

Report for Missouri Birding Society Bauer Graduate Research Scholarship

Nest-site Selection and Nest Success of Northern Harriers (*Circus hudsonius*) in California's Sacramento Valley

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A pair of Northern Harrier fledglings beg their parents for food

Background:

The Northern Harrier (*Circus hudsonius*) is a medium sized, ground-nesting hawk widely distributed across North America (Smith et al. 2020). In the United States, this species is listed as endangered, threatened, or a species of concern in multiple states (Smith et al. 2020), with the latest North American Breeding Bird Atlas (NABBA) reporting an estimated 0.93% decline since 1966 (Hostetler et al. 2025). In California, the Northern Harrier is designated as a Species of Special Concern (breeding, priority 3), due to the degradation and loss of suitable breeding habitat in the state (Davis and Nielmela 2008). The NABBA estimates a decline of 1.83% since 1966 in California (Hostetler et al. 2025). California's Central Valley region once held some of the highest breeding densities of Northern Harriers in the state but has undergone extensive landscape change due to the expansion and intensification of both agriculture and urban development (Davis and Nielmela 2008, Matchett and Fleskes 2017). The loss of breeding habitat and a lack of recent monitoring and research of the species is the impetus for my research. In conjunction with the California Department of Fish and Wildlife, I am investigating the current distribution and size of the Northern Harrier breeding population in the northern portion of the Central Valley (i.e. the Sacramento Valley). Over two field seasons, I will be surveying for breeding Northern Harrier pairs, monitoring nests, and quantifying both nesting habitat and success. This project will provide baseline data for future research and

management of Northern Harriers in California and will add to our knowledge of this species' breeding ecology across their range. The following is a summary of the findings from the first season of fieldwork.

2025 Field Season Recap:

The 2025 field season occurred from April through July of 2025. Surveying for Northern Harrier breeding behavior occurred at 8 sites throughout the Sacramento Valley (Figure 1). Surveys mostly occurred on public wildlife areas (both state and federal owned) due to project logistical constraints. In total approximately 134 hours of surveys were conducted, which included 446 km of driving and walking surveys, as well as 94 stationary observation points. From these surveys, 17 Northern Harrier nesting attempts were identified; our team was able to find and consistently monitor 14 of these nests (see Figure 1). Nests were monitored at least once a week by visual observation of adult harrier behavior, and nests were not physically visited until failure or ~1-2 weeks post-fledging. A second season of fieldwork and monitoring of new nests will occur in the Spring/Summer of 2026. Next season, more private land will be surveyed in addition to these public wildlife areas that were surveyed in 2025.

4 out of 14 confirmed Northern Harrier nests were successful (29%) and successful nests fledged a range of 1-3 young. Because nests were not physically visited until final status was confirmed, causes of nest failure were difficult to determine. However, cause of nest failure was confirmed at 3 nests (abandonment = 1, predation = 2) (Figure 2). Aerial prey passes were the main behavior used to determine the status of an occupied nesting territory, and prey type was recorded when possible. Most prey items were small rodents, but also included lagomorphs, birds, and reptiles (Figure 3).

Once final nest status was confirmed, our team evaluated nesting habitat via vegetation surveys at each nest and 5 paired random points. Vegetation surveys included measurements of vegetation heights and covers, as well as nest site moisture. The majority of nests (50%) were found in seasonal wetlands, followed by upland (36%), and then permanent wetlands (14%) (Table 1). The two nests located in permanent wetlands were successful, but only 20% of upland nests and 14.3% of seasonal wetland nests were successful (Table 1). Emergent graminoids were the most dominant vegetation cover type, and the ground in the vicinity of most nests was completely dry, with only two nests located over standing water.

29% nest success is low but is not unexpected for a ground nesting species and falls within the range of nest success reported for Northern Harriers in other studies (Jiménez and Conover 2001, Skalos 2021). Interestingly, most nests were found in seasonal wetlands, and yet these nests were not as successful as nests in permanent wetlands. Northern Harriers are known to have greater nest success in wetlands, with standing water and tall vegetation hypothesized as protecting nests from predators (Simmons and Smith 1985). Both successful nests in permanent wetlands were in knee-deep water and tall (>300 cm) vegetation. I suspect that the use of these seasonal wetlands may be an example of an ecological trap (Chalfoun and Schmidt 2012). Wetlands in the Sacramento Valley are flooded in winter through early spring, with some retaining some water through the breeding season ("permanent wetlands") and others draining/dried out by the end of

the season (“seasonal wetlands”). While my small sample size from one field season is not enough data to make any substantial claims, I suspect that these seasonal wetlands may present the cues of “good” nesting habitat (i.e. tall/dense wetland vegetation and standing water) in late March/April when Northern Harriers begin to defend breeding territories, but then become more susceptible to predation as they dry out.

Acknowledgments:

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2025 Northern Harrier team (left: Georgia Coleman, right: Finn Velisaris)

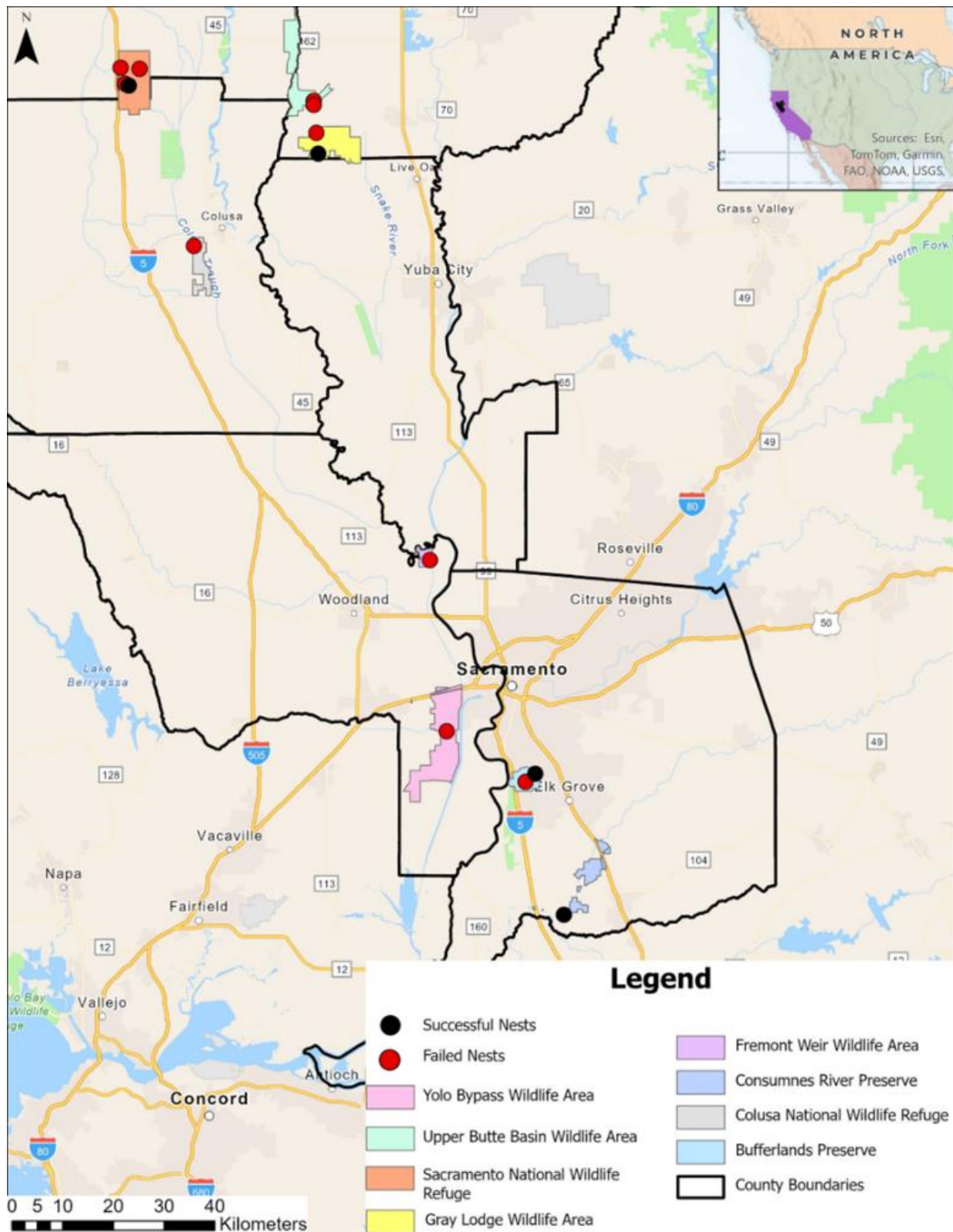


Figure 1. Locations and status of Northern Harrier nests monitored in 2025

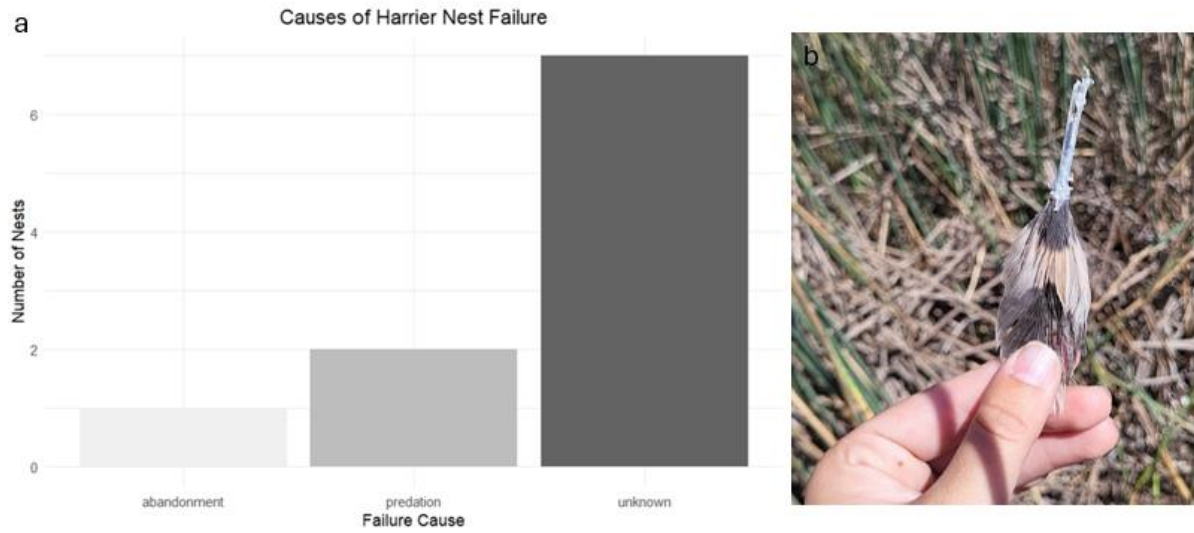


Figure 2. a) Causes of Northern Harrier Nest Failure in 2025, b) Nestling feather from a depredated Northern Harrier nest

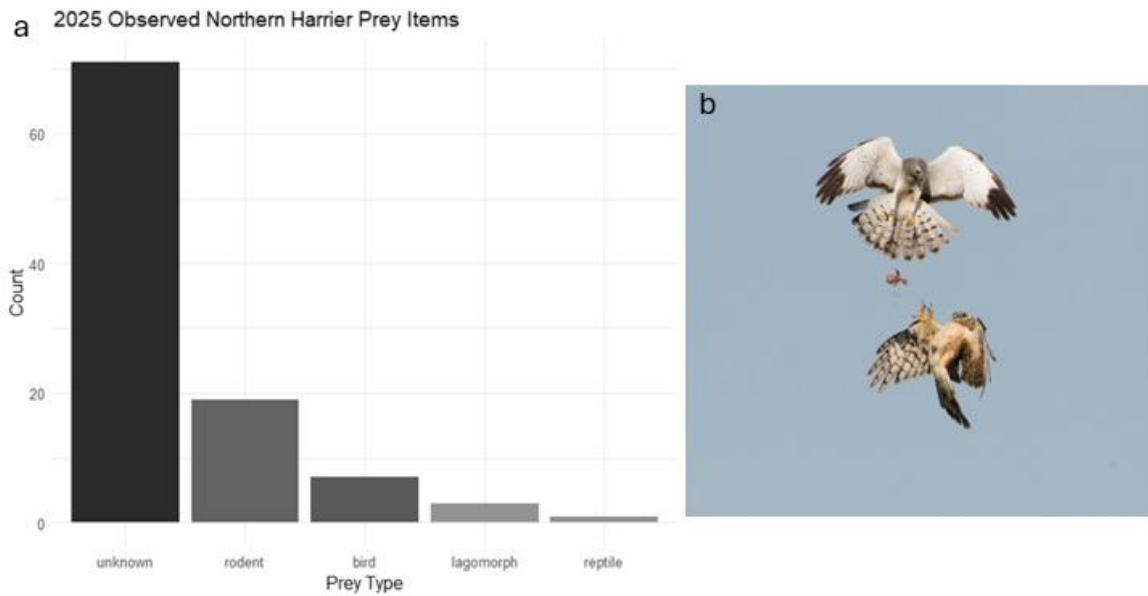


Figure 3. a) Prey of observed Northern Harrier prey passes, b) A Northern Harrier pair prey-passing a passerine nestling (photo credit Georgia Coleman)

Table 1. Nest success and nest habitat characteristics (vegetation height and cover) by habitat type. Harrier nests were found in three habitat types: seasonal wetland, upland, and permanent wetland.

Habitat Type	Successful Nests	Apparent Nest Success	Mean (range) Vegetation Height (cm)	Dominant Vegetation Cover Type
Seasonal Wetland (n= 7)	1	14.3%	151(75-260)	Emergent Graminoid
Upland (n= 5)	1	20%	162 (95-260)	Terrestrial Graminoid
Permanent Wetland (n= 2)	2	100%	330 (310-350)	Emergent Graminoid

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