Status of Breeding Mountain Plovers *(Charadrius montanus*) on Cultivated Landscapes in Western Oklahoma

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We studied mountain plovers (*Charadrius montanus*) on cultivated fields of the western end (primarily Cimarron County) of the Oklahoma Panhandle during the breeding season in 1999. We compared plover use of cultivated fields in 1999 with our observations in 1986-1998. Of 51 cultivated fields used in 1986-1994 that could be surveyed in 1999, 16 (31%) were reused, but the remaining 35 (69%) were not. That suggested that inter-year fidelity of mountain plovers to specific sites was relatively weak, although our data indicated that fidelity within a general region may be high. The number of cultivated fields used and total number of mountain plovers observed in 1999 were comparable with the highest numbers located in 1992-1994 when similar amounts of effort were expended on field research. Considerable research is required to identify and implement the best management approach to have cultivation without deleterious effects to breeding mountain plovers.

INTRODUCTION

Currently, the mountain plover (*Charadrius montanus*) is a candidate species under consideration for threatened species status (*1*). During research on five rare breeding bird species of the Oklahoma Panhandle in 1986, Shackford (*2*) located mountain plovers on 25 sites, 9 of which were cultivated fields, a habitat previously unknown to be used by the species, and he also verified the first record of a mountain plover nest on a cultivated field. To date, the total number of nests we have found on cultivated fields is 53, all of them in southern latitudes (southward from southeastern Wyoming).

During breeding seasons of mountain plovers in 1992 and 1995, Shackford and coworkers (*3*) found new breeding populations of mountain plovers on cultivated fields in southwestern Kansas, eastern Colorado, southeastern Wyoming (Laramie County), southwestern Nebraska (Kimball and Cheyenne counties), and central Montana (one plover in Judith Basin County). Otherwise, mountain plovers were absent on cultivated fields north of southeastern Wyoming (Laramie County), which likely indicated more frequent plowing in northern latitudes, necessitated by a harsher climate, than in southern latitudes from southeastern Wyoming southward (*3*).

During the breeding seasons of mountain plovers in 1993 and 1994, we intensively studied 71 cultivated fields in Cimarron County, Oklahoma, southwestern Kansas, and east-central Colorado. Fidelity of mountain plovers to a single field appeared to be high within a single breeding season; residency on a particular cultivated field averaged 41 days (Shackford and Leslie, unpublished data). During the 1999 breeding season, we restudied mountain plover use of cultivated fields in Oklahoma and compared it to previous years.

METHODS

Our study area comprised cultivated fields in Cimarron County and the western 16 km of Texas County in the Oklahoma Panhandle. The study period was 1 June-14 July. We defined a cultivated field as that area in a single location that a land manager or

farmer attempted to plant and/or manage as a single unit. We compiled a list of all cultivated fields (*n* = 99) where we had located mountain plovers in 1986-1998 ("old" fields) in Cimarron County. Ninety-eight of the fields were inspected from a vehicle to determine suitability for surveying for mountain plovers. We did not survey "old" fields if (a) they had been reconverted to grasslands (Conservation Reserve Program grasslands, etc.) or overgrown by thick weeds, or (b) the extant crop or other vegetation was >60 cm high.

Suitable fields (vegetation ≤60 cm tall) were searched with the aid of 10 x 50 binoculars. We inspected many additional cultivated fields that appeared suitable as breeding habitat but where we never located plovers in the past, finding mountain plovers on many of those "new" fields. In the final tally of all fields surveyed, we counted only those fields where we either found at least one mountain plover or searched for 30 min without finding a plover. Because we did not survey any "new" fields without plovers as long as 30 minutes, only those "new" fields where we found plovers appear in our tally of total fields surveyed. All fields were within a 32-km radius of Boise City.

At each field where mountain plovers were located, we recorded data on a field data sheet and a map sheet developed by J. S. Shackford. We compared the number of townships and fields with breeding mountain plovers between 1992-1994 and 1999. We expended similar amounts of effort in field research in each of those four years.

RESULTS

We inspected 98 of 99 fields where Shackford and coworkers (*3*) had observed mountain plovers in Oklahoma from 1986 through 1998. Nine fields (9%) had been reconverted to pasture land (Conservation Reserve Program grasslands, etc.) or were overgrown with thick vegetation, and 38 fields (39%) had crops or vegetation too high (>60 cm) to be surveyed effectively. Fifty-one fields (52%) had crops or vegetation ≤60 cm and were searched for plovers. We found mountain plovers on 16 (31%) of the 51 fields. Of the 38 fields with vegetation deemed too tall to survey effectively, mountain plovers were located fortuitously on two (5%). Thus, we found mountain plovers on 18 (18%) of the 98 fields where they had been observed in the past.

We located mountain plovers on 22 "new" fields for the first time in the 1999 breeding season. Thus, of the 120 cultivated fields surveyed in the 1999 breeding season, mountain plovers were located on 40 (33%) fields; 18 (45%) of those were "old" fields and 22 (55%) were "new" fields. On the 40 fields where we found mountain plovers during the 1999 breeding season, we located 86 plovers ($\bar{x}$ = 2.2 plovers/field): 56 (65%) on "new" fields, 28 (33%) on the 16 "old" surveyable fields, and two (2%) on the "old" fields with vegetation >60 cm. The 40 cultivated fields with mountain plovers encompassed 2,754 ha, and average field size was 69 ha. The best evidence of breeding activities (*n* = 40) were: a single adult plover during the breeding season (16 fields), courtship calls and flights (12 fields), flightless young (six fields), two plovers of unknown sex (four fields), nesting (one field), and fledged young (one field). During the 1992 breeding season, Shackford and coworkers (*3*) found 45 mountain plovers on 35 cultivated fields in eight townships; in 1993, 39 plovers on 25 fields in 10 townships; in 1994, 90 plovers on 37 fields in 7 townships; and in 1999, 86 plovers on 40 fields in 7 townships.

Dan Robinson, a farmer who is very familiar with mountain plovers, reported seeing the species while farming a specific field in Texas County, Oklahoma, in 1999, but he did not have an exact date. We suspected that his sighting was during the breeding season but were not certain. That particular field and the surrounding area in Texas County were searched extensively on two occasions, but we found no plovers. However, based on the suitable habitat and other species found there (long-billed curlew, *Numenius americanus*), we have no reason to doubt his report. We are still, however, trying to verify the first record of a mountain plover during the breeding season in Texas County.

DISCUSSION

Graul (*4,5*) studied banded mountain plovers on native prairie in northeastern Colorado and found that site fidelity among years on native prairie was strong for at least some adults that built nests within 100 m of their nest site of the previous year. Our data suggested somewhat more flexibility of mountain plover reuse of fields among years than within a particular year; for example, plovers could be located on only 16 (31%) of the 51 "old" fields that we surveyed. Furthermore, only 18 (45%) of 40 fields with plovers in 1999 were "old" fields, whereas 22 (55%) were "new" fields. Only 30 (35%) of 86 plovers used "old" fields, whereas 56 (65%) used "new" fields.

On cultivated fields, however, changes of nesting sites among years are no doubt often abetted, if not necessitated, by differing land uses. Furthermore, our data span 13 yr so that plover reuse of many fields likely did not involve the same individuals that originally used them, although this does not rule out use by descendents of the original plovers. Early in the nesting season, bareness of a field seems to be preferred over the precise nesting area of the previous year (J. S. Shackford, personal observation). For all years of our research on cultivated fields, however, we usually have found plovers in the same geographic areas as in previous years, suggesting that general site fidelity of individuals or small populations and/or their descendants may be high.

Shackford and coworkers (*3*) spent similar effort in Cimarron County in 1999 looking for mountain plovers on cultivated fields as in 1992-1994. We, therefore, believe counts in these 4 yr have comparative value. Although our results in 1999 were quite similar to those in 1994 (the year with the highest numbers of fields with plovers and total number of plovers), our counts may have been biased because field research began later in 1999 (10 June) than in earlier years (mid to late April). Thus, plovers, on average, were searched for in older, and therefore taller, crops or other vegetation, making searches more difficult in 1999. Also, in the earlier years, we tried to determine all plovers present on a field, particularly our study fields, whereas in 1999 we were primarily interested in presence/absence. After the first bird was found on a field, we normally moved on to permit adequate time to survey the remaining fields. Presumably, skill in finding plovers on cultivated fields in 1999 was increased over earlier years.

We have found mountain plovers most often on bare or nearly bare fields and least often in fields with standing crops >30 cm. However, cultivated fields that have standing crops cannot be dismissed as potential plover breeding habitat. Cryptically colored mountain plovers on bare fields are easier to see than in vegetated fields, but we have observed one mountain plover at an active nest in growing wheat 45 cm high and have seen or heard mountain plovers on at least three occasions in vegetation that was >60 cm. As noted above, our data in 1993-1994 suggested considerable site fidelity to a specific field within a given year, even if the crop had grown higher than 30 cm (J. S. Shackford, personal observation). Furthermore, for crops such as milo and corn, and to a lesser extent wheat, the ground surrounding a 30-cm tall crop is still mostly bare; for example, rows of milo are 75 cm apart.

Several of our past findings may be relevant to conservation of the mountain plover. In 1993 and 1994, we estimated plowing dates based primarily on crop and weed growth. We determined that in southern latitudes, mountain plovers on cultivated fields (n = 71) averaged at least one period without mechanical farming operations long enough to permit hatching of young. Courtship through hatching of young requires 46-50 days, while the longest period without farming operations averaged 55.8 days (range = 29-91 days). Furthermore, production of young, on average, was theoretically possible during the longest period without mechanical farming operations for all seven field types we surveyed (Table 1).

Farmers are bound by certain constraints, so that their methods are usually quite standardized. For example, they usually plant milo as a grain crop on or about 15 June, a necessity if the milo is to "head

TABLE 1. Mean number of days for the longest period without mechanical farming operations on cultivated fields with various crops in southern latitudes during the breeding season of the mountain plover (mid-April to mid-July).

Field type	*n*	$\bar{X}$ (d)	Range (d)
Bare	43	53.5	29-91
Milo	15	52.5	31-71
Wheat	4	89.8	86-91
Corn	3	51.3	35-61
Turned-under wheat	3	55.0	36-72
Milo stubble	2	72.0	53-91
Wheat stubble	1	48.0	

out" before the first frost. Likewise, winter wheat usually is planted in September or October and is not disturbed until the following June when it is harvested. We believe that many mountain plovers are successful at producing young during the longer intervals of no disturbance in southern latitudes because even if nests are destroyed by early cultivation, renesting almost always occurs, frequently on the field where the nest was lost (J. S. Shackford, personal observation).

We believe it is an open question whether populations of mountain plovers on cultivated fields in southern latitudes are helped or harmed by farming when averaged over several years in different locations. Our data suggest that breeding populations on cultivated fields in the Oklahoma Panhandle remained fairly stable from 1994 to 1999. We suspect that plover populations in at least part of Kiowa County in southeastern Colorado have been helped, on average, by farming operations because of the relatively large numbers of mountain plovers we found on cultivated fields there in 1993 and 1994 (*3*; Shackford and Leslie, unpublished data) compared with their apparent absence on cultivated fields in this same area in the late 1960s (*4*).

Populations of mountain plovers on cultivated fields may have several advantages over populations on native prairie. One of these may be low nest predation. We found a nest predation rate of only 3.3% on cultivated fields (*3*), far below the 62.5% rate Knopf and Rupert (*7*) found on native prairie on the Pawnee National Grassland. The primary predator of mountain plover nests there was the swift fox (*Vulpes velox*), also a candidate species for Endangered Species status (6).

Shade is an important habitat component for mountain plovers (*8*). Graul (*5*) found that temperatures of 27°C were lethal within 15 min when ≤5-d-old chicks were exposed to direct sunlight. Shackford (*8*) observed that during midday in hot weather, adult mountain plovers on cultivated fields actively sought out, and competed for, shade beneath sparse green vegetation. Knopf and Rupert (*9*) reported that mountain plovers in northeastern Colorado that had the opportunity to use either plowed or prairie surfaces, used both equally. In southeastern Colorado, however, we found that where both habitats were adjacent and both appeared suitable (i.e., short or little vegetative cover), mountain plovers preferred plowed ground. Seventy-one (87%) of 82 observations of adult or fledged plovers were on four plowed fields, with an additional nine unfledged young there; only 11 (13%) were on two native prairie pastures with no unfledged young (Shackford and Leslie, unpublished data). We suspect that one important difference between prairie habitats in northeastern and southeastern Colorado is the relative abundance of cacti and forbs on native prairies of northeastern Colorado, particularly on the Pawnee National Grassland (J. S. Shackford, personal observation). The general absence of such vegetation on native prairies in southeastern Colorado results in largely shadeless habitat.

We believe the wisest management approach is to work with farmers in southern

latitudes to learn the benefits and costs to the mountain plover of nesting on cultivated fields. Low-till (infrequent tilling) and no-till farming are gaining popularity among farmers as prudent anti-wind and anti-water erosion measures that save money. To eliminate all tillage, however, may be missing an opportunity to help the plover, because adults arriving on the breeding grounds each spring appear to select bare fields that have been recently tilled. Thus, tilling in late March-early April, prior to or shortly after the arrival of mountain plovers, combined with low- or no-till farming thereafter (to reduce the plowing up of nests) may be particularly effective in enhancing reproductive success of plovers. Finally, farmers should be encouraged to leave a small amount of growing vegetation on unplanted fields for use as shade.

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