

ABILITY OF BLUE-THROATED AND RIVOLI'S HUMMINGBIRDS TO SURVIVE SUBFREEZING TEMPERATURES

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Observations at a bird-feeding station in southeastern Arizona over several winters indicate that, if food is provided, it is possible for the larger native hummingbirds, Rivoli's (*Eugenes fulgens*) and Blue-throated (*Lampornis clemenciae*), to survive periods of subfreezing temperature even while spending considerable time and energy defending artificial nectar feeders.

Prior to 1973-74 there were few records of these two species wintering in southern Arizona, although Christmas Bird Counts at Ramsey Canyon in the Huachuca Mountains included one or both species for 1969 through 1971. In 1973-74 a female Blue-throat spent the winter near Portal, in the Chiricahua Mountains, visiting several feeding stations. That was a relatively mild winter, the temperature rarely going below freezing. Since that year we have had one or two of either or both species winter over each year, feeding on an artificial nectar mixture of 5 parts water and 1 part sugar. On cold nights we brought nectar feeders indoors to prevent freezing, returning them to outdoor hangers at daybreak.

In December 1978 an extreme cold spell hit southern Arizona, when a high pressure system moved into the state from the west, following a period of precipitation. On 7 December at Portal, 18 cm of snow had fallen at our elevation (1500 m) and the temperature remained between -2° and -7°C all day. Considerably more snow had fallen at higher elevations. Four individual male Blue-throated Hummingbirds and two Rivoli's, one an adult male and one a female, fed frequently all day at Portal, with occasional interaction as they attempted to defend the feeders. The morning of 8 December, the temperature was -15°C at our elevation and -20°C at the Southwestern Research Station at elevation 1650 m, 8 km up Cave Creek Canyon from our feeding station. We warmed the sugar water on the stove and replaced it as necessary when the feeders froze. At 0730 the first Blue-throat appeared. After feeding, the bird flew rather sluggishly to a low, nearly leafless mesquite (*Prosopis juliflora*) near the house and perched, fluffed up, just above the snow. At 0800 we discovered that there were three Blue-throats perched close together in the same mesquite (Figure 1). A male Rivoli's then came to the feeder, drank, and flew strongly up into a large evergreen oak tree (*Quercus emoryi*).

Surrounding mountains and cliffs prevent direct sun rays from touching our yard in December until 0900. Shortly after the sun illuminated the feeders, the Blue-throats became more active and by 0930 one was guarding the bottles, driving away the others, and even challenging a House Finch (*Carpodacus mexicanus*) and a Bridled Titmouse (*Parus wollweberi*) which ventured near the sugar water. At 1000 we realized that there were four Blue-throats but we never noted all four perched in the mesquite at one time. The temperature reached -5°C in the early afternoon, with bright sun and no wind. The last sighting was at 1715 when one Blue-throat drank and flew off. We did not see a female Rivoli's that day.

On 9 December the temperature was again -15°C at daybreak and we repeated the routine—putting out warm sugar water and rewarming it at intervals throughout the day. The first Blue-throat appeared at 0715 and seemed stronger than at first appearance the previous day, although it still perched low in the mesquite and made no attempt to fly up to its usual higher daytime perches. A second individual appeared at 0730 and displayed mild aggression. We were certain of only three Blue-throats and one male Rivoli's Hummingbird that day.

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In mid-morning I noticed that one Blue-throat had his mandibles spread apart, and his tongue, coated with ice, was hanging out. He attempted to feed but could not get his beak into the tube. As he was weak, I managed to catch him and bring him inside where I thawed his tongue, let him rest inside a paper bag, and then fed him. He drank steadily in short sips for almost 5 minutes. At first his tongue extended into the tube only a few millimeters, but eventually it came out full length as he drank. I released him and he flew strongly up into the oak tree.

The temperature again that day reached only -5°C . When not feeding, the hummers usually perched low in the mesquite, although sometimes the Rivoli's, when not in the oak, came onto a low crossbar beneath the seat of a folded lawn chair leaning against the house. Several times in the late afternoon a Blue-throat landed on the ground outside the door, once in the snow, but flew off when I attempted to catch him.

On 10 December the early morning temperature was -11°C ; that afternoon it finally went above freezing (1°C) and the crisis seemed to be over. Three Blue-throats and one Rivoli's had survived almost 90 hours of below-freezing temperatures, but it must be noted that except on the 7th, the sun shone brightly and there was no wind.

On 11 December, with a temperature span of -6° - $+4^{\circ}\text{C}$, there was considerable aggression among the hummingbirds. Blue-throats seemed dominant over the Rivoli's, and the "boss" Blue-throat appeared to be a first-year bird, judging by his incompletely blue throat.

The periods of perching in the low mesquite, during times of lowest temperature, were sometimes as long as 30 minutes. We speculate, although it was impossible to determine, that the birds went into a state of partial torpidity at this time, and presumably also overnight, in order to survive. They assumed the position described by Bartholomew, Howell and Cade (Condor 59:145-155, 1957), with bill pointing upward about 45° and feathers greatly fluffed (Figure 1).

We had noted previously that in cold rainy spells in April, after a number of the migrating and summering hummingbirds had returned, up to a dozen might be seen perching low in the same mesquite, from 15 cm to 1 m above the ground. Presumably



Figure 1. Three Blue-throated Hummingbirds perched close to the ground in snow-covered mesquite in subfreezing temperature, 8 December 1978, Portal, Arizona.

Photo by S.H. Spofford

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the low perch offered protection from wind and perhaps some warmth from the ground.

As already pointed out here, once warmed up and well fed in the morning, the birds turned to feeder defense. More detailed observations of this type of behavior had been made by us in December 1974 when the problem of mere survival did not seem so acute.

On 8 December 1974 it began snowing lightly in late morning and the male Blue-throat, which usually perched high in the oak tree between visits to the feeder, took up a perch on the bent wire from which one of the feeders was suspended, under a porch roof, where he was sheltered from the falling snow and a scant 2 m from my desk (Figure 2). The temperature was just a few degrees above freezing. From this perch he repeatedly drove away a female Blue-throat and a male Rivoli's Hummingbird, both of which were trying to come to the feeders. When I realized he was staying almost continuously on this perch, I observed his behavior for 2.5 hours beginning at approximately 1430. During this period he was off the perch, other than to feed, a total of only 24 minutes, 11 minutes of which was just before going to roost. He sometimes fed from a gravity feeder while perched on its supporting wire but more often at a "flying saucer" type feeder with three small tube-openings, on the rim of which he perched while sipping.

During this time period, whenever he was on his perch, his head jerked constantly, bill pointed upwards, the head jerks coming at one-second intervals. Frequently, while facing the house, he looked back at the direction from which intruding birds usually approached.

When he drank from the feeder, located 50 cm from his perch, it was usually for less than 30 seconds, involving four to eight quick sips at a time. During the 2.5 hour observation period he visited the feeders almost 20 times, feeding a total of less than 10 minutes during this period.



Figure 2. Male Blue-throated Hummingbird guarding feeder during snow storm, December 1974, Portal, Arizona.

Photo by S.H. Spofford

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Whenever the male Rivoli's or the female Blue-throat approached, even to visit a feeder 4 m or more from his perch, he immediately flew after the intruder, sometimes pursuing it for 100 m or more. Then he returned either to the oak tree or directly to the wire perch under the eaves.

A Painted Redstart (*Myioborus pictus*) made repeated visits during this time to the sugar water feeders. The reaction of the Blue-throat was to chirp loudly, jerk his head more rapidly, and occasionally to leave the perch to buzz around the warbler. However, this hummingbird paid no attention to House Finches which came to "his" feeders.

At 1630 the temperature had dropped just below freezing and other birds were leaving the feeding area. During the last 20 minutes before the Blue-throat disappeared for the night, he did considerable twitching and wing-fluttering, and seemed to be breathing more rapidly. At 1656 he left the perch, took two quick sips of nectar and vanished. The following morning he returned to the feeders at 0730 and spent most of the day there, though not so continuously on the perch. He returned the next day when the temperature dropped to -8°C and survived the day.

It is of interest that at a time when the bird must be hard pressed just to survive, because of low temperatures, it still expends considerable energy in aggression and defense of feeding territory.

These field observations did not of course permit use of techniques employed by Lasiewski and Lasiewski under laboratory conditions (Auk 84:34-38, 1967) to ascertain exact physiological responses in the species discussed in this paper. However our field observations show that the hummingbird species that survived artificially induced low temperatures of the laboratory can also survive subfreezing temperatures in the wild, provided they have access to food during the day.

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