

## EFFECTS OF NECK BANDS ON THE BEHAVIOR OF WINTERING GREATER WHITE-FRONTED GEESE

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**Abstract.**—Activity budgets of adult Greater White-fronted Geese (*Anser albifrons frontalis*) with and without neck bands during the non-breeding season revealed that geese with neck bands spent more time preening than geese without neck bands while at foraging sites, but not while at roosting sites. Neck-banded and control geese spent equal time in other important activities (alert, feeding, sleeping, locomotor activities, flying, or social interactions) while at both foraging and roosting sites. Neck-banded geese apparently compensated for the increase in preening activity by reducing the amount of time spent in alert postures relative to control geese (23.9 vs. 28.6%), although the decrease was not significant ( $P = 0.106$ ). There was a significant negative relationship ( $P = 0.038$ ) between the length of time a goose had worn a neck band and the amount of time spent preening while at roost sites. After a short acclimation period, neck bands probably have minimal effect on the activity of wintering Greater White-fronted Geese.

### EFFECTO DE ANILLAS EN EL PESCUEZO EN *ANSER ALBIFRONS FRONTALIS*

**Sinopsis.**—La comparación de presupuestos de actividad en individuos de *Anser albifrons frontalis* con y sin anillas en el pescuezo durante la época no-reproductiva, reveló que los animales anillados pasan más tiempo acicalándose que aquellos que no la tienen particularmente en los lugares en donde estos gansos forrajean. Esto no fue así en las áreas donde las aves pernoctan. Las aves con bandas en el pescuezo y los controles utilizaron el tiempo de forma similar en otras actividades (ej. alimentándose, volando o interacciones sociales) mientras se encontraban tanto en áreas de forrajeo como de pernoctar. Las aves con anillas aparentemente compensaron el aumento en la actividad de acicalamiento reduciendo la conducta de alerta (23.9 vs. 28.6% en los controles), aunque la disminución de la última no fue significativa ( $P = 0.106$ ). Se encontró una relación negativa significativa ( $P = 0.038$ ) entre el largo de tiempo que los gansos tienen la anilla y el tiempo que utilizan acicalándose mientras se encuentran en áreas de pernoctar. Sugerimos que luego de un corto periodo de habituación, las anillas en el pescuezo tienen un efecto mínimo en las actividades normales de estos gansos durante el invierno.

Neck bands have been used extensively to study the ecology of free-living geese (Anserini), and have contributed greatly to our understanding of these long-lived animals. Some investigators have reported that neck bands inhibit reproduction (Lensink 1968, MacInnes and Dunn 1988), and contribute to mortality (Ankney 1975, Craven 1979, Zicus et al. 1983), while others have found little or no measurable effect (Chabreck and Schroer 1975, Raveling 1978). The potential for negative effects likely varies with band design, species or subspecies of goose, and weather variables. Hence, reports of effects of neck bands on reproductive success, survival, and band recovery or reporting rates vary accordingly (Lensink 1968; Raveling 1969, 1976, 1978; Ankney 1975, 1976; Chabreck and

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TABLE 1. Activity budgets (percent of time in behavior) of neck-banded and unmarked adult Greater White-fronted Geese wintering in California, 1981-1982.

Site	<i>n</i> <sup>b</sup>	Behavior <sup>a</sup>					
		Feed		Alert		Motor	
		$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE
Roost							
Neck-banded	35	1.3	1.1	18.1	3.8	4.9	1.9
Un-marked	35	1.5	0.9	18.0	3.1	4.2	1.8
Difference		-0.2		0.1		0.7	
Field							
Neck-banded	54	43.7	4.7	23.9	2.9	5.4	1.3
Un-marked	54	44.0	4.7	28.6	3.1	6.3	1.5
Difference		-0.3		-4.7		-0.9	

<sup>a</sup> See text for description of behavior categories.

<sup>b</sup> Observations were paired; therefore an equal number of neck-banded and unmarked geese were sampled at each site. Geese at roosts were observed for a total of 1234 bird-mins, and at field sites for 1435 bird-mins.

Schroer 1975; Craven 1979; Prevett and MacInnes 1980). However, such reports have generally been qualitative, or anecdotal. Prevett and MacInnes (1980) concluded that there was a need for "controlled studies that compare behavior (especially feeding) of collared and unmarked geese." Here I present activity budgets of wintering Greater White-fronted Geese with and without neck bands. This is the first study of which I am aware that quantitatively assesses the impact of neck bands on the activity of geese.

#### METHODS

Greater White-fronted Geese were caught with cannon-nets at feeding and roosting sites. Geese were captured during autumn and spring in the Klamath Basin of California and during winter in the Sacramento Valley of California (1979-1981). An additional sample of geese was caught while molting in western Alaska in the summer of 1981. All birds captured were fitted with U.S. Fish and Wildlife Service metal leg bands and 2-ply yellow plastic neck bands with digits engraved into the black second ply. Neck bands were 60 mm tall, 45 mm in diameter, and 2 mm thick.

I collected activity data for adult Greater White-fronted Geese in the Klamath Basin in autumn and spring, and the Central Valley of California during winter, as geese concentrated in these areas during these time periods. Geese generally flew from roost sites each morning and evening to feed on surrounding agricultural land. Data were therefore collected from field sites during morning and evening, and from roost sites during mid-day.

To determine the effect of neck bands on behavior, I simultaneously sampled the behavior of a neck-banded and the nearest unmarked adult goose for between 5 and 60 min (focal animal sampling [Altmann 1974]).

TABLE 1. Extended.

Behavior <sup>a</sup>							
Comfort		Sleep		Social		Fly	
$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE
12.4	3.6	57.2	6.1	0.8	0.2	5.2	2.7
12.8	3.7	56.9	6.0	0.8	0.2	5.9	2.7
-0.4		0.3		0.0		-0.7	
11.7	2.9	10.2	3.4	1.3	0.4	3.9	1.1
6.2	1.5	9.8	3.1	1.0	0.2	4.1	1.1
5.5		0.4		0.3		-0.2	

Additional time budget information was collected using observations of individual birds (unpaired samples) to test whether behavior was affected by how long a goose had worn a neck band. Behavior was recorded instantaneously at 5-sec intervals using a printing calculator (Ely 1987). Behavior was categorized as alert, feed, comfort (preen or bathe), fly, motor (walk or swim), social (agonistic and intra-family behaviors), and sleep. Preening was the dominant comfort behavior at field sites. Marked geese were selected for sampling if they had not been sampled before and if habitat and location were likely to allow sustained viewing (geese in tall vegetation or at a great distance from the observer could not be consistently observed). If one of the pair of focal birds was lost from view during an observation period, the observation was ended, and the next closest pair of marked and unmarked geese was sampled.

Differences in the proportion of time neck-banded and control geese spent in an activity were tested with paired *t*-tests on each behavior. Before testing, data were normalized with an arcsine transformation (Sokal and Rohlf 1981). Simultaneous sampling of geese with and without neck bands reduced the sample variance by holding constant other factors possibly influencing behavior (e.g., season, time of day, habitat, weather, disturbance events, etc.), thereby increasing the power of the test. The relationship between number of days a goose had worn a neck band and proportion of time spent in different behaviors was examined with Pearson's' correlation coefficients.

#### RESULTS

Neck-banded geese at foraging sites spent significantly more time in comfort behavior than control geese ( $t = 2.41$ ,  $df = 14$ ,  $P = 0.019$ ) (Table

1). As geese rarely bathed while at foraging sites (Water was seldom available), preening was essentially the only comfort behavior at field sites. The increased time spent preening while in the field appeared to be primarily offset by a decrease in time spent alert (23.9 vs. 28.6%), although the difference was not significant ( $t = -1.64$ ,  $df = 14$ ,  $P = 0.106$ ). Neck-banded geese and control geese did not differ in proportion of time devoted to any behavior at roost sites ( $P > 0.05$  all behavior). There was a weak ( $r = -0.205$ ), but statistically significant ( $P = 0.038$ ) negative correlation between the number of days a goose had worn a neck band, and the proportion of time spent preening while at roost sites ( $n = 103$ ; 5 to 881 d after banding,  $\bar{x} = 429$  d). The correlation was not significant for other behavior ( $P > 0.10$ ), or for geese at feeding sites ( $P > 0.10$ ,  $n = 302$ ). Neck bands were frequently the focus of excessive preening activity the first few days after banding, however, this initial response is not reflected in the present analysis, as  $>95\%$  of the geese in this study had worn neck bands for more than 30 d.

#### DISCUSSION

The increased preening activity of neck-banded Greater White-fronted Geese was not unexpected, as geese have previously been reported to preen and manipulate their neck bands shortly after banding (Raveling 1969). However, it was somewhat unexpected that this difference occurred when geese were at foraging sites rather than when roosting. Foraging time is thought to be limiting for many wild animals, especially herbivores (Owen 1980, Townsend and Hughes 1981). I had anticipated that any long term effects would most likely be revealed at roosting sites, where time and activities may have been less constrained, and excessive preening activity therefore less detrimental. In retrospect, the movement of the band sliding up-and-down on the neck during feeding probably caused annoyance, and temporary feather disruption which may have stimulated preening.

To compensate for the increase in time spent preening, neck-banded geese apparently spent less time alert (not significant) than unmarked geese. A decrease in vigilance could adversely affect the fitness of marked individuals if it limited their abilities to detect predators and secure resources (Dimond and Lazarus 1974, Lima 1987). However, geese seldom preened for more than a few seconds without looking up, and were almost always found in flocks, where food finding and predator detection was probably enhanced (Lazarus 1978).

The behavior of marked and unmarked geese was virtually indistinguishable during this study; the absence of an effect of neck bands on activities other than preening, indicates that neck bands probably did not negatively affect Greater White-fronted Geese. However, neck bands (or other marking devices) are most likely to affect the behavior of geese immediately after attachment. Behavioral studies of marked birds should account for the possible impact of marking, and future studies should try to determine the shape of the acclimation curve after marking.

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