		2.3	+	
Loggerhead Shrike	2.0	0.6	4.4	4.4	0.3	+	2.8	1.7	0.7	5.5	1.2	2.2	3.3
Starling	23.2	59.0	24.1	17.5	10.9	42.2	33.4	11.5	6.3	16.0	16.5	9.6	4.5
White-eyed Vireo	6.0		+	13.3			1.5	+		0.8			1.9
Bell's Vireo	0.4	0.1	0.7			+	0.8	0.2		2.6		0.2	1.6
Yellow-throated Vireo	0.6	0.1	+	0.8	+	0.3	0.3	+	0.1	0.1		+	0.1
Solitary Vireo					+	0.2					+	0.1	
Red-eyed Vireo	5.6	0.2	0.1	3.5	5.2	15.6	3.5	0.2	0.4	1.6	4.9	0.2	1.2
Philadelphia Vireo					+	0.1					+		
Warbling Vireo	0.3	1.1	1.2	0.1	7.8	2.0	1.5	1.0	1.5	0.4	3.6	1.0	+
Black-and-white Warbler	1.3			0.4	+	1.4	0.1		+	0.3	0.1		0.1
Prothonotary Warbler	1.6			3.2			0.1			+			0.1
Swainson's Warbler	+			0.1									+
Worm-eating Warbler	0.3	+		0.1			+			+			+
Golden-winged Warbler		+				0.3							
Blue-winged Warbler	0.1	+				+	0.2						
Tennessee Warbler						0.3			+				
Nashville Warbler					+	8.2					+		
Northern Parula	0.9	+	+	4.0		0.3	0.9	+		0.4			0.3
Yellow Warbler	0.1	0.4	0.2		8.5	4.0	0.3	0.8	3.4	0.1	7.0	1.0	
Magnolia Warbler					+	1.3					+		
Cape May Warbler						0.1					+		
Myrtle Warbler						0.7					0.1		
Black-throated Green Warbler					+	0.6					+		
Cerulean Warbler	0.1					+	+			+			+
Blackburnian Warbler						1.1							
Yellow-throated Warbler	0.3			0.2			0.1			0.1			+
Chestnut-sided Warbler					0.2	9.2					+		
Pine Warbler	3.2			4.7		0.1	0.2			0.6			0.8
Prairie Warbler	1.8			0.6			0.4			0.3			0.1
Ovenbird	1.5	+	+	+	0.5	12.0	0.2	+	+	0.3	0.3	0.3	+
Northern Waterthrush					+	0.2					+		
Louisiana Waterthrush	0.2		+	0.1			0.1			0.1			+
Kentucky Warbler	3.6	+	+	1.6			0.5			0.3			0.3
Connecticut Warbler					+	0.2					0.1		
Mourning Warbler					0.4	5.5					0.1		
Common Yellowthroat	7.9	25.0	1.2	6.8	4.9	21.9	9.3	4.4	11.5	1.4	1.7	6.9	0.4
Yellow-breasted Chat	14.1	+	0.1	12.6			6.2	+	0.2	2.1	+	0.7	1.1
Hooded Warbler	1.3			2.4			+			0.2			0.3
Canada Warbler						0.8					+		
American Redstart	0.3	0.1		0.3	0.1	1.9	0.1	+	0.1	+	0.1	0.1	+
House Sparrow	48.5	178.2	103.3	49.6	26.9	42.8	96.3	65.2	25.2	34.0	75.8	24.3	91.2
Bobolink		10.7	+		6.8	10.9	0.5	2.5	12.8		1.6	3.4	
Eastern Meadowlark	43.2	14.8	37.3	36.5	+	1.8	61.3	5.0		67.3		+	46.7

Table 3. *Continued.*

No. of Routes	29	34	38	25	14	49	37	35	25	34	30	35	117
States and Provinces	Ark	Iowa	Kans	La	Man	Minn	Mo	Nebr	NDak	Okla	Sask	SDak	Tex
Western Meadowlark		69.0	145.1		39.7	42.5	4.7	128.5	128.0	29.0	57.1	253.7	16.1
Yellow-headed Blackbird		0.4	3.4		10.0	8.5	+	1.8	42.2		26.3	14.1	
Red-winged Blackbird	101.9	173.5	87.7	88.8	79.4	95.8	85.1	76.2	152.3	31.4	110.4	115.2	45.9
Orchard Oriole	9.1	0.3	5.6	9.2	+	0.1	3.3	1.8	0.9	5.5	+	3.1	3.2
Scott's Oriole													0.6
Baltimore Oriole	2.2	4.2	10.1	1.3	5.6	3.2	2.7	4.3	2.3	4.7	2.4	0.7	0.1
Bullock's Oriole			0.3					0.2		0.8		+	2.6
Brewer's Blackbird		+	0.2		19.3	6.0		0.3	4.2	0.1	30.1	2.2	+
Great-tailed Grackle	+		0.1	+						1.9			29.6
Boat-tailed Grackle				8.5									+
Common Grackle	36.9	54.3	44.5	81.5	5.3	70.9	64.3	47.2	27.9	13.0	5.6	58.3	6.1
Brown-headed Cowbird	14.8	20.5	38.2	16.2	27.0	16.7	22.3	27.5	49.5	29.4	26.8	34.2	18.8
Bronzed Cowbird													1.4
Western Tanager											+	0.3	
Scarlet Tanager	0.9	+	+			0.5	0.2	+	+	0.4		+	
Summer Tanager	4.5		0.1	4.9			2.8	+		2.1			1.5
Cardinal	34.5	7.9	13.5	58.1		0.8	31.0	2.1	+	17.3		+	26.7
Pyrrhuloxia													10.2
Rose-breasted Grosbeak	+	2.5	0.1		1.2	5.2	1.5	0.7	0.4	+	0.1	+	
Black-headed Grosbeak			0.1					0.1	+			0.1	+
Blue Grosbeak	3.2	0.2	1.2	0.9		0.1	4.1	1.1		4.5		0.8	1.7
Indigo Bunting	24.7	4.9	2.9	10.2	+	2.9	24.3	1.1	0.1	8.0		0.1	1.7
Lazuli Bunting		+	+					+	0.5	+	+	0.1	+
Painted Bunting	0.9		0.1	6.6			+			8.2			14.6
Dickcissel	14.2	62.1	59.7	4.5	+	6.2	54.7	28.6	2.6	29.1		20.5	9.7
Evening Grosbeak						0.9					+		
Purple Finch					0.1	1.0					+		
House Finch								+		+			2.0
Pine Siskin					0.2	0.2			+		0.2	0.3	
American Goldfinch	0.8	11.2	2.3	+	9.2	7.3	4.9	2.5	5.5	1.1	6.0	2.3	+
Lesser Goldfinch													0.9
Red Crossbill						0.1					+	2.0	
Olive Sparrow													0.3
Rufous-sided Towhee	1.9	0.2	0.1	3.9	0.2	0.3	4.7	0.2	0.6	+	0.1	1.3	+
Brown Towhee													0.8
Lark Bunting		+	34.1				+	27.3	93.0	1.1	12.8	102.5	1.4
Savannah Sparrow		2.3			18.8	9.4		+	9.8		16.2	0.6	
Grasshopper Sparrow		11.0	19.0		0.1	2.0	7.8	15.0	14.9	3.7	0.6	21.1	1.2
Baird's Sparrow					0.2				6.9		1.6	0.1	
Le Conte's Sparrow					0.8	0.2			0.1		0.9	+	
Henslow's Sparrow		+	+				0.1					+	
Sharp-tailed Sparrow					0.1	+			0.1		0.1	+	
Vesper Sparrow		17.3	+		15.6	13.6	0.1	1.0	13.8		16.7	4.7	
Lark Sparrow	0.7	0.1	4.2	0.3	+	0.1	1.4	4.0	0.4	18.4	0.2	1.5	21.6
Rufous-crowned Sparrow										0.1			0.8
Bachman's Sparrow	0.1			1.0			+			+			+
Cassin's Sparrow			8.7					0.1		3.2		+	17.7
Black-throated Sparrow													9.4
White-winged Junco												0.3	
Slate-colored Junco						0.1					+		
Chipping Sparrow	3.0	1.8	0.1	2.2	1.5	6.9	3.4	0.8	0.5	0.6	1.5	1.4	0.6
Clay-colored Sparrow					23.7	3.7			13.8		29.9	0.7	
Brewer's Sparrow			+					0.2	+			0.1	+
Field Sparrow	7.5	4.1	2.3	0.7		1.0	21.1	1.9	0.9	15.1		1.2	2.0
White-throated Sparrow					0.7	11.4					0.5		
Swamp Sparrow		+			+	2.1			+		+	0.1	
Song Sparrow		13.5			15.4	18.8	0.9	0.2	3.5		14.0	1.5	
McCown's Longspur								+	0.1		14.9	+	
Chestnut-collared Longspur					0.1			3.0	33.4		6.4	28.4	

Table 4. *Mean number of birds per route*

No. of Routes	42	16	10	39	56	64	16	43	36	5	22	56	27	26
States	Ala	Conn	Del	Fla	Ga	Ill	Ind	Ky	Me	Md	Mass	Mich	Miss	NB
Common Loon									0.9			0.1		0.7
Pied-billed Grebe	+	+	+	0.6	+	0.1	+	+	+	+	+	0.2	+	0.1
Brown Pelican	1.6			0.8										
Double-crested Cormorant	+	0.1	0.1	4.2	+	+			0.8	+	0.3			9.4
Anhinga	+			1.4	0.1								+	
Magnificent Frigatebird				0.2										
Great White Heron				0.3										
Great Blue Heron	0.3	+	0.7	2.4	0.3	0.3	0.3	0.1	0.5	0.9	0.1	0.6	0.2	0.9
Green Heron	1.0	0.3	1.0	3.3	0.9	0.5	0.7	1.7	0.1	1.1	0.3	1.0	1.3	
Little Blue Heron	1.1		+	3.6	1.2	0.1		+		0.1			1.3	
Cattle Egret	9.6		3.0	56.4	10.0	0.1		+	+	1.7			8.2	+
Great Egret	0.2		0.5	6.9	2.8	0.2		+		0.2	+		0.6	
Snowy Egret	0.3		0.4	2.1	0.8				+	0.3	0.2		+	
Louisiana Heron	0.2		+	1.6	0.3					+				
Black-crowned Night Heron	+	+	0.1	0.2	0.2	0.1	+	+	+	0.1	0.3		+	0.1
Yellow-crowned Night Heron	0.1	+	+	0.1	0.1	0.1		+		+			0.4	
Least Bittern	+	+		0.3	+	+				+		+		
American Bittern		+	+	+	+	+	+	+	0.2	+	0.1	0.3		1.0
Wood Stork				1.3	0.4								+	
Glossy Ibis			1.2	0.4	0.4				+	0.5	+			
White Ibis	0.6			14.1	1.2								0.2	
Roseate Spoonbill				0.3										
Mute Swan		+									+	0.1		
Canada Goose	0.1	2.5	0.5			0.2	0.1	+	+	0.2	0.8	0.3		+
Mallard	0.2	2.3	1.0	+	+	1.4	0.6	0.1	0.1	1.3	0.8	1.6	+	+
Black Duck		0.5	0.4				+	+	0.4	0.3	1.1	0.1		1.2
Mottled Duck				1.1										
Gadwall			+			+								
Pintail						+	+							+
Green-winged Teal						+						+		0.1
Blue-winged Teal	+		0.1			0.2	+	+	+	+	+	0.3	+	0.3
American Wigeon												+		0.1
Wood Duck	0.2	0.7	0.3	0.8	0.5	0.4	0.4	0.3	+	0.3	0.3	0.3	0.3	0.1
Ring-necked Duck									+			+		0.2
Lesser Scaup												+		
Common Goldeneye									0.2			+		0.1
Common Eider									+					0.6
Hooded Merganser		0.1				+		+	+			+	+	+
Common Merganser									0.1			+		0.2
Red-breasted Merganser														+
Turkey Vulture	1.4	0.1	4.5	6.1	1.3	0.2	0.8	1.8		3.8	+	0.3	1.4	
Black Vulture	1.8		0.1	4.6	1.6	+	+	0.2		2.2			2.4	
Swallow-tailed Kite	+			0.1	+									
Mississippi Kite	0.1			0.1	+	+		+					0.1	
Everglade Kite				0.2										
Goshawk		+							+		+	+		
Cooper's Hawk	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Red-tailed Hawk	0.2	0.2	0.3	0.4	0.3	0.4	0.4	0.4	+	0.2	0.1	0.3	0.2	+
Red-shouldered Hawk	0.4	0.1	0.1	2.8	0.4	0.1	0.1	0.2	+	0.2	0.1	0.1	0.2	+
Broad-winged Hawk	0.2	0.2	+	0.1	0.1	+	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.1
Bald Eagle				+						+		+		+
Northern Harrier			+			+	+		+	+	+	0.2		0.1
Osprey	+		0.4	0.6	+	+			0.1	0.3	+	+		0.2
Sparrow Hawk	0.1	0.3	0.5	0.3	0.1	0.7	0.9	1.5	1.1	0.5	0.5	0.7	0.1	0.3
Ruffed Grouse		0.1			+			+	0.2	+	0.1	0.2		0.3
Bobwhite	48.1	2.1	46.8	31.9	48.9	31.5	30.6	29.3	+	39.3	8.8	7.1	41.8	
Ring-necked Pheasant		0.8	0.6			13.5	6.7		+	6.2	2.2	11.2		0.2
Turkey	0.1			+	+	+				+	+	0.1	0.1	
Sandhill Crane				0.8	+							0.4	+	
Limpkin				0.6										
King Rail	+		+	0.2	0.1					+		+	+	
Clapper Rail	0.1		0.4	0.1	0.2					+				
Virginia Rail			+	+		+			0.1	0.1	+	+		+

in Eastern States and Provinces, 1965–79.

11 Nfld	23 NH	26 NJ	106 NY	31 NC	24 NS	45 Ohio	72 Ont	89 Pa	4 PEI	46 Que	4 RI	20 SC	42 Tenn	21 Vt	46 Va	34 WVa	67 Wis
0.6	0.1		+		0.7		1.5		0.6	0.8				+			0.5
	+	+	+	+	+	+	0.1	+	0.1	+		+	+	+	+		0.2
				0.1								+					
	+	+		+	1.4			+	1.4	1.2	0.6				+		0.1
												+					
	0.3	0.3	0.5	0.2	1.2	1.4	1.2	0.3	14.0	0.6	+	0.2	+	0.4	0.2	+	1.0
	0.1	0.7	0.6	1.2	+	0.6	0.2	0.5	+	+	0.4	1.0	1.3	0.2	0.9	0.7	0.7
		+		0.1				+				0.5	+		+		
		0.4	+	1.8				0.1				5.0	0.1		0.2		+
		0.1	+	0.3		0.1	+	+			0.3	1.2	+		+		0.1
		0.1	+	0.1							0.6	0.2			+		
		+		0.1								0.1			+		
	+	0.1	0.1	+	+	0.1	0.1	+		0.1	0.7	+	0.1	0.1			+
			+	+		+		+				+	+		+		
	+		+	+			+			+				+			+
0.5	0.5	+	0.1		0.7	+	0.8	+	0.2	0.4		+		0.3	+	+	0.4
												0.1					
		0.2	+	0.1							0.4	+			+		
				0.3								2.5					
		0.1	0.2														
1.5	0.1	1.3	1.3		0.1	0.3	0.3	0.8	+		0.7		0.1	0.1	+	+	0.4
	0.6	1.3	2.4	0.1	0.1	5.1	1.6	1.8		0.1	2.1	0.1	0.1	0.2	0.2	0.1	4.6
0.4	0.5	0.3	0.3	0.1	0.6	+	0.6	0.1	4.6	0.6	1.1			0.5	+	+	0.1
			+					+		+	0.1			+			+
0.3					+	+	+		0.1	0.1							+
1.3	+		+		+		0.2	+		0.1				+			+
	+		+		+	+	0.3	+	1.3	+	0.1		+	0.1		+	1.2
					+	+	+	+	+	+							+
	0.1	0.2	0.3	0.2	+	0.4	0.1	0.1	0.3	+	+	0.6	0.2	0.2	0.3	0.3	0.5
			+		0.2		0.2		0.2	+							+
0.1							+			+							+
0.6	+						0.2		+	0.2				+			+
					0.7				0.2	9.9							
+	+		+				0.1			+				+			0.1
0.3	+		+		0.1		0.3	+		0.1				+			+
0.2			+		0.1		0.1		0.2					+			0.1
	+	2.0	0.1	0.6		2.0	+	0.8				0.6	1.3	+	2.8	1.1	+
				0.2		+		+				0.5	0.4		0.5	+	
				+													
												+	+		+		
0.1	+		+		+		+	+	+	+				+			+
	+	+	+	+	+	+	+	+			+	0.1	+	+	+	0.1	+
+	+	0.2	0.6	0.2	0.2	0.5	0.3	0.3		+	0.1	0.3	0.3	0.2	0.2	0.1	0.6
	0.1	+	0.1	0.2		+	+	0.1		+	0.1	0.3	0.1	0.1	0.2	0.2	0.1
	0.3	0.1	0.1	0.1	+	+	0.3	0.2		0.1	0.4	+	0.2	0.1	0.1	0.1	0.2
		+			0.1	+	+	+							+		+
	+		0.1	+	0.1	+	0.2	+	0.2	0.2			+	+	+	+	0.3
0.3	+	+	+	0.2	0.3	+	+	+	0.1	0.1		+	+		+		+
	0.5	1.0	1.3	0.1	0.2	0.9	1.0	0.6	+	0.4	0.8	+	0.4	0.6	0.3	0.4	0.7
	0.3	+	0.1		0.5	+	0.5	0.1	0.6	0.2	+		+	0.4	+	+	0.3
	+	15.8	1.1	40.7		26.1	0.3	2.3			3.4	46.9	31.7		39.5	10.5	1.0
	0.2	5.6	4.9		1.3	2.9	0.3	6.8	0.3	+	5.4			+	0.6	0.2	4.0
	+		+	+		+		0.1				+	0.1	+	0.1	+	+
							+										0.3
														+	+	+	+
		+	+	+								0.1			+		
	+		+		+	+	+	+		+				0.1			+

Table 4. *Mean number of birds per route*

No. of Routes	42	16	10	39	56	64	16	43	36	5	22	56	27	26
States	Ala	Conn	Del	Fla	Ga	Ill	Ind	Ky	Me	Md	Mass	Mich	Miss	NB
Sora	+					+	+	+	+			+		0.1
Purple Gallinule				0.1	0.1									
Common Gallinule	+			2.1	+	+				+	+	+		
American Coot	0.1	+		1.4		0.2	+	+				+		
Wilson's Plover	+			0.1										
Killdeer	1.9	0.9	4.0	2.3	0.6	3.3	5.8	4.1	1.8	3.1	1.3	7.4	2.4	2.7
American Woodcock	+	0.1	+	+	+	+	+	+	0.2	0.1	0.1	+	+	0.1
Common Snipe						+			0.5			0.4		4.9
Upland Sandpiper						0.3	0.1		0.7	+	0.1	0.5		+
Spotted Sandpiper	+	+	+	+	+	+	+	+	0.1	+	+	0.2		1.0
Solitary Sandpiper														
Willet	0.1		6.4	0.2						0.3				
Greater Yellowlegs														
Least Sandpiper									+					
Black-necked Stilt				0.5										
Great Black-backed Gull		+	1.1						0.7	+	1.2			1.6
Herring Gull	+	2.0	5.5	0.1					12.1	0.2	36.5	4.0		11.6
Ring-billed Gull	+	+	3.6	+		+				0.2	0.2	2.5		0.2
Laughing Gull	0.7		16.5	5.0					+	8.7	+			
Black-legged Kittiwake														
Gull-billed Tern				+						+				
Forster's Tern	+		+	0.1	0.1	+				+				
Common Tern		+	3.1	+			+		+	+	1.3	+		1.0
Arctic Tern														
Roseate Tern				+							0.1			
Least Tern	0.6		2.4	4.9	+	+		+		+	0.8			
Royal Tern	0.2		+	0.9						+				
Caspian Tern	+		0.1	+						+		+		
Black Tern						0.1						0.2		0.1
Black Skimmer	0.1		0.8	0.7	0.2					+				
White-crowned Pigeon				0.9										
Rock Dove	3.5	4.4	7.7	2.0	4.0	15.8	10.9	4.3	1.1	19.1	8.1	6.8	1.1	3.3
Mourning Dove	33.9	19.5	18.4	19.1	39.7	37.5	50.3	34.6	1.8	29.0	15.4	18.4	30.1	0.2
Ground Dove	0.4			9.2	3.0								+	
Yellow-billed Cuckoo	9.3	1.0	3.0	3.5	6.6	4.5	3.9	10.1	+	4.6	0.2	0.8	10.7	
Black-billed Cuckoo	+	2.0	0.4		0.1	0.4	0.5	0.1	1.4	0.2	0.4	1.7		0.8
Smooth-billed Ani				0.4										
Screech Owl	0.1	+	+	+	0.1	+	+	0.1	+	+	+	+	+	
Great Horned Owl	+	+	0.2	0.1	+	0.1	+	0.1	+	0.1	+	0.1	+	+
Burrowing Owl				0.7										
Barred Owl	0.2	+	0.1	0.4	0.1	0.1	0.1	0.1	+	0.1	+	+	0.1	+
Short-eared Owl						+								
Chuck-will's-widow	3.2		0.2	2.6	2.8	+	0.2	0.5		0.2			2.6	
Whip-poor-will	0.1	0.1	1.1		0.2	0.5	0.3	0.8	0.1	0.9	0.2	0.2	+	0.1
Common Nighthawk	0.8		1.1	11.7	0.8	0.2	0.1	0.2	0.2	0.1	+	0.4	1.3	0.6
Chimney Swift	18.1	6.2	9.1	4.1	16.1	15.6	10.2	21.4	4.9	12.0	10.3	2.1	11.7	2.2
Ruby-throated Hummingbird	0.3	+	0.3	0.1	0.3	0.3	0.5	0.5	0.4	0.5	0.1	0.1	0.5	0.5
Belted Kingfisher	0.8	0.3	0.2	0.1	0.5	0.2	0.5	0.6	0.3	0.4	0.3	0.4	0.4	0.7
Yellow-shafted Flicker	2.8	8.0	3.8	3.0	3.0	4.2	4.9	5.1	3.1	5.4	6.4	5.8	2.5	3.2
Pileated Woodpecker	1.3	0.2	0.1	1.4	1.5	0.1	0.3	1.3	0.6	0.5	0.1	0.1	1.0	0.1
Red-bellied Woodpecker	11.0	+	6.4	15.4	11.8	2.9	3.9	6.9		6.5		0.3	8.3	
Red-headed Woodpecker	1.5		+	2.3	2.3	6.9	4.6	0.6		0.1		1.3	1.3	
Yellow-bellied Sapsucker		0.2							4.6	+	0.7	0.3		11.4
Hairy Woodpecker	0.3	1.2	0.2	0.1	0.3	0.1	0.2	0.4	2.0	0.4	0.9	0.6	0.3	0.7
Downy Woodpecker	2.9	4.3	1.8	1.4	2.6	1.5	1.8	3.4	1.3	3.2	2.0	1.4	1.9	0.5
Red-cockaded Woodpecker	+			0.1	+								+	
Northern Three-toed Woodpecker														+
Eastern Kingbird	9.0	5.8	2.5	3.7	8.2	4.0	3.9	5.7	2.5	3.7	5.7	6.3	8.6	1.2
Gray Kingbird	+			0.8						+				
Great Crested Flycatcher	6.3	2.9	3.0	12.4	7.5	2.3	3.2	2.9	0.7	4.4	2.6	4.9	4.3	0.1
Eastern Phoebe	0.8	5.5	1.3	+	0.5	0.8	0.9	3.7	3.3	1.5	5.0	1.9	0.1	1.0
Yellow-bellied Flycatcher									0.8		+	+		2.7

in Eastern States and Provinces, 1965-79—Continued.

11 Nfld	23 NH	26 NJ	106 NY	31 NC	24 NS	45 Ohio	72 Ont	89 Pa	4 PEI	46 Que	4 RI	20 SC	42 Tenn	21 Vt	46 Va	34 WVa	67 Wis
	+				+	+	0.1	+	0.1	+				+			0.2
			+	+		+	0.1	+		+		+		+			+
			+	0.1		+		+					+			+	0.1
	1.8	1.4	6.0	0.6	0.3	7.7	6.7	3.9	1.3	6.6	0.8	0.5	2.2	3.1	1.7	1.7	8.5
	+	+	0.1	+	0.1	+	0.1	+	1.2	0.1	0.1	+	+	0.1	+	+	0.1
8.2	0.6		0.2		4.4	+	2.3	+	12.3	2.7	+			0.6			0.8
		0.1	0.3		+	0.4	0.6	0.1		0.2	+			+		+	1.1
1.8	0.2	+	0.4	+	1.1	0.1	0.7	0.1	0.1	0.8			+	0.4	+	+	0.4
4.2																	
		0.2		0.4	2.7							+			+		
4.2					0.1					+							
0.9					+					+							
				+													
8.7	0.2	+	+	+	9.9				15.0	1.0	2.0						
23.7	6.3	0.6	1.1	+	29.6	0.8	7.3	+	59.5	10.1	69.6	+		0.8	0.2		5.8
		0.1	1.7	0.1	+	1.1	10.9	+	0.2	1.7		0.3		3.7	+		1.8
		4.1	+	4.2							0.1	1.7			9.9		
1.0																	
				0.1								+					
		+		+											+		+
1.6		0.1	0.1	0.2	0.9	+	0.2		5.5	1.3	3.4				+		0.4
0.2					+												
					+												
		0.1	+	0.2								+	+		+		
		+		1.1								0.1			+		
							+			+		+					0.1
			+			+	0.5			+							1.1
		0.1	+	+								+			+		
0.3	2.5	18.8	13.9	5.8	2.0	14.4	4.1	19.0	5.2	2.2	16.0	1.8	4.0	6.6	5.1	10.7	17.5
	5.5	31.6	12.1	49.4	+	32.7	4.0	14.8	0.1	0.7	7.6	34.7	31.3	3.6	31.9	9.0	16.2
				+								0.1					
	+	1.3	0.3	4.9		2.1	0.1	1.6		+	0.3	5.3	9.8	0.1	5.6	2.8	0.7
	0.4	0.5	0.6	+	0.1	0.5	1.7	0.7	0.2	0.8	1.1	+	+	0.5	0.5	0.8	1.9
				+		+						+	+	+	+	+	+
0.1	+	+	0.1	+	+	0.1	0.1	+	0.1	+	+	+	+	+	+	+	0.1
	0.1		0.1	0.1	0.1	+	+	+		+	+	0.2	0.1	0.1	0.1	+	0.1
0.1					+		+			+							+
				1.3								1.7	1.0		0.3		
	0.2	0.5	+	0.7	+	0.2	0.1	0.1		0.1	0.7	0.6	0.7	+	1.1	0.4	0.2
	0.1	0.1	+	0.2	0.2	0.1	0.5	0.1		0.1	+	1.0	0.4	0.1	0.1	+	0.2
	10.5	7.9	3.6	16.7	2.9	15.6	1.1	9.4		1.1	7.3	12.9	15.6	4.0	10.4	11.3	4.2
	0.4	0.1	0.2	0.5	0.3	0.2	0.2	0.2	0.1	0.2	0.1	0.6	0.4	0.5	0.5	0.4	0.2
0.3	0.5	0.2	0.7	0.5	0.8	0.3	1.1	0.6	1.2	0.8		0.5	1.0	0.9	0.8	0.6	0.5
0.4	4.1	5.6	6.3	5.5	3.4	4.4	4.7	7.2	4.3	2.7	5.9	3.8	3.2	5.6	5.6	6.2	6.3
	0.3	+	0.3	1.0	0.2	0.4	0.3	0.3		+		1.5	1.6	0.2	1.2	1.5	0.4
		0.4	0.1	7.6		1.9	+	0.3				11.0	7.6		7.9	1.5	0.5
		+	0.1	0.8		2.0	0.1	0.1				1.5	0.3	+	0.1	+	3.0
	1.8		1.5		2.5	+	2.5	0.2	0.2	1.7				1.8		+	0.9
0.1	1.5	0.3	0.6	0.3	0.7	0.2	0.7	0.4	0.4	0.3	0.3	0.4	0.3	1.3	0.4	0.3	0.7
0.2	1.7	1.7	1.8	2.3	0.8	1.4	0.8	1.9	0.1	0.4	1.6	2.9	2.6	1.7	3.0	2.5	1.4
				0.1								0.4			+		
0.8							+										
	5.6	4.8	4.6	3.6	1.0	1.4	3.5	1.9	1.0	2.0	2.7	6.5	4.5	5.1	4.5	1.5	3.9
	1.7	3.7	2.9	5.0	0.1	2.0	2.5	2.9		1.2	2.3	8.3	2.4	1.7	3.9	3.2	6.1
	8.3	1.4	4.2	2.3	+	1.9	1.7	4.0	0.4	1.4	5.6	1.2	2.7	7.2	4.3	6.8	1.9
12.8	0.3		+		2.1		0.2		0.6	0.5				0.1			

Table 4. *Mean number of birds per route*

No. of Routes	42	16	10	39	56	64	16	43	36	5	22	56	27	26
States	Ala	Conn	Del	Fla	Ga	Ill	Ind	Ky	Me	Md	Mass	Mich	Miss	NB
Acadian Flycatcher	1.2	+	1.9	0.3	1.2	0.4	1.2	3.1	+	3.2	+	0.1	0.7	
Willow Flycatcher		0.2	+		+	0.6	1.2	0.1	+	0.3	0.2	1.6		
Alder Flycatcher		0.1				+	+		4.7	+	0.2	0.9		13.5
Least Flycatcher		3.5			+	0.1	0.1	+	3.5	0.4	3.2	4.3		6.3
Eastern Wood Pewee	5.2	3.9	3.7	0.5	3.6	2.4	4.4	7.9	2.5	6.8	3.2	4.0	2.2	2.2
Olive-sided Flycatcher									0.8		+	0.1		2.0
Horned Lark	0.1		5.4			37.9	18.0	1.3	0.1	3.3	0.1	4.4	0.9	0.5
Tree Swallow		3.6	0.6			0.4	0.1	+	24.8	0.2	7.7	7.6		15.4
Bank Swallow	+	1.2	0.2			0.9	0.8	0.1	8.5	1.4	2.2	2.9	+	18.0
Rough-winged Swallow	3.0	0.3	0.6	0.3	2.1	0.8	1.5	2.1	0.2	0.5	0.3	0.5	0.8	+
Barn Swallow	8.2	10.4	19.4	0.3	2.1	23.5	17.1	33.7	30.1	22.5	10.1	15.0	11.5	23.6
Cliff Swallow	0.3	0.1		+		0.2	0.2	+	11.0	0.2	0.3	3.8		6.2
Purple Martin	24.6	0.1	6.6	10.6	12.0	5.6	6.5	5.7	0.4	6.0	0.1	3.3	11.8	1.5
Gray Jay									0.1			+		1.2
Blue Jay	38.6	22.5	12.4	23.4	39.6	9.9	9.5	16.7	8.9	12.4	29.5	11.1	26.1	5.5
Scrub Jay				0.7										
Common Raven									8.7	+		1.5		11.4
Common Crow	30.7	28.1	24.6	17.5	36.8	20.3	22.6	34.3	18.9	37.3	20.7	28.1	19.3	24.9
Fish Crow	6.7	+	3.1	14.3	2.5	+		+		2.5			2.8	
Black-capped Chickadee		10.2				1.0	0.1		6.5	0.6	15.0	3.2		2.8
Carolina Chickadee	8.8		3.7	2.3	6.3	0.5	1.4	5.0		5.4			4.7	
Boreal Chickadee									0.3		+	+		1.5
Tufted Titmouse	9.4	6.0	8.3	6.8	6.8	3.7	6.7	11.4	+	11.0	2.0	1.3	7.1	
White-breasted Nuthatch	0.2	3.8	+		0.2	0.4	0.7	0.6	0.6	0.5	2.1	1.6	0.1	0.1
Red-breasted Nuthatch		0.1							2.0		0.3	0.4		1.2
Brown-headed Nuthatch	2.6		+	1.4	3.1					0.1			0.6	
Brown Creeper		0.3							0.2	+	0.3	+		+
House Wren	+	15.2	1.9		+	6.3	4.0	0.5	0.4	7.1	9.1	4.0	+	+
Winter Wren		0.1							4.8	+	0.2	0.5		6.9
Bewick's Wren	+					+	+	0.9		+			0.5	
Carolina Wren	16.8	0.1	6.5	20.4	14.2	1.4	3.0	8.7		7.4	0.1	+	12.3	
Long-billed Marsh Wren		+	0.8			+	+			0.7	0.1	0.1		
Short-billed Marsh Wren		+	+			0.1	0.1	+	+	+	+	0.5		
Northern Mockingbird	45.4	4.0	23.5	59.9	39.1	5.5	5.7	15.6	0.1	26.6	3.4	0.1	35.2	+
Gray Catbird	2.2	23.7	7.3	+	2.9	3.6	4.5	8.3	7.6	12.8	19.3	5.1	0.7	3.4
Brown Thrasher	6.2	4.1	3.1	3.4	7.7	6.9	4.8	5.5	1.6	4.6	3.4	4.6	6.2	+
American Robin	6.8	52.0	32.7	+	3.8	36.0	33.3	33.9	44.0	42.4	72.1	46.4	8.4	62.9
Wood Thrush	13.7	19.1	13.6	0.6	8.9	1.1	3.1	10.8	9.7	18.1	15.2	2.3	8.5	2.2
Hermit Thrush		0.4							11.4	+	0.9	2.4		8.0
Swainson's Thrush		+							4.5		0.1	0.4		24.2
Gray-cheeked Thrush									0.1		+			+
Veery		8.9				+	+	+	12.9	0.9	6.3	4.4		14.9
Eastern Bluebird	4.1	0.7	0.4	3.5	4.2	2.0	3.4	10.9	0.2	1.2	0.3	1.5	2.5	+
Blue-gray Gnatcatcher	3.0	0.1	0.4	2.0	1.9	0.3	1.1	3.3		1.1	+	0.1	1.7	
Golden-crowned Kinglet		+							1.1		+	+		0.2
Ruby-crowned Kinglet		+							2.5		+	0.3		11.7
Cedar Waxwing	+	1.9	0.2		+	0.9	0.6	0.6	6.8	0.7	4.1	7.2		4.8
Northern Shrike														
Loggerhead Shrike	3.3			8.5	3.6	0.7	+	1.0		+		+	3.3	
Starling	26.0	64.7	116.0	6.8	19.1	98.5	121.6	76.8	57.8	113.8	91.4	88.7	15.8	49.9
White-eyed Vireo	9.2	0.2	4.7	10.5	5.7	0.6	1.0	6.0		3.1	+	+	9.5	
Bell's Vireo						0.3	+					+	+	
Yellow-throated Vireo	1.2	1.7	0.4	0.9	0.8	0.2	0.6	1.4	0.1	0.7	0.1	0.3	1.0	
Solitary Vireo	+	0.1			+			+	3.3	+	0.4	+		1.4
Black-whiskered Vireo				0.4										
Red-eyed Vireo	5.3	14.5	9.9	2.2	4.1	0.7	2.8	8.3	26.2	15.8	19.8	11.1	2.1	15.4
Philadelphia Vireo									0.1					0.3
Warbling Vireo	+	1.5	0.1			1.9	2.6	0.8	0.6	0.2	0.6	3.5	0.2	+
Black-and-white Warbler	0.4	3.5	0.7		0.1	+	+	0.6	4.8	0.6	3.5	0.8	0.4	2.9
Prothonotary Warbler	1.6		0.5	1.6	1.0	0.1	+	0.3		0.3			1.8	
Swainson's Warbler	+			+	+			+		+			0.2	
Worm-eating Warbler	0.1	0.2	0.3		+	+	+	0.2		0.3			0.1	

in Eastern States and Provinces, 1965–79—Continued.

11 Nfld	23 NH	26 NJ	106 NY	31 NC	24 NS	45 Ohio	72 Ont	89 Pa	4 PEI	46 Que	4 RI	20 SC	42 Tenn	21 Vt	46 Va	34 WVa	67 Wis
	+	+	+	2.6		1.8		0.7				1.5	3.0		5.3	6.8	+
	0.1	0.2	1.8	0.1		2.4	0.3	1.4		+			+	0.2	0.2	0.5	0.8
+	2.7	+	1.0		18.3	0.1	5.5	0.1	7.0	7.8				1.7		+	1.0
0.1	8.9	0.2	5.3	0.2	4.3	0.2	7.5	2.5	1.4	5.2	0.9		+	5.0	0.3	0.4	5.2
	4.1	1.6	3.3	7.0	2.2	3.9	1.6	4.4	1.4	1.1	3.7	4.3	6.8	2.8	9.7	8.1	4.0
0.3	0.4		0.2		1.8		0.8	+	1.2	0.6				0.3			0.1
1.5		0.2	1.6	+	+	11.8	1.3	0.9	0.8	1.7			0.7	0.1	0.6	0.3	4.8
4.6	17.8	1.2	7.1	+	14.3	0.5	11.7	1.7	17.1	9.9	2.5			20.5	0.1	+	9.0
0.3	3.7	2.0	7.2	0.1	9.4	0.9	7.7	1.0	56.2	19.1			0.1	6.7	0.1	0.4	8.0
	0.3	0.7	0.5	1.6		0.9	0.4	0.8		0.1	0.1	1.3	1.4	0.3	1.6	1.2	1.5
	20.7	12.3	25.9	9.4	21.9	15.6	14.3	24.4	13.0	19.8	8.0	4.1	25.7	31.4	18.3	16.8	17.0
	4.8	+	1.4	1.0	2.0	0.1	5.4	1.3	0.3	2.9			0.8	1.5	0.2	0.3	21.0
	0.3	6.2	1.2	5.4		6.5	1.4	2.6		0.3	0.9	8.9	4.1	1.2	2.2	2.3	8.3
7.6	+		+		0.1		1.0		0.1	0.5							+
	18.3	19.4	11.1	21.9	3.4	6.6	4.3	8.4	2.6	2.8	18.7	28.0	19.9	13.1	15.6	3.8	13.3
1.6	0.3		+	0.1	8.7		5.9	0.1	4.7	1.5				0.2	0.2	0.1	1.3
8.3	16.0	26.1	29.4	27.5	40.8	24.7	24.7	31.6	83.4	35.3	16.9	24.3	27.7	25.3	47.7	37.4	37.6
		2.0	+	2.8				0.3				2.7	+		0.7	0.1	
0.4	12.8	0.9	6.1		3.6	0.4	2.7	3.1	1.4	2.0	8.0			8.5	0.2	0.6	3.0
		2.3		7.2		1.1		0.2				7.1	5.5		8.0	4.4	
4.4	0.1		+		2.2		0.1		0.7	0.4				+			+
	+	4.5	0.4	8.6		8.3		3.9			3.1	7.2	10.9	+	10.9	11.9	0.1
	2.0	0.6	1.3	0.5	0.1	0.6	0.3	1.1		0.2	1.2	0.2	0.6	1.7	1.1	1.8	1.8
+	1.0	+	0.5	+	0.6	+	1.2	+	0.2	0.9	0.2		+	0.6		+	0.3
				1.2								2.8			0.1		
	0.3	+	0.2		+	+	0.1	0.1	+	0.1				0.1		+	+
	4.8	9.2	10.3	0.5		6.4	1.6	12.8		0.4	8.5	0.1	0.1	2.4	2.3	3.9	10.0
1.2	2.1		0.9	+	1.4		3.1	+	+	8.0			+	1.3	+	+	0.5
						0.1		+					0.5		0.1	0.2	+
		0.7	+	16.2		3.5	+	0.8			0.2	24.7	9.2		9.5	7.2	+
	0.1	0.2	0.1	+		+	+	+		+	0.1			0.1	+		0.3
	+		+			+	0.2	+		+		+					3.1
	0.2	20.2	1.1	28.5	+	3.3	+	3.0		+	6.1	34.9	24.4	0.1	25.2	4.6	+
	12.9	14.4	12.3	5.7	3.3	4.9	2.1	14.3	0.2	2.0	19.2	2.9	4.4	8.0	6.9	12.7	7.8
	2.8	4.5	3.1	6.3	+	3.3	2.5	2.7		1.1	2.3	6.8	5.4	1.5	5.8	4.4	5.0
37.1	56.8	58.5	64.0	14.2	57.4	49.9	33.8	69.4	98.4	32.6	60.3	5.9	12.7	57.4	22.8	42.8	41.9
	23.7	8.3	15.5	17.9	+	5.8	2.6	15.2	0.1	2.8	13.6	18.2	10.0	19.0	22.7	22.1	1.6
10.1	1.9	+	1.1		9.2	+	5.3	0.7	1.4	5.8	0.4			2.6	+	+	1.3
7.6	1.2		0.4		14.8		7.9	+	3.9	17.5				0.2			+
12.9	+				0.1		0.1			0.1							
	17.2	0.5	9.0	0.3	3.9	0.1	18.1	3.2	0.1	12.9	5.3			15.0	+	0.1	7.1
	0.5	0.1	0.5	2.7		3.8	0.2	1.2		0.2	0.2	4.0	6.2	0.7	3.4	7.0	1.9
	+	0.1	+	2.5		1.6	+	0.6				3.5	3.5	+	3.0	4.4	+
	0.2	+	0.2	+	0.6	+	0.3	+	0.2	0.5				0.1		+	0.1
7.7	0.7		0.1		17.1		3.5		4.4	7.2				0.3			0.1
	9.5	0.2	8.6	0.2	0.9	2.6	5.9	4.7	+	5.0	0.3	+	0.3	5.5	0.4	2.6	5.6
0.1																	
			+	2.0	+	+	0.1	+		+		2.5	2.3		0.8	+	+
2.2	50.5	124.7	119.4	43.4	38.9	146.1	60.1	93.7	72.6	64.8	108.9	33.8	48.3	69.0	75.6	77.5	69.3
		0.5	+	2.7		1.1	+	0.1			0.2	3.8	5.5		2.6	4.7	+
																	+
	0.2	0.2	0.6	1.0		0.6	0.1	0.7		+	0.4	0.4	1.7		0.3	2.1	0.2
	1.9		0.9	0.6	3.2	+	0.9	0.2	0.2	0.6	0.1	+	0.1	1.0	0.1	0.2	0.2
	40.8	3.3	18.4	10.6	14.9	4.9	26.9	18.1	8.5	16.6	16.4	5.5	9.0	24.3	20.0	23.9	13.4
	+		+				0.3			1.4				+			+
	1.4	0.4	2.4	+	+	2.6	1.1	0.7		0.6	0.1		0.1	1.1	0.2	1.7	4.2
1.4	6.1	1.0	1.2	0.9	5.0	+	2.6	1.0	0.5	1.6	3.0	0.1	1.1	1.9	1.1	2.1	1.3
		+	+	0.8				+				1.2	0.4		0.3	+	+
				0.1								+	+		+	+	
	+	+	+	0.3		+		0.2					0.4		0.4	0.6	+

Table 4. *Mean number of birds per route*

No. of Routes	42	16	10	39	56	64	16	43	36	5	22	56	27	26
States	Ala	Conn	Del	Fla	Ga	Ill	Ind	Ky	Me	Md	Mass	Mich	Miss	NB
Golden-winged Warbler		+			+	+	+	+		0.1	0.1	0.2		
Blue-winged Warbler	0.1	4.6	+		+	+	0.1	0.4		0.1	0.8	0.1	+	
Tennessee Warbler									0.9		+	+		9.9
Nashville Warbler		+				+			7.1		0.5	2.3		7.5
Northern Parula	1.1	0.1	+	4.1	1.7	0.1	+	0.3	5.4	1.0	0.1	0.1	2.1	4.8
Yellow Warbler	0.2	6.7	1.0	+	0.1	0.4	1.3	2.9	5.6	1.2	5.9	4.2	+	8.1
Magnolia Warbler		0.1							5.1	0.1	0.2	0.1		12.1
Cape May Warbler									0.7			0.1		1.5
Black-throated Blue Warbler		0.2			+				1.5	0.1	0.5	0.1		0.4
Myrtle Warbler		+				+			3.6		0.3	0.7		3.2
Black-throated Green Warbler	0.2	0.3			+			+	5.1	0.1	1.0	1.0		4.8
Cerulean Warbler	+	+				+	0.2	1.0		0.1	+	+		
Blackburnian Warbler	+	0.3							2.8	0.1	0.5	0.4		1.1
Yellow-throated Warbler	0.6		0.1	0.7	0.6	+	0.1	0.7		0.1			0.1	
Chestnut-sided Warbler		5.9			+		+	+	7.9	0.5	5.6	2.7		4.8
Bay-breasted Warbler									1.1					3.6
Blackpoll Warbler									0.2		0.1			1.0
Pine Warbler	5.1	+	2.1	6.3	3.1	+		0.2	0.1	2.4	1.0	0.3	2.0	+
Prairie Warbler	3.6	2.1	0.9	0.3	2.7	+	0.7	3.6	+	2.1	1.7	+	0.5	
Palm Warbler									+			+		+
Ovenbird	0.3	9.5	4.9		0.4	0.1	+	1.4	21.1	4.3	8.9	11.1	+	19.4
Northern Waterthrush		0.3							1.8	+	0.1	0.4		4.3
Louisiana Waterthrush	0.2	0.4	0.2		0.1	+	0.1	0.3		0.4	0.2	+	0.1	
Kentucky Warbler	1.8		1.4	+	0.8	0.1	0.8	2.2	+	1.0			1.6	
Connecticut Warbler												+		
Mourning Warbler									0.2		+	0.8		1.7
Common Yellowthroat	7.0	16.2	14.0	16.5	6.6	9.9	12.2	18.8	21.8	12.5	20.0	9.1	11.6	22.7
Yellow-breasted Chat	18.4	0.1	2.6	0.5	7.5	1.9	5.6	18.6	+	4.3	0.3	0.1	12.6	+
Hooded Warbler	1.7	+	0.1	0.7	1.1	+	0.1	0.7		0.4		+	1.2	
Wilson's Warbler									0.3					1.0
Canada Warbler		0.9							2.0	0.1	0.5	0.2		4.7
American Redstart	0.5	4.0	0.2		0.1	0.2	+	0.6	10.8	1.0	4.3	2.6	0.3	19.3
House Sparrow	45.6	30.6	96.2	22.7	31.4	235.7	214.5	62.4	6.8	88.6	29.4	61.1	32.5	17.0
European Tree Sparrow						0.4								
Bobolink		1.6				4.5	3.7	+	17.0	0.3	3.4	14.2		19.2
Eastern Meadowlark	28.2	3.9	7.6	44.0	20.9	41.3	27.5	56.7	2.4	15.5	4.0	13.5	36.7	0.1
Western Meadowlark						6.7	0.8	+				1.4		
Yellow-headed Blackbird						+								
Red-winged Blackbird	44.4	58.3	58.6	54.0	40.1	191.7	182.1	63.2	18.5	68.4	36.5	95.7	65.3	27.2
Orchard Oriole	10.2	0.1	1.3	2.4	4.3	0.7	1.1	6.8	+	1.9	+	+	12.5	
Spotted-breasted Oriole				0.1										
Baltimore Oriole	+	16.2	1.0		+	2.4	2.0	0.7	1.3	2.2	12.7	4.9	1.7	0.2
Rusty Blackbird									0.3					0.4
Brewer's Blackbird						0.1	+					0.7		
Boat-tailed Grackle	0.3		2.6	24.8	1.3					0.1				
Common Grackle	48.5	35.2	161.2	35.8	46.2	131.5	110.6	142.1	14.5	140.2	48.7	52.7	67.8	28.5
Brown-headed Cowbird	8.1	8.3	3.9	0.7	3.8	10.2	11.9	14.2	6.6	9.0	5.7	15.5	9.2	12.1
Scarlet Tanager	0.2	6.6	2.3		0.2	0.2	0.8	1.6	1.4	4.7	5.3	1.6	+	0.2
Summer Tanager	5.9		0.2	4.0	5.1	0.2	0.7	5.1		0.6			4.9	
Cardinal	53.8	10.7	19.4	40.9	45.1	19.3	20.4	38.6	+	27.9	2.9	5.7	41.1	
Rose-breasted Grosbeak		6.8			+	1.2	0.2		4.1	0.2	2.7	5.6		6.5
Blue Grosbeak	6.6		5.9	1.5	7.9	0.2	+	0.4		3.8			5.3	
Indigo Bunting	26.0	4.1	17.8	2.9	15.1	24.4	30.6	54.6	0.4	23.0	1.8	9.7	17.4	+
Painted Bunting	+			0.2	1.3								1.0	
Dickcissel	0.2				+	32.5	6.7	3.6		+		0.1	6.6	
Evening Grosbeak									12.4			1.0		31.3
Purple Finch		1.5				+	+		10.3	+	1.9	0.8		12.5
House Finch		1.9	+						+	0.1	0.9			
Common Redpoll														
Pine Grosbeak									0.2					0.8
Pine Siskin									1.0		0.1	0.1		4.6
American Goldfinch	0.7	5.7	3.7		0.6	9.7	10.2	8.5	18.4	7.4	6.3	14.3	0.2	13.1

in Eastern States and Provinces, 1965–79—Continued.

11 Nfld	23 NH	26 NJ	106 NY	31 NC	24 NS	45 Ohio	72 Ont	89 Pa	4 PEI	46 Que	4 RI	20 SC	42 Tenn	21 Vt	46 Va	34 WVa	67 Wis
	+	0.1	0.3	0.3		+	+	0.3		+			0.2	+	0.1	1.1	1.1
	+	0.8	0.4	+		0.9		0.3			1.2		0.4		+	1.2	0.2
5.0	+		+		3.5		1.9		0.6	5.8				+			
	1.9		0.7		3.8		7.1	+	0.5	9.0							2.5
	0.5	+	0.2	1.9	5.0	+	0.1	0.1	0.9	0.2		5.5	0.4	0.2	1.6	2.2	0.2
7.7	4.6	2.9	12.9	0.7	13.8	4.6	5.1	7.5	14.3	3.1	4.8	+	2.2	7.0	1.8	13.2	5.0
1.2	2.0		1.3		18.8		3.1	0.1	1.8	5.6				1.3		0.1	0.1
	0.1		+		0.4		0.1		0.2	1.0				+			+
	1.0	+	1.0	0.5	0.6	+	0.4	0.1	0.2	0.4	0.1		0.1	0.9	0.1	0.1	+
12.2	1.8		1.5		5.8	+	3.6	+	1.6	3.4				1.4			0.6
0.7	1.6	+	1.3	0.2	7.4	+	1.4	0.5	0.9	1.5			0.5	1.1	0.1	0.4	1.1
		+	+	+		0.4	+	0.2					0.9	+	0.1	2.7	+
0.1	1.4	+	1.0	0.1	1.3		1.4	0.4	0.2	0.7	+		+	0.5	0.1	+	0.4
				0.8		0.2		+				1.0	1.4		0.3	0.6	
	14.7	0.1	6.3	1.4	9.2	+	14.4	2.2	0.7	7.8	2.8		0.1	10.3	0.1	0.5	4.9
+	0.4		+		0.9		0.3		0.2	1.9				+			+
22.5	0.1		0.1		1.5		0.1		0.1	3.4				+			
	0.4	1.9	+	4.1		+	0.2	+	0.1	+	0.8	3.8	0.3	0.1	4.3	0.2	0.5
	0.2	3.4	0.1	4.1		1.5	+	0.5			3.3	2.2	3.0	+	5.1	4.3	+
0.4					1.3		+		+	+							+
0.5	17.6	4.3	6.2	3.1	7.3	0.3	18.6	4.7	1.5	8.3	6.8	0.2	2.3	7.8	5.0	2.4	11.4
23.9	1.1	+	0.3		0.9		1.3	0.1	+	1.6	0.2			0.2	+	+	0.1
	0.1	0.1	0.1	0.2		0.1		0.2			+	0.1	0.7	0.1	0.7	1.5	+
		0.1	+	0.3		0.5		0.4				0.1	2.4		1.4	2.3	
							0.6			+							0.1
6.6	0.1		0.6		4.3		8.3	0.1	1.0	5.1				0.1		+	1.9
1.5	22.4	10.4	18.2	10.6	25.6	9.5	12.9	13.3	21.3	17.6	14.7	10.2	13.6	20.6	7.9	12.9	17.0
		0.3	+	4.9	+	6.1	+	2.0				8.3	15.6		9.5	15.3	+
		0.1	+	2.4		0.2		0.3				1.4	1.3		1.7	1.6	
8.6	0.2		+		0.5		0.3		0.1	0.9				+			+
	2.2	+	1.0	0.2	1.3		1.9	0.2	0.4	1.9	0.7			0.9	+	+	0.3
4.7	11.6	0.3	5.4	0.4	18.8	0.3	5.5	2.8	5.0	7.1	0.9	+	1.0	6.6	0.9	3.4	2.4
0.6	8.8	43.4	42.1	67.4	12.9	195.4	14.7	52.8	44.7	21.1	29.3	38.2	27.4	20.0	40.8	38.8	92.3
	9.7	0.3	12.4		14.7	4.2	16.6	5.0	24.6	20.4	0.3			17.9		0.1	19.0
	2.6	5.7	15.1	17.5	0.1	27.9	7.7	14.1	0.2	3.1	1.1	22.9	41.7	3.7	26.9	15.7	16.0
			+			0.2	0.5	+		+							25.2
						+	+										0.8
	31.8	34.5	140.7	11.0	11.5	242.1	41.3	94.7	57.5	39.8	49.2	29.9	29.4	85.0	29.3	56.2	158.8
		0.6	+	3.4		0.4	+	0.2			0.2	6.1	8.4		1.9	1.3	+
	6.2	6.3	9.6	+	0.1	2.6	2.8	6.8		1.1	9.8	+	0.2	5.6	1.1	3.5	7.4
8.3	0.1		+		1.2		0.2		0.3	0.6				0.1			+
							0.6										3.6
		0.1		0.6								0.9			+		
	15.9	125.5	59.1	71.0	13.2	109.3	25.5	94.4	143.4	22.1	37.6	76.1	85.1	22.3	133.7	77.7	53.1
	7.2	3.1	12.1	4.5	3.6	9.6	10.9	10.3	7.3	11.3	3.0	2.3	9.3	5.0	6.9	13.9	21.4
	4.6	1.0	3.6	1.3	+	1.7	0.9	6.0		0.8	6.1	+	1.6	4.0	3.8	6.1	2.6
		+		3.0		0.6		+				6.1	4.5		2.5	1.7	
	0.1	8.6	5.2	41.1		19.1	0.6	11.0			0.5	45.1	35.7	1.1	33.7	23.7	4.3
+	4.4	0.6	4.5	0.3	1.1	0.5	5.3	2.0	1.2	4.6	0.9		+	3.4	0.1	0.2	9.1
		0.2		6.6		+		+				8.3	2.3		4.4	0.1	
	1.7	4.8	5.2	26.4	+	18.2	2.0	13.7		1.3	0.8	20.8	40.8	2.4	37.1	36.4	11.2
				0.2								2.1					
	+					0.5		+				+	1.6	+	+	0.1	5.2
+	0.4		0.2		1.2		3.7	+	0.3	10.2				0.1			0.2
1.3	4.0	+	2.3		5.0	0.1	2.1	0.7	1.9	4.2	1.7			3.4		+	1.0
	+	0.5	0.7					0.3			3.1						
3.8							+			+							
10.9					0.3		+		+	0.2							
1.4	1.0		0.1		2.0		1.3		+	7.0				0.3		+	0.1
	12.1	3.7	20.8	2.5	14.1	13.7	9.9	12.4	3.5	11.3	4.2	0.4	3.7	19.6	9.2	15.1	11.6

Table 4. *Mean number of birds per route*

No. of Routes	42	16	10	39	56	64	16	43	36	5	22	56	27	26
States	Ala	Conn	Del	Fla	Ga	Ill	Ind	Ky	Me	Md	Mass	Mich	Miss	NB
Red Crossbill									0.1	+	+	+		0.2
White-winged Crossbill									+					0.6
Rufous-sided Towhee	27.5	18.5	13.7	36.0	29.5	1.9	2.7	12.8	1.9	13.1	25.5	2.7	13.6	+
Savannah Sparrow		0.1				1.6	4.7	+	5.0	0.4	0.5	18.0		12.9
Grasshopper Sparrow	0.2	0.6	1.9		1.2	4.4	6.9	4.5	+	5.6	0.1	1.5	0.3	
Henslow's Sparrow			+			+	0.2	+	+	+		0.6		
Sharp-tailed Sparrow			0.1							+				0.1
Seaside Sparrow	0.4		0.6	+						0.4				
Vesper Sparrow		+	0.9		+	3.6	10.2	+	6.6	2.3	0.1	9.2		0.6
Lark Sparrow						0.5	+	0.1					+	
Bachman's Sparrow	0.3			3.0	0.4			0.1					0.3	
Slate-colored Junco		+							3.3		1.0	0.5		12.2
Tree Sparrow														
Chipping Sparrow	3.0	17.3	15.5	+	2.0	1.4	4.2	9.9	8.1	18.0	12.8	15.4	0.7	13.0
Clay-colored Sparrow						+						0.3		
Field Sparrow	8.0	5.7	11.1	0.5	9.0	11.4	15.9	27.5	0.6	15.1	3.5	7.9	1.9	+
White-crowned Sparrow														
White-throated Sparrow		0.5							32.5		2.9	5.9		59.8
Fox Sparrow														0.3
Lincoln's Sparrow									0.1			+		0.9
Swamp Sparrow		1.0	0.8			+	0.2		1.1	0.1	0.9	0.9		2.3
Song Sparrow	+	30.4	12.7		0.5	19.7	41.1	14.8	24.4	14.2	25.8	32.7		29.4

in Eastern States and Provinces, 1965–79—Continued.

11 Nfld	23 NH	26 NJ	106 NY	31 NC	24 NS	45 Ohio	72 Ont	89 Pa	4 PEI	46 Que	4 RI	20 SC	42 Tenn	21 Vt	46 Va	34 WVa	67 Wis
0.3	0.2		+		0.6		0.1			0.1					+	+	0.3
2.7	0.1		+		0.3		0.4			1.5				+			+
	16.8	17.3	7.4	20.6	+	4.1	0.4	12.1		+	25.6	23.3	11.6	3.3	19.5	14.1	3.2
7.3	1.3		10.9	+	11.1	5.3	18.2	2.6	42.0	22.8	0.1			2.4	+	0.2	28.7
	+	0.2	0.6	0.5		4.9	0.3	2.2		+		1.0	0.9	+	4.0	2.9	2.1
			0.3			0.3	+	0.1						+	+	0.1	0.3
					0.2				2.2		+						
		+	+	0.2								+					
	0.2	0.1	1.6	+	+	5.2	2.8	1.8	1.1	2.0			+	0.4	0.4	0.5	9.8
						+	+						0.1				+
				+		+						0.3	+		+		
11.4	2.4		1.6	0.7	15.5		1.8	0.8	6.0	6.3			+	1.7	+	0.1	0.1
0.8																	
	11.7	10.1	16.7	9.1	4.5	7.7	13.8	21.1	9.7	10.2	7.3	4.8	6.1	9.4	14.7	20.5	10.0
			+				0.4			+							2.3
	3.4	6.7	7.6	11.7		16.5	0.7	12.2		0.2	2.8	12.3	15.7	2.7	16.7	13.1	5.9
20.4							+			+							
26.2	16.0		6.7		44.1		31.3	0.2	43.4	50.5	+			16.9			3.0
21.8					0.8		+			0.4							
11.7	0.6		+		4.4		1.5		0.2	4.2							+
3.3	2.7	0.3	1.1		1.8	0.1	3.1	0.4	1.9	1.3	0.3			1.3		+	1.6
	23.4	18.8	39.8	6.8	33.3	43.5	20.2	28.4	58.0	25.0	23.7	0.5	6.1	33.7	9.8	28.8	30.2

Table 5. *Comparison of Physiographic regions.*

Regions	No. of routes	Total species	Individuals per route	H′
Atlantic Coastal Plain				
01 Subtropical	4	100	1,067	3.464
02 Floridian section	18	147	845	3.491
03 Lower Coastal Plain	54	187	627	3.868
04 Upper Coastal Plain	197	232	819	3.781
05 Mississippi Alluvial Plain	26	147	949	3.253
06 East Texas Prairies	35	215	926	3.384
07 South Texas Brushlands	18	185	1,406	3.363
08 Glaciated Coastal Plain	8	136	1,067	3.219
Eastern Piedmont Plateau				
10 Northern Piedmont	39	159	1098	3.194
11 Southern Piedmont	53	139	743	3.733
12 Southern New England	44	193	718	3.685
13 Ridge and Valley	92	190	864	3.609
14 Highland Rim	49	144	1,021	3.528
15 Lexington Plain	19	131	1,317	3.243
16 Great Lakes Plain	81	201	1,218	3.163
17 Wisconsin Driftless Area	23	155	1,069	3.326
18 St. Lawrence Plain	43	197	1,030	3.300
19 Ozark–Ouachita Plateau	33	139	620	3.821
20 Great Lakes Transition	50	198	753	3.843
Appalachian Mts. & Boreal Forest				
21 Cumberland Plateau	22	123	651	3.897
22 Ohio Hills	50	149	787	3.620
23 Blue Ridge Mountains	15	123	525	3.908
24 Allegheny Plateau	108	188	798	3.541
25 Open Boreal Forest	11	131	415	3.898
26 Adirondack Mountains	27	170	676	3.923
27 Central New England	50	179	672	3.816
28 Spruce–Hardwood Forest	214	253	709	4.146
29 Closed Boreal Forest	74	212	523	4.110
30 Aspen Parklands	61	246	786	4.009
Great Plains				
31 Till Plains	68	171	1,199	2.937
32 Dissected Till Plains	59	178	1,004	3.231
33 Osage Plains	61	207	810	3.570
34 High Plains Border	38	197	943	3.301
35 Staked and Pecos Plains	19	136	580	2.930
36 High Plains	31	190	886	2.849
37 Drift Prairie	44	197	998	3.629
38 Missouri Plateau-Glaciated	35	178	937	3.561
39 Missouri Plateau-Unglaciated	55	208	851	3.008
40 Black Prairie	35	177	992	3.403
53 Edwards Plateau	19	150	630	3.403
54 Colorado and Uinta Basins	5	94	198	3.201
Western Mountains				
61 Black Hills	4	103	457	3.468
62 Southern Rocky Mountains	12	170	463	3.932
63 High Plateaus of Utah	2	98	298	3.456
64 Central Rocky Mountains	79	260	501	4.218
65 Dissected Rocky Mountains	16	198	593	3.779
66 Sierra–Trinity Mountains	24	186	477	4.071
67 Cascade Mountains	20	178	474	4.206
68 Canadian Rocky Mountains	32	175	404	3.868

Table 5. *Continued.*

Regions	No. of routes	Total species	Individuals per route	H′
Arid Interior				
81 Mexican Highlands	30	215	458	3.868
82 Sonoran Desert	19	152	954	2.512
83 Mojave Desert	27	127	203	2.956
84 Pinyon-Juniper Woodland	34	236	395	4.012
85 Pitt-Klamath Plateau	17	208	910	3.987
86 Wyoming Basin	20	169	593	3.467
88 Great Basin	27	195	318	3.596
89 Columbia Plateau	40	211	694	3.627
Pacific Slope				
91 Central Valley	24	153	1,309	3.217
92 California Foothills	53	230	856	3.766
93 Southern Pacific Rain Forest	49	226	704	4.260
94 Northern Pacific Rain Forest	23	189	693	3.894
95 Los Angeles Ranges	10	161	718	3.997

Appendix A

Common[1] and Scientific Names of Avian Species Mentioned

Common name	Scientific name
Common Loon	*Gavia immer*
Arctic Loon	*Gavia arctica*
Red-necked Grebe	*Podiceps grisegena*
Horned Grebe	*Podiceps auritus*
Eared Grebe	*Podiceps nigricollis*
Western Grebe	*Aechmophorus occidentalis*
Pied-billed Grebe	*Podilymbus podiceps*
(American) White Pelican	*Pelecanus erythrorhynchos*
Brown Pelican	*Pelecanus occidentalis*
Double-crested Cormorant	*Phalacrocorax auritus*
Olivaceous Cormorant	*Phalacrocorax olivaceus*
Brandt's Cormorant	*Phalacrocorax penicillatus*
Pelagic Cormorant	*Phalacrocorax pelagicus*
Anhinga	*Anhinga anhinga*
Magnificent Frigatebird	*Fregata magnificens*
Great Blue Heron	*Ardea herodias*
Green (-backed) Heron	*Butorides striatus*
Little Blue Heron	*Egretta caerulea*
Cattle Egret	*Bubulcus ibis*
Great Egret	*Casmerodius albus*
Snowy Egret	*Egretta thula*
[Louisiana] (Tricolored) Heron	*Egretta tricolor*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Yellow-crowned Night-Heron	*Nycticorax violaceus*
Least Bittern	*Ixobrychus exilis*
American Bittern	*Botaurus lentiginosus*
Wood Stork	*Mycteria americana*
Glossy Ibis	*Plegadis falcinellus*
White-faced Ibis	*Plegadis chihi*
White Ibis	*Eudocimus albus*
Roseate Spoonbill	*Ajaia ajaja*
Mute Swan	*Cygnus olor*
Trumpeter Swan	*Cygnus buccinator*
Canada Goose	*Branta canadensis*
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*
Fulvous Whistling-Duck	*Dendrocygna bicolor*
Mallard	*Anas platyrhynchos*
(American) Black Duck	*Anas rubripes*
Mottled Duck	*Anas fulvigula*
Gadwall	*Anas strepera*
(Northern) Pintail	*Anas acuta*

[1]Common names follow 5th edition of the A.O.U. *Check-list of North American Birds* (6th edition additions in parentheses, deletions in brackets); scientific names are from the 6th edition.

Common name	Scientific name
Green-winged Teal	*Anas crecca*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
American Wigeon	*Anas americana*
Northern Shoveler	*Anas clypeata*
Wood Duck	*Aix sponsa*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Canvasback	*Aythya valisineria*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Common Goldeneye	*Bucephala clangula*
Barrow's Goldeneye	*Bucephala islandica*
Bufflehead	*Bucephala albeola*
Oldsquaw	*Clangula hyemalis*
Harlequin Duck	*Histrionicus histrionicus*
Common Eider	*Somateria mollissima*
White-winged Scoter	*Melanitta fusca*
Surf Scoter	*Melanitta perspicillata*
Ruddy Duck	*Oxyura jamaicensis*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Turkey Vulture	*Cathartes aura*
Black Vulture	*Coragyps atratus*
[White-tailed] (Black-shouldered) Kite	*Elanus caeruleus*
(American) Swallow-tailed Kite	*Elanoides forficatus*
Mississippi Kite	*Ictinia mississippiensis*
[Everglade] (Snail) Kite	*Rostrhamus sociabilis*
(Northern) Goshawk	*Accipiter gentilis*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-tailed Hawk	*Buteo jamaicensis*
Red-shouldered Hawk	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Swainson's Hawk	*Buteo swainsoni*
Zone-tailed Hawk	*Buteo albonotatus*
White-tailed Hawk	*Buteo albicaudatus*
Rough-legged Hawk	*Buteo lagopus*
Ferruginous Hawk	*Buteo regalis*
Harris' Hawk	*Parabuteo unicinctus*
Golden Eagle	*Aquila chrysaetos*
Bald Eagle	*Haliaeetus leucocephalus*
[Marsh Hawk] (Northern Harrier)	*Circus cyaneus*
Osprey	*Pandion haliaetus*
(Crested) Caracara	*Polyborus plancus*
Prairie Falcon	*Falco mexicanus*
Peregrine Falcon	*Falco peregrinus*
Merlin	*Falco columbarius*

Common name	Scientific name
American Kestrel	*Falco sparverius*
Blue Grouse	*Dendragapus obscurus*
Spruce Grouse	*Dendragapus canadensis*
Ruffed Grouse	*Bonasa umbellus*
Willow Ptarmigan	*Lagopus lagopus*
Greater Prairie-Chicken	*Tympanuchus cupido*
Lesser Prairie-Chicken	*Tympanuchus pallidicinctus*
Sharp-tailed Grouse	*Tympanuchus phasianellus*
Sage Grouse	*Centrocercus urophasianus*
(Northern) Bobwhite	*Colinus virginianus*
Scaled Quail	*Callipepla squamata*
California Quail	*Callipepla californica*
Gambel's Quail	*Callipepla gambelii*
Mountain Quail	*Oreortyx pictus*
Ring-necked Pheasant	*Phasianus colchicus*
Chukar	*Alectoris chukar*
Gray Partridge	*Perdix perdix*
(Wild) Turkey	*Meleagris gallopavo*
Sandhill Crane	*Grus canadensis*
Limpkin	*Aramus guarauna*
King Rail	*Rallus elegans*
Clapper Rail	*Rallus longirostris*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Yellow Rail	*Coturnicops noveboracensis*
Purple Gallinule	*Porphyrula martinica*
[Common Gallinule] (Common Moorhen)	*Gallinula chloropus*
American Coot	*Fulica americana*
(American) Black Oystercatcher	*Haematopus bachmani*
Semipalmated Plover	*Charadrius semipalmatus*
Snowy Plover	*Charadrius alexandrinus*
Wilson's Plover	*Charadrius wilsonia*
Killdeer	*Charadrius vociferus*
Mountain Plover	*Charadrius montanus*
(Lesser) Golden-Plover	*Pluvialis dominica*
American Woodcock	*Scolopax minor*
Common Snipe	*Gallinago gallinago*
Long-billed Curlew	*Numenius americanus*
Whimbrel	*Numenius phaeopus*
Upland Sandpiper	*Bartramia longicauda*
Spotted Sandpiper	*Actitis macularia*
Solitary Sandpiper	*Tringa solitaria*
Willet	*Catoptrophorus semipalmatus*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Least Sandpiper	*Calidris minutilla*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Stilt Sandpiper	*Calidris himantopus*

Common name	Scientific name
Semipalmated Sandpiper	*Calidris pusilla*
Marbled Godwit	*Limosa fedoa*
Hudsonian Godwit	*Limosa haemastica*
American Avocet	*Recurvirostra americana*
Black-necked Stilt	*Himantopus mexicanus*
Wilson's Phalarope	*Phalaropus tricolor*
[Northern] (Red-necked) Phalarope	*Phalaropus lobatus*
Parasitic Jaeger	*Stercorarius parasiticus*
Glaucous Gull	*Larus hyperboreus*
Glaucous-winged Gull	*Larus glaucescens*
Great Black-backed Gull	*Larus marinus*
Western Gull	*Larus occidentalis*
Herring Gull	*Larus argentatus*
California Gull	*Larus californicus*
Ring-billed Gull	*Larus delawarensis*
Mew Gull	*Larus canus*
Laughing Gull	*Larus atricilla*
Franklin's Gull	*Larus pipixcan*
Bonaparte's Gull	*Larus philadelphia*
Black-legged Kittiwake	*Rissa tridactyla*
Gull-billed Tern	*Sterna nilotica*
Forster's Tern	*Sterna forsteri*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisaea*
Least Tern	*Sterna antillarum*
Royal Tern	*Sterna maxima*
Sandwich Tern	*Sterna sandvicensis*
Caspian Tern	*Sterna caspia*
Black Tern	*Chlidonias niger*
Black Skimmer	*Rhychops niger*
Common Murre	*Uria aalge*
Pigeon Guillemot	*Cepphus columba*
Marbled Murrelet	*Brachyramphus marmoratus*
Rhinoceros Auklet	*Cerorhinca monocerata*
White-crowned Pigeon	*Columba leucocephala*
Band-tailed Pigeon	*Columba fasciata*
Rock Dove	*Columba livia*
White-winged Dove	*Zenaida asiatica*
Mourning Dove	*Zenaida macroura*
Spotted Dove	*Streptopelia chinensis*
(Common) Ground-Dove	*Columbina passerina*
Inca Dove	*Columbina inca*
[White-fronted] (White-tipped) Dove	*Leptotila verreauxi*
Yellow-billed Cuckoo	*Coccyzus americanus*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
(Greater) Roadrunner	*Geococcyx californianus*
Smooth-billed Ani	*Crotophaga ani*
Groove-billed Ani	*Crotophaga sulcirostris*
(Common) Barn-Owl	*Tyto alba*

Common name	Scientific name
(Eastern) Screech-Owl	*Otus asio*
(Western) Screech-Owl	*Otus kennicottii*
Great Horned Owl	*Bubo virginianus*
(Northern) Pygmy-Owl	*Glaucidium gnoma*
Burrowing Owl	*Athene cunicularia*
Barred Owl	*Strix varia*
Long-eared Owl	*Asio otus*
Short-eared Owl	*Asio flammeus*
(Northern) Saw-whet Owl	*Aegolius acadicus*
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*
(Common) Poorwill	*Phalaenoptilus nuttallii*
(Common) Pauraque	*Nyctidromus albicollis*
Common Nighthawk	*Chordeiles minor*
Lesser Nighthawk	*Chordeiles acutipennis*
Black Swift	*Cypseloides niger*
Chimney Swift	*Chaetura pelagica*
Vaux's Swift	*Chaetura vauxi*
White-throated Swift	*Aeronautes saxatalis*
Ruby-throated Hummingbird	*Archilochus colubris*
Black-chinned Hummingbird	*Archilochus alexandri*
Costa's Hummingbird	*Calypte costae*
Anna's Hummingbird	*Calypte anna*
Broad-tailed Hummingbird	*Selasphorus platycercus*
Rufous Hummingbird	*Selasphorus rufus*
Allen's Hummingbird	*Selasphorus sasin*
Calliope Hummingbird	*Stellula calliope*
Blue-throated Hummingbird	*Lampornis clemenciae*
Broad-billed Hummingbird	*Cynanthus latirostris*
[Coppery-tailed] (Elegant) Trogon	*Trogon elegans*
Belted Kingfisher	*Ceryle alcyon*
Yellow-shafted (Northern) Flicker	*Colaptes auratus*
Hybrid flicker	*Colaptes auratus*
Red-shafted (Northern) Flicker	*Colaptes auratus*
Gilded (Northern) Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Golden-fronted Woodpecker	*Melanerpes aurifrons*
Gila Woodpecker	*Melanerpes uropygialis*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Acorn Woodpecker	*Melanerpes formicivorus*
Lewis' Woodpecker	*Melanerpes lewis*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Williamson's Sapsucker	*Sphyrapicus thyroideus*
Hairy Woodpecker	*Picoides villosus*
Downy Woodpecker	*Picoides pubescens*
Ladder-backed Woodpecker	*Picoides scalaris*
Nuttall's Woodpecker	*Picoides nuttallii*
[Arizona] (Strickland's) Woodpecker	*Picoides stricklandi*

Common name	Scientific name
Red-cockaded Woodpecker	*Picoides borealis*
White-headed Woodpecker	*Picoides albolarvatus*
Black-backed [Three-toed] Woodpecker	*Picoides arcticus*
[Northern] Three-toed Woodpecker	*Picoides tridactylus*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Kingbird	*Tyrannus dominicensis*
Tropical Kingbird	*Tyrannus melancholicus*
Western Kingbird	*Tyrannus verticalis*
Cassin's Kingbird	*Tyrannus vociferans*
Thick-billed Kingbird	*Tyrannus crassirostris*
Scissor-tailed Flycatcher	*Tyrannus forficatus*
(Great) Kiskadee [Flycatcher]	*Pitangus sulphuratus*
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*
Great Crested Flycatcher	*Myiarchus crinitus*
[Wied's Crested] (Brown-crested) Flycatcher	*Myiarchus tyrannulus*
Ash-throated Flycatcher	*Myiarchus cinerascens*
[Olivaceous] (Dusky-capped) Flycatcher	*Myiarchus tuberculifer*
Eastern Phoebe	*Sayornis phoebe*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Acadian Flycatcher	*Empidonax virescens*
Willow Flycatcher	*Empidonax traillii*
Alder Flycatcher	*Empidonax alnorum*
Least Flycatcher	*Empidonax minimus*
Hammond's Flycatcher	*Empidonax hammondii*
Dusky Flycatcher	*Empidonax oberholseri*
Gray Flycatcher	*Empidonax wrightii*
Western Flycatcher	*Empidonax difficilis*
Unidentified *Empidonax*	
Eastern Wood-Pewee	*Contopus virens*
Western Wood-Pewee	*Contopus sordidulus*
Olive-sided Flycatcher	*Contopus borealis*
Vermilion Flycatcher	*Pyrocephalus rubinus*
(Northern) Beardless (-Tyrannulet) [Flycatcher]	*Camptostoma imberbe*
(Eurasian) Skylark	*Alauda arvensis*
Horned Lark	*Eremophila alpestris*
Violet-green Swallow	*Tachycineta thalassina*
Tree Swallow	*Tachycineta bicolor*
Bank Swallow	*Riparia riparia*
(Northern) Rough-winged Swallow	*Stelgidopteryx ruficollis*
Barn Swallow	*Hirundo rustica*
Cliff Swallow	*Hirundo pyrrhonota*
Purple Martin	*Progne subis*
Gray Jay	*Perisoreus canadensis*
Blue Jay	*Cyanocitta cristata*
Steller's Jay	*Cyanocitta stelleri*
Scrub Jay	*Aphelocoma coerulescens*
[Mexican] (Gray-breasted) Jay	*Aphelocoma ultramarina*

Common name	Scientific name
Green Jay	*Cyanocorax yncas*
Black-billed Magpie	*Pica pica*
Yellow-billed Magpie	*Pica nuttalli*
Common Raven	*Corvus corax*
[White-necked] (Chihuahuan) Raven	*Corvus cryptoleucus*
[Common] (American) Crow	*Corvus brachyrhynchos*
Northwestern Crow	*Corvus caurinus*
Fish Crow	*Corvus ossifragus*
Pinyon Jay	*Gymnorhinus cyanocephalus*
Clark's Nutcracker	*Nucifraga columbiana*
Black-capped Chickadee	*Parus atricapillus*
Carolina Chickadee	*Parus carolinensis*
Mountain Chickadee	*Parus gambeli*
Boreal Chickadee	*Parus hudsonicus*
Chestnut-backed Chickadee	*Parus rufescens*
Tufted Titmouse	*Parus bicolor*
Black-crested Titmouse (now combined with Tufted Titmouse)	
Plain Titmouse	*Parus inornatus*
Bridled Titmouse	*Parus wollweberi*
Verdin	*Auriparus flaviceps*
Bushtit	*Psaltriparus minimus*
White-breasted Nuthatch	*Sitta carolinensis*
Red-breasted Nuthatch	*Sitta canadensis*
Brown-headed Nuthatch	*Sitta pusilla*
Pygmy Nuthatch	*Sitta pygmaea*
Brown Creeper	*Certhia americana*
Wrentit	*Chamaea fasciata*
(American) Dipper	*Cinclus mexicanus*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes troglodytes*
Bewick's Wren	*Thryomanes bewickii*
Carolina Wren	*Thryothorus ludivicianus*
Cactus Wren	*Campylorhynchus brunneicapillus*
[Long-billed] Marsh Wren	*Cistothorus palustris*
[Short-billed Marsh] (Sedge) Wren	*Cistothorus platensis*
Canyon Wren	*Catherpes mexicanus*
Rock Wren	*Salpinctes obsoletus*
(Northern) Mockingbird	*Mimus polyglottos*
(Gray) Catbird	*Dumetella carolinensis*
Brown Thrasher	*Toxostoma rufum*
Long-billed Thrasher	*Toxostoma longirostre*
Bendire's Thrasher	*Toxostoma bendirei*
Curve-billed Thrasher	*Toxostoma curvirostre*
California Thrasher	*Toxostoma redivivum*
Le Conte's Thrasher	*Toxostoma lecontei*
Crissal Thrasher	*Toxostoma dorsale*
Sage Thrasher	*Oreoscoptes montanus*
(American) Robin	*Turdus migratorius*

Common name	Scientific name
Varied Thrush	*Ixoreus naevius*
Wood Thrush	*Hylocichla mustelina*
Hermit Thrush	*Catharus guttatus*
Swainson's Thrush	*Catharus ustulatus*
Gray-cheeked Thrush	*Catharus minimus*
Veery	*Catharus fuscescens*
Eastern Bluebird	*Sialia sialis*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird	*Sialia currucoides*
Townsend's Solitaire	*Myadestes townsendi*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Black-tailed Gnatcatcher	*Polioptila melanura*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Water Pipit	*Anthus spinoletta*
Sprague's Pipit	*Anthus spragueii*
Bohemian Waxwing	*Bombycilla garrulus*
Cedar Waxwing	*Bombycilla cedrorum*
Phainopepla	*Phainopepla nitens*
Loggerhead Shrike	*Lanius ludovicianus*
(European) Starling	*Sturnus vulgaris*
Black-capped Vireo	*Vireo atricapillus*
White-eyed Vireo	*Vireo griseus*
Hutton's Vireo	*Vireo huttoni*
Bell's Vireo	*Vireo bellii*
Gray Vireo	*Vireo vicinior*
Yellow-throated Vireo	*Vireo flavifrons*
Solitary Vireo	*Vireo solitarius*
Black-whiskered Vireo	*Vireo altiloquus*
Red-eyed Vireo	*Vireo olivaceus*
Philadelphia Vireo	*Vireo philadelphicus*
Warbling Vireo	*Vireo gilvus*
Black-and-white Warbler	*Mniotilta varia*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Worm-eating Warbler	*Helmitheros vermivorus*
Golden-winged Warbler	*Vermivora chrysoptera*
Blue-winged Warbler	*Vermivora pinus*
Tennessee Warbler	*Vermivora peregrina*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Virginia's Warbler	*Vermivora virginiae*
Lucy's Warbler	*Vermivora luciae*
Northern Parula	*Parula americana*
Olive Warbler	*Peucedramus taeniatus*
Yellow Warbler	*Dendroica petechia*
Magnolia Warbler	*Dendroica magnolia*
Cape May Warbler	*Dendroica tigrina*
Black-throated Blue Warbler	*Dendroica caerulescens*

Common name	Scientific name
Myrtle (Yellow-rumped) Warbler	*Dendroica coronata*
Audubon's (Yellow-rumped) Warbler	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*
Black-throated Green Warbler	*Dendroica virens*
Golden-cheeked Warbler	*Dendroica chrysoparia*
Hermit Warbler	*Dendroica occidentalis*
Cerulean Warbler	*Dendroica cerulea*
Blackburnian Warbler	*Dendroica fusca*
Yellow-throated Warbler	*Dendroica dominica*
Grace's Warbler	*Dendroica graciae*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Bay-breasted Warbler	*Dendroica castanea*
Blackpoll Warbler	*Dendroica striata*
Pine Warbler	*Dendroica pinus*
Prairie Warbler	*Dendroica discolor*
Palm Warbler	*Dendroica palmarum*
Ovenbird	*Seiurus aurocapillus*
Northern Waterthrush	*Seiurus noveboracensis*
Louisiana Waterthrush	*Seiurus motacilla*
Kentucky Warbler	*Oporornis formosus*
Connecticut Warbler	*Oporornis agilis*
Mourning Warbler	*Oporornis philadelphia*
MacGillivray's Warbler	*Oporornis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
Yellow-breasted Chat	*Icteria virens*
Red-faced Warbler	*Cardellina rubrifrons*
Hooded Warbler	*Wilsonia citrina*
Wilson's Warbler	*Wilsonia pusilla*
Canada Warbler	*Wilsonia canadensis*
American Redstart	*Setophaga ruticilla*
Painted Redstart	*Myioborus pictus*
House Sparrow	*Passer domesticus*
[European] (Eurasian) Tree Sparrow	*Passer montanus*
Bobolink	*Dolichonyx oryzivorus*
Eastern Meadowlark	*Sturnella magna*
Western Meadowlark	*Sturnella neglecta*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Tricolored Blackbird	*Agelaius tricolor*
Orchard Oriole	*Icterus spurius*
[Black-headed] (Audubon's) Oriole	*Icterus graduacauda*
[Spotted-] (Spot-) breasted Oriole	*Icterus pectoralis*
Hooded Oriole	*Icterus cucullatus*
Scott's Oriole	*Icterus parisorum*
Baltimore (Northern) Oriole	*Icterus galbula*
Bullock's (Northern) Oriole	*Icterus galbula*
Rusty Blackbird	*Euphagus carolinus*
Brewer's Blackbird	*Euphagus cyanocephalus*

Common name	Scientific name
Great-tailed Grackle	*Quiscalus mexicanus*
Boat-tailed Grackle	*Quiscalus major*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Bronzed Cowbird	*Molothrus aeneus*
Western Tanager	*Piranga ludoviciana*
Scarlet Tanager	*Piranga olivacea*
Hepatic Tanager	*Piranga flava*
Summer Tanager	*Piranga rubra*
(Northern) Cardinal	*Cardinalis cardinalis*
Pyrrhuloxia	*Cardinalis sinuatus*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Guiraca caerulea*
Indigo Bunting	*Passerina cyanea*
Lazuli Bunting	*Passerina amoena*
Varied Bunting	*Passerina versicolor*
Painted Bunting	*Passerina ciris*
Dickcissel	*Spiza americana*
Evening Grosbeak	*Coccothraustes vespertinus*
Purple Finch	*Carpodacus purpureus*
Cassin's Finch	*Carpodacus cassinii*
House Finch	*Carpodacus mexicanus*
Pine Grosbeak	*Pinicola enucleator*
Common Redpoll	*Carduelis flammea*
Pine Siskin	*Carduelis pinus*
American Goldfinch	*Carduelis tristis*
Lesser Goldfinch	*Carduelis psaltria*
Lawrence's Goldfinch	*Carduelis lawrencei*
Red Crossbill	*Loxia curvirostra*
White-winged Crossbill	*Loxia leucoptera*
Olive Sparrow	*Arremonops rufivirgatus*
Green-tailed Towhee	*Pipilo chlorurus*
Rufous-sided Towhee	*Pipilo erythrophthalmus*
Brown Towhee	*Pipilo fuscus*
Abert's Towhee	*Pipilo aberti*
Lark Bunting	*Calamospiza melanocorys*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savannarum*
Baird's Sparrow	*Ammodramus bairdii*
Le Conte's Sparrow	*Ammodramus leconteii*
Henslow's Sparrow	*Ammodramus henslowii*
Sharp-tailed Sparrow	*Ammodramus caudacutus*
Seaside Sparrow	*Ammodramus maritimus*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
Rufous-winged Sparrow	*Aimophila carpalis*
Rufous-crowned Sparrow	*Aimophila ruficeps*
Bachman's Sparrow	*Aimophila aestivalis*

Common name	Scientific name
Botteri's Sparrow	*Aimophila botterii*
Cassin's Sparrow	*Aimophila cassinii*
Black-throated Sparrow	*Amphispiza bilineata*
Sage Sparrow	*Amphispiza belli*
White-winged (Dark-eyed) Junco	*Junco hyemalis*
Slate-colored (Dark-eyed) Junco	*Junco hyemalis*
Oregon (Dark-eyed) Junco	*Junco hyemalis*
Gray-headed (Dark-eyed) Junco	*Junco hyemalis*
[Mexican] (Yellow-eyed) Junco	*Junco phaeonotus*
(American) Tree Sparrow	*Spizella arborea*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Brewer's Sparrow	*Spizella breweri*
Field Sparrow	*Spizella pusilla*
Black-chinned Sparrow	*Spizella atrogularis*
Harris' Sparrow	*Zonotrichia querula*
White-crowned Sparrow	*Zonotrichia leucophrys*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
White-throated Sparrow	*Zonotrichia albicollis*
Fox Sparrow	*Passerella iliaca*
Lincoln's Sparrow	*Melospiza lincolnii*
Swamp Sparrow	*Melospiza georgiana*
Song Sparrow	*Melospiza melodia*
McCown's Longspur	*Calcarius mccownii*
Lapland Longspur	*Calcarius lapponicus*
Smith's Longspur	*Calcarius pictus*
Chestnut-collared Longspur	*Calcarius ornatus*

Appendix B

Instructions for Conducting Breeding Bird Survey Routes

Migratory Nongame Bird Studies
Patuxent Wildlife Research Center, Laurel, Maryland 20708
U.S. Fish and Wildlife Service

STRICT ADHERENCE TO THE RULES IS ESSENTIAL FOR STATISTICAL ANALYSIS OF RESULTS!

REQUIREMENTS: It is very important that the observer be familiar with songs, calls and visual identification of all species likely to be encountered. It is advisable, even for experienced observers, to learn the less common species on the available records and tapes. Since identification by songs and calls is required, acute hearing is extremely important. An observer with a significant hearing loss should consider that this will have a serious negative effect on the results.

SCOUTING: Much time can be lost due to closed roads, washed out bridges, and wrong turns. The importance of familiarization with the 50 stops and the proper turns before the day of the run cannot be over-stressed. A scouting trip can save time and frustration, especially for first-time observers or on new routes. First-time observers should also try a dry run to get familiar with the technique and the forms. If the route is far away, try 10 or 20 practice stops somewhere closer to home.

WHEN TO RUN ROUTES: In most States, routes should be run in early or mid-June. In Canada and most bordering States the first week of July can be acceptable. In the desert regions of California, Nevada, Arizona, New Mexico, Texas, and in south Florida routes may be run as early as May, at the discretion of the State Coordinators. In general, a date as near as possible to last year's is desirable, but not necessary.

STARTING: Start at the marked starting point -- do not reverse the route even if the end is closer to home. The starting point is stop number 1. At the proper starting time, which is shown on the Starting Time Map included with the packet, start counting birds at the marked starting point. The times shown are 1/2 hour before official sunrise. This map is accurate -- use it; local papers and TV stations often give incorrect sunrise data. Be at the starting point early to record weather data and odometer readings.

STOP LOCATIONS: Stops are supposedly located at 1/2 mile intervals; unfortunately, car odometers vary. The most important point concerning stops is that all 50 stops should be made in exactly the same location from year to year. If your route map has stops marked on it or a list of stop descriptions attached, use those stops regardless of what your odometer says unless the marked stops are entirely unreasonable -- in which case contact this office on the matter. Please mark the stops or make a list if the map has neither -- this can be done while scouting. The problem of metric odometers makes this a very real necessity. For new routes or unmarked ones, the best approach with a metric odometer is to go 0.8 km for every stop. Two stops (perhaps #17 and #34) may be placed at 0.9 km intervals for more precision, but this can be confusing and odometers vary so much as to render it unnecessary. Most important -- mark the stops and/or make a list, so those stops can be duplicated in the future. If a route problem arises, see the section on route problems.

COUNTING: One and only one observer should count. Counting should be done from outside the car, but from a stationary point. Every bird seen within 1/4 mile and every bird heard by the one observer should be counted during the 3 minutes at each stop. Do not exceed 3 minutes because you are sure a certain "good bird" is there and not calling -- it will probably be recorded some other year, and valid negative data are as important as positive in this Survey. Do not stay less or more than 3 minutes. ABSOLUTELY NO METHOD OF COAXING BIRDS SHOULD BE USED under any circumstances during the 3-minute counting periods. This means no "spishing" or tape playbacks or any other method. It is crucial that all surveys be done consistently, because the goal of the Survey is to establish a comparison index not an actual count or census. Birds seen between stops or before and after the three minutes or on scouting runs should not be counted, but may be noted in the margin. Such birds are of some interest, but do not spend extra time pursuing them, as it is important to finish within the time limit, which should be 4 to 4.5 hours; bird activity changes drastically after this time.

WHICH BIRDS TO COUNT: Count individuals (except dependent young wherever possible or downy chicks of water and shorebirds) of all species seen or heard during each 3-minute period. Only estimate flocks too large to count in the brief time they are seen. Do not use check marks even for abundant species. No one will detect all birds within hearing or seeing distance. Hundreds of birds present will not be active during each 3-minute count, and you must not try to guess how many you are missing. Report only those birds actually seen or heard during the prescribed 3-minute stops. Be careful not to count any individuals known or strongly suspected to have been counted at a previous stop. Any bird known to be a non-breeder (late migrant, injured bird, or summer vagrant) should be included but marked on the Summary Sheet as such. Species recorded that are not found on the form should be added at the bottom. Any species unusual in the area, whether it appears on the form or not, should be verified by including some details of the observation.

RECORD KEEPING: Using the field sheets provided is highly recommended; spend some time getting used to them. Whichever method is used in the field, submit the original field sheets. A word of caution concerning dictating observations to a tape recorder: it is risky because the data can easily be lost by one manner of malfunction or another. Transferring the data is tedious and also subject to error. Another problem is that the tape is technically the original field sheet and it would be unreasonable for people to send us tapes. If you must use a tape recorder, indicate so on the assistant line and please be careful. Remember to record weather data at start and finish. Take the Summary Sheet along if it helps remind you, or write it on the Field Sheets. Record the start and finish time for each page of the Field Sheets and use the small blocks for odometer readings and individual stop times if you find it convenient. Use a dark pencil or pen on Field and Summary Sheets. We must photocopy or microfilm these records, which is impossible with light images or blue ink. Do not use a felt-tip pen; the ink is not water-proof, hence it smudges, washes out easily, and makes corrections difficult.

ACCEPTABLE WEATHER: To be comparable, routes must be run under satisfactory weather conditions: good visibility, little or no precipitation, light winds. Occasional light drizzle or a very brief shower may not affect bird activity, but fog, steady drizzle, or prolonged rain should be avoided. Except in those prairie States and Provinces where winds normally exceed Beaufort 3, counts preferably should be made on mornings when the wind is less than 8 m.p.h. and not taken if the wind exceeds 12 m.p.h. If you can walk faster than the wind is blowing, wind conditions are very satisfactory.

WIND SPEED CODES: (enter Beaufort Numbers on Summary Sheet, not m.p.h.)

Beaufort Number	Wind Speed miles per hr.	Indicators of Wind Speed
0	Less than 1	Smoke rises vertically
1	1 to 3	Wind direction shown by smoke drift
2	4 to 7	Wind felt on face; leaves rustle
3	8 to 12	Leaves, small twigs in constant motion; light flag extended
4	13 to 18	Raises dust and loose paper; small branches are moved
5	19 to 24	Small trees in leaf sway; crested wavelets on inland waters

SKY CONDITION CODES: (enter these Weather Bureau code numbers on Summary Sheet)

0 Clear or a few clouds
1 Partly cloudy (scattered) or variable sky
2 Cloudy (broken) or overcast
4 Fog or smoke
5 Drizzle
7 Snow
8 Showers

ROUTE PROBLEMS: Scouting of routes should eliminate most last-minute adjustments. If any problems arise, notify this office as soon as possible. For maximum consistency, it is best that an alternative be worked out here that pleases both you and us. If it is not possible to scout a route and a problem arises while running it, remember that it is most important to use the same stops in the same order as in previous years. If a detour is necessary, go around and resume on the other side of the obstruction, attempting to preserve as many stops as possible. Do not make new stops along the detour unless necessitated by inaccessible sections of road or if detouring around will take in excess of an hour. If a stop is in a dangerous location it is acceptable to move it as much as 0.1 mile (forward or backward) or put it on a side road. Counting may be extended by 1 minute at stops with excessive traffic noise. This should be restricted to only a few stops; if many stops have excessive traffic, notify this office. In some cases a replacement route will have to be drawn up.

REPORTING RESULTS: Upon completion of the route, the data should be transferred from the Field Sheet to the Summary Sheet; again, use a dark pencil or pen, but not a felt-tip marker. The species total for each of the 5 Field Sheets should be entered under the appropriate page total columns on the Summary Sheet. The sum of these 5 columns should then be entered in the Total Indiv. column. The number of stops, out of the total of 50, at which each species was seen should be entered in the Stops per Spec. column (e.g., if Robins are recorded on 15 different stops out of the 50, enter the number 15 in the Stops per Spec. column). Try counting stops per species before totalling the Field Sheets to avoid the mistake of counting the total column as a stop. Another way of avoiding this problem is to do the Field Sheet total column in a different color ink or pencil from the rest of the Field Sheet. Be sure to count stops on all pages; page 5 often gets missed. Please double-check the transfer of data to your Summary Sheet; we have found that many observers inadvertently omit species when transferring. For this and other reasons we need your original Field Sheets. (If you used the blank Field Sheets they should be sent; we are not concerned if they are "soiled"). Copied Field Sheets tend to be less accurate than originals. Be sure to furnish all information requested at the top of the Summary Sheet. Please enter only 1 number or letter per block (except the "first name" block) and start the data and starting time entries with a "0". Put nothing in the blocks labelled T and C. Please print plainly because all information must be keypunched. Only 12 spaces can be allotted for the observer's last name. The one person doing the observing should be the name entered here, not the driver or the recorder or the person filling out the summary sheet.

Married women should use their own initials, not those of their husbands and circle the Mrs. title. Two people should not observe together and take turns putting each other's name in the observer block from year to year. The 5 original Field Sheets (representing 50 stops), 1 Summary Sheet, the starting time map, these instructions, and the route map should be sent in the envelope provided to the Migratory Nongame Bird Studies, Patuxent Wildlife Research Center, Laurel, Maryland 20708, as soon as possible after completion of the count. An extra set of forms is provided for your records. You will want to keep a copy of your data so that you can check the computer printout that will be sent at a later date. If you photocopy your results for your files, please return the unused forms.

ALL FORMS MUST BE COMPLETED AND RETURNED BY JULY 31: If a route is not run, RETURN THE PACKET AS SOON AS POSSIBLE. If for any reason it should be impossible for you to cover your route during the prescribed period, inform the State or Provincial Coordinator or this office immediately--a replacement observer may be found.

PROCESSING OF RESULTS: Upon receipt of the forms the Summary Sheets are checked against the Field Sheets, addresses are checked, AOU numbers of write-ins are inserted, and continuity and type codes entered. Data from the Summary Sheet are then entered onto magnetic tape and run through a computer edit program. A machine listing will be mailed to each observer and a State tabulation will be mailed to each State or Provincial Coordinator. A newsletter analyzing continental bird population changes will later be sent to each participant. Data on distribution and comparative abundance of individual species are available to research workers on request.

INCOME TAX DEDUCTION: Drivers who itemize deductions on their Income Tax Returns may make a deduction for mileage necessary for the scouting and running of official Breeding Bird Survey routes. Currently, the legal amount is 9¢ per mile, but check your 1040 instructions each year; it could change. Costs of motels, campgrounds, meals, etc. involved with the scouting and running of routes are also deductible. On the itemized deductions form ("Schedule A"), there is a line for "contributions other than cash". This is where the cash value of these items belongs.

THANK YOU VERY MUCH FOR YOUR PARTICIPATION IN THE BREEDING BIRD SURVEY.

EQUIPMENT CHECK LIST

Clipboard
Pencils (dark lead)
Forms (field and summary sheets)
Route map
Starting time map
Binoculars
Watch with second hand (or timer)
Gasoline
Thermometer

5/3/83

Appendix C

BBS Field Sheet

OBSERVER'S NAME _____

CANADIAN WILDLIFE SERVICE AND
U.S. FISH AND WILDLIFE SERVICE

FIELD SHEET, BREEDING BIRD SURVEY

PROV. STATE [ ] ROUTE NO. [ ] ROUTE NAME [ ] DATE [/ /] (Mo Day Year) PAGE [ ]

Starting Time [:] Ending Time [:]

STOP NUMBER	_1	2	3	4	5	6	7	8	9	_0	Total
TIME											
SPEEDOMETER											
COMMON LOON . . .											
GREAT BLUE HERON .											
GREEN HERON											
AM. BITTERN											
MALLARD											
_____ DUCK											
_____ DUCK											
RED-TAILED HAWK. .											
BROAD-WG. HAWK .											
AM. KESTREL.											
_____ GROUSE											
RING-NK. PHEASANT											
KILLDEER											
AM. WOODCOCK . .											
COMMON SNIPE . . .											
SPOTTED SANDPIPER.											
HERRING GULL											
RING-BILLED GULL . .											
ROCK DOVE.											
MOURNING DOVE . .											
_____ CUCKOO											
_____											
CHIMNEY SWIFT . . .											
RUBY-T. HUMMINGBD											
BELTED KINGFISHER .											
YEL-SHAFTED FLICKER											
PILEATED WOODPECKR											
RED-HEADED WDPKR											
YEL-BEL. SAPSUCKER											
HAIRY WOODPECKER											
DOWNY WOODPECKR											
E. KINGBIRD											
GT. CREST. FLYC. . .											
E. PHOEBE											
YEL-BEL. FLYCATCHR											
WILLOW FLYCATCHR											
ALDER FLYCATCHER .											
LEAST FLYCATCHER .											
E. WOOD PEWEE . . .											
OLIVE-SD. FLYCATCHR											
HORNED LARK											
TREE SWALLOW. . . .											
BANK SWALLOW . . .											
BARN SWALLOW . . .											
CLIFF SWALLOW . . .											
PURPLE MARTIN . . .											
BLUE JAY.											
COMMON RAVEN . . .											
COMMON CROW . . .											
BLK-CAP. CHICKADEE											
WHITE-BR. NUTHATCH											
RED-BR. NUTHATCH.											
HOUSE WREN											
WINTER WREN											
_____ WREN											
GRAY CATBIRD . . .											
BROWN THRASHER . .											
AM. ROBIN											
WOOD THRUSH. . . .											
HERMIT THRUSH . . .											

STOP NUMBER	_1	2	3	4	5	6	7	8	9	_0	Total
SWAINSON'S THRUSH											
VEERY.											
E. BLUEBIRD											
GOLDEN-CR. KINGLET											
RUBY-CR. KINGLET .											
CEDAR WAXWING . .											
STARLING.											
YEL-THR. VIREO . . .											
SOLITARY VIREO . . .											
RED-EYED VIREO . . .											
WARBLING VIREO. . .											
BLK-&-WHT. WARBLER											
GOLDEN-WG. WARBLER											
NASHVILLE WARBLER.											
N. PARULA WARBLER.											
YELLOW WARBLER . .											
MAGNOLIA WARBLER.											
BLK-THR. BLUE WARB											
MYRTLE WARBLER . .											
BLK-THR. GREEN WARB											
BLACKBURNIAN WARB											
CHESTNUT-SD. WARB											
PINE WARBLER											
OVENBIRD.											
NO. WATERTHRUSH .											
MOURNING WARBLER.											
COM.YELLOWTHROAT											
CANADA WARBLER . .											
AM. REDSTART. . . .											
HOUSE SPARROW . . .											
BOBOLINK.											
E. MEADOWLARK. . .											
W. MEADOWLARK . .											
RED-WG. BLACKBIRD.											
BALTIMORE ORIOLE. .											
BREWER'S BLACKBIRD.											
COMMON GRACKLE .											
BROWN-HD. COWBIRD											
SCARLET TANAGER .											
CARDINAL											
ROSE-BR. GROSBEAK .											
INDIGO BUNTING . .											
EVENING GROSBEAK .											
PURPLE FINCH											
PINE SISKIN											
AM. GOLDFINCH. . .											
RUFOUS-SD. TOWHEE											
SAVANNAH SPARROW.											
VESPER SPARROW. . .											
SLATE-COL. JUNCO .											
CHIPPING SPARROW .											
CLAY-COL. SPARROW											
FIELD SPARROW. . . .											
WHITE-THR. SPARROW											
SWAMP SPARROW. . .											
SONG SPARROW. . . .											
_____											
_____											
_____											

Form 3-1a (1979)

Appendix D

BBS Summary Sheet

CANADIAN WILDLIFE SERVICE AND
U.S. FISH AND WILDLIFE SERVICE

SUMMARY SHEET, BREEDING BIRD SURVEY

(1) STATE-PROV. 61
(3) ROUTE NO. 087
(6) ROUTE NAME INLET
(18) COORDINATES 4343-07447
STRATUM 26 (40)

USE ONLY NUMBERS — ONE DIGIT PER BLOCK

	Start	Finish
(42) TEMP. (F)	59	76
(46) WIND SPEED	0	1
(48) SKY	1	1

(91) TOTAL SPECIES 78 C (39)

ASSISTANT: Myrtle Bullock

OBSERVER (please print) Dr. Mr. (Mrs.) Miss (circle one)

(27) WRENN (Last Name) Phoebe (First Name) A (M.I.)

(50) DATE 06 08 80 (Month Day Year)

(56) TIME 0450 (Start) 0855 (Finish) (64)

Species	AOU (65)	Page Totals 1 (69)	2 (72)	3 (75)	4 (78)	5 (81)	Total Indiv. (84)	Stops per Spec. (88)
COMMON LOON	007	1	2				3	2
GREAT BLUE HERON	194		1				1	1
GREEN HERON	201							
AM. BITTERN	190							
MALLARD	132							
BLACK DUCK	133							
BLUE-WINGED TEAL	140							
WOOD DUCK	144							
RED-TAILED HAWK	337							
BROAD-WG. HAWK	343							
AM. KESTREL	360							
RUFFED GROUSE	300							
RING-NECK PHEASANT	3091							
SORA	214							
KILLDEER	273		1		1		2	2
AM. WOODCOCK	228							
COMMON SNIPE	230							
UPLAND SANDPIPER	261							
SPOTTED SANDPIPER	263							
HERRING GULL	051							
RING-BILLED GULL	054							
ROCK DOVE	3131				1		2	1
MOURNING DOVE	316		1				1	1
YEL-BILLED CUCKOO	387							
BLK-BILLED CUCKOO	388							
WHIP-POOR-WILL	417							
COMMON NIGHTHAWK	420							
CHIMNEY SWIFT	423				2		2	1
RUBY-T. HUMMINGBIRD	428			1			1	1
BELTED KINGFISHER	390	1					1	1
YEL-SHAFT. FLICKER	412		1	1	1		3	3
PILEATED WOODPECKR	405							
RED-HD. WOODPECKER	406							
YEL-BEL. SAPSUCKER	402	1	2	2		2	7	6
HAIRY WOODPECKER	393			1			1	1
DOWNY WOODPECKR	394			1		1	2	2
E. KINGBIRD	444		1		2		3	3
GT. CREST FLYCATCHR	452	1		2			3	3
E. PHOEBE	456	1	1	1	1		4	4
YEL-BEL. FLYCATCHR	463							
WILLOW FLYCATCHER	4664							
ALDER FLYCATCHER	4663		1				1	1
LEAST FLYCATCHER	467	2		3		5	10	5
E. WOOD PEWEE	461			2		1	3	3
OLIVE-SD. FLYCATCHR	459			1		1	1	1
HORNED LARK	474							
TREE SWALLOW	614	4	2	1	8		15	10
BANK SWALLOW	616		12				12	1
ROUGH-WG. SWALLOW	617							
BARN SWALLOW	613		10	8	12		30	6
CLIFF SWALLOW	612		4				4	1
PURPLE MARTIN	611							
GRAY JAY	484							
BLUE JAY	477	2	2	2	2	2	10	10
COMMON RAVEN	486							
COMMON CROW	488	2	4		6		12	10
BLK-CAP. CHICKADEE	735	3	1	5		2	11	8
WHITE-BR. NUTHATCH	727	2					2	2
RED-BR. NUTHATCH	728			2		1	3	3
BROWN CREEPER	726				1		1	1
HOUSE WREN	721		2		2		4	4
WINTER WREN	722	1		2		2	5	3
SHORT-B. MARSH WREN	724							
GRAY CATBIRD	704	2	2	1	2	1	8	4
BROWN THRASHER	705		1		1		2	2
AM. ROBIN	761	20	10	5	4	5	44	37
WOOD THRUSH	755	10	5	5		2	22	15
HERMIT THRUSH	759	3		1			4	2

Species	AOU (65)	Page Totals 1 (69)	2 (72)	3 (75)	4 (78)	5 (81)	Total Indiv. (84)	Stops per Spec. (88)
SWAINSON'S THRUSH	758				1	1	2	2
VEERY	756	8	3	5	3	4	23	20
E. BLUEBIRD	766							
GOLDEN-CR. KINGLET	748							
RUBY-CR. KINGLET	749							
CEDAR WAXWING	619		10	9			19	2
STARLING	493		20		15	1	36	6
YELLOW-THR. VIREO	628							
SOLITARY VIREO	629	2				2	4	4
RED-EYED VIREO	624	10	4	20	4	10	48	40
WARBLING VIREO	627							
BLK-&-WHT. WARBLER	636			2		2	4	4
GOLDEN-WG. WARBLER	642							
TENNESSEE WARBLER	647							
NASHVILLE WARBLER	645		1	2			3	3
N. PARULA WARBLER	648							
YELLOW WARBLER	652		2		2		4	4
MAGNOLIA WARBLER	657	1		3		2	6	5
CAPE MAY WARBLER	650							
BLK-THR. BLUE WARB.	654	2		2			4	4
MYRTLE WARBLER	655	3		2		1	6	5
BLK-THR. GREEN WARB	667	1		3			4	4
BLACKBURNIAN WARB	662	2				2	4	4
CH-SIDED WARBLER	659	3	5	3	4	3	18	15
BAY-BR. WARBLER	660							
PINE WARBLER	671							
OVENBIRD	674	8	1	2	1	6	18	14
NO. WATERTHRUSH	675				1		1	1
MOURNING WARBLER	679					1	2	2
COM. YELLOWTHROAT	681	3	4	3	5	4	19	16
CANADA WARBLER	686	1		2			3	3
AM. REDSTART	687	5		4	2	4	16	12
HOUSE SPARROW	6882		5				5	1
BOBOLINK	494		2		2		4	2
E. MEADOWLARK	501		2				2	2
W. MEADOWLARK	5011							
RED-WING. BLACKBRD	498		20	1	20	6	47	35
BALTIMORE ORIOLE	507		1	1	1		3	3
BREWER'S BLACKBIRD	510							
COMMON GRACKLE	511		10		5	3	18	10
BROWN-HD. COWBIRD	495		8	1	3	1	13	7
SCARLET TANAGER	608	2		3	1	1	7	6
CARDINAL	593							
ROSE-BR. GROSBEAK	595	1		4	1	2	8	5
INDIGO BUNTING	598	1	1	1			3	3
DICKCISSEL	604							
EVENING GROSBEAK	514							
PURPLE FINCH	517	2	2	3			7	5
PINE SISKIN	533							
AM. GOLDFINCH	529	3	4	3	4		14	10
RED CROSSBILL	521							
RUFOUS-SIDE TOWHEE	587				2	2	4	2
SAVANNAH SPARROW	542				2		2	1
GRASSHOPPER SPAR	546							
VESPER SPARROW	540							
SLATE-COLOR JUNCO	567	3		3			6	5
CHIPPING SPARROW	560	3	4	3	3	4	17	10
CLAY-COLOR SPARROW	561							
FIELD SPARROW	563		1		2		3	2
WHITE-THR. SPARROW	558	10	2	6	5	5	28	18
SWAMP SPARROW	584		2				2	2
SONG SPARROW	581	1	5	1	8	1	16	12
BARRED OWL		1					1	1

MAILING ADDRESS 722 Phainopepla Lane, Birdtown, N.Y. Zip Code 13988

Form 3-1 (1979)

USE ONLY DARK PENCIL OR DARK INK ON THIS FORM - NO FELT TIPS!

Appendix E

New Method of Computing Long-Term Trends

The average annual proportional change (trend) is calculated for each route using linear regression to estimate the slope of the logarithmic transformed annual counts. In other words, for each route we estimate b in the model $C_y = ab^y \epsilon_y$ by taking logarithms and obtaining a least squares fit to the model $\ln(C_y) = \ln(a) + y \ln(b) + \ln(\epsilon_y)$. Here C_y is the count of birds in the yth year, a is the estimated intercept parameter (not used), b is the estimated trend, and ϵ_y is the error term (deviation from the line).

These route estimates are combined to estimate the population trends for physiographic strata, States and Provinces, regions, and North America, using

$$t = \sum_r b_r w_r / \sum_r w_r$$

where

t = estimated trend on logarithmic scale for strata, State or Province, region, or continent,

b_r = estimated trend on r^{th} route on logarithmic scale [$\ln(b)$], and

w_r = weight for the rth route.

The weight w_r is the product of the following factors:

(1) Relative area represented by each route. This is done so that equal areas will have equal weight if other factors are the same. This avoids implicitly weighting an area by the number of volunteers who are available to run routes. This factor is defined as (M/Nn) where M is the area of the State or Province within the physiographic stratum containing the rth route, N is the area of the strata, State or Province, region, or continent, and n is the number of routes in the M area.

(2) Abundance expressed as the geometric mean count on each route, to allow estimation of the trend of the total population of the species. The population trend in an area with a high bird population has a greater impact on the total population trend than does the trend in an area with a low bird population. To avoid problems with zero counts, we define the geometric mean as $[\pi_y (C_y + 0.5)]^{1/p} - 0.5$ where C_y is the count on the rth route in the yth year, and there are p annual counts.

(3) The number of years of data for each route and the spacing of these years, using the quantity $[(m-1)\ \Sigma_y i_y (y-\bar{y})^2]^{0.5}$, which is approximately proportional to the reciprocal of the variance of the estimated trend on the rth route. Here $i_y = 1$ if the route was run in the yth year and $= 0$ if not, $\bar{y} = \Sigma_y i_y y / \Sigma_y i_y$ is the mean of the year indices, and $y = 1,2,\ldots,m$ is the index to the years. This factor has the effect of reducing the variance of the estimated trends. Estimated trends based on many years of data receive higher weight because they are more reliable. The quantity $\Sigma_y i_y (y-\bar{y})^2$ is the sum of squared deviations of the year indices in which the route was run. This gives more weight to widely spaced annual observations because a larger difference would be expected in a bird population subjected to a consistent rate of change.

The weighted estimates for physiographic strata, regions, and North America are back transformed from the logarithmic scale, compensating for the bias inherent in the transformations. Because the expected value of the lognormal distribution is exp $(\mu + 0.5\ \sigma^2)$, we use $t' = \exp(t - 0.5\mathrm{v}(t))$ as our estimate of the trend in the original scale where $\mathrm{v}(t)$ is the estimated variance of t, and μ and σ^2 are the mean and variance of the lognormal distribution. Variances are calculated using the jackknife method (Geissler and Noon 1981).

Routes that have been run only one year are not included in the trend analysis because a rate of change cannot be calculated for these routes.

Appendix F

Reference List of Published Maps Showing Relative Abundance

The purpose of this list is to provide easy reference to the maps published in this report, to previously published maps based on BBS data, and for comparison, to quantitative maps based on Christmas Bird Counts. References cited herein are listed at the end of this Appendix.

Species	Breeding	Winter
Loons		
Common Loon		B 17
Arctic Loon		B 18
Red-throated Loon		B 19
Grebes		
Horned Grebe		B 20
Eared Grebe		B 21
Western Grebe		B 22
Pied-billed Grebe		B 23
Pelicans		
White Pelican		B 24
Brown Pelican		B 25
Cormorants		
Great Cormorant		B 26
Double-crested Cormorant		B 27
Olivaceous Cormorant		B 28
Brandt's Cormorant		B 29
Pelagic Cormorant		B 30
Anhinga		
Anhinga		B 31
Frigatebird		
Magnificent Frigatebird		B 32
Herons		
Great Blue Heron		B 33, AB 26:538
Green Heron		B 34
Little Blue Heron		B 35
Cattle Egret		B 36
Common Egret		B 37
Snowy Egret		B 38
Louisiana Heron		B 39
Black-crowned Night Heron		B 40
Ibises		
Glossy Ibis		B 41
White-faced Ibis		B 41
White Ibis		B 42
Swans and Geese		
Whistling Swan		B 43
Canada Goose		B 44
Brant		B 45
Black Brant		B 46
White-fronted Goose		B 47
Blue Goose		B 49
Ducks		
Mallard		B 50
Mexican Duck		B 51
Black Duck		B 52
Mottled Duck		B 51
Gadwall		B 53
Pintail		B 54
Green-winged Teal		B 55
Blue-winged Teal		B 56
Cinnamon Teal		B 57
American Wigeon		B 58
Shoveler		B 59
Wood Duck		B 60
Ring-necked Duck		B 61
Canvasback		B 62
Greater Scaup		B 63
Lesser Scaup		B 64
Common Goldeneye		B 65
Barrow's Goldeneye		B 66
Bufflehead		B 67
Oldsquaw		B 68
Common Eider		B 69
White-winged Scoter		B 70
Surf Scoter		B 71
Black Scoter		B 72
Hooded Merganser		B 73
Red-breasted Merganser		B 74
Vultures		
Turkey Vulture		B 75, AB 25:956
Black Vulture		B 76
California Condor		B 76
Kites, Hawks, and Harriers		
White-tailed Kite		B 77
Goshawk		B 78
Red-tailed Hawk		B 79

Species	Breeding	Winter
Red-shouldered Hawk		B 80, AB 26:539
Rough-legged Hawk		B 81
Ferruginous Hawk		B 82
Harris' Hawk		B 83
Bald Eagle		B 84
Marsh Hawk		B 85, AB 26:540
Falcons		
Prairie Falcon		B 86
American Kestrel		B 87
Quail		
Bobwhite	SSR 102:24 (east)	
Cranes		
Whooping Crane		B 88
Sandhill Crane		B 89
Coot		
American Coot		B 90
Plovers		
Semipalmated Plover		B 91
Piping Plover		B 92
Snowy Plover		B 93
Wilson's Plover		B 94
Mountain Plover		B 94
Killdeer		B 95
Black-bellied Plover		B 96
Sandpipers		
Ruddy Turnstone		B 97
Black Turnstone		B 98
American Woodcock		B 99
Common Snipe		B 100
Long-billed Curlew		B 101
Spotted Sandpiper		B 102
Willet		B 103
Greater Yellowlegs		B 104
Lesser Yellowlegs		B 105
Knot		B 106
Purple Sandpiper		B 107
Least Sandpiper		B 108
Dunlin		B 109
Short-billed & Long-billed Dowitchers		B 110
Semipalmated Sandpiper		B 111
Western Sandpiper		B 112
Marbled Godwit		B 113
Sanderling		B 114
Avocet and Stilt		
American Avocet		B 115
Black-necked Stilt		B 116
Gulls and Terns		
Glaucous-winged Gull		B 117
Great Black-backed Gull		B 118
Western Gull		B 119
Herring Gull		B 120
California Gull		B 121
Ring-billed Gull		B 122
Mew Gull		B 123
Laughing Gull		B 124
Bonaparte's Gull		B 125
Heermann's Gull		B 126
Black-legged Kittiwake		B 127
Gull-billed Tern		B 128
Forster's Tern		B 129
Common Tern		B 130
Royal Tern		B 131
Caspian Tern		B 132
Skimmer		
Black Skimmer		B 133
Doves		
Mourning Dove	SSR 124:33	
Cuckoos		
Black-billed Cuckoo	SSR 124:34	
Owls		
Snowy Owl		B 134
Burrowing Owl		B 135
Goatsuckers		
Chuck-will's-widow	SSR 124:35	
Swifts		
Chimney Swift	SSR 124:36	
Hummingbirds		
Anna's Hummingbird		AB 26:541
Woodpeckers		
Yellow-shafted Flicker	SSR 124:37	
Red-shafted Flicker	SSR 124:38	
Red-bellied Woodpecker	SSR 102:26 (east)	
Flycatchers		
Eastern Kingbird	SSR 124:39	
Western Kingbird	SSR 124:40	
Scissor-tailed Flycatcher	SAB 6:40	
Great Crested Flycatcher	SSR 124:41	
Acadian Flycatcher	SSR 124:42	
Eastern Wood Pewee	R&V 1974:173	
Western Wood Pewee	R&V 1974:173	
Larks		
Horned Lark	SSR 124:43, R&V 1974:174	B 136
Swallows		
Barn Swallow	R&V 1974:175	
Jays, Magpies, and Crows		
Blue Jay	RB&G, SSR 124:44	
Steller's Jay	RB&G	
Scrub Jay	RB&G	
Black-billed Magpie	RB&G	
Yellow-billed Magpie	RB&G	
Common Raven	RB&G	B 137
White-necked Raven	RB&G	B 138
Common Crow	RB&G	B 139
Fish Crow	RB&G	B 141

Species	Breeding	Winter
Pinyon Jay	RB&G	
Clark's Nutcracker	RB&G	
Titmice, Verdins, and Bushtits		
Black-capped Chickadee	RB&G	
Carolina Chickadee	RB&G, SSR 124:45	
Mountain Chickadee	RB&G	
Chestnut-backed Chickadee	RB&G	
Tufted Titmouse	RB&G, SSR 124:46	
Black-crested Titmouse	RB&G	
Plain Titmouse	RB&G	
Bridled Titmouse	RB&G	
Verdin	RB&G	
Bushtit	RB&G	
Nuthatches		
White-breasted Nuthatch	RB&G	
Red-breasted Nuthatch	RB&G	
Brown-headed Nuthatch	RB&G, SSR 124:47	
Wrentit		
Wrentit	RB&G	
Dipper		
Dipper	RB&G	
Wrens		
House Wren	RB&G	
Winter Wren	RB&G	
Bewick's Wren	RB&G	
Carolina Wren	SSR 102:27, SSR 124:48, RB&G	
Cactus Wren	RB&G	
Long-billed Marsh Wren	RB&G	
Short-billed Marsh Wren	RB&G	
Canyon Wren	RB&G	
Rock Wren	RB&G	
Mockingbirds and Thrashers		
Northern Mockingbird	RB&G, SSR 102:28 (east)	AB 26:542
Gray Catbird	RB&G, SSR 124:49	AB 29:603
Brown Thrasher	RB&G, SSR 124:50	
Bendire's Thrasher	RB&G	
Curve-billed Thrasher	RB&G	
California Thrasher	RB&G	
Le Conte's Thrasher	RB&G	
Crissal Thrasher	RB&G	
Sage Thrasher	RB&G	
Thrushes		
American Robin	RB&G	B 142
Varied Thrush	RB&G	AB 26:541
Wood Thrush	RB&G, SSR 124:51	
Hermit Thrush	RB&G	
Swainson's Thrush	RB&G	
Veery	RB&G	
Eastern Bluebird	RB&G, SSR 124:52, S	
Western Bluebird	RB&G	
Mountain Bluebird	RB&G	
Townsend's Solitaire	RB&G	
Pipits		
Water Pipit		AB 26:543
Starlings		
Starling	D 7	B 143
Vireos		
Red-eyed Vireo	SSR 124:53	
Warbling Vireo	SSR 102:29 (east)	
Wood Warblers		
Prothonotary Warbler	SSR 102:30 (east)	
Northern Parula	SSR 124:54	
Yellow-throated Warbler	SSR 124:55	
Pine Warbler	SSR 124:56	
Prairie Warbler	SSR 124:57	
Weaver Finches		
House Sparrow	R 1973:8	AB 29:611
Meadowlarks, Blackbirds, and Orioles		
Eastern Meadowlark	SSR 124:58	B 144
Western Meadowlark		B 145
Yellow-headed Blackbird		B 146
Red-winged Blackbird	D 4	B 147
Tricolored Blackbird		B 148
Orchard Oriole	SSR 102:31 (east)	
Rusty Blackbird		B 149
Brewer's Blackbird		B 150
Boat-tailed and Great-tailed Grackles		B 151
Common Grackle	E 1971:353–354, D 5	B 152
Brown-headed Cowbird	D 6	B 153
Bronzed Cowbird		B 154
Tanagers		
Scarlet Tanager	SSR 124:59	
Grosbeaks, Finches, Sparrows, and Buntings		
Cardinal	SSR 124:60	
Blue Grosbeak	SSR 102:32 (east)	
Dickcissel	SSR 124:62–63, R&V 1974:177	
Evening Grosbeak		AB 26:545
House Finch	SSR 124:61, SAB 6:39	AB 36:347
American Goldfinch		AB 29:609
Rufous-sided Towhee	SSR 102:33 (east), SSR 124:64	AB 26:544
Grasshopper Sparrow	SSR 102:34	
Le Conte's Sparrow		AB 29:604
Chipping Sparrow		AB 29:605
Field Sparrow	SSR 124:65	
Black-chinned Sparrow		AB 29:604
Harris' Sparrow		AB 26:546
White-crowned Sparrow		AB 29:606
White-throated Sparrow		AB 29:607
Swamp Sparrow		AB 29:608
Song Sparrow	SSR 102:35	
Lapland Longspur		B 155
Snow Bunting		B 156

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Appendix G

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We are most grateful to all of the following observers who conducted Breeding Bird Survey counts during the period 1965–1979. An asterisk (*) marks those to whom very special thanks are due for conducting 10 or more routes during this period. We extend our apologies to any observers who may have been inadvertently omitted from this list.

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J. R. Travis*, C. R. Wahl, R. H. Wauer, B. R. Zimmer, D. A. Zimmerman.

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North Dakota:

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Prince Edward Island:

A. J. Erskine, J. C. Hooper, H. W. Johnston, S. Lunn, A. A. Maclean, B. L. Maclean, K. Martin, G. I. Mason, B. C. Pigot, M. L. Thomas*, S. E. Vass, M. L. Willms, J. A. Wright.

Quebec:

G. Allaire, C. Bedard, R. Bisson, P. Blain, B. Blanchet*, P. Boily. A. B. Bouchard, J. Boulva, J. M. Bouvier, C. Brassard, C. C. Briere, F. M. Brigham*, P. W. Browne*, J. Burton, R. Cayouette, S. R. Clayden, F. Cloutier, R. Cote, A. Cyr, N. David, J. DeMarre, J. L. Des Granges, P. Ducas, P. D. Dupuy, A. J. Erskine*, R. A. Foxall, K. E. Freemark, W. Gaboriault, M. Gaudet, J. Gauthier, Y. G. Gauthier, G. Gendron, J. Gerraro, C. Griere, F. Hamel*, G. R. Hanes*, G. Harvey, C. Lacroix, P. Laporte, J. Larivee, J. M. Larouche*, M. L. Larrivee, Y. L. Lauziere, H. Lavoie, F. Leduc, J. Legris, R. Lepage*, B. D. MacTavish, M. W. McIntosh*, H. L. Mead, G. M. Michaud, G. H. Montgomery*, J. F. Munro, R. Ouellet*, J. R. Pelletier, J. L. Piuze, J. Roberge, F. Robichaud, J. Rocheleau, G. Samson, M. D. Spencer, J. B. Steeves, M. Suprenant, R. Tanguay, R. Taylor, T. W. Thormin, C. Tremblay, S. Wendt, J. Wright*, R. F. Yank.

Rhode Island:

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Saskatchewan:

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South Carolina:

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South Dakota:

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Tennessee:

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Appendix H

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We are greatly indebted to those State and Provincial coordinators, past and present, who have played such a vital part in making the BBS a success. Their unfailing cooperation and their persistence in finding qualified observers to run BBS routes is gratefully acknowledged. Names of the present coordinators are listed below.

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Robbins, Chandler S., Danny Bystrak, and Paul H. Geissler. **The Breeding Bird Survey: Its First Fifteen Years, 1965–1979.** U.S. Fish Wildl. Serv., Resour. Publ. 157. 196 pp. 1986.

The Breeding Bird Survey is an ongoing cooperative program sponsored jointly by the Service (Patuxent Wildlife Research Center) and the Canadian Wildlife Service. Its main purpose is to estimate population trends of more than 230 species of birds that nest in North America north of Mexico and that migrate across international boundaries. This survey provides information, both locally by ecological or political regions and on a continental scale about (1) short-term population changes that can be correlated with specific weather incidents, (2) recovery periods following catastrophic decline, (3) normal year-to-year variations, (4) long-term population trends, and (5) invasions of exotics.

The three major regions discussed are the Eastern, Central, and Western bounded by the Mississippi and the eastern base of the Rocky Mountains. Additional graphs for certain State or physiographic regions are included for selected species of special interest.

Keywords: Bird, Breeding, Canada, Census, Map, Physiographic region, Population trend, Roadside count, Survey, United States.

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