MAMMALIAN SPECIES No. 77, pp. 1–4, 3 figs.

Euderma maculatum. By Larry C. Watkins

Published 15 June 1977 by The American Society of Mammalogists

Euderma H. Allen, 1892

Euderma H. Allen, 1892:467. Type species *Histiotus maculatus* J. A. Allen.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Vespertilionidae, Subfamily Vespertilioninae, Group Plecotini (Williams *et al.*, 1970:605). There is one species of the genus *Euderma* and it is known only from western North America.

Euderma maculatum (J. A. Allen, 1891)
Spotted Bat

Histiotus maculatus J. A. Allen, 1891:195. Type locality near Piru, Ventura Co., California. According to Miller (1897:49), this locality is "probably [the] mouth of Castac Creek, Santa Clara Valley, 8 miles east of Piru, Los Angeles County, California."

Euderma maculata H. Allen, 1894:61. First use of current name combination as emended.

CONTEXT AND CONTENT. Context noted in generic summary above. No subspecies are currently recognized (Handley, 1959:122).

DIAGNOSIS. The most recently published diagnosis is that of Handley (1959), which follows: supraorbital region sharply ridged; temporal ridges not coalescing posteriorly to form a sagittal crest; braincase exceptionally elongated; zygoma rela-

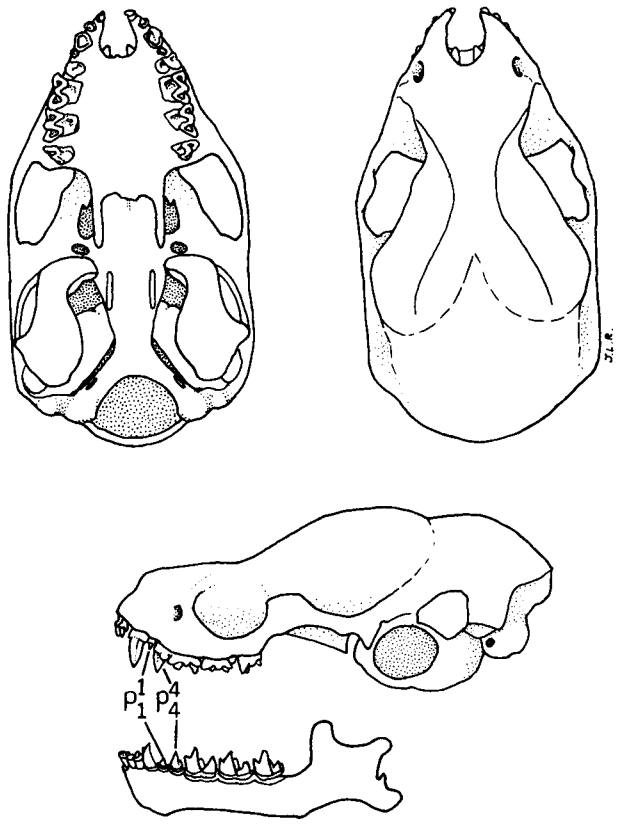

FIGURE 1. Ventral, dorsal, and lateral views of skull, and lateral view of lower jaw of *Euderma maculatum* (male, Univ. New Mexico no. 25000, from Weir Tank, 1.5 mi. E Springtime Campground, Socorro Co., New Mexico; courtesy J. S. Findley).

FIGURE 2. Dorsal view of adult female *Euderma maculatum*, Big Bend National Park, Brewster Co., Texas, 11 August 1969 (above); head view of juvenile male *E. maculatum*, Rio Grande Village, Big Bend National Park, 9 July 1969 (below). Photographs courtesy of D. A. Easterla.

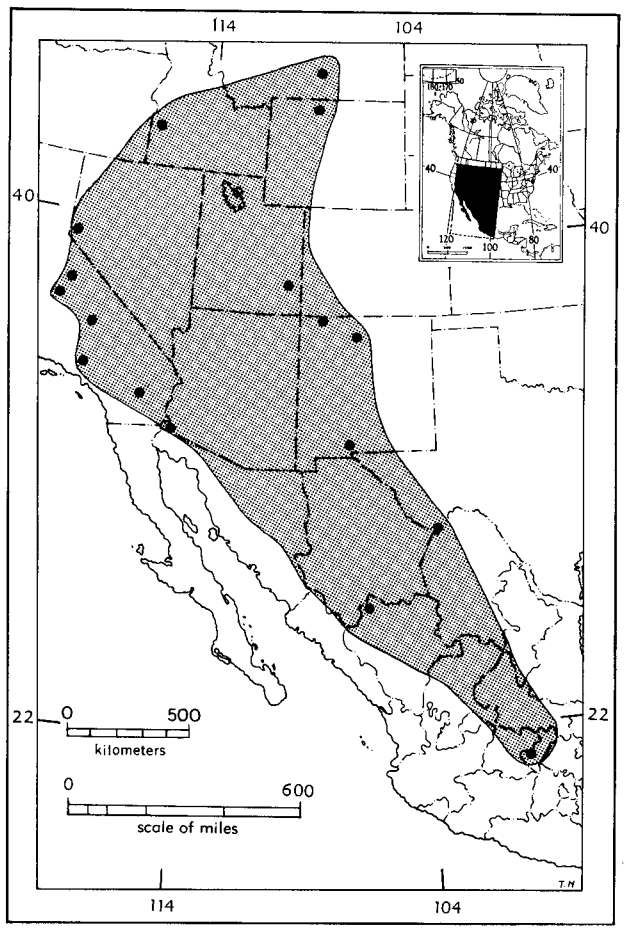

FIGURE 3. Map of western North America showing marginal distribution records of *Euderma maculatum* and its inferred geographic range (modified from Hall and Kelson, 1959).

tively heavy, with postorbital expansion in middle third of the arch; median postpalatal process a bifid prominence; auditory bulla roughly elliptical in outline and somewhat specialized (see figure 1).

Upper incisors in line with toothrow; I1 simple, without accessory cusps, except occasionally near cingulum, and small, only slightly larger than I2; I2 near or touching upper canine; P1 minute; hypocone cusp barely indicated on M1 and M2; third commissure longer than second and metacone relatively well developed on M3; lower canine reduced in thickness, not exceeding p4 in height, and possessing a prominent anterointernal secondary cusp almost equaling primary cusp in height; p1 about half the size of p4, and not crowded; p3 absent; p4 single rooted and possessing a well-defined metaconid cusp. As noted by Handley (1959:108), the anterior portions of the toothrows show great specialization in *Euderma*. In the upper jaw I1 and P1 are reduced; in the lower the canine is reduced (though provided with a prominent accessory cusp), p3 has been eliminated, and p4 is single rooted. Dental formula is i 2/3, c 1/1, p 2/2, m 3/3, total 34.

GENERAL CHARACTERS. In general, the spotted bat has a nose lacking large glandular masses; small nostril openings of primitive vespertilionid type; tragus and auricle large; no basal lobe on tragus; ears 45 to 50 mm from notch to tip when turgid, naked, and for their size, remarkably sturdy; forearm 48 to 51 mm in length (including wrist and elbow); total length 107 to 115 mm; tail 47 to 50 mm long, with membrane attached to base of last caudal vertebra; membranes of wings and tail thin and pliable; fur usually black above with unique pattern of white spots; venter white with basal portion of fur black; *Euderma* has a naked area on the throat that usually is circular and about 10 mm in diameter (this non-glandular area is hidden from view by nearby fur unless the head is tipped backward—Easterla, 1971:476). Membranes of wings, tail, and ears are pinkish-red when this species is alive, grayish in preserved specimens (Easterla, 1965:667, figure 2). Line drawings illustrating the various features used to recognize *Euderma maculatum* as well as tables of measurements were given by Handley (1959).

DISTRIBUTION. The distribution is mapped in figure 3. Marginal records of this species were given by Hall and Kelson (1959:198) and Handley (1959:127). Extensions of known range later were reported by Constantine (1961) for New Mexico, Gardner (1965:105) for Durango, Easterla (1970) for Texas, and Medeiros and Heckmann (1971) for California. More recently, D. J. Schmidly and C. O. Martin (1973) recorded this species from the Mexican state of Queretaro, some 925 kilometers southeast of the Durangan locality. This bat occurs from 57 meters below sea level (Grinnell, 1910) to the high transition zone of Yosemite National Park, Mariposa Co., California (Ashcraft, 1932), in habitat ranging from bleak desert to montane coniferous forest (Jones, 1965). There are no reported fossil specimens of *Euderma maculatum*.

FORM. The combination of huge pinkish-red ears and a unique black and white pattern of the pelage make *Euderma maculatum* one of the most striking bats found in the New World. Grinnell (1910) commented: "The coloration of this animal, suggesting the 'death's-head' pattern displayed upon the thorax in certain moths, is, as far as I am able to learn, unique among bats. Some adaptive function is suggested by the recurrence of this pattern among distantly related groups of animals. Conspicuously contrasted black and white markings appear to be prevalent among crepuscular birds, as night hawks and poorwills, and have been thought to be directive in meaning." Easterla (1965:668) postulated that this color pattern "would certainly be inconspicuous" if the bat was hanging on rock walls of corresponding color. However, daytime roosts are now thought to be within rock crevices (Easterla, 1970, 1973).

Only the Old World bats of the genus *Glauconycteris* can compare in coloration (Walker *et al.*, 1968:361). The spots on *Euderma* are located at the base of the ears, over each shoulder, and on the rump. Except for the spots, *Euderma* is black dorsally. The spots are approximately 15 mm in diameter, and tend to be two-toned—black basally and white distally. The ventral pelage is much like the spots and although it appears white, parting of the fur reveals a dark base. No drastic deviation from the general pattern just described has been reported. The altricial young lack the pattern at birth (Easterla and Easterla, 1974; Easterla, 1974). Nothing is known about the deciduous dentition of this species. The skeleton of *Euderma* was partly described by Hall (1934). Notable is the unusual length and shape of the presternum and the sharp angle of the acromion process of the scapula. The second phalanx of the third digit is longer than the first. No literature on the baculum, penis, testes, or sperm morphology has been found, nor have the organ systems been described.

REPRODUCTION AND ONTOLOGY. Few data have been gathered on the reproductive habits of *Euderma Maculatum*. Constantine (1961:96) reported the testes of a male *Euderma* as 2 by 4 mm. These measurements were made on 6 November after the bat had been held in captivity for several days. Gardner (1965:105) reported two adult male *Euderma* netted on 29 May in Durango, Mexico, that had "small, undescended testes." Easterla (1965:666) found testes measuring 7 by 3 mm in a male taken on 21 August in Garfield County, Utah. Jones (1961:539) found no mature sperm in the testes or epididymides of two males from Catron County, New Mexico, netted on 23 June. Parturition apparently occurs prior to mid-June. Females in post-partum condition have been noted for 23 June and 1 July in Catron County, New Mexico (Jones, 1961:539), 30 June in Catron County, New Mexico (Findley and Jones, 1965:679), 10, 15, and 18 August in Garfield County, Utah (Easterla, 1965), and 3 and 9 August in Brewster County, Texas (Easterla, 1970). Findley and Jones (1965:679) noted that in one bat the right uterine horn was enlarged and flaccid and contained a placental scar. In another "the right uterine horn was larger than the left, although no scar was evident." They found the left ovary of one specimen measured 2 mm in greatest diameter, whereas the right measured 1½ mm. A netted pregnant female gave birth to a single young male weighing 4 grams on 11 June at 1145 (MST) at Big Bend National Park, Texas (Easterla, 1971). Photographs show a naked altricial newborn with no indications of the striking color pattern of adults. The eyes were tightly closed at birth, and the ears were large and floppy. The pinnae were not fully developed, but they tended to be pointed. Recently Easterla (personal communication with editor) captured two pregnant *Euderma* in western Texas that gave birth to a single young in early June. The single young one is in agreement with other evidence, especially that presented by Findley and Jones (1965).

ECOLOGY. The spotted bat frequents a wide variety of habitats. Early accounts (Vorhies, 1935:225) indicated that this species favored forests and some authors (Hardy, 1941: 293; Parker, 1952:481; Vorhies, 1935:225) recorded observations of this bat in caves or cave-like situations. *Euderma* has been collected most often in dry, rough, desert terrain, not unlike the habitat of some other plecotines. Easterla (1973) netted 54 during the summer in the Lower Sonoran life-zone of the Chihuahuan Desert (Ernst Tinaja Canyon, Big Bend National Park). Stomachs and scats examined have contained little other than the remains of noctuid moths (Ross, 1967:232). Spotted bats generally pull the wings and heads from moths before eating them (Easterla, 1965:667). Easterla and Whitaker (1972:889) found some evidence that this bat will take June beetles (Scarabaeidae). Captive individuals have eaten flies (Durrant, 1935: 226), cottage cheese (Parker, 1952:481), mealworms (Constantine, 1961:95), and katydids and grasshoppers (Easterla, 1970: 307).

Easterla (1973) observed a kestrel, peregrine falcon, and red-tailed hawk diving at released banded *Euderma*, and the capture of a released *Euderma* by a kestrel was reported by Black (1976). Whitaker and Easterla (1975) reported the external parasites *Cryptonyssus* sp., *Basilia rondanii*, and *Ornithodorus* sp. on *Euderma* from west Texas, and *Basilia forcipata* from a bat from New Mexico. Poché and Keirans (1975) reported a larval tick, *Ornithodoros rossi*, on a spotted bat from Utah. No internal parasites have been reported, and of diseases thought to have decimating effects on bat populations, only rabies has been confirmed (Medeiros and Heckmann, 1971). Constantine (1961:95) found no evidence of rabies in two *Euderma* from Rio Arriba County, New Mexico.

From 1891, when it was first described, until 1965, only 35 specimens were reported in the literature. Because of the scarcity of this bat in collections, *Euderma* was listed as rare on the Bureau of Sport Fisheries and Wildlife Rare and Endangered Species List of 1968 (Snow, undated) and in the Red Data Book (IUCN, 1969). Since 1965, more than 18 additional individuals have been preserved for study (Easterla and Whitaker, 1972:889).

BEHAVIOR. Parker (1952:480) first noted that *Euderma* traverses flat surfaces with relative ease. Easterla (1970:307) suggested that this behavior may be linked to roosting habits in horizontal rock crevices. More recently, Richard Poché (personal communication) has observed *Euderma* landing on the ground and pursuing food items as does the pallid bat, *Antrozous pallidus*. Easterla (1973) watched with binoculars 13 banded and released *Euderma* in Brewster County, Texas; all ignored trees and flew to cliffs and entered crevices or sought refuge under loose rocks and boulders. The voice of *Euderma* has been described as a "soft, extremely high-pitched, metallic squeak" by Parker (1952:481) and as a series of high-pitched squeaks (Medeiros and Heckmann, 1971:858). Jones (1961:539) reported the voice as much like that of *Plecotus phyllotis* but higher pitched. *Euderma* is apparently a late flyer; of 54 *Euderma* netted in western Texas, 49 were captured after midnight (Easterla, 1973:132). Easterla (1970:307) noted a high incidence of injury for *Euderma* and postulated that its flight speed was greater than average. The delicate nature of this bat also may account for a high injury rate. Constantine (1961:95) found that when *Euderma* was cooled, it became torpid and the enormous ears were rolled into a "rams head" position. Rectal temperatures of 8.9°C were recorded while the bat was torpid, compared with 25.4°C at "room" temperature.

GENETICS. According to Williams *et al.* (1970:602), the karyotype of *Euderma maculatum* consists of ". . . a 2N-30, and FN-52, and a total chromosomal arms number of 55. The autosomes are composed of 11 metacentric and submetacentric pairs, generally graded from large to small, one medium-sized subtelocentric pair, and two very small acrocentric pairs. The X chromosome is medium-sized and submetacentric, and the Y is a small acrocentric chromosome." They concluded that the karyotype of *E. maculatum* was most similar to that of *Plecotus phyllotis* and that the two genera were probably derived from the same ancestral stock.

REMARKS. The scientific name is of Latin origin. *Euderma* means "good skin" and *maculatum* means "spotted." The vernacular name most used is "spotted bat," although "pinto bat" is occasionally used. Robert S. Hoffmann criticized early drafts of this manuscript, and Jeanne Robertson prepared two of the illustrations.

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