

SNOW MELTOUT DATES AND BREEDING DENSITY IN BREWER'S SPARROWS (*SPIZELLA BREWERI*)

MARTIN L. CODY ✦ UNIVERSITY OF CALIFORNIA ✦ LOS ANGELES

✦ INTRODUCTION

We have conducted a breeding bird monitoring program in GTNP since the early 1990s, utilizing fixed-area census sites of around 5 ha in size. The sites are located throughout the park in all habitat types and elevations, and number 30 in all. Some have been censused each year in June, at the height of the breeding season, others have been censused repeatedly but more sporadically, and other less frequently. The power of these census data to interpret variation in bird species composition and breeding densities, species-to-species, site to site, and especially year to year, clearly increases with the longevity of the data set. With the data from some sites now covering 18 successive years (1991-2008), it is possible to attempt some interpretation of the bird species variables. One such is reported here, the influence of snow meltout date on breeding density of a common species of the sagebrush flats, Brewer's Sparrow *Spizella breweri*.

Y2008 Weather

Weather data summarized here comes from the Moran 5WNW station near Jackson Lake dam, and were collected and reported to NCDC by Mr. Larry Robinson. Note that peak snow depths at this weather site are around 4.5' (1.36 m), average Mar 1 snow depth is 36.2" (0.91 m), and the mean snow meltout date (first spring day of zero snow depth) is DOY 113 \pm 11.1SD (Apr 23rd). This latter date has varied, however, some 40 d between earliest and latest melt dates over the 18 y period shown in the figure, illustrating the unpredictability of the feeding conditions near the site, from the point of view of ground-foraging birds at the springtime return to breeding habitat. Of course, there is also spatial

variability, during the meltout, in the degree to which snow is retained in various microsites (cooler, more open, etc.), but the year-to-year variation in habitat availability to birds that require ground foraging sites is generally reflected in the figure.

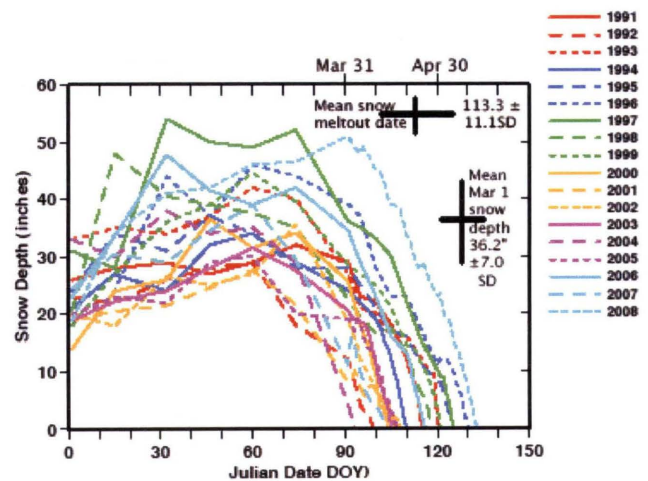


Figure 1. Variation in snow depths and snow meltout dates at weather station "Moran 5 WNW" near Jackson Lake dam.

Y2008 was a year of particularly heavy winter and spring snowfall (see Fig. 1). In early March snow depths along roads in the northern section of GTNP were well in excess of 4' (1.21 m). At that time the only ground-foraging birds seen at the sagebrush flats (monitoring Site #4), 1.7 km downriver from the dam, north side, were the ubiquitous (and adaptable) raven (*Corvus corax*) and Black-billed Magpie (*Pica pica*). In the southern part of the park, and foraging along the sides of ploughed roads, were in addition Snow Buntings (*Plectrophenax nivalis*) and Horned Lark (*Eremophila alpestris*), but overall winter and spring allow only

uncertain habitats for the ground foragers until snow meltout. This uncertainty applied to the majority of sparrows Emberizinae, thrushes Turdinae, and blackbirds and meadowlarks Icteridae, subfamilies and families that comprise the majority of the breeding species in the park's more open and non-forested habitats in the breeding season.

In the southern part of the Jackson Hole, a second weather station near park headquarters at Moose reports snow depths. Two other monitoring sites in sagebrush habitat are located in the vicinity of Moose, namely the Burned/Unburned Sage Site #5 on the Antelope Flats road 5.6 km east of Moose, and the Airport Sagebrush Site #6 located 3.5 km south of Moose. Snowfall is lighter at Moose than at Moran; Moose is at elevation 6470' (1960 m), 99 m lower than Moran, and snow meltout dates average 10 d sooner.

Brewer's Sparrow, a Sagebrush Indicator Species.

Brewer's Sparrow has a geographic range in the western United States and Canada closely associated with Great Basin sagebrush (*Artemisia tridentata*) habitat, and abundant in the intermontane regions of the Great Basin Desert. However, breeding populations extend north beyond the Okanagan region of British Columbia with major gaps to SE Alaska, and also occur east of the Rockies in the western Great Plains, often in saltbush (*Atriplex*) flats, from SW Kansas through Colorado, Wyoming, Montana to Alberta and Saskatchewan. After wintering in the Sonoran and Chihuahuan Deserts, and with stopovers in the Mojave Desert (Cody 1991), birds return to breeding habitats in Nevada and New Mexico in late March, to Jackson Hole in mid-April (Raynes 1995), to Montana by mid May (MT.gov web site) and Alberta by late May (see Rotenberry et al. 1999). Brewer's Sparrow return dates to breeding grounds are known to be quite variable, and to depend on local weather conditions. Best and Peterson (Best and Petersen 1985) found that Brewer's Sparrows returning to the Snake River plains in S Idaho were significantly delayed, between years, in setting up territories by low ambient temperatures, and nest initiation began two weeks later following a 6 °C decrease in April temperatures. This is unsurprising in a ground-foraging bird of around 10.5 g mass, with a lower critical temperature of 26 °C; below this ambient temperature, Brewer's Sparrow must elevate metabolic rate to compensate for bodily heat loss.

Brewer's Sparrow breeding densities in the northern Jackson Hole site #4 are extremely variable. Mean density is 0.99 pr/ha, with a CV of 0.79; the

highest value recorded was 2.18 pr/ha, but in three years there were no Brewer's Sparrows on the site (1998, 1999, 2005) and in 2008 only part of a single territory was found at site #4. All years of low to zero Brewer's Sparrow density were those in which there was a late snow meltout date. Figure 2 shows this relationship; about one-half of the variation in Brewer's Sparrow breeding density is accounted for by variation in meltout dates among years; $p < 0.001$ that meltout DOY is not a significant contributor to sparrow density variation. In the southern part of Jackson Hole, neither of the sagebrush monitoring sites (#s5, 6) shows a statistically significant relation between breeding density of the sparrow and Moose meltout date (#5, 6: $p = 0.10, 0.33$ respectively). At site #6 the sagebrush is taller and denser, supporting an average breeding density of Brewer's Sparrow of 1.73 pr/ha, but with a low CV (0.25) and no dramatic year-to-year density swings.

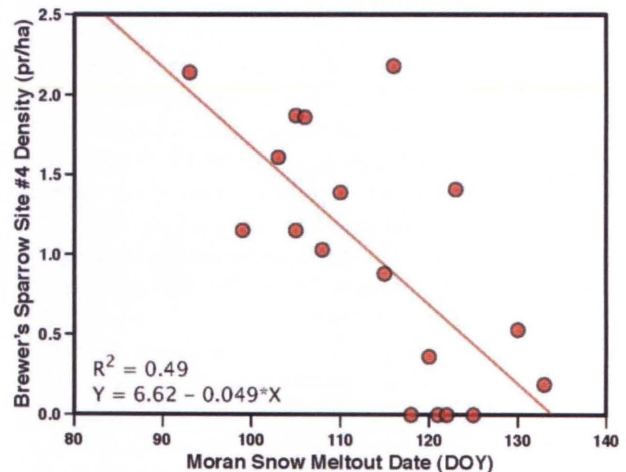


Figure 2. Brewer's sparrow breeding density (ordinate) at site # 4, one mile downriver from the weather station at the dam, is high in years with early snow meltout dates (abscissa), low when snow persists longer.

Whereas site #6 is clearly better Brewer's Sparrow habitat than site #4, which has lower and more open sagebrush, the reverse is true for Vesper Sparrow (*Pooecetes gramineus*). This is a larger bird (24 g; T_{crit} 23 °C) that arrives earlier and departs later than Brewer's Sparrow, and prefers drier, lower, and more open habitat than the latter. Vesper Sparrow densities have averaged 0.84 pr/ha at site #4, and 0.52 pr/ha at site #6; its CV values are 0.25 and 0.35 respectively, somewhat more variable at site #6, but low variation overall. This larger bird seems much less influenced by snow meltout dates than is Brewer's Sparrow. At neither site is there a significant relationship between breeding density and meltout DOY: $p > 0.50$ (site #6) and $p = 0.18$ (site #4) that the former varies independently of the latter.

Given that snow meltout dates are quite closely related between the southern and northern parts of Jackson Hole ($r = 0.72$, Moran vs. Moose meltout DOY), it is not surprising that Brewer's Sparrow densities are similarly correlated between sites #4 and #6 ($r = 0.80$, $n = 15$). The same is not the case for the independently-varying Vesper Sparrow ($r = 0.22$, $n = 15$), indicating no Hole-specific controls that override site-specific influences. There is, however, a final factor to be considered, namely the direct influence of one species on the other. It appears that in early meltout years, when Brewer's Sparrow densities are high at site #4, Vesper Sparrow density is unexpectedly low ($r = 0.28$; $n=18$, p), just when we might expect Vesper Sparrow to be present in this preferred habitat at relatively high densities. This direct interaction between the two species, further evidenced by the spatial segregation of their territories within the site (even taking account of interspecific differences in habitat microsites) was detected earlier (Cody 1996)

◆ ACKNOWLEDGEMENTS

Partially supported by NSF Award #016554.

◆ LITERATURE CITED

- Best L.B. and K.L. Petersen. 1985. Seasonal-Changes in Detectability of Sage and Brewers Sparrows. *Condor* 87:556-558.
- Cody, M.L. 1991. Finch Flocks in the Mojave Desert. *Theory of Population*. *Biology* 2:142-158.
- Cody, M.L. 1996. Bird communities in the central Rocky Mountains. Ch. 11,291-343 in: *Long-term Studies of Vertebrate Communities*. ML Cody & JA, Smallwood editors. 597p. New York: Elsevier.
- Raynes, B. 1995. *A Pocket Guide to the Birds of Jackson Hole*. Moose WY:Homestead Publ.
- Rotenberry, J.T., M.A. Patten and K.L. Preston. 1999. Brewer's Sparrow (*Spizella breweri*). In: *The Birds of North America*, No. 390. A. Poole, F. Gill, (eds.). Philadelphia: The Birds of North America, Inc.