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BREEDING COLONIES OF LEAST TERNS (*STERNULA ANTILLARUM*) IN NORTHERN SONORA, MEXICO, 2006–2008

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Abstract—We document distribution of breeding least terns (*Sternula antillarum*) in northern Sonora, Mexico, 2006–2008. We report breeding activity at six sites with active colonies, including three previously undocumented colonies.

Resumen—Documentamos la distribución del charrán mínimo (*Sternula antillarum*) reproduciéndose en el norte del estado de Sonora, México, 2006–2008. Reportamos actividad reproductiva en seis sitios con colonias activas, incluyendo tres colonias no documentadas anteriormente.

The least tern (*Sternula antillarum*) is federally protected in Mexico (Secretaría de Medio Ambiente y Recursos Naturales, 2010) and its nests on barrier beaches and peninsulas are susceptible to pressure from encroachment by humans. Limited information is available on distribution and numbers of least terns nesting in Sonora, Mexico. Starting in 1991, parts of the northern coast of Sonora were surveyed sporadically (Mellink and Palacios, 1993). A colony at La Purinera, estimated at 200 nesting pairs, was surveyed intermittently during 1991–1995 (Palacios and Mellink, 1996; Zuria and Mellink, 2002, 2005). Two small colonies at Morúa East and West also were recorded in 1992 (Alcock, 1992; Mellink and Palacios, 1993). Two pairs of terns in 1991 and one pair in 1992 were recorded nesting in the salt flat west of Bahía Adair (Mellink and Palacios, 1993). Two other small

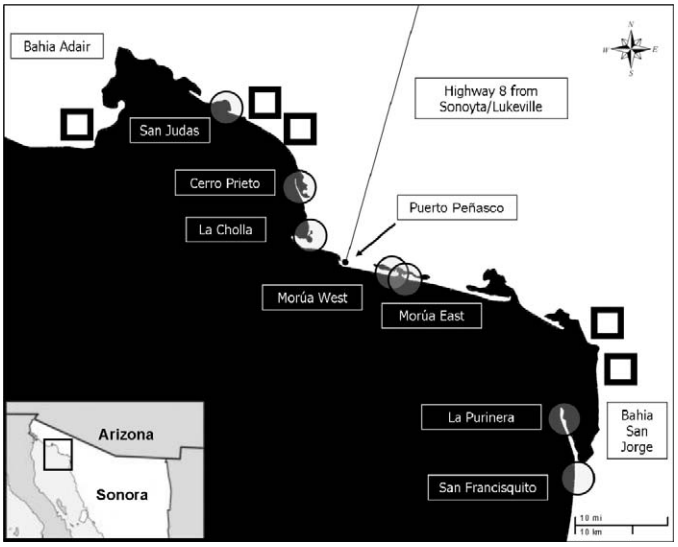

FIG. 1—Sites with breeding colonies of least terns (*Sternula antillarum*) on the coast of Sonora, Mexico, 2006–2008. Circles are centered on sites occupied ≥1 year during 2006–2008. Squares indicate salt flats with no evidence of nesting.

colonies were recorded in 1991 and 1992: one in Estero San Francisquito, adjacent to Bahía San Jorge, and one in Estero Los Tanques, 60 km to the south. Bahía Adair potentially is an important nesting area for least terns, although locations of colonies have never been identified (R. Brusca et al., in litt.). Occupancy of potential sites in the estuaries of Almejas, La Pinta, Cholla Bay, Cerro Prieto, and in the wetland of the Bahía Adair complex has not been studied; no other information is available on distribution of colonies of least terns along the coast of Sonora (Russell and Monson, 1998).

We designed our survey to fill a gap in the reported distribution of breeding least terns on the Sonoran coast of the northern Gulf of California. Our survey was a necessary first step in evaluating status of the species and in assessing the contribution that this region makes to populations of the species in the Gulf of California.

We surveyed 160 km of the Sonoran coastline for breeding least terns, from Bahía San Jorge in the south to Bahía Adaír in the north (30°53′N, 113°05′W to 31°29′N, 114°04′W; Fig. 1). This region is comprised of many wetlands and wetland complexes (nearest wetlands beyond the study area are 30 km north and 60 km south). Based on satellite images obtained from GoogleEarth (2006) and Instituto Nacional de Estadística Geografía e Informática (2000) and from published records (Alcock, 1992; Mellink and Palacios, 1993; Palacios and Mellink, 1996; Zuria and Mellink, 2002, 2005), we identified potential locations to survey that were flat, sparsely vegetated sandbars, spits, shellpiles, and salt flats within 3 km of open water. Surveys were conducted April–June 2006–2008. We conducted ground surveys of four sites in 2006, 10 sites in 2007, and three sites in 2008. Each site was surveyed once each year with the following excep-

TABLE 1—Site, size of area surveyed, date, and number of adults and nests of least terns (*Sternula antillarum*) detected, 2006–2008.

Site	Area (m^2)	Ground survey 2006			Ground survey 2007			Ground survey 2008			Adults		Nests		Aerial survey 15 May 2008
		Date	Adults	Nests	Date	Adults	Nests	Date	Adults	Nests	Mean	±*SD*	Mean	±*SD*	Adults
San Francisquito	32,800	—	—	—	28 May	14	3	—	—	—	14	—	3	—	15
La Purinera	288,333	16 May	324	108	29 May	134	85	10 May	46	126	168	142	106	21	46
Estero Morúa East	27,376	3 June	28	7	6 May	19	9	17 May	15	12	21	7	9	3	11
Estero Morúa West	65,000	2 June	51	19	26 May	8	1	—	—	—	30	30	10	13	10
La Cholla	28,000	—	—	—	18 May	26	13	4 May	3	1	15	16	7	8	8
Main sandbar at Cerro Prieto I	—	—	—	—	30 May	0	0	—	—	—	0	—	0	0	16
Small sandbars in marsh at Cerro Prieto II	50,000	20 May	18	3	30 May	5	5	—	—	—	12	9	4	1	0
San Judas	15,000	—	—	—	5 June	3	1	—	—	—	3	—	1	—	0
La Salina	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Total											261		141		106

tions: Morúa East, three times in 2007; La Cholla, two times in 2007; La Purinera, three times in 2008; and Morúa East, three times in 2008. We report data from the survey with the peak number of nests in these cases. In 2008, an aerial survey of the 160 km of coast was conducted.

Observers walked, drove, or traveled by boat along the 160 km of coastline searching for suitable habitats (as defined previously) and for presence of adult least terns. When nesting activity was encountered, inconspicuous observation areas were established, from which observers had an uninterrupted view of the entire colony. Two observers equipped with 8 by 42 binoculars recorded number of nests, juveniles, and adults, and they mapped locations of nests on a grid. Total size of colony was determined by taking GPS locations along its perimeter. If size was >200 by 100 m, observers divided the colony into sections of ca. 200 by 100 m each and surveyed each section as described previously.

To locate colonies, two observers flew in a Cessna 182 from Bahía San Jorge to Bahía Adair. When a least tern was observed flying, standing, or sitting, the plane flew a longitudinal transect at ca.160 k/h at an altitude of 60–150 m on the coastal side of the potential colony. Equipped with 8 by 42 binoculars, two observers independently counted number of terns that were standing, sitting, or flying over land at every site and recorded GPS location and altitude of each survey.

We surveyed 12 potential colonies and found evidence of breeding activity at eight of them, including three previously undocumented colonies (La Cholla, Cerro Prieto, and San Judas; Fig. 1). We report numbers of adults and nests observed at each colony (Table 1). Average difference between the two observers during aerial surveys was 3.1 (±4) terns/colony. Aerial surveys were similar to ground surveys: La Purinera (ground 46, aerial 46) and Morúa East (ground 14, aerial 11).

Some locations that we had identified as appropriate habitat with satellite imagery were deemed inappropriate in ground surveys, while other locations appeared appropriate in both images and surveys but were not occupied by least terns during surveys. The main sandbars of Almejas and La Pinta estuaries appeared suitable in images, but surveys determined that terrain was uneven or there was thick vegetative cover. Large salt flats east of Bahía San Jorge and around Bahía Adair appeared to be appropriate nesting habitat, but no evidence of nesting was observed. Zero counts from aerial surveys should be interpreted cautiously given decreased probability of detection. All other sites that were identified through satellite imagery were suitable habitat and occupied by nesting least terns in ≥1 survey (Fig. 1). Aerial and ground surveys did not reveal additional suitable habitat.

Based on our 3-year averages of nests detected, ≥141 pairs of least terns (±47) breed within northern Sonora, Mexico. This total represents a substantial proportion of the 400 estimated pairs within the Gulf of California (Palacios and Mellink, 1996). The colony at La Purinera is one of only two known colonies with >100 pairs in the Gulf of California (Palacios and Mellink, 1996). Changes that we documented in number of individuals present at La Purinera were within the range of interannual fluctuations at this site (60–240 pairs; Palacios and Mellink, 1996; Zuria and Mellink, 2005).

We discovered three previously unrecorded colonies (La Cholla, Cerro Prieto, and San Judas) in northern Sonora. Two of these (San Judas, Cerro Prieto) were not occupied in all the years of our study, confirming the need to manage clusters of alternate sites (Massey and Fancher, 1989; Palacios and Mellink, 1996).

A significant increase in surveying effort is needed to develop accurate estimates of the breeding population of least terns in our study area. Yearly aerial surveys should be used to determine occupancy and to guide ground surveys (M. Steinkamp et al., http://www.pwrc.usgs.gov/cwb/manual/). Ground and aerial surveys should be conducted at all potential nesting sites within a short temporal window to better account for individuals moving within the region and for temporal fluctuations in sizes of colonies through the breeding season. The large and continuously occupied colony at La Purinera in Bahía San Jorge merits ground monitoring throughout the breeding season due to its potential importance to the population of least terns in Sonora and the Gulf of California.

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CTENOPHTHALMUS PSEUDAGYRTES (SIPHONAPTERA: CTENOPTHALMIDAE): NEW TO THE FLEA FAUNA OF TEXAS

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Abstract—Two female ctenophthalmid fleas, *Ctenophthalmus pseudagyrtes*, were collected in June 2003 from an eastern mole *Scalopus aquaticus* from Marion County, Texas. This flea originally was described from *S. aquaticus* in Michigan; *C. pseudagyrtes* has been reported from various mammalian hosts collected primarily east of the Mississippi River. This is the first report from Texas. In addition, we provide the second record of the mite *Haemogamasus harperi* in Texas from the same host.

Resumen—Dos pulgas hembras ctenophthálmidas, *Ctenophthalmus pseudagyrtes*, fueron recolectadas en junio de 2003 de un topo oriental, *Scalopus aquaticus,* del condado de Marion, Texas. Esta pulga fue originalmente descrita de *S. aquaticus* en el estado de Michigan; *C. pseudagyrtes* se ha registrado de varios huéspedes mamíferos recogidos principalmente del este del río Mississippi. Este es el primer registro de Texas. Además, proveemos el segundo registro del ácaro *Haemogamasus harperi* en Texas del mismo huésped.

Ctenophthalmus pseudagyrtes is a common flea on soricomorphs and rodents throughout much of eastern North America. The species originally was described from the eastern mole *Scalopus aquaticus* from East Lansing, Ingham County, Michigan (Baker, 1904). It often occurs as an ectoparasite of shrews, voles, and other small mammals; however, moles most likely are its preferred host (Fox, 1940; Olive, 1950). The species has been reported from various mammals in Alabama, Alaska, Arizona, Florida, Georgia, Indiana, Illinois, Iowa, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Hampshire, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, Washington, D.C., and Wisconsin (Fox, 1940; Hubbard, 1947; Jackson and DeFoliart, 1976; Benton, 1980; Spicka, 1981; Whitaker, 1982; Durden, 1987, 1990, 1992, 1995; Haas et al., 1989; Durden and Wilson, 1990; McCay and Durden, 1996; Durden and Kollars, 1997; Kollars et al., 1997; Fagerlund et al., 2001; Eckerlin, 2008; Haas et al., 2010), New Brunswick and Yukon Territory, Canada (Whitaker and French, 1982; Haas et al., 1989), and Mexico (Tipton and Mendez, 1968; Morrone et al., 2000; Acosta, 2005). Interestingly, *C. pseudagyrtes* also has been collected in a cave in Georgia (Reeves et al., 2000). There is no record of *C. pseudagrytes* in Texas (Eads and Menzies, 1949; Eads, 1950; Richerson et al., 1992; Haas et al., 2004; L. F. Mayberry et al., http://www-museum.unl.edu/research/parasitology/UTEP-UNL/utep.pdf). Therefore, collection of *C. pseudagyrtes* reported herein represents a new state record for Texas.

On 16 June 2003, D. I. Moore collected an adult *S. aquaticus* with a Victor plunger-style mole trap (model 0645; Woodstream Corporation, Lititz, Pennsylvania) 9.7 km NW Jefferson, Marion County, Texas (32.7953°W, 94.2956°N). Two fleas and two mites were observed on the skin and placed into vials containing 70% ethanol and sent to NW for identification. Specimens were prepared as outlined by Haas et al. (2004). Voucher specimens of ectoparasites were deposited in the Florida State Collection of Arthropods, Gainesville. A voucher specimen of the host (skin and skull) was deposited in the Texas A&M University-Texarkana collection of mammals.

Fleas were two female *C. pseudagyrtes*. Not only is this the first time this species has been reported in Texas, but more importantly, it provides a new record of a common eastern flea west of the Mississippi River. In addition, two mites, *Haemogamasus harperi*, reported from moles, shrews, and voles in Florida, Georgia, Illinois, Indiana,