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SUBSPECIFIC STATUS OF THE PALLID BAT, ANTROZOUS PALLIDUS, IN THE TEXAS PANHANDLE AND ADJACENT AREAS

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Although the pallid bat (*Antrozous pallidus*) long has been recognized as a species indigenous to the Panhandle of Texas and adjacent areas, there has been controversy in the literature as to the correct subspecific allocation of specimens from that region. In the most recent study of geographic variation in this species, Martin and Schmidly (1982) assigned the relatively few specimens available to them from the Panhandle to *Antrozous pallidus pallidus* (Le Conte), with type locality at El Paso, El Paso Co., Texas, rather than to the geographically more probable race *A. p. bunkerii* Hibbard (type locality near Sun City, Barber Co., Kansas). They restricted *bunkerii* to gypsum formations of Barber County, Kansas, and nearby Woods County, Oklahoma, opining that this subspecies was "apparently isolated from other populations of the species by hundreds of miles of unsuitable habitat in the form of featureless prairie that is completely devoid of rocky prominences and canyons," the latter presumably containing retreats utilized by these bats as roosting sites and especially as hibernacula in winter.

In the past few years, we have acquired several significant samples of *Antrozous* from the Texas Panhandle and eastward along the Red River, many more specimens than were available to Martin and Schmidly. We were struck initially with the

relatively large size of these bats. Subsequently, we have had the opportunity to compare adult specimens in our series with the holotype and other representatives of *A. p. bunkerii* from Kansas, and with material judged as typical of *A. p. pallidus* from Trans-Pecos Texas (Brewster, Jeff Davis, and Presidio counties). In so doing, we recorded length of forearm and cranial measurements as described by Martin and Schmidly (1982), with the exception of palatal length, which we found too difficult to measure consistently, and length of dentary, in which we included incisors. Additionally, we measured breadth of braincase (greatest breadth of cranium in temporal region above the zygomatic arch). All specimens listed as examined are in The Museum, Texas Tech University, except those from Barber County, Kansas, which are housed in the Museum of Natural History at the University of Kansas. Multivariate analysis of variance (MANOVA) and discriminant function analysis were performed using statistical packages on SPSS^x (SPSS, Inc., 1986) programs MANOVA and DISCRIMINANT, respectively.

In overall color and size, our material from the Texas Panhandle and adjacent regions bears a strong resemblance to *A. p. bunkerii* (see Table 1). Indeed, bats in a pooled sample from Collingsworth and Hardeman counties, Texas, and Harmon County, Oklahoma (see specimens examined), actually average larger than those from the type locality of *bunkerii* in five of 11 measurements. Specimens in the two other Panhandle samples available to us average slightly smaller than typical *bunkerii*, but are much larger than bats from the Trans-Pecos representing typical *pallidus* (Table 1).

Two-way MANOVA results indicate the presence of highly significant ($P < 0.001$) geographic variation among our samples. Significant ($P < 0.05$) sexual dimorphism also was indicated, but this can be accounted for at least in part by the unequal sex ratios in our samples. In any event, Martin and Schmidly (1982) did not separate sexes in their study because they found "sexual differences to be slight and, for the most part, nonsignificant."

Discriminant function analysis was performed using the Kansas and Trans-Pecos samples as *a priori* groups and treating the three other samples (see Table 1 and specimens examined) as unknowns. As a result, all individuals in the Collingsworth-Hardeman-Harmon sample and those in the Briscoe sample were classified with bats from Kansas (*bunkerii*). Most individuals from the Deaf Smith-Oldham-Potter sample were grouped with

TABLE 1.—Comparative measurements of specimens from five samples of *Antrozous pallidus*. Sample size is indicated in parentheses following each subheading.

Measurements and statistics	Length of forearm	Greatest length of skull	Zygomatic breadth	Mastoid breadth	Breadth of braincase	Postorbital breadth	Breadth across M3-M3	Length of max. toothrow	Depth of skull	Length of dentary	Length of M3
<i>Antrozous pallidus bunkeri</i> , Barber County, Kansas (20)											
Ave.±1 S.E.	54.33±0.34	21.74±0.10	13.12±0.07	10.55±0.06	8.91±0.05	4.16±0.04	8.51±0.06	7.41±0.03	9.09±0.06	14.23±0.06	8.36±0.04
Min.	50.26	20.76	12.45	9.93	8.51	3.75	8.05	7.13	8.43	13.81	7.98
Max.	56.10	22.60	13.67	10.93	9.20	4.52	8.86	7.63	9.48	14.70	8.68
C.V.	2.83	2.05	2.53	2.67	2.40	4.32	2.92	2.03	2.82	1.76	2.08
Collingsworth, Hardeman counties, Texas—Harmon County, Oklahoma (17)											
Ave.±1 S.E.	54.40±0.38	21.59±0.14	13.03±0.07	10.35±0.07	8.81±0.05	4.21±0.05	8.56±0.04	7.48±0.05	9.07±0.06	14.16±0.08	8.37±0.05
Min.	51.72	20.32	12.49	9.68	8.37	3.83	8.18	7.09	8.66	13.67	8.00
Max.	56.64	22.36	13.52	10.87	9.15	4.57	8.93	7.75	9.45	14.72	8.66
C.V.	2.85	2.62	2.28	2.97	2.50	4.83	2.17	2.60	2.55	2.39	2.43
Briscoe County, Texas (9)											
Ave.±1 S.E.	53.21±0.57	20.95±0.08	12.73±0.18	10.10±0.08	8.64±0.17	4.17±0.04	8.38±0.07	7.36±0.03	8.95±0.10	13.80±0.08	8.27±0.03
Min.	51.21	20.68	11.71	9.73	7.96	4.04	7.99	7.23	8.43	13.44	8.14
Max.	56.83	21.40	13.31	10.43	9.90	4.37	8.70	7.45	9.42	14.18	8.45
C.V.	3.23	1.14	4.34	2.27	6.03	3.13	2.66	1.19	3.38	1.74	1.12
Deaf Smith, Oldham, Potter counties, Texas (27)											
Ave.±1 S.E.	54.10±0.31	20.98±0.07	12.61±0.07	10.04±0.06	8.66±0.06	4.11±0.04	8.18±0.05	7.25±0.05	8.81±0.06	13.63±0.06	8.11±0.05
Min.	51.27	20.16	11.72	9.32	8.00	3.46	7.66	6.44	8.02	12.66	7.26
Max.	57.84	21.97	13.35	10.61	9.40	4.46	8.64	7.65	9.34	14.28	8.51
C.V.	2.94	1.81	2.95	2.92	3.36	4.86	2.98	3.33	3.65	2.30	3.10
<i>Antrozous pallidus pallidus</i> , Brewster, Jeff Davis, Presidio counties, Texas (23)											
Ave.±1 S.E.	51.18±0.34	19.93±0.08	11.92±0.07	9.52±0.04	8.28±0.04	4.01±0.02	7.59±0.05	6.80±0.03	8.55±0.07	12.82±0.06	7.60±0.03
Min.	48.29	19.14	11.36	9.07	7.63	3.82	7.14	6.42	7.63	12.24	7.18
Max.	53.84	20.49	12.51	9.81	8.57	4.27	8.04	7.06	9.16	13.35	7.88
C.V.	3.14	1.85	2.64	1.96	2.48	2.89	3.21	1.95	4.17	2.29	2.16

bunkerii, but a few of the smaller specimens in that sample were classified with *pallidus*, possibly indicating intergradation between the two races in the western Canadian River Valley.

We interpret the available data as supporting assignment of specimens from the Texas Panhandle and immediately adjacent parts of north-central Texas, the Oklahoma Panhandle, extreme northeastern New Mexico, and probably southeastern Colorado to *Antrozous pallidus bunkerii* Hibbard, 1934. We agree with Martin and Schmidly (1982) that vast expanses of uninhabitable terrain provide potential breaks in gene flow among populations of *A. pallidus*. We would argue, however, that the Canadian breaks and associated rough country of north-central Texas, the gypsum caves in Collingsworth County, Texas, that extend eastward into Oklahoma, the Wichita Mountains (Morse and Glass, 1960), and finally the gypsum formations along the Kansas-Oklahoma border in Barber and Woods counties, respectively, link northeastern populations of pallid bats, particularly when it is recognized that individuals of this species disperse in summer to a variety of roosting sites, many man-made. Surely the vast expanse of the Llano Estacado (from which there are no recorded specimens south of the Red River drainage) would be of greater significance as a barrier to gene flow, the only potential contact between northern and southern populations being along the escarpment of the Llano and broken country immediately to the east thereof, and the breaks extending along the Canadian River into northeastern New Mexico.

SPECIMENS EXAMINED

Specimens of *Antrozous pallidus bunkerii* examined by us totaled 147, as follows:—KANSAS: *Barber Co.*: Aetna, 2; 4.5 mi. S, 0.25 mi. E Sun City, 3; 5.5 mi. S Sun City, 11; 7 mi. S Sun City, 4; no precise locality, 5. NEW MEXICO: *Quay Co.*: 10 mi. SE Nara Visa, 1. OKLAHOMA: *Cimarron Co.*: within 5.5 mi. SE Kenton, 6. *Harmon Co.*: 7.2 mi. S, 1 mi. W Hollis, 9. TEXAS: *Collingsworth Co.*: 3 mi. N, 2 mi. E Lutie, 1. *Briscoe Co.*: 6.1 mi. N, 0.1 mi. W Quitaque, 5; Caprock Canyons, 3 mi. N Quitaque, 4; Los Lingos Canyon, 2. *Deaf Smith Co.*: 4.8 mi. S, 4.9 mi. E Glenrio, 4. *Hardeman Co.*: 20.3 mi. N Goodlett, 8. *Oldham Co.*: Griffin Ranch, 18 mi. N, 1 mi. W Adrian, 3; 17 mi. N, 1 mi. W Adrian, 40. *Potter Co.*: Fain Ranch, 16 mi. N Amarillo, 39.

Specimens of *Antrozous pallidus pallidus* used in comparisons are as follows.—TEXAS: *Brewster Co.*: 13.2 mi. N, 2.6 mi. E Marathon, 1; 11.5 mi. N, 2 mi. W Marathon, 1; Big Bend National Park, 2; Black Gap Wildlife Management Area, 57 mi. S Marathon, 5. *Jeff Davis Co.*: 10 mi. N Fort Davis, 2; 6 mi. NE Fort Davis, 1; Sawtooth Mt., 8 mi. S jct. hwy. 118 and 166, 1; Harris Ranch, Davis Mts., ca. 3 mi. E jct. hwy. 166 and 505, 1; Limpia Canyon, 3.5 mi. NE Fort Davis, 1; Fraiser Canyon, 3. *Presidio Co.*: Pinto Canyon, Chinati Mts., ca. 14 mi.

E Ruidosa, 1; Pinto Canyon, Shely Ranch, Chinati Mts., 2; ZH Canyon, Sierra Vieja Mts., ca. 9 mi. W Valentine, 2.

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