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Status, Condition, and Movement Patterns of Red-breasted Nuthatches in Anchorage, Alaska, 1990-1995

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ABSTRACT

I studied the migration, body condition, and age and sex demographics of Red-breasted Nuthatch (Sitta canadensis) *populations in Anchorage, Alaska, from 1990 - 1995. Red-breasted Nuthatches are a recent addition to the avifauna of much of Alaska. Presumably, habitat change and climate change are ameliorating conditions near the northern range limits for this species.The sampled population (n = 94) included 73.5% migrants and 20.2% winter residents and winter visitors and was dominated by males (64.9%). Winter residents showed a high degree of site fidelity between years. Fall migration occurred from mid-Jul to mid-Sep and peaked from 22 Aug - 3 Sep. Over-wintering birds returning from previous years arrived before the onset of peak migration. Mean body mass was 11.16 g (n = 164) before midday and 11.52 g (n = 178) after midday. Mean body mass for all individuals at all times of day did not vary much by month (range = 11.1 g in Sep to 11.9 g in Apr). Migrants and wintering birds gained mass at a rate of 0.07 ± 0.02 - 0.03 g/hr from dawn to dusk. Maximum fat accumulation occurred Dec - Feb, and minimums occurred Apr - Jun. Peak body molt (ventral tract) occurred in Jul, with heavy molt persisting into Aug and moderate molt persisting into Oct. Heavy and moderate capital tract molt occurred 20 Aug - 3 Oct. Apparently, most adult rectrix and remige molt occurred on the breeding grounds before fall migration commenced. Mean adult wing and tail length are larger in Anchorage than elsewhere in North America. The data suggest Red-breasted Nuthatches migrating through Anchorage were produced locally, rather than from irruptions from Canada or elsewhere in Alaska.*

INTRODUCTION

Red-breasted Nuthatch *(Sitta canadensis)* populations have expanded considerably in range and number in Alaska before, during, and after the study. Gabrielson and Lincoln (1959) reported only nine known occurrences in Alaska, with all but one in southeast Alaska. Of these occurrences, at least six were between 1899 and 1913, and all records with dates were from 23 Apr - Jul. The lone observation outside of southeast Alaska occurred in the Copper River Valley prior to 1929. However, Red-breasted Nuthatches were documented near Anchorage from 1952 - 1954 and 1961 - 1962, and on the Kenai Peninsula in 1954 and 1962 (Williamson et al. 1965); all records were from 24 Apr - 1 Sep. The first overwinter records (>3 birds) occurred in Juneau, starting on 13 Oct 1963 and culminating in breeding and fledging of young in Jun 1964 (Hemming 1966). In 1964, Red-breasted Nuthatches also showed up in Cordova, Tonsina, and Snowshoe Lake (in the Copper River Valley), near Dillingham in southwest Alaska, and in Anchorage where five fledglings were found near their nest (Hemming 1966).The nests in Juneau and Anchorage in 1964 were the first documentation of nesting in Alaska, though nest prospecting behavior was noted in 1907 on Admiralty Island (Gabrielson and Lincoln 1959) and in 1961 in Anchorage (Williamson et al. 1965). Since 1964, Red-breasted Nuthatches have expanded their range to and/or been documented on Kodiak Island, the Alaska Peninsula, Fairbanks, and St. Lawrence Island (Kessel and Gibson 1978).

Christmas Bird Count (CBC) data for south-central Alaska also show that the population has been increasing (National Audubon Society [NAS] 2017). In Anchorage, the number of nuthatches found on CBCs ranged from 0 - 4 during 1970 - 1980, from 23 - 71 during 1984 - 1990, from 95 - 157 during 1991 - 1994, and from 197

- 297 during 1995 - 2000. Similar substantial increases occurred on CBCs during the period 1990 - 1993 including in Eagle River, Palmer, Kodiak, Seward and Homer. Red-breasted Nuthatches have also been regularly found on the Fairbanks CBC since 1992, with a peak of 23 in 1993.

Very little information is available about population age and sex composition and body masses, especially during winter (Ghalambor and Martin 1999). Because Anchorage is at the northern (and western) extreme of the Red-breasted Nuthatches year-around range, nutritional dynamics during the short winter days may reflect an extreme condition the species can tolerate (see Root 1988). There are few opportunities to study winter body condition in other locales at the northern end of the range other than in Anchorage where sufficient sample sizes can be obtained.

Limited information is available on the movements of Red-breasted Nuthatches in Alaska. Since none of the records available to Gabrielson and Lincoln (1959) were during winter, they believed the species undertook a true migration out of the state. The series of observations near Dillingham in 1964 are suggestive of spring and fall migration patterns; i.e., observations of numerous individuals and groups from 25 Apr - 28 May and 19 Sep - 16 Oct, with no observations Jun - Aug (Hemming 1966). Ghalambor and Martin (1999) classified Red-breasted Nuthatches as partial migrants, and indicated they potentially undertake several types of movements: 1) true southward migrations with return to specific breeding areas, 2) centrifugal migration (southward migration without return to specific breeding areas), 3) altitudinal migration in montane areas, and 4) no migration (i.e., remain as permanent residents). Northern populations are more likely to be migratory, showing an irruptive pattern of migration, and southern populations are more likely to be permanent residents. I studied the migration, body condition, and age and sex demographics of Red-breasted Nuthatch populations in Anchorage, Alaska, from Apr 1990 - Mar 1995. My findings suggest another potential type of movement is simply a local shift between summer and winter habitats, irrespective of altitude.

METHODS (Tables 1-6 See Appendix)

Red-breasted Nuthatches were captured year-around from 21 Mar 1990 - 1 Apr 1995 using 1 - 2 mist nets (6-m long, 30-mm mesh) arrayed around a feeding station and designed to intercept migrants that I observed following vegetation lines and local terrain. Net placement was consistent from Aug 1991 - Apr 1995. Nets were usually checked at least once every 15 min but never less than once every hour. Newly captured nuthatches were banded with a metal U.S. Fish and Wildlife Service size-0 band, aged by examining degree of skull ossification, sexed by crown color, weighed and measured, and examined for wing and body molt and abdominal fat condition. Recaptured nuthatches were usually weighed and often re-measured and examined for molt and fat condition. Mass, fat and molt conditions from recaptured birds are included in analyses that assess daily and seasonal changes. Of all the individuals recaptured multiple times in a single day, only one, a female, was weighed twice in the same day, once in the AM and once in the PM, and both weights are included in analyses. Wing and tail measurements from recaptured birds are used only once per molt cycle, from the first recapture following molt, in assessments of age-related growth. From 21 Mar 1990 - 27 Oct 1992, nuthatches were weighed with a 50g Pesola scale to the nearest 1 g; thereafter, they were measured with a more-precise Ohaus 300g electronic scale to the nearest 0.1 g. Wing chord and tail were measured to the nearest 0.5 mm. Abdominal fat and body molt were rated on a scale of 0 - 3 (none to heavy). Capture times were recorded to the nearest 10-min interval and standardized to Alaska Standard Time.

I used a multivariate analysis (Program JMP [SAS]) to explore differences in mass by sex, month, time of day (before and after midday, which occurred at 1245 AST), and scale type. Because scale type was not significant ($F = 1.1297$, $p = 0.3244$), further analyses combined masses across scale types.

Captured birds were classified as fall migrants, spring migrants, winter residents, winter visitors, permanent residents, summer residents, locals, or unknown based on the following criteria. Migrants

were captured once or very few times in a short period of time during spring (Mar – May) or fall (mid-Jul - Sep). Winter residents were regularly captured throughout the winter or captured frequently for a long period of the winter before recaptures ceased (the latter assumes mortality, but could have included emigration). Winter visitors were captured infrequently and widely spaced through time. Both winter residents and winter visitors may also have been present spring, summer, or fall, but not year-around. The differentiation between winter residents and winter visitors is valid only at the site-level scale; there is no difference at the landscape scale. This differentiation is useful to examine settling patterns. Summer residents were known or likely breeders, and not present the previous or following winter. Locals were hatch-year birds that showed up at the banding station shortly after fledging occurred and before fall migration began.

The study site was a heavily-wooded, sparsely-populated residential area on the Anchorage hillside, at an elevation of 110 m above mean sea level (msl), at 61°07' N, 149°49' W. Dominant trees in the area included paper birch *(Betula papyrifera),* aspen *(Populus tremuloides, P. balsamifera),* and white spruce *(Picea glauca)*. Dominant shrubs included willows *(Salix spp.),* red elderberry *(Sambucus racemosa)*, and devil's-club *(Oplopanax horridum).* Dominant herbaceous vegetation was fireweed *(Epilobium angustifolium)* and bluejoint grass *(Calamagrostis canadensis)*. I, and other residents in the neighborhood, provided supplemental food throughout the year, which likely influenced weight and fat conditions, especially in winter. Forested habitats in Anchorage ranged from sea level (0 m msl) 3.4 km west of my banding station) to tree line in the foothills of the Chugach Mountains at about 450 m msl (6.5 km east of my banding station). The foothills of the Chugach Mountains in Anchorage form part of a continuous arc of interface between mountains and lowlands extending from the Denali area (to the north) to the southern end of the Kenai Peninsula; this north-south interface likely funnels many south-bound migratory birds from interior Alaska through Anchorage. Seasons in Anchorage vary considerably based on amount of daylight and snow cover. Birds in Anchorage experience short winter days from early November through January, with daylight occurring from about 1000-1530. Hours of daylight change quickly over a two-month period centered around each equinox. Heavy snows and deep snow cover can occur from November through April, although temperatures are mild relative to interior Alaska.

RESULTS

I captured and banded 93 Red-breasted Nuthatches, and found one other dead male at the base of a window from which I collected morphological data. Of these, 67 (71.3%) were classified as fall migrants, 1 (1.1%) as a spring migrant, 1 (1.1%) as a spring and fall migrant, 12 (12.8%) as winter residents, 7 (7.4%) as winter visitors, 3 (3.2%) as locally hatched fledglings, and 3 (3.2%) as unknown. None were classified as permanent or summer residents or local breeders, although one of the winter residents likely nested one spring, and one other winter resident did not leave one year (these apparent discrepancies are clarified later). Of the 93 banded nuthatches, 36 (38.7%) were recaptured: 30 nuthatches recaptured 1 - 9 different dates, 2 females recaptured 17 different dates, 2 males recaptured 26 different dates, 1 female recaptured 42 different dates, and 1 male recaptured 61 different dates, with a maximum of 5 recaptures per day.

Overall Sex and Age Composition - The sex composition of the 94 nuthatches encountered was 64.9% male (n = 61), 34.0% female (n = 32), and 1.1 % unknown (n = 1; Table 1). The overall sex ratio was significantly different from a 50:50 sex ratio ($X^2 = 9.04$, df = 1, $p < 0.005$). When all initial captures and recaptures are combined, the sex ratio was slightly skewed in favor of males (56:44; $X^2 = 1.44$, df = 1, $p > 0.05$) from Nov - Mar, but widely skewed in favor of males (67:33; $X^2 = 11.56$, df = 1, $p < 0.001$) from May - Oct (Table 1). Possible reasons for the skewed sex ratios include differing catchability, differing survival rates, or differing migration strategies between the sexes.

During the period Jul - Sep when ages could be determined by degree of skull ossification, new captures consisted of 54 (65.9%) juveniles, 9 (11.0%) adults, and 19 (23.2%) unknown-aged birds. However, this ratio is biased against adults

that were banded previous years or seasons. When recaptures are included in the age tally (once per year for this time period), the age ratio becomes 54 (57.4%) juveniles, 21 (22.3%) adults, and 19 (20.2%) unknown-aged birds. The age composition of all new captures from year-around data was 54 (57.4%) juveniles, 10 adults (10.6%), and 30 (31.9%) unknown-aged birds.

Fall Migrants - Sixty-eight birds were classified as fall migrants (n = 67) or spring and fall migrants (n = 1). Two fall migrants were recovered in subsequent years. The composition of fall migrants included 45 (66.2%) males, 22 (32.4%) females, and 1 (1.4%) of unknown sex, by sex; and 41 (58.6%) juveniles, 12 (17.1%) adults (9 new captures plus 3 recoveries), and 17 (24.3%) unknown-aged birds, by age. Initial captures of fall migrants ranged from 9 Jul - 20 Sep, with peak migration occurring 22 Aug - 3 Sep (n = 28 [40%]). Bimonthly totals (n = 67 new captures and 3 recoveries) included 12 birds 15 - 31 Jul, 9 birds 1 - 15 Aug, 26 birds 16 - 31 Aug, and 20 birds 1 - 14 Sep; outliers are 1 on 9 Jul and 2 on 20 Sep. The average duration of stay of fall migrants (n = 70, including 50 that were not recaptured) was 4.1 days (range 0 - 49 days). The average duration of stay of the 20 fall migrants that were recaptured was 14.3 days (range 1 - 49 days). The 2 birds recovered subsequent years were a juvenile male captured 22 Aug 1992, 22 Aug 1993, and 11 Sep 1993; and an adult female captured 28 - 29 Aug 1992, 11 Oct 1992, and 10 Sep 1993. The spring and fall migrant was an adult male caught 4 Apr, 18 Jul, 21 Aug, and 5 Sep 1993.

Winter Residents and Winter Visitors - I classified 12 birds as winter residents and 7 as winter visitors. All winter residents were captured numerous times to provide a consistent record of their presence (e.g., male #81400 was caught 29 times on 27 dates; female #81401 was caught 47 times on 43 dates; male #81687 was caught 35 times on 27 dates; and male #81688 was caught 69 times on 62 dates). Three winter residents were present for two consecutive winters, and two were present for four consecutive winters (including one male that did not leave one of the three intervening summers). The 12 winter residents (7 male, 5 female) were initially captured between 31 Jul - 29 Oct; however, those that returned in subsequent winters (n = 8) did so from 24 Jul - 20 Aug, prior to peak fall migration. When initially captured, 9 winter residents were juveniles (75.0%), one was an adult (8.3%), and two were of unknown age (16.7%).

Spring departure dates were more difficult to determine precisely, as overwintering birds became gradually more accustomed to mist nets and were captured less frequently. Nonetheless, all birds that successfully overwintered were present through the end of March (n = 11). Male #81400 and female #81401 were present well into June in 1991 (female #81401 had large brood patches 4 and 6 May), and may have remained in the area all summer; female #81401 was not present after April in 1992 (no banding effort was made in April 1992) and was last caught 22 May in 1993. Male #81687 was last caught 16 May in 1992. Male #81688 did not depart in 1992, but was last caught 3 Jun in 1993 and 28 Apr in 1994. Female #75336 was last caught 30 Apr in 1994.

Initial capture dates for winter visitors (5 male, 2 female; all unknown age) were 27 Jul, 11 Oct, 6 and 12 Nov, 11 Jan, and 2 and 8 Mar. It is possible the latter two birds, which were never recaptured, were early spring migrants. In total, capture dates for winter visitors were 2 in Jul, 4 in Oct, 5 in Nov, 1 each Dec - Feb, 6 in Mar, and 1 in May. These data suggest there is considerable movement by unsettled birds in Oct - Nov in fall, and in Mar in spring, but that they are more settled Dec - Feb.

Spring Migrants - Two birds classified as spring migrants were caught on 4 Apr and 15 May 1993. Two other birds caught only once and classified as unknown status were captured on 4 and 20 May 1990. These were likely spring migrants, but because I initiated banding at this station in late March 1990, I cannot be certain they were not present over winter. These limited data, combined with departure dates for winter residents, suggest spring migration peaks in late Apr - late May, though it appears less sedentary individuals (e.g., winter visitors) begin to move around more widely in March.

Body Mass and Condition - Body masses (from all captures pooled) were examined by month,

time of day, and sex. Overall mean AM body mass was 11.16 g and mean PM body mass was 11.52 g (Table 2). When AM and PM weights were combined, they remained remarkably stable throughout the year, irrespective of month, sex, or sample size (Table 2). This was especially evident for the months Nov - Apr. Overall month mean body mass ranged from 11.1 g in September (n = 89) to 11.9 g in June (n = 3). Overall mean female body mass was 11.27 ± 0.06 g (n = 123; range 9.6 - 12.4 g) and mean male body mass was 11.40 ± 0.05 g (n = 210; range 10.0 - 13.6 g).

A multivariate analysis of variance (with and without scale type) found that the greatest amount of variation in body mass can be explained by time of day, followed by month and then sex (Table 3). Regression analyses of weights of all individuals captured from mid-Jul - Sep (n = 69 migrant and winter bird weights, 67 d.f.) and all individuals captured from Oct - Mar (n = 66 winter bird weights, 64 d.f.) showed both subsets of birds gained weight at the rate of 0.07 ± 0.02 - 0.03 g/hr from dawn to dusk, though the winter birds started out at a slightly higher mass (=constant; Table 4). Regression analyses of winter weights of four-birds taken from 20 Oct - 21 Feb (the four darkest months of the year) showed individual rates of weight gain ranged from 0.05 - 0.15 g/hr (Table 4). Weighted mean abdominal body fat rating was highest (>2.00) in Dec - Feb, and lowest (<1.00) Apr - Jun (Table 5). All birds stored some fat Dec - Mar; no birds stored heavy fat from Mar - Jun.

Molt - Some degree of molt (excluding traces of molt) was recorded in the ventral feather tract from Jul - Nov. Ventral tract molt began and peaked in July, with 37% of birds exhibiting heavy or moderate molt; only 13% of birds did not exhibit molt during this period (Table 5). Heavy molt persisted into August, and moderate molt persisted into October. Over 50% of birds exhibited some degree of molt when examined from Jul - Oct. Heavy and moderate molt of the capital tract (crown) was noted from 20 Aug - 3 Oct.

Flight feather molt apparently proceeded quickly. One adult male was replacing only the first primary on 20 Aug but finishing replacing the ninth and tenth primaries on 28 Aug. The only other adult remige molt was noted 24 Jul and 1 Aug. Another second-year male was known to have completed remige molt between 24 Jul and 16 Aug. The only adult rectrix molt was noted 25 May and 1 Aug, and a second-year female had completed rectrix molt by 6 Aug. I believe most adult rectrix and remige molt occurs on the breeding area before fall migration begins. The timing of molt in Red-breasted Nuthatches is highly variable between individuals, with primary molt occurring relatively early (Banks 1970).

Wing and Tail Measurements: Males - There were no differences in wing lengths and tail lengths between juvenile and unknown-aged males (Table 6), suggesting most of the unknown-aged birds were probably juveniles. Tail lengths were significantly greater in adult males than juvenile ($p < 0.01$) and unknown-aged ($p = 0.02$) males. Differences in wing lengths were present but not statistically significant between adult and juvenile ($p = 0.09$) and unknown-aged $p = 0.18$) males. Wing length in juvenile males ranged from 64 - 72.5 mm (n = 33) and in adult males from 67 - 75 mm (n = 16). Both of the upper extremes were from the same individual one year apart; only 2 other males (both unknown age) had wing lengths of 72 mm. At the lower extreme, only 2 males (both juveniles) had wing lengths of 64 - 65 mm. Tail lengths ranged from 35 - 40 mm. Range of wing and tail lengths correspond closely to those given by Ghalambor and Martin (1999), but adult means are larger in Anchorage than for the rest of its range.

Wing and Tail Measurements: Females - Wing length was shorter among unknown-aged females than either juvenile or adult females (Table 6). Differences were significant between adult and juvenile ($p < 0.01$) and unknown-aged ($p < 0.01$) females, but not between juvenile and unknown-aged females ($p = 0.44$). Tail length did not differ between adult and unknown-aged females; differences between adult and juvenile females were significant ($p < 0.01$) but were not significant between unknown-aged and juvenile females ($p = 0.11$). Wing and tail length ranged from 64 - 70 mm and 33 - 38 mm, respectively. In Anchorage, range of wing

length is at upper end of range given for continental population by Ghalambor and Martin (1999), while range of tail lengths is identical to those given by Ghalambor and Martin (1999); adult means are larger in Anchorage than for the rest of their range.

DISCUSSION

Kessel and Gibson (1978) describe the occurrence of Red-breasted Nuthatches in Alaska as common to abundant in fall and winter following irruptions, however, there is no explanation as to where these birds came from. They describe the general pattern of occurrence as characterized by "... periodic autumnal influxes of birds, followed by a decrease in numbers during the winter; some birds remain as visitants and breeders the following summer and into the second winter, when most disappear" (Kessel and Gibson 1978:64). The pattern of abundance I detected agrees with that described by Kessel and Gibson (1978). Fall movements of Red-breasted Nuthatches and other migratory birds (e.g., thrushes *(Catharus)* spp*.,* Ruby-crowned Kinglets *(Regulus calendula)*, Orange-crowned Warblers *(Oreothlypis celata)*, Yellow-rumped Warblers *(Setophaga coronata),* Wilson's Warblers *(Cardellina pusilla)*, and Dark-eyed Juncos *(Junco hyemalis)* at my banding station were generally from northeast to southwest (pers. obs.). The northeast/southwest skew is likely due to local terrain and vegetation lines. I could not detect whether the true movement direction was from east to west, which would follow an altitudinal gradient from alpine and tree line areas down to coastal areas, or north to south following the landscape alignment of the interface between lowlands and mountains. An east-to-west movement would also be the expected direction of movement of Red-breasted Nuthatches in an irruption year migration from the main breeding range in boreal Canada.

However, I do not believe the Red-breasted Nuthatches I sampled in Anchorage are the result of an irruption. I believe the primary source of the population I sampled was from local breeding at higher elevations on the Anchorage Hillside or the Interior. The timing of movements (Jul - Sep), and the fact that Red-breasted Nuthatches are following the general course of migration of other species, including neotropical migrants that depart the state, argue against irruptive migrations but leaves open the possibility that some birds emigrate out of the area or the state, perhaps by following the Pacific coast. Ghalambor and Martin (1999) noted there are winter concentrations of Red-breasted Nuthatches in British Columbia (but no winter records north of 52° N), eastern Washington, Oregon and northern California. The steadily increasing numbers of Red-breasted Nuthatches being counted on the Anchorage CBC support that many or most of the birds I sampled are undergoing a local migration, and argue against the theory of irruptive migrations (which should produce widely fluctuating numbers). However, because there were no recoveries of my banded birds beyond my banding station, my data do not provide strong evidence for one type of migration over another.

An increase in Red-breasted Nuthatch wintering populations, as indicated by CBCs in south-central Alaska, apparently has not occurred in southeast Alaska or Cordova (National Audubon Society 2017). Perhaps over-wintering populations in southeast Alaska are more influenced by irruptive migrations from British Columbia. This hypothesis is supported by CBC data from Tenakee Springs, on Chichagof Island, 80 km southwest of Juneau. There, no Red-breasted Nuthatches were recorded on CBC's from 1993 - 1999, but 81 were recorded in 2000 (NAS 2017).

One possible explanation for the large discrepancy of fall versus spring migrants sampled at my station is that spring migration of birds in the Anchorage area is generally concentrated in coastal areas which are snow-free long before higher elevations. However, large discrepancies, up to 30-fold, are typical between fall and spring migration in this species (Ball 1947, Ghalambor and Martin 1999). The timing of both spring and fall migration I recorded in Anchorage corresponds closely to timing elsewhere in North America (e.g., 20 Apr - 20 May in Wisconsin, beginning mid-July and usually peaking in August in Quebec, and Aug - Sep in British Columbia; see Ball 1947, and Ghalambor and Martin 1999).

The skewed sex ratio I found (66 male:34 female) appears to be typical of other populations. Matthysen et al. (1992) found a 64:36 male:female ratio during winter in Ohio, but their differences were not significant due to sample size. Yunick (2017) reported a 56.3:43.7% (male:female) ratio for 1604 Red-breasted Nuthatches in New York State. Male dominance over females (see Matthysen et al. 1992) may force females into suboptimal habitat where their survival rate is lower.

Patterns of weight gain described here may have future value in understanding Red-breasted Nuthatch responses to climate change, both latitudinal (*sensu* Root 1988) or perhaps altitudinal (*sensu* Inouye et al. 2000). Body masses remained fairly constant between months and between sexes, but the potential effects of environmental fluctuations in natural foods may have been mitigated by the presence of bird feeders in an exurban setting.

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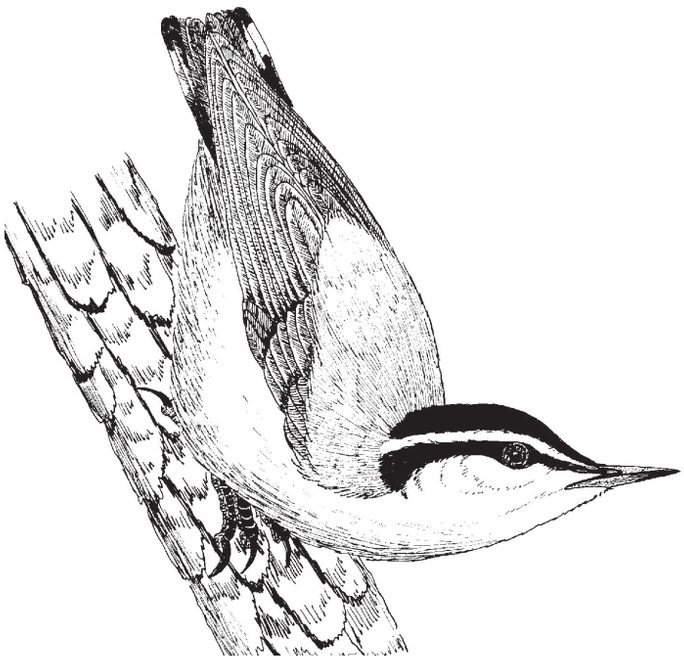

Red-breasted Nuthatch
by George West

APPENDIX

Table 1. Age and Sex Composition of New Captures and Sex Composition of Total Captures of Red-breasted Nuthatch

	New Captures						Total Captures			
Month	**n**	**Male**	**Female**	**Juv**	**Adult**	**Unk**	**n**	**Male**	**Female**	**% Male**
Jan	1	1				1	18	10	8	55.6
Feb	0						11	6	5	54.5
Mar	2	1	1			2	13	9	4	69.2
Apr	1	1				1	13	9	4	69.2
May	3	2	1			3	11	8	3	72.7
Jun	0						4	3	1	75.0
Jul	18	12	6	10	3	5	36	28	8	77.8
Aug*	39	25	13	28	3	8	71	47	23	66.2
Sep	25	15	10	16	3	6	100	60	40	60.0
Oct	3	3			1	2	52	37	15	71.1
Nov	2	1	1			2	29	16	13	55.2
Dec	0						18	9	9	50.0
Totals	94	61	32	54	10	30	372	238	133	
Percent		64.9	34.0	57.4	10.0	31.9		64.0	35.8	
*Total includes 1 bird of unknown sex										

Table 2. Mean body masses of Red-Breasted Nuthatches by month, time of day, and sex, Anchorage, Alaska.

Month	**AM only**	**PM only**	**AM and PM**	**Male**	**Female**
Jan	11.4 (9)	11.7 (8)	11.5 (17)	115 (10)	11.5 (7)
Feb	11.4 (5)	11.7 (6)	11.6 (11)	11.6 (6)	11.5 (5)
Mar	11.1 (5)	11.5 (9)	11.4 (14)	11.4 (10)	11.4 (4)
Apr	11.3 (3)	11.8 (6)	11.5 (9)	11.5 (5)	11.8 (4)
May	11.2 (4)	11.2 (4)	11.2 (8)	11.0 (6)	11.8 (2)
Jun	11.8 (2)	12.0 (1)	11.9 (3)	11.5 (2)	12.5 (1)
Jul	10.9 (6)	11.6 (27)	11.5 (33)	11.6 (25)	11.6 (8)
Aug	10.9 (24)	11.6 (43)	11.4 (67)	11.4 (42)	11.2 (24)
Sep	11.1 (43)	11.2 (46)	11.1 (89)	11.2 (54)	11.1 (35)
Oct	11.1 (35)	11.6 (14)	11.2 (49)	11.3 (37)	11.0 (14)
Nov	11.5 (19)	11.9 (8)	11.6 (27)	11.9 (16)	11.3 (13)
Dec	11.3 (9)	11.7 (6)	11.5 (15)	11.5 (5)	11.4 (6)
Mean	11.16	11.52	11.35	11.40	11.27
n	164	178	342	210	123

Table 3. Results of multivariate analysis of variance using Program JMP by SAS.

				Effect tests:			
Model	R^2	F	P	Sex	Month	Time	Scale
Sex+month+time-of-day+scale	0.18	4.47	<0.0001	0.0393	0.0233	<0.001	0.324
Sex+month+time-of-day	0.17	4.94	<0.0001	0.0560	0.0044	<0.0001	
Month+time-of-day	0.15	5.22	<0.0001		0.0058	<0.0001	

Table 4. Hourly mass accumulation by Red-breasted Nuthatches weighed with Ohaus scale, Anchorage, Alaska.						
Individual(s)	**Time Frame**	**Constant**	**Hourly Gain**	**R^2**	**n**	**df**
All	mid-Jul-Sep	10.4 ± 0.7 g	0.07 ± 0.02 g	0.12	69	67
All	01 Oct-01 Apr	10.6 ± 0.6 g	0.07 ± 0.03 g	0.08	66	64
Female 75336	20 Oct-21 Feb	10.7 ± 0.3 g	0.05 ± 0.05 g	0.17	7	5
Female 76087	20 Oct-21 Feb	9.6 ± 0.2 g	0.13 ± 0.02 g	0.70	14	12
Male 76091	20 Oct-21 Feb	11.4 ± 0.2 g	0.09 ± 0.04 g	0.55	7	5

Table 5. Abdominal fat and ventral feather tract molt ratings. (N = none, T = trace, L = light, M = moderate, H = heavy)										
Month	**Abdominal Fat**					**Ventral Tract Feather Molt (%)**				
					Weighted Mean(n)					
	N	**L**	**M**	**H**		**N**	**T**	**L**	**M**	**H**
Jan		18	53	29	2.12 (17)	100				
Feb		36	27	36	2.00 (11)	88	12			
Mar		38	62		1.62 (13)	100				
Apr	44	11	44		1.00 (9)	100				
May	60	20	20		0.60 (10)	100				
Jun	75	25			0.25 (4)	100				
Jul	20	40	37	3	1.23 (30)	13		50	27	10
Aug	36	30	28	7	1.05 (61)	31	5	24	13	5
Sep	24	42	29	5	1.16 (93)	43	3	40	14	
Oct	12	49	39		1.27 (51)	41	2	41	16	
Nov	11	15	67	7	1.70 (27)	81	4	15		
Dec	0	12	59	29	2.18 (17)	100				

Table 6. Wing and tail measurements (mm) of Red-breasted Nuthatches in Anchorage, Alaska, 1990-1995						
Age/Sex		**Wing**			**Tail**	
	Mean ±SE	**n**	**Range**	**Mean ± SE**	**n**	**Range**
Juvenile female	67.0 ± 0.5	20	64 - 70	35.6 ± 0.3	20	33 - 38
Unknown female	66.4 ± 0.6	10	64 - 70	36.5 ± 0.2	9	36 - 37.5
Adult Female	68.8 ± 0.4	5	68 - 70	36.5 ± 0.4	5	35.5 - 38
Juvenile male	68.6 ± 0.3	33	64 - 72.5	37.1 ± 0.2	33	35 - 39
Unknown male	68.7 ± 0.4	20	66 - 72	37.1 ± 0.3	18	35 - 40
Adult male	69.6 ± 0.5	16	67 - 75	38.3 ± 0.3	16	35 - 40