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SALT-EATING BY BLACK AND TURKEY VULTURES

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Although birds and mammals obtain sodium from their natural foods, many also ingest salt directly. For some animals, supplemental salt may be necessary and its availability can affect the distribution and physiology of these species (Dalke et al. 1965, Weeks and Kirkpatrick 1976, Belovsky and Jordan 1981). Although a need for supplemental salt has not been demonstrated in birds, salt-eating has been reported in woodpeckers (*Melanerpes lewis, Picoides pubescens*), jays (*Cyanocitta* sp.), Black-billed Magpies (*Pica pica*), White-breasted Nuthatches (*Sitta carolinensis*), Rock Wrens (*Salpinctes obsoletus*), crows (*Corvus* sp.), House Sparrows (*Passer domesticus*), finches (*Carduelis pinus, C. tristis, C. psaltria, C. lawrencei, Carpodacus purpureus, C. mexicanus, C. cassinii, Coccothraustes vespertinus, Loxia curvirostra*), Gambel's Quail (*Callipepla gambelii*), Savannah Sparrows (*Passerculus sandwichensis*), pigeons (*Columba livia, C. fasciata*), and Mourning Doves (*Zenaida macroura*; Reeks 1920, Mousley 1921, Pierce 1921, McCabe 1927, Gorsuch 1934, Aldrich 1939, Marshall 1940, Peterson 1942, Calhoun 1945, Mousley 1946, Packard 1946, Neff 1947, Bleitz 1958, Duncan 1962, Cade 1964, and Dawson et al. 1965). We are unaware, however, of any reports of salt-eating by falconiforms.

From 14 November to 23 December 1983, while studying habitat use by vultures, we saw Turkey Vultures (*Cathartes aura*; 22 birds on six occasions) and Black Vultures (*Coragyps atratus*; nine birds on four occasions) eating from a salt block in a pasture 4 km south of Gettysburg, Pennsylvania. The salt was 400 m from a stand of trees used by 400–600 roosting vultures. We have previously observed vultures eating cattle feces, and because the salt was surrounded by sheep droppings, we tested whether the birds had been attracted to the droppings by moving the block 100 m to a location free of feces. Within a day, we saw the vultures eating salt at this new location. Turkey Vultures obtained salt either by scraping their upper mandibles across the block or by nipping at the block, while Black Vultures only nipped at the block. The scraping movements differed from wiping the bill after feeding in that the bill was drawn in a straight line for approximately 8 cm, as opposed to the back-and-forth movement characteristic of bill-wiping. Only one bird fed at a time, with older birds displacing younger; we have observed this behavior and the nipping movement in birds feeding on carrion.

Cade (1964) suggested that cardueline finches, which have 0.001–0.03% sodium in their diets (Altmann and Dittmer 1968), may eat salt because they have a sodium deficiency. Domestic Chickens (*Gallus gallus*, var. *domesticus*) and Japanese Quail (*Coturnix japonica*) require 0.09–0.15% dietary sodium to maintain maximum growth and egg production (Skadhauge 1981). Wild birds, however, rarely show symptoms of sodium deficiency when kept on a low salt diet (Cade 1964, Dawson et al. 1965). From data on radio-tagged vultures, we know that the wintering birds consumed carrion of white-tailed deer (*Odocoileus virginianus*), domestic pig (*Sus scrofa*), and cow (*Bos taurus*) during the period we observed salt-eating. The raw muscles and organs of these animals contain more sodium (0.04–0.30%) than do seeds (Altmann and Dittmer 1968, McCullough and Ullrey 1983). Since this level is similar to that required by laying chickens and growing Japanese Quail, it seems sufficient for maintenance of non-laying, adult vultures. The sodium requirements of birds need to be studied further in order to understand the reasons for salt-eating.

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FEEDING ACTIVITIES OF THE ANNA'S HUMMINGBIRD AT SUBFREEZING TEMPERATURES

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In the past two decades or so, Anna's Hummingbirds (*Calypte anna*) have moved northward in the Pacific Northwest (US and Canada) to about 50°N latitude as year-round residents of urban areas. In this northern expansion of their range, winter exposes them to daylengths as short as 8 h, food limitations both in number of flowering species and in abundance, and periods of intense cold. Anna's Hummingbirds have been recorded during winter in Portland, Oregon, since late 1965 (Baldridge and Crowell, Audubon Field Notes 20:81–87, 1966); a first-year male was recorded between June and August, 1966, and subsequently the species has been seen in this area throughout most or all of the year (Zimmerman, Amer. Birds 27:827–835, 1973). With increased awareness of the presence of these hummingbirds during winter months, people have been maintaining hummingbird feeders year-round. We describe here feeding and resting activities of an Anna's Hummingbird near a feeder during low temperatures that may have approached the lethal point for thermoregulatory capacity in this species. Ambient temperatures during this period of cold approached the lowest ever recorded at a site of trochilid activity, and we have documented the longest profile of exceptionally low temperatures known to us within a hummingbird's home range.

On 26 December 1982, we placed a tube hummingbird feeder in our north-facing garden in Portland at 245 m elevation. Within three days, a male Anna's Hummingbird was attracted to the feeder, and one or more has visited daily ever since. Visitations peaked in July and August, when adults and immatures emptied the contents of the feeder (118 cc) daily. The sugar solution used in the feeder yielded approximately 1.7 kcal per cc, except when diluted in the tube by capillary action of surface water when it rained. A displacement air bubble, noticeable when a bird drank from the tube, approximated an intake of 0.5 cc, or 0.85 kcal, when the solution was at full strength. An 8-day continuous temperature recorder, connected to a thermocouple located at the same height as the feeder and 2 m away, provided a continuous profile of ambient temperature and was checked for accuracy at least four times a year.

A four-day period of cold, overcast weather, commencing 08:00 on 21 December 1983, broke previous records of low temperature for Portland on 23 and 24 December. In our garden, all but one hour of this period was below −4.4°C and ambient temperature dropped to −11.1°C (Fig. 1). When a hummingbird was present, we used a hand anemometer (Dwyer) to measure the winds that blew continuously from the east for the latter two days. These measurements revealed that the wind chill factor dropped the effective temperature to a low of −35°C on 23 December and to a low of −30°C on the following day while the bird was active.

Ambient temperature declined over the first two days, except during mid-day, at which times we saw hummingbirds at the feeder only between about noon and just before dusk at 16:30 (Fig. 1). This interval of sightings approximated the warmest segment of the subzero temperatures during daylight hours on each of these days and also on the third day, when the ambient temperature reached its nadir.

During the first two days, the hummingbirds usually came singly, and we observed no more than two, one of each sex, at a time. The birds were not banded, however, so we could not establish how many hummingbirds were visiting this feeder. When two were present simultaneously, they buzzed one another at the feeder in minor skirmishes. The male appeared to be the more frequent victor and also the more frequent visitor. Both sexes fed most actively just before dusk and ingested up to eight "bubbles-worth" of solution each in their final visits for the day. On the third day and until after the subsequent week, the visits were made only by a solitary male. He used the same twigs of a nearby rhododendron as perch sites between bouts of feeding on each visit, which suggested that it was the same individual each time.

Throughout the 4-day cold spell, the occasional precipitation was fine snow that did not accumulate and was driven horizontally when the east wind blew hard. The feeding and resting behavior of a hummingbird was essentially the same in routine, regardless of the extent of wind or precipitation. A visiting period lasted up to 10 min, during which an individual usually fed more than once and appeared to ingest 1–4 "bubbles-worth" of solution before departing. Between bouts of feeding in a visiting period, the bird usually perched 10–20 cm inside a rhododendron 3 m from the feeder. Even though its leaves were drooped and curled, this bush protected the birds from winds and periods of snow. Except for head movement and occasional preening, the bird was almost motionless while perched.

Ambient temperature rose to −1.67°C by 10:00 on 25 December and hovered between −2.78 and −1.67°C, with a wind chill of −15 to −10°C, until after dusk. Sleet and freezing rain fell throughout the day. On this morning, we placed a mechanic's light (40-watt bulb) in a rose trellis 10 m from the feeder, at the same height, and under the overhang of an eave. We first saw the male hummingbird at 14:30. After feeding and resting in the rhododendron several times, he flew to the trellis and perched there 30 cm from the light. Except for remaining in the garden and perching on the trellis, the routine of feeding activity was the same as on previous days. In the next two hours, he had about six bouts of feeding as sleet fell, returning to the protected trellis perch each time. By 15:30, when he was 15 cm from the light, we approached him, placing one bulb thermometer 15 cm from the light and within 5 cm of the bird, which remained on the perch, and another bulb thermometer 15 cm from the feeder. They registered 0.66°C and −2.30°C, respectively. From time to time, the