

## AVIAN POPULATION TRENDS IN CENTRAL NEW YORK STATE, 1935-1972

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Because bird populations are highly mobile and rather sensitive to local environmental conditions, their numerical status and geographic distributions are constantly subject to change. Many birds respond to short-term environmental changes such as the changing of the seasons; consequently the numbers and types of birds at a given locality vary greatly during the year. Birds also respond to long-term environmental alterations, and the resulting population changes that span many years are often overlooked or subjectively defined in studies of bird populations. Because of the difficulties in keeping consistent long-term records on bird populations, very few attempts have been made in North America. The nationwide Christmas Bird Count records are one important exception, and these well-kept reports have been used to document quantitatively long-term changes in many species of birds. However, several restrictions placed on the way in which these counts are taken make long-term population trends difficult to decipher. Because Christmas Bird Counts are held on a single day, weather conditions on or prior to the count day are a major factor that biases results from year to year. Other problems exist with the Christmas Bird Count data, and these have been discussed at length elsewhere (Stewart, 1954; Preston, 1958; Brown, 1971).

Perhaps preferable to a yearly count on a single day is a weekly bird census over a given season. This method avoids many of the problems with single-day counts but is, of course, more difficult to manage over a period of many years. Nonetheless, there does exist such a collection of long-term weekly bird census data. Early in his career at Cornell University, Arthur A. Allen organized a weekly ornithology seminar at which careful records were kept of the bird species that had been observed in the region around Cayuga Lake in central New York State (Allen, 1962). These weekly records have been kept from the 1920's to the present time, but until now no attempt has been made to analyze these data to assess their value. Some information on changes in central New York State bird populations obtained from these records is presented here.

### METHODS

Each week from mid-September through late May, Cornell University's academic year, the bird species that were seen in the Cayuga Lake Basin (Figure 1) were recorded at ornithology seminars. Although these records were actually begun in the 1920's, it was not until about 1935 that these weekly seminars became a well-attended and formally scheduled event at the university. Consequently, we have chosen to analyze only the records kept between the 1936-1937 and the 1971-1972 academic years.

At the weekly meetings, a checklist of the birds known to occur in the region was read, and those in attendance noted either the

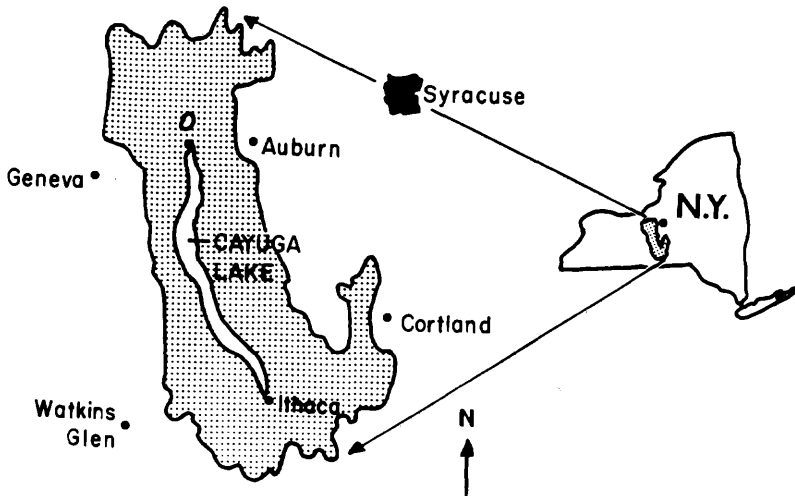


FIGURE 1. The census region, the Cayuga Lake Basin, is indicated by stippling. Cayuga Lake is 36 miles long.

presence or absence of each species during the previous week. No records were kept of the number of individuals seen. Over the 36-year period for which we analyzed records, weekly attendance at seminars varied from less than 12 to over 100 persons. Such diverse factors as weather, war years, and the opening of the Laboratory of Ornithology at Sapsucker Woods accounted for the variation. The attendants were mostly students and staff in the biology department of the university and serious amateur bird watchers. The number of weekly meetings held during an academic year also varied slightly from a low of 24 to a high of 32. Once again, such factors as weather, war years, and changes in the university's academic calendar accounted for this variation.

In analyzing the records, we noted the number of weekly checklists on which a species of bird was recorded during each academic year. From this we calculated the percentage of checklists on which the species occurred each year. Because the popularity of bird watching and the expertise and mobility of observers have increased greatly over the time period included in our records, we realized that some account would have to be made of the bias introduced by these factors. We decided that an appropriate measure of this bias would be the average number of species that were recorded on weekly checklists each year. We found that, indeed, this seemed to reveal an increased efficiency at observing birds; in Figure 2 the yearly variations in the average number of species recorded per checklist are shown.

We decided that to compare the observations from different academic years, a correction factor would have to be applied to the data. For the 36 years included in our analysis, we found that the overall mean number of species recorded per checklist was 79.8.

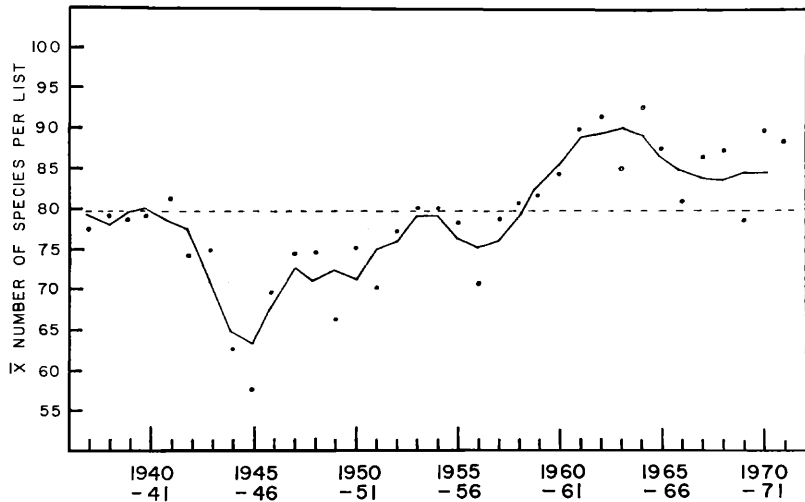


FIGURE 2. Yearly variations in the mean number of species recorded on weekly checklists are indicated by points. The solid line connects three-year moving averages. The broken line shows the overall mean number of species recorded per weekly checklist over the entire 35 year study period.

We calculated a corrected percent frequency of occurrence for each species for each year as follows:

$$AB/79.8 = C,$$

where A is the percent frequency of occurrence on checklists for the year, B is the mean number of species per checklist during the year, and C is the corrected percent frequency of occurrence for the species for the year. The corrected percentage was used for making comparisons. In the very few cases where application of this correction factor made the percentage of occurrence greater than 100%, the figure was only recorded as 100%.

Since only the presence or absence of a species was recorded on checklists, it was not possible to analyze data for very common species since these birds always occurred on 100% of the checklists of a given year. Hence, we only analyzed data for 35 bird species that are not abundant in the Cayuga Lake Basin but are, nonetheless, regularly seen birds. Particular attention was paid to species that *a priori* were thought to have undergone changes in their local status. The resulting trends in frequency of occurrence on checklists can be taken as an indication of the changing status of each of these species in the Cayuga Lake Basin.

For each species except those that were cyclic in occurrence, we calculated regression coefficients from the data on percentage of occurrence on checklists over the time period 1936-1972 or other specified time periods. We then tested the significance of each regression coefficient using a *t*-test and rejected the null hypothesis if  $P \leq 0.05$ .

## RESULTS AND DISCUSSION

Our results show that the 35 analyzed species fall into general groups with respect to their frequency of occurrence on checklists over the 36-year period. Some were notably stable in their occurrence on checklists whereas others either increased, decreased, or showed cyclic fluctuations. By species, the results of our analyses and a discussion of their significance are as follows:

Great Blue Heron (*Ardea herodias*)

According to our data, the Great Blue Heron's status in central New York has changed little over the past 36 years (Fig. 3-1). Although Benning (1969) has data that indicate local declines in breeding numbers within the census area, our data suggest that the overall frequency of occurrence of this heron has remained relatively stable.

American Bittern (*Botaurus lentiginosus*)

This bittern has decreased significantly in its occurrence on checklists (Fig. 3-2). This decline can probably be attributed to the reduction of extensive cattail-sedge marshes that provide the preferred habitat for the bittern. Although no accurate account of the extent of local marshland destruction is available, large areas of marshland have been drained, especially since World War II. The bittern apparently declined when its nesting marshes were destroyed while the Great Blue Heron persisted because of its upland nesting sites.

Redhead (*Aythya americana*)

Surprisingly, the Redhead seems to be cyclic in its occurrence on checklists (Fig. 3-3), and the frequently discussed 10-year wildlife cycle (Lack, 1945) seems to apply in this case. Although at 10-year intervals the Redhead occurs at nearly twice the frequency as in the intervening period, there is no indication of any long-term upward or downward trend. It is known that flocks of Redheads seen on Cayuga Lake in the winter are now smaller in number than in former times, but birds are still seen regularly. Alternatively, the cyclic nature of our data may be accounted for by cyclic characteristics of the Redhead's breeding (Hochbaum, 1960) or cyclic changes in the geographic distribution of wintering grounds.

Canvasback (*Aythya valisineria*)

This diving duck shows no significant changes in its frequency of occurrence in the region (Fig. 3-4). Although, once again, the wintering flocks have decreased in size, the Canvasback is still frequently observed on Cayuga Lake.

Greater and Lesser Scaup (*Aythya marila* and *A. affinis*)

Because of difficulties in field identification, these two species were grouped together for analysis. Unlike the other diving ducks that have remained relatively stable over the study period, Scaup (Fig. 3-5) are reported significantly less often now than in former

years. The reasons for this decline are not at all clear, but, as with the Redhead, either changes on the breeding grounds or a shift away from Cayuga Lake as a wintering locality may be responsible.

#### Turkey Vulture (*Cathartes aura*)

The Turkey Vulture shows a significant long-term increase in frequency of occurrence in the census area (Fig. 3-6). A similar increase in most northern areas has been noted, and several explanations have been offered (Bagg and Parker, 1951). A possible explanation may be the increase in central New York deer herds with the resulting greater number of deer carcasses available in the woods.

#### Goshawk (*Accipiter gentilis*)

This northern accipiter has undergone a recent dramatic increase in its frequency of occurrence in the region (Fig. 3-7). Before 1960, the Goshawk was a rare migrant and winter visitor, not recorded in most years. However, during the 1960's it became a resident breeding bird. This increase may be attributed to changes in land use over the last few decades. Large tracts of farmland retired from use in the 1920's had reached the forest stage by the 1960's, affording the Goshawk large areas of suitable forest habitat in central New York.

#### Sharp-shinned Hawk (*Accipiter striatus*)

The Sharp-shinned Hawk has decreased significantly in frequency of occurrence (Fig. 3-8). Meng (1951) reported the Sharp-shinned Hawk as a resident breeding bird in the Cayuga Lake Basin. His intensive research on these birds while a graduate student at Cornell University showed the high frequency of occurrence from 1948 to 1950. However, since the early 1950's, this hawk has decreased with occasional years when the frequency of occurrence is unusually high. Although still common as a migrant, the Sharp-shinned Hawk has definitely decreased as a resident bird in central New York.

#### Cooper's Hawk (*Accipiter cooperii*)

Meng (1951) reported the Cooper's Hawk as a resident breeding bird in the Cayuga Lake Basin, but since his studies, this accipiter has decreased significantly in the region (Fig. 3-9). During the period of Meng's thesis work, the Cooper's Hawk was reported on 90% of the checklists, but, beginning in the late 1950's a sudden decline occurred so that by 1965-1966, the bird occurred on only 15% of the checklists. It has been shown that the decline of the Cooper's Hawk in the eastern United States corresponds with the pesticide era (Schriver, 1969), and probably the well known pesticide-bird of prey syndrome has played some role in the regional decline shown here.

#### Red-tailed Hawk (*Buteo jamaicensis*)

This large buteo is one of the commonest raptors in central New York State, and its stable occurrence on checklists reflects

this status (Fig. 3-10). After a slight increase in frequency of occurrence during the 1930's, the Red-tailed Hawk has been recorded on almost every count.

#### Red-shouldered Hawk (*Buteo lineatus*)

The Red-shouldered Hawk is usually a bird of swamp forests and river valleys in New York State. The gradual reduction of preferred habitat is probably responsible for the steady and significant decrease in frequency of occurrence of this buteo (Fig. 3-11). The Red-shouldered Hawk is now an uncommon bird in the Cayuga Lake Basin, whereas in the 1930's and early 1940's, it was frequently observed. Once again, pesticides may have played some role. Similar declines in other widely scattered Red-shouldered Hawk populations have been reported (Brown, 1971).

#### Rough-legged Hawk (*Buteo lagopus*)

The Rough-legged Hawk is an irregular winter visitor to the Cayuga Lake Basin (Fig. 3-12). The availability of this hawk's microtine rodent food supply in the North is probably the major factor influencing its occurrence in central New York State. Our data indicate that approximately every 6-7 years a peak in frequency of observation occurs, but, in recent years, these fluctuations seem to be less marked.

#### Marsh Hawk (*Circus cyaneus*)

The Marsh Hawk is irregular in its frequency of occurrence in the Cayuga Lake Basin (Fig. 3-13), and there is no apparent pattern to the fluctuations in its occurrence. Perhaps the fluctuations can be accounted for by some combination of the vagaries of snow cover, winter temperatures, and local fluctuations in microtine rodent populations. All these factors must influence the suitability of the Cayuga Lake Basin as a winter hunting area for the Marsh Hawk.

#### Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon has become a symbol of the problems that result when organochlorine pesticides accumulate in the tissues of raptorial birds (Hickey, 1969; Peakall, 1970; Zimmerman, 1972). Our data show clearly the decrease of the Peregrine Falcon in central New York (Fig. 3-14). Peregrines formerly nested at Taughannock Falls Gorge in the Cayuga Lake Basin. In 1947-1948 and 1948-1949 this aerie was occupied by a single bird, and since then no birds have been present at the long-used site. The static low frequency of occurrence after 1950-1951 represents observations of migrant arctic Peregrines passing through the region.

#### American Kestrel (*Falco sparverius*)

Unlike its larger relative, this small falcon has remained common in the census region (Fig. 3-15). Although the Kestrel is still a frequently observed species, its occurrence on checklists has seemingly become more erratic in recent years.

*Ruffed Grouse (Bonasa umbellus)*

The Ruffed Grouse is another species that has been reported to show 10-year cycles in its abundance (Bump et al., 1947), and our data seem to support this theory (Fig. 3-16). At approximately 10-year intervals, there is a year when grouse are far less frequently recorded than in prior and following years (i.e. 1944-5, 1954-55, 1960-61, 1964-65). The causes of these cyclic fluctuations are not well understood, but the grouse, nonetheless, has remained a common bird in the region.

*Bobwhite (Colinus virginianus)*

The frequent attempts to introduce Bobwhite into the Cayuga Lake Basin all seem to have ended in eventual failure. Our data show the history of these introductions, particularly in the Ithaca region (Fig. 3-17). Birds were released in large numbers during 1950, 1960, and 1966, and, in each case, these releases resulted in one or two year peaks of abundance with a severe "crash" in the population soon thereafter. By 1970, this species had nearly disappeared.

*Turkey (Meleagris gallopavo)*

The wild Turkey, on the other hand, is a game bird that has fared well after being reintroduced in the central New York region (Eaton, 1964). After being released in the Connecticut Hill area in the late 1950's, these wild-trapped birds were soon being observed, and the frequency of observation rose steadily thereafter. The reports of birds seem to have reached a plateau level in the mid-1960's (Fig. 3-18).

*Great Black-backed Gull (Larus marinus)*

This typically coastal gull has been gradually extending its range inland, and our records show clearly its arrival on Cayuga Lake (Fig. 3-19). A steady and significant increase in frequency of observation occurred through the 1940's and 1950's until by the 1960's the bird was commonly observed. Peakall (1967) has discussed the factors responsible for this range expansion, and our data on the history of this species in central New York agree largely with his.

*Screech Owl (Otus asio)*

The Screech Owl shows a significant decrease in frequency of occurrence in the Cayuga Lake Basin (Fig. 3-20). Formerly reported on almost every checklist, the Screech Owl now occurs on less than one half. The reasons for this decline are not definitely known, but pesticides may be involved. Screech Owls seem to show a preference for orchards as nesting sites and hunting ranges (Bent, 1938). The orchards of central New York have become heavily contaminated with organochlorine pesticides since in the 1940's.

### Great Horned Owl (*Bubo virginianus*)

Being the nocturnal counterpart of the Red-tailed Hawk, it is not surprising that the Great Horned Owl has remained rather stable in its occurrence in the region. This bird is still commonly seen or heard (Fig. 3-21).

### Snowy Owl (*Nyctea scandiaca*)

Like the Rough-legged Hawk, the Snowy Owl visits the central New York region in years when its microtine rodent food supply in the North fails. Our data (Fig. 3-22) show that at approximately 5-6 year intervals the Snowy Owl is frequently seen in the Cayuga Lake Basin (1942-43, 1945-46, 1950-51, 1954-55, 1962-63, 1968-69). These years correspond well with the invasion years for the Rough-legged Hawk.

### Barred Owl (*Strix varia*)

The Barred Owl is often thought of as the nocturnal equivalent of the Red-shouldered Hawk, and, as such, it is not surprising that these species show similar trends in the central New York region. Like the Red-shouldered Hawk, the Barred Owl has declined significantly during our study period (Fig. 3-23), and the reasons for its decline are probably the same.

### Red-bellied Woodpecker (*Centurus carolinus*)

The northward range expansion of this southern woodpecker has been well documented (Seeber, 1963; Bull, 1964), and our data show clearly the arrival of this species in central New York (Fig. 3-24). The reason for the recent success of this species in the North is not entirely clear, and several possible explanations exist. Certainly one factor is the bird's ability to utilize bird feeders as a source of winter food.

### Red-headed Woodpecker (*Melanerpes erythrocephalus*)

This woodpecker has been decreasing significantly over the 36 years of our records (Fig. 3-15). It is now a rather rare bird in the Cayuga Lake Basin, and the causes for its decline are not clear. Ehrenfield (1970) speculated that one reason for the bird's disappearance from developed areas is its decidedly unadaptive habit of flying over roadways where it is often killed by vehicles.

### Purple Martin (*Progne subis*)

The plight of the Purple Martin is well-known, and our data show a significant decline in this species (Fig. 3-26). Unlike some other species that have declined rapidly, the Purple Martin seems to be disappearing very gradually.

### Tufted Titmouse (*Parus bicolor*)

Another southern bird that has become recently established in the North is the Tufted Titmouse (Eaton, 1959; Beddall, 1963). Our data show the initial appearance of the titmouse in the Cayuga Lake Basin in 1944-45 and its fantastically rapid increase there-



after (Fig. 3-27). The shape of this population growth curve closely approximates a classical logarithmic curve which further indicates that once it arrived, the Tufted Titmouse encountered essentially no opposition to its establishment. By 1960-61, the titmouse had become a common bird, recorded on almost every checklist.

#### Short-billed Marsh Wren (*Cistothorus platensis*)

The destruction of sedge marshes and wet meadows that resulted in the decline of the American Bittern also resulted in a significant decline in the Short-billed Marsh Wren (Fig. 3-28). This wren has gradually become an uncommon bird in the Cayuga Lake Basin, and it is doubtful that it can ever recover its former numbers.

#### Mockingbird (*Mimus polyglottos*)

Another southern species that has invaded northern regions is the Mockingbird (Beddall, 1963). An uncommon and irregularly observed species in central New York up to 1950, it has since increased and established itself as a frequently observed resident bird (Fig. 3-29).

#### Eastern Bluebird (*Sialia sialis*)

Our data show that the Bluebird has declined significantly in the Cayuga Lake Basin. Once a common resident species, the Bluebird is now recorded with about one third the frequency with which it was seen in the 1930's (Fig. 3-30). The possible reasons for this decline have been discussed at length elsewhere (James, 1961).

#### Northern Shrike (*Lanius excubitor*)

The Northern Shrike is a periodic winter visitor to central New York. Like other birds that feed on microtine rodents in the far North, the Northern Shrike seems to be cyclic in its invasion patterns (Fig. 3-31). Many of the peaks in frequency of observation coincide with Snowy Owl invasion years (i.e. 1940-41, 1946-47, 1950-51, 1954-55, 1960-61, 1969-70), but this shrike is definitely more erratic than the owl in its invasion frequency.

#### Loggerhead Shrike (*Lanius ludovicianus*)

Not all of the southern species that have expanded their range northward were successful in establishing themselves. The Loggerhead Shrike is once such species. Although it showed a brief increase during the 1940's, it levelled off to its previously low frequency of occurrence in the 1950's and has remained rather uncommon ever since (Fig. 3-32).

#### Yellow-throated Vireo (*Vireo flavifrons*)

This vireo has declined significantly in the Cayuga Lake Basin during the past 20 years (Fig. 3-33), and the reasons for the decline are not clear. Perhaps it reported preference for nesting in elms

(Bent, 1950) has been a factor in its decline, but why it should have virtually disappeared is still a mystery.

Golden-winged and Blue-winged warblers (*Vermivora chrysoptera* and *V. pinus*)

These warblers are a classical example of what happens when two closely related species meet after a period of separation. Many accounts of the hybridization and competitive replacement that occur between these warblers have been published (Benton, 1960; Short, 1962). Our data show clearly the decline of the Golden-winged Warbler and the increase of the Blue-winged Warbler during the 1950's (Fig. 3-34).

#### SUMMARY

Weekly checklist records of birds in the Cayuga Lake Basin have been used to indicate long-term population changes in birds from 1935 to 1972. Our analysis of 35 selected species showed that, based on frequency of observation, 8 species increased, 15 decreased, 6 remained stable and 6 were cyclic. The validity of these trends cannot be tested strictly but, in the instances where other records are available (i.e. Great Black-backed Gull, Peregrine Falcon, Tufted Titmouse, Mockingbird, Eastern Bluebird, Blue-winged and Golden-winged warblers), the data obtained from the weekly checklist records are fully corroborated. Also the synchrony of trends among species with a similar life history and ecology lends support to the accuracy of the data (i.e. Red-shouldered Hawk and Barred Owl; Rough-legged Hawk, Snowy Owl and Northern Shrike). We suggest that weekly checklist records can be of great value in elucidating long-term trends in bird populations, and we would encourage the collection of similar data in other regions for future comparisons.

#### ACKNOWLEDGMENTS

The insight of the late Arthur A. Allen is witnessed by the value of the weekly checklist records that he initiated over 40 years ago. Grateful appreciation must go to the, no doubt, thousands of observers who over the years have reported their bird observations at Cornell ornithology seminars each week; the apparent accuracy of their reporting is a tribute to the integrity of modern bird watching. We thank David B. Peakall for his assistance in the preparation of this manuscript.

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FIGURE 3. Each of the following 34 graphs contains the percentage of weekly checklists on which the indicated species was recorded each year from 1935 to 1972. The solid line connects three-year moving averages.

