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NOTES ON THE NESTING BIOLOGY OF PYGMY NUTHATCHES
IN NEBRASKA

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INTRODUCTION

Pygmy Nuthatches (*Sitta pygmaea*) were considered to be no more than casual or rare winter visitors to the northwest part of Nebraska by previous investigators (Bruner et al. 1904; Swenk 1918; Haecker et al. 1945; Rapp et al. 1958, 1971). I.S. Trostler's earlier comment that the species was "a rare resident, breeds in Omaha" (Bruner 1896) was later felt to be in error, as evidenced by Bruner's later comment that it was, "A fall and winter visitor.....not breeding in the state." (Bruner et al. 1904.)

The first evidence of breeding was the collection of a juvenile male by Dr. Harrison Tordoff for the University of Kansas on 18 July 1957, 5 miles north of Harrison, Sioux Co. (Ford 1959). A note on nesting in Dawes Co. by Doris Gates was included in the annual nesting report for 1961, but there were no details of date, location, or visual evidence of breeding (Wensien 1962). Unfortunately, I could not locate further details of the report. The next indication of breeding was a report of a pair of adults carrying food to young in a nest in 1970 at Ft. Robinson State Park, Sioux Co. (Rosche 1972). A report of an adult carrying food in 1981 in either Dawes or Sioux County was appended to the nesting report for that year (Bennett 1982). During the Nebraska Breeding Bird Atlas Project (1984-89), the species was reported from eight survey blocks in Dawes and Sioux Counties, with one confirmed breeding record (Mollhoff unpublished). More recently, apparent breeding has been reported, without publication of details, from Scotts Bluff and Banner Counties (Grzybowski 1996).

While doing field work on other early-nesting birds in northwestern Nebraska on 3 May 1997, I found Pygmy Nuthatches to be both rather common and very involved in courtship and nest

building, and I decided to document this poorly known species. Although I must emphasize that these are only preliminary observations, I feel that an adequate sample size was studied to warrant publication. Further long-term study is planned to gain a better understanding of the breeding ecology of this interesting species.

STUDY AREA AND METHODS

The initial phase of this study took place in West Ash Creek Canyon in Dawes Co. (SE 1/4 of T31N, R51W), in one of the survey blocks established for the Breeding Bird Atlas project. This site is on the southern edge and approximately in the middle (west to east) of the Pine Ridge. Later, the study was expanded to include blocks at both ends of the Pine Ridge in Sioux and Sheridan Counties, to determine whether the findings were typical of the entire area. These sites were chosen because of my familiarity with the area and because they are on public land and readily available to current and future researchers. The blocks also appear to be representative of habitat in the area.

The arc of the Pine Ridge is the southernmost of the encircling ring of escarpments tipped outward by the Black Hills Uplift. The area in Nebraska stretches from 102° 30' to 104° W. and 42° 30' to 43° N. The forest, which cloaks the ridges and canyons, is the southernmost extension of the coniferous Black Hills forest, itself an eastern outlier of the Rocky Mountain forests. The forest consists almost entirely of ponderosa pine (*Pinus ponderosa*) with scattered red cedar (*Juniperus* sp.). The canyon floors are dominated in many places by riparian stands of mixed hardwoods, consisting mostly of hackberry (*Celtis occidentalis*), willow (*Salix* sp.), cottonwoods (*Populus* sp.), elm (*Ulmus americana*), box elder (*Acer negundo*), and green ash (*Fraxinus pennsylvanica*). Elevation ranges from about 1200 meters (3900 ft.) at the lower northeast end of the Ridge in Sheridan Co., to about 1575 meters (5100 ft) at the northwestern end in Sioux Co. Local relief from canyon bottom to adjoining ridge top is usually in the range of 100 - 150 meters (300-450 ft).

The climate may be characterized as semi-arid and continental with hot summers and cold winters. It is subject to prolonged dry periods, with diurnal temperature fluctuations of 25° C (or 45° F) being the norm during the breeding season. The overall setting is shortgrass prairie surrounding the scarp woodland of the ridges and canyons (Urbatsch & Eddy 1973).

Equipment

Equipment essential for this study included a pair of lineman's pole-climbing spikes and belt, a Coleman Powermate inspector's pocket light, Model 5398C700 (which has a 1.7 cm diameter flashlight head attached to the flashlight body by a 20 cm length of semi-flexible wire that can be bent to the desired shape), an oval mirror 2.0 X 4.5 cm glued to a 30 cm length of 14 gauge copper wire, topographic maps, leather gloves, canteens, safety rope, camera, binoculars, tape recorder, notebook, etc. and a backpack to carry it all.

Methods

On 3-4 May 1997, pairs of Pygmy Nuthatches were located initially by random encounter while traversing habitats in West Ash Creek Canyon, from canyon floor to ridgetop. After noting similarities in the habitat used by the first six pairs found, further searching was concentrated in areas of similar habitat. If no birds were seen in likely habitat, a tape of their call was played and brought an immediate response if any were in the area.

Initially, eight pairs and three trios were located in the West Ash Creek area.

On a return visit to the site on 30 May 1997, four active nests were located. On 31 May 1997, I visited the block in Monroe Canyon (Gilbert-Baker State Wildlife Management Area), Sioux Co. (NW 1/4 of T32N, R56W) and found two pairs and two active nests, and a block in the Metcalf State Wildlife Management Area, Sheridan Co. (NW 1/4 of T33N, R45W), where I found four more pairs and two active nests. Thus, information was collected on a total of 17 pairs/trios and from 8 active nests. The birds in the West Ash study area were found along a 12 km (7.5 mi.)-long route scattered across 5 sections. The locations of each pair and of each active nest were plotted on a topographic map so that they could be relocated for further study.

After an active nest was found, the tree was climbed, either with the aid of the climbers and belt, or by free climbing if sufficient, solid hand- and foot-holds were present. Upon reaching the nest hole, the flexible head of the flashlight was bent and hung in the hole to illuminate the contents, and the mirror was inserted to bring the contents into view. It often took several minutes of adjusting the light and bending the mirror around the contortions of the narrow, twisting holes before the contents could be seen.

The nest holes constructed by the species are tiny, usually found in clusters placed exclusively in dead ponderosa pines, and therefore unlikely to be confused with those made by other cavity nesters found in the area. For this study, however, data on nest location, construction, etc. was collected only from active nests to preclude the possibility of misidentification.

RESULTS AND DISCUSSION

Habitat

Since the Pine Ridge lies at the eastern limit of Pygmy Nuthatch range, habitat use here may be at some variance from that observed nearer the core of its range. Other workers have consistently noted the close association of the species with ponderosa pine forests (Bailey & Niedrach 1965; Bent 1948; Ryser 1985). Some have commented on the near dependence of the birds on ponderosa pines, while others have noted that some use is made of other trees for foraging or nesting (Bent 1948; Scott et al. 1977).

In my study area, the only native coniferous trees present were ponderosa pine and red cedars. No use of the cedars was noted during the breeding season; the nuthatches observed thus far used pure to almost pure stands of ponderosa pines that were mature enough to bear cones. The stands ranged from areas where the trees shaded an estimated 40-50% of the ground, to dense, closed-canopy forest where the ground was 100% shaded and the boles were 5-10 meters apart. The birds were not noted in stands of saplings 2-6 meters tall, or in isolated saplings found scattered in stands of mature trees, although they very likely used them at least occasionally for foraging.

No birds were noted on the floors of the canyons among the deciduous trees or in the canyon-bottom stands of pines. The lowest birds found were about 1/3 of the way up the side of the canyon, but most (12 of 17 pairs) were at or near the tops of the ridges. They were most readily found along the ridge tops between canyons, often at the very upper reaches where small grassy clearings occurred, or near the forest - grassland border. These areas are often rather open, with perhaps 60-70% of the ground shaded and little or no undergrowth beneath the pines.

All active nests were within 40 meters of the edge of a

clearing or the forest edge, and half of them were located at the edge. This may give a somewhat skewed impression, however, because the nest trees were easier to find in this setting. Within stands of mature pines, the major limiting component seemed to be the availability of standing dead pines for nest holes. In those instances where there were no standing dead pines for a distance of .3 - 1.0 km, no nuthatches were found. Conversely, in extensive areas of healthy, vigorously growing pines, I often had only to search out an isolated dead tree of the proper specifications to find a pair of the birds. They seemed to be absolutely dependent on the presence of free-standing dead pines and did not use dead trees that were uprooted or broken and tipped against another tree.

Territory size

No attempt was made to map the specific boundaries of the territory of any of the pairs encountered, nor was a gridded search made in an attempt to locate all the pairs in a given area. However, a general idea of the breeding density could be inferred from the minimum distance between territorial pairs, which was about 200 meters. This distance occurred 4 times for the 17 pairs found, in extensive areas of what appeared to be suitable habitat. The same density was noted throughout the three separate study blocks.

Nests

Although instances have been reported of the species making opportunistic use of existing cavities (Bent 1948), the overall impression is that of all the nuthatch species found on this continent, the Pygmy Nuthatch is most likely to excavate its own nest hole. Harrison (1979) commented that of 17 nests he examined, all appeared to have been excavated by the birds themselves. Scott et al. (1977) stated that the species normally makes its own cavities.

All eight of the active nests examined in my study were in dead ponderosa pines and appeared to have been excavated by the birds themselves. No use was noted of natural cavities or of holes made by woodpeckers. The two newest holes appeared to be 1-4 years old, two were estimated at 5-10 years old, while the remaining four holes appeared to be at least 10 years old. These estimates were based on the comparative appearance of dead trees of known age from various burned areas in the vicinity, but are reasonably accurate. In trees with active nests, all nuthatch holes, both partial and complete, were noted for use as a baseline for continued study. Each active nest was identified and measured (after the young had fledged) to establish accurate known ages and time sequences for nest excavation, reuse, etc.

Each of the 8 trees examined had 1-2 completed nest holes, plus an additional 0-2 partially excavated holes. Several of the trees were in close proximity to another 1-2 dead tree(s), which also contained holes that appeared typical of the species. Close observation in future years will reveal whether the same hole is used repeatedly in successive years, or whether adjacent holes in the same or nearby trees are used in some sort of rotation system.

While locating nesting pairs initially on 3-4 May 1997, only one case of excavation of a new hole was noted. I watched one bird spend 10-12 minutes of actual excavation time during the 30 minutes I was watching. The hole was 2.0 cm in diameter and had penetrated 4.0 cm into the tree. When I revisited the site on 30 May 1997, the hole was 2.2 cm in diameter and excavated to a depth of 6 cm. Meanwhile, the pair had laid their eggs in a previously completed hole a meter higher up in the same tree. When rechecking the site

on 23 August 1997, I found that the entrance measured 2.5 X 3.0 cm and the entry tunnel was excavated to a depth of 7.0 cm but had not yet begun to expand to form the nest cavity. Two other pairs were modifying or completing holes that had been started several years before. In both cases, the holes were used for nesting in 1997.

Grinnell, cited in Bent (1948), reported a pair of Pygmy Nuthatches that were still excavating a nest hole after 35 days, but he did not indicate whether the nest was used that season. My own observations suggest that only 1 out of 11 pairs was actively excavating a new nest during nest-building season; that a new nest was still far less than one-fourth done after being worked on from mid-late April through late August; and that all active nests were in holes that had been initiated several years to more than a decade previously. Therefore, I believe that the excavation of a hole takes a year or more before it is actually used for nesting.

Bent (1948) and Harrison (1979) both found old holes in which the cracks and splits in the trunk of the tree, caused by drying and weathering, had penetrated into the nest cavity itself. These splits had sometimes been "weather-proofed" by packing the crack with nest material to allow continued use. Three of the eight nests in this study had been repaired in this manner, with the cracks or holes packed with plant fiber, nuthatch feathers, or wood and bark chips. Continued use of old holes may indicate extended nest-site fidelity by a pair and may correlate with the cooperative nesting behavior reported for the species (Sydeman et al. 1988).

Extended nest-site fidelity, that is, reuse of the same tree/hole for many years, and suggestions of cooperative breeding (3 of 17 "pairs" were trios), are clues that may indicate permanent family territories. In addition, Sydeman et al. (1988) reported year-round occupation of the territory by groups whose breeding units consisted of a breeding pair, plus 0-3 helpers made up of previous offspring. This raises intriguing implications. The birds have an enormous investment of time and energy in excavating just a single hole. Most pairs also had at least one or two partially completed holes available for completion when needed, many of them several years old. It appears to be common to have at least one extra completed hole ready as a "standby." Once completed, a hole appears to be used for years by successive generations of birds. Indeed, it is entirely possible that successive generations may be involved in excavating a given hole.

The investment of time and energy in excavating and maintaining a hole or suite of holes, plus their susceptibility to loss through blowdown, lightning, usurpation, etc., could logically lead to strategies to protect their investment. These may include: year-round occupation (and defense?) of the territory against neighboring groups of the same species; interspecific defense against other hole nesters; and cooperative breeding among parents, offspring, and siblings (Sydeman et al. 1988); all done to defend and propagate a family resource (the nest), which is passed on from generation to generation. The construction and maintenance of reserve holes may also serve other functions as well, e.g. extra roost sites during incubation for the "helpers," winter roosts and bonding for members of the extended family, etc.

Many previous workers have noted that nest holes are usually placed near the top of a dead, broken snag, with the implication that the holes were deliberately excavated in that position (e.g. Bent 1948; Johnsgard 1979). My observations lead me to a different conclusion. The new hole in the initial stage of excavation mentioned earlier was placed about 2/3 of the way up a dead tree, but the nest used by the pair this year was placed in a hole that was 1-2 years old and was located a meter farther up the tree,

while another partial hole was 15 cm above the new hole. This was very similar to other trees with multiple holes. Other standing snags with nest holes had partially completed holes in the detached top portion, which lay on the ground nearby. Based on these observations, I propose the following sequence of events. After a tree has been dead for several years, but the bark is still on the tree and retaining moisture, the wood is softened by decay and becomes somewhat spongy, enabling the nuthatches to begin work. The birds tunnel horizontally 3-6 cm, then turn sharply downward, enlarging the tunnel to form a cavity as they go deeper. If the wood is soft throughout the trunk, the hole simply expands to the necessary dimensions. If some portion of the trunk core is pitchy and the wood still sound, the hole turns to the side and down to form a rather flat cavity between the solid core and the outer surface (more than half the holes had this configuration). If solid wood is encountered before reaching the necessary distance in from the surface, hole excavation is suspended until decay progresses further. Other nest holes may be initiated during the succeeding several years while the bark persists on the tree, thus keeping the surface of the trunk moist and soft enough to work. Later, the dead bark falls from the tree and the outer layer of wood dries out, becoming quite durable and too hard for the nuthatches to initiate holes. The inside remains soft and probably becomes even softer as rot sets in due to the entrance of additional moisture through the holes. As the rot continues, the birds are able to complete the holes that were initiated in previous years, examples of which I witnessed in two of the active nests I found.

After a tree has been dead for a number of years and weakened by decay and/or nest holes, wind may break off the upper part, about 1/2 to 2/3 of the original height of the tree, which coincides with the zone where most nestbuilding occurs. This leaves a broken-off snag, with nest holes near where the break occurred. Nest trees still standing at full height had nest holes, both active and empty, extending from about 1/3 of the way up, to about 3/4 of the way to the top of the tree, and farther up to where the trunk becomes too small in diameter to excavate a hole. The smallest trunk diameter at which I found a nest hole completed was 14 cm. Of the eight nests examined, half were located in broken snags, with the holes located 1-5 meters below the top of the snag. Thus, the position of the hole relative to the top of a broken snag is more likely determined by the place where the tree is broken off by the wind after the hole is built, and not by the birds actively deciding to make a hole near the top of a broken-off snag.

Specific information concerning the eight nests is as follows:

Height of nest: mean, 7.1 meters (range: 3.75-9.5 meters)
Height of tree: mean, 9.9 meters (range: 5.5-14.0 meters)
Cavity depth: mean, 16 cm (range: 12-19 cm)
Typical entrance hole: 2.8 X 3.2 cm

The holes faced every direction except south and southeast. The lining of the nests ranged from nothing but the residual sawdust-sized wood chips resulting from excavation, to the addition of a few scales of pine bark, a few feathers (all appearing to be nuthatch feathers), or a few shreds of vegetable fibers or mammal hair.

Competition

While playing the taped call at a large old snag, which had several holes typical of those made by Pygmy Nuthatches, the replying call from a nearby pine was that of a Red-breasted

Nuthatch, which immediately appeared, apparently ready to defend the tree. The bird was in very faded plumage with only a slight rusty wash to the underparts, and had I not heard the call, I might have mistaken it for a Pygmy Nuthatch. Due to its pale coloration, I suspected that it was a female. It did not enter any of the nest holes present, so after it left, I climbed the tree and checked all the holes I could see but did not find a nest. As I descended, it returned and entered a hole that I had not noticed near the top of the snag, then left a few seconds later. I climbed back up the tree and as I was inserting the flashlight tip and mirror into the hole, I was nearly struck in the face by the incubating bird as it exploded out of the hole. It was even paler than its mate, but was indeed a Red-breasted Nuthatch. The entrance to the hole was encircled by fresh pitch, liberally smeared around the hole, as described for the species by Bent (1948) and Harrison (1979). Otherwise, the hole was typical of other Pygmy Nuthatch nest holes in size, placement, configuration, etc. It appeared to be a case of usurpation of an old Pygmy Nuthatch hole by the Red-breasted Nuthatches.

Another of the active Pygmy Nuthatch nests I found, also in an old hole in an old snag, appeared typical of other nests of the species and had the hole surrounded by pitch, but in this instance, the pitch was old and dry. I interpreted this to be a hole excavated by Pygmy Nuthatches, later usurped by Red-breasted Nuthatches and, still later, reoccupied by the former.

A third case of interaction with other nuthatch species was witnessed when I surprised a pair of White-breasted Nuthatches carrying nest material into a natural cavity they were preparing to use. When they saw me, they immediately began to scold me, and were joined within seconds by a trio of Pygmy Nuthatches and, a few seconds later still, by a Red-breasted Nuthatch. Once assembled, the birds directed their attention at one another, with the White-breasted Nuthatches soon driving off the other four birds.

Based on these few examples, it seems that the three nuthatch species do not tolerate the presence of one another, at least in the vicinity of the nest during the breeding season. Based on my observations of the large investment made by Pygmy Nuthatches in hole excavation and their apparent usurpation by at least the Red-breasted Nuthatches, I would speculate that this intolerance might be based at least in part on competition for nest sites.

Breeding Cycle

When the initial observations were made on 3-4 May 1997, I found eight pairs and three trios. One nest was in the initial stages of excavation and two other nest holes were being modified/completed. Two more pairs were noted carrying nest material. Another pair was foraging together in a tree when approached by a single bird from across a narrow canyon; the encroaching bird was immediately driven off.

On a return visit on 30-31 May 1997, a search was made for 10 of the pairs and 8 of them were found; it got dark before I had a chance to search for the remaining two pairs. Of the eight pairs, four nests were found. On the second day, the search was extended to the other two study areas, where six more pairs and four nests were found.

On 30 May 1997, three of the nests in the Dawes Co. study area held only eggs, while the fourth held three eggs and three newly hatched young, one with a piece of eggshell still stuck on its back. On 31 May 1997, the four nests all contained only eggs. The Dawes Co. nests held clutches of 6, 6, 7, and 7. The Sioux Co. nests held clutches of 6 and 7, while the Sheridan Co. nests both

contained clutches of 8 eggs.

On 30-31 May, with an overnight temperature of 50° F, all nests found before noon were being incubated and the adult usually did not leave the nest until I was within about a meter of the nest hole. During the afternoons, with the temperature about 80° F, I found both adults foraging nearby as I approached one nest. A nest found just at dusk was occupied, but the bird came to the hole and peered out at me as I approached the tree.

After completing my examination of the nests, I noticed that several of the birds returned and re-entered the nest before I had descended two meters from the hole. In the other cases, I was too busy concentrating on making a safe descent to observe what the birds were doing.

SUMMARY

Preliminary findings are reported on a study of Pygmy Nuthatches in the Pine Ridge area of northwest Nebraska, and detailed information on the nesting habits in this state is presented for the first time. A total of 17 pairs / trios of Pygmy Nuthatches was located, and eight active nests with eggs, or eggs and young, were found during two weekends of field work. The three study sites were located in the middle and at both ends of the Pine Ridge in Dawes, Sioux, and Sheridan Counties. The observations on nests with eggs appear to be the first reported in Nebraska, and extend the known breeding range eastward slightly (but not surprisingly). The density of breeding pairs appeared the same throughout the area and, combined with the appearance of the nest trees, lead me to believe that breeding has been taking place in the entire area for a very long time. The birds are restricted to ponderosa pine forest and appear to be absolutely dependent on the presence of standing dead pine trees for nest sites. An indication of cooperative breeding was noted. Initial observations indicate that an extended period is required for nest building.

FURTHER STUDY

Further observations are planned to gather more information on the timing of various aspects of the breeding cycle, especially hatching and fledging dates. More study is needed to document the occurrence, prevalence, and activities of "helpers" that assist the breeding pair, and to record interactions with, and niche separation from, other hole-nesting species in the area, especially among the three nuthatch species. A long-term study will be needed to better understand the extended nest excavation period, reuse of nests, usurpation/reoccupation of nest holes, and, most importantly, the natural history of the dead trees themselves, without which the species could not exist in the area.

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