


BROWN-HEADED COWBIRD PARASITISM OF LAZULI BUNTINGS; RELATIONSHIPS WITH HABITATS AND UNGULATE HOSTS



ERICK GREENE ♦ DIVISION OF BIOLOGICAL SCIENCES
UNIVERSITY OF MONTANA ♦ MISSOULA

JOHN ROACH ♦ DEPARTMENT OF BIOLOGICAL SCIENCES
IDAHO STATE UNIVERSITY ♦ POCA TELLO

♦ INTRODUCTION

BROWN-HEADED COWBIRDS

Brown-headed Cowbirds *Molothrus ater*, a brood parasite that lays its eggs in the nests of other birds, has recently undergone a tremendous range expansion. Before European settlement, this species was restricted to short-grass prairie, where it followed buffalo *Bison bison* and fed on insects stirred up by their movements (Lowther 1993). Settlement of North America by Europeans, the subsequent large-scale deforestation, and extirpation of buffalo lead to Brown-headed Cowbirds shifting to associate with cows and horses. These changes in landscape and host associations allowed a rapid range expansion and increase in numbers (Payne 1977, Laymon 1987, Rothstein et al. 1980). Brown-headed Cowbirds now are found from the Pacific to the Atlantic coast, and from south-central Mexico north to tree line in Canada (Lowther 1993). Cowbirds are apparently expanding their range altitudinally as well, so that they can now be found breeding over 3,000 m in elevation (Hanka 1985).

During the breeding season, female cowbirds range widely searching for nests of other birds, and each female may lay 40 parasitic eggs per season. Cowbirds have parasitized more than 220 species of birds, of which over 144 species have

raised the parasitic young (Friedmann 1929, Friedmann et al. 1977, Friedmann and Kiff 1985). Although the impact of cowbird parasitism on the reproductive performance of hosts varies widely among species, parasitism is implicated as a factor contribution to the population declines of several species of smaller-sized passerine birds.

Cowbirds show a strong preference for searching for host nests in bushy habitats and along forest edges and other ecotonal boundaries, and tend to avoid forest interiors (Brittingham and Temple 1983, Johnson and Temple 1990). It is currently believed that female cowbirds venture about seven miles from their central feeding areas in their search for host nests (Norman and Robertson 1975). However, we have observed cowbirds in some alpine meadows in remote wilderness areas, feeding in association with herds of wild elk and deer. If cowbirds have come full circle, and are now associating with wild ungulates in remote areas, this would impact many species of neotropical migrants, and would have important consequences for effective management plans for our forests and refuges (Rodiek and Bolen 1991).

LAZULI BUNTINGS

Lazuli Buntings *Passerina amoena* are small neotropical migrant birds that breed

throughout western United States and southwestern Canada. These conspicuous birds breed in a wide variety of brushy habitats, ranging from sea level along the Pacific coast to over 3,000 m in Sierras and Rocky Mountains. Preferred breeding habitat includes arid bushy hillsides, riparian habitats, wooded valleys, aspen, willow, alder or cottonwood thickets, sage brush, chaparral, open scrub, recent post-fire habitats, thickets and hedges along agricultural fields, and residential gardens (Greene et al. in press).

During the breeding season, Lazuli Buntings are often one of the most numerous species in the habitats they occupy. Thus at first glance, populations of Lazuli Buntings appear to be robust, and there is currently little concern about their status. Indeed, Partners in Flight, the multi-agency group charged with monitoring the population status of neotropical migrant birds, suggests that Lazuli Bunting populations are stable, or perhaps increasing (Butcher et al. 1992). These analyses do not identify this as a species at risk.

However, other analyses of Breeding Bird Survey (BBS) data are equivocal. Sauer and Droege (1992; based on 1966 - 1988 BBS data) suggest that Lazuli Bunting populations may be declining in central and western regions, although these decreasing trends are not statistically significant. More detailed analyses of BBS data that take into account the magnitude of population changes and uncertainty of trends (1966 - 1991: DeSante and George 1994) suggest that populations are declining in seven states, especially in Utah. Analysis of the same data set over shorter time (1979 -1991) also suggests a weak decreasing trend (>50% of states showed decreasing trends, and ≤25% of states showed increasing trends). Analysis of BBS data from 1966 - 1991 indicates some increasing population trends in Central Rockies, British Columbia, New Mexico, South Dakota, and Washington, Missouri Plateau, Pitt-Klamath area; decreasing population trends occurred in Utah, the Basin and Range area, and Great Plains. The number of census routes in some of these areas is very small, which must temper these conclusions. In addition, all of these population analyses combine data from large geographic areas, and may mask some serious local reproductive failures and regional population declines. Some habitats, especially

western riparian habitats and grasslands, have been degraded or changed by human activities that have allowed Brown-headed Cowbirds to increase in distribution and abundance (DeSante and George 1994, Rothstein 1994).

In ongoing studies of song learning behavior and mate selection by Lazuli Buntings in western Montana, we have been disturbed to find extremely high levels of parasitism of bunting nests by Brown-headed Cowbirds in some areas. For example, some populations in western Montana are experiencing virtually complete parasitism, with almost every nest receiving 2 or more cowbird eggs. Yet Lazuli Buntings are still common breeders in these habitats. These observations raise the possibility that Lazuli Bunting populations may be composed of "source" areas that may be net exporters of young buntings that are restocking "sink" areas where parasitism is high. If this metapopulation structure of sources and sinks applies to Lazuli Buntings (as it appears to apply to some eastern neotropical species, such as Worm-eating Warblers and Wood Thrushes), then we may be caught by surprise by geographically widespread and severe population declines in the future. These disturbing possibilities suggest that long term monitoring programs of this species are critical while they are still common and widespread. More information on geographic patterns of reproductive success in relation to human land use patterns, parasitism and predation rates, and dispersal by buntings is urgently needed to better understand the large scale population dynamics of Lazuli Buntings.

This report summarizes the results of a preliminary project, conducted as part of a larger study investigating the geographic patterns of reproductive success and the metapopulation dynamics of Lazuli Buntings. The objectives of this report are to i) summarize the effect of cowbird parasitism on reproductive performance of Lazuli Buntings; ii) estimate breeding densities of Lazuli Buntings in suitable habitats near Jackson Hole; iii) estimate Brown-headed Cowbirds densities in those habitats; iv) summarize geographic patterns of Brown-headed Cowbird parasitism on Lazuli Buntings and v) determine spatial patterns of association between Brown-headed Cowbirds and native ungulates, such as bison and elk around Jackson Hole.

♦ METHODS

Suitable habitats around Jackson Hole were surveyed during late May and June 1994 to estimate breeding densities of Lazuli Buntings. Sizes of territories were estimated by spot-mapping the locations of male song perches, and noting the locations of fights between males along territory borders. In addition, songs of males were tape recorded. Each male has an individually distinct song that serves as an "acoustic barcode" that allows each male to be unambiguously identified (Thompson 1967, Greene et al. in press). These methods have been developed and successfully used in other populations of buntings, and recordings have verified that the spot-mapping methods accurately identified unmarked males.

Five-minute point counts were conducted to estimate cowbird densities. During these short censuses, the stationary observer noted all cowbirds detected, including number of males, females, and notes on their behavior (eg. flying over, in groups or single, searching in vegetation, etc.). Cowbirds disperse from their foraging areas early in the morning to search for nests and lay eggs, and return in the afternoon to forage near the herd of animals with which they associate (Lowther 1993). Hence, to estimate numbers of cowbirds in habitats away from feeding areas, cowbird counts were conducted in the morning. These counts were made during the nest building and egg-laying stage of Lazuli Buntings, so the counts provide an index of cowbird densities during the vulnerable period of the buntings' reproductive cycle. Cowbird censuses were made in the late afternoon near cows, horses, elk, buffalo, and pronghorn. These standardized censuses allow us to compare cowbird abundance and activity throughout the range of Lazuli Buntings.

To determine the effect of cowbird parasitism on bunting chick growth rates and fledging success, nests were located early in the nesting cycle. Timing of egg-laying by cowbirds and buntings was recorded, and mass of chicks was measured every day with Pesola balances.

♦ RESULTS AND DISCUSSION

EFFECT OF COWBIRD PARASITISM ON REPRODUCTION OF LAZULI BUNTINGS

Growth rates of bunting and cowbird chicks are summarized in Figure 1. The impact of cowbird parasitism depends upon the hatching sequence. If the cowbird chick hatches before or on same day that bunting chicks hatch, the bunting chicks fail to grow, and usually die within 2-3 days (Figure 1, curve C). The larger cowbird chicks usually cover and trample the smaller bunting chicks, so that bunting chicks receive little or no food brought in by parents. Cowbird chicks have also been observed vigorously pecking the heads and backs of Lazuli Bunting chicks.

However, if bunting chicks hatch 2-3 days before cowbird chicks, they are about the same mass as the younger cowbird chick, and are better able to compete for food. In these cases, growth rates of bunting chicks are statistically indistinguishable from bunting chicks in unparasitized nests (Figure 1 curve B).

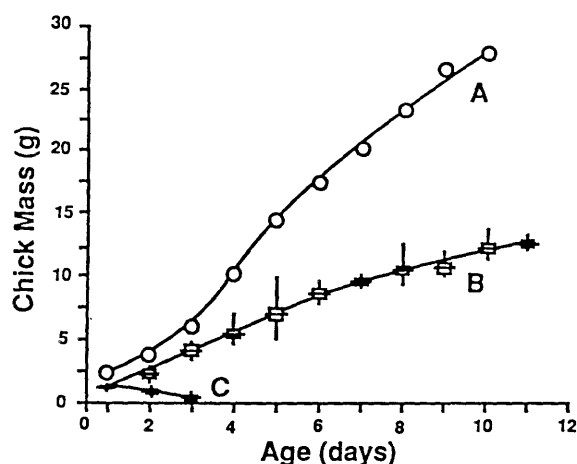


Figure 1. Growth of nestlings. A) Brown-headed Cowbird chicks raised by Lazuli Buntings; B) Lazuli Bunting chicks without Brown-headed Cowbirds; C) Lazuli Bunting chicks in nests with cowbird chicks that hatched the same day or before the bunting chicks. (From Greene et al. in press)

In northwest Montana and Wyoming it appears that most cowbird chicks hatch slightly before or at same time as bunting chicks, which severely reduces fledging success of buntings. In a sample of 38 nests that fledged cowbird chick(s), 73.7% fledged only one cowbird chick; 15.8% fledged two cowbird chicks; and only 10.5% fledged one cowbird chick and one bunting chick. The effect of cowbirds on Lazuli Buntings appears to be more detrimental than on the congeneric Indigo Bunting (*Passerina cyanea*) in Michigan. For example, Payne (1992) found that 67.1% of parasitized nests that fledged a cowbird also fledged an Indigo Bunting chick ($n=76$), while only 10.5% of Lazuli Buntings nests that fledged a cowbird also fledged a Lazuli Bunting chick ($n=38$) $X^2=32.4$, $P<0.001$). It is unclear how these differences arise. It is possible that food may be less abundant in the more xeric western habitats than at Payne's more mesic study sites in Michigan. It may also be possible that cowbirds lay eggs slightly earlier in the west than in Michigan.

The impact of multiple parasitism by cowbirds on the condition and survivorship of adults is unknown, but adults at such nests appear in poor condition and underweight. By four days of age, cowbird chicks weigh more than adult Lazuli Buntings, and are about twice as heavy when they fledge (Figure 1, Curve A). Cowbird chicks may also increase risk of nest predation, since cowbird begging calls are much louder and persistent than bunting chicks.

There is some evidence that age and experience of the bunting pair influences the probability of cowbird parasitism. At one site, pairs consisting of inexperienced yearling male and yearling female suffered 30% parasitism rates; pairs consisting of a yearling female but older male experienced 17% parasitism rates; pairs consisting of both sexes older than two years of age experienced 12% parasitism rates. This effect is possibly due to better nest placement by older females, and/or more vigorous nest defense by adults.

DENSITIES OF LAZULI BUNTINGS NEAR JACKSON HOLE

Lazuli Buntings are locally common breeders near Jackson Hole, occurring in brushy ravines and shrubby slopes. However, their distribution is patchy, so that many areas lack

buntings but appear similar to areas with buntings. Buntings are especially common in burns about three to five years after fires, when shrubs and bushes are large enough to provide dense nesting cover.

BROWN-HEADED COWBIRDS DENSITIES NEAR JACKSON HOLE

In the afternoons, Brown-headed Cowbirds were regularly found in flocks of 10-100 birds in pastures with cows or horses. Surprisingly, cowbirds were also found in large numbers (in mixed flocks with other blackbirds) in parking lots near visitor centers and campgrounds. In these situations, Brown-headed Cowbirds appear to be "Brown-headed Carbirds" since they forage by gleaning insects from the radiator grills of parked cars, as well as eating food provided by tourists and campers. This foraging behavior has not been previously described for cowbirds.

Cowbirds were rarely detected away from their afternoon foraging areas in habitats where Lazuli Buntings were breeding. The mean number of cowbirds per five minute census period was 0.63 ($n=80$ counts, $SD=1.91$). The distribution of number of cowbirds per count is grossly non-normal, with most counts registering no cowbirds, and just a few counts (made near parking lots) during which small flocks were encountered. If these outliers are excluded, the mean number of cowbirds per count drops to 0.001 cowbirds per five-minute census. These are very low densities of cowbirds compared to similar habitats in western Montana (Table 1). Finding large numbers of nests to determine parasitism rates was beyond the scope of this preliminary study. However, the low cowbird counts suggest that current parasitism rates on Lazuli Buntings in the Jackson Hole area are low.

Location	% Bunting Nests Parasitized	# Nests	# Cowbirds per 5-min count ($\bar{X} \pm SD$)
Jackson Hole, Wyoming	---	0	0.63 \pm 1.91
Kananaskis, Alberta (Northern edge of breeding range)	1	64	0.001 \pm 0.01
Bison Range, Montana			
Indian Springs 94 (bison present)	100	3	17.2 \pm 38.9
Trikey Creek 94 (bison absent)	2	17	0.13 \pm 0.47
Pauline Creek (bison present)	79	18	6.2 \pm 18.3
Trikey Creek 95 (bison present)	31	14	4.2 \pm 8.9
Missoula, Montana			
Mt Jumbo (near cowbird roost)	96	20	12.5 \pm 26.3
Mt Sentinel (near cowbird roost)	100	6	8.2 \pm 14.6
Mt Sentinel (away from cowbird roost)	6	48	0.03 \pm 1.5
Bitterroot River, Montana			
Riparian habitat	100	44	6.23 \pm 15.2
Lee Metcalf NWR	---	0	24.6 \pm 52.3

GEOGRAPHIC PATTERNS OF BROWN-HEADED COWBIRD PARASITISM BUNTINGS

There is considerable geographic variation in rates of cowbird parasitism on Lazuli Buntings (summarized in Table 1). At the extreme northern edge of the breeding range in Alberta, cowbird parasitism appears extremely low (1994 and 1995: 1.5% of 65 nests parasitized). In riparian habitat near Logan, Utah, parasitism, $n=48$ nests, J. Boylan, pers. comm.). In the bitterroot Valley in western Montana, 100% of nests were parasitized in riparian habitat (1994 and 1995, $n=44$ nests). At another study site in western Montana, over 95% of nests were parasitized close to a cowbird roost (1994, $n=20$ nests), but only 6% of nests parasitized away from cowbird roosts (1994, $n=48$ nests).

Note that in areas where the parasitism rates by Brown-headed Cowbirds are high, the sample sizes of nests are low. These areas were intensively searched for nests, but population sizes may be low because of local extinctions caused by high parasitism. For example, bunting do not breed at Lee Metcalf NWR, although the habitat appears ideal, and they were common breeders there until fairly recently. It is significant that Brown-headed Cowbirds are one of the most common species encountered in the riparian forests during the early mornings in the breeding season, and on average about 25 cowbirds were detected during 5-minute counts. This suggests that local extinctions have occurred in some areas with high densities of cowbirds.

In the heavily-parasitized populations, not only is the incidence of cowbird parasitism extremely high (Figure 2), but the number of cowbird eggs per nest is surprisingly high (Figure 3). Most bunting nests contain ≥ 2 cowbird eggs (mean = 2.3 cowbird eggs per bunting nest), with 10 cowbird eggs found in one nest.

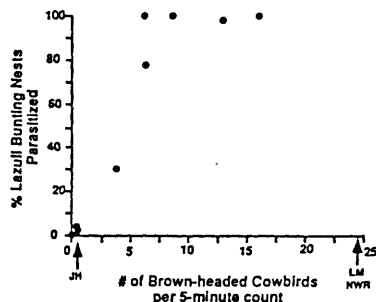


Figure 2. Relationship between cowbird abundance (as determined by 5-minute counts) and parasitism rates of Lazuli Buntings. Arrow on the left shows cowbird abundance in Jackson Hole area, while right arrow shows cowbird abundance in Lee Metcalf NWR, where Lazuli Buntings no longer breed.

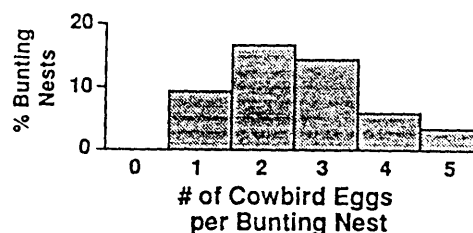


Figure 3. Distribution of number of cowbird eggs per nest in heavily parasitized population of Lazuli Bunting in Missoula, Montana. From a sample of 20 nests on Mount Jumbo, Montana.

ASSOCIATION BETWEEN BROWN-HEADED COWBIRDS AND NATIVE UNGULATES

Small to medium-sized flocks of cowbirds (10-50 birds) were regularly observed in the afternoons near cows or horses. However, cowbirds were rarely observed feeding with elk, buffalo, pronghorn, or deer. Our observations were limited to rather small groups of animals, and we did not examine whether cowbirds were associating with larger herds of elk or buffalo.

CONCLUSIONS

Brown-headed Cowbirds have a strong negative influence on the reproductive performance of Lazuli buntings. If the cowbird chick hatches about the same time or before the bunting chicks, as appears to be the case in many parts of western Montana, the bunting chicks usually starve to death within about 3 days. In the Jackson Hole area, Lazuli Buntings are patchily distributed during the breeding season, with some apparently suitable habitats unoccupied. However, in those areas where they are found, their breeding densities appear to be normal. Brown-headed Cowbirds were extremely rare in the breeding habitats of buntings, suggesting that current parasitism rates are extremely low. During the afternoons, cowbirds associate with horses, cows, and cars in visitor parking lots, and were rarely detected with native ungulates.

LITERATURE CITED

Brittingham, M.C. and S.A. Temple. 1983. Have cowbirds caused forest songbirds to decline? *BioScience* 33:311-35.

- Butcher, G.C. (Chair), and correspondents. 1992. Needs Assessment: Monitoring neotropical migratory birds. *Partners in Flight*. Cornell University, Ithaca, NY.
- DeSante, D. and T.L. George. 1994. Population trends in the landbirds of western North America. *Studies in Avian Biology* 15:173-190.
- Friedmann, H. 1929. *The Cowbirds: A study in the biology of social parasitism*. C. Thomas Publisher, Springfield, Illinois.
- Friedmann, H.L., L.F. Kiff, and S.J. Rothstein. 1977. A further contribution to Knowledge of the hosts relations of parasitic cowbirds. *Smithson. Contrib. Zool.* 295.
- Friedmann, H.L., and L.F. Kiff. 1985. The parasitic cowbirds and their hosts. *Proc. West. Found. Vert. Zool.* 2:226-304.
- Greene, E., V. Muehter and W. Davison. 1996. Lazuli Bunting *Passerina amoena*. In *The Birds of North America* (A. Poole and F. Gill, Eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C. (In press)
- Hanka, L.R. 1985. Recent altitudinal range expansion by the Brown-headed Cowbird in Colorado. *West. Birds* 16:183-184.
- Johnson, R.G. and S.A. Temple. 1990. Nest predation and brood parasitism of tallgrass prairie birds. *J. Wildl. Manage.* 54:106-111.
- Laymon, S.A. 1987. Brown-headed Cowbirds in California: historical perspectives and management opportunities in riparian habitats. *West. Birds* 18:63-70.
- Lowther, P.E. 1993. Brown-headed Cowbird *Molothrus ater*. In *The Birds of North America*, No. 47 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.
- Norman, R.F. and R.J. Robertson. 1975. Nest-searching behavior in the Brown-headed Cowbird. *Auk* 92:610-611.
- Payne, R. 1977. The ecology of brood parasitism in birds. *Ann. Rev. Ecol. Syst.* 8:1-28.
- Payne, R.B. 1992. Indigo Bunting. In *The Birds of North America*, No. 4 (A. Poole, Peter Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.; The American Ornithologists' Union.
- Rodiek, J.E. and E.G. Bolen (Eds.). 1991. *Wildlife and Habitats in Managed Landscapes*. Island Press, Washington, D.C.
- Rothstein, S.I., J. Verner, and E. Stevens. 1980. Range expansion and diurnal changes in dispersion of the Brown-headed Cowbird in the Sierra Nevada. *Auk* 97:253-267.
- Rothstein, S.J. 1994. The cowbird's invasion of the far west: History, causes and consequences experienced by host species. *Studies in Avian Biology* 15:301-315.
- Sauer, J.R. and S. Droege. 1992. Geographic patterns in population trends of neotropical migrants in North America. Pp. 26-42 In *Ecology and conservation of neotropical migrant landbirds*. (J. Hagan III and D.W. Johnston, Eds.). Smithsonian Institution Press, Washington, D.C.
- Thompson, W.L. 1976. Vocalizations of the lazuli bunting. *Condor* 78:195-207.