

WING MARKERS: VISIBILITY, WEAR, AND EFFECTS ON SURVIVAL OF BAND-TAILED PIGEONS

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Wing markers that provided high visibility, long retention, and individual identification without recapture were required as part of a study to evaluate Band-tailed Pigeon (*Columba fasciata*) census methods. A tag style was sought which would neither impair mobility nor cause behavioral changes, yet would be conspicuous and easy to apply in the field.

Patagial tags fabricated from vinyl and dichloromethane have been used on Bandtails, but most broke near the point of attachment after 1 year (Kautz 1977). Markers made from "Saflog" material (Safety Flag Company of America, Pawtucket, R.I.) were retained well in other studies (e.g., Hewitt and Austin-Smith 1966, Southern 1971, Morgenweck and Marshall 1977).

The techniques for attachment proposed by Anderson (1963) and Hester (1963) were time consuming when handling large numbers of pigeons and may cause injury to the birds. After consideration, we selected the method proposed by Hewitt and Austin-Smith (1966); a wing tag which could be fastened by a strap of tag material around the base of the humerus.

MATERIALS AND METHODS

Band-tailed Pigeons were captured with cannon-nets at bait sites near Niwot and Evergreen, Colorado (Curtis 1981). Pigeons were banded with U.S. Fish and Wildlife Service leg bands and tags were placed on both wings. Age and sex were ascertained following Braun (1976) and White and Braun (1978), and crop gland activity was determined by palpation of the crop lining (Zeigler 1971, Fitzhugh 1974). Weights were recorded to the nearest 2 g using a Hanson dietetic platform scale.

Patagial tags made of Saflog were similar to those described by Hewitt and Austin-Smith (1966). Tag shape was changed (Fig. 1) to prevent Band-tails from preening the alpha-numeric code written on the markers out of view under their body and wing feathers. Most tags were fastened with a metal staple because a better fit was obtained than with metal rivets. Alpha-numeric codes were applied to tags with 4 types of permanent markers and paint. Letter fading was compared among "Liquitex" paint (Permanent Pigments, Inc., Cincinnati, Ohio), "Ball Point" paint (Herrschners, Inc., Stevens Point, Wis.), "Sharpie" marking pen (Sandford Corp., Bellwood, Ill.), and "Marks-A-Lot" marking pen (Carter Ink Co., Cambridge, Mass.). White paint was used on black tags. Black paint or marker was used on green, red, orange, yellow, white, blue, pink, and chrome tags.

Observations of marked Band-tailed Pigeons were made at least twice weekly at the Niwot and Evergreen sites during May through August,

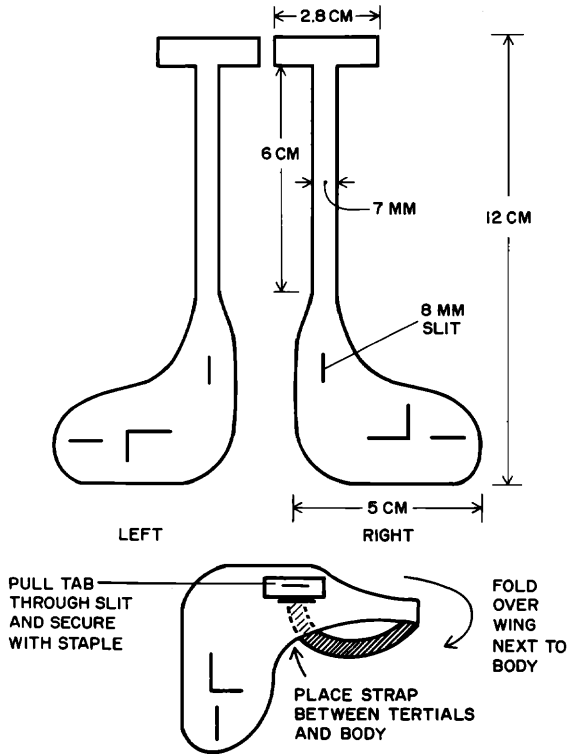


FIGURE 1. Tag design and method of attachment of Band-tailed Pigeon markers.

1979 and 1980. Counts of marked and unmarked birds were made from sunrise until late afternoon. Most tagged pigeons present were identified while feeding on the ground in flocks with a 15–60× spotting scope.

RESULTS AND DISCUSSION

Marker visibility.—Of 417 Band-tailed Pigeons tagged during 1979 at Niwot, 346 (83%) were observed at least once after tagging. Of 246 pigeons marked near Evergreen, 150 (61%) were seen again. Although fewer ($\chi^2 = 21.0$, $P < .005$) tagged birds were observed at Evergreen, the relationship was confounded because more alternate feeding sites were available there and pigeons were less likely to be observed at the site where marked. Of 49 Band-tailed Pigeons color-marked during 1980 at Niwot, 20 (41%) were seen at least once after tagging, while 51 of 115 (44%) birds tagged near Evergreen were observed. No differences ($\chi^2 = .01$, $P > .90$) in the percent of sightings (84%) which led to positive identification occurred between sites.

Feathers preened over lettering, number fading, and large flock size

TABLE 1. Observed fading of tags lettered with 4 types of ink or paint placed on Band-tailed Pigeons. Sample sizes are in parentheses.

Type of lettering	No wear	Slight fading	Severe fading	Illegible
Marks-A-Lot				
Mean No. of days on pigeon	29 (14)	70 (45)	313 (32)	382 (7)
Range	8-50	32-114	57-435	328-457
Sharpie				
Mean No. of days on pigeon	26 (3)		345 (16)	
Range	13-35		299-403	
Liquitex				
Mean No. of days on pigeon	66 (5)	434 (9)		
Range	48-96	360-784		
Ball Point				
Mean No. of days on pigeon	20 (3)	444 (2)		
Range	19-20	415-472		

were the 3 most common reasons that pigeons could not be individually identified. Tags are generally quickly accepted by birds and are treated as feathers (Anderson 1963), resulting in tags being "preened" in and out of view of the observer (Southern 1971). Similar behavior was observed for Band-tailed Pigeons carrying this style marker.

Tags lettered with paint faded less than those marked with permanent markers (Table 1). Tags lettered with "Marks-A-Lot" or "Sharpie" marking pens, and carried on pigeons an average of 313 and 345 days, respectively, showed severe letter fading. Seven pairs of tags lettered with the "Marks-A-Lot" pen were illegible after approximately 382 days. In contrast, tags marked with "Liquitex" and "Ball Point" paint exhibited only slight fading after being carried by Bandtails for an average of 434 and 444 days, respectively. One pigeon recaptured after 784 days carried slightly worn wing tags marked with "Liquitex" paint that showed little letter fading.

Several times flocks in excess of 200 Bandtails were observed feeding at Niwot. When this many birds congregated at a small grain pile, letter combinations of tagged birds were often obscured from view by adjacent pigeons. Tag color was recorded even though positive identification was not possible.

Hewitt and Austin-Smith (1966) noted tags rolled forward over the wing if the tag strap was too loose. We encountered this problem when strap width was decreased from 7 to 4 mm (Fig. 1). Thirteen of 295 (4%) pigeons carrying these tags had 1 tag roll over the wing. No pigeons with the 7-mm wide straps had tags roll forward. Strap width was initially

TABLE 2. Numbers of control and tagged Band-tailed Pigeons marked in 1979 and 1980 and recaptured in 1980 and 1981.

Date	Site	No. tagged and banded	No. banded only	No. recaptured (%)	
				Tagged	Control
1979	Niwot	417	72	6 (1.4)	5 (6.9)
	Evergreen	281	8	3 (1.1)	
	Totals	698	80	9 (1.3)	5 (6.3)
1980	Niwot	49	24	1 (2.0)	
	Evergreen	115	17	1 (0.9)	2 (11.8)
	Totals	164	41	2 (1.2)	2 (4.9)

decreased in an attempt to reduce feather wear and callousing observed on recaptured birds, but since this caused some tags to roll forward, we recommend a width of 7 mm.

Four of 142 (3%) Bandtails marked in 1979 and recaptured in 1980 had missing tags or tags that were severely worn and needed replacement. These tags had been carried by pigeons for 328–348 days and most wear was on the tag strap where it contacted the humerus. All 4 pigeons were from the group of 295 birds that carried tags with 4-mm wide straps. Other researchers have documented tag wear after 15 months (Morgenweck and Marshall 1977) and 3 years (Southern 1971). Hester (1963) thought "Saflog" patagial tags would remain on European Starlings (*Sturnus vulgaris*) for the life of the bird.

Color fading of "Saflog" occurs over a period of 1 (Nesbitt 1979) to 3 years (Southern 1971). We had no difficulty determining original tag color of marked pigeons more than 450 days after tagging. Chrome was the only color we do not recommend for future studies because paint or marker would not adhere to the shiny surface. We conclude that "Saflog" would be suitable for most bird color-marking studies lasting less than 2 years.

Effects of markers on survival.—Boag et al. (1975) found no increase in mortality for patagial-tagged Red Grouse (*Lagopus lagopus*) chicks. In contrast, a lower percentage ($\chi^2 = 10.5$, $P < .005$) of color-marked Bandtails was found in 1980 trap samples than leg-banded controls (Table 2). Although a similar difference in percentage was found in 1981 trap samples, this difference was not significant ($\chi^2 = 2.3$, $.10 < P < .25$), probably due to small sample sizes. It appears that tagging may have reduced Band-tailed Pigeon survival although few bands have been recovered.

The weight change of individual male and female Band-tailed Pigeons recaptured in 1979 that had inactive crops at both time of capture and recapture was used as an index to physical condition. Tagged males ($n = 20$) had a mean weight of 344 and 337 g at capture and recapture, respectively. Tagged females ($n = 21$) weighed an average of 332 g at

capture and 328 g at recapture. Differences in weight from capture to recapture were not significant ($t = 1.28$, $.2 < P < .4$). Tags were on males an average of 66 days and females 59 days prior to recapture. No untagged, leg-banded male controls were recaptured during 1979. Only 5 female controls were recaptured that had inactive crops at both trap times. Control females did not differ in weight between capture (337 g) and recapture (338 g) ($t = .08$, $P > .50$). An average of 23 days elapsed between capture and recapture.

Feather wear and callousing were found on the wings of some pigeons where the tag strap made contact with the humerus. This apparently resulted in no ill effects. Other researchers (Hewitt and Austin-Smith 1966) noted no feather wear after tags were carried by 5 species of small birds from 10 to 18 months. However, callouses may form on wings when the tags are fastened too tightly (Southern 1971, Morgenweck and Marshall 1977). This condition had no apparent effect on survival.

Wing tags had no apparent effect on pigeon mobility. Movement among several Evergreen feeding sites and the Niwot site was recorded. Eleven Band-tailed Pigeons color-marked during 1979 and 1980 that migrated south in the winter were recaptured the following year. Hester (1963) and Hewitt and Austin-Smith (1966) also found no apparent effects of tagging on mobility for the species studied.

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