TRENDS IN INDIANA HOUSE FINCH COUNTS: A COMPARISON OF INDIANA AUDUBON SOCIETY MAY, SUMMER, AND CHRISTMAS BIRD COUNTS, 1980-1995

Ronald A. Weiss
Chipper Woods Bird Observatory
10329 North New Jersey Street
Indianapolis, Indiana 46280

ABSTRACT: The house finch (*Carpodacus mexicanus*), first released in New York in 1940, has expanded its range throughout North America, making its first appearance in Indiana in the mid-1970s. The finch's first appearance in an annual Indiana Audubon Society bird count occurred in 1980, when two individuals were counted in Porter County during the Indiana Audubon Society Big May Day Bird Count. Five individuals were counted in the 1981 summer count, and a single individual was counted in the 1981 Indiana Audubon Society Christmas count. Since then, the annual Indiana Audubon Society bird counts have shown a dramatic increase in house finch numbers in Indiana. Trend analysis of the Indiana Audubon Society May, summer, and Christmas counts reveal that the Christmas counts are increasing at the greatest rate, followed by the May counts, and then the summer counts. Moving average plots of house finch counts show that count trends have been exponential with interruptions. House finch populations may be approaching their upper limit in Indiana.

KEYWORDS: Bird populations, *Carpodacus mexicanus*, Christmas bird counts, house finch, Indiana.

INTRODUCTION

The house finch (*Carpodacus mexicanus*), a Western species first released in New York in 1940 (Hill, 1993), has expanded westward, making sporadic appearances in Indiana from the mid-1970s to the early 1980s (Clay and Clay, 1981; Heller and Wise, 1982; Hill, 1993; Gill, 1984; Wiggins, 1987). The house finch was first recorded in the 1980 Indiana Audubon Society May count, when two individuals were observed in Porter County in northwestern Indiana (Hopkins, 1980). Five individuals were reported in the 1981 summer count (Jackson, 1983), and a single house finch was reported in the 1981 Christmas bird count (Mason and Mason, 1982). The number of house finches reported in subsequent counts has increased dramatically (Figure 1). The first breeding record for the house finch in Indiana occurred in Adams County in 1981 (Heller and Wise, 1982).

Studies of the house finch in Indiana have focused on the Christmas count data and the impact of the house finch on house sparrow (Wise and Walls, 1988; Hamilton and Wise, 1991), American goldfinch, and purple finch populations
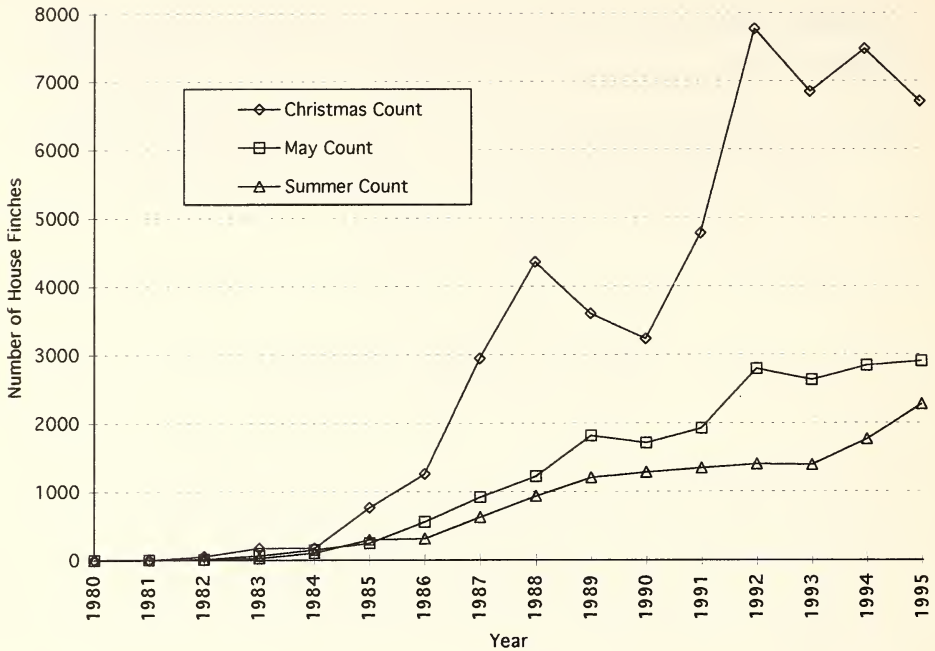
Figure 1. The Indiana Audubon Society house finch counts from 1980 to 1995.

(Hamilton and Wise, 1991). House finches appear to negatively impact house sparrow populations in the northeastern United States (Kricher, 1983). In Indiana, however, house sparrow populations may have declined prior to the arrival of the house finch (Hamilton and Wise, 1991).

What trends are reflected in the Indiana Audubon Society May and summer house finch counts? How do the Indiana Audubon Society May, summer, and Christmas count trends for this species compare with each other? Can these trends be used to predict the size of the future house finch population?

MATERIALS AND METHODS

House finch count data collected annually by volunteers from the Indiana Audubon Society in the Christmas, May, and summer counts were compiled from records published in the *Indiana Audubon Quarterly* from 1980 to 1996. The data collection protocols for each of these counts differed, making their comparison difficult. The May and summer counts were conducted county-by-county. The Christmas count, on the other hand, is not county based but is conducted within a 15 mile (24 km) diameter circle around an established center. Unlike the May and summer counts, at least 8 hours must be spent at each Christmas count site. Christmas counts are taken over a two week period. The May count occurs on the second Saturday in May.
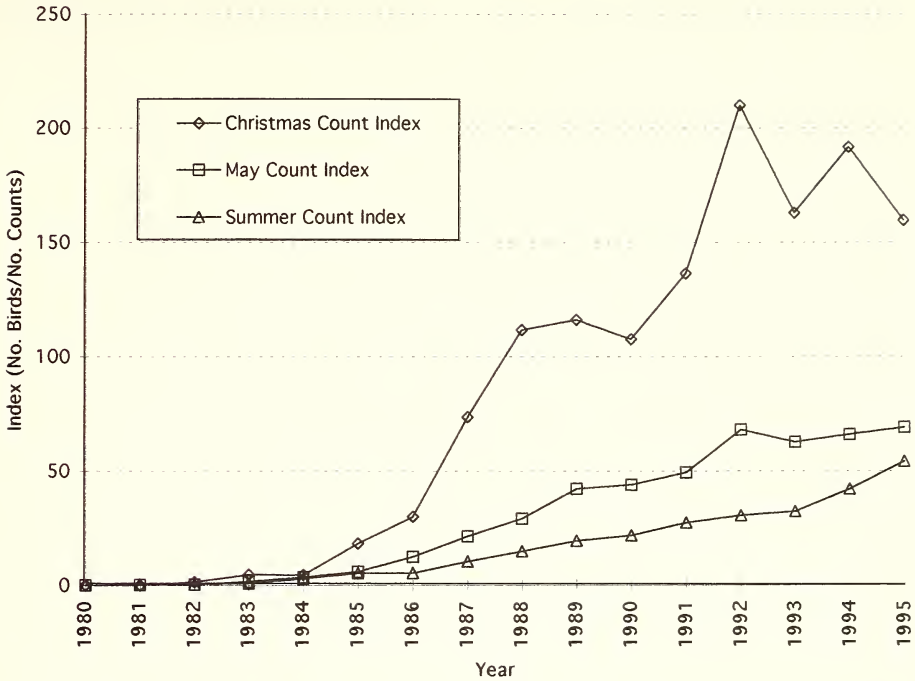
Figure 2. The Indiana Audubon Society house finch count indices from 1980 to 1995.

To compare data for the Christmas, May, and summer counts, a species detectability index was calculated for each respective count by dividing the total number of house finches observed in that count by the number of counties or Christmas counts participating each year. An index based on the number of field hours or the number of party hours could have been used, but those data were not complete for the period under study. The number of counties reporting each year reflects the total field effort and, by its nature, minimizes the variability in individual observer skill and the effort inherent in each respective count. The Christmas count trend, generated using the number of counts, is similar to the curve obtained by Hamilton and Wise (1991) using the number of Christmas count party hours.

The raw data for the Christmas, May, and summer counts were used to calculate a linear regression equation for each respective count (Figure 2). Linear regression analysis was also carried out using the index for each of the three counts (Figure 4). A moving average was calculated for each count based on the following formula and then plotted (Figures 5-7):

$$F_{(t+1)} = \frac{1}{N} \sum_{i=1}^{N} A_{t-i+1}$$
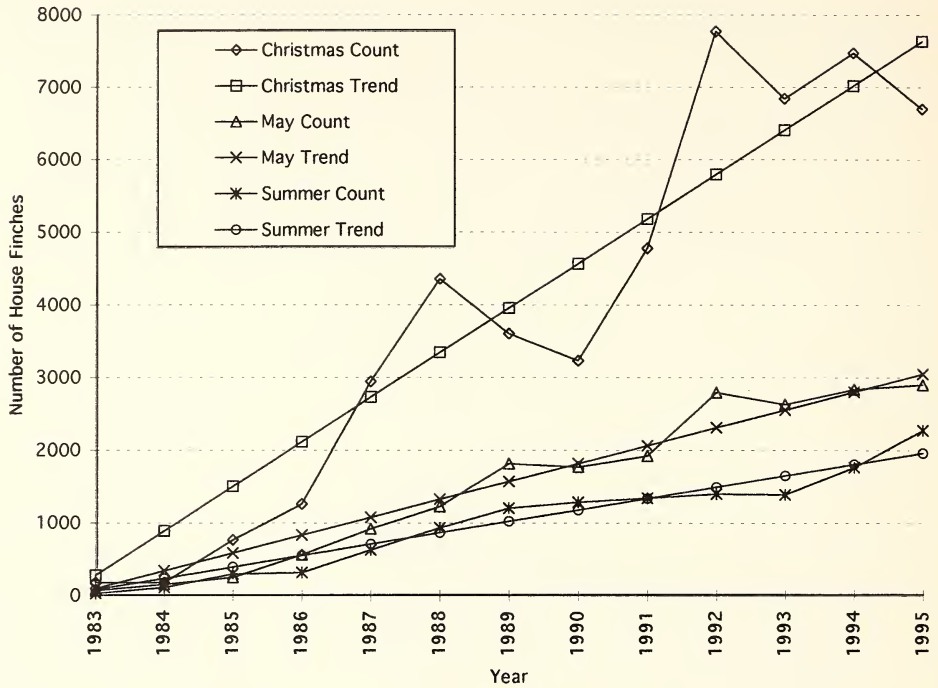
Figure 3. Indiana house finch count trends from 1980 to 1995.

where N, the number of periods included in the moving average, is 3, A_{t-i+1} is the actual value at time J, and $F_{(t+1)}$ is the forecasted value at time J. Data analysis was carried out using Microsoft Excel on a Macintosh Performa 6300CD.

RESULTS

House finch counts in Indiana have increased dramatically since the house finch was first reported in the Indiana Audubon Society's Christmas, May, and summer bird counts (Table 1). Plots of the count data from 1980 to 1995 demonstrate that the Christmas counts increased the most with the May counts and summer counts following in that order (Figure 1). The regression equation (Figure 3) calculated using the Christmas data had a slope of 644 (y = 644x - 1728), more than twice that for the May data, whose slope was 250 (y = 250x - 921), and more than four times that of the summer data, whose slope was 156 (y = 156x - 391).

Plots of the count indices for the period 1980-1995 (Figure 2) were similar to those for the raw data (Figure 1). Regression equations for the count indices for Christmas, May, and summer were calculated and plotted (Figure 4). The Christmas count index had a slope of 17 (y = 17x - 45), more than twice that of the May count index, whose slope was 6 (y = 6x - 16), and nearly five times that of the summer count index, whose slope of 3.6 (y = 3.6x - 11). Both the raw
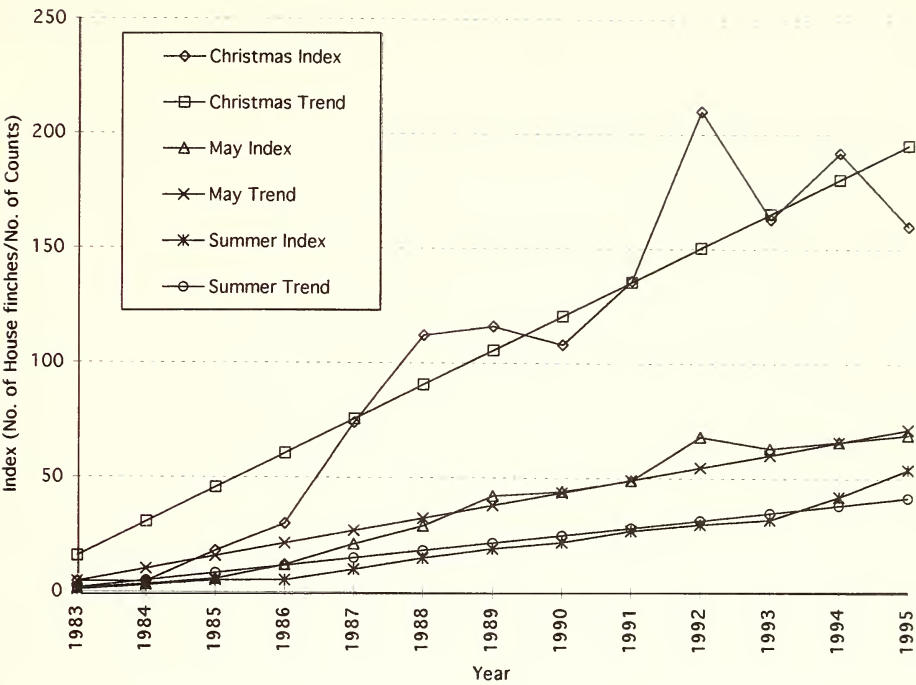
Figure 4. Indiana house finch index trends from 1980 to 1996.

Table 1. Indiana Audubon Society house finch count data.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Christmas counts																
Number of counts	35	34	40	39	40	42	42	40	39	31	30	35	37	42	39	
House finch count	0	1	56	179	178	766	1259	2942	4357	3600	3226	4777	7769	6842	7474	
Christmas Index[1]	0	0.03	1.4	4.6	4.5	18	30	74	112	116	108	136	210	163	192	
May counts																
Number of Counties reporting	40	39	41	42	44	43	45	43	42	43	39	39	41	42	43	
House finch count	2	7	13	65	151	919	560	919	1225	1816	1711	1923	1793	2629	2838	
Index[2]	0.05	0.18	0.32	1.5	3.4	21	12	21	29	42	44	49	68	63	66	
Summer counts																
Number of Counties reporting	12	19	29	35	39	57	60	61	63	62	59	49	46	43	42	42
House finch count	0	5	9	30	109	298	316	625	934	1202	1280	1340	1398	1385	1763	2269
Index[2]	0	0.26	0.31	0.86	2.8	5.2	5.3	10	15	19	22	27	30	32	42	54

[1] Christmas Index = House finch count/Number of Christmas counts.
[2] Index = House finch count/Number of counties reporting.
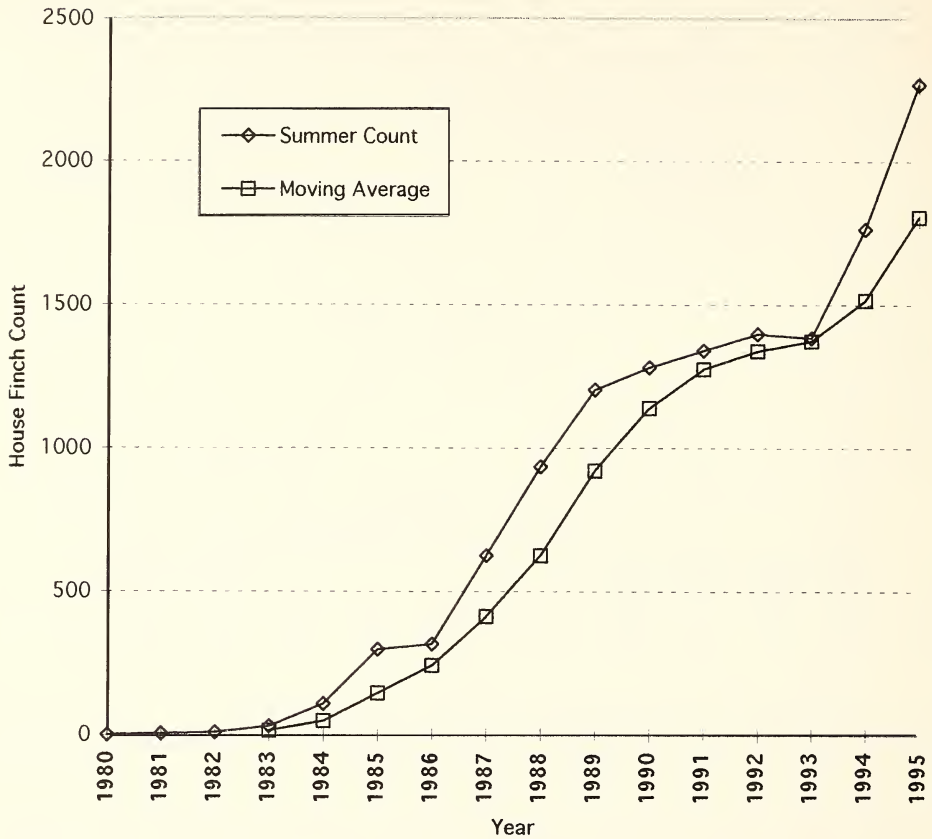
Figure 5. Moving average plot of the Indiana summer house finch counts.

count data and the count indexes demonstrate that the counts of wintering house finches in Indiana are growing at a greater rate than the May and summer counts.

Inspection of the Christmas count data (Figure 1) and the Christmas count indices (Figure 2) reveals a curvilinear trend from 1980 to 1994 with a break occurring between 1988 and 1990. May counts show a similar trend with a break in 1989-1990. Summer counts show a sigmoidal growth pattern from 1980-1993, followed by a renewal of count increases in 1994. Moving average plots of the raw data from the summer and Christmas counts clearly show exponential growth through the 1980s that slowed in the early 1990s and then was followed by con-tinued growth into the mid-1990s (Figures 5 and 6). The May house finch data do not show an obvious slowdown in growth in the early 1990s (Figure 7).

DISCUSSION

Ideally, small-bodied birds with a high reproductive potential and large brood sizes have an annual population growth potential of 50 to 100 percent (Ricklefs, 1973). Counts of wintering house finches in Indiana are increasing faster than
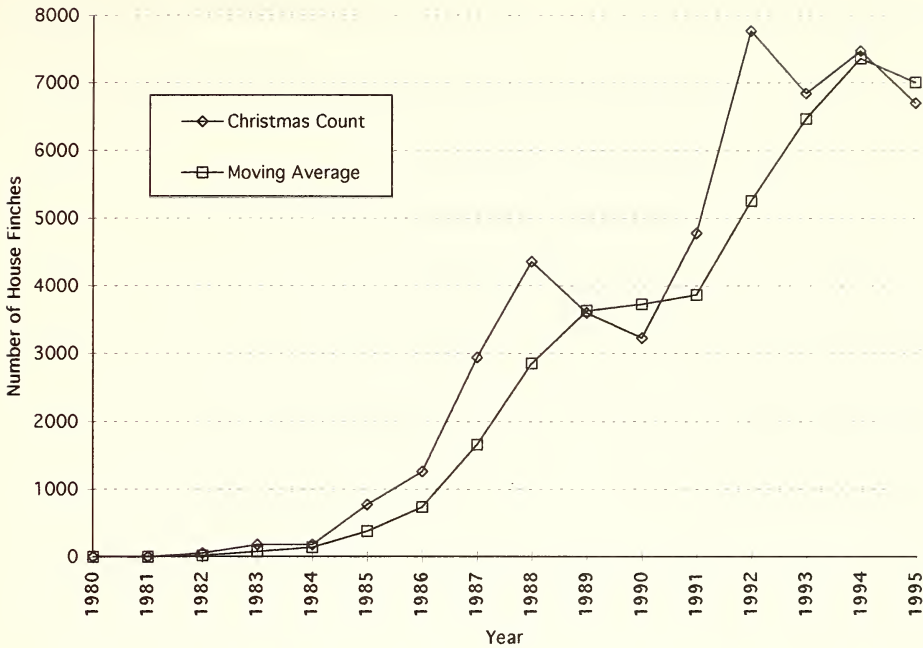
Figure 6. Moving average plot of the Indiana Christmas house finch counts.

the May or summer counts; the winter counts are increasing exponentially with interruptions. This growth might represent the early stages of a sigmoidal growth curve for a population expanding into a new environment. House finch population growth east of the Mississippi based on Christmas count data from 1962 to 1971 was exponential (Bock and Lepthein, 1976). Counts of individual house finches concentrated in wintering flocks would be expected to yield larger numbers per unit effort than more dispersed populations that occur during either the spring migration or summer breeding season. Observers who watch bird feeders during the Christmas count should record most of the house finches tallied. The Indiana data, smoothed somewhat by using an index obtained by dividing the raw data by the number of counts (or participating counties), also revealed similar trends.

Banding (Wiggins, 1987) and other studies (Hill, 1993) show that some house finches leave Michigan and other more northern localities during the winter. The southerly movement of the house finch into Indiana during the winter is reflected in the size of the Christmas counts. The wintering population is also increased by the finch's breeding success in the previous summer in Indiana and the surrounding States. May population counts consistently fall between the Christmas and summer counts, reflecting flock dispersal and the onset of the breeding season. Summer counts are consistently lower than either the Christmas or May counts.
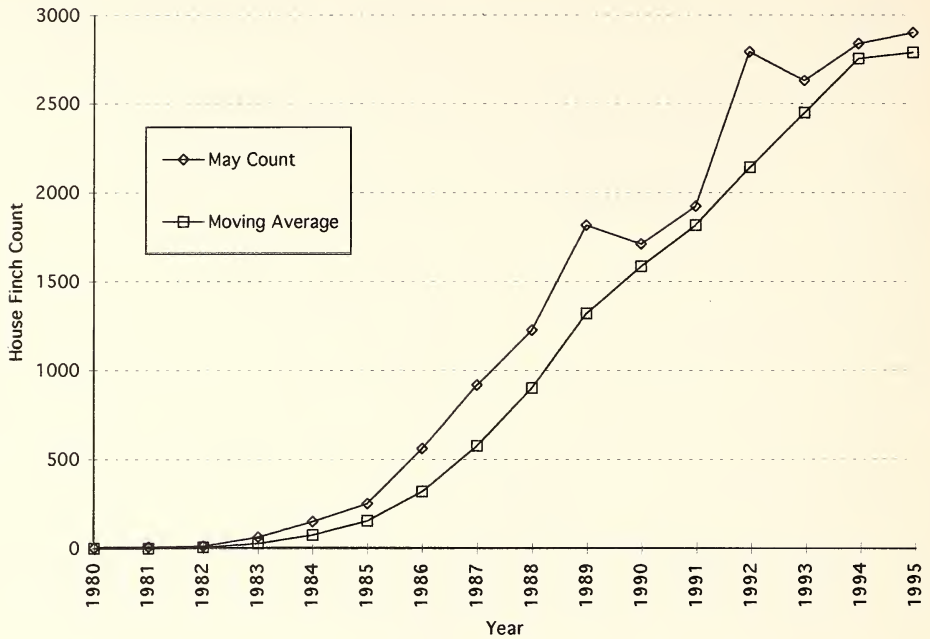
Figure 7. Moving average plot of the Indiana May house finch counts.

A number of density-dependent (recruitment, population size, dispersal, mortality, reproductive rate, competition, predation, and disease) and density-independent (climate, toxins, habitat alteration, backyard bird feeding, etc.) factors act to mediate growth and regulate house finch population size. The four principal ecological factors that limit bird populations are habitat, food supply, climate, and disease (Gill, 1995). Subtle social forces, such as territory size, aggressiveness, dispersal rates, and recruitment, also influence the rate of population growth. Recruitment of young birds into the local population varies inversely with adult mortality. The availability of winter feed to great tits (Van Balen, 1980) decreases the recruitment of young birds into the breeding population (lower adult mortality results in fewer vacancies in the local population), suggesting that backyard feeding may increase the dispersal rates of the house finch.

House sparrows, introduced into the U.S. in the early 1850s, benefitted from the existence of feed and grain stores as well as from horse droppings that contained undigested seeds. The coming of the automobile coupled with the decline in the number of feed stores stabilized house sparrow populations (Kastner, 1986). The recent increase in the popularity of backyard bird feeding has no doubt favored house sparrow populations as well as the populations of other species, including the house finch, that feed on the commonly served backyard bird foods.

In all seasons, 97% of the house finch diet is vegetable matter (Hill, 1993). The house finch prefers small sunflower seeds (oil) over milo, millet, or striped sunflower seeds, and, especially during winter months (Hill, 1993), benefits from the increasing popularity of backyard bird feeders (Bent, 1968). The use of feeders has stimulated a shift in the morphology of the house finch bill, allowing the finch to open sunflower seeds more efficiently (Sprenkle and Blem, 1984).

The decline observed in the 1989 and 1990 Christmas counts may reflect the negative impact of the severe drought that persisted in the mid- to late 1980s on nesting success. The negative impact of the drought on the populations of other bird species was observed in Michigan and Wisconsin during the same time period (Blake, *et al.*, 1989). In addition, Bock and Lepthien (1976) found that the house finch does not prosper in extraordinarily wet years. The decline in the Indiana 1993 Christmas count may reflect the negative impact of the excessively wet 1992 breeding season on nest success. Eastern house finch populations, however, seem to have adapted to wetter climates (Root, 1988). Christmas, May, and summer data for 1994 and summer data for 1995 indicate an increase in house finch numbers following the 1993 decline.

House finches suffer from pox on their feet and legs, which, when spread to the bill and eyes, leads to blindness and death (Hill, 1993). A contagious conjunctivitis infection now being reported by bird banders in house finch populations in the East may also lead to blindness and limit population growth. Competition with other bird species that occupy similar niches may also limit an otherwise explosive population increase in house finches.

CONCLUSIONS

The regression equation for the Christmas counts projects a wintering house finch population of more than 10,000 birds by the year 2000. Continued exponential growth could take population size well above that figure. Continuation of the May trends would result in slightly more than 4,000 birds by the year 2000, and a continuation of the summer trends projects the presence of nearly 3,000 birds by the year 2000.

The ultimate impact of increased house finch numbers on other bird species may begin to reveal itself when house finch numbers reach levels closer to Indiana's carrying capacity for this and similar species. Are competitive interactions with house sparrows, American goldfinches, and other species that share similar niche characteristics already limiting house finch population growth? What is the carrying capacity for the house finch in Indiana? How does backyard feeding effect the demographics of the house finch and other bird species?

As with house sparrows in the 19th Century, the arrival of house finches may be a mixed blessing. House finch depredations on commercial crops in California and Hawaii have been documented (Hill, 1993) as has the negative impact

of the house finch on house sparrow populations (Kricher, 1983). For bird enthusiasts, the house finch endears itself through a more attractive, melodious song than the house sparrow. Are control measures for the house finch needed? More work is needed to determine the long-term effect of the house finch on other bird species as well as agricultural crops.

The data collected by the dedicated volunteers who participate in the annual bird counts, although not always collected according to accepted scientific field methods, does provide a massive database for the many bird species that depend on Indiana habitats for their livelihood. Birds are sensitive indicators of the health of the environment, which justifies monitoring their population fluctuations and trends. A statewide program to standardize and train volunteers in data collection techniques would greatly enhance the value of future Christmas, May, and summer counts and provide the information to evaluate the status of Indiana's habitats well into the 21st Century.

ACKNOWLEDGMENTS

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