unoccupied by this species (Table 1), would seemingly indicate that diffusive losses of carbon dioxide from these burrows to the atmosphere are reduced.

In the burrows occupied by Bank Swallows convective means of ventilation appear to play a major role in determining the burrow gas environment. Evidence in support of this conclusion, in addition to the magnitude of the slope in the above relationship relating increases in carbon dioxide to decreases in oxygen in burrows of this species, comes from data relating burrow gas concentrations and depth of burrows. There is a positive but non-significant ($P > 0.05$) correlation ($r = 0.29$) between burrow depth and carbon dioxide concentration and a negative but non-significant ($P > 0.05$) correlation ($r = -0.26$) between depth and oxygen concentration in the burrows occupied by Bank Swallows. The same sort of relationships between gas concentration and burrow depth have been reported previously (Wickler and Marsh 1981). Interestingly, convective forms of ventilation have also been shown to be important in the burrows of the European Bee-eater (White et al. 1978).

Our data provide further evidence that the occupants of avian burrows produce and are subjected to respiratory gas environments much different from those in the free atmosphere, while the thermal regime is much buffered from that outside the burrow. The respiratory gas environments to which burrow-nesting birds are exposed are quite similar to those measured in many mammal burrows (for a review of the literature see Arieli, Comp. Biochem. Physiol. 63A:569–575, 1979; Maclean, Comp. Biochem. Physiol. 69A:373–380, 1981). Many of these fossorial mammals show a variety of physiological adjustments that help them cope with life-long exposure to low oxygen, high carbon dioxide environments (e.g., Darden, J. Comp. Physiol. 78:121–137, 1972; Ar et al., Respir. Physiol. 30:201–218, 1977; Arieli and Ar, J. Appl. Physiol. 47:1011–1017, 1979). Recent studies have revealed similar physiological adaptations in burrow dwelling birds as well (Kilgore and Birchard, Am. Zool. 20:766, 1980; Birchard and Kilgore, Physiol. Zool. 53:284–292, 1981; Boggs and Kilgore, J. Comp. Physiol. 149:527–533, 1983; Boggs et al., Comp. Biochem. Physiol. 77A:1–7, 1984).

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Sexual differences in longevity of House Sparrows at Calgary, Alberta.—The extensive body of data on survivorship of House Sparrows (*Passer domesticus*) obtained by Summers-Smith (The House Sparrow, Collins, London, England, 1963) and available from British and North American banding studies has been summarized by Dyer et al. (pp. 55–103 *in* Granivorous Birds in Ecosystems, J. Pinowski and S. C. Kendeigh, eds., Cambridge Univ. Press, Cambridge, England, 1977). In England, about 19% of House Sparrow fledglings survive to 1 year post-fledging, and annual adult survival from 1 year onward is about 50% in England and 34% in North America. Female House Sparrows have slightly higher annual survivorship than adult male House Sparrows (51% vs 45%, England; 37.3% vs 32.5%, North America; Dyer et al. 1977). Summers-Smith (1963) found that female mortality was higher than male mortality during the breeding season but the reverse obtained outside the

TABLE 1
NUMBERS OF RECOVERED HOUSE SPARROWS OF KNOWN AGE

Age (years)	No. of males	No. of females	Ratio (m/m + f)
1.0	28	23	0.55
1.5	16	13	0.55
2.0	29	33	0.47
2.5	19	9	0.68
3.0	3	1	0.75
3.5	1	0	—
4.0	6	2	0.75
4.5	2	0	—
5.5	1	0	—
6.5	1	0	—

breeding season. We monitored a large population of House Sparrows near Calgary, Alberta from 1975–1979 allowing us to evaluate sexual differences in adult survival in a harsher climatic regime than those covered by Dyer et al. (1977).

House Sparrow nestlings were banded from 1975–1978 on several farms 5–10 km E of Calgary, Alberta. Details of the study area and the House Sparrow populations can be obtained from Murphy (Condor 80:180–193, 1978; Ecology 59:1189–1199, 1978) and McGillivray (Wilson Bull. 93:196–206, 1981; Auk 100:25–32, 1983). Recoveries of banded birds were not made in a systematic way to permit formulation of a life table. Data presented here are from attempts to net all banded birds in the late autumn of 1977 and the spring of 1978. In the spring and late autumn of 1979, all recaptured birds were collected for anatomical study. A final collecting effort was made in the autumn of 1983 to recover any long-lived individuals. Hence, although our data cannot provide absolute estimates of annual adult survival, it is possible for us to examine the sex ratio of groups of survivors of known age to assess sexual differences in mortality.

Table 1 gives the number of male and female House Sparrows of known age recovered through the banding and collecting operations. All fledglings surviving to late autumn (25 October–10 November collecting dates) of their first year are assumed to be 0.5 years of age and those surviving to the following breeding season are treated as 1 year-olds even though fledging dates may range over several months. Table 1 shows that male and female sparrows have approximately equal survival to 2 years of age (ratio = no. males/[no. males + no. females] = .51, N = 142), whereas after 2 years, males are more likely to be recovered (ratio = .73, N = 45). Although it can be shown, using a test for proportions (Walpole and Myers, Probability and Statistics for Engineers and Scientists, MacMillan Publ. Co., New York, New York, 1978), that .51 is not significantly different from .5 ($Z = .24$, $P > 0.80$), whereas .73 is ($Z = 3.47$, $P < 0.001$), these tests are only descriptive since we have partitioned Table 1 into two groups arbitrarily. Nonetheless, very few females greater than 2 years old were recovered.

Lowther (Inland Bird Banding 51:23–29, 1979) documented an increased likelihood of dispersal from natal sites for female House Sparrows compared to males at Lawrence, Kansas. However, dispersal is common only among juveniles (Summers-Smith 1963; North, Ornithol. Monogr. 14:79–91, 1973; Will, Ornithol. Monogr. 14:60–78, 1973), and, if it is a factor modifying the sex ratio of survivors, a skewed ratio should have been evident at younger as well as older adult ages given in Table 1.

Summers-Smith (Bird Study 3:265–278, 1956) attributed higher male House Sparrow overwinter mortality to predation due to a lack of vigilance on the part of the males, a trait presumably lacking in females. At a high latitude site like Calgary, winter conditions should be a greater source of mortality than would be observed in more moderate climates such as in England or throughout much of the continental U.S. (Beimborn, M.Sc. thesis, Univ. Wisconsin, Milwaukee, 1967; Cink, Ph.D. diss., Univ. Kansas, Lawrence, Kansas, 1977). Cink's (1977) autumn and winter observations at Jamestown, North Dakota indicate that males are dominant over females and should obtain better positions at feeding sites. Bumpus (Biol. Lectures, Marine Biol. Lab., Woods Hole, 1899:209–226) reported that 72 individuals in a sample of 136 House Sparrows survived a severe winter storm in Providence, Rhode Island. Fifty-one of 87 males (59%) but only 21 of 49 females (43%) survived. Mortality was not independent of sex ($\chi^2 = 3.14$, df = 1, $0.05 < P < 0.1$), suggesting that harsh winter conditions disproportionately reduce the survivorship of females.

Our observations of House Sparrows in Calgary are atypical for sexually dimorphic species and coincide with those for monomorphic species wherein males usually survive better than females, presumably because of higher reproductive costs for females (Lack, The Natural Regulation of Animal Populations, Oxford Univ. Press, London, England, 1954). The differences between our observations and those of Summers-Smith (1956, 1963) indicate that higher susceptibility of males to predation is overriden in harsh winter climates by higher vulnerability of females to severe winter conditions.

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Seed selection by juncos.—Evidence suggests that avian predators may respond to food characteristics other than, or in addition to, energy content of the items (Pulliam, Ardea 68:75–82, 1980), yet little is known of the exact determinants of diet selection (Willson, Condor 73:415–429, 1979). Investigations of food variables that influence dietary choices should be valuable in understanding foraging behavior. In the present study, we asked whether Dark-eyed Juncos (*Junco hyemalis*) select seeds on the basis of physical characteristics of the seeds, such as size, shape, and color, or on the basis of nutrient content.

Materials and methods.—Thirty juncos were captured near Fort Collins, Colorado, color banded, and maintained on 12L:12D photoperiod at room temperature in cages (25 × 25 × 25 cm) individually so that they could hear but not see each other. Age and sex were unknown. Subjects were fed a mixed diet consisting of niger thistle (*Guizotia abyssinica*) (hereafter "thistle"), canary grass (*Phalaris canariensis*) (hereafter "canary"), millet (*Panicum milliaceum*), and flax (*Linum usitatissium*). Seed and water were freely available.