

penetrate the extremely wet and dense forests at about 1000 m on either the Cordillera Central or the Cordillera de Talamanca, along which the distribution of *Terenura* is probably continuous into western Panama.

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Radiotelemetry location of nesting Band-tailed Pigeons in Colorado.—Band-tailed Pigeons (*Columba fasciata*) occur throughout many of the forested mountain ranges of western North America (Goodwin, Pigeons and Doves of the World, British Museum [Nat. Hist.], London, England, No. 663, 1967). Most detailed nest information is available for the Coastal race (*C. f. monilis*) in California (Glover, Calif. Fish and Game 39:397–407, 1953; MacGregor and Smith, Calif. Fish and Game 41:315–326, 1955; Peeters, Condor 64:445–470, 1962). Although nests have been reported for the Interior race (*C. f. fasciata*) of Band-tailed Pigeons (Fitzhugh, Literature Review and Bibliography of the Band-tailed Pigeons of Arizona, Colorado, New Mexico, and Utah, Ariz. Game and Fish Dept. Spec. Rept., 1970), no quantitative study of nest-site preference has been attempted due to the difficulty of finding nests. The first two reported nests of *C. fasciata* from Colorado were in the Rampart Range, Pike National Forest (Neff and Niedrach, Condor 48:72–74, 1946; Neff, Habits, Food and Economic Status of the Band-tailed Pigeon, U.S. Dept. Inter., Fish and Wildl. Serv. N. Am. Fauna 58, 1947) and few nests have since been reported for the Interior population. The objective of our study was to determine if radiotelemetry equipment could be used to locate nests of Band-tailed Pigeons.

Study area.—The study was conducted from mid-May through early July 1981 near Evergreen, Jefferson Co., Colorado. Bandtails were trapped at the Forest Heights site (39°38'N, 105°18'W) at 2146 m elev. (Curtis, M.S. thesis, Colorado State Univ., Fort Collins, Colorado, 1981), where an extensive road network provides reasonable access. Few berry-producing trees or shrubs are found in the area (Braun, Proc. West. Assoc. State Game and Fish Comm. 53:336–344, 1973) and bandtails rely heavily upon grain supplied by local residents. Ponderosa pine (*Pinus ponderosa*) and, at higher elevations, lodgepole pine (*P. contorta*) are the most common overstory trees.

Methods.—Cannon nets were used to trap bandtails at Forest Heights (Braun, Methods for Locating, Trapping and Banding Band-tailed Pigeons in Colorado, Colorado Div. Wildl. Spec. Rept. 39, 1976). Captured pigeons were classified as to age and sex on the basis of plumage characteristics (White and Braun, J. Wildl. Manage. 42:564–569, 1978), weighed with a Hanson dietetic platform scale (Drewien et al., J. Wildl. Manage. 30:190–192, 1966), and leg banded.

Radio transmitters were fabricated by the Denver Wildlife Research Center, U.S. Fish and Wildlife Service. Transmitters were powered by an RM 675 mercury battery and had an estimated life of 45 days. An oval-shaped piece of latex rubber was glued to the base of the radio package to provide a bonding surface. Total transmitter weight was 6.3 ± 0.1 g, $N = 10$ (ca. 2% of pigeon body weight). Feathers on the lower middle back of selected birds were trimmed to about 0.5 cm in length, and the transmitter package was glued to the trimmed area with a cyanocrylate-base glue.

The receiving system consisted of a portable 12-channel receiver (AVM Instrument Co.,

TABLE 1
RADIOTELEMETRY DATA FOR BAND-TAILED PIGEONS NEAR FOREST HEIGHTS, COLORADO,
MAY-JULY 1981

Sex	Age	No. of days located (dates)	Remarks
Males	Adult	3 (15-25 May)	Lost contact
	Adult	17 (15 May-12 July)	Located on nest on 6 June
	Adult	16 (15 May-11 July)	Located on nest on 30 May
	Adult	16 (15 May-12 July)	Found radio hanging in tree
	Adult	16 (19 May-11 July)	Located on nest on 10 June
Females	Adult	6 (15 May-6 June)	Apparent loss to avian predator
	Adult	15 (19 May-11 July)	No nest found
	Subadult	16 (15 May-11 July)	No nest found
	Adult	2 (19-20 May)	Lost contact
	Adult	6 (15-24 May)	Lost contact (shot, see text)

Champaign, Illinois), and a 3-element hand-held Yagi directional antenna. Maximum reception range was 18.6 km, although there was considerable variation depending upon topography, vegetation density, and exact pigeon location.

Radio-tagged Band-tailed Pigeons were located throughout the day and attempts were made to find all marked birds at least once weekly from 15 May-12 July. Locations of radio-tagged bandtails were determined by triangulation and direct observation.

Nest locating.—Radio transmitters were placed on four male and three female bandtails on 14 May. An additional male and two females were fitted with transmitters on 18 May. All pigeons had inactive crop glands (indicating they were not yet prepared to feed young) when trapped. Nests of three of five radio-marked males were found but no nests were located for any of the five females (Table 1). Contact was lost with one male and two female pigeons shortly after radio marking.

Radio-marked male Band-tailed Pigeons on nests were easier to locate than females. Males were found on nests from approximately 08:00-17:00 MDT during which time females were at feeding sites. It was necessary to search between 06:00-08:00 and 17:00-20:00 to attempt to find females on nests. Neither time interval was long enough to locate and confirm a nest because extensive hiking was often required to reach nest-sites near rugged mountain peaks. Late afternoon electrical and rain storms also hampered efforts to find nesting females.

The area within 30 km of the trap site was searched intensively at least once weekly for all radio-marked birds. Considering the maximum reception range of 18.6 km, radio-marked pigeons not located may have flown a considerable distance from Forest Heights. Contact was lost with a female 9 days after radio marking. This pigeon was shot on 2 September near Montrose, Colorado; approximately 240 km from the trap site, with the transmitter still attached. Radio loss or failure may also explain the difficulty in finding certain pigeons.

Nest and habitat description.—Due to the small sample size, it was not possible to identify factors important in nest-site selection. The three bandtail nests located were in lodgepole pines along sloping (40-80%) ridgetops. A nest found by Neff (1947) in the Rampart Range was also in a lodgepole pine along a steep ridge.

Glover (1953) reported an outside nest diameter of 19.8 cm for eight nests in California. Nest heights in his study ranged from 2.1-45.7 m and the distance from the bole ranged

TABLE 2
CHARACTERISTICS OF THREE BAND-TAILED PIGEON NESTS NEAR EVERGREEN, COLORADO,
MAY-JUNE 1981

Characteristics	\bar{x}	Range
Nest size, L × W (cm)	24 × 22	22–27 × 19–26
Nest depth (cm)	8.8	7.8–9.5
Bowl depth (mm)	28	25–30
Distance from trunk (cm)	56	0–109
Diameter of twigs of nest (mm)	3.2	2.9–3.7
Twig length (mm)	—	200–300
Nest height (m)	4.6	2.1–5.9
Tree DBH (mm)	245	160–374
Elevation (m)	2845	2719–2938
Distance from trap site (km)	10.9	7.1–14.0

from 0.3–1.8 m. MacGregor and Smith (1955) reported an average nest height of 11 m (range = 3.7–29.0 m) for 26 nests. Peeters (1962) found six of 11 nests between 4.6 and 6.1 m in height. All nests in his study ranged from 2.1–12.2 m above the ground. These data for nests of pigeons in the Coastal population were similar to those for the three nests that we observed (Table 2).

Stand composition at nest-sites varied from 65–100% lodgepole pine and the understory vegetation consisted of sparse blueberry (*Vaccinium* spp.), pinegrass (*Blepharoneuron* spp.), russet buffaloberry (*Shepherdia canadensis*), quaking aspen (*Populus tremuloides*), common juniper (*Juniperus communis*), and bearberry manzanita (*Arctostaphylos urva-ursi*). Rock cover ranged from a few stone-size rocks to 15–20% stones and boulders. The parent material at all three nest-sites was granitic. The aspect of slopes where nests were found varied from NNE to S (AZ 20–175°). Nest limbs faced NNE to ESE (AZ 20–100°).

Nests of Band-tailed Pigeons can best be described as a loose platform of twigs that contain little besides the squabs. A few shell fragments were noted in two nests. One to three breast feathers were also found in two of three nests. Initially, chick droppings were found in only one nest, but as the squabs matured the accumulation of droppings became more apparent in all nests.

Radio-telemetry equipment was a useful tool for locating nests of Band-tailed Pigeons in Colorado. Females on nests were not found during this study. Because both male and female bandtails share nesting activities, it is doubtful that nest preference data would differ between nests located by following one or the other sex. Because males are associated with nests during a large proportion of the daylight hours, it may be more efficient to place radio transmitters only on this sex. Aerial radiotracking combined with a ground crew in vehicles and on foot, should aid in finding nests and birds for which radio signals have been lost.

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