

Environmental Perturbations and Rates of Nest Predation in Birds

T. E. Martin, I. J. Ball and J. Tewksbury

U.S. National Biological Service

Montana Cooperative Wildlife Research Unit

University of Montana

Missoula

Introduction

Nest predation commonly is the primary source of nesting mortality across a wide range of both nongame and game bird species and across virtually all habitat types and geographic locations (Martin 1991, 1992, 1993a). Perturbation of the environment through human-induced changes, such as habitat or land changes or modification of predator communities, commonly is thought to increase nest predation rates and reduce breeding productivity (e.g., Wilcove 1985, Ratti and Reese 1988, Andren 1992, Sieving 1992, Yahner and DeLong 1992). Of course, natural variation in the environment also can lead to variation in breeding productivity and very high nest predation rates in some cases (Martin 1993b). Breeding productivity exerts a major influence on subsequent population sizes and trends (Sherry and Holmes 1992, Johnson and Geupel 1996, McCleery et al. 1996, see also Martin 1991). Consequently, nest predation can become problematic when it reaches a level that creates "sink" populations (i.e., populations that cannot sustain themselves, Pulliam 1988); such populations can decline or even become extinct if not sustained by immigration (Loiselle and Hoppes 1982, Sieving 1992, Donovan et al. 1995). Indeed, long-term population declines in both nongame birds and waterfowl may be linked strongly to nest predation (Martin 1992, 1993a, Böhning-Gaese et al. 1993, Ball et al. 1994). As a result, a major issue facing wildlife managers is to understand the causal links between environmental perturbations and risk of nest predation in order to identify effective conservation strategies (Martin 1992). Here, we evaluate the common practice of using artificial nests to study patterns of nest predation, and explore the levels of nest success required for population maintenance.

Artificial Nest Studies

Rates of Nest Predation

Many studies that have examined the potential consequences of habitat and land modifications on nest predation rates have been based on experimental tests using artificial nests (e.g., see Paton 1994). This approach facilitates strong statistical design and large sample sizes with reasonably easy effort. Yet, ease should never be a substitute for accuracy and the accuracy of artificial nests in representing real patterns of nest predation is far from clear.

Studies of real populations, whether of nests or population sizes, are rarely allowed into print based on a single year of study because of the well-known annual variation in ecological phenomena. Yet, single-year studies using artificial nests commonly are accepted for publication, presumably because of clean designs and large sample sizes. Casual inspection of artificial nest studies that do provide temporal replicates shows that nest predation rates commonly increase over time. Such increases may reflect learning responses of predators (Martin 1987), suggesting some inherent biases in experiments using artificial nests (see also Willebrand and Marcström 1988, Roper 1992, Nour et al. 1993, Haskell 1995a, 1995b). Moreover, nest predation rates can vary

