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## Hummingbirds Eating Ashes

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The nectar-rich diet of hummingbirds results in their producing large volumes of hypo-osmotic cloacal fluids except under conditions of high heat stress. Their need to excrete or avoid absorbing the excess water is comparable to that of freshwater fish and frogs with urine production reaching 84% of body mass per day (Calder and Hiebert 1983, Beuchat et al. 1990)! Some of the ions lost in excretion are replaced by those present in the nectar. The insect portion of the diet also provides additional salts. Several fortuitous field observations suggest that some hummingbirds may also replace essential ions by consuming wood ashes during the stress of nesting.

On five separate occasions, I or my students have observed nesting female hummingbirds repeatedly licking, and probably consuming, powdery, gray wood ashes. Four of the five birds' nests contained two eggs each. The fifth nest was inaccessible to observation. The field observations were as follows: (1) Broad-tailed Hummingbird (*Selasphorus platycercus*) in Englemann spruce (*Picea engelmanii*) woodland, Shannon Camp, 3 km W of Heliograph Peak, Graham Co., Arizona (elevation 2,800 m), 7 July 1978. (2) Blue-throated Hummingbird (*Lampornis clemenciae*) in oak woodland, South Fork Camp, 8 km S of Portal, Cochise Co., Arizona (elevation 1,700 m), 11 July 1978. (3) Costa's Hummingbird (*Calypte costae*) in Low Colorado Desert wash, Milpitas Wash, near Highway S 78, 40 km SW of Blythe, Riverside Co., California (elevation 100 m), 26 March 1980. (4) Anna's Hummingbird (*C. anna*) in suburban garden, Claremont, Los Angeles Co., California (elevation 460 m), 8 Dec 1982. (5) Anna's Hummingbird in white alder (*Alnus rhombifolia*) woodland, Day Canyon, Etiwanda, San Bernardino Co., California (elevation 880 m), 27 April 1983.

In each case the bird made repeated visits to a dead campfire or barbecue pit and licked the fine ash that had fallen from the charred wood. The birds' behavior appeared purposeful in that all of them left the nest, flew 25 to 60 m directly to the ashes, licked for a few seconds, and returned to the nest. The routine was repeated several times per hour through the middle of the day, and was observed for up to 10 days. Feeding forays were interspersed with these trips to the ash heaps. When on the nest, the birds seemed to make no notable adjustments of nest material nor did they appear to deposit anything onto the nest material, so I am confident that material from the ash heaps was not being used in nest construction. None of these birds were using bird feeding stations during the periods of observation. I have never seen a male or a nonnesting female engaged in this behavior.

Wood ash is surprisingly rich in calcium. For example, CaO often comprises one-half to three-quarters of the total ash. Crystalline calcium carbonate and calcium oxalate frequently occur in wood (Wise 1944:436) and, thus, contribute significantly to ash composition. Sodium is also variably present in ash, primarily as $Na_2O$. Wise (1944) listed concentrations of $Na_2O$ ranging from 0.04 to 18.7% of the total ash. The ashes used by birds during my observations were from various tree species, and none of it was salty to my taste.

In feeder experiments Broom (1976) showed that hummingbirds consumed 0.27 M sucrose solutions and 0.27 M sucrose + 0.07 M NaCl solutions equally in preference to other concentrations but avoided more concentrated salt solutions. Carroll and Moore (1993) found strong preferences for feeders in which sugar solutions were supplemented with vitamins. Their system also contained high concentrations of calcium as an inadvertent component of the vitamin supplement. Bacon (1973) reported observing a single unidentified hummingbird apparently drinking ocean water from the surface of a quiet bay. The birds are evidently sensitive to and discriminate among the concentrations of a variety of dissolved substances in their diets.

Verbeek (1971) reported on hummingbirds eating sand grains, presumably for the calcium salts they contained. Furthermore, he suggested that this behavior was in response to the calcium deficit that accrued from egg production. A. S. Leopold (field notes; mentioned in Verbeek 1971) repeatedly observed one female or juvenile Allen's Hummingbird (*Selasphorus sasin*) apparently eating ashes from an outdoor fireplace. It may not be a coincidence that all of the birds we observed were nesting females.

The ash-eating birds we observed were probably utilizing a rich, convenient mineral source. Verbeek (1971) conjectured that the birds learn the locations of calcium-rich soils by haphazard sampling of the environment. Since wood ashes are a readily identifiable source of essential minerals, I suggest that ash feeding by nesting birds may be more common than the limited records suggest.

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## Habitat-specific Nutritional Condition in Loggerhead Shrikes (*Lanius ludovicianus*): Evidence from Ptilochronology

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Over much of North America, the density of Loggerhead Shrikes (*Lanius ludovicianus*) has been steadily declining for much of the 20th century (see references in Yosef and Grubb 1992). Even populations formerly thought to be strongholds of the species (Droege and Sauer 1990) have recently been losing ground at 5 to 10% per year (Tyler 1992, Yosef 1992). Although several causal factors for the decline have been implicated (e.g. H. M. Hands, R. D. Drobney, and M. R. Ryan unpubl. report), attention has recently focused on modern agricultural practices involving either habitat destruction or introduction of herbicides and insecticides (e.g. Anderson et al. 1978, Yosef and Grubb 1992). Despite considerable recent attention to the species, little is known about the possible effects of human-modified habitats on this shrike's survival and fecundity. Here, we report evidence that nutritional condition in Loggerhead Shrikes resident in south-

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