

Population and Individual Responses of Red-breasted Nuthatches (*Sitta canadensis*) to Supplemental Food in Central Maine

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ABSTRACT

Ten Red-breasted Nuthatches (*Sitta canadensis*) were color-banded at two constantly stocked feeding stations in a remote part of central Maine in the winter of 1995/1996. All of the banded nuthatches survived the winter. Total feeder visits by Red-breasted Nuthatches increased over the course of the winter. Mark-recapture analysis showed that this increase was due to discovery of the feeders by unbanded nuthatches. The intensity of feeder use by Red-breasted Nuthatches and Black-capped Chickadees was similar.

INTRODUCTION

In populated areas, many wintering land birds are able to supplement their diet at bird feeders. Bird feeding stations represent a predictable component of the landscape and, hence, must be acknowledged by researchers in any study of the winter ecology of birds that frequent feeders (Wilson 1994). Ornithologists have used food supplementation as a tool to assess the likelihood of food limitation on the wintering grounds for land birds. We know that food supplementation can increase the winter survivorship of Black-capped Chickadees (*Poecile atricapilla*) in several different regions of North America (Brittingham and Temple 1988, 1992a, 1992b; Desrochers et al. 1988; Egan and Brittingham 1994). Supplemental food improves the physiological condition of Downy Woodpeckers (*Picoides pubescens*), Carolina Chickadee (*Poecile carolinensis*), Tufted Titmouse (*Baeolophus bicolor*), and White-breasted Nuthatches (*Sitta carolinensis*) (Grubb and Cimprich 1990).

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Food supplementation can affect the social structure of wintering birds. Flocks of wintering birds decrease in size when supplemental food is provided (Grubb 1987; Szekeley et al. 1989). Territorial defense weakens in the presence of bird feeders (Wilson 2001). Habitat choice of wintering birds can be altered by the presence of feeding stations (Wilson 1994).

In the winter of 1995/1996, I conducted a food supplementation study in a remote part of central Maine. Most of the work to date on the impacts of supplemental food has concentrated on population responses (e.g., Yunick 1997; Wedeking et al. 2001). One goal of my study was to examine inter-individual variability in feeder use in addition to assessing the impacts of supplemental food on local populations. A companion paper (Wilson 2001) focused on Black-capped Chickadees. In this paper, I report on population and individual responses of Red-breasted Nuthatches (*Sitta canadensis*) to supplemental food during the winter.

METHODS

To avoid areas where other people were maintaining bird feeders that might influence the birds studied, I chose a remote site 100 km northwest of Colby College. This study was conducted along Long Falls Dam Road on the eastern shore of Flagstaff Lake (45°10' N, 70°01' W) at altitudes ranging from 350 m to 440 m in Somerset and Franklin counties, Maine. I established two feeding stations on Maine Reserved Land, which is protected second growth forest. There were no human dwellings along this portion of the road and the closest bird feeders were 15 km distant. The forest was dominated by conifers: red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), eastern white cedar (*Thuja occidentalis*), eastern hemlock (*Tsuga canadensis*), and eastern white pine (*Pinus strobus*).

A National Weather Service station was located at Long Falls Dam, adjacent to Long Falls Dam Road. Mean high and low monthly temperatures for the study period were -4.9° and -13.7° C for December, -5.4° and -17.4° C for January, and -4.2° and -15.7° C for February.

I set up the two feeding stations on 25 Oct 1995 at densely forested sites within 30 m of the road. The sites are called Site 1 and Site 12 in Wilson (2001) and for comparability, those names are used in this paper. The two sites are 16 km apart. I placed two cylindrical Magnum™ feeders at each site. The feeders were 20 cm in diameter and 40 cm tall. I suspended the feeders from steel cable strung between two trees at a height of 2 m. The feeders were located within 5 m of each other to facilitate simultaneous observation. Each feeder was filled with black oil sunflower seeds. On four dates between 25 Oct and 19 Nov, I captured, with mist-nets, birds coming to the feeders. Red-breasted Nuthatches, White-breasted Nuthatches, and Black-capped Chickadees were color-banded with unique combinations of two color bands. Other species were fitted only with numbered aluminum bands from the Bird Banding Laboratory. Six Red-breasted Nuthatches were color-banded at Site 1 and four at Site 12. All ten Red-breasted Nuthatches were alive at the end of the study on 12 Mar 1996.

Beginning on 29 Nov 1995, I made weekly two-day trips to the area with the exception of an hiatus between 19 Dec 1995 and 5 Jan 1996. Each week, I made observations at each site for at least four 30-min periods at different times of the day. From a vantage point 8 m away affording views of both feeders, I recorded the number of visits by all birds to the feeders. To qualify as a visit, a bird had to remove a sunflower seed. Birds that came to the feeder and were displaced or frightened away before feeding were not counted. I used Zeiss 7x42 binoculars and a hand-held tape recorder to observe feeders and record data.

Bird feeders were filled during each visit. Typically, half of the food in each feeder was removed by the birds each week. To ensure that neither site was ever without sunflower seed, I put up an additional feeder for a 17-day period in late December and

early January when I was unable to visit the field site. A modicum of food was still present at each site on 5 Jan.

Individual Red-breasted Nuthatches were identified with various degrees of precision. Some birds that came to the feeders did not provide me a sufficient view to determine if bands were present; these nuthatches were recorded as R (Red-breasted). I recorded unbanded birds that visited a feeder as uR (unbanded Red-breasted). Other birds were obviously banded but viewing angles prevented me from seeing all three bands; these birds were recorded as bR (banded Red-breasted). Finally, some birds that came to the feeder could be identified by their unique combination of color bands.

For each 30-min period, I calculated the total number of successful feeder visits made by the nuthatches. However, two confounding effects, variable nuthatch numbers and variable feeding rates, make such data difficult to interpret. To separate these two effects, I used the mark-recapture analysis program NOREMARK (White 1996) to estimate the total number of nuthatches using the feeders each week. This software explicitly allows for resighting of marked but imprecisely identified individuals (bRs in the present analysis). The software also does not assume that the probability of resighting for each marked individual is the same. NOREMARK does incorporate the assumption of a closed geographic population. Before generating population estimates, I had to classify the R nuthatches, i.e. those that could not be seen well enough to know if they had been banded or not. I classified the R nuthatches for each 30-min observation period by totaling the number of uR bird visits and the number of banded bird visits (bR birds plus all visits by uniquely identified birds). The proportions of unbanded and banded birds were used to apportion the unclassified nuthatches between the banded or unbanded class. The data for all 30-min observation periods in each week were summed to provide NOREMARK input.

RESULTS

The banded Red-breasted Nuthatches varied in their feeder visitation rate (Table 1). At site 1, one

nuthatch was identified taking a seed 97 times in 26.5 hours of observations. The least frequent visitor at Site 1 took a seed on 21 occasions over that same time period. At Site 12, in 23 hours of observations, feeder visitation ranged from 138 to 21 visits.

Table 1. Total feeder visitations by the ten Red-breasted Nuthatches at the two feeding sites. For Site 1, 51 30-min observations were made; for Site 12, 46 30-min observations were made. X indicates the numbered aluminum band. The aluminum band was on the left tarsus and the color-bands on the right tarsus.

Color Combination	Site	Number of Feeder Visitations
X:Yellow-Red	Site 1	97
X:Yellow-Green	Site 1	60
X:Yellow-Mauve	Site 1	36
X:Orange-Green	Site 1	34
X:Yellow-White	Site 1	21
X:Yellow-Yellow	Site 1	10
X:Orange-Yellow	Site 12	138
X:Orange-White	Site 12	38
X:Green-Red	Site 12	24
X:Green-Orange	Site 12	21

Figure 1 shows the abundance of banded and unbanded nuthatches over the course of the study (29 Nov 1995 until 12 Mar 1996). Analysis of variance (ANOVA) indicates that significant differences in visitation rate by banded nuthatches occurred at Site 1 ($F_{13,37} = 2.702$, $p = 0.0089$). Pair-wise Scheffé post-hoc contrasts reveal that nearly all of the significant differences occur from comparisons to the anomalously low number of feeding visits on 7 Feb. No significant differences are found between most other dates, indicating that feeder use by the six banded nuthatches is nearly constant throughout. Strong differences in feeder visitations by unbanded nuthatches occurred at Site 1 ($F_{13,37} = 3.115$, $p = 0.0033$). I will not give a tedious account of all of the pair-wise Scheffé contrasts. Inspection of Fig. 1 reveals the general result of the post-hoc tests; unbanded nuthatch visits increase through time.

The dynamics of banded and unbanded Red-breasted Nuthatches at Site 12 are given in Fig. 1 as well. For banded nuthatches, ANOVA indicates no significant differences in feeder use throughout

the study ($F_{13,32} = 1.445$, $p = 0.1930$). For the unbanded nuthatches at Site 12, however, a strong pattern of increasing use is evident ($F_{13,32} = 2.702$, $p = 0.0089$). Significant pair-wise contrasts are found between most of the dates before 19 Jan with dates after 19 Jan. A clear pattern of increasing visitations by unbanded nuthatches is evident.

The results of total population sizes using NOREMARK are shown in Fig. 2. Inspection of the points (with the 95% confidence intervals indicated) reveals a pattern of increasing number of Red-breasted Nuthatches for Site 1. The population estimate of 61 birds on 7-8 Feb is remarkable and perhaps anomalous. At Site 12, an overall pattern of increase is evident as well, although the large confidence intervals indicate the population estimates are not different statistically on most dates.

DISCUSSION

Red-breasted Nuthatches spend the winter either alone or in small flocks (Ghalambor and Martin 1999). They often are found in mixed-species flocks with Black-capped Chickadees. In this study, the 10 color-banded Red-breasted Nuthatches showed high site fidelity. All individuals banded in the fall were seen during the last week of the study in March. It is not known how widely each banded Red-breasted Nuthatch ranged. The two sites were separated by 16 km and no nuthatch banded at one site was ever seen at the other site.

The banded nuthatches varied in their feeder use (Table 1). A comparison to the visitation of rates by Black-capped Chickadees at the two sites indicates a similar feeder use. At Site 1, banded Black-capped Chickadees visited the feeders an average of 85.4 times over the 26.5 hr of observation (Wilson 2001) while Red-breasted Nuthatches visited an average of 56.8 times. These means are not statistically different ($t_{21} = 1.15$, $p = 0.2630$). At Site 12, the mean for chickadees was 38.2 and for nuthatches, 55.8. These means are also not different statistically ($t_{21} = 0.807$, $p = 0.4300$). The average mass of the two species is quite similar. The range for Black-capped Chickadee is 8.2-13.6 g and for Red-breasted Nuthatch, 8.0-12.7 g (Dunning 1993). Therefore, one expects the two species to have similar basal metabolic rates (Withers 1992), although Red-

Fig. 1. The mean number of feeder visits per 30-min observation period at the two sites. The error bars represent one standard error.

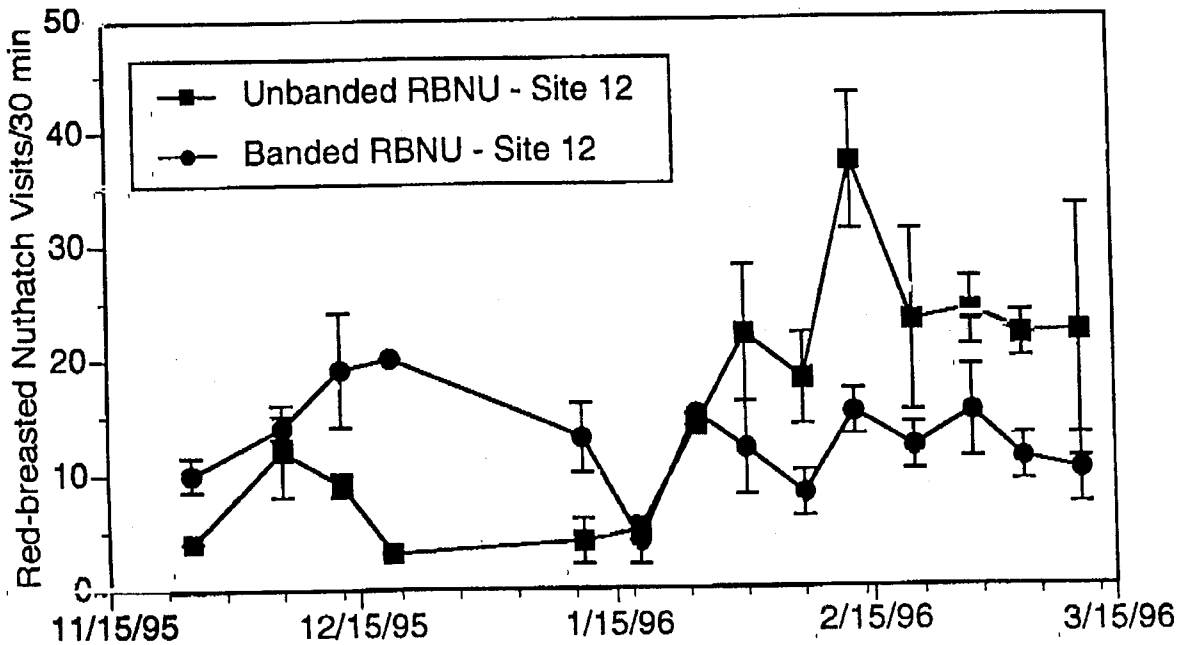
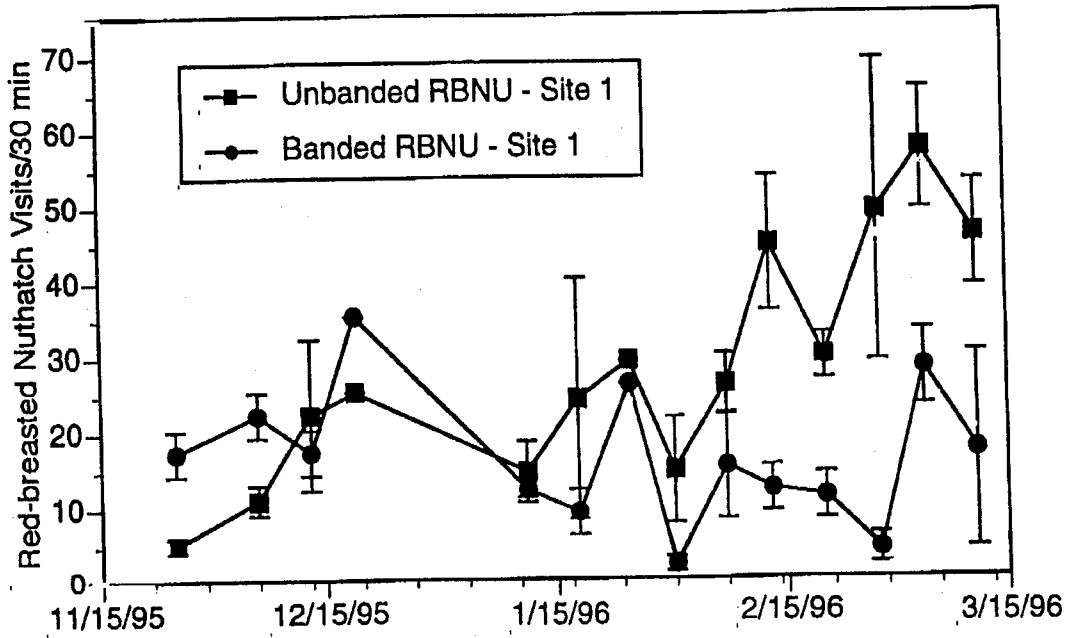
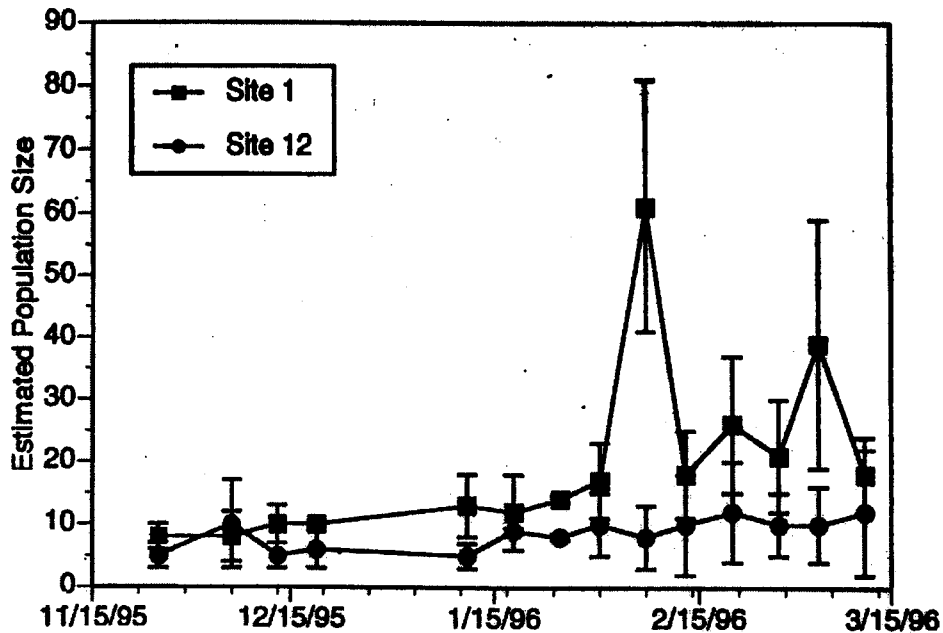


Fig. 2. Estimated population size of Red-breasted Nuthatches during each week of the study. The estimates were obtained using NOREMARK software (White 1996). Error bars represent 95% confidence intervals.



breasted Nuthatches seem less frenetic than Black-capped Chickadees. The data suggest that the two species used the sunflower seeds provided at the feeders to a similar degree.

The number of visits by banded nuthatches remained reasonably constant throughout the study (Fig. 1). However, a clear pattern of increasing visits by unbanded nuthatches emerged (Fig. 1). This rise in feeder visitations could be explained by increasing use by a fixed number of unbanded nuthatches or by an increasing population of nuthatches. Mark-recapture analysis suggests the latter explanation (Fig. 2). The population of unbanded nuthatches increased at both sites, particularly at Site 1.

As demonstrated in Wilson (2001) for Black-capped Chickadees at these field sites, feeders are magnets for Red-breasted Nuthatches in the Flagstaff Lake region. The feeders were discovered by nuthatches throughout the study leading to an increase in total Red-breasted Nuthatch population size over the course of the winter. These findings reinforce the observation by Wilson (1994) that field ornithologists need to be aware of the proximity of feeders in avian population studies.

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