than a dusky discoloration. According to Haffer's interpretation (1974: 294–307), this blackish mottling indicates the hybrid nature (between *R. t. tucanus* and *R. t. cuvieri*) of these birds.

In summary, in accord with Hartert's intention it seems best to think of "*aurantiirostris*" as the most unmottled manifestation of *R. t. tucanus*. It is normally red-billed but may show an orange bill color in a few living birds (as morphs, perhaps limited to Guyana), or may pass through such a hue in the process of postmortem fading of the red pigment normally present. The type of *aurantiirostris* probably belongs to the latter category. Hartert's name *R. monilis aurantiirostris* is best consigned to the synonymy of *R. t. tucanus*.

I am indebted to E. Eisenmann for providing the original Hartert description, for comments about the specimens in the American Museum of Natural History, and for various suggestions.—PAUL SCHWARTZ, *Ministerio de Ambiente y de los Recursos Naturales Renovables, Centro Nacional de Investigaciones de Fauna Silvestre, Apartado 184, Maracay, Aragua, Venezuela.* Accepted 12 July 76.

Hanging behavior in Common Ravens.—During the winter of 1974–75, I studied the behavior of the Common Raven (*Corvus corax*) at a feeding and banding station and watched the following unusual displays. On 26 January 1975, with three other people, I noticed six ravens in a dead white pine on a bluff overlooking the Cornwallis River in New Minas, Kings County, Nova Scotia, close to a dump where refuse from a poultry processing plant attracted many scavengers. When first seen, one of the ravens was hanging beneath an exposed branch by one foot, as if trapped in a snare. The raven then grasped the branch with its bill and released its foot so the weight of the body was supported by the bill. The wings were partly open but motionless, and were not used for support. The bird then gripped the branch with both feet, released its bill and hung by its feet with the wings folded, the mirror image of a raven perched normally above the branch. It then climbed onto the branch with the help of its bill and flapping wings and stood erect with its throat hackles ruffled.

The raven then flew to the same branch from below, grasped the branch with its bill, folded its wings and hung with its body suspended by the bill. After about 10 sec, it pulled itself back on top of the branch using both feet and wings. It then repeated the displays of hanging by 1 foot, by 2 feet, and by the bill alone over a period of 3–4 min, periodically pausing for 15–45 sec while perched on the branch. It was adept at maneuvering itself under the branch and regaining its position above it.

Following this display, the raven flew to a perch higher in the tree. One of the other ravens immediately flew up to the original branch and grasped it with its bill. This bird was unable to support its weight by the bill alone, and flapped its wings to keep from falling. The first raven then returned, croaking loudly, supplanted the second, and hung expertly by its bill. It then alternated between the three types of hanging behavior, occasionally pausing while perched on the branch. Most of the other ravens remained perched in the tree during these displays.

The displays ended after about 10 min when all the birds flew from the pine, apparently following one particular raven that had been perched near the top of the tree. Immediately after they reached some woods to the northeast, we saw a similar display of bill-hanging from the exposed branch of a live white spruce.

Although ravens are known for their wide variety of aerial displays, hanging by the bill or by the feet has apparently not been reported in the literature. Pearse (*in* Bent 1946, U.S. Natl. Mus. Bull. 191, part 1, p. 195) describes the behavior of flying ravens tugging off cones or clipping twigs from branches of douglas fir while in the air, but does not mention their hanging from branches. On several occasions in Kings County, within the last 10 years, ravens have been seen hanging by their feet, although not by the bill (C. K. Coldwell and G. L. Hansen-MacInnis, pers. comm.).

As neither the sex nor the age of the displaying ravens, or of those perched in the tree was known, it is difficult to interpret the function of this behavior. As noted by Witherby (*in* Witherby et al. 1940, The handbook of British Birds, London, H. F. & G. Witherby Ltd., vol. 1, p. 8) aerial displays are a feature of courtship, although they are also performed at other times. As courtship in ravens does occur in midwinter (Bent, ibid.), I suggest that the hanging behaviors we saw were the displays of courting males. They appeared to be directed toward one particular raven, presumably a female, which the others followed when it flew from the tree.

To determine the proportion of ravens that are physically capable of supporting their own weight by the bill, 15 were live-trapped on 4 January 1976. A spring scale was used to measure the force the hand-held birds could pull with the bill when hanging quietly below the scale. Ten of these could sustain a force of 2,500 g (twice their own average weight of 1,230 g) for 10 sec, and the others could briefly pull with 2,000 g of force. Nine other ravens supported their own weight for an average of 37 sec (range: 11–78 sec).

The least excited ravens appeared to be the most proficient at supporting their weight, particularly if they had a well-developed hook on their upper mandible. The width of the branch they are gripping and the roughness of its surface would also be expected to affect their efficiency. There was no apparent relationship between age or body weight and hanging ability.—RICHARD D. ELLIOT, *Department of Biology, Acadia University, Wolfville, Nova Scotia, Canada B0P 1X0*. Accepted 16 July 76.

Spring migrant mortality during unseasonable weather.—For vernal migrating birds, premigratory lipid deposition has been theorized to have adaptive significance. Although some early-spring, short-range migrants may not increase lipid reserves significantly, most migrant birds undergo hyperlipogenesis coupled with increased cutaneous and subcutaneous adipose tissue deposition. The amount of lipid accumulated is a selective function of the distance to be covered, departure time, and flight load capacities of the bird (for review, see Berthold 1975) and should be sufficient to render the bird reproductively fit upon arrival at the breeding grounds.

Two periods of unseasonable cold and stormy weather in Utah during late April and mid-May 1975 caused mortality in spring migrant birds. Ligon (1968) reports a similar case in southeastern Arizona, Dence (1946) cites Tree Swallow mortality in New York, while Bull and Dawson (1968), and Skead and Skead (1970) cite spring migrant mortality in the southern hemisphere. As in the studies reported in the latter two papers, heavy snowfall accompanied the cold weather in Utah.

This study documents spring avian mortality with special reference to dry weight, lipid levels, muscle and gonad condition, and, in the case of the swallows, comparisons to live-trapped birds. A total of 569 individuals of 32 species were found dead, of which 136 individuals of 29 species were in good enough physical condition to be analyzed quantitatively (Table 1). Those not analyzed were primarily badly decomposed, partially eaten, or crushed by passing vehicles when they flocked to roads after snow covered the nearby ground.

Dead birds were collected between 30 April and 23 May 1975 at several locations in central Utah including the Provo Boat Harbor, Provo; Hobble Creek near Utah Lake; the cities of Holden, Kanosh, Nephi, and Mapleton; Palmyra Campground in Diamond Fork; Fish Springs Wildlife Refuge; and the Desert Experimental Range Station. For comparative purposes a small sample of swallows was collected live at Hobble Creek on 10 May 1975 between the periods of bad weather.

Immediately after collection birds were weighed, sexed, their gonads measured, and were then stored in a freezer in airtight plastic bags. Prior to lipid analysis stomach contents were examined. To obtain dry weights the birds were placed in a drying oven (78–80°C) until repeated weighings remained constant, usually 48–72 h. Whole body fat extraction was performed using the standard Soxlet apparatus with a solvent of petroleum ether. Wet and dry weights were obtained with triple beam balance while a Mettler balance was used to obtain lipid weights. Percent wet weight of the birds could not be accurate as the birds were dead for varying lengths of time before collection. Weather data were obtained through the courtesy of Dr. Ferron Anderson, Parasitology Weather Station at Brigham Young University.

Univariate statistical tests were made using a Hewlett-Packard 9810A desk calculator whereas multivariate tests were made on the IBM 360/75 computer at West Virginia University. For a description of the various multivariate statistical techniques used in the study see Morrison (1968) or Whitmore (1977).

The X values listed in Tables 1 and 2 are based on the Rogers and Odum (1964) equation for the relation between fat and nonfat weight in normal and stressed birds. They state that 0.2 g of fat per gram of dry weight nonfat tissue is present as tissue fat and can be utilized only at the expense of burning nonfat components. Birds with a body fat content less than this amount have to metabolize other tissues, such as muscle, to obtain the needed existence energy, and can be considered stressed. The X values were calculated by multiplying the nonfat weight of the bird by 0.2 thus giving the hypothetical amount of fat present in a bird just prior to being stressed, i.e. before having used all its available free lipid reserves.

Daily temperature, rain, and snowfall for 1970–75 during the two periods of avian mortality were tabulated. A multivariate analysis of variance (MANOVA) as well as a stepwise discriminant analysis were conducted to determine if 1975 was, in fact, significantly harsher than the previous 5 years (where no unusual mortality was recorded) and if so, which of the weather factors was most important in the difference. The results of the stepwise discriminant analysis indicated that the single variable most responsible for weather differences between the years was maximum temperature. The other variables, minimum temperature, rainfall, and snowfall also contributed to the differences but to a lesser degree. The results of the MANOVA (Approximate $F = 2.11$ with 20 and 190 degrees of freedom) indicate a significant difference in weather between the years at $P < 0.01$. To find out which of the individual years differ, a series