

COMPARISON OF BLACK-HEADED GROSBEAKS NESTING IN RIPARIAN AND GAMBEL OAK PASTURES IN SOUTHWESTERN COLORADO

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ABSTRACT—From mid-May through July, 1992 to 1998, we searched for black-headed grosbeak (*Pheucticus melanocephalus*) nests in riparian and Gambel oak (*Quercus gambelii*) pastures in La Plata County, Colorado. Twenty-six nests (63%) were successful in fledging at least 1 young, and 15 nests (37%) failed because of predation. The mean number of grosbeaks hatched and fledged per nest did not differ between riparian pastures and oak pastures. The proportion of nests depredated in riparian pastures (10/25, 40%) and oak pastures (5/17, 29%) did not differ significantly. Mortality rates did not differ between habitats during the incubation stage (riparian: 0.056 nests/day; oak: 0.046 nests/day) or during the nestling stage (riparian: 0.011 nests/day; oak: 0.0 nests/day). Mean nest height did not differ between depredated nests and successful nests in either riparian pastures or oak pastures.

RESUMEN—De mediados de mayo a julio de 1992 a 1998, buscamos nidos del tigrillo (*Pheucticus melanocephalus*) en pastizales ribereños y del encino *Quercus gambelii* en el condado La Plata, estado de Colorado, USA. Veintiséis nidos (63%) fueron exitosos en producir por lo menos 1 volantón, y 15 nidos (37%) fracasaron debido a la depredación. El número promedio de *P. melanocephalus* que eclosionó y voló no difirió entre nidos en pastizales ribereños y nidos en pastizales encinales. A pesar de que más nidos fueron víctimas de la depredación en pastizales ribereños (10/25, 40%), que en los de encino (5/17, 29%), la diferencia no fue significativa. La tasa de mortandad no difirió entre hábitats durante el período de incubación (ribereño: 0.056 nidos/día; encinal: 0.046 nidos/día) o durante la etapa de anidación (ribereño: 0.011 nidos/día; encinal: 0.0 nidos/día). La altura promedio de nido no difirió entre nidos depredados y los exitosos ni en pastizales ribereños o en pastizales encinales.

Understanding nesting success is critical to conservation efforts that emphasize protection of the highest quality avian habitats (Robbins et al., 1989; Johnson and Temple, 1990). Many studies have used bird abundance to determine habitat quality (Whitcomb et al., 1981; Ambuel and Temple, 1983), but several recent studies have shown that bird abundance does not necessarily equate to habitat quality. For example, Johnson and Temple (1990) found that nesting success was low in study areas where abundance was high, and Van Horne (1983) suggested that nesting success, density, and individual survival should all be considered in the evaluation of habitat quality.

Various habitat attributes and land use patterns can affect nesting success. Numerous studies have shown negative effects of fragmentation (Andrén and Angelstam, 1988; Yahner and Scott, 1988; Picman and Schriml, 1994),

decreased forest patch size (Wilcove, 1985; Tellería and Santos, 1992), and edge effects (Chasko and Gates, 1982; Marini et al., 1995; Winter et al., 2000) on nesting success, primarily because of higher rates of depredation (Chasko and Gates, 1982) and brown-headed cowbird (*Molothrus ater*) parasitism (Brittingham and Temple, 1983). Additionally, differences in predation rates occur with differences in habitat (Seitz and Zegers, 1993; Sloan et al., 1998) and nest placement (Martin, 1987; Seitz and Zegers, 1993).

Nest site characteristics also can affect the nesting success of birds. For example, Kelly (1993) found that well concealed nests were more successful than conspicuous nests. In another study, a higher density of trees or shrubs surrounding the nest seemed to be a better predictor of nest success (Martin and Roper, 1988). However, various nest concealment in-

dices often fail to demonstrate a difference between successful and depredated nests (Holloway, 1991; Burhans and Thompson, 1998; Ortega and Ortega, 2001).

Higher success of nests in a particular habitat or with specific nest-site characteristics might have contributed to the evolution of some species with narrow habitat requirements. Many North American songbirds, however, use a broad range of habitats and nest sites. For these birds, one might predict that nesting success would be equivalent among habitat types.

Black-headed grosbeaks (*Pheucticus melanocephalus*) have a large range, covering much of western North America, and they nest in a wide variety of habitats (Hill, 1995); thus, they present a good case study for comparing nest success among habitat types. Although a few studies have been conducted on plumage (Hill, 1994) and song (Ritchison, 1981), surprisingly few comprehensive studies have been conducted on the breeding biology of black-headed grosbeaks (Hill, 1995).

In this study, we examined the nesting success of black-headed grosbeaks in a riparian zone and in associated upland Gambel oak (*Quercus gambelii*) habitat in southwestern Colorado, where an average of 2 to 3 individuals were counted per Breeding Bird Survey route (Sauer et al., 1999). We tested the hypothesis of no difference in nesting success between riparian and upland oak habitats. Riparian zones have been identified as one of the most important habitats for breeding birds in North America (Kauffman and Krueger, 1984; Bock et al., 1993). They are particularly important in the southwestern United States, where approximately 77% of 166 nesting species are associated with riparian habitat, and 50% of nesting bird species are completely dependent on riparian ecosystems (Johnson et al., 1977). While riparian habitats are rare in the arid Southwest, Gambel oak is a dominant component of vegetation in the Southwest, covering approximately 4 million hectares in Colorado, Utah, Arizona, and New Mexico (Harper et al., 1985).

METHODS—From mid May through July, 1992 to 1998, we systematically searched for black-headed grosbeak nests at the Colorado State University San Juan Basin Research Center, 8 km south of Hesper-

us, La Plata County, Colorado (37°14'N, 108°2'W). The Research Center, located along the La Plata River, consists of pastures grazed by cattle at various intensities (0 to 0.4 head/ha). The riparian pastures are dominated by narrow-leaf cottonwoods (*Populus angustifolia*) and to a lesser degree by riverbirch (*Betula fontinalis*). The riparian zone varies from approximately 5 to 200 m on either side of the river; shrubs and other heavy understory vegetation are scarce. The upland pastures are dominated by Gambel oak and grasses.

We visited nests every 1 to 3 days and recorded the contents of each nest until all birds fledged or until the nest failed through predation or abandonment (although the results suggested no abandonment). We considered predation of nestlings to have occurred if all nestlings disappeared from the nest before they were 9 d old on the last nest visit. We estimated nest height and nesting plant height using 2-m poles.

Most of our data did not fit a normal distribution; therefore, we used nonparametric statistical tests. For contingency tables, we used log-likelihood goodness of fit tests with Williams' correction. To detect differences in rank values between and among groups, we employed 2-tailed Mann-Whitney *U*-tests and 2-tailed Kruskal Wallis tests, respectively, corrected for ties when appropriate (Zar, 1996). To calculate mortality rates, we used the Mayfield method (Mayfield, 1961, 1975), and we compared mortality rates between habitats with CONTRAST (Hines and Sauer, 1989; Nur et al., 1999). We used the Spearman rank correlation test to determine if numbers of depredated nests were correlated with numbers of available nests over the nesting season (Zar, 1996).

RESULTS—We found 26 nests (60%) in riparian pastures and 17 nests (40%) in upland oak pastures. Of these 43 nests, 35 (81%) were found during nest construction, egg laying, or early incubation. All nests in the oak-dominated pastures were constructed in oaks. In the riparian pastures, 14 (54%) were in narrow-leaf cottonwoods, 10 (38%) were in riverbirches, 1 (4%) was in a juniper (*Juniperus*), and 1 (4%) was in a willow (*Salix*).

We did not know the final outcome of 1 nest; therefore, this nest was not included in the analyses of success or predation. The mean incubation period from the last egg laid was 11.2 ± 0.9 d ($n = 8$), and the mean nestling period of grosbeaks in nests in which we actually observed fledging was 11.2 ± 1.1 d ($n = 5$). Twenty-seven nests (64%) were successful in fledging at least 1 grosbeak, and 15 nests

(36%) failed because of predation. No nests were abandoned, and no nests were parasitized by brown-headed cowbirds. The mean clutch size of those confirmed to be complete did not differ between nests in riparian (3.6 ± 0.5 , $n = 18$) and oak pastures (3.5 ± 0.6 , $n = 14$, $Z = 0.477$, $P = 0.63$). Nest trees were significantly taller in riparian pastures (6.7 ± 3.2 m, $n = 26$) than in oak pastures (3.5 ± 0.9 m, $n = 17$, $Z = 4.613$, $P = 0.0001$). Nests were also significantly higher in riparian pastures (3.2 ± 1.1 m, $n = 26$) than in oak pastures (2.0 ± 0.7 m, $n = 17$, $Z = 3.77$, $P = 0.0002$).

Mean number of grosbeaks hatched or fledged per nest did not differ between riparian pastures (hatched: 2.3 ± 1.6 , $n = 25$; fledged: 1.8 ± 1.6 , $n = 24$) and oak pastures (hatched: 2.5 ± 1.5 , $n = 17$; $U = 205$, $P = 0.84$; fledged: 2.1 ± 1.5 , $n = 17$; $U = 189$, $P = 0.67$). There was no significant difference ($G_{adj} = 0.65$, $df = 1$, $P = 0.64$) in proportions of nests depredated in riparian pastures (10/25, 40%) and oak pastures (5/17, 29%). Mortality rates during the incubation stage did not differ between nests in riparian pastures (0.056 nests/day ± 0.02 SE) and oak pastures (0.046 nests/day ± 0.020 SE), and mortality rates during the nestling stage did not differ between pastures (riparian: 0.011 nests/day ± 0.008 SE; oak: 0.0 nests/day ± 0.0 SE). Mean nest height did not differ between depredated nests and successful nests in either riparian pastures (depredated: 3.3 ± 1.2 m, $n = 10$, successful: 3.2 ± 1.1 m, $n = 14$; $U = 66$, $P = 0.81$) or oak pastures (depredated: 2.3 ± 0.8 m, $n = 5$, successful: 1.9 ± 0.6 m, $n = 12$; $U = 22.5$, $P = 0.43$).

The earliest date of clutch initiation was 11 May, and the latest was 19 June. The date of clutch initiation did not differ among years (Kruskal-Wallis test, corrected for ties, $H = 0.1079$, $df = 6$, $P = 0.10$); therefore, data were pooled among years. Nest predation was highest when more nests were available ($r_s = 0.954$, $P < 0.0001$, Fig. 1).

DISCUSSION—Our results support the hypothesis of no significant difference in success of nests between riparian and oak pastures. Black-headed grosbeak nests were, however, the most successful passerines in the study area. The success of other birds ranged from 14% in plumbeous vireos (*Vireo plumbeus*) to 59% in western wood-pewees (*Contopus sordidulus*; Or-

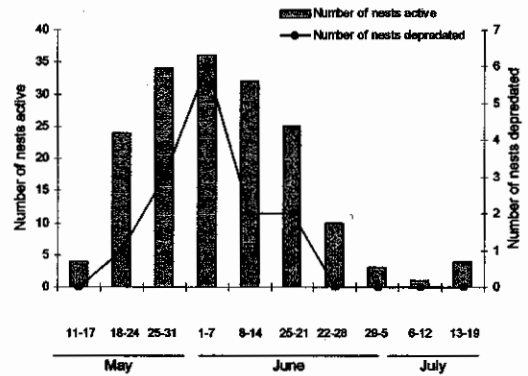


FIG. 1—Total number of black-headed grosbeak clutches initiated and number of nests that were depredated during 1-week periods, La Plata County, Colorado, 1996 through 1998.

tega and Ortega, unpubl. data) compared to 63% success of black-headed grosbeaks. Their success is also higher than many other open-cup nesting passerines in North America, even when negative effects of brood parasitism are removed (Table 7.6 in Ortega, 1998). Similarly, Martin and Li (1992) found a high rate (8/9, 89%) of nest success among black-headed grosbeaks in Arizona.

Black-headed grosbeak nests did not appear to be more concealed than nests of other birds in the study area. In fact, several black-headed grosbeaks decorated the outside of their nests with purple flowers from lupines (*Lupinus*). The flashy purple color in the oak trees made the nests conspicuous to us and also perhaps to avian predators. However, black-headed grosbeaks might have been more effective in thwarting predators than were other species. Hill (1995) reported that black-headed grosbeaks were aggressive in protecting their nests against intruders, using their thick bills as weapons. Black-headed grosbeaks were noisier and more noticeable than other species as we approached their nests.

Surprisingly few studies have compared nest success of the same species in different habitats. Similar to our study, Hatchwell et al. (1996) found that nesting success of blackbirds (*Turdus merula*) did not differ between farmland and woodland. However, other investigators found differences in nest success of birds between or among habitat types (Crabtree et al., 1989; Hayward, 1993; LaHaye et al., 1997).

Varying predator assemblages could explain differences in nesting success between habitats. The main predators at our study site are black-billed magpies (*Pica pica*), western scrub-jays (*Aphelocoma californica*), Steller's jays (*Cyanocitta stelleri*), rock squirrels (*Spermophilus variegatus*), chipmunks (*Tamias*), deer mice (*Peromyscus maniculatus*), long-tailed weasels (*Mustela frenata*), striped skunks (*Mephitis mephitis*), raccoons (*Procyon lotor*), and garter snakes (*Thamnophis*). These species are found in riparian pastures, but long-tailed weasels, striped skunks, raccoons, and Steller's jays are generally not associated with upland oak pastures in the study area. Thus, oak pastures might have had a lower diversity of predators. Vander Haegen and Degraaf (1996) have suggested that a higher rate of predation in riparian buffer strips might have resulted from a higher diversity of predators. Nest density of all birds was lower in oak pastures than in riparian pastures, and several investigators have found an association between nest density and intensity of predation (Krebs, 1971; Dunn, 1977; Page et al., 1983; Sugden and Beyersbergen, 1986).

Martin (1993) suggested that it is critical to understand habitat features that affect nesting success to preserve these critical habitats; he also highlighted that these habitat needs are unknown for most species. How black-headed grosbeaks select nest sites and habitat is not known (Hill, 1995), but it is clear that they are successful in a variety of habitats. It is not surprising that this habitat generalist shows no significant differences in nest success between habitats.

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