

## WINTER POPULATION DYNAMICS OF THREE SPECIES OF MAST-EATING BIRDS IN THE EASTERN UNITED STATES<sup>1</sup>

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**ABSTRACT.**— Winter population dynamics of Black-capped Chickadee (*Parus atricapillus*), Blue Jay (*Cyanocitta cristata*), and Red-headed Woodpecker (*Melanerpes erythrocephalus*) were examined in the eastern half of North America using National Audubon Society Christmas Count data from count areas that have had the highest number of individuals for each species in at least one winter between 1947-48 and 1983-84. All three species store and consume mast. Red-headed Woodpecker populations were most variable and Blue Jay populations were more variable than those of Black-capped Chickadees. Year-to-year comparisons show that Red-headed Woodpeckers are relatively nomadic in winter; that Blue Jays make movements between New England and the Mid-Atlantic coast with some regularity; and that Black-capped Chickadees may make relatively short population movements between central and southern New England. Movements of the 3 species were independent of mean January temperatures at the count areas examined. Results presented here are consistent with the hypothesis that increased dependence on mast as a winter food source is correlated with increased variability in winter population dynamics. In particular, the nearly periodic nature of the east-west shift of Red-headed Woodpecker high counts among years is strikingly similar to the periodic pattern of boreal seed-eating birds discovered by Bock and Lepthien (1976a). Received 8 Oct. 1985, accepted 18 Feb. 1986.

Most studies of birds that eat tree seeds during winter in North America have focused on species that consume conifer seeds (reviewed in Bock and Lepthien 1976a). Although a number of bird species consume mast (e.g., acorns) during fall and winter, few New World studies have examined the importance of these seeds to avian population dynamics (e.g., White and West 1977, Smith 1986). The relationship between mast production and bird abundance has received considerably more attention in Europe (e.g., Evans 1966, Perrins 1966, Eriksson 1970, Bejer and Rudeno 1985, Greig-Smith and Wilson 1985).

This study examines winter population dynamics of three common woodland birds in eastern North America: Black-capped Chickadees (*Parus atricapillus*), Blue Jays (*Cyanocitta cristata*), and Red-headed Woodpeckers (*Melanerpes erythrocephalus*). These species were chosen because they consume and cache mast crops during fall or winter (Darley-Hill and Johnson 1981, Sherry 1984, Johnson and Adkisson 1985), but differ

<sup>1</sup> This paper is dedicated to Frank A. Pitelka, who has long had an interest in jay and woodpecker research, on the occasion of his 70th birthday.

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markedly in population movements during that time. Black-capped Chickadees rarely make mass population movements (Lawrence 1958, Bagg 1969, Yunick 1981, Elder and Zimmerman 1983, Loery and Nichols 1985), Blue Jays occasionally make mass population movements (reviewed in Smith 1979a), and Red-headed Woodpeckers commonly abandon and invade areas on a yearly basis (Bock et al. 1971, Smith 1986). These differences presumably are due to the differing degrees to which these three species depend on mast as a winter food supply: Red-headed Woodpeckers completely desert areas with low acorn abundance (reviewed in Smith 1986), Blue Jays are capable of using other winter food sources (Bock and Lepthien 1976b), and Black-capped Chickadees usually depend on winter food sources other than mast crops (e.g., Forbush 1929).

I predicted that, based on dependence on mast crops, Red-headed Woodpecker winter populations would vary geographically more than those of the other two species and that Blue Jay winter populations would fluctuate more than those of Black-capped Chickadees. I also predicted that movements of these species would be independent of severe winter weather. Here I test these predictions using Christmas Bird Count data by examining those count areas that have had highest total number of individuals of the 3 species in at least one winter from 1947–48 through 1983–84. I also examine mean January temperature at each count area, a variable that T. Root (pers. comm.) has found to be a good predictor of wintering patterns of many bird species in eastern United States.

#### METHODS

Data were extracted from Audubon Field Notes and American Birds for those count areas that have had the highest total number of Red-headed Woodpeckers, Blue Jays, or Black-capped Chickadees in at least one year since winter 1947–48 (see Table 1), when annual summaries of highest totals for all species reported on all Christmas Bird Counts were first reported (Stewart 1948). Although quality of CBC data vary among counts and among years (e.g., Bock and Lepthien 1974), I judged the information on these 3 species to be relatively reliable because species are common, easily identified, and conspicuous during winter.

Observer party-hours, i.e., total time in hours that parties of observers spent in the field, were also recorded for each count area. As relationships between time and bird numbers can be confounded by observer effort, which has increased greatly over the years for most counts (Smith 1979b), results of each count were divided by total observer party-hours reported to produce standardized numbers for each species (Bock and Lepthien 1974).

To determine general increases or decreases in abundance over the last 37 years, correlations were calculated between year and the highest total each year for each species. To detect local changes in abundance of each species, correlations were also calculated between year and the standardized numbers of individuals reported at each count area. Patterns in geographical variation for each species were examined by calculating correlations for standardized numbers of individuals reported each year among all count areas for a particular species. Coefficients of variation were calculated for each count area to compare variability in numbers of birds among count areas and among the 3 bird species.

**TABLE 1**  
**MEAN (STANDARD ERROR) AND COEFFICIENT OF VARIATION FOR BLACK-CAPPED CHICKADEE, BLUE JAY, AND RED-HEADED WOODPECKER NUMBERS REPORTED AT CHRISTMAS BIRD COUNTS THAT HAD THE HIGHEST NUMBER OF CHICKADEES, JAYS, OR WOODPECKERS AT LEAST ONCE SINCE 1947 (MEAN [STANDARD ERROR] OF PARTY HOURS, NUMBER OF YEARS THAT A COUNT HAD THE HIGHEST TOTAL, AND [NUMBER OF YEARS] A COUNT HAS BEEN PERFORMED SINCE 1947 ARE ALSO PRESENTED)**

Count location	Mean (SE)	CV	Mean party-hours (SE)	Number high count years (N)
<b>Black-capped Chickadee</b>				
Concord, Massachusetts	1697.6 (175.4)	50.6	175.1 (16.1)	16 (24)
Westport, Connecticut	994.5 (61.8)	36.6	143.0 (9.1)	14 (35)
Cape Cod, Massachusetts	795.1 (49.1)	37.6	77.0 (3.3)	3 (37)
Greenwich, Connecticut	922.4 (100.9)	66.5	155.6 (15.0)	2 (37)
Hamilton, Ontario	657.8 (53.5)	49.5	169.5 (6.7)	1 (37)
<b>Blue Jay</b>				
Concord, Massachusetts	1209.2 (152.5)	61.8	175.1 (16.1)	10 (24)
Memphis, Tennessee	327.4 (17.5)	32.5	85.8 (4.2)	6 (37)
Seneca, Maryland	733.8 (126.5)	86.2	200.1 (26.4)	4 (25)
Springfield, Massachusetts	754.3 (69.4)	49.5	107.9 (4.9)	4 (29)
Northhampton, Massachusetts	713.7 (75.9)	63.8	153.5 (15.5)	3 (36)
Nashua, New Hampshire	466.9 (116.6)	96.7	44.4 (5.0)	2 (15)
Triadelphia, Maryland	449.3 (69.4)	92.6	112.3 (11.3)	2 (36)
Westport, Connecticut	515.3 (50.6)	58.1	143.0 (9.1)	2 (35)
Atlanta, Georgia	363.9 (51.8)	86.6	96.0 (8.0)	1 (37)
Bronx, New York	548.2 (56.0)	62.1	111.3 (8.1)	1 (37)
Central Suffolk County, New York	390.7 (48.6)	69.3	118.0 (8.5)	1 (31)
Hartford, Connecticut	595.4 (59.4)	60.7	177.5 (15.5)	1 (37)
<b>Red-headed Woodpecker</b>				
Pere Marquette Park, Illinois	108.2 (22.9)	127.0	52.7 (4.3)	6 (36)
Tulsa, Oklahoma	117.6 (18.1)	93.3	56.6 (4.6)	5 (37)
Manhattan, Kansas	94.5 (35.7)	210.4	88.4 (14.9)	4 (31)
White River N.W.R., Arkansas	34.2 (8.4)	131.7	23.1 (2.2)	3 (29)
Buckeye Lake, Ohio	52.0 (10.0)	116.8	100.4 (6.1)	2 (37)
Cincinnati, Ohio	33.6 (6.5)	118.4	167.1 (12.7)	2 (37)
Indiana Dunes Lakeshore, Indiana	89.9 (31.5)	121.4	119.3 (9.3)	2 (12)
Sullivan, Missouri	43.8 (19.2)	164.1	47.3 (6.0)	2 (14)
Beverly, Illinois	92.5 (17.4)	80.0	53.7 (5.8)	1 (18)
Forest Glen Preserve, Illinois	76.3 (15.5)	78.7	63.1 (4.9)	1 (15)
Fort Smith, Arkansas	26.7 (6.4)	134.2	38.0 (2.7)	1 (31)
Hulah Reservoir, Oklahoma	50.9 (7.5)	71.9	54.7 (2.7)	1 (24)
Land Between the Lakes, Kentucky	32.3 (9.1)	119.8	38.0 (2.3)	1 (18)
Mingo N.W.R., Missouri	66.0 (16.3)	113.0	26.6 (2.4)	1 (21)
Montrose Lake, Missouri	81.8 (13.1)	71.8	43.9 (4.7)	1 (20)
Murphysboro, Illinois	46.3 (30.0)	194.3	24.8 (2.0)	1 (9)
Orchard Farms, Missouri	44.2 (9.4)	104.3	30.8 (3.2)	1 (24)
Turkey Run S.P., Indiana	45.8 (8.7)	82.7	15.8 (1.5)	1 (19)
Union County, Illinois	116.6 (27.8)	82.7	60.9 (7.5)	1 (12)

Mean January temperatures were extracted from Climatological Data (National Oceanographic and Atmospheric Administration) for the weather station closest to each count area within the United States. (All were within 25 km of count areas.) For each count area, correlations were calculated between mean January temperature and total and standardized numbers of each species.

#### RESULTS

*Black-capped Chickadee population dynamics.*—The highest number of Black-capped Chickadees reported within one count area has increased steadily over the last 37 years (Spearman  $\rho = 0.91$ ,  $P < 0.0001$ ), reaching a total of 3441 individuals in winter 1983–84 at Concord, Massachusetts (Fig. 1). Number of party-hours associated with the highest chickadee total also increased significantly ( $\rho = 0.86$ ,  $P < 0.0001$ ), but no strong relationship existed between year and the standardized chickadee numbers (Pearson  $r = -0.09$ ,  $P = 0.59$ ). Thus, much of the increase in the high count of chickadees is probably due to increased observer effort.

The high total of Black-capped Chickadees during the last 36 years has been confined to 5 count areas (Table 1). (As the focus of this study is on eastern North America, the winter 1947–48 high total at Portland, Oregon, was deleted from further analysis.) The Westport, Connecticut, count had the perennial high total through the mid-1960s, but the count around Concord (started in 1960) has had 16 of the last 18 high totals. Based upon standardized numbers, Concord ( $r = 0.49$ ,  $P = 0.01$ ,  $N = 24$ ) and Cape Cod, Massachusetts ( $r = 0.33$ ,  $P = 0.05$ ,  $N = 37$ ) and Hamilton, Ontario ( $r = 0.50$ ,  $P = 0.002$ ,  $N = 37$ ) all have experienced significant increases in winter chickadee sightings over the years.

Chickadee numbers in Concord were negatively correlated with those at Westport ( $r = -0.41$ ,  $P = 0.04$ ,  $N = 24$ ), as were those on Cape Cod ( $r = -0.37$ ,  $P = 0.03$ ,  $N = 35$ ) and at Greenwich, Connecticut ( $r = -0.32$ ,  $P = 0.05$ ,  $N = 37$ ), suggesting significant shifts in winter abundance between central and southern New England from year to year. Chickadee numbers were positively correlated between Hamilton and Greenwich ( $r = 0.38$ ,  $P = 0.02$ ,  $N = 37$ ).

None of the correlations between mean January temperature and total or standardized numbers of chickadees were statistically significant ( $P > 0.05$ ) at the 4 count areas in the United States.

*Blue Jay population dynamics.*—The highest total for Blue Jays increased steadily during the period ( $\rho = 0.86$ ,  $P < 0.0001$ ), peaking at 2251 individuals in winter 1981–82 at Concord (Fig. 1). Number of party-hours associated with the high total also increased significantly ( $\rho = 0.60$ ,  $P < 0.0001$ ). The relationship between standardized Blue Jay numbers and year was significant ( $r = 0.36$ ,  $P = 0.03$ ), suggesting that Blue

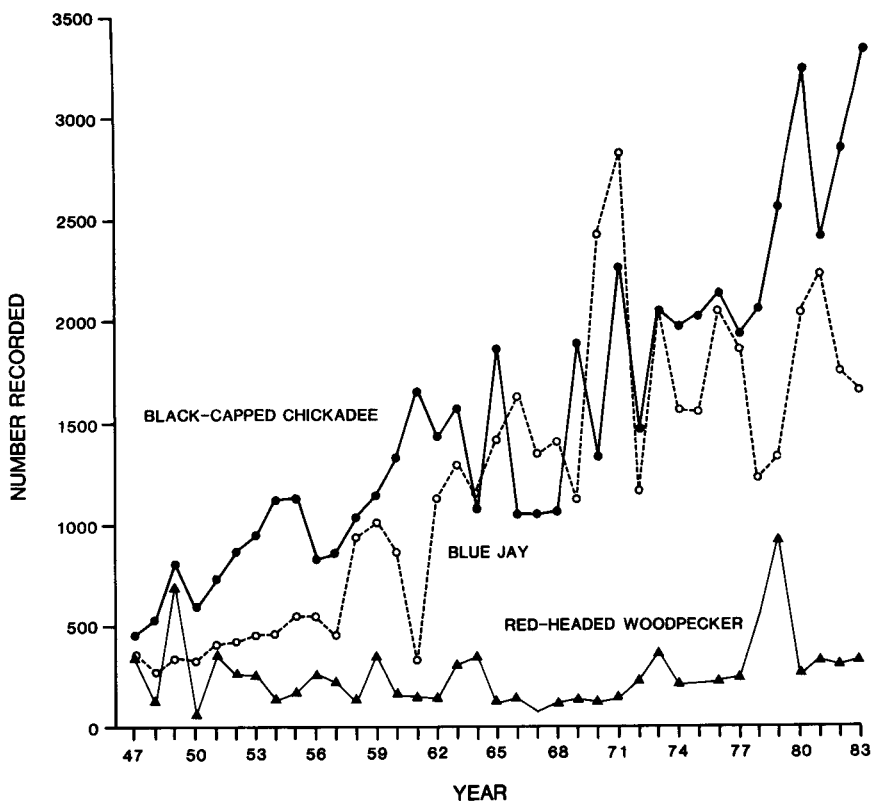


FIG. 1. Number of Red-headed Woodpeckers, Blue Jays, and Black-capped Chickadees reported on Christmas Bird Counts that had the highest number of individuals from winter 1947-48 through 1983-84.

Jay numbers have increased independently of observer effort (cf. Bock and Lepthien 1976b). Standardized jay numbers, however, were significantly correlated with year at only 2 of 12 count areas (Atlanta:  $r = 0.44$ ,  $P = 0.006$ ,  $N = 37$ ; Seneca:  $r = 0.39$ ,  $P = 0.05$ ,  $N = 25$ ).

Twelve count areas have had the high total number of Blue Jays at least once in the last 37 years. Four of these (33%) had the high total only once (Table 1). Jay high-count areas were more widely dispersed than were those for chickadees, and they could be classified into 4 groups based on latitude (Fig. 2A). These included southern areas (34-35°) where high counts occurred early in the history of high counts (Memphis, Atlanta), Maryland (Triadelphia, Seneca) (39°), Connecticut (Hartford, Westport) and the New York City area (Bronx, Central Suffolk County) (41°), and

central Massachusetts (Concord, Northhampton, Springfield) and southern New Hampshire (Nashua) (42–43°). Over the last 30 years, the high-count areas have been in New England, particularly Massachusetts, or in Maryland (Fig. 2A). Over the last 12 years there appears to be an approximate two-year cycle between Massachusetts and Maryland.

Examination of statistically significant correlations among count areas based on standardized jay numbers revealed a pattern that was consistent with a north–south shift in winter population dynamics of Blue Jays. In the north, numbers of jays at Concord were positively correlated with those at Northhampton ( $r = 0.43$ ,  $P = 0.05$ ,  $N = 21$ ), Springfield ( $r = 0.42$ ,  $P = 0.04$ ,  $N = 24$ ), and Bronx ( $r = 0.48$ ,  $P = 0.02$ ,  $N = 24$ ); numbers at Springfield were positively correlated with those at Northhampton ( $r = 0.42$ ,  $P = 0.05$ ,  $N = 22$ ), Hartford ( $r = 0.68$ ,  $P < 0.0001$ ,  $N = 29$ ), Westport ( $r = 0.55$ ,  $P = 0.002$ ,  $N = 29$ ), and Bronx ( $r = 0.37$ ,  $P = 0.05$ ,  $N = 29$ ); numbers at Northhampton were positively correlated with those at Bronx ( $r = 0.54$ ,  $P = 0.009$ ,  $N = 22$ ), as were those at Hartford and Westport ( $r = 0.65$ ,  $P < 0.0001$ ,  $N = 35$ ). In the south, jay numbers at Seneca were positively correlated with those at Triadelphia ( $r = 0.41$ ,  $P = 0.04$ ,  $N = 25$ ) and Atlanta ( $r = 0.45$ ,  $P = 0.02$ ,  $N = 25$ ). The only significant negative correlation among all count areas was between Westport and Atlanta ( $r = -0.34$ ,  $P = 0.05$ ,  $N = 35$ ).

Significant correlations between jay numbers at Memphis with those at Concord ( $r = 0.47$ ,  $P = 0.02$ ,  $N = 24$ ), Northhampton ( $r = 0.44$ ,  $P = 0.04$ ,  $N = 22$ ), Springfield ( $r = 0.63$ ,  $P = 0.0002$ ,  $N = 29$ ), Hartford ( $r = 0.44$ ,  $P = 0.007$ ,  $N = 37$ ), and Westport ( $r = 0.34$ ,  $P = 0.05$ ,  $N = 35$ ) are inconsistent with the pattern mentioned above. The reason for these relationships remains obscure, particularly as jay numbers (and party-hours) have remained relatively constant at Memphis, while varying considerably at the other sites (Table 1).

Mean January temperatures and jay numbers were negatively correlated at Northhampton ( $\rho = -0.45$ ,  $P = 0.007$ ,  $N = 34$ ), Hartford ( $\rho = -0.33$ ,  $P = 0.05$ ,  $N = 36$ ), and Atlanta ( $\rho = -0.40$ ,  $P = 0.01$ ,  $N = 36$ ). The relationships at the two Maryland count areas were close to being significant (Triadelphia:  $\rho = -0.33$ ,  $P = 0.06$ ,  $N = 34$ ; Seneca:  $\rho = -0.36$ ,  $P = 0.08$ ,  $N = 24$ ), suggesting that more jays were observed in more southerly areas during cold winters there. All of these relationships may be due to increased observer effort as no correlations between standardized jay numbers and temperature were statistically significant at any count area, although the correlation for the Atlanta count was close to significance ( $r = -0.31$ ,  $P = 0.06$ ).

*Red-headed Woodpecker population dynamics.*—In contrast to the other species studied, the high total for Red-headed Woodpeckers has not

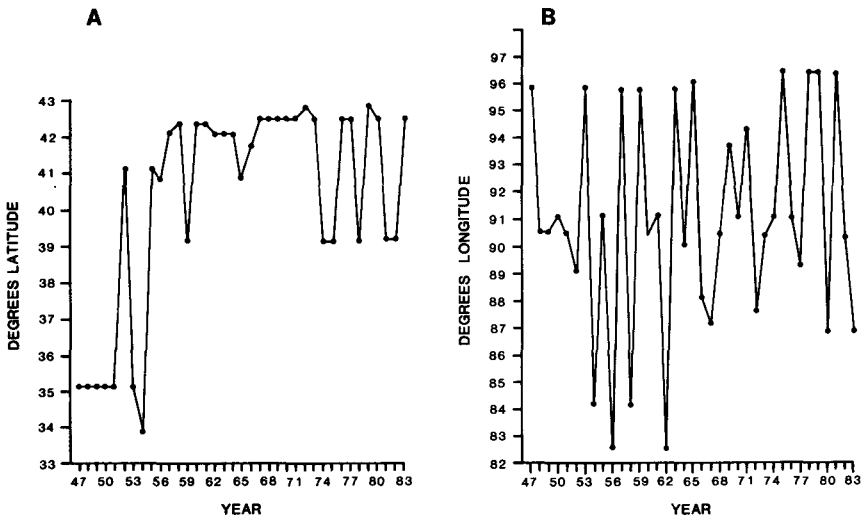


FIG. 2. Latitude of count area with the highest number of Blue Jays (A) and longitude of the count area with highest number of Red-headed Woodpeckers (B) from winter 1947–48 through 1983–84.

increased significantly over the last 37 years ( $\rho = 0.16$ ,  $P = 0.33$ ). The highest number reported was 914 individuals at Manhattan, Kansas, in winter 1979–80 (Fig. 1). There was also an “estimate” of 700 woodpeckers associated with pecan groves around the Pere Marquette Park count in winter 1949–50 (Anonymous 1952). Party-hours associated with the high woodpecker number have continued to increase significantly ( $\rho = 0.42$ ,  $P = 0.01$ ), meaning that more observer effort has produced relatively fewer woodpeckers ( $r = -0.35$ ,  $P = 0.04$ ).

During the last 37 years, 19 Christmas Bird Count areas had the high count for Red-headed Woodpeckers; 11 of these (58%) had the high total only once (Table 1). These count areas are more widely dispersed than those of the previous 2 species, and they can be classified into 4 groups based on longitude (Fig. 2B). These include Ohio (Cincinnati, Buckeye Lake) (82–85°); Indiana (Indiana Dunes, Turkey Run), Kentucky (Land Between Lakes), eastern Illinois (Forest Glen Preserve) (87–88°); western Illinois (Murphysboro, Beverly, Pere Marquette), eastern Missouri (Orchard Farms, Mingo National Wildlife Refuge, Sullivan), eastern Arkansas (White River National Wildlife Refuge) (89–91°); and western Missouri (Montrose Lake), western Arkansas (Fort Smith), Oklahoma (Tulsa, Hulah Reservoir), Kansas (Manhattan) (94–96°). Year-to-year geographic variation in these areas was great. For example, for each year that the

high total was in Ohio, the high total either the preceding or succeeding year was in Tulsa (Fig. 2B). No obvious long-term trends in woodpecker occurrence were evident from examination of the location of individual count areas. For example, the Pere Marquette Park count had the high total during winters 1948–49, 1949–50, 1951–52, 1968–69, 1973–74, and 1982–83. Also, unlike the other two species, it was unusual for the high total to be at the same count area for two consecutive years (two instances) (Fig. 2B).

Although it appears difficult to predict where the high count for Red-headed Woodpecker will occur in any given year, nearly half the high totals have occurred near the center of the wintering range (e.g., Peterson 1980). About a fourth of the high totals have occurred with regularity over the last 37 years along the extreme western edge of the wintering range, formerly in Oklahoma and more recently in Kansas. The high total area formerly was found as far east as Ohio, but recently it has not been farther east than Indiana.

Unlike the other two species, no geographic pattern was evident in the statistically significant correlations among count areas based on standardized woodpecker numbers. Only 13 of the 171 pair-wise comparisons (7.6%) between the 19 high count areas were significant ( $P < 0.05$ ), which is not much higher than predicted by chance alone.

No correlations between mean January temperature and woodpecker numbers were statistically significant. Only one of the 19 comparisons between temperature and standardized numbers was statistically significant (Fort Smith:  $r = 0.41$ ,  $P = 0.02$ ,  $N = 30$ ), which is the number expected by chance alone.

*Comparisons among the three species.* — The high annual totals for Black-capped Chickadees and Blue Jays were significantly correlated ( $\rho = 0.74$ ,  $P < 0.0001$ ,  $N = 36$ ). This relationship disappeared, however, when standardized numbers were analyzed ( $r = -0.04$ ,  $P = 0.81$ ,  $N = 34$ ), suggesting that increased observer effort was the underlying cause of the relationship. Red-headed Woodpecker annual high totals were not significantly correlated with those for either chickadees or jays in any analysis.

Red-headed Woodpecker winter populations fluctuated to a greater degree than those of chickadees or jays (Table 1). Blue Jay and Black-capped Chickadee populations had similar magnitudes of fluctuation in New England, but jay populations in Maryland and at Atlanta were relatively more variable than those further north.

#### DISCUSSION

Results presented here are consistent with the hypothesis that greater dependence on mast crops as a winter food source is associated with



greater spatial and temporal variation in abundance during winter. Numbers of Red-headed Woodpeckers, the species most reliant on mast crops, were more variable than those of the other two species in all aspects of wintering population dynamics examined. Fluctuations in jay numbers were intermediate between those of woodpeckers and chickadees. Severe winter weather (based on mean January temperature) did not appear to influence the population dynamics of these species.

The relatively large number of count areas that have had the high total of Red-headed Woodpeckers supports the suggestion by Bock et al. (1971) that Red-headed Woodpeckers seek out areas with high mast abundance. For example, the Pere Marquette Park count has had the high total more than other counts presumably due to woodpeckers being attracted to the pecan groves near the count area. Manhattan has had the high count several times in recent years because participants in the count devote more attention to the riparian oak woodlands on the Konza Prairie, areas within the census circle that were neglected in years past (C. C. Smith, pers. comm.). But even at these two areas, there were years when no Red-headed Woodpeckers were reported. In some respects, the winter population fluctuations of Red-headed Woodpeckers are similar to those of nomadic carduline finches (e.g., crossbills) that search for and are attracted to areas with high coniferous cone crops (Smith 1978). A high count of Red-headed Woodpeckers one year is no guarantee that any woodpeckers will be present the following year in the same area.

The relative consistency with which the high count for Red-headed Woodpeckers occurs on the extreme western edge of the wintering range is of interest. Although the origin of birds appearing in these areas is unknown at present, it is tempting to speculate that these birds are coming from the breeding areas to the west and north of the wintering range, stopping in years when mast crops are abundant, but continuing eastward when mast crops are low. Fall mast crop surveys conducted by Christisen (1980) in Missouri from 1954 through 1980 lend support to this theory. During those 27 years, only two years (1964 and 1970) were classified by Christisen as "good" mast crop years, the other 25 years being classified as "fair." In both those good years, the count area with the highest number of Red-headed Woodpeckers was in Missouri (Mingo National Wildlife Refuge and Sullivan, respectively).

Unlike Red-headed Woodpeckers, Blue Jays almost never completely abandon wintering areas; rather, populations fluctuate between high and low years (Smith 1986). Nonetheless, in areas where these species co-occur in winter, such as the Ozarks, populations of both species closely co-vary, which Smith (1986) attributed to use of mast crops by both species. Results presented here suggest that in some years populations of Blue Jays in the east move down the coast from New England to Maryland,

presumably corresponding to food shortages in the north. Such a migratory pattern for Blue Jays is well-documented by banding recovery data (e.g., Kennard 1980, Stewart 1982). These results are also consistent with the claim that Blue Jays in general appear to be wintering further north now than they have in the past (Bock and Lephien 1976b; T. Root, pers. comm.).

Winter populations of Black-capped Chickadees also experienced high and low years (Loery and Nichols 1985). Several researchers (Perrins 1966, Bejer and Rudeno 1985) have linked mast crop abundance with population density in several species of European parids. Bagg (1969) demonstrated that movement of primarily juvenile chickadees in Maine and Ontario was correlated with low levels of both conifer and mast crops. Results presented here suggest some coordination between population levels in Massachusetts and the Connecticut coast. Chickadee populations may move between central and southern New England (see Lawrence 1958), but, at present, most data suggest shorter winter movements for Black-capped Chickadees in Massachusetts (Smith 1984). Also, based on the last 18 years, one might expect the high total for Black-capped Chickadees to occur at Concord nearly every year.

The nearly cyclic east-west pattern found in the occurrence of the Red-headed Woodpecker high counts (Fig. 2B) strikingly parallels the north-south eruptive pattern of seed-eating boreal birds discovered by Bock and Lephien (1976a). By combining a variety of data sets on seed abundance, these researchers were able to demonstrate that southern movements were correlated with a general circumboreal seed crop failure. While comparable data for mast abundance throughout the eastern United States are lacking, mast abundance may be the underlying factor responsible for the geographic pattern in Red-headed Woodpecker high counts. A cyclic north-south pattern also emerges in the occurrence of Blue Jay high counts (Fig. 2A).

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#### NORTH AMERICAN LOON FUND GRANTS

The North American Loon Fund (NALF) announces the availability of two grant programs for support of new or current research, management, or education projects that may yield useful information for Common Loon conservation in North America.

The first of these programs, the Robert J. Lurtsema Research Award, consists of a \$1,000 stipend available annually for a suitable research project focused on a member of the Family Gaviidae. Preference will be given to students and independent researchers with limited availability of other funding.

The second program offers modest grants in support of research, management, or educational projects directly related to the conservation of Common Loons as a breeding species. Proposals in the range of \$500 to \$3,000 are most likely to be considered for funding.

Further guidelines for prospective applicants are available upon request from the NALF Grants Committee. Deadline for submission of proposals is January 31, 1987. Funding awards will be announced by March 15th.

Please submit guideline requests to:

North American Loon Fund Grants Committee  
North American Loon Fund  
Main St., Meredith, NH 03253