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## THE BREEDING BIRD SURVEY IN FLORIDA: 1969-1983

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**Abstract.**—Trends in breeding bird populations were analyzed from 1969-1983 using 19 Breeding Bird Survey routes established in Florida. Four species had strong increasing trends, 15 species had strong decreasing trends, and 66 species showed no strong trends. Six of 20 cavity-nesting species appeared to be decreasing, and this result argues for devoting increased management and research attention to this group. The Breeding Bird Survey appears to be a very valuable monitoring tool for many breeding birds in Florida.

Breeding Bird Surveys (BBS) sponsored by the U. S. Fish and Wildlife Service (USFWS) are a valuable source of information for studying the distributions, local densities, and population trends of breeding birds (Bystrak 1981). Each year hundreds of volunteer observers devote considerable effort towards the collection of these data, and the trends detected for some species have provided early warnings of population declines (Bystrak 1979). Other trend analyses of BBS data have helped to elucidate broad-scale relationships between environmental factors and changes in avian populations (Erskine 1978, Bystrak 1979).

Though most trend analyses have focused on large geographic regions (Robbins and Van Velzen 1974, Erskine 1978, Bystrak 1979, 1981, Geissler and Noon 1983), a few state-specific analyses have been completed (Zimmerman 1979, Thompson 1980, Castrale 1985). However, no analysis of Florida BBS data has been presented, this despite the fact that the state is experiencing a rapid rate of human growth and contains many rare and unusual forms of breeding birds sensitive to anthropogenic habitat changes (Kale 1978). In this paper I analyze BBS data collected on 19 routes in Florida from 1969-1983.

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## METHODS

BBS data are collected at census stations placed along 24.5-mile stretches of secondary highways (for a complete description, see Bystrak 1981). Census stations are spaced at half-mile intervals, and observers spend three minutes at each of the fifty stations along a route recording all bird species seen or heard within an estimated quarter-mile wide radius. In Florida, 37 BBS routes have been established (Fig. 1), and a few have been run consecutively since the program's inception in 1966 (Table 1).

BBS data are often difficult to analyze because of numerous biases affecting the data. Perforce a road-side bias is prevalent, and differences in weather, observers, time of year, surrounding habitat, and species detectability create additional variation (Geissler and Noon 1981). If very large samples are obtained, the variation due to these extrinsic factors might tend to be less than variation in local bird abundances. However, in Florida there has been poor continuity and coverage since BBS began in 1966. In recent years, just over half the routes delineated in the state were completed, and even during peak coverage during the early 1970's only in two years were all routes censused.

For this report, I analyzed data from 19 routes where no more than one year was not censused over the 15-year period from 1969-1983. When I obtained a computer tape of BBS data for Florida, the 1984 and 1985 data had not been entered. The distribution of these 19 routes (Fig. 1) about the state is not extensive, however, with a paucity of coverage in the southeast, western panhandle, and northwest-central portions of the state.

I used the total number of stops at which a species was detected per year (detection rate), averaged over routes run that year, as an index to population trends. Bart and Schoultz (1984) showed that density estimates obtained for a single species at a stop may be biased when many individuals are present, and this bias can lead to underestimations of abundance for common species. Using the number of stops at which a species was detected has been suggested as a more accurate estimate (S. Droege, pers. comm.). The estimate is a measure of distributional changes and is analogous to conducting a yearly breeding bird atlas. Detection rate also is strongly correlated with abundance on BBS routes (S. Droege, pers. comm.).

Spearman's correlation technique (Hollander and Wolfe 1973) was used to assess trends in detection rates of species versus year (time). Care must be taken when analyzing BBS data using correlation methods because the significance levels (or $P$-values) of correlation coefficients are reliable and comparable among different species only when there are few comparisons (Wilkinson 1985). If the correlation coefficient was larger in absolute value than 0.62 (equivalent to a $P \leq 0.01$ for a limited number of comparisons with the 15-year samples used here: Hollander and Wolfe 1973), then the species was categorized as having a strong trend and plots of detection rates were made against year to analyze better the trend for the species. A nonparametric procedure was used because normal probability plots (Gnanadesikan 1977) of detection rates did not appear to be normally distributed for most species. Finally, correlation analyses were limited to species that were detected on at least two routes over most of the 15-year period.

I also tabulated correlation coefficients for species with similar life history traits to assess any general trends among cavity-nesting species, neotropical migrants, and recently established breeders or exotics in the state. In these tabulations I categorized the trend of a species using the following criteria: 1) the species has been declining if the correlation coefficient was $< -0.52$, 2) the species has been increasing if the correlation coefficient was $>0.52$, and 3) the species has no detectable trend if the coefficient fell between $-0.52$ and 0.52. A correlation coefficient with an absolute value of 0.52 corresponds to a $P \leq 0.05$ with the samples obtained here (Hollander and Wolfe 1973).

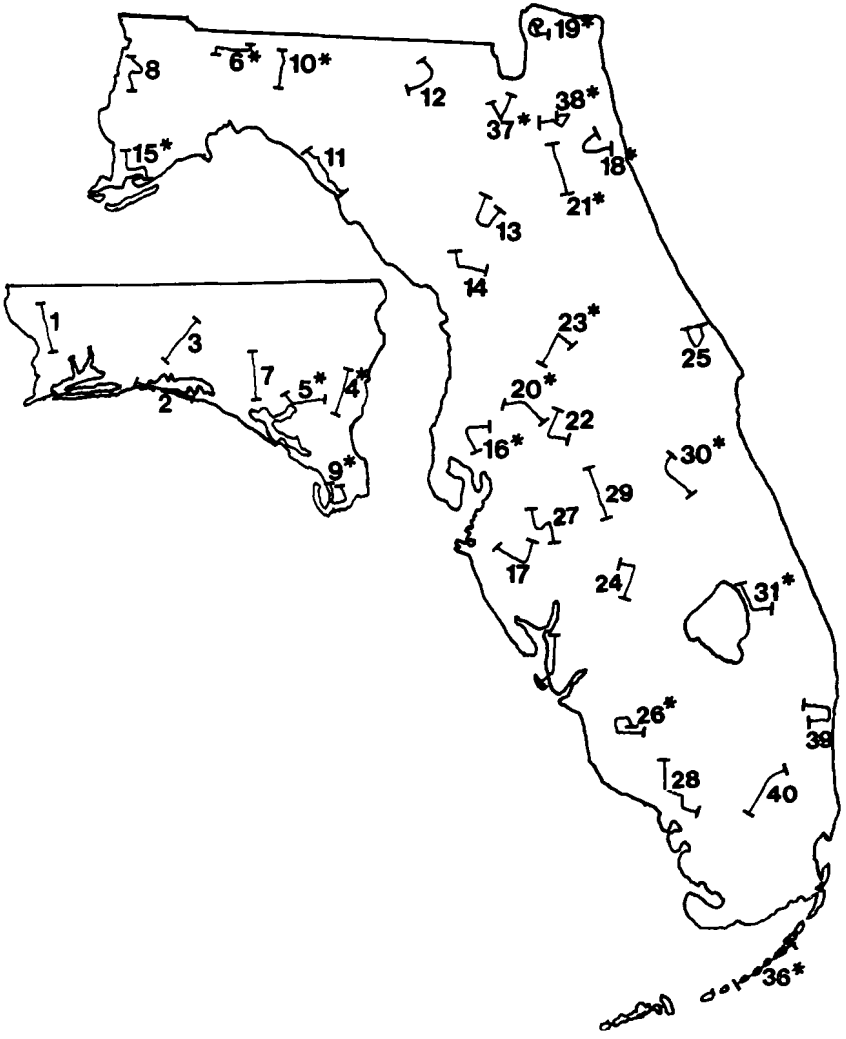


**Figure 1. Distribution of Breeding Bird Survey routes in Florida. Asterisked routes were those used in analyses. Numbers refer to the route numbers in Table 1.**

## Results

Over 200 species have been detected on all BBS routes run in Florida, but only 85 species were detected frequently enough on the 19 routes analyzed here to provide potential trend estimates. This total is approximately 45% of the breeding species recorded for the state (Stevenson 1986). The 20 species detected most frequently at BBS stops statewide are listed in Table 2.

**Table 1. Breeding Bird Survey routes in Florida and years of coverage from 1969-1983. Routes were occasionally replaced with new routes and given new numbers beginning in the 100's (e.g., route 032 was replaced by route 132).**

| Route Number | Route Name | Years Covered |
|---|---|---|
| 001 | Oak Grove | 13 |
| 002 | Fort Walton Beach | 12 |
| 003 | Mossy Head | 12 |
| 004 | Blountstown[1] | 15 |
| 005 | Broad Branch[1] | 14 |
| 006 | Miccosukee[1] | 15 |
| 007 | Seminole Hills | 12 |
| 008 | Telogia | 9 |
| 009 | Port St. Joe[1] | 14 |
| 010 | Covington[1] | 15 |
| 011 | Steinhatchee | 13 |
| 012 | Belmont | 11 |
| 013 | Micanopy | 10 |
| 014 | Romeo | 11 |
| 015 | Fort Gadsden[1] | 15 |
| 016 | Dale Mabry[1] | 14 |
| 017 | Myakka Head | 9 |
| 018 | St. Augustine[1] | 15 |
| 019 | Hilliard[1] | 15 |
| 020 | San Antonio[1] | 15 |
| 021 | Belmore[1] | 15 |
| 022 | Polk City | 11 |
| 023 | Mabel[1] | 15 |
| 024 | Childs | 10 |
| 025 | Scottsmoor | 5 |
| 026 | Sunniland Gr.[1] | 15 |
| 027 | Fort Lonesome | 5 |
| 028 | Pinecrest | 5 |
| 029 | Alturas | 5 |
| 030 | Kenansville[1] | 15 |
| 031 | Indiantown[1] | 15 |
| 032 | Salvista | 5 |
| 033 | Broward | 5 |
| 035 | Tamiami | 4 |
| 036 | Plantation[1] | 15 |
| 037 | Sanderson[1] | 14 |
| 038 | Doctor Inlet[1] | 14 |
| 039 | Boca Raton[1] | 15 |
| 040 | Andytown | 9 |
| 105 | Nixon | 3 |
| 132 | Punta Gorda | 3 |
| 135 | Flamingo | 1 |

[1]Routes used in statistical analyses.

**Table 2. Twenty most commonly detected species on 19 Breeding Bird Surveys in Florida, 1969-1983.[1]**

| Species | Stops/Year |
|---|---|
| Northern Mockingbird | 355 |
| Northern Cardinal | 318 |
| Rufous-sided Towhee | 316 |
| Northern Bobwhite | 262 |
| Carolina Wren | 256 |
| Eastern Meadowlark | 199 |
| Red-winged Blackbird | 196 |
| Blue Jay | 182 |
| Red-bellied Woodpecker | 176 |
| Great-crested Flycatcher | 175 |
| Mourning Dove | 171 |
| Common Grackle | 170 |
| Common Yellowthroat | 140 |
| Cattle Egret | 140 |
| White-eyed Vireo | 117 |
| Fish Crow | 115 |
| Common Nighthawk | 78 |
| Common Ground Dove | 69 |
| Loggerhead Shrike | 68 |

[1]Scientific names appear in Table 3.

Nonparametric correlation coefficients obtained for each species are presented in Table 3. In addition to the caveats given above regarding correlation analysis, the variable nature of natural populations (Krebs 1978) may create problems when trend analyses focus on limited periods of time. For example, the Northern Mockingbird (scientific names provided in Table 3; A.O.U. Checklist 1983) shows a strong negative correlation coefficient, but a plot of detection rates against year (Fig. 2) shows a more variable trend. The detection rate fluctuates considerably, though in the last few years the population appears to be generally declining. The situation might be somewhat different, however, if the population soon begins to increase and the data are reanalyzed. Overall, many more species show strong decreasing trends than show strong increasing trends using the 0.62 criterion (15 declines versus 4 increases).

In tabulations of species with similar life history traits (Table 4), cavity-nesting species appear to be undergoing the most dramatic changes in distribution (6 decreases, 10 no changes, 4 increases). Tropical migrants show proportionately less variability as a group (4 decreases, 16 no changes, 3 increases) and recently established breeders (Sprunt 1954) also show variability (1 decrease, 3 no changes, 1 increase), though Brown-headed Cowbird and Cattle Egret have relatively large positive values just below the 0.52 criterion used to categorize trends.

**Table 3. Spearman rank correlation coefficients for total number of stops a species was detected on (DETECTIONS) against year. Asterisks indicate that a plot of DETECTIONS against year was made for that species.**

| SPECIES | DETECTIONS |
|---|---|
| Brown Pelican (*Pelecanus occidentalis*) | 0.335 |
| Anhinga (*Anhinga anhinga*) | –0.152 |
| Double-crested Cormorant (*Phalacrocorax auritus*) | –0.210 |
| Great Blue Heron (*Ardea herodias*) | 0.421 |
| Great Egret (*Casmerodius albus*) | –0.282 |
| Snowy Egret (*Egretta thula*) | –0.120 |
| Little Blue Heron (*Egretta caerulea*) | –0.409 |
| Cattle Egret (*Bubulcus ibis*) | 0.490 |
| Tricolored Heron (*Egretta tricolor*) | –0.584 |
| Green-backed Heron (*Butorides striatus*) | –0.086 |
| White Ibis (*Eudocimus albus*) | –0.088 |
| Wood Stork (*Mycteria americana*) | 0.247 |
| Wood Duck (*Aix sponsa*) | –0.125 |
| Turkey Vulture (*Cathartes aura*) | –0.446 |
| Black Vulture (*Coragyps atratus*) | –0.517 |
| Red-tailed Hawk (*Buteo jamaicensis*) | –0.398 |
| Red-shouldered Hawk (*Buteo lineatus*) | –0.313 |
| Osprey* (*Pandion haliaetus*) | 0.725 |
| Northern Bobwhite (*Colinus virginianus*) | –0.514 |

**TABLE 3. (Continued)**

| SPECIES | DETECTIONS |
|---|---|
| Common Moorhen (*Gallinula chloropus*) | 0.346 |
| Willet (*Catoptrophorus semipalmatus*) | 0.289 |
| Killdeer (*Charadrius vociferus*) | –0.088 |
| Laughing Gull (*Larus atricilla*) | 0.132 |
| Least Tern (*Sterna antillarum*) | –0.392 |
| Rock Dove (*Columba livia*) | 0.009 |
| White-crowned Pigeon (*Columba leucocephala*) | 0.336 |
| Mourning Dove* (*Zenaida macroura*) | 0.807 |
| Common Ground Dove* (*Columbina passerina*) | –0.913 |
| Smooth-billed Ani (*Crotophaga ani*) | –0.389 |
| Yellow-billed Cuckoo (*Coccyzus americanus*) | 0.300 |
| Barred Owl (*Strix varia*) | 0.345 |
| Chuck-will's-widow (*Caprimulgus carolinensis*) | 0.048 |
| Common Nighthawk* (*Chordeiles minor*) | –0.618 |
| Chimney Swift (*Chaetura pelagica*) | 0.538 |
| Downy Woodpecker (*Picoides pubescens*) | 0.097 |
| Pileated Woodpecker (*Dryocopus pileatus*) | 0.182 |
| Red-headed Woodpecker* (*Melanerpes erythrocephalus*) | –0.696 |
| Red-bellied Woodpecker (*Melanerpes aurifrons*) | –0.177 |
| Northern Flicker* (*Colaptes auratus*) | –0.681 |

**Table 3. (Continued)**

| SPECIES | DETECTIONS |
|---|---|
| Eastern Kingbird* (*Tyrannus tyrannus*) | –0.793 |
| Gray Kingbird (*Tyrannus dominicensis*) | –0.322 |
| Great Crested Flycatcher (*Myiarchus crinitus*) | –0.292 |
| Eastern Wood Peewee (*Contopus virens*) | 0.116 |
| Acadian Flycatcher (*Empidonax virescens*) | 0.154 |
| Purple Martin (*Progne subis*) | 0.563 |
| Northern Rough-winged Swallow (*Stelgodopteryx serripennis*) | 0.238 |
| Blue Jay (*Cyanocitta cristata*) | –0.132 |
| American Crow (*Corvus brachyrhynchos*) | –0.047 |
| Fish Crow (*Corvus ossifragus*) | 0.521 |
| Brown-headed Nuthatch* (*Sitta pusilla*) | –0.832 |
| Tufted Titmouse (*Parus bicolor*) | –0.268 |
| Carolina Chickadee (*Parus carolinensis*) | –0.068 |
| Carolina Wren (*Thryothorus ludivicianus*) | 0.538 |
| Blue-gray Gnatcatcher (*Polioptila caerulea*) | 0.161 |
| Wood Thrush (*Hylocichla mustelina*) | –0.326 |
| Eastern Bluebird* (*Sialia sialis*) | –0.828 |
| Northern Mockingbird* (*Mimus polyglottos*) | –0.757 |
| Brown Thrasher (*Toxostoma rufum*) | –0.082 |
| Loggerhead Shrike* (*Lanius ludovicianus*) | –0.832 |

**TABLE 3. (Continued)**

| SPECIES | DETECTIONS |
|---|---|
| European Starling (*Sturnus vulgaris*) | 0.553 |
| Black-whiskered Vireo (*Vireo altiloquus*) | 0.274 |
| Red-eyed Vireo (*Vireo olivaceus*) | 0.215 |
| Yellow-throated Vireo (*Vireo flavifrons*) | 0.041 |
| White-eyed Vireo (*Vireo griseus*) | –0.446 |
| Prothonotary Warbler (*Protonotaria citrea*) | –0.415 |
| Northern Parula (*Parula americana*) | –0.046 |
| Yellow-throated Warbler* (*Dendroica dominica*) | –0.732 |
| Pine Warbler (*Dendroica pinus*) | –0.431 |
| Common Yellowthroat* (*Geothylpis trichas*) | –0.657 |
| Hooded Warbler* (*Wilsonia citrina*) | 0.721 |
| Yellow-breasted Chat (*Icteria virens*) | 0.048 |
| Summer Tanager (*Piranga rubra*) | 0.522 |
| Field Sparrow* (*Spizella pusilla*) | –0.658 |
| Bachman's Sparrow (*Aimophilia aestivalis*) | –0.116 |
| Rufous-sided Towhee (*Pipilo erythrophthalmus*) | –0.341 |
| Northern Cardinal (*Cardinalis cardinalis*) | –0.446 |
| Blue Grosbeak* (*Guiraca caerulea*) | 0.670 |
| Indigo Bunting (*Passerina cyanea*) | –0.527 |
| Brown-headed Cowbird (*Molothrus ater*) | 0.503 |

**TABLE 3. (Continued)**

| SPECIES | DETECTIONS |
|---|---|
| Red-winged Blackbird* (*Agelaius phoeniceus*) | –0.679 |
| Eastern Meadowlark* (*Sturnella magna*) | –0.954 |
| Orchard Oriole (*Icterus spurius*) | 0.064 |
| Common Grackle (*Quiscalus quiscalus*) | 0.011 |
| Boat-tailed Grackle (*Quiscalus major*) | 0.568 |
| House Sparrow* (*Passer domesticus*) | –0.847 |

## DISCUSSION

Climatic factors, environmental pollutants, habitat changes on breeding and wintering grounds, stochastic phenomena, and a plethora of other variables influence population distributions and local abundances. Isolating the particular mechanisms responsible for the distributional trend in any one species may be impossible. However, I will attempt to provide some general discussion of the trends observed on these 19 routes compared to nationwide trends (e.g., Tate and Tate 1982). That declines outdistance increases by almost a four-fold margin should be cause for concern in light of the fact that surveys analyzed here are, for the most part, located outside of areas with large human population growth (Fig. 1).

Declines for Red-headed Woodpecker, Northern Flicker, Brown-headed Nuthatch, and Eastern Bluebird have been noted elsewhere (Bystrak 1979, Tate and Tate 1982). The declines probably stem primarily from habitat changes and a decreasing availability of nesting cavities. Competition for snags with European Starlings also is thought to be a problem for some cavity nesting species (Zeleny 1976), and detection rates for starlings are generally increasing on BBS in Florida. Three of the four cavity-nesting species that are declining are known to interact with starlings for cavities (Zeleny 1976).

The decline of many cavity-nesting species underscores the need for additional research and management activities. McComb et al. (1986) analyzed the availability of snag resources throughout Florida and concluded that they were probably deficient for primary cavity-nesters, particularly on young pine stands and industrial forest lands. McComb et al.

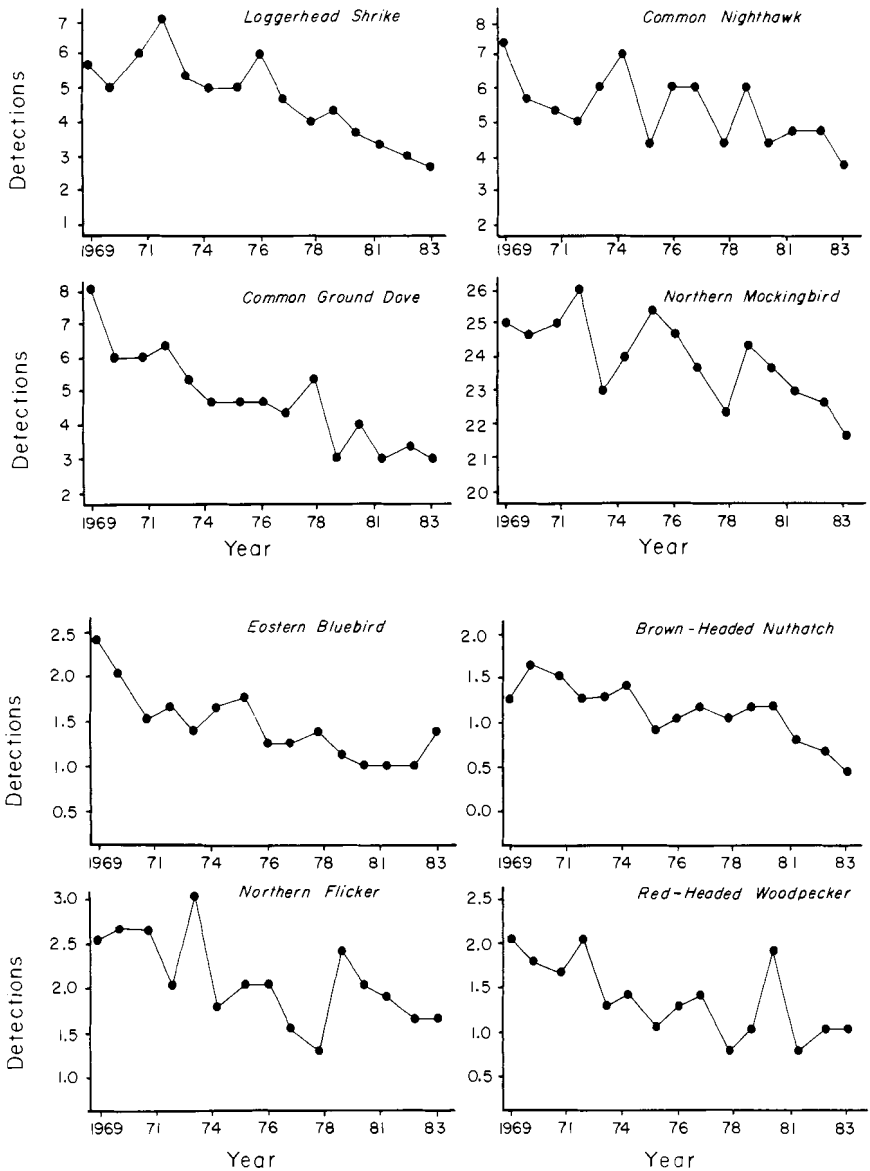


**Figure 2. Plots of detection rate versus year for species with strong declining or increasing trends.**

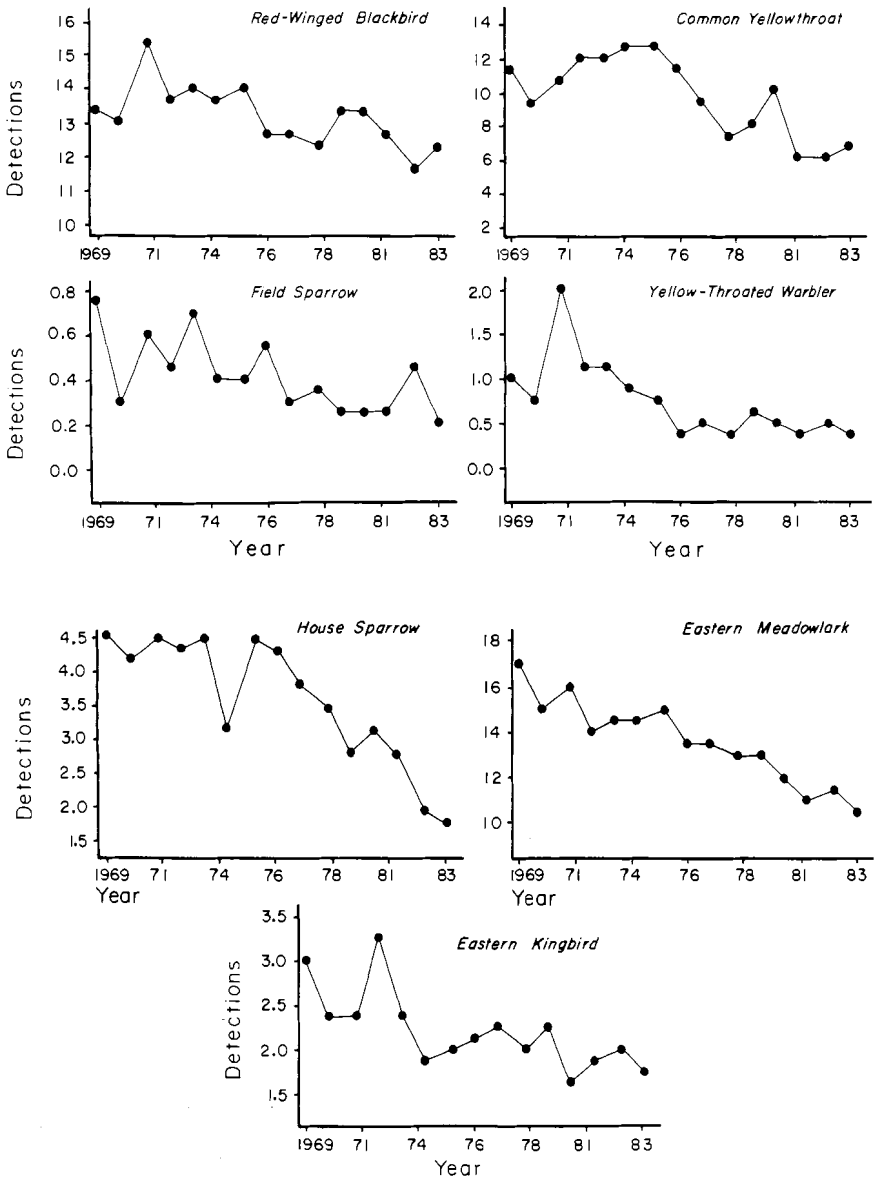


**Figure 2. continued.**

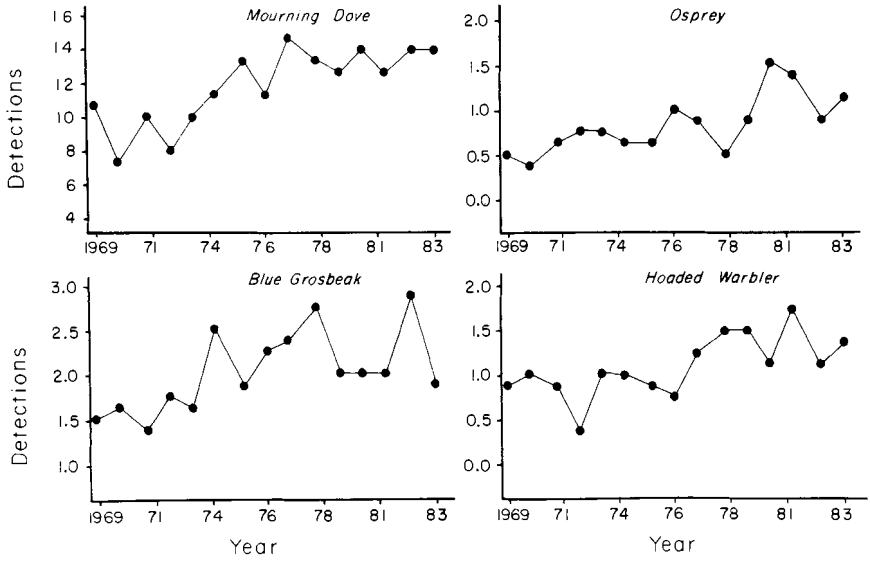


**Figure 2. continued.**

(1986) recommended that snags could be created as part of timber stand improvement procedures. Nest box programs might also be effective for mitigating declines of some cavity-nesting species (Zeleny 1976) and for increasing public awareness of this problem.

The decline of the Common Ground Dove appears to be occurring throughout the southeastern United States and is currently being analyzed more thoroughly (S. Droege, pers. comm.). Declines for Loggerhead Shrike and Eastern Kingbird also have been described (Tate and Tate 1982), though little attention has been given to studying the underlying causes. Given the low detection rates for these species on BBS routes in Florida, some additional management and research attention may be warranted.

Declines for Common Yellowthroat, Red-winged Blackbird, Northern Mockingbird, and Eastern Meadowlark are not cause for concern since these species are still relatively common on BBS routes. The declines for redwings, meadowlarks, and mockingbirds may seem somewhat incongruous since these species generally favor different types of human-altered settings (Sprunt 1954). However, relatively widespread species often show regionalized declines despite their general prosperity at a larger scale (e.g., Dolton 1985). Declining trends for the House Sparrow also seem incongruous because of this species affinities for human altered settings. Some BBS contributors may not count House Sparrows (H. Stevenson, pers. comm.), and, as mentioned, the surveys analyzed here are located outside of major urban areas in the state.

**Table 4. Categorization of trends among species with similar life history characteristics.**

| Increases | Decreases | No Change |
|---|---|---|
| **Cavity Nesters** | | |
| Chimney Swift | Black Vulture | Wood Duck |
| Purple Martin | Red-headed Woodpecker | Turkey Vulture |
| Carolina Wren | Northern Flicker | Barred Owl |
| European Starling | Brown-headed Nuthatch | Downy Woodpecker |
| | Eastern Bluebird | Pileated Woodpecker |
| | House Sparrow | Red-bellied Woodpecker |
| | | Great-crested Flycatcher |
| | | Tufted Titmouse |
| | | Carolina Chickadee |
| | | Prothonotary Warbler |
| **Neotropical Migrants** | | |
| Increases | Decreases | No Change |
| Chimney Swift | Common Nighthawk | Chuck-will's-widow |
| Purple Martin | Eastern Kingbird | Yellow-billed Cuckoo |
| Hooded Warbler | Indigo Bunting | Gray Kingbird |
| Blue Grosbeak | | Great-crested Flycatcher |
| | | Eastern Wood Peewee |
| | | Acadian Flycatcher |
| | | Rough-winged Swallow |
| | | Wood Thrush |
| | | Red-eyed Vireo |
| | | Black-whiskered Vireo |
| | | Yellow-throated Vireo |
| | | Prothonotary Warbler |
| | | Northern Parula |
| | | Yellow-breasted Chat |
| | | Summer Tanager |
| | | Orchard Oriole |
| **Exotics and Recently Established Breeders** | | |
| Increases | Decreases | No Change |
| European Starling | House Sparrow | Cattle Egret |
| | | Rock Dove |
| | | Brown-headed Cowbird |

Increases for Ospreys may reflect a response to decreased DDT levels (Ames 1966), but there have been concomitant habitat changes throughout the southeastern United States during the period of this study that also have benefited this species (e.g., increases in the number of river and stream impoundments; D. Wood, pers. comm.). Despite the increase, Osprey detections rates are relatively low, and this species should continue to receive appropriate levels of attention. Similarily, increases for

the Hooded Warbler and Blue Grosbeak were not large over the period covered here and should be viewed cautiously.

Some caution also should be exercised when extrapolating from these results to actual statewide trends for some of the breeding species analyzed here. As mentioned, only half of the BBS in Florida were used in the analyses, and the coverage of these routes about the state shows some distinct gaps. However, many of the gaps occur in areas where tremendous amounts of anthropogenic habitat changes have occurred during the period covered here, so the declines and increases detected may be conservative estimates of actual statewide trends.

The BBS method appears to be a valuable method for following trends in many of Florida's breeding birds. The method would probably prove to be even more precise and comprehensive if all routes had been censused since the program's inception. For example, in 1966 when 24 BBS were censused, a total of 120 species was detected on all routes. In 1971 when 37 routes were censused, an additional 29 species were detected. Efforts to improve on the consistency of BBS coverage in Florida therefore would probably result in more precise trend analyses for more species.

ACKNOWLEDGMENTS

Many thanks go out to Florida birders who have donated their valuable time in collecting BBS data. I would especially like to acknowledge Dr. Henry Stevenson, who served as state coordinator for the BBS effort during the period covered here and also ran many BBS routes. I also thank D. Cook, S. Droege, B. Gruver, J. Sauer, H. Stevenson, and an anonymous reviewer for helpful comments on earlier drafts of this manuscript.

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