



CURRENT RAPTOR STUDIES IN MÉXICO

Edited by

Ricardo Rodríguez-Estrella



Centro de Investigaciones Biológicas del Noroeste, S.C.
Comisión Nacional para el Conocimiento y Uso de la Biodiversidad



Current Raptor Studies in México

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PREFACE

Biological diversity of México, raptors and scientific research

México is one of the most biologically diverse countries on the planet, as a result of its very complex geological history, geographic position, and environmental heterogeneity, among other factors. Its biological diversity is such, that together with 17 other countries such as India, China and Brazil, it is referred to as Megadiverse. Together, these countries sustain more than 70% of all living organisms, including plants, animals and microorganisms, México ranking first for its diversity of reptiles and amphibians, third for its mammalian diversity, fourth for its diversity of vascular plants, and eleventh for its diversity of birds. Moreover, a high percentage of the species, up to 65% in amphibians, are endemic to México; i.e. with geographic ranges restricted to the country.

The biological diversity of México has been part of the geographic and natural settings that have accompanied its inhabitants since they first settled in the country more than 12,000 years ago. The legendary diversity of the country has astonished scientists such as Baron Alexander Von Humbolt, who described México as a biological paradise. Unfortunately, this impressive natural diversity of the country is practically unknown by most Mexicans, who instead should be proud of their biological inheritance.

Nowadays, the biological diversity of México is seriously threatened. Hundreds of species and thousands of populations are endangered, mainly because of human population size and social inequity. México's population size is expected to become stable around 145 millions, but only in three decades. The loss of biological diversity has severe consequences at a biological and social level, because populations and species are the basis for the structure and functioning of biological systems, which provide us for free with environmental goods and services. These goods and services, which include the maintenance of a proper atmospheric gas composition, the ozone layer, soil fertility and quality and quantity of water, among others, generate the environmental conditions that allow life on Earth. They are the basis of our existence. Paradoxically, their continuance depends on our activities.

The only way to understand the complex relationships of living organisms with their environment, their role in providing environmental services, and better management of these living organisms to reconcile their use with their conservation, is through a solid investment in scientific research. However, many governments, including the Mexican government, surrender to the temptation of investing little in scientific and technological research, focusing on other approaches to fight social and economic problems. Those governments ignore that one of the few ways out of poverty is through the generation of scientific and technological knowledge, which is fundamental to the development of any country.

That is why I have received with great satisfaction this volume addressing the ecology and conservation of raptors – one group of species very sensitive to anthropogenic disturbances. As top predators, with low population sizes, raptors are susceptible to environmental changes that can affect them negatively, and thus increase the risk of their extinction. That is precisely why their status is an indication of environmental conditions, much like canary birds long ago used to indicate the presence of toxic gases to miners. The results presented by researchers working with raptors in México can have an immediate application in conservation.

The careful editing of the editor has produced an interesting book of high scientific quality. I am sure that time will be the best test of the benefits of this type of publications, which are essential to maintain the welfare of our society.

Gerardo Ceballos
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Resident and wintering populations of the burrowing owl (*Athene cunicularia*) in México

Ricardo Rodríguez-Estrella
Javier Bruno Granados Ruíz

ABSTRACT



The burrowing owl was officially listed as a threatened species in México in 1994, but was delisted in 2001. However, little is known of its current status and distribution and only scattered quantitative information of its abundance throughout México exists. There is no published information on estimates and trends of resident and wintering burrowing owl numbers in México. We present our information of burrowing owl local populations in the northwestern states of Chihuahua, Durango, and Sonora, and the Baja California Peninsula. Xerophytic scrub dominates the Durango and Sonora deserts, and a desert thicket dominates the Baja California desert. Sandy-clay and sandy soils are common in the areas where burrowing owls are found. Burrows were located in arroyos, dunes, and valleys, and were originally made by kangaroo rats, fox, badgers, coyotes, and desert tortoises. Our preliminary data indicate the most important threats for burrowing owls in México are habitat loss, burrow destruction by cattle, and poisoning. Official international agreements are needed to establish functioning cooperative programs between official agencies, universities, and research centers of the three countries

included in NAFTA and to find common strategies of natural resource management and conservation that can be presented to the appropriate national agencies within NAFTA. We also propose a study in México, involving local residents, to study the ecology and the threats to burrowing owls during winter seasons in the desert and coastal lowlands. Status, ecological requirements, feeding habits, and threats should be studied simultaneously at several locations. This information is crucial for its conservation.

Key words: burrowing owl, habitat, conservation management, *Athene cunicularia*, Durango, Chihuahua, Sonora, Baja California Peninsula, México

RESUMEN

La lechucita de madrigueras fue considerada como una especie amenazada en México en 1994. Al presente, ha sido sacada de esta lista, aunque se sabe poco sobre su estatus y distribución, existiendo poca información publicada sobre su abundancia en México. No hay información publicada sobre estimaciones en números y tendencias de las poblaciones residentes y migratorias en México. Se presenta información de poblaciones locales en Chihuahua, Durango, y Sonora, y de la península de Baja California. El matorral xerófilo domina los desiertos en Durango y Sonora, y un tipo de matorral desértico particular es el desierto de Baja California. Los suelos arenoso-arcillosos y arenosos son comunes en las áreas donde se han registrado las lechucitas de madrigueras. Las madrigueras donde anidan o pernoctan se han localizado en arroyos

secos, dunas y valles; éstas fueron originalmente construidas por ratas canguro, zorras, tejones, coyotes y tortugas del desierto. Nuestros datos preliminares indican que las amenazas más importantes para las lechucitas de madrigueras en México son la pérdida de hábitat, la destrucción de las madrigueras por el ganado, y el envenenamiento. Se requieren tratados internacionales oficiales efectivos con los que se puedan establecer programas funcionales de cooperación entre las agencias oficiales, universidades, y centros de investigación de los 3 países incluidos en el NAFTA (y la CCA). Es necesario encontrar estrategias comunes para el manejo de recursos y la conservación en particular que se puedan presentar a las agencias nacionales correspondientes dentro del NAFTA. También proponemos un estudio en México que involucre a los residentes de las áreas, para estudiar la ecología y las amenazas que enfrentan las poblaciones de lechucitas de madrigueras durante la estación de invierno en el desierto y zonas costeras. El estatus, requerimientos ecológicos, dieta, y las amenazas deberían ser estudiadas simultáneamente en varias localidades. Esta información es crucial para establecer medidas de conservación.

INTRODUCTION

The burrowing owl (*Athene cunicularia*) ranges from Canada to Argentina, mainly occurring in grasslands and arid lands throughout its territorial range (Haug *et al.* 1993). The burrowing owl is a relatively well-studied species throughout its northern breeding range, but little is known of its wintering grounds (Wellicome and Holroyd 2001). Very

little is known of its current status, distribution, and ecology throughout México. There is no published information on estimates and trends of resident and wintering populations in México. Only scattered quantitative information of its abundance exists (Holroyd *et al.* 2001). Estimating population trends is particularly relevant for the burrowing owl because its current status in most of its northern territory is endangered or declining in part of this distribution (see Holroyd *et al.* 2001).

The burrowing owl has been listed as a threatened species in México (NOM-059-ECOL-1994), but has been delisted recently (NOM-059-ECOL-2001). It is unclear whether a population decline has occurred in México and, if it is true, we do not know the extent of this decline. If a population decline existed in México, it is unknown how the decline is happening because this species has been poorly studied. Most works related to this owl in México are anecdotal, mainly distributional records, with only a few referring to its ecology (see Clark *et al.* 1997). For instance, we found only one publication on productivity and feeding habits (Rodríguez-Estrella 1997).

Without adequate information, it is not possible to determine the current status and population trends of resident and wintering populations in México. This information is crucial if we want to take actions to stop or reduce further declines in burrowing owl populations.

In this paper, we present information on the current knowledge of northern México's burrowing owl populations and discuss the areas where resident and migrant populations have been found. Few studies have previously been done with Mexican

resident populations (Rodríguez-Estrella 1994, 1997). The relative importance of México for wintering burrowing owls had been previously recognized (James and Ethier 1989, Enriquez-Rocha 1997, Valdez and Holroyd 2000).

METHODS

Our accounts on habitats, breeding, and winter distribution of burrowing owls were based on an extensive search of the literature and field studies made in different locations over about 10 years time. Partial information on their ecology has been published (Rodríguez-Estrella *et al.* 1983, Rodríguez-Estrella and Ortega 1993, Rodríguez-Estrella 1997, Valdéz 2003; a detailed description of the studied areas and methods can be found in these publications).

RESULTS

Information on burrowing owls in México

According to the literature, museum specimens, and recent scattered surveys, the burrowing owl seems to be widely distributed in México, especially in northern arid regions, and is common in a few localities (Fig. 1, Table 1). Unfortunately, only a few studies have described their habitat. For example, Enriquez-Rocha (1997) and Enriquez-Rocha *et al.* (1993), in an extensive work, compiled and analyzed data on 279 burrowing owls in 27 museum collections (21 outside of México), and found that they were widely distributed, present in 28 of 32 states of México. However, accurate

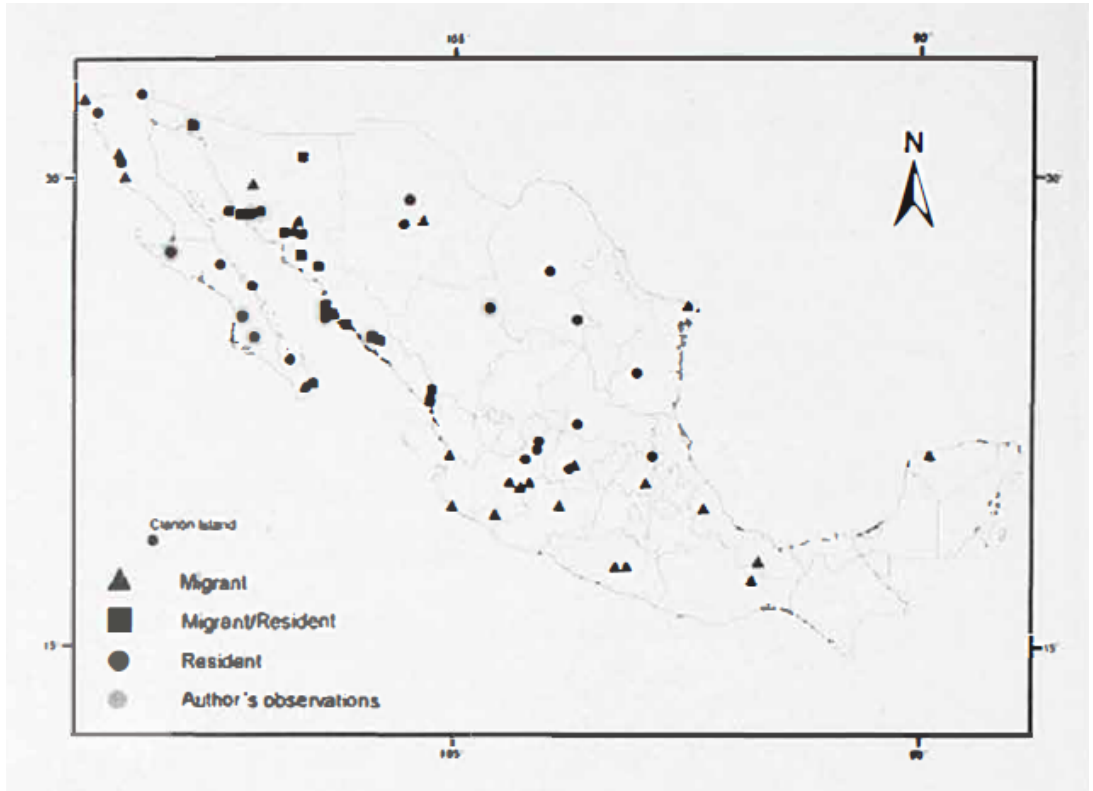


Figure 1. Resident and wintering populations of burrowing owls in México. Data comes from museum specimens, literature, and authors' records.

information is not available, the data does not specify the habitat type where the specimens were found.

In our surveys of Durango, Sonora, and Baja California, we can now provide a general assessment of the status of the burrowing owl in those localities of northern México States where we studied their populations in a brief period of time. We can also evaluate the habitats where they occur seasonally.

Table 1. Distribution of burrowing owls in México from 1 (Macouzet 1993); 2 (Rodríguez-Estrella 1997); 3 (Rodríguez-Estrella *et al.* 1983); 4 (Valdez 2003); * (Authors' observations); KU (Colección de Aves y Mamíferos del Valle de Cuatrociénegas; MVZ (Museum of Vertebrate Zoology, University of California, Berkeley); MZFC (Museo de Zoología de la Facultad de Ciencias, UNAM); MCZ (The Museum of Comparative Zoology, Harvard University); CAS (California Academy of Sciences, San Francisco). The high number of records given in Palacios *et al.* (2000) for the peninsula of Baja California are not included in this table, but in Appendix 1.

state	location	museum	status
Baja California	San Ramon, mouth of Río Santo Domingo	MVZ	Resident ?
	Alamo River, 20 mi SW Pilot Knob	MVZ	Resident ?
	Tijuana	MVZ	Migrant ?
	No Location	MVZ	Migrant ?
	Guadalupe	MCZ	Resident ?
	San Quintin	MCZ	Resident ?
	El Rosario	MCZ	Migrant ?
	San Pedro Nolasco	CAS	Resident ?
	Clarion	MCZ	Resident
Baja California Sur	No Location	MVZ	Resident ?
	Arroyo Malarrimo	*	Resident
	Arroyo San José de Castro	*	Resident
	Cd. Constitución	*	Mig/Res
	Eureka	MCZ	Mig/Res
	San Javier	MCZ	Mig/Res
	La Paz	MCZ	Migrant
	Miraflores	MCZ	Migrant
	Ildefonso	MCZ	Mig/Res
	Llanos de Hyrais	*	Mig/Res
Chihuahua	Chihuahua	MCZ	Migrant ?
	Cerro Campana	MVZ	Resident ?
	Laguna Bustillos	1	Resident?
Coahuila	Cuatrociénegas - 14.4 km E, 1.8 km S from Cuatrociénegas	KU	Resident
	Saltillo	1	Resident ?
Colima	Plains of Colima	MCZ	Migrant ?
Durango	Mapimi	2	Resident
Guerrero	Chilpancingo	1	Migrant ?
	Omilteme	MVZ	Migrant ?
	Chilpancingo	MCZ	Migrant ?
Guanajuato	Valencianita (Irapuato)	1	Migrant

Table 1. *Continued.*

state	location	museum	status
Hidalgo	Actopan	1	Migrant ?
	San Salvador	1	Resident?
Jalisco	El Guayabo (Pegueros)	4	Migrant
	Paso de Trujillo (San Juan de Los Lagos)	4	Migrant
	Potrero La Cantera (Encarnación de Díaz)	4	Migrant
	Chamela	1	Migrant ?
	La Barca	1	Migrant ?
	Lago Chapala	1	Migrant ?
Michoacán	Pátzcuaro	1	Migrant ?
	Escuinapa	MCZ	Migrant ?
Morelos	El Cedral	1	Migrant ?
	Alejandra	1	Migrant ?
Nayarit	Las Varas	1	Migrant ?
ND	Clarion	MCZ	Migrant ?
Oaxaca	Tutla	1	Migrant ?
	San Pablo	1	Migrant ?
	Villa de Mitla	1	Migrant ?
Sinaloa	16 km SE Topolobampo	MZFC	Mig/Res
	Ahome	MZFC	Mig/Res
	Boca del Río Sinaloa	MZFC	Mig/Res
	Culiacan	MZFC	Mig/Res
	Chele	MZFC	Mig/Res
	Escuinapa	MZFC	Mig/Res
	Estación Biteruto, before El Tamarindo, near San Blas	*	Mig/Res
	Road to El Maviri SW from Topolobampo	*	Mig/Res
Ahome	CAS	Migrant ?	
San Luis			
Potosí	San Luis Potosí	MCZ	Resident
Sonora	Arenas, near	MZFC	Mig/Res
	Bacuachi	MZFC	Mig/Res
	Pinacate	3	Mig/Res
	Bahía Kino	MZFC	Mig/Res
	Cd. Obregón	MZFC	Mig/Res
	Isla San Esteban	MZFC	Mig/Res
	La Bonancita	MZFC	Mig/Res
	Las Arenas	MZFC	Mig/Res
	Tesia	MZFC	Mig/Res

Table 1. *Continued.*

state	location	museum	status
	Road to Puerto Libertad	*	Mig/Res
	Bacuachito	MCZ	Migrant ?
	Bonancita	MCZ	Migrant ?
	Arenas	MCZ	Migrant ?
Tamaulipas	Cd. Victoria	1	Resident
	Altamira	MCZ	Migrant ?
	Matamoros	MCZ	Migrant ?
Veracruz	Achotal	1	Migrant ?
	Mountains of Coatepec	MCZ	Migrant ?
Yucatán	San Ignacio	MCZ	Migrant ?
Zacatecas	La Cinta (Mpio de Pinos)	4	Migrant ?

1. Existing ecological information about burrowing owls in México

Durango: The northeastern part of this state is part of the Chihuahuan Desert. Information on its summer and winter status in the Mapimi Biosphere Reserve is available. Breeding performance, nest-habitat preferences, kinds of nest-burrows, diet during the breeding season (Table 2), and threats (Table 3) have already been described (Rodríguez-Estrella 1997, Rodríguez-Estrella and Ortega 1993, Table 2). Currently, analyses of the winter diet and use of burrows are in progress (Rodríguez-Estrella, Holroyd, and Uranga unpubl. data).

Chihuahua: New information on occurrence, habitat characteristics, and limited data on diet during the winter in the grasslands of Chihuahua has been published elsewhere (i.e. poisoning, habitat loss, grazing; Chávez-Ramírez 1990) (Fig. 1, Table 1). The important threats to burrowing owls have been previously defined (Chávez-Ramírez

1990).

Sonora: We have information of a population located in northwestern Sonora, the Pinacate area within the Sonora Desert. Only limited information about occurrence, habitat characteristics, diet, and threats is available (Rodríguez-Estrella *et al.* 1983, Hiraldo, Delibes, Rodríguez-Estrella, and Donázar, unpubl. data; Table 3).

Table 2. Habitat characteristics of burrowing owl populations of northern México. The status and productivity are given for known populations.

area	Habitat	status	Productivity
Durango (Mapimí) 20,000 Ha	Xerophytic scrub desert: <i>Larrea</i> , <i>Hilaria</i> , <i>Prosopis</i> . Soils: Sandy-clay. Topography: valleys with small hills, arroyos. Precipitation: 230 mm. Temperature: 11-28°C. Known nesting burrow preferences: Kangaroo rat, fox, badger, coyote, and desert tortoise burrows	stable ± 40 pairs	1.2 + 1.1 fledglings/ attempts
Sonora (Pinacate)	Xerophytic scrub: <i>Croton</i> , <i>Larrea</i> , <i>Baccharis</i> , <i>Ambrosia</i> , <i>Fouquieria</i> . Soils: Sand Topography: valleys, dunes, arroyos. Precipitation: 50-120 mm. Temperatures: 10-30°C. Nest burrow preferences: unknown, possibly fox, coyote, and kangaroo rat burrows	stable ± 15 pairs	?
Baja California (Vizcaino)	Desert thicket: <i>Asclepias</i> , <i>Fouquieria</i> <i>Larrea</i> , <i>Encelia</i> , <i>Ambrosia</i> . Soils: Sandy Topography: gentle hills, dunes, arroyos. Precipitation: 92 mm. Temperatures: 18-22°C. Nest burrow preferences: fox, badger, coyote, and kangaroo rat burrows	stable ± 10 pairs	?

Baja California Peninsula: the burrowing owl is a widespread, but uncommon resident throughout the length of the peninsula (Palacios *et al.* 2000). The population in

the Vizcaino Desert in the center of the peninsula has been studied during all seasons and information is available on occurrence, nest habitat preferences, burrow types, feeding habits during the breeding and wintering periods (Table 2), and threats (Table 3). Wintering owls have also been found throughout the peninsula (Palacios *et al.* 2000, Rodríguez-Estrella, unpubl. data; Fig. 1).

Xerophytic scrub dominates the Chihuahuan and Sonoran Deserts and a subtropical desert chaparral dominates the southern third of the Baja California Peninsula (Table 2). Sandy-clay and sandy soils are common in the areas where burrowing owls are found. Burrows were located in arroyos, dunes, and valleys, originally constructed by kangaroo rats *Dipodomys* spp., foxes *Urocyon cinereargenteus* and *Vulpes macrotis*, badgers *Taxidea taxus*, coyotes *Canis latrans*, and desert tortoises *Gopherus flavomarginatus* (Table 2).

Table 3. Threats to burrowing owl populations in some regions of México.

population	threats
Durango	Loss of habitat, burrow destruction by cattle, pesticides in areas with intensive agriculture in central Durango
Sonora	Destruction of burrows by cattle, pesticides in areas with intensive agriculture, loss of habitat in central and southern coastal Sonora, probably sport hunting
Baja California	Probably pesticides in areas with intensive agriculture; in northern populations, possibly loss of habitat and destruction of burrows by cattle

2. Loss and degradation of habitat, a potential problem leading to population decline

México has one of the highest rates of loss of biodiversity in Latin America from

loss and degradation of habitats (SEMARNAT 2003). Although little information is available on habitat preferences of burrowing owl populations in México, we frequently found them in the xerophytic scrub habitats of northern México during the breeding and wintering seasons (Table 1). We also found owl pairs among dune vegetation near the coast (Table 1, Fig. 2). However, burrowing owls use a variety of habitats, from undisturbed areas to disturbed grassland and cultivated areas (Figs. 1 and 2).

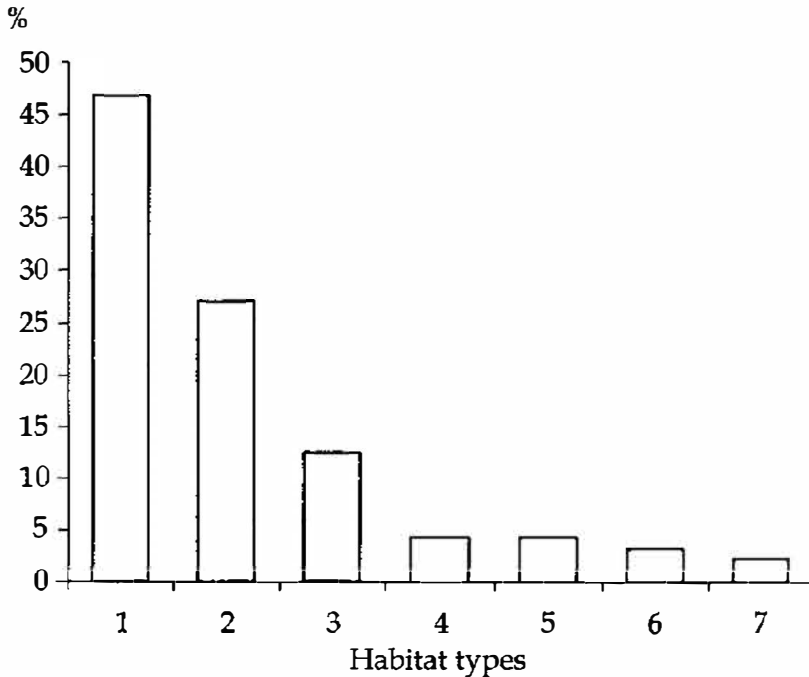


Figure 2. Habitats where burrowing owls have been recorded in México, both during resident and migration periods. 1. suburban and cultivated areas; 2. sarcocaulescent scrub, thorn scrub, and subtropical, tropical deciduous wooded savanna, riparian woodlands, and xerophytic desert scrub; 3. microphyllous scrub, gypsophilous and halophilous vegetation, halophilous vegetation and vegetation associated with sandy soils; 4. tropical medium-height forest, cloud forest, pine forest, and tropical rainforest; 5. chaparral and coastal sage scrub; 6. grassland and open areas; 7. mangrove

Xerophytic scrub in México is being converted to agricultural and ranching uses and coastal vegetation is also lost to tourist facilities. The grassland vegetation has been heavily disturbed by cattle raising and agriculture (SEMARNAT 2003). It is expected that this dramatic change will affect distribution of the burrowing owl, including a decline in the number of resident and migrating populations (see Holroyd *et al* 2001). In spite of continual habitat losses, xerophytic scrub covers a very large area of northern México and, in many areas, is well preserved. This may assure stability of many burrowing owl populations in the short to medium term. Studies of habitat preferences of resident and wintering populations in México are still needed to determine which areas are at risk, so that most populations will be conserved. Also, studies on habitat use of burrowing owls in agriculture and town locations could help to determine the risks owl populations will face in the near future. Of particular concern is the high number of records of burrowing owl in, or near agricultural and town locations (Fig. 2); populations should be evaluated in these areas.

3. Identifying wintering areas, understanding wintering ecology, and establishing international agreements

Most burrowing owl populations seem to be resident, but researchers demonstrated that populations from the USA and Canada overwinter in México (James and Ethier 1989, Holroyd and Trefry 1998). Overwintering populations have been recorded in Guanajuato, Tamaulipas, Coahuila, Chihuahua, the Baja California

and Veracruz (Holroyd *et al.* 2001, Palacios *et al.* 2000). Most wintering populations have been recorded and collected in central and southern México (Fig. 1, Table 1). At present, international agreements between México, USA, and Canada have been few and have not had continuity, although international agreements officially exist in all countries.

Very little information has been published on the ecology and threats to burrowing owl populations in México. Our preliminary data indicate that the most important threats are habitat loss, burrow destruction by cattle, and poisoning. However, the information available is limited and obtained only on a local scale. Data on degradation of habitats for breeding and wintering populations on a regional scale is needed. Information of the effects of pesticides and contaminants and land-use changes where burrowing owls are present is also needed.

Specific information on the effects of human activity and environmental factors on the biology and habitat use of burrowing owls is lacking. Some raptors may take advantage of areas containing crop fields, particularly migrant species in their wintering areas, to exploit abundant food sources (i.e. insects, rodents) (Rodríguez-Estrella *et al.* 1998). However, intensive cultivation of grasslands is recognized as a cause of declining owl populations (Haug *et al.* 1993). We found some pairs of burrowing owl nesting at the edge of crop fields, where they fed on small mammals and invertebrates (e.g., near Ciudad Constitución, Baja California Sur). Information on owls during overwintering is increasing, but is still very scarce. Particular studies on the effects of land use changes

and habitat degradation on burrowing owl resident and withering populations are urgently needed.

Any conservation plan for burrowing owls in México requires baseline information on distribution, habitat preferences, feeding habits, and identification of threats on the local and regional level on a seasonal and long-term basis and different spatial scales. We also need information on the economic needs of landowners. This information is crucial for conservation programs. More detailed information can be found in Holroyd *et al.* (2001).

Another important issue needed for conservation is to establish more international agreements. One important step to achieve this is to establish functional cooperative programs between government agencies, universities, and research centers of the three NAFTA nations, and to find common strategies for natural resources management and conservation that can be presented jointly to the appropriate national agencies in these countries. Conservation of burrowing owls throughout their range depends on the evaluation of threats at a regional scale, giving solutions at this scale.

We propose an international study in México, including Canada, USA, and México research teams to study the ecology and threats facing burrowing owls during the winter (see Holroyd *et al.* 2001). The study could start in northern México and spread through the central desert areas and coastal lowlands. Status, ecological requirements, feeding habits, and threats could be studied simultaneously at several locations. Geographical Information Systems will help with spatial analysis. Modeling of

human-related factors to determine the effects of human activities (agriculture, deforestation, ranching, poisoning) on burrowing owl populations could help us understand the threats of these activities on the persistence of the species at the regional scale.

CONCLUSION

Little is known of the status and distribution of burrowing owl populations in México, and only scattered quantitative information of abundance throughout its range exists. Conservation of northern migrant populations in México depends primarily on the knowledge of the habitats that owls are using in the winter. Since 1992 (Lincer 1997), little has been added to our understanding of breeding and wintering burrowing owl populations in México. However, we propose that the burrowing owl be officially listed again as a threatened species in Mexico. Its decline in Canada and in the northern populations of the USA justify this proposal because we need to establish conservation actions at regional scale, including Mexico, for wintering populations of this species.

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Appendix 1. Historical and recent records of burrowing owls on the peninsula of Baja California and Sonora, México. Modified from Palacios *et al.* 2000. The "?" indicates the status is not completely confident.

state	location	status	vegetation
Colorado Delta Region			
BC	Alamo River	Migrant?	Riparian
	Ejido Hermosillo	Migrant?	Agricultural
	Mexicali	Resident	Agricultural
	Colonia Robledo	Resident	Agricultural
	Cerro Prieto	Resident	Agricultural
	Between ejidos Nayarit and Sonora	Migrant?	Agricultural
	Río Hardy	Migrant/Resident	Riparian
	Cucapa Indigena	Migrant/Resident	Riparian
	Between Rancho El Caiman and Highway	Resident?	Riparian
	Ejido Monterrey	Resident?	Riparian
	El Mayor	Resident?	Agricultural
	Yuri Muri. south of Mexicali	Resident?	Agricultural
	San Felipe road	Resident?	Desert
SON	N of Estación Coahuila	Resident	Agricultural
	Mexicali Valley	Migrant?	Agricultural
	Ciénaga de Santa Clara	Resident	riparian
	Bordo Lerma	Migrant?	Agricultural
	Colorado delta region	Uncommon	Desert & agricultural
Northwestern Baja California			
BC	Rancho Neji	Resident?	Riparian
	Tecate	Resident?	Agricultural
	Tijuana	Migrant?	Coastal sage scrub
	Playas de Tijuana	Resident	Coastal sage scrub
	Rosarito	Resident	Coastal sage scrub
	San Antonio de Las Minas	Migrant?	Agricultural
	Between El Tigre and San Antonio de Las Minas	Resident?	Agricultural
	N of Ensenada	Resident?	Coastal sage scrub
	Mounth of Arroyo Ensenada	Migrant?	Coastal sage scrub
	Sand Dunes	Migrant?	Sand Dunes
	Laguna El Ciprés	Resident	Agricultural
	El Ciprés Airport	Resident?	Agricultural
	On road to Punta Banda, just south of Ensenada	Migrant?	Irrigation Dike
	Meneadero	Resident?	Agricultural
	Estero Punta Banda	Migrant/Resident	Wetland

Appendix 1. *Continued.*

state	location	status	vegetation
	Valle de Maneadero	Resident	Agricultural
	Punta Banda, between La Bufadora and Villarino	Migrant?	Chaparral/grass edge
	Ojos Negros	Resident	Riparian
	Real del Castillo	Resident	Riparian
	Marsh north of Ojos Negros	Resident	Agricultural
	Santo Tomas	Resident?	Agricultural
	N of San Vicente	Resident	Agricultural
	7 km N of San Vicente	Resident	Agricultural
	San Antonio del Mar	Resident	Coastal sage scrub & Agricultural
	Punta Colonet	Resident?	Coastal sage scrub
	San Telmo	Resident?	Agricultural
	Bocana de Santo Domingo	Resident?	Riparian
	Field northeast of Laguna Figueroa	Resident?	Agricultural
	Laguna Figueroa south	Resident?	Wetland
	Bahía de San Quintín	Resident?	Coastal sage scrub-Desert
	San Quintín valley	Resident?	Agricultural
	San Quintín	Resident	Agricultural
	Mouth of Cañón de Agua Chiquita	Resident	Coastal sage scrub
	Bahía de San Quintín. Muelle Viejo	Resident	Coastal sage scrub
	Bahía de San Quintín, saltpond	Resident	Coastal sage scrub
	Bahía de San Quintín. Punta Azufre	Resident	Wetland
	San Quintín, English Graveyard	Resident	Wetland
	Bahia San Simon north	Resident	Wetland
Central Desert of Baja California			
BC	El Rosario	Migrant?	Desert
	Near San Fernando	Resident?	Desert
	"San Jabier" (San Javier)	Resident?	Desert
Vizcaino Desert			
BCS	Guerrero Negro	Resident	Desert
	E shore of Estero San Jose, W Guerrero Negro	Resident	Old Salt Works
	Estero de San José W of Guerrero Negro	Resident	Old Salt Works
	Laguna San Ignacio	Resident	Desert and Wetland
	Laguna San Ignacio. El Cardón	Resident	Desert
	Laguna San Ignacio, El Delgadito	Resident	Wetland
	Isla Pelicanos	Migrant	Desert
	Road to Punta Abreojos	Resident	Desert

Appendix 1. *Continued.*

state	location	status	vegetation
	Loreto	Resident?	Desert
	Bahia Magdalena	Resident	Desert
Cape Region			
BCS	La Paz	Migrant	Desert
	19 km N of La Paz	Migrant	Desert
	Ejido Chametla	Migrant	Desert
	Ejido Alfredo V. Bonfil	Migrant	Abandoned field
	3 Km N of El Centenario	Migrant	Desert
	Todos Santos	Migrant	Desert
	Miraflores	Migrant	Subtropical deciduous scrub
	Eureka	Migrant	Subt. deciduous scrub
	San José del Cabo	Migrant	Subt. deciduous scrub
	Cabo San Lucas	Migrant	Subt. deciduous scrub
Offshore islands of Baja California peninsula (including those belonging to Sonora)			
BC	Los Coronados	Resident?	
	Todos Santos	Not Uncommon	
	San Martin	Migrant?	
	Guadalupe	Resident?	
	San Jerónimo	Resident?	
	San Benitos	Not Common	
	Cedros	Migrant?	
	Natividad	Resident	
BCS	Magdalena	Resident?	
	Santa Margarita	Resident?	
	Angel de la Guarda	Resident?	
	Piojo	Resident?	
	Cardonosa	Resident?	
	Rasa	Resident?	
	Salsipuedes	Resident?	
	San Lorenzo Norte Las Animas	Resident?	
	Tortuga	Migrant?	
	San Ildefonso	Migrant?	
	Cerralvo	Resident?	
	Coronados	Migrant?	
SON	San Esteban	Common Winter Visitant	
	Tiburón	Common Winter Visitant	
	San Pedro Mártir	Resident?	