

# COWBIRD PARASITISM AND NEST SUCCESS OF THE LAZULI BUNTING IN THE SACRAMENTO VALLEY

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Reports of the frequency of Brown-headed Cowbird (*Molothrus ater*) parasitism on the Lazuli Bunting (*Passerina amoena*) vary greatly. The bunting has often been described as an uncommon host (Friedmann et al. 1977, Friedmann and Kiff 1985), though King (1954) found two of three nests parasitized and four family groups of fledglings with a juvenile cowbird. Greene et al. (1996) reported substantial geographic and local variations in parasitism rates, from 0 to 100%. The higher levels may not be surprising, as the closely related Indigo Bunting (*P. cyanea*) has long been considered a common cowbird host (Payne 1992).

As a result of the conversion of native habitats to farms and pastures, the Brown-headed Cowbird has undergone a remarkable population explosion and range expansion during this century (Rothstein et al. 1980, Laymon 1987, Lowther 1993). Cowbird parasitism is frequently cited as a contributing factor threatening the populations of many host species in North America (Gaines 1974, Brittingham and Temple 1983, Terborg 1989). Breeding-Bird-Survey data from the past 25 years suggest that Lazuli Buntings are declining in California, although the trends are not significant (Sauer et al. 1997). Over 25 years, the number of migrating Lazuli Buntings trapped on Southeast Farallon Island has declined significantly in both fall and spring (Pyle et al. 1994). A concordant significant decline in the proportion of immatures to adults suggests decreased productivity on the breeding grounds.

We found a high rate of cowbird parasitism on Lazuli Buntings in the Sacramento Valley of California. We present parasitism rates, nest success, and an index of "cowbird pressure."

## METHODS

From 1993 to 1997 we monitored nests at six locations along the Sacramento River (Figure 1). Four of the study sites (La Barranca, Ohm, Flynn, and River Vista) are on the Sacramento National Wildlife Refuge; the other two (Kopta Slough and Stony Creek) are owned and managed by The Nature Conservancy. The refuge sites (except River Vista) are remnants of the Sacramento River's riparian forests, while the Nature Conservancy sites and River Vista are revegetated riparian plots planted between 1989 and 1993.

The remnant riparian plots are wooded with Fremont Cottonwood (*Populus fremontii*), California Black Walnut (*Juglans californica*), Valley Oak (*Quercus lobata*), Oregon Ash (*Fraxinus latifolia*), Goodding's Black Willow (*Salix gooddingii*), Arroyo Willow (*Salix lasiolepis*), and Sandbar Willow (*Salix sessilifolia*). Dominant shrubs are Blue Elderberry (*Sambucus mexicana*), California Blackberry (*Rubus ursinus*), and Himalayan Blackberry (*R. discolor*); dominant herbs are Mugwort (*Artemisia douglasiana*), Stinging Nettle (*Urtica dioica*) and sedge (*Carex* sp.). The revegetated

# COWBIRD PARASITISM AND NEST SUCCESS OF THE LAZULI BUNTING

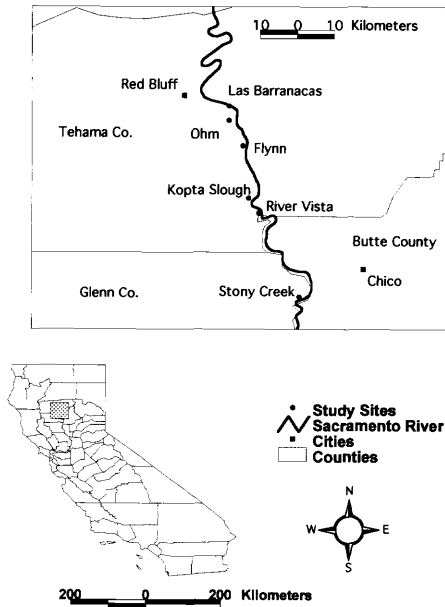


Figure 1. Location of study sites in the Sacramento River Valley, California.

riparian plots were planted primarily with Fremont Cottonwood, Valley Oak, Arroyo Willow, and Blue Elderberry; Mugwort and annual grasses compose most of the herbaceous layer.

We located and monitored nests using standardized procedures described by Martin and Geupel (1993). Nest-finding began in late April and lasted until breeding activity declined in mid-July. Plots were searched as often as possible, sometimes every day. Nests were checked every 1–4 days until their outcome was determined, usually by conditions at the nest or by observing fledglings near the nest. We tried to minimize observer-related mortality (for further description see Martin and Geupel 1993).

## RESULTS

We based our analyses on nests with known outcomes only. Brown-headed Cowbirds parasitized 39 of 45 (86.7%) Lazuli Bunting nests found. The annual parasitism rate ranged from 71 to 100% (Table 1). Of the 39 parasitized nests, three (8%) fledged a total of 4 cowbirds and six (15%) fledged a total of 13 buntings (Table 2). The six unparasitized nests failed to fledge any buntings. We considered a nest successful if it fledged one or more Lazuli Buntings; two nests that fledged only a cowbird were considered unsuccessful. Nest success for all 6 years combined was 11.1%, by fraction estimates. Total nest survivorship by the Mayfield method (1975) was 11.7% (daily survivorship =  $0.923 \pm 0.013$ ).

## COWBIRD PARASITISM AND NEST SUCCESS OF THE LAZULI BUNTING

Of the 39 parasitized nests, 18 (46%) contained one cowbird egg, 15 (39%) contained two eggs, three (8%) contained three eggs, two (5%) contained four eggs, and one (3%) contained six eggs. In ten of these nests only cowbird eggs were observed. Cowbird eggs were accepted by Lazuli Buntings at 29 (74.4%) nests. We found no evidence that buntings removed cowbird eggs or buried them within the lining of the nest. Failure due to parasitism was often difficult to ascertain, but we estimate that 11 nests failed as a result of parasitism. Failure of this type was most often due to abandonment either immediately after cowbird eggs were laid or during incubation. In one instance a bunting incubated 4 cowbird eggs for 16 days before abandoning. In another instance a cowbird laid an egg in a nest that was under construction, resulting in abandonment.

McGeen (1972) presented a cowbird-pressure index that he suggested is dependent upon and reflects cowbird female density with respect to available hosts (based upon the incidence and intensity of parasitism). This index is the mean of the incidence (percent of nests parasitized) and the intensity of parasitism as measured by the percent frequency of multiple cowbird eggs (>1 cowbird egg) with respect to total cowbird eggs laid. The cowbird-pressure index for Lazuli Buntings at our study sites was 81.3 (all years combined).

## DISCUSSION

The very high parasitism rates (71 to 100%) Lazuli Buntings suffered at our study sites are comparable only to those reported by Greene et al. (1996) from western Montana. Our cowbird-pressure index (81.3) is higher than any of those calculated by McGeen (1972). His indices for the American Goldfinch (*Carduelis tristis*), Willow Flycatcher (*Empidonax traillii*), Yellow Warbler (*Dendroica petechia*), and Song Sparrow (*Melospiza melodia*) range from 0 to 64.

Many factors have been reported as contributing to the cause and intensity of cowbird parasitism. Microhabitat features such as nest concealment (Burhans 1997), proximity to open habitat (Brittingham and Temple 1983), host behavior (Uyehara and Narins 1995), cowbird abundance (McGeen 1972, Hoover and Brittingham 1993, Robinson et al. 1995), and the cowbirds' habitat preferences (Hahn and Hatfield 1995) may all influence rates of parasitism. Studies in mid-western and eastern North America have reported the highest rates of parasitism (and predation) along forest edges created by fragmentation (reviewed in Yahner 1988, Robinson 1992).

**Table 1** Frequency of Parasitism of Lazuli Bunting Nests along the Sacramento River, 1993-1997

	1993	1994	1995	1996	1997	Total
Unparasitized nests	0	0	2	3	1	6
Parasitized nests	2	16	5	8	8	39
Parasitism (%)	100	100	71	73	89	87

## COWBIRD PARASITISM AND NEST SUCCESS OF THE LAZULI BUNTING

**Table 2** Productivity of Parasitized and Unparasitized Lazuli Bunting Nests along the Sacramento River, 1993–1997

	Parasitized Nests	Unparasitized Nests
Total number of nests	39 (87%)	6 (13%)
Nests that fledged cowbirds	3 (8%)	—
Number of cowbirds produced per nest	0.10	—
Nests that fledged buntings	6 (15%)	0
Number of buntings produced per nest	0.33	0

We believe that the high rate of parasitism on Lazuli Buntings at our study sites reflects a combination of many factors. According to McGeen (1972), a high cowbird-pressure index indicates a high density of female cowbirds. Density of female cowbirds alone, however, may not play as large a role as other factors at our study sites. For example, the scarcity of alternate host species along the Sacramento River probably contributed to the observed high rates of parasitism of the Lazuli Bunting. Many of the species most frequently targeted by cowbirds, including Bell's Vireo (*Vireo bellii*), Warbling Vireo (*V. gilvus*), Yellow Warbler (*Dendroica petechia*), Common Yellowthroat (*Geothlypis trichas*) and Song Sparrow, have been extirpated or have suffered severe declines in the Sacramento Valley (Gaines 1974, PRBO unpublished data). The cowbirds may be resorting to a secondary host whose nesting success is low and is not effective at raising young cowbirds. This suggests that there are more factors than abundance of hosts and cowbirds affecting population viability for the Lazuli Bunting (and perhaps the Brown-headed Cowbird) in the Sacramento Valley.

What factors influence the incidence of parasitism? The cowbird is an edge-loving species, and the creation of forest edges by fragmentation has been reported as one of the most influential factors affecting the incidence of parasitism (Brittingham and Temple 1983, Robinson 1992). Vegetation along the Sacramento river is indeed fragmented, linear, and narrow (the greatest estimated width of riparian woodland at our sites being 500 meters). Today the Sacramento River's riparian vegetation is 1.5% of what it was historically (Roberts et al. 1980). Habitat loss, limiting the amount of potential nest sites, is likely compounding the effects of fragmentation in relation to cowbird parasitism. Our study sites are habitat islands providing the last remaining breeding areas for the majority of songbird species in the Sacramento River Valley (PRBO unpublished report). As it has been demonstrated that cowbirds seek hosts in forested habitats (Hahn and Hatfield 1995), we would expect high rates of parasitism. Riparian vegetation in the Sacramento River Valley has been replaced by orchards, row crops, pasture, and human habitation, all of which provide suitable foraging areas for cowbirds (Lowther 1993).

In addition to high parasitism rates, buntings on our study sites suffered very low nest success (11.7%), indicating that parasitism is not their only threat. Their nest success was much lower than the average calculated by Martin (1992) for 32 neotropical migrant species (42%) and lower than that

## COWBIRD PARASITISM AND NEST SUCCESS OF THE LAZULI BUNTING

of any individual species except Bell's Vireo (11%) and Indigo Bunting (7.7%). Like the cowbird, nest predators may be benefiting from the conversion of native habitats. It has been suggested that the creation of edges may increase predator activity and nest visibility, and surrounding areas may provide additional food sources that attract predators (Suarez et al. 1997). Robinson et al. (1995) suggested that populations of migratory songbirds with daily nest mortality rates of 6% ( $\geq 80\%$  of all nests lost) or higher are not self sustaining.

We fear that the Lazuli Bunting population along the Sacramento River may represent a "sink" that can be maintained only by immigrants from areas exposed to less parasitism and predation (Hassel and May 1974, Robinson et al. 1995). Since the fidelity of Lazuli Buntings to their nest territories is low (Greene et al. 1996), heavy losses in the Sacramento Valley may be draining the population over a wider area. Thus, the future of the Lazuli Bunting in the Sacramento Valley and perhaps throughout northern California warrants concern.

### ACKNOWLEDGMENTS

This research was funded by the U. S. Fish and Wildlife Service, The Nature Conservancy, and the National Fish and Wildlife Foundation. We thank the staff of the Sacramento Wildlife Refuge and the Stony Creek Preserve, particularly Ramon Vega, Joe Silveira, John Carlon, and Tom Griggs, for assistance with study design and logistical arrangements. Grant Ballard designed database files, analysis programs, and the map. Nadav Nur aided in study design and provided useful comments to an early version of the manuscript. Special thanks to the numerous skilled and dedicated field biologists that found and monitored most of the nests, especially Matt Noel. Pamela L. Williams, Stephen A. Laymon, and Philip Unitt provided helpful comments on the manuscript. This is contribution 808 of the Point Reyes Bird Observatory.

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## COWBIRD PARASITISM AND NEST SUCCESS OF THE LAZULI BUNTING

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Accepted 25 March 1998