

backed Gulls (*L. fuscus*) in England. As a result of his experiment the number of mixed pairs in the colony increased in subsequent years.

It is significant that this booby was about 3 years old in 1965 (based on the original banding data) and probably had never bred. Therefore it is unlikely that a frigatebird imprinted on boobies laid its egg in the booby nest.

Both species feed mainly on flying fish and squid, and both feed their young in a similar manner

(VanTets, AOU Orn. Mon. No. 2, 1965), so it seems possible that either species might raise or help raise a nestling of the other.

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BREEDING STATUS OF THE MOUNTAIN PLOVER

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AND
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The Mountain Plover (*Charadrius montanus*) is an endemic species of North America, nesting on the shortgrass prairie mainly east of the Rocky Mountains and wintering from California and Texas to northern Mexico. Information on the status of this species on the wintering ground is noticeably lacking. Jurek (1973), however, has found that in California these birds are now absent or rare in many areas where they were previously numerous, although flocks of hundreds still winter in some California valleys.

Several researchers have commented on the breeding status of this species. Bent (1929) described the main breeding range as extending along the eastern edge of the Rockies, from New Mexico into Canada, and eastward into North Dakota and Texas (fig. 1). Within this area the Mountain Plover was initially described as a common breeding resident (Coates 1874, Knight 1902). In fact, prior to 1900 it was abundant enough to be considered an important game bird by market hunters (Grinnell et al. 1918, Sandoz 1954).

Cooke (1915), however, noted that this species seemed to be decreasing in numbers. He acknowledged that market hunting may have been partly to blame for the decrease, but he felt that the major problem was the reduction of the breeding range due to cultivation and dairying activities. Later, Abbot (1939) reported that it was becoming still rarer in the 1930's; he felt that one reason for many fatalities was that they were "absurdly dumb." More recently Laun (1957) concluded that the Mountain Plover population had diminished markedly with the majority now breeding in southern Montana, Wyoming, and Colorado. Apparently in response to these reports, this species was included on the "status undetermined" list of the U.S. Department of the Interior (1973).

Aware of the above trend, Webster began a study of the Mountain Plover in 1967 and Graul began work on the species in 1969. We have been hitherto reluctant to estimate the total number of Mountain Plovers because of the limited nature of our data, but it now seems that even a highly tentative estimate is badly needed. We present here our information on the breeding status of this plover, and suggestions for preserving the species.

Webster studied the Mountain Plover in 1967 and 1968 to determine its current Colorado breeding

range. Her study included personal correspondence, organized group field surveys, and much personal travel throughout the bird's known historic Colorado range. Graul (1973a, 1973b, 1974, 1975) conducted field work in 1969-72 and 1974 in Weld County, northeastern Colorado and he corresponded with many people residing in the shortgrass prairie region. In May, 1975, he traveled through 11 eastern Colorado counties in an effort to supplement Webster's work.

Our data support Laun's (1957) contention that most Mountain Plovers now breed in Montana, Wyoming, and Colorado. Stewart (1971) listed this species as accidental for North Dakota and, indeed, Graul found no evidence of recent nesting in North Dakota, South Dakota or Kansas. Ross Lock found an adult with one young 6 mi W of Bushnell, Kimball County, Nebraska on 7 June 1975, but this is the only Nebraska record in several years. George M. Sutton (pers. comm.) informed us that in some years they nest in northwestern Oklahoma. Kenneth Seyffert (pers. comm.) in June, 1974, found them nesting in Union County, northeastern New Mexico and saw two birds in Hartley County, northwestern Texas. Hubbard (1970) reported that some nest in central and southwestern New Mexico, but we have not found any recent nesting records for these areas. Duane Tolle

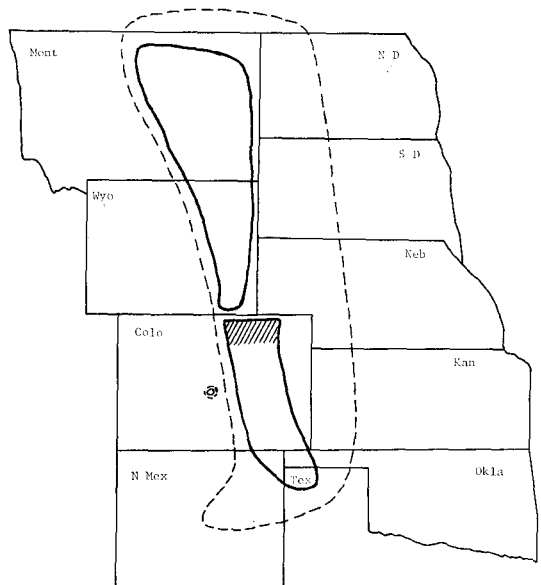


FIGURE 1. Former (dotted line) and presumed present (solid line) main breeding range of the Mountain Plover. Slanted lines represent present stronghold of the species.

(pers. comm.) found a nest in extreme northwestern New Mexico, west of the Continental Divide.

In Montana and Wyoming Mountain Plovers apparently occur only as isolated populations. Laun (1957) studied a population just west of Laramie, Wyoming, and Finzel (1962) found a population west of Cheyenne. In June, 1974 Dale Stahlecker (pers. comm.) saw one in the Shirley Basin south of Casper, Wyoming.

Within Colorado, Webster recorded this species in June or July in the following counties: Baca, Bent, Crowley, Elbert, El Paso, Huerfano, Kiowa, Las Animas, Lincoln, Logan, Otero, Park, Pueblo, and Weld. Graul also found birds present in May in Cheyenne and Morgan Counties. The plovers formerly also nested in Adams, Arapahoe, Denver, and Larimer counties (Bailey and Niedrach 1965), but our surveys produced no records for these counties.

With the above information we can map the present presumed main breeding range of this species (fig. 1). Although most birds breed on the shortgrass prairie east of the Rockies, the small, isolated population in Colorado (Park County) is actually in a shortgrass valley surrounded by mountains—west of Colorado Springs.

In Weld County, Colorado most Mountain Plovers nest within an overall area of about 3,470 sq. km, on or adjacent to the Pawnee National Grassland. This is an area bordered by Highway 85 on the west, Highway 14 on the south, Highway 71 on the east, and on the north by an east-west line transecting Hereford, Colorado. In this area good nesting habitat for the plovers consists of large flats covered predominantly by blue grama grass (*Bouteloua gracilis*) and/or buffalo grass (*Buchloe dactyloides*), but some birds also nest on flats covered by the latter two species mixed with taller vegetation such as fourwing saltbrush (*Atriplex canescens*) (Graul 1975).

In 1971 Graul sampled the above area to determine how much of it represented good nesting habitat, marginal nesting habitat, and highly doubtful or impossible nesting habitat. A 60 mi road route transecting the area was chosen and potential sample points were established every one-half mile along the route. The route started 6 mi E and 3 mi N of Keota, continued northwest to Grover, and then went west to a point 6 mi S of Rockport. The 120 potential sample points were numbered consecutively and pieces of paper containing the numbers were placed in a jar. Twenty of these numbers were randomly chosen. If a selected point occurred on a north-south road it was located by pacing 50 m west of the fence. If the point was on an east-west road the same distance was paced north, and if the point was at an intersection the point was located by pacing 100 m west and 50 m north.

The resulting sample points were evaluated by comparing them to known nesting parameters such as vegetative characteristics and slope of the ground (Graul 1975). The results are as follows: 20% good nesting habitat, 20% marginal nesting habitat, 60% highly doubtful or impossible nesting habitat.

By combining the above figures with known nest densities we can estimate the total number of Mountain Plovers nesting on the 3,470 sq. km area in an average year. We assume that one nest represents one adult, since Graul (1973b) found that a female lays a set of eggs for a male and then one for herself. In good habitat, densities ranged from 32 birds per sq. km to 4 birds per sq. km during 1969–74, with about 20 birds per sq. km being most representative. In the less favorable areas, densities averaged about

one-half that in good habitat, yielding 10 birds per sq. km. This gives a total of 20,820 birds for the overall 3,470 sq. km area, or 6 birds per sq. km.

Estimating the population for the remainder of Colorado and the northeastern corner of New Mexico (about 70,000 sq. km) is more difficult. Webster recorded 350 adults and chicks in Weld County, and only 96 adults and chicks for the remaining Colorado counties. We are convinced that densities drop rapidly going south from Weld County across the breeding range. For our estimates we calculated the population assuming that the density for the 70,000 sq. km area is one-fourth and one-half, respectively, the density in northern Weld County. This value range seems reasonable to us. This would yield 105,000 to 210,000 birds.

It is even more difficult to estimate the population in Montana-Wyoming (about 221,000 sq. km). Laun (1957) reported an average of one bird per 804 acres (0.3 birds per sq. km) on his study area near Laramie, Wyoming, but he acknowledged that his values were probably highly conservative. Finzel (1962) found 1.3 pair per 100 acres (6.4 birds per sq. km) on the same area and found 2.5 pair per 100 acres (12.3 birds per sq. km) on an area just west of Cheyenne. As a result of Graul's travel and correspondence, it appears that most of the overall Montana-Wyoming area does not contain breeding Mountain Plovers. Skaar (1975) documented recent breeding in Montana in only five locations. Clifford Davis and Louis Moos (pers. comm.) estimate that not over 5–10% of the potential Montana breeding area shown in fig. 1 contain breeding Mountain Plovers. Conservatively assuming that only 5% of the Wyoming-Montana area contains breeding plovers and that in the existing populations a density of 8.0 birds per sq. km is representative, then we get a population of 88,400 birds.

By combining all of the above figures, we estimate about 214,200 to 319,220 breeding Mountain Plovers. Of course, these figures do not include some nesting areas in New Mexico, Nebraska, Oklahoma, Texas, or Park County, Colorado. Our figures, consequently, must be viewed as extremely rough estimates, but at least they give us an order of magnitude and indicate that there are probably more birds than previously suspected.

The tendency for the Mountain Plover to nest on blue grama-buffalo grass flats is a key to the preservation of this species. Weld County, Colorado apparently represents the stronghold of its breeding range, and within this area most good nesting habitat is subjected to heavy summer grazing. Grazing pressure may help maintain the blue grama-buffalo grass community, since Mitchell (1971) found that the frequency of these grass species increases under heavy grazing. Unfortunately, many of these same flats were the first to be plowed and planted to wheat or other crops. Additionally, many shortgrass areas are subjected to a practice termed "pitting," whereby a special machine digs a series of many shallow holes in a row. Each hole measures about 15.0 cm deep \times 25.0 cm wide \times 110.0 cm long and the holes are separated by intervals of 3.0 to 5.0 m. This procedure, by increasing soil moisture retention, can presumably result in taller grasses. Such a change could render an area unsuitable for Mountain Plovers, since they avoid tall vegetation.

Agricultural activities are probably the reason why the Mountain Plover presumably no longer breeds in the Dakotas or Kansas. These activities continue to reduce the habitat in the remaining breeding range.

Unfortunately, if a shortgrass area is plowed and allowed to revert to grassland, it may well be revegetated with taller grasses (Bergman 1975). In fact, many areas in Weld County that were plowed in the 1930's and later allowed to go back to grass still are not good Mountain Plover areas because of the presence of taller grasses. We suspect that such a past history of plowing may be the reason why many shortgrass prairie areas now lack Mountain Plovers.

If this species is to be preserved, then large areas must remain subject to heavy grazing and be kept free of plowing or pitting. Whether this is done may well depend upon the relationship between wheat prices and cattle prices. For instance, when wheat prices were high in 1974 Webster found that several large shortgrass tracts in Baca County, Colorado were being plowed and Graul found the same in Weld County. Of course, these comments apply only to the breeding areas and research is badly needed to determine the problems these plovers may be encountering on their wintering areas.

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LITERATURE CITED

- ABBOT, C. C. 1939. Mountain Plover of San Diego, California. *Condor* 42:125.
 BAILEY, A. M., AND R. J. NIEDRACH. 1965. Birds of Colorado. Vol. 1. Denver Mus. Nat. Hist., Denver, Colo.
 BENT, A. C. 1929. Life histories of North American shorebirds. Part 2. U.S. Natl. Mus. Bull. 146.
 BERGMAN, H. L. 1975. Final report, environmental assessment of Black Thunder Mine Site, Campbell County, Wyoming. Wyo. Environ. Inst., Jackson, Wyo.
 COOKE, W. W. 1915. Our shorebirds and their future. *Condor* 17:237-238.

SUPERIMPOSITION OF AN AMAKIHI NEST ON ONE OF AN ELEPAIO

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On 3 June 1973, while working on the northwestern slope of Mauna Kea, Hawaii at approximately 2,286 m elevation, I found an Amakihi (*Loxops v. virens*) building on top of an Elepaio (*Chasiempis s. sandwichensis*) nest. The Amakihi is a member of the endemic Hawaiian family Drepanididae whereas the Elepaio is an Old World Flycatcher (Muscicapidae). The nests (fig. 1) were placed in a lateral fork of a 7.9-m mamane (*Sophora chrysophylla*) tree, 6.25 m above the ground. I know of only one reference to superimposition of nests in Hawaiian birds (van Riper, Wilson Bull. 85:238-240, 1973)—Apapane (*Himati-*

- COUES, E. 1874. Birds of the northwest. Govt. Print. Off., Washington, D.C.
 FINZEL, J. E. 1962. Avian populations of four herbaceous communities at various elevations in southeastern Wyoming. *Condor* 66:496-500.
 GRAUL, W. D. 1973a. Possible functions of head and breast markings in *Charadriinae*. Wilson Bull. 85:60-70.
 GRAUL, W. D. 1973b. Adaptive aspects of the Mountain Plover social system. *Living Bird* 12: 69-94.
 GRAUL, W. D. 1974. Vocalizations of the Mountain Plover. Wilson Bull. 86:221-229.
 GRAUL, W. D. 1975. Breeding biology of the Mountain Plover. Wilson Bull. 87:6-31.
 GRINNELL, J., H. C. BRYANT, AND T. I. STORER. 1918. The game birds of California. Univ. California Press, Berkeley.
 HUBBARD, J. P. 1970. Checklist of the birds of New Mexico. New Mexico Ornithol. Soc. Publ. No. 3.
 JUREK, R. M. 1973. California shorebird study: accelerated research program for shore and upland migratory game birds, project final report. Calif. Dept. Fish & Game, Sacramento, 233p.
 KNIGHT, W. 1902. The birds of Wyoming. Bull. 55, Wyo. Exper. Station.
 LAUN, C. H. 1957. A life history study of the Mountain Plover, *Eupoda montana*, Townsend, on the Laramie plains, Albany County, Wyoming. M.S. thesis, Univ. of Wyoming, Laramie.
 MITCHELL, G. C. 1971. Spatial distribution and successional state of grassland vegetation related to grazing intensity treatments. U.S. IBP Grassland Biome Prog., Tech. Rep. 101, Colorado State Univ., Ft. Collins.
 SANDOZ, M. 1954. The buffalo hunters. Hastings House, N.Y.
 SKAAR, P. D. 1975. Montana bird distribution. P. D. Skaar, Bozeman, Mont.
 STEWART, R. E. 1971. Checklist of birds in North Dakota. *Prairie Nat.* 3:3-12.
 U.S. DEPARTMENT OF THE INTERIOR. 1973. Threatened wildlife of the United States. Fish and Wildl. Serv. Resour. Publ. 114.

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one sanguinea) nests built on top of one another in a lava cave. I have found over 450 Amakihi nests on Hawaii, but in no other case have I observed a bird to build over another nest.

Both nests had typical shapes; the Amakihi nest agreed well with others I have measured for this species. The outer depth varied from 7.1 to 11.9 cm and outer width from 11.2 to 17.3 cm; the bowl was 3.3 cm deep and 5.1 cm wide. The nest rim thickness varied from 2.0 to 3.3 cm.

I watched the nest for 10 days, and although it appeared completed, the Amakihi never laid any eggs. Berger (Occ. Pap. Bernice Pauahi Bishop Mus. 24:1-8, 1969) stated that the breeding season of the Amakihi is protracted, extending from mid- or late-October to June. At the late date in the breeding season, with probable regression of the gonads and the resulting decrease in hormone level, desertion of this nest may not have been unusual. Nickell (Auk 68: