Status of the Mountain Plover (*Charadrius montanus*) in Mexico

A special report submitted to
The U.S. Fish and Wildlife Service

August 31, 2010

Rocky Mountain Bird Observatory
PO Box 1232
Brighton, CO 80601
303.659.4348
www.rmbo.org
Tech. Report # I-MOUP-USFWS-10-01

ROCKY MOUNTAIN BIRD OBSERVATORY

***Mission**: To conserve birds and their habitats*

***Vision**: Native bird populations are sustained in healthy ecosystems*

***Core Values**: (Our goals for achieving our mission)*

1. ***Science** provides the foundation for effective bird conservation.*
2. ***Education** is critical to the success of bird conservation.*
3. ***Stewardship** of birds and their habitats is a shared responsibility.*

RMBO accomplishes its mission by:

- ***Monitoring** long-term bird population trends to provide a scientific foundation for conservation action.*
- ***Researching** bird ecology and population response to anthropogenic and natural processes to evaluate and adjust management and conservation strategies using the best available science.*
- ***Educating** people of all ages through active, experiential programs that create an awareness and appreciation for birds.*
- ***Fostering** good stewardship on private and public lands through voluntary, cooperative partnerships that create win-win situations for wildlife and people.*
- ***Partnering** with state and federal natural resource agencies, private citizens, schools, universities, and other non-governmental organizations to build synergy and consensus for bird conservation.*
- ***Sharing** the latest information on bird populations, land management and conservation practices to create informed publics.*
- ***Delivering** bird conservation at biologically relevant scales by working across political and jurisdictional boundaries in western North America.*

Suggested Citation:

Macias-Duarte, Alberto and Arvind Panjabi. 2010. Status of the Mountain Plover (*Charadrius montanus*) in Mexico. Rocky Mountain Bird Observatory, Brighton, CO, Special report submitted to U.S. Fish and Wildlife Service I-MOUP-USFWS-10-01. 17 pp.

***Cover Photo**:* Mountain Plover near Janos, Chihuahua. Photo by José Hugo Martinez Guerrero.

Contact Information:

Alberto Macias-Duarte alberto.macias@rmbo.org
Arvind Panjabi arvind.panjabi@rmbo.org
Rocky Mountain Bird Observatory
PO Box 1232
Brighton, CO 80601
303-659-4348

ACKNOWLEDGEMENTS

The Rocky Mountain Bird Observatory research cited in this report was made possible through support provided by the US Fish and Wildlife Service, USDA Forest Service International Program, and The Nature Conservancy (TNC), under the terms of TNC Contract number MBP120107 and USFWS Agreement No. CO-N131C. Additional funding was provided by the U.S.D.A. Rio Grande Research Center at Sul Ross State University, the Sonoran Joint Venture, and the Commission for Environmental Cooperation. The content and opinions expressed herein are those of the author(s) and do not necessarily reflect the position or the policy of the USDA Forest Service, the US Fish and Wildlife Service, The Nature Conservancy, the U.S.D.A. Rio Grande Research Station, Sul Ross State University, the CEC or the Sonoran Joint Venture and no official endorsement should be inferred. Implementation of field work for this project was made possible by the Facultad de Ciencias of the Universidad Autónoma de Nuevo León. The Nature Conservancy-Chihuahua provided facilities for training and field operations near Janos and Biodiversidad y Desarrollo Armónico (BIDA) provided similar support in Sonora. In addition, The Universidad Juárez del Estado de Durango, Pronatura Noreste, Pronatura Noroeste, and Profauna Coahuila conducted many of the field surveys.

BACKGROUND

Mountain Plovers are believed to have an extensive winter range in Mexico (Howell and Webb 1995, Knopf and Wunder 2006), but little is known about their abundance and distribution in much of this range. Since factors on the wintering grounds may be responsible for population declines observed in many migratory birds (Rappole and McDonald 1994), an extensive evaluation of the status of the Mountain Plover in Mexico is an indispensable component in considering the species' proposed listing. However, as in most neotropical migratory species, and particularly for Mountain Plovers, information on winter ecology is lacking or scarce.

The Mountain Plover is listed as a threatened species by the Mexican federal government (Secretaria de Medio Ambiente y Recursos Naturales 2002). In spite of the species' legal status, Mountain Plovers continue to face major threats in Mexico. In this regard, the objective of this report is to summarize the knowledge about Mountain Plovers in Mexico, with emphasis in survey data collected over the last five years in northern Mexico by Rocky Mountain Bird Observatory (RMBO) and Universidad Autónoma de Nuevo León (UANL).

WINTER ECOLOGY

Distribution

Mountain Plovers winter in northern Mexico but the species' distribution is poorly known (Knopf and Wunder 2006). Mountain Plovers have been found in Baja California and Sonora south of the well-known wintering grounds of California and Arizona (Monson and Phillips 1981, Rosenberg et al. 1991, Knopf and Rupert 1995, Wunder and Knopf 2003). However, published records only cover a few locations in that region. These records include 11 sightings of Mountain Plovers (11-65 plovers per sighting) on the Pacific coast near Vicente Guerrero (south

of Ensenada) in fall and winter of 2003-2010 (eBird 2010). In addition, 145 plovers were recorded on the coast near Ensenada in the winter of 1992 (Page et al. 1997). East of the Pacific slope, Mountain Plover records are even more infrequent with one record in each the Mexicali Valley in Baja California (Patten et al. 2001), the Sierra del Pinacate (Russell and Lamm 1978) and Bahía Adair (May 1976). The Mexicali Valley has similar habitat characteristics to the Imperial Valley, with more than 200,000 ha of irrigated farmland (Instituto Nacional de Estadística Geografía e Informática 1994), and appears suitable for wintering Mountain Plovers. However, surveys conducted by ProNatura Noroeste in the Mexicali Valley during the last three winters have yielded no observations of Mountain Plovers (O. Hinojosa-Huerta, pers. comm.).

The winter range of Mountain Plover extends through much of the Chihuahuan Desert in Mexico, including the states of Chihuahua, Coahuila, Durango, San Luis Potosi, Nuevo León and Zacatecas (Howell and Webb 1995). Within this range, however, recent surveys conducted by the Rocky Mountain Bird Observatory (RMBO), the Universidad Autónoma de Nuevo León (UANL) and others suggest that Mountain Plover populations may be limited primarily to two areas within the Chihuahuan Desert, the Janos grasslands in northwestern Chihuahua (Manzano-Fischer et al. 1999, Manzano-Fischer et al. 2006, Levandoski et al. 2009, eBird 2010) and the El Tokio grasslands in southern Coahuila and Nuevo León, northeast Zacatecas, and northern San Luís Potosí (Gonzalez Rojas et al. 2008, Levandoski et al. 2009). A 10-year bird monitoring effort conducted by the Peregrine Fund in the Valles Centrales region of Chihuahua found no Mountain Plovers; this effort consisted of surveys conducted eight times a year (three times during the winter) at each of 130 3-ha fixed area-search plots from 1998 to 2007 (Macias-Duarte et al. 2009). Mountain Plovers have apparently been found in the past in the Mapimí grasslands (Commission for Environmental Cooperation and The Nature Conservancy 2005) in the border

region of Chihuahua, Coahuila and Durango, although details on specific observations were not available at the time of this report, and recent surveys there by RMBO have not found any plovers there (Levandoski et al. 2009).

Patterns of abundance

An analysis of presence-absence data from 2007-2010 at RMBO grassland monitoring sites in Grassland Priority Conservation Areas (GPCA, Commission for Environmental Cooperation and The Nature Conservancy 2005, Fig. 1) and other large grasslands in Mexico (Fig. 1) suggest that Mountain Plovers are scarce within grassland in the region (Table 1). Mountain Plovers were observed on only 11 of 1,964 1-km transects surveyed at 653 randomly-located sites in desert grasslands. The probability of Mountain Plover occurrence in these grasslands was 0.55% (95% C.I.: 0.26-0.95%). Mountain Plovers were found only in the Janos and El Tokio GPCAs, the only two areas in Mexico currently harbouring populations of prairie dogs (*Cynomys* spp.). Within these sites Mountain Plover appear to be found primarily in association with prairie dogs; all detections were in native grasslands with prairie dog colonies.

Even within areas with prairie dog colonies, Mountain Plover occurrence is relatively low. RMBO data suggest that Mountain Plover probabilities of occurrence at El Tokio and Janos grasslands are 4.68% and 0.64%, respectively, with odds of occupancy at El Tokio are 7.64 times larger than at Janos (*t*-test $\beta = 0$ for variable *AREA:El Tokio* in a logistic regression model, $P = 0.01$). No yearly variation in occurrence was found from 2007-2010 in both areas (*t*-test $\beta = 0$ for factor *year* in a logistic regression model, $P = 0.66$), although abundance data suggests a decreasing trend (see below). We emphasize that the RMBO sampling design and methodology is designed to monitor regularly-occurring, fairly common bird species found in a broad variety

of grassland habitats in GPCAs and is not specifically designed to monitor low-density or specialized species such as Mountain Plovers. A more precise estimation of occurrence and abundance of Mountain Plovers in GPCAs would require other sampling designs appropriate for rare species, such as stratified adaptive sampling.

UANL has been conducting extensive winter surveys for Mountain Plover in the desert grasslands of Janos and La Soledad (part of El Tokio grassland complex) since the winter of 2004-2005 (Gonzalez Rojas et al. 2008). Both areas harbour high densities of prairie dogs (*C. ludovicianus* and *C. mexicanus*, respectively). UANL data suggest a possible decline in the density of wintering Mountain Plovers from 2005-2009 in each of these wintering grounds (*t*-test of $\beta = 0$ for variable *year* in a linear regression model, $P = 0.07$), with steepest declines at La Soledad (*t*-test of $\beta = 0$ for variable *year* and its interaction with *SITE:La Soledad* in a linear regression model, $P = 0.08$) (Fig. 2). The analysis and interpretation of the UANL dataset requires some caveats however, as the sampling area increased after the winter of 2006-2007, but reduced detectability further away from the transects was not accounted for. Therefore, a declining trend in plover densities at La Soledad may simply be an artifact of these methodological changes rather than a real trend. An analysis of the UANL data that includes the specific distances at which plovers were detected is needed to account for differential detectability across the two sampling schemes employed. RMBO survey data from the El Tokio GPCA suggest no temporal trend in Mountain Plover abundance from 2007 to 2010 (*t*-test of $\beta = 0$ for variable *year* in a weighted-by-sampling-effort linear regression model, $P = 0.99$, Fig. 3).

The scope of inference for winter population trend estimates from the analyses of UANL and RMBO datasets is further limited by the relatively short study period (4-5 years) and any inference beyond this period may be inaccurate. In addition, as with any low-density and

patchily-distributed species, rigorous monitoring of populations is difficult, especially over a short period of time. Continued monitoring is needed to adequately estimate Mountain Plover trends in the wintering grounds of Mexico.

The analysis of UANL data provides suggestive evidence of higher plover densities at La Soledad (*t*-test of $\beta = 0$ for variable *SITE:La Soledad* in a linear regression model, $P = 0.04$), a location that harbours the largest colony of *C. mexicanus*, the Mexican prairie dog (Scott-Morales et al. 2004). Applying the highest density estimate over the study period (21.1 plovers km^{-1} in the winter of 2005-2006) to the total extension of La Soledad (approximately 100 km^2), the wintering population of Mountain Plovers in La Soledad was approximately 2,110 individuals. This estimate appears to be reasonably comparable to the 1,500 wintering plovers estimated by the Western Hemisphere Shorebird Reserve Network in La Soledad (WHSRN 2010). This estimate becomes approximately 6,800 plovers if extrapolated to the total estimated area covered by Mexican prairie dog colonies at El Tokio grassland complex (322 km^2, Scott-Morales et al. 2004). The estimated population size of wintering Mountain Plovers in Janos in the winter of 2005-2006 was 1,435 plovers (Salinas 2006). Therefore, Janos and El Tokio together may have supported up to approximately 8,200 Mountain Plovers during the winter of 2005.

Habitat characteristics

Mountain Plovers respond to variation in habitat structure within prairie dog colonies where plovers are found, according to RMBO winter survey data from 2008. There is convincing evidence that the abundance of wintering Mountain Plovers at these sites decreases with increasing grass cover (*t*-test of $\beta = 0$ for variable *grass cover* in a Poisson regression model, $P =$

0.05). The number of Mountain Plovers decreased by 36% for each 10%-increase in grass cover (95% C.I.: 9-64% decrease). There is also suggestive but inconclusive evidence that the abundance of Mountain Plovers decreases as shrub cover increases (*t*-test of $\beta = 0$ for variable *shrub cover* in a Poisson regression model, $P = 0.14$). Low number of Mountain Plover detections in RMBO surveys in 2007 and 2009 prevents the modelling of habitat relationships during those years, and 2010 vegetation data was not available at the time of this report. These results show that Mountain Plovers have preferences for open habitats during the winter, and that plovers appear to prefer grasslands near prairie dogs. Mean grass cover and mean shrub cover at Mountain Plover sites were 13.99±4.38% and 0.28±0.16%, respectively. The species' low tolerance to grassy and shrubby areas in winter is also supported by observations that Mountain Plovers are more frequently found in perturbed grasslands in Janos, where overgrazing has depleted the grass cover (Salinas 2006). Other anecdotal observations by RMBO and others (B. Howe, pers. comm.) of Mountain Plovers on degraded rangelands in the Janos region, also support the notion that the species prefers areas with low grass and shrub cover, and may utilize such areas even in the absence of prairie dogs.

Contrary to Mountain Plovers in the northwestern Sonoran Desert, Mountain Plovers in El Tokio and Janos have not been documented using agricultural habitats in winter, including abandoned fields, fallow fields, or other available types. Biologists from UANL surveyed over 100 sites in agricultural areas in El Tokio in January and February of 2010 and found no Mountain Plovers (Allen-Bobadilla 2010), despite known populations wintering only a few kilometers away. No Mountain Plovers were detected at UANL survey locations in agricultural areas in Janos either (Salinas 2006), and the species has apparently not been observed on agricultural fields during the Ejido San Pedro Christmas Bird Count near Janos (B. Howe, D.

Krueper, D. Mehlman, pers. comm.), although locations of specific observations are not maintained for this survey.

BREEDING ECOLOGY

Distribution and abundance

Available information on Mountain Plover breeding biology previously suggested that the species' breeding range was limited to the United States. However, two nesting attempts by Mountain Plovers have been recently documented in Mexico, both in the gypsophilic grasslands of southeastern Coahuila and western Nuevo Leon (Desmond and Chavez-Ramirez 2002, Gonzalez-Rojas et al. 2006). The same authors further document the presence of paired and single birds during the Mountain Plover breeding season (July). These findings suggest the presence of a breeding population of Mountain Plovers in northeastern Mexico. Additional recent observations suggest that Mountain Plover may also nest 200 km south of this area in the Mexican State of San Luis Potosí (Luevano et al. 2010). The importance of Mexico to the persistence of breeding populations in the United States is unknown given the lack of information on population size and continental population connectivity, but this apparently resident population may represent a distinct population segment.

THREATS

Decline and extirpation of prairie dogs

Mexican and black-tailed prairie dogs promote the creation of open winter habitat for Mountain Plovers in northern Mexico (Ceballos et al. 2010). As revealed by RMBO surveys, wintering Mountain Plovers require open habitats with low grass cover and shrub cover, and are

found mainly in association with prairie dog colonies. Prairie dogs populations in Mexico have significantly declined from their historic levels. The distribution of the Mexican prairie dog suffered a dramatic 33% reduction from 1996 to 1999 and an overall reduction of 74% of its historic distribution (Scott-Morales et al. 2004). Black-tailed prairie dog colonies have retracted 73% in Janos since 1988 (Ceballos et al. 2010). Although both species of prairie dogs are listed as federally protected in Mexico, enforcement of existing environmental laws is lacking and prairie dog colonies continue to be destroyed. Destruction and fragmentation by agriculture reduces the size and survival of prairie dog colonies (Scott-Morales et al. 2004, Manzano-Fischer et al. 2006). Poisoning, drought, and overgrazing have also contributed to prairie dog population declines in Mexico (Ceballos et al. 2010).

Agricultural practices

Agricultural areas appear to be a primary wintering habitat for Mountain Plovers in southern California and Arizona and they harbour a significant proportion of the continental population in winter (Wunder and Knopf 2003). Therefore, the Mountain Plovers may be highly vulnerable to changes in agricultural practices in the region. Irrigated agriculture in the region extends south of the U.S. border into the Mexicali Valley of Baja California, but as mentioned earlier, there is little evidence to date of large wintering populations in the area.

RECOMMENDATIONS FOR CONSERVATION PRIORITIES

Given that Mountain Plover appears to be largely restricted to prairie dog colonies in Mexico, and these habitats areas have been demonstrated to support thousands of Mountain Plovers at times, conservation of prairie dog habitat is needed. Enforcement of Mexican

environmental regulations that are designed to protect both species of prairie dogs in Mexico (Secretaria de Medio Ambiente y Recursos Naturales 2002) and their habitats must be addressed. In this regard, the recent creation of state and federal natural protected areas encompassing prairie dog colonies in Nuevo León (Secretaria de Desarrollo Urbano y Obras Públicas del Estado 2002) and Chihuahua (Secretaria de Medio Ambiente y Recursos Naturales 2009) was a much-awaited step for conservation of both prairie dogs and Mountain Plover habitat in Mexico and hopefully will contribute to stop or reverse the trends in these species. Higher Mountain Plover occupancy rates at El Tokio compared to those at Janos may reflect the importance of large complexes of prairie dogs for Mountain Plovers. While both areas have suffered significant losses of prairie dogs, the area covered by prairie dog colonies at El Tokio is 322 km^2, while the area covered at Janos, once believed to be the largest prairie dog complex in the world, has been reduced to 155 km^2. Further investigations into how the landscape matrix, including the extent and contiguity of prairie dog towns and other suitable habitats, affects Mountain Plover occupancy may shed light on the reasons for these differences in occupancy rates and may reveal relevant information for Mountain Plover habitat management and conservation in Mexico.

Based largely on anecdotal observations, Mountain Plover appears to be a highly mobile species in winter, often travelling in flocks, presumably to optimize foraging strategies. Studies of Mountain Plover movements and time budgets, through use of telemetry, would provide much needed insight into how this species uses the landscape in winter, and the importance of various habitats.

Although RMBO and UANL surveys have found that wintering Mountain Plovers in Mexico are largely restricted to prairie dog towns, the use of heavily degraded rangelands, and even agricultural habitats, in other areas of the Chihuahuan Desert should not yet be ruled out.

Recent censuses of Mountain Plovers in agricultural lands in the Imperial Valley tallied 4,687 birds in January of 2007 and 2,955 birds in February of 2008 (K. Molina, Natural History Museum of Los Angeles County). We optimistically estimated a winter population of Mountain Plovers in the Chihuahuan Desert of about 8,200 individuals. Together, these figures account for, at most, 12,900 plovers in the wintering grounds. Given that the most recent estimate of the continental Mountain Plover is around 18,000 plovers (Andres and Stone 2009), current knowledge of wintering areas and habitats does not account for a third of the continental population. Thus, the winter distribution of this segment of the population remains a mystery. Therefore, additional survey efforts to identify other significant wintering areas and better understand the population size, distribution, and habitat use of Mountain Plovers in Mexico should be made a priority, as should the adequate protection and management of known wintering sites. In this regard, future efforts should focus both on quantifying the annual extent and size of wintering Mountain Plover populations at known sites, and targeting heavily grazed rangelands and agricultural habitats for additional surveys to identify new populations. Since Mountain Plovers heavily use agricultural areas in the Imperial Valley, agricultural areas in northern Baja California, the coastal plains of Sonora and Sinaloa, and throughout the northern Chihuahuan Desert states could be productive for future survey efforts. We also recommend reaching out to agricultural producers to learn more about the species distribution, promote awareness and encourage practices, including providing incentives, that are beneficial for its survival.

LITERATURE CITED

Allen-Bobadilla, J. 2010. Monitoreo Invernal de Aves Migratorias en Campos Agrícolas en el Área de El Tokio. Internal Report. Universidad Autónoma de Nuevo León, Monterrey, N.L.

Andres, B. A. and K. L. Stone. 2009. Conservation Plan for the Mountain Plover (*Charadrius montanus*), Version 1.0. Manomet Center for Conservation Sciences, Manomet, Massachusetts.

Ceballos, G., A. Davidson, R. List, J. Pacheco, P. Manzano-Fischer, G. Santos-Barrera, and J. Cruzado. 2010. Rapid Decline of a Grassland System and Its Ecological and Conservation Implications. Plos One **5**:e8562. doi:8510.1371/journal.pone.0008562.

Commission for Environmental Cooperation and The Nature Conservancy. 2005. North American Central grasslands priority conservation areas: technical report and documentation. Commission for Environmental Cooperation and The Nature Conservancy, Montreal, Quebec.

Desmond, M. J. and F. Chavez-Ramirez. 2002. Nest documentation confirms the presence of a breeding population of Mountain Plovers (Charadrius montanus) in north-east Mexico. Cotinga **17**:17–19.

eBird. 2010. eBird: An online database of bird distribution and abundance [web application]. Version 2. eBird, Ithaca, New York. Available: http://www.ebird.org.

Gonzalez Rojas, J. I., I. Ruvalcaba-Ortega, R. Canales-del-Castillo, A. Olalla-Kerstupp, and G. Ruiz-Ayma. 2008. Estudio y Conservacion de las Aves Vulnerables de los Pastizales del Noreste de Mexico. Universidad Autonoma de Nuevo Leon.

Gonzalez-Rojas, J. I., M. A. Cruz-Nieto, O. Ballesteros-Medrano, and I. Ruvalcaba-Ortega. 2006. First breeding record of a Mountain Plover in Nuevo Leon, Mexico. The Wilson Bulletin **118**:81-85.

Howell, S. N. G. and S. Webb. 1995. A Guide to the Birds of Mexico and Northern Central America. Oxford University Press, New York.

Instituto Nacional de Estadística Geografía e Informática. 1994. Panorama Agropecuario, VII Censo Agropecuario 1991, Aguascalientes, Mexico.

Knopf, F. L. and J. R. Rupert. 1995. Habits and Habitats of Mountain Plovers in California. Condor **97**:743-751.

Knopf, F. L. and M. B. Wunder. 2006. Mountain Plover (*Charadrius montanus*).*in* A. Poole, editor. The Birds of North America Online. Cornell Lab of Ornithology, Ithaca, NY.

Levandoski, G., A. Panjabi, and R. Sparks. 2009. Wintering Bird Inventory and Monitoring in Priority Conservation Areas in Chihuahuan Desert Grasslands in Mexico: 2008 results. Rocky Mountain Bird Observatory, Brighton, CO.

Luevano, J., E. Mellink, and M. Riojas-Lopez. 2010. Plovers Breeding in the Highlands of Jalisco, Aguascalientes, Zacatecas, and San Luis Potosi, Central Mexico. Western North American Naturalist **70**:121-125.

Macias-Duarte, A., A. B. Montoya, C. E. Mendez-Gonzalez, J. R. Rodriguez-Salazar, W. G. Hunt, and P. G. Krannitz. 2009. Factors Influencing Habitat Use by Migratory Grassland Birds in the State of Chihuahua, Mexico. Auk **126**:896-905.

Manzano-Fischer, P., R. List, and G. Ceballos. 1999. Grassland Birds in Prairie-dog Towns in Northwestern Chihuahua, Mexico. Studies on Avian Biology **19**.

Manzano-Fischer, P., R. List, G. Ceballos, and J. L. E. Cartron. 2006. Avian diversity in a priority area for conservation in North America: the Janos-Casas Grandes Prairie Dog Complex and adjacent habitats in northwestern Mexico. Biodiversity and Conservation **15**:3801-3825.

May, L. A. 1976. Fauna de los vertebrados de la región del Gran Desierto de Sonora. Anales del Instituto de Biología de la Universidad Nacional Autónoma de México, Serie Zoología **47**:143-182.

Monson, G. and A. R. Phillips. 1981. Annotated checklist of the birds of Arizona. 2 edition. University of Arizona Press, Tucson, Arizona.

Page, G. W., E. Palacios, L. Alfaro, S. Gonzalez, L. E. Stenzel, and M. Jungers. 1997. Numbers of Wintering Shorebirds in Coastal Wetlands of Baja California, Mexico Journal of Field Ornithology **68**:562-574.

Patten, M. A., E. Mellink, H. Gómez-de-Silva, and T. E. Wurster. 2001. Status and Taxonomy of the Colorado Desert Avifauna of Baja California. Monographs in Field Ornithology **3**:29-63.

Rappole, J. H. and M. V. McDonald. 1994. Cause and effect in population declines of migratory birds. Auk **111**:652-660.

Rosenberg, K. V., R. D. Ohmart, W. C. Hunter, and B. W. Anderson. 1991. Birds of the lower Colorado River valley. University of Arizona Press, Tucson, Arizona.

Russell, S. M. and D. W. Lamm. 1978. Notes on Distribution of Birds in Sonora, Mexico. Wilson Bulletin **90**:123-131.

Salinas, M. 2006. Poblaciones invernales de tres especies de aves: *Athene cunicularia*, *Charadrius montanus* y *Numenius americanus*, en la region de los pastizales de Janos, Chihuahua, Mexico. Universidad Autonoma de Nuevo Leon.

Scott-Morales, L., E. Estrada, F. Chavez-Ramirez, and M. Cotera. 2004. Continued Decline in Geographic Distribution of the Mexican Prairie Dog (*Cynomys mexicanus*). Journal of Mammalogy **85**:1095-1101.

Secretaria de Desarrollo Urbano y Obras Públicas del Estado. 2002. Decreto - Se declaran como Areas Naturales Protegidas, los 3 lugares conocidos como: "La Trinidad", "Llano La Soledad" y "La Hediondilla", ubicadas en el Municipio de Galeana, Nuevo León. Periódico Oficial, Gobierno del Estado de Nuevo León**, 14 de Enero de 2002**.

Secretaria de Medio Ambiente y Recursos Naturales. 2002. Protección Ambiental - Especies Nativas de México de Flora y Fauna Silvestres - Categorías de Riesgo y Especificaciones para su Inclusión, Exclusión o Cambio - Lista de Especies en Riesgo. Diario Oficial de la Federación**, 6 de marzo de 2002**.

Secretaria de Medio Ambiente y Recursos Naturales. 2009. Decreto por el que se declara como área natural protegida, con el carácter de reserva de la biosfera, la zona conocida como Janos, localizada en el Municipio de Janos, en el Estado de Chihuahua. Diario Oficial de la Federación**, 8 de diciembre de 2009**.

WHSRN. 2010. Llano de la Soledad (http://www.whsrn.org/western-hemisphere-shorebird-reserve-networkl). Accessed on 25 August 2010.

Wunder, M. B. and F. L. Knopf. 2003. The Imperial Valley of California is critical to wintering Mountain Plovers. Journal of Field Ornithology **74**:74-80.

Table 1. Monitoring effort (number of 1-km linear transects) by Rocky Mountain Bird Observatory in Grassland Priority Conservation Areas (GPCA) in Mexico from 2007 to 2010 and number transects with Mountain Plover detections (in parenthesis).

GPCA	2007	2008	2009	2010	Total
Lagunas del Este*	0	0	76	76	152
Cuatrocienegas	18	18	18	18	72
Cuchillas de la Zarca	24	96	96	102	318
Janos	73	78(**2**)	78	84	313(**2**)
Malpais*	0	0	0	36	36
Mapimi	23	71	76	78	248
Sonoita	0	12	36	36	84
El Tokio	9(**1**)	60(**3**)	62(**1**)	61(**4**)	192(**9**)
Valles Centrales	58	126	126	126	436
Valle Colombia	5	36	36	36	113
Total	210(**1**)	497(**5**)	604(**1**)	653(**4**)	1,964 (**11**)

* to be proposed as new GPCAs in 2010

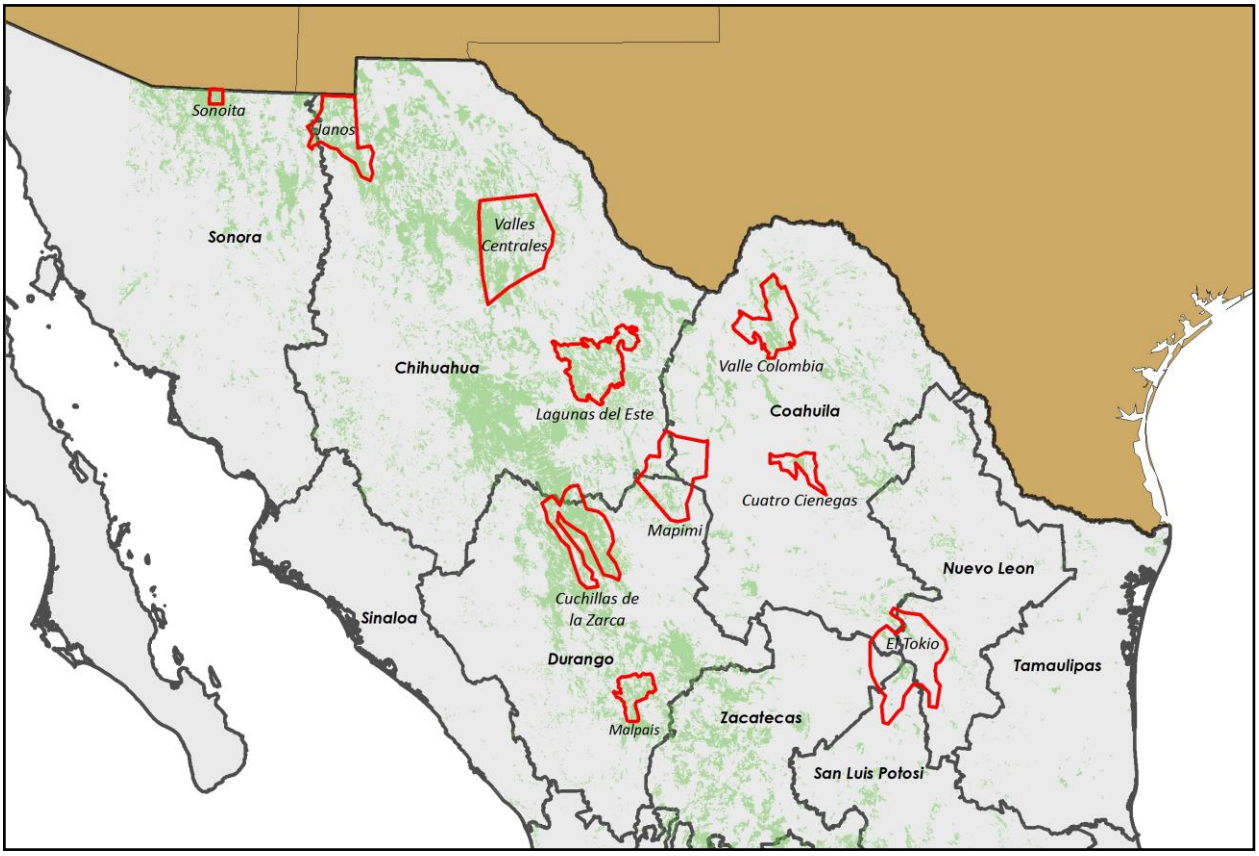

Fig. 1. Grassland Priority Conservation Areas (GPCA) in Mexico. Mountain Plovers have only been found by RMBO and UANL in GPCAs Janos and El Tokio.

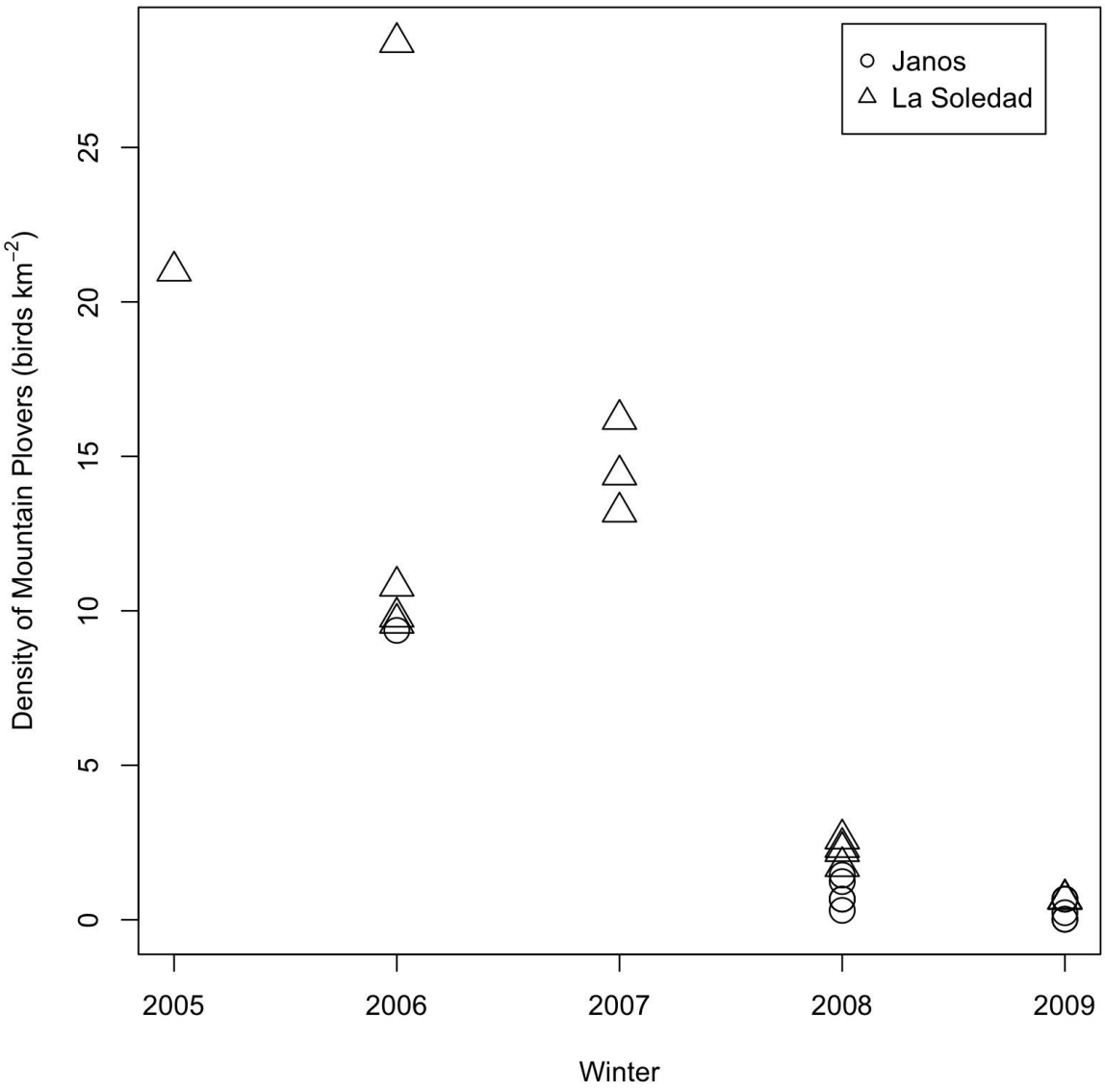

Fig. 2. Estimates of Mountain Plover density from the winter of 2005-2009. Sampling effort and methodology varies during the study period.

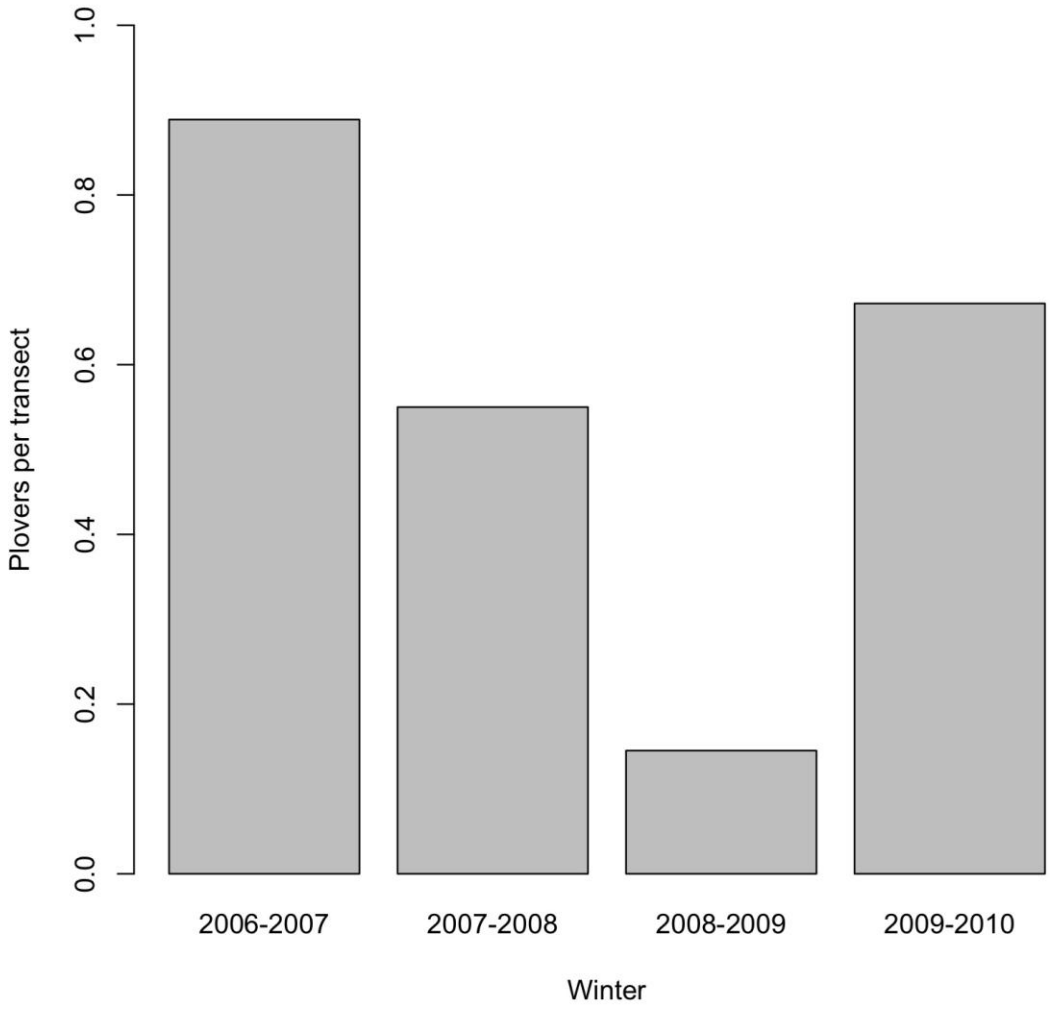

Fig. 3. Relative abundance (individuals per transect) of Mountain Plovers detected in RMBO winter bird surveys at El Tokio GPCA from winters of 2007 to 2010. Total number of transects for 2007, 2008, 2009, and 2010 are 9, 60, 62, and 61, respectively.