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EFFECTS OF PATAGIAL MARKERS ON THE NESTING SUCCESS OF GOLDEN EAGLES

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Kochert et al. (1983) evaluated the long-term effectiveness of patagial markers for golden eagles (*Aquila chrysaetos*), red-tailed hawks (*Buteo jamaicensis*), and common ravens (*Corvus corax*) in southwestern Idaho. They concluded that when birds were marked as nestlings, patagial markers had no adverse effect on future breeding success. However, the question of whether attaching colored wing-markers to adult eagles disrupts breeding success was unresolved. We had the opportunity to address this question while conducting a study to evaluate the effect of relocating resident breeding golden eagles (Phillips et al. 1991). We here evaluate the impact of colored wing-markers on the nesting success of golden eagles.

METHODS

During the period January 1988-July 1990 we spent a minimum of 400 hours observing eagles at nest sites. Observation periods ranged from a brief "fly-by" to 8 continuous hours of watching individual pairs. Observations were made from the ground and air throughout the nesting season to determine nesting success for both marked and unmarked eagle pairs. Pairs were selected for marking from the study area described by Phillips et al. (1991) on the basis of access to private lands and the suitability of terrain for capturing eagles. The effect of patagial tags on golden eagle reproduction was assessed by comparing nesting success of marked and unmarked eagles. Two criteria were used in selecting marked pairs for this study: (1) 1 or both members of the pair had a visible patagial marker prior to the beginning of the breeding season (15 February), and (2) neither member of the mated pair was relocated during the breeding season when comparative reproductive data were collected. Our study was conducted on an area in northern Wyoming and southeastern Montana where an 11-year database had been accumulated on the reproductive success of the local golden eagle population (Phillips et al. 1990). The reproductive success of 26 unmarked pairs from this population was monitored for comparative purposes.

Fourteen adult golden eagles were captured within their nesting territories using either padded No. 3 steel traps, cannon nets, or a net gun fired from a helicopter (O'Gara and Getz 1986). Eagles were individually color-marked on 1 or both wings with wraparound pa-

FIG. 1. Golden eagle equipped with wraparound patagial tag and tail-mounted radio transmitter.

tagial markers made from Armortite® (Cooley, Inc., Pawtucket, R.I.; use of trade names for identification of materials does not constitute endorsement by the federal government) and fitted with tail-mounted radio transmitters (Fig. 1). Colors used were dark green, blue, yellow, and orange. Following the return of patagial-marked eagles from relocation sites to their nesting territories (Phillips et al. 1991), nests were monitored to determine the reproductive performance of marked eagles as compared to other nesting eagles within the same geographic area.

RESULTS AND DISCUSSION

We obtained nesting success data from 6 of the 8 territorial pairs that were marked during the relocation study (Phillips et al. 1991). Four marked pairs were monitored in 1989 and 4 in 1990. The pairs used in 1990 included 2 of the 1989 pairs plus 2 new pairs. Similar reproductive data were collected on 26 unmarked pairs in both years. All marked pairs (where 1 or both members of the pair carried a patagial tag) nested successfully in both years and fledged an average of 1.5 (SE = 0.28) and 1.4 (SE = 0.18) young per occupied nest in 1989 and 1990, respectively (Table 1). The 26 unmarked pairs had 69% nesting success in 1989 and 73% in 1990 with an average of 1.2 (SE = 0.15) and 1.0 (SE = 0.14) young fledged per occupied nest, respectively. While our sample size was too small for valid statistical comparisons, long-term studies conducted in the area have shown that nesting success in the past has ranged from 30% to 90% and averaged 54% (Phillips et al. 1990).

Behavioral observations of marked and unmarked eagle pairs during the breeding season did not reveal any abnormal behavioral reactions to patagial-marked eagles. They appeared to be accepted by other eagles, and were seen participating in courtship flights, nest building, copulation, incubation of eggs, and the rearing of young. Two marked eagles were found dead near their nest sites during this study. Also, 2 additional marked eagles were displaced from their former nesting territories following relocation. It is unknown whether the presence of markers influenced these deaths or territory displacements. For those marked eagles that regained their territories following relocation, we found no evidence that colored patagial markers adversely impacted their breeding activities or reproductive performance.

Table 1. Reproductive success of golden eagle pairs showing marking combinations and number of young fledged during the 1989 and 1990 nesting seasons in northern Wyoming.

Territory No.[a]	Tag color		Number young fledged/territory		Date captured	
	Male	Female	1989	1990	Male	Female
1	yellow	unmarked	1	1	3 Feb 1988	
2	unmarked	yellow	2	NC[b]		9 Feb 1988
4	green	unmarked	2	A[c]	13 Mar 1988 13 Dec 1989	
5	unmarked	yellow/blue	A[c]	1		26 Jan 1989
6	green/green	orange	1	2	13 Mar 1988	14 Mar 1988
7	unmarked	orange/blue	A[c]	1		27 Jan 1989

[a] Territory numbers correspond to those used by Phillips et al. (1991).
[b] NC = presence of a marked eagle was not confirmed on the territory during this breeding season.
[c] A = marked eagle was absent from territory following relocation during a portion of nesting season, so no data were available for comparison.

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