

HUMMINGBIRDS FEEDING ON SAND

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On 19 May 1969, 2 mi. E of Jamesburg, Monterey County, California, a female Anna's Hummingbird (*Calypte anna*) perched at the edge of a small hole, 19 mm wide and 11 mm deep, and repeatedly poked her bill into it. The hole was located in sand that had accumulated on a rock halfway down the side of an outdoor stairwell. The bird appeared to be eating sand. On subsequent days I often saw a hummer at this hole, and from 17-28 July I watched for longer periods, beginning observations about 15 min before the first visit and terminating after the last time indicated. The visits witnessed occurred at 07:30, 08:32, and 09:37 on 17 July; 15:21 and 17:42 on 19 July; 06:21, 08:32, 09:27, 15:59, 16:57, and 18:10 on 20 July; 07:20, 09:12, 09:55, 11:49, 13:01, 16:22, and 17:57 on 21 July; 06:54, 08:10, and 09:08 on 22 July; 06:16 and 08:51 on 27 July; and at 05:27 on 28 July. A strong hourly periodicity (or multiples thereof) is apparent. I saw the bird last on 30 July. The fact that she did not always appear at expected hourly intervals suggests that she had one or more alternative sources of sand within her territory. One of these may have been about 100 m away in front of my office window, where, on 16 June and other days until the end of June, I saw a female hovering near the ground and poking her bill about 5 mm into the sand. The bill was opened at the tip about 3 mm. After a few pecks, still hovering, she flicked her tongue in and out, then resumed pecking. Each visit lasted about 25 sec and was always followed by bill-wiping on a nearby branch.

Arnold (1930) reports a female Anna alighting on a sandy area on 4 January, and a bird of unknown sex landing on some plaster on 16 March. At the latter site small mites were present. Woods (1940) saw a female Anna hover over a site where she appeared to pick up scattered particles of mortar. She also "plunged her bill in the loose sandy soil nearby." Legg and Pitelka (1956) report seeing females of *Calypte anna* on the ground twice, once on a sandy area and once on a pile of ashes. On both occasions they found small ants at the sites.

I checked the site at the stairwell carefully many times shortly before the bird's expected arrival and I failed to see any insects. In any case, the regularity of the visits and the fact that the bill tip was thrust into the sand about 5 mm, suggest that the birds were taking the sand itself.

Other species of hummers appear to eat sand. Haverschmidt (1952) saw *Amazilia fimbriata* pecking sand on two occasions in Surinam. He did not find any insects at the sites. On 17 and 21 July 1967, at Sagehen Creek, Nevada County, California, G. DeBell and L. F. Baptista (pers. comm.) saw a female (or juvenile) *Selasphorus rufus* hovering over a cement step while she picked up grains of sand with her tongue. Occasionally she sat down to feed in like manner. At the same locality, between 27 June and 2 July 1970, A. S. Leopold (field notes) saw a female (or juvenile) *Selasphorus sasin* hovering over the edge of an out-door fireplace, pecking at the ash and "apparently ingesting" it. The bird occasionally sat down

to feed on the ash. During several visits hot coals and flames were present in the center of the fireplace. The bird was definitely not seen again from 7 July on. Linsdale (notes on file at the Hastings Reservation) saw on 14 June 1938 a female *Archilochus alexandri* picking something from bare, coarse, sandy ground, after which she flew to her nest containing fully feathered young. In the last two cases the site was not checked for the presence of insects.

What can be the explanation of this behavior? Woods (1940) suggests that the birds require some additional mineral in their diet during the nesting season. The fact that in 8 of the 11 cases where the sex is given, females are involved seems to support this suggestion. Assuming a need for calcium to be responsible for this behavior I had the soil analyzed at the two sites, as well as at 10 other sites located randomly within 100 m. The stairwell site contained 23500 ppm of calcium, while at the office it was 10250 ppm. Of the ten other sites, one had 46000 ppm, the next highest was 9220 ppm, and the remaining eight varied between 2550 and 7100 with an average of 5359. As sites have to be located by trial and error the two (?) females had found the second and third highest in calcium, lending further support to the possible importance of calcium in this behavior.

The mean weight of a clutch of two blown eggs of the Anna Hummingbird is 52.2 mg ($n = 11$). Not all this weight is calcium, as the egg shell contains other organic and inorganic materials, and the egg membranes remain behind when the egg is blown. Assuming that the two eggs minus the membranes weigh 50 mg, about 98 per cent of this weight is calcium carbonate, and about 40 per cent, or 20 mg, is calcium. At the stairwell site the bird had to consume 0.85 g of sand to obtain this much calcium, assuming that all the calcium is retained. However, chickens retain only about 60 per cent per day of the calcium supplied (Hurwitz and Griminger 1961), and if the same applies to hummers, the bird had to consume 1.41 g of sand.

Although some calcium for egg production is taken from structural bones, there is a special system of bone deposited in the marrow cavities of the skeleton under influence of androgens and estrogens (Simkiss 1960). This medullary bone is stored prior to egg laying and its calcium can be rapidly recycled for the formation of the egg shell. Simkiss notes that this system must be particularly important in birds living in lime-deficient areas or in birds whose diets are deficient in calcium, such as nectar feeders.

At the Hastings Reservation the latest date reported for a clutch of the Anna Hummingbird is 15 June (Tomich, notes on file). The frequency and regularity of the visits to the stairwell at the end of July is thus well past the egg laying period (see also Pitelka 1951; Legg and Pitelka 1956). The fact that she was still eating sand at a time significantly past the normal laying season would suggest that she was paying off a calcium debt to structural bone, as it would be non-adaptive at this post-breeding interval to increase her weight by storing medullary bone. The approximately hourly visits might be triggered by the rate of absorption of calcium from the sand and a lowering of the calcium level in the blood. In nectar feeders, structural bone as a source of calcium for egg production may be more important than medullary bone.

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UNUSUAL PREDATORY ACTIVITIES OF MEXICAN JAYS AND BROWN-HEADED COWBIRDS UNDER CONDITIONS OF DEEP SNOW IN SOUTHEASTERN ARIZONA

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Snows of any depth and duration are unusual in the Chiricahua Mountains at the elevation of the Southwestern Research Station (5400 ft). Usually the snow covers the surface for only a day or two, after which large patches melt off, allowing ground-feeding winter birds access to foraging areas. On 14 December 1967 an area-wide storm struck southeastern Arizona and southwestern New Mexico. By 17 December 31 inches of snow covered the ground. It remained for a full week before the first patches of earth were exposed. Many local birds were obviously hungry and the Mexican Jays (*Aphelocoma ultramarina*) became especially aggressive at our feeding stations.

During this time one of these jays was seen to swoop down on a small bird and kill it by pecking. The prey appeared to be a sparrow but could not be retrieved because of the deep snow. On the same day two male Brown-headed Cowbirds (*Molothrus ater*) were seen attacking a junco (*Junco* sp.) on the snow. A female cowbird standing in the snow about a foot away watched the attack. Both males were pecking at the junco, which was struggling in the snow. The attackers were disturbed by the author and the junco flew off, but fell into the snow about 50 ft away, obviously hurt or weakened. Feathers were strewn about the area of attack. Tufts of feathers, perhaps also of juncos, gave evidence of three other attacks, probably by jays. The evidence is circumstantial but there were no mammal tracks about, or predatory birds. The cowbirds were not seen again, but a flock of 13 jays remained in the area through the winter. A. C. Bent (U.S. Natl. Mus., Bull. 191, 1946, and Bull. 211, 1958) does not mention predatory activities by this species of jay or by the Brown-headed Cowbird.

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ROOSTING HABITS OF WHITE-BREADED NUTHATCHES

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The following observations bring out three peculiarities in the roosting habits of White-breasted Nuthatches (*Sitta carolinensis*): (1) a close interchange with Downy Woodpeckers (*Dendrocopos pubescens*) in use of roost holes, many of which were probably excavated by the woodpeckers originally; (2) the regular removal of feces from its roost hole by *S. carolinensis* at dawn, and (3) a reversal of dominance at roost holes in the spring when the female takes over the hole occupied by the male. These situations have been noted in Lyme, New Hampshire, between 1963 and 1970, among wild as well as among several pairs of hand-raised individuals in an aviary.

A first roost hole noted was 30 cm from the top of a paper birch stub 3 m tall and 12 cm in diameter. Between 16 and 31 December 1964 a Downy Woodpecker flew from this hole on nine early winter mornings, but on 25 January and on 3 February 1965 the woodpecker had left and a male White-breasted Nuthatch emerged at dawn. Nuthatches do not always,

however, roost in cavities in stubs. At 15:50 on 5 January 1967 a male White-breasted Nuthatch gave a sudden burst of *aan* notes, then swooped into a curl of bark partially loosened and hanging down from a high, dead maple limb. Three days later he returned to roost in the same place, again at 15:50. The lowest roost hole encountered was in a small hemlock stub less than 2 m above the ground. Here a male White-breasted Nuthatch made a sudden swoop down into the hole at 16:30 on 18 February 1967. When I knocked on the stub, he did not come out.

A male (MB), coming to a swamp where flooding by beavers had resulted in numbers of stubs, used three of them, all of yellow birch, at different times. The first stub was one in which a Downy Woodpecker had roosted for a week previously. On 2 February 1969 MB emerged from it at 06:55 with a gob of feces in his bill. He emerged in similar fashion a week later at 06:57. In the following winter MB was roosting in an adjacent yellow birch stub. Here the hole, instead of being round, was elliptical and about twice the size needed for the bird to emerge. On 21, 25, and 26 December 1969 MB flew from it at 07:20, 07:25, and 07:30, respectively, having a gob of feces in his bill on each occasion. He usually deposited the feces on the bark of the first tree to which he came. On 22 and 27 February 1970 MB flew from a hole 7 m up in a third well-rotted